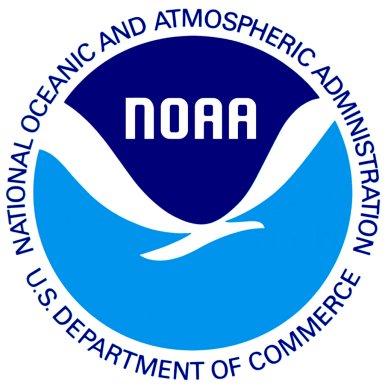
The following report is an abbreviated version of the full GARM Report. It contains information that is only pertinent to winter flounder stocks.



Northeast Fisheries Science Center Reference Document 15-XXXX

Stock Assessment Update of 20 Northeast Groundfish Stocks Through 2014

by Northeast Fisheries Science Center

October 2015

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NOAA, National Marine Fisheries Service,

Northeast Fisheries Science Center, 166 Water Street, Woods Hole, MA 02543

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

October 2015

Northeast Fisheries Science Center Reference Documents

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1 Executive Summary

Note:Working Paper

Update assessments were conducted for the twenty stocks in the Northeast Multispecies Fishery Management Plan in 2015 (Table 1). The updates replicated the methods recommended in the most recent benchmark decisions, as modified by any subsequent operational assessments or updates (Table 2), with the intention of simply adding years of data (Table 3). However, minor flexibility was allowed to address emerging issues (Table 4).

Stock status did not change for 15 of the 20 stocks, worsened for two stocks, improved for one stock, and became more uncertain for two stocks (Table 5).

The number of stocks with retrospective adjustments applied increased from the last assessment from 2 to 7 (Table 6). The previous Georges Bank cod assessment did apply a retrospective adjustment, however, the assessment model was not approved at the 2015 Updates so it has been excluded from these counts.

While the number of overfished stocks and stocks experiencing overfishing has generally decreased since 2007 (Figure 1), the magnitude of overfishing or depletion for several stocks has worsened considerably (Figures 2 and 3); Gulf of Maine cod, Southern New England/Mid-Atlantic yellowtail flounder, witch flounder and Cape Cod/Gulf of Maine yellowtail flounder). Of those Northeast groundfish stocks for which stock status can be determined, the majority remain below their biomass targets (69%; Figures 1 and 3).

Recent NEFSC survey biomass indices for both the spring and fall surveys are below the long term means. For the majority of stocks the average of the most recent five years are below the time series means (Figures 4 and 5)

Estimates of overall (aggregate) groundfish minimum swept area biomass are at, or near, all-time highs (Figures 6 and 7). However, the current stock diversity of the overall groundfish biomass is less than that seen in the 1960s and 1970s. Current groundfish biomass is dominated by only a few stocks: For example the combined biomass of the Georges Bank haddock, Gulf of Maine haddock, and redfish stocks currently make up more than 80% of the overall groundfish biomass (Figure 8).

Information supplemental to the assessment report for each stock can found on the Stock Assessment Support Information (SASINF) website.

The appendix to this document contains: The letter from the Northeast Regional Coordinating Council providing guidance on the operational assessment procedure (Section 22.1), a summary of the meeting with the Assessment Oversight Panel during which assessment plans were developed (Section 22.2), a summary of NEFSC outreach on 2015 groundfish operational assessments (Section 22.3) and statements from fishing industry members (Section 22.4).

Table 1: List of stocks included in the groundfish update and the abbreviations used for each in this document.

Stock Abbrev	Stock Name
CODGM	Gulf of Maine Cod
CODGB	Georges Bank Cod
HADGM	Gulf of Maine Haddock
HADGB	Georges Bank Haddock
YELCCGM	Cape Cod/Gulf of Maine Yellowtail Flounder
YELSNEMA	Southern New England/Mid-AtlanticYellowtail Flounder
FLWGB	Georges Bank Winter Flounder
FLWSNEMA	Southern New England/Mid-Atlantic Winter Flounder
REDUNIT	Acadian Redfish
PLAUNIT	American Plaice
WITUNIT	Witch Flounder
HKWUNIT	White Hake
POLUNIT	Pollock
CATUNIT	Wolffish
HALUNIT	Atlantic Halibut
FLDGMGB	Gulf of Maine/Georges Bank Windowpane
FLDSNEMA	Southern New England/Mid-Atlantic Windowpane
OPTUNIT	Ocean Pout
FLWGM	Gulf of Maine Winter Flounder
YELGB	Georges Bank Yellowtail Flounder

Table 2: Lead scientist for each stock (current/previous if different), information about last assessment, including: the forum for review of the last assessment (Forum), the type of assessment done (Type), publication year (Pub.) the terminal year of the catch data included (Term. yr.), overfished/overfishing status, rebuilding status, and reference. *Note: Op. Update = Operational Update*

Stock	Lead	Forum	Type	Pub.	Term. yr.	Overfished?	Overfishing?	Rebuild status	Reference
CODGM	Michael Palmer	Op. Update	Update	2014	2013	Yes	Yes	By 2024	CRD14-14
CODGB	Loretta O'Brien	SARC 55	Benchmark	2012	2011	Yes	Yes	By 2026	CRD13-11
HADGM	Michael Palmer	SARC 59	Benchmark	2014	2013	No	No	Rebuilt	CRD14-09
HADGB	Liz Brooks	GARM2012	Update	2012	2010	No	No	Rebuilt	CRD12-06
YELCCGM	Larry Alade/Chris Legault	GARM2012	Update	2012	2010	Yes	Yes	By 2023	CRD12-06
YELSNEMA	Larry Alade	SARC 54	Benchmark	2012	2011	No	No	Rebuilt	CRD12-18
FLWGB	Lisa Hendrickson	Op. Update	Update	2015	2013	No	No	By 2017	CRD15-01
FLWSNEMA	Tony Wood/Mark Terciero	SARC 52	Benchmark	2011	2010	Yes	No	By 2023	SARC52
REDUNIT	Brian Linton/Tim Miller	GARM2012	Update	2012	2010	No	No	Rebuilt	CRD12-06
PLAUNIT	Loretta O'Brien	GARM2012	Update	2012	2010	No	No	By 2024	CRD12-06
WITUNIT	Susan Wigley	GARM2012	Update	2012	2010	Yes	Yes	By 2017	CRD12-06
HKWUNIT	Kathy Sosebee	SARC 56	Benchmark	2013	2011	No	No	By 2014	CRD13-10
POLUNIT	Brian Linton	Op. Update	Update	2015	2013	No	No	Rebuilt	CRD15-01
CATUNIT	Chuck Adams/Chad Keith	GARM2012	Update	2012	2010	Yes	No	Unknown	CRD12-06
HALUNIT	Dan Hennen/Jessica Blaylock	GARM2012	Update	2012	2010	Yes	No	By 2055	CRD12-06
FLDGMGB	Toni Chute/Lisa Hendrickson	GARM2012	Update	2012	2010	Yes	Yes	By 2017	CRD12-06
FLDSNEMA	Toni Chute/Lisa Hendrickson	GARM2012	Update	2012	2010	No	No	Rebuilt	CRD12-06
OPTUNIT	Susan Wigley	GARM2012	Update	2012	2010	Yes	No	By 2014	CRD12-06
FLWGM	Paul Nitschke	Op. Update	Update	2015	2013	Unknown	No	Unknown	CRD15-01
YELGB	Chris Legault	TRAC 2015	Update	2015	2014	Unknown	Unknown	By 2032	TRAC2015

Table 3: Data used in each assessment. The column heads are US commercial landings (US c-land), US commercial discards (US c-disc), US recreational landings (US r-land), US recreational discards (US r-disc), Canadian catch (CA catch), NEFSC spring, fall and winter surveys (NEFSC S, NEFSC F and NEFSC W), Massachusetts spring and fall surveys (MA S and MA F), Maine/New Hampshire spring and fall surveys (ME/NH S and ME/NH F) and Canadian Department of Fisheries and Oceans February survey (DFO S).

	Catch					**Surveys**							
Stock	US c-land	US c-disc	US r-land	US r-disc	CA Catch	NEFSC S	NEFSC F	NEFSC W	MA S	MA F	ME/NH S	ME/NH F	DFO S
CODGM	Yes	Yes	Yes	Yes	No	Yes	Yes	No	Yes	No	No	No	No
CODGB	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	Yes
HADGM	Yes	Yes	Yes	Yes	No	Yes	Yes	No	No	No	No	No	No
HADGB	Yes	Yes	No	No	Yes	Yes	Yes	No	No	No	No	No	Yes
YELCCGM	Yes	Yes	No	No	No	Yes	Yes	No	Yes	Yes	Yes	Yes	No
YELSNEMA	Yes	Yes	No	No	No	Yes	Yes	Yes	No	No	No	No	No
FLWGB	Yes	Yes	No	No	Yes	Yes	Yes	No	No	No	No	No	Yes
FLWSNEMA	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	No	No	No	No
REDUNIT	Yes	Yes	No	No	No	Yes	Yes	No	No	No	No	No	No
PLAUNIT	Yes	Yes	No	No	Yes	Yes	Yes	No	Yes	Yes	No	No	No
WITUNIT	Yes	Yes	No	No	No	Yes	Yes	No	No	No	No	No	No
HKWUNIT	Yes	Yes	No	No	Yes	Yes	Yes	No	No	No	No	No	No
POLUNIT	Yes	Yes	Yes	Yes	No	Yes	Yes	No	No	No	No	No	No
CATUNIT	Yes	Yes	Yes	No	No	Yes	Yes	No	Yes	No	No	No	No
HALUNIT	Yes	Yes	No	No	Yes	No	Yes	No	No	No	No	No	No
FLDGMGB	Yes	Yes	No	No	No	No	Yes	No	No	No	No	No	No
FLDSNEMA	Yes	Yes	No	No	No	No	Yes	No	No	No	No	No	No
OPTUNIT	Yes	Yes	No	No	No	Yes	No	No	No	No	No	No	No
FLDWGM	Yes	Yes	Yes	Yes	No	Yes	Yes	No	Yes	Yes	Yes	Yes	No
YELGB	Yes	Yes	No	No	Yes	Yes	Yes	No	No	No	No	No	Yes

Table 4: Assessment type and reference points from previous assessment. *Note: sp=stochastic projection.*

Stock	Assess.	Type	F def.	B def.	F_{MSY} type	F_{MSY} value	B_{MSY} type	B_{MSY} value	MSY type	MSY value
CODGM	ASAP	age-based	F_{Full}	SSB	$F_{40\%SPR}$	0.18	sp	47,184 (M=0.2) or 69,621 (Mramp)	sp	7,753 (M=0.2) or 11,388 (Mramp)
CODGB	ASAP	age-based	F_{Full}	SSB	$F_{40\%SPR}$	0.18	sp	186,535	sp	30,622
HADGM	ASAP	age-based	F_{Full}	SSB	$F_{40\%SPR}$	0.46	sp	4,108	sp	955
HADGB	VPA	age-based	avg F ages 5-7	SSB	$F_{40\%SPR}$	0.39	sp	124,900	sp	28,000
YELCCGOM	VPA	age-based	avg F ages 4-6	SSB	$F_{40\%SPR}$	0.26	sp	7,080	sp	1,600
YELSNEMA	ASAP	age-based	avg F ages 4-5	SSB	$F_{40\%SPR}$	0.32	sp	2,995	sp	773
FLWGB	VPA	age-based	avg F ages 4-6	SSB	Fmsy	0.44	sp	8,100	sp	3,200
FLWSNEMA	ASAP	age-based	avg F ages 4-5	SSB	Fmsy	0.29	sp	43,661	sp	11,728
REDUNIT	ASAP	age-based	F_{Full}	SSB	$F_{50\%SPR}$	0.04	sp	238,000	sp	8,891
PLAUNIT	VPA	age-based	avg F ages 6-9	SSB	$F_{40\%SPR}$	0.18	sp	18,398	sp	3,385
WITUNIT	VPA	age-based	avg F ages 8-11	SSB	$F_{40\%SPR}$	0.27	sp	10,051	sp	2,075
HKWUNIT	ASAP	age-based	F_{Full}	SSB	$F_{40\%SPR}$	0.20	sp	32,400	sp	5,630
POLUNIT	ASAP	age-based	avg F ages 5-7	SSB	$F_{40\%SPR}$	0.27	sp	76,900	sp	14,800
CATUNIT	SCALE	length-based	F_{Full}	SSB	$F_{40\%SPR}$	0.33	sp	1,756	sp	261
HALUNIT	RYM	surplus production	biomass wted F	B	F0.1	0.07	deterministic	49,000	deterministic	3,500
FLDGMGB	AIM	index	relative F (catch/survey biomass)	surv. B	replacement ratio	0.44	MSY *proxy* / $F_{MSYproxy}$	1.60	median catch 1995-2001	700
FLDSNEMA	AIM	index	relative F (catch/survey biomass)	surv. B	replacement ratio	2.09	MSY *proxy* / $F_{MSYproxy}$	0.24	median catch 1995-2001	500
OPTUNIT	index	index	relative F (catch/survey biomass)	surv. B	median relative F 1977-1985	0.76	median surv. B 1977-1985	4.94	F_{MSY} * B_{MSY}	3,754
FLWGM	empirical	survey expansion	exploitation rate (catch/30+cm biomass)	surv. B	exploitation rate ($F_{40\%}$ from YPR)	0.23	NA	NA	NA	NA
YELGB	empirical	survey expansion	NA	surv. B	NA	NA	NA	NA	NA	NA

Table 5: Synopsis of status by stock.

Stock	Last Assessment	Status Change?	Overfishing?	Overfished?
CODGM	2014	Same	Yes	Yes
CODGB	2012	More uncertain	Unknown	Yes
HADGM	2012	Same	No	No
HADGB	2014	Same	No	No
YELCCGM	2012	Same	Yes	Yes
YELSNEMA	2012	Worse	Yes	Yes
FLWGB	2014	Worse	Yes	Yes
FLWSNEMA	2011	Same	No	Yes
REDUNIT	2012	Same	No	No
PLAUNIT	2012	Same	No	No
WITUNIT	2012	Same	Yes	Yes
HKWUNIT	2013	Same	No	No
POLUNIT	2014	Same	No	No
CATUNIT	2012	Same	No	Yes
HALUNIT	2012	More uncertain	Unknown	Yes
FLDGMGB	2012	Better	No	Yes
FLDSNEMA	2012	Same	No	No
OPTUNIT	2012	Same	No	Yes
FLWGM	2014	Same	No	Unknown
YELGB	2014	Same	Unknown	Unknown

Table 6: Comparison of biomass (B) and fishing mortality (F) rate Mohn's rho values (ρ) by stock between the previous assessment and the 2015 updates. The biomass and fishing mortality rate point estimates and ρ adjusted values (Adj.) are provided for the 2015 update assessments. The total number of stocks using ρ adjusted values in the last assessment and the 2015 assessments (ρ adj. vs. pt. est. for those stocks that did not use the ρ adjustment), along with the type of ρ adjustment used in the 2015 assessment (NAA=numbers at age, SSB=spawning stock biomass applied to all ages), are also provided. Only age-based and length-based stocks that could exhibit retrospective patterns are included in this table. *Note: Because the Georges Bank cod assessment was rejected at the 2015 OA Update it has been excluded from this table.*

		Biomass				**Fishing Mortality Rate**				**Used**		
Stock	Model	ρ_{last}	ρ_{2015}	B_{2015}	Adj.	ρ_{last}	ρ_{2015}	F_{2015}	Adj.	Last assess.	2015	Proj. adj.
CODGM	ASAP(M=0.2)	0.53	0.54	2225	1445	-0.33	-0.31	0.956	1.386	pt. est.	pt. est.	none
CODGM	ASAP(M-ramp)	0.17	0.2	2536	2113	-0.05	-0.08	0.932	1.013	pt. est.	pt. est.	none
HADGM	ASAP	-0.15	-0.04	10325	10755	0.3	0.03	0.257	0.25	pt. est.	pt. est.	none
HADGB	VPA	0.2	0.5	225080	150053	-0.15	-0.34	0.159	0.241	pt. est.	ρ adj.	SSB
YELCCGM	VPA	0.68	0.98	1695	857	-0.19	-0.45	0.35	0.64	ρ adj.	ρ adj.	NAA
YELSNEMA	ASAP	0.14	1.06	502	243	-0.16	-0.53	1.64	3.53	pt. est.	pt. est.	none
FLWGB	VPA	0.26	0.83	5275	2883	-0.16	-0.51	0.379	0.778	pt. est.	ρ adj.	SSB
FLWSNEMA	ASAP	0.35	0.21	6151	5105	-0.31	-0.25	0.16	0.214	pt. est.	pt. est.	none
REDUNIT	ASAP	0.04	0.26	414544	330004	-0.04	-0.19	0.012	0.015	pt. est.	ρ adj.	NAA
PLAUNIT	VPA	0.62	0.32	14439	10915	-0.35	-0.32	0.08	0.12	ρ adj.	ρ adj.	NAA
WITUNIT	VPA	0.61	0.51	3129	2077	-0.33	-0.38	0.428	0.687	pt. est.	ρ adj.	SSB
HKWUNIT	ASAP	0.15	0.18	28553	24197	-0.13	-0.12	0.076	0.086	pt. est.	pt. est.	none
POLUNIT	ASAP	0.29	0.28	198847	154865	-0.25	-0.28	0.051	0.07	pt. est.	ρ adj.	NAA
CATUNIT	SCALE	0.96	0.83	592	324	-0.55	-0.36	0.003	0.005	pt. est.	pt. est.	none

Table 7: The biomass (B) and exploitation rate (F) values used for status determination were adjusted to account for a retrospective pattern in some stocks. In general, when the B or F values adjusted for restrospective pattern (B_ρ and F_ρ) were outside of the approximate 90% confidence interval (Conf. limits), the ρ adjusted values were used to determine stock status (Adj. = Yes). There were exceptions however, such as YELSNEMA and CODGM(M=0.2) and details regarding each decision can be found in the report and reviewer comments sections for each stock. Only stocks that had both an estimable 7-year Mohn's ρ for B and F and estimable approximate 90% confidence limits on terminal year B and F values are included.

Stock	B_{2014}	B_ρ	Conf. limits	F_{2014}	F_ρ	Conf. limits	Adj?
CODGM(M=0.2)	2,225	1,443	1,942 - 2,892	0.956	1.39	0.654 - 1.387	No
CODGM(M ramp)	2,536	2,106	1,921 - 3,298	0.932	1.01	0.662 - 1.304	No
HADGB	225,080	150,053	171,911 - 301,282	0.159	0.241	0.13 - 0.203	Yes
HADGM	10,325	10,712	7,229 - 14,453	0.257	0.25	0.164 - 0.373	No
YELSNEMA	502	243	355 - 739	1.64	3.53	1.053 - 2.348	No
YELCCGM	1,695	857	1,375 - 2,111	0.355	0.64	0.25 - 0.52	Yes
FLWSNEMA	6,151	5,105	5,045 - 7,500	0.16	0.21	0.12 - 0.213	No
FLWGB	5,275	2,883	3,783 - 6,767	0.379	0.778	0.254 - 0.504	Yes
PLAUNIT	14,543	10,977	12,742 - 16,439	0.08	0.116	0.069 - 0.093	Yes
WITUNIT	3,129	2,077	2,643 - 3,864	0.428	0.687	0.321 - 0.603	Yes
HWKUNIT	28,553	24,197	24,351 - 33,480	0.076	0.086	0.063 - 0.092	No
POLUNIT	198,847	154,919	37,243 - 255,097	0.051	0.07	0.084 - 0.066	Yes
REDUNIT	414,544	330,004	368,906 - 465,828	0.012	0.015	0.011 - 0.014	Yes

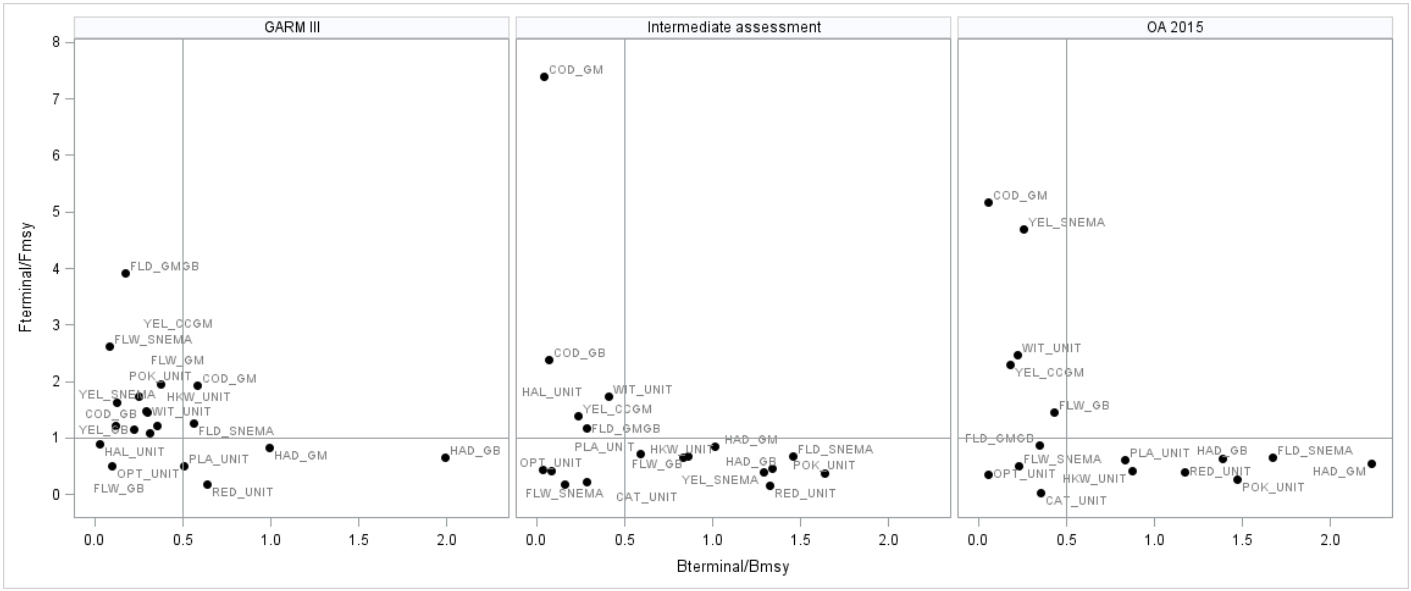

Figure 1: Status of the Northeast Multispecies Fishery Management Plan (groundfish) stocks in 2007 (GARM III) and 2014 (OA 2015) with respect to the F_{MSY} and B_{MSY} proxies. The 'Intermediate assessment' represents the last stock assessment conducted prior to the OA 2015 assessment (year varies by stock). Stocks on which overfishing is occurring are those where the $\frac{F_{terminal}}{F_{MSY\,proxy}}$ ratio is greater than 1 and overfished stocks are those where the $\frac{B_{terminal}}{B_{MSY\,proxy}}$ ratio is less than 0.5. *Notes: (1) the GARM III assessments did not include wolfish; (2) for the intermediate assessments stock status could not be determined for Gulf of Maine winter flounder (OA 2014) or Georges Bank yellowtail (TRAC 2015); and, (3) based on the OA 2015 assessments stock status could not be determined for Atlantic halibut, Gulf of Maine winter flounder and Georges Bank yellowtail flounder. In the OA 2015 assessment, the stock status for Georges Bank cod remained overfished and overfishing is occurring; however, since the assessment was rejected, ratios of terminal conditions to reference points cannot be determined. Species codes: COD-Atlantic cod, HAD-haddock, POL-pollock, RED-redfish, WHK-white hake, OPT-ocean pout, CAT-wolffish, PLA-American plaice, FLW-winter flounder, YEL-yellowtail flounder, WIT-witch flounder, FLD-windowpane flounder, HAL-Atlantic halibut.*

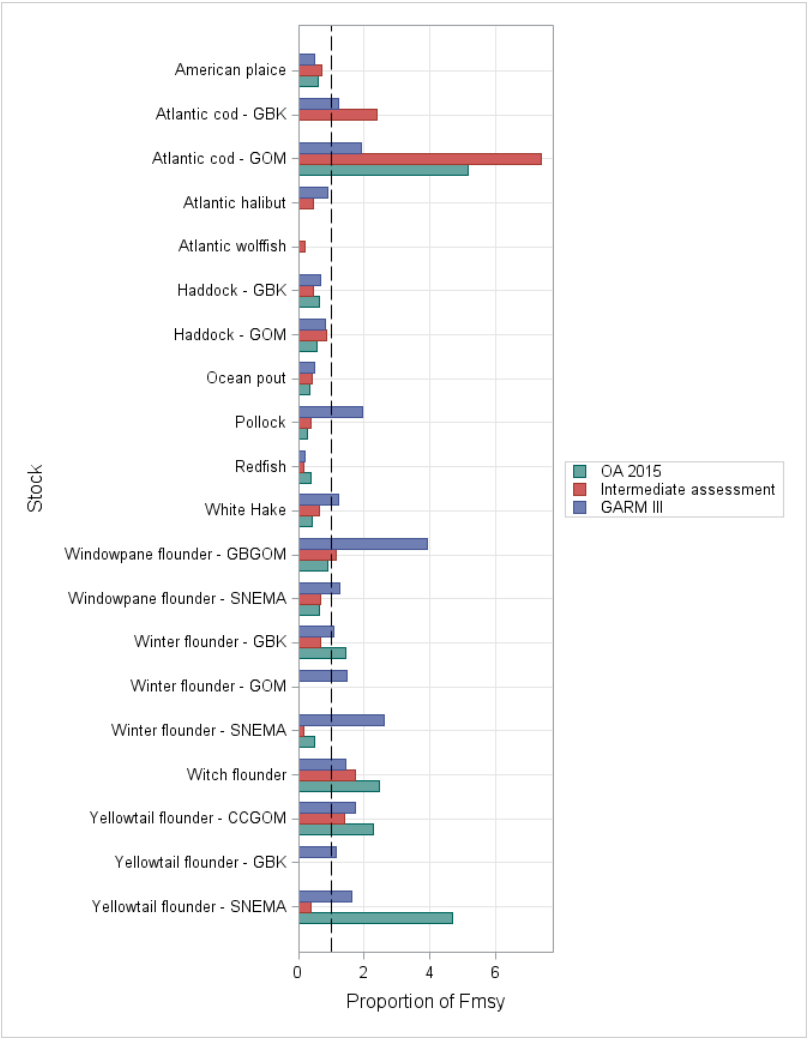

Figure 2: Changes in the ratio of fishing mortality to FMSY proxy from 2007 (GARM III) to 2014 (OA 2015) for the twenty Northeast Multispecies Fishery Management Plan (groundfish) stocks. The results from the assessment prior to the OA 2015 assessment are shown for each stock to provide an 'Intermediate' value. Stocks on which overfishing is occurring are those where the $\frac{F_{terminal}}{F_{MSYproxy}}$ ratio is greater than 1. *Notes: (1) the GARM III assessments did not include wolfish; (2) stock status in the 'Intermediate' assessment could not be determined for Gulf of Maine winter flounder or Georges Bank yellowtail flounder; and, (3) based on the OA 2015 assessments stock status could not be determined for Atlantic halibut, Gulf of Maine winter flounder and Georges Bank yellowtail flounder. In the OA 2015 assessment, the stock status for Georges Bank cod remained overfished and overfishing is occurring; however, since the assessment was rejected, ratios of terminal conditions to reference points cannot be determined.*

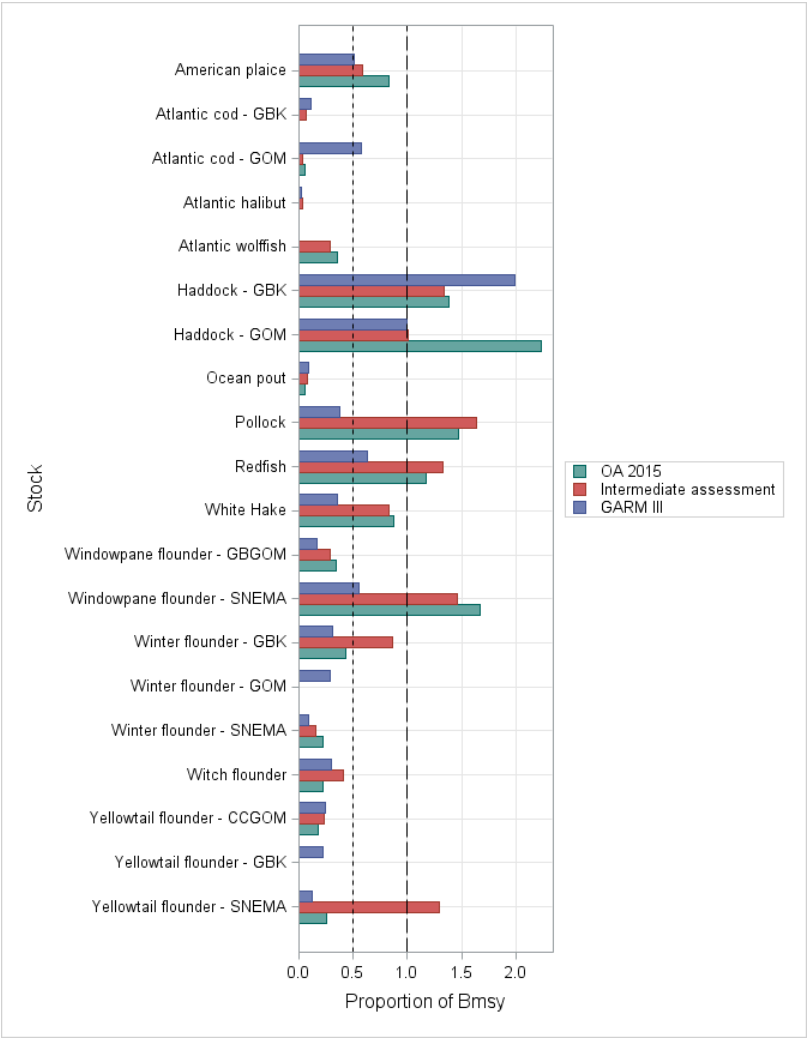

Figure 3: Changes in the ratio of stock biomass to BMSY proxy from 2007 (GARM III) to 2014 (OA 2015) for the twenty Northeast Multispecies Fishery Management Plan (groundfish) stocks. The results from the assessment prior to the OA 2015 assessment are shown for each stock to provide an 'Intermediate' value. Stocks that are overfished stocks are those where the $\frac{B_{terminal}}{B_{MSYproxy}}$ ratio is less than 0.5. *Notes: (1) the GARM III assessments did not include wolfish; (2) stock status in the 'Intermediate' assessment could not be determined for Gulf of Maine winter flounder or Georges Bank yellowtail flounder; and, (3) based on the OA 2015 assessments stock status could not be determined for Atlantic halibut, Gulf of Maine winter flounder and Georges Bank yellowtail flounder. In the OA 2015 assessment, the stock status for Georges Bank cod remained overfished and overfishing is occurring; however, since the assessment was rejected, ratios of terminal conditions to reference points cannot be determined.*

Figure 4: NEFSC spring bottom trawl survey index standardized anomalies (Z-score) for the Northeast Multispecies Fishery Management Plan (groundfish) stocks from 1968 to 2015. *Note that both the Georges Bank/Gulf of Maine and Southern New England/Mid-Atlantic windowpane flounder stocks are not included since the spring survey is uninformative as an index of abundance and not used in the stock assessment.*

Figure 5: NEFSC fall bottom trawl survey index standardized anomalies (Z-score) for the Northeast Multispecies Fishery Management Plan (groundfish) stocks from 1963 to 2014. *Note that ocean pout is not included since the fall survey is uninformative as an index of abundance and not used in the stock assessment.*

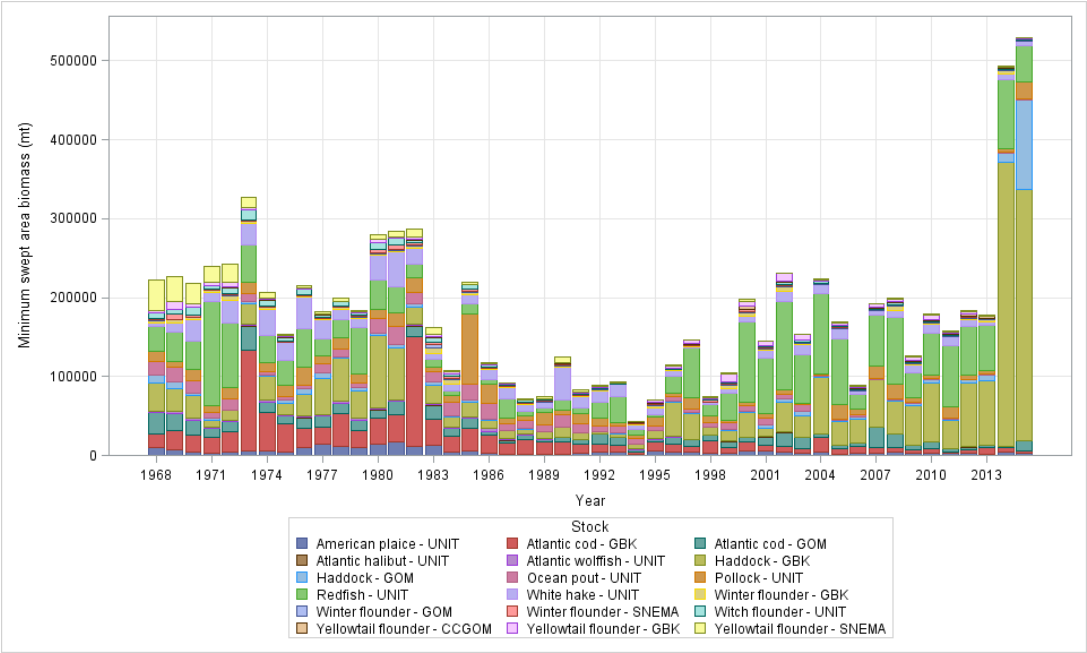

Figure 6: NEFSC spring bottom trawl survey minimum swept area biomass (mt) for the Northeast Multispecies Fishery Management Plan (groundfish) stocks from 1968 to 2015, by stock. Minimum swept area estimates assume a trawl swept area of 0.0112 nm^2) (0.0384 km^2) based on the wing spread of the trawl net. *Note that both the Georges Bank/Gulf of Maine and Southern New England/Mid-Atlantic windowpane flounder stocks are not included since the spring survey is uninformative as an index of abundance and not used in the stock assessment.*

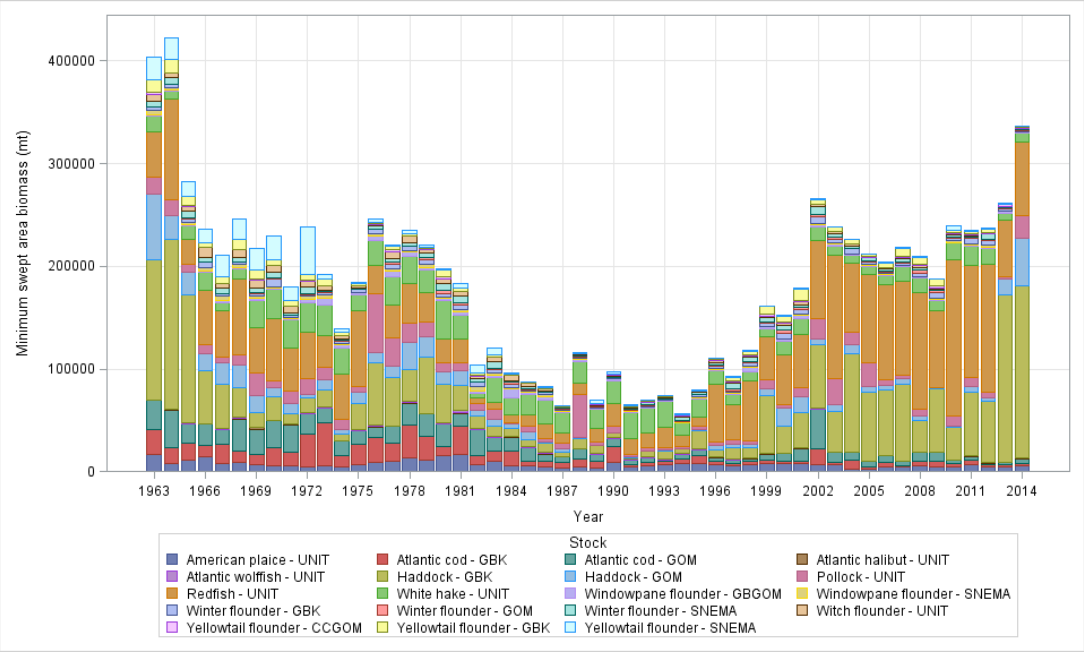

Figure 7: NEFSC fall bottom trawl survey minimum swept area biomass (mt) for for the Northeast Multispecies Fishery Management Plan (groundfish) stocks from 1963 to 2014, by stock. Minimum swept area estimates assume a trawl swept area of 0.0112 nm^2 (0.0384 km^2) based on the wing spread of the trawl net. *Note that ocean pout is not included since the fall survey is uninformative as an index of abundance and not used in the stock assessment.*

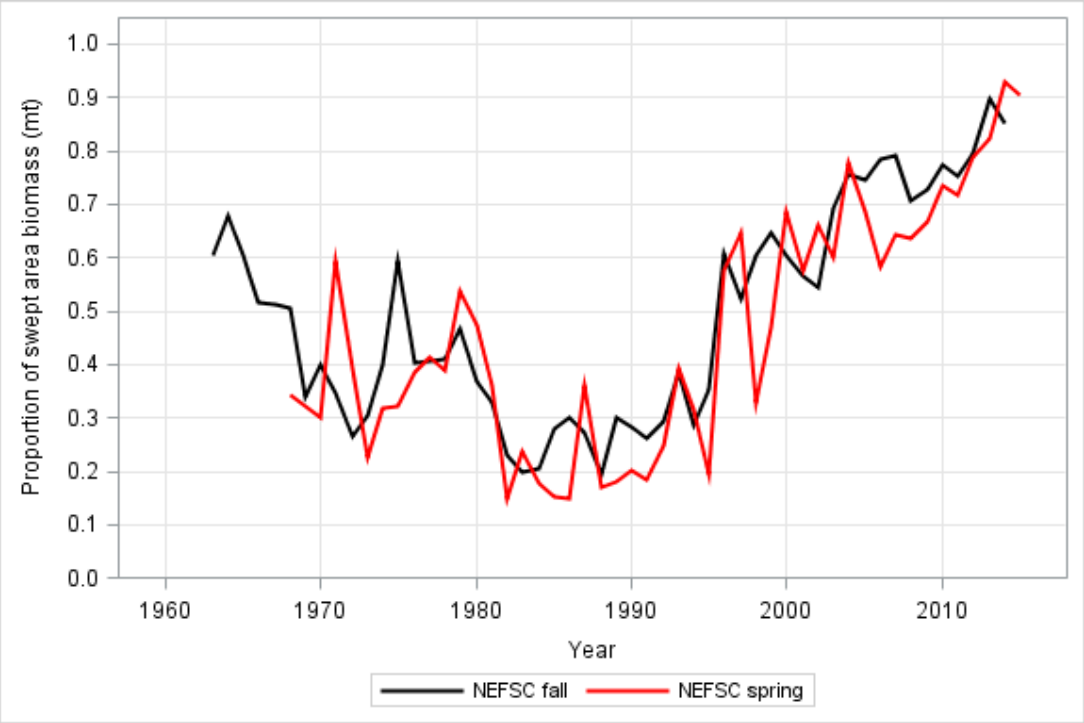

Figure 8: Proportion of the total groundfish swept minimum swept area biomass contributed by Georges Bank and Gulf of Maine haddock and Redfish based on the NEFSC spring and fall bottom trawl surveys.

8 Georges Bank winter flounder

Lisa Hendrickson

This assessment of the Georges Bank winter flounder (Pseudopleuronectes americanus) stock is an operational update of the existing 2014 operational VPA assessment which included data for 1982-2013 (Hendrickson et al. 2015). Based on the previous assessment the stock was not overfished and overfishing was not ocurring. This assessment updates commercial fishery catch data, research survey biomass indices, and the analytical VPA assessment model and reference points through 2014. Additionally, stock projections have been updated through 2018.

State of Stock: Based on this updated assessment, the Georges Bank winter flounder (*Pseudopleuronectes americanus*) stock is overfished and overfishing is occurring (Figures 39-40). Retrospective adjustments were made to the model results. Spawning stock biomass (SSB) in 2014 was estimated to be 2,883 (mt) which is 43% of the biomass target for an overfished stock (SSB_{MSY} = 6,700 with a threshold of 50% of SSBMSY; Figure 39). The 2014 fully selected fishing mortality (F) was estimated to be 0.778 which is 145% of the overfishing threshold (F_{MSY} = 0.536; Figure 40).

Table 26: Catch input data and VPA model results for Georges Bank winter flounder. All weights are in (mt), recruitment is in (000s) and F_{Full} is the average fishing mortality on ages (ages 4-6). Catch and model results are only for the most recent years (2005-2014) of the current updated VPA assessment.

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
					Data					
US landings	2,012	825	795	947	1,658	1,252	1,801	1,911	1,675	1,114
CA landings	73	55	12	20	12	45	52	83	12	12
US discards	118	110	188	143	91	138	129	113	47	46
CA scall dr discards	145	135	44	69	252	109	88	79	29	47
Catch for Assessment	2,348	1,125	1,039	1,179	2,013	1,544	2,070	2,186	1,763	1,219
					Model Results					
Spawning Stock Biomass	4,426	4,478	4,316	3,931	4,282	4,997	5,157	4,829	4,645	5,275
F_{Full}	0.679	0.265	0.309	0.371	0.459	0.365	0.507	0.5	0.533	0.379
Recruits $age1$	3,840	6,106	9,566	12,874	11,355	5,789	7,650	6,519	6,217	6,575

Table 27: Comparison of reference points estimated in the 2014 assessment and the current assessment update and stock status during 2013 and 2014, respectively. An estimate of F_{MSY} was used for the overfishing threshold and was based on long-term stochastic projections.

	2014	Current
F_{MSY}	0.44	0.536
SSB_{MSY} (mt)	8,100	6,700 (4,370 - 10,610)
MSY (mt)	3,200	2,840 (1,850 - 4,480)
Median recruits (age 1) (000s)	13,235	9,880
Overfishing	No	Yes
Overfished	No	Yes

Projections: Short-term projections of biomass were derived by sampling from a cumulative distribution function of recruitment estimates (1982-2013 year classes) from the final run of the ADAPT VPA model. The annual fishery selectivity, maturity ogive, and mean weights-at-age used in the projection are the most recent 5 year averages (2010-2014). An SSB retrospective adjustment factor of 0.546 was applied in the projections.

Table 28: Short-term projections of catch (mt) and spawning stock biomass (mt) for Georges Bank winter flounder based on a harvest scenario of fishing at 75% of F_{MSY} between 2016 and 2018. Catch in 2015 was assumed to be 1,150 (mt).

Year	Catch (mt)	SSB (mt)	F_{Full}
2015	1,150	2,623 (1,802 - 3,813)	0.362
2016	755	2,295 (1,472 - 3,482)	0.402
2017	830	2,595 (1,894 - 3,594)	0.402
2018	1,110	3,581 (2,390 - 5,948)	0.402

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 is the estimate of natural mortality based on longevity (max. age = 20 for this stock), which is not well studied in Georges Bank winter flounder, and assumed constant over time. Natural mortality affects the scale of the biomass and fishing mortality estimates. Other sources of uncertainty include the underestimation of catches. Discards from the Canadian bottom trawl fleet were not provided by the CA DFO and the precision of the Canadian scallop dredge discard estimates, with only 1-2 trips per month, are uncertain. The lack of age data for the Canadian spring survey catches requires the use of the US spring survey age/length keys despite selectivity differences. In addition, there are no length or age composition data from the Canadian landings or discards of Georges Bank winter flounder.

- Does this assessment model have a retrospective pattern? If so, is the pattern minor, or major? (A major retrospective pattern occurs when the adjusted SSB or F_{Full} lies outside of the approximate joint confidence region for SSB and F_{Full}; see Table 7).

  The 7-year Mohn's ρ, relative to SSB, was 0.26 in the 2014 assessment and was 0.83 in 2014. The 7-year Mohn's ρ, relative to F, was -0.16 in the 2014 assessment and was -0.51 in 2014. There was a major retrospective pattern for this assessment because the ρ adjusted estimates of 2014 SSB (SSB_{ρ}=2,883) and 2014 F (F_{ρ}=0.778) were outside the approximate 90% confidence region around SSB (3,783 - 6,767) and F (0.254 - 0.504). A retrospective adjustment was made for both the determination of stock status and for projections of catch in 2016. The retrospective adjustment changed the 2014 SSB from 5,275 to 2,883 and the 2014 F_{Full} from 0.379 to 0.778.

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

  Population projections for Georges Bank winter flounder are reasonably well determined.

- 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 only change made to the Georges Bank winter flounder assessment, other than the incorporation of an additional year of data, involved fishery selectivity. During the 2014 assessment update, stock size estimates of age 1 and age 2 fish were not estimable in the VPA during year t + 1 (CVs near 1.0). When age 2 stock size is not estimated in year t + 1, the VPA model calculates the stock size of age 1 fish (i.e., recruitment) in the terminal year by using the age 1 partial recruitment (PR) value to derive the F at age 1 in the terminal year. The age 1 PR value used in the 2014 assessment update was 0.001. However, when this same age 1 PR value was used in a VPA run for the current assessment update, the low PR value combined with the low age 1 catch in 2014 resulted in an unlikely high stock size estimate for age 1 recruitment in 2014 (i.e., 41,587,000 fish) when compared to survey observations of the same cohort (i.e., age 1 in 2014 and age 2 in 2015). In order to obtain a more realistic estimate of age 1 recruitment in 2014, I allowed the VPA model to estimate age 2 stock size in 2015 (and thereby avoided the use of an age 1 PR value in the age 1 stock size calculation for 2014) and used the back-calculated PR values from this VPA run to derive a new PR-at-age vector which was used in the final 2015 VPA run. Similar to the 2014 assessment update, the final 2015 VPA run did not include the estimation of age 2 stock size and the new PR-at-age vector was computed using the same methods as in the 2014 assessment. Full selectivity occurs at age 4. For the 2015 assessment update, fishery selectivity for ages 1-3 was changed from the 2014 assessment values of 0.001, 0.10 and 0.43, respectively, to 0.01, 0.08 and 0.55, respectively. Differences between estimates of F, SSB and R values from the final 2015 VPA run, with the new PR vector, and a 2015 VPA run that utilized the PR vector from the 2014 assessment are shown in Table G30 (see SASINF).

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

  The overfished and overfishing status of Georges Bank winter flounder has changed in the current assessment update due to a worsening of the retrospective error associated with fishing mortality and SSB.

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

The Georges Bank winter flounder assessment could be improved with discard estimates from the Canadian bottom trawl fleet and age data from the Canadian spring bottom trawl surveys.

- Are there other important issues?
  None.

8.1 Reviewer Comments: Georges Bank winter flounder

Recommendation: The Panel concluded that the updated assessment with retrospective adjustment was acceptable as a scientific basis for management advice. The revised partial recruitment assumption for VPA calibration was well justified.

Alternative Assessment Approach: Not applicable

Sources of Uncertainty: The major source of uncertainty is the retrospective pattern. The magnitude of the retrospective pattern is substantially greater than the 2014 update assessment. The decrease in estimates of stock size from the previous update is largely influenced by updated survey indices. The natural mortality assumption was revised in the SAW52 benchmark assessment, but the assumption is based on limited longevity information. The catch is underestimated and uncertain, because the magnitude of Canadian trawl discards is unknown. The Panel also noted that age composition of the Canadian survey and fishery is not sampled, and that weight at age and maturity at age have declined since 2008. The MSY reference point is conditional on an assumed steepness value.

Research Needs: The Panel recommends that the sources of the retrospective pattern need to be addressed. Considering that retrospective patterns are a common problem, the generic problem may be most appropriately addressed in a research track topic, and all possible sources of the retrospective problem should be investigated (misspecified natural mortality, changes in natural mortality, under-reported catch, changes in survey catchability and misspecified selectivity, etc.). Survey data should be updated to monitor rebuilding or persistent decreases and better sampling of the magnitude and age composition of Canadian discards is needed. Dedicated age samples are needed for the Canadian survey and fishery.

References:

Hendrickson L, Nitschke P, Linton B. 2015. 2014 Operational Stock Assessments for Georges Bank winter flounder, Gulf of Maine winter flounder, and pollock. US Dept Commer, Northeast Fish Sci Cent Ref Doc. 15-01; 228 p.

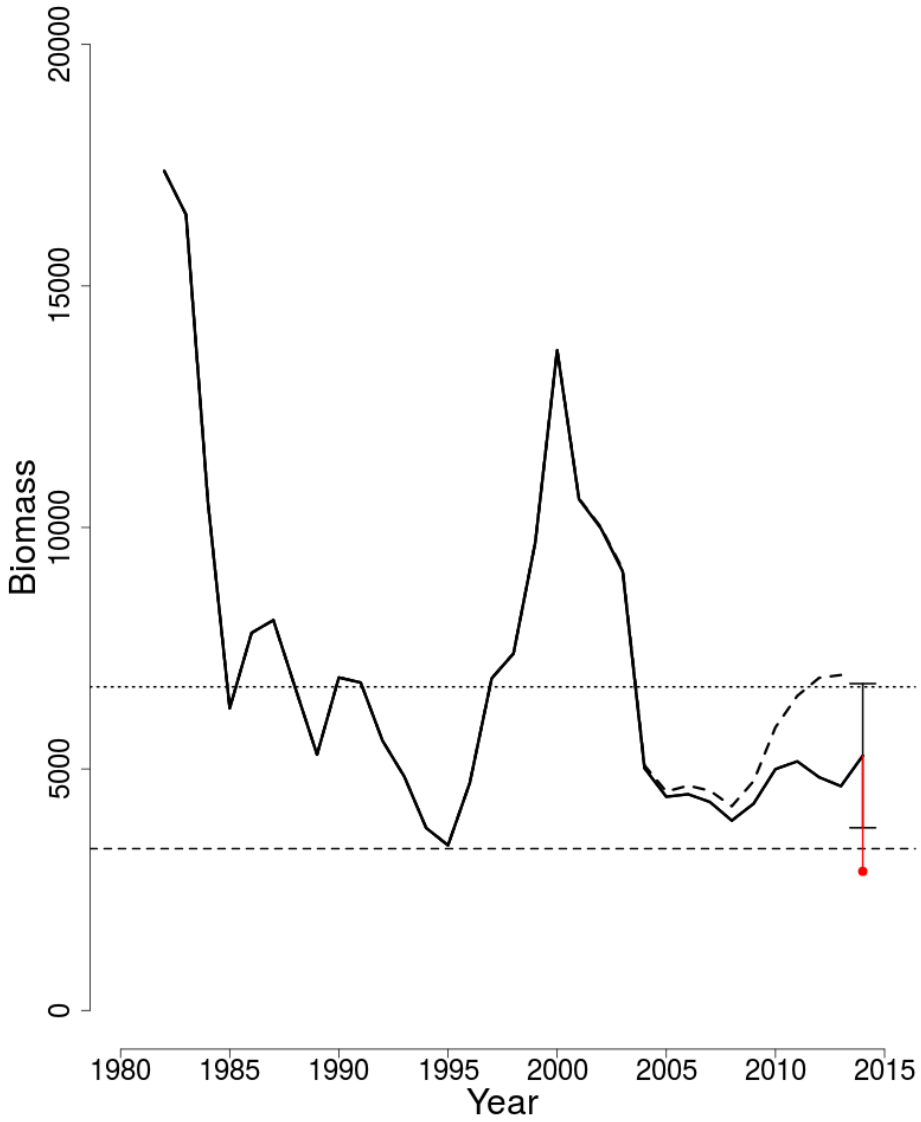

Figure 39: Trends in spawning stock biomass (mt) of Georges Bank winter flounder between 1982 and 2014 from the current (solid line) and previous (dashed line) assessments and the corresponding $SSB_{Threshold}$ ($\frac{1}{2}$ SSB_{MSY}; horizontal dashed line) as well as SSB_{Target} (SSB_{MSY}; horizontal dotted line) based on the 2015 assessment. Biomass was adjusted for a retrospective pattern and the adjustment is shown in red. The approximate 90% normal confidence intervals are shown.

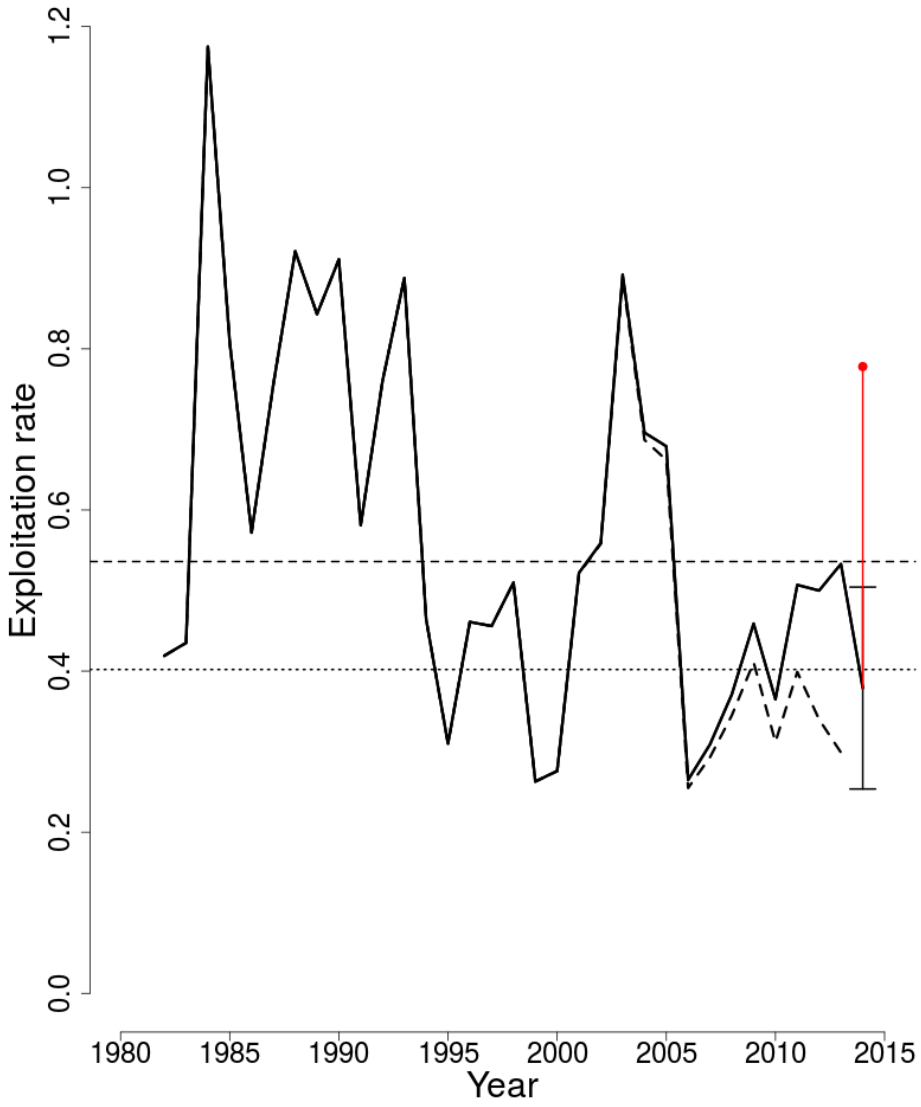

Figure 40: Trends in fully selected fishing mortality (F_{Full}) of Georges Bank winter flounder between 1982 and 2014 from the current (solid line) and previous (dashed line) assessments and the corresponding $F_{Threshold}$ (F_{MSY}=0.536; horizontal dashed line) as well as (F_{Target}= 75% of FMSY; horizontal dotted line). F_{Full} was adjusted for a retrospective pattern and the adjustment is shown in red. The approximate 90% normal confidence intervals are also shown.

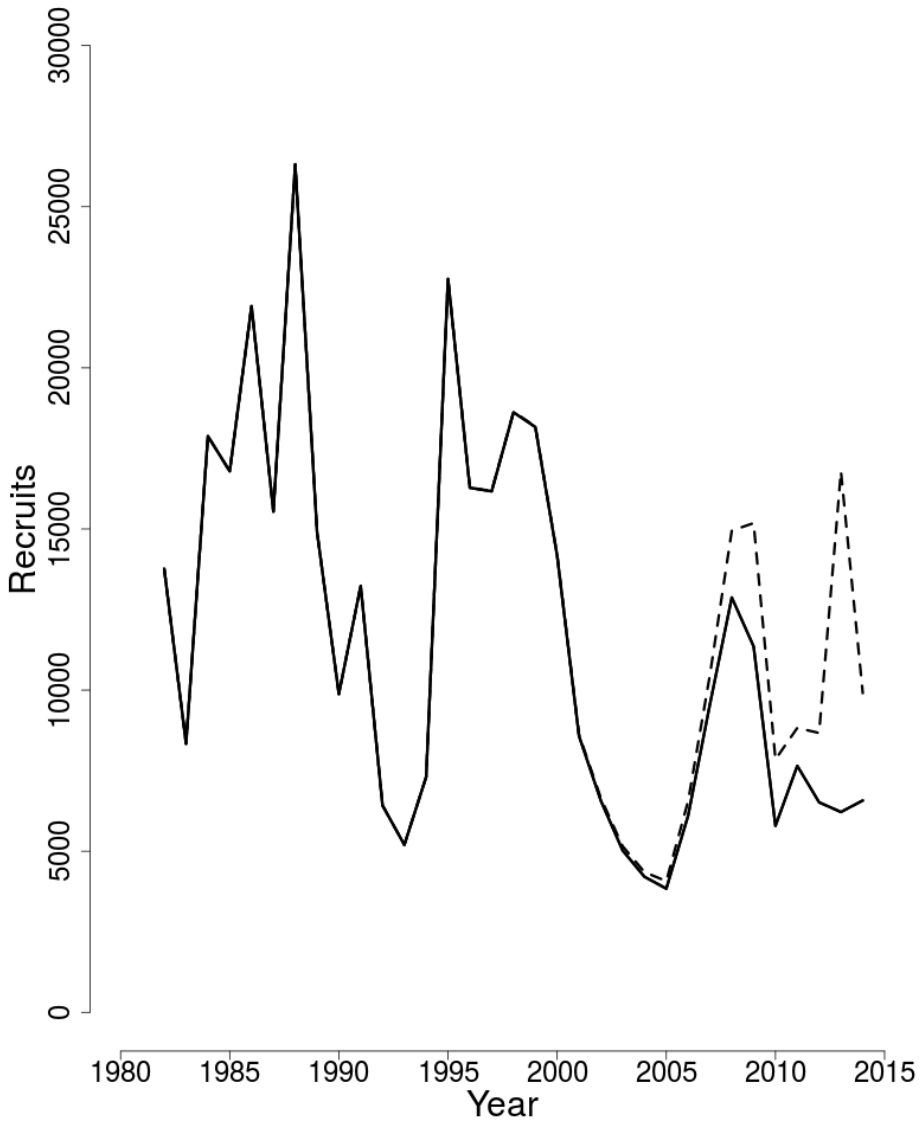

Figure 41: Trends in Recruits (age 1) (000s) of Georges Bank winter flounder between 1982 and 2014 from the current (solid line) and previous (dashed line) assessments. The approximate 90% normal confidence intervals are shown.

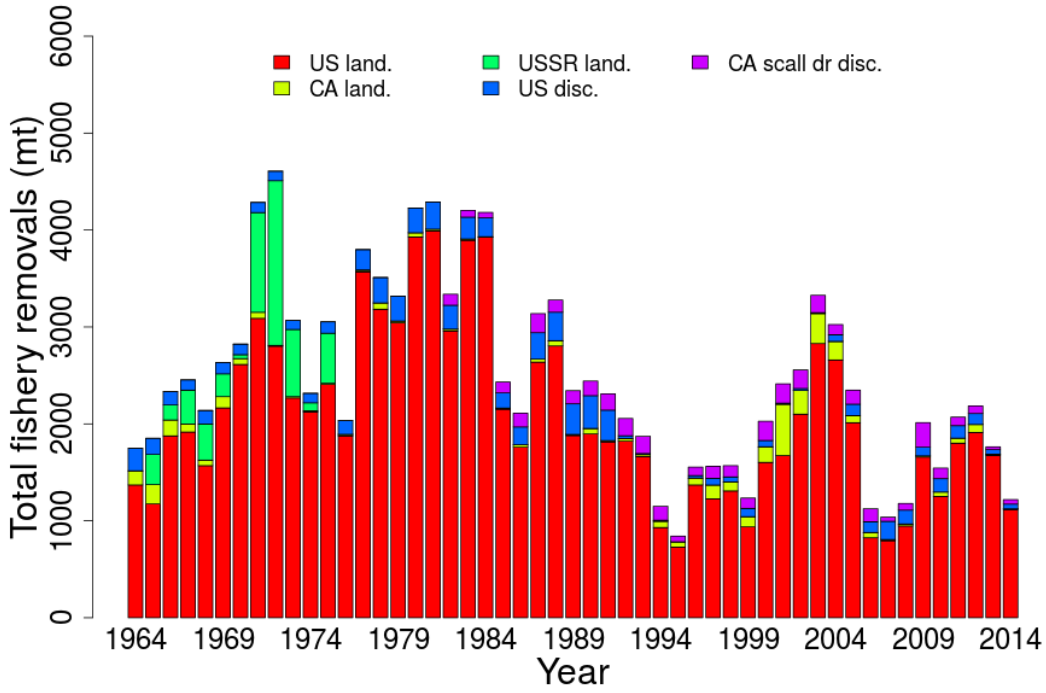

Figure 42: Total catches (mt) of Georges Bank winter flounder between 1982 and 2015 by country and disposition (landings and discards).

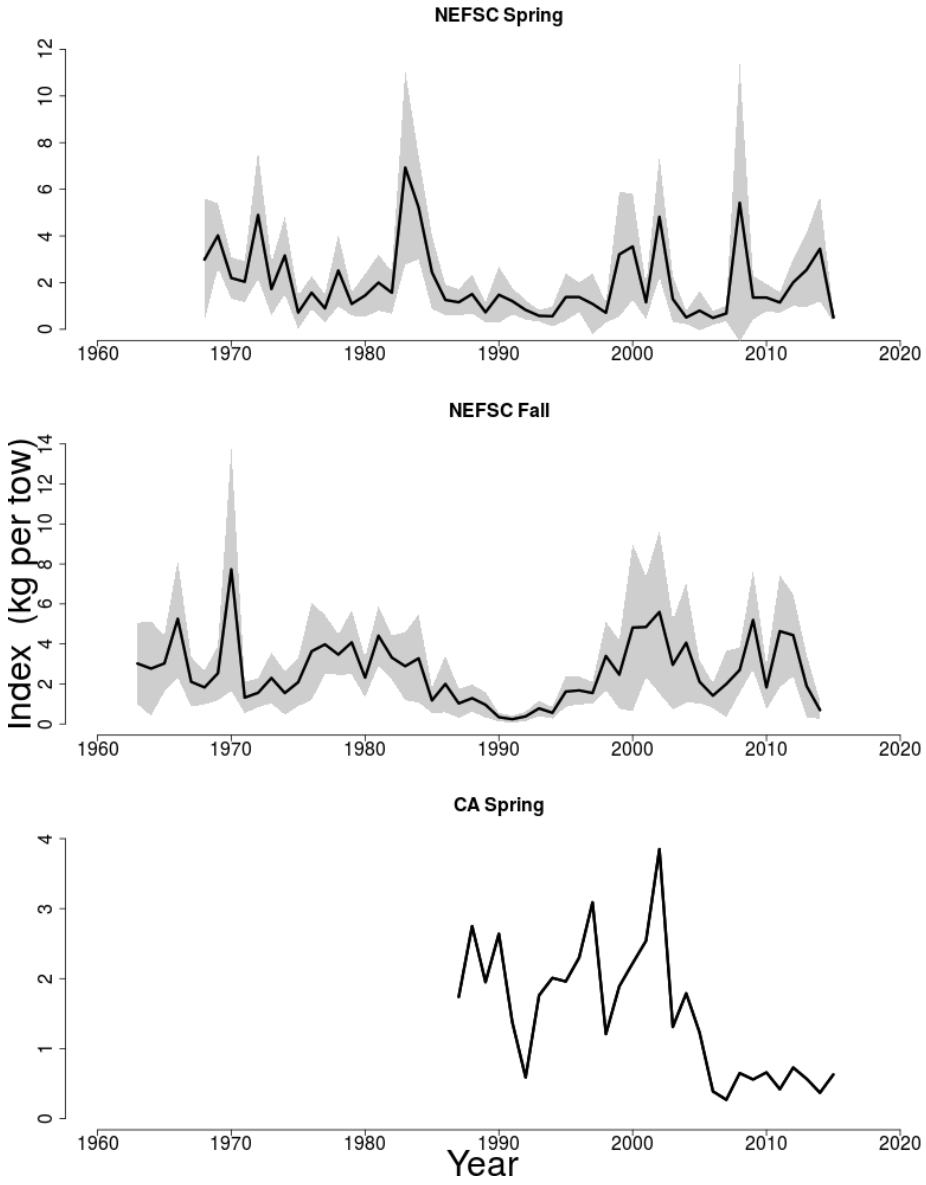

Figure 43: Indices of biomass for the Georges Bank winter flounder for the Northeast Fisheries Science Center (NEFSC) spring (1968-2015) and fall (1963-2014) bottom trawl surveys and the Canadian DFO spring survey (1987-2015). The approximate 90% normal confidence intervals are shown.

9 Southern New England Mid-Atlantic winter flounder

Anthony Wood

This assessment of the Southern New England Mid-Atlantic winter flounder (Pseudopleuronectes americanus) stock is an operational update of the existing 2011 benchmark ASAP assessment (NEFSC 2011). Based on the previous assessment the stock was overfished, but overfishing was not ocurring. This assessment updates commercial fishery catch data, recreational fishery catch data, and 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 Southern New England Mid-Atlantic winter flounder (*Pseudopleuronectes americanus*) stock is overfished but overfishing is not occurring (Figures 44-45). Retrospective adjustments were not made to the model results. Spawning stock biomass (SSB) in 2014 was estimated to be 6,151 (mt) which is 23% of the biomass target (26,928 mt), and 23% of the biomass threshold for an overfished stock ($SSB_{Threshold}$ = 13464 (mt); Figure 44). The 2014 fully selected fishing mortality was estimated to be 0.16 which is 49% of the overfishing threshold (F_{MSY} = 0.325; Figure 45).

Table 29: Catch and status table for Southern New England Mid-Atlantic winter flounder. All weights are in (mt) recruitment is in (000s) and F_{Full} is the fishing mortality on fully selected ages (ages 4 and 5). Model results are from the current updated ASAP assessment.

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
					Data					
Recreational discards	14	16	5	3	9	8	18	2	4	1
Recreational landings	124	136	116	73	87	28	65	31	7	30
Commercial discards	105	151	118	109	165	153	298	483	206	64
Commercial landings	1,320	1,720	1,628	1,113	271	174	150	134	857	658
Catch for Assessment	1,563	2,023	1,867	1,298	532	363	531	650	1,074	753
					Model Results					
Spawning Stock Biomass	5,021	5,517	6,338	5,552	5,038	5,806	6,946	7,116	7,077	6,151
F_{Full}	0.35	0.41	0.36	0.28	0.11	0.07	0.09	0.11	0.19	0.16
Recruits $age1$	13,244	7,368	6,212	9,422	7,416	7,070	5,365	5,281	2,633	4,906

Table 30: Comparison of reference points estimated in an earlier assessment and from the current assessment update. F_{MSY} was generated assuming a Beverton-Holt S-R relationship and an SSB_{MSY} proxy was used for the overfished threshold and was based on long-term stochastic projections. Recruitment estimates are median values of the time-series. 90% CI are shown in parentheses.

	2011	Current
F_{MSY}	0.290	0.325
SSB_{MSY} (mt)	43,661	26,928 (18,488 - 39,847)
MSY (mt)	11,728	7,831 (5,237 - 11,930)
Median recruits (age 1) (000s)	19,256	16,448
Overfishing	No	No
Overfished	Yes	Yes

Projections: Short term projections of biomass were derived by sampling from a cumulative distribution function of recruitment estimates assuming a Beverton-Holt stock recruitment relationship. The annual fishery selectivity, maturity ogive, and mean weights at age used in projection are the most recent 5 year averages; The model exhibited minor retrospective pattern in F and SSB so no retrospective adjustments were applied in the projections.

Table 31: Short term projections of total fishery catch and spawning stock biomass for Southern New England Mid-Atlantic winter flounder based on a harvest scenario of fishing at F_{MSY} between 2016 and 2018. Catch in 2015 was assumed to be 717 (mt), a value provided by GARFO (Dan Caless pers. comm.). 90% CI are shown next to SSB estimates.

Year	Catch (mt)	SSB (mt)	F_{Full}
2015	717	5,439 (4,423 - 6,607)	0.183
2016	1,041	4,732 (3,827 - 5,774)	0.325
2017	973	3,782 (3,057 - 4,645)	0.325
2018	1,515	4,612 (3,267 - 7,339)	0.325

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).

  A large source of uncertainty is the estimate of natural mortality based on longevity, which is not well studied in Southern New England Mid-Atlantic winter flounder, and assumed constant over time. Natural mortality affects the scale of the biomass and fishing

mortality estimates. Natural mortality was adjusted upwards from 0.2 to 0.3 during the last benchmark assessment assuming a max age of 16. However, there is still uncertainty in the true max age of the population and the resulting natural mortality estimate. Other sources of uncertainty include length distribution of the recreational discards. The recreational discards, are a small component of the total catch, but the assessment suffers from very little length information used to characterize the recreational discards (1 to 2 lengths in recent years).

- Does this assessment model have a retrospective pattern? If so, is the pattern minor, or major? (A major retrospective pattern occurs when the adjusted SSB or F_{Full} lies outside of the approximate joint confidence region for SSB and F_{Full}; see Table 7).

  No retrospective adjustment of spawning stock biomass or fishing mortality in 2014 was required.

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

  Population projections for Southern New England Mid-Atlantic winter flounder are reasonably well determined. There is uncertainty in the estimates of M. In addition, while the retrospective pattern is considered minor (within the 90% CI of both F and SSB) the rho adjusted terminal value is very close to falling outside of the bounds, becoming a major retrospective pattern. This would lead to retrospective adjustments being needed for the projections.

- 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.

  No changes, other than the incorporation of new data were made to the Southern New England Mid-Atlantic winter flounder assessment for this update.

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

  The stock status of Southern New England Mid-Atlantic winter flounder has not changed since the previous benchmark in 2011.

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

  The Southern New England Mid-Atlantic winter flounder assessment could be improved with additional studies on maximum age, as well additional recreational discard lengths. In addition, further investigation into the localized struture/genetics of the stock is warranted. Also, a future shift to ASAP version 4 will provide the ability to model envirionmental factors that may influence both survey catchability and the modeled S-R relationship

- Are there other important issues?

  None.

9.1 Reviewer Comments: Southern New England Mid-Atlantic winter flounder

Recommendation: The Panel concluded that the updated assessment was acceptable as a scientific basis for management advice.

Alternative Assessment Approach: Not applicable

Sources of Uncertainty: The major sources of uncertainty are the change in productivity and poor fit to some survey data. There are residual patterns for some surveys (e.g., NEFSC fall and CTDEP) and the retrospective magnitude is close to the confidence limits of the estimates. The natural mortality assumption was revised in the SAW52 benchmark, but the assumption is based on limited longevity information. The Panel noted that the size composition of recreational catch, particularly discards, is poorly sampled.

Research Needs: The Panel recommends that the decrease in productivity should be explored, including environmental effects on recruitment. The potential for depletion of stock components should be considered and information on natural mortality should be investigated. The next benchmark assessment should investigate the weighting of multiple surveys. Recent investigations of maturity should be considered in the next assessment.

References:

Smith, A. and S. Jones. 2008. In. Northeast Fisheries Science Center. 2008. Assessment of 19 Northeast Groundfish Stocks through 2007: Report of the 3^{rd} Groundfish Assessment Review Meeting (GARM III), Northeast Fisheries Science Center, Woods Hole, Massachusetts, August 4-8, 2008. US Dep Commer, NOAA Fisheries, Northeast Fish Sci Cent Ref Doc. 08-15; 884 p + xvii. http://www.nefsc.noaa.gov/publications/crd/crd0815/

Northeast Fisheries Science Center. 2011. 52^{nd} Northeast Regional Stock AssessmentWorkshop (52^{nd} SAW) Assessment Report. US Dept Commer, Northeast Fish SciCent Ref Doc. 11-17; 962 p. Available from: National Marine Fisheries Service, 166Water Street, Woods Hole, MA 02543-1026, or online at http://www.nefsc.noaa.gov/nefsc/publications/

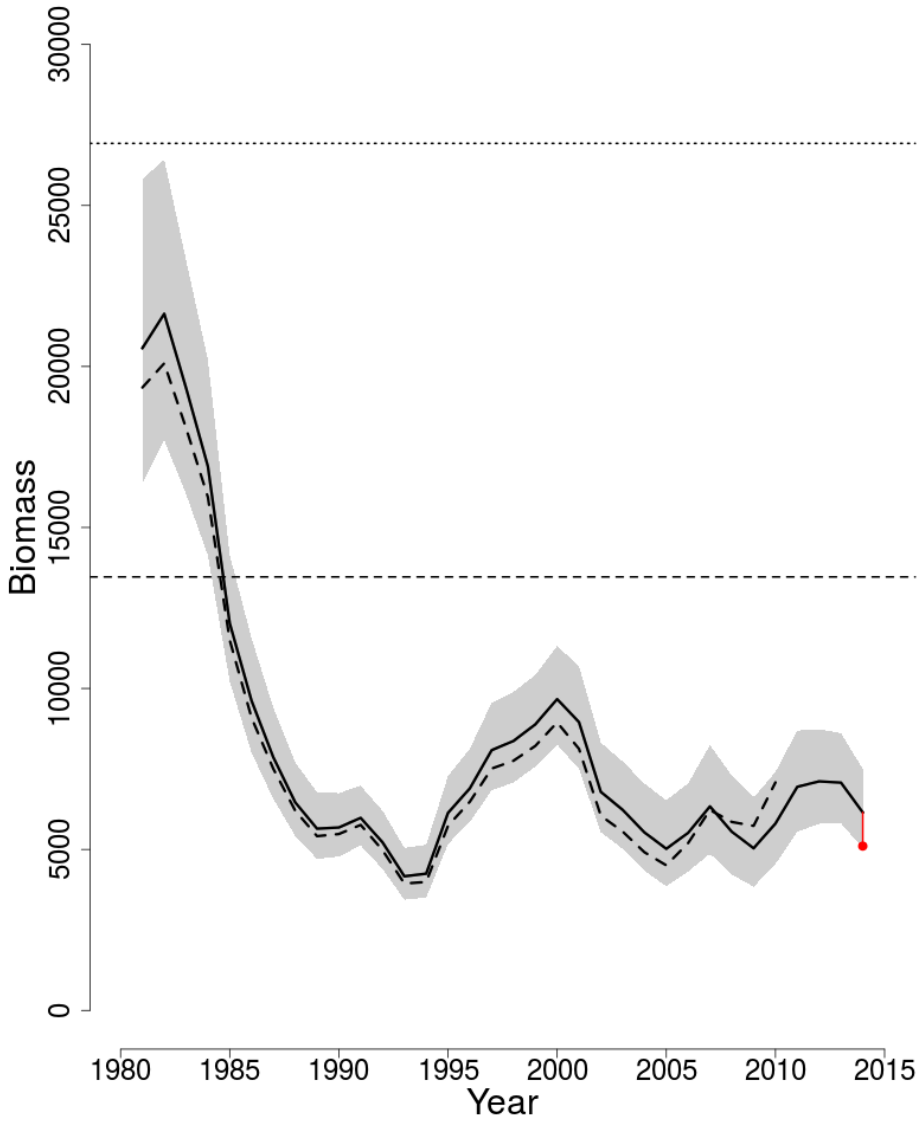

Figure 44: Trends in spawning stock biomass of Southern New England Mid-Atlantic winter flounder between 1981 and 2014 from the current (solid line) and previous (dashed line) assessment and the corresponding $SSB_{Threshold}$ ($\frac{1}{2}$ SSB_{MSY} *proxy*; horizontal dashed line) as well as SSB_{Target} (SSB_{MSY} *proxy*; horizontal dotted line) based on the 2015 assessment. The approximate 90% lognormal confidence intervals are shown.

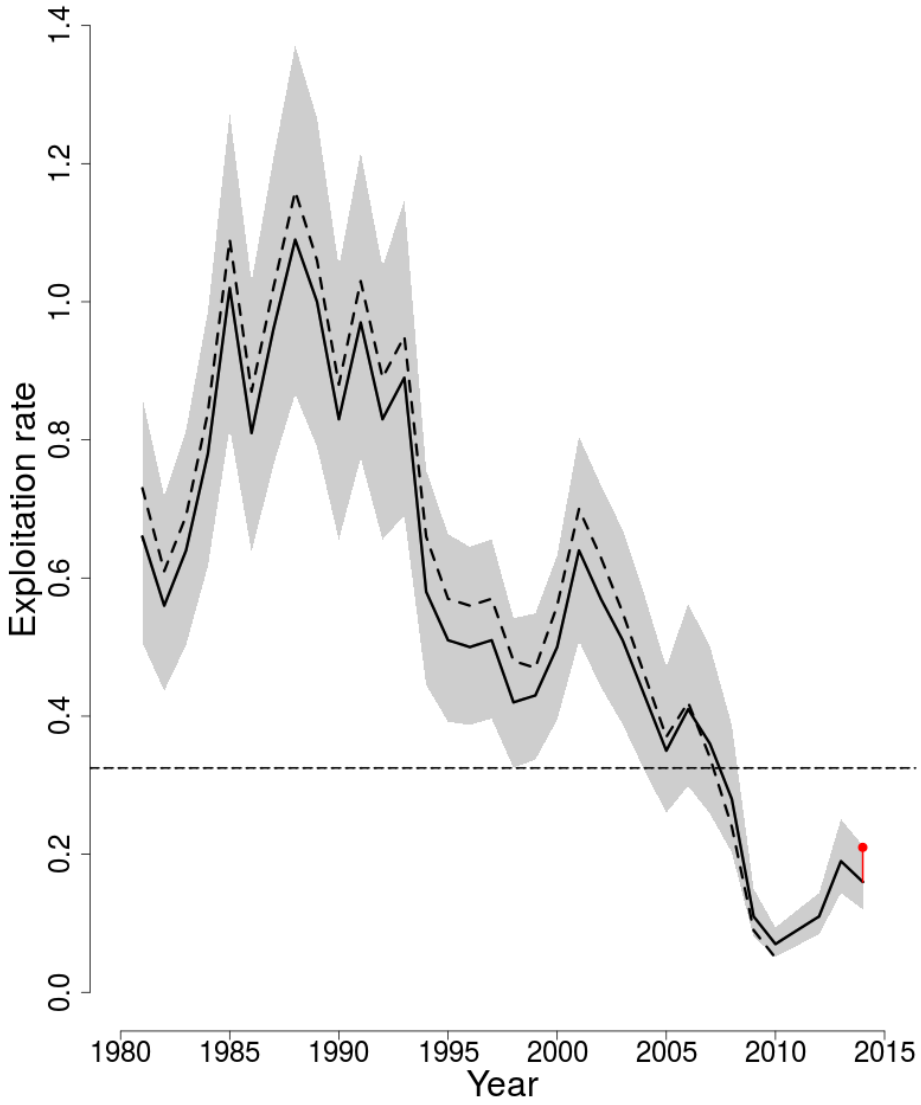

Figure 45: Trends in the fully selected fishing mortality (F_{Full}) of Southern New England Mid-Atlantic winter flounder between 1981 and 2014 from the current (solid line) and previous (dashed line) assessment and the corresponding $F_{Threshold}$ (F_{MSY}=0.325; horizontal dashed line) based on the 2015 assessment. The approximate 90% lognormal confidence intervals are shown.

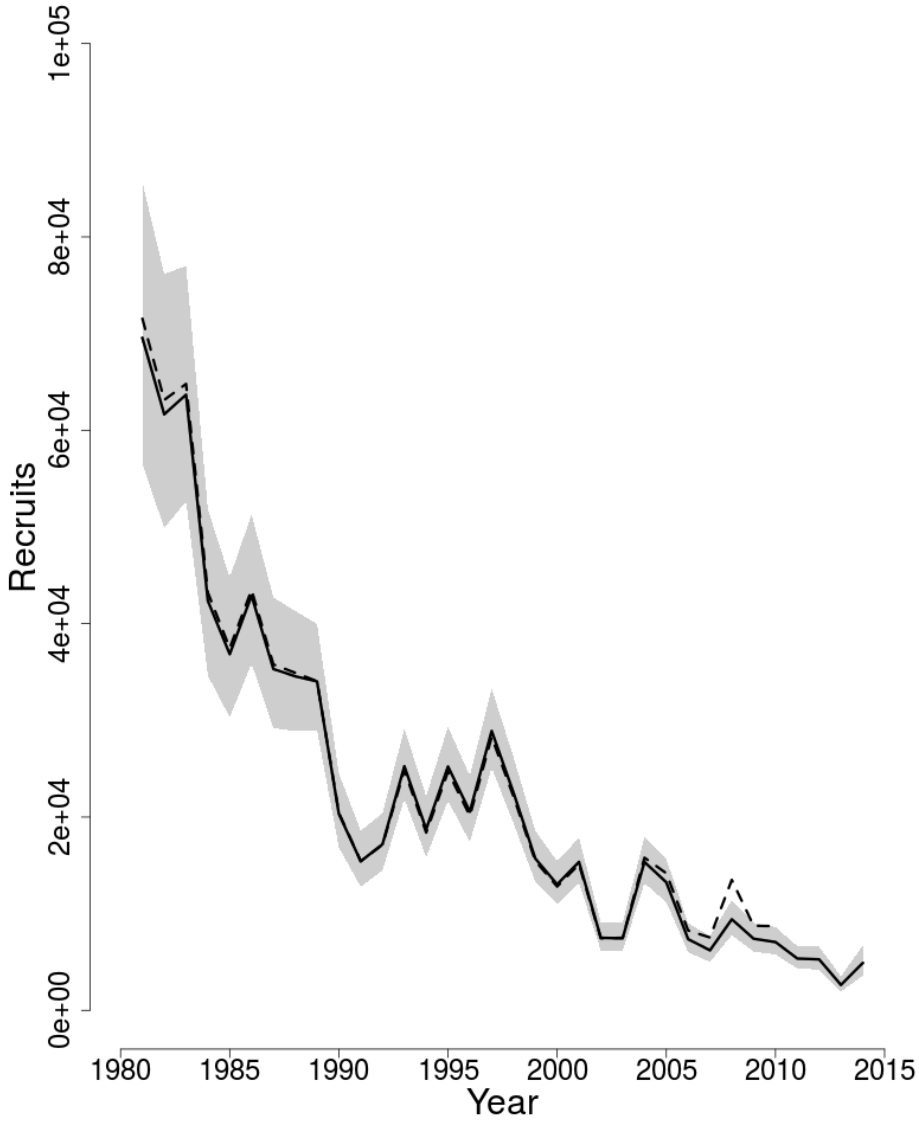

Figure 46: Trends in Recruits (age 1) (000s) of Southern New England Mid-Atlantic winter flounder between 1981 and 2014 from the current (solid line) and previous (dashed line) assessment. The approximate 90% lognormal confidence intervals are shown.

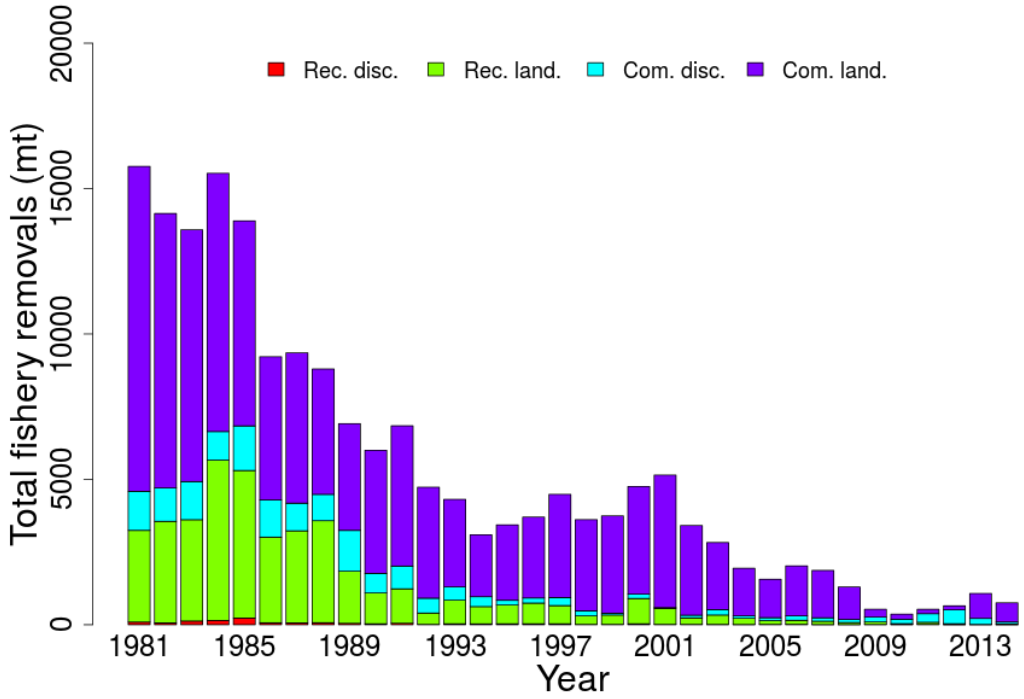

Figure 47: Total catch of Southern New England Mid-Atlantic winter flounder between 1981 and 2014 by fleet (commercial, recreational) and disposition (landings and discards).

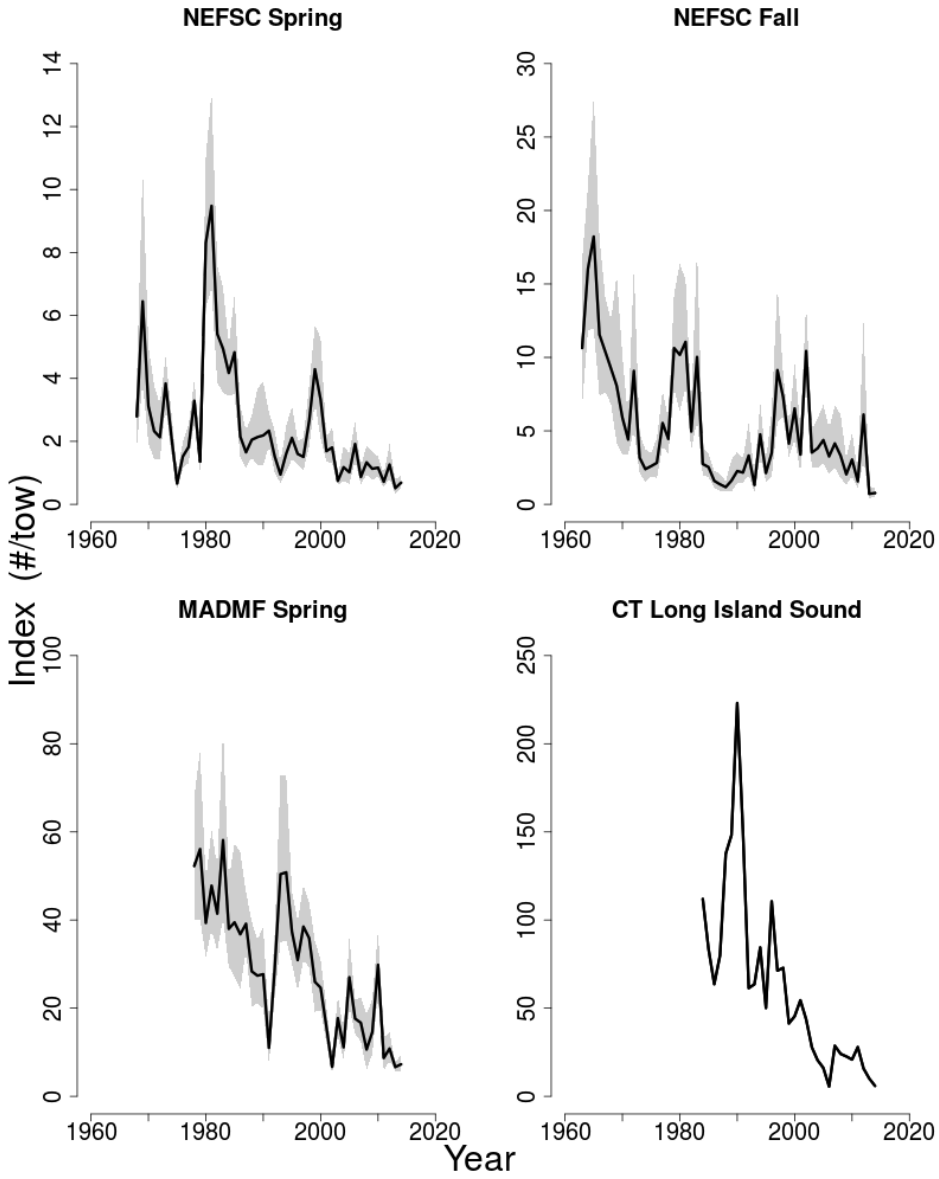

Figure 48: Indices of biomass for the Southern New England Mid-Atlantic winter flounder between 1963 and 2014 for the Northeast Fisheries Science Center (NEFSC) spring and fall bottom trawl surveys, the MADMF spring survey, and the CT LISTS survey The approximate 90% lognormal confidence intervals are shown.

20 Gulf of Maine winter flounder

Paul Nitschke

This assessment of the Gulf of Maine winter flounder (Pseudopleuronectes americanus) stock is an operational update of the existing 2014 operational update area-swept assessment (NEFSC 2014). Based on the previous assessment the biomass status is unknown but overfishing was not occurring. This assessment updates commercial and recreational fishery catch data, research survey indices of abundance, and the area-swept estimates of 30+ cm biomass based on the fall NEFSC, MDMF, and MENH surveys.

State of Stock: Based on this updated assessment, the Gulf of Maine winter flounder (*Pseudopleuronectes americanus*) stock biomass status is unknown and overfishing is not occurring (Figures 95-96). Retrospective adjustments were not made to the model results. Biomass (30+ cm mt) in 2014 was estimated to be 4,655 mt (Figure 95). The 2014 30+ cm exploitation rate was estimated to be 0.06 which is 26% of the overfishing exploitation threshold proxy (E_{MSY} *proxy* = 0.23; Figure 96).

Table 58: Catch and status table for Gulf of Maine winter flounder. All weights are in (mt) and E_{Full} is the exploitation rate on 30+ cm fish. Biomass is estimated from survey area-swept for non-overlaping strata from three different fall surveys (MENH, MDMF, NEFSC) using a q=0.6 assumption on the wing spread.

	2009	2010	2011	2012	2013	2014
	Data					
Recreational discards	4	3	4	1	1	2
Recreational landings	60	40	38	22	29	55
Commercial discards	12	6	4	10	6	5
Commercial landings	283	139	173	348	218	213
Catch for Assessment	359	187	219	381	254	275
	Model Results					
30+ cm Biomass	7,612	6,341	6,666	3,337	2,932	4,655
E_{Full}	0.05	0.03	0.03	0.11	0.09	0.06

Table 59: Comparison of reference points estimated in an earlier assessment and from the current assessment update. An $E_{40\%}$ exploitation rate proxy was used for the overfishing threshold and was based on a length based yield per recruit model from the 2011 SARC 52 benchmark assessment.

	2014	Current

E_{MSY} *proxy*	0.23	0.23
B_{MSY}	Unkown	Unkown
MSY (mt)	Unkown	Unkown
Overfishing	No	No
Overfished	Unknown	Unknown

Projections: Projections are not possible with area-swept based assessments. Catch advice was based on 75% of $E_{40\%}$(75% E_{MSY} *proxy*) using the fall area-swept estimate assuming q=0.6 on the wing spread. Updated 2014 fall 30+ cm area-swept biomass (4,655 mt) implies an OFL of 1,080 mt based on the E_{MSY} *proxy* and a catch of 810 mt for 75% of the E_{MSY} *proxy*.

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 with the direct estimates of stock biomass from survey area-swept estimates originate from the assumption of survey gear catchability (q). Biomass and exploitation rate estimates are sensitive to the survey q assumption (0.6 on wing spread). The 2014 empirical benchmark assessement of Georges bank yellowtail flounder based the area-swept q assumption on an average value taken from the literature for west coast flatfish (0.37 on door spread). The yellowtail q assumption corresponds to a value close to 1 on the wing spread which would result in a lower estimate of biomass (2,995 mt). Another major source of uncertainty with this method is that biomass based reference points cannot be determined and overfished status is unknown.

- Does this assessment model have a retrospective pattern? If so, is the pattern minor, or major? (A major retrospective pattern occurs when the adjusted SSB or F_{Full} lies outside of the approximate joint confidence region for SSB and F_{Full}; see Table 7).

  The model used to determine status of this stock does not allow estimation of a retrospective pattern. An analytical stock assessment model does not exist for Gulf of Maine winter flounder. An analytical model was no longer used for stock status determination at SARC 52 (2011) due to concerns with a strong retrospective pattern. Models have difficulty with the apparent lack of a relationship between a large decrease in the catch with little change in the indices and age and/or size structure over time.

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

  Population projections for Gulf of Maine winter flounder, do not exist for area-swept assessments. Catch advice from area-swept estimates tend to vary with interannual variability in the surveys.

- 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.

  No changes, other than the incorporation of new data were made to the Gulf of Maine winter flounder assessment for this update. However, stabilizing the catch advice may be desired and could be obtained through the averaging of the area-swept fall and spring survey estimates.

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

  The overfishing status of Gulf of Maine winter flounder has not changed.

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

  Direct area-swept assessment could be improved with additional studies on survey gear efficiency. Quantifying the degree of herding between the doors and escapement under the footrope and/or above the headrope for each survey is needed since area-swept biomass estimates and catch advice are sensitive to the assumed catchability.

- Are there other important issues?

  The general lack of a response in survey indices and age/size structure is the primary source of concern with catches remaining far below the overfishing level.

20.1 Reviewer Comments: Gulf of Maine winter flounder

Recommendation: The panel concluded that the updated assessment was acceptable as a scientific basis for management advice. Trends were updated for the NEFSC, MDMF, and MENH surveys. The 2015 catch was estimated including commercial and recreational landings; and the recreational, large mesh trawl, and gillnet discards. Analytic models used previously were deemed inappropriate by the SARC 52 benchmark due to concerns with a large retrospective pattern. The lack of an apparent relationship between a large decrease in catch and little change in indices and age or size structure cause poor fit in models that have been used. Currently the assessment is based on a 30+ cm area swept biomass estimated directly from the surveys. Projections are not possible with area-based assessments.

Alternative Assessment Approach: Not applicable

Sources of Uncertainty: The largest source of uncertainty originates from the assumption of survey gear catchability (q). Biomass and exploitation rate estimates are sensitive to the survey q assumption. Another major source of uncertainty is that biomass-based reference points cannot be determined and overfished status is unknown. The lack of a relationship between the large decrease in catch with little changes in the indices and age and/or size structure over time is perplexing. Catch advice from area-swept estimates tend to vary with interannual variability in the surveys. The lack of an analytical model contributes to uncertainty. It is unknown why the stock is not responding to low catches and low exploitation rates. This is a data-limited assessment, and as such, the results are limited.

Research Needs: Direct area-swept assessment could be improved with additional studies on survey gear efficiency. Inclusion of the spring survey into the assessment should be considered.

References:

Hendrickson L, Nitschke P, Linton B. 2015. 2014 Operational Stock Assessments for Georges Bank winter flounder, Gulf of Maine winter flounder, and pollock. US Dept Commer, Northeast Fish Sci Cent Ref Doc. 15-01; 228 p. Available from: National Marine Fisheries Service, 166 Water Street, Woods Hole, MA 02543-1026, or online at http://nefsc.noaa.gov/publications/

Northeast Fisheries Science Center. 2011. 52^{nd} Northeast Regional Stock AssessmentWorkshop (52^{nd} SAW) Assessment Report. US Dept Commer, Northeast Fish SciCent Ref Doc. 11-17; 962 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/

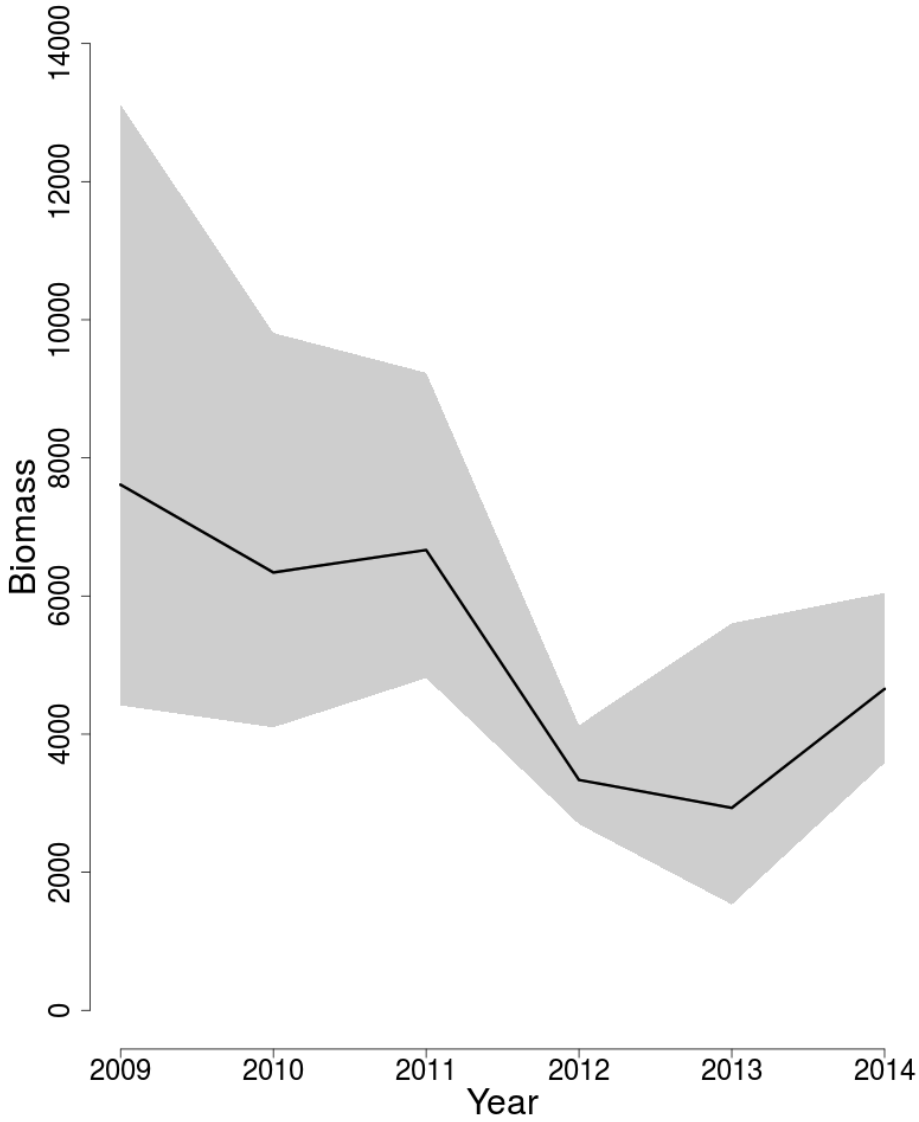

Figure 95: Trends in 30+ cm area-swept biomass of Gulf of Maine winter flounder between 2009 and 2014 from the current assessment based on the fall (MENH, MDMF, NEFSC) surveys. The approximate 90% lognormal confidence intervals are shown.

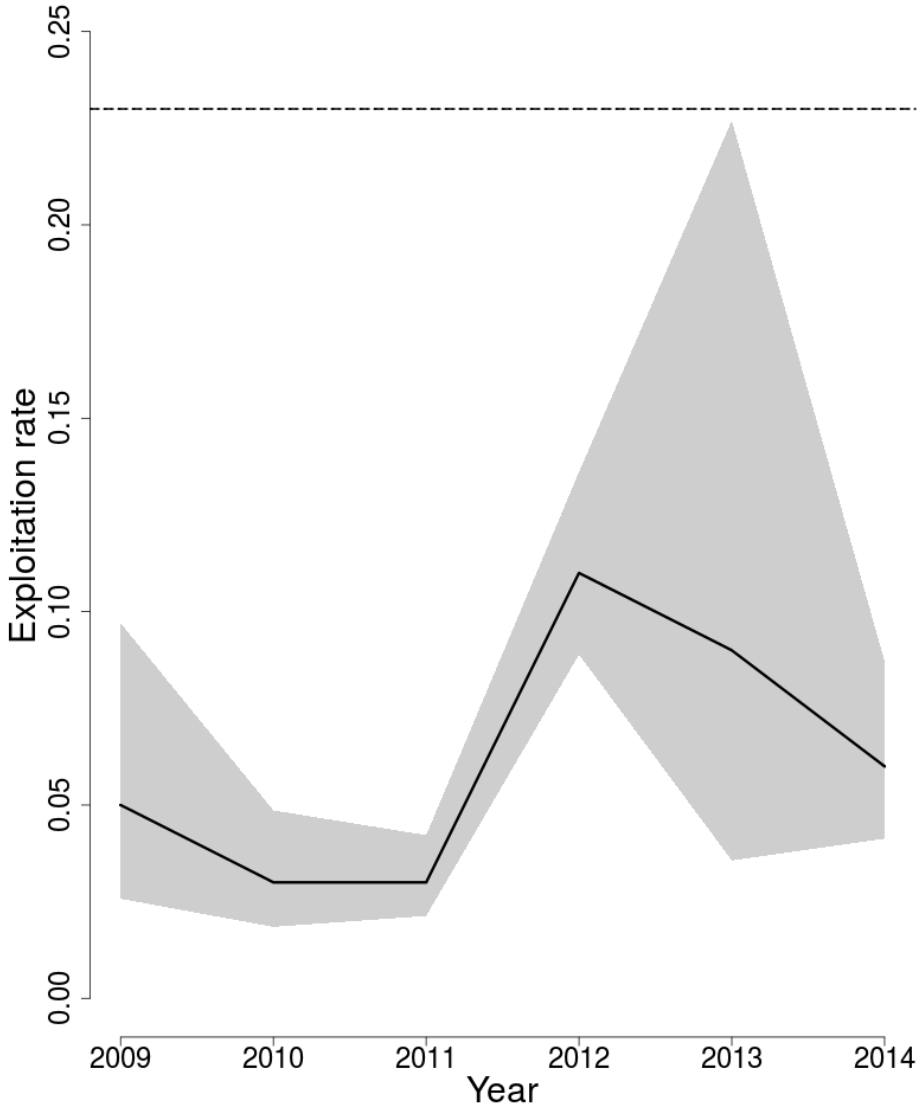

Figure 96: Trends in the exploitation rates (E_{Full}) of Gulf of Maine winter flounder between 2009 and 2014 from the current assessment and the corresponding $F_{Threshold}$ (E_{MSY} *proxy*=0.23; horizontal dashed line). The approximate 90% lognormal confidence intervals are shown.

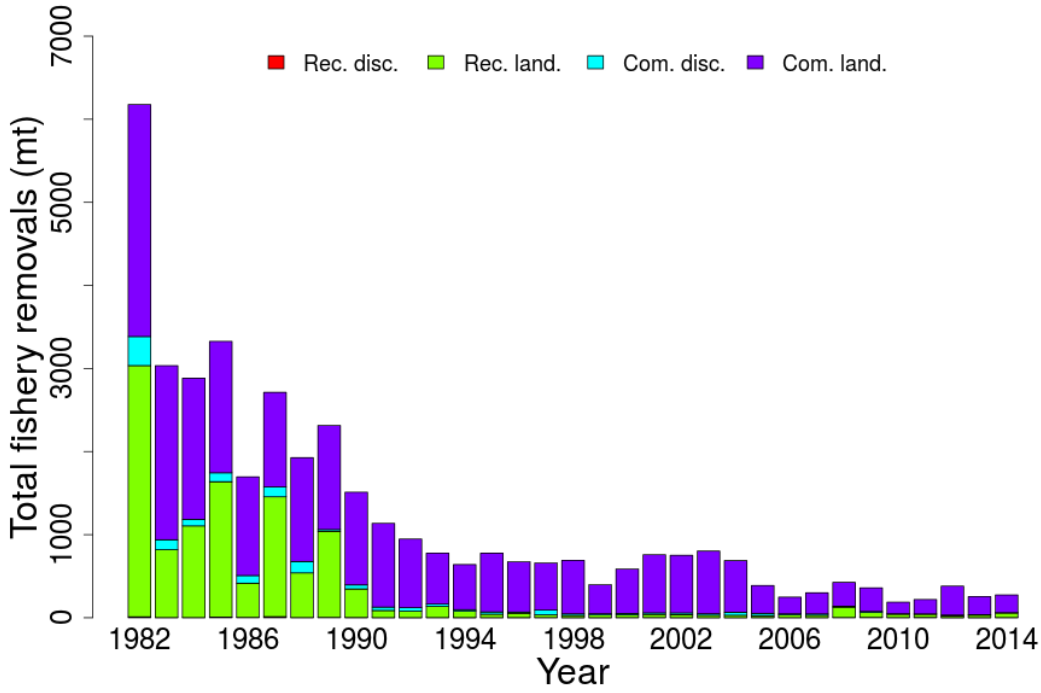

Figure 97: Total catch of Gulf of Maine winter flounder between 2009 and 2014 by fleet (commercial and recreational) and disposition (landings and discards). A 15% mortality rate is assumed on recreational discards and a 50% mortality rate on commercial discards.

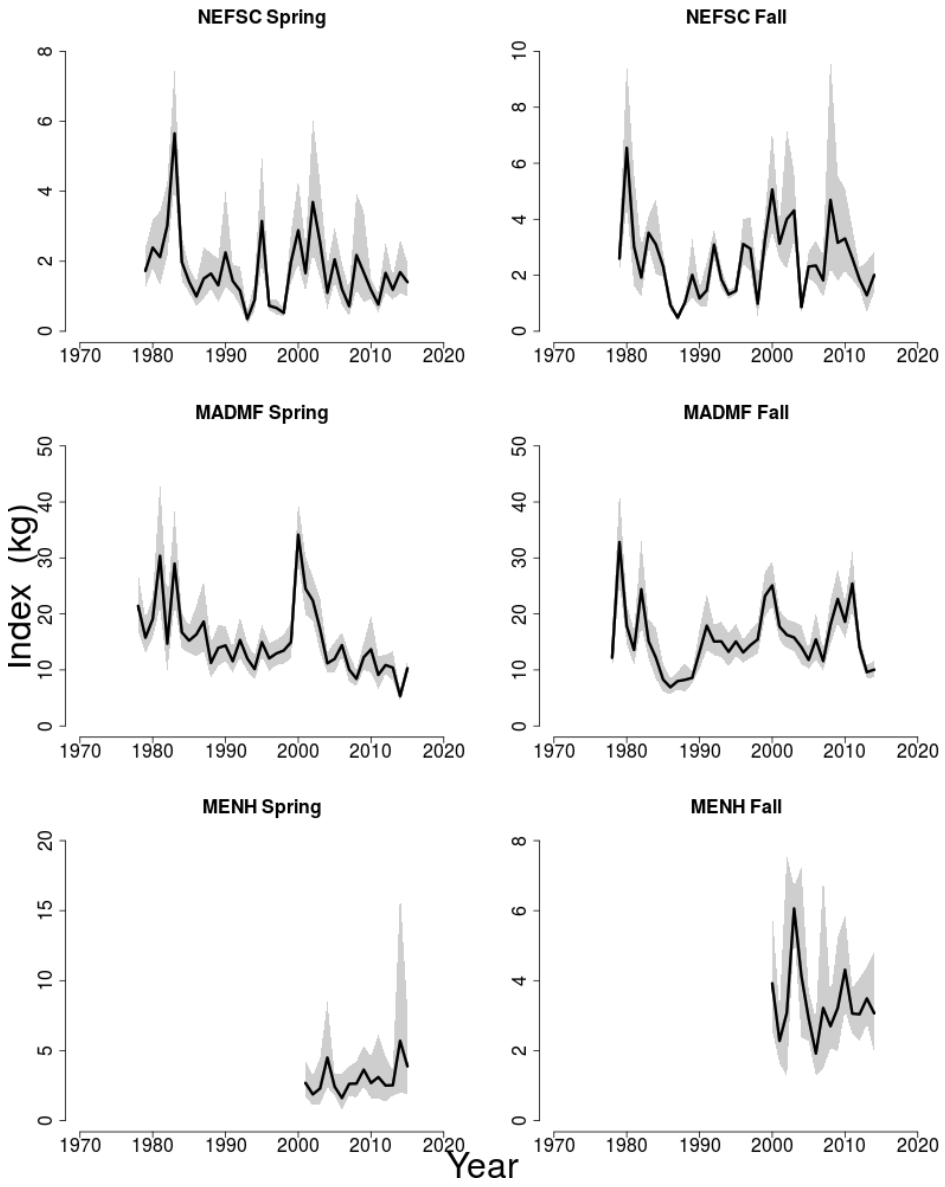

Figure 98: Indices of biomass for the Gulf of Maine winter flounder between 1978 and 2015 for the Northeast Fisheries Science Center (NEFSC), Massachusetts Division of Marine Fisheries (MDMF), and the Maine New Hampshire (MENH) spring and fall bottom trawl surveys. NEFSC indices are calculated with gear and vessel conversion factors where appropriate. The approximate 90% lognormal confidence intervals are shown.

22 Appendix

22.1 Northeast Regional Coordinating Council letter

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Northeast Fisheries Science Center
166 Water Street
Woods Hole, MA 02543-1026

June 30, 2015

Dear NRCC Partners:

At our May 2015 meeting, we discussed the upcoming suite of Operational Assessments for 20 New England groundfish stocks. The NRCC recognized the value in this operational approach, in that it provides information useful to making fishery management decisions for a larger number of stocks and more rapidly and frequently. However, the NRCC also understood that trade-offs are inherent with this approach.

To provide more rapid assessments, these Operational Assessments are conducted using the existing, peer-reviewed assessment model for each stock, updated with new data collected since the last assessment. There is little to no scope for revising the underlying assessment model, as any such changes would require significant analytical work and would also require expanded peer review and discussion. This additional analytical work and peer review are typical of Benchmark Assessments, which are conducted for stocks that require incorporation of significant new information or a different analytical approach.

The NRCC supported completion of the upcoming 20 Operational Assessments and also recognized the importance of setting clear constraints on modifications to the existing models and data streams for each Operational Assessment. These constraints are essential to avoid the possibility for greatly increasing the complexity of each assessment, with resultant delays and reduction in our capacity to complete such a large number of assessments. Communication of these constraints is necessary to discourage external scientists or stakeholders from investing in developing new approaches or data streams that could not be accommodated within the Operational Assessment framework.

In the interest of setting and communicating these constraints, the NRCC reviewed a comprehensive list of types of modifications and agreed whether each type of modification could be accommodated within an Operational Assessment or if the modification could only be considered within a Benchmark Assessment. Since efficiency is essential to the success of the Operational Assessment concept, the majority of modifications could not be accommodated. However, in addition to incorporating new data from existing data streams to update current parameters in the existing assessment models, the NRCC felt that Operational Assessments could make minor adjustments to account for (a) updated information on growth and maturation of fish; (b) changes in values of reference points, but not the underlying basis for the reference points; and (c) introduction or modification of retrospective adjustments for biomass or fishing mortality. Modifications to the discard mortality data stream would be beyond the scope of an Operational Assessment in most cases, but, given recent changes to discard mortality data used for management of the cod recreational fishery, the NRCC agreed that modifications to discard mortality data streams could be considered for the Operational Assessment for Gulf of Maine cod and for other stocks with similar significant changes to discard mortality data.

Other modifications to existing assessment models or data streams would require more extensive analysis consistent with Benchmark Assessments. Modifications of this sort include: (a) changes to the abundance and trend data streams (e.g., changes to surveys, survey indices, LPUE); (b) changes to measures of scale (e.g., new or revised measures of catchability, new catch estimate data streams); (c) changes to the bases for reference points (e.g., updated priors on steepness, incorporation of regime changes); (d) changes in model configuration (e.g., changes in selectivity function, differential weighting of likelihood components, down-weighting of information such as specific year classes, splitting surveys and modeling data separately, new models); and (e) changes in biological information (e.g., changes in natural mortality). None of the modifications in items (a) to (e) will be considered in the Operational Assessments of groundfish in September 2015.

We provide this summary of our discussion for your review and feedback, and seek your concurrence in communicating these guidelines to the public, on behalf of the NRCC.

John K. Bullard
Regional Administrator
Greater Atlantic Regional Fisheries Office

William A. Karp, Ph.D.
Science and Research Director
Northeast Fisheries Science Center

cc: R. Beal, ASMFC
C. Moore, MAFMC
T. Nies, NEFMC

22.2 Assessment Oversight Panel summary

Summary of Assessment Oversight Panel Meeting
July 27, 2015
Woods Hole MA 02543
Draft--September 13, 2015

As part of the Operational Assessment process for the 20 Groundfish stock assessments, the Assessment Oversight Panel (AOP) met in Woods Hole to review the assessment plans for each stock. The meeting was also broadcast as a Webinar.

The AOP consisted of:

Jake Kritzer, Environmental Defense Fund, Boston, MA
Jean Jacques Maguire, Sillery, Quebec
Steve Cadrin, SMAST, University of Massachusetts
Paul Rago, Northeast Fisheries Science Center, Woods Hole

In addition to lead scientists for each stock and other staff from the Population Dynamics Branch, participants included: Tom Nies (NEFMC Exec Director), Jonathan Peros (NEFMC staff), Terry Alexander (NEFMC member), Mike Simpkins (NEFSC) and Jim Weinberg(NEFSC). Participants on the webinar included Aja Szumylo (GARFO), Amanda Helwig, Chris Kellogg (NEFMC), Erica Fuller, Katie Almeida (GARFO), Sally Sherman (MEDMR), Sarah Robinson, Vito Giacalone, Jackie O'Dell, and Doug Butterworth.

The following reports and presentations were reviewed or served as background for the meeting.

- Individual presentations by stock, combined in the file= "AOP 7-27-2015 All Presentations. Pdf"
- Overview of NEFMC Multispecies Groundfish: Data and Model Configuration Summary, in the file "Model-Data-Summary.pdf"
- Summary of Stock Assessment Prospectuses for all stocks assessed by the NEFSC in the file "Stock Prospectus.pdf"
- Memo of June 30, 2015 from Regional Administrator John Bullard and Science and Research Director William Karp to NRCC on guidance for Operational Assessments. File = "nrcc-memo.pdf"

The meeting began at 10:00 am. Lead scientists for each stock gave a series of presentations on the data to be used, model specifications, evaluation of model performance, the process for updating the biological reference points, and the basis for catch projections. Presentations ranged from 10 to 25 minutes and we were able to address all 20 stocks before 4:30pm. Three background documents were provided to the Panel. The first was an updated prospectus for each stock. The second was an overview summary all the salient data and model information for each stock. The third was the NRCC Guidance memo on the Operational Assessments. The NRCC guidance memo was recognized as particularly relevant to the deliberations of the AOP.

The meeting served as a valuable forum for standardizing methods across assessments and resolving a number of potentially contentious issues. The overarching issues addressed included:

- A 90% confidence interval for fishing mortality and spawning stock biomass will be used as an objective way of applying a retrospective adjustment to terminal year stock size estimates. When the Mohn's rho adjusted F and SSB lie outside the joint confidence region of the terminal year estimates, the terminal year abundance estimates will be adjusted by the SSB rho estimate for stock status determination and catch advice projections.

- The likelihood function for the ASAP stock recruitment relationship will not include the constants as part of the function. This precedent was established at the most recent Operational Assessment of Atlantic herring and will be continued here.

- Projections for stock size and catches will be based on the Fmsy proxy and 75% Fmsy (or Frebuild if this rate is already in effect as the default for management (e.g. witch flounder).

- Estimates of catch in 2015 will be provided by the GARFO and will be used in all projections.

- The data quality assurance filter for tows from the FSV Bigelow bottom trawl survey will be based on TOGA criteria rather than SHG, an earlier filter used for the R/V Albatross.

- Values of all assessment reference points will be updated and based on updated growth and maturation values for reference point determination. Biological information will be averaged over the same time period (e.g., 3 or 5 years) as in last assessment. However, there will be no adjustments to the basis of biological reference points (e.g., change from F40% to F30%).

- Changes to natural mortality rate will not be allowed per the NRCC memo.

- For only a few stocks with issues identified in the table below, sensitivity runs will be presented to the Review Panel.

- The AOP provided a review of a study discard mortality rates of GOM cod that is currently in review for the ICES journal. The AOP agreed that the results of the study were sufficient for use in the September Operational Assessments for both the GOM and GB cod stocks.

- The NRCC guidance memo noted the possibility of changing other discard mortality rates if appropriate, and scientifically sound studies were available. In particular, consideration will be given to studies for wolffish and Atlantic halibut.

- The SSC will determine the most appropriate method for determining the OFL and ABC. In the absence of an approved model, this would likely utilize recent average catch over a number of

years to be determined based on the trends observed in the stock. If an ABC has already been approved by the Council under Framework 53 for the 2016 fishing year, it might be utilized in the event the updated model is an insufficient basis for catch determination.[1]

- No alternative dynamic models will be applied in the event that the operational model for a given stock that was approved in the most recent benchmark assessment does not pass the upcoming peer review. Development and application of an alternative model for assessment generally requires a benchmark assessment with a greater scope for review and participation than is feasible in an Operational Assessment.

One of the general conclusions from the meeting was that recommendations for benchmark assessments should be expected for assessments that reveal either revised status or poor agreement between data and models (i.e. lack of fit or strong retrospective patterns). Decisions on benchmarks and their timing will be made by the Northeast Regional Coordinating Council.

Specific recommendations for each assessment were summarized in the attached set of Powerpoint presentations. In general the AOP approved these plans but highlighted a number of clarifications as summarized below:

Stock Name	***Lead Scientist***	***Major Comments***
Overview of Process	Paul Rago	Terms of Reference listed in presentation will be used.
Gulf of Maine Cod	Michael Palmer	Results for both the Mramp and constant M will be presented. Discard mortality for recreationally caught fish will be reduced from 30% to 15%.
Georges Bank Cod	Loretta O'Brien	Discard mortality for recreationally caught fish will be reduced from 30% to 15%. The M=0.8 VPA and associated consequence analysis developed by the TRAC for EGB cod are outside the scope of the update, and any inconsistency between the GB cod update, and EGB cod assessment methods or TMGC decisions will need to be reconciled in the Council process.
Gulf of Maine Haddock	Michael Palmer	Base run should turn the likelihood constants OFF but should be turned on for a sensitivity run.
Georges Bank Haddock	Liz Brooks	Base case model will omit certain strong recruitments from bootstraps but a sensitivity analysis will include them. Results are relevant to estimation of 2013 year class.
Cape Cod/Gulf of Maine Yellowtail Flounder	Larry Alade	No comments
Southern New England/Mid-Atlantic	Larry Alade	Split survey run will not be included. Confirm that recent recruitment is low vis-à-vis projection assumptions.

[1] Subsequent to the meeting NEFMC staff noted that the 2016 ABCs for GM haddock and GOM cod were approved by the SSC only with the understanding that new ABCs would be adopted in the 2015 assessments. Hence it may not be appropriate to use the existing ABCs as "Plan B" alternatives. The AOP did not comment on this.

Yellowtail Flounder		
Georges Bank Winter Flounder	Lisa Hendrickson	Do not use AIM as Plan B. Discard mortality =100% because no satisfactory alternative is available for this stock.
Southern New England/Mid-Atlantic Winter Flounder	Tony Wood	Do not use scaled Q as Plan B for this stock
Acadian Redfish	Brian Linton	No Comments
American Plaice	Loretta O'Brien	No Comments.
Witch Flounder	Susan Wigley	This VPA assessment has a split series. If a significant retrospective pattern is observed, the rho adjustment factor will be applied.
White Hake	Kathy Sosebee	Per the SARC 56 benchmark, a truncated CDF of recruitment will be used for catch projections (1995-2012). Reference points will be based on recruitments from 1963-2012. Plan B = catch for 2016 per Framework Adjustment.
Pollock	Brian Linton	Perform sensitivity analysis with flat-topped selectivity assumption. This sensitivity run has been useful to SSC for setting ABC in the past.
Wolffish	Chuck Adams	Recent average catch will be used as basis for Plan B. Updated maturation data will be used in model formulation. This is additional information collected in same manner as used in previous assessment.
Atlantic Halibut	Dan Hennen	The current model for Atlantic halibut sensitive to initial conditions. The final determination of the model's utility will be determined by the review panel in September. AOP recommended sensitivity analysis of model to assumed discard mortality rate. Plan B = recent average catch.
Gulf of Maine/Georges Bank Windowpane	Toni Chute	Recent average catch will be used for Plan B if assessment model fails. Canadian catches have not been reported in recent years and cannot be used in this assessment. The use of projections was questioned, noting that the PDT has chosen not to use these in recent years. However, the AIM projection method is part of original assessment benchmark and should not be changed.
Southern New England/Mid-Atlantic Windowpane	Toni Chute	As above
Ocean Pout	Susan Wigley	No changes
Gulf of Maine Winter Flounder	Paul Nitschke	No changes to BRPs values expected because no changes in growth rates observed. Empirical model only uses data from Bigelow surveys.
Georges Bank Yellowtail Flounder	Chris Legault	This assessment was updated as part of the TRAC. No further revisions will be done at the Operational Assessment.

The meeting concluded at 4:30 pm. Assessment reports will be prepared by the lead scientists and uploaded to the following website http://www.nefsc.noaa.gov/groundfish/operational-assessments-2015/. Draft assessment reports will be made available approximately two weeks before the Peer Review Panel meets September 14-18. In addition to the short summary reports, all of the model inputs and outputs, and supporting tables, figures and graphs will be made available via a web-based tool.

22.3 Outreach on 2015 groundfish operational assessments

Outreach on 2015 Groundfish Operational Assessments

Given the relatively new process associated with these operational assessments, the NEFSC made an extra effort to promote understanding of the process ahead of the peer review meeting. These efforts included a webinar/seminar for in-house outreach staff, sector managers, and New England fishery Management Council groundfish and recreational fishing advisors on July 20, and a data-rich dedicated website:
http://www.nefsc.noaa.gov/groundfish/operational-assessments-2015/

On July 22, 2015 the NEFSC also held five port-based outreach meetings for fishermen and other stakeholders. These occurred in Maine (Portland), New Hampshire (Hampton), and Massachusetts (Gloucester, Woods Hole, New Bedford.) Assessment analysts met with attendees at each location to learn more about recent observations from the fleet and ports that might help focus future research to improve assessments. Each meeting started with a brief introduction on the timeline for the assessments, what new information would be considered, and how the results would be reviewed before use in the fishery management process.

Although not the first time that outreach meetings have been held for industry ahead of an assessment, this is the first time that summaries of the meetings are included in the assessment report and provided to peer reviewers. The summaries were prepared from notes taken by NEFSC communications staff, then provided to meeting attendees for comment before they were finalized for publication.

2015 Groundfish Operational Assessment Industry Outreach Meeting—Portland Maine
22 July 2015

Observations

Scientific surveys are unreliable indicators of fish abundance: Many attendees were concerned that there will be decreases in their quotas because of survey data, which they do not believe reflects fish abundance. They're concerned that the timing of the survey cruises and the sparse coverage of areas where fishermen are seeing the most fish do not give a complete representation of the fish population. In particular, two fishermen noted that they avoid fishing Platt's/New Ledge because there is an abundance of cod there, yet three NEFSC tows that occurred in that area caught zero cod in the spring. Overall, they worry that the survey is "too thin" because of the variability in the movement of fish. For example, there may be an area where fishermen don't catch anything for weeks, but then after a month or so that same area is flooded with fish. If the survey only covers that area on one day, and that day happens to be an off day, then the scientists won't know that sometimes that area is full of fish. A participant at the meeting noted that all these characteristics would be expected to increase the variability of the survey, but not create bias, meaning the long term trends should be representative.

Concerns that reduced landings of a species are interpreted as lower abundance: Some fishermen stated that they are under their quota on some fish (such as monkfish) simply because they are trying to avoid species such as dabs and gray soles. They would like a higher quota on the dabs and gray soles so that they can take their quota on monkfish. The fact that they aren't catching as many monkfish as allowed is not because that stock is low, but because fishermen are trying to avoid other fish that occur

with monkfish. There is concern that the way this appears in the landings data suggests that there are fewer fish in the water than are really there. An NEFSC analyst noted that low catch is not assumed to mean low population abundance.

Fishermen report large numbers of cod in pocketed areas they are avoiding or can't access: The fishermen and charter boats aggregate in one area in order to avoid catching "choke" stocks. They see pockets of cod everywhere and are afraid to fish in those areas because they don't want to go over their quotas. They are hearing from scallopers that there are cod on Georges Bank and near Canada. Lobstermen tell them they are seeing young cod in their lobster traps.

Cod populations, while not at high levels, are in better condition than the assessments indicate: Many fishermen said they simply do not see evidence on the water of what the science is finding. They feel that cod is recovering, perhaps not at record highs, but it is not as low as the assessment.

Revised Gulf of Maine cod recreational discard mortality rates will lower quotas: Some fishermen are worried that the fact that revised recreational discard rates allowed in the upcoming assessments will lead to a lower quota overall. There is concern that their quotas will only drop as a result of these assessments. An analyst noted this was not the case; quotas could increase if the updated assessments indicate increased stock abundance.

Early warning of a changing trend in the population or quota allocation would be welcome: A seafood processor raised the issue of stability and predictability. He cannot always buy the fish that come in locally because he might be set up to process something different. If he had some advance warning about which species would be allowed more catch, then he could be prepared to process what comes in. Overall, industry members indicated that they would like some advance notice of what to expect from these assessments and that more stability would be helpful. But one participant noted that stability at low catch amounts is not desirable.

Are Gulf of Maine cod and gray sole being out-competed? The fishermen had questions about fish that swim together possibility out-competing depleted stocks for resources. For example, monkfish might be outcompeting gray soles and haddock might be outcompeting cod. Other ecological concerns were raised, such as red tide. An NEFSC analyst noted the difficulty in trying to find a direct link between two species in such a complex ecosystem with many species and interactions.

Fishermen would like to take a more active role in the assessments: Fishermen would like to communicate with the assessment scientists and relay them what they are seeing on the water. The fishermen feel that the scientists should be able to reach out to them if they come across data that doesn't add up and perhaps they could explain something that's happening at sea that would factor into what the science seems to be showing.

Scientific surveys should better track fishery practices: Some felt it would be better if the survey used the same kind of gear, same trawl speed, and go to the same places as the fishermen. Let the fishermen show the scientists where the fish are and what they are seeing. Side by side tows with the survey vessel and the commercial fishing vessels might provide useful information and would help improve credibility

in the survey. An analyst noted this is exactly what is done during cooperative research projects when catching fish for a particular study is the goal, scientists rely on the fishermen's knowledge to find the fish. However, multispecies surveys require sampling in all the habitats, some of which will not be suited for a particular species.

Fishermen's feedback needs to be reflected in assessments: Several fishermen felt that the cooperative research programs were useful in bridging the gap between the fishing industry and the assessment scientist. Most importantly, if NEFSC shows that it is using fishermen's feedback in the assessment process, then there will be more willingness for future collaboration and continued dialog. An NEFSC analyst noted that these meetings were the first step towards doing exactly that.

Potential Areas for Further Examination or Research

- Consider fine-scale surveys of areas where fishermen expect large cod are occurring, or other ways of increasing survey stations in these areas
- Investigate occurrence of cod and gray sole in lobster gear and whether this significant enough to warrant further sampling or monitoring.
- Interrogate food habits data regarding competition among monkfish, cod, haddock, and gray sole in the Gulf of Maine
- Seek a way to turn the kinds of observations obtained in industry outreach meetings like this one into data that can inform assessments
- Find ways to more effectively use cooperative research to bridge the gap between the fishing industry and the assessment scientist

2015 Groundfish Operational Assessment Industry Outreach Meeting—Hampton, NH
22 July 2015

Observations

Scientific surveys are unreliable indicators of fish abundance and vary too much: There was a general frustration in what was called the "inconsistency" of the survey. If fishermen could see reliable, consistent results from the survey, results that match up with what they are seeing on the water, then they would believe the survey is consistent. Because they feel the results are not reliable, some are calling for a complete overhaul of the trawl data and how scientists are collecting it. Those present were concerned about the small number of surveys per year, the number of stations (too few), the tow protocols, the timing, the reluctance to change the survey to account for changing water temperatures, and so on. There were also concerns about trawl gear bottom contact, and avoiding survey stations where other fishing activity is occurring (particularly lobster pots). An analyst noted more tows in each survey would increase the precision of the survey, but would not be expected to change the mean.

Seasonality is an overlooked parameter in the scientific surveys: The fishermen feel the time of year when the survey occurs is even more important than location. The research survey tows in the spring,

but cod swim in certain areas a certain times of the season. It doesn't make sense to tow when the fish aren't around, so of course the survey isn't going to catch anything at the beginning of May. Still location remains a factor. There's the concern that the areas the research cruises tow are not a representative sample.

Closed areas should be better surveyed: There were concerns the closed areas don't get surveyed at all on any given year. It was suggested that the strata need to be redrawn to ensure sampling occurs in each closed area during each survey.

Fish are present in relatively large numbers in areas fishermen are avoiding or can't access: Fishermen are concerned that the assessments are not going to capture the numbers of fish and their location in the areas fishermen are avoiding because they contain an abundance of cod. They worry that the scientists will assume they are catching less fish because there are fewer fish available, not because they are avoiding going over their quotas. An NEFSC analyst noted that reduced catch by the fishery is not assumed to mean fewer few in the population, and that fishery models relate the annual amounts of catch to changes in the survey to estimate the size of the population.

Surveys should cover the line of areas where fishermen expect to catch cod: The fishermen worry that the population of several stocks is increasing but this is not reflected in assessments because the research vessels are not capturing that information. As a result, the fishermen are not taking quotas of healthier stocks because they are avoiding the ones with lower quotas. They are frustrated that research vessels do not survey along a line of areas where they expect to catch cod, and then the scientists could note the differences from year to year in the places where cod are typically caught. An NEFSC analyst noted that the Maine-New Hampshire originally included fixed stations but that these were abandoned after a number of years because they were not providing additional information.

Are changing environmental factors (climate variability and change) and competition among species being considered in establishing survey stations and in assessments? If the water temperatures have been rising, fish that like colder water might be swimming deeper to stay in those ideal temperatures. Many of these fish are now living at deeper depth than they used to according to some participants. NEFSC analysts noted that the surveys do sample in these deeper waters as well. Fishermen also asked about competition for resources among different species. For example, is it possible that the abundant numbers of haddock are outcompeting cod because they occur together? The fishermen were concerned about maximum sustainable yield of all stock simultaneously when they compete at the same niche. Many species compete in pairs, e.g., cod and haddock, witch flounder and American plaice, yellowtails and blackbacks. All the species compete, but it is most fishermen's experience that when one of the species in the pairs listed is abundant, the other species is less abundant. So when, for example, haddock is abundant cod is less abundant. Fishermen would like to have this observation investigated.

An NEFSC analyst noted that there are many species in the region that are generalist feeders, making it hard to directly relate the change in abundance of one species to that of another.

Spring and summer 2015 conditions should be used in operational assessments: Some seemed discouraged that the data being used for the upcoming assessments will not reflect the population

dynamics found in the water this spring and summer. An NEFSC analyst noted that one goals of the operational assessments is to reduce the lag between the most recent data that can be included and the most recent data collected. Data from spring and fall 2015 will be included n the next update. To include these data in the 2015 operational assessment would delaying the analyses until these most recent data collected are ready for use.

Fishery-dependent data does not accurately reflect abundance: From Gloucester to Maine, some suggested, all the charter party boats are huddled in a ten mile spot, and VTRs will show that they are in the one same area to avoid catching cod. This is problematic because there won't be much fishery-dependent data on the many areas where the fishermen are seeing high numbers of cod.

Fishermen want more opportunities to talk to assessment scientists, but worry about the risks of doing so: Fishermen are reluctant to say exactly where the fish are because they're worried NOAA will then close those areas. Industry members would like more opportunities to interact with the scientists. They'd like to review the assessment reports before they are public, and if there's an FAQ section on the website, they'd like the ability to respond so that there's more of a dialogue and exchange happening, rather than information only flowing one way. An NEFSC analyst noted his participation in cooperative research aboard a commercial boat was a positive experience and suggested that meetings like these would also help. The participants were asked if there were other ways of communicating between scientists and the fishing industry that could be tried. Google hangout was mentioned as a possibility.

Something doesn't add up if the fishermen are seeing cod at the same rate they have been for 10 years, but the scientists are saying that the population is only at 3%: Many said they could not believe that the stock size of cod is what the assessments indicate because they are catching so many. Some fishermen said there was a dip five years ago, but this year they are seeing the healthiest levels that they've seen in 7 years. They are finding cod higher up in the water column. One fisherman works on research projects and has no trouble targeting cod of any age or size. In addition, lobstermen are seeing age 1 cod in their traps, more than they've seen before.

Potential Areas for Further Examination or Research

- Consider fine-scale surveys of areas where fishermen expect large cod or other fish believed to be scarce are occurring, or other ways of increasing survey stations in these areas
- Investigate occurrence of cod and wolfish in lobster gear and whether this significant enough to warrant further sampling or monitoring.
- Interrogate food habits data regarding competition among monkfish, cod, haddock, and gray sole in the Gulf of Maine
- Seek a way to turn the kinds of observations obtained in industry outreach meetings like this one into data that can inform assessments

2015 Groundfish Operational Assessment Industry Outreach Meeting—Gloucester, MA
22 July 2015

Observations

Catch rates for Gulf of Maine cod are increasing: Fishermen observed that their catch rates for cod are increasing. They contended that, after a few years of decline, the cod are back and are plentiful, much more so than in the 1990s. Several said that they are easily filling the current quota and fear they cannot avoid all of the cod that are out there, even by using cod-end sensors to try to avoid large catches of cod, as many in the Gloucester fleet have been doing since 2009. Participants questioned how, if GOM cod is at 3% of the SSB target, they could be consistently finding Gulf of Maine cod throughout the range (inshore and offshore) and be spending so much time avoiding cod. By way of example, some fishermen noted that during the 2014 fishing year they were actively staying away from areas where they knew Gulf of Maine cod would be located because of the 2014 reduction in ACL (1,500 mt). But, when word of a pending Emergency Action became known, more GOM cod were caught (easily) in the weeks leading up to the Emergency Action than during the prior 5-6 months of the 2014 fishing year to date. These observations do not comport with the Gulf of Maine cod assessment, which indicates that the stock is at historic lows.

The Gulf of Maine cod population has significant numbers of large fish that are not available to the fishery and therefore not showing up in logbooks or landings: Participants were concerned about the reported "age truncation" of the stock. Their belief is that there has been a consistent supply of Gulf of Maine cod of many sizes (scrod, market and large) being caught and landed. Several fishermen reported that large fish are showing up in their catch. There was discussion of what was meant by “large” and a range of views on that. Among the measures discussed were relative size (large or small), absolute length (measured in inches or centimeters), market category (scrod, market, large), and age structure (i.e., what ages are considered “old” and what length does that represent? Are those “old” fish associated primarily with the large market category?) Many felt that these large cod are sheltering in areas that are no longer fished because vessels are too small to reach them, or where they are too numerous to avoid (thereby risking quota overage or opportunities to fish for other species), or in closed areas. Some of the areas mentioned as harboring the large cod are: Cash’s Ledge, Whaleback, deeper waters, and the mid-western portion of Gulf of Maine closure. The reported presence of significant numbers of large cod is at odds with the assessment finding that the age structure of the population is truncated.

Recreational fishermen are catching large cod inside the western Gulf of Maine closure: Several commercial fishermen asserted that this is the case. The reported presence of significant numbers of large cod in recreational catch is at odds with catch data collected from the recreational fishery that reflect a truncated size structure, similar to data from the commercial catch.

The Gulf of Maine cod population has significant numbers of large fish that are not available to the research surveys: The fishermen have numerous concerns about the scientific resource surveys. These

include the density of sampling (too sparse), the frequency of sampling (not often enough), and not in the right place (where cod do not occur).

Prevalence of lobster gear inshore prevents detection of cod that are present in these areas: Several people expressed concern that important areas of the Gulf of Maine are not being surveyed by scientists or fished by groundfishermen because of the density of lobster traps. There's a perception that those unsampled areas are providing a refuge for cod and gray sole that are not being counted in the assessment. Fishermen also referenced anecdotal reports of lobstermen seeing lots of cod. Scientists from the Northeast Fisheries Science Center (NEFSC) and from Massachusetts Division of Marine Fisheries (MADMF) indicated that the MADMF survey is consistently able to make tows along inshore areas where lobster gear occur, and that a review of their database indicated very few occurrences where a planned tow was moved due to presence of gear.

Undocumented discarding in the 1990s may be skewing abundance estimates: Fishermen acknowledged that there was undocumented discarding of cod in the 1990s when the restrictive trip limits were introduced. The result was discarded cod unaccounted for in catch data, and a skewed picture of age composition based on landings because of high grading, both of which could still be affecting the population abundance trend in the assessment.

Survey data have too much influence on population estimates, while commercial data have too little: This was a widely held view.

Potential Areas for Further Examination or Research

- Seek a way to turn the kinds of observations obtained in industry outreach meetings into data that can inform assessments.
- To better explain perceived inconsistencies between fishermen's observations and assessment results, conduct work to:
    - Better document fishing patterns and how they have changed under sectors and in response to management measures. This could be characterized both spatially and temporally, including maps of fishing grounds, and geographic distribution of landings by statistical area and port. This could also include an examination of seasonal oceanographic conditions relative to well-defined fishing grounds over time. Input from fishermen as well as analysis of VTRs could help identify well-defined fishing grounds over time.
    - Examine the implications of 1990s unreported discarding and high grading on assessments. This could take the form of a limited set of sensitivity analyses to bound the scale of unreported catch.
- Examine density of survey tows by strata over time, and spatial distribution of tows within strata over time, to address concerns that the survey sampling is inadequate. This could be compared with reported areas of fishery landings over time from VTRs and observer data.
- Investigate the effects of closed areas and fishing patterns on port sampling data (age, length and market category)

- Investigate occurrence of cod and gray sole in lobster gear and whether this is significant enough to warrant further sampling or monitoring. It was noted by NEFSC scientists that there is now increased observer coverage on lobster trips. Sampling and monitoring of this fishery will likely evolve over time based on reviewing annual patterns of bycatch.

2015 Groundfish Operational Assessment Industry Outreach Meeting--Woods Hole, MA
July 22, 2015

The NEFSC Woods Hole Laboratory hosted guests from the Nature Conservancy and the Mass. Fisherman's Partnership. Roughly a dozen fishermen and fishery managers participated in the conference call/webinar, which was also open to the meeting held in New Bedford. Following the presentation and Q&A, New Bedford exited the conference call, and each location hosted its own discussion. Some callers remained on the phone to participate in the Woods Hole meeting. Most discussion points were covered in conjunction with New Bedford, but Woods Hole-specific topics are highlighted below.

Many attendees expressed appreciation for the opportunity to talk with the NEFSC, though there were requests that future meetings be held in the late afternoon/early evening to accommodate fishing schedules.

OBSERVATIONS

(WH, NB)

Timing of Operational Assessments: The idea was floated by one caller to conduct the more thorough benchmark assessments more frequently. NEFSC staff explained why conducting large-scale benchmarks every year is not efficient, and does not result in a better picture of stock status. Benchmarks are best used to consider significant new data or methods, things that fundamentally change the patterns of scale and that are not available on an annual basis. Because of their complexity, expense, and required analyst time, doing more benchmarks also means fewer annual updates and operational assessments and more time between assessments for each species.

Assessment Process Data Sharing: Several participants and callers wanted specific timing for when the data portal associated with the groundfish operational assessments would be available for use. NEFSC staff indicated that the database will be functional by the time reports are delivered to the reviewers, currently expected to be at least one week, but possibly two weeks ahead of the assessment meetings.

Assessment Meeting Reviews: There was a question about the groundfish operational assessment process. Would the peer reviewers have the authority to reject a stock review outright? NEFSC staff said the peer reviewers can recommend changes similar to those that occurred with the 2015 Herring Operational Assessments, which incorporated retrospective adjustments. NEFSC staff noted that biological reference points used in the last assessments for these species are being retained, but

reference point values may change based on new data, which could actually result in a change in stock status if systematic trends in weight and age are found.

Assessment Meeting Logistics: Callers requested the names of the panel as well as schedule details for September's meetings. NEFSC replied that the report would include text written by peer review panel, and short summary statements on all 20 stocks. Monday through Thursday would be used to present and discuss assessment results for each species/stock. Friday will be used for synthesis and report writing. NEFSC staff reiterated that brief, detailed feedback would be welcomed throughout the entire process.

Assessment Meeting—Stock Prioritization: Several participants wanted to know how we currently prioritize future benchmark studies, and wondered how we will prioritize them going forward. NEFSC staff explained that it was a long-term issue with many components, but this may represent an opportunity for further developing a process.

Observer Monitoring : Several callers expressed considerable reluctance to embrace the fishery monitoring process. Many were concerned about relying on fishery monitoring data, given the significant changes happening and the level of turmoil in the process. The controversy over funding the monitors continues to be a challenge, with several callers voicing strong opinions on whether the presence/absence of an at-sea monitor affects observation bias. Specific comments are as follows:

"Trip duration and landing quantities are measures of bias induced by monitoring."

"Monitoring reduces scope for normal behavior. "

"I haven't changed my fishing limits based on observer status. I don't have the time or bank account to change anything I do to accommodate a monitor. But I think I'm in the minority, because I know a lot of other fishermen who will change their behavior to skew the data."

A related discussion at the Woods Hole meeting centered on random selection of trips for fishery monitoring. Some participants felt strongly that the selection is not as random as it should be. The perception is that observers only seem to want certain boats. One caller asked what the effect would be if at-sea monitoring is eliminated, with NEFSC staff replying that discard estimates would be less precise due to a smaller sample size. The NEFSC may have an opportunity here to assist the fishing community by offering as much info on the fishery monitoring program as possible—one example being an online tutorial on the program.

Data usage and assessment cut-off dates: One caller requested an explanation of how NEFSC incorporates fishery and fishing data into its operational and benchmark Assessments. NEFSC staff attempted to explain how fishermen's data is used, noting that vessel trip reports are key to estimating abundance and catch, and biological samples taken from catch on observed trips as well as from landed fish are important for determining the characteristics of fish removed by harvesting.

There was a question about cutoff dates for data for September's assessment. NEFSC staff reported that data collected though calendar year 2014 would be used for landings, discards and survey data but

several species may incorporate Spring 2015 survey data. Gulf of Maine cod, specifically, will **not** use Spring 2015 data.

WH only: It was pointed out that Spring 2014 and Spring 2015 were polar opposites in GOM, one very warm and one unseasonably frigid. Is there an opportunity for scientific discussion regarding stock status in temperature extremes?

P**otential Areas for Further Examination or Research**

- Work to develop a wider common understanding of assessment prioritization and process, and how industry generated data enter the assessments
- Work to better characterize observer bias in the data, and account for it as needed in the assessments
- Work to better explain the Northeast Fishery Observer Program goals and operations
- Examination of stock performance in years when water temperatures have been unusually high or low

2015 Groundfish Operational Assessment Industry Outreach Meeting--New Bedford, MA
July 22, 2015

Observations

Concerns from industry that reduced landings are interpreted as lower abundance and the Total Allowable Catches (TAC) are being lowered: Fishermen are landing 20-25 percent of their TAC and feel like the TACs, other than for haddock, are being lowered because of the lower landings. Mention of yellowtail as an example. Some fishermen believe predation is causing poor recruitment, that places like Nantucket Lightship have not seen yellowtail in years, while others question numbers and believe there is more yellowtail out there. An analyst noted that yellowtail recruitment was poor despite low fishing pressure, that lack of young fish recruited to the population results in lack of adult biomass to support higher catches. Analyst also noted that while predation may be part of the equation, there is no evidence of that and predation is not believed to be a primary source hindering population productivity.

Scientific surveys aboard the *Bigelow* do not match what fishermen are seeing and are therefore unreliable indicators of what is really happening: Industry representatives questioned where the *Bigelow* goes and the lack of a station match with where fish are being caught. They felt only a few stations, maybe six, were useful. They suggested they provide guidance for where the Bigelow could go at certain times of the year to get a more accurate picture of what they believe is going on. They don't understand why the *Bigelow* goes to areas where there are no fish, or why all the zero tows are included in assessments from these areas when they are catching plenty of fish in other areas. An analyst noted that we need to know where the fish are not as well as where they are, that the survey shows trends in the populations, while the commercial data provides information on the scale of the populations.

Changing fishing patterns in response to regulatory mandates makes it difficult to interpret the use of CPUE in the assessments. Industry was concerned about how assessments take into account changing fishery effort patterns in response to regulatory mandates. Reviewers have not accepted CPUE as a measure of abundance. Fishing industry wants to know if there is a baseline of effort expected, and if industry does not hit that, are they penalized in the assessment model. An analyst replied that their job is not to penalize fishermen for not achieving a baseline level; they are interested in population levels and harvest,. Vessel trip reports and dealer data are important sources for getting information on fishery removals, along with survey data to monitor population trends over time.

Industry felt their discard rates are low, and want to know how discard rates are applied since each sector has a different rate. Several said their rates are low, about 10%, while scientists see higher rates. Questions on what impact observers have on how the rates are applied to all trips, and what is the discard rate for the industry as a whole. An analyst noted there is variability from one sector to another, that it depends on gear types across many trips, and explained the discard estimate procedure and how it is applied.

Climate change needs to be factored into assessments. A study and evidence in the cold pool area regarding temperature related to recruitment success was extensively studied to explain yellowtail recruitment patterns in recent decades. Evidence that reduced suitable habitat may have contributed to low recruitment trends was not considered strong enough and required further research. Analyst noted that Stony Brook University is working with NEFC to look at this issue. Better information is needed.

Fishermen/the fishing industry wants to be more involved in the assessments. Fishermen don't come to these meetings because they are tired and frustrated with the process. They are fishing at about 25 percent capacity, perceive they have lost market share and wonder how/if they will get it back. They want to have more input to the assessments, suggest digging into the data from past side-by side tows (i.e. a dedicated Georges Bank yellowtail survey with industry to compare catches at different times of the year). They would like to know how to get more information to and from fishermen and scientists about what each is seeing. They feel their information is not being used in assessments and should be. Multiple offers were made extending an invitation to NEFSC scientists to come down to the boats to see them and talk in an informal way, face to face. An analyst noted that the meeting was a first step in bridging that gap.

Industry wants to know what they can do to help improve the situation. They mentioned they are providing a lot of information now and want to know what else they could do. An analyst stated the need for consistent, accurate vessel trip report data, that it has improved over time but could be better. The analysts noted the data is being used now and is the basis of any assessment, that their data is invaluable and is used with the survey data.

Retrospective patterns in models are biased toward lower estimates and are a concern. A question arose about how uncertainty from the government shutdown, Bigelow breakdowns, and other interruptions is incorporated in stock assessments since an analytical assessment can place certain weight on these factors. An analyst explained that the government shutdown did not affect the

completion of the Bigelow survey, that not all stocks were affected by the Bigelow breakdowns but due diligence would be applied to understand the effects of a truncated survey, and these uncertainties would be presented or accounted for in a modeling context for the reviewers. The analyst explained how models are adjusted within confidence levels, that uncertainties will be flagged and carried forward in a systematic way to inform future benchmarks.

Potential Areas for Further Examination or Research

- Consider guidance from fishermen as to where the *Bigelow* could go (survey stations) at certain times of the year to get a more accurate view of where fish are and when
- Take fishermen and scientists out together on a one-day *Bigelow* survey to show how the nets and sensors work
- Find a way to turn industry observations into data that can inform assessments
- Create more face-to-face opportunities for fishermen and scientists to talk informally about what each is seeing
- Find ways to more effectively use cooperative research, such as comparison tows and other joint projects with industry, to bridge the gap between the fishing industry and assessment scientists

22.4 Industry statements

I begin my comment with an open invitation to Loretta O Brian and Mike Palmer to come out on a fishing trip with me anytime. in the past Steve Murawski and John Brodsiak made trips with me and found them enlightening.

My name is Mike Russo, I am the owner operator of the FV GULF VENTURE. The Gulf Venture Is a 40' gillnetter currently enrolled in the Trip Gillnet category. undoubtedly the smallest trip netter in New England. We make 3 to 5 day trips anywhere inside the US Canadian line.We fish between 48 to 96 nets daily depending on location and conditions. Soak times typically under 16 hrs.

I have been groundfishing as a crew and Captain for 30 years now,primarily with tub trawl and gillnet. Most of my experience is from fishing east of the Cape but in recent years have expanded my range thru out the Gulf of Maine and out to the Eastern area on GB.

After last year's GOM cod assessment and the subsequent quota reduction ,I had to bring my boat back to the Cape to fish on GB. There's more cod in the GOM than what nmfs says and the quota is very difficult to lease.Now we're going to be up against the same situation on GB.

This summer I've made 9 trips in the EGB and WGB stock sreas. In the eastern area I have no experience, I found cod in 25 to 30 fathom and had hauls over 10000lbs in one day. On my last trip there I fished in 100 to 110 fathom and found cod ,I left the because I was looking for pollock and hake. Day 2 and 3 of that same trip Was spent on Franklin Swell . By day 3 I had found fish and it was primarily cod in 90 to 100 fathoms. I made 3 more trips to Franklin and had good catches with 50% of the Catch being cod. In my past experience I've never had that kind of cull deeper than 65 fathom. Also my catch of cod has been averaging 25% large cod,the best %s being up to 50% in 95 fathom. That's an indication to me that there's some large cod around ,large cod tend to bounce off 6.5 in gear ,the ones you catch are usually rolled up in the net. Same trend I have been experiencing in the GOM . I feel the cod stock has shifted to the deep water in the WGB area. .Grey Seals,dogfish and water temps I believe are the biggest reasons.

If a 150 mt TAC were in place this year my wgb my landings would have accounted for close to 8% of the quota in 9 days. I can't stress enough that this is the SMALLEST boat currently groundfishing in New England In the trip gillnet catagory. I have been working without the benefit of a network on GB. I steam 18 hrs and not see another groundfish boat. I'm finding cod in various quantity everywhere I go beyond the inshore bottom off the Cape.

I do not believe the trawl survey is finding the fish in the deep water on GB and GOM. If the stock is so low , why am I finding them from 25 to 110 fathom and over a wide geographic range? I will not accept the excuse that I'm seeing the last aggregation of cod .

However there are problems inside of 50 miles from the Cape .that's why I shifted offshore.
The Grey seals And dogfish have destroyed the inshore fishing . I have little hope that I'll be able to catch a trip of cod within sight of the Cape for the rest of my career. Cutting the WGB cod quota will do nothing to solve those issues. It's not a problem caused by commercial fisherman and I feel we shouldn't be penalized for it.

sincerely
Michael A Russo