GROUNDFISH #3

New England Fishery Management Council
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MEMORANDUM

DATE: October 28, 2010

TO: Science and Statistical Committee (SSC)

FROM: Groundfish Plan Development Team

SUBJECT: **GOM Winter Flounder ABCs, FY 2010 – 2012**

1. In June 2010, the Council asked the SSC to consider fishery dependent and independent data to evaluate whether the new information would affect current ABC recommendations for GOM winter flounder. The SSC reviewed catch and survey information provide by the PDT at its August 2010 meeting. The SSC also considered an approach suggested by the PDT to use the information in setting ABCs. The PDT approach was based on swept area biomass estimates from the NMFS, Massachusetts, and Maine/NH trawl surveys. The SSC report stated the following:

> "Conflicting signals persist in the updated information provided by the PDT which continue to confound attempts to assess the Gulf of Maine winter flounder stock. The PDT developed an alternative approach to deriving ABC that is consistent with the ABC control rule for groundfish and which is based on survey data that have been used to assess Gulf of Maine winter flounder. Area-swept survey estimates of exploitable biomass suggest that the current ABC (238 mt) represents a more conservative exploitation rate than 75%F_{MSY}. The SSC concluded that an area-swept survey approach to deriving ABC may provide a better scientific basis for ABC than the current approach, which is based on recent average catch, and is appropriate for the uncertainties in the data and the possibility that the stock is overfished.
>
> The SSC requested an evaluation by the PDT of candidate ABCs for 2011 based on area-swept survey biomass estimates, including a 75%F_{MSY} option and further exploration of survey data properties (e.g., confidence intervals, geographic distributions, inter-annual variability, trawl mensuration) to be considered by the SSC in November 2010. A benchmark assessment is scheduled for spring 2011, so any revision for ABC would be an interim until a peer-review assessment is developed."

This memo replies to the SSC request for additional information.

2. In the absence of an approved peer-reviewed assessment, in 2009 the SSC based the GOM winter flounder ABC on 75 percent of the average catch for the last three years. While this approach is similar to an approach suggested by Restrepo et al (1998) for data poor stocks, it does not make use of available survey information to inform the setting of ABCs. In the absence of an approved assessment, the survey information could be analyzed using standard techniques to help inform the specification of an ABC.

3. Survey information provided to the SSC and considered in the GARM III assessment for GOM winter flounder came from three survey programs: the NMFS bottom trawl survey (spring and fall), the Massachusetts Department of Marine Fisheries (DMF) bottom trawl survey (spring and fall) and the Maine/New Hampshire Inshore Trawl Survey (spring and fall). These surveys are often used in the stock assessments performed by the Northeast Fisheries Science Center. Trawl mensuration data is in enclosure (1). Relevant documentation for these surveys includes:

Azarovitz TR. 1981. A brief historical review of the Woods Hole Laboratory trawl survey time series. Pages 62-67 in W.G. Doubleday and D. Rivard, editors. Bottom trawl surveys. Can Spec Publ Fish Aquat Sci. 58.

Chouniard, Ghislain, Beutel, D., and Legault, C. 2005. Consensus Report of the Technical Review of the Maine Department of Marine Resources Maine-New Hampshire Inshore Groundfish Trawl Survey. Available online at: http://www.nero.noaa.gov/StateFedOff/coopresearch/Consensus%20Report_Maine_NH_survey_vs3_final.pdf .

King, J. R., Camisa, M. J., and Manfredi, V. M. 2010. Massachusetts Division of Marine Fisheries Trawl Survey Effort, Lists of Species Recorded, and Bottom Temperature Trends, 1978 -2007. Massachusetts Division of Marine Fisheries Technical Report TR - 38. Available online at: http://www.mass.gov/dfwele/dmf/publications/tr_38.pdf .

Northeast Fisheries Center (NEFC). 1988. An evaluation of the bottom trawl survey program of the Northeast Fisheries Center. NOAA Tech Memo.

Sherman, Sally A, Stepanek, K., and Sowles, J. 2005. Maine-New Hampshire Inshore Groundfish Trawl Survey: Procedures and Protocols. Maine Department of Marine Resources reference Document 05/01. Available online at http://www.maine.gov/dmr/rm/trawl/reports/proceduresandprotocols.pdf.

4. Appendix (2) details the PDT analyses. Note this appendix describes both work performed for the August 2010 SSC meeting and the work performed in response to the SSC's requests for additional information.

5. The SSC asked the PDT for an ABC based on 75 percent of F_{MSY}. The PDT notes two caveats with responding to this request. While GARM III provided a range for F40% of between 0.267 and 0.295 as a proxy for F_{MSY}, the yield-per-recruit calculations providing these estimates are based on the selectivity patterns from VPA models that were not accepted

by the review panel. In addition, the selectivity pattern used to develop this reference point does not match the assumed knife-edged selectivity used for determining swept area biomass. Restrepo et al (1998) noted that the natural mortality rate has been advocated as a target or limit for fisheries with a modest amount of information. If M=0.2 is assumed (the value used for other winter flounder stocks), using F=0.2 gives a limit or target exploitation rate of 0.165. The example yield-per-recruit analysis in Appendix (2) gives an $F_{40\%}$ of 0.24 (similar to the F_{MSY} proxy for both GB winter flounder (0.26) and SNE/MA winter flounder (0.25)), or an exploitation rate of 0.194. So absent an approved status determination criteria a limit or target exploitation rate to guide catch advice might be an exploitation rate in the range of 0.165 – 0.194.

6. The question remains what is an appropriate exploitation rate for this stock. While there is no approved assessment for this stock, the GARM III panel advised that "...there is a substantial probability that it {*biomass*} is below ½ B_{MSY}." As a result, stock rebuilding is necessary and catches should not result in an exploitation rate above 0.165 - 0.194. An examination of Figure 13 shows that catches of 500 mt or less result in an exploitation rate of less than 0.2 under all values assumed for q. Catches of between 350 to 450 mt return exploitation rates between 0.088 and 0.174 if q is assumed to be one; the rates decline for all other values of q. The current ABC (238 mt) returns exploitation rates below 0.10 under all scenarios.

7. Using the GARM III estimate of F40%=0.28 from the split-survey VPA, the PDT calculated 75% for F40% as 0.21, or an exploitation rate of 0.17. The ABC that returns this exploitation rate ranges from 450 - 550 mt based on the spring combined survey (see Figure 13); catches would be higher based on the fall combined survey.

8. An additional analysis examined the uncertainty of the swept area biomass estimates and exploitation rate at three candidate catch levels. The details of the analysis are provided in the appendix. This analysis also provided estimates of the probability of exceeding five candidate reference points. Generally, when compared to the point estimates, this uncertainty analysis provides slightly higher median estimates of swept area biomass and slightly higher catch levels because the distributions are skewed to the right. The probability that catches might exceed the candidate reference points are summarized in Table 8.

9. **PDT recommendation**: Based upon the expected exploitation rates associated with the catch, the PDT recommends the SSC select an interim GOM winter flounder ABC of between 350 – 450 mt for FY 2010 and 2011. Analysis of survey swept area biomass estimates suggests this should result in exploitation rates below candidate mortality targets until the SAW-52 assessment results can be incorporated into management advice. Table 4, Table 5, and Table 8 are the main tables supporting this recommendation.

Enclosure (1) Survey trawl mensuration data

Measure	Bigelow (fall/spring survey)	Albatross IV (fall/spring survey) Recent years	Gloria Michele (summer survey)	ME/NH survey	MADMF (fall/spring survey) Gloria Michele
Tow speed	3.0 knots SOG	3.8 knots SOG	2.0 knots	2.5 knots	2.5 knots
Tow duration	20min	30 mins	15 mins	20 mins	20 min.
Headrope height	3.5-4m	1-2m	~3 m	12 feet	~1.5m
Ground gear (cookies, rock hoppers, etc.)	Rockhopper Sweep Total Length-25.5m Center- 8.9m length, 16" rockhoppers. Wings- 8.2m each 14" rockhoppers	Roller Sweep Total Length-24.5m Center-5m length, 16" rollers. Wings- 9.75m each, 4" cookies.	Sweep has 3 sections. Side sections of sweep (each 34'6") are composed mostly of 3"cookies with 10" rock hoppers spaced every 23.3". Middle section of sweep (8'4") is composed mostly of 3" cookies with 14" rock hoppers spaced every 18.2".	Cookies, largest in the center of sweep 8 in.	3/8" chain sweep with 3.5" rubber cookies.
Mesh size	Poly webbing Forward Portion of trawl (jibs, upper and lower wing ends, 1st&2nd side panels, 1st bottom belly)12cm,4mm Square aft to	Nylon webbing Body of trawl= 12.7cm Codend- 11.5cm Liner (codend and aft portion of top belly)- 1.27cm knotless	1 3/8" stretched mesh (knot to knot) throughout top wing, square, belly. Extensions and codend are made of 1 ¼" stretched mesh	2 in. overall w/1 in. liner	3.5" stretched in wings and square. 2.5" stretched in bellies and codend. 0.25" knotless liner in

Enclosure (2)

Gulf of Maine winter flounder exploitation rates using 30+ cm biomass from survey area swept estimates

Part I (August SSC meeting)

The NEFSC (RV Bigelow series), MDMF, and ME/NH surveys catch significant numbers of winter flounder per tow. Exploitation rates can be inferred from using a range of assumed survey efficiencies (Q) along with consideration of survey stock area coverage and different candidate ABC catches. The range of the estimates using different assumptions may help show what the likely exploitation rates are under different catches. A knife edge approximation of exploitable biomass was assumed as legal sized 30+ cm numbers converted to weight from a length-weight equation. Exploitable biomass was estimated as;

Exploitable Biomass = 30+ cm biomass index per tow /1000 x total survey Area/tow footprint x 1/q

and exploitation rate as;

Exploitation rate = catch / 30+ cm biomass

There are several important facts to take into consideration when interpreting the exploitation rate table (Table 1);

1. No single survey covers the entire stock (Figures 1 to 4)).
2. Winter flounder is a shallow water species with a stock boundary from north of Cape Cod to the Canadian border.
3. Much higher survey catch rates are seen inshore verse offshore strata. However a significant proportion of the stock may be offshore due to the much larger strata area (offshore NEFSC 26, 40, 39).
4. The ME/NH survey catches significant numbers of fish. However relatively few exploitable 30+ cm fish are seen in the survey (Figure 5). Updated age data suggests slower growth rates in Maine waters.
5. The most recent three year average biomass was used for the spring and fall MDMF surveys, two years for Bigelow spring survey and only one year for the Bigelow fall survey. The combined biomass estimate was calculated from non-overlapping strata from all three surveys.
6. Most of the catch is taken from statistical area 514 (Cape Cod Bay, Mass Bay, Ipswich Bay, Stellwagen bank). MDMF exploitation estimates conservatively assume that the entire stock is within Massachusetts state waters.
7. A Q equal to 1 conservatively assumes that the survey gear is 100% efficient.
8. The combined estimate using non-overlapping strata from all three surveys covers most of the stock area (Table 2, Figure 4).

Part II (November SSC meeting)

Exploitable 30+ cm biomass and exploitation rates with the associated error distribution were re-estimated from 2004 to 2010 (Table 3, Figure 6 and 7) using the Survey Area Graphical Analysis (SAGA) program. The 80 percent confidence intervals were plotted to evaluate the inter-annual variation. The Bigelow to Albatross conversion coefficients were not incorporated into the calculations since length based conversions are still in development. However the use of the estimated Miller et al (2010) conversion of 2.086 Kg/tow would result in similar biomass estimates between the Albatross and Bigelow series (Figure 6). Questions with regards to the relative low catchability and inshore sampling coverage in the Albatross series, uncertainty in the conversion coefficients for larger fish and possible effects of changes in stock size over time can be avoided by limiting the analysis to the most recent Bigelow time series (spring 2009 & 2010, fall 2009). An analysis limited to strata which overlapped both the NEFSC Bigelow and Mass DMF survey suggests there is relatively little difference in gear efficiency between the surveys (Figure 8). Adjusting of the area difference in the overlapping strata between the MDMF and NEFSC surveys brings the estimates closer together (Figure 9). A small difference in the survey gear efficiency helps justify the use of non-overlapping strata among the surveys as a single biomass estimate. A comparison of the survey components used in the combined estimate (MDMF near-shore, NEFSC inshore, NEFSC offshore) between the spring and the fall surveys shows that a higher proportion of the stock close to shore during the spring (Table 4, Figures 10 and 11). The lower overall 30+ biomass estimates in the spring may be a function of unavailable fish to the surveys that are residing inside the estuaries during the spawning season. However survey information in the fall is also limited since only one survey year exists.

Reference points consistent with the 30+ cm biomass were estimated using a length-based yield per recruit analysis (NOAA Fisheries Toolbox) to help interpret the area swept exploitation rates (Figure 12). Von bertalanffy parameters were taken from Witherell and Burnett (1993). Maturity at length information is estimated from the spring MDMF survey (L_{50}=29cm). The reference points were converted to exploitation rates to be consistent with the swept area biomass approach. An $F_{40\%}$ exploitation rate was estimated at 0.19 and 75%$F_{40\%}$ exploitation was 0.15 with M=0.2 (note that the fishing mortality rates in Figure 12 have been converted to exploitation rates). These mortality reference points are similar to the estimated reference points from other winter flounder assessments. The PDT used $F_{40\%}$ as a rough estimate for F_{msy}. In general $F_{40\%}$ was also similar to the F=M=Fmsy rule of thumb reference from Restrepo et al 1998.

The GARM III reference point from the split-survey model run estimated F40% as 0.28. 75 percent of this value is F=0.21, or an exploitation rate of 0.17.

Uncertainty Estimates

Methods

The sampling distributions of biomass and fishing mortality are approximated by integrating over the factors which constitute the primary sources of uncertainty. These factors include the sampling variability in the Northeast Fisheries Science Center (NEFSC), Massachusetts Division of Marine Fisheries (MADMF), and Maine-New Hampshire (MENH) spring and fall bottom surveys for 2009 and 2010. The second major source of variability for the survey estimates is the variation in the size of the area swept by an average tow. The sample means and variances for each of these factors were used to parameterize their respective normal distributions.

Sampling theory and boot-strapping analyses for other species suggests that the survey means should be asymptotically normal. We exploit this feature to simplify the estimation of the sampling distribution of biomass and exploitation rate.

The estimator of total stock size can be written as

$$B_{Tot} = A_{NEFSC}\frac{I_{NEFSC}}{e\,a_{NEFSC}} + A_{MADMF}\frac{I_{MADMF}}{e\,a_{MADMF}} + A_{MENH}\frac{I_{MENH}}{e\,a_{MENH}} \quad \text{(Eq. 1)}$$

Where **A** represents the total stratum area, **I** represents the mean index of abundance (kg/tow) for winter flounder greater than 30 cm, and **a** represents the average area swept per tow, and **e** represents the trawl efficiency (probability of capture given encounter). Each of the measures of survey abundance and swept area are measured with uncertainty. In this exercise it is assumed that the total stratum area A is constant and measured without error. The gear efficiency **e** is unknown but cannot be greater than one unless significant herding occurs. If herding does occur the maximum efficiency is approximately equal to the ratio of the trawl door width to the wing width. For the purposes of this exercise, gear efficiency was examined over a range of values between 0.6 and 1.0. The sampling distribution B_{tot} can be estimated by integrating over all possible sources of variation. In this exercise there are six normally distributed random variables to consider I_{NEFSC}, I_{MADMF}, I_{MENH}, a_{NEFSC}, a_{MADMF}, and a_{MENH}. The means and variances of these variables are summarized in Table 1. The variance of the footprints for the MADMF and MENH survey were not measured. It was assumed that the CV of these estimates was equal to the estimates for the NEFSC survey. All NEFSC survey estimates were conducted on the FSV Bigelow.

The sampling distribution of each of the Fs described above was evaluated by integrating over each of the normal distributions for average weight I, survey footprint ***a***. The density **I** and footprint a parameters were evaluated over 40 equal probability intervals. The full evaluation of the six sources of variability required 40^6 = 4,096,000,000 evaluations. The proposed method is sometimes known as a Latin hypercube approach because it samples each of the distributions over equal probability intervals. In contrast, a parametric bootstrap sampling randomly from each of the component distributions may not adequately characterize the underlying variability. This of course could be tested and compared with the Latin hypercube approach.

Let Φ = Normal cumulative distribution function. The inverse of Φ, denoted as Φ^{-1} , allows the evaluation of a set of values over a specified range, say α_{min} and α_{max} , over equal probability intervals. The value of the random variable X associated with the α level is defined as:

$$I'_{\alpha} = \Phi^{-1}(\alpha \mid \bar{I}, S_I^2) \qquad \text{(Eq. 2)}$$

The step size between successive values of α was set as δ = 1/40 (0.975-0.025), where α_{min} = 0.025 and α_{max} = 0.975. An equivalent approach was used for evaluation of the footprint parameter **a** where $a \sim N(\mu_a, \sigma_a^2)$.

This property can be illustrated for the biomass estimates by substituting Equation 2 into Eq. 1 and integrating over all possible step sizes. Let i, j, k, l, m, n represent the indices for survey and footprint components, and let a prime denote the value of each component that is derived by evaluating Eq. 2. corresponding the α probability level.

The expected value of $\boldsymbol{B_{tot}}$ is obtained by summing over the sampling distributions of $\boldsymbol{X}$ and $\boldsymbol{a}$ as follows:

$$E[B_{Tot}] = \sum_{i=1}^{40}\sum_{j=1}^{40}\sum_{k=1}^{40}\sum_{l=1}^{40}\sum_{m=1}^{40}\sum_{n=1}^{40}\left[A_{NEFSC}\frac{X_i^t}{e\,a_j^t} + A_{MADMF}\frac{X_k^t}{e\,a_l^t} + A_{MENH}\frac{X_m^t}{e\,a_n^t}\right]\delta^6$$

(Eq .3)

The sampling distribution of ***Btot*** can be constructed by noting that the each element within the brackets of the rhs of Equation 3 has a probability weight of δ =(1/40).

The sampling distribution of F is simply the assumed value of the quota divided by the estimate of the biomass in Equation 3. This approximation of the multidimensional integration provides reasonable assurance that the sampling distribution of the F and B will be appropriately estimated.

Results of Uncertainty Analyses

Summary statistics for the biomass estimates are provided in Table 7 and plotted in Figure 14. Under the null hypothesis that the distribution is normally distributed, the sample statistics for skewness and kurtosis estimates have expected values of zero. Values of skewness greater than zero indicate positive skewing (i.e, a longer tail on the right or in a positive direction from the mean). Values of kurtosis greater than zero provide evidence that the sampling distribution is more peaked than a normal distribution with a comparable mean and variance.

The sampling distribution statistics for exploitation rate are provided in detail in Appendix 1. The probability of exceeding candidate biological reference points are provided in Table 8 and graphically depicted in Figure 15 through Figure 17.

Table 1. A range of estimated 30+ cm biomass and exploitation rates for different surveys using a range of assumed qs (1, 0.8, 0.6, 0.4) and assumed catch (mt) or ABCs (238, 344, 500, 800). A combined estimate using non-overlapping strata is also shown. Exploitation rates exceeding 0..2 are highlighted.

		Bigelow	Bigelow	MDMF	MDMF	Combined	Combined
Q = 0.4	**Catch**	**Spring**	**Fall**	**Spring**	**Fall**	**Spring**	**Fall**
30+ Biomass		3,520	10,271	2,895	3,713	7,074	11,390
ABC	238	0.07	0.02	0.08	0.06	0.03	0.02
3yr avg	344	0.10	0.03	0.12	0.09	0.05	0.03
	500	0.14	0.05	0.17	0.13	0.07	0.04
	800	0.23	0.08	0.28	0.22	0.11	0.07
Q = 0.6							
30+ Biomass		2,347	6,847	1,930	2,475	4,716	7,593
ABC	238	0.10	0.03	0.12	0.10	0.05	0.03
3yr avg	344	0.15	0.05	0.18	0.14	0.07	0.05
	500	0.21	0.07	0.26	0.20	0.11	0.07
	800	0.34	0.12	0.41	0.32	0.17	0.11
Q = 0.8							
30+ Biomass		1,760	5,135	1,448	1,856	3,537	5,695
ABC	238	0.14	0.05	0.16	0.13	0.07	0.04
3yr avg	344	0.20	0.07	0.24	0.19	0.10	0.06
	500	0.28	0.10	0.35	0.27	0.14	0.09
	800	0.45	0.16	0.55	0.43	0.23	0.14
Q = 1							
30+ Biomass		1,408	4,108	1,158	1,485	2,829	4,556
ABC	238	0.17	0.06	0.21	0.16	0.08	0.05
3yr avg	344	0.24	0.08	0.30	0.23	0.12	0.08
	500	0.36	0.12	0.43	0.34	0.18	0.11
	800	0.57	0.19	0.69	0.54	0.28	0.18

Table 2 - Survey total area coverage, average tow footprint, kg/tow and expansion factors for non-overlapping strata used in the combined estimate.

	Combined Survey Estimate		
	NEFSC	ME/NH	MDMF
survey area (nm2)	2,990	3,475	309
Avg tow (area swept)	0.007	0.00462	0.003846
Total area/tow footprint	427,143	752,154	80,343
Tow duration	20 min	20 min	20 min
Numbers per tow	34-65	35	80
Proportion of 30+ biomass	0.59	0.09	0.33

Table 3 - Survey total area coverage, average tow footprint, kg/tow expansion factors and tow during for the different surveys and survey components. NEFSC offshore (39,40,26) = 2322 nm^2, NEFSC inshore overlap (59,60,61,64,65,66) = 668 nm^2, MDMF overlap (27,28,29,30,34,35,36) = 484 nm^2,MDMF near shore (25,26,31,32,33) = 309 nm^2

	NEFSC						MDMF		
	Albatross			Bigelow			Gloria Michele		
	inshore overlap	offshore	combined	inshore overlap	offshore	combined	state waters	near shore	overlap
survey area (nm2)	668	2,322	2,990	668	2,322	2,990	793	309	484
Avg tow (area swept)	0.0112	0.0112	0.0112	0.007	0.007	0.007	0.0038	0.0038	0.0038
Total area/tow footprint	59,643	207,321	266,964	95,429	331,714	427,143	206,188	80,343	125,845
Tow duration	30 min	30 min	30 min	20 min	20 min	20 min	20 min	20 min	20 min

Table 4 - A range of estimated 30+ cm biomass and exploitation rates for the combined survey estimate in spring 2009, spring 2010 and fall 2009 using a conservative qs assumptions of 1 and 0.8 and a range of assumed catch (mt) or ABCs (238, 344, 400, 500, 800). The proportion of the biomass in each survey area is also shown.

Q=1					Exploitation from assumed catch				
	NEFSC	MDMF	ME/NH	Total 30+ biomass	238	344	400	500	800
Spring 2009	0.54	0.26	0.20	3,072	0.08	0.11	0.13	0.16	0.26
Spring 2010	0.45	0.33	0.21	2,587	0.09	0.13	0.15	0.19	0.31
Spring avg	0.49	0.30	0.21	2,829	0.08	0.12	0.14	0.18	0.28
Fall 2009	0.90	0.06	0.03	4,556	0.05	0.08	0.09	0.11	0.18

Q=0.8					Exploitation from assumed catch				
	NEFSC	MDMF	ME/NH	Total 30+ biomass	238	344	400	500	800
Spring 2009	0.54	0.26	0.20	3,840	0.06	0.09	0.10	0.13	0.21
Spring 2010	0.45	0.33	0.21	3,233	0.07	0.11	0.12	0.15	0.25
Spring avg	0.49	0.30	0.21	3,537	0.07	0.10	0.11	0.14	0.23
Fall 2009	0.90	0.06	0.03	5,695	0.04	0.06	0.07	0.09	0.14

Table 5 – Exploitation ratios at various levels of catch using swept area biomass estimates from the combined surveys

q =	catch	50	100	150	200	250	300	350	400	450	500	550	600	650	700	750	800	850	900	950	1000
1	30+biomass																				
Spring 2009	3,072	0.016	0.033	0.049	0.065	0.081	0.098	0.114	0.130	0.146	0.163	0.179	0.195	0.212	0.228	0.244	0.260	0.277	0.293	0.309	0.325
Spring 2010	2,587	0.019	0.039	0.058	0.077	0.097	0.116	0.135	0.155	0.174	0.193	0.213	0.232	0.251	0.271	0.290	0.309	0.329	0.348	0.367	0.387
Spring avg	2,829	0.018	0.035	0.053	0.071	0.088	0.106	0.124	0.141	0.159	0.177	0.194	0.212	0.230	0.247	0.265	0.283	0.300	0.318	0.336	0.353
Fall 2009	4,556	0.011	0.022	0.033	0.044	0.055	0.066	0.077	0.088	0.099	0.110	0.121	0.132	0.143	0.154	0.165	0.176	0.187	0.198	0.209	0.219
q =	catch	50	100	150	200	250	300	350	400	450	500	550	600	650	700	750	800	850	900	950	1000
0.8	30+biomass																				
Spring 2009	3,840	0.013	0.026	0.039	0.052	0.065	0.078	0.091	0.104	0.117	0.130	0.143	0.156	0.169	0.182	0.195	0.208	0.221	0.234	0.247	0.260
Spring 2010	3,233	0.015	0.031	0.046	0.062	0.077	0.093	0.108	0.124	0.139	0.155	0.170	0.186	0.201	0.217	0.232	0.247	0.263	0.278	0.294	0.309
Spring avg	3,537	0.014	0.028	0.042	0.057	0.071	0.085	0.099	0.113	0.127	0.141	0.156	0.170	0.184	0.198	0.212	0.226	0.240	0.254	0.269	0.283
Fall 2009	5,695	0.009	0.018	0.026	0.035	0.044	0.053	0.061	0.070	0.079	0.088	0.097	0.105	0.114	0.123	0.132	0.140	0.149	0.158	0.167	0.176
q =	catch	50	100	150	200	250	300	350	400	450	500	550	600	650	700	750	800	850	900	950	1000
0.6	30+biomass																				
Spring 2009	5,121	0.010	0.020	0.029	0.039	0.049	0.059	0.068	0.078	0.088	0.098	0.107	0.117	0.127	0.137	0.146	0.156	0.166	0.176	0.186	0.195
Spring 2010	4,311	0.012	0.023	0.035	0.046	0.058	0.070	0.081	0.093	0.104	0.116	0.128	0.139	0.151	0.162	0.174	0.186	0.197	0.209	0.220	0.232
Spring avg	4,716	0.011	0.021	0.032	0.042	0.053	0.064	0.074	0.085	0.095	0.106	0.117	0.127	0.138	0.148	0.159	0.170	0.180	0.191	0.201	0.212
Fall 2009	7,593	0.007	0.013	0.020	0.026	0.033	0.040	0.046	0.053	0.059	0.066	0.072	0.079	0.086	0.092	0.099	0.105	0.112	0.119	0.125	0.132

q =	catch	50	100	150	200	250	300	350	400	450	500	550	600	650	700	750	800	850	900	950	1000
0.4	30+biomass																				
Spring 2009	7,681	0.007	0.013	0.020	0.026	0.033	0.039	0.046	0.052	0.059	0.065	0.072	0.078	0.085	0.091	0.098	0.104	0.111	0.117	0.124	0.130
Spring 2010	6,466	0.008	0.015	0.023	0.031	0.039	0.046	0.054	0.062	0.070	0.077	0.085	0.093	0.101	0.108	0.116	0.124	0.131	0.139	0.147	0.155
Spring avg	7,074	0.007	0.014	0.021	0.028	0.035	0.042	0.049	0.057	0.064	0.071	0.078	0.085	0.092	0.099	0.106	0.113	0.120	0.127	0.134	0.141
Fall 2009	11,390	0.004	0.009	0.013	0.018	0.022	0.026	0.031	0.035	0.040	0.044	0.048	0.053	0.057	0.061	0.066	0.070	0.075	0.079	0.083	0.088

q =	catch	50	100	150	200	250	300	350	400	450	500	550	600	650	700	750	800	850	900	950	1000
0.2	30+biomass																				
Spring 2009	15,362	0.003	0.007	0.010	0.013	0.016	0.020	0.023	0.026	0.029	0.033	0.036	0.039	0.042	0.046	0.049	0.052	0.055	0.059	0.062	0.065
Spring 2010	12,933	0.004	0.008	0.012	0.015	0.019	0.023	0.027	0.031	0.035	0.039	0.043	0.046	0.050	0.054	0.058	0.062	0.066	0.070	0.073	0.077
Spring avg	14,147	0.004	0.007	0.011	0.014	0.018	0.021	0.025	0.028	0.032	0.035	0.039	0.042	0.046	0.049	0.053	0.057	0.060	0.064	0.067	0.071
Fall 2009	22,780	0.002	0.004	0.007	0.009	0.011	0.013	0.015	0.018	0.020	0.022	0.024	0.026	0.029	0.031	0.033	0.035	0.037	0.040	0.042	0.044

Table 6 - Summary of model input data for estimation of swept area biomass estimates for GOM winter flounder.

Survey	Season	Year	Total Survey Area in nm^2	Area per tow in nm^2 (SE)	Survey in kg/tow (SE)
NEFSC	Spring	2009	2990	0.006974755 (0.000835526)	3.86178 (1.229921)
MADMF			309	0.003846 (0.0004607)	10.0972 (1.63578)
ME-NH			3475	0.00462 (0.000553443)	0.81315 (0.13173)
NEFSC	Fall	2009	2990	0.006974755 (0.000835526)	9.61792 (4.10)
MADMF			309	0.003846 (0.0004607)	3.59066 (0.627)
ME-NH			3475	0.00462 (0.000553443)	0.21176 (0.03698)
NEFSC	Spring	2010	2990	0.006974755 (0.000835526)	2.76052 (0.608083)
MADMF			309	0.003846 (0.0004607)	10.7822 (2.8331)
ME-NH			3475	0.00462 (0.000553443)	0.73656 (0.19354)

Table 7 - Summary of estimated sampling distribution of biomass estimates for Gulf of Maine winter flounder for varying seasons, years and assumed survey efficiency estimates.

	Fall2009			*Spring2009*			*Spring2010*		
	0.6	***0.8***	***1***	***0.6***	***0.8***	***1***	***0.6***	***0.8***	***1***
Min	2,260	1,680	1,330	2,890	2,150	1,700	2,590	1,920	1,520
Max	15,690	12,400	9,930	8,240	6,230	5,010	6,540	4,940	3,970
Range	13,430	10,720	8,600	5,350	4,080	3,310	3,950	3,020	2,450
Mean	7,761	5,826	4,659	5,203	3,899	3,116	4,375	3,278	2,620
SD	2,643	1,995	1,599	913	686	550	612	460	368
CV	0.341	0.342	0.343	0.176	0.176	0.176	0.14	0.14	0.141
Skewness	0.231	0.248	0.249	0.242	0.246	0.249	0.191	0.195	0.195
Kurtosis	-0.471	-0.434	-0.432	-0.332	-0.32	-0.313	-0.178	-0.165	-0.157
Percentiles									
1%	2,700	2,020	1,610	3,380	2,530	2,020	3,070	2,300	1,840
5%	3,560	2,670	2,130	3,770	2,820	2,250	3,400	2,550	2,030
10%	4,300	3,220	2,570	4,030	3,020	2,410	3,600	2,690	2,150
20%	5,360	4,020	3,210	4,390	3,290	2,630	3,840	2,880	2,300
25%	5,800	4,350	3,470	4,530	3,400	2,710	3,940	2,950	2,360
30%	6,200	4,650	3,710	4,670	3,500	2,800	4,030	3,020	2,410
40%	6,940	5,200	4,160	4,920	3,690	2,950	4,200	3,140	2,510
50%	7,650	5,740	4,590	5,160	3,870	3,090	4,350	3,260	2,610
60%	8,370	6,280	5,020	5,410	4,050	3,240	4,510	3,380	2,700
70%	9,150	6,870	5,490	5,670	4,250	3,400	4,690	3,510	2,810
75%	9,590	7,200	5,760	5,820	4,360	3,490	4,790	3,590	2,870
80%	10,080	7,570	6,050	5,990	4,490	3,590	4,890	3,670	2,930
90%	11,350	8,530	6,820	6,430	4,820	3,850	5,180	3,890	3,110
95%	12,350	9,290	7,430	6,780	5,090	4,070	5,420	4,070	3,250
99%	14,010	10,570	8,470	7,410	5,560	4,450	5,860	4,400	3,520

Table 8 – Summary of estimated probabilities of exceeding alternative exploitation reference points for GOM winter flounder for three candidate quotas of 238, 400, and 500 mt

Summary of estimated probabilities of exceeding alternative exploitation reference points for Gulf of Maine winter flounder for three candidate quotas of 238, 400, and 500 mt.

					Probability of Exceeding Ref Pt		
					Quota (mt)		
Season -Yr	*Assumed Efficiency*	*Source*	*Basis*	*Value*	*238*	*400*	*500*
Spring 2009	0.6	New SPR (30cm, knife edge Selection)	F_40%	0.19	0.00000	0.00000	0.00000
			75% F_40%	0.1425	0.00000	0.00005	0.01730
		GARM III Model	F_40%	0.21	0.00000	0.00000	0.00000
			75% F_40%	0.17	0.00000	0.00000	0.00025
		Ad hoc	F=M	0.2	0.00000	0.00000	0.00000
	0.8	New SPR (30cm, knife edge Selection)	F_40%	0.19	0.00000	0.00004	0.01682
			75% F_40%	0.1425	0.00000	0.04260	0.29173
		GARM III Model	F_40%	0.21	0.00000	0.00000	0.00235
			75% F_40%	0.17	0.00000	0.00170	0.07035
		Ad hoc	F=M	0.2	0.00000	0.00000	0.00680
	1	New SPR (30cm, knife edge Selection)	F_40%	0.19	0.00000	0.01682	0.18777
			75% F_40%	0.1425	0.00003	0.29173	0.74475
		GARM III Model	F_40%	0.21	0.00000	0.00235	0.08028
			75% F_40%	0.17	0.00000	0.07035	0.37461
		Ad hoc	F=M	0.2	0.00000	0.00680	0.12556
Fall 2009	0.6	New SPR (30cm, knife edge Selection)	F_40%	0.19	0.00000	0.00000	0.00649
			75% F_40%	0.1425	0.00000	0.01384	0.04654
		GARM III Model	F_40%	0.21	0.00000	0.00000	0.00067
			75% F_40%	0.17	0.00000	0.00042	0.01940
		Ad hoc	F=M	0.2	0.00000	0.00000	0.00257
	0.8	New SPR (30cm, knife edge Selection)	F_40%	0.19	0.00000	0.01363	0.04621
			75% F_40%	0.1425	0.00003	0.06000	0.12964
		GARM III Model	F_40%	0.21	0.00000	0.00358	0.02986
			75% F_40%	0.17	0.00000	0.02800	0.07086
		Ad hoc	F=M	0.2	0.00000	0.00784	0.03737
	1	New SPR (30cm, knife edge Selection)	F_40%	0.19	0.00000	0.04621	0.10446
			75% F_40%	0.1425	0.01283	0.12964	0.25179
		GARM III Model	F_40%	0.21	0.00000	0.02986	0.07428
			75% F_40%	0.17	0.00030	0.07086	0.14886
		Ad hoc	F=M	0.2	0.00000	0.03737	0.08803
Spring 2010	0.6	New SPR (30cm, knife edge Selection)	F_40%	0.19	0.00000	0.00000	0.00025
			75% F_40%	0.1425	0.00000	0.00140	0.06841
		GARM III Model	F_40%	0.21	0.00000	0.00000	0.00001
			75% F_40%	0.17	0.00000	0.00000	0.00372
		Ad hoc	F=M	0.2	0.00000	0.00000	0.00005
	0.8	New SPR (30cm, knife edge Selection)	F_40%	0.19	0.00000	0.00135	0.06691
			75% F_40%	0.1425	0.00000	0.14340	0.67656
		GARM III Model	F_40%	0.21	0.00000	0.00008	0.01566
			75% F_40%	0.17	0.00000	0.01258	0.21995
		Ad hoc	F=M	0.2	0.00000	0.00036	0.03341
	1	New SPR (30cm, knife edge Selection)	F_40%	0.19	0.00000	0.06691	0.49602
			75% F_40%	0.1425	0.00115	0.67656	0.98649
		GARM III Model	F_40%	0.21	0.00000	0.01566	0.24629
			75% F_40%	0.17	0.00000	0.21995	0.78280
		Ad hoc	F=M	0.2	0.00000	0.03341	0.35947

Figure 1 - Gulf of Maine winter flounder inshore and offshore survey coverage map. Green shaded areas are the NEFSC offshore strata used for the 30+ biomass estimate.

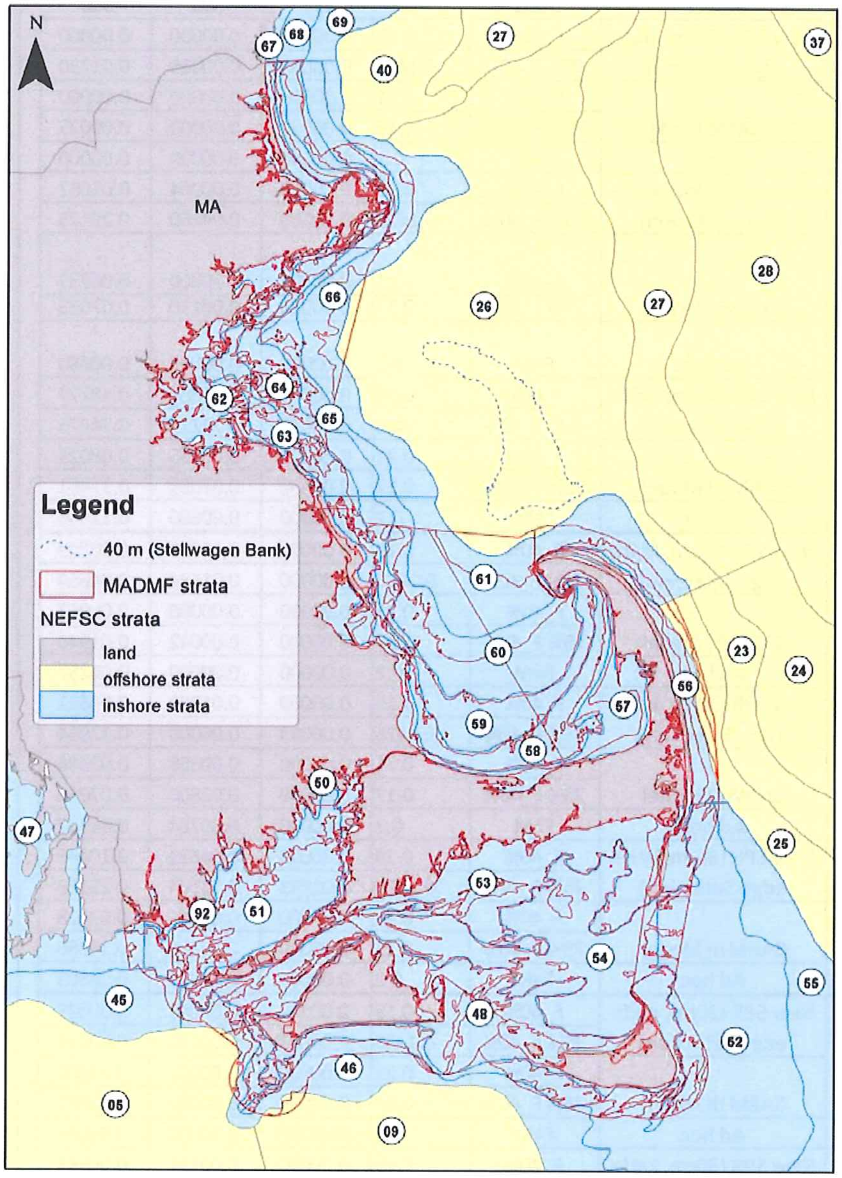


Figure 2 - Gulf of Maine winter flounder inshore survey overlap between the NEFSC and MDMF surveys.

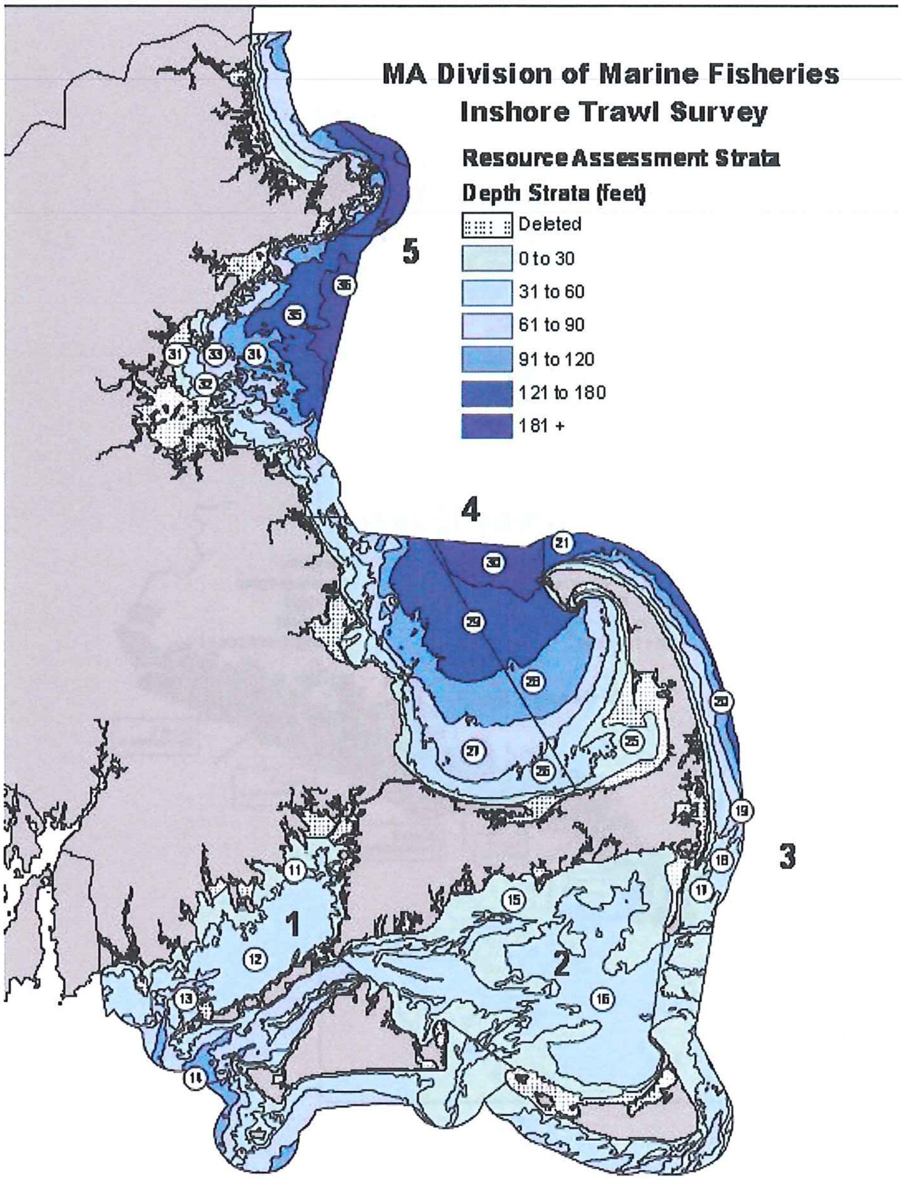


Figure 3 - MDMF survey strata. The gulf of Maine winter flounder stock uses strata north of Cape Cod.

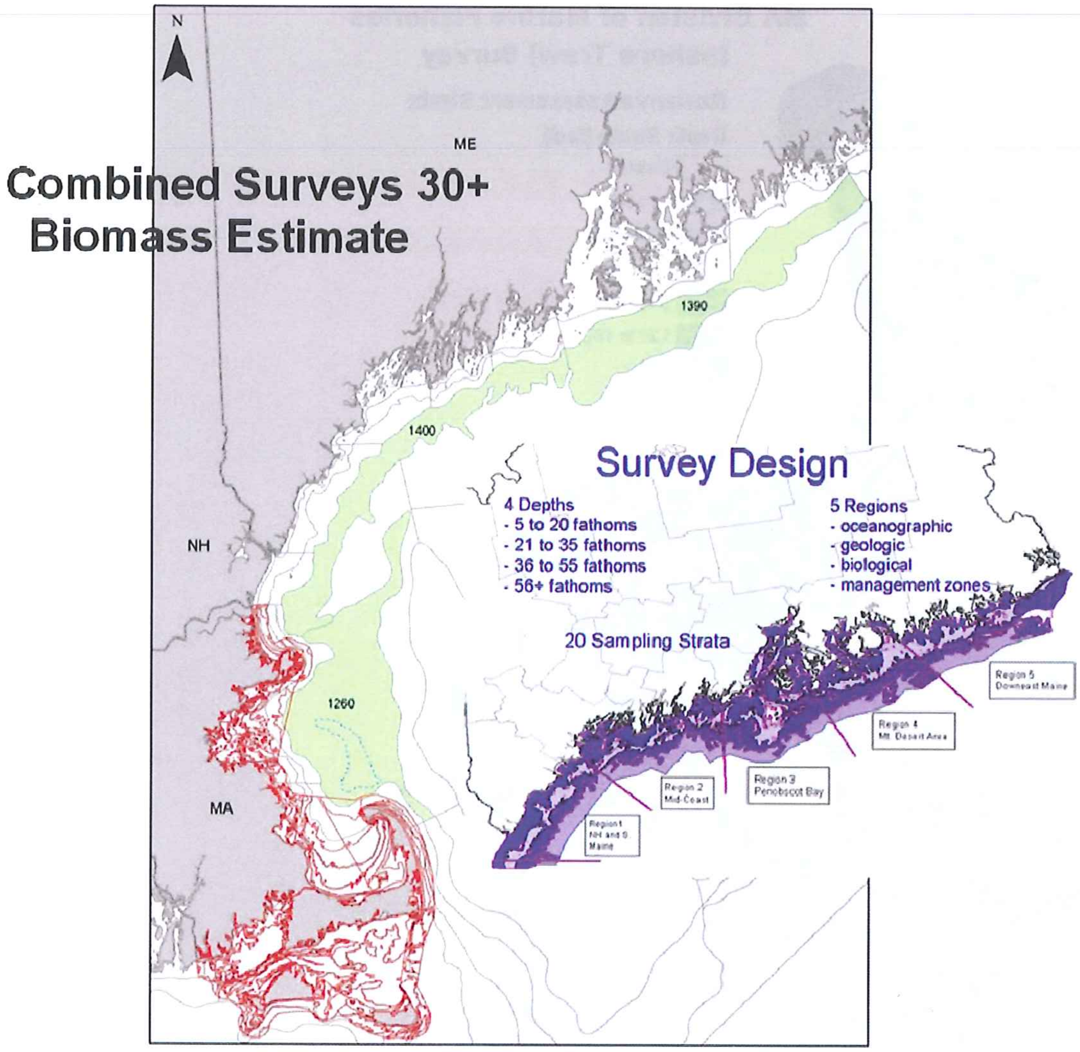
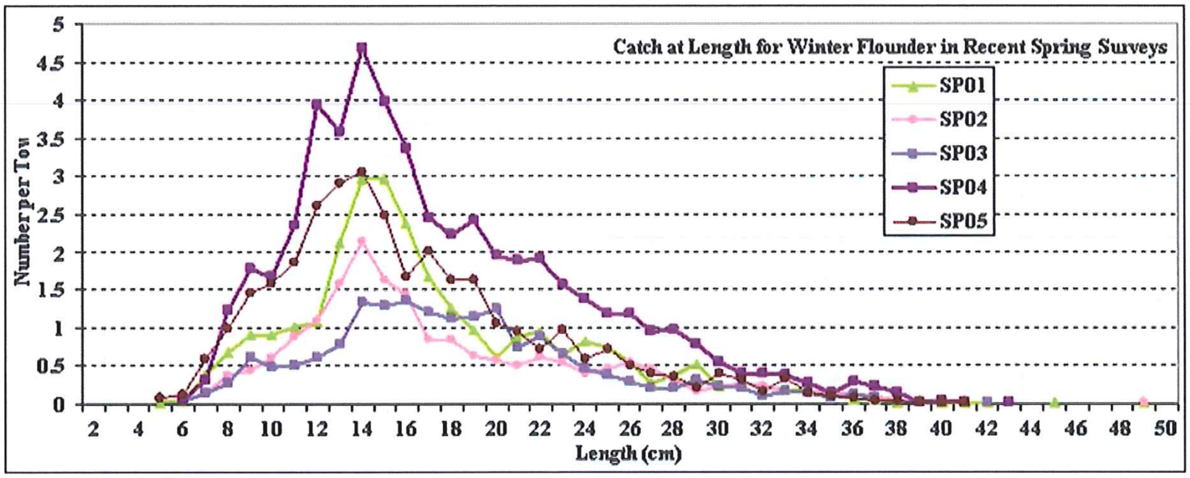


Figure 4 - NEFSC, MDMF, and MENH survey areas used in the combined survey 30+ cm biomass estimate.



ME/NH Survey Spring

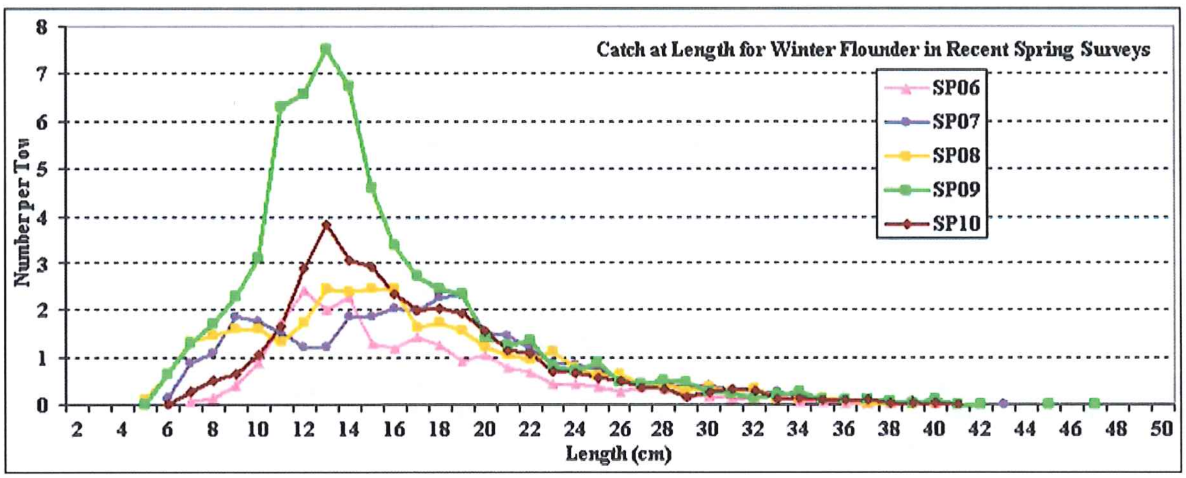


Figure 5 - Numbers per tow at length from the inshore MENH survey. Relatively few fish 30 cm and greater are caught in the MENH survey.

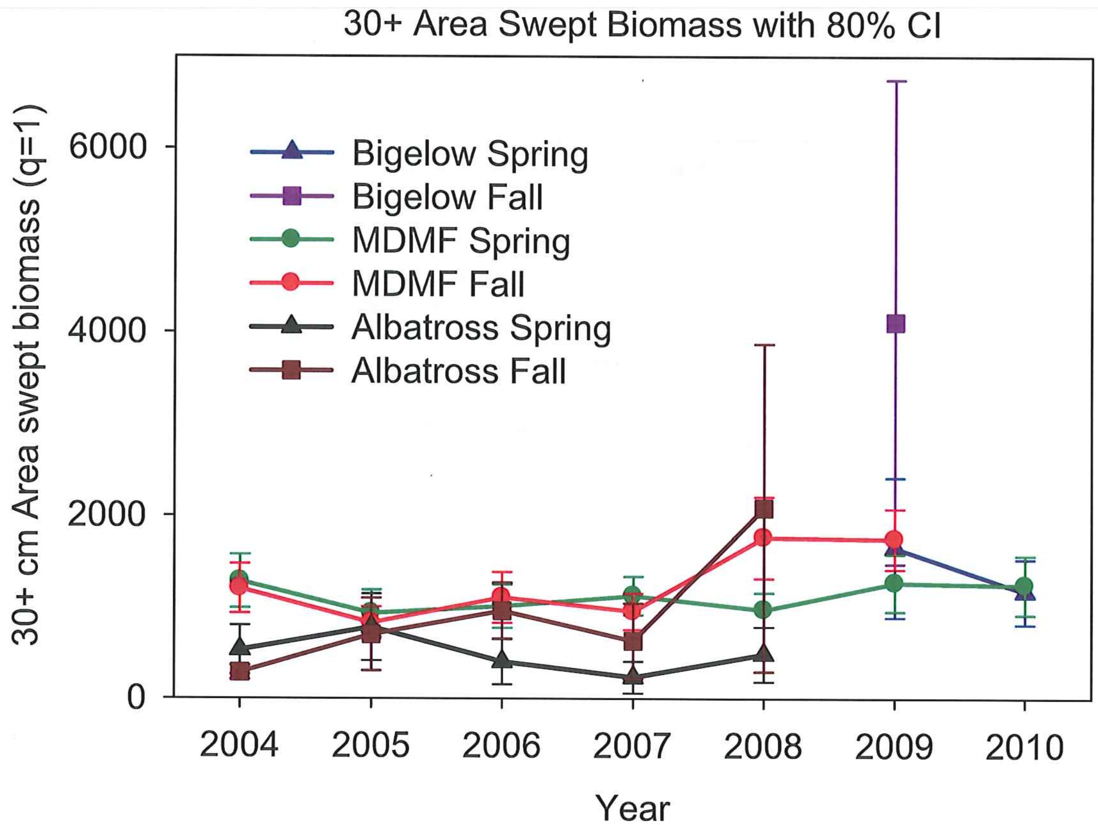


Figure 6 - Minimum area swept exploitable biomass (30+cm) estimates by year with the associated 80% confidence intervals for the NEFSC (Albatross and Bigelow) and MDMF survey. Bigelow estimates were not adjusted to Albatross units.

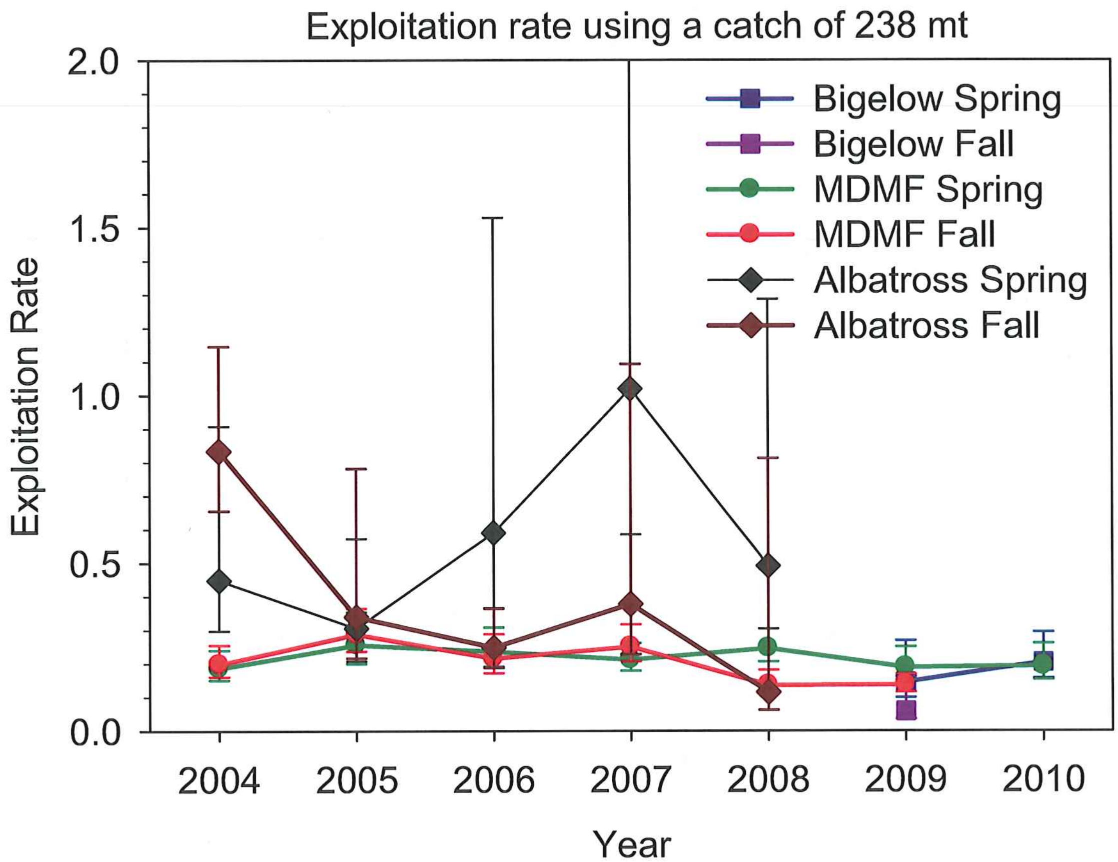


Figure 7 - Exploitation rates assuming the ABC of 238 mt by year with the associated 80% confidence intervals for the NEFSC (Albatross and Bigelow) and MDMF surveys. Bigelow estimates were not adjusted to Albatross units.

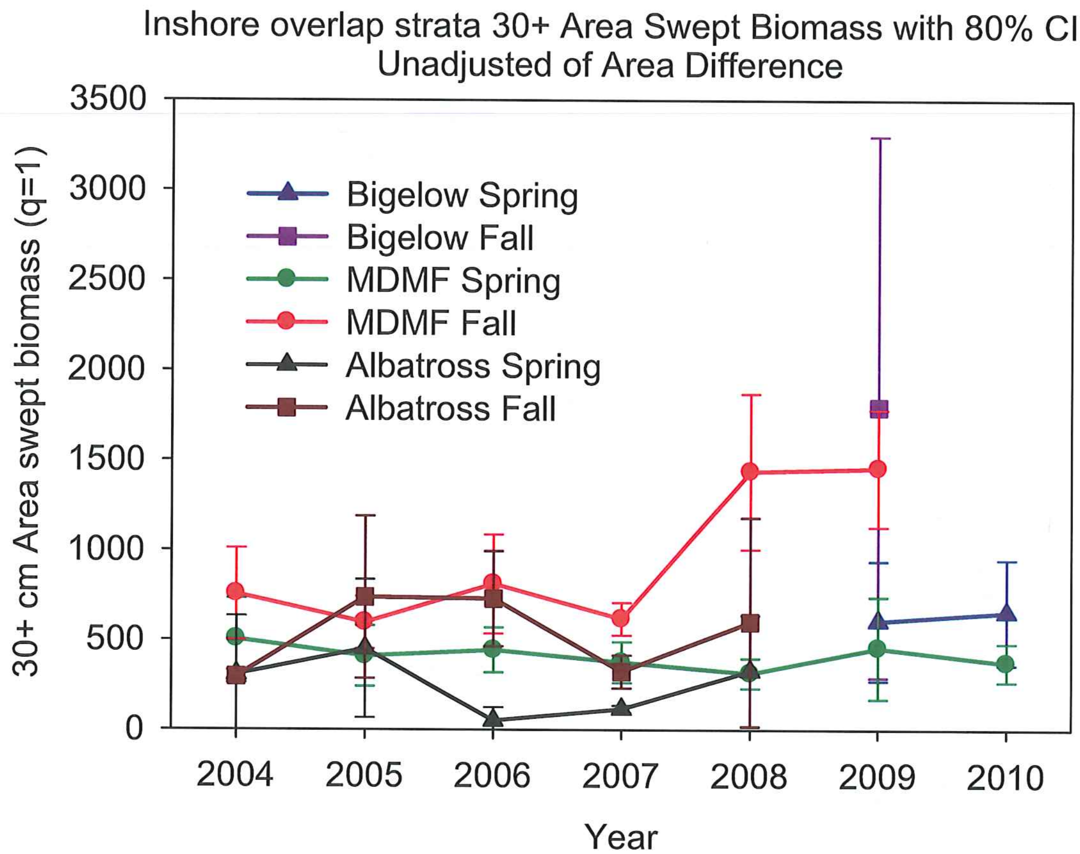


Figure 8 - Minimum unadjusted area swept exploitable biomass (30+cm) estimates by year with the associated 80% confidence intervals limited to the overlap strata between the NEFSC (Albatross and Bigelow) and MDMF surveys. Bigelow estimates were not adjusted to Albatross units. NEFSC overlap strata equals 72% of the total DMF overlap area.

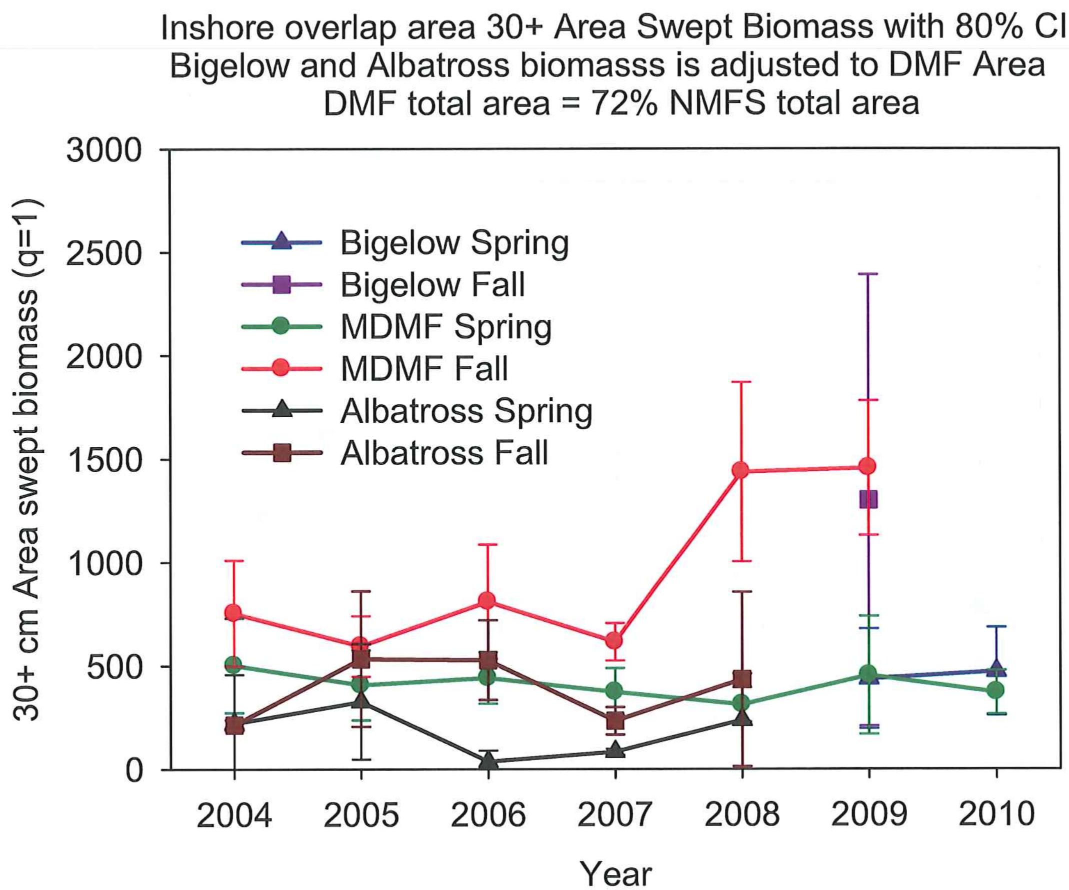


Figure 9 - Minimum area adjusted area swept exploitable biomass (30+cm) estimates by year with the associated 80% confidence intervals limited to the overlap strata between the NEFSC (Albatross and Bigelow) and MDMF surveys. Bigelow estimates were not adjusted to Albatross units. NEFSC overlap strata equals 72% of the total DMF overlap area.

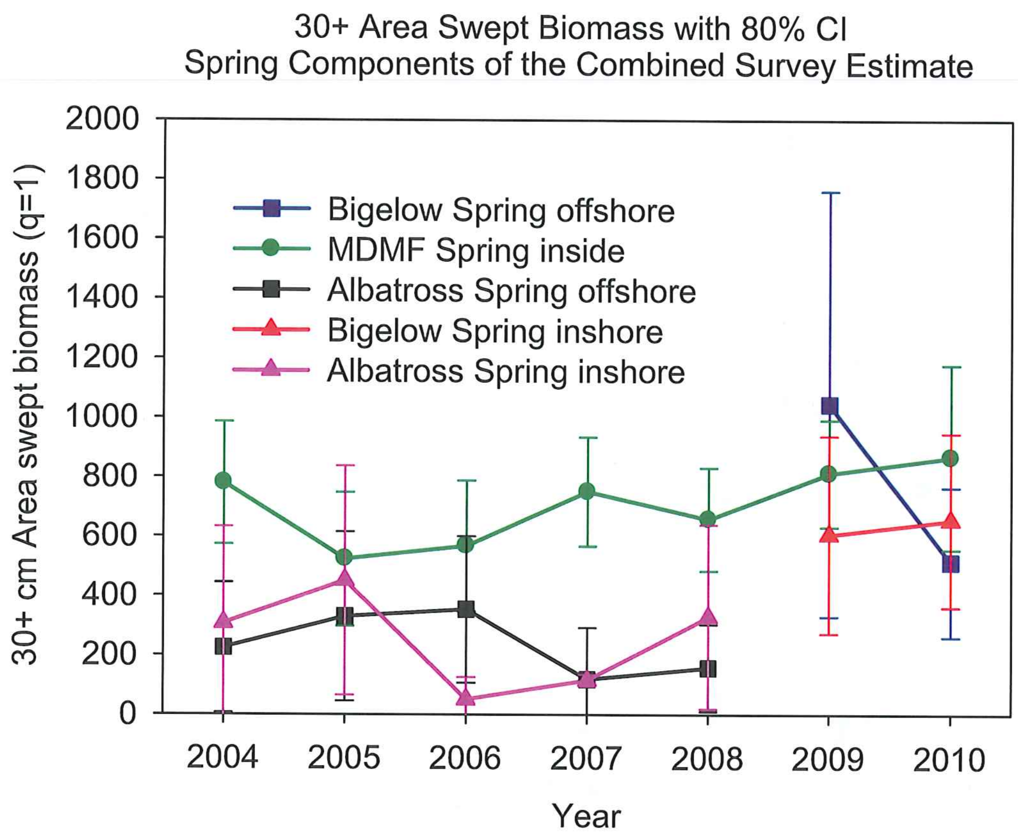


Figure 10 - Spring minimum area swept exploitable biomass (30+cm) estimates by year with the associated 80% confidence intervals for the non-overlapping strata used in the combine biomass estimate. Bigelow estimates were not adjusted to Albatross units.

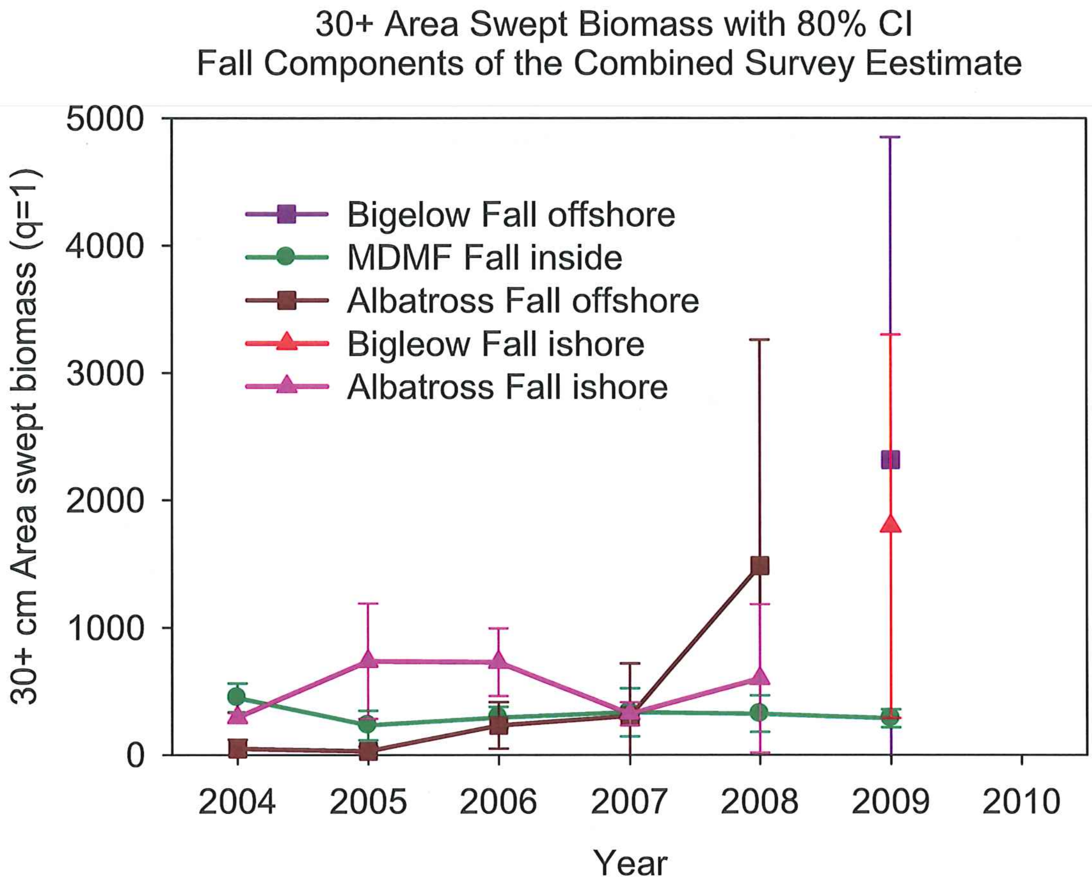


Figure 11 - Fall minimum area swept exploitable biomass (30+cm) estimates by year with the associated 80% confidence intervals for the non-overlapping strata used in the combine biomass estimate. Bigelow estimates were not adjusted to Albatross units.

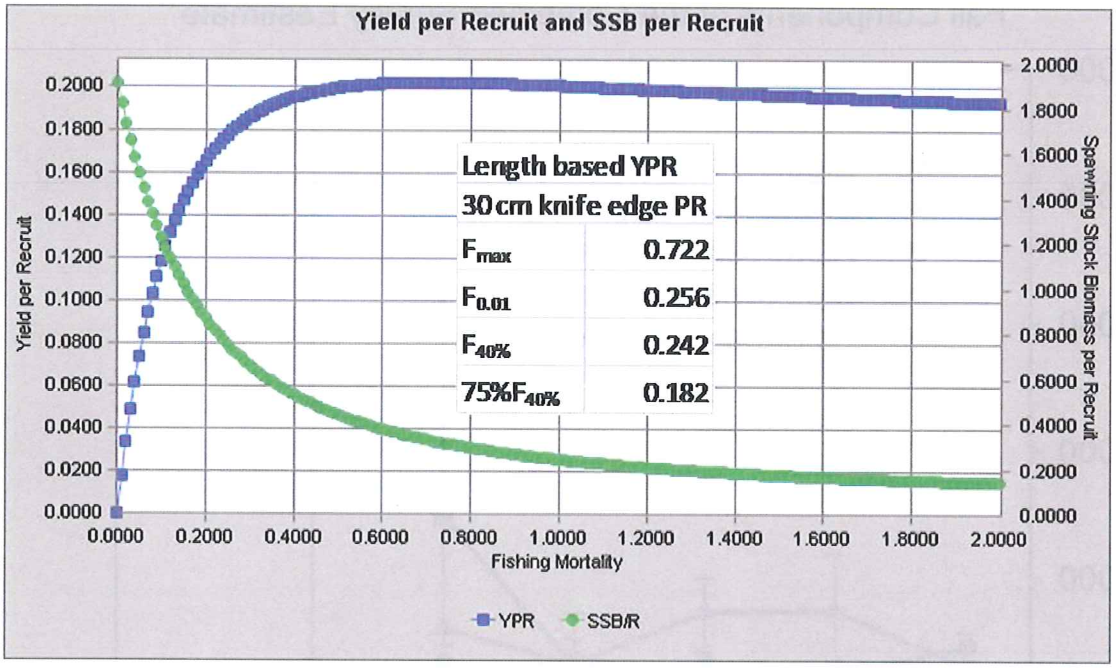


Figure 12 - Length based yield per recruit analysis using the published von Bertalanffy parameters (Witherell and Burnett 1993), maturity at length from the MDMF survey and assuming a natural mortality of 0.2.

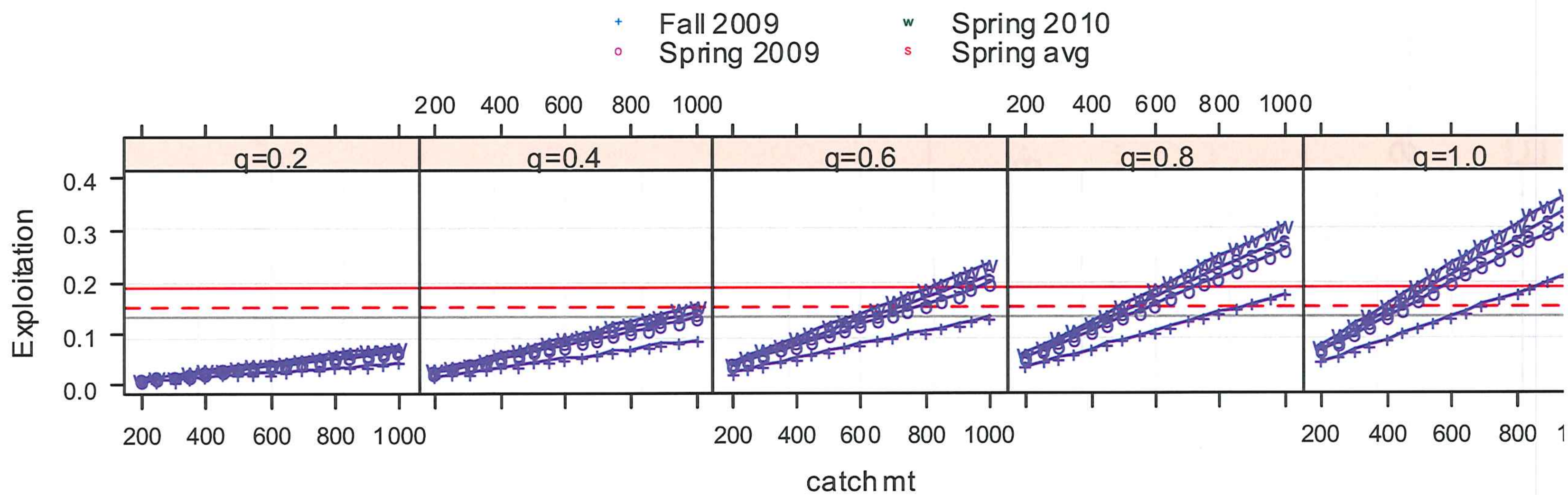


Figure 13 - Exploitation rate (catch over survey biomass) for different catches and combined surveys. Solid red line is exploitation rate of 0.19 (F40%=0.24), dashed red line is 0,15 (75% F40%=0.18), and solid gray line is 0.13 (75% M= 0.2).

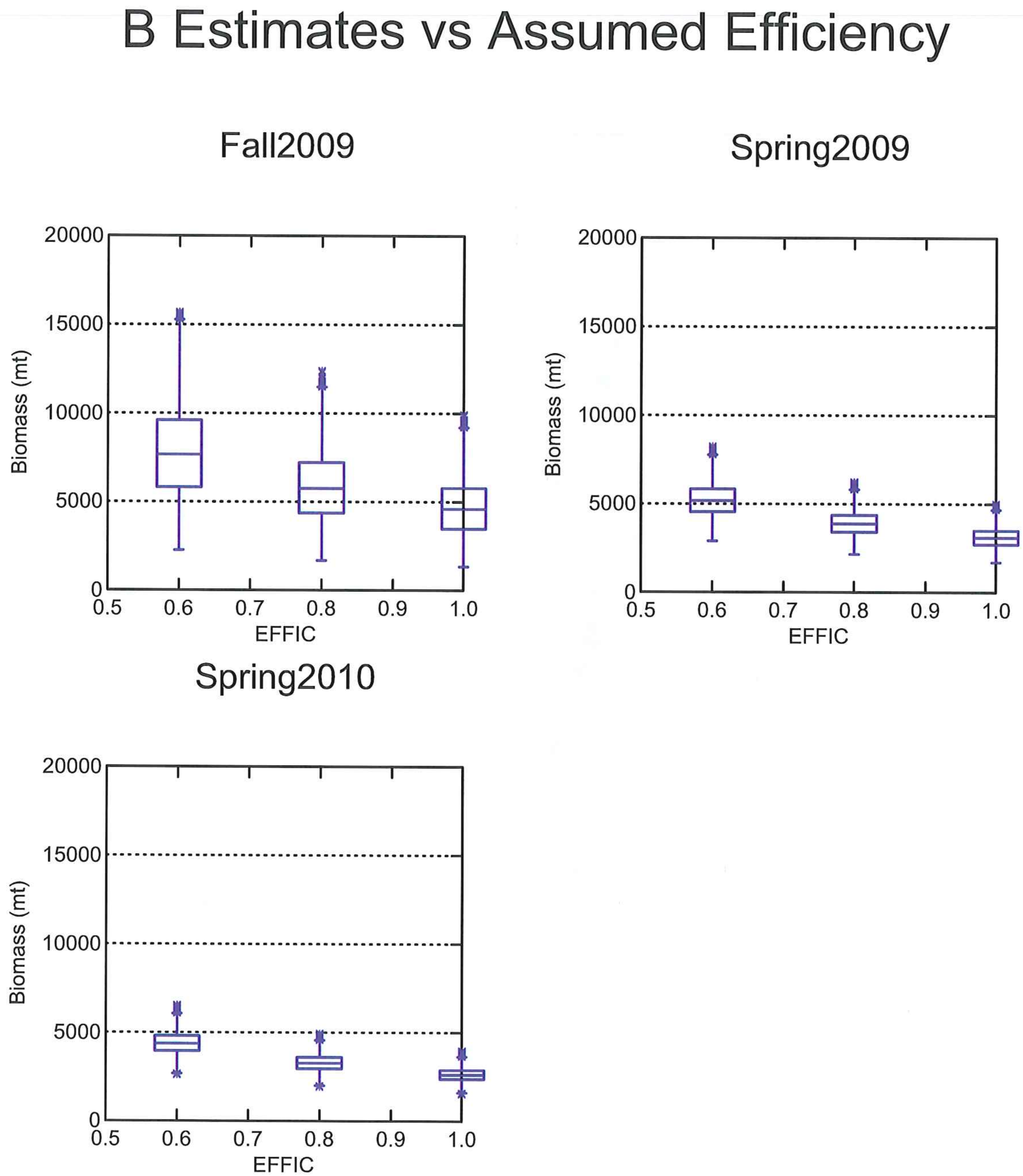


Figure 14 - Swept area biomass estimates for Gulf of Maine winter flounder for varying seasons and years under three alternative assumed values of trawl efficiency.

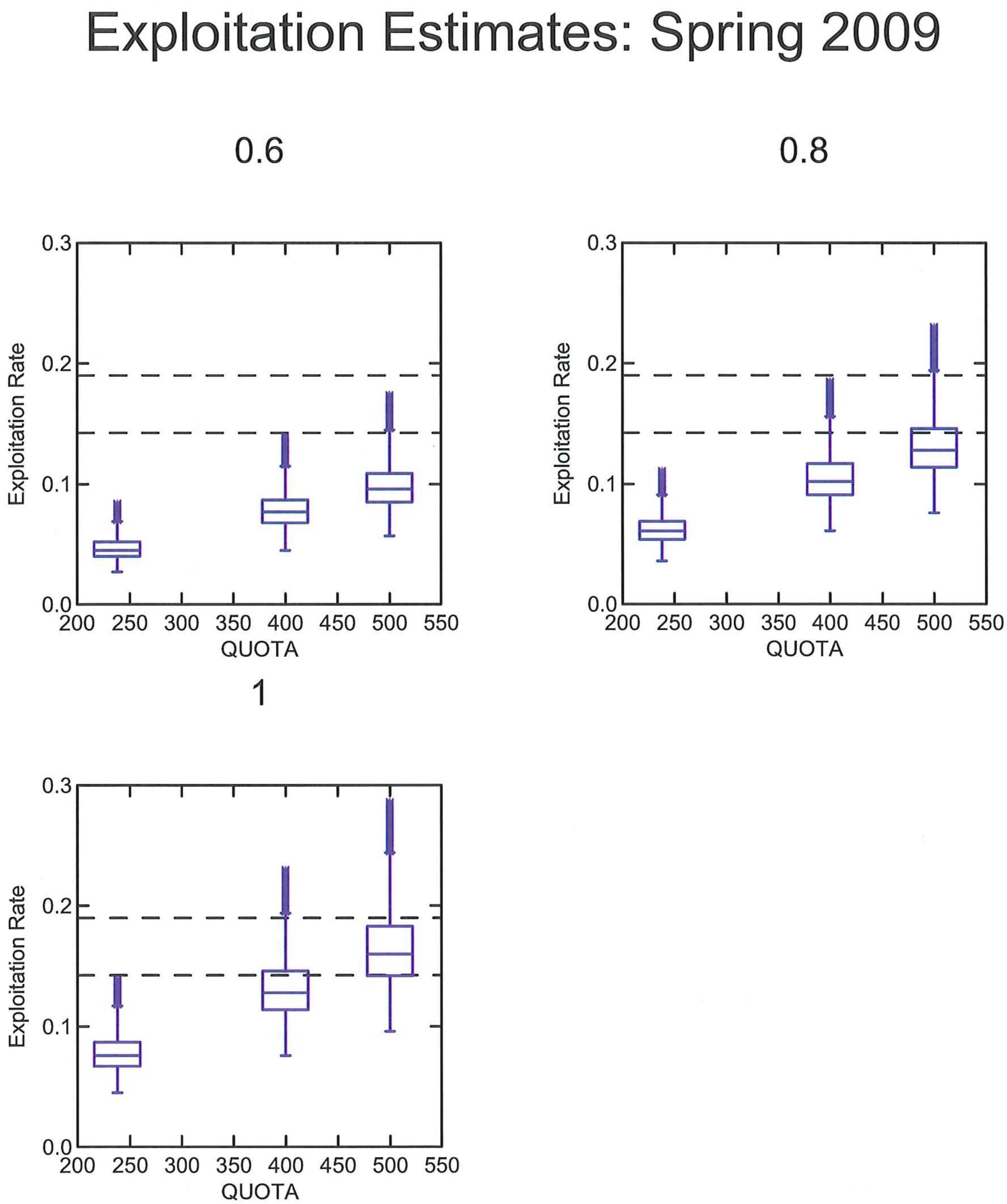


Figure 15 - Estimated exploitation rates for Gulf of Maine winter flounder for spring 2009 based on three assumed estimates of gear efficiency (0.6, 0.8, and 1.0) and three assumed catch quotas of 238, 400, and 500 mt. Dashed lines represent length based estimates of F40% (0.19) and 75% of F40% (0.1425). SSB per recruit is derived using GOM winter flounder growth and maturation relationships and an assumed knife edge selection curve at 30 cm.

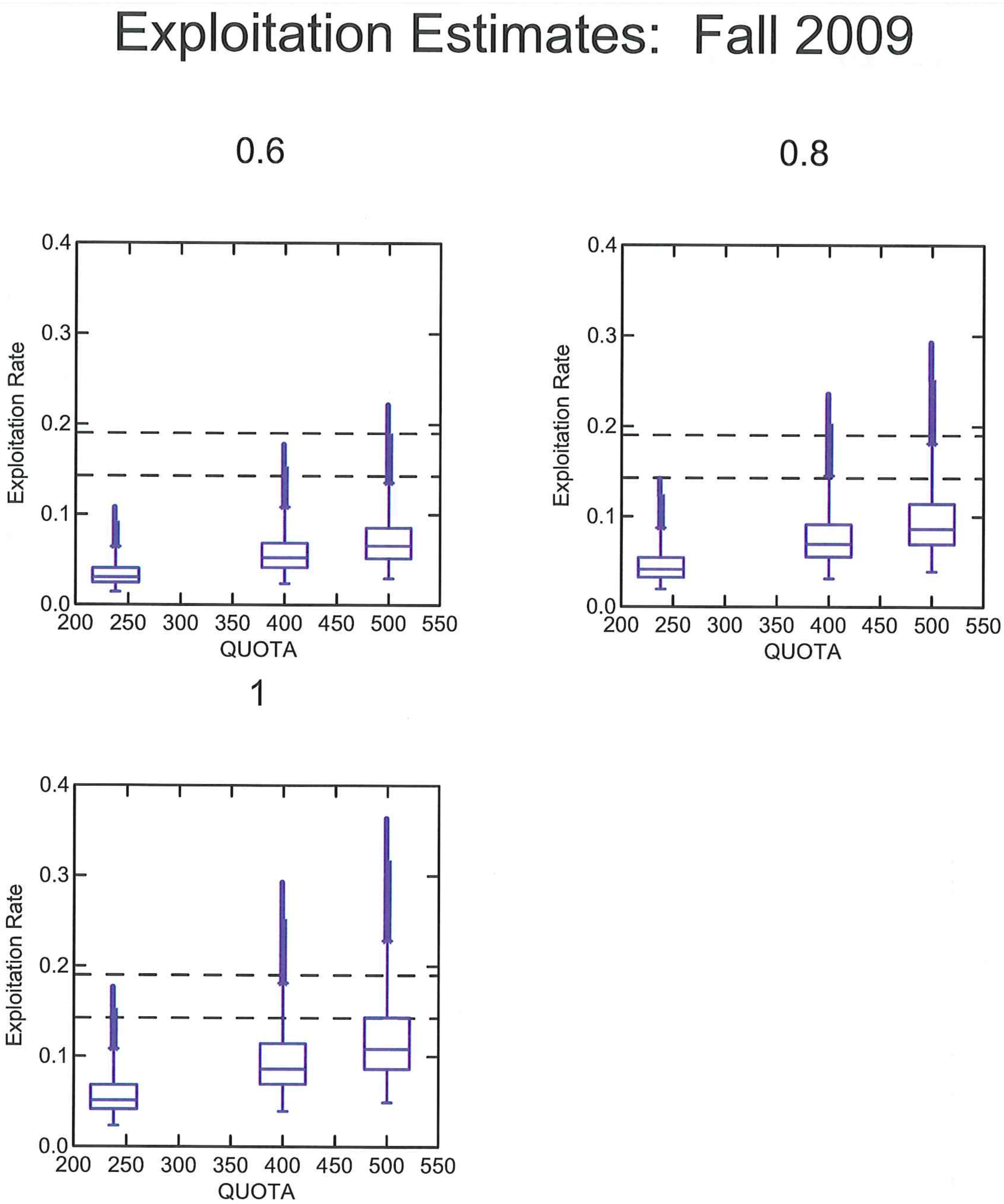


Figure 16 - Estimated exploitation rates for Gulf of Maine winter flounder for Fall 2009 based on three assumed estimates of gear efficiency (0.6, 0.8, and 1.0) and three assumed catch quotas of 238, 400, and 500 mt. Dashed lines represent length based estimates of F40% (0.19) and 75% of F40% (0.1425). SSB per recruit is derived using GOM winter flounder growth and maturation relationships and an assumed knife edge selection curve at 30 cm.

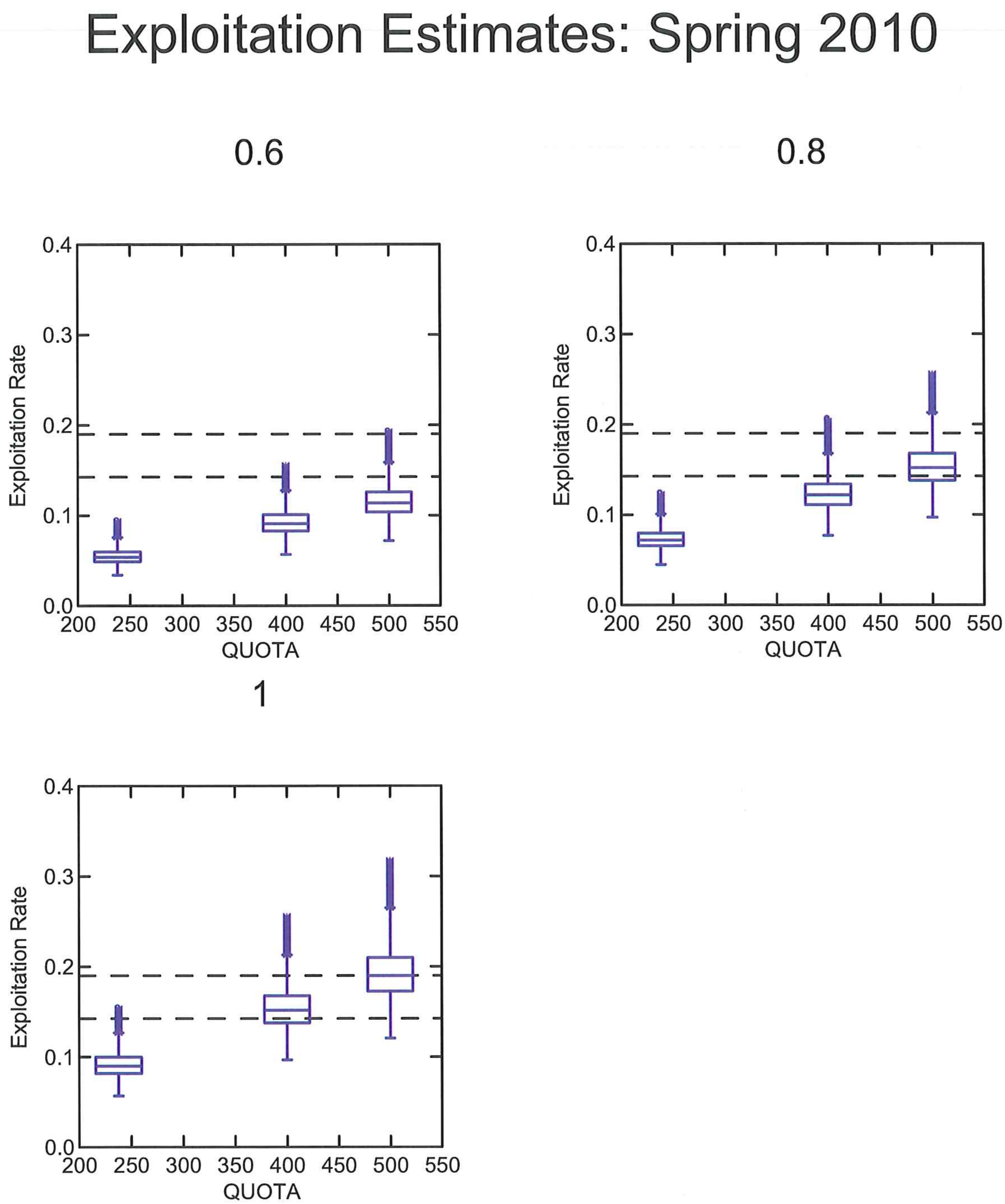


Figure 17 - Estimated exploitation rates for Gulf of Maine winter flounder for Spring 2010 based on three assumed estimates of gear efficiency (0.6, 0.8, and 1.0) and three assumed catch quotas of 238, 400, and 500 mt. Dashed lines represent length based estimates of F40% (0.19) and 75% of F40% (0.1425). SSB per recruit is derived using GOM winter flounder growth and maturation relationships and an assumed knife edge selection curve at 30 cm.

Appendix 1. Summary of sampling distribution for exploitation rates for varying seasons, years, assumed efficiencies, and assumed quotas for Gulf of Maine winter flounder.

The following results are for:
SEASONYR$ = Fall2009
EFFIC = 1.000
QUOTA = 238.000
Data for the following results were selected according to:
vname$="F"

Case frequencies determined by value of variable V2FREQ.

	VBIN
Minimum	0.023
Maximum	0.175
Range	0.152
Mean	0.058
Standard Dev	0.025
C.V.	0.429
Skewness(G1)	1.558
Kurtosis(G2)	2.639
Method = EMPCDF	
1 %	0.027
5 %	0.031
10 %	0.034
20 %	0.039
25 %	0.041
30 %	0.043
40 %	0.047
50 %	0.051
60 %	0.056
70 %	0.063
75 %	0.068
80 %	0.073
90 %	0.091
95 %	0.111
99 %	0.146

The following results are for:
SEASONYR$ = Fall2009
EFFIC = 1.000
QUOTA = 400.000
Data for the following results were selected according to:
vname$="F"

Case frequencies determined by value of variable V2FREQ.

	VBIN
Minimum	0.039
Maximum	0.291
Range	0.252
Mean	0.098
Standard Dev	0.042
C.V.	0.426
Skewness(G1)	1.553
Kurtosis(G2)	2.621
Method = EMPCDF	
1 %	0.046
5 %	0.053
10 %	0.058
20 %	0.065
25 %	0.069
30 %	0.072
40 %	0.079
50 %	0.086
60 %	0.095
70 %	0.107
75 %	0.114
80 %	0.123
90 %	0.154
95 %	0.186
99 %	0.244

The following results are for:
SEASONYR$ = Fall2009
EFFIC = 1.000
QUOTA = 500.000
Data for the following results were selected according to:
vname$="F"

Case frequencies determined by value of variable V2FREQ.

	VBIN
Minimum	0.049
Maximum	0.362
Range	0.313
Mean	0.122
Standard Dev	0.052
C.V.	0.425
Skewness(G1)	1.552
Kurtosis(G2)	2.618
Method = EMPCDF	
1 %	0.058
5 %	0.066
10 %	0.072
20 %	0.082
25 %	0.086
30 %	0.090
40 %	0.099
50 %	0.108
60 %	0.119
70 %	0.133
75 %	0.143
80 %	0.154
90 %	0.192
95 %	0.232
99 %	0.305

The following results are for:
SEASONYR$ = Fall2009
EFFIC = 0.800
QUOTA = 238.000
Data for the following results were selected according to:
vname$="F"

Case frequencies determined by value of variable V2FREQ.

	VBIN
Minimum	0.019
Maximum	0.140
Range	0.121
Mean	0.046
Standard Dev	0.020
C.V.	0.430
Skewness(G1)	1.559
Kurtosis(G2)	2.646
Method = EMPCDF	
1 %	0.022
5 %	0.025
10 %	0.027
20 %	0.031
25 %	0.032
30 %	0.034
40 %	0.037
50 %	0.041
60 %	0.045
70 %	0.051
75 %	0.054
80 %	0.058
90 %	0.073
95 %	0.088
99 %	0.116

The following results are for:
SEASONYR$ = Fall2009
EFFIC = 0.800
QUOTA = 400.000
Data for the following results were selected according to:
vname$="F"

Case frequencies determined by value of variable V2FREQ.

	VBIN
Minimum	0.031
Maximum	0.234
Range	0.203
Mean	0.078
Standard Dev	0.033
C.V.	0.427
Skewness(G1)	1.556
Kurtosis(G2)	2.631
Method = EMPCDF	
1 %	0.037
5 %	0.042
10 %	0.046
20 %	0.052
25 %	0.055
30 %	0.057
40 %	0.063
50 %	0.069
60 %	0.076
70 %	0.085
75 %	0.091
80 %	0.099
90 %	0.123
95 %	0.149
99 %	0.196

The following results are for:
SEASONYR$ = Fall2009
EFFIC = 0.800
QUOTA = 500.000
Data for the following results were selected according to:
vname$="F"

Case frequencies determined by value of variable V2FREQ.

	VBIN
Minimum	0.039
Maximum	0.291
Range	0.252
Mean	0.098
Standard Dev	0.042
C.V.	0.426
Skewness(G1)	1.553
Kurtosis(G2)	2.621
Method = EMPCDF	
1 %	0.046
5 %	0.053
10 %	0.058
20 %	0.065
25 %	0.069
30 %	0.072
40 %	0.079
50 %	0.086
60 %	0.095
70 %	0.107
75 %	0.114
80 %	0.123
90 %	0.154
95 %	0.186
99 %	0.244

The following results are for:

SEASONYR$ = Fall2009
EFFIC = 0.600
QUOTA = 238.000

Data for the following results were selected according to:
vname$="F"

Case frequencies determined by value of variable V2FREQ.

	VBIN
Minimum	0.014
Maximum	0.106
Range	0.092
Mean	0.035
Standard Dev	0.015
C.V.	0.432
Skewness(G1)	1.560
Kurtosis(G2)	2.651
Method = EMPCDF	
1 %	0.016
5 %	0.019
10 %	0.020
20 %	0.023
25 %	0.024
30 %	0.025
40 %	0.028
50 %	0.030
60 %	0.034
70 %	0.038
75 %	0.040
80 %	0.044
90 %	0.055
95 %	0.066
99 %	0.087

The following results are for:
SEASONYR$ = Fall2009
EFFIC = 0.600
QUOTA = 400.000
Data for the following results were selected according to:
vname$="F"

Case frequencies determined by value of variable V2FREQ.

	VBIN
Minimum	0.023
Maximum	0.176
Range	0.153
Mean	0.058
Standard Dev	0.025
C.V.	0.428
Skewness(G1)	1.556
Kurtosis(G2)	2.629
Method = EMPCDF	
1 %	0.028
5 %	0.032
10 %	0.034
20 %	0.039
25 %	0.041
30 %	0.043
40 %	0.047
50 %	0.052
60 %	0.057
70 %	0.064
75 %	0.068
80 %	0.074
90 %	0.092
95 %	0.111
99 %	0.147

The following results are for:
SEASONYR$ = Fall2009
EFFIC = 0.600
QUOTA = 500.000
Data for the following results were selected according to:
vname$="F"

Case frequencies determined by value of variable V2FREQ.

	VBIN
Minimum	0.029
Maximum	0.220
Range	0.191
Mean	0.073
Standard Dev	0.031
C.V.	0.428
Skewness(G1)	1.556
Kurtosis(G2)	2.635
Method = EMPCDF	
1 %	0.035
5 %	0.040
10 %	0.043
20 %	0.049
25 %	0.051
30 %	0.054
40 %	0.059
50 %	0.065
60 %	0.071
70 %	0.080
75 %	0.085
80 %	0.092
90 %	0.115
95 %	0.139
99 %	0.183

The following results are for:
SEASONYR$ = Spring2009
EFFIC = 1.000
QUOTA = 238.000
Data for the following results were selected according to:
vname$="F"

Case frequencies determined by value of variable V2FREQ.

	VBIN
Minimum	0.045
Maximum	0.139
Range	0.094
Mean	0.078
Standard Dev	0.014
C.V.	0.183
Skewness(G1)	0.612
Kurtosis(G2)	0.160
Method = EMPCDF	
1 %	0.053
5 %	0.058
10 %	0.061
20 %	0.065
25 %	0.067
30 %	0.069
40 %	0.073
50 %	0.076
60 %	0.080
70 %	0.084
75 %	0.087
80 %	0.090
90 %	0.098
95 %	0.104
99 %	0.116

The following results are for:
SEASONYR$ = Spring2009
EFFIC = 1.000
QUOTA = 400.000
Data for the following results were selected according to:
vname$="F"

Case frequencies determined by value of variable V2FREQ.

	VBIN
Minimum	0.076
Maximum	0.230
Range	0.154
Mean	0.131
Standard Dev	0.024
C.V.	0.182
Skewness(G1)	0.605
Kurtosis(G2)	0.134
Method = EMPCDF	
1 %	0.089
5 %	0.097
10 %	0.103
20 %	0.110
25 %	0.114
30 %	0.117
40 %	0.122
50 %	0.128
60 %	0.135
70 %	0.142
75 %	0.146
80 %	0.151
90 %	0.164
95 %	0.176
99 %	0.196

The following results are for:
SEASONYR$ = Spring2009
EFFIC = 1.000
QUOTA = 500.000
Data for the following results were selected according to:
vname$="F"

Case frequencies determined by value of variable V2FREQ.

	VBIN
Minimum	0.096
Maximum	0.286
Range	0.190
Mean	0.164
Standard Dev	0.030
C.V.	0.182
Skewness(G1)	0.604
Kurtosis(G2)	0.128
Method = EMPCDF	
1 %	0.111
5 %	0.122
10 %	0.129
20 %	0.138
25 %	0.142
30 %	0.146
40 %	0.153
50 %	0.160
60 %	0.168
70 %	0.177
75 %	0.183
80 %	0.189
90 %	0.206
95 %	0.220
99 %	0.245

The following results are for:
SEASONYR$ = Spring2009
EFFIC = 0.800
QUOTA = 238.000
Data for the following results were selected according to:
vname$="F"

Case frequencies determined by value of variable V2FREQ.

	VBIN
Minimum	0.036
Maximum	0.111
Range	0.075
Mean	0.062
Standard Dev	0.011
C.V.	0.183
Skewness(G1)	0.612
Kurtosis(G2)	0.158
Method = EMPCDF	
1 %	0.042
5 %	0.046
10 %	0.049
20 %	0.052
25 %	0.054
30 %	0.055
40 %	0.058
50 %	0.061
60 %	0.064
70 %	0.067
75 %	0.069
80 %	0.072
90 %	0.078
95 %	0.083
99 %	0.093

The following results are for:
SEASONYR$ = Spring2009
EFFIC = 0.800
QUOTA = 400.000
Data for the following results were selected according to:
vname$="F"

Case frequencies determined by value of variable V2FREQ.

	VBIN
Minimum	0.061
Maximum	0.185
Range	0.124
Mean	0.105
Standard Dev	0.019
C.V.	0.182
Skewness(G1)	0.608
Kurtosis(G2)	0.143
Method = EMPCDF	
1 %	0.071
5 %	0.078
10 %	0.082
20 %	0.088
25 %	0.091
30 %	0.093
40 %	0.098
50 %	0.102
60 %	0.108
70 %	0.113
75 %	0.117
80 %	0.121
90 %	0.131
95 %	0.140
99 %	0.157

The following results are for:
SEASONYR$ = Spring2009
EFFIC = 0.800
QUOTA = 500.000
Data for the following results were selected according to:
vname$="F"

Case frequencies determined by value of variable V2FREQ.

	VBIN
Minimum	0.076
Maximum	0.230
Range	0.154
Mean	0.131
Standard Dev	0.024
C.V.	0.182
Skewness(G1)	0.605
Kurtosis(G2)	0.134
Method = EMPCDF	
1 %	0.089
5 %	0.097
10 %	0.103
20 %	0.110
25 %	0.114
30 %	0.117
40 %	0.122
50 %	0.128
60 %	0.135
70 %	0.142
75 %	0.146
80 %	0.151
90 %	0.164
95 %	0.176
99 %	0.196

The following results are for:
SEASONYR$ = Spring2009
EFFIC = 0.600
QUOTA = 238.000
Data for the following results were selected according to:
vname$="F"

Case frequencies determined by value of variable V2FREQ.

	VBIN
Minimum	0.027
Maximum	0.084
Range	0.057
Mean	0.047
Standard Dev	0.009
C.V.	0.184
Skewness(G1)	0.613
Kurtosis(G2)	0.166
Method = EMPCDF	
1 %	0.031
5 %	0.034
10 %	0.036
20 %	0.039
25 %	0.040
30 %	0.041
40 %	0.043
50 %	0.045
60 %	0.048
70 %	0.050
75 %	0.052
80 %	0.054
90 %	0.058
95 %	0.062
99 %	0.070

The following results are for:
SEASONYR$ = Spring2009
EFFIC = 0.600
QUOTA = 400.000
Data for the following results were selected according to:
vname$="F"

Case frequencies determined by value of variable V2FREQ.

	VBIN
Minimum	0.045
Maximum	0.140
Range	0.095
Mean	0.079
Standard Dev	0.014
C.V.	0.183
Skewness(G1)	0.612
Kurtosis(G2)	0.157
Method = EMPCDF	
1 %	0.053
5 %	0.058
10 %	0.061
20 %	0.066
25 %	0.068
30 %	0.070
40 %	0.073
50 %	0.077
60 %	0.081
70 %	0.085
75 %	0.087
80 %	0.090
90 %	0.098
95 %	0.105
99 %	0.117

The following results are for:
SEASONYR$ = Spring2009
EFFIC = 0.600
QUOTA = 500.000
Data for the following results were selected according to:
vname$="F"

Case frequencies determined by value of variable V2FREQ.

	VBIN
Minimum	0.057
Maximum	0.174
Range	0.117
Mean	0.098
Standard Dev	0.018
C.V.	0.182
Skewness(G1)	0.610
Kurtosis(G2)	0.151
Method = EMPCDF	
1 %	0.066
5 %	0.073
10 %	0.077
20 %	0.083
25 %	0.085
30 %	0.087
40 %	0.092
50 %	0.096
60 %	0.101
70 %	0.106
75 %	0.109
80 %	0.113
90 %	0.123
95 %	0.132
99 %	0.147

The following results are for:
SEASONYR$ = Spring2010
EFFIC = 1.000
QUOTA = 238.000
Data for the following results were selected according to:
vname$="F"

Case frequencies determined by value of variable V2FREQ.

	VBIN
Minimum	0.057
Maximum	0.154
Range	0.097
Mean	0.092
Standard Dev	0.013
C.V.	0.145
Skewness(G1)	0.576
Kurtosis(G2)	0.370
Method = EMPCDF	
1 %	0.067
5 %	0.072
10 %	0.076
20 %	0.080
25 %	0.082
30 %	0.084
40 %	0.087
50 %	0.090
60 %	0.094
70 %	0.098
75 %	0.100
80 %	0.102
90 %	0.109
95 %	0.116
99 %	0.128

The following results are for:
SEASONYR$ = Spring2010
EFFIC = 1.000
QUOTA = 400.000
Data for the following results were selected according to:
vname$="F"

Case frequencies determined by value of variable V2FREQ.

	VBIN
Minimum	0.097
Maximum	0.255
Range	0.158
Mean	0.154
Standard Dev	0.022
C.V.	0.144
Skewness(G1)	0.569
Kurtosis(G2)	0.341
Method = EMPCDF	
1 %	0.113
5 %	0.122
10 %	0.128
20 %	0.135
25 %	0.138
30 %	0.141
40 %	0.147
50 %	0.152
60 %	0.158
70 %	0.164
75 %	0.168
80 %	0.172
90 %	0.184
95 %	0.195
99 %	0.215

The following results are for:
SEASONYR$ = Spring2010
EFFIC = 1.000
QUOTA = 500.000
Data for the following results were selected according to:
vname$="F"

Case frequencies determined by value of variable V2FREQ.

	VBIN
Minimum	0.121
Maximum	0.317
Range	0.196
Mean	0.193
Standard Dev	0.028
C.V.	0.144
Skewness(G1)	0.566
Kurtosis(G2)	0.330
Method = EMPCDF	
1 %	0.141
5 %	0.153
10 %	0.160
20 %	0.169
25 %	0.173
30 %	0.177
40 %	0.183
50 %	0.190
60 %	0.197
70 %	0.205
75 %	0.210
80 %	0.215
90 %	0.230
95 %	0.243
99 %	0.269

The following results are for:
SEASONYR$ = Spring2010
EFFIC = 0.800
QUOTA = 238.000
Data for the following results were selected according to:
vname$="F"

Case frequencies determined by value of variable V2FREQ.

	VBIN
Minimum	0.045
Maximum	0.124
Range	0.079
Mean	0.073
Standard Dev	0.011
C.V.	0.145
Skewness(G1)	0.579
Kurtosis(G2)	0.387
Method = EMPCDF	
1 %	0.053
5 %	0.058
10 %	0.060
20 %	0.064
25 %	0.066
30 %	0.067
40 %	0.070
50 %	0.072
60 %	0.075
70 %	0.078
75 %	0.080
80 %	0.082
90 %	0.087
95 %	0.092
99 %	0.102

The following results are for:
SEASONYR$ = Spring2010
EFFIC = 0.800
QUOTA = 400.000
Data for the following results were selected according to:
vname$="F"

Case frequencies determined by value of variable V2FREQ.

	VBIN
Minimum	0.077
Maximum	0.206
Range	0.129
Mean	0.123
Standard Dev	0.018
C.V.	0.144
Skewness(G1)	0.576
Kurtosis(G2)	0.366
Method = EMPCDF	
1 %	0.090
5 %	0.097
10 %	0.102
20 %	0.108
25 %	0.111
30 %	0.113
40 %	0.117
50 %	0.122
60 %	0.126
70 %	0.131
75 %	0.134
80 %	0.138
90 %	0.147
95 %	0.156
99 %	0.172

The following results are for:
SEASONYR$ = Spring2010
EFFIC = 0.800
QUOTA = 500.000
Data for the following results were selected according to:
vname$="F"

Case frequencies determined by value of variable V2FREQ.

	VBIN
Minimum	0.097
Maximum	0.255
Range	0.158
Mean	0.154
Standard Dev	0.022
C.V.	0.144
Skewness(G1)	0.569
Kurtosis(G2)	0.341
Method = EMPCDF	
1 %	0.113
5 %	0.122
10 %	0.128
20 %	0.135
25 %	0.138
30 %	0.141
40 %	0.147
50 %	0.152
60 %	0.158
70 %	0.164
75 %	0.168
80 %	0.172
90 %	0.184
95 %	0.195
99 %	0.215

The following results are for:
SEASONYR$ = Spring2010
EFFIC = 0.600
QUOTA = 238.000
Data for the following results were selected according to:
vname$="F"

Case frequencies determined by value of variable V2FREQ.

	VBIN
Minimum	0.034
Maximum	0.094
Range	0.060
Mean	0.055
Standard Dev	0.008
C.V.	0.146
Skewness(G1)	0.583
Kurtosis(G2)	0.405
Method = EMPCDF	
1 %	0.040
5 %	0.043
10 %	0.045
20 %	0.048
25 %	0.049
30 %	0.050
40 %	0.052
50 %	0.054
60 %	0.056
70 %	0.058
75 %	0.060
80 %	0.061
90 %	0.065
95 %	0.069
99 %	0.077

The following results are for:
SEASONYR$ = Spring2010
EFFIC = 0.600
QUOTA = 400.000
Data for the following results were selected according to:
vname$="F"

Case frequencies determined by value of variable V2FREQ.

	VBIN
Minimum	0.057
Maximum	0.155
Range	0.098
Mean	0.092
Standard Dev	0.013
C.V.	0.145
Skewness(G1)	0.576
Kurtosis(G2)	0.373
Method = EMPCDF	
1 %	0.067
5 %	0.073
10 %	0.076
20 %	0.081
25 %	0.083
30 %	0.085
40 %	0.088
50 %	0.091
60 %	0.094
70 %	0.098
75 %	0.101
80 %	0.103
90 %	0.110
95 %	0.117
99 %	0.129

The following results are for:
SEASONYR$ = Spring2010
EFFIC = 0.600
QUOTA = 500.000
Data for the following results were selected according to:
vname$="F"

Case frequencies determined by value of variable V2FREQ.

	VBIN
Minimum	0.072
Maximum	0.193
Range	0.121
Mean	0.116
Standard Dev	0.017
C.V.	0.144
Skewness(G1)	0.573
Kurtosis(G2)	0.359
Method = EMPCDF	
1 %	0.084
5 %	0.091
10 %	0.096
20 %	0.101
25 %	0.104
30 %	0.106
40 %	0.110
50 %	0.114
60 %	0.118
70 %	0.123
75 %	0.126
80 %	0.129
90 %	0.138
95 %	0.146
99 %	0.161

August 6, 2010

Attachment 2
Gulf of Maine Winter Flounder

1. ABCs for GOM winter flounder were established by the Council in 2009 (FW 44) based on the recommendations of the SSC. GARM III did not produce an approved assessment for this stock. Reviewers reported stock status as unknown but also provided this statement:

> "While the Panel was unable to determine the stock's status relative to the BRPs, it agreed that the current trend in the population was very troubling. The Panel generally agreed that it is highly likely that biomass is below B_{MSY}, and that there is a substantial probability that it is below ½ B_{MSY}. The Panel noted that other stocks in the area of this mixed fishery were also at low levels. As a result, the ABC control rule used by the SSC was " Interim ABCs should be determined for stocks with unknown status according to case-by case recommendations from the SSC."

2. Since there was no assessment for this stock, the ABC control rule used by the SSC was "Interim ABCs should be determined for stocks with unknown status according to case-by case recommendations from the SSC." Based on SSC guidance, ABCs were calculated as 75% of the recent catches. The PDT calculated the ABC using the three-year average catch of 2006 – 2008. As a result, the ABC was set as 238 mt for 2010- 2012. Since a benchmark assessment is planned for spring 2011, should the SSC decide to revise the ABC a value is needed for 2011 and 2012.

While reviewing the OFLs and ABCs for this stock, the PDT noted an inconsistency in that the OFLs were set using a projection from a rejected assessment. This has no effect on management and the PDT recommends correcting these values only if the SSC recommends revising the ABCs.

3. Concerns have been raised that the low ABC for this stock may limit sector and common pool fishing in the Gulf of Maine. At the June Council meeting the following motion was passed unanimously

> "to ask the SSC to examine any recent fisheries independent and fisheries dependent data collected since GARM 3 for GOM winter flounder and to evaluate whether this new information would affect their current ABC recommendation for GOM winter flounder."

4. Updated survey and catch information is provided for the SSC's review. Catch information includes a summary of FY 2010 sector and common pool catches as of July 27, 2010.

5. If the ABC is changed to 75 percent of the average of the 2007-2009 catch it would increase to 257.8 mt. If OFL is set at the average of the 2007-2009 catch, it would be 343.7 mt.

6. NEFSC survey indices were updated using the overall abundance and biomass conversion coefficients developed by Miller et al. 2010. Winter flounder has an estimated abundance conversion of 2.490 and a biomass conversion coefficient of 2.086 for combined seasons and all stations. Additional uncertainty surrounding the conversion factors exist with the ongoing development of length based factors. The recent updated TRAC assessments used a newly developed length based conversion coefficients. Comparisons of length frequency distributions between the Albatross and Bigelow suggests that a length based conversion may be more appropriate for many of the flatfishes.

7. Updated catch for 2008 and 2009 show little change from the relatively low catch over the past five years (about 5-10% of the catch from the early 1980s). Overall there is little change in the 2008-2010 survey indices compared to the mid 2000s. Judging from the updated data since GARM III there is little justification for a change in the ABC. However an evaluation of the survey time series still shows little response in abundance with the large change in the catch over time. The high catchability of winter flounder in the spring and fall Mass DMF survey (80 fish per tow average) and the overall tracking of all four survey indices make it difficult to discount the surveys as a good measure of abundance. The conflicting signals between the survey information and the large reduction in the catch resulted in the lack of a reliable population model. However the PDT felt there may be some scope for change in the present ABC calculation considering the conflicting trends in the data, the bounds that result from this conflict within the population models and the relativity high survey area swept estimates.

8. Last year the PDT ABC recommendation included this text:

> "e. GOM winter flounder: While the recommendation is based on SSC guidance to use 75 percent of recent catches, the PDT notes that this result is 70 percent of the catch at 75%FMSY applied to the most pessimistic estimate of stock size reviewed at the GARM III meeting. GARM III struggled with the comparison between the base case run which had a severe retrospective pattern (not overfished and overfishing was not occurring) and a split run which resulted in a large shift in the stock status determination (overfished and overfishing was occurring). An implausible change in q was needed to reconcile the conflict within the model between a large change in the catch and the relatively flat survey indices over the time series. The GARM was reluctant to accept the split run given the lack of a declining trend in all four survey indices, but could not accept the base case run because of the retrospective pattern. Using 75% of recent catches results in a lower catch than if the split run were accepted and a projection was run off it at 75% of F_{MSY}."

The original split survey GOM winter flounder (which was not accepted at GARM III) produced a 2011 catch of 439 mt and a 2012 catch of 527 mt. An ABC equal to the average catch of the last three years (344 mt for the years 2007 -2009) would approximate the control rule catch from the most pessimistic assessment reviewed (but not approved) at GARM III.

Table 1 – GOM winter flounder catch

Year	Rec Landings	Comm. Landings	Rec. Discards	Comm Discards	Total Catch
1981	2,270				
1982	3,024	2,793	11	350	6,178
1983	817	2,096	2	120	3,035
1984	1,103	1,699	3	79	2,883
1985	1,629	1,582	8	107	3,327
1986	411	1,185	5	91	1,692
1987	1,443	1,140	12	118	2,713
1988	537	1,250	2	137	1,927
1989	1,035	1,253	6	20	2,315
1990	344	1,116	3	48	1,511
1991	86	1,008	1	41	1,136
1992	77	825	1	43	947
1993	134	611	3	30	778
1994	77	543	2	18	640
1995	40	707	1	28	776
1996	52	606	2	15	674
1997	32	569	3	57	660
1998	27	643	1	18	689
1999	34	350	1	14	399
2000	31	535	2	18	587
2001	37	698	3	19	756
2002	35	682	1	22	740
2003	29	754	1	18	801
2004	29	623	0	36	687
2005	24	335	1	26	387
2006	35	199	1	11	247
2007	26	260	0	17	303
2008	104	284	3	12	402
2009	65	244	4	12	326

Table 2 – GOM winter flounder survey indices. Cells highlighted reflect new data since GARM III.

	NEFSC Spring		NEFSC Fall		MA Spring		MA Fall	
year	number	weight	number	weight	number	weight	number	weight
1978					98.556	20.772	59.152	12.741
1979	4.487	1.73	6.003	2.602	71.834	15.787	134.251	32.837
1980	5.586	2.391	13.141	6.553	72.142	19.108	83.805	17.868
1981	6.461	2.122	4.179	3.029	106.341	30.383	50.847	13.595
1982	7.67	3.022	4.201	1.924	61.612	14.713	108.203	24.418
1983	12.367	5.653	10.304	3.519	112.487	28.984	76.658	15.143
1984	5.155	1.979	7.732	3.106	68.949	16.716	39.541	12.212
1985	3.469	1.418	7.638	2.324	54.21	15.302	48.677	8.288
1986	2.342	0.998	2.502	0.938	68.984	16.352	44.646	6.92
1987	5.609	1.503	1.605	0.488	85.18	18.64	54.434	8.018
1988	6.897	1.649	3	1.03	54.039	11.266	38.419	8.237
1989	3.717	1.316	6.402	2.013	64.696	13.94	39.249	8.602
1990	5.415	2.252	3.527	1.177	82.125	14.375	67.661	13.218
1991	4.517	1.436	7.035	1.467	46.63	11.513	101.716	17.58
1992	3.932	1.16	10.447	3.096	79	15.356	87.581	15.089
1993	1.556	0.353	7.559	1.859	78.018	12.051	93.527	15.109
1994	3.481	0.891	4.87	1.319	72.578	9.779	67.789	13.246
1995	12.185	3.149	4.765	1.446	89.361	14.96	76.736	15.092
1996	2.736	0.732	10.099	3.116	70.494	12.082	77.006	13.144
1997	2.806	0.664	10.008	2.95	85.396	12.959	78.402	14.438
1998	2.001	0.527	3.218	0.987	77.771	13.473	98.45	15.454
1999	6.51	1.982	10.921	3.269	80.776	14.957	125.742	23.204
2000	10.383	2.885	12.705	5.065	162.19	34.16	99.953	25.1
2001	5.242	1.663	8.786	3.133	89.743	24.51	81.072	17.743
2002	12.066	3.692	10.691	4.003	91.083	22.391	65.812	16.264
2003	7.839	2.544	10.182	4.315	83.693	17.323	90.477	15.801
2004	3.879	1.103	2.763	0.867	79.115	11.201	107.591	14.091
2005	6.92	2.056	8.807	2.314	94.044	11.98	78.591	11.812
2006	4.173	1.211	7.117	2.346	85.548	14.434	86.985	15.463
2007	2.5	0.717	6.378	1.82	53.583	10.06	76.669	11.599
2008	11.543	2.177	13.319	4.692	46.863	8.424	90.919	18.085
2009	5.732	1.529	9.107	3.162	71.316	12.277	108.996	22.677
2010	5.973	1.178						

Figure 1 - Trends in relative abundance in NEFSC and MADMF trawl surveys. Note that y-scales differ among panels. Redline is time series median

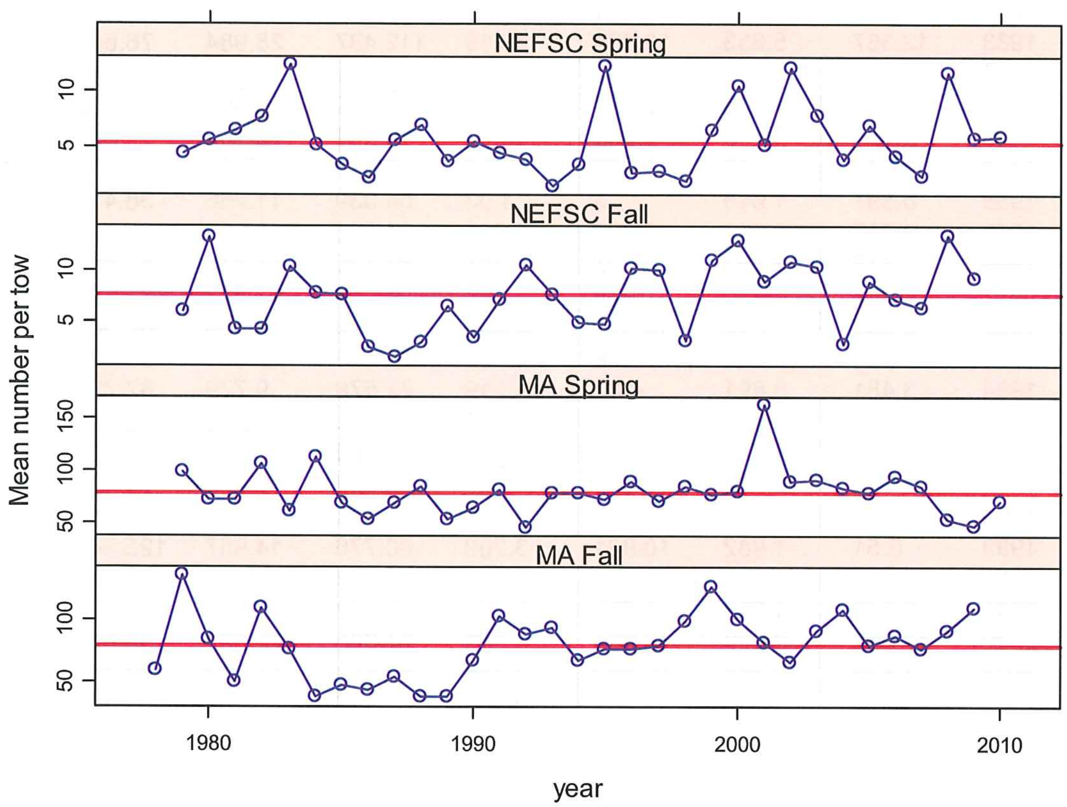


Figure 2 - Trends in relative biomass in NEFSC and MADMF trawl surveys. Note that y-scales differ among panels. Redline is time series median

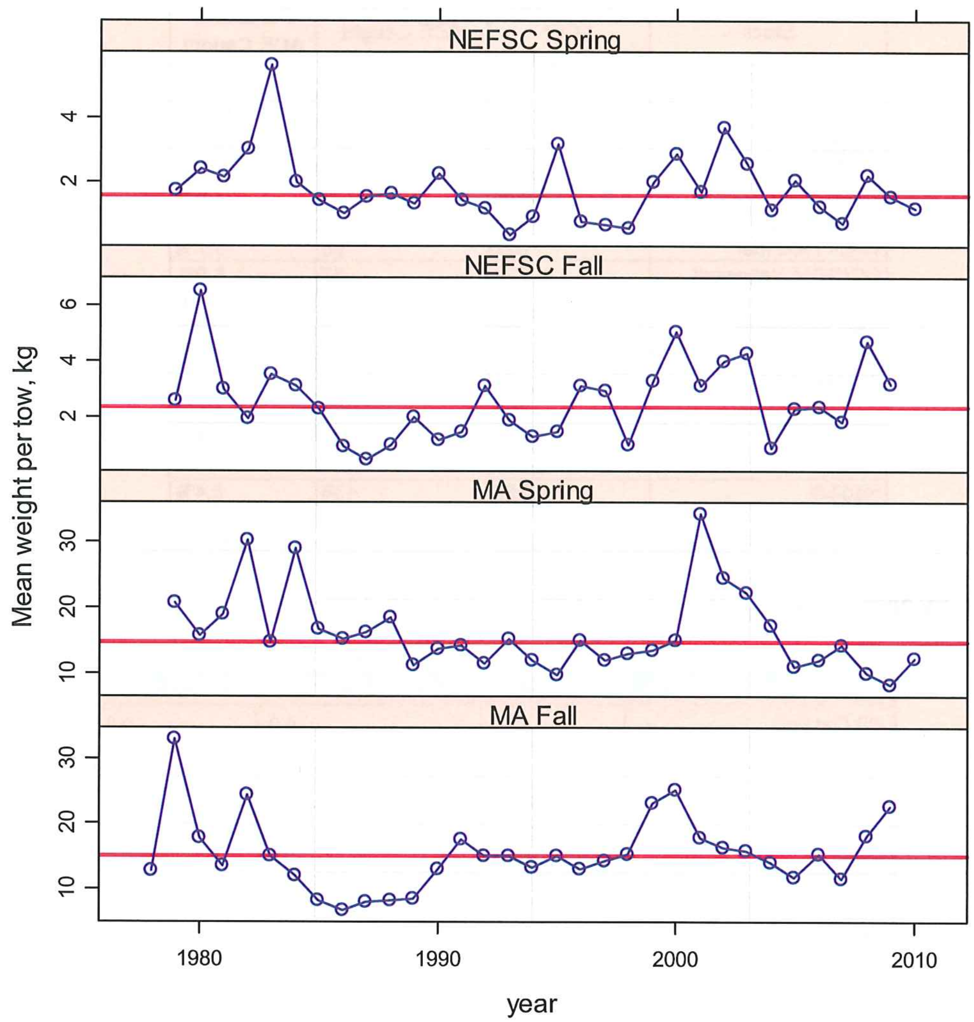


Table 3 – FY 2010 sector catch and ACE, as of July 27, 2010

Summary of Sector ACEs and Usage

Using sector summary reports through the week ended July 17, 2010

Stock	Total Sector ACE* (Metric tons T)	Total Sector ACE Caught (T)	Percent of ACE Caught
EGB Cod	325	81	25.0%
GB Cod	3,302	481	14.6%
GOM Cod	4,327	667	15.4%
American Plaice	2,748	167	6.1%
GB Winter Flounder	1,823	234	12.8%
GOM Winter Flounder	133	9	6.5%
Witch Flounder	827	80	9.7%
CC/GOM Yellowtail	729	37	5.0%
GB Yellowtail	941	123	13.1%
SNE Yellowtail	235	1	0.2%
EGB Haddock	11,913	144	1.2%
GB Haddock	40,186	2,179	5.4%
GOM Haddock	799	37	4.6%
White Hake	2,505	284	11.4%
Pollock	2,686	454	16.9%
Redfish	6,756	436	6.4%

*Total sector allocation as specified in Framework 44, adjusted for final FY2010 sector rosters.

Table 4 FY 2010 common pool catch and ACL, as of July 27, 2010

Stock	Sub-ACL (mt)	Cumulative Catch (mt)	Percent Caught
GB Cod East	12.6	0.0	0.0
GB Cod	128.0	11.1	8.7
GOM Cod	240.0	184.4	76.8
Plaice	100.0	16.8	16.8
GB Winter Flounder	29.0	8.0	27.5
GOM Winter Flounder	25.0	15.6	62.5
Witch Flounder	25.0	19.0	75.9
CC/GOM Yellowtail Flounder	50.0	14.7	29.4
GB Yellowtail Flounder	23.0	16.3	70.9
SNE/MA Yellowtail Flounder	75.0	0.6	0.9
GB Haddock East	75.3	0.0	0.0
GB Haddock	254.0	90.8	35.7
GOM Haddock	26.0	4.7	18.2
White Hake	51.0	23.2	45.5
Pollock	375.0	23.8	6.4
Redfish	90.0	5.0	5.6