P. Gulf of Maine/Georges Bank windowpane flounder

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Additional details and supporting information can be found in the Appendix of the GARM-III Report (NEFSC 2008).

1.0 Background

No stock structure information is available. Therefore, a provisional arrangement has been adopted that recognizes two stock areas based on apparent differences in growth, sexual maturity, and abundance trends between windowpane flounder from Georges Bank and Southern New England. The proportion of total landings contributed by the Gulf of Maine is low, so these windowpane flounder landings are combined with those from Georges Bank and the two regions are assessed as the Gulf of Maine-Georges Bank (GOM-GB) stock.

An age-based assessment for this stock is not possible because there is no age composition data available from either the research surveys or fishery samples. The stock has never been formally assessed as part of the SAW/SARC process. However, index-based assessments have been conducted at previous Groundfish Assessment Review Meetings (GARM). At the most recent GARM, in September 2005, the stock was assessed based on trends in relative biomass indices (stratified mean kg per tow) from the NEFSC fall surveys and relative fishing mortality rates (landings / NEFSC fall survey biomass index) during 1963-2004. Stock status was determined from the 2002-2004 averages of the NEFSC fall survey biomass indices and relative fishing mortality rates. In 2004, the stock was not overfished and overfishing was not occurring (NEFSC 2005).

Several major changes have been made to the current assessment, including model type and input data. Two of the research recommendations from the 2005 GARM, discard estimation and the inclusion of inshore survey strata in the calculation of survey indices are addressed herein. An index-based model (AIM) is used to estimate an F_{MSY} proxy, defined as the relative fishing mortality rate (catch in year t / average NEFSC fall survey relative biomass index during year t, t-1, and t-2) at which the stock can replace itself.

2.0 The Fishery

Landings

The GOM-GB stock boundary includes statistical areas 511-525, 542-543, 551-552, and 561-562 (Figure P1). Commercial landings data are available for 1975-2007. During 1964 through May of 1994, commercial landings and additional fishery-related data were collected and entered into a Federal database by NMFS port agents. Since then, such data have been electronically reported by fish dealers and fishing location (statistical area) and fishing effort data related to landings are only available in the Vessel Trip Report database. As a result, the landings data and biological sampling data were allocated to Statistical Areas (SA) based on Vessel Trip Report data using the method described in Wigley et al. (2007a).

Landings of GOM-GB windowpane flounder were highest (1,212 - 2,862 mt) when a directed fishery existed during 1985-1993 (Figure P2, Table P1). Since 1994, landings have occurred as a result of bycatch and during 1994-2000, ranged between 339 and 147 mt. During

2001-2006, landings declined to their lowest levels, totaling less than 50 mt. Landings in 2007 totaled 119 mt.

During most years, at least 97% of the annual landings were taken with bottom trawls. During 1988-1994 and in 2006, a higher percentage of the annual landings (4.4-7.1%) were taken with scallop dredges (Table P2). A majority of the landings occurred during the first half of the year and the percentage during this time period increased after 1994 and ranged between 61% and 97% (Figure P3). During the period of the directed fishery, landings occurred over a broader area. However, since 1994, landings from Georges Bank (mainly SA 561, denoted as 524 in Figure P4) have been reduced from some SAs due to regulatory measures. During 1994-1999, most of the landings occurred in SAs 521 and 525, and since 2000, in SA 525 (32-74%, Figure P4).

Discards

Initial estimates of windowpane flounder discards, during 1975-2007, are provided for the large mesh bottom trawl fleet (codend mesh size ≥ 5.5 inches), small mesh groundfish fleet (codend mesh size < 5.5 inches), and the sea scallop fleets (dredge and bottom trawl combined, "limited permits" only) in Table P1. Discards (mt) for 1989-2007 were estimated using Northeast Fisheries Observer Program (NEFOP) data and the combined ratio method described in Wigley et al. (2007b). Due to the low numbers of trips sampled by quarter, the small mesh bottom trawl and scallop dredge/trawl fleets were binned by half year to derive discard estimates (Table P3). For both fleets, imputations were necessary during years where fewer than two trips were available. There were no observed trips for the scallop fleets during 1989 and 1990 and only one trip in 1991. As a result, scallop dredge discards for 1989-1991 were estimated using the hindcast method described below. Discards from the large mesh bottom trawl fleet were estimated by quarter and cells with fewer than two trips were imputed using annual values. Due to a lack of fisheries observer data prior to 1989 for the trawl fleets and prior to 1992 for the scallop fleet, discard estimates were hindcast back to 1975 based on the following equation:

$$\hat{D}_{t,h} = \bar{r}_{c,1989-1991,h} * K_{t,h} \quad (1)$$

where:

$\hat{D}_{t,h}$ is the annual discarded pounds of windowpane flounder for fleet *h* in year *t*

$\bar{r}_{c,1989-1991,h}$ is an average combined D/K ratio (discarded pounds of windowpane flounder / total pounds of all species kept) for the fleet *h* during either 1989-1991 (for the trawl fleets) or 1992-1998 (for the scallop fleet)

$K_{t,h}$ is the total pounds of all species kept (landed) for fleet *h* in year *t*

During most years, discards are primarily (70%-80%) from the large mesh bottom trawl fleet (considered as the small mesh fleet prior to 1982 when the minimum codend mesh size was less than 5.5 inches). However, the scallop dredge fleet also contributed a substantial percentage (30%-60%) of the total discards during two time periods, 1977-1981 and 1987-1993 (Table P1). The small mesh bottom trawl fleet comprised a low percentage of the total discards, generally ≤ 5%, during most years. However, the CVs of the annual discard estimates for the small mesh fleet were high, greater than 40% during most years, due to the low numbers of trips sampled (Table P4). Although scallop dredge trips were sampled in much lower numbers than the large mesh fleet, CV's of the discard estimates were not as high as for the small mesh fleet and ranged between 12% and 48% during most years. Discard estimates for the large mesh fleet during

2000-2007 were more precisely estimated (CV range of 16%-38%) than during 1989-1999 (CV range of 36%-98%).

During the directed fishery period, windowpane flounder catches filled the market void left by depleted yellowtail flounder stocks. NEFOP data indicate the primary reason for discarding since 1994 is the lack of a market for this thin-bodied flatfish. There is no minimum size limit for landed fish, but the landings length composition data indicate that only the largest fish are retained (fish ≥ 29 cm since 1994). During the directed fishery period, 1985-1993, discards represented a smaller percentage of the total catch, averaging 27%, but have since comprised a majority of the catch and ranged between 82% and 96% during 2001-2007 (Figure P2, Table P1). The amount of discards declined during 1997-2002, but has been increasing since then and reached the third highest level on record in 2007 (913 mt). Discards more than tripled between 2004 (288 mt) and 2005 (806 mt). The precision of the total discard estimates was moderate to high during most years (Table P1).

The bycatch of GOM-GB windowpane flounder is likely higher during winter and spring when the species is distributed across a broader area on Georges Bank (Figure P5). The discard analyses confirm that during most years since 1989, discards by the large mesh bottom trawl fleet have been highest during the first half of the year.

Catches

During 1975-2007, catches of windowpane flounder were highest during 1985-1991 and ranged between 2,013 mt and 3,645 mt (Table P1, Figure P2). Thereafter, catches declined to a time series low of 105 mt in 1999. Since 2002, catches have been increasing due to increased discarding, primarily in the large mesh bottom trawl fleet (69-96% of the total discards). In 2007, catches reached the highest level (1,032 mt) since 1997.

3.0 Research Survey Data

Previous assessments incorporated NEFSC fall survey relative abundance and biomass indices (stratified mean number and kg per tow) that were derived using data from an offshore strata set (13-30 and 37-40) and that were not standardized for changes in trawl doors, vessels, and gear. However, the inshore strata comprise a substantial portion of the total windowpane flounder habitat. Therefore, NEFSC fall survey indices were revised to include catches from inshore strata 58-61 and 65-66, along with offshore strata 13-30 and 37-40 (Figure P6). The revised survey indices were also standardized for changes in trawl doors (numbers = 1.54 and weight = 1.67), gear (numbers = 1.67 and weight = 1.37), and vessels (numbers = 0.82 and weight = 0.80). For the fall survey biomass indices used in the assessment, door conversion coefficients (Byrne and Forrester 1991a) were applied to the 1975-1984 catches and vessel conversion coefficients (Byrne and Forrester 1991b) were applied when the R/V *Delaware II* was utilized instead of the R/V *Albatross IV*. The latter occurred both within and between surveys on an irregular basis.

Annual relative biomass indices were above the median during 1976-1986 (Figure P7, Table P5). During 1984-1991, biomass indices declined to a level below the median but increased thereafter and were above the median in 1998. However, biomass indices declined in 1999 and remained stable near the median through 2002. During 2002-2006 biomass indices declined gradually but declined further in 2007 to the second lowest level on record. The spike in abundance during 2007, the second highest in the time series, was attributable to very large catches of juveniles at three stations located on Georges Bank, one of which was located within Closed Area II near its western edge.

Trends in relative biomass indices are also presented for: NEFSC spring (March) surveys (1975-2008, inshore strata 58-61 and 65-66 and offshore strata 13-30 and 37-40); Canadian spring (February) surveys (1996-2008, Georges Bank strata 5Z1-5Z4); Massachusetts spring (May) and fall (September) surveys (1978-2007, strata 25-36) and Maine/ New Hampshire (2000-2006, spring and fall, strata 1-3 in regions 1-5) bottom trawl surveys are also presented (Figure P8). The Canadian, MA, and NH/ME surveys do not encompass the entire stock area and consist of shorter time series than the two NEFSC survey series. Therefore, the NEFSC fall survey time series is considered the best indicator of stock abundance and biomass. However, these other surveys can be used to confirm trends in the NEFSC fall survey indices. Similar to NEFSC fall survey indices, recent trends in the MA fall and spring biomass indices indicate a general decline during 2000-2004 to some of the lowest levels observed, followed by a gradual increase through 2006, then a decrease during 2007 (Figure P8). The Canadian spring survey biomass indices show a general declining trend after1996 to the lowest levels observed in 2008.

4.0 Assessment

Annual catches and NEFSC fall survey relative biomass indices were used as input data to the AIM (version 2.0) software provided in version 3.0 of the NOAA Fisheries Toolbox (http://nft.nefsc.noaa.gov/). Computations conducted within the AIM software package and an explanation of the model parameters are provided in the Final Report of the Working Group on Re-evaluation of Biological Reference Points for New England Groundfish (Anon 2002). The NEFSC fall survey indices were utilized in the final model run because an initial run that included relative biomass indices from all of the available surveys indicated that the model regression was only significant for the NEFSC fall survey time series. Lagged smoothers of three years and five years were applied to the relative F values and survey biomass indices, respectively. The 90% CI for the AIM model estimate of F_{MSY} were determined from 1,800 bootstrap iterations.

Input data to the AIM model include annual catches and NEFSC fall survey biomass indices for 1975-2007 which were used to compute annual relative fishing mortality rates (relative F) and stock replacement ratios (Table P6). Trends in catches, survey biomass indices, relative F values, and stock replacement ratios, along with the relationship between ln(relative F) and ln(replacement ratio) are also presented in Figure P9. Annual relative fishing mortality rates increased during 1977-1991 then decreased through 2002 (Figure P9B). Thereafter, relative fishing mortality rates increased through 2007. Stock replacement ratios increased between 1991 and 1998 and were above or near 1.0 during 1995-2001. However, concurrent with the 2002-2007 increase in relative fishing mortality rates, stock replacement ratios declined and the stock was unable to replace itself during 2002-2007 (Figure P9C). The decline in replacement ratio was particularly severe between 2006 and 2007. The correlation between relative fishing mortality rates and stock replacement ratios was marginally significant ($p = 0.087$) and the model results suggest that the stock can replace itself at a relative F value of 0.50 (the relative F value where the log of the replacement ratio is equal to 0, Figure P9D). Positive trends in the standardized residuals were evident during 1995-1998 and negative trends existed for 1999-2004 (Figure P10).

5.0 Biological Reference Points

The current biological reference points are: F_{MSY} proxy = 1.11 and B_{MSY} proxy = 0.94 kg per tow and were derived by an Overfishing Definition Review Panel (Applegate et al. 1998) based on trends in the landings and NEFSC fall survey biomass indices for 1975-1996. MSY was assumed to be 1,000 mt because landings greater than this amount appeared to cause declines in the biomass indices. The 1975-1987 median of the NEFSC fall survey biomass indices was chosen as a B_{MSY} proxy based on trends in relative fishing mortality rates (landings / NEFSC fall survey biomass indices) and NEFSC fall survey biomass indices. The F_{MSY} proxy was computed from the assumed MSY and B_{MSY} values.

The BRPs were re-estimated using data for 1975-2007 and represent survey-based proxies of relative biomass and relative fishing mortality rates (catch / NEFSC fall survey relative biomass index). The re-estimated BRPs are shown in Table P8 in relation to the 2007 biomass index and relative F value which were used to determine stock status. The F_{MSY} proxy (relative F) was estimated using the AIM model and the results indicate that the stock can replace itself at a relative F value of 0.50. Thus, this value can serve as an F_{MSY} proxy for the stock. The 90% CI for the F_{MSY} point estimate indicate that the estimate is very imprecise (Table P7). Based on an examination of the trends in replacement ratios during a period when catches were most precisely estimated (1989-2007), the stock appeared to be able to sustain the levels of catch that occurred during 1995-2001 because replacement ratios were near or above 1.0 during this period (Figure P9C). During 1995-2001, the median catch was approximately 700 mt and this value was considered as an MSY proxy. Division of the MSY proxy (700 mt) by the estimated F_{MSY} proxy from the AIM model (0.50) results in a B_{MSY} proxy of 1.40 kg per tow. It is important to note that the re-estimated BRPs cannot be compared to the current BRPs because different survey strata sets and time series were used in their derivations and the revised estimates include discards. Furthermore, different estimation methods were utilized.

5.0 Projections

Stochastic projections were run for 2008 and 2009 using the AIM model for two scenarios: F status quo (F_{sq}) and F_{MSY}. Estimated catches and NEFSC fall survey relative biomass indices for 2008 and 2009 catches are presented in Table P9 for both projection scenarios. Although the stock is overfished, the August GARM Review Panel recommended against projections based on a $F_{REBUILD}$ scenario because there is no directed fishery.

7.0 Summary

The relative F value for 2007 was computed as the catch in 2007 divided by the average of the NEFSC fall survey relative biomass indices during 2005-2007 (Table P8). The 2007 relative F value of 1.96 was much higher than the F_{MSY} proxy value of 0.50, indicating that overfishing was occurring in 2007. The 2007 relative biomass index of 0.24 kg per tow was well below 1/2 B_{MSY} (= 0.70 kg per tow), indicating that the stock was also overfished in 2007 (Figure P11).

Although there continues to be no directed fishery, increased discarding resulted in an increase in catches during 2004-2007. Relative biomass indices declined gradually between 2002 and 2004 to a level slightly below the median and remained at this level through 2006, but then dropped sharply in 2007 to the second lowest level on record. Concurrent with an increase in relative fishing mortality rates during 2002-2007 and below-median biomass indices, stock replacement ratios have declined and the stock has not been able to replace itself since 2002.

Sources of uncertainty

The underestimation of total discards, because discards from the Canadian scallop dredge and bottom trawl fleets were not available and the species is distributed on the Canadian side of Georges Bank; the imprecision of the F_{MSY} estimate from the AIM model; and the fact that either MSY or B_{MSY} must be subjectively determined external to the AIM model and this approach does not afford a means of quantifying uncertainty in the estimates of current biomass and relative F. The August 2008 GARM Review Panel recommended that quantification of such uncertainty be investigated in the future.

8.0 Panel Discussion/Comments

Conclusions

The Panel concluded that that index based assessment was appropriate for this stock and provides the best available information for management. The Panel recommended that the estimates of relative biomass and fishing mortality should not be converted to absolute units. Given that current catch is mostly incidental and also given the high uncertainty of index based assessments, it was concluded that it was not appropriate to calculate F rebuild for this stock.

Research Recommendations

The Panel had no specific research recommendations for this stock.

9.0 References

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10.0 Acknowledgements

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Table P1. Landings, discards, and catches (mt) of GOM-GB windowpane flounder during 1975-2007. Landings and discards include data from statistical areas 511-525, 542-543, 551-552, and 561-562. Discards estimates include the large mesh (codend mesh size ≥ 5.5 inches) bottom trawl fleet, small mesh groundfish fleet (codend mesh size < 5.5 inches) and the sea scallop dredge fleet.

Year	Landings[1] (mt)	Discards (mt)					Catch (mt)
		Large mesh	Small mesh	Scallop dredge	Total	CV	
1975	1,300		201	52	253		1,553
1976	1,516		213	70	283		1,799
1977	1,099		267	173	441		1,539
1978	923		292	173	465		1,388
1979	856		305	222	527		1,383
1980	408		344	246	591		999
1981	413		329	317	646		1,059
1982	411	368	206	243	816		1,227
1983	460	628	88	182	898		1,358
1984	743	642	49	124	815		1,558
1985	2,141	545	40	106	691		2,833
1986	1,842	447	35	141	623		2,465
1987	1,396	427	20	170	617		2,013
1988	1,377	413	23	269	705		2,082
1989	1,577	188	2	293	483		2,060
1990	1,079	600	60	382	1,042		2,121
1991	2,862	463	1	319	783		3,645
1992	1,519	137	0	190	454	0.46	1,974
1993	1,212	249	6	110	497	0.72	1,709
1994	339	118	158	66	458	0.17	796
1995	668	740	24	35	889	0.53	1,557
1996	773	346	0.4	63	452	0.35	1,226
1997	416	828	27	276	996	0.67	1,412
1998	398	192	0	80	363	0.36	761
1999	49	34	1	20	305	0.40	354
2000	147	124	57	21	202	0.26	349
2001	43	167	0.3	23	190	0.33	233
2002	13	126	6	21	153	0.19	166
2003	16	342	2	11	354	0.27	371
2004	26	268	13	7	288	0.25	315
2005	50	627	262	17	906	0.11	955
2006	46	530	34	76	641	0.13	687
2007	119	811	4.5	97	913	0.15	1,032

[1] Since May of 2004, landings have been self-reported by dealers and were allocated to statistical area based on Vessel Trip Report data.

Table P2. Landings (mt) of Gulf of Maine-Georges Bank windowpane flounder, by gear type, during 1975-2007.

Year	Bottom trawls	Sea scallop dredges	Gillnets	Other	Total	Percent landed by bottom trawls
1975	1,299	0.3	0.0	0.5	1,300	99.9
1976	1,514	1.4	0.1	0.9	1,516	99.8
1977	1,096	1.3	0.6	0.5	1,099	99.8
1978	905	0.9	0.1	42.5	923	98.0
1979	849	2.9	0.0	5.6	856	99.2
1980	383	2.8	0.0	22.5	408	98.7
1981	410	1.1	0.1	1.2	413	99.4
1982	405	1.8	0.1	3.5	412	98.7
1983	456	0.6	0.0	2.5	459	99.3
1984	739	1.3	0.8	2.5	742	99.4
1985	2,137	1.4	0.1	2.8	2,141	99.8
1986	1,810	23.9	4.3	2.8	1,841	98.3
1987	1,354	38.7	0.2	2.5	1,396	97.0
1988	1,315	59.9	1.2	0.9	1,377	95.5
1989	1,508	57.3	10.6	1.6	1,577	95.6
1990	1,001	64.8	9.8	2.1	1,079	92.9
1991	2,736	124.2	0.8	1.4	2,862	95.6
1992	1,434	79.1	1.8	4.6	1,519	94.4
1993	1,149	48.0	0.7	14.7	1,212	94.9
1994	322	12.8	3.6	0.9	339	94.9
1995	663	0.9	2.4	1.6	668	99.3
1996	771	0.4	0.8	0.7	773	99.8
1997	413	0.5	0.6	2.0	416	99.3
1998	395	0.4	1.0	1.3	398	99.3
1999	48	0.2	0.1	0.0	48	99.4
2000	147	0.2	0.2	0.1	147	99.6
2001	42	0.1	0.0	0.0	42	99.8
2002	14	0.0	0.1	0.1	14	99.0
2003	16	0.0	0.1	0.1	16	99.1
2004	26	0.0	0.5	0.0	27	98.0
2005	50	0.0	0.1	0.9	51	98.0
2006	44	0.7	0.2	1.5	46	95.0
2007	117	0.4	0.2	1.9	119	97.9

Table P3. Number of observed trips, by fleet and quarter, included in the discards of GOM-GB windowpane flounder estimated using data from the Northeast Fisheries Observer Program, 1989-2007.

	Large mesh otter trawl					Small mesh groundfish otter trawl			Scallop dredge/otter trawl		
Year	Q1	Q2	Q3	Q4	Total	Q1and Q2	Q3 and Q4	Total	Q1and Q2	Q3 and Q4	Total
1989	3	22	20	7	52	11	30	41			0
1990	4	13	10	11	38	2	17	19			0
1991	14	12	18	26	70	1	37	38		1	1
1992	31	15	5	9	60	4	21	25	3	6	9
1993	8	10	4	7	29	2	7	9	7	4	11
1994	12	6	3	3	24	1	1	2	2	5	7
1995	22	12	6	8	48	2	30	32	1	5	6
1996	7	12		4	23	3	38	41	8	6	14
1997	10		5	2	17	4		4	6	5	11
1998	3	4	2		9	1		1	2	8	10
1999		3	14	14	31	1	11	12	4	17	21
2000	25	29	20	19	93	4	3	7	25	159	184
2001	18	30	39	52	139	6	6	12	17		17
2002	24	14	78	89	205	3	48	51		10	10
2003	105	77	102	88	372	15	25	40	3	7	10
2004	71	72	118	164	425	19	74	93	2	28	30
2005	278	259	241	302	1,080	61	87	148	10	61	71
2006	219	107	132	58	516	24	20	44	16	68	84
2007	106	140	118	158	522	10	22	32	25	55	80

Table P4. Summary of GOM-GB windowpane flounder discard estimates (mt) for the large mesh (codend mesh size ≥ 5.5 in.) and small mesh (codend mesh size < 5.5 in.) groundfish bottom trawl fisheries and the scallop dredge/trawl fisheries (limited permit category), 1975-2007. Discards were hindcast for: large mesh bottom trawls (1982-1988); small mesh bottom trawls (1975-1988); and scallop dredges (1975-1991).

Large Mesh Bottom Trawl				
YEAR	N Observed trips	D/K	Discards (mt)	CV
1975			-	
1976			-	
1977			-	
1978			-	
1979			-	
1980			-	
1981			-	
1982			368	
1983			628	
1984			642	
1985			545	
1986			447	
1987			427	
1988			413	
1989	52	0.004	188	0.50
1990	38	0.009	600	0.36
1991	70	0.007	463	0.48
1992	60	0.002	137	0.50
1993	29	0.005	249	0.98
1994	24	0.003	118	0.41
1995	48	0.021	740	0.57
1996	23	0.008	346	0.42
1997	17	0.023	828	0.91
1998	9	0.005	192	0.42
1999	31	0.001	34	0.61
2000	93	0.003	124	0.32
2001	139	0.003	167	0.38
2002	205	0.003	126	0.22
2003	372	0.007	342	0.28
2004	425	0.006	268	0.27
2005	1,080	0.017	627	0.11
2006	516	0.019	530	0.15
2007	522	0.026	811	0.16

Table P4. (cont.)

Small Mesh Groundfish Bottom Trawl				
YEAR	**N Observed trips**	**D/K**	**Discards (mt)**	**CV**
1975			201	
1976			213	
1977			267	
1978			292	
1979			305	
1980			344	
1981			329	
1982			206	
1983			88	
1984			49	
1985			40	
1986			35	
1987			20	
1988			23	
1989	41	0.00027	1.9	0.72
1990	19	0.00708	59.6	0.60
1991	38	0.00016	1.4	0.75
1992	25	0.00000	0.0	
1993	9	0.00073	5.7	0.81
1994	2	0.02282	158.0	0.00
1995	32	0.00393	24.0	1.02
1996	41	0.00005	0.4	0.99
1997	4	0.00453	26.8	1.39
1998	1	0.00000	0.0	
1999	12	0.00011	1.0	0.34
2000	7	0.00797	56.8	0.61
2001	12	0.00004	0.3	0.82
2002	51	0.00091	5.6	0.73
2003	40	0.00019	1.5	0.43
2004	93	0.00065	13.4	0.46
2005	148	0.02097	261.7	0.26
2006	44	0.00623	34.0	0.52
2007	32	0.00065	4.5	0.70

Table P4. (cont.)

Scallop dredge/trawl, Limited category permits				
YEAR	N Observed trips	D/K	Discards (mt)	CV
1975			52	
1976			70	
1977			173	
1978			173	
1979			222	
1980			246	
1981			317	
1982			243	
1983			182	
1984			124	
1985			106	
1986			141	
1987			170	
1988			269	
1989			293	
1990			382	
1991			319	
1992	9	0.0034	190	0.71
1993	11	0.0030	110	0.91
1994	7	0.0051	66	0.45
1995	6	0.0035	35	0.41
1996	14	0.0032	63	0.16
1997	11	0.0120	276	0.42
1998	10	0.0044	80	0.71
1999	21	0.0005	20	0.37
2000	184	0.0007	21	0.12
2001	17	0.0008	23	0.24
2002	10	0.0009	21	0.46
2003	10	0.0004	11	0.47
2004	30	0.0004	7	0.44
2005	71	0.0004	17	0.32
2006	84	0.0010	76	0.40
2007	80	0.0021	97	0.48

Table P5. Stratified mean catch per tow indices (in kg and numbers) for GOM-GB windowpane flounder caught during NEFSC fall research bottom trawl surveys, 1975-2007. Indices include catches from offshore strata 13-30, 37-40 and inshore strata 58-61, 65-66 and standardization coefficients were applied for trawl door changes (numbers = 1.54 and weight = 1.67), gear changes (numbers = 1.67 and weight = 1.37), and vessels (numbers = 0.82 and weight = 0.80).

Year	Mean kg per tow	Mean number per tow
1975	0.629	9.10
1976	1.910	8.73
1977	2.033	8.99
1978	1.505	10.16
1979	0.958	4.12
1980	0.899	2.80
1981	1.022	3.86
1982	0.820	3.43
1983	0.940	3.27
1984	3.305	18.41
1985	0.828	10.86
1986	1.143	5.15
1987	0.629	3.39
1988	0.712	4.73
1989	0.323	1.41
1990	0.925	5.23
1991	0.193	1.18
1992	0.429	2.12
1993	0.464	4.24
1994	0.263	1.43
1995	0.790	7.40
1996	0.513	3.14
1997	0.423	4.87
1998	1.588	12.46
1999	0.759	4.29
2000	0.708	3.83
2001	0.891	9.82
2002	0.856	5.45
2003	0.742	4.62
2004	0.669	7.35
2005	0.680	9.07
2006	0.660	5.94
2007	0.242	15.59

Table P6. AIM model input data for the GOM-GB windowpane flounder stock: including catch (000's mt), NEFSC fall survey relative biomass indices (stratified mean kg per tow), relative fishing mortality rates (catch in year *t* / mean NEFSC fall survey biomass index for years *t*, *t*-1, and *t*-2), and stock replacement ratios (NEFSC fall survey biomass index in year *t* / mean biomass index for previous five years).

Year	Catch (000's mt)	Relative biomass index (kg per tow)	Relative F	Replacement Ratio
1975	1.553	0.629		
1976	1.799	1.910		
1977	1.539	2.033	1.010	
1978	1.388	1.505	0.764	
1979	1.383	0.958	0.923	
1980	0.999	0.899	0.891	0.639
1981	1.059	1.022	1.104	0.700
1982	1.227	0.820	1.343	0.639
1983	1.358	0.940	1.464	0.903
1984	1.558	3.305	0.923	3.562
1985	2.833	0.828	1.675	0.593
1986	2.465	1.143	1.402	0.826
1987	2.013	0.629	2.323	0.447
1988	2.082	0.712	2.514	0.520
1989	2.060	0.323	3.714	0.244
1990	2.120	0.925	3.245	1.272
1991	3.645	0.193	7.588	0.259
1992	1.847	0.429	3.582	0.771
1993	1.577	0.464	4.356	0.899
1994	0.681	0.263	1.767	0.563
1995	1.467	0.790	2.901	1.737
1996	1.183	0.513	2.266	1.199
1997	1.547	0.423	2.689	0.860
1998	0.670	1.588	0.796	3.237
1999	0.105	0.759	0.114	1.061
2000	0.349	0.708	0.343	0.869
2001	0.233	0.891	0.296	1.116
2002	0.166	0.856	0.203	0.980
2003	0.371	0.742	0.447	0.773
2004	0.315	0.669	0.417	0.846
2005	0.955	0.680	1.370	0.879
2006	0.687	0.660	1.026	0.860
2007	1.032	0.242	1.957	0.335

Table P7. AIM model estimate of the F_{MSY} proxy and the probability value for the randomization test for GOM-GB windowpane flounder.

	Point estimate (90% CI)	Bootstrap mean
F_{MSY} proxy	0.50 (0.26, 0.88)	0.45
Randomization test *p* value	0.087	

Table P8. Biological reference point estimates for GOM-GB windowpane flounder and stock status for 2007. Relative F for 2007 is the catch in 2007 divided by the average relative biomass index for the NEFSC fall surveys during 2005-2007.

2007 Relative F	F_{MSY} proxy
1.96	0.50
2007 Relative biomass index (kg per tow)	**B_{MSY} proxy (kg per tow)**
0.24	1.40

Table P9. Stochastic projections of catch (mt) and NEFSC fall survey relative biomass indices (kg per tow) in 2008 and 2009, assuming F status quo (F_{sq}) and F_{MSY}, for GOM-GB windowpane flounder.

2008			2009	
Catch (mt)	Relative Biomass Index (kg per tow)	F 2009	Catch (mt)	Relative Biomass Index (kg per tow)
871	0.44	F_{sq} (= 1.96)	647	0.33
299	0.60	F_{MSY} (= 0.50)	299	0.60

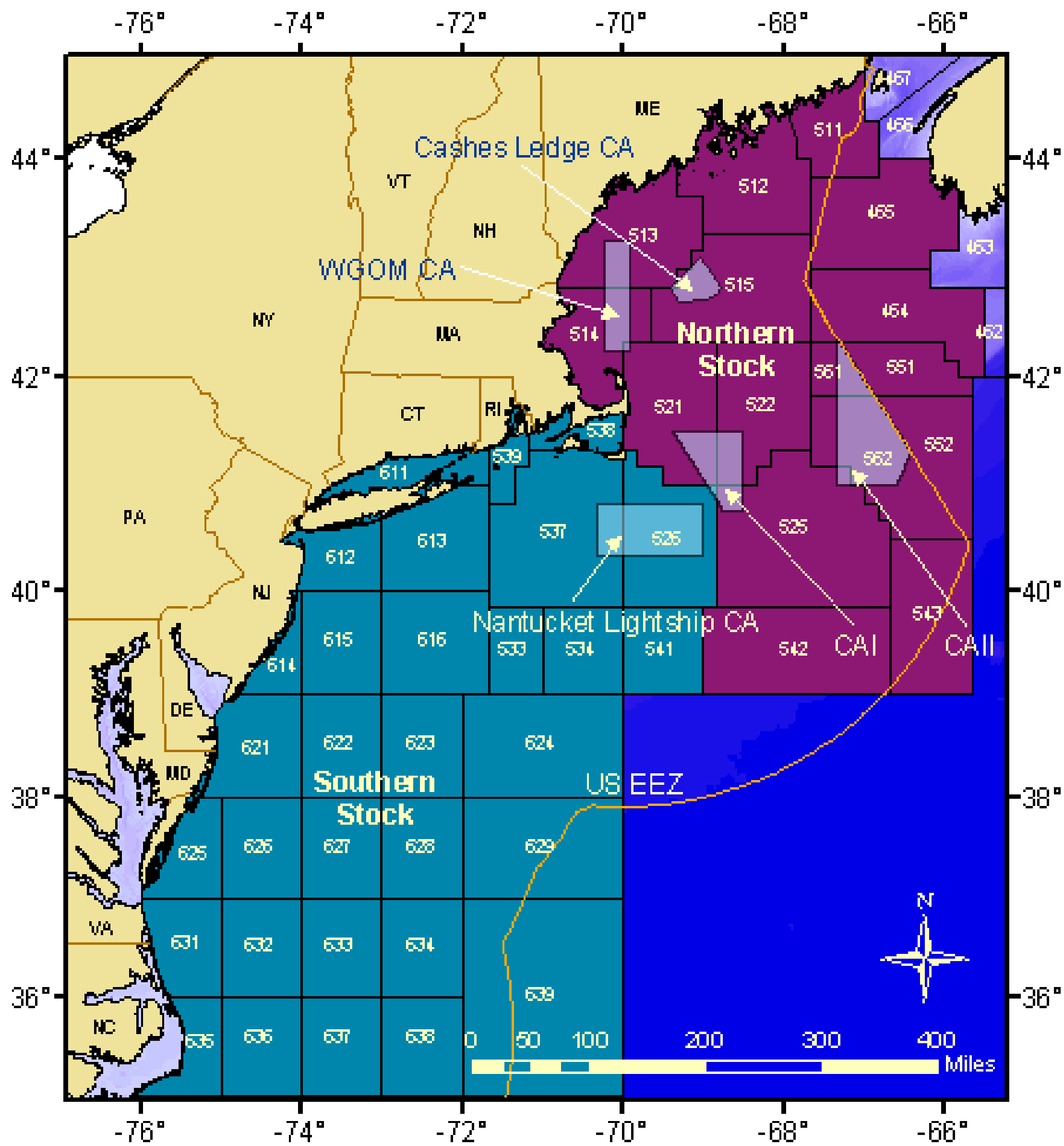

Figure P1. Statistical Areas comprising the northern (Gulf of Maine-Georges Bank) and southern (Southern New England-Mid-Atlantic Bight) windowpane flounder stocks.

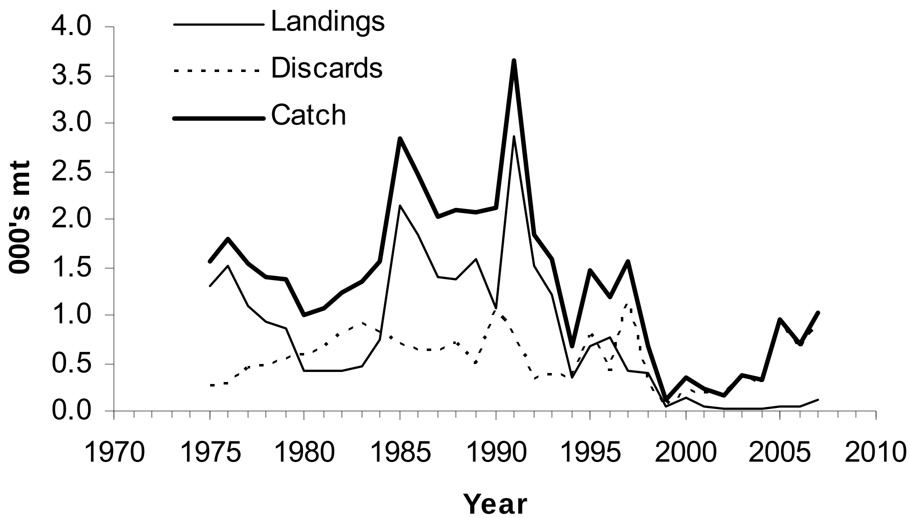

Figure P2. Commercial landings, discards, and catches (000's mt) of Gulf of Maine-Georges Bank windowpane flounder during 1975-2007.

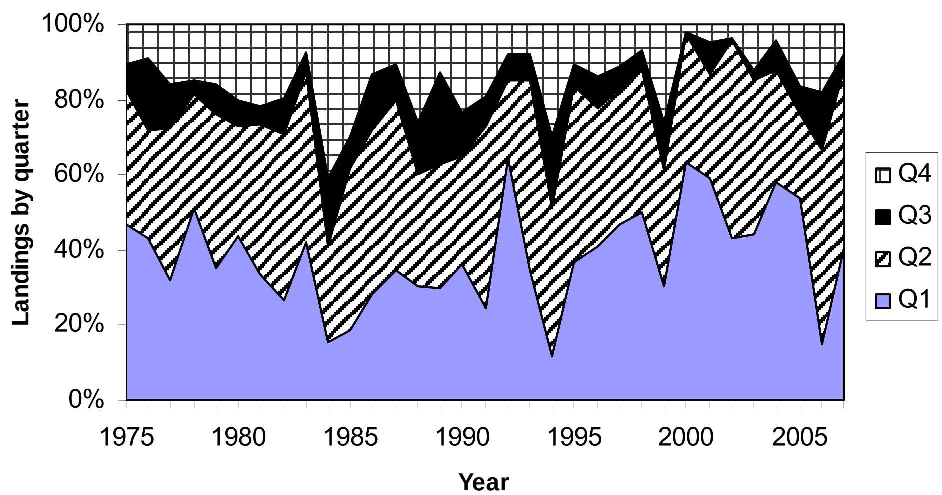

Figure P3. Percentage of landings of GOM-GB windowpane flounder. by quarter, during 1975-2007.

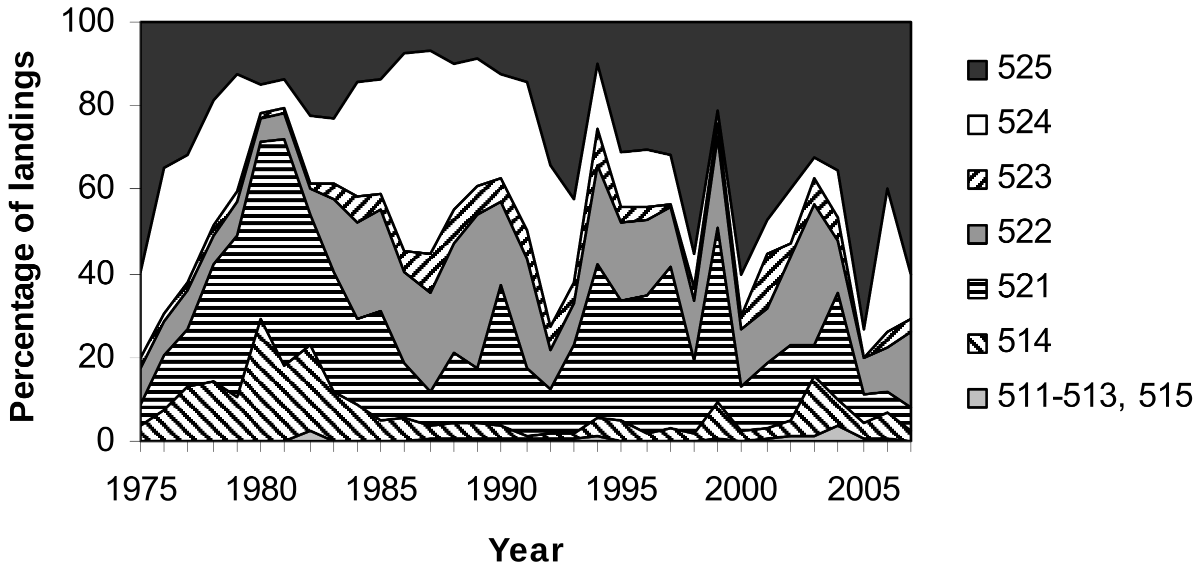

Figure P4. Percentage of landings of GOM-GB windowpane flounder, by Statistical Area, during 1975-2007.

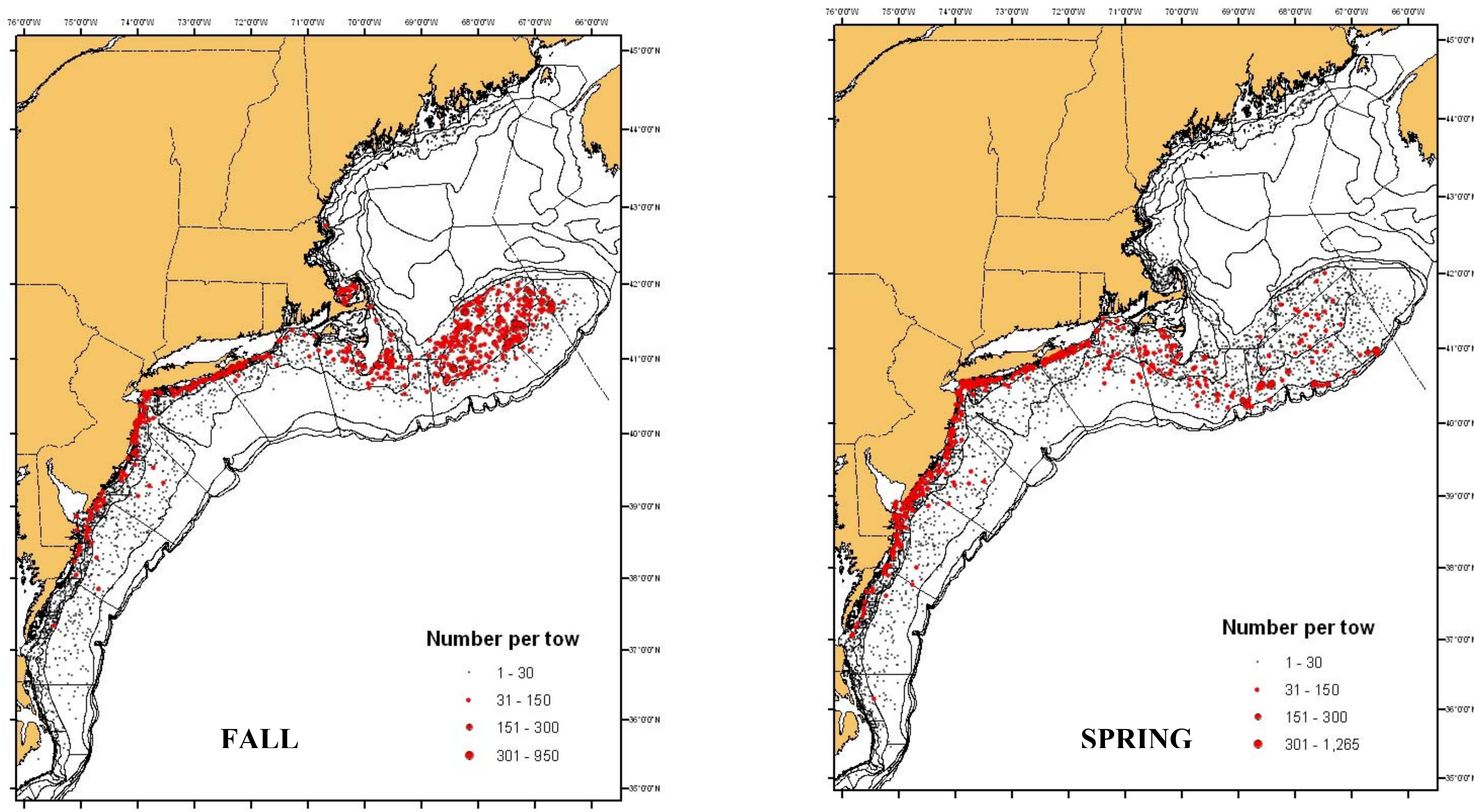

Figure P5. Spatial distribution of windowpane flounder during NEFSC fall and spring bottom trawl surveys, 1968-2007.

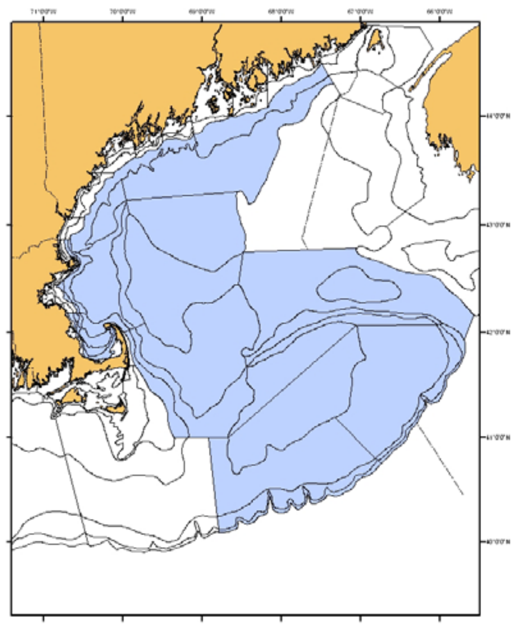

Figure P6. Strata set used to derive abundance and biomass indices, from NEFSC fall and spring bottom trawl surveys, for the Gulf of Maine-Georges Bank windowpane flounder stock.

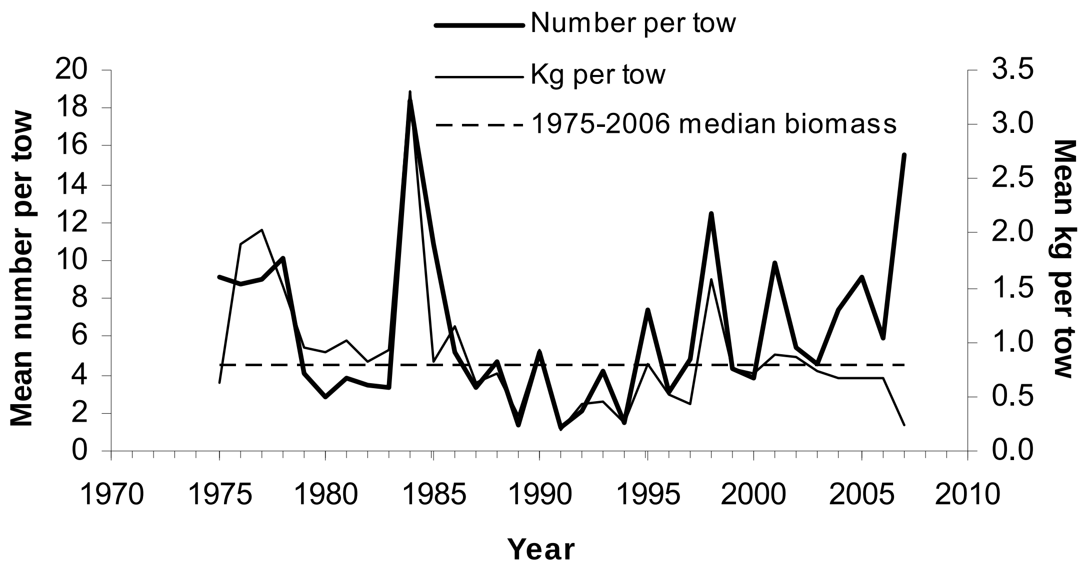

Figure P7. Relative abundance (stratified mean number per tow) and biomass indices (stratified mean kg per tow) for GOM-GB windowpane flounder caught during NEFSC autumn bottom trawl surveys, 1975-2007.

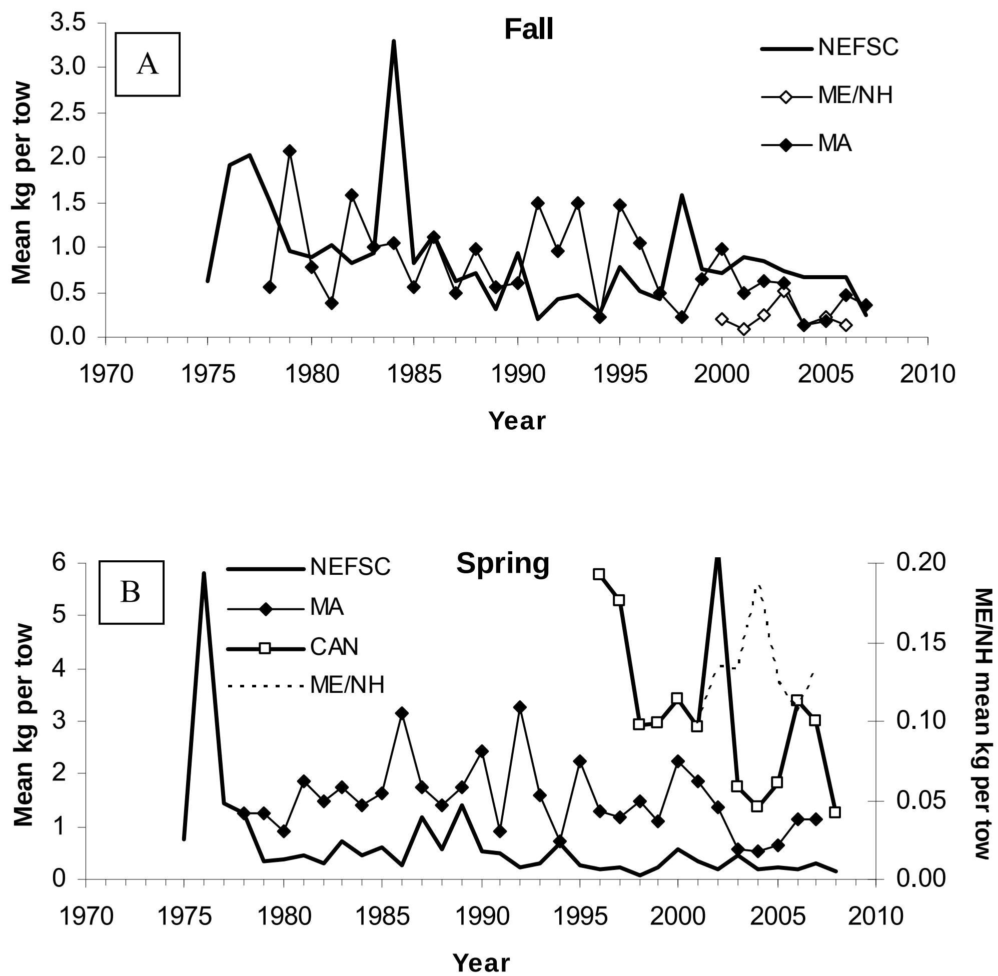

Figure P8. Relative biomass indices (stratified mean kg per tow) for GOM-GB windowpane flounder caught during (A) NEFSC, MA, and ME/NH fall surveys and (B) during NEFSC, MA, ME/NH and Canada spring surveys.

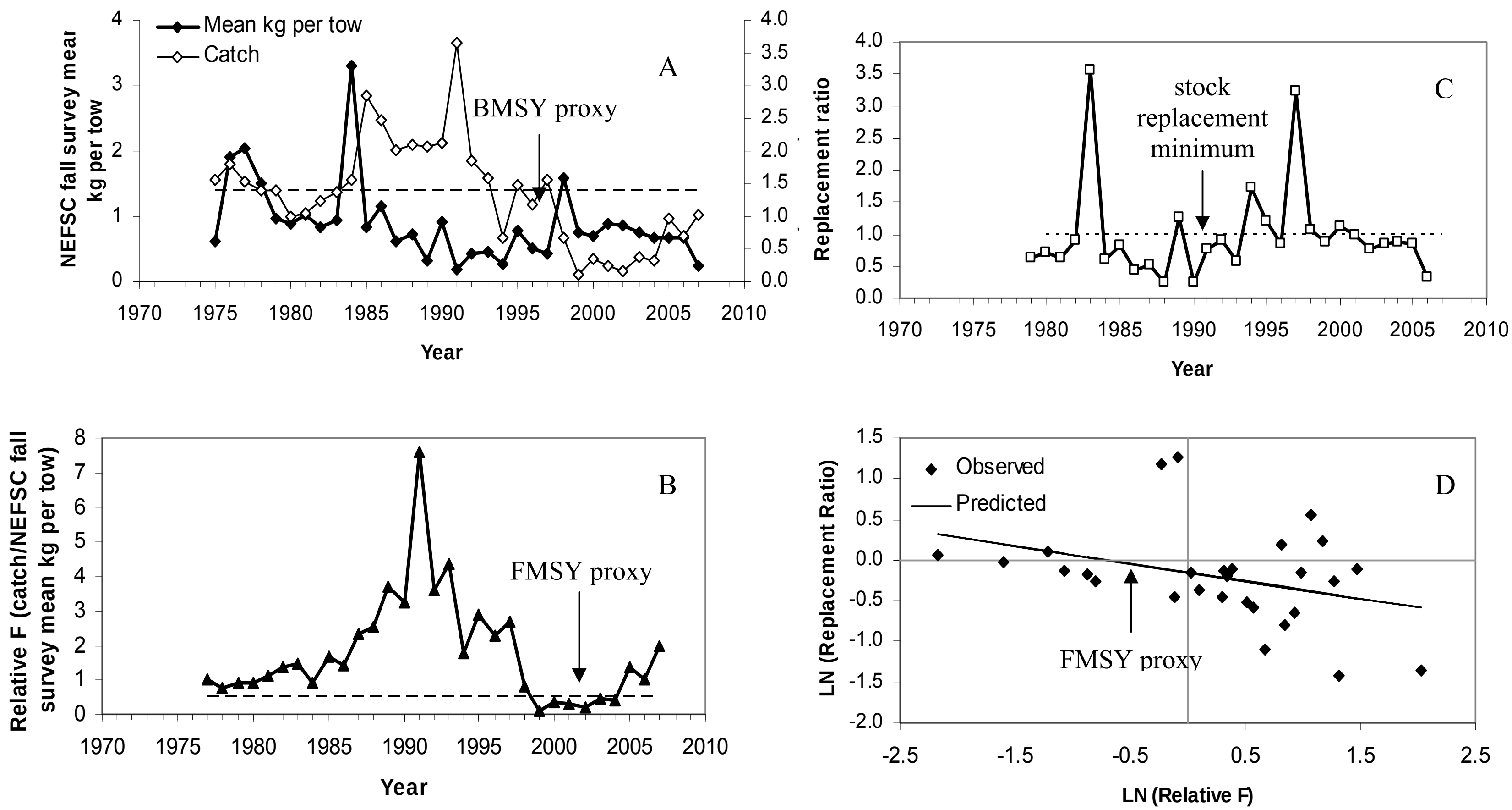

Figure P9. Trends in (A) GOM-GB windowpane flounder catches (000's mt) and NEFSC fall survey relative biomass indices (stratified mean kg per tow), (B) relative fishing mortality rates (catch/NEFSC fall survey biomass index), (C) stock replacement ratios, and (D) the regression of ln(relative F) against ln(replacement ratio) used to calculate an F_{MSY} proxy (= 0.50), 1975-2007.

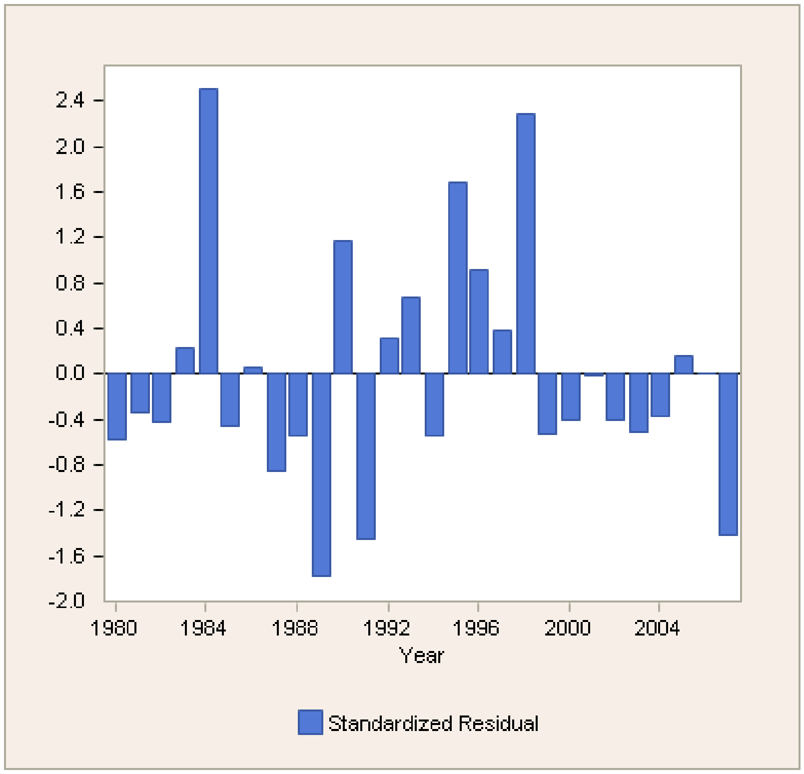

Figure P10. Standardized residuals from the final AIM model run for GOM-GB windowpane flounder.

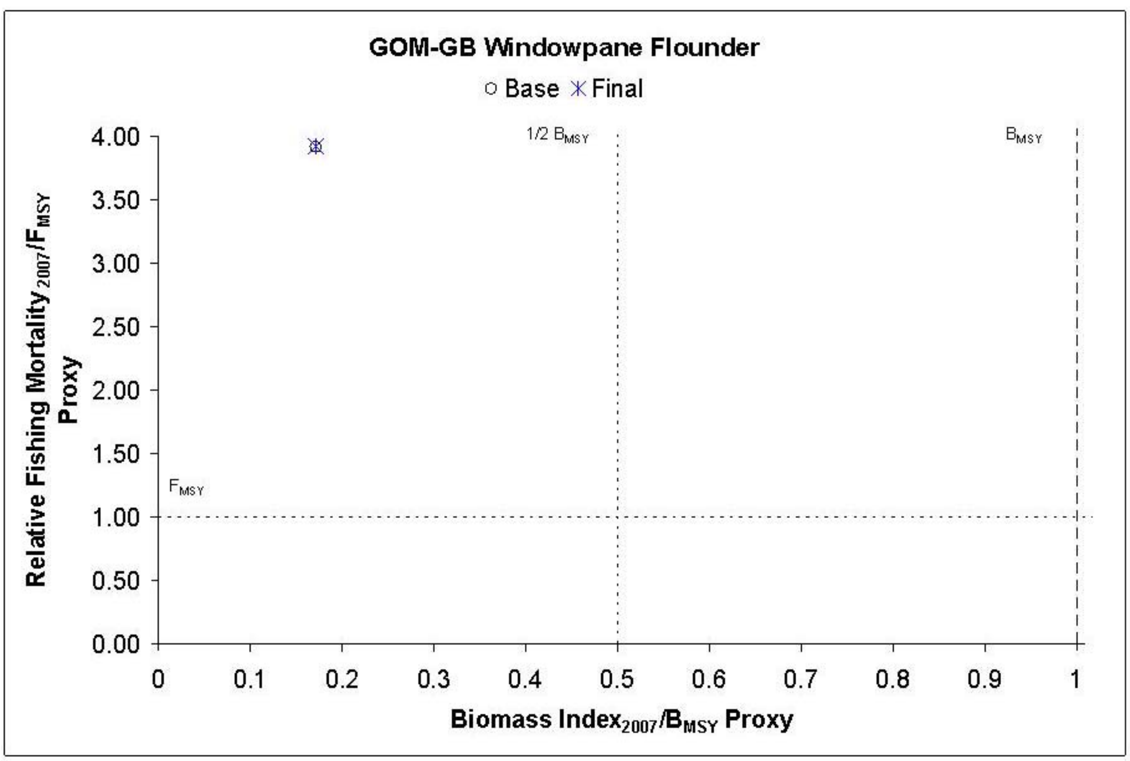

Figure P11. Stock status for GOM-GB windowpane flounder during 2007.