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Southern New England-Mid-Atlantic Bight Windowpane Flounder

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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 Mid-Atlantic area is low, so these windowpane flounder landings are combined with those from Southern New England and the two regions are assessed as the southern New England and Mid-Atlantic Bight (SNE-MAB) stock. The SNE-MAB stock boundary includes statistical areas 526, 533-539, 541, and 611-639.

The SNE-MAB windowpane flounder 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), most recently in September 2005, at which time the stock was deemed to be overfished, but overfishing was not occurring (NEFSC 2005). 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 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.

2.0 The Fishery

Landings

Commercial landings data are available for 1975-2006 (Table Q1, Figure Q1). 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 reporting areas based on Vessel Trip Report data using the method described in Wigley et al. (2007a).

Landings of SNE-MAB windowpane flounder fluctuated between 532 mt in 1975 and 898 mt in 1982 then increased sharply to a peak of 2,065 mt in 1985 (Figure Q1, Table Q1). When a directed fishery for windowpane flounder occurred, during 1984-1990, landings ranged between 890 mt and 2,065 mt. Thereafter, landings gradually declined to 120 mt in 1995 and remained stable at this low level until 2001. During 2002-2006, landings were at the lowest levels observed and ranged between 39 mt and 85 mt.

Discards

Initial estimates of windowpane flounder discards, during 1975-2006, 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 A.Q1 of the Appendix. Discards (mt) for 1989-2006 were estimated using fisheries observer data and the combined ratio method described in Wigley et al. (2007b). Due to the low numbers of trips sampled by quarter, the large mesh bottom trawl and scallop dredge/trawl fleets were binned by half year to estimate discards (Table A.Q2). As a result, no imputations were necessary. There were no observed trips for the scallop fleets during 1989 and 1990 and only two trips in 1991. As a result, scallop dredge discards for 1989-1991 were estimated using the hindcast method described below. Discards for the small mesh groundfish bottom trawl fleet were estimated by quarter with the exception of 1993 and 1994 which were binned by half year. The discard estimate for the first half of 1994 was imputed. 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:

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

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*

The Observer Program database indicates that the primary reason for discarding windowpane flounder is the lack of a market for this thin-bodied flatfish. There is no minimum size limitation on landings but the length data indicate that only the largest fish are landed (fish larger than 27 cm). During most years, discards were primarily 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), with intermittent years of predominance for the scallop dredge/trawl fleet (1993 and 1996-1997) and the small mesh groundfish fleet (1992, 1994 and 2001-2002, Table Q1). During 1982-1991, discards from the large mesh trawl fleet were generally 2-3 times the amount attributable to the small mesh groundfish fleet and scallop dredge discards were generally lower than discards from the small mesh fleet.

Even during the time period of the directed fishery, the landings were dwarfed by the high level of discards that occurred; generally 2-5 times the landings (Table Q1, Figure Q1). During 1982-1991, total discards ranged between 2,838 mt and 4,510 mt. Since 1992, total discards have been much lower. However, during 2003-2006 discards from the large mesh trawl fleet have increased to 200-300 mt per year. During late 2004, a windowpane flounder trip limit of 1,000 lbs (100 lbs per day) was implemented for “B day” fishing trips. Discards totaled 405 mt in 2006.

<u>Catches</u>

Catches of windowpane flounder increased gradually from 1,169 mt in 1975 to 1,805 in 1981 and but were highest during 1982-1991, ranging between 3,614 mt and 5,400 mt (Table P1, Figure P1). After 1991, catches declined rapidly to a time series low of 181 mt in 2001 then increased slightly to 461 mt in 2006. Since 1994, most of the catch has been comprised of discards, and in recent years (2003-2006), the discards totaled 7-8 times the landings.

3.0 Research Survey Data

Relative abundance (stratified mean numbers per tow) and biomass (stratified mean kg per tow) indices for SNE-MAB windowpane flounder were computed using data from NEFSC autumn bottom trawl surveys conducted during 1975-2006 (Table Q2, Figure Q2). Indices from previous assessments were computed with data solely from an offshore strata set (1-12 and 61-76) and 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, the revised survey indices include catches from inshore strata 2-46 and 55 and offshore strata 1-12 and 61-76. 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 time series 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 abundance and biomass indices from the NEFSC fall surveys are quite variable for this thin-bodied flatfish. However, relative abundance generally increased between 1975 and 1982, reaching the time series peak of 9.5 fish per tow (Figure P2, Table P2). Thereafter, relative abundance declined to a level below the 1975-2006 median (1.93 fish) in 1989 and has oscillated at or below the median since then.

Relative abundance indices from the NEFSC winter (1992-2007, strata 1-3, 5-7, 9-11,61-63, 65-67, 69-71, and 73-75) and spring surveys (1975-2007, same strata as fall surveys), as well as the Massachusetts (spring and fall, strata 11-21), Connecticut (spring and fall, all strata) and New Jersey (spring and fall, all strata) bottom trawl surveys are also presented in the Appendix (Figure A.Q1). Indices from the state surveys do not encompass the entire stock area and consist of shorter time series than the two NEFSC survey series. The NEFSC winter surveys have much higher catchabilities than the spring and fall surveys, but do not cover the inshore strata and utilize a different net. Therefore, the NEFSC fall survey time series is considered the best indicator of stock relative abundance and biomass. However, the CT survey series does show a declining relative abundance trend similar to the NEFSC fall survey trends and the MA survey series indicates a decline in relative abundance during 1996-2007. In addition, the overall declining trend in the NEFSC fall survey relative abundance indices, after 1982, is mirrored by the NEFSC spring surveys and the MA and CT spring surveys.

4.0 Assessment Results

Annual catches and NEFSC fall survey relative biomass indices were used as input data to the AIM (An Index-based Model, 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).

Trends in annual catches and NEFSC fall survey relative biomass indices, data inputs to the AIM model, and the model results for trends in relative exploitation rates (relative F) and stock replacement ratios are presented in Figure Q3. Annual relative exploitation rates (relative F), computed as the annual catch in year *t* divided by fall survey relative biomass index in year *t*, increased gradually after 1980 and reached a time series peak in 1990 then declined to a time series low in 2001 (Figure Q3). Relative exploitation rates increased during 2001-2006. Replacement ratios were above 1.0 during 1980-1982 then declined sharply to a time series low in 1989 (Figure Q3). Since then, replacement ratios have been above 1.0 for short periods of time (1995-1996, 1998, 2001-2003). After 2001, replacement ratios declined sharply and remained been below 1.0 during 2004-2006 but have shown an increasing trend. The model correlation between relative exploitation rates and stock replacement ratios was highly significant ($p = 0.003$). The model results suggest that the stock can replace itself at a relative F value of 1.526 (the relative F value where the log of the replacement ratio is equal to 0, Figure Q4).

5.0 Biological Reference Points

There are two distinct stanzas exhibited by the stock with respect to relative biomass indices: high biomass levels during 1979-1983 and very low biomass levels during 1989-2007. As a result, reference points were estimated based on two hypotheses: 1) that the stock is able to rebuild to the high biomass levels observed during 1979-1983; and 2) that the stock has shown little capacity to respond to management actions during the past two decades and will remain at the very low biomass levels observed since 1989. Both sets of reference point estimates consist of relative biomass and relative exploitation rate proxies for B_{MSY} and F_{MSY}, respectively.

With respect to hypothesis 1, the AIM model results suggest that the stock can replace itself at a relative F of 1.526. This value represents an F_{MSY} proxy estimate for the stock. Replacement ratios estimated by the AIM model suggest that the stock was able to replace itself during 1980-1982, but it has not been able to replace itself for extended periods of time since then. Based on an examination of the trends in catch relative to fall survey relative abundance indices, during a period when catches were most precisely estimated (1989-2006), the stock appeared to be able to sustain the levels of catch that occurred during 1995-2003 (Figure Q5). Stock replacement ratios were above 1.0 in most years during this time period, indicating sustainability, but declined rapidly during 2001-2003 (Figure Q3). During 1995-2001, the median catch was 486 mt. This value can be considered as an MSY proxy. Division of the MSY proxy of 500 mt by the estimated F_{MSY} proxy from the AIM model (= 1.526) results in a survey-based B_{MSY} proxy of 0.33 kg per tow for the SNE-MAB windowpane flounder stock.

With respect to hypothesis 2, the 75th percentile of the fall survey biomass indices during 1975-2006 takes into account the high biomass levels observed historically and provides a second B_{MSY} proxy estimate (= 0.70 kg per tow). Multiplying this B_{MSY} proxy by the AIM F_{MSY} proxy (= 1.526) results in a long-term potential yield of approximately 1,110 mt at a rebuilt stock size.

6.0 Literature Cited

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Table Q1. Landings, discards, and catches (mt) of SNE-MAB windowpane flounder during 1975-2006. Landings and discards include data from statistical areas 526, 533-539, 541, and 611-639. 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	
1975	681		429	59	488	1,169
1976	568		517	107	624	1,192
1977	647		478	105	583	1,230
1978	898		811	185	996	1,894
1979	633		929	142	1,070	1,704
1980	532		887	106	992	1,524
1981	883		850	72	922	1,805
1982	651	2,087	784	93	2,964	3,614
1983	798	2,830	709	141	3,681	4,478
1984	1,088	2,523	809	153	3,485	4,572
1985	2,065	2,098	602	138	2,838	4,903
1986	1,381	2,257	740	161	3,158	4,539
1987	887	2,054	760	292	3,106	3,993
1988	1,172	2,159	756	237	3,152	4,324
1989	1,121	1,347	1,861	295	3,503	4,624
1990	890	3,904	346	261	4,510	5,400
1991	817	1,940	902	292	3,133	3,950
1992	584	78	342	130	550	1,134
1993	469	152	71	180	403	872
1994	186	207	679	104	989	1,175
1995	120	210	105	52	367	486
1996	191	138	60	216	414	605
1997	116	51	23	151	224	340
1998	122	237	16	149	402	524
1999	117	258	27	124	408	526
2000	125	91	21	26	138	263
2001	135	18	21	7	47	181
2002	85	31	86	45	162	247
2003	47	310	20	71	402	449
2004	61	205	76	40	320	381
2005	39	123	50	103	275	314
2006	56	300	33	72	405	461

[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 Q2. Stratified mean catch per tow, in kg and numbers, for SNE-MAB windowpane flounder caught during NEFSC fall research bottom trawl surveys, 1975-2007. Indices include offshore strata 1-12 and 61-76 and inshore strata 2-46 and 55. 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	0.46	2.72
1976	0.70	3.56
1977	0.91	4.32
1978	0.70	3.52
1979	1.62	7.71
1980	1.24	4.71
1981	1.25	5.08
1982	1.92	9.52
1983	1.04	4.44
1984	0.92	3.84
1985	0.68	4.04
1986	0.62	3.48
1987	0.40	2.54
1988	0.42	2.42
1989	0.22	1.42
1990	0.24	1.27
1991	0.33	1.81
1992	0.28	1.58
1993	0.12	0.68
1994	0.22	1.11
1995	0.33	1.96
1996	0.27	1.68
1997	0.15	0.72
1998	0.23	1.32
1999	0.19	1.09
2000	0.18	1.06
2001	0.41	1.75
2002	0.39	2.00
2003	0.35	1.89
2004	0.17	0.93
2005	0.18	0.91
2006	0.26	1.33
2007	0.19	1.26

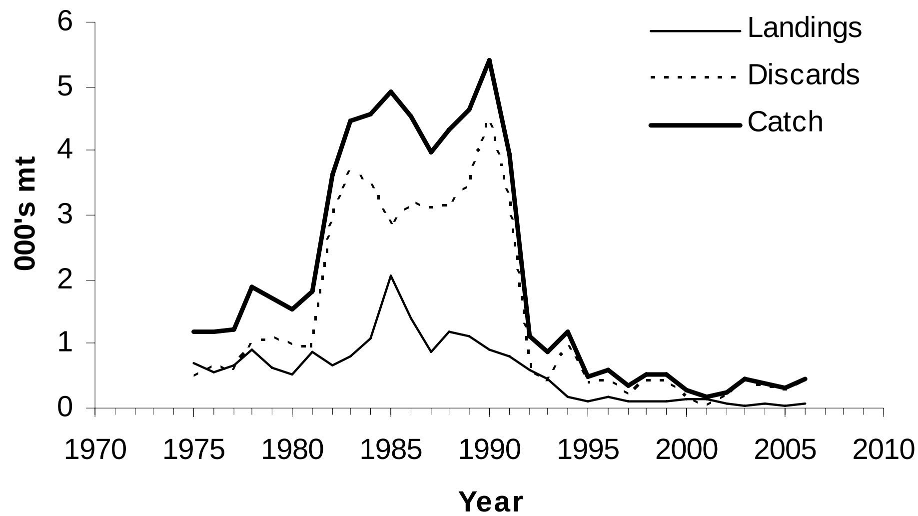

Figure Q1. Commercial landings, discards and catches of Southern New England-Mid-Atlantic Bight windowpane flounder during 1975-2006.

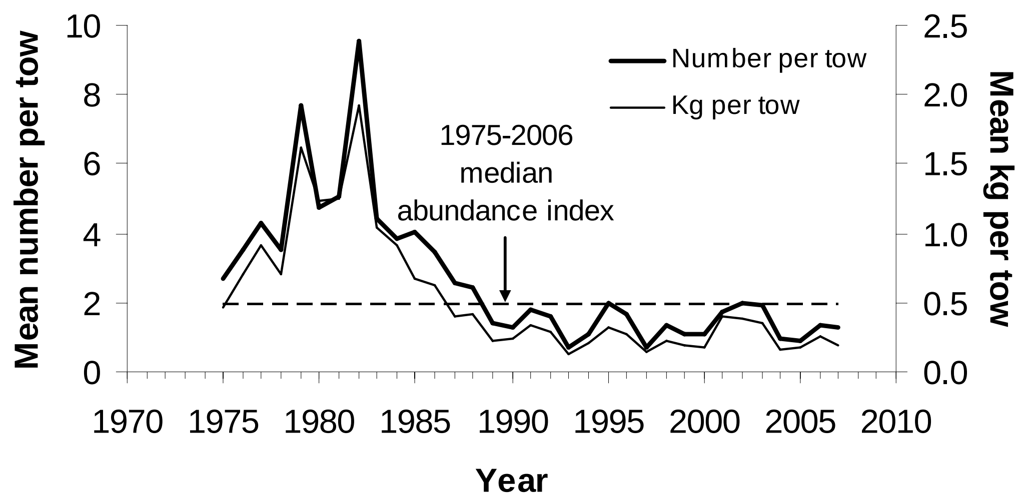

Figure Q2. Relative abundance (stratified mean number per tow) and biomass indices (stratified mean kg per tow) for SNE-MAB windowpane flounder caught during NEFSC autumn bottom trawl surveys conducted during1975-2007.

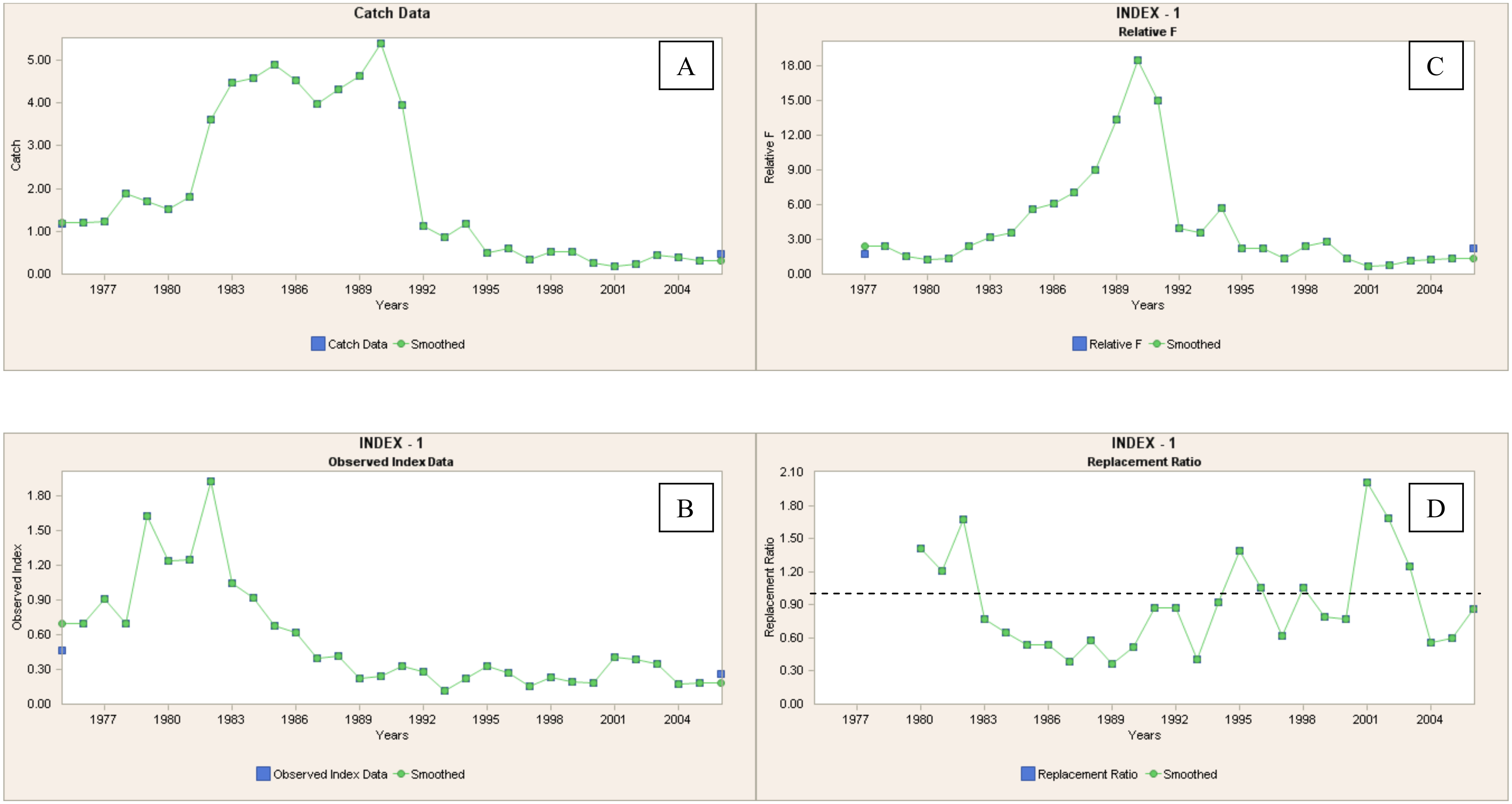

Figure Q3. Trends in (A) SNE-MAB windowpane flounder catches (000's mt), (B) NEFSC fall survey relative biomass indices (stratified mean kg per tow), (C) relative exploitation rates (catch/fall survey biomass index), and (D) stock replacement ratios.

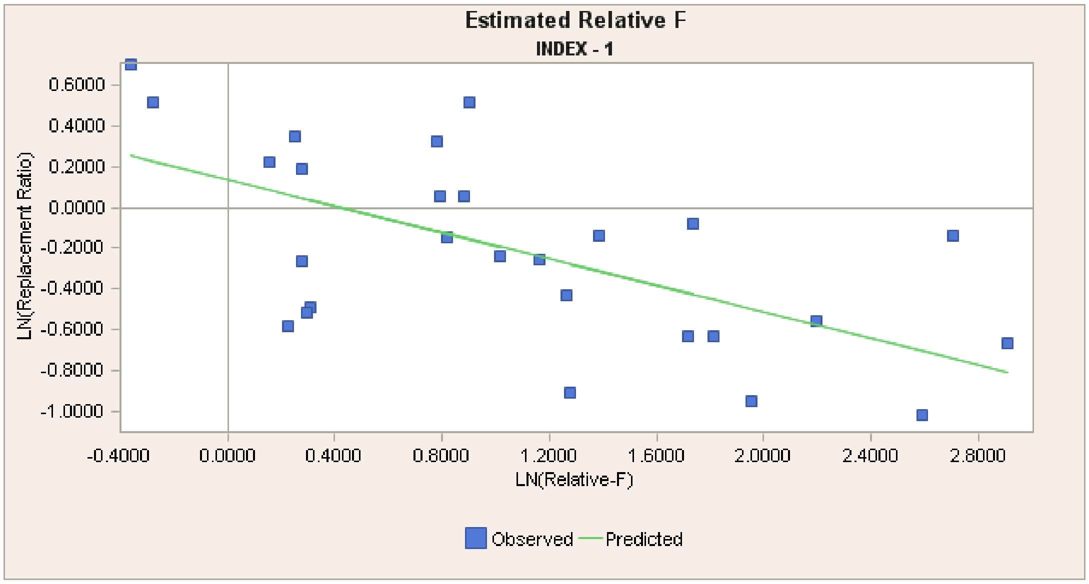

Figure Q4. AIM model results for the regression of ln(relative F) against ln(replacement ratio) indicating that the stock can replace itself (relative F value where the log of the replacement ratio is equal to 0) at a relative F value of 1.526 (F_{MSY} proxy estimate).

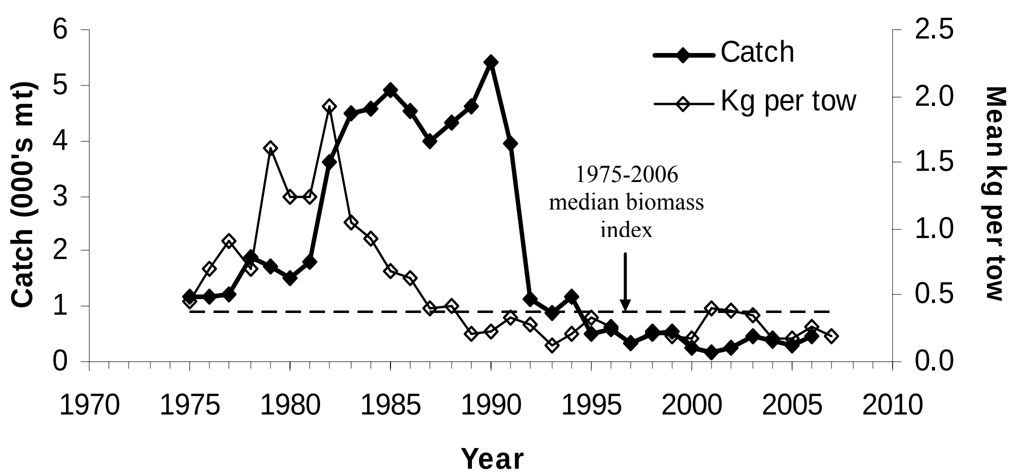

Figure Q5. Trends in NEFSC fall survey relative biomass indices of SNE-MAB windowpane flounder in relation to catches (mt).

7.0 Appendices

Table A.Q1. Summary of SNE-MAB 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), 1975-2006. Discards were hindcast for: large mesh bottom trawl during1982-1988; small mesh bottom trawl during 1975-1988; and scallop dredge during 1975-1991.

Large Mesh Bottom Trawl				
YEAR	**N Observed trips**	**D/K**	**Discards (mt)**	**CV**
1975			-	
1976			-	
1977			-	
1978			-	
1979			-	
1980			-	
1981			-	
1982			2,087	
1983			2,830	
1984			2,523	
1985			2,098	
1986			2,257	
1987			2,054	
1988			2,159	
1989	10	0.057	1,347	0.54
1990	22	0.135	3,904	0.27
1991	21	0.064	1,940	0.99
1992	25	0.002	78	0.44
1993	13	0.006	152	0.45
1994	17	0.008	207	0.51
1995	72	0.009	210	0.32
1996	32	0.006	138	0.42
1997	11	0.002	51	1.14
1998	14	0.010	237	0.46
1999	8	0.011	258	0.52
2000	33	0.005	91	0.58
2001	55	0.001	18	0.20
2002	48	0.002	31	0.25
2003	48	0.018	310	0.39
2004	198	0.010	205	0.28
2005	362	0.006	123	0.20
2006	172	0.015	300	0.19

Table A.Q1 (cont.)

Small Mesh Groundfish Bottom Trawl				
YEAR	**N Observed trips**	**D/K**	**Discards (mt)**	**CV**
1975			429	
1976			517	
1977			478	
1978			811	
1979			929	
1980			887	
1981			850	
1982			784	
1983			709	
1984			809	
1985			602	
1986			740	
1987			760	
1988			756	
1989	75	0.0361	1,861	0.53
1990	63	0.0067	346	0.39
1991	118	0.0149	902	0.59
1992	67	0.0057	342	0.39
1993	18	0.0012	71	4.78
1994	37	0.0111	679	0.55
1995	72	0.0022	105	0.56
1996	91	0.0011	60	0.39
1997	71	0.0004	23	0.61
1998	41	0.0002	16	0.89
1999	54	0.0006	27	0.77
2000	53	0.0005	21	3.30
2001	67	0.0006	21	1.11
2002	65	0.0031	86	1.77
2003	108	0.0007	20	1.84
2004	319	0.0014	76	0.38
2005	273	0.0015	50	0.36
2006	190	0.0006	33	0.53

Table A.Q1 (cont.)

Scallop dredge/trawl, Limited category permits				
YEAR	**N Observed trips**	**D/K**	**Discards (mt)**	**CV**
1975			59	
1976			107	
1977			105	
1978			185	
1979			142	
1980			106	
1981			72	
1982			93	
1983			141	
1984			153	
1985			138	
1986			161	
1987			292	
1988			237	
1989			295	
1990			261	
1991			292	
1992	12	0.0020	130	0.52
1993	14	0.0057	180	0.50
1994	18	0.0022	104	0.92
1995	22	0.0010	52	0.52
1996	31	0.0051	216	0.35
1997	19	0.0052	151	0.53
1998	13	0.0056	149	0.50
1999	8	0.0034	124	1.16
2000	77	0.0003	26	0.84
2001	91	0.0001	7	0.71
2002	91	0.0003	45	0.24
2003	103	0.0004	71	0.28
2004	213	0.0003	40	0.21
2005	120	0.0010	103	0.36
2006	88	0.0009	72	0.38

Table A.Q2. Number of observed trips, by fleet and quarter, included in the discard estimates of SNE-MAB windowpane flounder, 1989-2006.

	Large mesh otter trawl			Small mesh groundfish otter trawl [1]					Scallop dredge/otter trawl		
Year	Q1and Q2	Q3 and Q4	Total	Q1	Q2	Q3	Q4	Total	Q1and Q2	Q3 and Q4	Total
1989	6	4	10	13	18	21	23	75			0
1990	13	9	22	16	21	11	15	63			0
1991	10	11	21	31	21	20	46	118		2	2
1992	19	6	25	28	9	13	17	67	7	5	12
1993	4	9	13	14		4		18	11	3	14
1994	9	8	17	1		18		19	9	9	18
1995	23	49	72	13	12	30	17	72	14	8	22
1996	11	21	32	9	25	30	27	91	16	15	31
1997	9	2	11	32	13	23	3	71	13	6	19
1998	10	4	14	15	4	7	15	41	6	7	13
1999	3	5	8	11	19	12	12	54	2	6	8
2000	19	14	33	17	12	16	8	53	9	68	77
2001	10	45	55	19	17	18	13	67	43	48	91
2002	10	38	48	10	18	24	13	65	34	57	91
2003	29	19	48	16	36	23	33	108	42	61	103
2004	73	125	198	55	63	89	112	319	76	137	213
2005	141	221	362	66	50	80	77	273	71	49	120
2006	93	79	172	64	34	56	36	190	20	68	88

[1] Trips were combined by half year during 1993 and 1994.

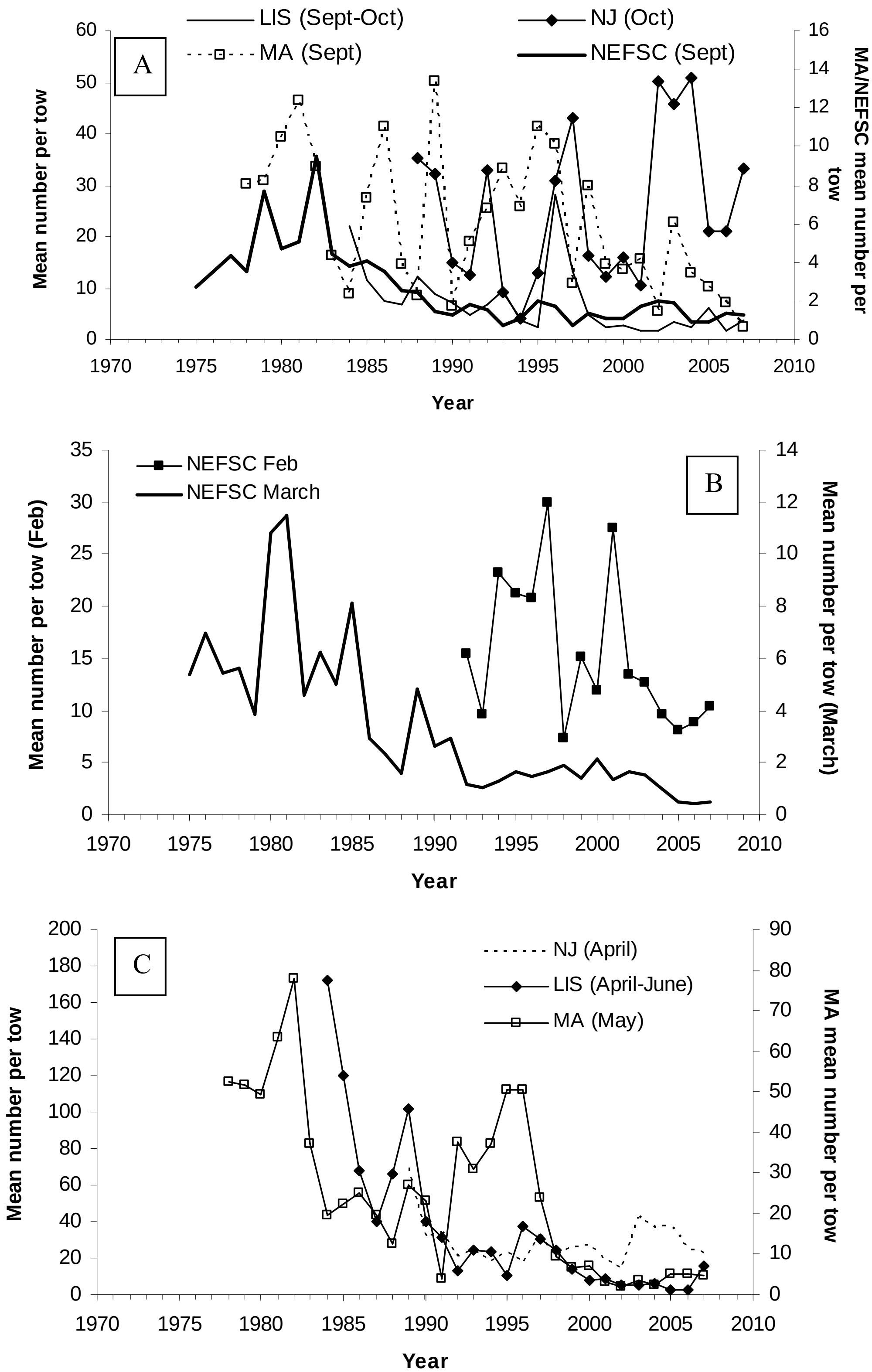

Figure A.Q1. Relative abundance indices for SNE-MAB windowpane flounder caught during: (A) fall surveys conducted by the NEFSC, MA, NJ, and CT; (B) winter and spring surveys conducted by the NEFSC, MA, NJ, and CT; and (C) spring surveys conducted by MA, NJ, and CT.