

J. Southern New England/Mid-Atlantic (SNE/MA) winter flounder by M. Terceiro

1.0 Background

The current assessment of the SNE/MA stock complex of winter flounder is an update of the previous assessment completed in 2002 at SAW 36 (NEFSC 2003). The SAW 36 assessment included catch through 2001, research survey abundance indices through 2002, and catch at age analyzed by Virtual Population Analysis (VPA) for 1981-2001. Current biological reference points are based on stock-recruitment modeling conducted by the 2002 Working Group on Re-estimation of Biological Reference points for New England Groundfish (NEFSC 2002), which indicated that $F_{MSY} = 0.32$, $SSB_{MSY} = 30,100$ mt, and $MSY = 10,600$ mt. The SAW 36 assessment concluded that the stock complex was overfished and that overfishing was occurring. Spawning stock biomass (SSB) in 2001 was estimated to be 7,600 mt, about 25% of $SSB_{MSY} = 30,100$ mt. The fully recruited fishing mortality rate in 2001 was estimated to be $F = 0.51$, about 60% above $F_{MSY} = 0.32$. The current assessment updates landings and discard estimates, research survey abundance indices, and analytical models through 2004-2005, as applicable.

2.0 2005 Assessment

The Fishery

After reaching an historical peak of 11,977 metric tons (mt) in 1966, then declining through the 1970s, total U.S. commercial landings again peaked at 11,176 mt in 1981, and then steadily declined to 2,159 mt in 1994. Commercial landings then increased to 4,410 mt in 2001 before falling a record low of 1,458 mt in 2004 (Table J1, Figure J1). The primary gear in the fishery is the otter trawl which accounts for an average of 98% of landings since 1989. Scallop dredges, handlines, pound nets, fyke nets, and gill nets account for the remaining 2% of total landings.

Recreational landings reached a peak in 1984 of 5,772 mt but declined substantially thereafter (Table J2, Figure J1). Landings have been less than 1,000 mt since 1991, with the lowest estimated landings in 2004 of 206 mt. The principal mode of fishing is private/rental boats, with most recreational landings occurring during January to June.

Length samples of winter flounder are available from both the commercial and recreational landings. In the commercial fishery, annual sampling intensity varied from 28 to 264 mt landed per 100 lengths measured during 1981-2004 (Table J3). Since 1997, port sampling has been adequate to develop the commercial fishery landings at age on a half-year, market category basis across all statistical areas.

In the recreational fishery, annual sampling intensity varied from 28 to 231 mt landed per 100 lengths measured during 1981-2004. Ages were determined using NEFSC survey spring and fall age-length keys.

For the SNE/MA stock complex of winter flounder, commercial Vessel Trip Reports (VTR) provide the most reliable data from which to estimate commercial fishery discards. VTR trawl gear fishery discards to landings ratios on a half-year basis were applied to corresponding commercial fishery landings to estimate discards in weight (Table J4, Figure J1). The NEFSC Fishery Observer length frequency samples were judged adequate to directly characterize the proportion discarded at length. A discard mortality rate of 50% (Howell et al., 1992) was applied to trawl discards to produce the number of fish discarded dead at length. Samples at length are generally applied on an annual basis due to low sample sizes. Ages were determined using NEFSC survey spring and fall age-length keys.

A discard mortality of 15% was assumed for recreational discards (B2 category from MRFSS data), as assumed in Howell et al. (1992). Discard losses peaked in 1984-1985 at 0.7 million fish. Discards have since declined and reached a low in 2004 of 15,000 fish (Table J4). Since 1997, irregular sampling of the recreational fisheries by state fisheries agencies has indicated that the discard is usually of fish below the minimum landing size of 12 inches (30 cm). For 2002-2004, discard length samples from the NYDEC sampling of the recreational party-boat fishery and from the CTDEP Volunteer Angling Survey (VAS) have been used to better characterize the recreational fishery discard. Ages were determined using NEFSC survey spring and fall age-length keys.

Input data and analyses

The Virtual Population Analysis (VPA) was calibrated using the NOAA Fisheries Toolbox (NFT) ADAPT VPA version 2.3. Total fishery catch at age and mean weight at age matrices used as input to the VPA are presented in Tables J5-J6. Abundance indices at age for use in VPA calibration were available from several research surveys: NEFSC spring trawl ages 1-7+, NEFSC fall trawl ages 1-5 (advanced to tune January 1 abundance of ages 2-6), NEFSC winter trawl ages 1-5, Massachusetts spring trawl ages 1-7+, Rhode Island fall seine age 0 (advanced to tune age-1), Rhode Island spring trawl ages 1-7+, Connecticut spring trawl ages 1-7+, New York trawl age 0 (advanced to tune age-1) and age-1, Massachusetts summer seine index of age-0 (advanced to tune age-1), Delaware juvenile trawl age-0 (advanced to tune age-1), New Jersey Ocean trawl ages 1-7+, and New Jersey River trawl ages 1-7+. Survey indices were selected for inclusion in VPA calibration based on consideration of the partial variance in an initial VPA trial run including all indices, residual error patterns from the various trial runs, and on the significance of the correlation among indices and with VPA abundance estimates from the initial trial run. A conditional non-parametric bootstrap procedure (Efron 1982) was used to evaluate the precision of fishing mortality and SSB. A retrospective analysis was performed for terminal year fishing mortality (F), SSB and age-1 recruitment.

3.0 Assessment results

Research surveys

Mean weight per tow and number per tow indices for the NEFSC spring, fall, and winter time series are presented in Table J7. Indices declined from the beginning of the time series in the

1960s to a low point in the early to mid-1970s, then increased to a peak by the early 1980s. Following several years of high indices, abundance once again declined to below the low levels of the 1970s. NEFSC survey indices reached near- or record low levels for the time series in the late 1980s-1990s. Indices from the three survey series generally increased during 1993-1998/1999, but have since declined again (Figure J2).

Several state survey indices were available to characterize the abundance of SNE/MA winter flounder. The Massachusetts Division of Marine Fisheries (MADMF) spring and fall survey, Rhode Island Division of Fish and Wildlife (RIDFW) spring and fall survey, Connecticut Department of Environmental Protection (CTDEP) Long Island Sound Trawl Survey, and the New Jersey Division of Fish, Game and Wildlife (NJDFW) ocean survey trends are summarized in Tables J8-J9 and Figure J2. The numerous state recruitment surveys (MADMF, RIDFW, CTDEP, New York Department of Environmental Conservation (NYDEC), NJDFW, Delaware Division of Fish and Wildlife (DEDFW)) are summarized in Table J10 and Figure J3.

Virtual Population Analysis

During 1981-1993, fishing mortality (fully recruited F, ages 4-5) varied between 0.4 (1982) and 1.4 (1988), and was as high as 1.3 as recently as 1997. Fishing mortality has been in the range of 0.9-0.4 during 2001-2004 (Table J11, Figure J4). SSB declined from 14,792 mt in 1983 to a record low of 2,651 mt in 1994. SSB increased to 5,012 mt in 2001, before declining again to 3,938 mt in 2004 (Table J11, Figure J5). Recruitment declined continuously from 62.9 million age-1 fish in 1981 to 7.8 million in 1992. Recruitment then averaged 14.7 million fish during 1993-2001, below the VPA time series average of 21.9 million. The 2002 year class is estimated to be the smallest on record, at only 4.4 million fish. The 2003 year class of 21.6 million is estimated to be of about average size, and the largest to recruit to the stock since 1989 (Table J11, Figure J5).

VPA diagnostics

The same VPA calibration configuration as used in the SAW 36 assessment (NEFSC 2003) was retained for this update. Changes in the software version of the VPA (from the previous FACT v1.5 to the current NFT v2.3) and updates to the 2001 catch at age had very little effect on the estimates. (Table J12). The precision of the 2005 stock size at age, F at age in 2004, and SSB in 2004 from VPA was evaluated using bootstrap techniques (Efron 1982). Five hundred bootstrap iterations were realized in which errors (differences between predicted and observed survey values) were resampled. Bootstrap estimates of stock size at age indicate low bias (<8%) for ages 1-6, but relatively high bias for age 7+ (20%). Bootstrap standard errors provide stock size CVs ranging from 20% at age 3 and age 5 to 107% at age 7+. Bootstrapped estimates of SSB indicate a CV of 11%, with low bias (bootstrap mean estimate of SSB of 3,977 mt compared with VPA estimate of 3,938 mt). There is an 80% probability that spawning stock in 2004 was between 3,451 mt and 4,562 mt. The bootstrap estimates of standard error associated with fishing mortality rates at age indicate moderate precision. Coefficients of variation for F estimates

ranged from 17% at age 4 to 33% at age 5. There is an 80% probability that fully recruited F for ages 4-5 in 2004 was between 0.32 and 0.49.

A retrospective analysis of the VPA was conducted back to a terminal catch year of 1995 (Figure J6). The SNE/MA winter flounder VPA exhibits a severe retrospective pattern of underestimation of F and overestimation of SSB during the late 1990s and into 2001. The most likely cause of this pattern is the underestimation of the total catch. The pattern has been less severe since the terminal year 2001. The retrospective pattern for SSB has been a tendency for overestimation since 1991. The overestimation of SSB was most severe for the 1997 and 1998 terminal years. The retrospective estimation of age-1 recruits indicated a tendency for overestimation during 1993-2001.

4.0 Biological reference points

The Working Group on Re-Evaluation of Biological Reference Points for New England Groundfish (NEFSC 2002) re-estimated the biological reference points for SNE/MA winter flounder in 2002 using yield and SSB per recruit analyses (Thompson and Bell 1934) and Beverton-Holt stock-recruitment models (Beverton and Holt 1957, Brodziak et al. 2001, Mace and Doonan 1988) based on the SARC 28 assessment (NEFSC 1999). The yield and SSB per recruit analyses indicated that $F_{40\%} = 0.21$ and $F_{0.1} = 0.25$. The stock-recruitment model indicated that $MSY = 10,600$ mt, $F_{MSY} = 0.32$, and $B_{MSY} = 30,100$ mt.

Amendment 13 projected target F, SSB and landings were forecast to be $F_{2004} = F_{MSY} = 0.32$, $SSB_{2004} = 6,855$ mt, and catch in 2004 = 2,804 mt. Relative to these reference points and projected targets, $F_{2004} = 0.38$ is estimated to be 19% above $F_{MSY} = 0.32$ (Figure J7). $SSB_{2004} = 3,938$ mt is about 13% of B_{MSY} and 57% of the Amendment 13 projected SSB_{2004} (Figure J7). Total fishery catch in 2004 was 1,699 mt, 61% of the Amendment 13 projection. (Figure J7).

5.0 GARM comments

The Panel noted the large decrease in the 2004 landings and an estimate of fishing mortality for 2004 that is higher than projected in 2003. It was noted that the projections of SSB were not realized because the starting biomass was lower due to the retrospective pattern in the VPA and poor recruitment. The Panel suggested plotting the start point (2002) on the projection plots to show difference in the starting conditions in the previous projection and the updated assessment.

Projection Advice - Projections of future stock status should consider mean weights and partial recruitment patterns estimated for the most recent 3 years in the assessment (2002-2004) to reflect current conditions in the stock and fishery. Future levels of recruitment should be estimated from the stock-recruitment relationship provided in NEFSC (2002).

6.0 Sources of uncertainty

1) Landings data for 1994 and later years are derived by proration using Vessel Trip Reports (VTRs) and are considered provisional.

2) Commercial fishery discard estimates are based on rates provided by fishermen in the VTRs, due to inadequate Fishery Observer sampling for most of the assessment time series. Sampling levels have increased significantly since 2001 and observer data may now be adequate to provide reliable estimates of discard rates.

3) The SNE/MA winter flounder VPA exhibits a severe retrospective pattern of underestimation of F and overestimation of SSB during the late 1990s and into 2001.

7.0 Summary

The Southern New England/Mid-Atlantic (SNE/MA) winter flounder stock complex is overfished and overfishing is occurring. Fishing mortality (F) in 2004 was estimated to be 0.38 (exploitation rate = 29%), about 19% above $F_{MSY} = 0.32$. There is an 80% chance that the F in 2004 was between 0.32 and 0.49. The SNE/MA winter flounder VPA exhibits a severe retrospective pattern of underestimation of F and overestimation of SSB during the late 1990s and into 2001. SSB in 2004 was estimated to be 3,938 mt, about 13% of $B_{MSY} = 30,100$ mt. There is an 80% chance that the SSB in 2004 was between 3,451 mt and 4,562 mt. The retrospective pattern for SSB has been a tendency for overestimation since 1991. The 2002 year class is estimated to be the smallest on record, at only 4.4 million fish. The 2003 year class of 21.6 million is estimated to be of about average size, and the largest to recruit to the stock since 1989. The retrospective estimation of recruitment indicated a tendency for overestimation during 1993-2001.

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Table J1. Winter flounder commercial landings (metric tons) for Southern New England/Mid-Atlantic stock complex area (U.S. statistical reporting areas 521, 526, divisions 53, 61-63) as reported by NEFSC weighout, dealer, state bulletin and general canvas data.

Year	Metric tons
1964	7,474
1965	8,678
1966	11,977
1967	9,478
1968	7,070
1969	8,107
1970	8,603
1971	7,367
1972	5,190
1973	5,573
1974	4,259
1975	3,982
1976	3,265
1977	4,413
1978	6,327
1979	6,543
1980	10,627
1981	11,176
1982	9,438
1983	8,659
1984	8,882
1985	7,052
1986	4,929
1987	5,172
1988	4,312
1989	3,670
1990	4,232
1991	4,823
1992	3,816
1993	3,010
1994	2,159
1995	2,634
1996	2,781
1997	3,441
1998	3,208
1999	3,444

Table J1 continued.

Year	Metric tons
2000	3,800
2001	4,687
2002	3,136
2003	2,427
2004	1,458

Table J2. Estimated number (000's) and weight (mt) of winter flounder caught, landed, and discarded in the recreational fishery, Southern New England/Mid-Atlantic stock complex.

Year	Catch A+B1+B2 (N; '000)	Landed A+B1 (N; '000)	Released B2 (N; '000)	15% Release Mortality (N; '000)	Landed A+B1 (mt)
1981	11006	8089	2916	437	3050
1982	10665	8392	2273	341	2457
1983	11010	8365	2645	397	2524
1984	17723	12756	4967	745	5772
1985	18056	13297	4759	714	5198
1986	9368	6995	2374	356	2940
1987	9213	6900	2313	347	3141
1988	10134	7358	2775	416	3423
1989	5919	3682	2236	335	1802
1990	3827	2486	1340	201	1063
1991	4325	2795	1530	230	1214
1992	1360	806	555	83	393
1993	2211	1180	1031	155	543
1994	1829	1209	620	93	598
1995	1850	1390	461	69	661
1996	2679	1554	1125	169	689
1997	1901	1207	694	104	621
1998	1008	584	425	64	290
1998	1071	658	412	62	320
2000	2043	1346	697	105	831
2001	1421	892	529	79	546
2002	706	408	298	45	224
2003	740	557	182	27	316
2004	448	350	98	15	206

Table J3. The total number of commercial lengths sampled by market category for Southern New England/Mid-Atlantic winter flounder. The landings (mt) and metric tons per 100 lengths are also shown.

Year	Number of Lengths				Total	Landings (mt)	mt/100 lengths
	Uclass	Small	Medium	Large			
1981	1,904	1,542	-	784	4,230	11,176	264
1982	513	2,425	657	2,201	5,796	9,438	163
1983	927	1,790	1,044	1,840	5,601	8,659	155
1984	551	1,171	637	1,338	3,697	8,882	240
1985	716	2,632	1,663	1,396	6,407	7,052	110
1986	799	2,206	1,024	1,091	5,120	4,929	96
1987	99	2,524	670	1,978	5,271	5,172	98
1988	269	1,731	958	1,250	4,208	4,312	102
1989	106	1,224	1,220	975	3,525	3,670	104
1990	102	1,473	1,180	1,333	4,088	4,232	104
1991	-	1,220	921	917	3,058	4,823	158
1992	402	1,343	1,259	1,159	4,163	3,816	92
1993	62	1,249	401	642	2,354	3,010	128
1994	142	1,092	816	543	2,593	2,159	83
1995	79	1,182	290	325	1,876	2,634	140
1996	480	854	521	109	1,964	2,781	142
1997	201	1,327	1,176	1,301	4,005	3,441	86
1998	942	899	1,325	415	3,581	3,208	90
1999	2,381	798	607	821	4,607	3,444	75
2000	1,653	942	2,893	965	6,453	3,800	59
2001	658	897	2,203	2,284	6,042	4,687	78
2002	688	2,532	1,099	1,581	5,900	3,136	53
2003	901	1,236	881	1,660	4,678	2,427	52
2004	412	2,311	563	1,889	5,175	1,458	28

Table J4. Total winter flounder recreational and commercial catch for the Southern New England/Mid-Atlantic stock complex in weight (mt) and numbers (000s).

Year	Commercial Landings		Commercial Discards		Recreational Landings		Recreational Discards		Total Catch		% Discards/Total	
	mt	000s	Mt	000s	mt	000s	mt	000s	mt	000s	mt	000s
1981	11,176	20,705	1,343	5,123	3,050	8,089	88	437	15,657	34,354	9.1	16.2
1982	9,438	19,016	1,149	4,271	2,457	8,392	66	341	13,110	32,020	9.3	14.4
1983	8,659	16,312	1,311	5,251	2,524	8,365	125	399	12,619	30,327	11.4	18.6
1984	8,882	17,116	986	3,936	5,772	12,756	148	745	15,788	34,553	7.2	13.5
1985	7,052	14,211	1,534	4,531	5,198	13,297	230	714	14,014	32,753	12.6	16.0
1986	4,929	9,460	1,273	4,902	2,940	6,994	66	356	9,208	21,712	14.5	24.2
1987	5,172	10,524	950	3,545	3,141	6,899	61	347	9,324	21,315	10.8	18.3
1988	4,312	8,377	904	3,728	3,423	7,359	69	416	8,708	19,880	11.2	20.8
1989	3,670	7,888	1,404	5,761	1,802	3,684	49	335	6,925	17,668	21.0	34.5
1990	4,232	7,202	673	2,567	1,063	2,485	31	201	5,999	12,455	11.7	22.2
1991	4,823	9,063	784	2,701	1,214	2,794	51	230	6,872	14,788	12.2	19.8
1992	3,816	6,759	511	1,811	393	802	15	83	4,735	9,455	11.1	20.0
1993	3,010	5,336	457	1,580	543	1,180	31	155	4,041	8,251	12.1	21.0
1994	2,159	1,948	304	344	598	1,210	34	93	3,095	3,595	10.9	12.2
1995	2,634	2,321	121	107	661	1,390	23	69	3,439	3,887	4.2	4.5
1996	2,781	2,372	173	149	689	1,555	64	168	3,707	4,244	6.4	7.5
1997	3,441	5,834	267	1,200	618	1,204	26	85	4,352	8,323	6.7	15.4

Table J4 continued.

Year	Commercial Landings		Commercial Discards		Recreational Landings		Recreational Discards		Total Catch		% Discards/Total	
	mt	000s	Mt	000s	mt	000s	mt	000s	mt	000s	mt	000s
1998	3,208	6,224	456	1,503	290	584	13	64	3,967	8,375	11.8	18.7
1999	3,444	7,356	329	1,074	320	658	14	62	4,107	9,150	8.4	12.4
2000	3,800	6,590	148	534	831	1,346	30	105	4,809	8,575	3.7	7.5
2001	4,687	8,087	86	268	546	892	18	79	5,337	9,326	1.9	3.7
2002	3,136	4,834	109	319	224	408	12	45	3,481	5,606	3.5	6.5
2003	2,427	3,697	266	648	316	557	1	27	3,010	4,929	8.9	13.7
2004	1,458	2,190	34	91	206	350	1	15	1,699	2,646	2.1	4.0

Table J5. Total fishery catch at age used as input to Virtual Population Analysis (VPA) for the Southern New England/Mid-Atlantic winter flounder stock complex.

Year	Age						
	1	2	3	4	5	6	7+
1981	1362	14089	14352	3593	665	182	111
1982	587	14257	12421	3730	610	213	202
1983	617	7241	13308	6126	1794	696	545
1984	501	11575	14093	4928	1776	876	804
1985	277	7366	12836	6054	2953	1843	1424
1986	215	6327	9102	4216	1053	442	357
1987	73	5268	8999	3091	2703	755	426
1988	84	3941	9402	3964	1207	979	303
1989	463	5246	7176	3503	849	222	209
1990	36	2109	6275	2931	767	196	141
1991	53	3027	7140	3344	858	251	115
1992	25	1503	4457	2581	674	162	53
1993	274	2062	3329	1728	585	157	116
1994	61	1097	1152	713	311	162	99
1995	24	195	1862	889	415	291	211
1996	32	886	1450	1107	343	258	168
1997	385	2135	3300	1811	540	106	46
1998	50	2132	3663	1797	511	90	131
1999	66	2746	4008	1744	458	97	32
2000	69	1442	3500	2455	862	180	67
2001	21	2093	3765	2284	841	220	102
2002	20	570	1992	1742	886	282	115
2003	112	810	2020	1222	440	216	109
2004	16	296	898	797	309	187	142

Table J6. Total fishery mean weights at age used as input to Virtual Population Analysis (VPA) for the Southern New England/Mid-Atlantic winter flounder stock complex.

Year	Age						
	1	2	3	4	5	6	7+
1981	0.130	0.276	0.478	0.802	1.065	1.243	1.202
1982	0.090	0.261	0.438	0.694	1.048	1.253	1.837
1983	0.195	0.237	0.353	0.516	0.774	1.046	1.552
1984	0.146	0.258	0.366	0.542	0.693	0.913	1.282
1985	0.111	0.282	0.364	0.482	0.522	0.467	0.613
1986	0.129	0.292	0.398	0.480	0.685	0.879	0.961
1987	0.046	0.287	0.384	0.551	0.475	0.564	0.853
1988	0.039	0.279	0.351	0.508	0.634	0.517	0.827
1989	0.118	0.258	0.378	0.508	0.660	0.716	1.073
1990	0.082	0.295	0.394	0.525	0.672	0.808	0.990
1991	0.093	0.317	0.420	0.534	0.603	0.823	1.168
1992	0.079	0.287	0.427	0.599	0.802	0.945	1.395
1993	0.169	0.334	0.460	0.592	0.689	0.878	1.167
1994	0.156	0.347	0.448	0.597	0.741	0.692	0.818
1995	0.167	0.323	0.449	0.578	0.714	0.763	0.780
1996	0.193	0.407	0.507	0.569	0.705	0.826	0.853
1997	0.093	0.369	0.510	0.659	0.806	1.071	1.511
1998	0.202	0.332	0.438	0.580	0.665	0.892	1.241
1999	0.079	0.314	0.435	0.562	0.782	0.951	1.317
2000	0.100	0.396	0.484	0.613	0.738	0.915	1.144
2001	0.102	0.423	0.507	0.638	0.798	1.053	1.261
2002	0.127	0.356	0.493	0.636	0.799	1.036	1.341
2003	0.168	0.408	0.520	0.675	0.895	1.093	1.227
2004	0.106	0.390	0.540	0.609	0.788	0.953	1.267

Table J7. Winter flounder NEFSC survey index stratified mean number and mean weight (kg) per tow for the Southern New England/Mid-Atlantic stock complex. Spring and fall strata set (offshore 1-12, 25, 69-76 ; inshore 1-29, 45-56); winter strata set (offshore 1-2, 5-6,9-10,69,73).

Year	Spring				Fall			
	Number	N(CV)	Weight	W(CV)	Number	N(CV)	Weight	W(CV)
1963					8.554	33.2	3.284	41.4
1964					13.673	22.1	4.894	19.4
1965					15.537	32.5	4.435	28.7
1966					9.843	31.5	3.275	27.3
1967					9.109	20.6	2.745	18.7
1968	2.444	26.7	0.734	37.2	8.105	21.0	2.190	18.7
1969	5.640	34.3	3.414	53.7	6.841	34.9	1.939	29.7
1970	2.729	30.9	1.326	35.6	5.110	36.1	2.375	47.8
1971	2.035	32.9	0.756	36.2	3.861	17.5	1.231	19.1
1972	1.865	28.1	0.656	32.1	7.687	39.4	3.053	44.6
1973	7.458	19.9	2.013	20.6	2.691	26.9	0.775	25.8
1974	3.362	21.9	1.043	19.3	2.032	31.1	0.822	29.4
1975	1.135	22.6	0.354	20.8	2.196	20.3	0.688	22.1
1976	3.085	16.3	0.804	17.2	2.376	32.2	1.251	42.9
1977	4.209	17.2	1.189	18.6	4.722	22.5	1.735	25.2
1978	6.695	11.1	1.758	13.3	3.743	17.6	1.430	22.6
1979	2.966	16.8	1.069	25.0	10.058	18.4	2.606	15.4
1980	15.250	17.5	3.551	13.6	9.964	31.0	3.216	29.5
1981	18.234	20.9	4.762	16.9	10.206	20.3	3.110	19.9
1982	6.986	20.1	1.918	15.8	4.927	22.8	1.683	25.9
1983	6.262	18.4	2.469	28.0	8.757	37.6	2.690	31.7
1984	5.524	19.0	2.072	28.4	2.681	21.1	0.887	21.0
1985	5.360	17.4	1.983	16.5	2.727	21.5	0.991	21.5
1986	2.266	23.9	0.766	23.4	1.538	21.9	0.487	19.1
1987	1.763	21.3	0.568	17.9	1.167	28.9	0.419	37.8
1988	2.126	19.6	0.730	19.3	1.246	22.4	0.530	27.5
1989	2.485	33.5	0.582	29.6	1.435	40.7	0.341	30.4
1990	1.992	36.8	0.472	33.1	1.979	29.6	0.546	25.8
1991	2.473	15.6	0.692	14.7	1.950	23.6	0.708	25.6

Table J7 continued.

Year	Number	Spring			Fall				Winter			
		N(CV)	Weight	W(CV)	Number	N(CV)	Weight	W(CV)	Number	N(CV)	Weight	W(CV)
1992	1.579	23.4	0.435	22.1	2.963	32.4	0.829	31.8	3.680	27.3	0.928	26.0
1993	0.961	19.1	0.219	14.8	1.382	25.0	0.392	25.9	2.590	29.4	0.456	21.5
1994	1.510	26.4	0.329	21.9	4.134	24.8	1.482	27.3	3.797	30.8	1.183	35.5
1995	2.097	23.4	0.592	19.1	2.253	20.7	0.626	17.3	2.221	26.1	0.697	29.1
1996	1.517	14.3	0.428	15.2	3.186	39.8	1.063	45.3	3.778	28.4	0.734	25.2
1997	1.436	22.1	0.399	20.0	7.893	32.6	2.583	26.7	3.906	19.7	1.043	21.6
1998	2.774	20.6	0.845	22.1	6.597	13.6	2.232	9.9	7.169	21.6	1.830	24.1
1999	4.171	16.2	1.245	16.4	3.596	17.0	1.549	16.5	10.328	31.8	3.100	32.3
2000	3.172	26.6	1.123	31.9	6.168	25.5	2.143	26.2	5.571	32.9	1.525	29.5
2001	1.568	14.3	0.581	13.3	4.877	28.1	2.030	28.5	3.096	31.6	0.873	29.0
2002	2.043	15.7	0.782	16.3	8.858	18.9	3.637	19.8	2.901	27.7	1.188	38.3
2003	0.767	11.8	0.267	11.1	3.209	24.2	1.568	27.5	2.199	42.1	0.782	42.0
2004	1.243	27.1	0.442	30.6	3.357	27.6	0.882	27.0	4.336	35.2	0.881	44.4
2005	0.928	28.8	0.306	30.0					4.045	30.4	1.143	26.0

NOTE: 1968-1972 spring index does not include inshore strata ; 1963-1971 fall index does not include inshore strata. All indices calculated with trawl door conversion factors where appropriate. Winter trawl survey began in 1992.

Table J8. SNE/MA winter flounder mean weight per tow for annual state surveys.

Year	MADMF Spring	RIDFW Spring	RIDFW Fall	CTDEP	NJDFW Ocean (April)
1978	18.12				
1979	18.17	7.72	7.24		
1980	15.18	13.57	4.88		
1981	15.77	12.13	2.12		
1982	14.82	5.23	1.30		
1983	19.67	9.52	2.28		
1984	14.68	8.43	3.38	15.68	
1985	11.60	5.93	3.01	13.91	
1986	10.36	6.47	3.12	10.33	
1987	9.57	8.14	2.25	11.76	
1988	6.64	6.02	1.45	18.28	
1989	8.46	3.09	0.79	22.62	5.86
1990	5.38	3.07	0.71	29.01	4.78
1991	2.91	7.38	0.18	24.59	5.32
1992	7.99	0.95	0.42	12.29	2.48
1993	8.16	0.22	0.50	10.26	3.87
1994	12.59	1.67	0.33	12.20	3.25
1995	7.98	6.04	0.89	7.72	8.06
1996	9.78	4.45	0.91	20.41	3.73
1997	10.02	4.57	0.64	15.53	6.52
1998	7.99	5.00	0.32	14.66	4.17
1999	4.44	3.66	0.57	10.29	6.83
2000	6.52	4.52	0.56	12.63	5.24
2001	3.73	3.56	0.28	14.02	6.36
2002	1.91	3.29	0.28	10.83	8.80
2003	5.50	1.56	0.68	8.87	5.81
2004	2.87	1.85	0.53	6.11	5.45
2005	3.56				

Table J9. SNE/MA winter flounder mean number per tow for annual state surveys.

Year	MADMF Spring	RIDFW Spring	RIDFW Fall	CTDEP	NYDEC Peconic Bay	NJDFW Ocean (April)
1978	51.62					
1979	53.78	83.76				
1980	38.94	63.10				
1981	46.12	87.97	25.21			
1982	40.23	31.39	18.55			
1983	56.84	58.97	17.29			
1984	37.36	41.64	19.02	111.96		
1985	38.38	34.97	21.44	83.58	4.87	
1986	36.27	41.02	31.28	63.65		
1987	37.85	56.21	20.90	79.92	6.07	
1988	27.91	34.44	10.64	137.59	4.31	
1989	24.41	20.88	7.17	148.19	17.02	25.60
1990	25.86	20.33	8.83	223.09	12.22	17.47
1991	10.66	41.95	1.77	150.20	21.50	22.17
1992	28.83	4.40	10.60	61.39	79.11	9.88
1993	46.96	2.92	6.65	63.60	31.20	20.13
1994	48.55	10.25	2.21	84.44	22.09	14.16
1995	37.84	32.19	7.00	50.12	8.15	30.04
1996	30.18	20.67	7.79	110.62	19.24	9.60
1997	39.31	22.28	5.48	71.31	10.99	36.24
1998	34.63	19.22	2.02	72.91	7.20	18.05
1999	25.11	13.45	2.80	41.35	10.96	17.84
2000	26.23	16.32	2.58	45.41	2.61	10.13
2001	16.00	12.49	2.10	54.50	7.99	13.83
2002	6.74	11.56	1.45	43.71	0.43	22.72
2003	19.38	5.56	5.21	27.84	1.40	12.55
2004	10.70	11.16	4.40	20.46	5.99	5.45
2005	25.85					

Table J10. State survey indices (stratified mean number per tow or haul) for young-of-year winter flounder in Southern New England/Mid-Atlantic stock complex.

Year	CTDEP	RIDFW	DEDFW	MADMF	NYDEC
	Seine		Seine		
1975				0.30	
1976				0.32	
1977				0.60	
1978				0.34	
1979				0.49	
1980				0.40	
1981				0.32	
1982				0.37	
1983				0.23	
1984				0.32	
1985				0.34	1.52
1986		29.00	0.17	0.32	
1987		11.60	0.09	0.27	2.65
1988	15.50	8.90	0.02	0.18	1.45
1989	1.90	18.90	0.29	0.42	11.15
1990	3.10	22.10	0.63	0.33	8.53
1991	5.80	12.00	0.03	0.27	14.60
1992	13.70	33.20	0.27	0.29	76.87
1993	6.00	5.50	0.04	0.07	16.99
1994	16.60	2.60	0.31	0.15	14.84
1995	12.50	5.30	0.10	0.16	4.04
1996	19.20	2.80	0.04	0.22	16.25
1997	7.47	4.40	0.10	0.39	4.42
1998	9.38	2.50	0.13	0.16	3.11
1999	8.70	14.60	0.07	0.19	7.49
2000	4.30	52.90	0.08	0.33	0.90
2001	1.30	12.90	0.06	0.21	2.31
2002	3.06	18.50	0.01	0.10	0.07
2003	8.10	31.20	0.28	0.18	0.86
2004	10.96	18.90	0.20	0.10	0.50
2005				0.08	

Table J11. Virtual Population Analysis estimation results for SNE/MA winter flounder, 1981-2004.

JAN-1 Population Numbers					
AGE	1981	1982	1983	1984	1985
1	62859.	52020.	56503.	35617.	34615.
2	52566.	50232.	42060.	45703.	28708.
3	27768.	30289.	28226.	27884.	26945.
4	7146.	9748.	13560.	11068.	10077.
5	1468.	2600.	4606.	5559.	4603.
6	363.	600.	1577.	2148.	2944.
7	221.	569.	1235.	1971.	2275.
Total	152391.	146059.	147766.	129950.	110167.
AGE	1986	1987	1988	1989	1990
1	32795.	25973.	26725.	23109.	17359.
2	28090.	26656.	21199.	21805.	18501.
3	16839.	17273.	17057.	13790.	13106.
4	10446.	5551.	6000.	5458.	4797.
5	2773.	4738.	1748.	1325.	1299.
6	1096.	1317.	1433.	339.	317.
7	886.	743.	444.	319.	228.
Total	92924.	82251.	74605.	66145.	55607.
AGE	1991	1992	1993	1994	1995
1	11345.	7797.	8817.	8171.	12297.
2	14180.	9241.	6361.	6971.	6635.
3	13239.	8871.	6206.	3342.	4714.
4	5052.	4379.	3230.	2069.	1694.
5	1276.	1111.	1250.	1081.	1048.
6	369.	268.	299.	494.	604.
7	169.	88.	221.	302.	438.
Total	45631.	31753.	26383.	22429.	27430.
AGE	1996	1997	1998	1999	2000
1	15730.	18403.	17662.	14718.	10800.
2	10046.	12850.	14719.	14416.	11990.
3	5255.	7424.	8588.	10121.	9318.
4	2175.	2991.	3092.	3717.	4660.
5	582.	779.	810.	905.	1465.
6	483.	167.	149.	201.	327.
7	314.	72.	217.	66.	122.
Total	34587.	42685.	45238.	44144.	38682.

Table J11 continued

JAN-1 Population Numbers

AGE	2001	2002	2003	2004	2005
1	9853.	5681.	4417.	21590.	10624.
2	8780.	8048.	4633.	3515.	17662.
3	8512.	5294.	6073.	3061.	2610.
4	4462.	3562.	2532.	3144.	1693.
5	1594.	1586.	1340.	967.	1853.
6	420.	544.	497.	699.	512.
7	195.	222.	251.	490.	152.
=====					
Total	33814.	24938.	19744.	33467.	35106.

Table J11 continued

Fishing Mortality Calculated

AGE	1981	1982	1983	1984	1985
1	0.0242	0.0125	0.0121	0.0157	0.0089
2	0.3513	0.3764	0.2111	0.3284	0.3335
3	0.8468	0.6037	0.7362	0.8178	0.7476
4	0.8112	0.5497	0.6917	0.6774	1.0905
5	0.6945	0.3002	0.5629	0.4356	1.2346
6	0.7903	0.4917	0.6575	0.5899	1.1335
7	0.7903	0.4917	0.6575	0.5899	1.1335
AGE	1986	1987	1988	1989	1990
1	0.0073	0.0031	0.0035	0.0224	0.0023
2	0.2863	0.2464	0.2300	0.3091	0.1347
3	0.9098	0.8575	0.9395	0.8559	0.7532
4	0.5907	0.9557	1.3101	1.2356	1.1246
5	0.5442	0.9957	1.4411	1.2311	1.0574
6	0.5808	0.9739	1.3382	1.2347	1.1099
7	0.5808	0.9739	1.3382	1.2347	1.1099
AGE	1991	1992	1993	1994	1995
1	0.0052	0.0035	0.0349	0.0083	0.0022
2	0.2691	0.1982	0.4436	0.1911	0.0330
3	0.9064	0.8103	0.8986	0.4796	0.5736
4	1.3150	1.0539	0.8947	0.4795	0.8675
5	1.3600	1.1109	0.7285	0.3827	0.5753
6	1.3239	1.0652	0.8455	0.4452	0.7455
7	1.3239	1.0652	0.8455	0.4452	0.7455
AGE	1996	1997	1998	1999	2000
1	0.0023	0.0234	0.0031	0.0050	0.0071
2	0.1025	0.2029	0.1745	0.2364	0.1426
3	0.3637	0.6759	0.6374	0.5756	0.5364
4	0.8266	1.1063	1.0281	0.7309	0.8728
5	1.0522	1.4522	1.1947	0.8187	1.0502
6	0.8702	1.1686	1.0605	0.7475	0.9124
7	0.8702	1.1686	1.0605	0.7475	0.9124
AGE	2001	2002	2003	2004	
1	0.0024	0.0039	0.0284	0.0008	
2	0.3058	0.0815	0.2147	0.0977	
3	0.6711	0.5376	0.4582	0.3919	
4	0.8341	0.7775	0.7622	0.3287	
5	0.8749	0.9603	0.4507	0.4354	
6	0.8447	0.8304	0.6431	0.3820	
7	0.8447	0.8304	0.6431	0.3820	

Table J11 continued

Average Fishing Mortality For Ages 4-5

Year	Average F	N Weighted	Biomass Wtd	Catch Wtd
1981	0.7528	0.7913	0.7851	0.7929
1982	0.4249	0.4972	0.4753	0.5146
1983	0.6273	0.6591	0.6474	0.6625
1984	0.5565	0.5966	0.5789	0.6133
1985	1.1625	1.1356	1.1433	1.1377
1986	0.5675	0.5809	0.5783	0.5814
1987	0.9757	0.9741	0.9743	0.9744
1988	1.3756	1.3396	1.3468	1.3407
1989	1.2333	1.2347	1.2344	1.2347
1990	1.0910	1.1103	1.1070	1.1107
1991	1.3375	1.3240	1.3256	1.3242
1992	1.0824	1.0655	1.0681	1.0657
1993	0.8116	0.8483	0.8397	0.8527
1994	0.4311	0.4463	0.4410	0.4501
1995	0.7214	0.7558	0.7382	0.7745
1996	0.9394	0.8743	0.8836	0.8800
1997	1.2792	1.1778	1.1872	1.1857
1998	1.1114	1.0627	1.0684	1.0650
1999	0.7748	0.7481	0.7527	0.7491
2000	0.9615	0.9152	0.9227	0.9189
2001	0.8545	0.8448	0.8467	0.8451
2002	0.8689	0.8338	0.8431	0.8391
2003	0.6064	0.6544	0.6348	0.6797
2004	0.3820	0.3538	0.3591	0.3585

Table J11 continued

Spawning Stock Biomass

AGE	1981	1982	1983	1984	1985
1	0.	0.	0.	0.	0.
2	0.	0.	0.	0.	0.
3	4735.	4753.	3765.	3551.	3621.
4	3891.	4592.	5124.	3859.	3106.
5	1205.	2157.	2898.	2927.	1838.
6	342.	604.	1391.	1542.	1283.
7	218.	910.	1614.	2158.	1068.
Total	10392.	13015.	14792.	14037.	10916.
AGE	1986	1987	1988	1989	1990
1	0.	0.	0.	0.	0.
2	0.	0.	0.	0.	0.
3	2395.	2482.	2285.	1921.	1830.
4	3541.	1960.	1861.	1643.	1558.
5	1373.	1781.	744.	576.	590.
6	635.	647.	522.	171.	178.
7	728.	501.	270.	257.	174.
Total	8672.	7371.	5682.	4569.	4330.
AGE	1991	1992	1993	1994	1995
1	0.	0.	0.	0.	0.
2	0.	0.	0.	0.	0.
3	1980.	1413.	959.	598.	845.
4	1626.	1624.	1239.	899.	661.
5	525.	559.	667.	637.	586.
6	203.	157.	204.	300.	376.
7	146.	95.	209.	217.	283.
Total	4479.	3848.	3279.	2651.	2751.
AGE	1996	1997	1998	1999	2000
1	0.	0.	0.	0.	0.
2	0.	0.	0.	0.	0.
3	1007.	1505.	1548.	1746.	1661.
4	851.	1265.	1250.	1454.	1845.
5	289.	379.	406.	497.	735.
6	299.	110.	98.	132.	221.
7	217.	83.	210.	72.	111.
Total	2663.	3341.	3511.	3902.	4574.

Table J11 continued

Spawning Stock Biomass

AGE	2001	2002	2003	2004
1	0.	0.	0.	0.
2	0.	0.	0.	0.
3	1698.	1106.	1214.	676.
4	1915.	1580.	1145.	1512.
5	899.	898.	888.	621.
6	300.	403.	392.	575.
7	199.	242.	260.	553.
=====				
Total	5012.	4229.	3899.	3938.

Table J12. Comparative results for 2001/2002 from ADAPT/VPA runs incorporating data and software updates since SAW 36: SNE/MA winter flounder.

Run	SAW 36 FACT v1.5	SAW 36 NFT v2.0	SAW 36 NFT v2.3	SAW 36 NFT v2.3 Update 2001 CAA
Terminal Year	2001	2001	2001	2001
RSS	353.8	356.9	356.9	356.9
N_{t+1} age 1	5,665	5,658	5,658	5,665
N_{t+1} age 2	15,553	15,536	15,536	15,549
N_{t+1} age 3	6,671	6,661	6,661	6,604
N_{t+1} age 4	2,912	2,904	2,904	2,871
N_{t+1} age 5	2,179	2,610	2,610	2,557
N_{t+1} age 6	1,602	1,864	1,864	1,824
N_{t+1} age 7+	1,057	703	703	703
F age 1	0.00	0.00	0.00	0.00
F age 2	0.24	0.24	0.24	0.25
F age 3	0.76	0.76	0.76	0.78
F age 4	0.65	0.56	0.56	0.59
F age 5	0.37	0.32	0.32	0.35
F age 6	0.23	0.44	0.44	0.47
F age 7+	0.23	0.44	0.44	0.47
F (ages 4-5)	0.51	0.44	0.44	0.47
SSB (mt)	7,643	7,514	7,514	7,521

SNE/MA Winter Flounder Landings and Discards

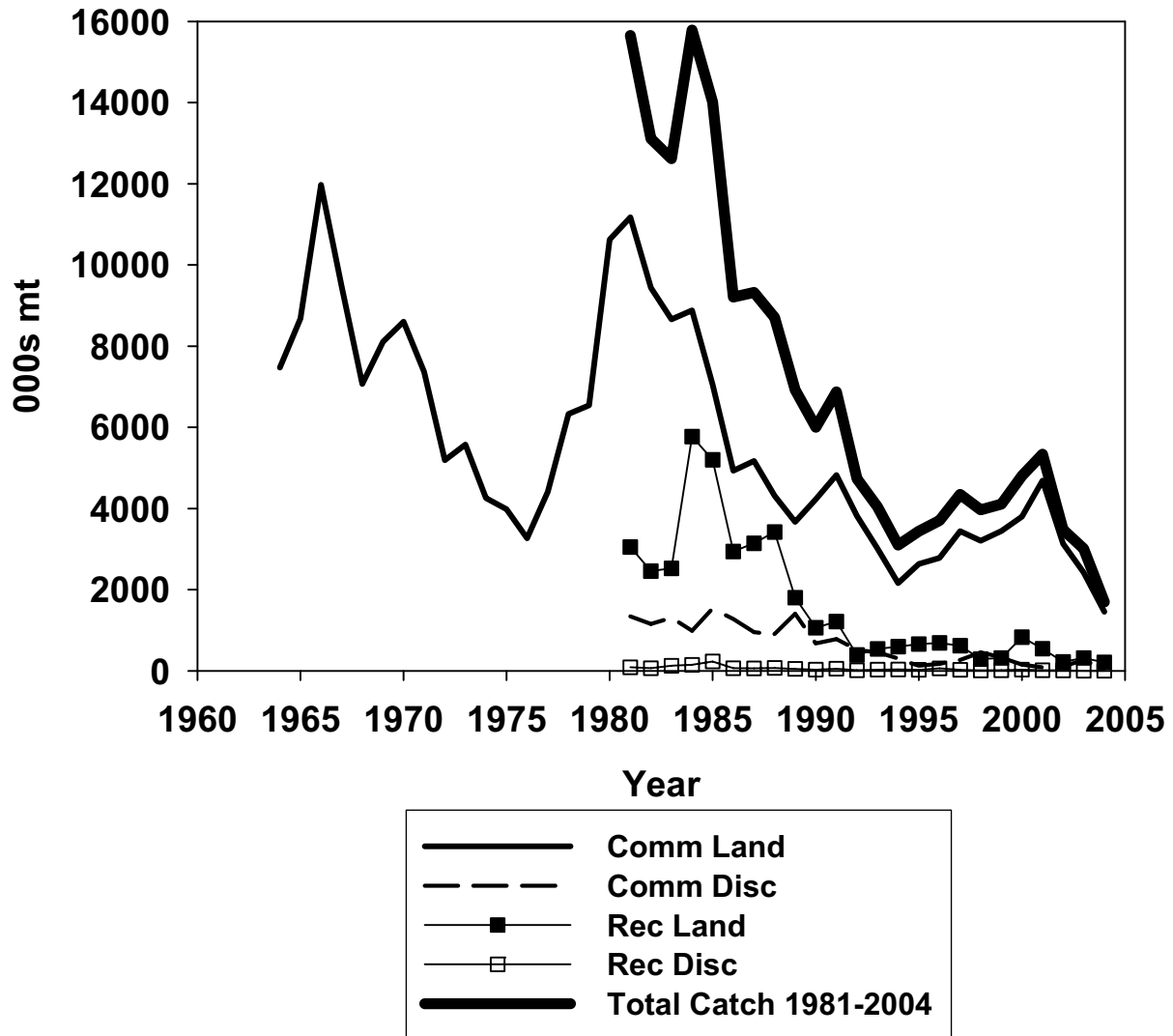


Figure J1. Commercial landings (1964-2004), commercial discards (1981-2004) recreational landings (1981-2004), recreational discards (1981-2004) and total fishery catch (1981-2004) for the SNE/MA winter flounder stock complex.

SNE/MA Winter Flounder Survey Biomass Indices

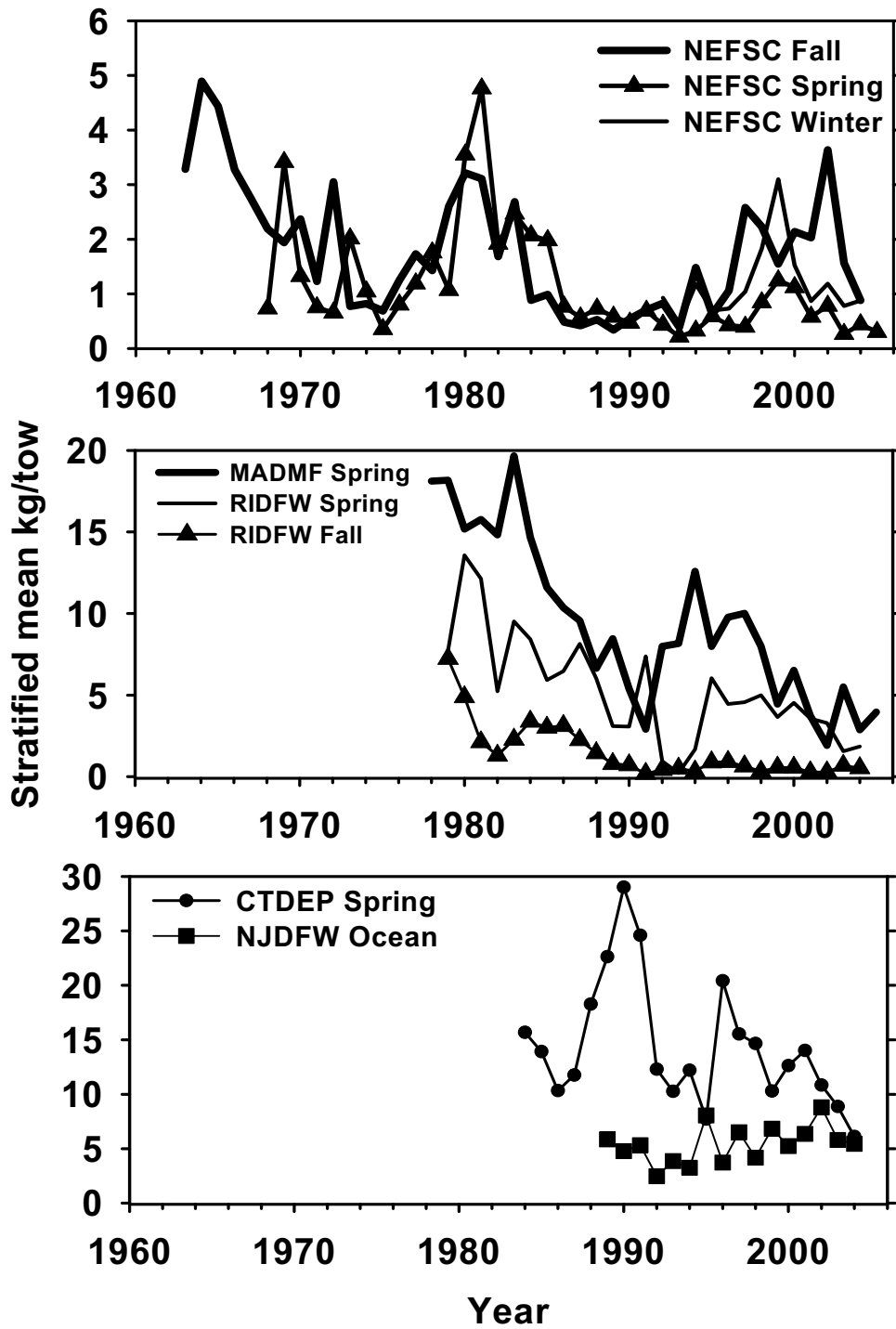


Figure J2. Trends in research survey biomass indices for SNE/MA winter flounder.

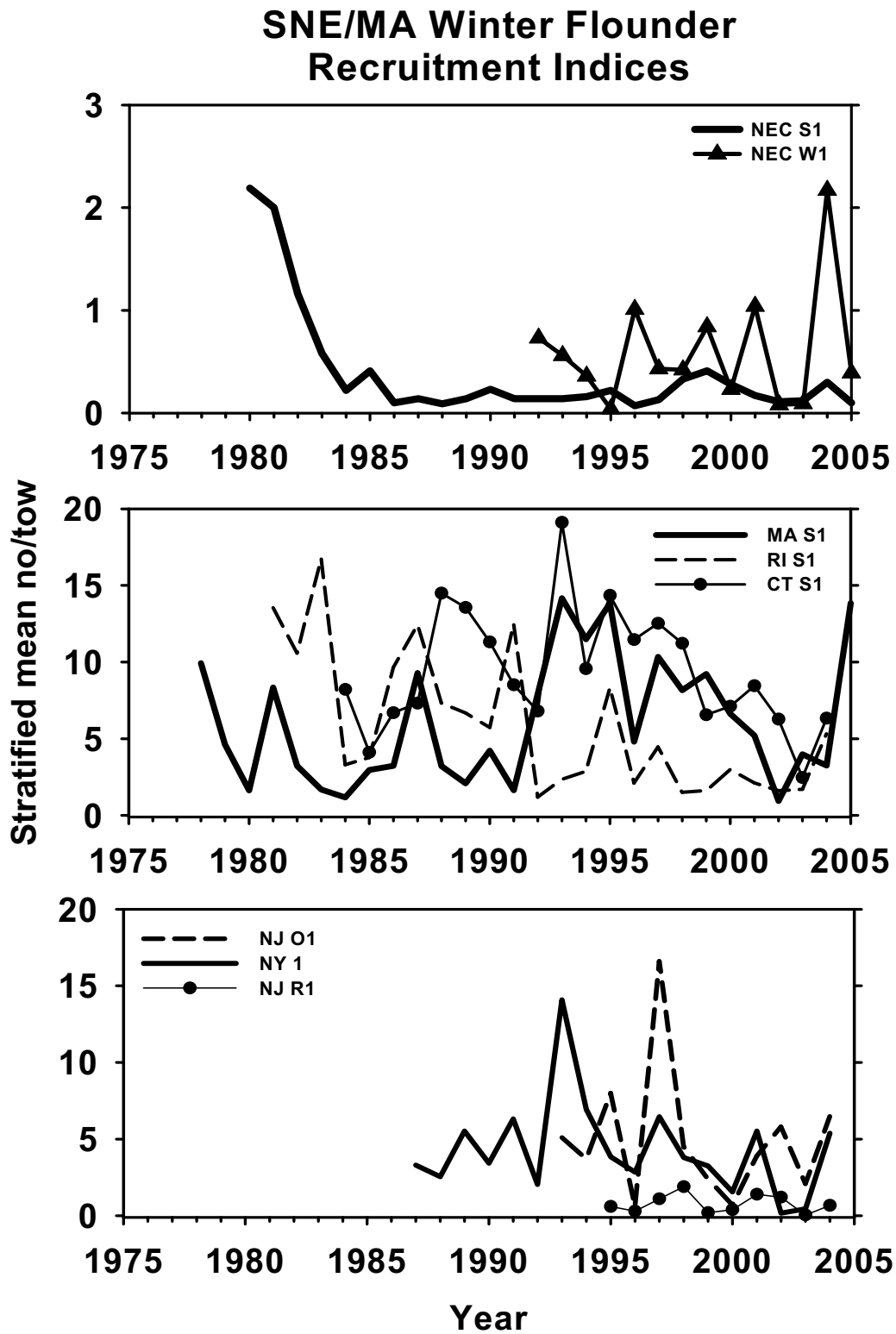


Figure J3. Trends in research survey recruitment indices for SNE/MA winter flounder. Includes spring survey age-1 indices and fall YOY indices.

SNE/MA Winter Flounder Recruitment Indices

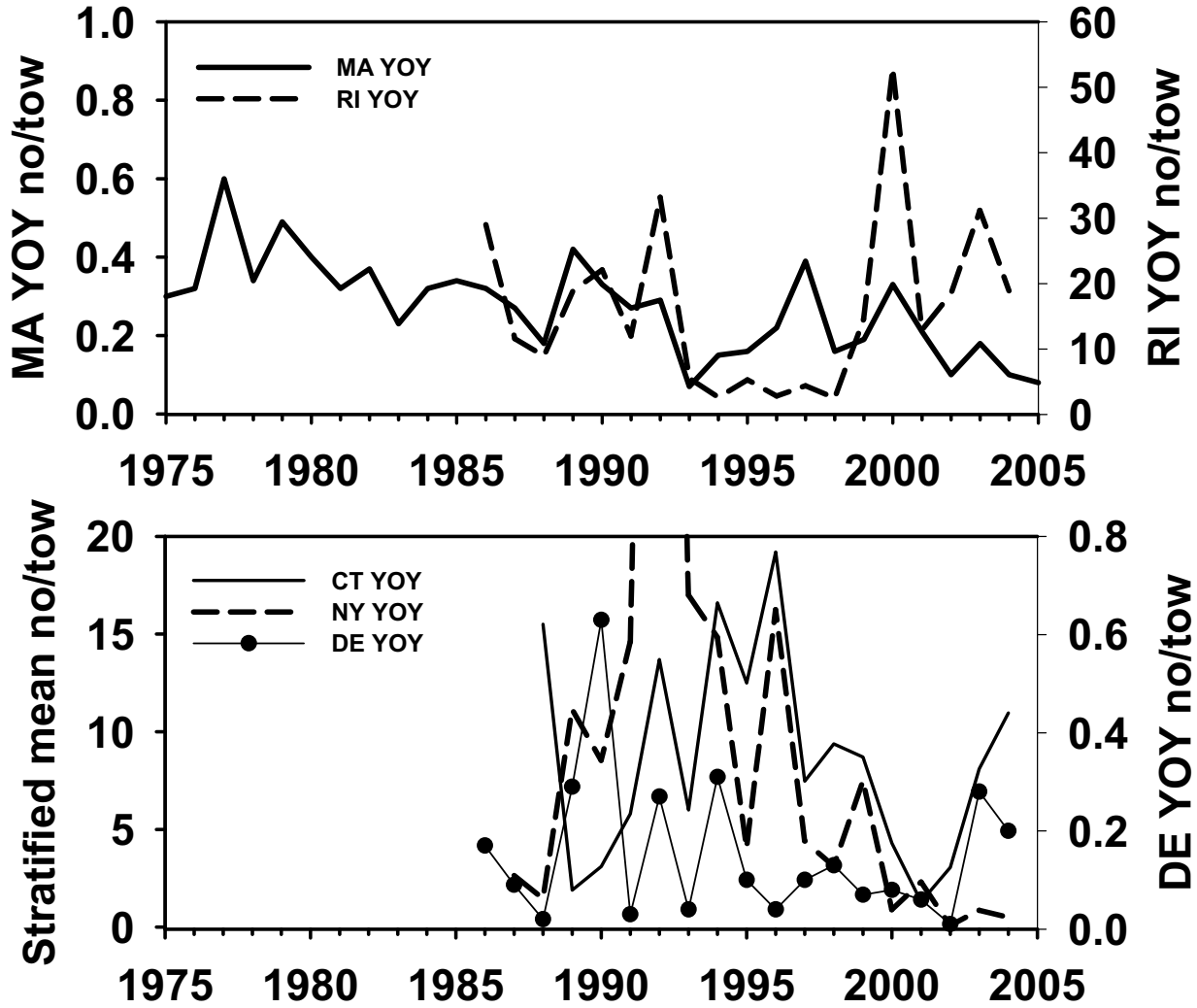


Figure J3 continued.

SNE/MA Winter Flounder Total Catch and Fishing Mortality

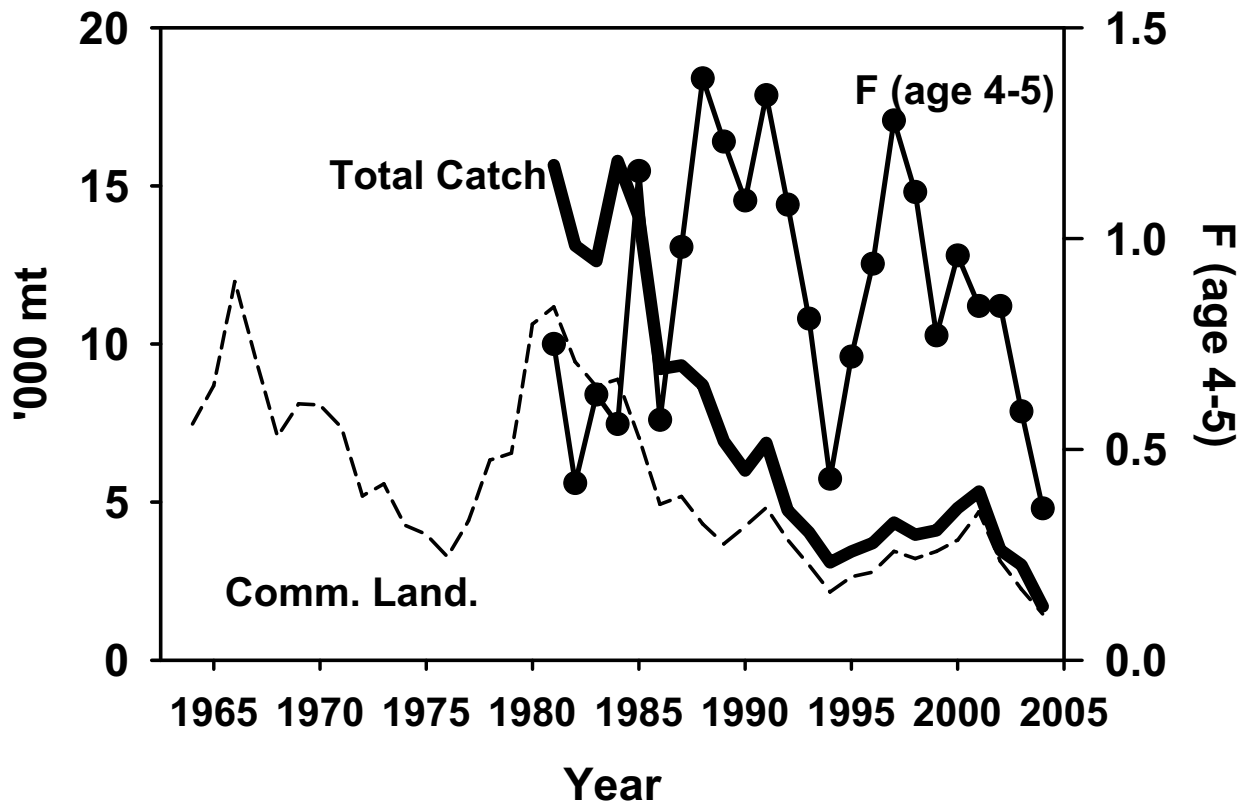


Figure J4. Total catch (landings and discards, '000 mt), commercial landings('000 mt), and fishing mortality rate (F, ages 4-5, unweighted) for SNE/MA winter flounder.

SNE/MA Winter Flounder SSB and Recruitment

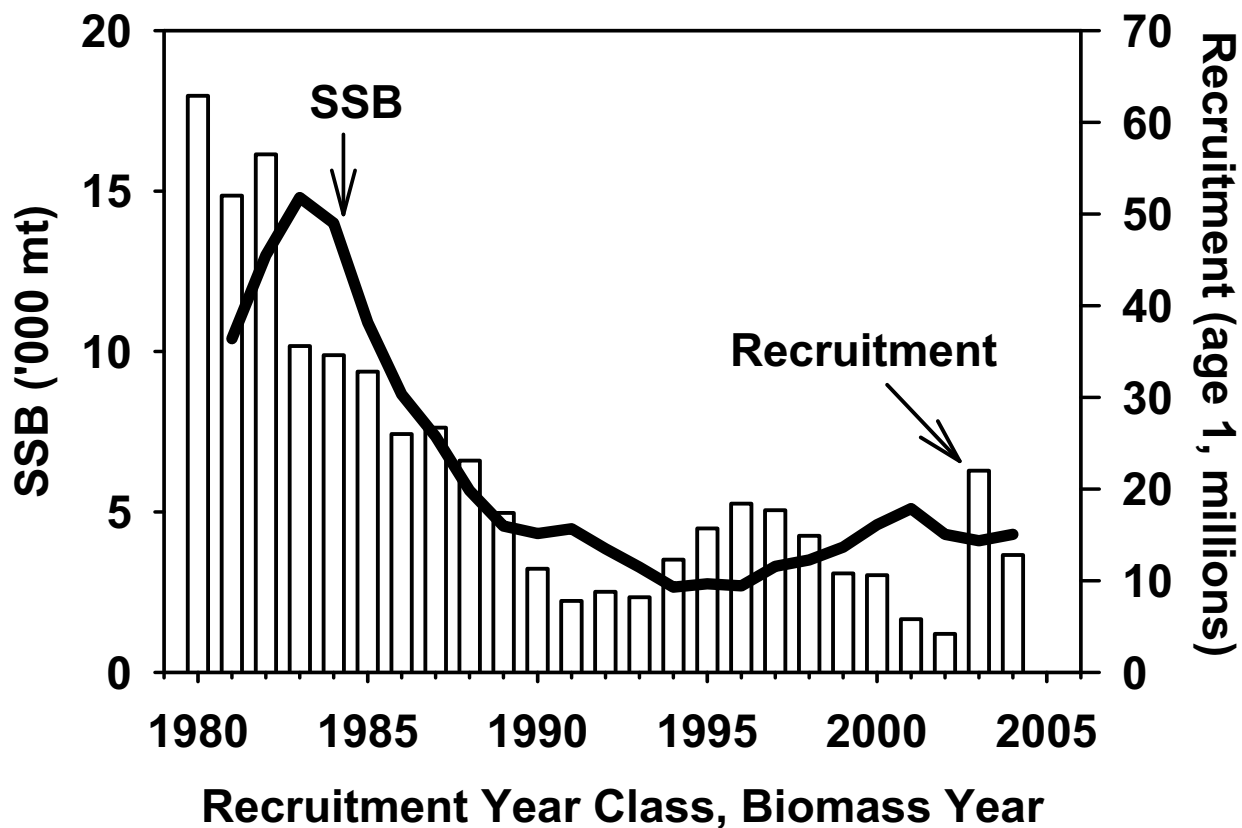


Figure J5. Spawning stock biomass (SSB, ages 3-7+, '000 mt) and recruitment (millions of fish at age-1) for SNE/MA winter flounder.

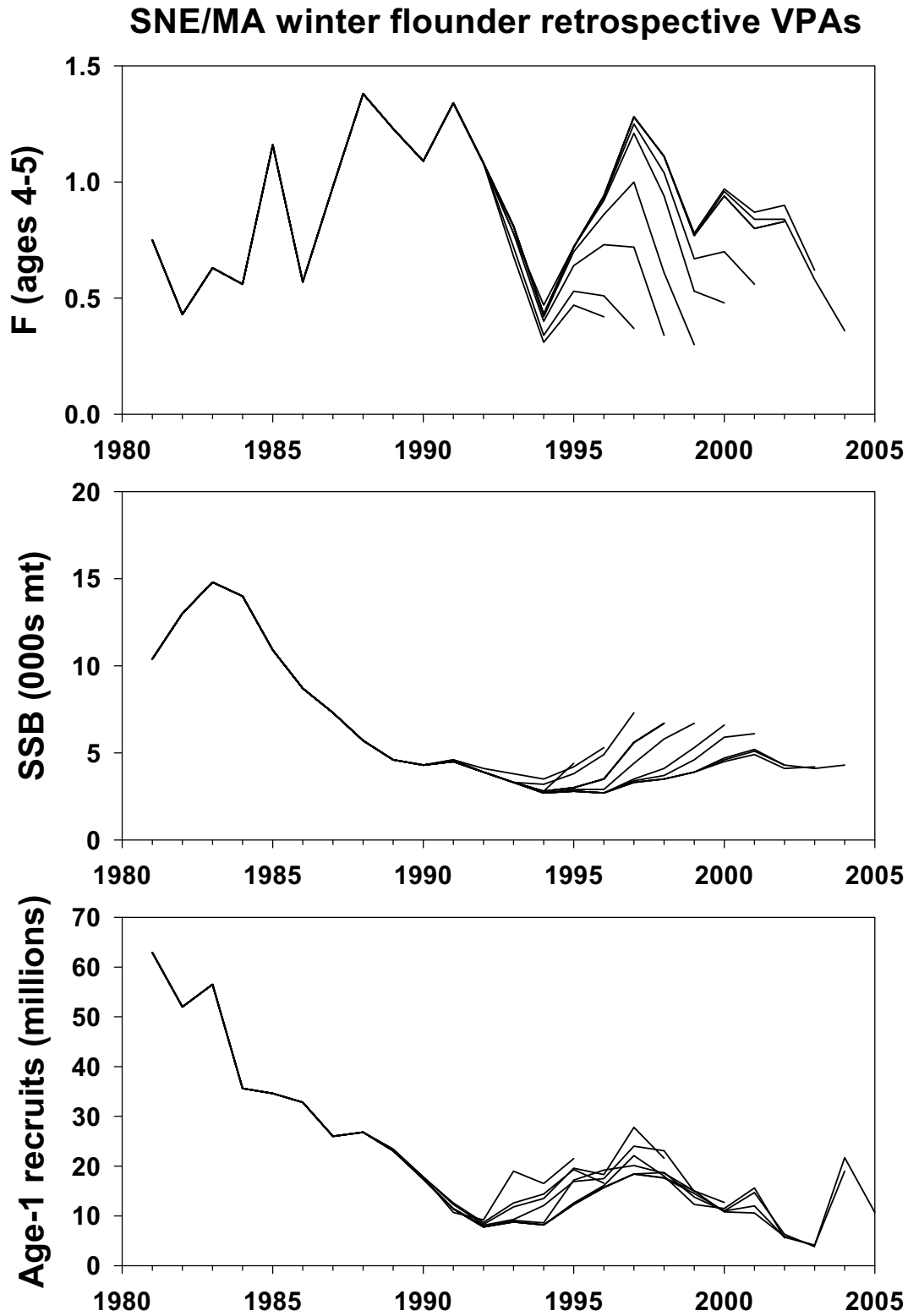


Figure J6. Retrospective VPAs for SNE/MA winter flounder.

Amend 13 Projection Comparison

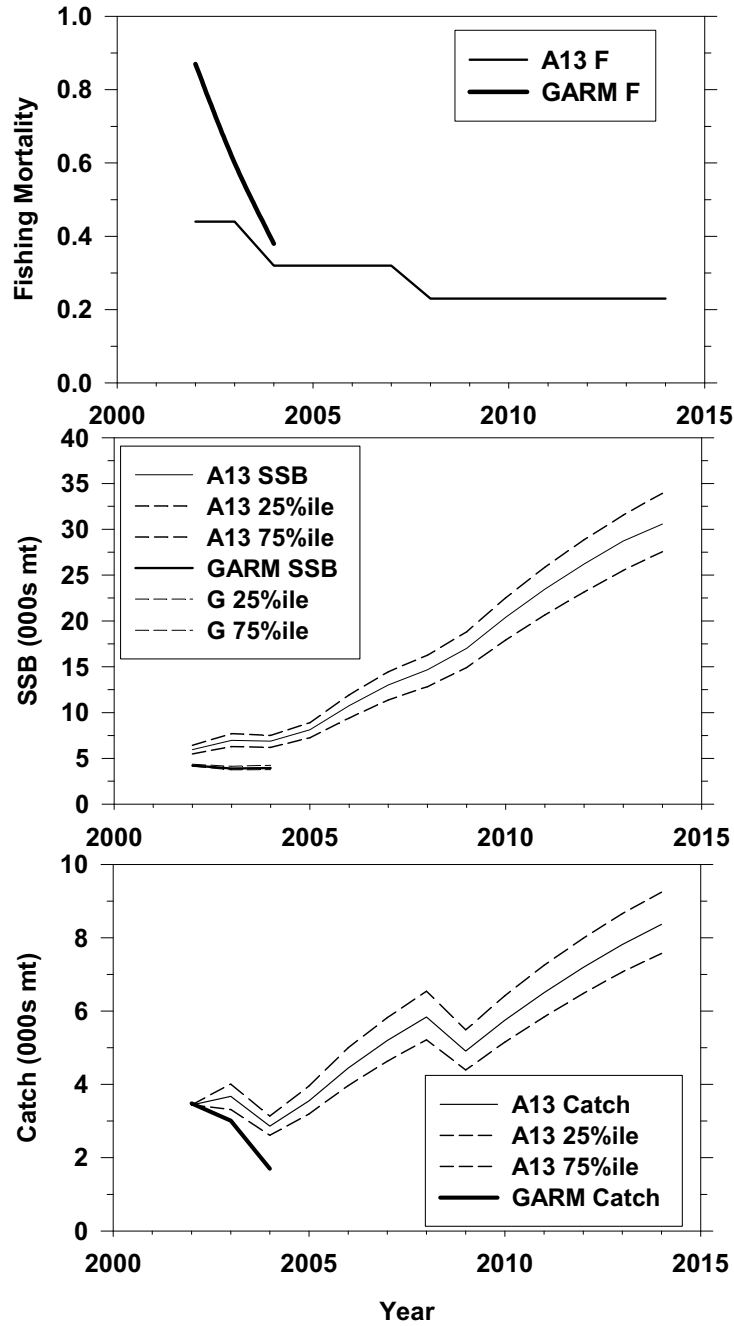


Figure J7. Comparison of Amendment 13 projections and current estimates.