

H. Gulf of Maine/Georges Bank American Plaice by L. O'Brien, J. Burnett, and L. Col

1.0 Background

This stock was last assessed in 2002 (O'Brien et al. 2002) and reviewed by the Groundfish Assessment Review Meeting (Northeast Fisheries Science Center 2002).

Landings in 2001 were 4,479 mt and fully recruited F (ages 5-8, u) in 2001 was estimated to be 0.43, a 30% increase from 2000. Spawning stock biomass was 13,822 mt in 2001, a decrease of 3% from 2000. The 1998 and 2001 year classes were above average and the 2000 year class was the lowest in the time series.

2.0 Fishery

Total commercial landings of Gulf of Maine-Georges Bank American plaice were 1,711 mt in 2004, a 31% decrease from 2003 and a 51% decrease from 2002 (Table H1, Figure H1). USA landings account for about 98% of the landings in recent years (2002-2004) and Canada accounts for the remainder. The otter trawl fleet accounts for more than 95% of the landings and the fishery is prosecuted primarily during the 2nd and 3rd calendar quarter of the year. The highest proportion of landings are in the small market category. The number of samples obtained for characterizing the catch at age were adequate during 2002-2004, however, landings had to be pooled by half-year in 2002 for the medium market category (Table H2). The total catch at age (Table H3, Figure 2) includes estimates of discarded fish from both the Northern shrimp fishery and the large mesh fishery and landings from the commercial fishery.

Discarding of small fish occurs in the northern shrimp fishery during the 1st and 4th calendar quarter, and year-round by the large mesh fishery. Discarded catch in the Northern shrimp fishery is estimated directly from sea-sampled trips (1989-1997) and indirectly using survey data (1980-1988, 1998-2004). Discards in the large mesh fishery are also estimated based on survey data. During 2002-2004 discards in the shrimp fishery accounted for about 0.8% of the total catch (in numbers) and discards in the large mesh fishery account for about 23% of the total catch (in weight).

3.0 Research Surveys

The NEFSC survey indices of abundance and biomass have generally been increasing during 1988-2000. The most recent spring and autumn indices, however, both indicate a decreasing trend (Table H4, Figure H3 and H4) during 2000-2005. Recruitment indices of age 1 fish from NEFSC autumn surveys indicate that both the 1997 and 1998 year classes are above average and the 2001 year class is just about average (Fig. H5a). The 1997 and 1998 year classes are just below average in the autumn Massachusetts state survey, however the 2003 is above average (Fig H5b) .

4.0 Assessment

Input data and Analyses

The current assessment is an update assessment and employs the same ADAPT formulation as in the 2002 assessment (O'Brien *et al.* 2002). Catch at age has been updated with 2002, 2003, and 2004 landings, and discards have been estimated for the Northern shrimp fishery and the large mesh fishery. Research survey indices have been estimated for the spring NEFSC (ages 1-8) and MADMF (ages 1-5) surveys and the autumn NEFSC (ages 1-6) and MADMF (ages 1-5) surveys for 2002-2004 (Table H5a-d). The ADAPT calibration method (Parrack 1986), (Gavaris 1988), (Conser and J.E. Powers. 1990) was used to derive estimates of instantaneous fishing mortality and beginning year stock sizes in 2004. A conditional non-parametric bootstrap procedure (Efron 1982) was used to evaluate the precision of fishing mortality, spawning stock biomass, and mean biomass estimates. A retrospective analysis was performed for terminal year fishing mortality, spawning stock biomass, and age 1 recruitment.

Assessment results

Fully recruited fishing mortality (age 5-8) was estimated at 0.15 in 2004 (Table H6, Figure H6). Spawning stock biomass in 2004 was estimated at 14,149 mt, a 16% decrease from 2001 and a 10% decrease from 2003 (Table H6, Figure H7). Recruitment of the 2001 year class (32.4 million age 1 fish) is estimated to be similar to the above average 1998 year class (35.7 million age 1 fish). The 2003 (54.8 million age 1 fish) and 2004 (66.7 million age 1 fish) year classes are well above the long term average (33.1 million age 1 fish) (Table H6, Figure H7).

VPA Diagnostics

Stock size estimates for ages 1-8 were well estimated with CVs ranging from 0.16 to 0.44. The distribution of F estimates from the bootstrap analysis ranged from 0.12 to 0.20 with an 80% probability that F in 2004 was between 0.14 and 0.17. The distribution of SSB estimates from the bootstrap analysis ranged from 12,000 mt to 18,000 mt with an 80% probability that SSB in 2000 was between 13,000 mt to 16,000 mt.

The retrospective analysis indicates a pattern in the estimate of F and SSB with this model formulation (Figure H8). The terminal year estimates of fishing mortality exhibit a pattern of overestimating F before 2003, whereas, SSB has a pattern of underestimation before 2003. The terminal year estimates of recruits are underestimated prior to 2002 and overestimated after 2002. These patterns are very different from the previous assessment (O'Brien *et al.* 2002) in which there was not a strong retrospective pattern .

5.0 Biological Reference Points

Biological reference points were established for Gulf of Maine -Georges Bank American plaice based on yield per recruit analyses using $F_{40\%}$ as a proxy for F_{MSY} (NEFSC 2002) as:

MSY= 4,900 mt
SSB_{MSY} = 28,600 mt and
F_{MSY}= 0.166

In 2004, spawning stock biomass was estimated at 14,149 mt, about 49% of the target SSB_{MSY}. The stock is considered to be overfished, although the upper 80% confidence interval includes biomass >50% SSB_{MSY}. Overfishing is not occurring on this stock since $F_{2004} = 0.15 < F_{MSY}$, although the upper 80% confidence interval about F_{2004} is above F_{MSY} .

6.0 Summary

American plaice in the Gulf of Maine-Georges Bank region are overfished but overfishing is not occurring. Estimates of F and SSB are similar to the A13 projection trajectories for 2002-2004 (Figure H9). Fishing mortality on this stock has declined during 2001-2004. Spawning stock biomass increased during 1995 to 2000 to 16,815 mt and has since decreased to 14,149 mt in 2004. The 1998 and 2001 year classes are just above average, whereas the 2000 year class is the lowest on record. The 2003 and 2004 year classes are well above average. The NEFSC survey biomass indices show a declining trend during 2002-2005, however, the 2001 and 2003 and 2004 year classes appear to be at or near the long term average.

7.0 Sources of Uncertainty

Lack of direct estimates of discards from sea sampled trips for large mesh fishery and shrimp fishery.

8.0 Panel Discussion

The Panel noted that discards from the northern shrimp fishery and the large-mesh otter trawl fishery estimated using survey-based methods are likely to be more uncertain than those estimated directly from Observer data. While the survey-based methods are consistent with previous American plaice assessments, direct estimates based on observer data are desirable.

The Panel discussed the number of fish estimated at age 1 in 2004 (68 million fish) and noted that there is some uncertainty associated with this estimate (bootstrap CV 93%). The high CV, coupled with the retrospective pattern of overestimating recruits, indicate that future assessments may estimate a lower value for this year class.

The Panel noted the retrospective analysis indicated a weak pattern where F was overestimated, spawning stock biomass was underestimated and estimates of Age 1 were underestimated prior to 2002 and overestimated after 2002.

Projection Advice - Given the declining trend in mean weights at age, the Panel agreed that the average of the three most recent years (2002 - 2004) of mean weights at age should be used for short-term projections. Additionally, a 'smoothed' partial recruitment vector based on 2002 -

2004 and the most recent maturity stanza (2003 - 2005) should be used. Although Age 1 in 2004 (2003 year class) is poorly estimated, this year class will not be influential on the short-term projected estimates of spawning stock biomass, and so the Panel agreed to retain the estimated value. The Panel agreed that re-sampling from the entire recruitment series should be used in the short-term projections.

9.0 References

Conser, R.J. and J.E. Powers. 1990. Extensions of the ADAPT VPA tuning method designed to facilitate assessment work on tuna and swordfish stocks. *Int. Comm. Conserv. Atlantic Tunas. Coll. Vol. Sci. Pap.* **32**: 461-467.

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Table H1. Commerical landings (metric tons, live weight) of American plaice from the Gulf of Maine, Georges Bank, Southern New England and the Mid-Atlantic, 1960-2004.

Year	Gulf of Maine		Georges Bank		Southern New England		Mid - Atlantic		Grand Total		
	USA	Can	USA	Can	USA	USSR	Other	USA	Other	Total	
1960	620	1	689	-	-	-	-	0	1309	1	1310
1961	692	-	830	-	-	-	-	0	1522	0	1522
1962	694	-	1233	44	-	-	-	0	1927	44	1971
1963	693	-	1489	127	24	-	-	0	2182	151	2333
1964	811	-	2800	177	-	11	2988	0	3611	188	3799
1965	967	-	2376	180	112	-	-	0	3343	292	3635
1966	955	2	2388	242	279	1	2910	0	3343	524	3867
1967	1066	6	2166	203	1018	10	3397	0	3236	1237	4473
1968	904	5	1695	173	193	5	2066	637	3254	523	3777
1969	1059	7	1738	71	63	17	1889	505	3432	507	3939
1970	895	-	1603	92	927	658	3280	88	2594	1735	4329
1971	648	5	1511	38	228	296	2071	11	2176	887	3063
1972	569	-	1222	22	358	-	1602	3	1794	451	2245
1973	687	-	910	38	289	-	1237	5	1602	485	2087
1974	945	2	1039	27	16	2	1084	92	2076	51	2127
1975	1507	-	1507	913	25	148	-	3	2423	173	2596
1976	2550	-	948	24	3	-	975	10	3509	27	3536
1977	5647	-	1408	35	50	-	1493	6	7068	163	7231
1978	7287	30	2193	77	-	-	2270	15	9503	107	9610
1979	8835	-	2478	23	-	-	2501	13	11330	30	11360
1980	11139	-	2399	43	-	5	2447	10	13549	48	13597
1981	10327	1	2482	15	-	2	2499	26	12881	20	12901
1982	11147	-	3935	27	-	1	3963	35	15126	30	15156
1983	9142	7	3955	30	-	-	3985	40	13141	37	13178
1984	6833	2	3277	6	-	-	3283	17	10134	8	10142
1985	4766	1	2249	40	-	-	2289	12	7029	41	7070
1986	3319	-	1146	34	-	-	1180	4	4472	34	4506
1987	2766	-	1032	48	-	-	1080	2	3801	48	3849
1988	2271	-	1097	108	-	-	1205	13	3382	108	3490
1989	1646	-	703	68	-	-	771	1	2353	68	2421
1990	1802	-	639	52	-	-	690	2	2445	52	2497
1991	2936	-	1310	26	-	-	1310	15	4261	26	4287
1992	4564	-	1838	3	-	-	1838	10	6416	3	6419
1993	3865	-	1838	-	-	-	1838	11	5718	-	5718
1994	3357	-	1683	30	-	-	1562	22	5066	30	5096
1995	3105	-	1505	2	-	-	1486	15	4645	2	4647
1996	2912	-	1430	2	-	-	1423	40	4396	2	4398
1997	2312	-	1576	65	-	-	1560	23	3937	65	4002
1998	2234	-	1385	20	-	-	1405	23	3663	20	3683
1999	1718	-	1384	123	-	-	1507	11	3134	123	3257
2000	2497	-	1687	143	-	-	1830	10	4213	143	4356
2001	2602	-	1814	46	-	-	1860	7	4433	46	4479
2002	1987	-	1473	98	-	-	1510	6	3416	97.549	3514
2003	1480	-	934.1	57	-	-	991.3	10	2430	57.17	2487
2004	1041	-	654	3	-	-	656.8	4	1708	2.825	1711

* 1994-2004 data are provisional and spatially distributed based on proportions of landings recorded by area in the VTR database

Table H2. Sampling of commercial American plaice landings, by market category, for the Gulf of Maine and Georges Bank areas (NAFO Division 5Y and 5Z), 1985-2004. Outline indicates samples pooled to estimate landings at age.

	Small				Medium				Large				Number of tons landed / sample		
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Sm.	Med.	Lrg.
1985 GB	2	4	14	3	---	2	2	2	---	3	7	1	49	55	116
GM	2	5	5	5	3	1	9	5	1	10	6	5			
total	4	9	19	8	3	3	11	7	1	13	13	6			
1986 GB	3	6	5	3	2	4	3	2	1	4	3	2	33	35	56
GM	9	5	3	5	3	4	5	1	10	10	7	4			
total	12	11	8	8	5	8	8	3	11	14	10	6			
1987 GB	4	5	5	1	---	2	3	2	2	4	4	1	39	40	63
GM	2	6	5	3	1	5	2	3	3	3	6	5			
total	6	11	10	4	1	7	5	5	5	7	10	6			
1988 GB	3	7	4	2	1	3	4	2	4	5	2	4	34	21	40
GM	4	7	4	5	6	6	4	3	6	5	3	2			
total	7	14	8	7	7	9	8	5	10	10	5	6			
1989 GB	2	5	5	---	1	1	6	1	5	3	3	---	35	29	63
GM	1	3	3	3	1	---	4	3	2	1	---	1			
total	3	8	8	3	2	1	10	4	7	4	3	1			
1990 GB	---	5	6	---	2	1	2	2	---	2	5	---	33	26	42
GM	5	5	3	3	1	6	3	5	1	5	3	5			
total	5	10	9	3	3	7	5	7	1	7	8	5			
1991 GB	---	3	1	---	3	1	1	---	3	3	2	---	78	67	67
GM	5	3	7	6	3	1	4	3	---	1	5	2			
total	5	6	8	6	6	2	5	3	3	4	7	2			
1992 GB	---	4	1	---	---	1	1	---	---	2	2	1	168	143	155
GM	1	5	2	2	1	4	3	2	2	2	3	2			
total	1	9	3	2	1	5	4	2	2	4	5	3			
1993 GB	---	2	1	1	---	1	---	---	---	3	2	1	133	260	253
GM	2	4	4	1	---	2	2	---	---	1	2	---			
total	2	6	5	2	0	3	2	0	0	4	4	1			
1994 GB	---	---	---	---	---	---	1	1	---	1	---	1	205	97	181
GM	---	2	5	3	---	4	3	3	---	2	3	3			
total	0	2	5	3	0	4	4	4	0	3	3	4			
1995 GB	1	---	---	---	1	---	---	---	1	---	---	---	323	336	332
GM	1	3	---	2	---	2	---	---	---	2	---	1			
total	2	3	0	2	1	2	0	0	1	2	0	1			
1996 GB	---	2	2	1	---	1	4	---	---	2	1	1	189	53	75
GM	2	3	2	1	2	1	3	5	3	1	4	2			
total	2	5	4	2	2	2	7	5	3	3	5	3			
1997 GB	2	4	2	3	---	2	3	1	---	2	---	---	82	77	69
GM	4	4	3	1	2	3	3	---	1	5	3	2			
total	6	8	5	4	2	5	6	1	1	7	3	2			
1998 GB	1	4	1	---	2	1	1	1	1	1	1	1	111	41	87
GM	2	3	1	1	6	3	7	7	2	2	2	2			
total	3	7	2	1	8	4	8	8	3	3	3	3			

Table H2 continued . Sampling of commercial American plaice landings, by market category, for the Gulf of Maine and Georges Bank areas (NAFO Division 5Y and 5Z), 1985-2004. Outline indicates samples pooled to estimate landings at age.

		Small				Medium				Large				Number of tons landed / sample		
		Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Sm.	Med.	Lrg.
1999	GB	4	4	---	1	5	2	1	---	---	4	1	---	31	29	61
	GM	6	8	6	9	7	4	5	7	1	6	3	2			
	total	10	12	6	10	12	6	6	7	1	10	4	2			
2000	GB	14	11	3	1	1	2	---	1	2	2	2	2	21	85	78
	GM	15	29	4	1	2	6	3	---	---	4	1	3			
	total	29	40	7	2	3	8	3	1	2	6	3	5			
2001	GB	4	2	1	2	---	2	2	4	---	3	2	1	76	70	81
	GM	5	5	4	---	3	3	2	2	4	2	1	4			
	total	9	7	5	2	3	5	4	6	4	5	3	5			
2002	GB	1	2	2	1	2	1	2	---	4	3	2	---	93	85	54
	GM	2	3	2	3	2	1	3	---	1	3	3	2			
	total	3	5	4	4	4	2	5	0	5	6	5	2			
2003	GB	---	3	---	---	1	---	---	1	---	3	2	---	41	33	16
	GM	3	8	6	6	2	6	6	6	6	10	11	6			
	total	3	11	6	6	3	6	6	7	6	13	13	6			
2004	GB	1	1	1	4	2	---	2	4	1	---	3	1	33	22	12
	GM	5	3	7	2	2	6	4	2	11	12	2	6			
	total	6	4	8	6	4	6	6	6	12	12	5	7			

Table H3. Catch at age (thousands of fish; metric tons) and mean weight (kg), of commercial landings, and large mesh and northern shrimp fishery discards of American plaice, ages 1-9+, from Gulf of Maine - Georges Bank, and South, 1980-2004.

Year	0	1	2	3	4	5	6	7	8	9+	Total
Catch in Numbers (000's) at Age											
1980	0	5	99	1072	2672	3939	3933	3632	1185	3369	19906
1981	0	5	982	2192	5055	5337	3648	2401	1582	1706	22907
1982	0	10	603	3348	4574	4503	3599	3297	2038	2710	24681
1983	0	15	663	1478	5177	4918	3913	2270	1272	2062	21768
1984	0	3	370	991	2422	6031	3244	1936	580	1350	16927
1985	0	65	158	1217	1336	2405	2872	2228	1081	887	12250
1986	0	59	639	738	2284	1700	1476	1307	631	460	9295
1987	0	38	590	1840	1439	2282	1337	895	543	309	9274
1988	0	314	786	1840	1833	1597	1444	553	270	321	8957
1989	0	132	1653	1831	1125	829	536	753	471	411	7740
1990	0	68	676	3389	2664	1369	531	291	349	450	9787
1991	0	13	323	1001	4410	3403	1123	321	164	402	11161
1992	0	37	231	1083	2222	6810	2724	819	198	342	14467
1993	0	107	426	2032	4141	3583	3139	1403	265	563	15658
1994	1	288	506	623	2627	4459	1703	1288	608	688	12791
1995	1	518	1488	2285	6503	4826	2001	654	584	315	19174
1996	0	195	936	1418	4443	2958	1471	549	250	224	12444
1997	0	158	1375	803	2739	3919	1701	718	230	335	11978
1998	0	37	63	281	883	2607	2476	1044	320	272	7983
1999	0	4	202	205	985	1713	2073	1273	463	261	7180
2000	0	3	316	659	1265	1960	2460	1797	554	221	9235
2001	0	0	85	505	1355	2460	2168	1606	905	410	9494
2002	0	1	4	81	1611	2694	2116	1435	626	678	9246
2003	0	0	30	54	570	1823	1675	790	537	574	6051
2004	0	0	6	41	291	997	1309	576	375	375	3970
Catch at Age (mt)											
1980	0	0	8	165	715	1611	2571	3009	1232	5132	14442
1981	0	0	106	370	1598	2360	2837	2125	1547	2243	13186
1982	0	0	69	768	1323	1884	2028	3165	2320	4010	15567
1983	0	1	20	211	1827	2542	2612	1872	1334	3118	13536
1984	0	0	17	160	735	3159	2046	1720	689	2236	10761
1985	0	1	9	102	279	796	1534	1887	1263	1435	7306
1986	0	1	27	102	523	652	867	1101	741	782	4796
1987	0	0	27	241	337	934	815	799	637	521	4312
1988	0	5	36	293	521	716	927	486	333	522	3839
1989	0	2	68	247	309	370	303	554	403	632	2888
1990	0	1	39	469	707	623	339	240	338	608	3364
1991	0	0	17	120	1458	1696	797	308	191	594	5182
1992	0	1	15	173	701	3304	1956	776	238	554	7717
1993	0	2	33	430	1259	1556	1852	1313	327	927	7699
1994	0	4	14	121	863	1866	961	984	659	1244	6715
1995	0	6	40	464	2091	2178	1238	534	653	490	7695
1996	0	3	35	155	1503	1403	937	495	294	371	5196
1997	0	2	29	89	865	1577	1030	536	219	525	4872
1998	0	1	2	46	248	968	1281	840	330	676	4391
1999	0	0	4	41	319	715	1110	894	407	366	3856
2000	0	0	9	137	388	842	1319	1326	554	279	4854
2001	0	0	2	60	406	1022	1132	1106	760	465	4952
2002	0	0	0	14	494	1024	1021	771	443	729	4496
2003	0	0	1	12	189	704	812	504	430	581	3232
2004	0	0	0	4	99	384	619	359	289	379	2132

Table H3 Catch at age (thousands of fish; metric tons) and mean weight (kg), of commercial landings, large mesh and northern shrimp fishery
continued discards of American plaice, ages 1-9+, from Gulf of Maine - Georges Bank, and South, 1980-2004.

Year	0	1	2	3	4	5	6	7	8	9+	Average
1980	0.000	0.030	0.076	0.154	0.267	0.409	0.653	0.829	1.039	1.523	0.725
1981	0.000	0.032	0.108	0.168	0.316	0.442	0.778	0.885	0.978	1.315	0.576
1982	0.000	0.018	0.115	0.230	0.290	0.418	0.564	0.960	1.138	1.479	0.631
1983	0.002	0.013	0.033	0.185	0.378	0.530	0.670	0.823	1.042	1.479	0.630
1984	0.000	0.004	0.045	0.161	0.303	0.524	0.630	0.888	1.187	1.657	0.636
1985	0.000	0.018	0.058	0.084	0.209	0.331	0.534	0.847	1.167	1.618	0.596
1986	0.001	0.016	0.042	0.138	0.229	0.384	0.587	0.842	1.174	1.702	0.516
1987	0.000	0.013	0.046	0.131	0.234	0.409	0.609	0.892	1.173	1.688	0.465
1988	0.000	0.016	0.046	0.159	0.284	0.449	0.641	0.880	1.231	1.630	0.429
1989	0.000	0.012	0.041	0.135	0.275	0.446	0.566	0.736	0.857	1.537	0.373
1990	0.000	0.021	0.058	0.138	0.265	0.455	0.639	0.824	0.968	1.352	0.344
1991	0.000	0.015	0.053	0.120	0.330	0.498	0.710	0.960	1.161	1.479	0.464
1992	0.000	0.028	0.065	0.159	0.315	0.485	0.717	0.948	1.202	1.617	0.533
1993	0.000	0.016	0.078	0.212	0.304	0.434	0.590	0.936	1.234	1.647	0.492
1994	0.001	0.014	0.028	0.194	0.328	0.418	0.564	0.763	1.083	1.807	0.525
1995	0.001	0.012	0.027	0.203	0.322	0.453	0.646	0.909	1.166	1.399	0.407
1996	0.000	0.014	0.038	0.110	0.338	0.474	0.637	0.902	1.172	1.657	0.418
1997	0.000	0.014	0.021	0.111	0.316	0.402	0.605	0.746	0.951	1.565	0.407
1998	0.001	0.013	0.030	0.165	0.281	0.371	0.518	0.805	1.031	2.482	0.550
1999	0.000	0.008	0.018	0.198	0.324	0.417	0.535	0.702	0.879	1.401	0.537
2000	0.000	0.013	0.029	0.208	0.307	0.429	0.536	0.738	1.000	1.258	0.526
2001	0.000	0.000	0.018	0.119	0.300	0.416	0.522	0.689	0.839	1.133	0.522
2002	0.000	0.000	0.029	0.174	0.307	0.380	0.482	0.537	0.707	1.075	0.486
2003	0.000	0.000	0.022	0.216	0.332	0.386	0.485	0.639	0.802	1.011	0.534
2004	0.000	0.000	0.011	0.092	0.340	0.385	0.473	0.622	0.771	1.011	0.537
1980-2004	0.001	0.016	0.045	0.159	0.300	0.430	0.596	0.812	1.038	1.501	0.514
2000-2004	0.000	0.003	0.022	0.162	0.317	0.399	0.500	0.645	0.824	1.098	0.521

Table H4. Standardized stratified mean number and mean weight per tow (kg) of American plaice in NEFSC spring and autumn bottom trawl surveys in the Gulf of Maine - Georges Bank area, 1963 -2005 (Offshore strata 26-30,36-40,13-25)

Year	SPRING		AUTUMN	
	Number	Weight	Number	Weight
1963	-	-	14.17	5.87
1964	-	-	8.20	2.84
1965	-	-	11.95	3.80
1966	-	-	17.78	4.90
1967	-	-	11.05	2.69
1968	11.36	3.40	8.61	2.91
1969	8.59	2.68	7.51	2.36
1970	5.43	1.81	6.46	2.01
1971	3.80	1.26	7.47	1.96
1972	4.28	1.32	7.44	1.60
1973	7.18	1.85	6.19	1.94
1974	8.34	1.94	6.89	1.42
1975	5.78	1.72	8.12	2.43
1976	11.85	3.37	9.98	2.99
1977	14.57	5.11	11.80	3.52
1978	10.61	3.82	15.13	4.66
1979	9.23	3.62	9.96	4.00
1980	18.34	4.78	14.24	5.12
1981	18.75	5.88	13.04	5.62
1982	11.61	3.80	5.88	2.49
1983	16.94	4.60	9.34	3.45
1984	4.10	1.42	7.12	2.02
1985	4.94	1.88	6.95	2.00
1986	3.09	0.92	5.61	1.56
1987	3.50	0.81	4.38	1.09
1988	3.58	0.84	9.69	1.46
1989	4.81	0.75	9.21	1.17
1990	5.09	0.75	15.46	2.90
1991	5.91	1.05	7.71	1.56
1992	4.11	1.36	6.31	1.78
1993	5.29	1.39	11.89	2.39
1994	4.89	0.85	18.07	2.67
1995	9.43	1.94	11.84	2.58
1996	7.83	1.69	7.58	2.23
1997	7.62	1.62	6.27	1.94
1998	4.52	1.11	9.29	2.22
1999	4.18	1.20	11.03	2.57
2000	9.96	2.30	12.23	2.80
2001	10.65	2.19	10.40	2.63
2002	6.70	1.76	9.69	2.24
2003	4.17	0.87	9.29	2.27
2004	8.16	1.35	5.42	0.96
2005	5.02	0.83		

Table H5a. Standardized stratified mean number per tow by age and mean weight per tow (kg) of American plaice in NEFSC spring and autumn research bottom trawl surveys in the Gulf of Maine and Georges Bank area (offshore strata 13-30,36-40) ; 1980-2005.

YEAR	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	no/tow	wt/tow
Spring																	
1980	0	0.45	3.69	4.55	3.05	2.93	1.61	1.14	0.26	0.31	0.23	0.04	0.04	0.03	0.006	18.34	4.78
1981	0	0.13	3.43	4.21	3.46	2.61	1.69	1.41	0.77	0.4	0.32	0.07	0.09	0.07	0.09	18.75	5.88
1982	0	0.03	1.05	1.79	3.17	2.13	1.33	0.92	0.5	0.35	0.19	0.07	0.02	0.05	0.01	11.61	3.80
1983	0	0.2	3.68	3.33	4.48	2.64	1.18	0.58	0.32	0.15	0.15	0.11	0.05	0.02	0.04	16.93	4.60
1984	0	0.01	0.35	0.56	0.9	1.29	0.58	0.22	0.1	0.01	0.02	0.01	0.01	0	0.04	4.10	1.42
1985	0	0.03	0.32	0.98	0.86	0.73	0.86	0.46	0.42	0.12	0.07	0.04	0.02	0.02	0.02	4.95	1.88
1986	0	0.01	0.46	0.34	1.01	0.59	0.29	0.21	0.1	0.04	0.04	0	0	0	0	3.09	0.92
1987	0	0.09	0.61	0.99	0.69	0.51	0.25	0.17	0.07	0.03	0.03	0.03	0.01	0	0	3.48	0.81
1988	0	0.2	0.99	0.84	0.76	0.31	0.23	0.12	0.01	0.09	0.01	0.01	0	0	0	3.57	0.84
1989	0	0.05	1.59	1.27	0.86	0.49	0.29	0.16	0.03	0.07	0.01	0.01	0	0	0	4.83	0.75
1990	0	0	0.57	2.65	1.02	0.54	0.17	0.06	0.04	0.05	0	0	0	0	0	5.10	0.75
1991	0	0.03	0.71	1.63	2.33	0.92	0.15	0.07	0.04	0.02	0	0.02	0	0	0.01	5.93	1.05
1992	0	0.06	0.34	1.15	0.88	1.07	0.43	0.11	0.04	0.02	0.01	0	0.01	0	0	4.12	1.36
1993	0	0.33	0.84	1.16	1.58	0.61	0.45	0.17	0.08	0.02	0.01	0.02	0.03	0	0	5.30	1.39
1994	0	0.03	1.43	1.14	1.12	0.75	0.23	0.1	0.03	0.01	0	0.01	0.01	0.01	0.01	4.88	0.85
1995	0	0.03	1.97	3.21	2.3	1.11	0.44	0.22	0.03	0.04	0.03	0.01	0.02	0.01	0.01	9.43	1.94
1996	0	0.02	0.47	1.94	3.3	1.31	0.53	0.2	0.05	0.02	0	0	0	0	0	7.84	1.69
1997	0	0.01	0.85	1.66	2.52	2.05	0.39	0.09	0.01	0	0.01	0	0.02	0	0	7.61	1.62
1998	0	0.06	0.19	1.02	1.12	1.22	0.68	0.16	0.06	0.01	0.01	0.003	0.01	0	0	4.54	1.11
1999	0	0.08	0.41	0.52	1.13	0.79	0.64	0.41	0.17	0.02	0.02	0	0	0	0	4.19	1.20
2000	0	0.03	1.91	2.48	2.22	1.6	0.86	0.6	0.15	0.07	0.02	0.003	0.01	0	0	9.95	2.30
2001	0	0	0.708	3.67	3.37	1.45	0.75	0.37	0.17	0.09	0.05	0.02	0	0	0	10.65	2.19
2002	0.00	0.10	0.35	0.98	2.35	1.66	0.51	0.33	0.20	0.14	0.07	0.01	0.00	0.00	0.00	6.70	1.76
2003	0.00	0.04	0.76	0.27	0.70	1.24	0.64	0.22	0.10	0.09	0.04	0.03	0.01	0.02	0.00	4.17	0.87
2004	0	0.36	0.87	2.03	1.79	1.33	1.14	0.34	0.10	0.18	0	0.01	0.02	0	0	8.16	1.35
2005	0	0.20	0.78	1.04	1.23	0.91	0.50	0.24	0.12	0	0.02	0	0	0	0	5.02	0.831

Table H5b. Standardized stratified mean number per tow by age and mean weight per tow (kg) of American plaice in NEFSC spring and autumn research bottom trawl surveys in the Gulf of Maine and Georges Bank area (offshore strata 13-30,36-40) , 1980-2005.

YEAR	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	no/tow	w/tow
Autumn																	
1980	0	1.58	2.23	2.72	2.84	1.53	1.02	0.93	0.57	0.3	0.19	0.11	0.04	0.09	0.09	14.24	5.12
1981	0.003	0.44	2.64	2.16	2.48	2.16	1.44	0.59	0.53	0.06	0.16	0.15	0.02	0.02	0.16	13.04	5.62
1982	0	0.2	0.91	1.65	1.27	0.57	0.48	0.3	0.17	0.19	0.08	0.03	0	0	0.02	5.87	2.49
1983	0.06	0.5	1.01	2.02	2.92	1.36	0.68	0.34	0.17	0.1	0.03	0.05	0.06	0.01	0.03	9.34	3.45
1984	0.02	0.22	2.24	1.56	1.21	1.07	0.51	0.12	0.1	0	0.03	0.01	0.02	0	0.01	7.12	2.02
1985	0.02	0.91	0.83	2.64	1.05	0.79	0.41	0.19	0.05	0.03	0.02	0	0	0.01	0	6.95	2
1986	0.1	0.51	1.46	0.87	1.43	0.47	0.42	0.16	0.11	0.04	0.01	0.02	0.01	0	0	5.61	1.56
1987	0.01	0.53	1.27	0.99	0.43	0.69	0.25	0.1	0.04	0.04	0.01	0.02	0	0	0	4.38	1.09
1988	0	2.84	2.97	2.39	0.78	0.47	0.1	0.07	0	0.03	0	0.02	0	0	0	9.67	1.46
1989	0.05	0.48	4.45	2.86	0.98	0.19	0.1	0.02	0.02	0.02	0.02	0	0.01	0.02	0	9.22	1.17
1990	0.01	1.71	2.26	7.49	2.89	0.59	0.25	0.12	0.07	0.02	0.02	0.01	0.01	0.01	0	15.46	2.9
1991	0.01	0.47	2.47	2.02	1.59	0.73	0.29	0.04	0.06	0	0.01	0	0	0	0.01	7.70	1.56
1992	0.02	0.65	1.23	1.85	1.28	0.78	0.3	0.07	0.05	0.03	0.02	0	0.02	0	0	6.30	1.78
1993	0.01	1.7	2.34	3.47	2.28	1.05	0.8	0.11	0.04	0.04	0.04	0	0	0	0	11.88	2.39
1994	0.04	3.83	7.53	2.81	1.71	1.3	0.4	0.25	0.13	0.01	0.03	0.02	0	0	0	18.06	2.67
1995	0.01	0.5	3.8	3.82	2.5	0.9	0.22	0.04	0.03	0	0	0	0.02	0	0	11.84	2.58
1996	0.01	0.54	0.81	2	2.74	0.93	0.39	0.07	0.04	0.03	0	0	0.02	0	0.02	7.60	2.23
1997	0.01	0.36	1.06	1.55	1.86	1.04	0.32	0.04	0.01	0.01	0	0	0	0	0.02	6.28	1.94
1998	0.01	1.73	0.6	1.88	2.01	1.78	1.08	0.12	0.05	0.01	0.01	0	0.01	0	0	9.29	2.22
1999	0.02	2	2.2	2.05	2.13	1.6	0.81	0.2	0.03	0	0	0	0	0	0	11.04	2.57
2000	0.03	0.47	2.9	3.91	2.28	1.35	0.75	0.33	0.14	0.03	0.03	0	0	0	0	12.22	2.79
2001	0.02	0.4	1.22	3.31	2.64	1.46	0.53	0.41	0.2	0.17	0.02	0	0.01	0	0	10.39	2.63
2002	0.05	1.00	0.77	1.30	3.36	1.73	0.53	0.39	0.29	0.17	0.06	0.02	0.02	0.00	0.00	9.69	2.241
2003	0.03	0.70	2.26	1.26	1.76	1.74	0.88	0.35	0.13	0.06	0.08	0.01	0.00	0.03	0.00	9.29	2.269
2004	0.01	0.70	0.96	1.19	0.98	0.73	0.50	0.19	0.09	0.03	0.00	0.02	0.00	0.00	0.00	5.416	0.964
Average																	
1980-2004	0.03	1.00	2.10	2.39	1.90	1.08	0.54	0.22	0.13	0.07	0.05	0.04	0.02	0.03	0.05		

Table H5c. Stratified mean number per tow by age of American plaice in Massachusetts State spring and autumn bottom trawl surveys in Massachusetts Bay and Cape Cod Bay (Regions 4+5), 1982-2005.

Year	Age											Total #/tow					
	0	1	2	3	4	5	6	7	8	9	10		11				
Spring																	
1982	0.00	7.18	49.25	33.35	17.14	5.00	2.42	1.12	0.26	0.15	0.03	0.07	115.97				
1983	0.00	1.93	18.76	22.42	21.46	10.22	2.37	0.73	0.20	0.19	0.06	0.10	78.44				
1984	0.00	2.15	27.44	21.32	10.57	4.64	1.21	0.18	0.09	0.01	0.03	0.07	67.71				
1985	0.00	21.56	17.16	24.22	9.50	3.77	2.24	0.65	0.76	0.12	0.04	0.03	80.05				
1986	0.00	27.06	110.27	26.91	14.43	2.84	0.61	0.05	0.08	0.06	0.00	0.16	182.47				
1987	0.00	34.36	17.26	15.79	3.90	1.76	0.51	0.10	0.02	0.00	0.00	0.00	73.70				
1988	0.00	81.47	63.57	17.85	8.72	1.54	0.47	0.09	0.00	0.00	0.00	0.00	173.71				
1989	0.00	8.07	127.26	44.97	11.99	3.03	1.31	0.20	0.03	0.03	0.00	0.05	196.94				
1990	0.00	7.73	25.37	56.71	16.48	3.43	0.53	0.11	0.10	0.13	0.00	0.00	110.59				
1991	0.00	2.10	19.98	34.77	18.98	3.24	0.18	0.07	0.01	0.00	0.00	0.00	79.33				
1992	0.00	8.20	11.06	33.98	14.99	7.42	1.11	0.45	0.00	0.00	0.00	0.00	77.21				
1993	0.00	11.60	18.98	16.08	9.16	3.45	0.81	0.04	0.02	0.00	0.00	0.00	60.14				
1994	0.00	11.60	52.57	22.12	7.13	3.88	1.03	0.31	0.00	0.00	0.00	0.00	98.64				
1995	0.00	0.54	34.65	49.64	10.32	3.16	0.62	0.17	0.03	0.05	0.02	0.00	99.20				
1996	0.00	2.29	4.14	14.92	31.39	6.33	1.01	0.77	0.01	0.00	0.00	0.00	60.86				
1997	0.00	1.55	7.96	13.95	17.24	12.21	2.41	0.21	0.00	0.00	0.00	0.00	55.52				
1998	0.00	2.83	4.33	11.45	7.53	8.93	3.95	0.49	0.00	0.03	0.00	0.00	39.54				
1999	0.00	1.35	11.65	11.65	15.11	7.57	3.96	1.62	0.35	0.01	0.00	0.00	53.27				
2000	0.00	3.45	56.51	34.86	19.98	13.29	4.95	3.64	0.17	0.03	0.00	0.00	136.88				
2001	0.00	0.07	4.75	23.71	17.03	4.74	2.18	0.95	0.48	0.15	0.10	0.03	54.19				
2002	0.00	6.26	4.15	10.77	18.59	5.93	1.49	0.78	0.38	0.21	0.07	0.00	48.63				
2003	0.00	5.15	44.88	12.38	18.27	17.82	4.37	0.95	1.64	0.25	0.01	0.28	106.02				
2004	0.00	16.50	11.84	33.91	13.07	5.67	3.67	0.88	0.18	0.19	0.06	0.00	85.95				
2005	0.00	7.52	20.18	22.93	8.24	4.80	1.98	0.94	0.37	0.00	0.00	0.00	66.98				

Table H5d. Stratified mean number per tow by age of American plaice in Massachusetts State spring and autumn bottom trawl surveys in Massachusetts Bay and Cape Cod Bay (Regions 4+5), 1982-2005.

Year	0	1	2	3	4	5	6	7	8	9	10	11	Total #/tow
Autumn													
1982	0.17	13.24	15.46	10.22	5.11	1.14	0.56	0.14	0.05	0.05	0.01	0.08	46.23
1983	1.29	52.17	18.98	10.02	8.30	1.39	0.32	0.15	0.05	0.06	0.00	0.01	92.74
1984	0.11	3.14	13.24	4.27	1.83	0.77	0.24	0.04	0.05	0.00	0.00	0.00	23.69
1985	0.00	60.97	9.45	14.21	1.56	0.14	0.03	0.02	0.00	0.00	0.00	0.00	86.38
1986	0.23	41.27	40.08	12.07	5.30	0.39	0.13	0.01	0.00	0.00	0.00	0.00	99.48
1987	0.24	46.36	14.60	3.00	0.52	0.23	0.07	0.01	0.04	0.00	0.00	0.00	65.07
1988	0.00	85.63	41.28	13.98	1.34	0.45	0.08	0.00	0.00	0.00	0.00	0.00	142.76
1989	0.03	57.56	122.25	31.03	2.33	0.13	0.01	0.01	0.00	0.00	0.00	0.00	213.35
1990	0.08	31.99	14.20	20.12	3.93	0.21	0.03	0.00	0.00	0.00	0.00	0.00	70.56
1991	0.04	24.07	90.36	40.05	11.51	1.17	0.14	0.00	0.00	0.00	0.00	0.00	167.34
1992	0.00	46.33	12.99	29.79	11.04	1.38	0.00	0.00	0.12	0.00	0.00	0.00	101.66
1993	0.00	76.21	36.80	17.59	6.85	1.71	0.69	0.00	0.00	0.00	0.00	0.00	139.84
1994	0.00	36.71	79.31	10.76	2.91	1.56	0.23	0.14	0.00	0.00	0.00	0.00	131.62
1995	0.00	11.84	44.22	24.93	4.21	0.91	0.08	0	0.00	0.00	0.00	0.00	86.19
1996	0.09	16.25	19.25	27.55	13.96	1.39	0.28	0	0.00	0.00	0.00	0.00	78.78
1997	0.00	13.61	28.08	17.91	10.29	1.46	0.19	0.01	0.00	0.00	0.00	0.00	71.55
1998	0.16	34.56	6.12	13.80	7.10	3.76	0.62	0.01	0.00	0.00	0.00	0.00	66.13
1999	0.00	29.23	32.57	20.61	10.58	2.85	1.2	0.41	0.00	0.00	0.00	0.00	97.45
2000	0.03	6.26	25.67	19.42	6.01	2.99	1.07	0.35	0.03	0.02	0.00	0.00	61.85
2001	0.00	3.01	14.71	30.81	9.07	2.67	0.26	0.36	0.15	0.02	0.00	0.00	61.06
2002	0.17	39.31	9.37	11.78	14.88	3.72	0.78	0.41	0.28	0.10	0.02	0.00	80.87
2003	0	23.98	33.08	14.24	7.58	4.00	0.39	0.58	0.07	0.04	0.01	0.00	83.98
2004	0	60.02	19.1	9.96	6.31	2.74	1.03	0.18	0.08	0.04	0	0.04	99.5

Table H6. Estimates of beginning year stock size (thousands of fish), instantaneous fishing mortality (F), spawning stock biomass (mt), and percent mature of Gulf of Maine-Georges Bank American plaice, estimated from virtual population analysis (VPA), calibrated using the commercial catch at age ADAPT formulation, 1980-2004.

		1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
Stock Numbers (Jan 1) in thousands														
Age														
1		52643	25124	21947	25126	13190	14389	18443	36839	53337	27202	33128	33767	41054
2		42223	43096	20565	17960	20558	10796	11722	15046	30126	43385	22152	27061	27634
3		35918	34480	34395	16292	14104	16497	8697	9019	11785	23954	34025	17525	21863
4		24233	28437	26246	25131	12001	10651	12405	6452	5719	7984	17955	24791	13442
5		21552	17423	18708	17350	15891	7634	7511	8089	3981	3023	5519	12290	16307
6		17203	14082	9435	11243	9755	7554	4074	4612	4558	1814	1725	3280	6983
7		11091	10526	8228	4469	5664	5051	3586	2000	2566	2425	1000	932	1670
8		5103	5794	6445	3753	1605	2886	2119	1753	828	1601	1304	555	472
9+		14502	6249	8573	6085	3732	2368	1542	997	982	1400	1680	1357	815
Total		224467	185211	154544	127408	96501	77826	70099	84807	113881	112788	118489	121559	130241
		1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Age														
1		45554	44726	32749	34281	30102	31529	35722	18407	11698	32350	23492	54802	68708
2		33578	37200	36358	26344	27891	24502	25780	29243	15068	9578	26485	19233	44868
3		22416	27106	29999	28421	20721	21591	20004	20924	23656	12259	7838	21658	15741
4		16920	16515	21629	22493	21986	16239	17423	16192	16535	18912	9964	6369	17695
5		8995	10106	11144	11824	14396	15523	12496	13373	12113	12312	14026	7642	4951
6		7189	4123	4239	4758	7004	8240	10350	8681	9176	7692	7642	9834	5355
7		3252	3045	1835	1660	2564	4196	4506	6598	4882	5550	4383	4741	6867
8		626	1394	1328	911	862	1450	2491	2537	3776	2544	3245	2874	3360
9+		1330	1577	716	814	1258	1234	1403	1014	1710	2754	3471	2912	4065
Total		139861	145791	139997	131506	126785	124504	130175	116969	98612	103950	100546	130065	171611

Fishing Mortality

	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
Age													
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.00	0.00	0.00
2	0.00	0.03	0.03	0.04	0.02	0.02	0.06	0.04	0.03	0.04	0.03	0.01	0.01
3	0.03	0.07	0.11	0.11	0.08	0.09	0.10	0.26	0.19	0.09	0.12	0.07	0.06
4	0.13	0.22	0.21	0.26	0.25	0.15	0.23	0.28	0.44	0.17	0.18	0.22	0.20
5	0.23	0.41	0.31	0.38	0.54	0.43	0.29	0.37	0.59	0.36	0.32	0.37	0.62
6	0.29	0.34	0.55	0.49	0.46	0.55	0.51	0.39	0.43	0.40	0.42	0.48	0.56
7	0.45	0.29	0.58	0.82	0.47	0.67	0.52	0.68	0.27	0.42	0.39	0.48	0.78
8	0.29	0.36	0.43	0.46	0.50	0.53	0.40	0.41	0.44	0.39	0.35	0.39	0.61
9+	0.29	0.36	0.43	0.46	0.50	0.53	0.40	0.41	0.44	0.39	0.35	0.39	0.61
Total	0.32	0.35	0.47	0.54	0.49	0.54	0.43	0.46	0.43	0.39	0.37	0.43	0.64

	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Age												
1	0.00	0.01	0.02	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	0.01	0.02	0.05	0.04	0.06	0.00	0.01	0.01	0.01	0.00	0.00	0.00
3	0.11	0.03	0.09	0.06	0.04	0.01	0.01	0.04	0.02	0.01	0.01	0.00
4	0.32	0.19	0.40	0.25	0.15	0.06	0.06	0.09	0.09	0.10	0.07	0.05
5	0.58	0.67	0.65	0.32	0.36	0.21	0.16	0.18	0.25	0.28	0.16	0.16
6	0.66	0.61	0.74	0.42	0.31	0.40	0.25	0.38	0.30	0.36	0.28	0.16
7	0.65	0.63	0.50	0.45	0.37	0.32	0.37	0.36	0.45	0.34	0.22	0.14
8	0.62	0.65	0.65	0.36	0.35	0.28	0.23	0.27	0.31	0.31	0.20	0.15
9+	0.62	0.65	0.65	0.36	0.35	0.28	0.23	0.27	0.31	0.31	0.20	0.15
Total	0.63	0.64	0.64	0.39	0.35	0.30	0.25	0.30	0.33	0.32	0.21	0.15

Table H6. Estimates of beginning year stock size (thousands of fish), instantaneous fishing mortality (F), spawning stock biomass (mt), and percent mature of Gulf of Maine-Georges Bank American plaice, estimated from virtual population analysis (VPA), calibrated using the commercial catch at age ADAPT formulation, 1980-2004.

SSB at start of spawning season

	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
Age													
1	24	12	8	5	0	5	12	17	0	0	0	0	0
2	164	185	94	33	38	12	72	92	14	21	11	17	16
3	874	873	1203	529	230	227	397	328	155	299	402	233	320
4	2408	2938	2716	3437	1320	931	1283	853	611	989	2007	3097	1536
5	4539	4056	4729	4653	4640	1633	1789	2037	996	879	1611	3644	4997
6	7937	6459	3635	4662	4447	3085	1488	1907	1973	780	782	1559	3413
7	7052	6937	5727	2310	3617	2910	2010	1161	1670	1426	590	616	1072
8	4185	4540	5533	3180	1330	2449	1821	1494	738	1200	960	468	414
9+	19518	7152	10845	7623	5187	3194	2262	1443	1362	1857	1981	1731	1076
Total	46701	33152	34489	26430	20808	14446	11136	9332	7521	7451	8344	11365	12845
Age													
1	0	0	0	0	0	0	0	0	0	0	0	0	0
2	15	7	7	5	4	14	11	13	7	5	8	4	4
3	293	378	253	174	152	217	263	217	236	117	82	130	130
4	1963	2368	2789	3161	2254	1638	2300	2264	2340	2046	1322	956	956
5	2572	2725	3264	3810	4338	4419	3593	4174	3555	3394	4108	2325	2325
6	3071	1649	1725	2168	3267	3201	4079	3519	3791	2963	2883	3803	3803
7	2156	1660	1103	1076	1533	2570	2354	3606	2521	2569	2189	2389	2389
8	552	1135	1011	817	697	1128	1882	1888	2618	1561	1927	1847	1847
9+	1785	2305	809	1173	1718	2719	1766	1133	1707	2603	3175	2695	2695
Total	12405	12229	10960	12385	13963	15907	16248	16815	16776	15258	15694	14149	14149

Percent mature (females)

Age	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
1	3	3	3	3	3	3	7	7	0	0	0	0	0
2	8	8	8	8	8	8	24	24	2	2	2	2	2
3	24	24	24	24	24	24	55	55	17	17	17	17	17
4	52	52	52	52	52	52	83	83	65	65	65	65	65
5	79	79	79	79	79	79	95	95	94	94	94	94	94
6	93	93	93	93	93	93	99	99	99	99	99	99	99
7	98	98	98	98	98	98	100	100	100	100	100	100	100
8	100	100	100	100	100	100	100	100	100	100	100	100	100

Age	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
1	0	0	0	0	0	0	0	0	0	0	0	0
2	1	1	1	1	1	3	3	3	3	3	2	2
3	12	12	12	12	12	18	18	18	18	18	14	14
4	60	60	60	60	60	61	61	61	61	61	59	59
5	94	94	94	94	94	92	92	92	92	92	93	93
6	99	99	99	99	99	99	99	99	99	99	99	99
7	100	100	100	100	100	100	100	100	100	100	1	1
8	100	100	100	100	100	100	100	100	100	100	1	1

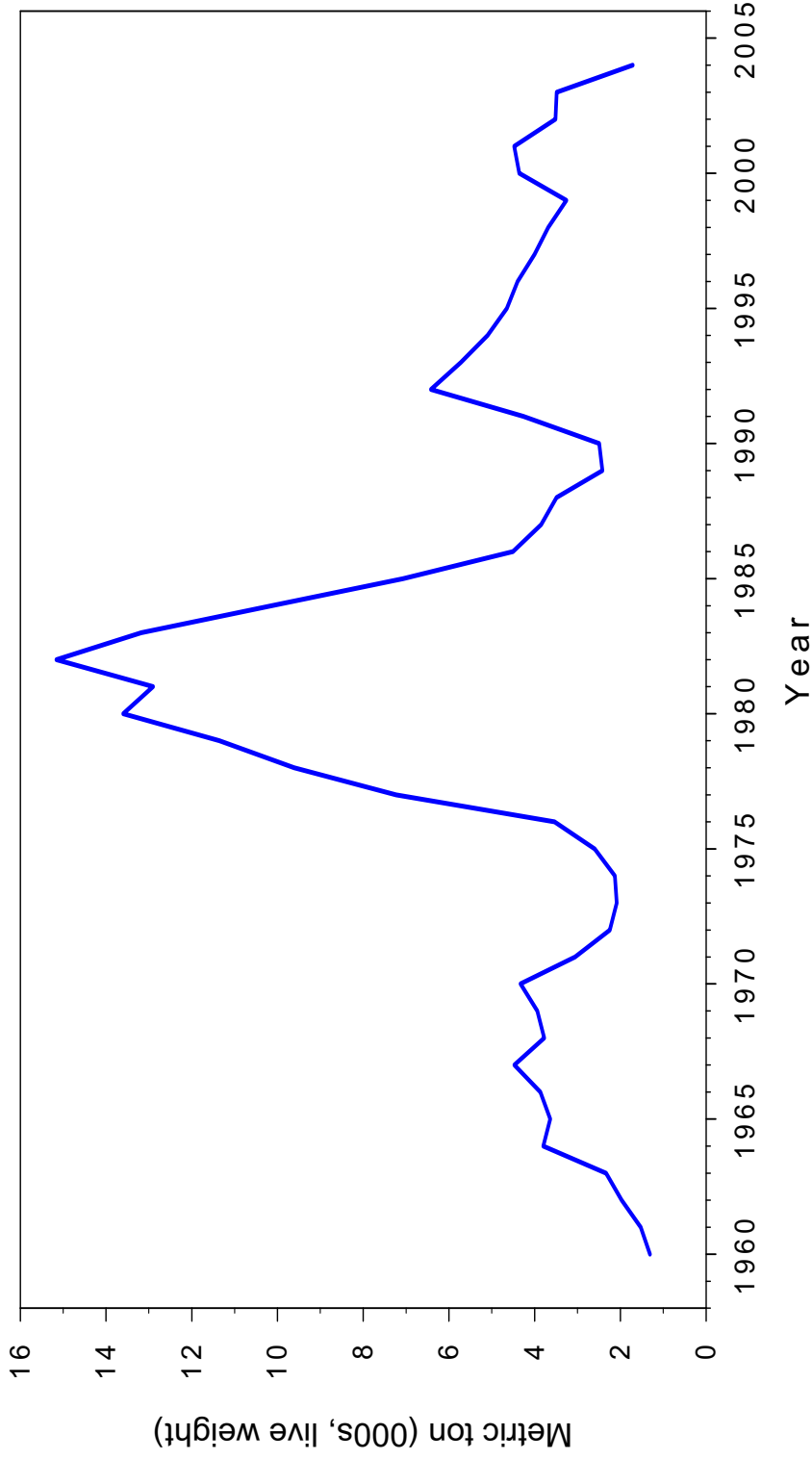


Figure H1. Total commercial landings of Gulf of Maine-Georges Bank American plaice (Division 5Z and 6), 1960-2004.

TOTAL CATCH ('000 of fish) AT AGE

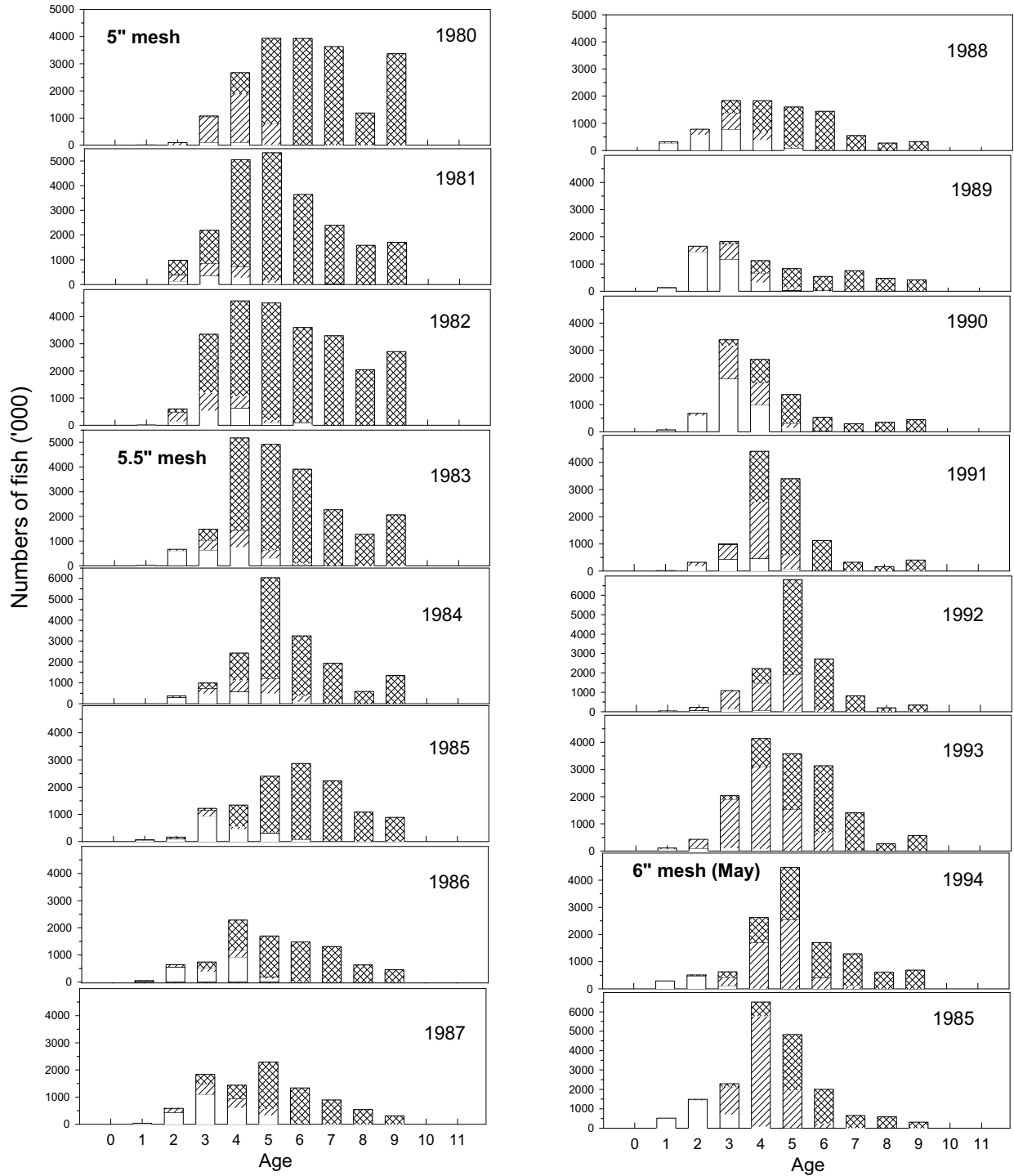


Figure H2. Number of American plaice ('000 of fish) at age in the total catch (discards from shrimp and large mesh fisheries, and landings), 1980 - 2004.

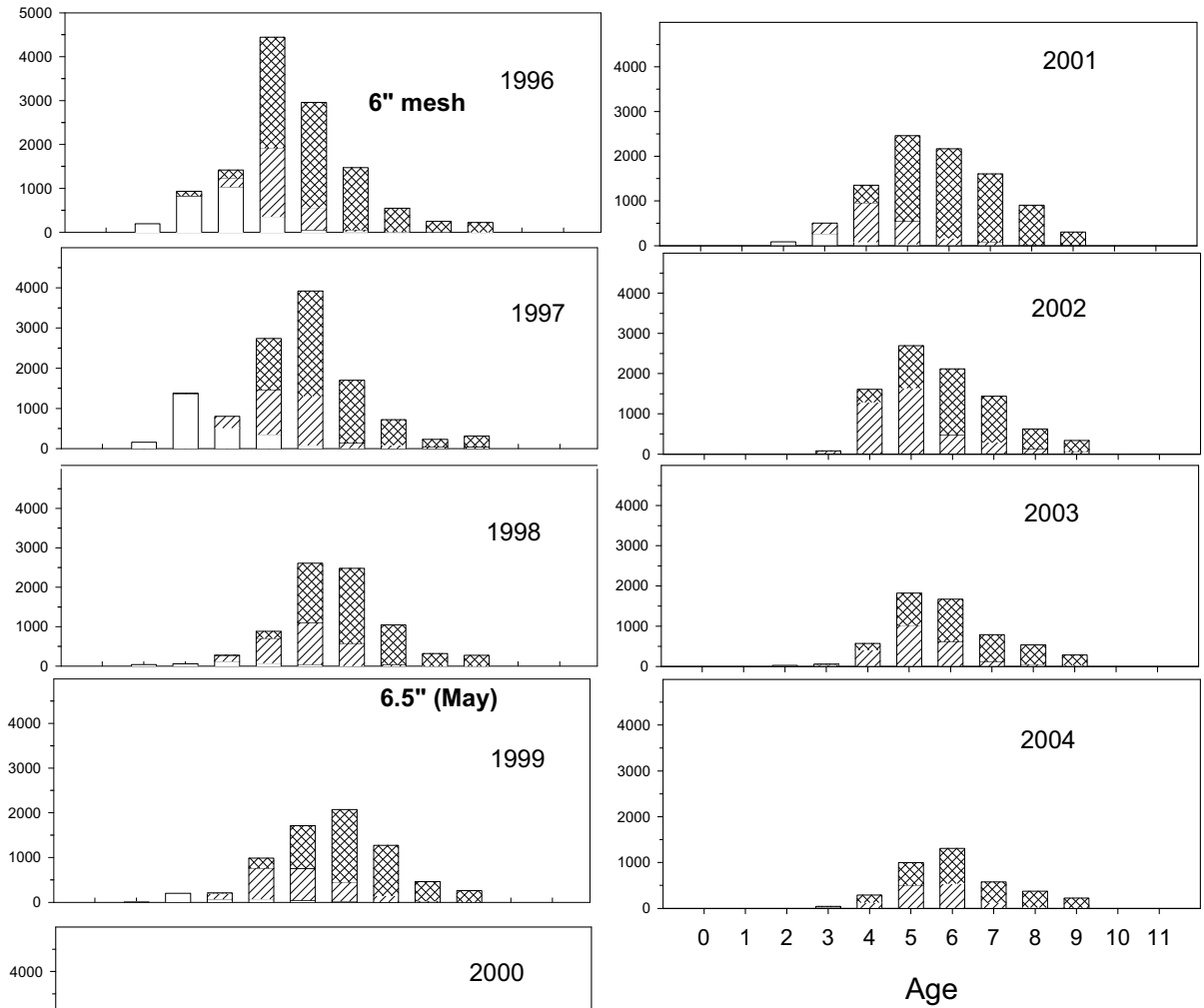


Figure H2 continued. Number of American plaice ('000 of fish) at age in the total catch (discards from the shrimp and large mesh fisheries, and landings), 1980-2004.

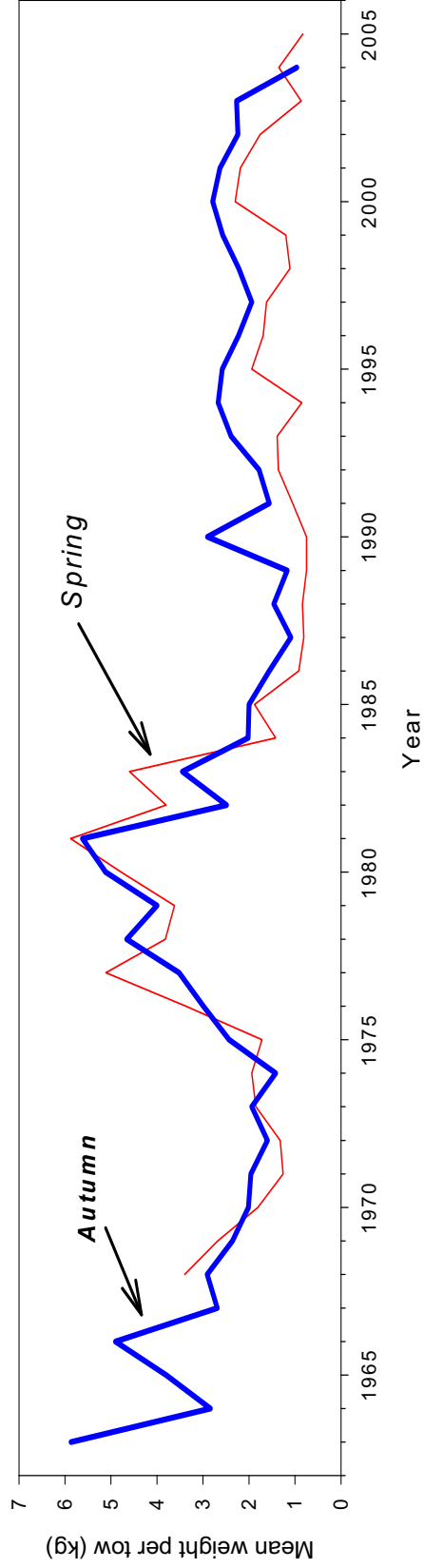


Figure H3. Standardized stratified mean weight per tow (kg) of American plaice in NEFSC spring and autumn research vessel bottom trawl survey in the Gulf of Maine-Georges Bank region, 1963-2005.

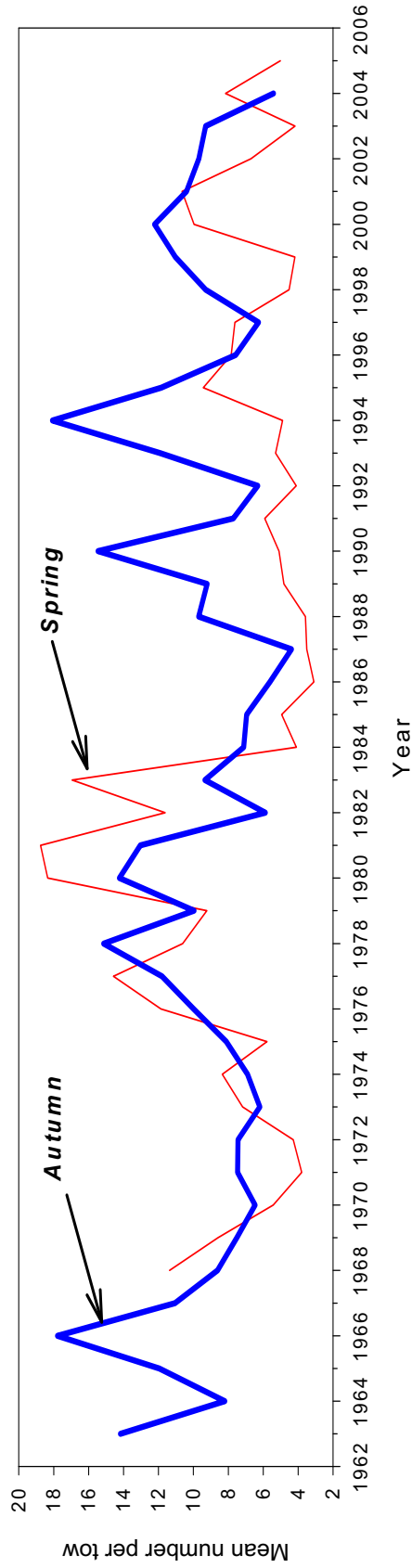


Figure H4. Standardized stratified mean number per tow (kg) of American plaice in NEFSC spring and autumn research vessel bottom trawl survey in the Gulf of Maine-Georges Bank region, 1963-2005.

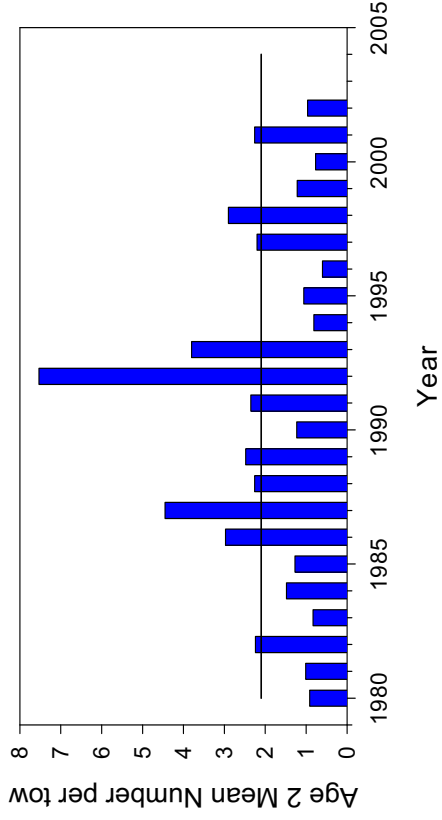
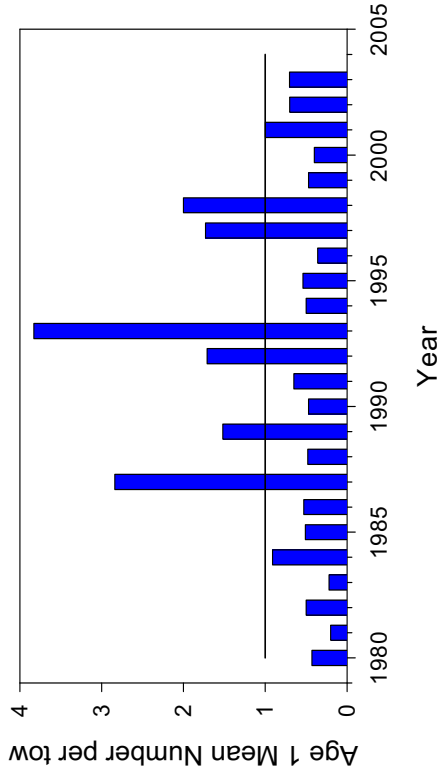


Figure H5a. Relative year class strength of age 1 and age 2 Gulf of Maine-George Bank American plaice from standardized catch (number) per tow indices from NEFSC autumn research vessel bottom trawl surveys, 1980-2004.

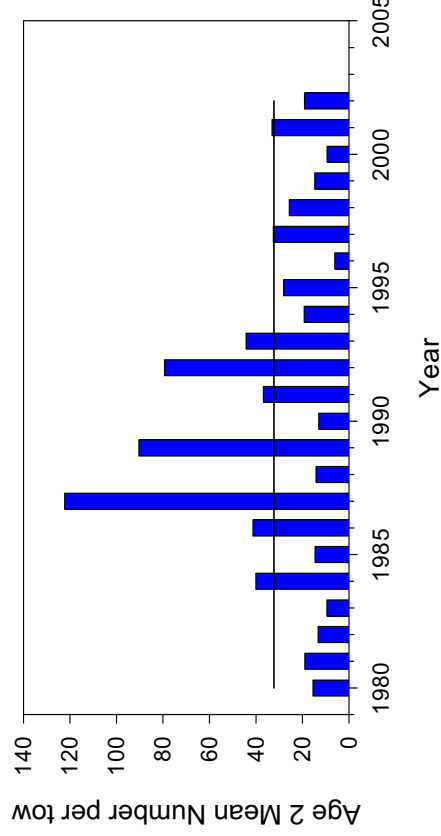
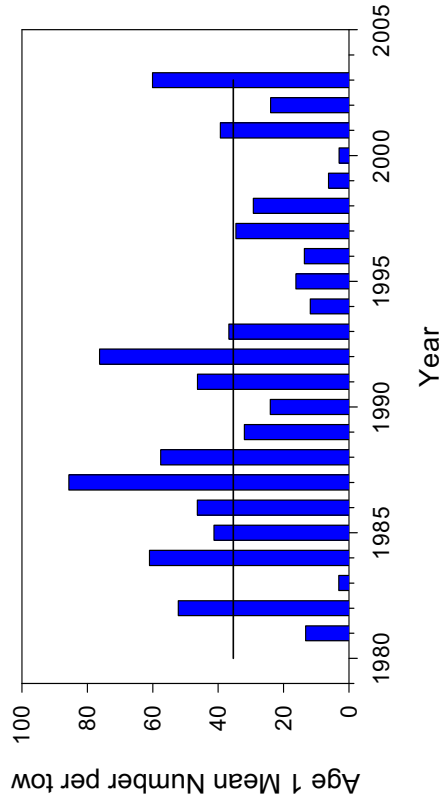


Figure H5b. Relative year class strength of age 1 and age 2 Gulf of Maine-George Bank American plaice from standardized catch (number) per tow indices from MADMF autumn research vessel bottom trawl surveys, 1980-2004.

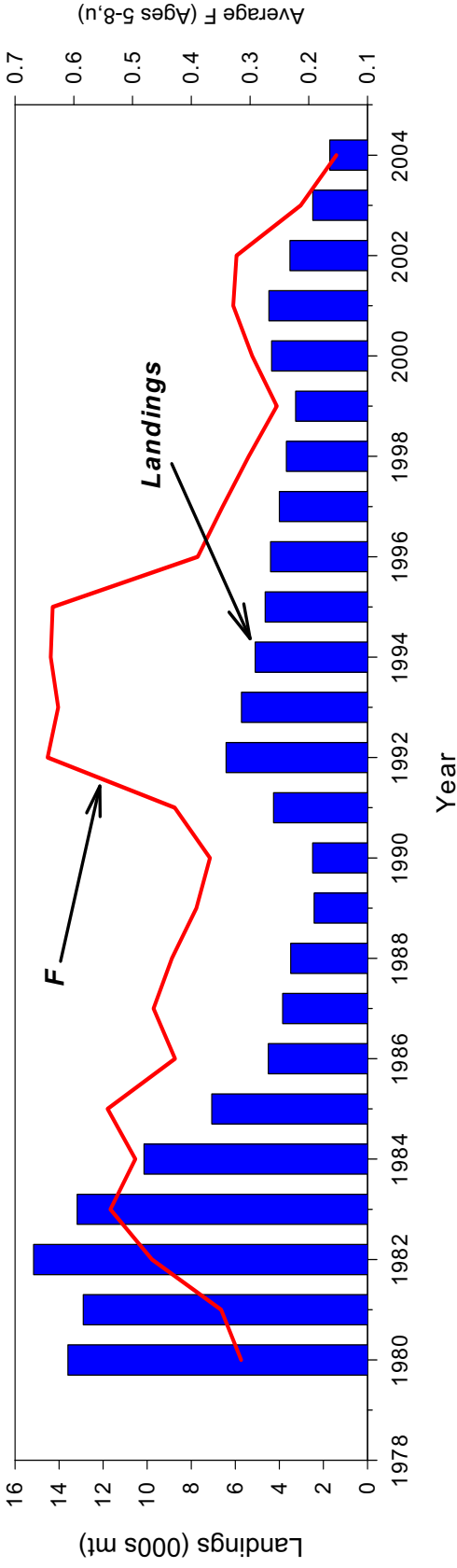


Figure H6. Trends in total commercial landings and fishing mortality for Gulf of Maine-Georges Bank American plaice, 1980-2004.

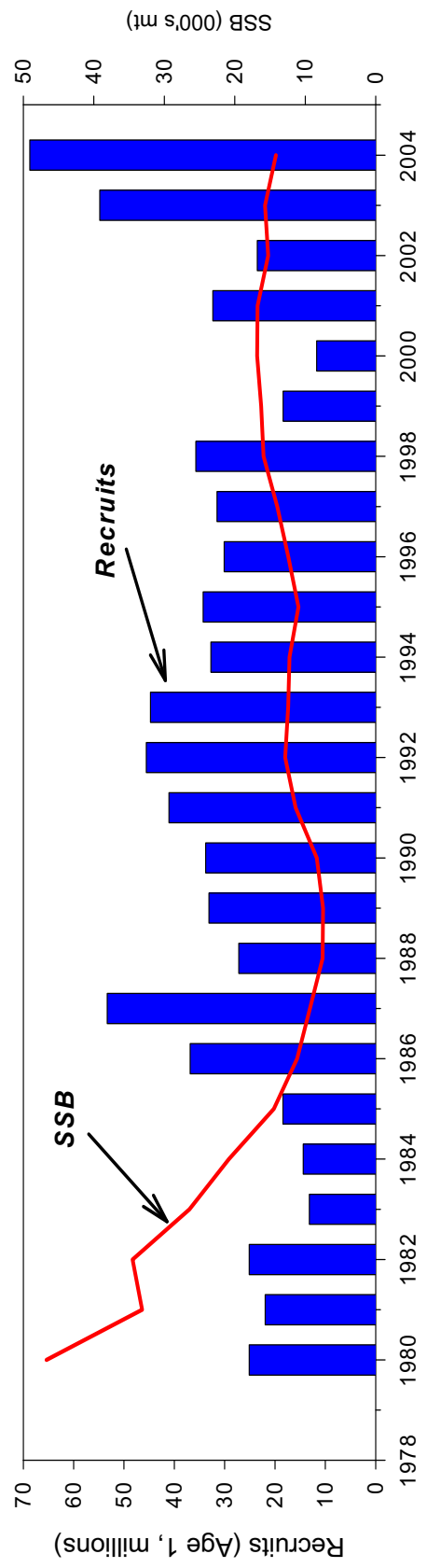


Figure H7. Trends in recruitment and spawning stock biomass for Gulf of Maine-Georges Bank American plaice, 1980-2004.

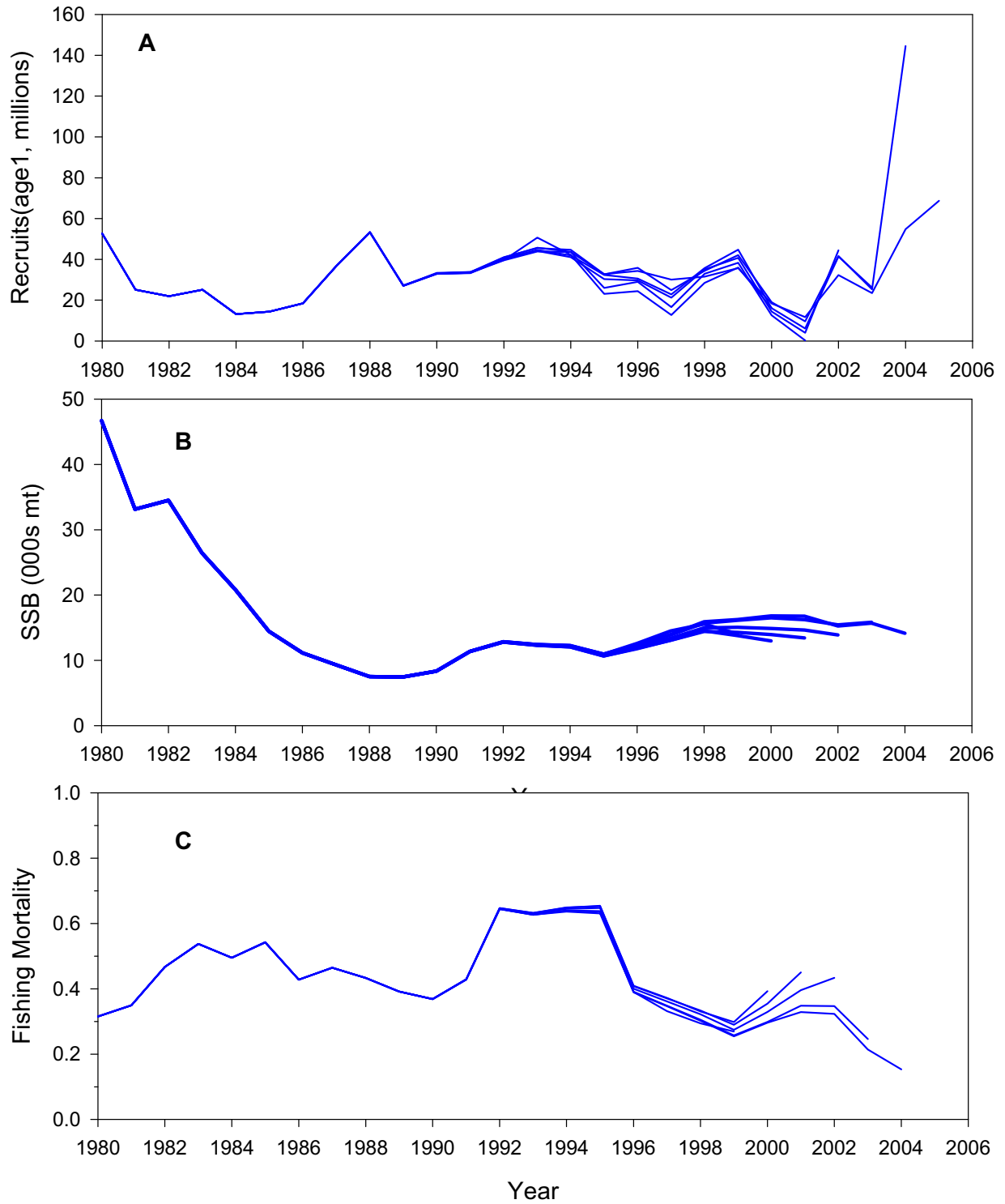
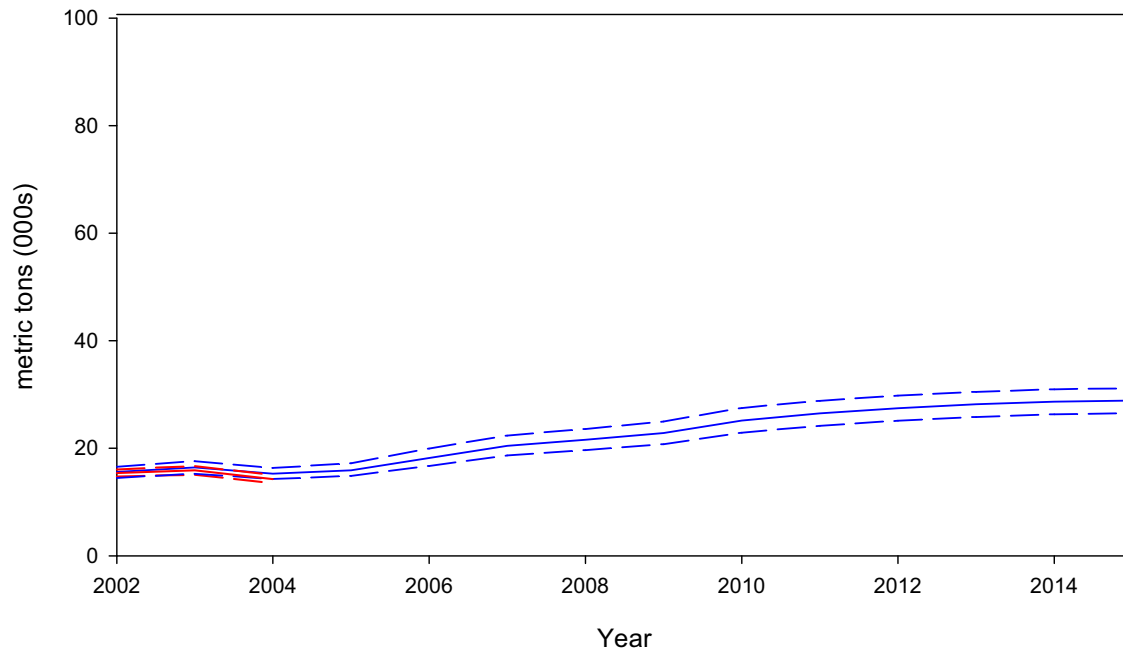


Figure H8. Retrospective analysis of Gulf of Maine-Georges Bank American plaice recruits at age 1 (A), spawning stock biomass (B), and fishing mortality (C, average F , ages 5-8, unweighted) based on the final ADAPT VPA formulation, 2004-1994.

American plaice Spawning Stock Biomass



Fishing Mortality

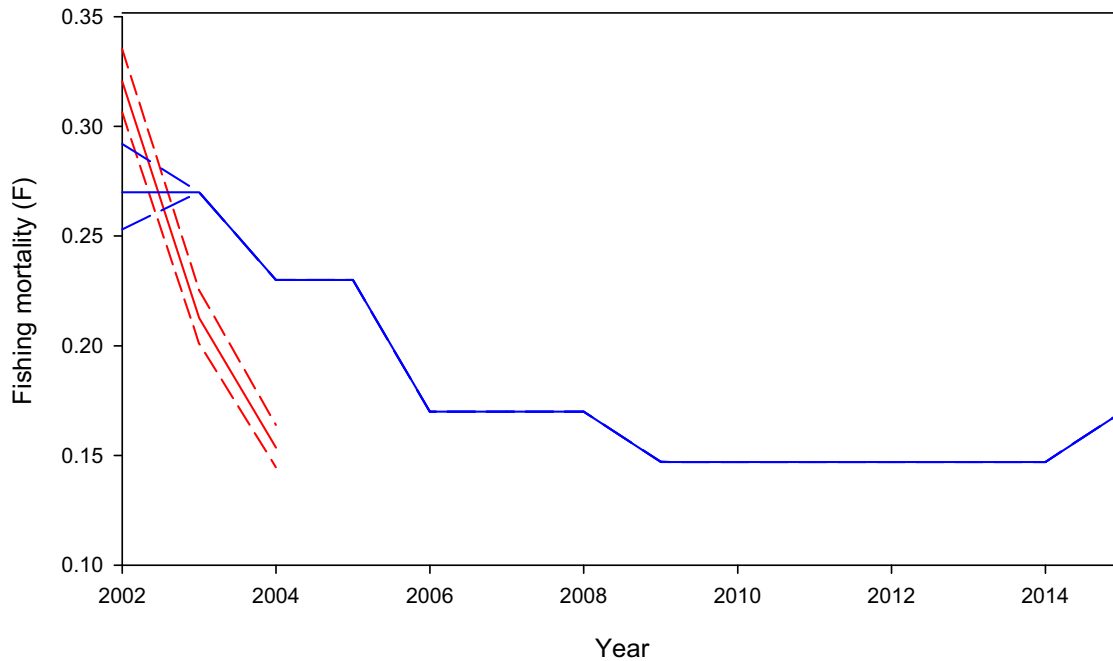


Figure H9. Comparison of A13 projections and current assessment bootstrap estimates of spawning stock biomass (SSB) and fishing mortality (F) , 2002-2004 for American plaice.