

H. Gulf of Maine-Georges Bank American Plaice by L. O'Brien, C. Esteves, and L. Col

1.0 Background

This stock was last assessed in 2000 (O'Brien and Esteves 2001) and reviewed by the 32nd Northeast Regional SAW (NEFSC 2001). Fully recruited F (ages 5-8, unweighted average) in 1999 was estimated to be 0.27, a decrease of 10% from 1998. Spawning stock biomass was 14,056 mt in 1999, a decrease of 9% from 1998. The most recent strong recruitment since 1993 was the above- average 1998 year class with an average recruit/SSB survival ratio.

2.0 Fishery

Total commercial landings of Gulf of Maine-Georges Bank American plaice were 4,479 mt in 2001, a 3% increase from 2000 and a 38% increase from 1999 (Table H1, Figure H1). Canadian fisheries landed 46 mt in 2001, and 143 mt in 2000, accounting for about 1%-3% of the total landings. The otter trawl fleet accounts for more than 90% of the landings. The fishery is prosecuted primarily during the 2nd and 3rd calendar quarter of the year.

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 (1980-1988,1998-2001). Discards in the large mesh fishery are also estimated based on survey data. Since 1998 discards in the shrimp fishery account for about 5% of the total catch (in numbers) and discards in the large mesh fishery account for about 20-30% of the total catch (in numbers) (Figure H2).

3.0 Research Surveys

The NEFSC survey indices of abundance and biomass have generally been increasing since 1988. The most recent spring and autumn indices, however, both indicate a decreasing trend (Table H2, Figure H3 and H4). Recruitment indices of age 1 fish from NEFSC autumn surveys indicate that both the 1997 and 1998 year classes are above average and similar in size to the 1992 year class (Table 3a). These same year classes in the autumn Massachusetts state survey are just below the time series average (Table 3b).

4.0 Assessment

Input data and Analyses

The current assessment is an update and employs the same ADAPT formulation as in the 2000 assessment (O'Brien and Esteves 2001). Landings at age has been updated with total 2000 and 2001 landings, and discards have been estimated for the Northern shrimp fishery and the large mesh fishery. Number of samples obtained for characterizing the catch at age have improved since 1995 and samples were adequate for 2000-2001 (Table H4). The total catch at age includes estimates of discarded fish from both the Northern shrimp fishery and the large mesh

fishery and landings from the commercial fishery (Table H5, Figure H2).

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 2000-2001. The ADAPT calibration method (Parrack 1986, Gavaris 1988, Conser and Powers 1990) was used to derive estimates of instantaneous fishing mortality and beginning year stock sizes in 2002. 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 to be 0.43 in 2001 (Table H6, Figure H5). Spawning stock biomass in 2001 was estimated to be 13,822 mt, a 3% decrease from 2000 and a 5% decrease from 1999 (Table H6, Figure H6). Recruitment of the 2001 year class (39.3 million age 1 fish) is estimated to be similar to the above average 1998 year class (40 million age 1 fish) (Table H6, Figure H6).

VPA Diagnostics

Stock size estimates for ages 1-8 were well estimated with CVs ranging from 0.16 to 0.48. The distribution of F estimates from the bootstrap analysis ranged from 0.32 to 0.75 with an 80% probability that F in 2001 was between 0.37 and 0.50. The distribution of SSB estimates from the bootstrap analysis ranged from 10,500 mt to 18,500 mt with an 80% probability that SSB in 2000 was between 12,250 mt to 15,390 mt.

There is not a strong retrospective pattern in this model formulation (Figure H7). The terminal year estimates of fishing mortality exhibit a pattern of being more than the converged estimates prior to 1997. The SSB estimates do not have a retrospective pattern. The terminal year estimates of recruits are less than converged estimates from 1993. These patterns are similar to the previous assessment (O'Brien and Esteves 2001).

Sensitivity Analyses

Analyses were conducted to determine the sensitivity of fishing mortality and spawning stock biomass estimates to changes in the magnitude of the research survey indices used to calibrate the VPA. NEFSC spring and autumn survey indices for 2000-2002 were arbitrarily increased by 10%, 25% and 100% and used to re-calibrate the VPA (Figure H8). Results are summarized in Section 5.2 (Summary of Assessment Advice).

5.0 Projections

Long term forecasts of catch (landings plus discards) and SSB were conducted with $F_{2002} = 0.85 * F_{2001}$. Input data and results for 2002-2004 are presented in Table H7. The $F_{rebuild}$ that would enable 50% probability of reaching SSB_{msy} by 2009 was 0.10. The current estimate of $F_{rebuild}$ is similar to the previous estimate of 0.13 (NEFSC 2002) which was based on the assessment results from 2000 (O'Brien and Esteves 2001). Landings are projected to be 1,336 mt in 2003 and 1,562 mt in 2004, and discards are projected to be 161 mt in 2003 and 128 mt in 2004 (Figure H9). SSB is projected to be 15,938 mt in 2003 and 17,038 mt in 2004 (Figure H9).

6.0 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 2001, spawning stock biomass was estimated at 13,822 mt, about 48% 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 occurring on this stock because 2001 $F = 0.43 > F_{MSY}$. The 80% confidence intervals about F_{2001} were also above F_{MSY} .

7.0 Summary

American plaice in the Gulf of Maine-Georges Bank region are overfished and overfishing is occurring. Fishing mortality on this stock declined during 1996-1999, but then increased in 2000-2001 as the 1996 and 1997 year classes recruited to the fishery. Spawning stock biomass increased from 1995 to 1998 and has been decreasing since 1998. Spawning stock biomass was 13,822 mt in 2001. The 1998 and 2001 year classes appear to be above average, whereas the 2000 year class is the lowest on record. The survey biomass indices generally show an increasing trend during the last decade and the 1997 and 1998 year classes appear to be near or above average. The recent strong year classes represent an opportunity to rebuild the stock with lower fishing mortality rates.

8.0 Sources of Uncertainty

- Lack of direct estimates of discards from sea sampled trips for large mesh fishery and shrimp fishery.
- Projections of SSB are likely to be underestimated if recruits are underestimated as indicated by the strong retrospective pattern of age 1 recruits.

9.0 GARM Panel Comments

Discards are estimated with a method that uses survey indices for 2001-2002. The sensitivity analyses of the impact of the offset trawl warp on survey catches could also include the impact on discard estimates. The working group asked to see one year's discard estimates bumped up to reflect a 100% increase in survey catch in order to see the magnitude of discards.

The GARM concluded that it is inappropriate to use the MADMF indices in sensitivity analyses of the influence of a single survey series on estimates of F and SSB because of the limited geographic coverage of the survey.

Discards are an important part of the catch at age. Sea sampling of small mesh fisheries has been incomplete in recent years e.g., no sampling of the northern shrimp fishery since 1997. It was recommended that improved sea sampling for the northern shrimp fishery and other small mesh fisheries (e.g. the whiting fishery), and the scallop fishery be implemented (this is also a general recommendation since these fisheries generate discards for many stocks (e.g., Cape Cod yellowtail, SNE yellowtail, witch, American plaice).

The GARM noted a strong pattern in residuals for the age 1 survey index. This is most likely because the catch at age 1 consists solely of discards that were, in some periods, estimated using the same survey indices that have the residual pattern.

10. Research Recommendations

The GARM panel recommended that sensitivity analyses be conducted to evaluate effects of uncertainty in discard estimates on assessment results.

The survey time series could be split into two tuning indices based on time periods corresponding to changes in methods for estimating discards

11.0 References

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Table H1. Commercial landings (metric tons, live weight) of American plaice from the Gulf of Maine, Georges Bank, Southern New England and the Mid-Atlantic, 1960-2001.

Year	Gulf of Maine			Georges Bank				Southern New England				Mid - Atlantic			Grand Total			
	USA	Can	Total	USA	Can	USSR	Other	Total	USA	USSR	Other	Total	USA	Other	Total	USA	Other	Total
1960	620	1	621	689	-	-	-	689	-	-	-	0	-	-	0	1309	1	1310
1961	692	-	692	830	-	-	-	830	-	-	-	0	-	-	0	1522	0	1522
1962	694	-	694	1233	44	-	-	1277	-	-	-	0	-	-	0	1927	44	1971
1963	693	-	693	1489	127	24	-	1640	-	-	-	0	-	-	0	2182	151	2333
1964	811	-	811	2800	177	-	11	2988	-	-	-	0	-	-	0	3611	188	3799
1965	967	-	967	2376	180	112	-	2668	-	-	-	0	-	-	0	3343	292	3635
1966	955	2	957	2388	242	279	1	2910	-	-	-	0	-	-	0	3343	524	3867
1967	1066	6	1072	2166	203	1018	10	3397	-	-	-	0	4	-	4	3236	1237	4473
1968	904	5	909	1695	173	193	5	2066	637	145	-	782	18	2	20	3254	523	3777
1969	1059	7	1066	1738	71	63	17	1889	505	349	-	854	130	-	130	3432	507	3939
1970	895	-	895	1603	92	927	658	3280	88	18	40	146	8	-	8	2594	1735	4329
1971	648	5	653	1511	38	228	296	2071	11	112	206	329	6	2	8	2176	887	3063
1972	569	-	569	1222	22	358	-	1602	3	71	-	74	-	-	0	1794	451	2245
1973	687	-	687	910	38	289	-	1237	5	158	-	163	-	-	0	1602	485	2087
1974	945	2	947	1039	27	16	2	1084	92	4	-	96	-	-	0	2076	51	2127
1975	1507	-	1507	913	25	148	-	1086	3	-	-	3	-	-	0	2423	173	2596
1976	2550	-	2550	948	24	3	-	975	10	-	-	10	1	-	1	3509	27	3536
1977	5647	-	5647	1408	35	50	-	1493	6	78	-	84	7	-	7	7068	163	7231
1978	7287	30	7317	2193	77	-	-	2270	15	-	-	15	8	-	8	9503	107	9610
1979	8835	-	8835	2478	23	-	-	2501	13	-	7	20	4	-	4	11330	30	11360
1980	11139	-	11139	2399	43	-	5	2447	10	-	-	10	1	-	1	13549	48	13597
1981	10327	1	10328	2482	15	-	2	2499	26	-	2	28	46	-	46	12881	20	12901
1982	11147	-	11147	3935	27	-	1	3963	35	-	2	37	9	-	9	15126	30	15156
1983	9142	7	9149	3955	30	-	-	3985	40	-	-	40	4	-	4	13141	37	13178
1984	6833	2	6835	3277	6	-	-	3283	17	-	-	17	7	-	7	10134	8	10142
1985	4766	1	4767	2249	40	-	-	2289	12	-	-	12	2	-	2	7029	41	7070
1986	3319	-	3319	1146	34	-	-	1180	4	-	-	4	3	-	3	4472	34	4506
1987	2766	-	2766	1032	48	-	-	1080	2	-	-	2	1	-	1	3801	48	3849
1988	2271	-	2271	1097	108	-	-	1205	13	-	-	13	1	-	1	3382	108	3490
1989	1646	-	1646	703	68	-	-	771	1	-	-	1	3	-	3	2353	68	2421
1990	1802	-	1802	639	52	-	-	690	2	-	-	2	2	-	2	2445	52	2497
1991	2936	-	2936	1310	26	-	-	1310	15	-	-	15	0	-	0	4261	26	4287
1992	4564	-	4566	1838	3	-	-	1838	10	-	-	10	4	-	4	6416	3	6419
1993	3865	-	3865	1838	-	-	-	1838	11	-	-	11	4	-	4	5718	-	5718
1994	3357	-	3431	1683	30	-	-	1562	22	-	-	22	4	-	4	5066	30	5096
1995	3105	-	3126	1505	2	-	-	1486	15	-	-	15	20	-	20	4645	2	4647
1996	2912	-	2922	1430	2	-	-	1423	40	-	-	40	15	-	15	4396	2	4398
1997	2312	-	2396	1576	65	-	-	1560	23	-	-	23	26	-	26	3937	65	4002
1998	2234	-	2234.4	1385	20	-	-	1405	23	-	-	23	20	-	20	3663	20	3683
1999	1718	-	1717.7	1384	123	-	-	1507	11	-	-	11	21	-	21	3134	123	3257
2000	2497	-	2497.5	1687	143	-	-	1830	10	-	-	10	19	-	19	4213	143	4356
2001	2602	-	2601.7	1814	46	-	-	1860	7	-	-	7	10	-	10	4433	46	4479

** 1994-2001 data are provisional and spatially distributed based on proportions of landings recorded by area in the VTR database

Table H2. 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 -2002 (Offshore strata 26-30,36-40,13-25)

	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		

Table H3a . Standardized stratified mean number per tow by age and mean weight per tow (kg) of American plaice in NEFSC spring and autumn bottom trawl surveys in the Gulf of Maine - Georges Bank¹ area, 1980-2002.

YEAR	AGE GROUP															#/tow	kg/tow
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14		
Spring																	
1980	0.00	0.57	3.55	4.49	3.00	2.89	1.60	1.12	0.25	0.31	0.23	0.04	0.02	0.02	0.04	18.34	4.78
1981	0.00	0.13	3.49	4.31	3.55	2.67	1.74	1.45	0.79	0.41	0.34	0.07	0.09	0.07	0.09	18.75	5.88
1982	0.00	0.06	1.04	1.79	3.17	2.13	1.34	0.92	0.49	0.35	0.19	0.07	0.01	0.04	0.02	11.601	3.80
1983	0.00	0.20	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	16.94	4.60
1984	0.00	0.02	0.35	0.57	0.90	1.30	0.58	0.22	0.10	0.01	0.02	0.01	0.01	0.00	0.03	4.10	1.42
1985	0.00	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	4.94	1.88
1986	0.00	0.01	0.46	0.34	1.01	0.59	0.29	0.21	0.10	0.04	0.04	0.00	0.00	0.00	0.00	3.09	0.92
1987	0.00	0.09	0.61	0.99	0.69	0.51	0.25	0.17	0.07	0.03	0.03	0.03	0.01	0.00	0.00	3.50	0.81
1988	0.00	0.20	0.99	0.84	0.76	0.31	0.23	0.12	0.01	0.09	0.01	0.01	0.00	0.00	0.00	3.58	0.84
1989	0.00	0.05	1.59	1.27	0.86	0.49	0.29	0.16	0.03	0.07	0.01	0.01	0.00	0.00	0.00	4.81	0.75
1990	0.00	0.00	0.57	2.65	1.02	0.54	0.17	0.06	0.04	0.05	0.00	0.00	0.00	0.00	0.00	5.09	0.75
1991	0.00	0.03	0.71	1.63	2.33	0.92	0.15	0.07	0.04	0.02	0.00	0.02	0.00	0.00	0.01	5.91	1.05
1992	0.00	0.06	0.34	1.15	0.88	1.07	0.43	0.11	0.04	0.02	0.01	0.00	0.01	0.00	0.00	4.11	1.36
1993	0.00	0.33	0.84	1.16	1.58	0.61	0.45	0.17	0.08	0.02	0.01	0.02	0.03	0.00	0.00	5.29	1.39
1994	0.00	0.03	1.43	1.14	1.12	0.75	0.23	0.10	0.03	0.01	0.00	0.01	0.01	0.01	0.01	4.88	0.85
1995	0.00	0.31	1.97	3.21	2.31	1.11	0.44	0.22	0.03	0.03	0.03	0.01	0.02	0.01	0.01	9.43	1.94
1996	0.00	0.02	0.47	1.94	3.30	1.31	0.53	0.20	0.05	0.02	0.00	0.00	0.00	0.00	0.00	7.83	1.69
1997	0.00	0.01	0.85	1.66	2.52	2.05	0.39	0.09	0.01	0.00	0.01	0.00	0.02	0.00	0.00	7.62	1.62
1998	0.00	0.06	0.19	1.02	1.12	1.22	0.68	0.16	0.06	0.01	0.01	0.003	0.01	0.00	0.00	4.52	1.11
1999	0.00	0.08	0.41	0.52	1.13	0.79	0.64	0.41	0.17	0.02	0.02	0.00	0.00	0.00	0.00	4.18	1.20
2000	0.00	0.03	1.91	2.48	2.22	1.60	0.86	0.60	0.15	0.07	0.02	0.003	0.01	0.00	0.00	9.96	2.30
2001	0.00	0.00	0.71	3.67	3.37	1.45	0.75	0.37	0.17	0.09	0.05	0.02	0.00	0.00	0.00	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

Table H3a (continued). Standardized stratified mean number per tow by age and mean weight per tow (kg) of American plaice in NEFSC spring and autumn bottom trawl surveys in the Gulf of Maine - Georges Bank¹ area, 1980-2002.

YEAR	AGE GROUP														#/tow	kg/tow	
	0	1	2	3	4	5	6	7	8	9	10	11	12	13			14
Autumn																	
1980	0.00	1.58	2.22	2.72	2.85	1.53	1.03	0.93	0.57	0.31	0.20	0.11	0.04	0.07	0.08	14.24	5.12
1981	0.00	0.43	2.79	2.22	2.62	2.30	1.55	0.63	0.58	0.07	0.20	0.20	0.02	0.02	0.12	13.04	5.62
1982	0.00	0.20	0.91	1.65	1.27	0.57	0.48	0.30	0.17	0.19	0.08	0.03	0.00	0.00	0.02	5.88	2.49
1983	0.06	0.50	1.01	2.02	2.92	1.36	0.68	0.34	0.17	0.10	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	0.10	0.00	0.03	0.01	0.02	0.00	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	0.00	0.00	0.01	0.00	6.95	2.00
1986	0.10	0.51	1.48	0.89	1.45	0.47	0.43	0.16	0.12	0.04	0.01	0.02	0.01	0.00	0.00	5.61	1.56
1987	0.01	0.53	1.27	0.99	0.43	0.69	0.25	0.10	0.04	0.04	0.01	0.02	0.00	0.00	0.00	4.38	1.09
1988	0.00	2.84	2.97	2.39	0.78	0.47	0.10	0.07	0.00	0.03	0.00	0.02	0.00	0.00	0.00	9.69	1.46
1989	0.05	0.48	4.45	2.86	0.98	0.19	0.10	0.02	0.02	0.02	0.02	0.00	0.01	0.02	0.00	9.21	1.17
1990	0.01	1.52	2.26	7.49	2.89	0.59	0.25	0.11	0.07	0.02	0.02	0.01	0.01	0.00	0.01	15.46	2.90
1991	0.02	0.47	2.48	2.03	1.59	0.73	0.30	0.04	0.07	0.00	0.01	0.00	0.00	0.00	0.01	7.71	1.56
1992	0.02	0.65	1.23	1.85	1.28	0.78	0.30	0.07	0.05	0.03	0.02	0.00	0.02	0.00	0.00	6.31	1.78
1993	0.01	1.71	2.35	3.47	2.28	1.05	0.80	0.11	0.04	0.04	0.04	0.00	0.00	0.00	0.00	11.89	2.39
1994	0.04	3.83	7.53	2.81	1.71	1.30	0.04	0.25	0.13	0.01	0.03	0.02	0.00	0.00	0.00	18.07	2.67
1995	0.01	0.50	3.80	3.82	2.50	0.90	0.22	0.04	0.03	0.00	0.00	0.00	0.02	0.00	0.00	11.84	2.58
1996	0.01	0.54	0.81	2.00	2.74	0.93	0.39	0.07	0.04	0.03	0.00	0.00	0.02	0.00	0.02	7.58	2.23
1997	0.01	0.36	1.06	1.55	1.86	1.04	0.32	0.04	0.01	0.01	0.00	0.00	0.00	0.00	0.02	6.27	1.94
1998	0.01	1.73	0.60	1.88	2.01	1.78	1.08	0.12	0.05	0.01	0.01	0.00	0.01	0.00	0.00	9.29	2.22
1999	0.02	2.00	2.20	2.05	2.13	1.60	0.81	0.20	0.03	0.00	0.00	0.00	0.00	0.00	0.00	11.03	2.57
2000	0.03	0.47	2.90	3.91	2.28	1.35	0.75	0.33	0.14	0.03	0.03	0.00	0.00	0.00	0.00	12.23	2.79
2001	0.02	0.40	1.22	3.31	2.64	1.46	0.53	0.41	0.20	0.17	0.02	0.00	0.01	0.00	0.00	10.40	2.63

¹ Offshore strata 13-30, 36-40

Table H3b. Stratified mean number per tow by age of American plaice in Massachusetts spring and autumn bottom trawl surveys in Massachusetts Bay and Cape Cod Bay (Regions 4+5), 1982-2002.

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
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	0.00	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	0.00	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

Table H4. Sampling of commercial American plaice landings, by market category, for the Gulf of Maine and Georges Bank areas (NAFO Division 5Y and 5Z), 1985-2001.

	Small				Medium				Large				Total Number Samples	Number of tons landed / sample			Total Lengths Measured	Total Numbers Aged
	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	40				537	828
GM	2	5	5	5	3	1	9	5	1	10	6	5	57				1885	1321
total	4	9	19	8	3	3	11	7	1	13	13	6	97	49	55	116	2422	2149
1986 GB	3	6	5	3	2	4	3	2	1	4	3	2	38				908	716
GM	9	5	3	5	3	4	5	1	10	10	7	4	66				1199	1420
total	12	11	8	8	5	8	8	3	11	14	10	6	104	33	35	56	2107	2136
1987 GB	4	5	5	1	---	2	3	2	2	4	4	1	33				715	633
GM	2	6	5	3	1	5	2	3	3	3	6	5	44				1226	885
total	6	11	10	4	1	7	5	5	5	7	10	6	77	39	40	63	1941	1518
1988 GB	3	7	4	2	1	3	4	2	4	5	2	4	41				1023	505
GM	4	7	4	5	6	6	4	3	6	5	3	2	55				2166	803
total	7	14	8	7	7	9	8	5	10	10	5	6	96	34	21	40	3189	1308
1989 GB	2	5	5	---	1	1	6	1	5	3	3	---	32				869	600
GM	1	3	3	3	1	---	4	3	2	1	---	1	22				863	432
total	3	8	8	3	2	1	10	4	7	4	3	1	54	35	29	63	1732	1032
1990 GB	---	5	6	---	2	1	2	2	---	2	5	---	25				698	494
GM	5	5	3	3	1	6	3	5	1	5	3	5	45				1558	938
total	5	10	9	3	3	7	5	7	1	7	8	5	70	33	26	42	2256	1432
1991 GB	---	3	1	---	3	1	1	---	3	3	2	---	17				494	123
GM	5	3	7	6	3	1	4	3	---	1	5	2	40				1211	736
total	5	6	8	6	6	2	5	3	3	4	7	2	57	78	67	67	1705	859
1992 GB	---	4	1	---	---	1	1	---	---	2	2	1	12				200	158
GM	1	5	2	2	1	4	3	2	2	2	3	2	29				1148	684
total	1	9	3	2	1	5	4	2	2	4	5	3	41	168	143	155	1348	842
1993 GB	---	2	1	1	---	1	---	---	---	3	2	1	11				69	190
GM	2	4	4	1	---	2	2	---	---	1	2	---	18				445	251
total	2	6	5	2	0	3	2	0	0	4	4	1	29	133	260	253	514	441
1994 GB	---	---	---	---	---	---	1	1	---	1	---	1	4				204	52
GM	---	2	5	3	---	4	3	3	---	2	3	3	28				1307	458
total	0	2	5	3	0	4	4	4	0	3	3	4	32	205	97	181	1511	510
1995 GB	1	---	---	---	1	---	---	---	1	---	---	---	3				149	44
GM	1	3	---	2	---	2	---	---	---	2	---	1	11				276	149
total	2	3	0	2	1	2	0	0	1	2	0	1	14	323	336	332	425	193
1996 GB	---	2	2	1	---	1	4	---	---	2	1	1	14				852	222
GM	2	3	2	1	2	1	3	5	3	1	4	2	29				1582	435
total	2	5	4	2	2	2	7	5	3	3	5	3	43	189	53	75	2434	657
1997 GB	2	4	2	3	---	2	3	1	---	2	---	---	19				460	231
GM	4	4	3	1	2	3	3	---	1	5	3	2	31				1138	489
total	6	8	5	4	2	5	6	1	1	7	3	2	50	82	77	69	1598	720
1998 GB	1	4	1	---	2	1	1	1	1	1	1	1	15				1440	247
GM	2	3	1	1	6	3	7	7	2	2	2	2	38				3994	577
total	3	7	2	1	8	4	8	8	3	3	3	3	53	111	41	87	5434	824
1999 GB	4	4	---	1	5	2	1	---	---	4	1	---	22				2356	308
GM	6	8	6	9	7	4	5	7	1	6	3	2	64				6428	967
total	10	12	6	10	12	6	6	7	1	10	4	2	86	31	29	61	8784	1275
2000 GB	14	11	3	1	1	2	---	1	2	2	2	2	41				2546	412
GM	14	28	4	1	2	7	3	---	---	4	1	3	67				4567	743
total	28	39	7	2	3	9	3	1	2	6	3	5	108	22	79	78	7113	1155
2001 GB	4	2	1	2	---	2	2	3	---	3	2	1	22				2143	228
GM	4	3	4	---	3	2	2	2	4	2	1	4	31				3089	435
total	8	5	5	2	3	4	4	5	4	5	3	5	53	87	79	81	5232	663

Table H5. Catch at age (thousands of fish; metric tons) and mean weight (kg), of commercial landings, large mesh and northern shrimp fishery discards of American plaice, ages 1-9+, from Gulf of Maine - Georges Bank, and South, 1980-2001.

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	320	744	1229	1838	2354	1676	560	220	8944
2001	0	0	85	520	1322	2470	2063	1649	935	439	9485

Table H5. (continued) 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, 1980-2001.

Year	0	1	2	3	4	5	6	7	8	9+	Average
	Mean Weight at age (kg)										
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	0.031	0.221	0.314	0.436	0.538	0.732	1.002	1.234	0.524
2001	0.000	0.000	0.018	0.131	0.297	0.418	0.518	0.681	0.823	1.130	0.522
1980-2001	0.001	0.016	0.049	0.159	0.296	0.437	0.611	0.841	1.075	1.564	0.514
1997-2001	0.001	0.012	0.024	0.165	0.306	0.409	0.543	0.733	0.937	1.562	0.508

Table H6. Estimates of beginning year stock size (thousands of fish), instantaneous fishing mortality (F) and spawning stock biomass (mt) of Gulf of Maine-Georges Bank American plaice, estimated from virtual population analysis (VPA) and calibrated using the commercial catch at age ADAPT formulation, 1980-2001.

Stock Numbers (Jan 1) in thousands																							
	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
1	52640	25117	21944	25115	13179	14379	18433	36791	53241	27075	33006	33292	40176	44722	40917	31176	29111	21210	34525	39965	14071	4015	39260
2	42215	43094	20559	17957	20548	10787	11714	15038	30088	43306	22048	26961	27245	32860	36518	33240	25056	23658	17223	28233	32717	11517	3287
3	35914	34473	34394	16287	14102	16489	8689	9012	11778	23923	33961	17440	21782	22097	26518	29441	25868	19667	18125	14044	22932	26497	9353
4	24231	28434	26241	25130	11997	10649	12399	6446	5714	7978	17929	24738	13373	16853	16253	21148	22037	19896	15376	14585	11313	18102	21223
5	21550	17421	18706	17345	15890	7631	7510	8085	3976	3020	5514	12269	16263	8938	10052	10930	11430	14022	13811	11790	11050	8150	13625
6	17203	14080	9434	11240	9751	7553	4072	4610	4554	1810	1722	3276	6966	7153	4076	4195	4582	6682	7934	8949	8102	7384	4438
7	11092	10526	8227	4467	5662	5048	3585	1998	2565	2422	997	929	1666	3238	3016	1796	1624	2420	3931	4255	5451	4504	4179
8	5101	5795	6445	3752	1603	2884	2117	1752	826	1600	1302	553	471	623	1382	1304	879	833	1332	2274	2332	2946	2195
9+	14407	6202	8496	6025	3694	2342	1531	989	973	1384	1666	1344	803	1307	1544	694	781	1204	1125	1274	910	1371	2295
1 +	224352	185140	154444	127318	96428	77763	70049	84722	113716	112518	118145	120802	128745	137793	140277	133924	121368	109592	113381	125369	108878	84486	99854
Fishing Mortality																							
	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	
1	0	0	0	0	0	0.01	0	0	0.01	0.01	0	0	0	0	0.01	0.02	0.01	0.01	0	0	0	0	
2	0	0.03	0.03	0.04	0.02	0.02	0.06	0.04	0.03	0.04	0.03	0.01	0.01	0.01	0.02	0.05	0.04	0.07	0	0.01	0.01	0.01	
3	0.03	0.07	0.11	0.11	0.08	0.09	0.1	0.26	0.19	0.09	0.12	0.07	0.06	0.11	0.03	0.09	0.06	0.05	0.02	0.02	0.04	0.02	
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	0.2	0.32	0.2	0.42	0.25	0.17	0.07	0.08	0.13	0.08	
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	0.59	0.67	0.67	0.34	0.37	0.23	0.18	0.2	0.41	
6	0.29	0.34	0.55	0.49	0.46	0.55	0.51	0.39	0.43	0.4	0.42	0.48	0.57	0.66	0.62	0.75	0.44	0.33	0.42	0.3	0.39	0.37	
7	0.45	0.29	0.59	0.82	0.47	0.67	0.52	0.68	0.27	0.42	0.39	0.48	0.78	0.65	0.64	0.51	0.47	0.4	0.35	0.4	0.42	0.52	
8	0.3	0.36	0.43	0.47	0.51	0.53	0.4	0.42	0.45	0.39	0.35	0.4	0.63	0.64	0.67	0.68	0.38	0.36	0.31	0.25	0.31	0.43	
9+	0.3	0.36	0.43	0.47	0.51	0.53	0.4	0.42	0.45	0.39	0.35	0.4	0.63	0.64	0.67	0.68	0.38	0.36	0.31	0.25	0.31	0.43	
mn 5-8,u	0.32	0.35	0.47	0.54	0.50	0.55	0.43	0.47	0.44	0.39	0.37	0.43	0.65	0.64	0.65	0.65	0.41	0.37	0.33	0.28	0.33	0.43	

Table H6 continued.

SSB at the start of the spawning season - males and females (mt)																						
	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
age																						
1	24	12	8	5	0	5	11	17	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	164	186	95	32	37	12	71	92	14	21	11	17	16	15	7	6	5	4	10	12	15	5
3	878	873	1206	529	230	225	395	327	156	299	400	230	320	287	370	246	157	144	182	184	245	289
4	2413	2943	2719	3438	1320	929	1285	853	611	988	2003	3084	1525	1955	2331	2720	3094	2027	1553	1917	1583	2633
5	4546	4061	4723	4651	4638	1633	1787	2036	995	878	1611	3634	4980	2555	2704	3183	3673	4218	3899	3377	3456	2332
6	7938	6457	3632	4659	4446	3084	1488	1908	1971	778	780	1556	3405	3053	1627	1703	2077	3105	3065	3491	3283	3012
7	7051	6935	5724	2308	3614	2906	2011	1160	1668	1425	588	614	1068	2144	1641	1076	1048	1436	2393	2208	2926	2277
8	4181	4535	5528	3174	1326	2443	1817	1492	736	1197	957	466	411	547	1121	986	785	670	1029	1707	1723	1952
9+	19379	7092	10734	7538	5125	3153	2243	1430	1349	1834	1962	1712	1056	1748	2247	779	1120	1636	2458	1593	989	1323
Total	46575	33094	34369	26333	20739	14391	11108	9315	7501	7420	8312	11313	12781	12303	12048	10699	11960	13240	14589	14490	14220	13822
Percent Mature (females)																						
	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
age																						
1	3	3	3	3	3	3	7	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	8	8	8	8	8	8	24	24	2	2	2	2	2	1	1	1	1	1	3	3	3	3
3	24	24	24	24	24	24	55	55	17	17	17	17	17	12	12	12	12	12	18	18	18	18
4	52	52	52	52	52	52	83	83	65	65	65	65	65	60	60	60	60	60	61	61	61	61
5	79	79	79	79	79	79	95	95	94	94	94	94	94	94	94	94	94	94	92	92	92	92
6	93	93	93	93	93	93	99	99	99	99	99	99	99	99	99	99	99	99	99	99	99	99
7	98	98	98	98	98	98	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
8	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100

Table H7. Input parameters and results of stochastic projection analysis using an empirical resampling model for Gulf of Maine-Georges Bank American plaice for 2002-2009 for $F_{2002} = 0.85F_{2001}$.

Input for Projections:

Age	Fishing Mortality(PR)	Discard Fraction	% Mature	Average Weight		
				Stock	Landed	Discarded
1	0.02	1.00	0.00	0.001	0.009	0.011
2	0.03	1.00	0.03	0.172	0.015	0.022
3	0.07	0.92	0.18	0.391	0.068	0.165
4	0.28	0.70	0.61	0.432	0.246	0.260
5	0.72	0.29	0.92	0.478	0.360	0.287
6	1.00	0.14	0.99	0.568	0.465	0.297
7	1.00	0.07	1.00	0.735	0.612	0.297
8	1.00	0.03	1.00	0.919	0.819	0.334
9	1.00	0.02	1.00	1.268	1.255	0.415

Projection results for 2002-2004

Year	Recruitment (000 fish)	F	Median Landings (000 mt)	Median Discards (000 mt)	Median SSB (000 mt)
F2002= 0.85 F2001					
2002	30174	0.37	4.030	0.711	15.269
2003	30121	$F_{rebuild}$ 0.10	1.336	0.161	15.938
2004	30101	0.10	1.562	0.128	17.038

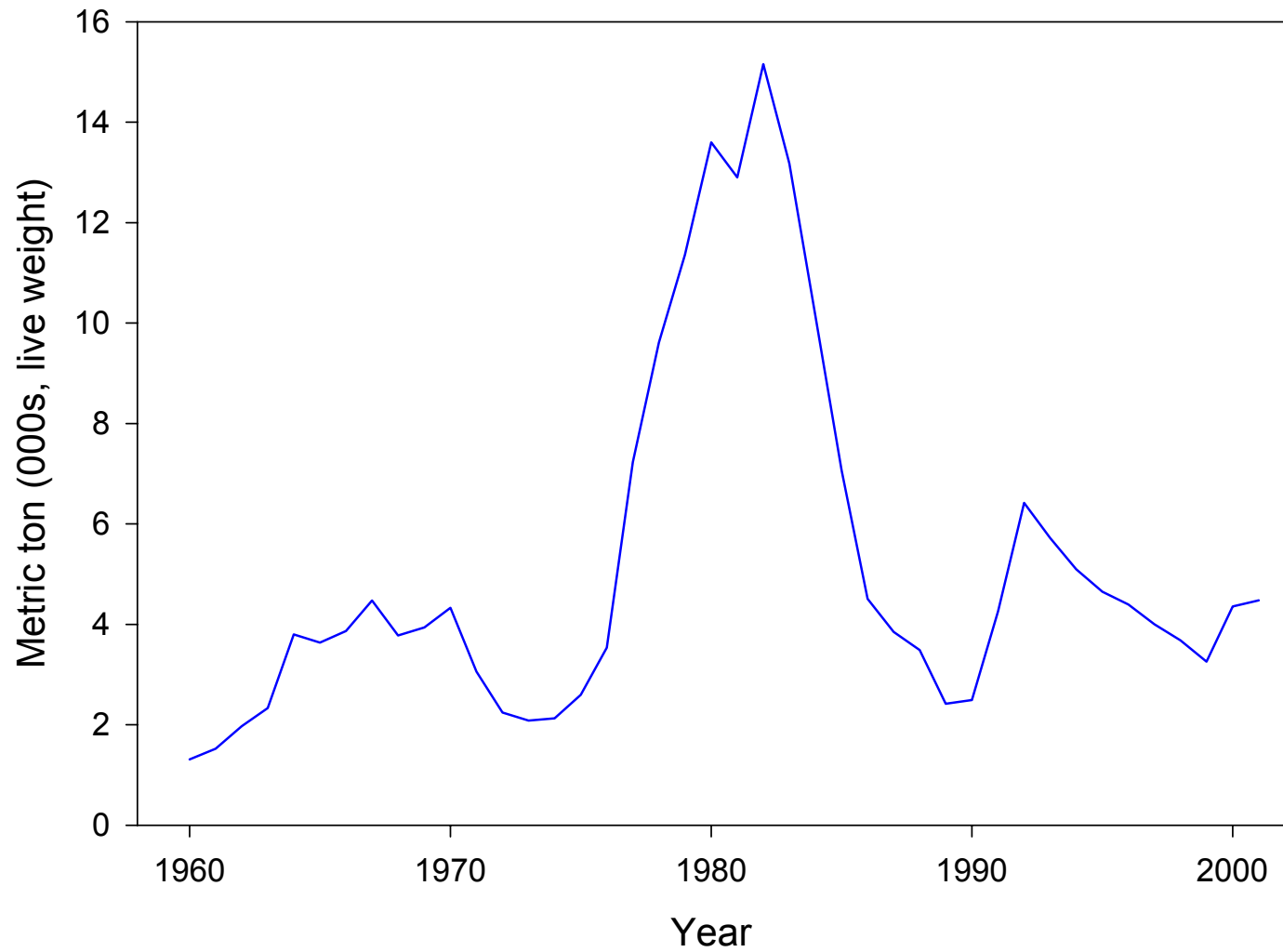


Figure H1. Total commercial landings of Gulf of Maine-Georges Bank American plaice (Division 5Z and 6), 1960-2001.

TOTAL CATCH ('000 of fish) AT AGE

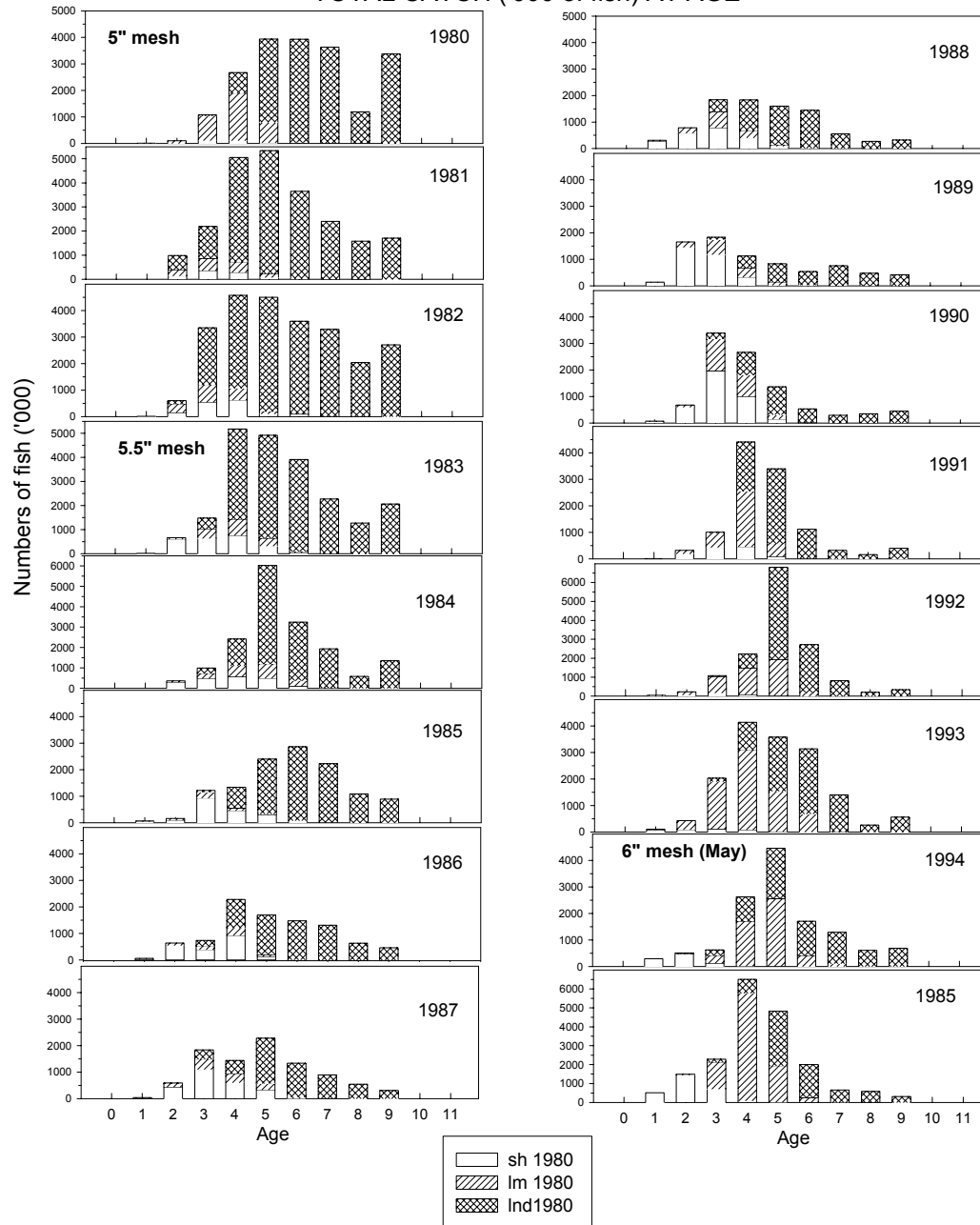


Figure H2. Number of American plaice ('000 of fish) at age in the total catch (discards from shrimp and large mesh fisheries, and landings), 1980 - 2001.

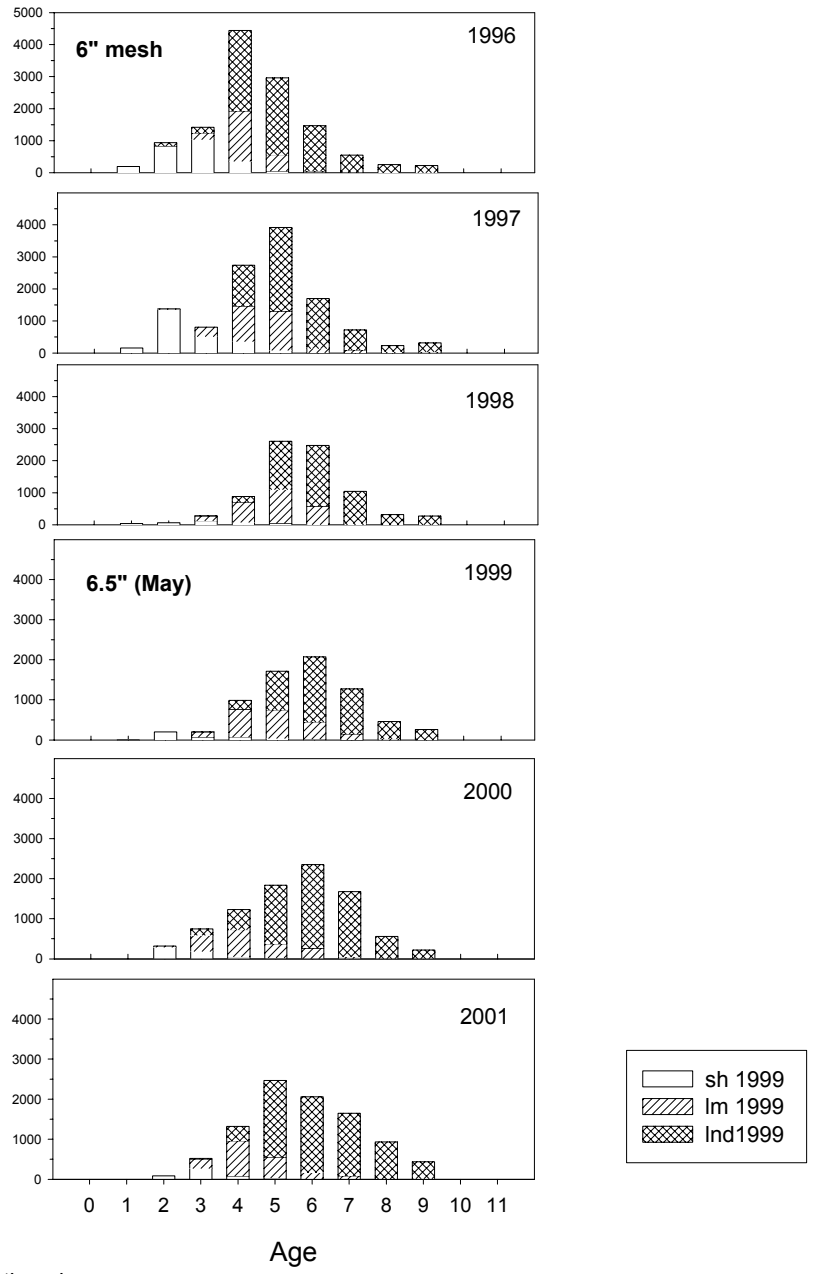


Figure H2 continued.

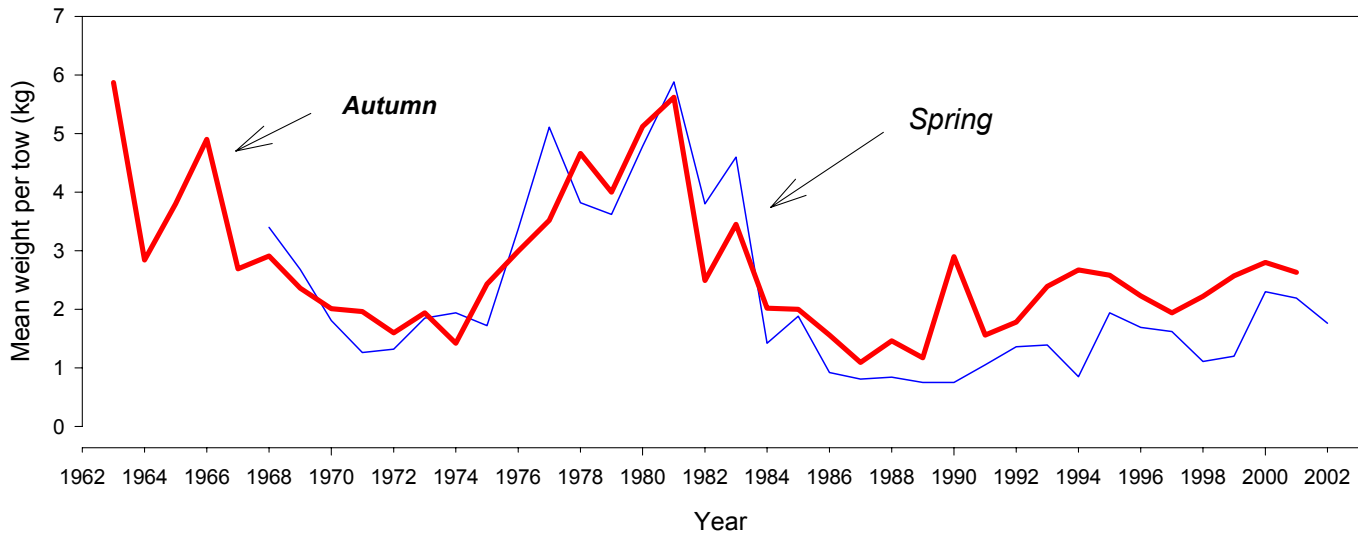


Figure H3. Standardized stratified mean weight per tow (kg) of American plaice in NEFSC spring and autumn research vessel bottom trawl survey in the Gulf of Maine-Georges Bank region, 1963-2002.

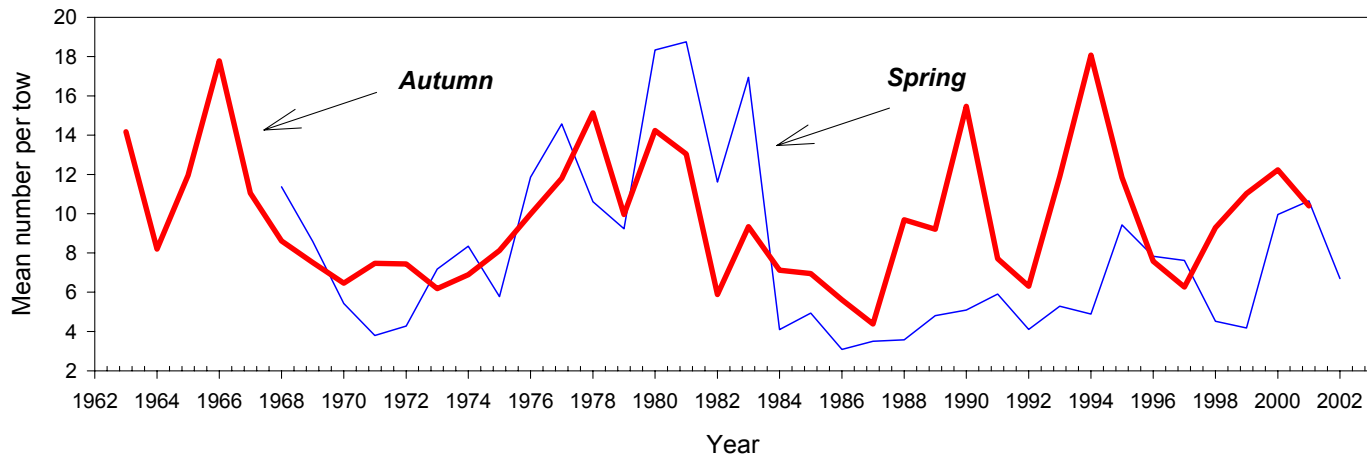


Figure H4. Standardized stratified mean number per tow of American plaice in NEFSC spring and autumn research vessel bottom trawl survey in the Gulf of Maine-Georges Bank region, 1963-2002.

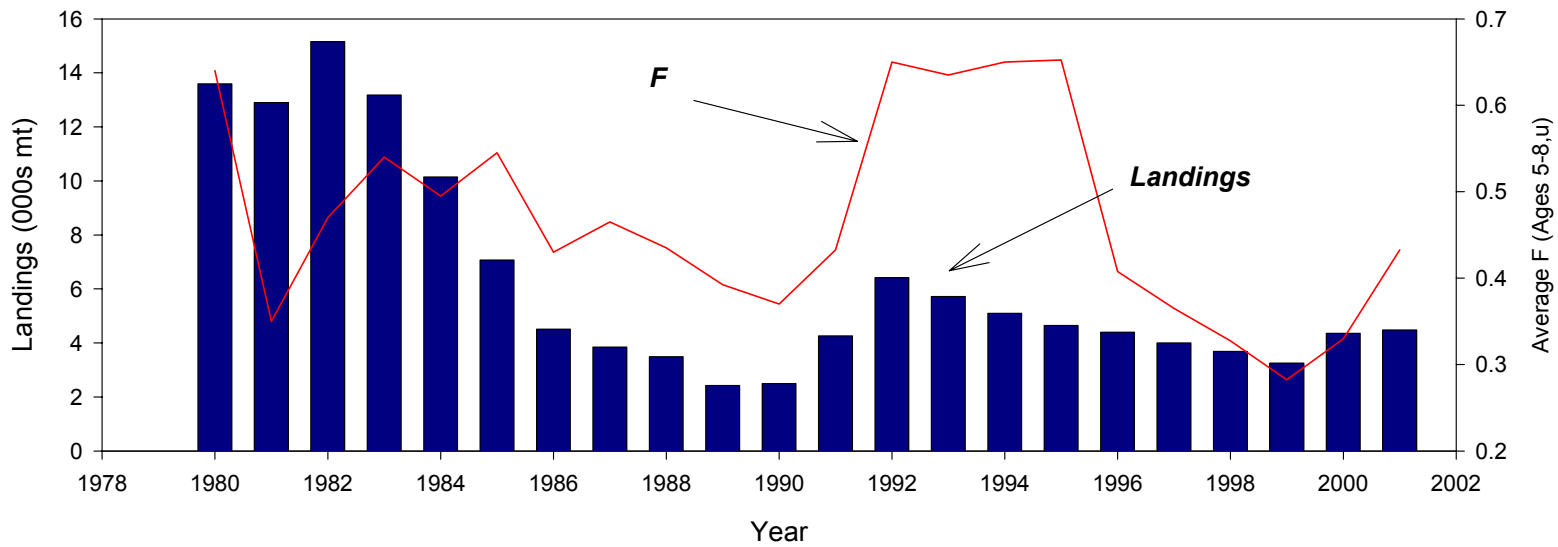


Figure H5. Trends in total commercial landings and fishing mortality for Gulf of Maine-Georges Bank American plaice, 1980-2001.

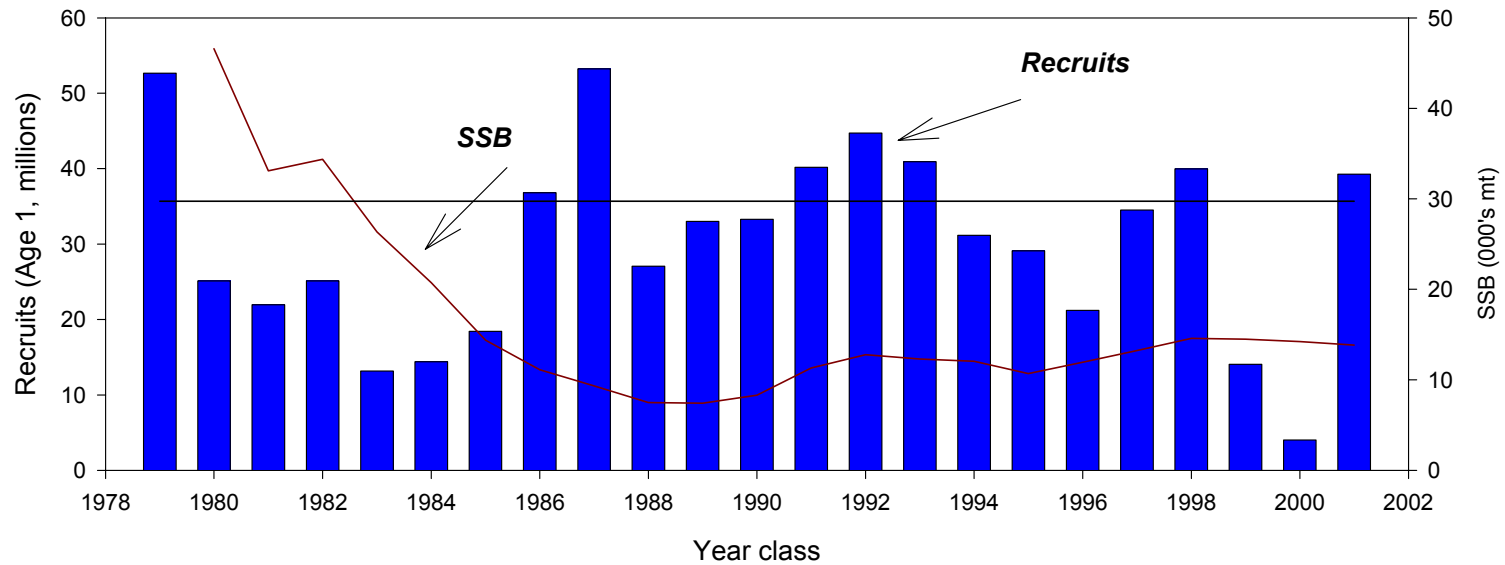


Figure H6. Trends in recruitment and spawning stock biomass for Gulf of Maine-Georges Bank American plaice, 1980-2001.

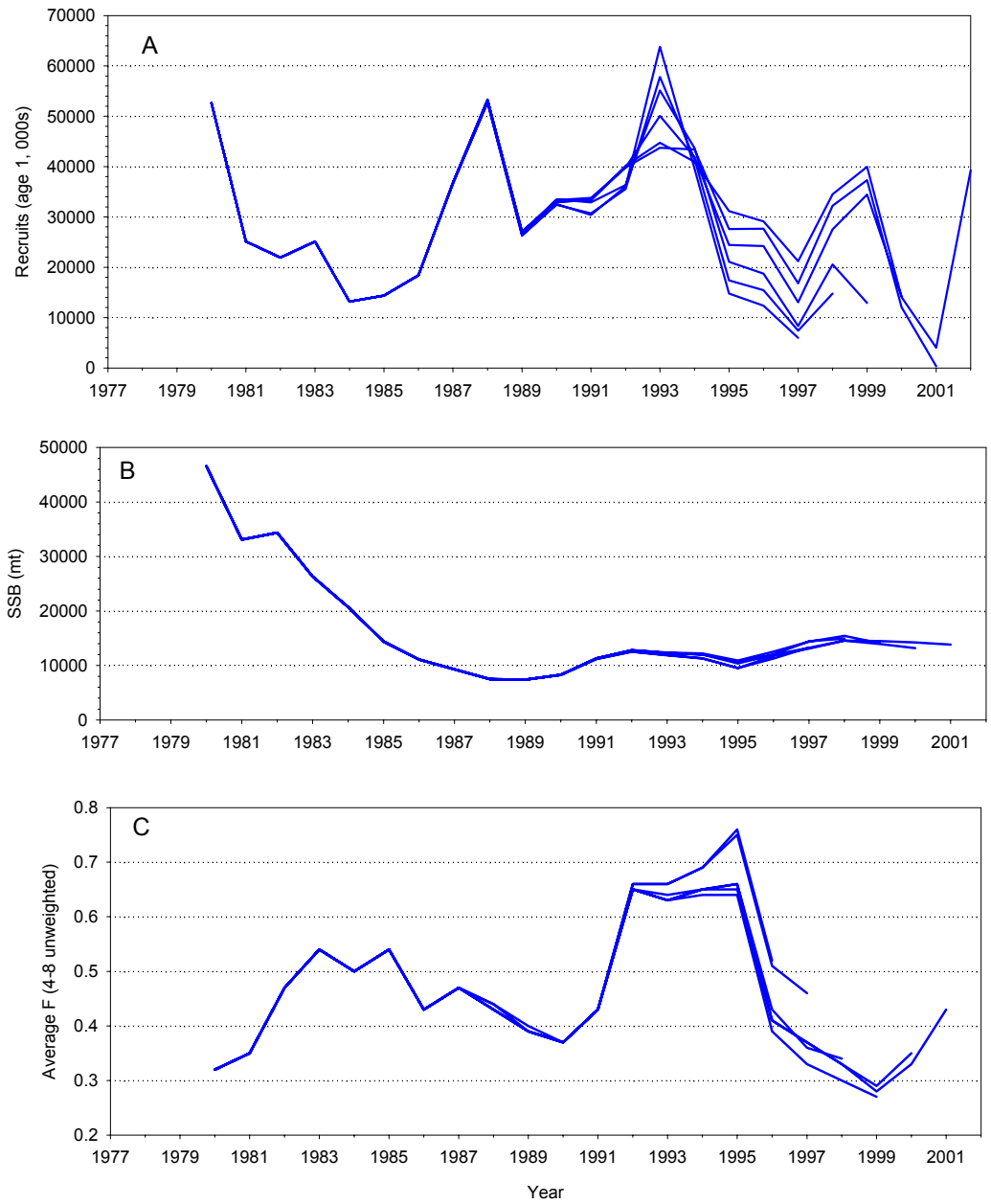


Figure H7. Retrospective analysis of Gulf of Maine-Georges Bank American plaice recruits at age 1(A), spawning stock biomass (B), and fishing mortality (C) (average F, aged 5-8, unweighted), based on the final ADAPT VPA formulation, 2001-1996.

GM- GB American plaice Sensitivity Runs (80% CI)

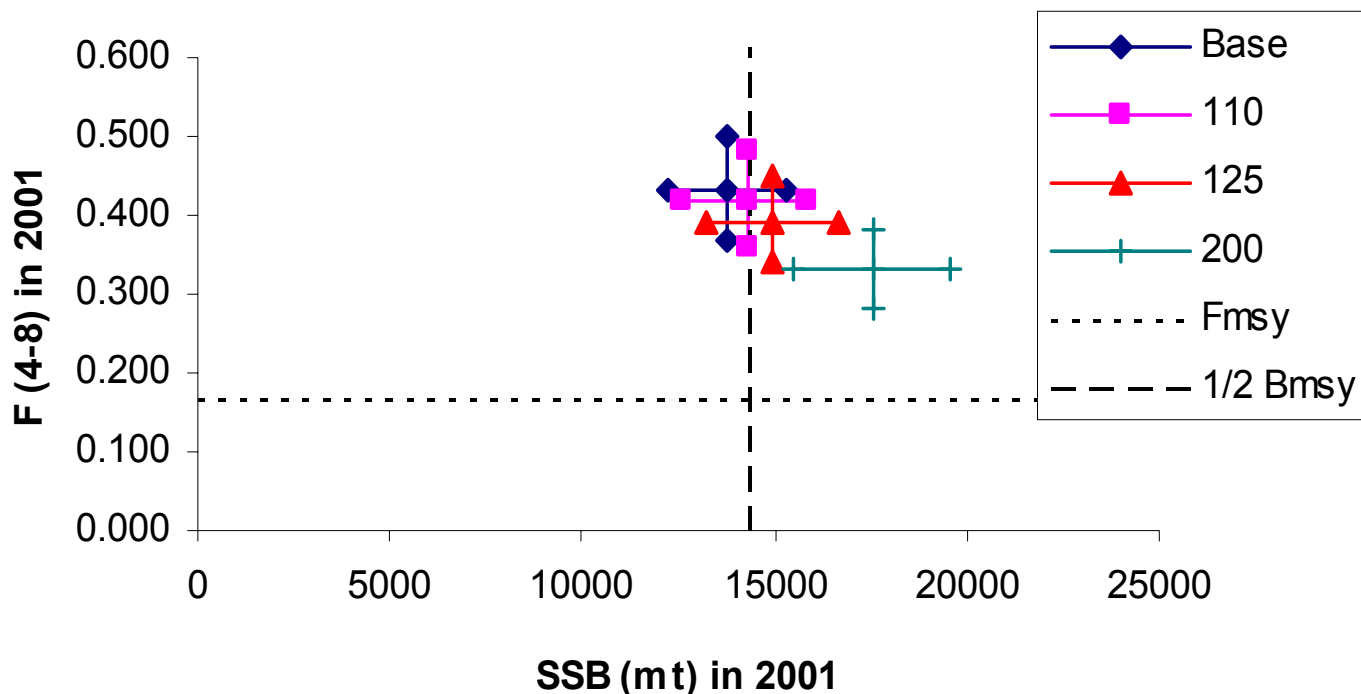


Figure H8. Fishing mortality and spawning stock biomass estimates from VPA calibrated using survey indices increased by 0% (base), 10% (110), 25% (125), and 100 % (200).

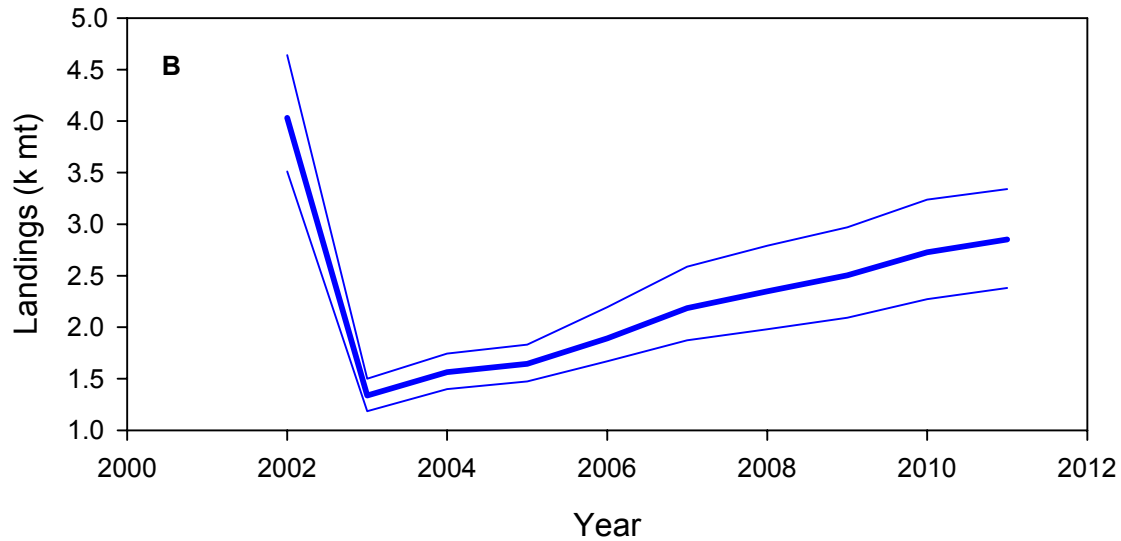
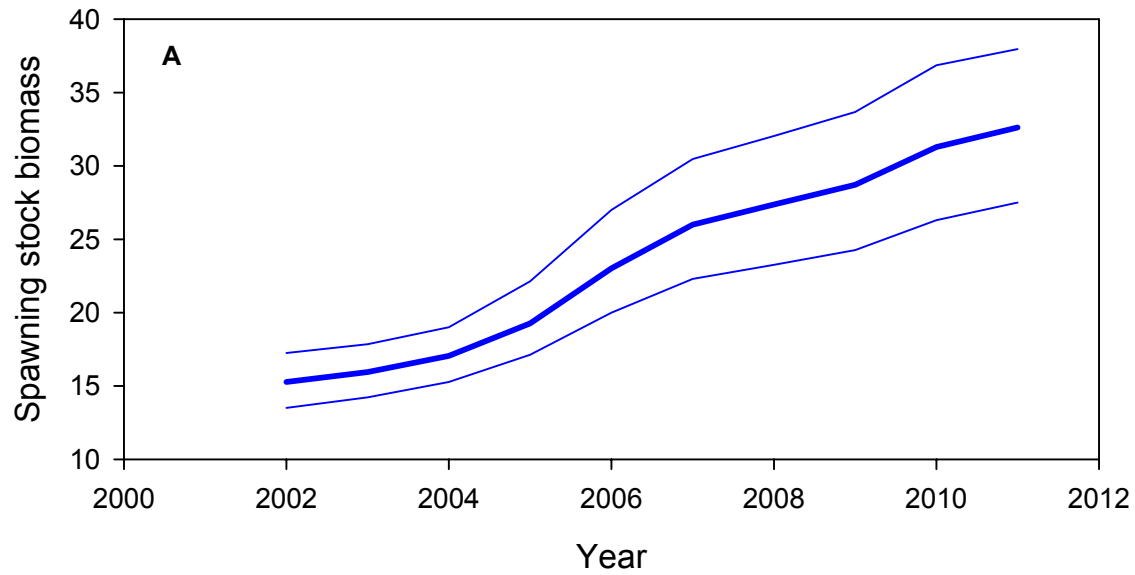


Figure H9. Median and 80% confidence intervals of predicted spawning stock biomass (panel A) and predicted landings (panel B) for American plaice under $F_{\text{rebuild}} = 0.10$.