H. Gulf of Maine/Georges Bank American plaice

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

1.0 Background

American plaice is distributed along the Northwest Atlantic continental shelf from southern Labrador to Rhode Island in relatively deep waters (Collette and Klein-MacPhee 2002). Off the U.S. coast, American plaice are managed as a single stock in the Gulf of Maine-Georges Bank region (Figure H1) where the greatest commercial concentrations exist between 90 and 182 m (50 and 100 fathoms).

This stock was last assessed and peer reviewed in August 2005 at the GARM-II meeting (O'Brien *et al.* 2005). The assessment was conducted using VPA with total catch including commercial landings, large mesh discards, and shrimp trawl discards for ages 1-9+. For terminal year 2004, total commercial landings were 1,711 mt and fully recruited F (ages 5-8, unweighted average) was estimated to be 0.15, the lowest F in the time series (1980-2004). Spawning stock biomass was 14,149 mt in 2004, a 10% decrease from 2003. The 2003 (54.8 million age 1 fish) and 2004 (66.7 million age 1 fish) year classes were well above the long term average (33.1 million age 1 fish). The spring and autumn research survey indices of abundance indicated a decreasing trend during 2000-2005. Recruitment indices of age 1 fish from NEFSC autumn surveys indicated that both the 1997 and 1998 year classes were above average and the 2001 year class was just about average. The 1997 and 1998 year classes were just below average in the autumn Massachusetts state survey, however the 2003 was above average.

In 2002, biological reference points (BRPs) were developed for Gulf of Maine - Georges Bank American plaice (NEFSC 2002) in a Yield-pre-recruit (YPR) analysis based on landings and discards using VPA estimated mean recruitment at age 1 during 1980-2004. The BRPs were estimated as:

$F_{MSY} = 0.17$,
MSY = 4,900 mt and
SSB_{MSY} = 28,600 mt.

2.0 Fishery

Total commercial landings of Gulf of Maine-Georges Bank (GM-GB) American plaice were 988 mt in 2007, a 10% decrease from 2006 (Table H1, Figure H2). USA fisheries have accounted for about 95-100% of the landings since the mid-1970s and Canadian fisheries account for the remainder. The otter trawl fleet accounts for more than 95% of the landings (Table H2) and the fishery is prosecuted primarily during the 2nd and 3rd calendar quarter of the year. Since the mid-1990s the largest proportion of the landings are in the small market category (Table H3).

Sampling intensity (metric tons landed per sample) has increased since the mid-1990s (Table H4). During 2000-2007, sampling intensity ranged between 8 mt -92 mt per sample for the three market categories : small, medium and large.

Landings at age were estimated separately for the Gulf of Maine and Georges Bank and then combined for the years 1985-1993 and 2003-2007, however, for 1994-2002, landings at age were estimated by pooling Gulf of Maine and Georges Bank samples. Samples were generally applied on a quarterly basis but were pooled by half year or annually if sampling was not adequate (Table H4).

Discards of American plaice were estimated for both the large mesh fisheries in the GM and GB and for the northern shrimp fishery in the GM. Discards were estimated from 1980-1988 for both fisheries using a survey method described in O'Brien and Esteves (2001) and WP4.5 from the GARM 2008 BRP meeting. The survey method applies the survey abundance indices at length, filtered by a mesh selectivity ogive and a culling ogive, and a measure of effort to derive discard length frequencies. Survey age-length keys were then applied to estimate the discards at age. For 1989-2007, the NEFSC Observer Data Base was used to estimate discard to kept ratios (d:k) of discarded American plaice to total kept of all species, on a trip basis. Total mt of American plaice discards were then estimated by applying the d:k to commercial landings. Observer length frequencies, and both research survey and commercial age-length keys were applied to estimate discards at age.

Discarding of small fish historically occurred in the northern shrimp fishery during the 1st and 4th calendar quarter, however, in recent years the discards are minimal. Discards in the large mesh fishery occur year-round (Table H5). Total discards accounted for about 18% of the total catch during 2005-2007.

Commercial landings, shrimp and large mesh fishery discards, and total catch at age, in numbers and weight, and mean weight and mean length at age are presented in Tables H6-H9. Total catch at age is dominated by ages 4-7 (Figure H3).

3.0 Research Bottom Trawl Surveys

Biomass and abundance indices

The NEFSC survey indices of abundance and biomass peaked around 1980, declined until the late 1980s, and have since fluctuated with no strong trend (Table H10, Figure H4-H5). The Canadian Department of Fisheries and Oceans (DFO) spring survey shows no strong trends during 1987-2008 (Table H10, Figure H4-H5). The Massachusetts Division of Marine Fisheries (MADMF) spring and autumn surveys indicate a peak in abundance in the late 1980s, with a generally declining trend until about 2000, then generally increasing, however the 2006-2007 autumn indices show a decline (Figure H6).

Catch at age for NEFSC and MADMF spring and autumn surveys is presented in Tables H11-H13 and Figures H7-10. NEFSC autumn age 1 recruitment indices indicate that the 1997, 1998, 2005, and 2006 year classes are the most recent above average year classes (Table H12,Fig. H11a). The autumn MADMF age 1 recruitment indices indicate the most recent above average year classes are the 1997, 2001, 2003, and 2004 (Table H13, Fig. H11b).

Maturity ogives

Logistic regression analysis was used to estimate female maturity ogives from NEFSC spring research survey data for 1980 - 2008. The number of samples taken each year, by sex, over the time series is not consistently high and does not allow for reliable annual estimates, so the data were smoothed by using a 5-year moving average. For example, the 1990 ogive was estimated by combining data from 1988-1992, and then the 1991 ogive was estimated by

combining data from 1989-1993 and so forth, for the time series. This means that the first year, 1980, only as three years of data (1980, 1981, and 1982) and the last year, 2007, has only 4 years of data (2005, 2006, 2007, and 2008). Confidence limits for proportion mature at age were estimated at the 95% level using the approximate variance for large samples (Ashton 1972, O'Brien et al. 1993) and inverse 95% confidence limits for A_{50} (median age at maturity) were estimated within the SAS PROBIT procedure (SAS) (App.H. Fig. H1).

4.0 Assessment

The Panel Summary for the GARM Model meeting indicated that GM-GB American plaice might better be assessed by applying a statistical catch at age model (SCAA) given that discards account for 10%-100% of the fish younger than age 4 in the catch at age. The estimate of total discards (mt) have CVs that range between 0.10 – 0.80, with an average of 0.30 during 1989-2007 (Table H5). CVs for discards at age are not available. The landings at age have CVs ranging between 0.06- 0.48 for ages 5-9 for the years 2003-2007 (App.H.Table H1). Given that these measures of uncertainty are relatively low on average and similar to other stocks that incorporate discards, e.g. witch flounder, a SCAA model was not explored at this time. In addition, at the GARM BRP meeting preliminary reference points for American plaice were estimated based on recruitment from the 2005 VPA model formulation (O'Brien et al. 2005).

The Panel Summary for the GARM Model meeting also stated the following:
"There is a potential problem of conducting an assessment on the combined Georges Bank and Gulf of Maine stock subcomponents if the relative proportion of abundance of these stocks is not stable over time. The survey trends in the two areas should be examined; if they are similar, then a combined assessment of the two components should not be problematic. However, if the trends are different, there may be a need to partition the catch-at-age between the two stocks and conduct separate assessments on each assuming that there is negligible migration between the two populations."
This issue was addressed by examining the relationship between American plaice caught on Georges Bank and those caught in the Gulf of Maine using regression analysis. The ln(number per tow) and ln(weight per tow) of fish from NEFSC spring and autumn research bottom trawl surveys from Georges Bank were regressed against corresponding indices of fish from the Gulf of Maine. A positive slope is shown for both numbers and weight, with a higher R2 for ln(weight per tow), indicating that production is similar between the two areas (App. H. Fig. H2). Given these results, a combined assessment of fish from the two areas does not appear to be problematic.

Input data and Analyses

The ADAPT calibration method (Parrack, 1986, Gavaris 1988, Conser and Powers 1990) was used to derive estimates of instantaneous fishing mortality (F) in 2007 and beginning year stock sizes in 2008. The catch at age used in the VPA includes commercial landings and discards from the Northern shrimp and large mesh fisheries from 1980-2007 for ages 1 to 11+. Research survey indices used for calibration include spring NEFSC abundance indices for ages 1-8, 9-11+, spring MADMF abundance indices for ages 1-5, autumn NEFSC abundance indices for ages 0-7, 8-10+, and autumn MADMF abundance indices for ages 1-5. The autumn indices were lagged forward an age and a year to match cohorts in the spring surveys. A conditional non-parametric bootstrap procedure (Efron 1982) was used to evaluate the precision of F and

spawning stock biomass (SSB). A retrospective analysis was performed for terminal year F, SSB, and age 1 recruitment.

In this formulation the average F is based on ages 6-9 which is a shift from the previous assessment that used F averaged on ages 5-8 (O'Brien et al. 2005). The catch at age is now 1-11+, whereas, in the previous assessment the catch at age was 1-9+.

Assessment results

The ADAPT calibration results for estimates of terminal year stock size and catchability (q) estimates, with corresponding standard error and coefficients of variation (CVs) are presented in Table H14. Stock size estimates are more precise for ages 3-10, (CVs ranging from 0.15 -.22) than for ages 1 and 2 (CVs between 0.29-0.65). Catchability estimates at age for the NEFSC surveys were more precise for ages 3-7 (0.07-0.09), than for ages 1-2 (0.12-0.19). The MADMF autumn survey q estimates at age were less precise for ages 2-5 (0.11-0.19) then the spring survey estimates for ages 3-5 (0.08-0.09)
(Table H14, Figure H12). There appears to be a dome in the survey q's where the youngest and oldest fish have relatively low catchability.

The residuals (observed – predicted), presented in App.H. Fig. H3, indicated a pattern of negative residuals in the early years of the time series and positive residuals in the latter part of the time series for most all ages 4 and older in all four surveys. Average fully recruited F (ages 6-9) in 2007 was estimated as 0.06, the lowest in the time series (Table H15, Figure H12, App.H.Table H2). The 2007 estimate of SSB was 15,569 mt, a 33% increase from 2006, and the highest SSB since 1984 (Table H15, Figure H13, App.H. Table H2). Since 1980, recruitment has ranged from 12 million to 53 million age 1 fish with a time series average of 28.8 million age 1 fish. The 2003 (36.8 million fish), 2004 (42.7 million), 2005 (51.4 million) and 2007 (42.1 million) are all above average year classes, and are the first to appear since the 1993 (38.8 million fish) above average year class (Table H15, Figure H13, App.H. Table H2).

Precision estimates of F and SSB

A conditional non-parametric bootstrap procedure (Efron 1982) was used to evaluate the uncertainty associated with the estimate of F and SSB from the final VPA. One thousand bootstrap iterations were performed to estimate standard errors, CVs, and bias for age 1-10 stock size estimates at the start of 2008 and age 1-11+ F estimates in 2007 (App. H. Table H3). The bootstrap results indicate that stock sizes were well estimated for ages 3-10 with CVs varying between 0.14-0.26., however, age 1(CV=1.09) and age 2 (CV=0.41) were not as well estimated. The fully recruited F for ages 6-9 was well estimated with CVs ranging between 0.14 and 0.19, with the exception of age 7 (CV=1.29). There is an 80% probability that the average F in 2007 is between 0.0573 and 0.0746 (Figure H15, App. H Table H3). The bootstrap results indicate that SSB was well estimated (CV=0.07) and slightly lower than the bootstrap mean. There is an 80% probability that SSB in 2008 is between 14,382 mt and 17,229 mt (Figure H15, App.H.Table H3).

Back-calculated partial recruitment

Back-calculated partial recruitment (PR) at age from VPA was averaged over 3 time periods corresponding to changes in management: 1980-1993, 1994-2001, and 2002-2007. Within a time period, the PR was scaled to the highest averaged PR value at age. All three PRs vectors appear to be flat topped. The shift from fully recruited F on age 5 during 1980-1993 to

age 6 during 2002-2007 is apparent (Figure H16).

Retrospective analysis

A retrospective analysis was performed to evaluate how well the current ADAPT calibration would have estimated F, SSB, and recruits at age 1 for seven years prior to the terminal year, 2007. Mohn's rho, calculated as the average of the 'tips' or terminal year values of each retrospective run, was calculated within each analysis. There is a retrospective pattern of estimating F values lower than the terminal year F (rho = -0.31) (Figure H17a) and a corresponding pattern of estimating higher values of SSB relative to the terminal year SSB (rho=0.41). The retrospective analysis in recruits at age 1 indicate that recruits are estimated at higher values relative to the terminal year (rho=0.60). There is one extremely high value in 2003 (Fig. H17c). The estimation of age 1 recruits is likely influenced by the absence of the MADMF spring survey data for terminal year + 1 (2008), which is typically available. The relative difference plot (Fig. H17c) in the current assessment is estimated by differencing the final run (without the spring survey) with retrospective runs that do have the terminal year + 1 spring survey available for estimation.

Sensitivity runs

Prior to selecting a final model, several sensitivity runs were conducted. The final model chosen was based primarily on comparisons of retrospective patterns and Mohn's rho statistic between model formulations. The VPAs included a 9+ and an 11+ catch at age, with the survey indices either split or not split between 1993 and 1994, and different average ages for estimation of F on the oldest age. Mohn's rho statistic for F, SSB, and age 1 recruitment are presented below for selected model formulations.

Initially, several runs were conducted using the 2005 assessment formulation (O'Brien et al. 2005) with a catch at age of 9+ and F on the oldest age averaged on ages 5-8. This base run was compared with a VPA that split the survey time series between 1993 and 1994, and another VPA that dropped several MADMF indices. Comparison of the rho statistic for recruitment at age 1 showed an increase from 0.52 (base) to 2.42 (split) and 1.96 (Ma. indices dropped).

Several more runs were conducted comparing a 9+ and 11+ catch at age with fully recruited F beginning at age 6. The 11+ catch at age was chosen over the 9+, primarily because the catch is well represented out to age 11 and in addition Mohn's rho statistics for F, SSB, and recruitment were similar between base VPAs (see table below). The final model selected included an aggregate survey tuning index of ages 9-11+ that provided more information on the older age classes. Mohn's rho statistic is slightly higher for SSB and recruitment compared to a model with no aggregate index, however, the rho for F is equivalent. The terminal year SSB is actually lower in the aggregate formulation compared to the model without the aggregate index.

CAA	9+	9+	11+	11+	11+
F average	6-7	6-7	6-9	6-9	6-9
survey split	no	yes	no	no	yes
SV + group	no	no	no	9-11+	9-11+
Mohn's rho statistic					
F	-0.30	-0.34	-0.31	-0.31	-0.31
SSB	0.36	0.70	0.36	0.43	0.52
age 1	0.56	2.47	0.57	0.60	2.44

5.0 Biological Reference Points

Yield per Recruit Analysis

A yield per recruit (YPR) analysis was conducted to provide an estimate of $F_{40\%}$ using the methods of Thompson and Bell (1934). Input data (Table H16) for catch weights and stock weights (ages 1-11+) were estimated as an average of the most recent 5 years (2003-2007). The PR was based on a normalized geometric mean of the 2003-2007 Fs from the VPA and the maturity ogive was estimated annually as a 5 year moving average as described above. The YPR and spawning stock biomass/recruit (SSB/R) plot is presented in Fig. H18.

The estimated biological reference points of $F_{0.1}$= 0.21 , F_{max} = 0.48 and $F_{40\%}$ = 0.19 are higher than those estimated by the Working Group on Re-Evaluation of Biological Reference Points: $F_{0.1}$=0.17 , F_{max} = 0.31 and $F_{40\%}$ = 0.17 (NEFSC 2002). Non-parametric estimates of MSY and SSB_{MSY} were derived from mean recruitment (28.8 million age 1 fish), Y/R (0.141) and SSB/R (0.772) as:

F_{MSY} = 0.19
MSY = 4,059 mt
SSB_{MSY} = 22,243 mt.

The GARM III BRP Panel selected the non-parametric YPR analysis as the basis for the estimation of BRPs for American plaice. Stochastic projections out to 100 years with F_{MSY} = 0.19 and recruitment estimated from a cumulative distribution function of 29 recruitments from the 2008 VPA provided the following parametric biomass reference points:

MSY = 4,011 mt
SSB_{MSY} = 21,940 mt.

6.0. Projections

Short term, 2-year stochastic projections were performed to estimate landings and SSB during 2008-2009. The input values for mean catch and stock weights, PR, and maturity are the same as described above for the YPR analysis. Catch in 2008 was assumed equal to catch in 2007. The projections were run under three F scenarios : F_{07}, F_{MSY}=$F_{40\%}$, and $F_{REBUILD}$. Recruitment was projected from a cumulative distribution function of 29 recruitments from the 2008 VPA. The rebuilding plan for American plaice requires that the stock reach SSB_{MSY} by 2014. The $F_{REBUILD}$ was estimated in a separate medium term projection out to 2014 using the same input data as above.

Short term projections were run for the Base Model unadjusted for retrospective pattern and Base Model adjusted for retrospective pattern. The results for both models (Table H17) indicate that under all three F scenarios both landings and SSB are projected to increase in 2009.

7.0 Summary

The GARM review panel accepted the final model as the Base Model adjusted for retrospective pattern using the 7-year Mohn's rho estimate.

The Gulf of Maine –Georges Bank American plaice stock is not overfished and overfishing is not occurring (Fig. H19), as determined by the **rho-adjusted Base Model.** Commercial landings have been declining since 2001. Fishing mortality in 2007 was 0.09 the lowest in the time series. Biomass has been increasing since 2002 and at 11,106 mt is 50% of SSB_{MSY}. Research survey indices indicate that the stock is below the long term average biomass in recent years, however, the 2004 and 2005 year classes are near or above average.

Sources of uncertainty
1) Small mesh fishery discards not included in catch at age
2) Georges Bank landings are not as well sampled as Gulf of Maine landings

8.0 Panel Discussion / Comments

Conclusions

The Base VPA exhibited a moderate retrospective pattern which the Panel considered needed to be addressed. In contrast to many other GARM III stocks, a VPA using a split survey time series did not reduce the retrospective pattern and appeared to make it worse.

Given that the retrospective pattern could not be adjusted by a split in the survey time series, the Panel agreed with the GARM III 'BRP' review that an adjustment to the terminal year's population numbers was required. Panel accepted the VPA with the Rho Adjustment to the 2007 population numbers as Final and the best available estimate of stock status and a sufficient basis for management advice. It agreed with the GARM III 'BRP' review which concluded that short term stock projections should be based on the adjusted terminal estimates from the Final run. It should be noted that while the adjustment reduced the retrospective pattern, it did not eliminate it, nor does the adjustment account for other sources of uncertainty in the terminal estimates of F and SSB.

A number of technical issues were encountered as to the appropriate method in which to undertake stock and rebuilding projections when there is a Rho Adjustment to the terminal year estimates of F and SSB. The approach used here was considered a pragmatic solution to the complicated issue of an accounting for retrospective pattern. This issue required further examination.

In particular, the use of age-specific Rho adjustments for stock numbers at start of 2007 gives an SSB estimate in 2007 of 10,873 mt. This is slightly different (~2%) than the SSB estimate obtained by applying the scalar adjustment for SSB based on a the average Rho (11,106 mt). These differences are considered minor but result in two different estimates of SSB in 2007. Average Rho adjusted SSB and F were used to derive stock status in 2007. Projections for 2008 and 2009 however, are based on the age-specific Rho-adjusted population estimates at the start of 2008.

The Panel noted that the BRPs and stock projections were consistent with the GARM III 'BRP' review.

Research Recommendations

Further analytical work is required to better characterize the uncertainties in stock size, projections, and rebuilding plans when using the Rho Adjustment to address retrospective pattern.

9.0 References

Ashton WD. The logit transformation with special reference to its uses in bioassay. 88. 72. London, UK. Griffin and Co.

Collette BB, Klein-MacPhee G (eds). 2002. Bigelow and Schroeder's Fishes of the Gulf of Maine. Smithsonian Institution Press. Washington, D.C.

Conser RJ, Powers JE. 1990. Extensions of the ADAPT VPA tuning method designed to facilitate assessment work on tuna and swordfish stocks. Int Comm Conserv Atl Tunas Coll Vol Sci. Pap. 32; p 461-467.

Efron B. 1982. The jackknife, the bootstrap and other resampling plans. Phila Soc Ind and Appl Math. 34; 92 p.

Gavaris S. 1988. An adaptive framework for the estimation of population size. CAFSAC Res Doc 88/29; 12 p.

NEFSC 2002. 2002. Final Report of the Working Group on Re-Evaluation of Biological Reference Points for New England Groundfish. NEFSC Ref Doc. 02-04; 254 p.O'Brien L, Burnett J, Col L. 2005. H. Gulf of Maine - Georges Bank American Plaice in: Assessment of 19 Northeast groundfish stocks through 2004. 2005 Groundfish Assessment Review Meeting (GARM) Woods Hole, MA. 2005. August 15-19. NEFSC Ref Doc. 05-13; 508 p.

O'Brien L, Burnett J, Mayo RK. 1993. Maturation of nineteen species of finfish off the northeast coast of the United States, 1985-1990. NOAA Tech Rep. 11; 66 p

O'Brien L, Esteves C. 2001. Update Assessment of American plaice in the Gulf of Maine - Georges Bank Region for 2000. NEFSC Ref Doc. 01-02; 114 p.

Palmer M, O'Brien L, Wigley S, Mayo R, Rago P, Hendrickson L. 2008. A brief overview of discard estimation methods where observer coverage is unavailable. Working Paper 4.5. GARM III Biological Reference Point Meeting. Woods Hole, MA 2008. April 28- 2 May 2

Parrack ML. 1986. A method of analyzing catches and abundance indices from a fishery. Int Comm Conserv Atl Tunas Coll Vol Sci Pap. 24; p 209-221.

Thompson WF, Bell FH. 1934. Biological statistics of the Pacific halibut fishery. (2) effect of changes in intensity upon total yield and yield per unit of gear. Rep Inter Fish Comm. 8; 49 p.

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, 1960-2007 (NAFO Div. 5Y, 5Z and 6).

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	3866	-	3866	1839	-	-	-	1839	11	-	-	11	4	-	4	5720	-	5720
1994	3545	-	3545	1387	30	-	-	1417	29	-	-	29	8	-	8	4969	30	4999
1995	3125	-	3125	1437	2	-	-	1439	34	-	-	34	8	-	8	4604	2	4606
1996	3014	-	3014	1309	2	-	-	1311	31	-	-	31	4	-	4	4358	2	4360
1997	2305	-	2305	1544	65	-	-	1609	37	-	-	37	1	-	1	3887	65	3952
1998	2287	-	2287	1312	20	-	-	1332	20	-	-	20	4	-	4	3623	20	3643
1999	1629	-	1629	1444	123	-	-	1567	23	-	-	23	4	-	4	3100	123	3223
2000	2590	-	2590	1571	143	-	-	1714	22	-	-	22	9	-	9	4192	143	4335
2001	2718	-	2718	1610	50	-	-	1660	44	-	-	44	2	-	2	4374	50	4424
2002	2003	-	2003	1355	98	-	-	1453	15	-	-	15	5	-	5	3378	98	3476
2003	1517	0.23	1517	873	114	-	-	987	29	-	-	29	3	-	3	2422	115	2537
2004	1014	0.17	1014	622	6	-	-	628	28	-	-	28	4	-	4	1668	6	1674
2005	733	0.56	734	537	9	-	-	546	13	-	-	13	2	-	2	1285	9	1294
2006	577	0.04	577	481	20	-	-	501	17	-	-	17	1	-	1	1076	20	1096
2007	607	0.1	607	366	3	-	-	369	6	-	-	6	6	-	6	985	3	988

Table H2. Percentage of landings of American plaice by gear type, 1980-2007.

	GEAR TYPE					
Year	Otter Trawl	Shrimp Trawl	Sink Gill Net	Scottish Seine	Danish Seine	Other
1980	96.8	0.7	0.8	0.0	1.5	0.3
1981	96.5	2.2	0.7	0.0	0.5	0.1
1982	96.3	2.0	0.8	0.5	0.3	0.1
1983	96.3	1.7	0.3	1.1	0.3	0.3
1984	97.2	1.0	0.2	0.6	0.6	0.4
1985	96.9	1.6	0.1	0.5	0.8	0.1
1986	96.1	2.5	0.3	0.3	0.7	0.1
1987	95.5	2.6	0.6	0.4	0.9	0.2
1988	96.2	1.7	0.6	0.4	1.0	0.2
1989	95.5	1.4	1.2	0.9	1.0	0.1
1990	93.4	2.2	2.0	0.9	1.2	0.4
1991	94.8	0.9	0.9	1.2	0.9	1.2
1992	96.1	1.3	0.1	0.9	0.2	1.4
1993	95.9	1.2	0.1	0.0	0.3	2.5
1994	97.2	0.1	1.1	0.2	0.0	1.4
1995	93.0	0.7	4.0	0.7	0.0	1.6
1996	94.6	0.1	3.2	0.7	0.0	1.4
1997	93.8	0.2	2.9	0.7	0.0	2.4
1998	91.4	2.0	3.5	0.9	0.0	2.2
1999	93.7	1.8	2.0	0.4	0.0	2.1
2000	96.7	1.4	1.0	0.3	0.0	0.6
2001	98.2	0.5	1.0	0.1	0.0	0.2
2002	98.3	0.0	0.6	0.1	0.0	0.9
2003	96.7	0.2	0.9	0.1	0.0	2.1
2004	95.4	0.0	1.0	0.1	0.0	3.5
2005	91.8	0.0	2.2	0.0	0.0	6.0
2006	94.8	0.0	1.4	0.0	0.0	3.8
2007	97.5	0.5	1.4	0.0	0.0	0.6

Table H3. Landings by market category (Sm = small + peewee; Md=medium; Lg=large+jumbo; Un=unclassified) for statistical areas 511-515, 521-522, 525-526, 561-562 for American plaice, 1980-2007.

	Quarter 1				Quarter 2				Quarter 3				Quarter 4				Total			
YEAR	Sm	Md	Lg	Un	Sm	Md	Lg	Un	Sm	Md	Lg	Un	Sm	Md	Lg	Un	Sm	Md	Lg	Un
1980	565	0	1527	3	1398	0	3667	100	1026	0	2399	16	479	0	1488	1	3468	0	9081	120
1981	730	0	1775	26	1233	0	3557	253	993	0	2209	34	457	0	1532	2	3413	0	9073	315
1982	581	0	1468	11	1353	5	4350	318	1191	524	2643	131	571	299	1570	40	3696	827	10031	500
1983	580	356	1624	5	1488	713	3148	57	1027	497	1816	18	399	276	1090	3	3494	1843	7678	83
1984	431	247	1071	10	954	649	2355	27	812	479	1444	19	372	309	909	13	2568	1684	5779	70
1985	512	253	708	14	709	511	1548	22	503	369	1046	13	239	188	521	9	1963	1321	3823	59
1986	187	132	409	13	539	350	1014	33	342	201	536	11	202	146	349	6	1269	829	2308	63
1987	169	108	304	20	460	275	744	43	367	203	475	20	199	126	246	35	1195	711	1768	117
1988	203	94	279	39	447	244	529	75	433	186	303	47	155	88	143	36	1238	612	1254	197
1989	117	76	158	25	300	208	423	68	222	126	222	29	139	81	135	21	778	491	938	142
1990	101	66	142	19	269	194	317	49	323	196	273	20	190	118	146	19	883	573	879	107
1991	138	78	116	20	594	347	367	61	773	378	353	40	435	263	241	41	1939	1066	1077	162
1992	302	174	291	35	902	634	805	112	887	624	674	80	426	278	394	17	2517	1710	2164	244
1993	277	183	413	17	706	516	868	81	589	371	602	27	423	232	401	14	1995	1302	2284	139
1994	236	120	243	22	660	434	702	15	653	386	492	8	435	216	343	6	1984	1155	1780	50
1995	212	116	196	9	806	422	579	28	793	286	323	9	433	175	212	4	2245	998	1310	50
1996	236	105	173	4	804	340	431	22	910	240	250	10	490	158	182	3	2439	844	1036	40
1997	321	98	157	2	692	389	359	56	538	399	238	15	314	172	133	2	1866	1059	887	75
1998	172	145	150	2	635	475	388	28	401	333	261	3	219	176	229	6	1427	1130	1029	38
1999	160	161	221	4	392	328	365	13	349	231	239	2	260	177	197	3	1161	897	1021	21
2000	182	179	221	1	426	388	371	14	655	388	325	8	395	307	321	10	1658	1263	1238	33
2001	236	218	328	17	525	429	437	21	586	356	320	4	369	248	276	3	1717	1251	1361	45
2002	308	232	300	2	341	269	259	18	508	241	215	3	312	184	183	2	1470	927	956	24
2003	209	136	175	2	246	209	151	11	389	216	151	3	223	158	143	0	1068	718	620	16
2004	155	89	107	3	147	101	94	4	292	181	114	1	170	112	97	0	764	483	412	9
2005	139	86	94	2	134	100	69	3	192	84	66	7	156	80	73	1	622	350	302	13
2006	134	70	81	1	92	85	57	6	135	82	67	1	129	55	78	2	491	292	282	10
2007	99	40	54	2	114	58	43	9	205	64	43	3	137	56	55	2	555	219	195	16

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), 1985-2007. 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			
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	49	55	116
1986 GB	3	6	5	3	2	4	3	2	1	4	3	2			
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	33	35	56
1987 GB	4	5	5	1	---	2	3	2	2	4	4	1			
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	39	40	63
1988 GB	3	7	4	2	1	3	4	2	4	5	2	4			
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	34	21	40
1989 GB	2	5	5	---	1	1	6	1	5	3	3	---			
GM	1	3	3	3	1	---	4	3	2	1	---	1			
total	3	8	8	3	2	1	10	4	7	4	3	1	35	29	63
1990 GB	---	5	6	---	2	1	2	2	---	2	5	---			
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	33	26	42
1991 GB	---	3	1	---	3	1	1	---	3	3	2	---			
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	78	67	67
1992 GB	---	4	1	---	---	1	1	---	---	2	2	1			
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	168	143	155
1993 GB	---	2	1	1	---	1	---	---	---	3	2	1			
GM	2	4	4	1	---	2	2	---	---	1	2	---			
total	2	6	5	2	0	3	2	0	0	4	4	1	133	260	254
1994 GB	---	---	---	---	---	---	1	1	---	1	---	1			
GM	---	2	5	3	---	4	3	3	---	2	3	3			
total	0	2	5	3	0	4	4	4	0	3	3	4	198	96	178
1995 GB	1	---	---	---	1	---	---	---	1	---	---	---			
GM	1	3	---	2	---	2	---	---	---	2	---	1			
total	2	3	0	2	1	2	0	0	1	2	0	1	321	333	328
1996 GB	---	2	2	1	---	1	4	---	---	2	1	1			
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	188	53	74
1997 GB	2	4	2	3	---	2	3	1	---	2	---	---			
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	81	76	68
1998 GB	1	4	1	---	2	1	1	1	1	1	1	1			
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	110	40	86

Table H4 continued . Sampling of commercial American plaice landings, by market category, for the Gulf of Maine and Georges Bank areas (NAFO Division 5Y and 5Z), 1985-2007. 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	---			
	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	31	29	60
	GB	14	11	3	1	1	2	---	1	2	2	2	2			
2000	GM	15	29	4	1	2	6	3	---	---	4	1	3			
	total	29	40	7	2	3	8	3	1	2	6	3	5	21	84	77
	GB	4	2	1	2	---	2	2	4	---	3	2	1			
2001	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	75	70	80
	GB	1	2	2	1	2	1	2	---	4	3	2	---			
2002	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	92	84	53
	GB	1	3	---	---	2	---	---	---	---	3	2	---			
2003	GM	2	8	6	5	1	6	6	5	6	7	11	7			
	total	3	11	6	5	3	6	6	5	6	10	13	7	43	36	17
	GB	1	1	1	4	3	---	2	4	1	---	3	1			
2004	GM	5	4	7	2	2	6	4	3	12	12	2	8			
	total	6	5	8	6	5	6	6	7	13	12	5	9	31	20	11
	GB	3	2	2	3	1	3	---	2	7	2	2	4			
2005	GM	2	5	6	4	4	1	6	2	6	6	3	2			
	total	5	7	8	7	5	7	6	4	13	8	5	6	23	16	9
	GB	2	2	---	2	3	2	1	1	4	5	2	2			
2006	GM	3	3	9	2	3	3	2	4	2	4	4	3			
	total	5	5	9	4	6	5	3	5	6	9	6	5	21	15	11
	GB	3	3	2	2	2	1	3	---	3	3	1	1			
2007	GM	4	4	6	1	3	2	3	2	5	1	6	4			
	total	7	7	8	3	5	3	6	2	8	4	7	5	22	14	8

Table H5. Discards of American plaice in Gulf of Maine and Georges Bank large mesh otter trawl and Gulf of Maine shrimp trawl fisheries, coefficient of variance (cv) of mean, and number of trips. Estimated with the SBRM method, 1989-2007.

	GM large mesh trawl			GB large mesh trawl			Shrimp			Total		
Year	mt	cv	# trips	mt	cv	# trips	mt	cv	# trips	mt	cv	# trips
1989	617.0	0.31	52	111.7	0.60	36	387.0	0.22	40	1115.7	0.20	128
1990	796.9	0.65	35	68.8	0.69	25	570.0	0.18	31	1435.6	0.37	91
1991	1367.5	0.37	48	199.8	0.63	28	232.5	0.13	52	1799.9	0.29	128
1992	438.0	0.26	52	57.6	0.52	29	124.4	0.19	82	620.0	0.19	163
1993	264.4	0.52	22	102.0	0.61	25	31.3	0.19	82	397.7	0.38	129
1994	546.9	0.91	10	44.6	0.24	31	33.8	0.22	87	625.3	0.80	128
1995	381.3	0.44	30	355.3	0.35	41	110.6	0.18	82	847.2	0.25	153
1996	208.2	0.35	14	120.1	0.85	19	142.2	0.28	35	470.5	0.28	68
1997	407.1	0.57	7	230.1	0.47	27	44.8	0.21	16	681.9	0.37	50
1998	634.6	0.77	10	77.0	0.00	9	*28.7* *			711.7	0.69	19
1999	584.5	0.38	41	97.2	0.31	26	*26.0* *			681.7	0.33	67
2000	58.5	0.37	79	159.6	0.33	20	*32.9* *			218.1	0.26	99
2001	198.0	0.39	113	148.4	0.17	33	*29.5* *			353.7	0.23	152
2002	182.1	0.48	149	103.3	0.24	68	*3.0* *			285.4	0.32	217
2003	193.4	0.14	253	50.0	0.21	147	22.0	0.27	30	265.4	0.11	430
2004	269.8	0.30	258	73.8	0.16	209	6.1	0.32	12	349.7	0.23	479
2005	208.3	0.15	498	55.2	0.11	702	8.0	0.19	17	271.6	0.12	1217
2006	114.1	0.43	206	122.1	0.13	363	6.6	0.23	26	242.8	0.21	595
2007	70.3	0.14	224	154.6	0.14	370	12.9	0.29	14	237.9	0.10	608

* as estimated by direct method (O'Brien and Esteves 2001, O'Brien et al. 2005), not included in total mt or # trips

Table H6. Landings at age (thousands of fish; metric tons), mean weight (kg), and mean length (cm) at age of American plaice commercial landings from Gulf of Maine - Georges Bank,1980-2007.

Year	1	2	3	4	5	6	7	8	9	10	11+	Total
						Landings in Numbers (000's) at Age						
1980	0	0	22	770	3129	3903	3629	1185	1139	850	1380	16007
1981	0	587	1332	4331	5100	3618	2381	1573	645	440	621	20628
1982	0	113	2134	3495	4295	3481	3293	2038	1256	737	717	21558
1983	0	1	438	3735	4270	3809	2252	1271	697	450	911	17834
1984	0	3	253	1298	4819	2865	1913	577	274	307	769	13078
1985	0	0	60	786	2066	2787	2213	1081	438	267	182	9881
1986	0	1	198	1082	1502	1462	1307	631	255	105	100	6644
1987	0	15	343	486	1703	1271	891	541	187	62	60	5557
1988	0	1	446	1148	1456	1427	543	270	177	88	55	5612
1989	0	0	76	451	686	504	749	469	193	103	116	3346
1990	0	0	202	846	1049	500	290	349	193	96	161	3686
1991	0	0	23	1850	2818	1105	319	164	201	97	104	6682
1992	0	0	46	739	4871	2563	812	191	131	118	93	9564
1993	0	0	123	1029	2037	2452	1382	265	287	151	125	7851
1994	0	23	196	896	1866	1262	1155	597	234	150	290	6670
1995	0	0	140	711	2854	1729	641	577	210	53	50	6964
1996	0	100	173	2493	2375	1400	529	239	124	35	63	7532
1997	0	0	2	1259	2582	1539	612	182	85	66	116	6443
1998	0	0	6	174	1493	1889	997	317	59	57	154	5147
1999	0	0	2	224	986	1663	1157	442	147	42	79	4741
2000	0	0	113	417	1430	2118	1713	566	138	70	20	6584
2001	0	0	0	391	1901	1991	1514	894	287	56	46	7080
2002	0	0	3	328	1072	1664	1155	500	273	157	176	5328
2003	0	0	0	129	782	1098	714	523	267	153	109	3775
2004	0	0	7	123	457	837	437	350	190	76	73	2550
2005	0	0	3	188	582	574	385	167	96	42	48	2085
2006	0	0	2	168	492	402	294	177	97	55	43	1729
2007	0	0	20	255	586	421	202	109	68	31	31	1722
						Landings at Age (mt)						Total
1980	0	0	6	271	1387	2562	3008	1232	1347	1168	2616	13597
1981	0	78	276	1485	2318	2832	2122	1545	729	552	963	12898
1982	0	23	620	1166	1845	2007	3164	2320	1502	1144	1364	15153
1983	0	0	149	1720	2484	2596	1864	1326	867	650	1531	13187
1984	0	1	84	549	2913	1957	1713	688	310	421	1506	10142
1985	0	0	13	212	747	1516	1884	1263	603	445	387	7070
1986	0	0	53	349	616	864	1101	741	380	183	219	4506
1987	0	3	97	187	809	797	797	636	278	107	137	3849
1988	0	0	126	413	689	922	484	333	247	151	124	3490
1989	0	0	26	177	335	295	553	403	257	150	224	2421
1990	0	0	78	355	547	330	240	338	210	125	273	2496
1991	0	0	8	839	1532	790	307	191	256	150	189	4261
1992	0	0	22	314	2623	1895	774	237	173	193	188	6418
1993	0	0	51	463	1055	1591	1306	327	400	238	289	5720
1994	0	3	47	383	989	792	920	646	302	213	704	4999
1995	0	0	50	298	1468	1131	526	647	280	111	95	4606
1996	0	17	59	1008	1225	910	486	288	171	55	142	4360
1997	0	0	0	535	1229	979	504	205	114	104	282	3952
1998	0	0	2	69	653	1097	823	328	80	83	509	3643
1999	0	0	0	98	483	987	871	409	164	61	151	3223
2000	0	0	46	173	702	1234	1322	570	151	99	37	4335
2001	0	0	0	173	872	1082	1078	755	304	82	77	4424
2002	0	0	1	133	495	870	785	451	292	196	254	3476
2003	0	0	0	52	348	618	498	447	261	169	144	2537
2004	0	0	2	55	217	468	303	277	187	77	88	1674
2005	0	0	1	78	281	325	265	146	91	45	61	1294
2006	0	0	1	72	237	235	199	150	90	57	55	1096
2007	0	0	8	103	276	233	133	91	67	33	46	988

Table H6 continued. Landings at age (thousands of fish; metric tons), mean weight (kg), and mean length (cm) at age of commercial landings of American plaice from Gulf of Maine - Georges Bank, 1980-2007.

Year	1	2	3	4	5	6	7	8	9	10	11+	
						Mean Weight at age (kg)						Average
1980	0.000	0.000	0.285	0.352	0.443	0.656	0.829	1.039	1.183	1.374	1.895	0.849
1981	0.000	0.133	0.207	0.343	0.454	0.783	0.891	0.982	1.130	1.254	1.551	0.625
1982	0.000	0.200	0.291	0.334	0.429	0.577	0.961	1.138	1.196	1.552	1.901	0.703
1983	0.000	0.184	0.341	0.460	0.582	0.682	0.828	1.043	1.244	1.446	1.680	0.740
1984	0.000	0.180	0.331	0.423	0.605	0.683	0.895	1.192	1.133	1.369	1.958	0.775
1985	0.000	0.000	0.221	0.270	0.362	0.544	0.852	1.167	1.377	1.665	2.128	0.716
1986	0.000	0.191	0.267	0.322	0.410	0.591	0.842	1.174	1.491	1.747	2.194	0.678
1987	0.000	0.201	0.284	0.386	0.475	0.627	0.895	1.177	1.483	1.732	2.284	0.693
1988	0.000	0.151	0.282	0.360	0.473	0.646	0.893	1.231	1.396	1.717	2.238	0.622
1989	0.000	0.000	0.339	0.393	0.489	0.586	0.739	0.858	1.334	1.463	1.940	0.724
1990	0.000	0.000	0.384	0.420	0.522	0.660	0.826	0.968	1.089	1.305	1.696	0.677
1991	0.000	0.000	0.333	0.453	0.543	0.715	0.963	1.161	1.276	1.541	1.813	0.638
1992	0.000	0.000	0.473	0.424	0.538	0.739	0.953	1.240	1.319	1.640	2.007	0.671
1993	0.000	0.000	0.416	0.451	0.518	0.649	0.945	1.234	1.394	1.577	2.313	0.729
1994	0.000	0.138	0.239	0.427	0.530	0.627	0.796	1.083	1.289	1.424	2.424	0.749
1995	0.000	0.000	0.359	0.420	0.517	0.685	0.914	1.168	1.099	2.105	1.921	0.676
1996	0.000	0.166	0.339	0.404	0.516	0.650	0.919	1.202	1.383	1.565	2.242	0.579
1997	0.000	0.000	0.214	0.424	0.476	0.636	0.822	1.127	1.336	1.570	2.425	0.613
1998	0.000	0.000	0.343	0.395	0.437	0.581	0.826	1.031	1.350	1.463	3.293	0.708
1999	0.000	0.000	0.255	0.437	0.490	0.593	0.753	0.925	1.113	1.462	1.908	0.680
2000	0.000	0.000	0.409	0.416	0.491	0.583	0.772	1.008	1.094	1.411	1.864	0.658
2001	0.000	0.000	0.000	0.443	0.459	0.543	0.712	0.845	1.059	1.455	1.684	0.625
2002	0.000	0.000	0.295	0.407	0.462	0.523	0.679	0.901	1.067	1.246	1.443	0.652
2003	0.000	0.000	0.000	0.402	0.445	0.563	0.697	0.855	0.976	1.105	1.322	0.672
2004	0.000	0.000	0.339	0.447	0.474	0.559	0.692	0.793	0.980	1.015	1.211	0.656
2005	0.000	0.000	0.432	0.414	0.483	0.566	0.688	0.876	0.947	1.074	1.277	0.621
2006	0.000	0.000	0.326	0.431	0.482	0.585	0.677	0.850	0.923	1.028	1.301	0.634
2007	0.000	0.000	0.383	0.403	0.471	0.552	0.658	0.836	0.985	1.085	1.512	0.574
						Mean Length at age (cm)						Average
1980	0	0.0	32.6	34.7	37.1	41.7	44.8	47.9	49.9	52.2	30.2	41.8
1981	0	25.8	28.8	34.0	36.9	43.3	45.2	46.7	48.8	50.3	34.7	38.9
1982	0	29.0	32.4	33.7	36.4	39.5	46.3	48.8	49.9	53.9	30.1	39.9
1983	0	28.7	34.2	37.2	39.8	41.9	44.2	47.5	50.2	52.9	32.7	41.0
1984	0	28.5	33.9	36.3	40.3	41.8	45.3	49.9	49.3	52.2	30.1	41.1
1985	0	0.0	30.0	31.9	34.6	39.1	45.0	49.6	52.0	55.2	27.9	40.8
1986	0	29.0	31.9	33.6	36.0	40.1	44.6	49.5	53.3	56.0	27.3	40.2
1987	0	29.4	32.5	35.5	37.8	41.0	45.6	49.5	53.3	55.8	26.5	41.0
1988	0	27.0	32.4	34.8	37.6	41.4	45.6	50.4	52.3	55.7	26.9	39.6
1989	0	0.0	34.3	35.8	38.2	40.2	43.0	44.6	51.5	52.9	29.7	41.0
1990	0	0.0	35.6	36.5	38.9	41.6	44.5	46.7	48.3	51.1	32.6	40.3
1991	0	0.0	34.2	37.4	39.4	42.6	46.6	49.3	50.6	53.9	31.1	40.4
1992	0	0.0	38.0	36.7	39.2	43.1	46.4	50.5	51.4	54.9	29.0	41.2
1993	0	0.0	36.5	37.3	38.8	41.4	46.6	50.5	52.4	54.4	26.1	41.7
1994	0	26.2	30.4	36.7	39.2	41.2	44.2	48.6	51.2	52.6	25.3	40.8
1995	0	0.0	35.0	36.6	38.8	41.6	44.6	49.0	51.7	59.4	30.0	41.1
1996	0	27.7	34.1	36.2	38.8	41.4	46.1	50.0	52.1	54.3	26.9	39.2
1997	0	0.0	30.0	36.7	37.9	41.3	44.5	49.0	51.7	54.2	25.2	39.5
1998	0	0.0	34.5	35.9	37.0	40.1	44.7	47.8	51.8	53.0	20.4	40.1
1999	0	0.0	31.6	36.9	38.2	40.4	43.4	46.2	48.9	52.9	30.0	41.2
2000	0	0.0	36.4	36.4	38.2	40.1	43.5	47.2	48.6	52.5	30.6	41.2
2001	0	0.0	0.0	37.1	37.5	39.3	42.6	44.7	47.8	53.1	32.8	40.5
2002	0	0.0	33.0	36.3	37.6	39.0	42.1	45.9	48.3	50.6	36.6	40.6
2003	0	0.0		36.1	37.2	39.8	42.4	45.1	46.7	48.4	38.6	41.2
2004	0	0.0	34.4	37.3	37.9	39.7	42.2	43.8	46.7	47.3	40.9	41.0
2005	0	0.0	37.0	36.4	38.1	39.8	42.1	45.4	46.3	48.0	39.8	40.4
2006	0	0.0	34.0	36.9	38.1	40.2	42.0	44.9	45.9	47.5	39.3	40.6
2007	0	0.0	35.7	36.1	37.8	39.5	41.6	44.6	46.6	48.3	35.5	39.3

Table H7. Discards at age (thousands of fish; metric tons) and mean weight (kg) at age of American plaice discarded in the **northern shrimp fishery** in the Gulf of Maine region , 1980-2007.

Year	0	1	2	3	4	5	6	7	8	9	10	11+	
						Discards in Numbers (000's) at Age							Total
1980	0.0	0.0	0.0	114.0	115.1	28.7	0.0	0.0	0.0	0.0	0.0	0.0	257.8
1981	0.0	0.9	147.8	364.4	287.2	79.6	0.4	0.0	2.9	0.0	0.0	0.0	883.2
1982	0.0	6.9	154.7	545.6	632.7	105.9	95.7	4.2	0.0	0.0	0.0	0.0	1545.7
1983	0.2	14.0	614.3	641.0	760.7	319.9	51.0	5.9	0.0	0.7	0.0	0.0	2407.8
1984	0.0	2.5	302.0	488.3	575.1	494.6	98.1	5.9	2.8	0.0	0.0	0.0	1969.3
1985	0.0	53.9	103.2	930.9	464.9	307.8	79.0	14.8	0.0	0.0	0.0	0.0	1954.6
1986	0.2	53.7	552.0	399.9	933.5	131.9	9.9	0.0	0.1	0.0	0.0	0.0	2081.2
1987	0.0	31.4	439.1	1107.6	609.5	338.4	12.8	0.7	0.0	0.0	0.0	0.0	2539.6
1988	0.0	283.1	587.4	786.4	408.4	90.8	11.8	10.1	0.0	0.0	0.0	0.0	2178.0
1989	0.0	14.8	1597.5	1396.5	736.7	227.6	100.6	22.6	6.6	0.1	0.0	0.0	4103.0
1990	0.0	0.0	957.5	3138.2	1053.8	221.7	35.2	14.3	11.4	0.1	0.0	0.0	5432.1
1991	0.0	0.4	225.3	609.6	670.8	143.9	6.8	0.1	0.0	0.0	0.0	0.0	1657.0
1992	0.0	9.6	242.1	649.4	213.5	88.0	2.9	3.9	0.0	0.0	0.0	0.0	1209.3
1993	0.0	21.8	278.7	125.2	36.1	8.7	2.5	0.1	0.0	0.0	0.0	0.0	473.0
1994	0.7	58.2	860.2	99.1	22.6	6.5	2.1	1.7	0.2	0.2	0.0	0.0	1051.4
1995	1.1	42.7	2101.7	576.8	49.8	13.6	3.3	0.3	0.2	0.0	0.0	0.0	2789.6
1996	0.0	12.5	788.3	545.8	511.3	85.6	23.7	8.4	0.0	0.0	0.0	0.0	1975.6
1997	0.0	14.7	627.0	128.0	120.5	55.3	8.5	0.3	0.0	0.0	0.0	0.0	954.3
1998	0.0	37.2	61.3	127.0	78.3	48.7	7.3	1.3	0.0	0.0	0.0	0.0	361.3
1999	0.0	4.2	200.0	73.6	79.0	41.5	26.0	6.8	0.6	0.0	0.0	0.0	431.6
2000	0.0	2.7	292.0	191.9	57.6	36.6	11.3	6.4	0.2	0.0	0.0	0.0	598.8
2001	0.0	0.0	84.7	274.1	82.9	39.2	11.8	5.0	0.5	0.1	0.0	0.0	498.2
2002	0.0	0.7	3.2	16.0	16.1	3.6	0.9	0.2	0.1	0.0	0.0	0.0	40.9
2003	0.0	10.2	666.6	11.7	11.5	5.4	1.1	0.0	0.6	0.0	0.4	1.0	708.8
2004	0.0	4.6	111.8	37.0	6.7	1.7	1.5	0.5	0.2	0.2	0.1	0.1	164.3
2005	0.0	33.8	269.6	33.9	3.6	0.9	0.1	0.3	0.0	0.0	0.0	0.5	342.7
2006	0.0	24.9	55.4	18.2	6.1	2.7	1.3	0.5	0.4	0.5	0.2	0.3	110.6
2007	0.0	159.1	210.2	35.0	9.0	3.8	0.8	0.3	0.1	0.0	0.0	0.0	418.3
						Discards at age (mt)							Total
1980	0.0	0.0	0.0	11.9	19.6	6.0	0.0	0.0	0.0	0.0	0.0	0.0	37.5
1981	0.0	0.0	5.9	31.9	43.4	15.2	0.1	0.0	0.7	0.0	0.0	0.0	97.3
1982	0.0	0.1	4.6	49.4	87.9	20.9	17.2	1.0	0.0	0.0	0.0	0.0	181.1
1983	0.0	0.2	18.0	58.3	103.4	53.4	9.8	1.1	0.0	0.2	0.0	0.0	244.3
1984	0.0	0.0	9.5	35.4	73.2	73.2	17.5	1.2	0.7	0.0	0.0	0.0	210.6
1985	0.0	0.8	4.4	63.2	56.2	44.4	16.7	2.9	0.0	0.0	0.0	0.0	188.6
1986	0.0	0.7	20.5	31.2	129.5	24.1	2.0	0.0	0.0	0.0	0.0	0.0	208.1
1987	0.0	0.3	12.7	83.0	80.3	66.1	3.2	0.2	0.0	0.0	0.0	0.0	245.8
1988	0.0	4.4	22.4	66.6	54.6	15.9	3.0	2.1	0.0	0.0	0.0	0.0	168.9
1989	0.0	0.1	51.4	123.8	132.2	51.5	20.4	5.2	2.3	0.0	0.0	0.0	386.8
1990	0.0	0.0	38.3	290.2	171.2	53.6	9.6	3.9	3.0	0.0	0.0	0.0	569.8
1991	0.0	0.0	5.9	54.7	128.4	40.7	2.7	0.1	0.0	0.0	0.0	0.0	232.5
1992	0.0	0.1	7.9	52.1	38.6	23.1	1.3	1.3	0.0	0.0	0.0	0.0	124.4
1993	0.0	0.1	8.6	12.6	6.8	2.2	1.0	0.0	0.0	0.0	0.0	0.0	31.3
1994	0.0	0.3	19.4	8.2	3.4	1.3	0.3	0.2	0.2	0.3	0.0	0.0	33.7
1995	0.0	0.3	53.2	42.5	9.4	3.8	1.2	0.1	0.1	0.0	0.0	0.0	110.5
1996	0.0	0.0	18.1	30.4	62.4	21.1	7.2	2.1	0.0	0.0	0.0	0.0	141.4
1997	0.0	0.1	12.3	8.4	12.9	9.3	1.6	0.1	0.0	0.0	0.0	0.0	44.8
1998	0.0	0.5	1.7	7.8	8.3	8.2	1.8	0.3	0.0	0.0	0.0	0.0	28.7
1999	0.0	0.0	3.4	3.2	7.9	5.1	4.4	1.8	0.2	0.0	0.0	0.0	26.0
2000	0.0	0.0	5.2	11.4	6.5	5.6	2.5	1.5	0.1	0.0	0.0	0.0	32.9
2001	0.0	0.0	1.5	10.9	8.6	5.1	2.0	1.2	0.2	0.0	0.0	0.0	29.5
2002	0.0	0.0	0.1	0.7	1.4	0.6	0.2	0.0	0.0	0.0	0.0	0.0	3.0
2003	0.0	0.3	15.8	0.9	1.2	0.8	0.2	0.0	0.1	0.0	0.8	1.8	21.8
2004	0.0	0.0	2.0	1.9	0.8	0.4	0.5	0.2	0.1	0.2	0.1	0.1	6.2
2005	0.0	0.3	4.6	1.7	0.4	0.1	0.0	0.1	0.0	0.0	0.0	0.8	8.0
2006	0.0	0.3	1.6	1.2	0.8	0.6	0.4	0.1	0.4	0.5	0.3	0.4	6.6
2007	0.0	1.2	6.0	2.8	1.5	0.9	0.3	0.1	0.0	0.0	0.0	0.0	12.8

Table H7 continued. Discards at age (thousands of fish; metric tons) and mean weight (kg) at age of American plaice discarded in the northern shrimp fishery in the Gulf of Maine region , 1980-2007.

Year	0	1	2	3	4	5	6	7	8	9	10	11+	
						Mean weight at age (kg)							Average
1980	0.000	0.000	0.000	0.104	0.170	0.210	0.359	0.000	0.000	0.000	0.000	0.000	0.145
1981	0.000	0.007	0.040	0.087	0.151	0.192	0.320	0.000	0.239	0.000	0.000	0.000	0.110
1982	0.000	0.014	0.030	0.091	0.139	0.197	0.180	0.239	0.000	0.000	0.000	0.000	0.117
1983	0.002	0.013	0.029	0.091	0.136	0.167	0.193	0.177	0.359	0.295	0.000	0.000	0.101
1984	0.000	0.004	0.032	0.072	0.127	0.148	0.178	0.198	0.239	0.000	0.000	0.000	0.107
1985	0.000	0.015	0.043	0.068	0.121	0.144	0.211	0.196	0.000	0.000	0.000	0.000	0.096
1986	0.001	0.014	0.037	0.078	0.139	0.183	0.204	0.000	0.359	0.000	0.000	0.000	0.100
1987	0.000	0.011	0.029	0.075	0.132	0.195	0.247	0.307	0.000	0.000	0.000	0.000	0.097
1988	0.000	0.016	0.038	0.085	0.134	0.175	0.253	0.209	0.000	0.000	0.000	0.000	0.078
1989	0.000	0.009	0.032	0.089	0.179	0.226	0.203	0.228	0.348	0.432	0.000	0.000	0.094
1990	0.000	0.000	0.040	0.092	0.162	0.242	0.272	0.275	0.261	0.472	0.000	0.000	0.105
1991	0.000	0.004	0.026	0.090	0.191	0.283	0.391	0.701	0.000	0.515	0.000	0.000	0.140
1992	0.000	0.006	0.032	0.080	0.181	0.263	0.443	0.323	0.000	0.962	0.000	0.000	0.103
1993	0.000	0.003	0.031	0.101	0.188	0.255	0.412	0.670	0.000	0.000	0.000	0.000	0.066
1994	0.001	0.004	0.023	0.083	0.152	0.207	0.151	0.133	1.349	1.349	0.000	0.000	0.032
1995	0.001	0.006	0.025	0.074	0.188	0.280	0.356	0.396	0.327	0.000	0.000	0.000	0.039
1996	0.000	0.003	0.023	0.056	0.122	0.246	0.306	0.252	0.000	0.609	0.000	0.000	0.072
1997	0.000	0.006	0.020	0.066	0.107	0.169	0.189	0.432	0.000	0.000	0.000	0.000	0.047
1998	0.001	0.013	0.027	0.062	0.106	0.168	0.248	0.258	0.604	0.714	0.000	0.000	0.079
1999	0.000	0.008	0.017	0.044	0.100	0.124	0.171	0.259	0.295	0.533	0.000	0.000	0.060
2000	0.000	0.013	0.018	0.059	0.113	0.152	0.223	0.241	0.454	0.000	0.000	0.000	0.055
2001	0.000	0.000	0.018	0.040	0.103	0.129	0.169	0.246	0.411	0.431	0.000	0.000	0.059
2002	0.000	0.000	0.022	0.046	0.085	0.163	0.223	0.222	0.318	0.432	0.000	0.000	0.074
2003	0.000	0.030	0.024	0.078	0.102	0.141	0.161	0.283	0.137	0.326	1.776	1.725	0.031
2004	0.000	0.004	0.018	0.051	0.119	0.251	0.316	0.402	0.705	1.049	1.141	1.148	0.038
2005	0.000	0.009	0.017	0.049	0.118	0.151	0.191	0.191	0.000	0.000	0.000	1.628	0.023
2006	0.000	0.010	0.029	0.066	0.134	0.229	0.265	0.253	1.001	1.183	1.110	1.183	0.060
2007	0.000	0.008	0.029	0.081	0.162	0.243	0.299	0.319	0.266	0.000	0.000	0.000	0.031
						Mean Length at age (cm)							Average
1980	----	----	----	23.8	27.7	29.6	35.0	----	----	----	----	----	26.2
1981	----	11.0	17.9	22.5	26.6	28.8	33.8	----	31.0	----	----	----	23.7
1982	----	13.2	16.2	22.6	26.0	28.9	28.3	31.0	----	----	----	----	24.1
1983	6.8	12.6	16.3	22.9	25.8	27.5	28.9	28.1	35.0	33.0	----	----	22.8
1984	----	8.5	16.1	21.1	25.1	26.3	28.2	29.3	31.0	----	----	----	23.2
1985	----	13.3	18.0	20.6	24.9	26.3	29.7	29.0	----	----	----	----	22.6
1986	5.0	13.2	16.8	21.6	25.9	28.3	29.5	----	35.0	----	----	----	22.5
1987	----	11.9	15.9	21.6	25.6	29.0	31.2	33.4	----	----	----	----	22.5
1988	----	13.6	17.2	22.0	25.7	28.0	31.5	29.7	----	----	----	----	20.6
1989	----	11.5	16.5	22.7	28.2	30.4	29.2	30.2	34.6	37.0	----	----	21.9
1990	----	----	17.9	22.9	27.1	30.9	32.1	32.2	31.7	38.0	----	----	23.3
1991	----	9.0	15.7	22.9	28.7	32.4	35.8	42.8	0.0	38.9	----	----	25.1
1992	3.0	10.0	16.8	21.9	28.1	31.7	36.7	33.5	0.0	47.0	----	----	22.7
1993	3.0	8.3	16.3	23.7	28.6	31.0	35.7	42.1	0.0	0.0	----	----	19.2
1994	5.0	9.1	15.0	22.1	26.8	29.3	26.7	26.0	52.0	52.0	----	----	15.7
1995	5.0	10.1	15.4	21.5	28.5	32.0	34.7	35.9	33.9	0.0	----	----	16.9
1996	5.0	8.6	15.1	19.7	24.8	30.7	33.1	31.1	----	41.0	----	----	19.8
1997	----	10.3	14.5	20.6	24.0	27.5	28.6	37.0	----	0.0	----	----	17.3
1998	5.0	12.8	15.9	20.3	23.8	27.5	30.8	31.4	40.8	43.0	----	----	20.8
1999	----	10.0	13.6	18.4	23.4	24.8	27.6	31.5	32.9	39.4	----	----	18.4
2000	---	13.0	13.9	20.2	24.4	26.5	29.5	30.6	37.3	----	----	----	18.2
2001	---	----	13.8	17.8	23.8	25.3	27.4	30.9	36.2	36.8	----	----	19.1
2002	--	9.5	15.1	18.6	22.3	27.3	30.0	29.6	33.6	36.5	----	----	20.7
2003	---	16.3	15.4	22.0	23.8	26.2	27.0	32.5	26.2	34.0	56.4	55.8	15.8
2004	---	8.8	14.1	19.2	24.9	31.0	33.2	34.9	41.8	48.0	49.4	49.5	16.1
2005	----	11.2	13.9	19.1	24.8	26.7	29.0	29.0	0.0	0.0	0.0	55.0	14.4
2006	----	11.9	16.2	20.9	25.6	30.4	31.8	31.5	46.3	50.0	48.6	50.0	17.6
2007	----	10.6	16.2	22.1	27.1	30.7	33.0	33.5	32.0	----	----	----	15.0

Table H8. Discards at age (thousands of fish; metric tons) and mean weight (kg) at age of American plaice discarded in the **large mesh fishery** in the Gulf of Maine-Georges Bank region , 1980-2007.

Year	0	1	2	3	4	5	6	7	8	9	10	11+	Total
Discards in Numbers (000's) at Age													
1980	0.0	5.2	98.9	935.7	1786.7	781.2	30.2	2.9	0.0	0.0	0.0	0.0	3641
1981	0.0	4.2	246.7	495.9	436.9	157.6	29.8	19.9	5.4	0.0	0.0	0.0	1396
1982	0.0	2.7	335.4	668.9	446.8	101.8	21.7	0.0	0.0	0.0	0.0	0.0	1577
1983	0.0	0.6	47.8	399.5	681.4	327.8	52.6	12.2	1.4	3.4	0.0	0.0	1527
1984	0.0	0.0	65.0	249.1	549.4	718.1	281.5	16.3	0.3	0.0	0.0	0.0	1880
1985	0.0	10.9	54.6	227.0	85.8	30.8	5.6	0.0	0.0	0.0	0.0	0.0	415
1986	0.0	5.6	85.9	139.6	268.3	65.7	4.4	0.1	0.0	0.0	0.0	0.0	570
1987	0.0	7.1	135.9	390.4	343.7	241.1	53.2	3.8	1.9	0.0	0.0	0.0	1177
1988	0.0	30.4	197.1	606.9	276.6	50.3	5.7	0.2	0.0	0.0	0.0	0.0	1167
1989	0.0	0.7	677.5	1133.6	1329.3	608.6	223.1	64.3	58.4	2.7	0.7	2.3	4101
1990	0.0	0.0	136.9	1385.4	1707.2	701.4	160.6	62.6	43.6	0.1	0.0	0.0	4198
1991	0.0	0.0	29.9	398.3	3476.4	1903.7	148.8	7.1	1.4	0.7	0.0	0.0	5966
1992	0.0	0.0	2.4	166.3	652.0	851.3	83.6	32.4	0.0	0.0	0.0	0.0	1788
1993	0.0	0.0	1.9	173.8	709.7	336.4	123.8	1.9	0.0	0.0	0.0	0.0	1348
1994	0.0	0.0	2.4	112.0	791.8	968.2	77.5	1.6	0.0	0.0	0.0	0.0	1953
1995	0.0	2.6	332.0	855.9	1598.7	426.9	121.7	13.7	11.2	0.5	0.0	0.0	3363
1996	0.0	0.0	261.2	538.1	727.4	251.8	82.7	29.0	3.3	2.7	2.0	4.8	1903
1997	0.0	0.0	9.1	207.0	937.6	977.8	169.4	21.2	0.3	0.0	0.0	0.0	2322
1998	0.0	0.0	24.1	216.0	613.8	1317.3	707.3	73.5	0.4	0.0	0.0	0.0	2952
1999	0.0	0.0	16.3	93.8	833.4	647.7	662.9	224.9	46.1	2.4	0.4	0.0	2528
2000	0.0	0.0	11.0	137.3	323.0	183.6	94.9	35.5	1.4	0.0	0.0	0.0	787
2001	0.0	0.0	7.0	139.7	484.8	356.8	195.1	60.2	17.5	5.9	0.1	5.9	1273
2002	0.0	0.4	9.6	90.1	428.0	374.2	146.2	36.1	15.6	9.8	4.2	1.3	1115
2003	0.0	1.7	22.5	33.8	156.2	450.7	175.9	30.0	33.6	11.5	0.2	9.3	925
2004	0.0	1.6	28.2	182.6	310.5	464.8	357.0	70.1	14.5	4.6	1.5	1.1	1437
2005	0.0	0.5	13.9	69.9	242.9	406.8	192.6	56.7	10.6	0.7	0.4	0.3	995
2006	0.0	3.5	27.9	94.0	303.5	273.4	132.7	59.5	13.9	2.0	4.4	0.5	915
2007	0.0	0.9	27.5	168.4	332.4	216.6	88.7	14.4	3.6	0.8	2.8	0.0	856
Discards at age (mt)													
1980	0.0	0.2	7.5	147.2	423.8	218.3	9.4	1.1	0.0	0.0	0.0	0.0	808
1981	0.0	0.2	21.9	61.7	70.0	26.7	5.6	3.4	1.1	0.0	0.0	0.0	191
1982	0.0	0.1	42.1	98.8	69.3	18.6	3.8	0.0	0.0	0.0	0.0	0.0	233
1983	0.0	0.0	4.0	65.8	134.5	69.7	12.0	2.8	0.4	0.8	0.0	0.0	290
1984	0.0	0.0	6.7	40.2	112.4	172.8	71.3	5.2	0.1	0.0	0.0	0.0	409
1985	0.0	0.3	4.8	25.4	11.3	4.8	0.9	0.0	0.0	0.0	0.0	0.0	48
1986	0.0	0.2	6.2	17.9	44.7	12.4	0.7	0.0	0.0	0.0	0.0	0.0	82
1987	0.0	0.1	11.4	60.2	69.5	59.2	15.2	1.1	0.2	0.0	0.0	0.0	217
1988	0.0	0.6	13.5	100.1	53.5	11.3	1.5	0.1	0.0	0.0	0.0	0.0	181
1989	0.0	29.3	123.3	298.5	164.4	59.9	24.2	23.0	2.2	1.0	1.0	1.9	729
1990	0.0	3.8	200.6	392.2	190.4	45.9	19.6	13.1	0.0	0.0	0.0	0.0	866
1991	0.0	1.1	50.5	851.3	595.2	62.2	5.2	0.9	0.5	0.0	0.0	0.0	1567
1992	0.0	0.1	24.3	160.5	266.7	30.3	9.5	0.0	0.0	0.0	0.0	0.0	491
1993	0.0	0.2	32.4	183.3	107.4	42.4	0.8	0.0	0.0	0.0	0.0	0.0	366
1994	0.0	0.1	21.7	230.4	315.3	23.8	0.2	0.0	0.0	0.0	0.0	0.0	592
1995	0.0	13.3	108.7	412.0	133.2	47.3	6.8	5.3	0.5	0.1	0.0	0.1	727
1996	0.0	8.0	35.0	113.0	97.2	39.3	12.8	4.3	4.6	3.7	9.9	0.0	328
1997	0.0	0.5	40.4	257.6	278.7	52.0	7.9	0.1	0.0	0.0	0.0	0.0	637
1998	0.0	0.9	25.4	135.1	333.5	197.3	19.0	0.3	0.0	0.0	0.0	0.0	712
1999	0.0	0.7	10.4	179.3	177.3	214.7	78.2	17.0	2.0	0.4	0.0	0.0	680
2000	0.0	0.6	24.5	79.0	58.4	36.1	15.3	1.1	0.0	0.0	0.0	0.0	215
2001	0.0	0.3	20.0	122.2	110.1	63.5	20.5	5.7	2.2	0.0	1.9	0.0	346
2002	0.0	0.4	13.3	93.7	107.0	46.1	11.9	5.3	3.6	1.7	0.7	1.7	285
2003	0.0	0.8	3.4	30.7	124.9	56.7	10.2	9.7	4.1	0.2	2.6	0.0	243
2004	0.0	0.7	12.8	50.7	128.1	112.2	25.8	7.3	3.1	1.0	0.8	0.2	343
2005	0.0	0.4	4.7	48.1	113.0	63.2	18.5	4.2	0.6	0.4	0.2	0.1	253
2006	0.0	1.1	10.8	66.8	82.2	44.0	20.7	6.6	1.6	1.9	0.4	0.1	236
2007	0.0	1.8	27.8	84.5	70.4	30.4	6.6	1.8	0.6	1.0	0.0	0.0	225

Table H8 continued. Discards at age (thousands of fish; metric tons) and mean weight (kg) at age of American plaice discarded in the **large mesh fishery** in the Gulf of Maine-Georges Bank region , 1980-2007.

Year	0	1	2	3	4	5	6	7	8	9	10	11+	Total
Mean weight at age (kg)													
1980	0.000	0.030	0.076	0.157	0.237	0.279	0.311	0.392	0.000	0.000	0.000	0.000	0.2
1981	0.000	0.037	0.089	0.124	0.160	0.169	0.189	0.171	0.209	0.000	0.000	0.000	0.1
1982	0.000	0.029	0.126	0.148	0.155	0.182	0.173	0.000	0.000	0.000	0.000	0.000	0.1
1983	0.007	0.024	0.083	0.165	0.197	0.213	0.228	0.234	0.308	0.229	0.000	0.000	0.2
1984	0.000	0.000	0.103	0.162	0.205	0.241	0.253	0.317	0.432	0.000	0.000	0.000	0.2
1985	0.000	0.030	0.088	0.112	0.132	0.155	0.168	0.000	0.000	0.000	0.000	0.000	0.1
1986	0.000	0.035	0.072	0.128	0.167	0.189	0.171	0.295	0.000	0.000	0.000	0.000	0.1
1987	0.000	0.020	0.084	0.154	0.202	0.246	0.286	0.295	0.116	0.000	0.000	0.000	0.2
1988	0.000	0.019	0.068	0.165	0.193	0.226	0.262	0.359	0.000	0.000	0.000	0.000	0.2
1989	0.000	0.010	0.043	0.108	0.224	0.271	0.268	0.376	0.394	0.828	1.350	1.242	0.2
1990	0.000	0.000	0.028	0.145	0.229	0.271	0.286	0.313	0.300	0.472	0.000	0.000	0.2
1991	0.000	0.000	0.037	0.127	0.245	0.313	0.418	0.732	0.660	0.675	0.000	0.000	0.3
1992	0.000	0.000	0.042	0.146	0.246	0.313	0.363	0.292	0.000	0.000	0.000	0.000	0.3
1993	0.000	0.000	0.083	0.186	0.258	0.319	0.342	0.418	0.000	0.000	0.000	0.000	0.3
1994	0.000	0.000	0.056	0.194	0.291	0.325	0.308	0.133	0.000	0.000	0.000	0.000	0.3
1995	0.000	0.007	0.040	0.127	0.258	0.312	0.389	0.498	0.478	1.089	1.183	1.183	0.2
1996	0.000	0.000	0.031	0.065	0.155	0.386	0.474	0.440	1.312	1.715	1.867	2.036	0.2
1997	0.000	0.000	0.060	0.195	0.275	0.285	0.307	0.373	0.561	0.000	0.000	0.000	0.3
1998	0.000	0.000	0.037	0.118	0.220	0.253	0.279	0.259	0.772	0.000	0.000	0.000	0.2
1999	0.000	0.000	0.041	0.110	0.215	0.274	0.324	0.348	0.369	0.855	1.106	0.000	0.3
2000	0.000	0.000	0.051	0.178	0.244	0.318	0.380	0.430	0.801	0.714	0.000	0.000	0.3
2001	0.000	0.000	0.036	0.143	0.252	0.309	0.326	0.341	0.328	0.370	0.432	0.326	0.3
2002	0.000	0.007	0.039	0.148	0.219	0.286	0.315	0.329	0.341	0.370	0.402	1.815	0.3
2003	0.000	0.011	0.035	0.100	0.197	0.277	0.322	0.340	0.288	0.360	0.787	0.278	0.3
2004	0.000	0.006	0.025	0.070	0.163	0.276	0.315	0.368	0.504	0.675	0.661	0.906	0.2
2005	0.000	0.009	0.025	0.066	0.198	0.278	0.328	0.327	0.396	0.814	0.992	1.155	0.3
2006	0.000	0.010	0.041	0.115	0.220	0.301	0.332	0.348	0.478	0.797	0.429	0.975	0.3
2007	0.000	0.010	0.065	0.165	0.254	0.325	0.343	0.458	0.500	0.702	0.343	0.945	0.3
Mean Length at age (cm)													
1980													
1981													
1982													
1983													
1984													
1985													
1986													
1987													
1988													
1989		12.0	18.3	24.0	30.1	32.0	31.7	34.7	35.6	44.0	51.8	50.1	27.0
1990		0.0	16.0	26.2	30.3	32.0	32.6	33.5	33.0	38.0	0.0	0.0	28.9
1991		0.0	17.7	25.1	31.0	33.5	36.3	43.3	42.0	42.1	0.0	0.0	31.5
1992		0.0	17.9	26.4	31.1	33.5	35.1	32.9	0.0	0.0	0.0	0.0	32.0
1993		0.0	22.5	28.5	31.6	33.7	34.4	36.5	0.0	0.0	0.0	0.0	32.0
1994		0.0	20.0	28.9	32.7	33.9	33.3	26.0	0.0	0.0	0.0	0.0	33.1
1995		11.0	17.8	25.2	31.5	33.3	35.5	38.1	37.2	48.6	50.0	50.0	28.9
1996		0.0	16.5	20.5	26.4	34.6	37.1	35.6	51.3	55.5	57.3	58.8	25.2
1997		0.0	20.2	28.9	32.1	32.5	33.2	35.4	40.0	0.0	0.0	0.0	32.0
1998		0.0	17.6	24.5	29.9	31.3	32.3	31.3	44.0	0.0	0.0	0.0	30.6
1999		0.0	18.2	23.9	29.7	31.9	33.5	34.2	34.5	45.0	49.0	0.0	31.5
2000		0.0	19.4	28.1	31.0	33.3	35.1	35.9	44.2	43.0	0.0	0.0	31.6
2001		0.0	17.3	25.9	31.2	33.3	33.9	34.4	34.0	35.3	37.0	34.0	31.8
2002		11.0	17.3	26.2	29.7	32.4	33.4	33.6	33.8	34.7	35.0	56.7	31.0
2003		10.9	17.2	23.7	28.8	32.1	33.7	34.0	32.4	34.8	44.0	32.2	31.3
2004		10.1	15.3	21.1	27.4	32.1	33.4	34.8	38.0	42.0	41.5	45.5	29.9
2005		11.6	15.7	21.0	28.9	32.2	33.9	33.5	35.6	44.4	46.6	48.5	30.8
2006		12.0	17.9	24.5	29.9	33.0	34.0	34.3	37.3	44.2	36.2	46.8	30.9
2007		11.8	20.5	27.4	31.3	33.8	34.3	37.2	37.6	42.6	34.2	46.8	31.3

Table H9. Catch at age (thousands of fish; metric tons) and mean weight (kg), of commercial landings, and large mesh and northern shrimp fisherydiscards of American plaice, ages 1-11+, from Gulf of Maine - Georges Bank, 1980-2007.

Year	1	2	3	4	5	6	7	8	9	10	11+	Total
Catch in Numbers (000's) at Age												
1980	5	99	1072	2672	3939	3933	3632	1185	1139	850	1380	19906
1981	5	982	2192	5055	5337	3648	2401	1582	645	440	621	22907
1982	10	603	3348	4574	4503	3599	3297	2038	1256	737	717	24681
1983	15	663	1478	5177	4918	3913	2270	1272	701	450	911	21768
1984	3	370	991	2422	6031	3244	1936	580	274	307	769	16927
1985	65	158	1217	1336	2405	2872	2228	1081	438	267	182	12250
1986	59	639	738	2284	1700	1476	1307	631	255	105	100	9295
1987	38	590	1840	1439	2282	1337	895	543	187	62	60	9274
1988	314	786	1840	1833	1597	1444	553	270	177	88	55	8957
1989	15	2275	2606	2517	1522	827	835	534	196	104	118	11550
1990	0	1094	4726	3607	1972	696	367	404	193	96	161	13316
1991	0	255	1031	5998	4866	1261	326	166	202	97	104	14306
1992	10	244	862	1605	5811	2649	849	191	131	118	93	12562
1993	22	281	422	1775	2382	2579	1384	265	287	151	125	9671
1994	58	886	407	1711	2841	1342	1158	597	235	150	290	9674
1995	45	2434	1573	2360	3294	1854	655	589	210	53	50	13116
1996	12	1150	1257	3732	2713	1506	566	243	126	37	68	11411
1997	15	636	337	2317	3615	1717	634	182	85	66	116	9720
1998	37	85	349	866	2859	2604	1071	318	59	57	154	8461
1999	4	216	169	1136	1675	2352	1389	488	150	42	79	7700
2000	3	303	442	797	1650	2224	1755	567	138	70	20	7970
2001	0	92	414	959	2297	2198	1579	912	293	56	52	8852
2002	1	13	109	772	1449	1811	1191	516	283	161	177	6484
2003	12	689	45	297	1238	1275	744	557	279	154	119	5409
2004	6	140	226	440	924	1195	508	364	195	77	74	4151
2005	34	283	106	434	990	767	442	177	97	42	49	3423
2006	28	83	114	478	768	536	354	191	99	60	43	2755
2007	160	238	224	596	806	511	216	113	68	33	31	2996
Catch at Age (mt)												
1980	0	8	165	715	1611	2571	3009	1232	1347	1168	2616	14442
1981	0	106	370	1598	2360	2837	2125	1547	729	552	963	13186
1982	0	69	768	1323	1884	2028	3165	2320	1502	1144	1364	15567
1983	0	22	273	1957	2607	2618	1868	1326	868	650	1531	13721
1984	0	17	160	735	3159	2046	1720	689	310	421	1506	10761
1985	1	9	102	279	796	1534	1887	1263	603	445	387	7306
1986	1	27	102	523	652	867	1101	741	380	183	219	4796
1987	0	27	241	337	934	815	799	637	278	107	137	4312
1988	5	36	293	521	716	927	486	333	247	151	124	3839
1989	29	175	448	474	446	340	581	407	258	151	226	3536
1990	4	239	760	717	647	360	257	341	210	125	273	3932
1991	1	56	914	1562	1634	798	308	191	256	150	189	6060
1992	0	32	234	619	2677	1906	775	237	173	193	188	7034
1993	0	41	247	578	1099	1593	1306	327	400	238	289	6118
1994	0	44	285	702	1014	792	920	646	303	213	704	5624
1995	14	162	505	441	1520	1139	531	647	280	111	95	5444
1996	8	70	202	1168	1285	930	493	292	175	64	142	4829
1997	1	53	266	826	1291	989	504	205	114	104	282	4634
1998	1	27	145	410	858	1118	824	328	80	83	509	4383
1999	1	14	183	283	702	1069	889	411	164	61	151	3929
2000	1	30	137	238	744	1252	1325	570	151	99	37	4583
2001	0	21	133	292	941	1104	1085	758	304	84	77	4800
2002	0	13	95	242	542	882	790	454	293	197	256	3764
2003	1	19	32	178	405	629	507	452	261	173	145	2802
2004	1	15	55	184	330	494	310	281	188	78	88	2023
2005	1	9	51	191	345	344	269	147	92	45	62	1556
2006	1	12	69	155	282	256	205	152	92	57	56	1338
2007	3	34	95	174	307	240	135	92	67	33	46	1226

Table H9 continued. 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 1-11+, from Gulf of Maine - Georges Bank, 1980-2007.

Year		1	2	3	4	5	6	7	8	9+	10	11+	Average
						Mean Weight at age (kg)							
1980		0.030	0.076	0.154	0.267	0.409	0.653	0.829	1.039	1.183	1.374	1.895	0.725
1981		0.032	0.108	0.168	0.316	0.442	0.778	0.885	0.978	1.130	1.254	1.551	0.576
1982		0.018	0.115	0.230	0.290	0.418	0.564	0.960	1.138	1.196	1.552	1.901	0.631
1983		0.013	0.033	0.185	0.378	0.530	0.670	0.823	1.042	1.238	1.446	1.680	0.630
1984		0.004	0.045	0.161	0.303	0.524	0.630	0.888	1.187	1.133	1.369	1.958	0.636
1985		0.018	0.058	0.084	0.209	0.331	0.534	0.847	1.167	1.377	1.665	2.128	0.596
1986		0.016	0.042	0.138	0.229	0.384	0.587	0.842	1.174	1.491	1.747	2.194	0.516
1987		0.013	0.046	0.131	0.234	0.409	0.609	0.892	1.173	1.483	1.732	2.284	0.465
1988		0.016	0.046	0.159	0.284	0.449	0.641	0.880	1.231	1.396	1.717	2.238	0.429
1989		0.009	0.035	0.105	0.241	0.362	0.454	0.697	0.801	1.327	1.462	1.926	0.306
1990	*	0.011	0.038	0.120	0.254	0.401	0.554	0.717	0.876	1.088	1.305	1.696	0.295
1991		0.004	0.027	0.110	0.303	0.445	0.678	0.958	1.157	1.274	1.541	1.813	0.424
1992		0.006	0.032	0.114	0.320	0.501	0.727	0.925	1.240	1.319	1.640	2.007	0.560
1993		0.003	0.031	0.228	0.368	0.489	0.634	0.944	1.234	1.394	1.577	2.313	0.633
1994		0.004	0.026	0.189	0.360	0.460	0.608	0.794	1.083	1.289	1.424	2.424	0.581
1995		0.006	0.027	0.128	0.305	0.489	0.665	0.905	1.155	1.099	2.104	1.920	0.423
1996		0.003	0.037	0.099	0.317	0.495	0.635	0.884	1.203	1.390	1.581	2.227	0.423
1997		0.006	0.021	0.146	0.347	0.420	0.601	0.807	1.127	1.336	1.570	2.425	0.477
1998		0.013	0.030	0.101	0.245	0.348	0.498	0.786	1.031	1.350	1.463	3.293	0.518
1999		0.008	0.019	0.083	0.251	0.397	0.513	0.685	0.872	1.109	1.458	1.908	0.510
2000		0.013	0.019	0.185	0.324	0.464	0.572	0.763	1.007	1.094	1.411	1.864	0.575
2001	*	0.011	0.019	0.075	0.317	0.430	0.522	0.696	0.835	1.045	1.454	1.529	0.542
2002		0.002	0.035	0.136	0.296	0.415	0.506	0.669	0.884	1.043	1.224	1.446	0.580
2003		0.027	0.024	0.095	0.282	0.383	0.530	0.683	0.820	0.950	1.106	1.243	0.518
2004		0.005	0.019	0.075	0.242	0.374	0.486	0.647	0.782	0.972	1.009	1.207	0.487
2005		0.009	0.017	0.070	0.291	0.399	0.507	0.641	0.848	0.946	1.073	1.280	0.454
2006		0.010	0.033	0.110	0.293	0.416	0.522	0.621	0.823	0.922	0.983	1.296	0.486
2007		0.008	0.033	0.172	0.316	0.430	0.515	0.644	0.825	0.981	1.023	1.511	0.409

*average of age 1 time series

Table H10. Standardized stratified mean catch per tow in numbers and weight (kg) for American plaice in N offshore spring and autumn and DFO spring research vessel bottom trawl surveys surveys, 1963 - 2008.

	NEFSC Spring		NEFSC Autumn		DFO Spring	
Year	No/Tow	Wt/Tow	No/Tow	Wt/Tow	No/Tow	Wt/Tow
1963	-	-	14.2	5.9		
1964	-	-	8.2	2.8		
1965	-	-	12.0	3.8		
1966	-	-	17.8	4.9		
1967	-	-	11.1	2.7		
1968	11.4	3.4	8.6	2.9		
1969	8.6	2.7	7.5	2.4		
1970	5.4	1.8	6.5	2.0		
1971	3.8	1.3	7.5	2.0		
1972	4.3	1.3	7.4	1.6		
1973	7.2	1.9	6.2	1.9		
1974	8.3	1.9	6.9	1.4		
1975	5.8	1.7	8.1	2.4		
1976	11.9	3.4	10.0	3.0		
1977	14.6	5.1	11.8	3.5		
1978	10.6	3.8	15.1	4.7		
1979	9.2	3.6	10.0	4.0		
1980	18.3	4.8	14.2	5.1		
1981	18.8	5.9	13.0	5.6		
1982	11.6	3.8	5.9	2.5		
1983	16.9	4.6	9.3	3.5		
1984	4.1	1.4	7.1	2.0		
1985	4.9	1.9	7.0	2.0		
1986	3.1	0.9	5.6	1.6		
1987	3.5	0.8	4.4	1.1	1.81	0.75
1988	3.6	0.8	9.7	1.5	1.72	0.56
1989	4.8	0.8	9.2	1.2	2.75	0.52
1990	5.1	0.8	15.5	2.9	5.06	1.13
1991	5.9	1.1	7.7	1.6	4.05	1.05
1992	4.1	1.4	6.3	1.8	7.07	1.33
1993	5.3	1.4	11.9	2.4	2.72	1.47
1994	4.9	0.9	18.1	2.7	1.07	0.49
1995	9.4	1.9	11.8	2.6	3.87	0.77
1996	7.8	1.7	7.6	2.2	3.86	1.01
1997	7.6	1.6	6.3	1.9	6.79	1.62
1998	4.5	1.1	9.3	2.2	2.28	0.85
1999	4.2	1.2	11.0	2.6	3.22	1.06
2000	10.0	2.3	12.2	2.8	5.07	1.44
2001	10.6	2.2	10.4	2.6	2.13	0.67
2002	6.7	1.8	9.7	2.2	3.88	1.2
2003	4.2	0.9	9.3	2.3	1.02	0.4
2004	8.2	1.4	5.4	1.0	1.17	0.44
2005	5.0	0.8	5.8	1.0	1.91	0.37
2006	7.4	1.0	12.5	1.7	3.94	0.56
2007	10.0	1.3	11.0	1.4	6.53	0.86
2008	8.0	1.5			2.8	0.54
1963-2008	7.8	2.0	9.7	2.6	3.4	0.9

* 2006 DFO, no tows in 5Z5,5Z7, 5Z8
* 2007 DFO, no tows in 5Z8

Table H11.Standardized stratified mean number per tow by age and mean weight per tow (kg) of American plaice in the NEFSC spring research bottom trawl survey in the Gulf of Maine and Georges Bank area (offshore strata 13-30,36-40) , 1980-2008.

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	0.01	18.34	4.78
1981	0	0.13	3.43	4.21	3.46	2.61	1.69	1.41	0.77	0.40	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	0.50	0.35	0.19	0.07	0.02	0.05	0.01	11.61	3.80
1983	0	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	16.93	4.60
1984	0	0.01	0.35	0.56	0.90	1.29	0.58	0.22	0.10	0.01	0.02	0.01	0.01	0.00	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	0.10	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	0.20	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	0.00	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	0.00	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	0.00	5.30	1.39
1994	0	0.03	1.43	1.14	1.12	0.75	0.23	0.10	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	2.30	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	3.30	1.31	0.53	0.20	0.05	0.02	0	0	0.00	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	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	0.00	0	0	4.19	1.20
2000	0	0.03	1.91	2.48	2.22	1.60	0.86	0.60	0.15	0.07	0.02	0	0.01	0	0	9.95	2.30
2001	0	0.00	0.71	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	0.10	0.35	0.98	2.35	1.66	0.51	0.33	0.20	0.14	0.07	0.01	0	0	0	6.70	1.76
2003	0	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	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	0.83
2006	0	0.76	1.62	1.71	1.70	0.84	0.32	0.30	0.11	0.02	0.02	0.01	0	0.01	0	7.42	0.99
2007	0	0.25	3.74	2.78	1.61	1.02	0.33	0.14	0.07	0.01	0.02	0.01	0	0	0	9.97	1.29
2008	0.00	0.11	0.58	2.05	2.84	1.40	0.64	0.22	0.09	0.06	0.04	0	0	0	0.005	8.04	1.47
Average 1980-2008	0.00	0.14	1.22	1.79	1.87	1.24	0.62	0.34	0.15	0.09	0.06	0.03	0.02	0.02	0.02	7.54	1.78

Table H12. Standardized stratified mean number per tow by age and mean weight per tow (kg) of American plaice in the NEFSC autumn research bottom trawl surveys in the Gulf of Maine and Georges Bank area (offshore strata 13-30,36-40) , 1980-2007.

YEAR	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	no/tow	wt/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	2.27
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	5.42	0.96
2005	0.00	0.69	1.65	0.72	1.17	0.75	0.43	0.15	0.10	0.08	0.04	0.00	0.01	0.00	0.00	5.77	0.99
2006	0.03	2.04	2.54	2.61	2.57	1.41	0.57	0.44	0.16	0.03	0.04	0.00	0.00	0.01	0.00	12.46	1.71
2007	0.02	1.08	3.45	2.83	2.19	0.85	0.42	0.15	0.02	0.02	0.00	0.00	0.00	0.00	0.00	11.02	1.44
Average																	
1980-2(	0.02	1.03	2.14	2.35	1.90	1.07	0.53	0.22	0.13	0.06	0.05	0.04	0.02	0.02	0.05	9.54	2.28

Table H13. 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), 1982-2007.

						Age							Total
Year	0	1	2	3	4	5	6	7	8	9	10	11	#/tow
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	6.66	21.04	22.93	8.24	4.80	1.98	0.98	0.35	0.00	0.00	0.02	66.99
2006	0.00	4.74	54.23	35.00	14.21	4.94	1.90	1.25	0.25	0.00	0.03	0.00	116.55
2007	0.00	2.53	48.78	42.88	15.77	7.45	1.39	0.73	0.18	0.01	0.14	0.04	119.89
2008	not available												
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	0	0.08	99.5
2005	0	41.42	54.52	14.74	11.65	4.22	1.43	0.2	0.18	0.06	0	0.03	128.44
2006	0	14.51	45.14	20.8	10.88	4.13	1.38	1.03	0.14	0.04	0.08	0	98.14
2007	0.07	7.95	24.53	19.24	10.82	2.79	1.61	0.43	0.08	0.06	0.00	0.02	67.6

Table H14. Selected VPA diagnostics, including predicted beginning year stock numbers for ages 1-10 and catchability estimates of each survey index, with standard error and CV for Gulf of Maine – Georges Bank American plaice.

```
Levenburg-Marquardt Algorithm Completed     9 Iterations
 Residual Sum of Squares =     300.043

 Number of Residuals     =    743
 Number of Parameters    =     10
 Degrees of Freedom      =    733
 Mean Squared Residual   =     0.409336
 Standard Deviation      =     0.639793


 Number of Years =    28
 Number of Ages  =    11
 First Year      =  1980
 Youngest Age    =     1
 Oldest True Age =    10

 Number of Survey Indices Available        =    30
 Number of Survey Indices Used in Estimate =    27
```

Age	Stock Predicted	Std. Error	CV
1	42084.333	0.274534E+05	0.652342E+00
2	19084.898	0.559295E+04	0.293056E+00
3	34216.404	0.749229E+04	0.218968E+00
4	23147.560	0.423645E+04	0.183019E+00
5	15758.500	0.259021E+04	0.164369E+00
6	7052.158	0.113337E+04	0.160712E+00
7	6866.112	0.105831E+04	0.154136E+00
8	1632.210	0.330953E+03	0.202763E+00
9	1801.068	0.358493E+03	0.199044E+00
10	2375.051	0.443839E+03	0.186875E+00

Catchability Values for Each Survey Used in Estimate

INDEX	Catchability	Std. Error	CV
1	0.756315E-02	0.142550E-02	0.188479E+00
2	0.117776E+00	0.131015E-01	0.111241E+00
3	0.237083E+00	0.226727E-01	0.956320E-01
4	0.345291E+00	0.278629E-01	0.806939E-01
5	0.332013E+00	0.234096E-01	0.705080E-01
6	0.270544E+00	0.198359E-01	0.733185E-01
7	0.239287E+00	0.222962E-01	0.931778E-01
8	0.178071E+00	0.243164E-01	0.136554E+00
9	0.183208E+00	0.279889E-01	0.152771E+00
11	0.106649E+00	0.124861E-01	0.117077E+00
12	0.299685E+00	0.259527E-01	0.865999E-01
13	0.454693E+00	0.396251E-01	0.871469E-01
14	0.545345E+00	0.407639E-01	0.747489E-01
15	0.521424E+00	0.446796E-01	0.856877E-01
16	0.460618E+00	0.447785E-01	0.972141E-01
17	0.328359E+00	0.416616E-01	0.126878E+00
18	0.310350E+00	0.441360E-01	0.142214E+00
20	0.421847E-01	0.102605E-01	0.243227E+00
21	0.234209E+00	0.370230E-01	0.158077E+00
22	0.318789E+00	0.249546E-01	0.782794E-01
23	0.228953E+00	0.182832E-01	0.798555E-01
24	0.128202E+00	0.126938E-01	0.990135E-01
26	0.265599E+00	0.400073E-01	0.150631E+00
27	0.341196E+00	0.393301E-01	0.115271E+00
28	0.271214E+00	0.304525E-01	0.112282E+00
29	0.140295E+00	0.194801E-01	0.138851E+00
30	0.542392E-01	0.102775E-01	0.189484E+00

Table H15. 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, 1980-2007.

Stock Numbers (Jan 1) in thousands

Age	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
1	50300	26027	20849	24666	15520	19012	23602	41613	53494	20981	21648	22668	25137	39653
2	39477	41178	21304	17061	20182	12704	15507	19270	34035	43514	17164	17722	18557	20571
3	32635	32231	32827	16898	13370	16189	10259	12120	15245	27156	33573	13065	14279	14973
4	24065	25752	24412	23858	12502	10053	12156	7733	8265	10824	19884	23231	9767	10913
5	19254	17295	16536	15870	14878	8056	7027	7897	5037	5118	6599	13034	13632	6552
6	13955	12221	9371	9494	8582	6785	4438	4225	4417	2691	2825	3633	6314	5966
7	9947	7894	6732	4451	4273	4121	2987	2310	2260	2321	1461	1687	1844	2800
8	4678	4891	4309	2570	1621	1770	1390	1278	1090	1354	1152	866	1088	752
9	3006	2765	2586	1709	970	807	489	574	561	649	630	581	560	719
10	2776	1441	1684	996	772	548	271	173	302	300	356	342	295	340
11+	4509	2035	1640	2019	1932	373	258	169	189	342	597	368	235	281
Total	204602	173729	142248	119593	94601	80418	78384	97362	124895	115250	105888	97197	91707	103521

Age	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
1	38756	26619	24201	21348	16743	26464	16173	12409	28387	22483	36846	42696	51397	23487	42084
2	32445	31678	21753	19803	17465	13674	21663	13239	10159	23239	18396	30161	34926	42054	19085
3	16589	25764	23741	16772	15639	14222	11000	17462	10756	8306	18404	14935	24438	28519	34216
4	11878	13215	19675	18303	13428	12489	11491	8607	13923	8708	6759	14864	12132	19905	23148
5	7337	8184	8695	12750	12897	10212	9201	8689	6182	10703	6862	5137	11777	9502	15759
6	3230	3464	3753	4686	7193	7988	6853	6047	5051	3759	7647	4785	3315	8949	7052
7	2580	1445	1185	1725	2299	3557	4429	3617	2982	2513	1934	5185	3228	2232	6866
8	1058	1077	598	465	844	926	1669	2056	1550	1376	1390	1128	3846	2324	1632
9	379	335	358	273	218	407	323	858	868	806	628	811	763	2976	1801
10	332	102	88	180	147	125	199	141	440	457	410	339	576	536	2375
11+	644	96	163	315	400	233	56	129	483	353	392	391	418	543	828
Total	115228	111979	104210	96620	87273	90296	83058	73255	80782	82703	99669	120431	146816	141027	154846

Fishing Mortality

Age	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00
2	0.00	0.03	0.03	0.04	0.02	0.01	0.05	0.03	0.03	0.06	0.07	0.02	0.01	0.02
3	0.04	0.08	0.12	0.10	0.09	0.09	0.08	0.18	0.14	0.11	0.17	0.09	0.07	0.03
4	0.13	0.24	0.23	0.27	0.24	0.16	0.23	0.23	0.28	0.29	0.22	0.33	0.20	0.20
5	0.25	0.41	0.35	0.41	0.59	0.40	0.31	0.38	0.43	0.39	0.40	0.52	0.63	0.51
6	0.37	0.40	0.54	0.60	0.53	0.62	0.45	0.43	0.44	0.41	0.32	0.48	0.61	0.64
7	0.51	0.41	0.76	0.81	0.68	0.89	0.65	0.55	0.31	0.50	0.32	0.24	0.70	0.77
8	0.33	0.44	0.72	0.77	0.50	1.09	0.68	0.62	0.32	0.57	0.48	0.24	0.21	0.49
9	0.53	0.30	0.75	0.59	0.37	0.89	0.84	0.44	0.42	0.40	0.41	0.48	0.30	0.57
10	0.41	0.41	0.65	0.68	0.57	0.76	0.55	0.49	0.39	0.47	0.35	0.37	0.57	0.66
11+	0.41	0.41	0.65	0.68	0.57	0.76	0.55	0.49	0.39	0.47	0.35	0.37	0.57	0.66
Total	0.44	0.38	0.70	0.69	0.52	0.87	0.66	0.51	0.37	0.47	0.38	0.36	0.46	0.62

Age	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
2	0.03	0.09	0.06	0.04	0.01	0.02	0.02	0.01	0.00	0.03	0.01	0.01	0.00	0.01
3	0.03	0.07	0.06	0.02	0.02	0.01	0.05	0.03	0.01	0.01	0.01	0.01	0.01	0.01
4	0.17	0.22	0.23	0.15	0.07	0.11	0.08	0.13	0.06	0.04	0.07	0.03	0.04	0.03
5	0.55	0.58	0.42	0.37	0.28	0.20	0.22	0.34	0.30	0.14	0.16	0.24	0.07	0.10
6	0.60	0.87	0.58	0.51	0.50	0.39	0.44	0.51	0.50	0.46	0.19	0.19	0.20	0.06
7	0.67	0.68	0.74	0.51	0.71	0.56	0.57	0.65	0.57	0.39	0.34	0.10	0.13	0.11
8	0.95	0.90	0.59	0.56	0.53	0.85	0.47	0.66	0.45	0.58	0.34	0.19	0.06	0.05
9	1.11	1.14	0.49	0.42	0.36	0.52	0.63	0.47	0.44	0.48	0.42	0.14	0.15	0.03
10	0.68	0.83	0.61	0.52	0.55	0.46	0.48	0.57	0.51	0.46	0.23	0.15	0.12	0.06
11+	0.68	0.83	0.61	0.52	0.55	0.46	0.48	0.57	0.51	0.46	0.23	0.15	0.12	0.06
Total	0.84	0.90	0.60	0.50	0.53	0.58	0.53	0.57	0.49	0.48	0.32	0.16	0.13	0.06

Table H15 continued. 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, 1980-2007.

SSB at start of spawning season

Age	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
1	8	4	3	2	0	6	4	3	5	1	0	0	0	0
2	77	111	61	20	32	18	28	25	39	39	6	6	4	5
3	496	612	812	389	191	241	205	196	299	384	298	118	111	157
4	2069	2339	2080	2751	1326	927	848	811	976	1236	1811	2326	995	1154
5	4076	3925	3871	4054	4299	1758	1472	1923	1312	1315	1661	3400	3974	1998
6	6449	5523	3535	3827	3839	2719	1595	1730	1906	1032	1101	1583	2901	2699
7	6293	5055	4436	2308	2591	2248	1604	1385	1456	1302	731	1101	1167	1819
8	4086	3755	3398	2015	1332	1293	1111	1033	1003	939	759	707	1069	677
9	2874	2646	2203	1663	913	785	498	645	614	714	505	518	611	779
10	3040	1508	1803	1052	829	593	348	234	416	362	408	384	352	396
11+	7339	2711	2521	2724	3121	625	469	324	366	556	882	578	388	524
Total	36807	28190	24722	20805	18474	11215	8183	8310	8393	7881	8162	10722	11572	10208

Age	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
1	0	0	0	0	0	0	0	0	0	0	0	2	3	1
2	5	6	6	3	4	4	5	4	4	5	8	8	17	29
3	156	181	161	140	95	101	98	100	78	68	96	93	181	408
4	1767	1600	1991	1740	1375	1013	1037	1190	1146	867	517	1181	932	2065
5	2302	2600	2635	3710	3658	2595	2601	2662	1822	2916	1833	1273	3405	2818
6	1426	1451	1705	2118	2731	2854	2756	2469	1959	1463	2964	1851	1343	3800
7	1471	860	719	1033	1259	1720	2287	1846	1452	1274	990	2685	1668	1197
8	803	783	513	384	642	589	1174	1323	1032	837	888	758	2620	1561
9	344	262	382	296	234	364	256	745	690	624	480	640	618	2527
10	376	129	95	222	171	148	210	146	416	416	361	317	513	487
11+	1255	142	297	640	1092	377	89	163	584	372	424	458	500	768
Total	9905	8014	8503	10285	11261	9764	10512	10648	9183	8843	8560	9266	11799	15659

Percent mature (females)

Age	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
1	0.01	0.01	0.01	0.01	0.02	0.03	0.02	0.01	0.01	0.01	0.00	0.00	0.00	0.00
2	0.04	0.05	0.05	0.05	0.07	0.10	0.07	0.05	0.05	0.04	0.02	0.02	0.02	0.02
3	0.15	0.18	0.17	0.17	0.21	0.26	0.24	0.24	0.25	0.22	0.15	0.15	0.15	0.13
4	0.45	0.46	0.43	0.44	0.50	0.55	0.56	0.65	0.69	0.66	0.62	0.60	0.60	0.57
5	0.80	0.77	0.74	0.76	0.79	0.80	0.84	0.92	0.94	0.93	0.94	0.93	0.92	0.92
6	0.95	0.93	0.91	0.93	0.93	0.93	0.96	0.99	0.99	0.99	0.99	0.99	0.99	0.99
7	0.99	0.98	0.97	0.98	0.98	0.98	0.99	1.00	1.00	1.00	1.00	1.00	1.00	1.00
8	1.00	1.00	0.99	1.00	0.99	0.99	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
9	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
10	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Age	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01
2	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.03	0.02	0.03	0.03	0.04
3	0.13	0.13	0.14	0.12	0.14	0.15	0.16	0.16	0.15	0.15	0.13	0.18	0.18	0.20
4	0.57	0.56	0.56	0.56	0.58	0.55	0.59	0.62	0.59	0.54	0.54	0.57	0.57	0.59
5	0.92	0.92	0.91	0.92	0.92	0.90	0.92	0.94	0.92	0.88	0.90	0.89	0.89	0.90
6	0.99	0.99	0.99	0.99	0.99	0.98	0.99	0.99	0.99	0.98	0.99	0.98	0.98	0.98
7	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
8	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
9	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
10	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Table H16. Input data for yield-per-recruit and projection analysis. Selectivity and mean weight estimated as an average of 2003-2007 data, and proportion mature estimated as five-year moving average, 2004-2008.

Age	VPA selectivity	Stock weight	Catch weight	Spawning stock weight	Proportion mature
1	0.00	0.0097	0.0118	0.0097	0.01
2	0.05	0.0148	0.0254	0.0148	0.03
3	0.05	0.0510	0.1041	0.0510	0.18
4	0.25	0.1649	0.2849	0.1649	0.57
5	0.76	0.3350	0.4004	0.3350	0.89
6	1.00	0.4510	0.5118	0.4510	0.98
7	1.00	0.5745	0.6472	0.5745	1.00
8	1.00	0.7309	0.8194	0.7309	1.00
9	1.00	0.8904	0.9544	0.8904	1.00
10	1.00	1.0020	1.0388	1.0020	1.00
11+	1.00	1.3074	1.3075	1.3074	1.00

Table H17. Projection results of catch and biomass in 2009 where 2008 catch = 2007 for 3 fishing mortality scenarios: $F_{STATUS\ QUO}$, F_{MSY}, and $F_{REBUILD}$ for the BASE Model , unadjusted for retrospective pattern and the BASE Model Adjusted for retropsective pattern using 7-year average rho.

BASE Model – unadjusted for retrospective

BASE	Year	Catch	SSB	F
F status quo	2008	1126	19,497	0.07
0.06	2009	**1495**	25,258	0.06
Fmsy	2008	1126	19,497	0.07
0.19	2009	**4,481**	24,558	0.19
Frebuild	2008	1126	19,497	0.07
0.257	2009	**5,896**	24,205	0.257

BASE Model with retrospective adjustment

BASE Adj.	Year	Catch	SSB	F
F status quo	2008	1,126	13,226	0.01
0.09	2009	**1,588**	18,143	0.09
Fmsy	2008	1,126	13,226	0.01
0.19	2009	**3,219**	17,768	0.19
Frebuild	2008	1,126	13,226	0.01
0.208	2009	**3,499**	17,703	0.208

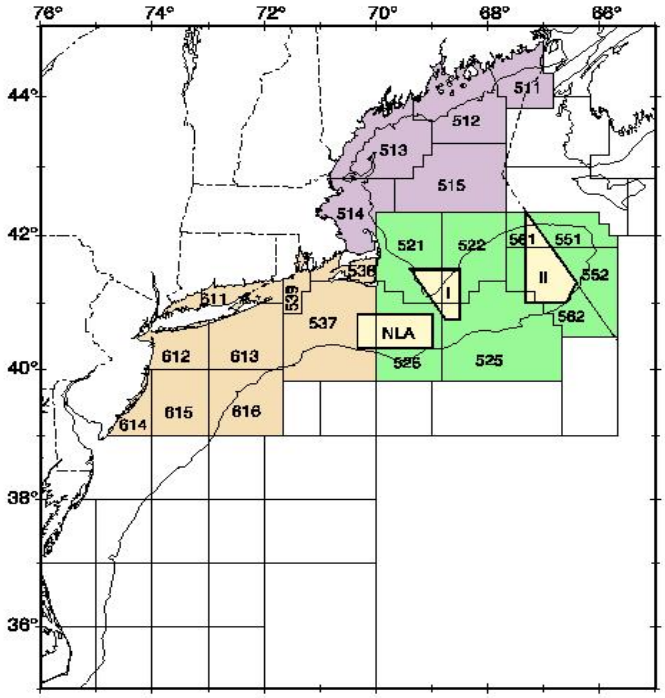


Figure H1. Stock area of American plaice as defined by Northwest Atlantic Fisheries Organization (NAFO) statistical areas : 511-515, 521-526, 551-552, and 561-562.

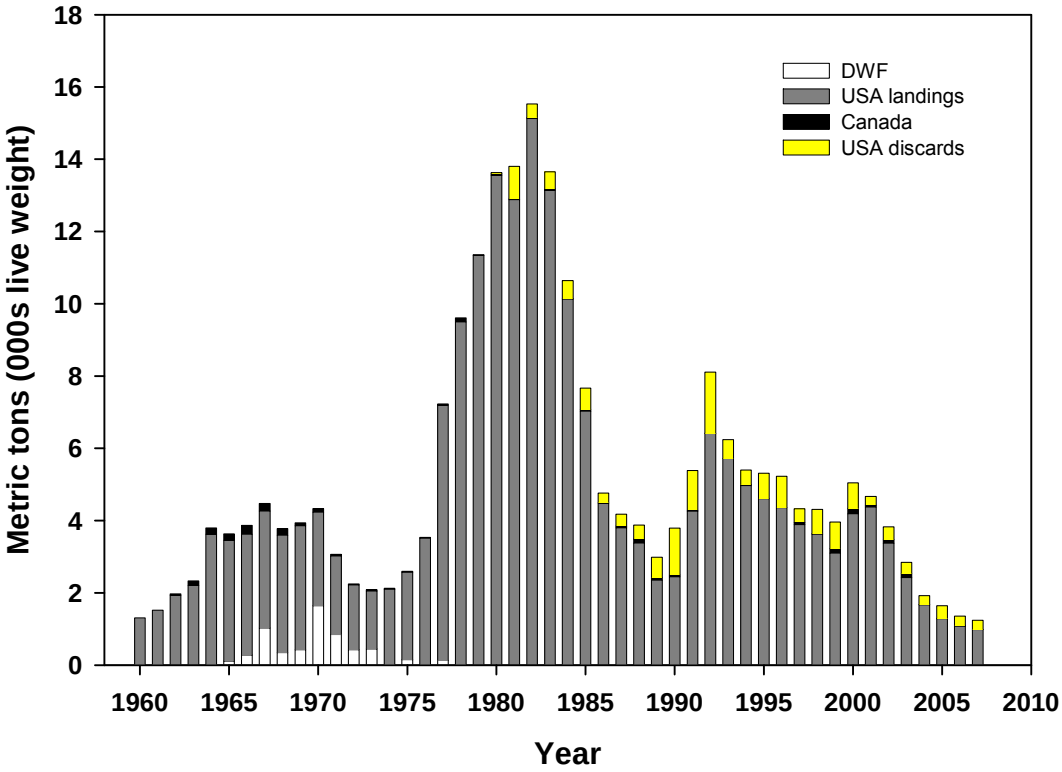


Figure H2. Total catch of Gulf of Maine-Georges Bank American plaice including USA commercial landings and discards, and Canadian landings, 1960-2007.

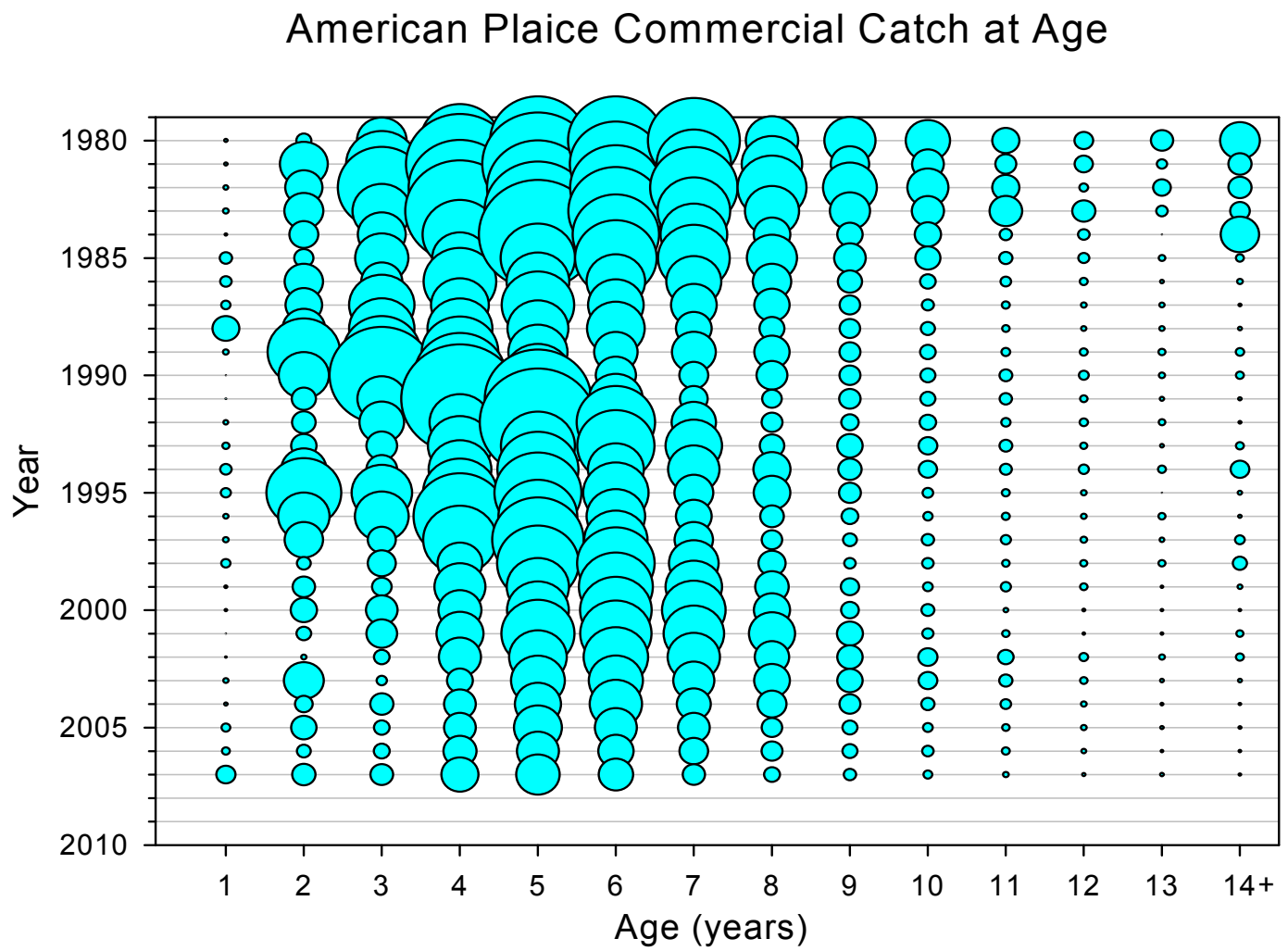


Figure H3. Catch at age (thousands of fish) of commercial landings, and large mesh and northern shrimp fishery discards for American plaice in the Gulf of Maine-Georges Bank region, 1980-2007.

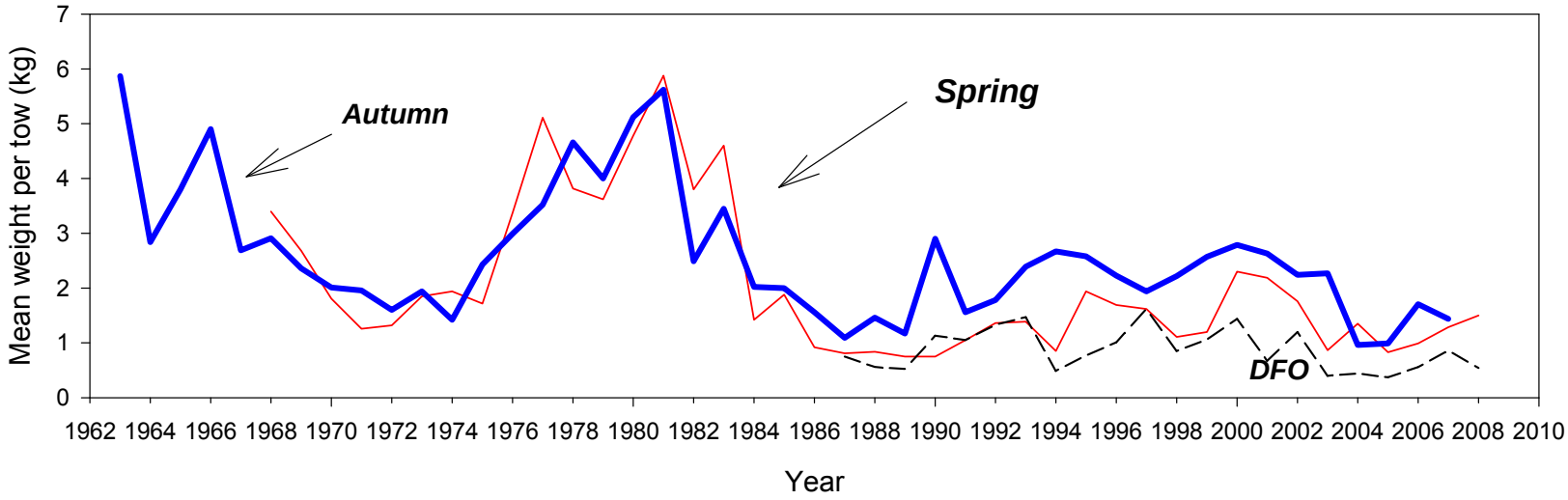


Figure H4. Standardized stratified mean weight per tow (kg) of American plaice in NEFSC and spring and autumn and spring DFO research vessel bottom trawl surveys in the Gulf of Maine-Georges Bank region, 1963-2008.

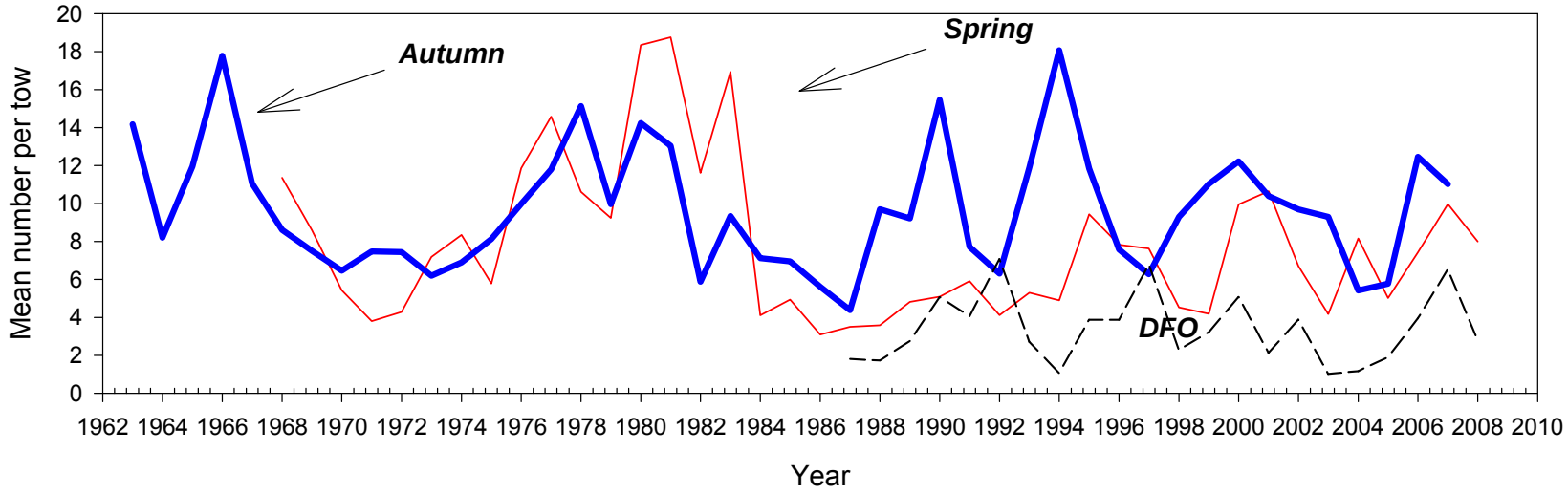


Figure H5. Standardized stratified mean number per tow (kg) of American plaice in NEFSC spring and autumn research and spring DFO research vessel bottom trawl surveys in the Gulf of Maine-Georges Bank region, 1963-2008.

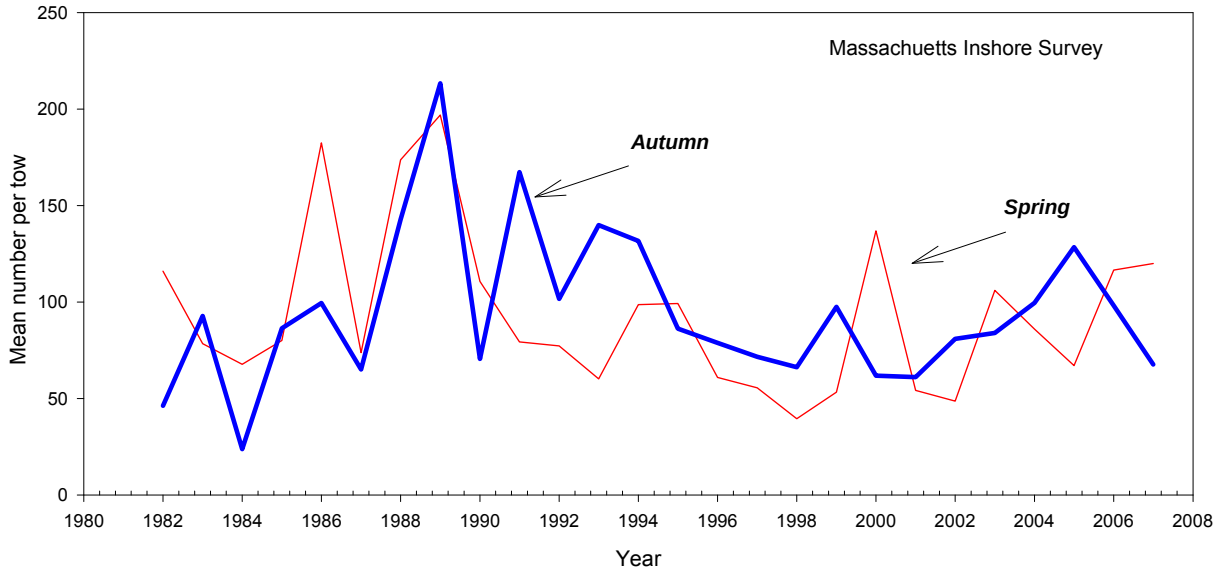


Figure H6. Standardized stratified mean number per tow (kg) of American plaice in MADMF spring and autumn research research vessel bottom trawl surveys region, 1982-2007.

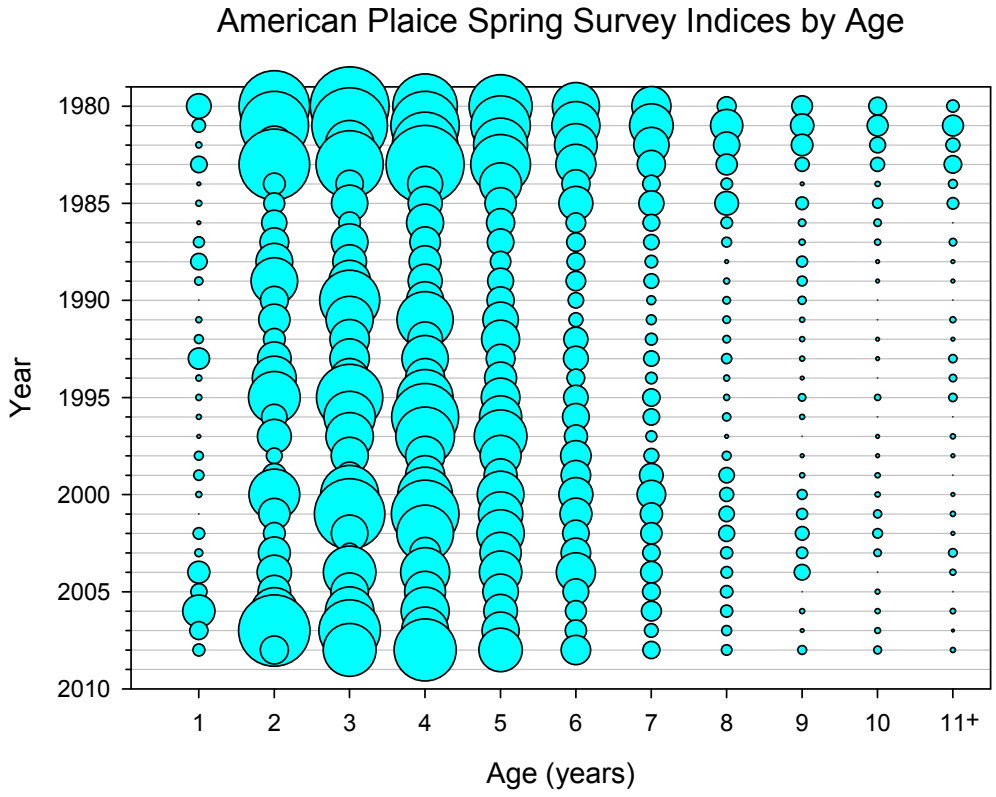


Figure H7. Standardized stratified mean catch per tow at age (numbers) of American plaice in NEFSC spring bottom trawl surveys, 1980-2008.

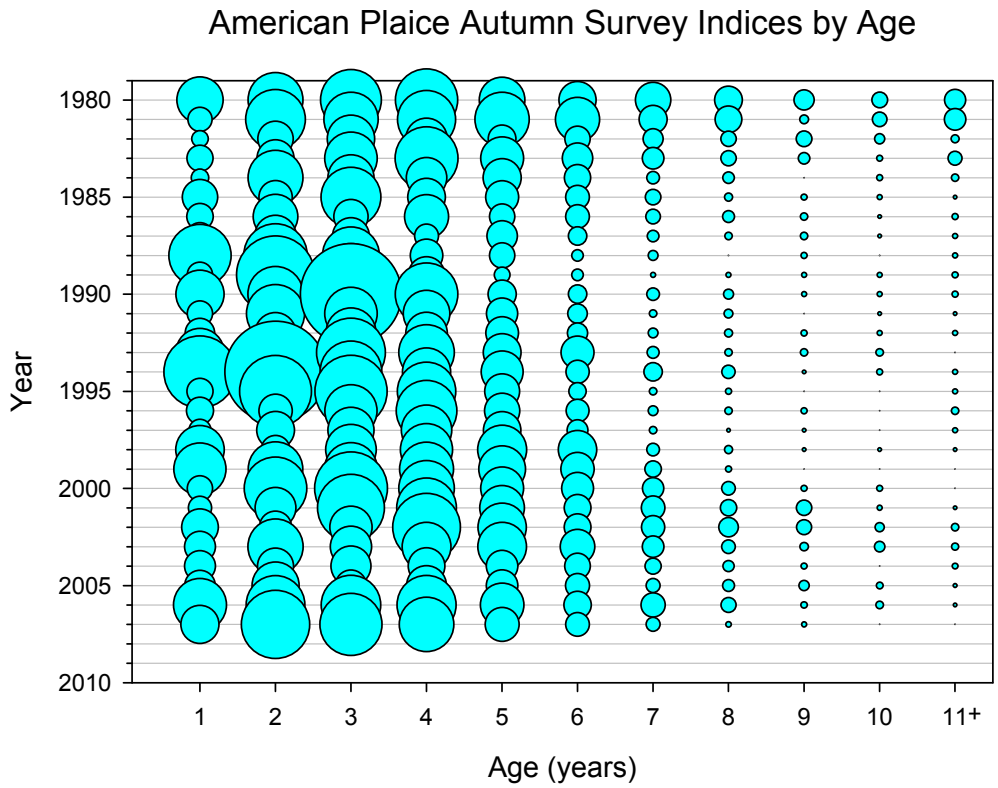


Figure H8. Standardized stratified mean catch per tow at age (numbers) of American plaice in NEFSC autumn bottom trawl surveys, 1980-2007.

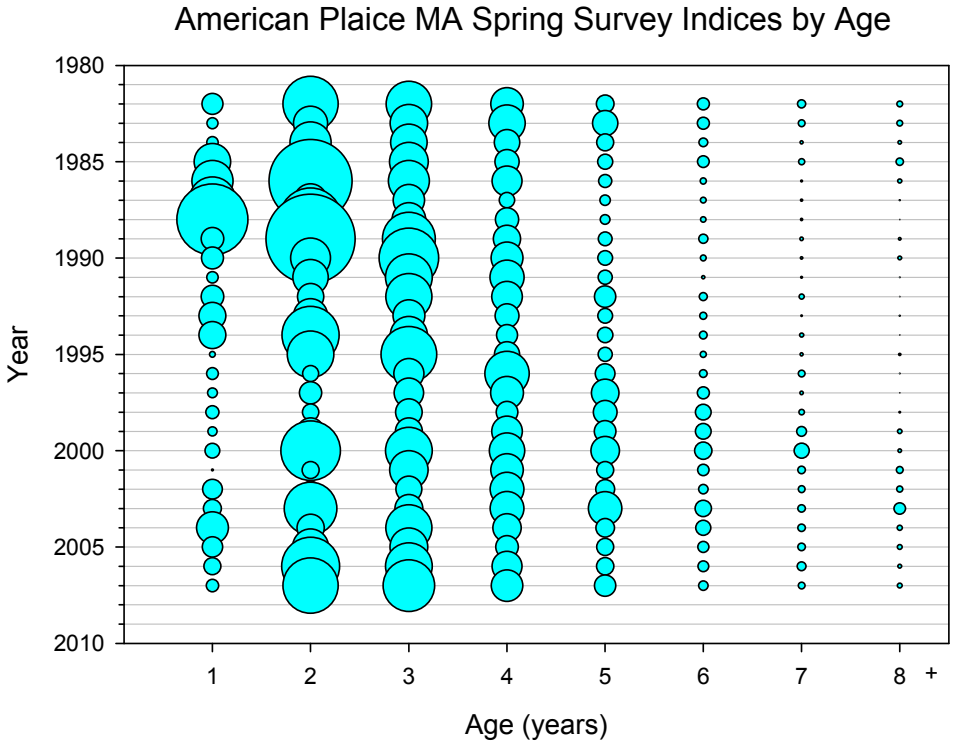


Figure H9. Standardized stratified mean catch per tow at age (numbers) of American plaice in Massachusetts State spring bottom trawl surveys, 1982-2007.

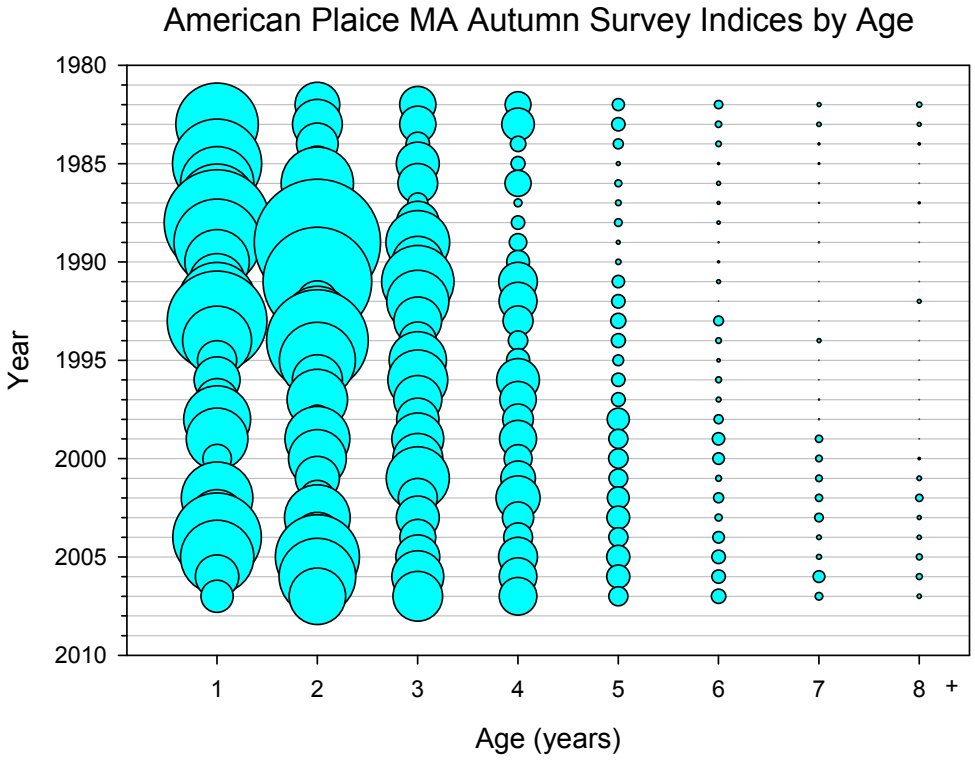
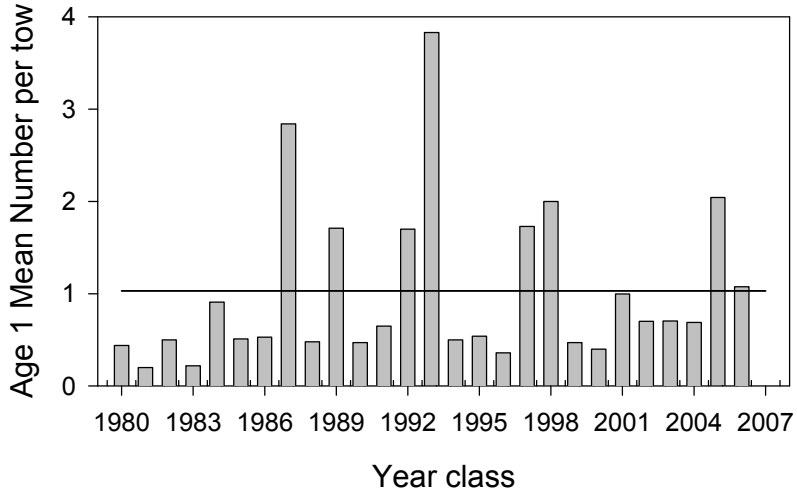


Figure H10. Standardized stratified mean catch per tow at age (numbers) of American plaice in Massachusetts State autumn bottom trawl surveys, 1982-2007.



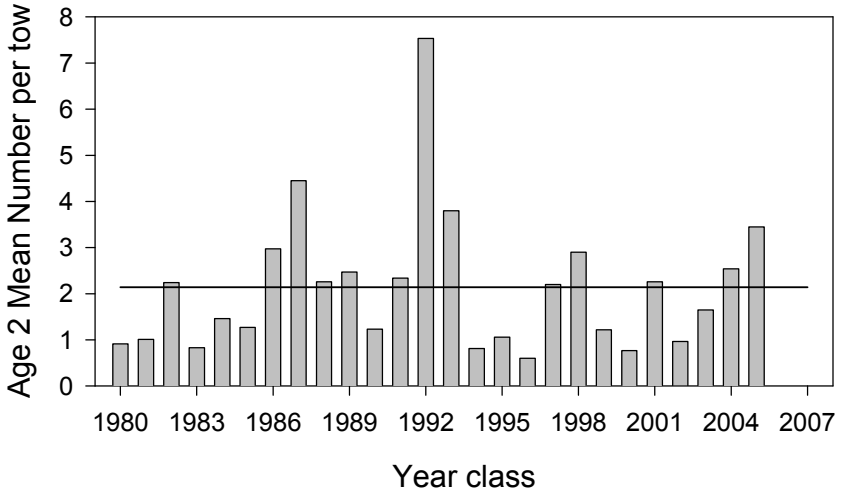
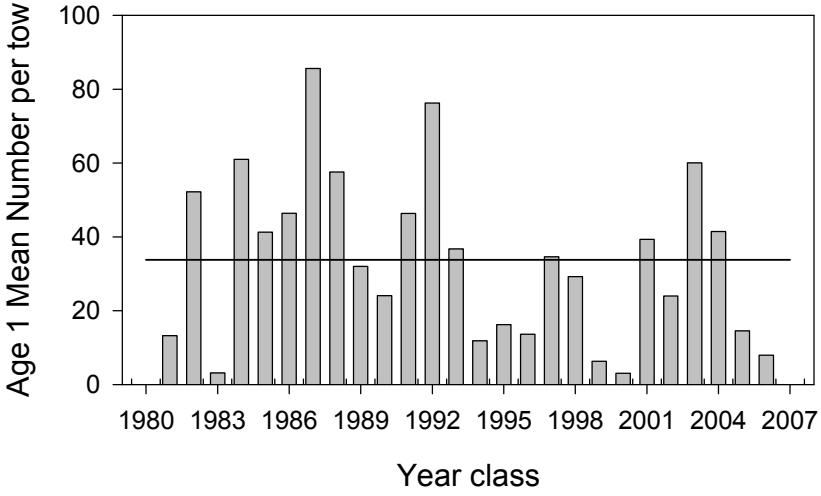


Figure H11a. Relative year class strength of age 1 and age 2 Gulf of Maine-George Bank American plaice from standardized catch (number) per tow indices from NEFSC autumn research vessel bottom trawl surveys, 1980-2007.



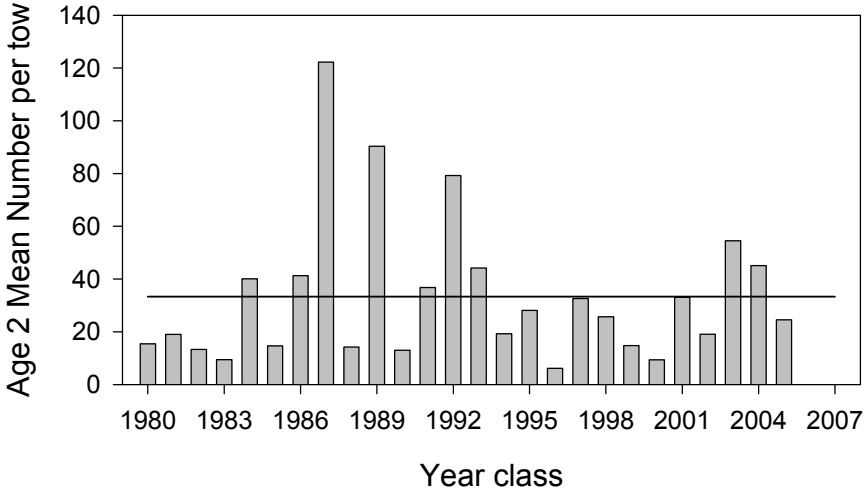


Figure H11b. Relative year class strength of age 1 and age 2 Gulf of Maine-George Bank American plaice from standardized catch (number) per tow indices from MADMF autumn research vessel bottom trawl surveys, 1982-2007.

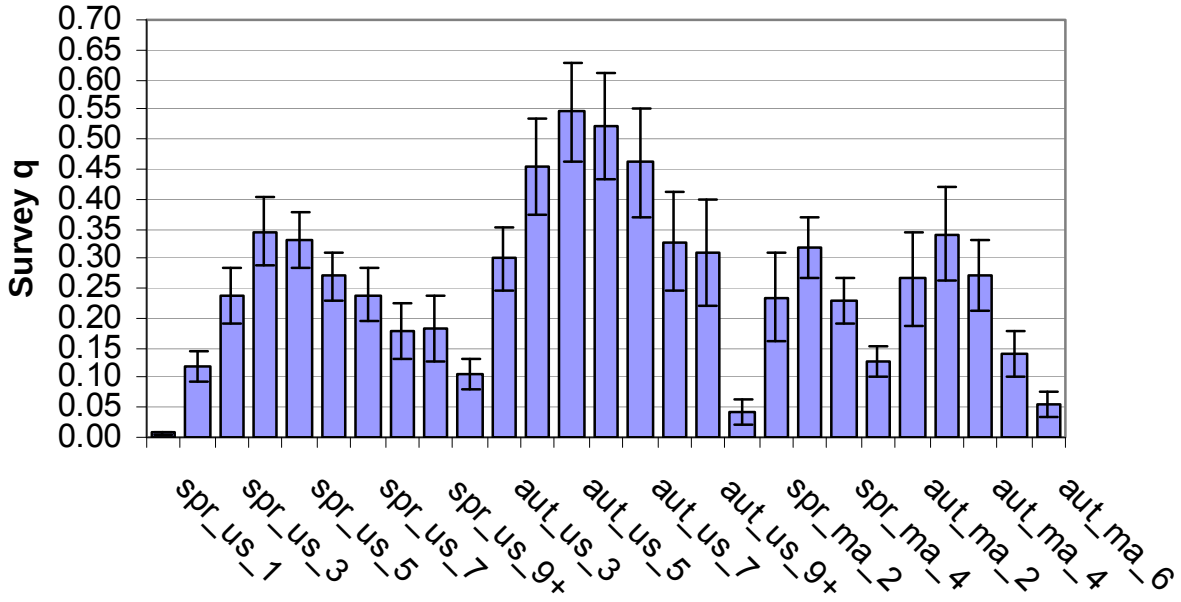


Figure H12. Survey catchability (q) estimates based on swept area estimates of American plaice in NMFS and MADMF spring and autumn research bottom trawl surveys.

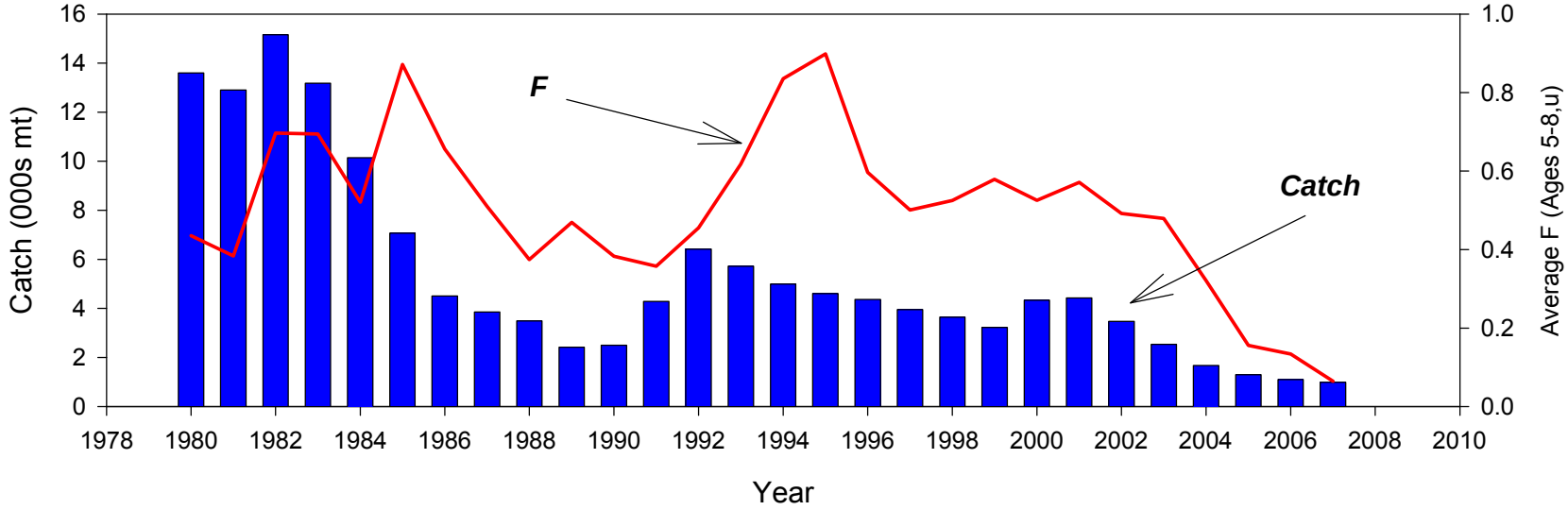


Figure H13. Trends in total commercial catch and fishing mortality for Gulf of Maine-Georges Bank American plaice, 1980-2007.

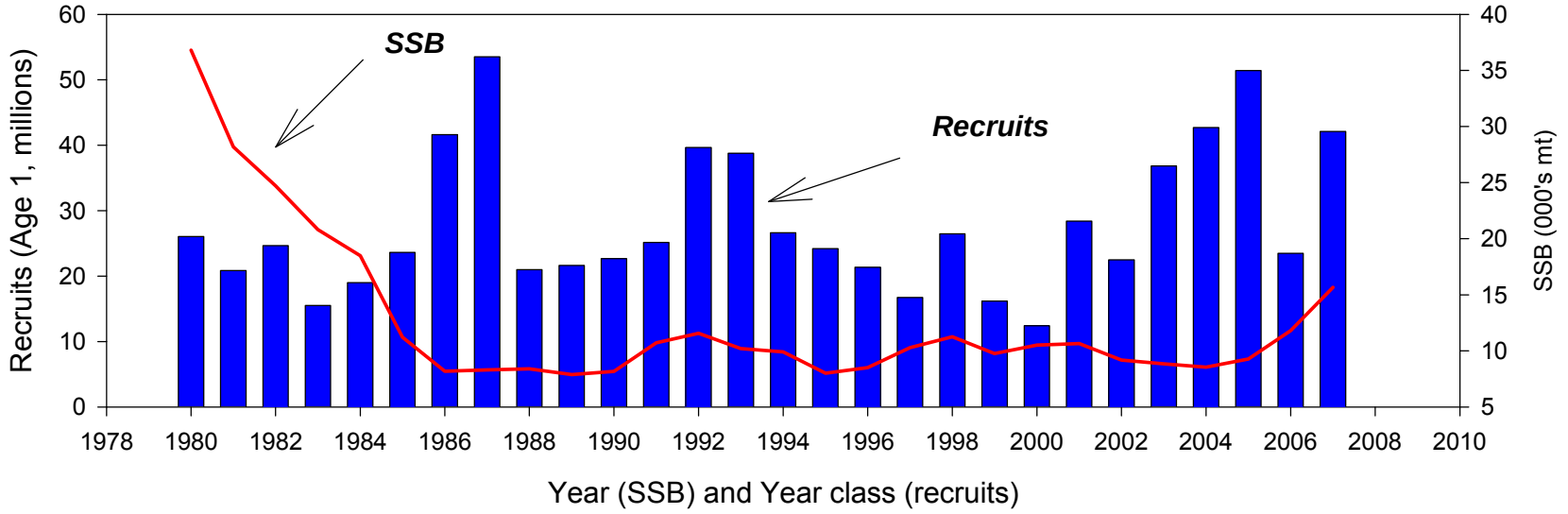
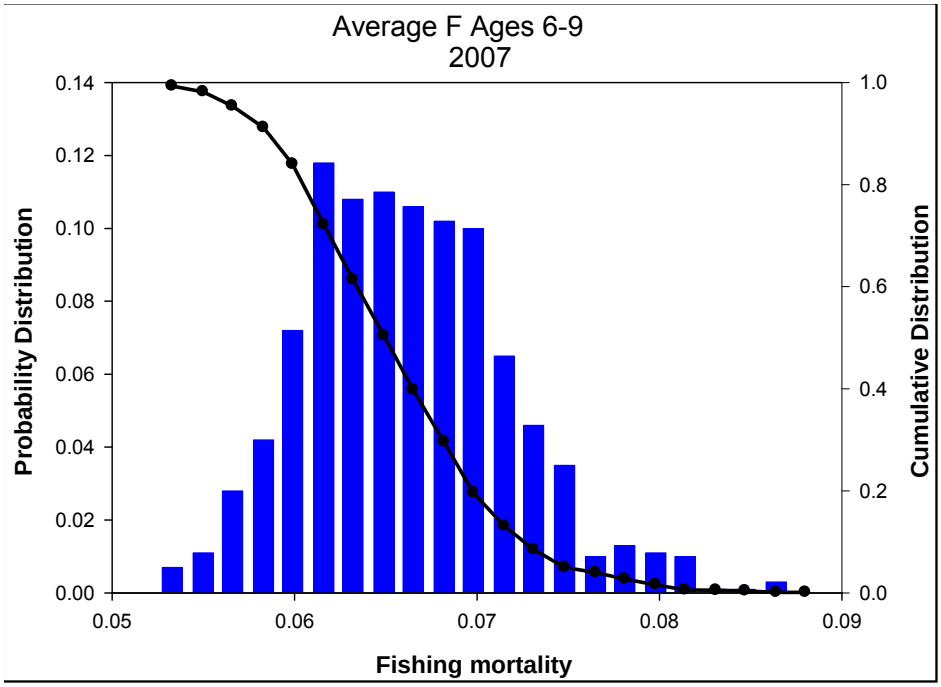


Figure H14. Trends in recruitment and spawning stock biomass for Gulf of Maine-Georges Bank American plaice, 1980 - 2007.



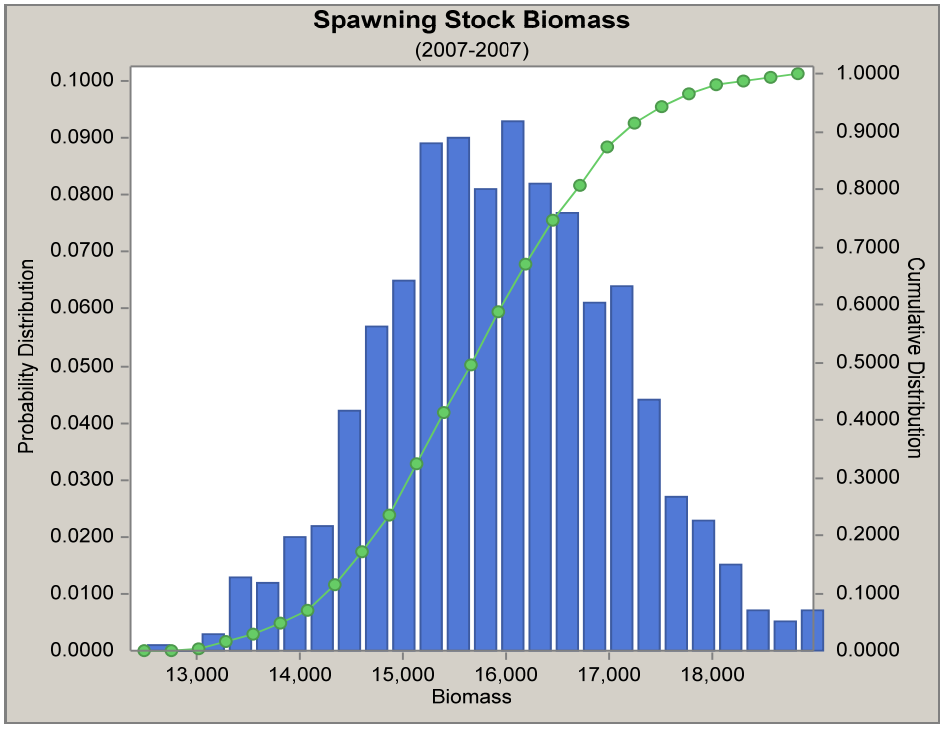


Figure H15. Precision of the estimates of the instantaneous rate of fishing (F) on the fully recruited ages(6-9) and spawning stock biomass at the beginning of the spawning season for Gulf of Maine – Georges Bank American plaice, 2007. Bar height indicates the frequency of values within that range. The solid line is the cumulative probability that F is greater than or SSB is less than any selected value on X- axis.

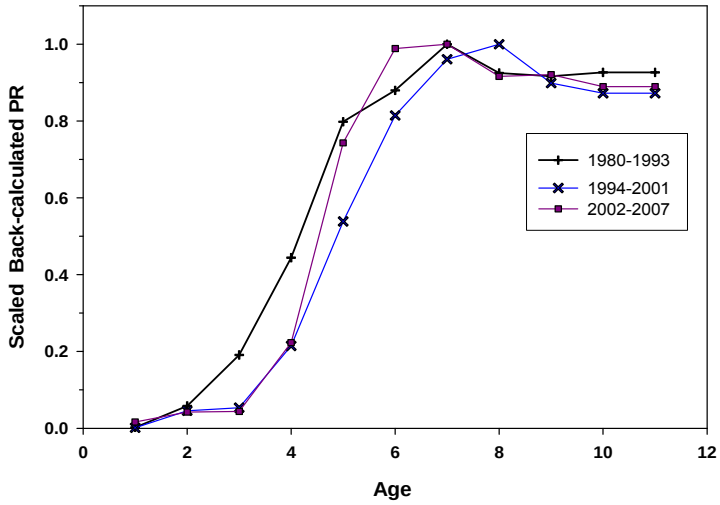


Figure H16. Scaled back-calculated partial recruitment (PR) from VPA for time periods 1980-1993, 1994-2001, and 2002-2007 for Gulf of Maine-Georges Bank American plaice.

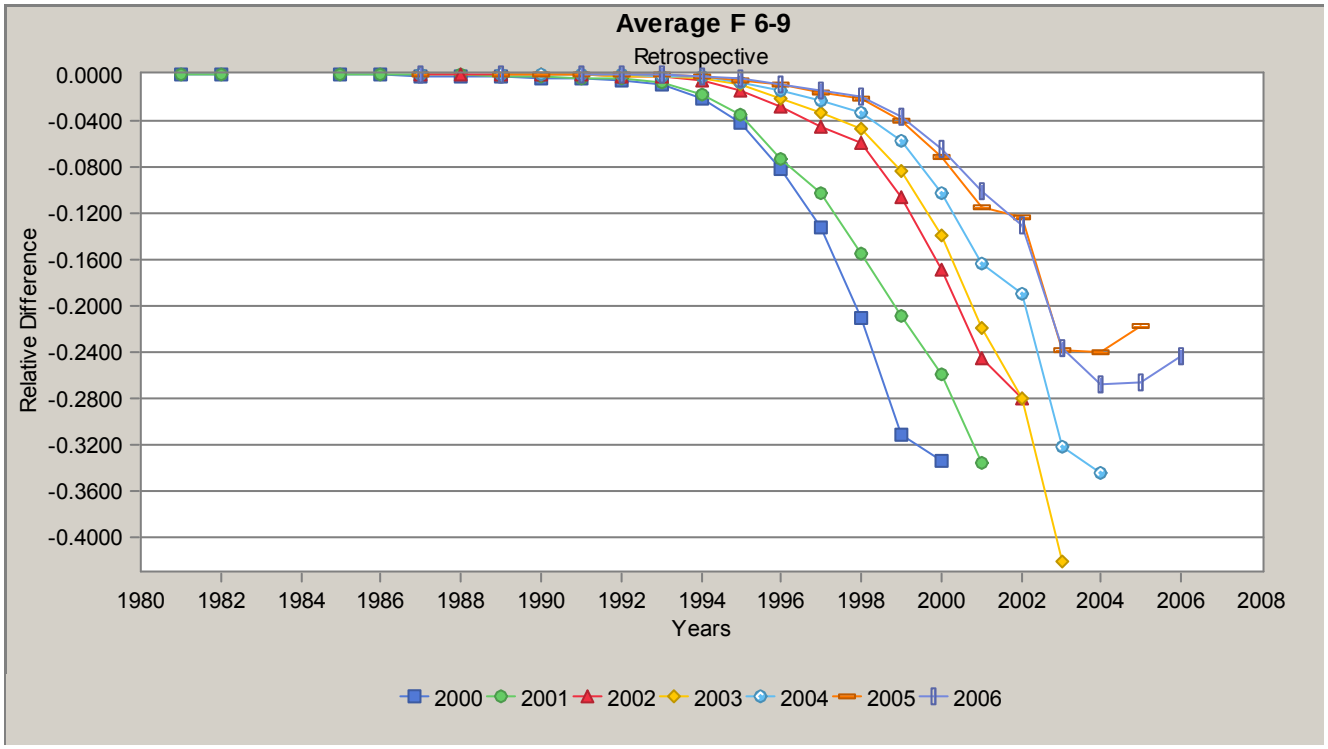


Figure H17a. Retrospective analysis of relative difference to terminal year 2007 of Gulf of Maine-Georges Bank American plaice fishing mortality (ages 6-9, unweighted), based on ADAPT VPA , 2000-2007.

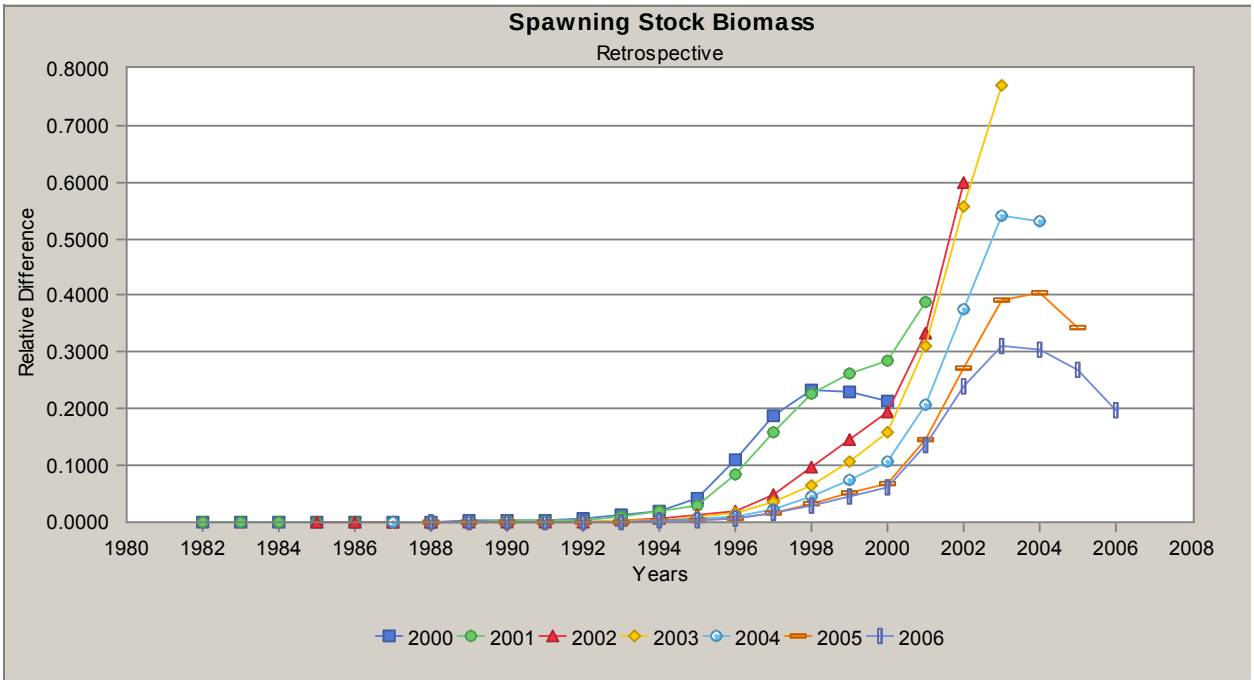


Figure H17b. Retrospective analysis of relative difference to terminal year 2007 of Gulf of Maine-Georges Bank American plaice spawning stock biomass based on ADAPT VPA , 2000-2007.

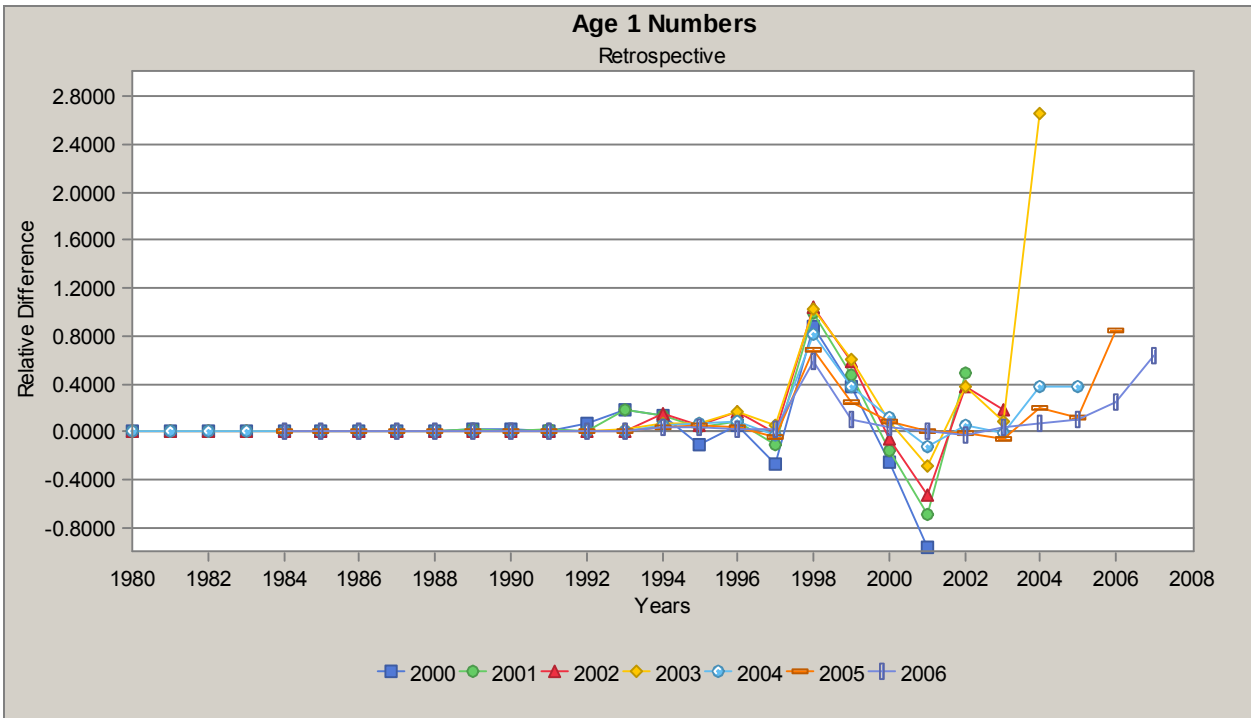


Figure H17c. Retrospective analysis of relative difference to terminal year 2007 of Gulf of Maine-Georges Bank American plaice age 1 recruits based on ADAPT VPA , 2000-2007.

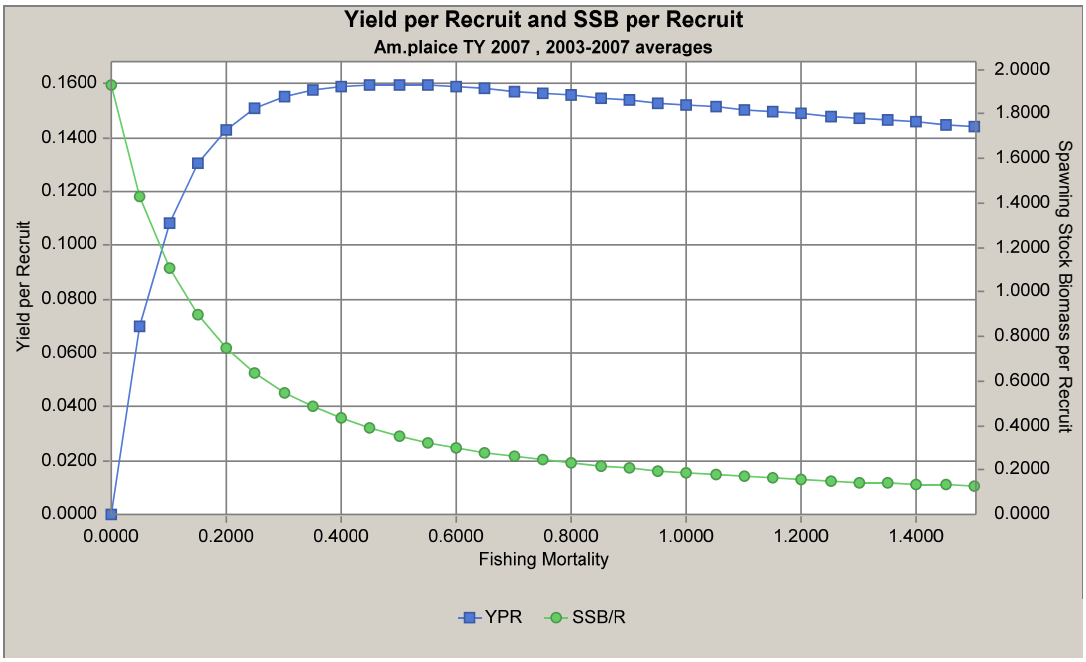


Figure H18. Yield- and Spawning Stock Biomass per-recruit analysis for Gulf of Maine – Georges Bank American plaice. $F_{0.1}$ =0.2 , F_{max} = 0.48 and $F_{40\%}$= 0.19.

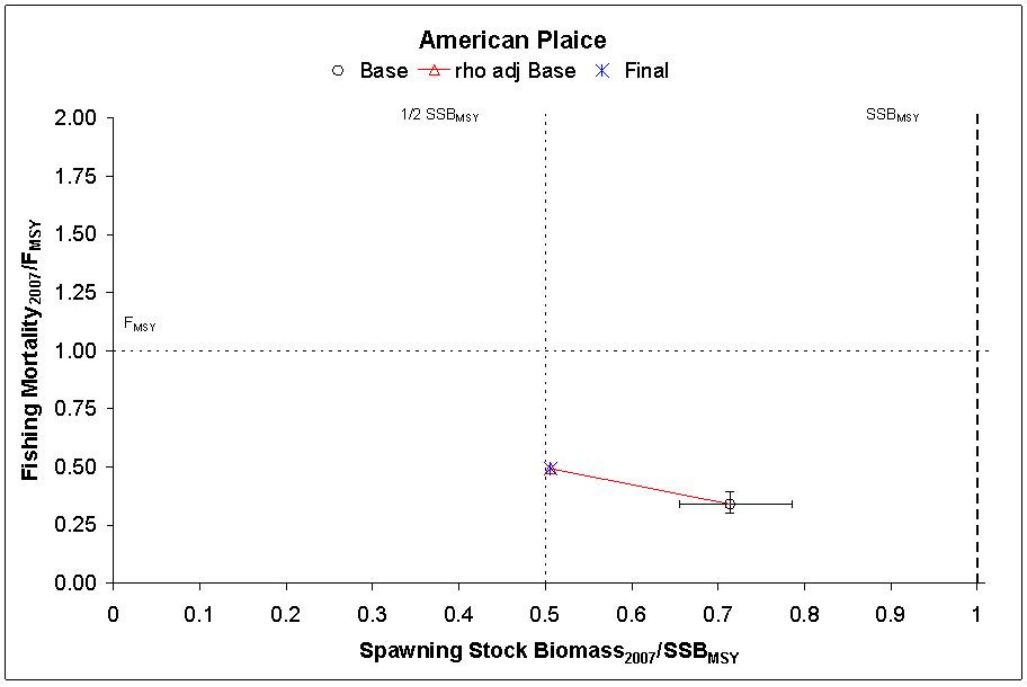


Figure H19. Status of 2007 fishing mortality (F) and spawning stock biomass (SSB) of Gulf of Maine-Georges Bank American plaice relative to F_{MSY} and SSB_{MSY} .