I. Gulf of Maine winter flounder
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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

Gulf of Maine winter flounder is the smallest of three winter flounder stocks (Figure I1). Gulf of Maine winter flounder was assessed in GARM II with ADAPT VPA model with catch through 2004 (NEFSC 2005). The GARM II assessment concluded that the stock is not overfished and overfishing is not occurring. Spawning stock biomass was estimated to be at 3,400 mt and fully recruited F = 0.13 in 2004. SSB at B_{MSY} was estimated to be at 4,100 mt and F_{MSY} = 0.43. The GARM II VPA possessed a severe retrospective pattern in F and a large overestimation of SSB. GARM II concluded that VPA results are too uncertain as a basis for performing projections.

Commercial and recreational landings were re-estimated from 1990 to 2007. Discards were re-estimated for the large mesh trawl and gillnet fisheries using discarded winter flounder to sum kept all species ratios from 1989-2007. The catch at age and catch at length was re-estimated through 2007. The lack of a relationship between catch and the indices did not produce reliable results from the AIM model (GARM III model meeting). Examination of an alternative forward projecting model (SCALE) that tunes to length data produced similar results and had similar diagnostic issues as the VPA. The lack of fit to the survey indices in the VPA results in high uncertainty in the status determination.

2.0 Fishery

Commercial landings were near 1,000 mt from 1964 to the mid 1970s. Thereafter commercial landings increased to a peaked of 2,793 mt in 1982, and then steadily declined to 350 mt in 1999. Landings have been near 500 mt from 2000 to 2004. Landings have declined to a record low of 200 mt in 2006 (Table I1, Figure I2). Landings remained low in 2007 at 260 mt. The primary gear used was the otter trawl from 1964-1985 that accounted for an average of 95% of the landings. Otter trawl accounted for an average of 75% of the landings from 1986- 2007 with an increase in the proportion of the landings coming from gillnets (25% from 1986-2007) (Table I2). In 2002 gillnet landings also shifted from occurring mostly in the first half of the year to a greater proportion coming from the second half. Since 1999 around 95% percent of the landings are taken in Massachusetts from statistical area 514 (Appendix I Figures I3 and I4, NEFSC 2008).

Recreational landings reached a peak in 1981 with 2,554 mt but declined substantially thereafter (Table I3, Figure I3). Landings have been less than 100 mt since 1995, with the lowest estimated landings in 2004 of 19 mt. Recreational landing weight was re-estimated using the expanded numbers at length and the length weight relationship by half year for input to the Scale and Aim models.

In the commercial fishery, annual sampling intensity varied from 6 to 310 mt landed per sample during 1982-2007. Overall sampling intensity was adequate, however temporal and market category coverage in some year was poor (Table I4). Samples were pooled by half year when possible. In 1982 mediums were pooled with unclassified by half year, in 1985, 1995, 2005, 2006, and 2007, smalls were pooled with mediums, and the large samples from adjacent years were used for the lack of samples in 1996, 1999, and 2001. Sampling coverage may have been poor but length frequency samples appeared relatively constant over time and there was a substantial amount of overlap between market categories which help justify the pooling used in the assessment. Lengths of kept fish from observer data were used to supplement length data of unclassified fish. Kept fish lengths taken from gillnet trips in the observer data were used to characterize the gillnet proportion of the landings (Table I5). The decline in landings has made it difficult to get samples from the medium and large market categories in recent years. Catch at age and catch at length was also estimated using only observe kept length measurements by gear type from 1999 to 2007. Characterization of the landings using the observer data produced expanded catch at length distributions similar to the length expansions using the port samples by market category for years which had relatively good port sampling (Figures I4 and I5). Observer length samples were used in the VPA and SCALE model to characterize the size distribution of the landings from 1999 to 2007.

Discards were estimated for the large mesh trawl (1982-2007), gillnet (1986-2007), and northern shrimp fishery (1982-2007) (Table I6 through I8). The survey method was used in estimating both the discard and proportion discards at length for the large mesh trawl fishery from 1982-1988 (Mayo et al. 1992). Observer discard to landings of all species ratios were applied to corresponding commercial fishery landings to estimate discards in weight from 1989 to 2007 for the large mesh trawl fishery. In GARM II the VTR large mesh otter trawl discards to landings of winter flounder ratios were used to estimate the discards. The Fishery Observer length frequency samples were judged inadequate to characterize the proportion discarded at length from 1989 to 1998 for the large mesh trawl fishery and the length proportion from the survey method was used to characterize the size distribution of discarded fish. Observer kept length sampling increased in 1999 and were used to characterize the large mesh trawl discards from 1999 to 2007. The observer sum discarded to landing of all species ratios were used for estimating gillnet discard rates. Observer sum discarded to days fished ratios were used for the northern shrimp fishery since landing of winter flounder in the shrimp fishery is prohibited. The observer length frequency data for gillnet and the northern shrimp fishery were used to characterize the proportion discarded at length. The sample proportion at length, converted to weight, was used to convert the discard estimate in weight to numbers at length. As in the southern New England stock (NEFSC 1999), a 50% mortality rate was applied to all commercial discard data (Howell et al., 1992). Numbers at ages were determined using NEFSC/MDMF spring and NEFSC fall survey age-length keys.

A discard mortality of 15% was assumed for recreational discards (B2 category from MRFSS data), as assumed in Howell et al. (1992). Discard losses peaked in 1982 at 140,000 fish. Discards have since declined to 4,000 fish in 2007 (Table I3, Figure I3). Since 1997, irregular sampling of the recreational fisheries by state fisheries agencies has indicated that the discard is usually of fish below the minimum landing size of 12 inches (30 cm). For 1982-2007, the recreational discard has been assumed to have the same length frequency as the catch in the MDMF survey below the legal size and above an assumed hookable fish size (13 cm). The recreational discard for 1982-2007 is aged using NEFSC/MDMF spring and NEFSC fall survey age-length keys.

A summary of how the catch at age was constructed can be seen in Table I9. The re-estimated discards for the large mesh trawl and gillnet fisheries are on the same order of magnitude with the previous GARM II estimates (Appendix I Figure I5). However, discard estimates from 1989 to 1992 using the survey filter method were higher than estimates from the new discard to kept all observer ratios. The predicted landings using the kept to landing of all species ratio are also on the same order of magnitude with the dealer landings (Appendix I Table I1 and Figure I6). Decreases in the catch at age components are shown in Table I10 through I13 and Figure I6. Mean weights at age and the total catch at age are given in Table I14 and I15 and Figures I7 and I8.

3.0 Research Surveys

Mean number per tow indices for the NEFSC and the Massachusetts Division of Marine Fisheries (MDMF) spring and fall time series are presented in Table I16 and Figures I9 through I12. All of the indices generally show a slight decrease in the population in the late 1980s from a high in the early 1980s with low abundance remaining through the early 1990s. All of the indices show signs of increase abundance starting in 1998 and 1999. Since 2001 all indices indicate a decrease in abundance. The MDMF survey catchability is on the order of 60 to 100 fish per tow while NEFSC survey catchability is on the order of 4 to 14 fish per tow. Age data for the MDMF fall survey are not available. The NEFSC fall ages where used to age the MDMF fall index.

Maine and New Hampshire have been conducting an inshore bottom trawl survey in the Spring since 2001 and in the Fall since 2000 (Appendix I Figures I10 through I12; NEFSC 2008)). These survey indices are relatively flat over the time series with slightly higher abundance in 2004 (Figure I13). Comparison of the Spring and Fall surveys show similar trends. Age information for this index is not available for the GARM III assessment.

The Seabrook Nuclear Power Plant in New Hampshire has conducted a monthly bottom trawl survey at 3 fixed sites since 1985. The monthly survey was broken down to a spring and fall survey. No survey was conducted in 1993. This survey also shows an increase in the number of fish in the late 1990s (Figure I14). However this survey does not show as much of a recent decline in the stock as the NEFSC and MDMF surveys. The Seabrook fall index is not used for tuning due to a lack of sampling in more recent years at one of the three stations because of the presence of lobster gear. Only age 1 and age 2 indices estimated by length slicing was used in the VPA and Scale model from this survey. Very few fish over 30 cm are caught in this survey. Some correspondence between the estimated age 1 and 2 indices can be seen in the indices (weak 1999 and strong 2003 yearclass) (Appendix I Figure I13; NEFSC 2008)).

Normandeau Associates, Inc. (2000-2006) and the Massachusetts Division of Marine Fisheries (1995-1999) conducted an area swept estimate of winter flounder in the Western Cape Cod Bay to assess impacts of the Pilgrim Nuclear power plant. Thousands of fish were measured in each year from 1995 to 2007 from a spatially limited area. A difference in the size distributions by sex is evident in the data (Appendix I Figure I14; NEFSC 2008)). The length frequency distributions where used for tuning in the SCALE model. There is little change in the distribution of 30+ cm fish over the 1995 to 2007 time series.

An examination of the survey catch per tow at length was conducted to determine the ability of the survey in tracking cohorts. Survey catch per tow at length were plotted with alternating spring and fall surveys over time (Figures I15 and I16, Appendix I Figures I16 and I17). Yearclasses were estimated using growth information. The growth and tracking of cohorts in the younger ages can be seen in the MDMF spring and fall surveys. The younger length modes are more difficult to observe in the NEFSC survey which has a lower catchability. However the MDMF survey appears to have lower catchability at larger sizes (30+cm) which is reflected in the VPA Q estimates for the older fish. The NH/ME survey catches very few fish over 30 cm (Appendix I Figure I18). Length modes also did not appear to match the MDMF survey for young fish. Aging of the NH/ME samples will be needed to determine if slower growth exists in inshore waters north of Massachusetts. Uncertainty in the age structure makeup of this survey precludes its use in the assessment models at this time. There was relatively good correspondence between the estimated age index by slicing the survey length frequencies and the actual index at age for both the NEFSC and MDMF surveys (Appendix I Figures I19 through I22; NEFSC 2008). The raw length frequency data suggests the occurrence of a strong 1998 yearclass evident in both the MDMF and NEFSC surveys. However the detection of this yearclass as it growths above legal size is more difficult to discern (Figure I15 and I16). The strong 1998 yearclass is not estimated in the VPA model. A relatively weak 1999 and stronger 2003 yearclasses can also be observed in the indices at length. However the tracking of yearclassess is more difficult to observe in the indices at age (Figures I17 through I19).

Some evidence for a change in the spatial distribution can be seen in the MDMF and NEFSC surveys. There appears to be a shift in abundance for all sizes from shallow water in early 1980s to deeper strata at the end of the time series (Figure I20). Offshore stratum 26 which contains Stellwagon bank also shows increase abundance starting in 1999 while the northern offshore strata off the coast of Maine show no signs of rebuilding (Appendix I Figures I23 and I24; NEFSC 2008).

4.0 Assessment

Abundance indices at age were available from several research surveys: NEFSC spring bottom trawl ages 1-8+, NEFSC fall ages 1-8+ (advanced to tune January 1 abundance of ages 2-8+), Massachusetts spring ages 1-8+, and Massachusetts fall ages 0-8+ (advanced to tune January 1 abundance of ages 1-8+) (Figures I21). There was little change in the female 3 year moving average maturity using MDMF spring survey (Appendix I Figure I28; NEFSC 2008). A logistic maturity estimate using all years combined (1982-2007) from the spring MDMF survey was used for the maturity schedule (Figure I22).

Both the VPA and an alternative SCALE model suffer from unstable estimates of fishing mortality and population abundance. There are conflicting trends between an overall increasing trend in the age 1 and age 2 recruitment indices and a large decline in the catch over the time series. A decline in the 4+ age indices at the end of the time series also contributes to the estimation difficulties.

Results of the alternative SCALE model are shown in Appendix I (NEFSC 2008). The SCALE model is a simple forward projecting model that tunes to age data for the younger recruitment ages (age 1, 2, and 3) and length data for the larger adult fish (30+ cm). The SCALE model assumes an overall time invariant growth curve with assumed input variation around the mean lengths at age. The population can be modeled with sex specific growth and natural mortality or with the sexes combined. The SCALE model suffered from similar diagnostic issues as seen in the VPA. The Base SCALE model run possessed a similar retrospective pattern as the VPA. Winter flounder exhibit sexual dimorphic growth. Abundance in the surveys by age and sex also suggests there is a difference in natural mortality between the sexes (Appendix I Figures I25 through I27). However modeling the population by sex did not produce a change the overall results nor did it improve model diagnostics. The split SCALE model results were sensitive to the weighting on the recruitment indices (Appendix I Figure I29). The SCALE model run with a low weight on fitting the recruitment ages indices produced similar results to the split VPA model (Appendix I Figure I32) and the SCALE model run which increased the weight on the recruitment indices produced a status determination similar to the base case VPA (Appendix I Table I4). The VPA model was considered for stock status determination since an a priori rationale for a higher weight on the surveys did not exist. In fact there was some evidence of a change in the surveys through a population distributional shift over time (Figure I20).

Sensitivity of the VPA model results to the inclusion of the poorest fitting indices and to indices which displaced the worst residual patterns can be seen in Table I17. The split VPA run (run 2b) which included all of the indices was used for the status determination. The geometric mean recruitment from 1982 to 2007 was used to estimate recruitment in t+1 due to the limited amount of survey indices available to estimate recruitment in t+1 (the preliminary NEFSC spring 2008 index). The high estimate of recruitment in t+1 in run 2A was thought to be unreliable since there appears to be a year effect in the NEFSC Spring 2008 index.

The base VPA run showed a severe pattern in the residuals (Figure I23). The base VPA run also exhibits a severe retrospective pattern in F, recruitment, and a large overestimation of SSB (Figures I24 and I25). Splitting all of the surveys between 1993 and 1994 did improve the retrospective pattern (Figures I26 and I27). The improvement in Mohn's rho from a seven year peel in the split VPA run can be seen in Table I18. A residual pattern still exists within each survey block (1982-1993 & 1994-2006) for the younger ages 1 to 3 (Figure I23). However the residual pattern did improve for the older ages (4+). Splitting the surveys allows the model to estimate further declines in abundance with higher Fs at the end of the time series (Figures I28 and I29). The split survey model is less constrained by the conflicts between the large decline in the catch and the survey abundance of the older fish (4+) at the end of the time series.

Area swept Q estimates suggest some efficiencies greater than one in both the base and split model runs (Figure I30). However the area coverage for an average MDMF survey tow is based on a limited number of mensuration tows. A doming of the survey Q for older ages can be seen in the MDMF survey. Many of the survey Qs more than tripled in the split VPA run. Only the base run limited to just the NEFSC surveys estimated all of the Qs under 1 (Appendix I Figure I34).

Split VPA Run 2b is summarized in Table I19. Fishing mortality ages 5-6 was 0.42 in 2007 from the split VPA (run 2b). There is a 80% chance that the 2007 F was between 0.34 and 0.53 Spawning stock biomass was estimated to be 1,100 mt in 2007 (Figure I31). There is an 80% chance that the spawning stock biomass was between 970 mt and 1,277 mt in 2007.

5.0 Biological reference points (BRPs)

Stock recruit relationships from the split VPA model are shown in Figure I32. The GARM III biological reference point review panel recommended not using stock recruit reference points due to uncertainty with the estimated recruitment. The VPA appears to produce a linear relationship between stock and recruitment. Empirical biological reference points were developed using the entire time series of recruitment and F40% as a proxy for F_{MSY} (Table I20). An age based yield per recruit model from the split VPA estimated F40% at 0.28 (Figure I33). The average of 2003 to 2007 partial recruitment, and mean weights at age from the VPA were used as inputs to the age based yield per recruit and the AGEPRO biological reference point calculations (Table I21).

SSB_{MSY} and MSY were estimated using long term AGEPRO projection using the models CDF of age-1 recruitment and the estimated F40% for the F_{MSY} proxy. Estimated reference points and status determination is summarized in Table I20 and Figure I34. Differences in estimated age-1 recruitment and a small difference in the partial recruitment pattern between the base and split VPA did produce some differences in the estimated reference points between the runs (Table I20). The change in status determination from the GARM I and GARM II and base GARM III VPA assessment runs are due to the large retrospective pattern.

6.0 Projections

The Gulf of Maine winter flounder assessment is too uncertain as a basis for performing projections.

7.0 Summary

The split VPA model estimated spawning stock biomass in 2007 at 1,100 mt or about 29% of SSB_{MSY} = 3,792 mt and fishing mortality in 2007 was 0.42 or about 147% of F_{MSY} = 0.28. Thus, the stock is likely in an overfished condition and overfishing is probably occurring. There is high uncertainty on the status determination in this assessment. The base case VPA and a split forward projection model (SCALE) which puts higher weight on the recruitment indices suggests the stock was not overfished and overfishing was not occurring. However the base case VPA had a severe strong retrospective pattern (Mohn's Rho on SSB was 212% and -70% on F). The VPA shows greater reductions in biomass than observed in the survey biomass trends. All models have difficulty fitting the relatively flat age 1 and age 2 recruitment indices and the decrease in adult indices with the large decline in the catch at the end of the time series. Questions remain with the high area swept Qs estimates along with the large magnitude of the change in Q from the split. The conflicting trends between the catch and the indices in the assessment results in high uncertainty in the status determination. However all models (VPA and SCALE) suggest spawning stock biomass is well below SSB_{MSY} and is likely below ½ SSB_{MSY}. This is consistent with biomass trends in the other flatfish stocks (southern New England winter flounder, American plaice, and Cape Cod – Gulf of Maine yellowtail). Projections were not conducted due to the high uncertainty in the assessment.

8.0 Panel discussion / comments

Conclusions

The proposed VPA exhibited a large retrospective pattern that could not be adjusted for by splitting the survey time series. A SCALE model which had been suggested (GARM III 'models' review) as an exploratory tool also did not fit the data. The Panel noted many of the difficulties in the assessment including a lack of tracking of year - classes in the surveys and catch, conflicting abundance trends between survey and catch, estimated survey efficiencies greater than one, and so on. For instance, whereas catch declined during the early part of the time series, survey abundance has relatively stable. Further, there was an apparent increase in survey abundance in the early 2000s that was inconsistent with trends in the catch and recruitment. These issues highlighted the problems with using an age-based class of model on this resource, a point raised earlier in the GARM III 'models' review. The Panel also had concerns about the unit stock, not only for this stock, but for all of the Winter Flounder stocks assessed. It recommended an analysis of Winter Flounder as a stock complex, rather than as individual stocks, be undertaken.

Given the problems encountered, the Panel agreed that none of the models put forth gave a clear picture of the status of the resource. Further, the Panel noted that until these issues were resolved, the proposed analysis could not be used to provide management advice nor stock projections.

While the Panel was unable to determine the stock's status relative to the BRPs, it agreed that the current trend in the population was very troubling. The Panel generally agreed that it is highly likely that biomass is below B_{MSY}, and that there is a substantial probability that it is below ½ B_{MSY}. The Panel noted that other stocks in the area of this mixed fishery were also at low levels.

Research Recommendations

Assessment approaches needs to be explored that consider all three Winter Flounder stocks as a stock complex within which there is significant interaction amongst the individual stock components.

9.0 References

Howell P, Howe A, Gibson M, Ayvasian S. 1992. Fishery management plan for inshore stocks of winter flounder. ASMFC. Fish Mgmt Rep. 21.

Mayo RK, O'Brien L, Buxton N. 1992. Discard estimates of American plaice, *Hippoglossoides platessoides*, in the Gulf of Maine northern shrimp fishery and the Gulf of Maine-Georges Bank large-mesh otter trawl fishery. SAW 14 Res Doc. 14/3; 40 p.

NEFSC. 2003 Report of the 36th Northeast Regional Stock Assessment Workshop (36th SAW): Stock Assessment Review Committee (SARC) consensus summary of assessments. NEFSC Ref Doc 03-06; 453 p.

NEFSC. 2005. Assessment of 19 Northeast groundfish stocks through 2004. 2005 Groundfish Assessment Review Meeting (GARM) 2005. August 15-19. NEFSC Ref Doc. 05-13.; 508 p. Woods Hole, MA.

Witherell B, Burnett J. 1993. Growth and maturation of winter flounder, *Pleuronectes americanus*, in Massachusetts. Fish Bull. 91; p 816-820.

Table I1. Winter flounder commercial landings (metric tons) for Gulf of the Maine stock (U.S. statistical reporting areas 511 to 515). Landings from 1964-1977 is taken from SARC 21, 1982-1993 is re-estimated from the WODETS data, 1994-2007 is estimated using the trip based allocated AA tables.

Year	metric tons	Year	Metric tons
1964	1,081	1990	1,116
1965	665	1991	1,008
1966	785	1992	825
1967	803	1993	611
1968	864	1994	543
1969	975	1995	707
1970	1,092	1996	606
1971	1,113	1997	569
1972	1,085	1998	643
1973	1,080	1999	350
1974	885	2000	535
1975	1,181	2001	698
1976	1,465	2002	683
1977	2,161	2003	754
1978	2,194	2004	623
1979	2,021	2005	335
1980	2,437	2006	199
1981	2,407	2007	260
1982	2,793		
1983	2,096		
1984	1,699		
1985	1,582		
1986	1,188		
1987	1,140		
1988	1,250		
1989	1,253		

Table I2. Gulf of Maine winter flounder commercial landings (metric tons) by gear.

Year	Trawl	Shrimp	Gillnet	Other	Total
1982	2,485	151	59	99	2,793
1983	1,819	142	54	80	2,096
1984	1,438	139	26	96	1,699
1985	1,446	62	16	59	1,582
1986	912	69	164	42	1,188
1987	848	97	135	60	1,140
1988	1,016	61	161	12	1,250
1989	1,008	58	138	48	1,253
1990	857	25	214	21	1,116
1991	868	22	94	25	1,008
1992	632	17	160	16	825
1993	460	1	138	13	611
1994	438	0	100	5	543
1995	511	1	184	10	706
1996	464	0	135	6	606
1997	426	0	134	9	569
1998	461	0	176	6	643
1999	248	0	101	1	350
2000	412	0	122	1	535
2001	529	0	160	9	698
2002	585	0	82	15	682
2003	564	0	185	5	754
2004	427	0	137	59	623
2005	230	0	67	38	335
2006	133	0	47	19	198
2007	169	0	70	20	260

Table I3. Estimated number (000's) and MRFSS estimated weight and predicted weight(mt) from length frequencies for Gulf of Maine winter flounder caught, landed, and discarded in the recreational fishery.

	Number (000's)				Metric tons	
	Catch A+B1+B2	Landed A+B1	Released B2	15% Release Mortality	MRFSS Landed A+B1	Predicted Landed
1981	6,200	5,433	767	115	2,554	2,270
1982	8,207	7,274	933	140	1,876	3,024
1983	2,169	1,988	181	27	868	817
1984	2,477	2,285	191	29	1,300	1,103
1985	3,694	3,220	474	71	1,896	1,629
1986	946	691	255	38	523	411
1987	3,070	2,391	679	102	1,809	1,443
1988	953	841	111	17	345	537
1989	1,971	1,678	294	44	620	1,035
1990	786	652	134	20	370	344
1991	213	154	59	9	91	86
1992	186	137	48	7	90	77
1993	398	249	150	22	140	134
1994	232	145	88	13	83	77
1995	150	83	67	10	40	40
1996	183	98	86	13	56	52
1997	192	64	129	19	43	32
1998	109	65	44	7	30	27
1999	109	65	44	7	33	34
2000	146	59	87	13	32	31
2001	173	72	102	15	45	37
2002	101	61	40	6	42	35
2003	86	52	34	5	32	29
2004	61	41	20	3	19	29
2005	79	40	39	6	25	24
2006	94	53	41	6	34	35
2007	74	48	26	4	28	26

Table I4. Number of lengths, samples, and metric tons per sample for Gulf of Maine winter flounder. Number of samples and calculations of metric tons per sample does not include observer data or gillnet landings from 1990-2007. * = redistributed according to market category and half year proportions. Bold numbers have additional lengths from observer trawl data but are not included in the number of samples.

	Number of lengths.						Number of samples						mt/samples					
year	half	lg	sm	med	un	total	half	lg	sm	med	un	total	half	lg	sm	med	un	total
1982	1	102	101		455		1	1	1		4		1	838	453		46	
	2	84	81		106	929	2	1	1		1	9	2	396	691		231	310
1983	1	380	100	99	407		1	4	1	1	4		1	120	510		53	
	2	115	1344		106	2551	2	2	11		1	24	2	125	44	64	95	87
1984	1	438	503		221		1	5	4		2		1	74	95			
	2	126	813	100		2201	2	1	6	1		19	2	189	67	114	124	89
1985	1	665	735				1	6	5				1	54				
	2	121			80	1601	2	2			1	14	2	87		182	176	113
1986	1	237	109	109	266		1	3	1	1	3		1		242	126	48	
	2		500	193	89	1503	2		6	2	1	17	2	113	37	31	56	70
1987	1				113		1				1		1					
	2	47	251	272		683	2	1	3	3		8	2	257	137	75	249	143
1988	1	102	258	706	*		1	1	3	7	*		1		108	23		
	2		169	107	*	1342	2		2	1	*	14	2	340	164	96		89
1989	1	113		91	**234**		1	1		1	**1**		1			168		
	2		95	220	**32**	785	2		1	2		6	2	313	435	42	**254**	209
1990	1	328	301		102		1	3	4		1		1	64	48			
	2	117	197	97		1142	2	1	2	1		12	2	83	90	144	111	75
1991	1	188	254	205	**143**		1	2	2	2	**2**		1	91	72			
	2	236	349			1375	2	3	3			14	2	32	62	95	57	65
1992	1	246	100	93	**107**		1	3	1	1			1					
	2	57	74	253		930	2	1	1	3		10	2	54	126	35		66
1993	1	100		288	**91**		1	1		3			1	84		17		
	2	80	55	157	**51**	822	2	1	1	2		8	2	47	178	30		59

Table I4. Continued.

	Number of lengths.						Number of samples						mt/samples					
year	half	lg	sm	med	un	total	half	lg	sm	med	un	total	half	lg	sm	med	un	total
1994	1		71	92			1		1	1			1			57		
	2	94		235	*	492	2	1		3		6	2	118	157	18		64
1995	1	101		474	**33**	474	1	1		5			1			29		
	2			414	**609**	1631	2			4		10	2	94		59		52
		↑																
1996	1		378				1		4				1		29			
	2		795	338	**112**	1623	2		7	4		15	2		23	16		31
		↓																
1997	1		127	75	*		1		2	1	*		1		34	33		
	2	407	1014	218	*	1841	2	5	11	3	*	22	2	20	11	19		18
1998	1		299	280	*		1		5	3	*		1		16	16		
	2	69	746	110	*	1504	2	1	9	1	*	19	2	51	12	32		17
		↑						↑										
1999	1			275	**122**		1			3			1					
	2		80		**430**	907	2		2			5	2		42	15		50
		↓				552												
2000	1	104	4331	250	**1046**		1	1	59	4			1	19	1			
	2	244	344		**130**	6449	2	4	6		**1**	75	2	7	20	24		6
		↑																
2001	1		89	474	**795**		1		1	6			1		66	10		
	2		254	250	**1756**	3618	2		3	3		13	2		35	47		41
		↓																
2002	1	28	507	173	**573**		1	1	7	2	**1**		1		7	34	**59**	
	2		982	133	**2734**	5130	2		14	2	**2**	29	2	57	14	48	**35**	21
2003	1		744		**2410**		1	1	10	1	**2**		1		11		**48**	
	2	384	818	110	**914**	5380	2	12	19	1	**6**	52	2	3	9	28	**18**	11
2004	1	223	692	86	**1915**		1	7	14	1	**6**		1		6		**12**	
	2	7	706		**2955**	6584	2	1	12		**4**	45	2	18	9	48	**6**	11
2005	1		269		**3202**		1		4		**11**		1		16.8		**3**	
	2	600	807		**5696**	10574	2	10	7		**11**	43	2	11	10		**2**	9
2006	1		732		**2330**		1		3		**11**		1		7		**1**	
	2	341	281		**823**	4507	2	4	3		**9**	30	2	14	14		**13**	9
2007	1		296		**1316**		1		3		**3**		1		11.3		**6**	
	2	15	272		**831**	2730	2	1	3		**3**	13	2	54	24.7		**4**	15

Table I5. Number of kept observer lengths, trips, and gillnet metric tons landed per 100 lengths sampled for Gulf of Maine winter flounder by half year.

Year	half	lengths	trips	gillnet landings	Mt/100 lengths
1990	1	500	90	185	
	2	78	1	29	
		578	91	215	37
1991	1	167	6	85	
	2	30	8	12	
		197	14	97	49
1992	1	1925	39	135	
	2	172	25	25	
		2097	64	160	8
1993	1	1990	63	97	
	2	375	20	42	
		2365	83	139	6
1994	1	330	22	75	
	2	207	10	25	
		537	32	100	19
1995	1	1132	20	156	
	2	275	23	28	
		1407	43	184	13
1996	1	930	26	114	
	2	118	17	22	
		1048	43	136	13
1997	1	656	18	105	
	2	42	4	29	
		698	22	134	19
1998	1	1163	19	145	
	2	431	8	31	
		1594	27	176	11
1999	1	747	5	84	
	2	538	12	17	
		1285	17	101	8
2000	1	911	8	104	
	2	259	4	18	
		1170	12	122	10

year	half	lengths	trips	gillnet landings	Mt/100 lengths
2001	1	862		124	
	2	42		36	
		904		160	18
2002	1	237		37	16
	2	691		45	7
		928		82	9
2003	1	1702		89	5
	2	3041		96	3
		4743		185	4
2004	1	2255		62	3
	2	4605		75	2
		6860		137	2
2005	1	635		26	4
	2	3982		41	1
		4617		67	1
2006	1	385		25	7
	2	174		21	12
		559		47	8
2007	1	651		30	5
	2	662		40	6
		1313		70	5

Table I6. Gulf of Maine winter flounder estimated discard ratios in the shrimp fishery (total discard kg / total days fished) estimated from NEFSC and MA Observer data by shrimp season. Ratio for 1982-1988 is the average ratio from 1989-1992. Total shrimp fishery days fished and estimated discards are also shown. A 50% mortality is used for estimating dead discards. Dotted line indicates the introduction of the Nordmore grate.

Year	trips	tows	ratio	Shrimp df	discard wt (kg)	dead discards (kg)
1982			*13.5*	970	13,120	6,560
1983			*13.5*	1157	15,646	7,823
1984			*13.5*	1754	23,721	11,860
1985			*13.5*	2081	28,149	14,074
1986			*13.5*	2395	32,391	16,196
1987			*13.5*	3708	50,149	25,075
1988			*13.5*	2815	38,072	19,036
1989	12	24	3.5	2840	10,023	5,011
1990	25	53	13.1	3205	41,853	20,927
1991	38	94	16.3	2588	42,265	21,132
1992	72	225	21.2	2313	48,978	24,489
1993	63	178	7.0	1902	13,401	6,700
1994	63	183	5.8	1982	11,586	5,793
1995	58	136	4.8	3376	16,186	8,093
1996	40	92	4.0	3243	13,126	6,563
1997	21	55	7.5	3661	27,391	13,695
1998	3	6	3.9	2204	8,526	4,263
1999	4	5	1.4	1217	1,696	848
2000	4	10	7.7	793	6,091	3,046
2001	4	6	6.1	673	4,095	2,048
2002	1	2	2.4	246	581	291
2003	18	36	8.7	532	4,628	2,314
2004	11	47	8.5	304	2,588	1,294
2005	17	47	15.9	313	4,973	2,486
2006	17	55	12.7	170	2,162	1,081
2007	17	58	4.1	451	1,851	926

Table 17. Gulf of Maine winter flounder re-estimated large and small mesh trawl and gillnet discard ratios (discard/sum all species kept), estimated discard CVs, and estimated discards in metric tons.

	Discard Ratio			CV			Metric Tons		
	trawl			trawl			trawl		
year	lg mesh	sm mesh	gillnet	lg mesh	sm mesh	gillnet	lg mesh	sm mesh	gillnet
1989	0.0011	0.0032	0.0006	0.51	0.54	0.34	23	6	9
1990	0.0004	0.0001	0.0027	0.55	1.00	0.44	11	0	44
1991	0.0011	0.0010	0.0005	0.45	0.61	0.23	34	2	7
1992	0.0005	0.0002	0.0020	0.37	0.86	0.15	14	0	25
1993	0.0003	0.0042	0.0023	0.79	0.92	0.17	8	10	38
1994	0.0000	0.0000	0.0009			1.42	0		13
1995	0.0009	0.0091	0.0015	0.53	0.43	0.46	16	21	23
1996	0.0003	0.0008	0.0008	1.69	0.29	0.56	4	2	12
1997	0.0001	0.0098	0.0061	0.61	0.02	0.58	2	19	75
1998	0.0011	0.0000	0.0011	0.45		0.43	15		14
1999	0.0016	0.0081	0.0010	0.38	0.30	0.50	18	14	8
2000	0.0004	0.0000	0.0030	0.84		0.39	6		24
2001	0.0016	0.0017	0.0008	0.38	1.91	0.64	27	2	6
2002	0.0021	0.0077	0.0014	0.37	0.43	0.43	33	10	9
2003	0.0014	0.0016	0.0008	0.33	0.50	0.32	25	1	5
2004	0.0023	0.0064	0.0010	0.29	0.40	0.30	62	2	7
2005	0.0025	0.0072	0.0003	0.28	1.10	0.23	47	2	2
2006	0.0018	0.0038	0.0001	0.33	0.44	0.42	20	2	1
2007	0.0031	0.0054	0.0002	0.35	0.42	0.39	31	4	1

Table I8. Gulf of Maine winter flounder updated number of trips in the large and small mesh trawl and gillnet fishery in the dealer and observer data.

	Large Mesh Trawl						Small Mesh Trawl						Gillnet					
	Dealer trips		Ob trips		Dealer	Ob	Dealer trips		Ob trips		Dealer	Ob	Dealer trips		Ob trips		Dealer	Ob
YEAR	half 1	half 2	half 1	half 2	sum	sum	half 1	half 2	half 1	half 2	sum	sum	half 1	half 2	half 1	half 2	sum	sum
1989	105,164	85,152	16	21	190,316	37	1,061	10,321	7	16	11,382	23	62,067	87,886		84	149,952	84
1990	100,659	91,373	10	16	192,032	26	321	12,384		8	12,705	8	60,170	102,906	64	56	163,076	120
1991	119,499	106,244	12	36	225,743	48	396	13,905		29	14,301	29	55,164	78,681	153	648	133,845	801
1992	131,273	104,500	33	11	235,773	44	291	19,427	3	12	19,718	15	49,030	78,145	357	539	127,175	896
1993	108,243	101,322	9	8	209,565	17	314	17,162	2	4	17,476	6	55,144	93,844	251	309	148,988	560
1994	88,950	61,405	4	2	150,356	6	745	9,029			9,774		42,555	63,675	55	30	106,230	85
1995	64,850	53,353	18	7	118,203	25	994	2,802		30	3,796	30	40,987	56,676	23	46	97,663	69
1996	59,537	51,512	8	3	111,049	11	268	3,789	2	38	4,057	40	32,990	45,074	21	25	78,064	46
1997	53,697	42,004	4	1	95,701	5	542	3,735	3		4,276	3	28,906	36,957	13	20	65,863	33
1998	59,039	45,854	6		104,893	6	236	2,689			2,925		30,234	34,076	29	49	64,309	78
1999	41,248	46,507	1	20	87,755	21	186	3,220		11	3,406	11	20,067	24,447	18	55	44,514	73
2000	48,204	50,184	48	31	98,387	79	349	2,176			2,524		21,613	30,685	41	40	52,298	81
2001	50,659	51,722	37	76	102,381	113	498	2,497	1	3	2,996	4	24,426	32,695	25	22	57,121	47
2002	44,086	56,806	28	121	100,892	149	213	2,374	1	34	2,587	35	16,513	32,746	23	57	49,259	80
2003	37,226	60,664	117	136	97,890	253	169	941	7	12	1,110	19	18,954	34,893	93	202	53,846	295
2004	31,568	51,904	70	188	83,471	258	146	945	12	55	1,091	67	16,860	33,270	156	619	50,130	775
2005	29,099	44,132	171	327	73,231	498	347	681	20	49	1,027	69	14,209	38,823	138	513	53,031	651
2006	24,765	34,470	143	63	59,235	206	223	1,034	14	10	1,257	24	15,359	35,986	74	54	51,344	128
2007	25,388	32,216	98	126	57,603	224	275	1,099	1	15	1,374	16	17,800	45,116	32	86	62,916	118

Table I9. GARM III Gulf of Maine winter flounder catch at age component summary.

Catch at age component	years	Half yr	length data	age data
trawl and other commercial landings	82-98	mix	commercial and observer (unclassified)	commercial
trawl and other commercial landings	99-07	whole & half yr	Observer (Trawl kept)	commercial
gillnet commercial Landings	90-07	whole & half yr	observer (gillnet kept)	commercial
recreational Landings	82-07	Half yr	MRFSS	combine NEFSC and MA DMF ages by half yr
recreational Discards	82-07	Half yr	spr & fall MA DMF	combine NEFSC and MA DMF ages by half yr
large mesh trawl discards (survey filter)	82-88	whole yr	survey method (spr & fall MA DMF)	combine NEFSC spr & fall survey
large mesh trawl disc (obs disc/keptall)	89-07	whole yr	survey method (89-00) observer disc (01-06)	combine NEFSC spr & fall survey
gillnet discards (obs disc/keptall)	86-07	Whole	observer discards	combine spr NEFSC and MA DMF ages
shrimp discards (obs disc/days fished)	82-04	shrimp season	observer (discards)	combine spr NEFSC and MA DMF ages

Table I10. Gulf of Maine winter flounder composition of the catch by number (000's).

	Landings		Discards				
year	recreational	commercial	recreational	gillnet	lg mesh	shrimp	Total
1982	7,274	5,282	140		1,397	56	14,149
1983	1,988	3,842	27		428	67	6,353
1984	2,285	3,992	29		249	102	6,657
1985	3,220	2,965	71		340	121	6,717
1986	691	2,055	38	45	253	139	3,221
1987	2,391	2,086	102	45	308	216	5,146
1988	841	2,210	17	45	406	164	3,682
1989	1,678	2,329	44	16	42	61	4,171
1990	652	1,981	20	84	20	113	2,870
1991	154	1,844	9	12	64	165	2,247
1992	137	1,620	7	44	27	241	2,078
1993	249	1,440	22	70	16	83	1,880
1994	145	1,153	13	24	23	86	1,443
1995	83	1,501	10	31	29	94	1,748
1996	98	1,228	13	21	8	59	1,427
1997	64	1,101	19	128	18	175	1,504
1998	65	1,147	7	24	28	53	1,323
1999	65	605	7	7	31	11	725
2000	59	940	13	39	11	38	1,100
2001	72	1,160	15	9	52	25	1,333
2002	61	1,126	6	11	72	3	1,279
2003	51	1,269	5	8	52	25	1,410
2004	41	993	3	12	137	15	1,200
2005	40	549	6	4	94	26	718
2006	53	317	6	1	40	10	427
2007	48	407	4	2	59	8	528

Table I11. Gulf of Maine winter flounder composition of the catch by weight (mt).

	Landings		Discards				
year	recreational	commercial	recreational	gillnet	lg mesh	shrimp	Total
1981	2,270						
1982	3,024	2,793	11		343	7	6,178
1983	817	2,096	2		112	8	3,035
1984	1,103	1,699	3		67	12	2,883
1985	1,629	1,582	8		93	14	3,327
1986	411	1,185	5	12	63	16	1,692
1987	1,443	1,140	12	12	81	25	2,713
1988	537	1,250	2	12	106	19	1,927
1989	1,035	1,253	6	4	11	5	2,315
1990	344	1,116	3	22	5	21	1,511
1991	86	1,008	1	3	17	21	1,136
1992	77	825	1	12	7	24	947
1993	134	611	3	19	4	7	778
1994	77	543	2	6	6	6	640
1995	40	707	1	12	8	8	776
1996	52	606	2	6	2	7	674
1997	32	569	3	38	5	14	660
1998	27	643	1	7	7	4	689
1999	34	350	1	4	9	1	399
2000	31	535	2	12	3	3	587
2001	37	698	3	3	14	2	756
2002	35	682	1	5	17	0	740
2003	29	754	1	3	13	2	801
2004	29	623	0	4	31	1	687
2005	24	335	1	1	23	2	387
2006	35	199	1	0	10	1	247
2007	26	260	0	1	15	1	303

Table I12. Gulf of Maine winter flounder landing at age (000's).

year	1	2	3	4	5	6	7	8+
1982	40	2,097	4,551	3,468	1,401	617	276	104
1983	93	748	1,680	1,799	856	362	158	133
1984	12	765	1,935	1,829	852	348	312	225
1985	0	137	1,335	2,039	1,922	398	218	136
1986	0	327	731	812	359	353	102	62
1987	0	312	1,626	1,161	792	311	138	136
1988	2	337	848	1,046	359	248	123	89
1989	0	162	1,309	1,462	774	212	51	38
1990	0	216	721	950	496	172	49	29
1991	0	186	782	580	232	119	57	41
1992	0	207	657	569	205	72	28	18
1993	0	132	688	644	145	68	9	3
1994	0	8	466	608	149	44	16	7
1995	0	8	291	744	387	120	16	18
1996	0	176	706	336	76	13	7	11
1997	0	150	499	382	92	22	8	12
1998	0	26	232	458	328	115	40	12
1999	0	0	61	229	224	101	29	27
2000	0	5	59	375	371	140	34	15
2001	0	0	52	358	425	239	101	56
2002	0	3	135	364	401	185	65	34
2003	0	6	156	382	412	242	77	46
2004	0	32	127	327	245	191	64	49
2005	0	12	119	235	136	54	17	16
2006	0	2	79	150	87	28	13	11
2007	0	6	69	157	133	61	18	11

Table I13. Gulf of Maine winter flounder discards at age (000's).

year	1	2	3	4	5	6	7	8+
1982	72	786	716	19	0	0	0	0
1983	42	167	275	38	0	0	0	0
1984	11	151	142	72	4	0	0	0
1985	31	151	263	83	3	0	0	0
1986	49	178	196	39	14	0	0	0
1987	53	174	378	63	2	0	0	0
1988	22	134	340	131	3	1	0	0
1989	24	77	43	16	3	1	0	0
1990	9	47	114	58	8	0	0	0
1991	18	117	82	30	2	0	0	0
1992	44	182	77	15	1	0	0	0
1993	28	64	70	25	4	0	0	0
1994	18	73	37	15	3	0	0	0
1995	27	62	44	22	5	2	1	0
1996	16	41	27	14	2	0	0	0
1997	19	136	93	66	26	0	0	0
1998	20	38	32	16	4	0	1	0
1999	7	13	18	11	3	2	1	1
2000	17	24	30	19	9	2	0	0
2001	13	21	32	26	7	3	0	0
2002	4	28	32	20	6	2	0	0
2003	9	36	28	11	4	1	0	1
2004	10	57	77	17	2	2	1	0
2005	15	42	46	20	4	2	0	0
2006	7	12	25	11	2	0	0	0
2007	7	11	34	16	4	0	0	0

Table I14. Gulf of Maine winter flounder total catch at age (000's).

year	1	2	3	4	5	6	7	8+
1982	112	2,883	5,267	3,487	1,402	617	276	104
1983	135	915	1,955	1,838	857	362	158	133
1984	23	916	2,077	1,901	856	348	312	225
1985	31	288	1,598	2,122	1,925	398	218	136
1986	49	505	928	851	373	353	102	62
1987	53	486	2,004	1,224	794	311	138	136
1988	23	471	1,188	1,177	361	248	123	89
1989	24	238	1,353	1,478	777	213	51	38
1990	9	263	836	1,008	504	172	49	29
1991	18	304	864	610	234	119	57	41
1992	44	390	734	585	207	72	28	18
1993	28	197	758	669	149	69	9	3
1994	18	81	503	623	152	44	16	7
1995	27	70	335	765	392	122	18	18
1996	16	217	733	350	79	13	7	11
1997	19	286	592	449	117	22	8	12
1998	20	64	264	474	333	115	41	12
1999	7	13	79	240	227	103	29	28
2000	17	29	89	394	380	142	34	15
2001	13	21	84	384	432	242	101	56
2002	4	31	167	383	408	187	65	34
2003	9	42	184	393	416	243	77	46
2004	10	89	205	344	247	193	65	49
2005	15	54	165	255	140	57	18	16
2006	7	14	104	160	89	28	13	11
2007	7	17	103	173	138	62	18	11

Table I15. Gulf of Maine winter flounder mean weights at age.

year	1	2	3	4	5	6	7	8+
1982	0.084	0.224	0.375	0.487	0.595	0.802	0.943	2.037
1983	0.123	0.257	0.358	0.502	0.644	0.795	0.946	1.164
1984	0.082	0.264	0.306	0.401	0.543	0.708	0.855	1.115
1985	0.043	0.174	0.312	0.447	0.584	0.809	0.927	1.122
1986	0.050	0.309	0.410	0.510	0.664	0.813	1.005	1.221
1987	0.035	0.259	0.392	0.527	0.690	0.858	1.070	1.284
1988	0.038	0.396	0.426	0.487	0.648	0.754	1.022	1.204
1989	0.040	0.229	0.427	0.582	0.629	1.004	1.175	1.397
1990	0.034	0.301	0.421	0.538	0.625	0.763	0.979	1.226
1991	0.038	0.277	0.451	0.583	0.599	0.695	0.744	0.929
1992	0.027	0.227	0.406	0.533	0.638	0.788	1.051	1.465
1993	0.028	0.238	0.367	0.439	0.645	0.667	1.115	1.453
1994	0.028	0.090	0.369	0.470	0.610	0.747	1.068	1.229
1995	0.038	0.105	0.341	0.421	0.535	0.635	0.833	1.563
1996	0.028	0.321	0.454	0.541	0.643	0.722	0.767	1.321
1997	0.038	0.240	0.421	0.512	0.628	0.889	0.784	0.921
1998	0.029	0.202	0.392	0.472	0.615	0.755	0.910	1.557
1999	0.039	0.114	0.377	0.487	0.542	0.665	0.838	1.219
2000	0.041	0.146	0.353	0.473	0.581	0.698	0.817	1.030
2001	0.034	0.115	0.319	0.448	0.538	0.693	0.852	1.194
2002	0.050	0.182	0.415	0.496	0.593	0.705	0.882	1.284
2003	0.035	0.158	0.360	0.480	0.559	0.703	0.887	1.449
2004	0.035	0.209	0.350	0.494	0.627	0.767	0.929	1.281
2005	0.042	0.172	0.380	0.505	0.670	0.896	1.038	1.335
2006	0.048	0.138	0.404	0.535	0.715	0.817	1.024	1.367
2007	0.050	0.195	0.372	0.491	0.649	0.845	0.956	1.502

Table I16. NEFSC and MDMF survey indices of abundance for Gulf of Maine winter flounder. Indices are stratified mean number and mean weight (kg) per tow. NEFSC indices are for inshore strata (58,59,60,61,65,66) and offshore strata (26,27,38,39,40). NEFSC indices are calculated with trawl door conversion factors where appropriate. MA DMF uses strata 25-36.

	NEFSC spring		NEFSC fall		MA spring		MA fall	
year	number	weight	number	weight	number	weight	number	weight
1978					98.556	20.772	59.152	12.741
1979	4.487	1.730	6.003	2.602	71.834	15.787	134.251	32.837
1980	5.586	2.391	13.141	6.553	72.142	19.108	83.805	17.868
1981	6.461	2.122	4.179	3.029	106.341	30.383	50.847	13.595
1982	7.670	3.022	4.201	1.924	61.612	14.713	108.203	24.418
1983	12.367	5.653	10.304	3.519	112.487	28.984	76.658	15.143
1984	5.155	1.979	7.732	3.106	68.949	16.716	39.541	12.212
1985	3.469	1.418	7.638	2.324	54.210	15.302	48.677	8.288
1986	2.342	0.998	2.502	0.938	68.984	16.352	44.646	6.920
1987	5.609	1.503	1.605	0.488	85.180	18.640	54.434	8.018
1988	6.897	1.649	3.000	1.030	54.039	11.266	38.419	8.237
1989	3.717	1.316	6.402	2.013	64.696	13.940	39.249	8.602
1990	5.415	2.252	3.527	1.177	82.125	14.375	67.661	13.218
1991	4.517	1.436	7.035	1.467	46.630	11.513	101.716	17.580
1992	3.932	1.160	10.447	3.096	79.000	15.356	87.581	15.089
1993	1.556	0.353	7.559	1.859	78.018	12.051	93.527	15.109
1994	3.481	0.891	4.870	1.319	72.578	9.779	67.789	13.246
1995	12.185	3.149	4.765	1.446	89.361	14.960	76.736	15.092
1996	2.736	0.732	10.099	3.116	70.494	12.082	77.006	13.144
1997	2.806	0.664	10.008	2.950	85.396	12.959	78.402	14.438
1998	2.001	0.527	3.218	0.987	77.771	13.473	98.450	15.454
1999	6.510	1.982	10.921	3.269	80.776	14.957	125.742	23.204
2000	10.383	2.885	12.705	5.065	162.190	34.160	99.953	25.100
2001	5.242	1.663	8.786	3.133	89.743	24.510	81.072	17.743
2002	12.066	3.692	10.691	4.003	91.083	22.391	65.812	16.264
2003	7.839	2.544	10.182	4.315	83.693	17.323	90.477	15.801
2004	3.879	1.103	2.763	0.867	79.115	11.201	107.591	14.091
2005	6.920	2.056	8.807	2.314	94.044	11.980	78.591	11.812
2006	4.173	1.211	7.117	2.346	85.548	14.434	86.985	15.463
2007	2.500	0.717	6.378	1.820	53.583	10.060	76.669	11.599
2008	11.543	2.177			NA	NA		

Table I17. Comparative Results from ADAPT/VPA runs. Run 2b is the preferred run for status determination. Run 4 also excludes surveys listed under run 3. Runs 6 through 9 use either the NEFSC or MDMF Spring and Fall surveys exclusively.

VPA RUNS	BASE	SPLIT	SPLIT	SPLIT	SPLIT	BASE	SPLIT	BASE	SPLIT
run	1	2A	2B	3	4	5	6	7	8
Indices Excluded	none	none	none	N_S1, N_F2, M_F6, M_F7 M_F8	N_S2_8, M_S1, M_S2 M_S3, M_F3, M_F5, M_S2_7, M_S2_8	NEFSC Seabrook	NEFSC Seabrook	MDMF Seabrook	MDMF Seabrook
Number	34	64	64	59	51	16	32	15	30
RSS	878	624	617	470	415	462	316	392	291
N t+1 age 1 (cv)	not est	9.5 (0.65)	not est	9.5 (0.58)	9.6 (0.58)	not est	not est	not est	not est
N t+1 age 2 (cv)	5.2 (0.43)	2.7 (0.38)	2.7 (0.37)	2.7 (0.34)	2.7 (0.34)	3.6 (0.63)	1.7 (0.53)	7.4 (0.00)	1.7 (0.00)
N t+1 age 3 (cv)	2.6 (0.32	1.4 (0.28)	1.4 (0.28)	1.4 (0.25)	1.4 (0.25)	2.5 (0.49)	1.2 (0.42)	2.8 (0.00)	1.2 (0.00)
N t+1 age 4 (cv)	2.0 (0.27)	1.0 (0.25)	1.0 (0.25)	1.0 (0.22)	1.0 (0.23)	2.9 (0.43)	1.4 (0.37)	1.5 (0.00)	1.4 (0.00)
N t+1 age 5 (cv)	2.2 (0.26)	1.1 (0.24)	1.1 (0.24)	1.1 (0.22)	1.1 (0.22)	2.4 (0.39)	1.1 (0.36)	1.8 (0.00)	1.1 (0.00)
N t+1 age 6 (cv)	1.0 (0.24)	0.2 (0.30)	0.2 (0.29)	0.2 (0.27)	0.3 (0.26)	0.8 (0.37)	0.2 (0.49)	0.9 (0.00)	0.2 (0.01)
N t+1 age 7 (cv)	0.5 (0.24)	0.1 (0.32)	0.1 (0.32)	0.1 (0.29)	0.1 (0.28)	0.4 (0.39)	< 0.1 (0.52)	0.6 (0.00)	< 0.1 (0.01)
N t+1 age 8 (cv)	0.1 (1.06)	< 0.1 (0.92)	< 0.1 (0.91)	< 0.1 (0.82)	< 0.1 (0.83)	< 0.1 (1.09)	< 0.1 (0.92)	0.2 (0.00)	< 0.1 (0.00)
F age 1	0.001	0.002	0.002	0.002	0.002	0.002	0.004	0.001	0.002
F age 2	0.006	0.011	0.011	0.011	0.011	0.006	0.013	0.006	0.010
F age 3	0.046	0.087	0.087	0.087	0.086	0.032	0.064	0.059	0.113
F age 4	0.068	0.134	0.134	0.134	0.131	0.063	0.131	0.081	0.162
F age 5	0.119	0.406	0.406	0.406	0.341	0.141	0.522	0.130	0.383
F age 6	0.111	0.428	0.428	0.428	0.353	0.136	0.536	0.090	0.324
F age 7	0.115	0.428	0.428	0.428	0.353	0.139	0.536	0.110	0.324
F (ages 5-6)	0.1149	0.4169	0.4169	0.4169	0.3468	0.1385	0.5291	0.11	0.3532
SSB (mt)	2,765	1,099	1,099	1,099	1,195	2,686	1,062	2,607	1,055

Table I18. Estimated Mohn's rho from the Base (run 1) and Split VPA run (2b).

	Mohn's rho		
Model	F (5-6)	SSB	age 1 recruitment
2000	-0.81	2.86	1.90
2001	-0.84	3.27	3.18
2002	-0.84	3.43	1.36
2003	-0.83	2.98	1.43
2004	-0.78	1.82	1.07
2005	-0.59	0.75	0.51
2006	-0.22	0.19	-0.06
Base VPA average	**-0.70**	**2.12**	**1.30**
2000	-0.26	0.31	0.76
2001	-0.32	0.43	1.50
2002	-0.14	0.40	0.93
2003	-0.12	0.29	1.39
2004	-0.07	0.16	0.96
2005	-0.15	0.31	0.52
2006	0.19	0.14	-0.07
Split VPA average	**-0.13**	**0.29**	**0.86**

Table I19. Split VPA run 2b results using 1000 bootstrap iterations.

JAN-1 Population Numbers

AGE	1982	1983	1984	1985	1986
1	11556.	8594.	6119.	9004.	7294.
2	14198.	9360.	6914.	4989.	7344.
3	10952.	9031.	6838.	4836.	3825.
4	6122.	4267.	5636.	3735.	2526.
5	3038.	1912.	1850.	2910.	1171.
6	1170.	1236.	800.	751.	679.
7	575.	408.	687.	344.	260.
8	217.	344.	495.	214.	158.
Total	47829.	35151.	29339.	26782.	23257.

AGE	1987	1988	1989	1990	1991
1	5710.	3740.	3507.	3739.	4092.
2	5928.	4627.	3041.	2850.	3053.
3	5557.	4415.	3364.	2275.	2096.
4	2297.	2755.	2548.	1543.	1114.
5	1305.	791.	1203.	772.	371.
6	624.	364.	325.	297.	186.
7	241.	234.	79.	77.	90.
8	238.	169.	59.	46.	65.
Total	21900.	17094.	14125.	11599.	11067.

AGE	1992	1993	1994	1995	1996
1	3161.	2292.	3611.	3886.	3420.
2	3334.	2548.	1851.	2940.	3157.
3	2225.	2378.	1909.	1443.	2344.
4	943.	1164.	1267.	1111.	880.
5	369.	253.	358.	482.	233.
6	96.	118.	75.	157.	51.
7	47.	15.	35.	22.	22.
8	30.	5.	15.	22.	34.
Total	10206.	8774.	9122.	10064.	10142.

Table I19. Cont.

JAN-1 Population Numbers

AGE	1997	1998	1999	2000	2001
1	3070.	2988.	2641.	2031.	1659.
2	2786.	2497.	2429.	2156.	1647.
3	2389.	2023.	1986.	1977.	1739.
4	1261.	1424.	1418.	1555.	1538.
5	407.	631.	741.	945.	919.
6	120.	228.	220.	403.	434.
7	30.	79.	84.	88.	203.
8	46.	23.	82.	39.	112.
Total	10110.	9893.	9601.	9193.	8251.

AGE	2002	2003	2004	2005	2006
1	1653.	1729.	3026.	2060.	2047.
2	1346.	1350.	1408.	2468.	1673.
3	1330.	1074.	1067.	1072.	1972.
4	1348.	938.	714.	689.	729.
5	914.	760.	417.	278.	336.
6	367.	384.	252.	122.	102.
7	140.	134.	99.	36.	49.
8	73.	80.	75.	32.	41.
Total	7171.	6449.	7057.	6758.	6950.

AGE	2007	2008
1	3248.	3513.
2	1670.	2653.
3	1357.	1352.
4	1521.	1018.
5	453.	1089.
6	195.	247.
7	59.	104.
8	35.	28.
Total	8538.	10005.

Table I19. Cont.

Fishing Mortality Calculated

AGE	1982	1983	1984	1985	1986
1	0.0107	0.0175	0.0042	0.0038	0.0074
2	0.2524	0.1139	0.1576	0.0657	0.0788
3	0.7427	0.2715	0.4048	0.4493	0.3097
4	0.9639	0.6355	0.4610	0.9600	0.4602
5	0.6997	0.6716	0.7022	1.2559	0.4293
6	0.8529	0.3874	0.6445	0.8599	0.8350
7	0.7400	0.5502	0.6844	1.1609	0.5598
8	0.7400	0.5502	0.6844	1.1609	0.5598

AGE	1987	1988	1989	1990	1991
1	0.0103	0.0068	0.0076	0.0027	0.0049
2	0.0947	0.1189	0.0902	0.1072	0.1161
3	0.5018	0.3498	0.5791	0.5141	0.5984
4	0.8665	0.6285	0.9937	1.2259	0.9045
5	1.0772	0.6892	1.2004	1.2241	1.1499
6	0.7827	1.3312	1.2338	0.9934	1.1805
7	0.9722	0.8509	1.2074	1.1546	1.1600
8	0.9722	0.8509	1.2074	1.1546	1.1600

AGE	1992	1993	1994	1995	1996
1	0.0155	0.0136	0.0055	0.0077	0.0052
2	0.1378	0.0890	0.0494	0.0266	0.0787
3	0.4482	0.4295	0.3413	0.2943	0.4195
4	1.1145	0.9785	0.7671	1.3605	0.5704
5	0.9396	1.0163	0.6226	2.0388	0.4632
6	1.6355	1.0053	1.0104	1.7829	0.3255
7	1.0490	1.0128	0.6799	1.9695	0.4369
8	1.0490	1.0128	0.6799	1.9695	0.4369

AGE	1997	1998	1999	2000	2001
1	0.0069	0.0074	0.0029	0.0093	0.0087
2	0.1200	0.0287	0.0059	0.0149	0.0142
3	0.3174	0.1550	0.0448	0.0509	0.0547
4	0.4935	0.4533	0.2059	0.3258	0.3202
5	0.3783	0.8548	0.4090	0.5786	0.7185
6	0.2246	0.7947	0.7164	0.4870	0.9315
7	0.3412	0.8385	0.4714	0.5503	0.7820
8	0.3412	0.8385	0.4714	0.5503	0.7820

Table I19. Cont.

Fishing Mortality Calculated

AGE	2002	2003	2004	2005	2006
1	0.0027	0.0058	0.0037	0.0081	0.0038
2	0.0257	0.0349	0.0722	0.0244	0.0093
3	0.1488	0.2086	0.2371	0.1854	0.0599
4	0.3733	0.6117	0.7446	0.5186	0.2757
5	0.6676	0.9045	1.0308	0.7966	0.3433
6	0.8097	1.1566	1.7316	0.7151	0.3562
7	0.7063	0.9822	1.2413	0.7711	0.3463
8	0.7063	0.9822	1.2413	0.7711	0.3463

AGE	2007
1	0.0024
2	0.0113
3	0.0873
4	0.1338
5	0.4060
6	0.4278
7	0.4278
8	0.4278

Average Fishing Mortality For Ages 5-6

Year	Average F
1982	0.7763
1983	0.5295
1984	0.6734
1985	1.0579
1986	0.6322
1987	0.9300
1988	1.0102
1989	1.2171
1990	1.1088
1991	1.1652
1992	1.2876
1993	1.0108
1994	0.8165
1995	1.9109
1996	0.3943
1997	0.3015
1998	0.8248
1999	0.5627
2000	0.5328
2001	0.8250
2002	0.7386
2003	1.0305
2004	1.3812
2005	0.7559
2006	0.3498
2007	0.4169

Spawning Stock Biomass

AGE	1982	1983	1984	1985	1986
1	0.	0.	0.	0.	0.
2	90.	51.	46.	22.	32.
3	982.	796.	577.	413.	315.
4	1706.	1322.	1593.	909.	752.
5	1236.	852.	763.	969.	540.
6	664.	734.	437.	382.	361.
7	396.	295.	454.	198.	194.
8	349.	332.	443.	171.	160.
Total	5422.	4381.	4313.	3065.	2352.

AGE	1987	1988	1989	1990	1991
1	0.	0.	0.	0.	0.
2	25.	20.	11.	12.	11.
3	568.	447.	398.	207.	221.
4	720.	861.	828.	456.	368.
5	557.	366.	464.	323.	149.
6	368.	179.	183.	152.	87.
7	168.	168.	52.	55.	48.
8	228.	156.	58.	40.	43.
Total	2633.	2198.	1995.	1244.	927.

AGE	1992	1993	1994	1995	1996
1	0.	0.	0.	0.	0.
2	11.	8.	3.	6.	13.
3	222.	205.	173.	78.	153.
4	293.	322.	364.	261.	274.
5	168.	109.	149.	137.	102.
6	42.	57.	39.	60.	28.
7	29.	11.	24.	10.	13.
8	32.	5.	15.	20.	38.
Total	797.	717.	767.	572.	622.

Table I19. Cont.

Spawning Stock Biomass

AGE	1997	1998	1999	2000	2001
1	0.	0.	0.	0.	0.
2	8.	8.	5.	6.	4.
3	270.	199.	180.	130.	123.
4	450.	475.	493.	507.	473.
5	203.	269.	319.	410.	365.
6	82.	123.	112.	209.	207.
7	20.	55.	57.	54.	122.
8	37.	28.	84.	33.	105.
Total	1070.	1155.	1250.	1348.	1400.

AGE	2002	2003	2004	2005	2006
1	0.	0.	0.	0.	0.
2	4.	5.	4.	7.	5.
3	93.	87.	79.	96.	170.
4	409.	301.	209.	213.	257.
5	375.	301.	166.	123.	174.
6	176.	177.	102.	73.	66.
7	87.	79.	56.	26.	41.
8	75.	86.	67.	34.	49.
Total	1219.	1034.	683.	572.	763.

AGE	2007
1	0.
2	6.
3	100.
4	548.
5	227.
6	130.
7	44.
8	44.
Total	1100

Table I19. Cont.

Bootstrap Summary Report

Number of Bootstrap Repetitions Requested = 1000
Number of Bootstrap Repetitions Completed = 1000
Bootstrap Output Variable: Stock Estimates (2008)

	NLLS Estimate	Bootstrap Mean	Bootstrap Std Error	C.V. For NLLS Soln.
N 2	2653.	2797.	854.	0.3053
N 3	1352.	1366.	281.	0.2059
N 4	1018.	1035.	179.	0.1730
N 5	1089.	1102.	175.	0.1586
N 6	247.	253.	63.	0.2495
N 7	104.	107.	34.	0.3138
N 8	28.	44.	42.	0.9683

	Bias Estimate	Bias Std. Error	Per Cent Bias	NLLS Estimate Corrected For Bias	C.V. For Corrected Estimate
N 2	144.	27.	5.4283	2509.	0.3403
N 3	14.	9.	1.0447	1338.	0.2103
N 4	17.	6.	1.6609	1001.	0.1788
N 5	13.	6.	1.1717	1076.	0.1623
N 6	6.	2.	2.3103	242.	0.2613
N 7	3.	1.	2.6007	101.	0.3305
N 8	15.	1.	54.1696	13.	3.2573

	LOWER 80. % CI	UPPER 80. % CI
N 2	1812.	3918.
N 3	1029.	1734.
N 4	817.	1277.
N 5	886.	1330.
N 6	177.	341.
N 7	66.	150.
N 8	8.	99.

Bootstrap Output Variable: Fishing Mortality (2007)

	NLLS Estimate	Bootstrap Mean	Bootstrap Std Error	C.V. For NLLS Soln.
AGE 1	0.0024	0.0025	0.000744	0.3015
AGE 2	0.0113	0.0117	0.002459	0.2109
AGE 3	0.0873	0.0883	0.014738	0.1668
AGE 4	0.1338	0.1353	0.020095	0.1485
AGE 5	0.4060	0.4161	0.088605	0.2129
AGE 6	0.4278	0.4481	0.119997	0.2678
AGE 7	0.4278	0.4481	0.119997	0.2678
AGE 8	0.4278	0.4481	0.119997	0.2678

Table I19. Cont.

	Bias Estimate	Bias Std. Error	Per Cent Bias	NLLS Estimate Corrected For Bias	C.V. For Corrected Estimate
AGE 1	0.000086	0.000024	3.6123	0.0023	0.3240
AGE 2	0.000365	0.000079	3.2281	0.0109	0.2250
AGE 3	0.001007	0.000467	1.1531	0.0863	0.1707
AGE 4	0.001473	0.000637	1.1007	0.1323	0.1519
AGE 5	0.010154	0.002820	2.5012	0.3958	0.2239
AGE 6	0.020311	0.003849	4.7479	0.4075	0.2945
AGE 7	0.020311	0.003849	4.7479	0.4075	0.2945
AGE 8	0.020311	0.003849	4.7479	0.4075	0.2945

	LOWER 80. % CI	UPPER 80. % CI
AGE 1	0.001604	0.003479
AGE 2	0.008765	0.014744
AGE 3	0.070206	0.107528
AGE 4	0.110876	0.162019
AGE 5	0.310293	0.528673
AGE 6	0.314910	0.607000
AGE 7	0.314910	0.607000
AGE 8	0.314910	0.607000

Bootstrap Output Variable: Average F (2007) AGES 5 - 6

	NLLS Estimate	Bootstrap Mean	Bootstrap Std Error	C.V. For NLLS Soln.
AVG F	0.4169	0.4321	0.077296	0.1789
N WTD	0.4125	0.4184	0.072220	0.1726
B WTD	0.4139	0.4197	0.071644	0.1707
C WTD	0.4127	0.4260	0.073988	0.1737

	Bias Estimate	Bias Std. Error	Per Cent Bias	NLLS Estimate Corrected For Bias	C.V. For Corrected Estimate
AVG F	0.015233	0.002491	3.6540	0.4016	0.1925
N WTD	0.005918	0.002291	1.4347	0.4066	0.1776
B WTD	0.005807	0.002273	1.4031	0.4081	0.1756
C WTD	0.013303	0.002377	3.2231	0.3994	0.1852

	LOWER 80. % CI	UPPER 80. % CI
AVG F	0.340225	0.529325
N WTD	0.334120	0.513389
B WTD	0.336272	0.512869
C WTD	0.340363	0.519663

Table I19. Cont.

JAN-1 Biomass (2008) Mean Biomass & SSB (2007)

	NLLS Estimate	Bootstrap Mean	Bootstrap Std Error	C.V. For NLLS Soln.
JAN-1	2064.	2123.	200.	0.0940
MEAN	1938.	1970.	177.	0.0898
SSB	1100.	1116.	113.	0.1015

	Bias Estimate	Bias Std. Error	Per Cent Bias	NLLS Estimate Corrected For Bias	C.V. For Corrected Estimate
JAN-1	59.	7.	2.8549	2005.	0.0996
MEAN	33.	6.	1.7002	1905.	0.0929
SSB	15.	4.	1.3865	1085.	0.1043

	LOWER 80. % CI	UPPER 80. % CI
JAN-1	1875.	2379.
MEAN	1755.	2208.
SSB	970.	1277.

Table I20. Biological reference points and stock status for Gulf of Maine winter flounder from GARM I, GARM II, GARM III BRP meeting and the final GARM III review. F_{MSY} was estimated from a stock recruit relationship in GARM I and F40% in GARM III. T-yr is for terminal year.

	GARM I	GARM II	GARM III BRP Meeting	GARM III Final Meeting	GARM III Final Meeting
Model	VPA Base	VPA Base	VPA Split	VPA Base	VPA Split
Terminal year	2001	2004	2006	2007	2007
F_{msy}	0.43	0.43			
F40%	0.26	0.26	0.267	0.295	0.283
YPR	0.220	0.220	0.217	0.237	0.235
SSBR	0.833	0.833	0.872	0.972	0.972
Mean Recruit million	6.726	5.638	4.046	4.585	4.072
MSY (mt)	1,500	1,500	854	1,052	917
SSB_{MSY} (mt)	4,100	4,100	3,557	4,312	3,792
SSB terminal year	5,866	3,436	806	2,765	1,100
F terminal year	0.14	0.13	0.49	0.11	0.42
$SSB_{t\text{-}yr}/SSB_{MSY}$	143%	84%	23%	64%	29%
$F_{t\text{-}yr}/F_{MSY}$	33%	30%	185%	39%	147%

Table I21. Partial recruitment pattern, maturity schedule, and mean weights at age inputs to the yield per recruit and the biological reference point AGEPRO calculations for the split VPA run.

age	Stock Size on 1 Jan 2008	Fishing Mortality Pattern	proportion mature	Mean Weights Spawning Stock	Mean Weights Catch
1	3,513	0.005	0.000	0.021	0.042
2	2,653	0.035	0.040	0.085	0.174
3	1,352	0.177	0.350	0.253	0.373
4	1,018	0.521	0.880	0.437	0.501
5	1,089	0.793	0.990	0.568	0.644
6	247	1.000	1.000	0.713	0.806
7	104	1.000	1.000	0.867	0.967
8+	28	1.000	1.000	1.387	1.387

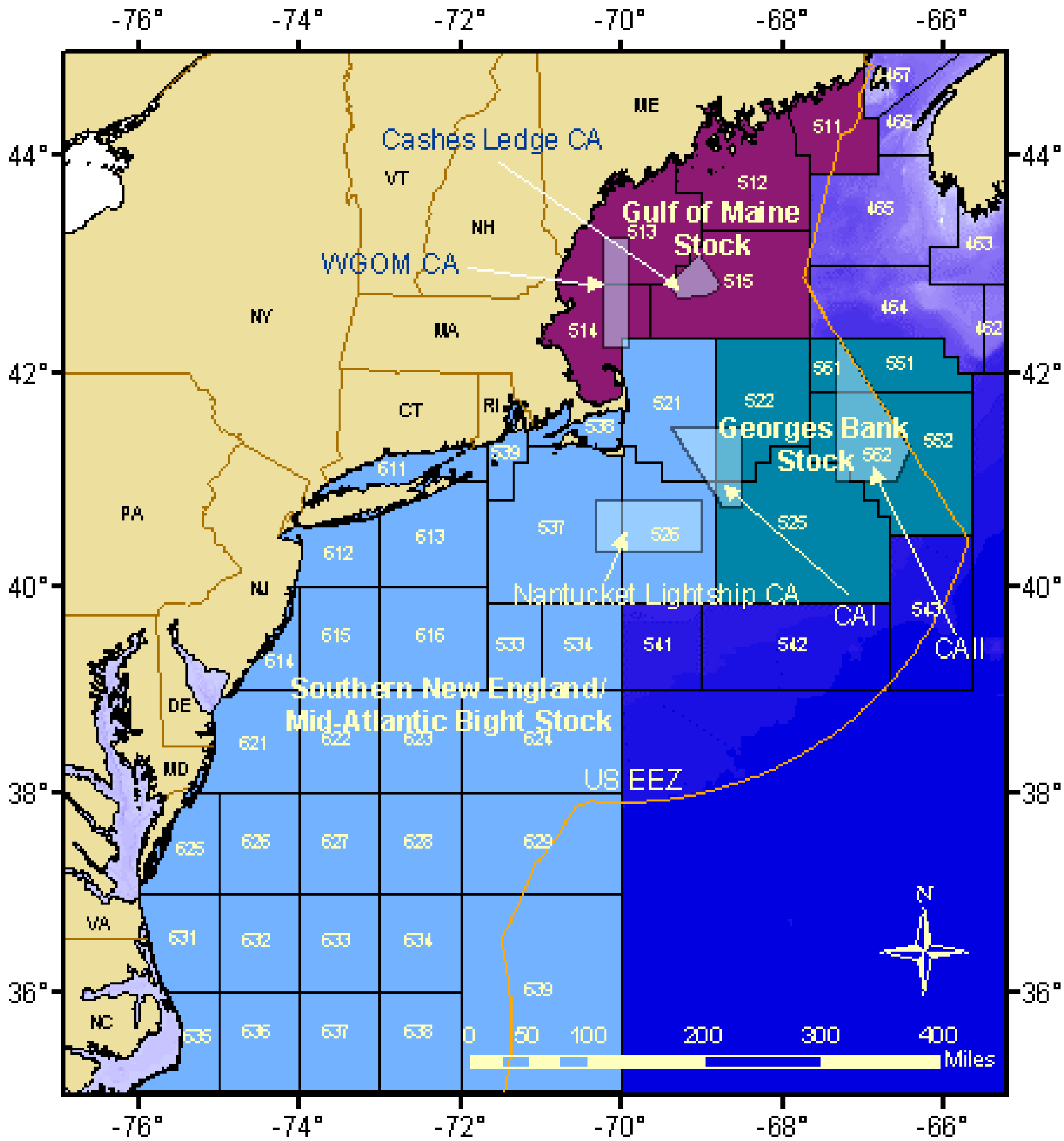


Figure I1. Statistical areas used to define winter flounder stocks. The Gulf of Maine stock includes area 511-515.

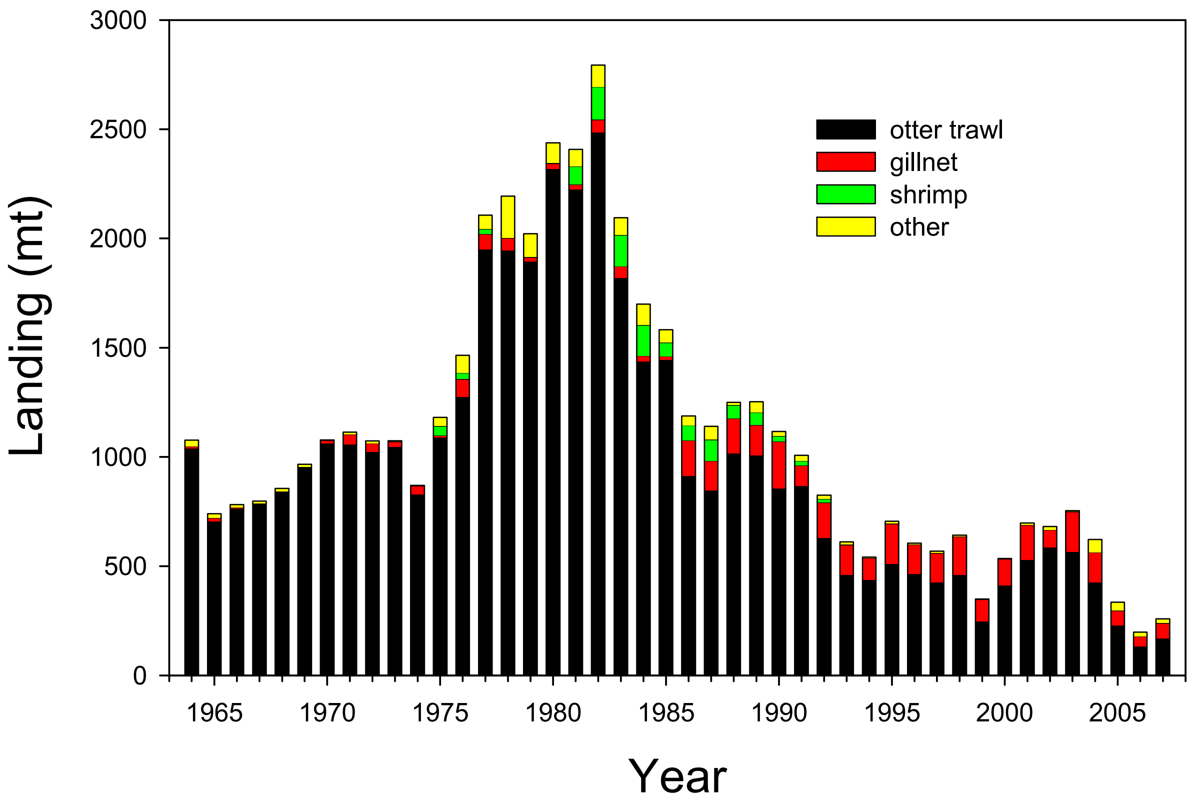


Figure I2. Commercial landings by gear 1964-2007.

Gulf of Maine Winter Flounder Recreational landings and b2 Catch

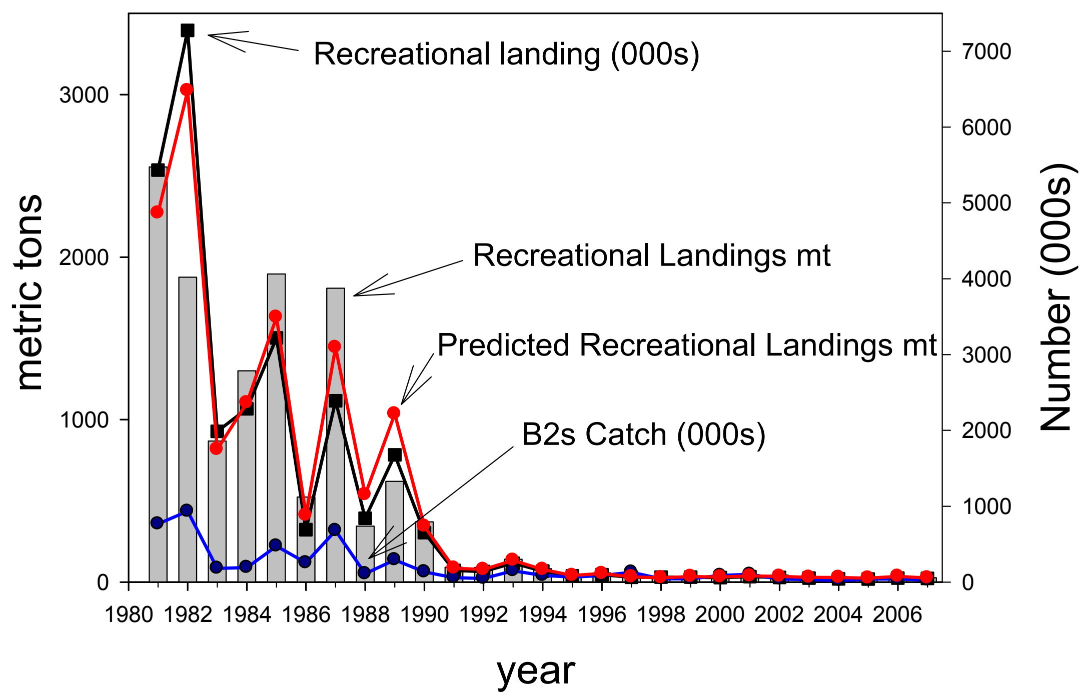


Figure I3 . Recreational landings in numbers and metric tons for Gulf of Maine winter flounder. B2 catch in numbers is also shown.

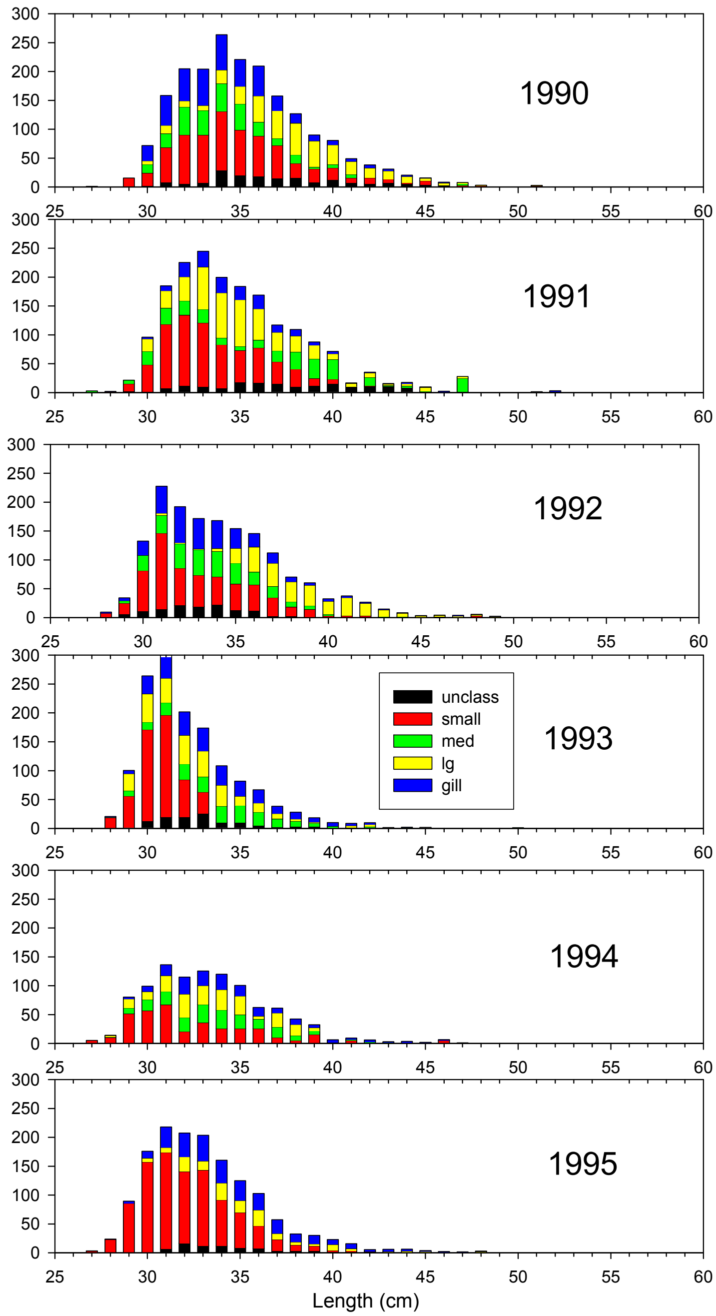


Figure I4. Expanded landing length distribution using port sampling data.

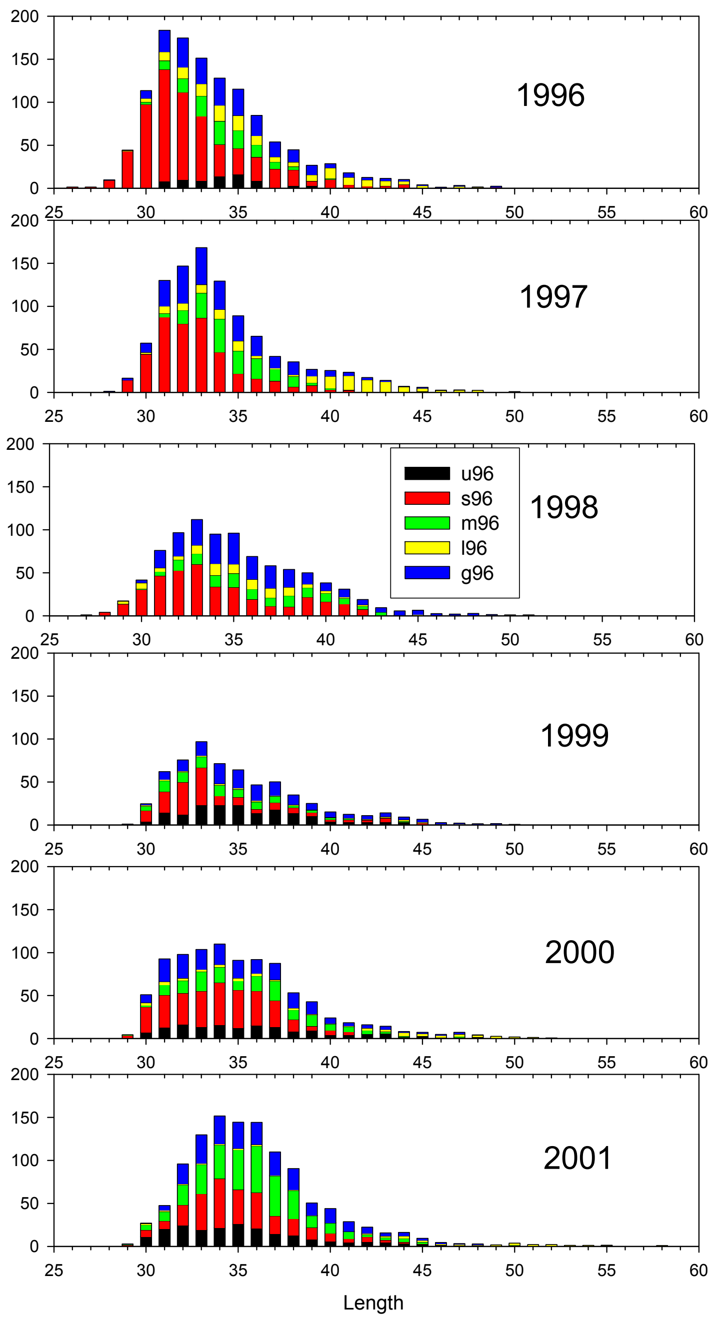


Figure I4. Cont.

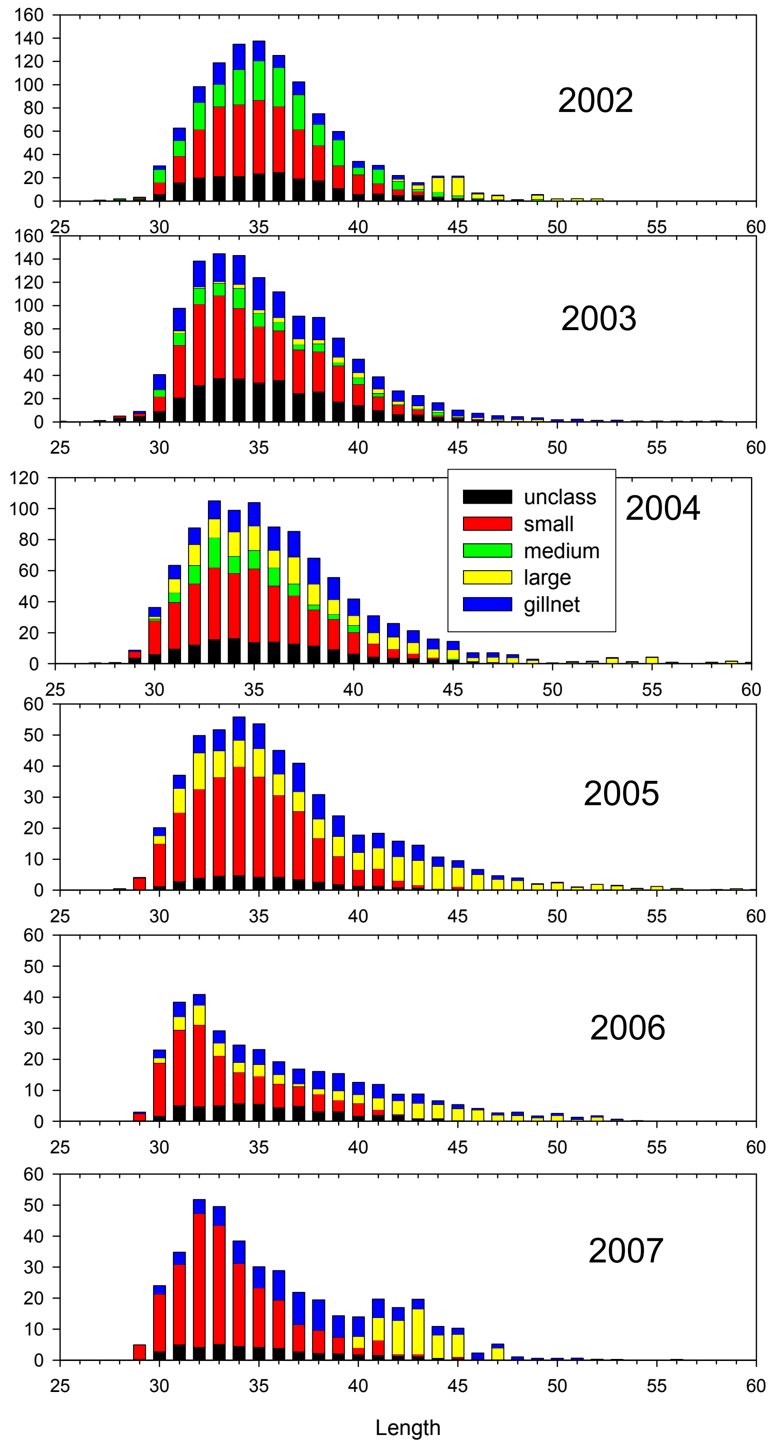


Figure I4. Cont.

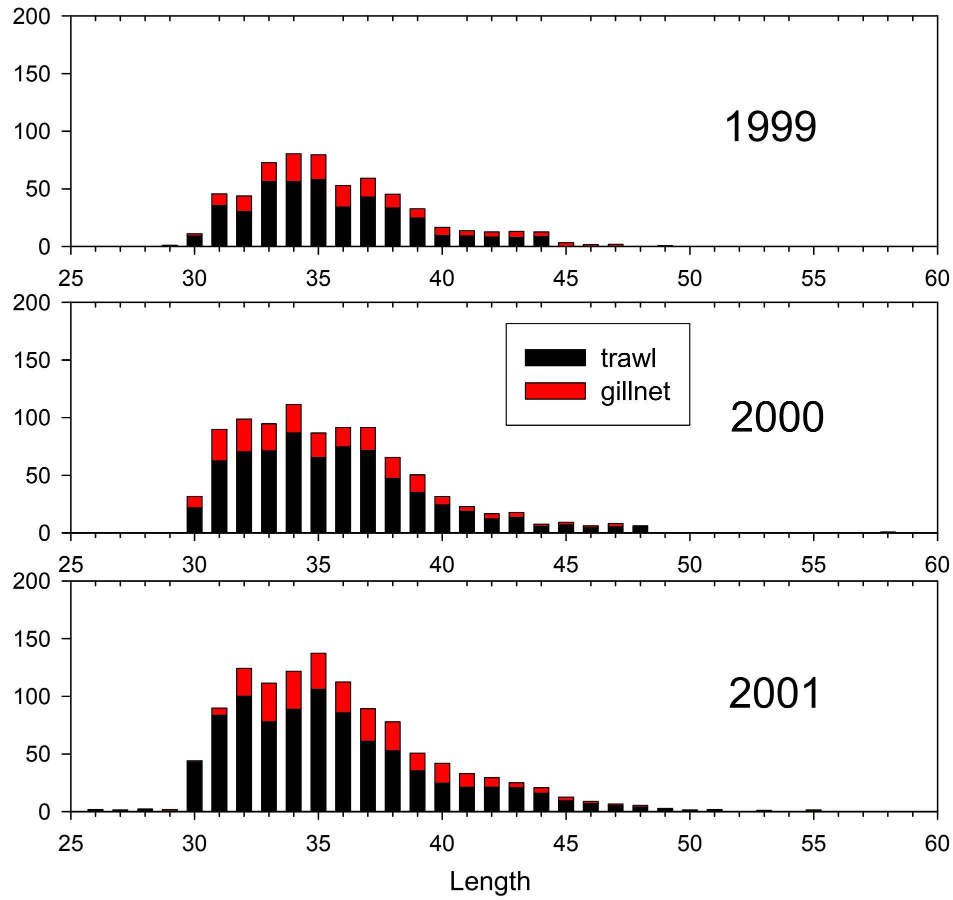


Figure I5. Expanded landing length distribution using observer data.

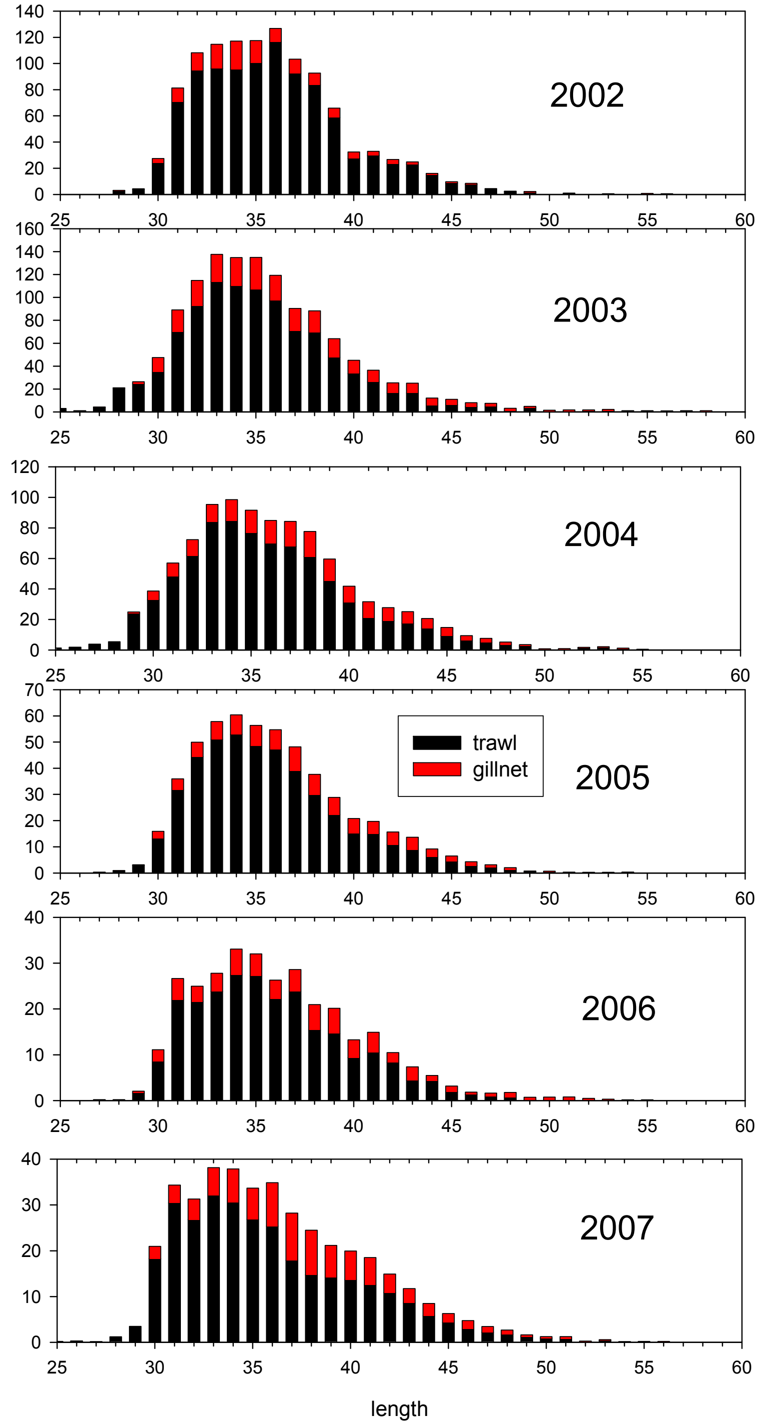


Figure I5 continued.

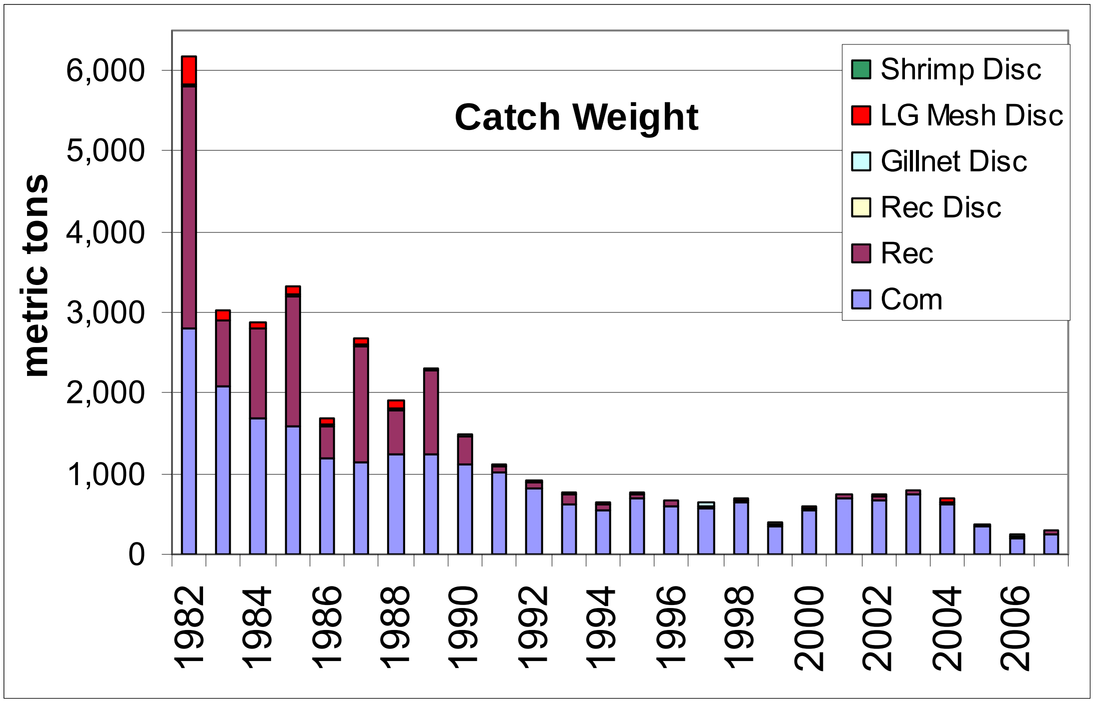


Figure I6. Gulf of Maine winter flounder composition of the catch by weight.

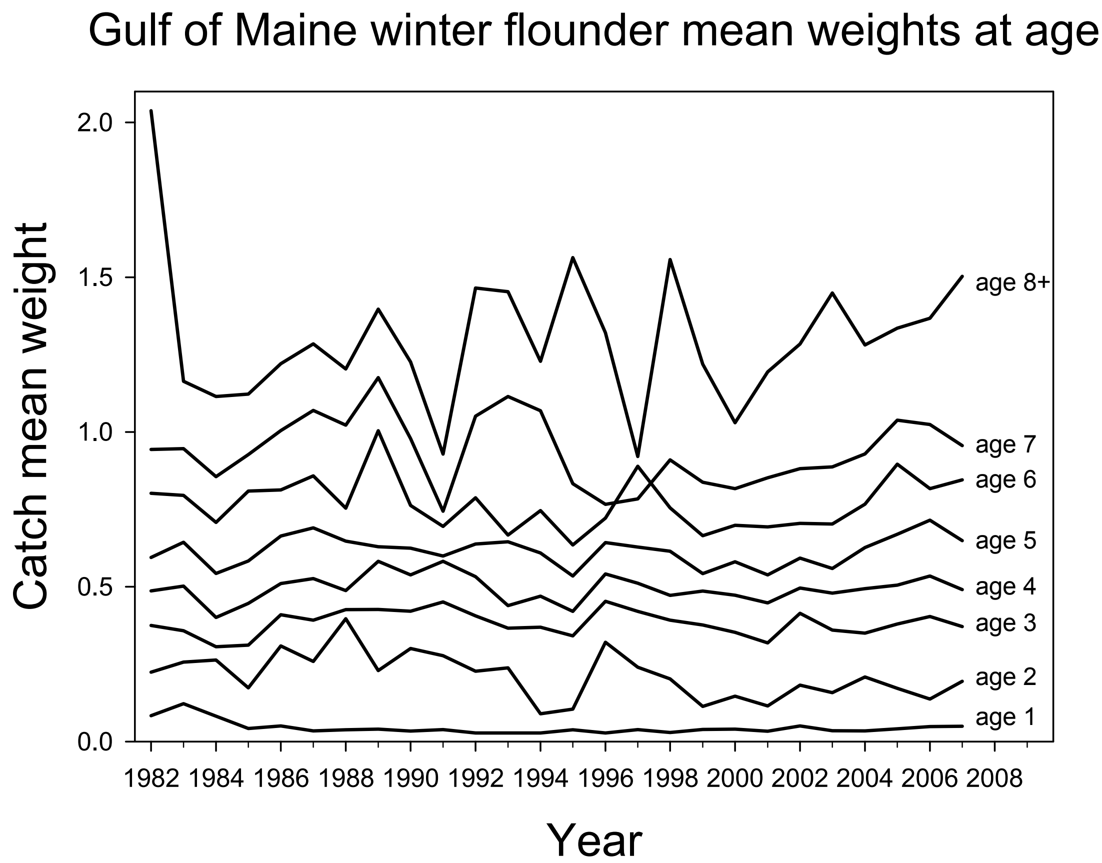


Figure I7. Gulf of Maine winter flounder mean catch weights at age (kg).

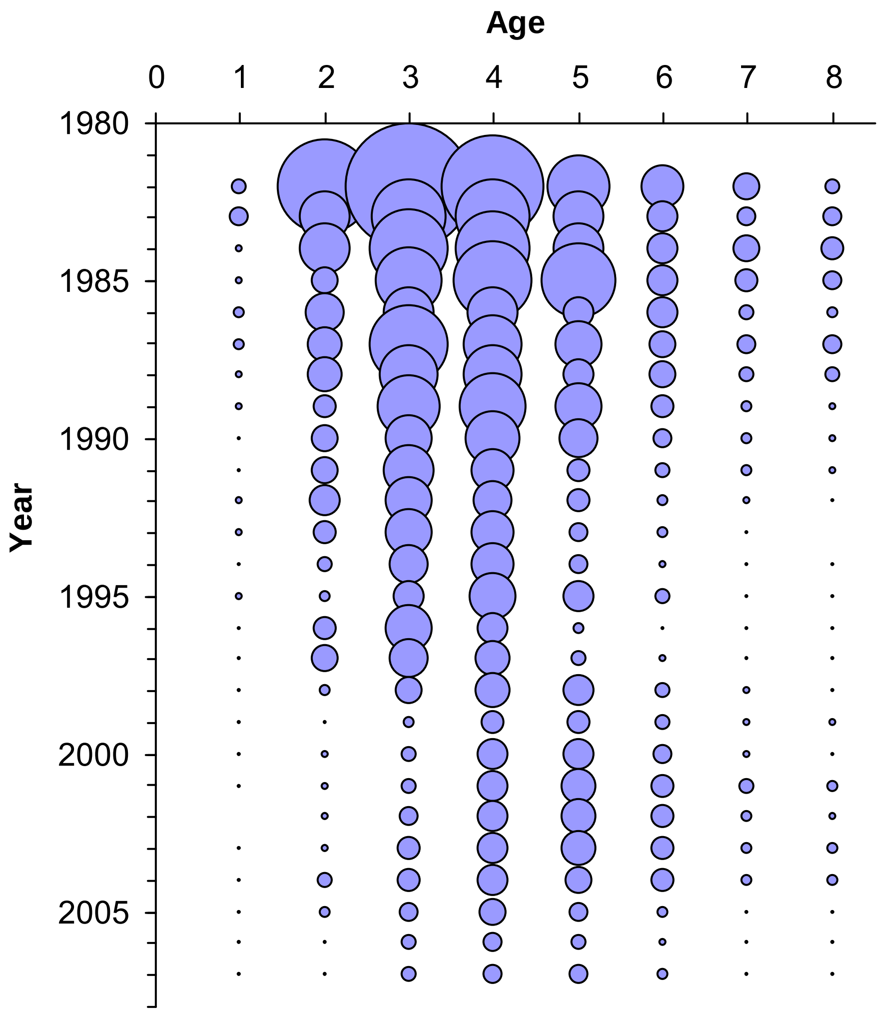


Figure I8. Gulf of Maine winter flounder bubble plot of the catch at age.

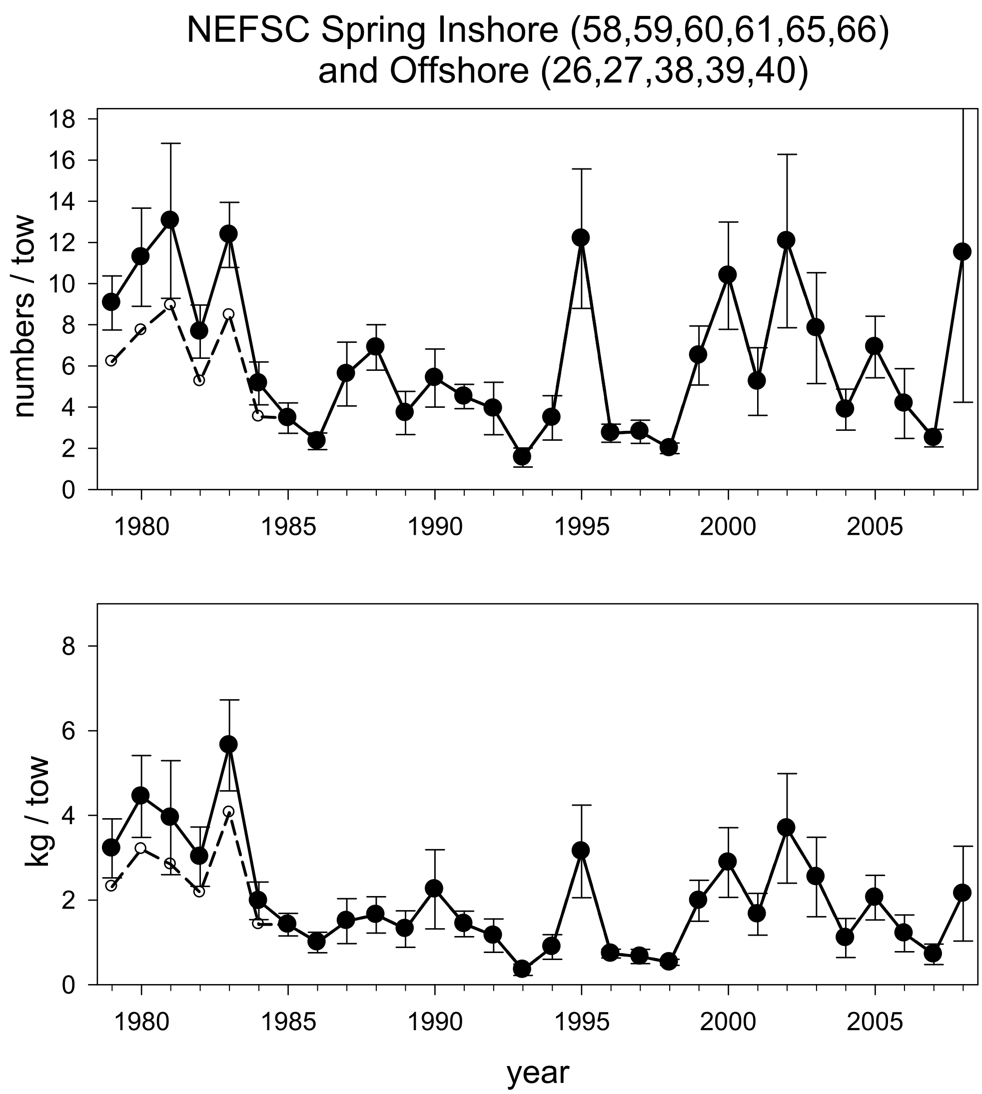


Figure I9. NEFSC Spring survey stratified mean numbers and mean weight (kg) per tow for Gulf of Maine winter flounder. Trawl door conversion factors are use where appropriate. Dotted lines are the unconverted indices. Data for 2008 is preliminary.

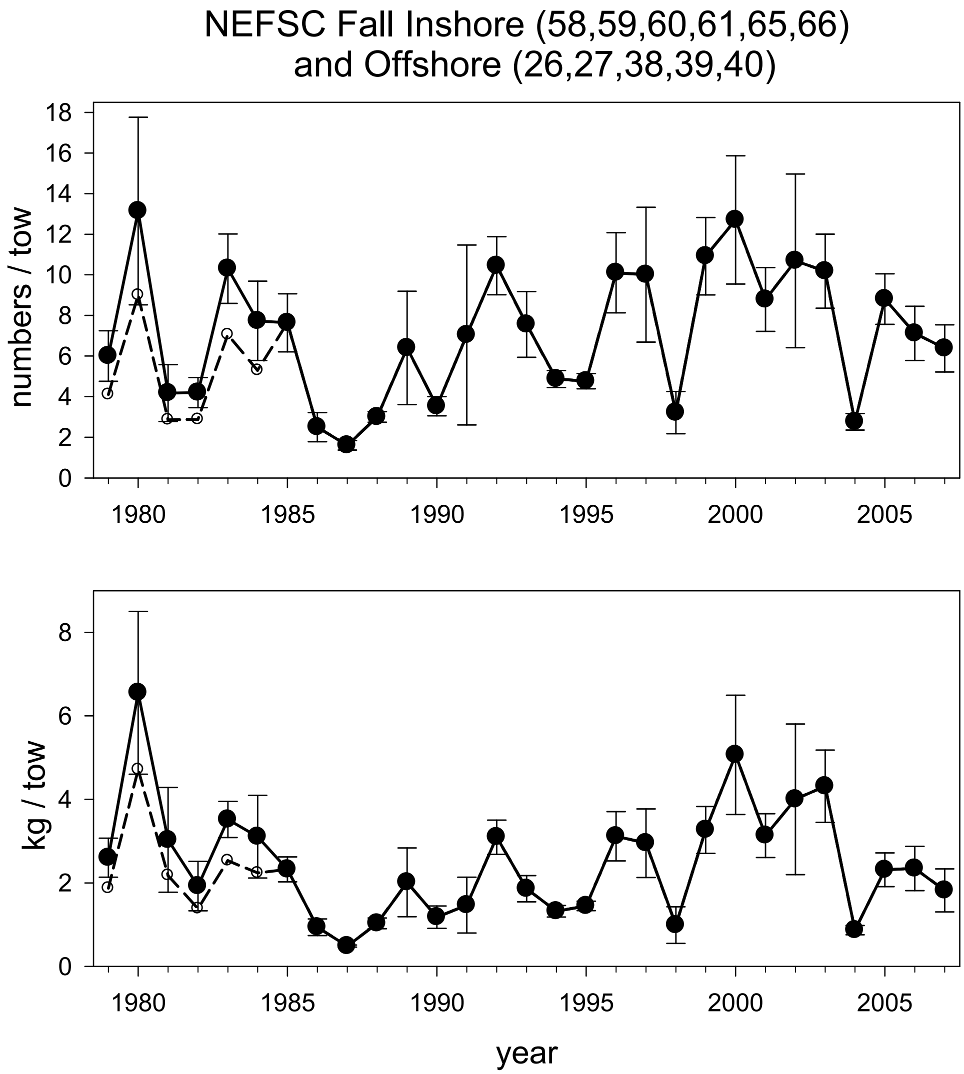


Figure I10. NEFSC Fall survey stratified mean numbers and mean weight (kg) per tow for Gulf of Maine winter flounder. Trawl door conversion factors are use where appropriate. Dotted lines are the unconverted indices.

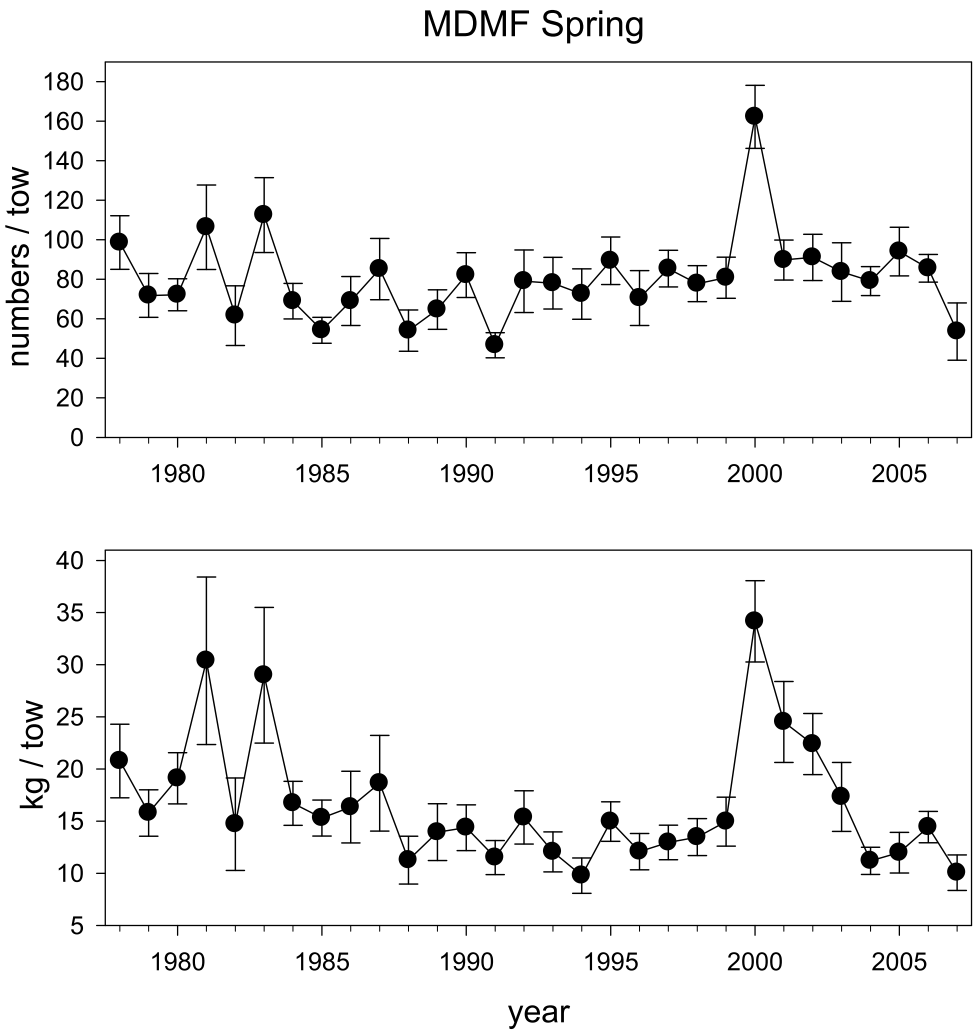


Figure I11. Massachusetts Division of Marine Fisheries (MDMF) Spring survey stratified mean numbers and mean weight (kg) per tow for Gulf of Maine winter flounder.

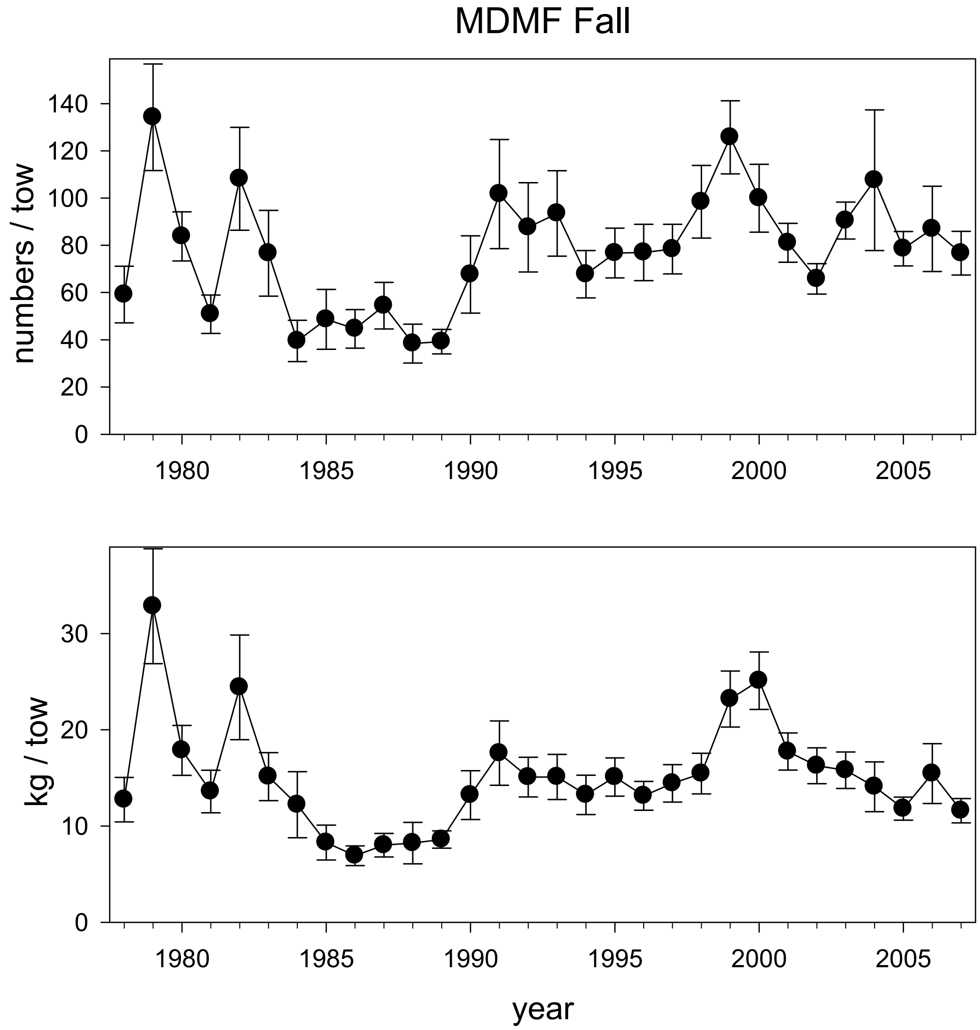
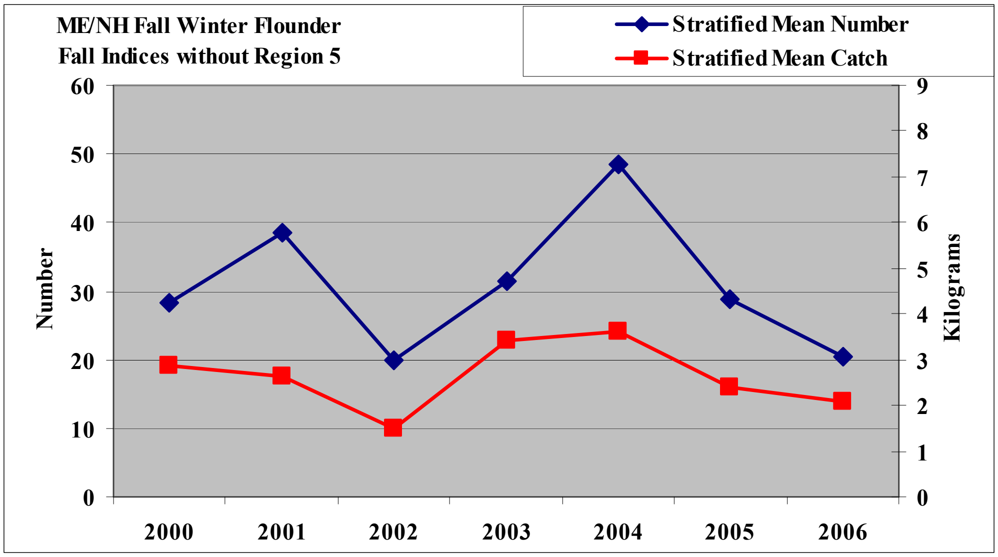


Figure I12. Massachusetts Division of Marine Fisheries (MDMF) Fall survey stratified mean numbers and mean weight (kg) per tow for Gulf of Maine winter flounder.



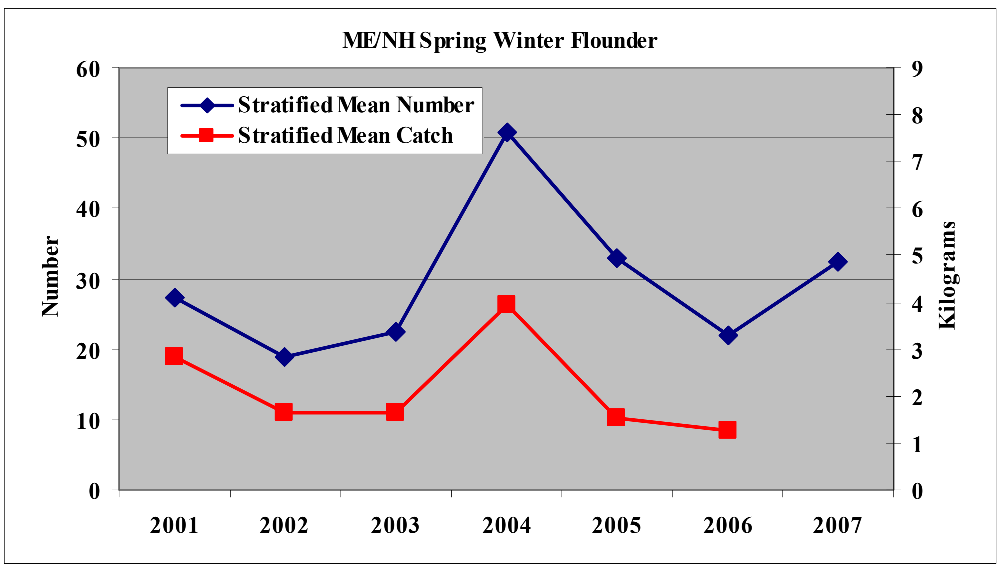


Figure I13. Spring and Fall ME/NH bottom trawl survey winter flounder abundance indices.

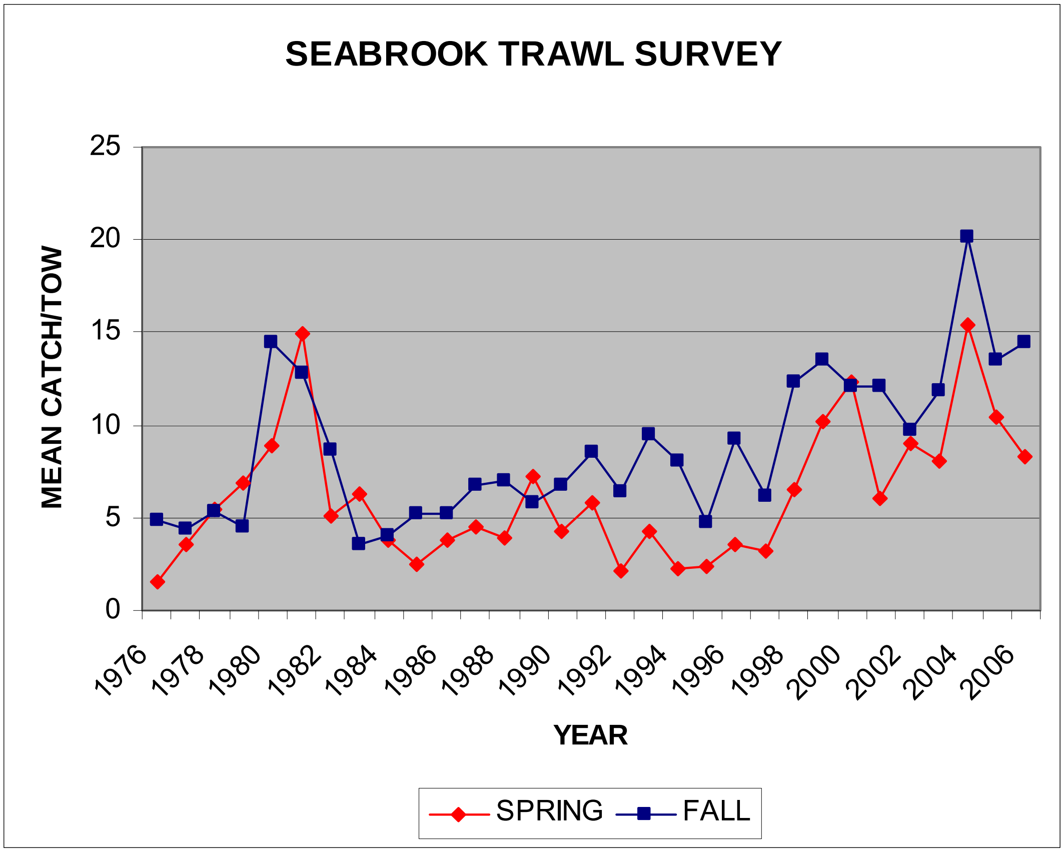


Figure I14. Seabrook Nuclear power plant in New Hampshire Spring and Fall survey mean number per tow for Gulf of Maine winter flounder.

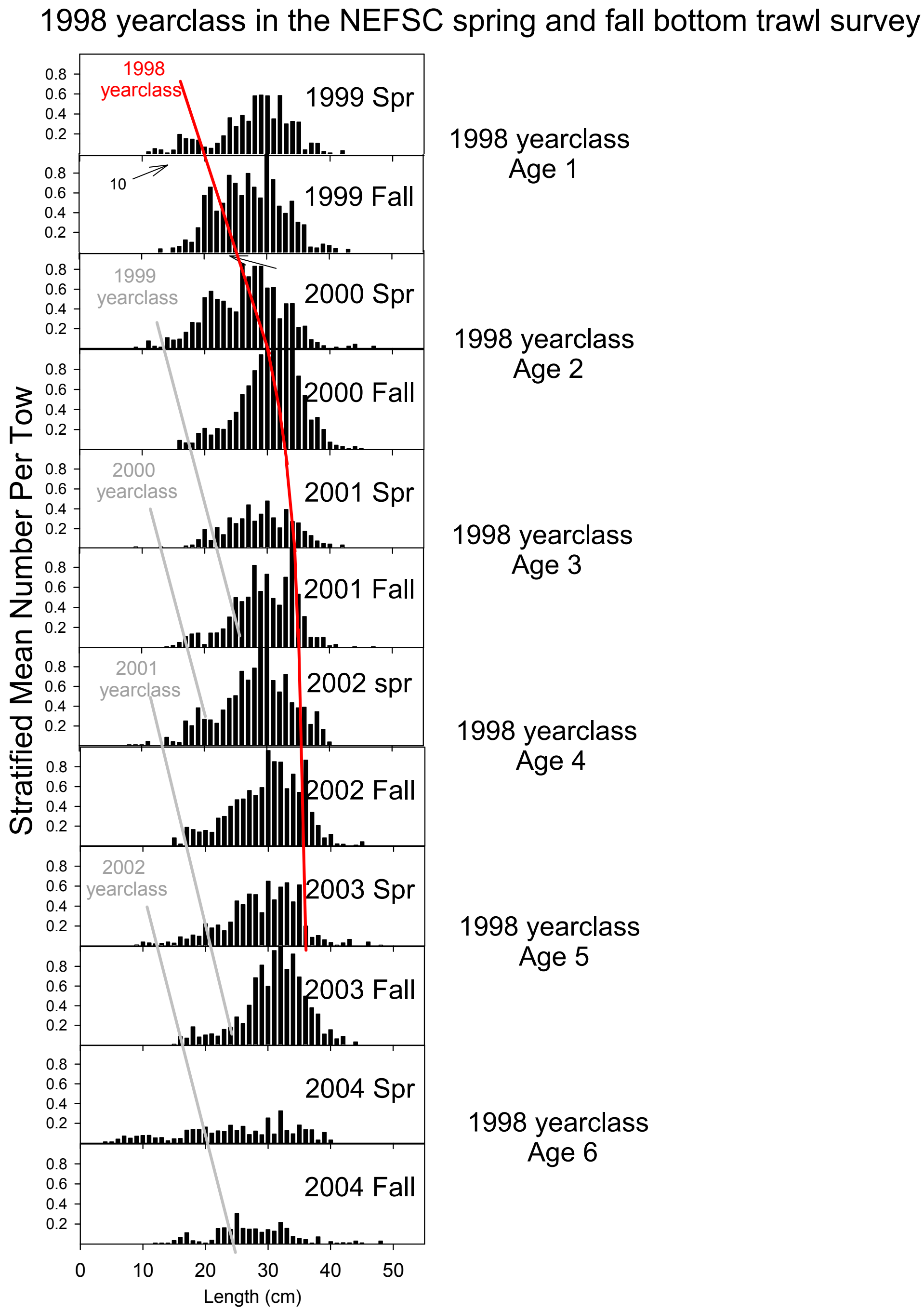


Figure I15. MDMF bottom trawl survey tracking of the 1998 yearclass in the Gulf of Maine winter flounder catch per tow at length (cm) distributions.

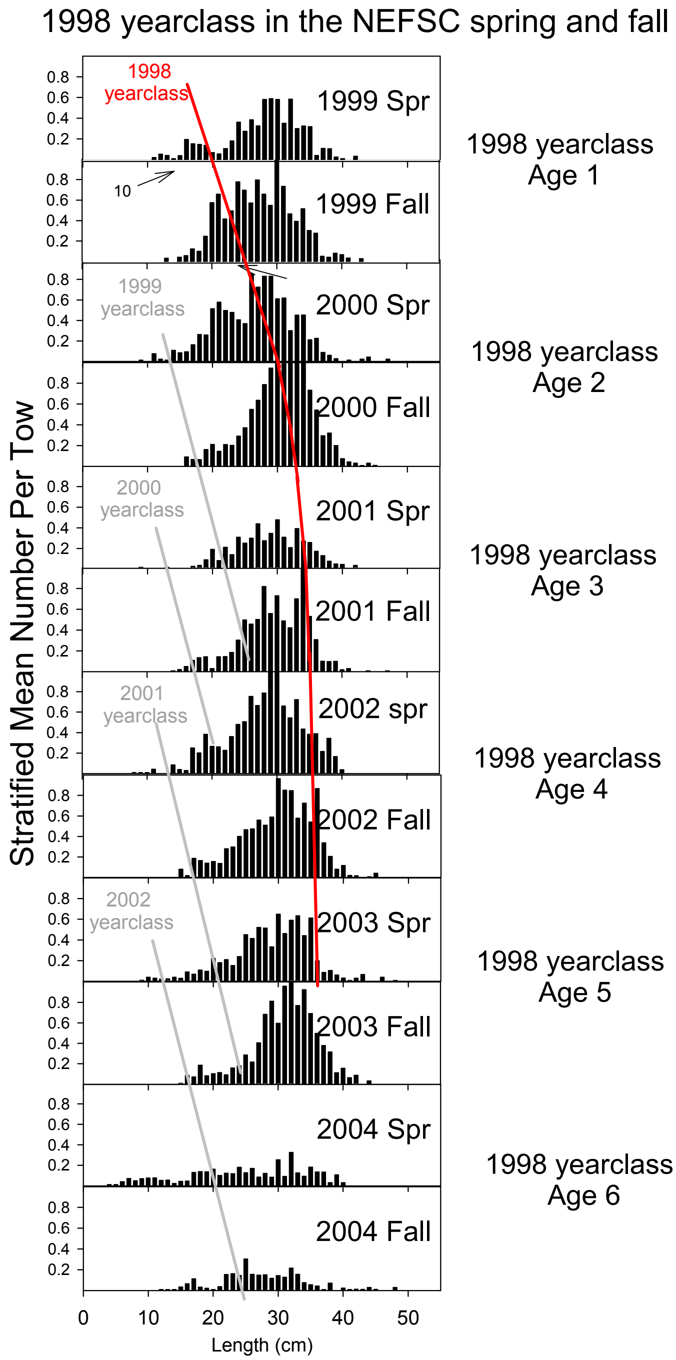


Figure I16. NEFSC bottom trawl survey tracking of the 1998 yearclass in the Gulf of Maine winter flounder catch per tow at length (cm) distributions.

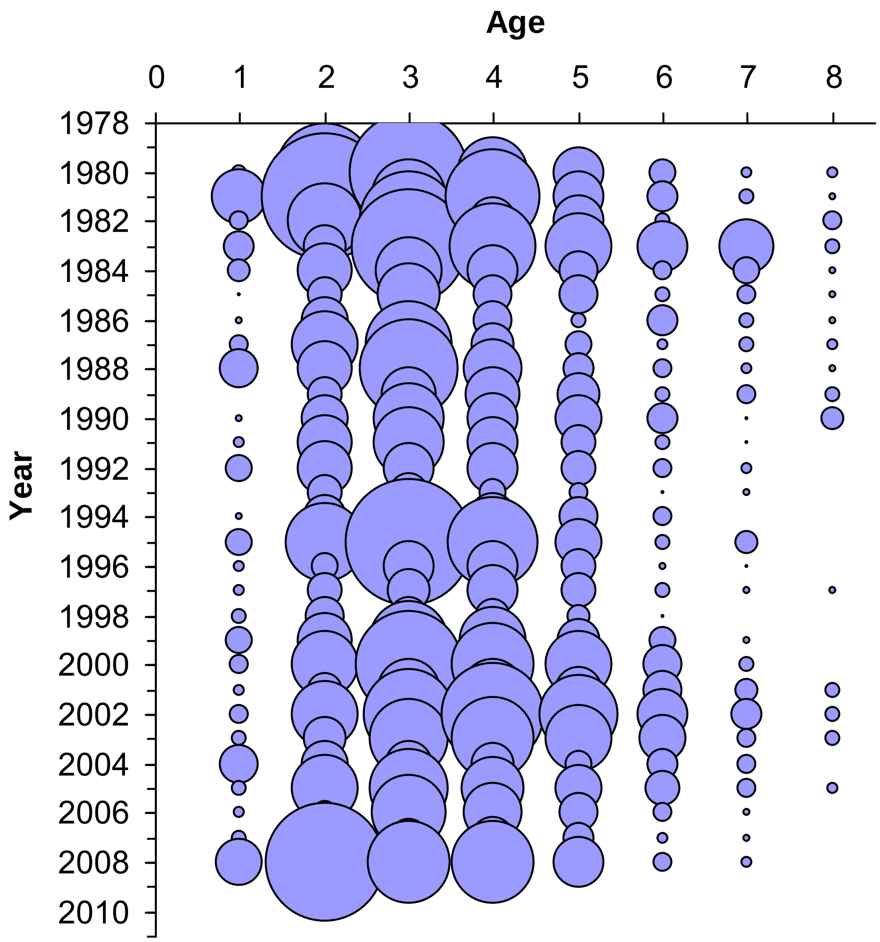


Figure I17. NEFSC Spring indices of abundance by age.

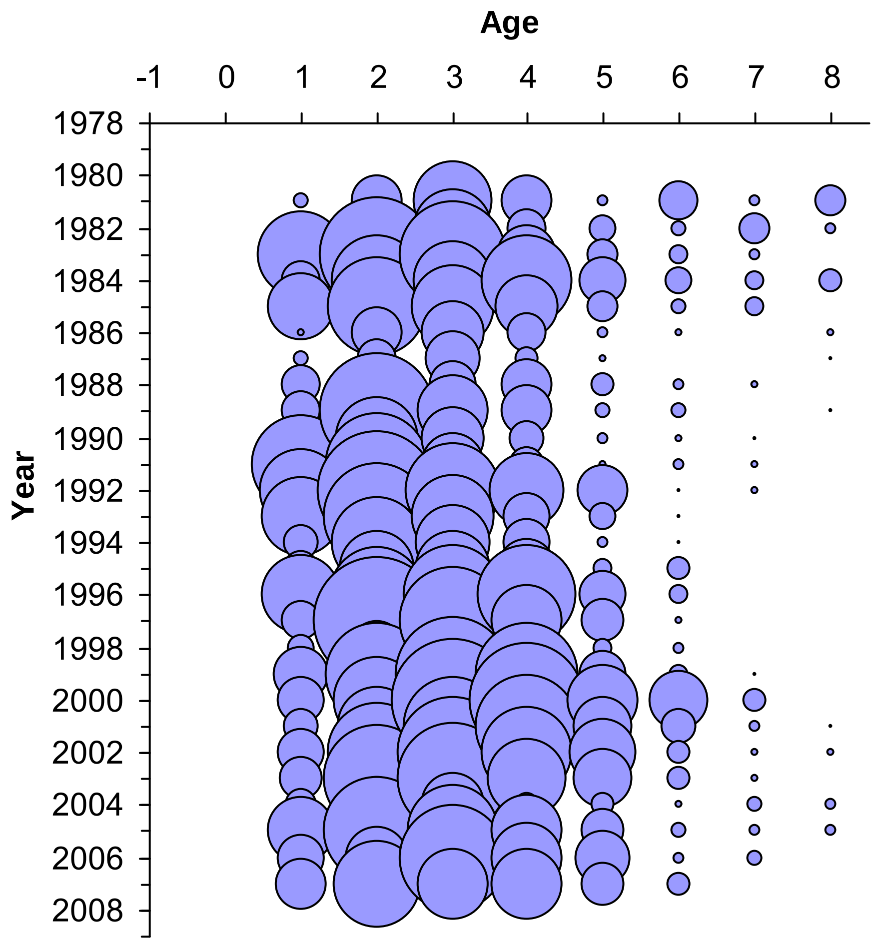


Figure I18. NEFSC Fall indices of abundance by age.

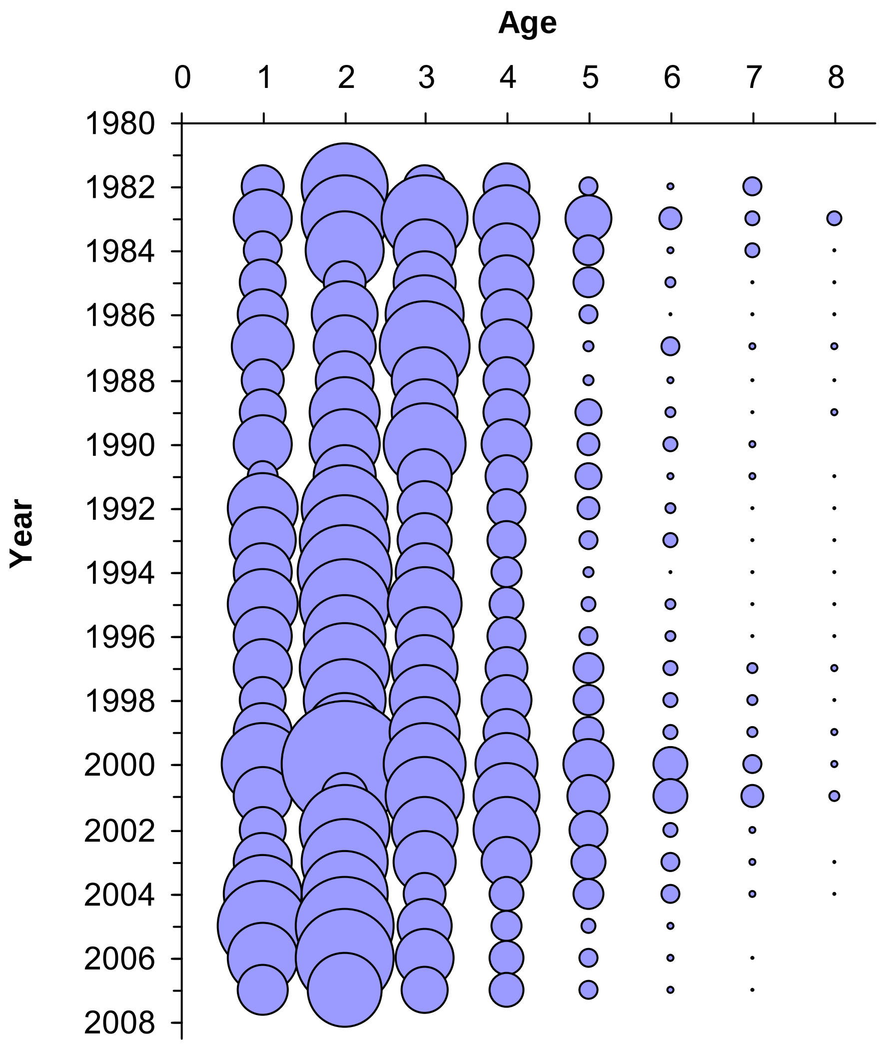


Figure I19. MDMF spring indices of abundance by age.

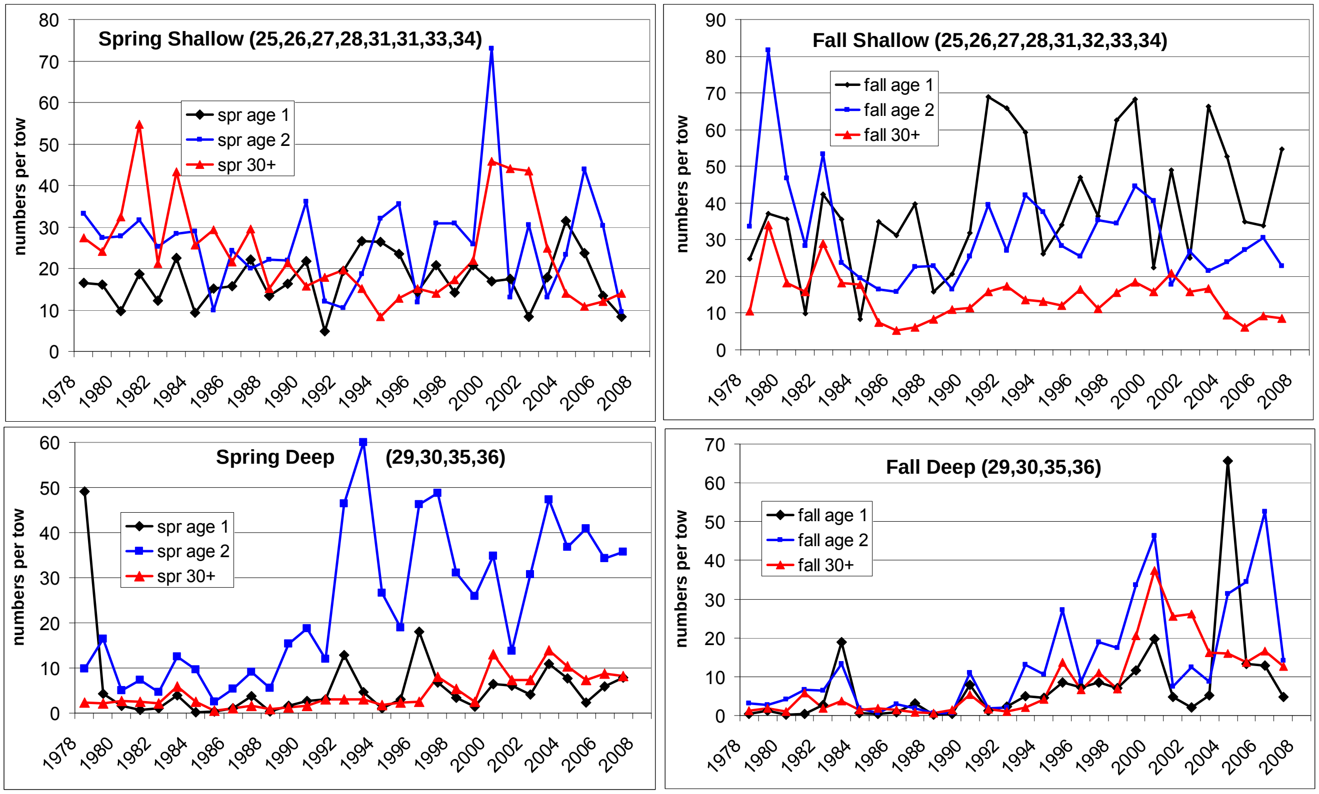


Figure I20. Number per tow indices from the Spring and Fall MDMF surveys by depth category (shallow and deep).

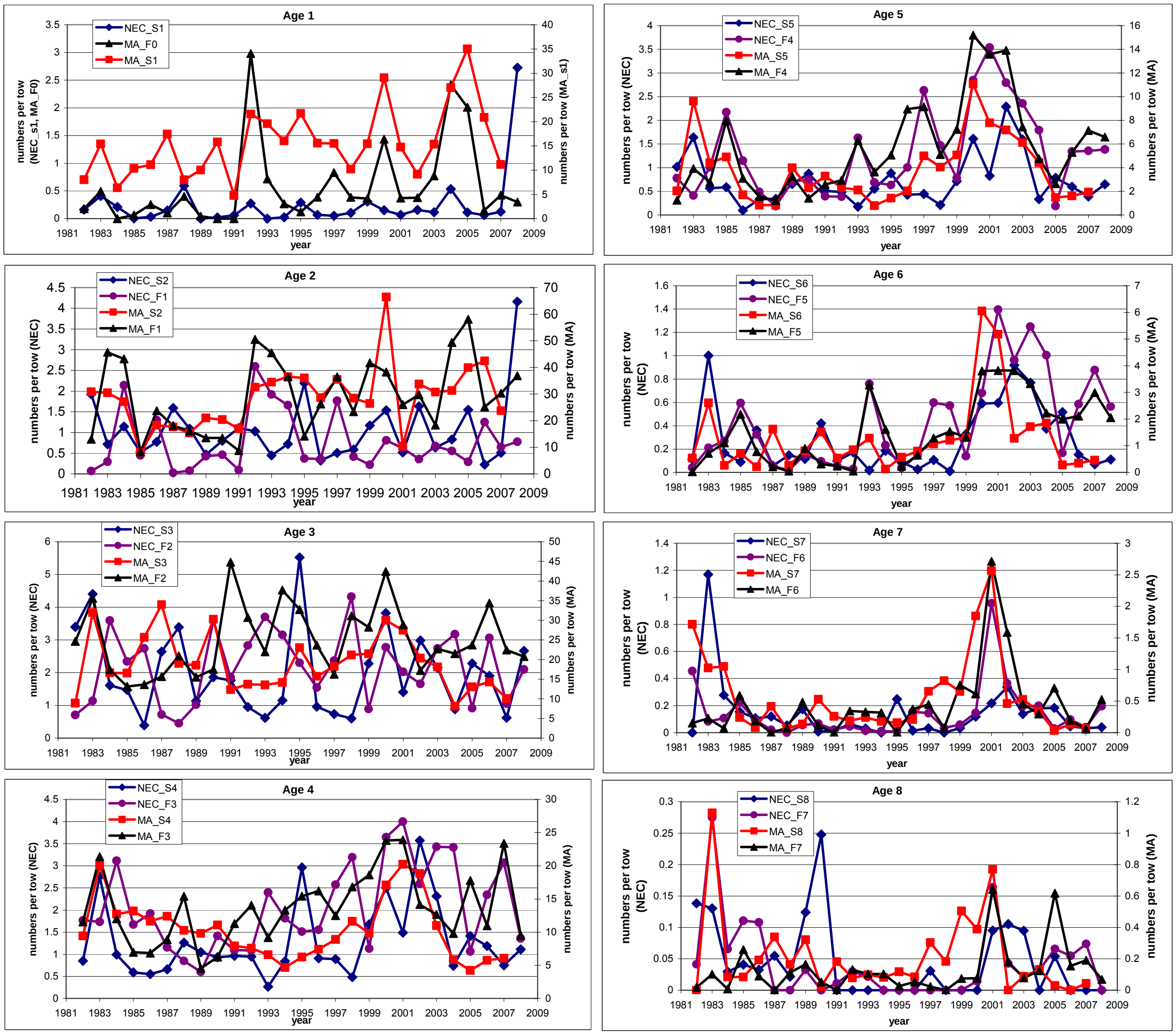


Figure I21. Indices at age from the Spring and Fall NEFSC and MDMF surveys.

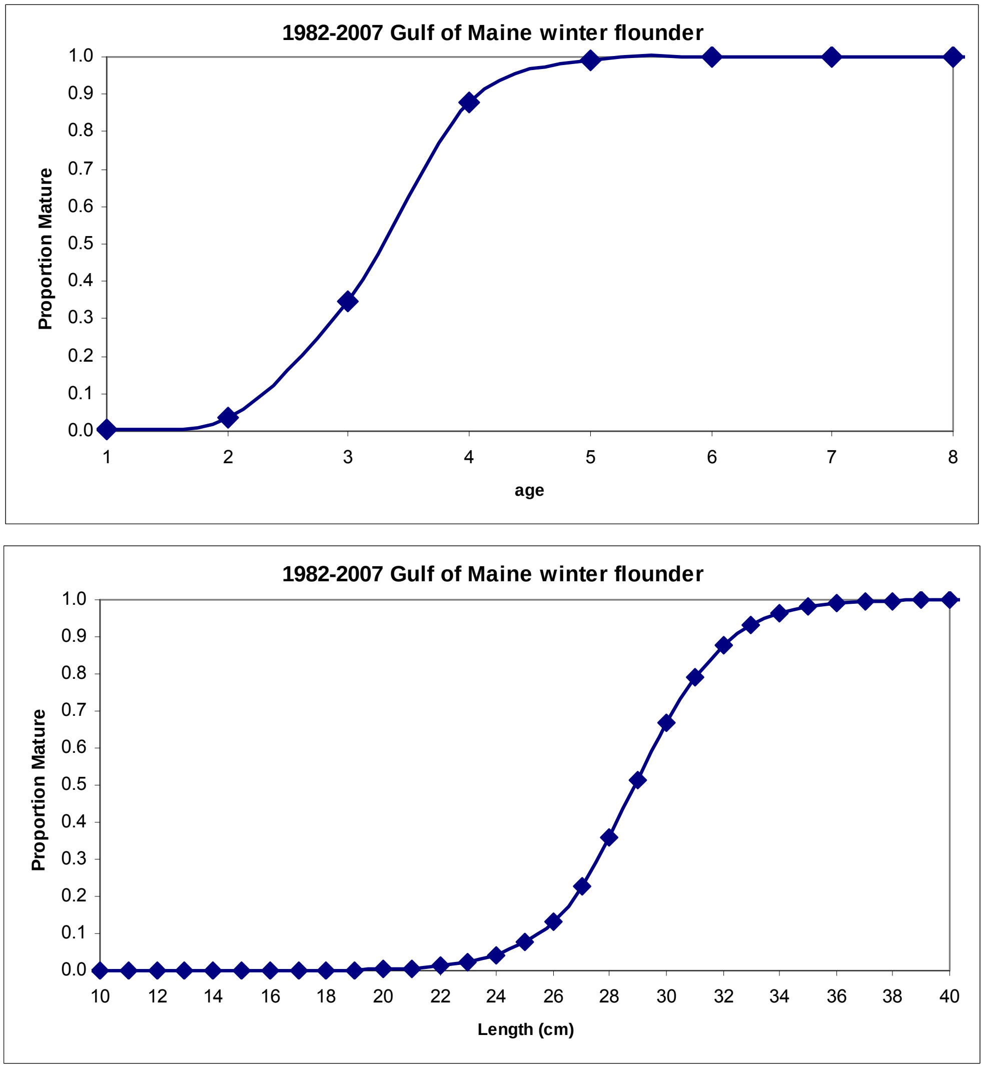


Figure I22. Female Gulf of Maine winter flounder logistic length and age maturity curves estimated with all years combine (1982-2007, n = 12,108) from the MDMF spring survey.

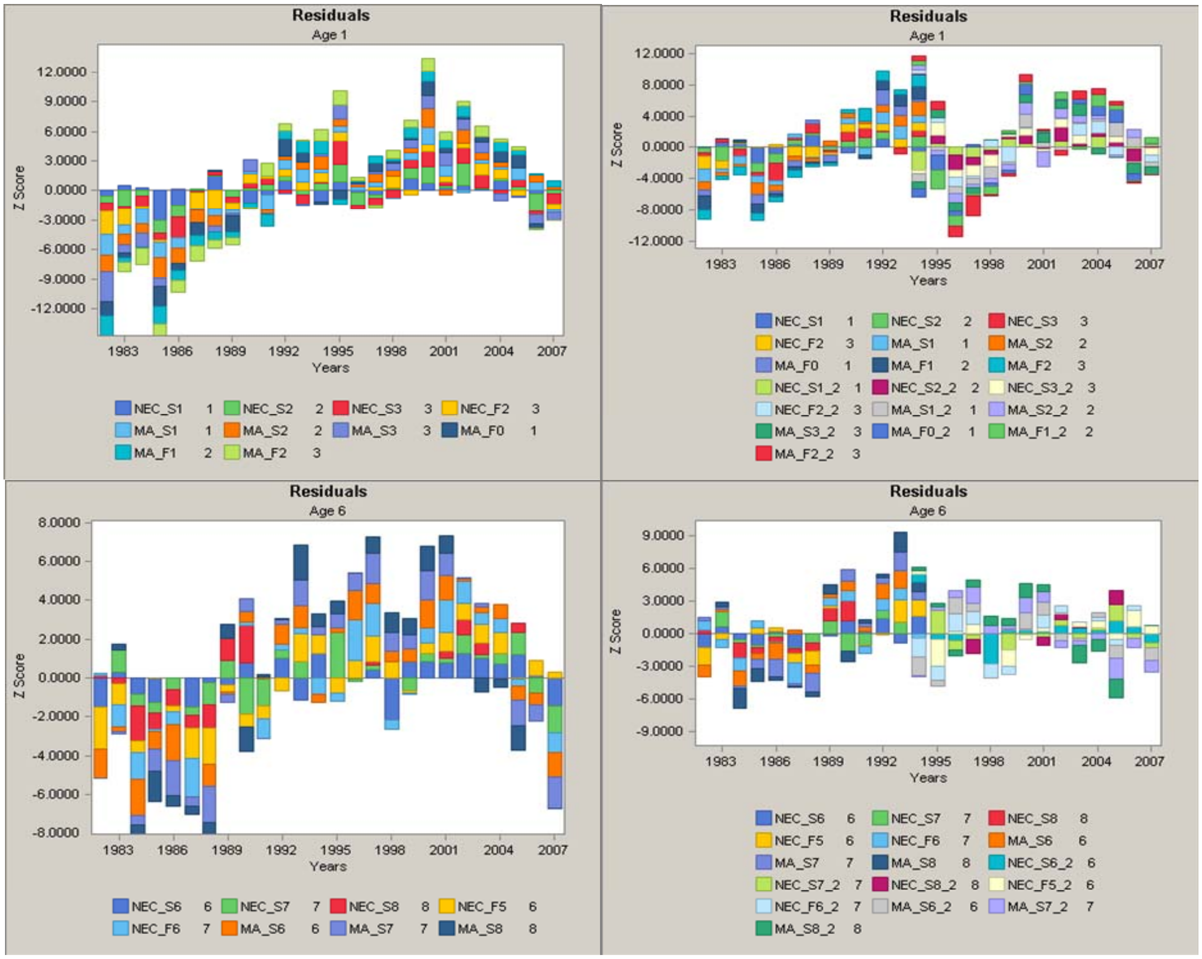


Figure I23. Base and split VPA residual pattern. Top plots are residuals for ages 1 through 3 for the base (left) and split VPA (right). Bottom plots are residuals patterns for ages 6 through 8 for the base (left) and split VPA (right).

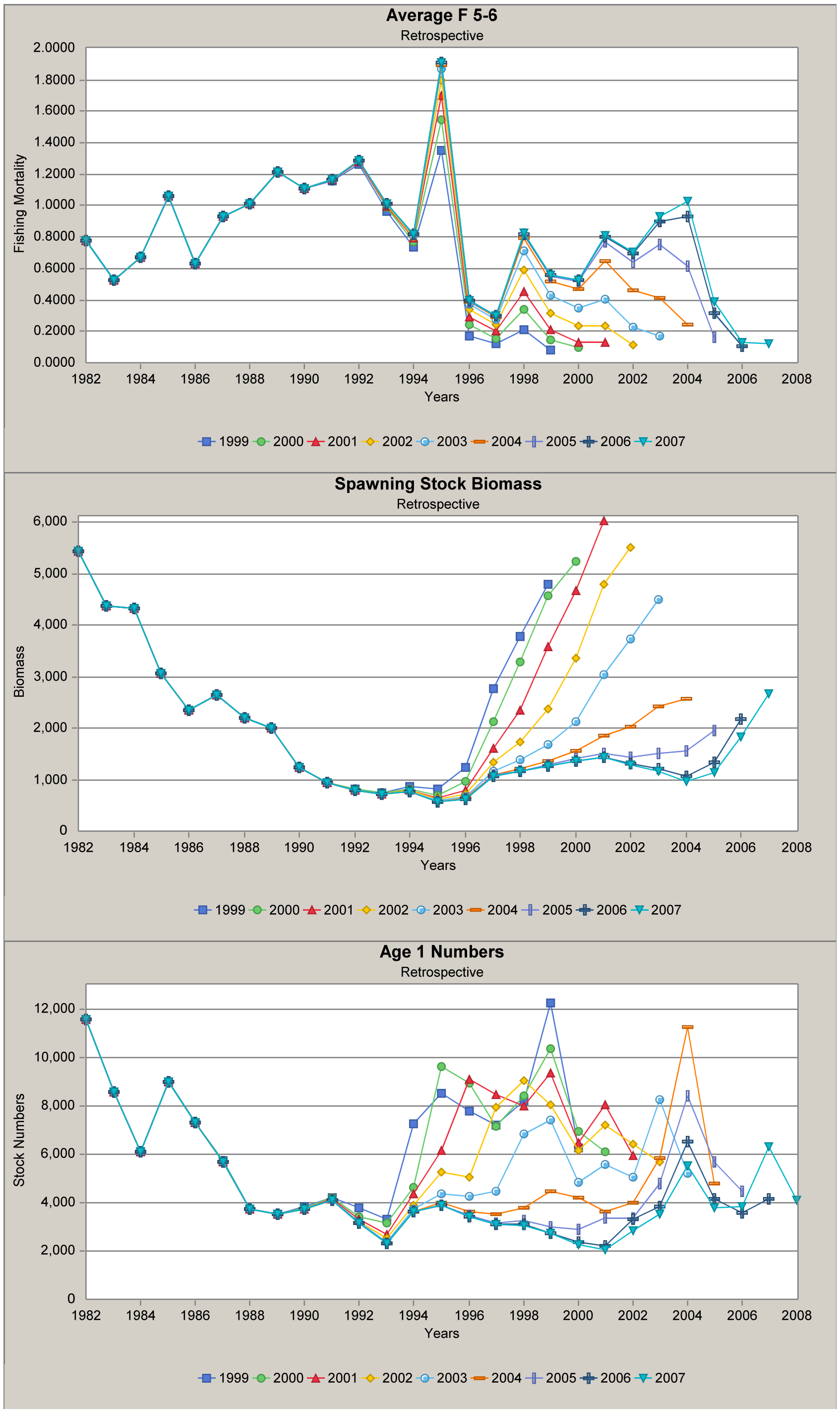


Figure I24. Gulf of Maine winter flounder Base VPA retrospective.

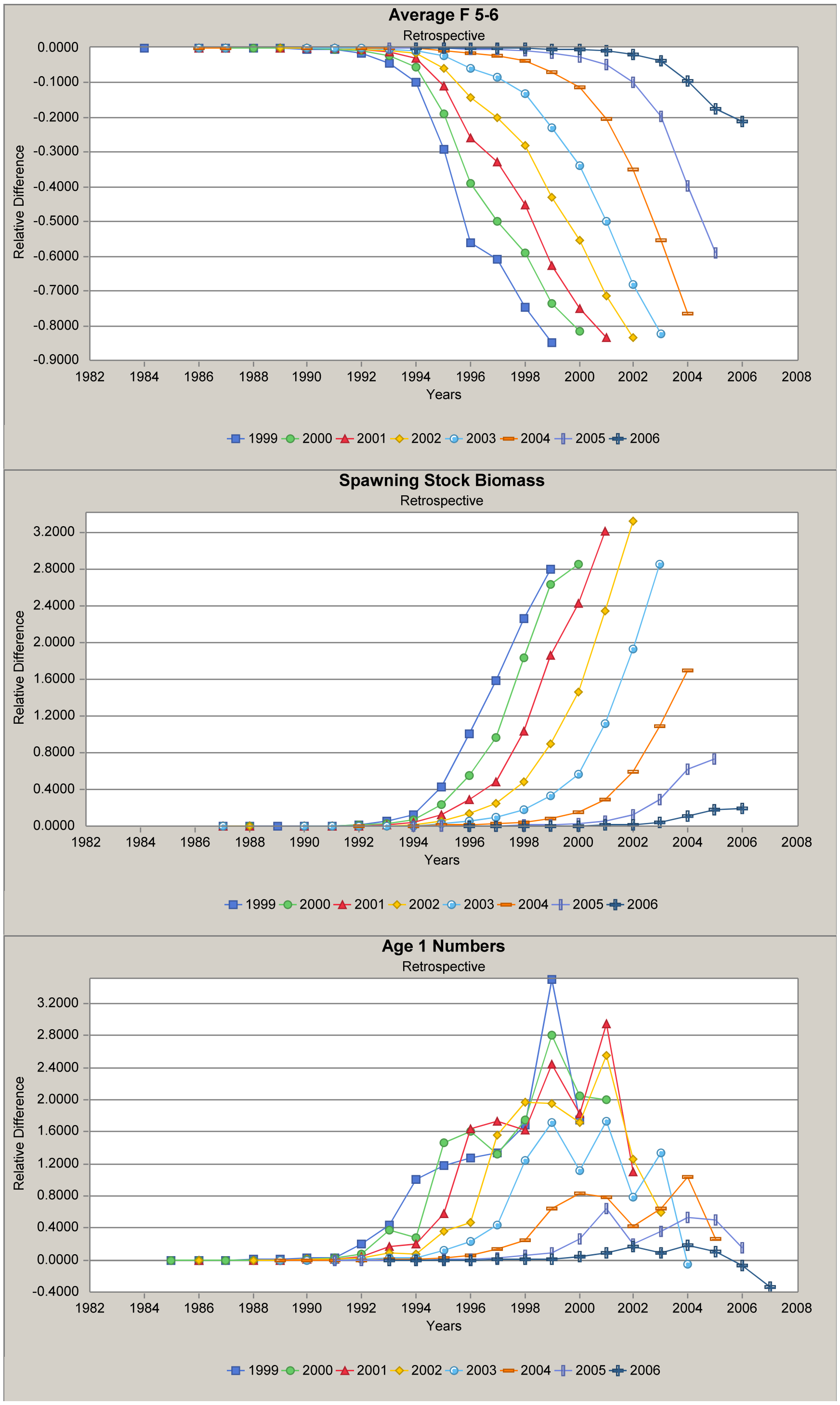


Figure I25. Gulf of Maine winter flounder Base VPA relative difference retrospective.

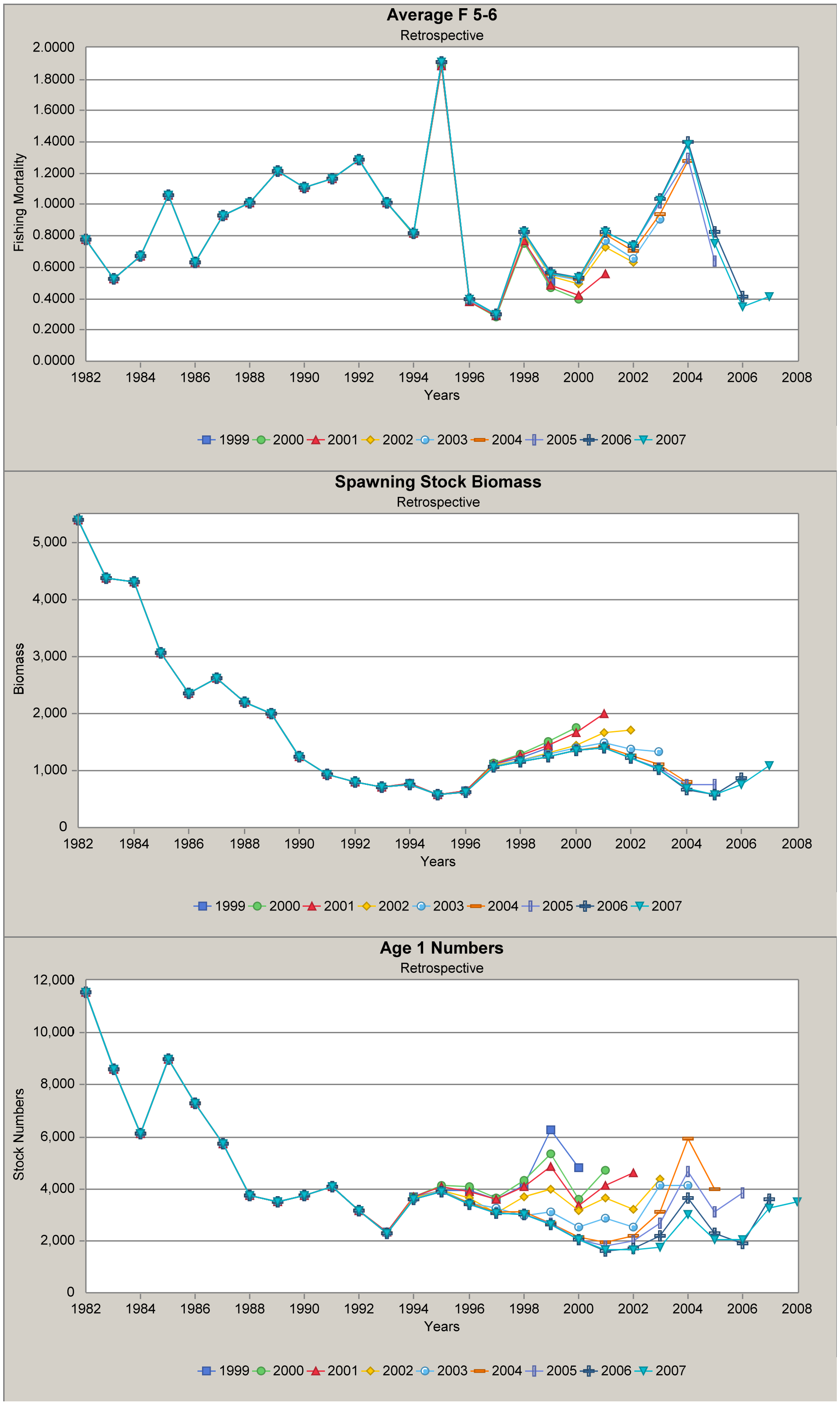


Figure I26. Gulf of Maine winter flounder split VPA retrospective.

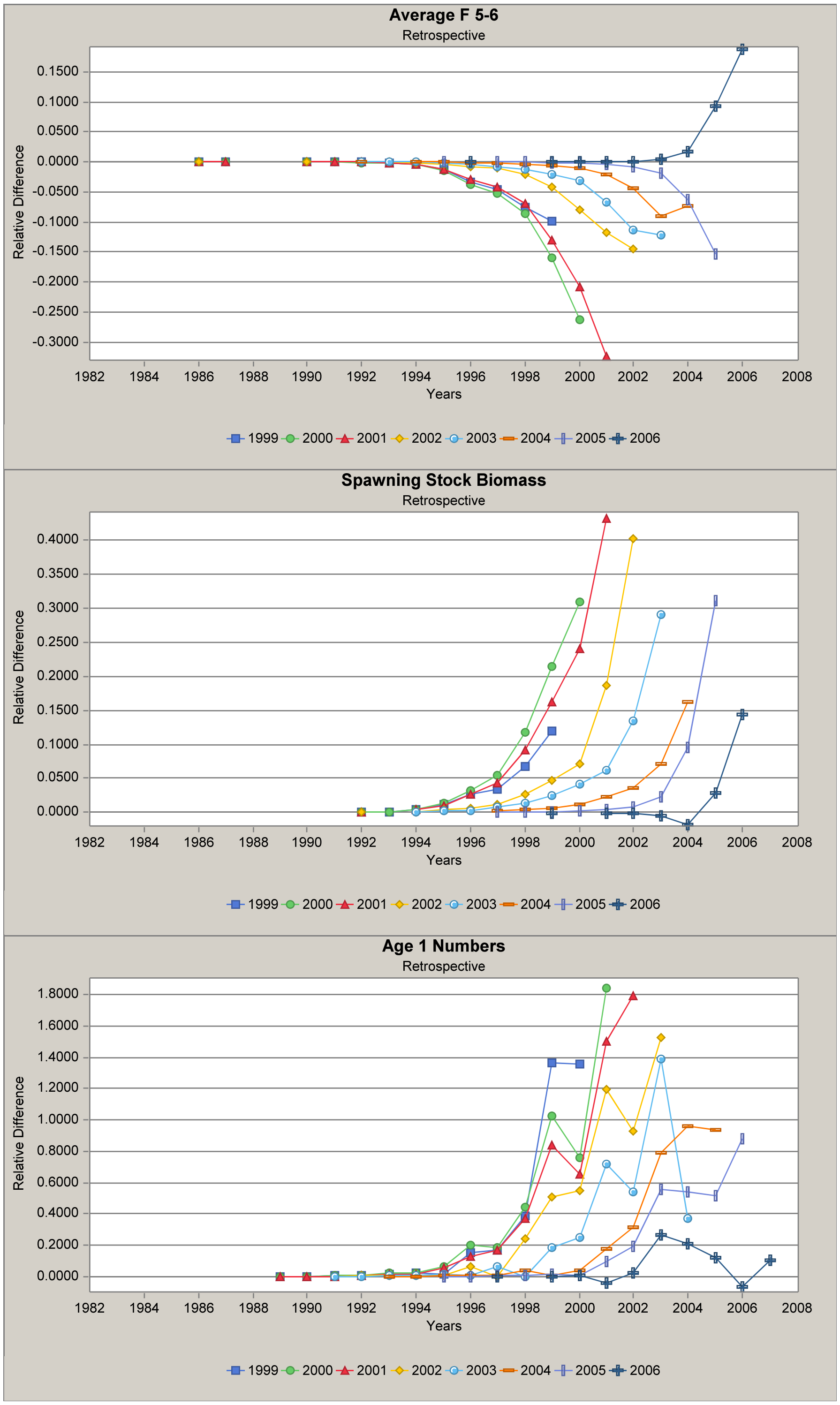


Figure I27. Gulf of Maine winter flounder split VPA relative difference retrospective.

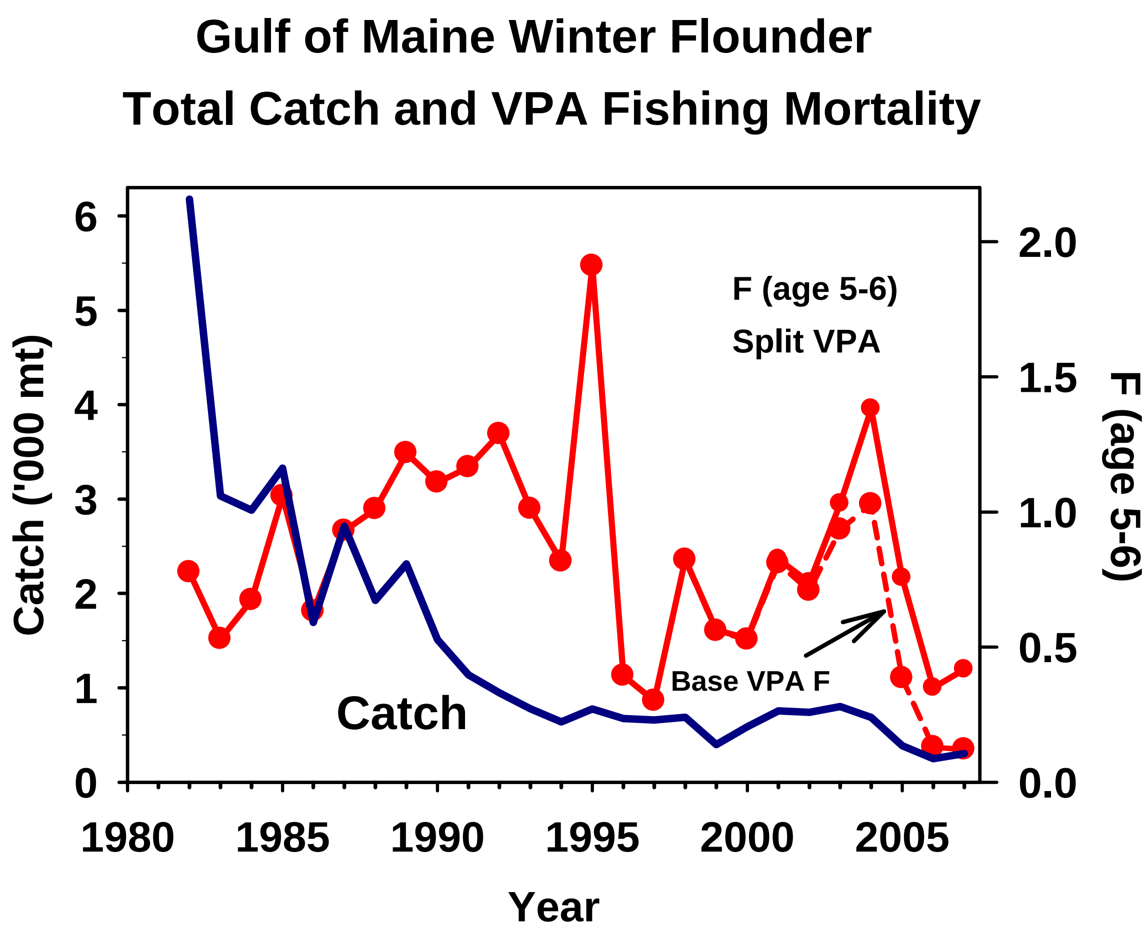


Figure I28. Total catch (landings and discards, thousands of metric tons) and fishing mortality rate (F, ages 5-6) from the split and base VPA for Gulf of Maine winter flounder.

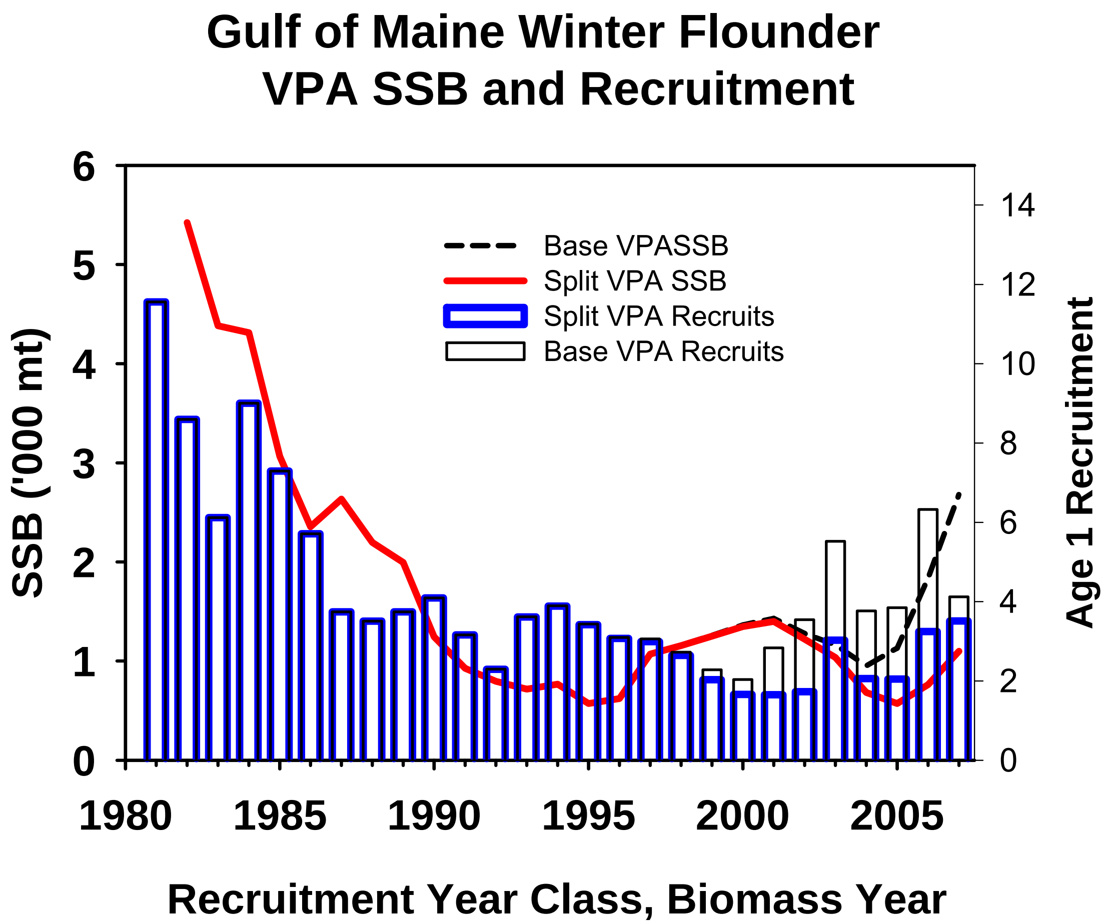


Figure I29. Estimated age 1 recruitment and spawning stock biomass from the split and base VPA runs for Gulf of Maine winter flounder.

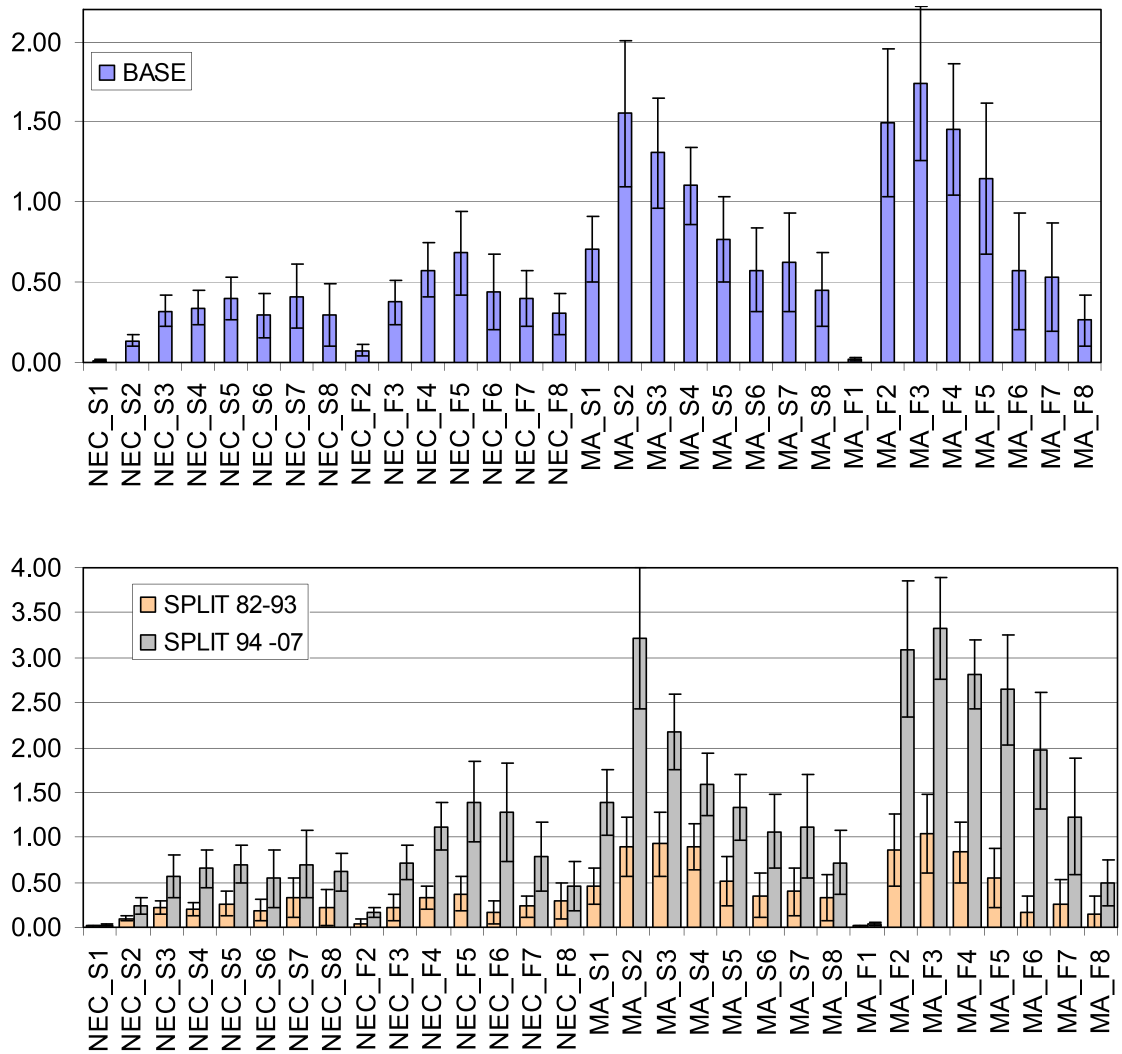


Figure I30. Gulf of Maine winter flounder Base and split VPA area swept Q estimates with standard deviations.

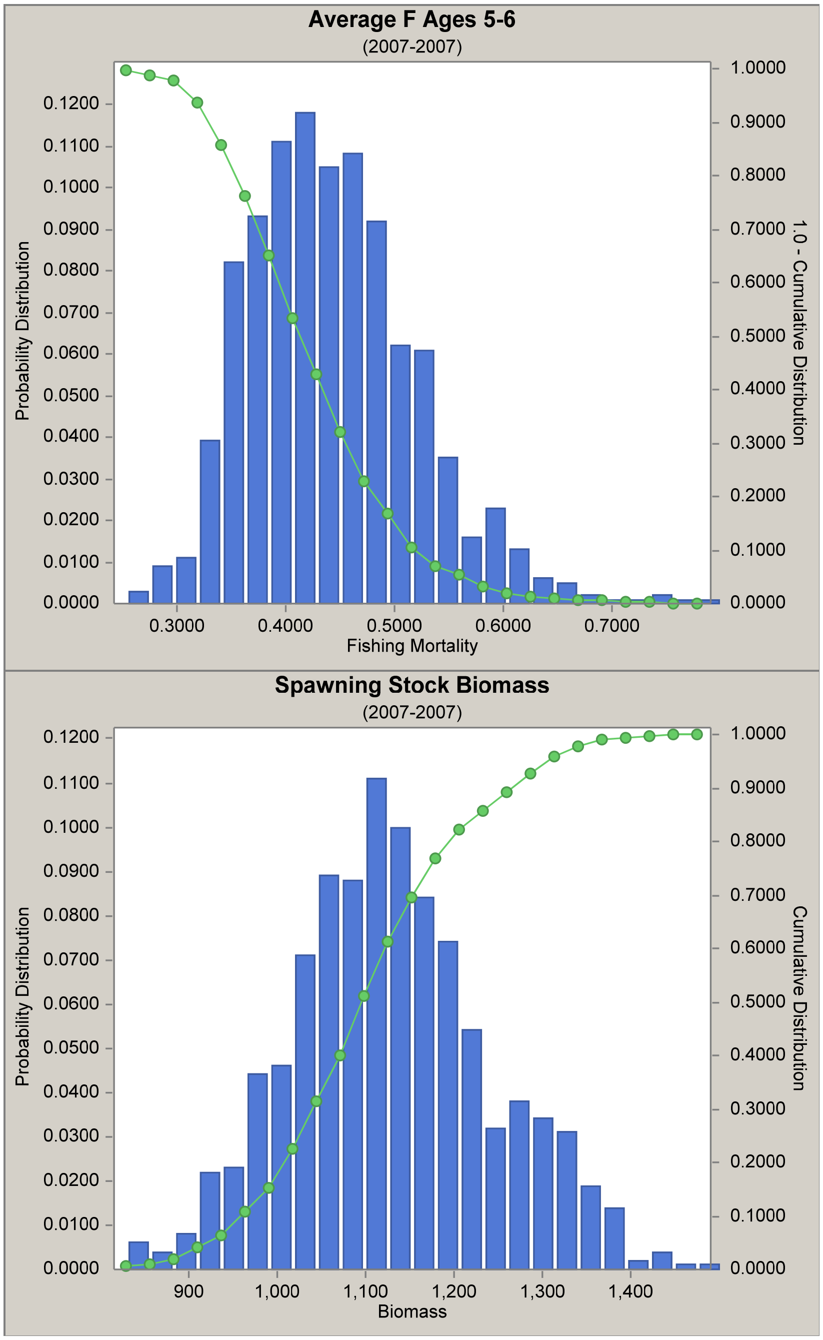


Figure I31. Precision estimates of spawning stock biomass and fishing mortality rate in 2007 for Gulf of Maine winter flounder from the split VPA (run 2b).

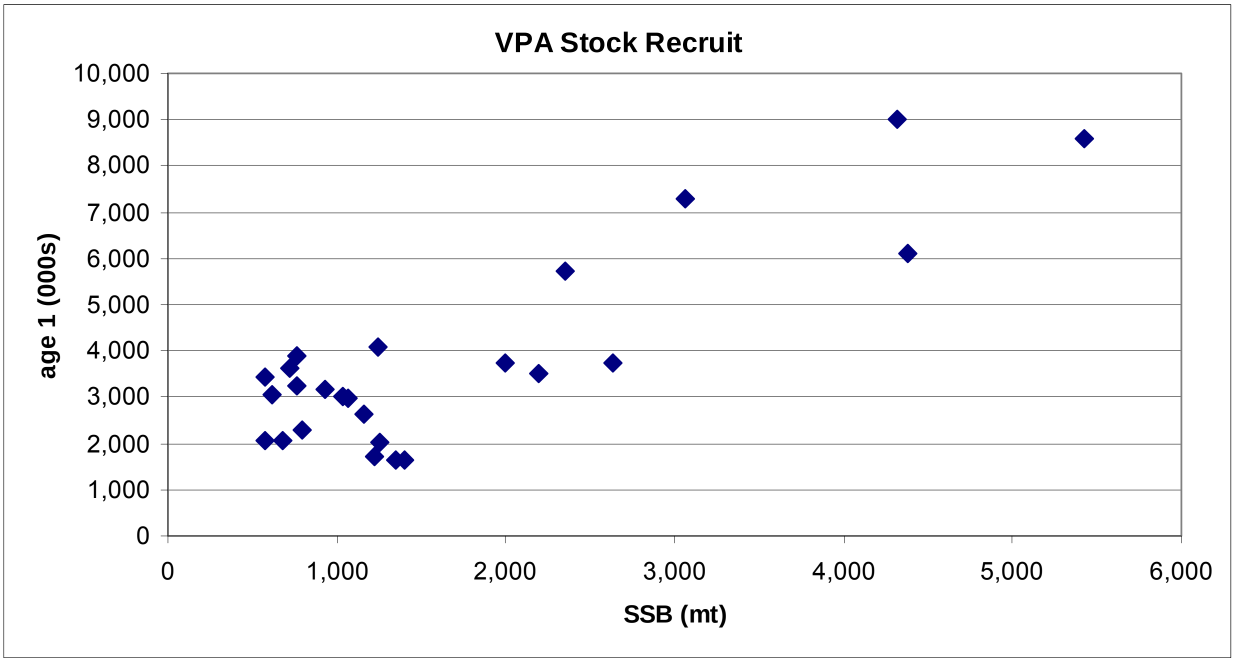


Figure I32. Stock recruit relationship for Gulf of Maine winter flounder from the split VPA (run 2b).

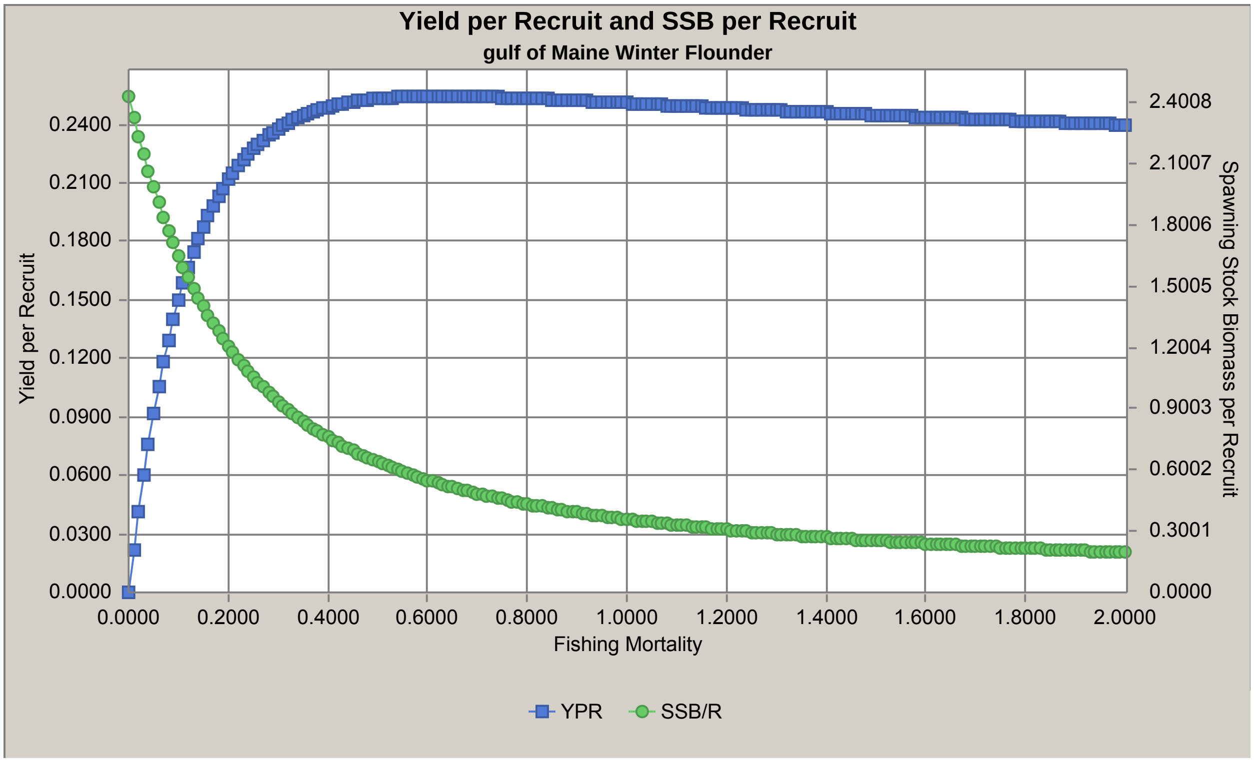


Figure I33. Age based yield per recruit and spawning stock biomass per recruit curves for Gulf of Maine winter flounder.

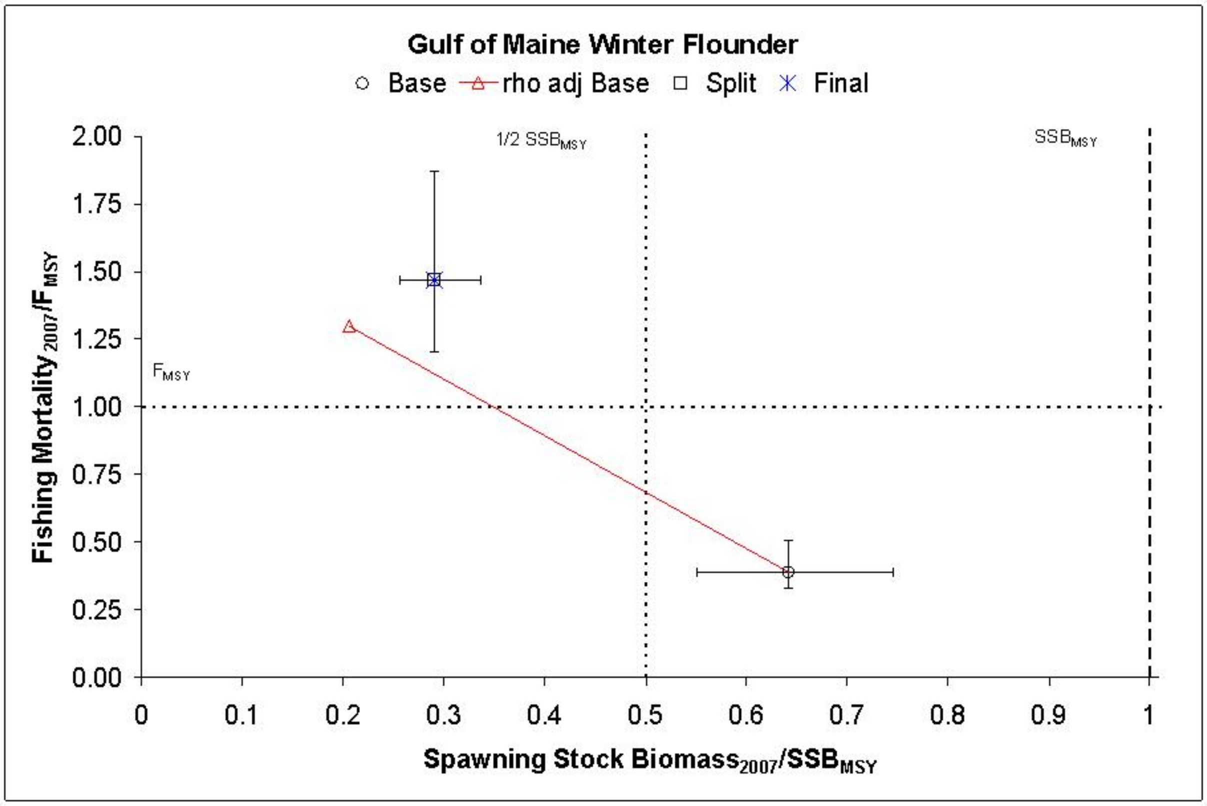


Figure I34. Gulf of Maine winter flounder 2007 status determination with 80% confidence intervals for the base VPA (circle), split VPA (rectangle), and Mohn's rho adjustment to the base VPA (triangle).