T. Gulf of Maine (GM) winter flounder by Paul Nitschke

1.0 Background

The last assessment for Gulf of Maine winter flounder was an index-based assessment reviewed at SARC 21 (NEFSC 1996). Low indices and the absence of large fish in the survey led SARC 21 to conclude that the stock was overexploited in the mid 1990s. The ASMFC Winter Flounder Technical Committee has constructed a benchmark virtual population analysis (VPA) in September 2002 which will be reviewed at SARC 36 (December 2002). Since this is a new benchmark assessment, full VPA output is not included here, but will be available in draft form to the council.

2.0 Fishery

Commercial landings were near 1,000 mt from 1964 to the mid 1970s. Thereafter commercial landings increased to a peak of 2,793 mt in 1982, and then steadily declined to a record low of 253 mt in 1999. Landings have remained near 500 mt since 1999 (Table T1, Figure T1). Otter trawl was the primary gear used during 1964-1985 (>95% of the landings). Since 1985 the proportion of landings coming from gill nets has increased, and has averaged 25% since1990.

Recreational landings reached a peak in 1981 (2,554 mt) but declined substantially thereafter (Table T2, Figure T2). Landings have been less than 1000 mt since 1995, with the lowest estimated landings in 1998 (30 mt). Landings in 2001 for Gulf of Maine winter flounder were 43 mt.

In the commercial fishery, annual sampling intensity varied during 1982-2001 from 4 to 310 mt landed per sample. Overall sampling intensity was adequate, however temporal and market category coverage in some years was poor (Table T3). Samples were pooled by halfyear when possible. Lengths of kept fish from observer data were used to supplement length data of unclassified fish. Lengths taken from gillnet trips in the observer data were used to characterize the gillnet proportion of the landings.

Discards were estimated for the large mesh trawl (1982-2001), gillnet (1986-2001), and northern shrimp fishery (1982-2001). The survey method was used in estimating both the discard and discard length composition for the large mesh trawl fishery from 1982-1993 (Mayo et al. 1992). VTR large mesh otter trawl discards to landings ratios were applied to corresponding commercial fishery landings to estimate discards in weight from 1994 to 2001. Fishery observer discard-to-landings ratios were used for estimating gillnet discard rates. Observer discard-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 for 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 (Table T5).

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 at 140,000 fish in 1982. Discards have since declined reaching a low of 7,000 fish in 1999. In 2001, 15,000 fish were estimated to have been discarded (Table T2, Figure T2). Since 1997, irregular sampling of recreational fisheries has indicated that discards are usually fish below the minimum landing size of 12 inches (30 cm). For 1982-2001, 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 1982-2001 is aged using NEFSC/MDMF spring and NEFSC fall survey age-length keys.

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 T4 and Figures T3 through T6. All of the indices generally show a 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 increased abundance starting in 1998 and 1999.

The Seabrook Nuclear Power Plant in New Hampshire has conducted a monthly bottom trawl survey since 1985. This survey also shows an increase in the number of fish in the late 1990s (Figure T7).

4.0 2001 Assessment

The VPA for Gulf of Maine winter flounder will be reviewed at SARC 36 (December 2002), therefore, results are not presented here. Estimates of Bmsy and Fmsy are not currently available.

5.0 Sources of uncertainty

* Landings data for 1994 and later years are derived by proration and are considered provisional.

* The lack of survey coverage in inshore New Hampshire and Maine where winter flounder are abundant is a source of uncertainty. Low number of tows taken per strata in inshore Massachusetts strata in the NEFSC survey is a source of variability in the index.

* Length frequency sampling coverage of the commercial fishery has been poor in some years.

* Observer sampling intensity of the commercial large mesh fishery has been low. Shrimp fishery discard sampling has been dropped in recent years. Commercial fishery discard

estimates are based on rates provided by fishermen in the vessel trip reports, due to inadequate fishery observer sampling.

6.0 GARM comments

The benchmark VPA assessment for Gulf of Maine winter flounder was presented to the GARM. However the GARM did not comment on the VPA assessment since a review has not been made on this assessment and a formal review will be conducted in the upcoming SARC. VPA results will be verbally presented to the council. The GARM also noted that all the surveys showed similar trends.

7.0 Summary

Stock summary information will be finalized at SARC 36.

References

Howell, P., A. Howe, M. Gibson and S. Ayvasian. 1992. Fishery management plan for inshore stocks of winter flounder. Atlantic States Marine Fisheries Commission. Fisheries Management Report No. 21. May, 1992.

Mayo, R.K., L. O'Brien, and N. Buxton. 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 pp.

NEFSC. 1996. Report of the 21th Northeast Regional Stock Assessment Workshop (21st SAW): Stock Assessment Review Committee (SARC) consensus summary of assessments. [By Northeast Regional Stock Assessment Workshop No. 21.] June 1996.

Table T1. Winter flounder commercial landings (metric tons) for Gulf of Maine stock (U.S. statistical reporting areas 512 to 515).

Year	metric tons
1964	1,081
1965	665
1966	785
1967	803
1968	864
1969	975
1970	1,092
1971	1,113
1972	1,085
1973	1,080
1974	885
1975	1,181
1976	1,465
1977	2,161
1978	2,194
1979	2,021
1980	2,437
1981	2,406
1982	2,793
1983	2,096
1984	1,699
1985	1,582
1986	1,188
1987	1,140
1988	1,250
1989	1,253
1990	1,116
1991	1,008
1992	825
1993	611
1994	552
1995	796
1996	600
1997	618
1998	637
1999	253
2000	382
2001	571

Table T2. Estimated number (000's) and weight (mt) of winter flounder caught, landed, and discarded in the recreational fishery, Gulf of Maine stock.

	Number (000's)				Metric tons
	Catch A+B1+B2	Landed A+B1	Released B2	15% Release Mortality	Landed A+B1
1981	6,200	5,433	767	115	2,554
1982	8,207	7,274	933	140	1,876
1983	2,169	1,988	181	27	868
1984	2,477	2,285	191	29	1,300
1985	3,694	3,220	474	71	1,896
1986	946	691	255	38	523
1987	3,070	2,391	679	102	1,809
1988	953	841	111	17	345
1989	1,971	1,678	294	44	620
1990	786	652	134	20	370
1991	213	154	59	9	91
1992	186	137	48	7	90
1993	396	249	147	22	140
1994	232	145	87	13	83
1995	150	82	68	10	39
1996	184	98	86	13	56
1997	192	64	129	19	43
1998	109	65	44	7	30
1999	115	67	48	7	34
2000	177	75	102	15	42
2001	172	72	100	15	43

Table T3. Number of samples, lengths, ages, and sampling intensity for Gulf of Maine winter flounder. Number of samples and calculations of metric tons per sample is done on a halfyear basis and does not include observer data or gillnet landings from 1990-2001. Lengths in bold font are from observer trawl data.

		Number of lengths					Ages	Number of samples					mt/samples				
year	qtr	lg	sm	md	un	total	total	lg	sm	md	un	total	lg	sm	md	un	total
1982	1	-	-	-	296			-	-	-	3						
	2	102	101	-	159			1	1	-	1		838	453	-	46	
	3	84	81	-	106			1	1	-	1						
	4	-	-	-	-	929	483	-	-	-	-	9	396	691	-	231	310
1983	1	80	-	99	-			1	-	1	-						
	2	300	100	-	407			3	1	-	4		120	510	-	53	
	3	108	388	-	-			1	3	-	-						
	4	107	956	-	106	2651	1182	1	8	-	1	24	125	44	64	95	87
1984	1	201	209	-	-			2	2	-	-						
	2	237	294	-	221			3	2	-	2		74	95	-	-	
	3	-	123	-	-			-	1	-	-						
	4	126	690	100	-	2201	908	1	5	1	-	19	189	67	114	124	89
1985	1	273	565	-	-			3	3	-	-						
	2	392	170	-	-			3	2	-	-		54	-	-	-	
	3	105	-	-	-			1	-	-	-						
	4	116	-	-	80	1701	318	1	-	-	1	14	87	-	182	176	113
1986	1	-	-	-	266			-	-	-	3						
	2	237	109	109	-			3	1	1	-		-	242	126	48	
	3	-	111	86	-			-	1	1	-						
	4	-	389	107	89	1503	344	-	5	1	1	17	113	37	31	56	70
1987	1	-	-	-	113			-	-	-	1						
	2	-	-	-	-			-	-	-	-		-	-	-	-	
	3	-	95	-	-			-	1	-	-						
	4	47	156	272	-	683	130	1	2	3	-	8	257	137	75	249	143
1988	1	-	258	311	-			-	3	3	-						
	2	102	-	395	-			1	-	4	-		-	108	23	-	
	3	-	-	-	-			-	-	-	-						
	4	-	169	107	-	1342	249	-	2	1	-	14	340	164	96	-	89
1989	1	-	-	-	100			-	-	-	1						
	2	113	-	91	**134**			1	-	1	-		-	-	168	-	
	3	-	95	120	**32**			-	1	1	-						
	4	-	-	100	-	785	148	-	-	1	-	6	313	435	42	254	209
1990	1	328	301	-	-			3	4	-	-						
	2	-	-	-	102			-	-	-	1		64	48	-	-	
	3	-	-	-	-			-	-	-	-						
	4	117	197	97	-	1142	241	1	2	1	-	12	83	90	138	118	75

Table T3. Continued.

		Number of lengths					Ages	Number of samples					mt/samples				
year	qtr	lg	sm	md	un	total	total	lg	sm	md	un	total	lg	sm	md	un	total
1991	1	100	51	105	101			1	1	1	1						
	2	88	203	100	**42**			1	2	1	-		92	72	-	-	
	3	-	95	-	-			-	1	-	-						
	4	236	254	-	-	1375	262	3	3	-	-	15	32	47	95	115	65
1992	1	110	-	-	**107**			1	-	-	-						
	2	136	100	93	-			2	1	1	-		47	119	84	-	
	3	-	-	-	-			-	-	-	-						
	4	57	74	253	-	930	270	1	1	3	-	10	75	134	19	-	67
1993	1	100	-	-	-			1	-	-	-						
	2	-	-	288	-			-	-	3	-		83	-	16	-	
	3	-	55	-	**91**			-	1	-	-						
	4	80	-	157	**51**	822	183	1	-	2	-	8	47	177	30	-	59
1994	1	-	-	-	-			-	-	-	-						
	2	-	71	92	102			-	1	1	1		-	-	75	-	
	3	-	-	-	-			-	-	-	-						
	4	94	-	235	-	594	139	1	-	3	-	7	112	143	15	60	62
1995	1	101	-	175	**63**			1	-	2	-						
	2	-	-	299	-			-	-	3	-		-	-	37	-	
	3	-	-	414	-			-	-	4	-						
	4	-	-	-	**609**	1661	248	-	-	-	-	10	134	-	42	-	55
1996	1	-	77	-	-			-	1	-	-						
	2	-	231	-	-			-	2	-	-		-	44	-	-	
	3	-	355	252	-			-	2	3	-						
	4	84	440	86	**112**	1637	246	1	5	1	-	15	80	16	18		29
1997	1	-	204	-	-			-	2	-	-						
	2	-	127	75	-			-	2	1	-		-	28	66	-	
	3	-	220	218	-			-	2	3	-						
	4	307	502	56	-	1709	295	4	8	1	-	23	25	11	14	-	19
1998	1	-	148	79	-			-	2	1	-						
	2	-	151	201	-			-	3	2	-		-	34	29	-	
	3	-	583	-	-			-	7		-						
	4	69	163	110	-	1504	341	1	2	1	-	19	65	14	30	-	25
1999	1	-	173	104	-			-	2	1	-						
	2	-		171	-			-	-	2	-		-	17	-	-	
	3	-	28	-	-			-	1	-	-						
	4	-	152	-	**408**	1036	149	-	3	-	-	9	-	5	10	-	19
2000	1	-	866	143	**480**			-	12	2	-						
	2	-	3441	51	**554**			-	45	1	-		-	1	-	-	
	3	-	102	-	**50**			-	2	-	-						
	4	-	114	-	**26**	5827	883	-	2	-	-	64	-	12	13	-	4
2001	1	-	-	187	**172**			-	-	2	-						
	2	99	157	189	**630**			1	2	3	-		-	37	10	-	
	3	-	100	52	**399**			-	1	1	-						
	4	-	154	198	**1307**	3644	246	-	2	2	-	14	26	21	24	-	32

Table T4. NEFSC and MA DMF 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		MDMF spring		MDMF fall	
year	number	weight	number	weight	number	weight	number	weight
1978					86.805	18.373	43.360	9.887
1979	9.063	3.218	6.003	2.602	64.952	14.407	119.506	28.978
1980	11.284	4.447	13.141	6.553	66.231	17.494	74.684	15.940
1981	13.051	3.946	4.179	3.029	100.569	28.370	47.342	13.228
1982	7.670	3.022	4.201	1.924	60.719	14.687	106.053	23.635
1983	12.367	5.653	10.304	3.519	108.508	27.233	88.143	15.772
1984	5.155	1.979	7.732	3.106	66.271	15.977	35.956	10.817
1985	3.469	1.418	7.638	2.324	48.651	13.594	44.564	7.381
1986	2.343	0.998	2.502	0.938	62.356	14.724	41.914	6.603
1987	5.609	1.503	1.605	0.488	83.171	17.648	50.426	7.227
1988	6.897	1.649	3.000	1.031	52.733	10.617	33.063	7.173
1989	3.717	1.316	6.402	2.013	63.595	13.317	33.983	7.462
1990	5.415	2.252	3.527	1.177	74.131	12.966	67.874	13.452
1991	4.517	1.436	7.035	1.467	49.265	11.587	88.777	15.473
1992	3.933	1.160	10.447	3.096	74.146	13.938	77.350	13.471
1993	1.556	0.353	7.559	1.859	80.133	12.390	92.476	14.996
1994	3.481	0.891	4.870	1.319	71.710	10.036	67.351	13.560
1995	12.185	3.149	4.765	1.446	87.848	14.560	84.768	17.250
1996	2.736	0.732	10.099	3.116	77.249	12.823	74.295	13.031
1997	2.806	0.664	10.008	2.950	95.918	14.796	74.347	14.316
1998	2.001	0.528	3.218	0.987	91.466	15.756	93.889	14.934
1999	6.510	1.982	10.921	3.269	77.941	14.198	117.648	22.672
2000	10.383	2.885	12.705	5.065	169.291	35.453	101.633	25.693
2001	5.242	1.666	8.845	3.143	90.153	23.891	80.978	18.367
2002	12.066	3.693			87.376	21.404		

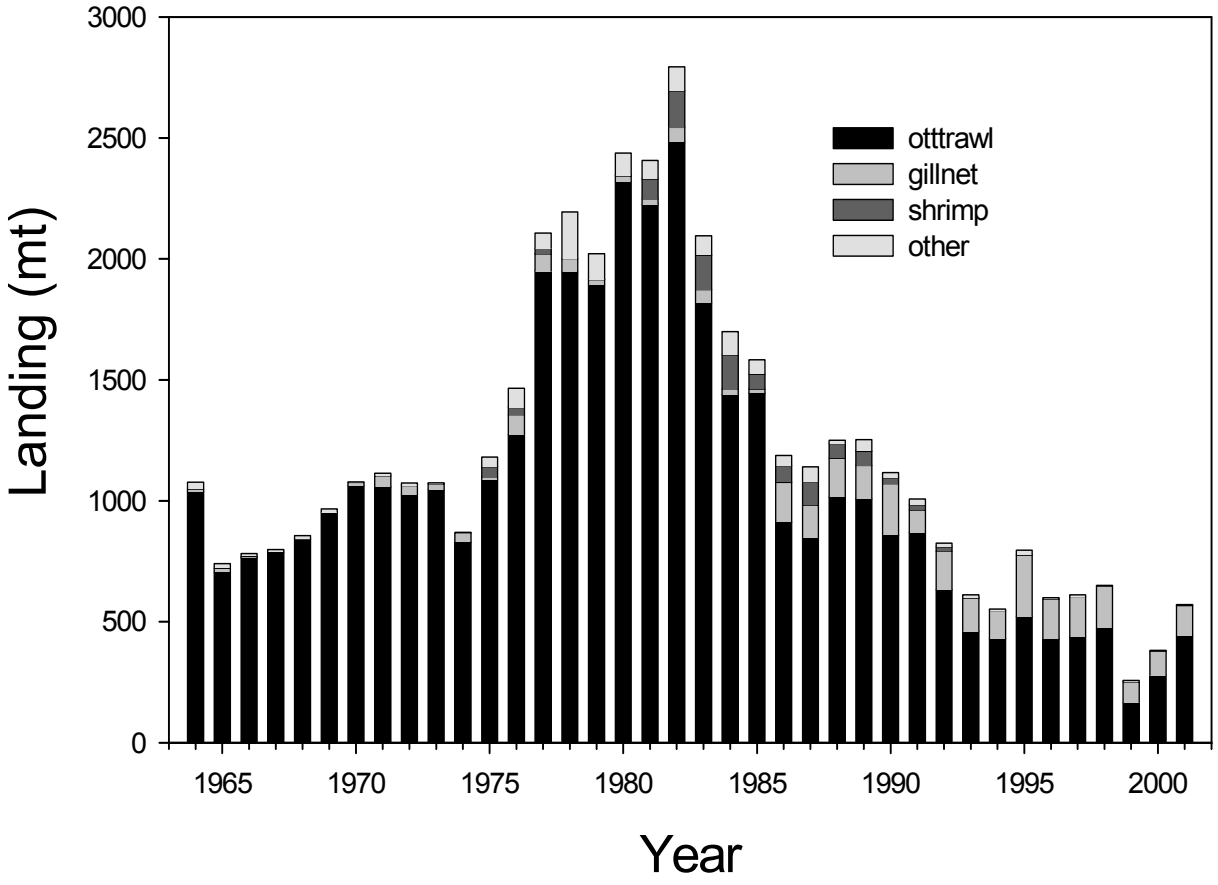

Figure T1. Gulf of Maine winter flounder landings (mt) by gear.

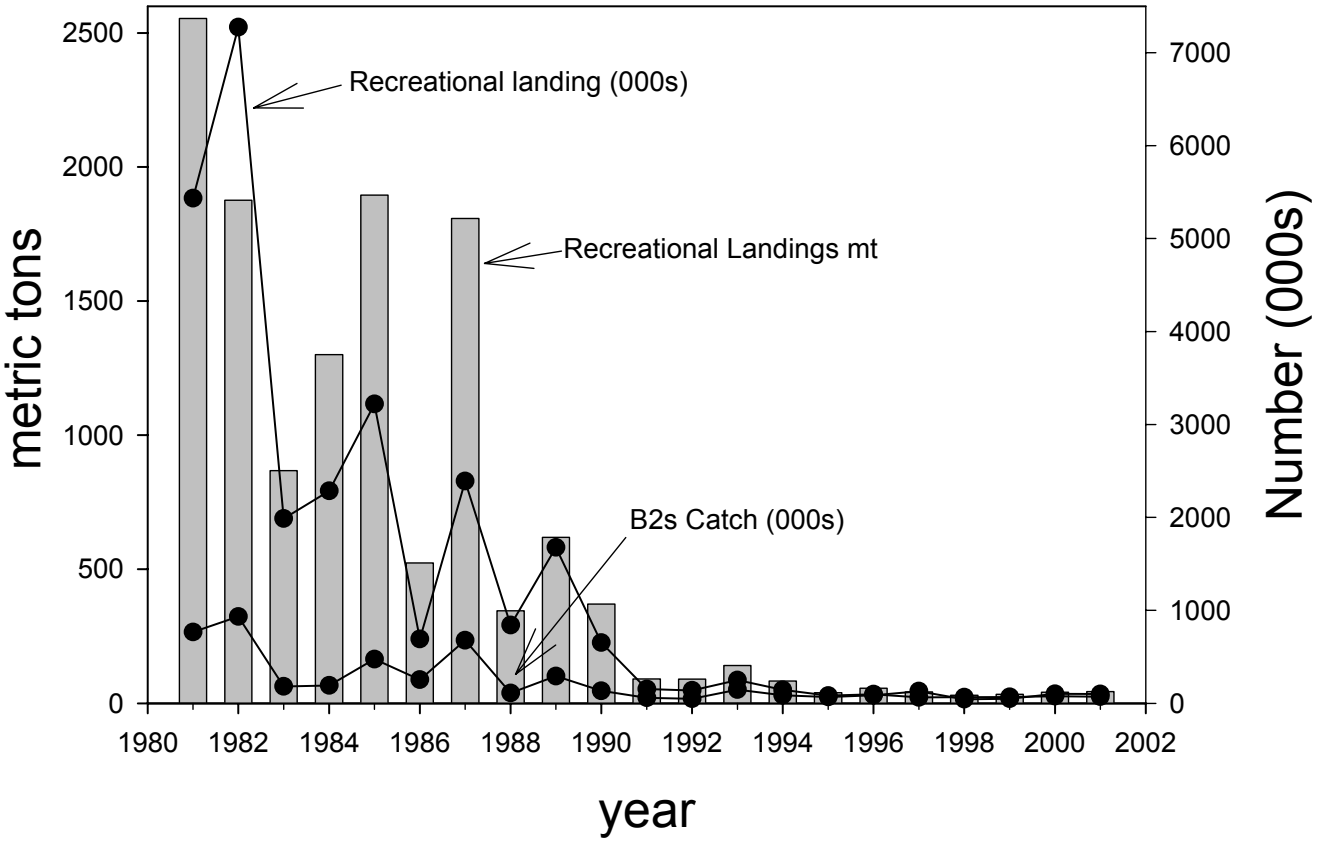

Figure T2. Recreational landings in numbers and metric tons for Gulf of Maine winter flounder. B2 catch is fished released alive.

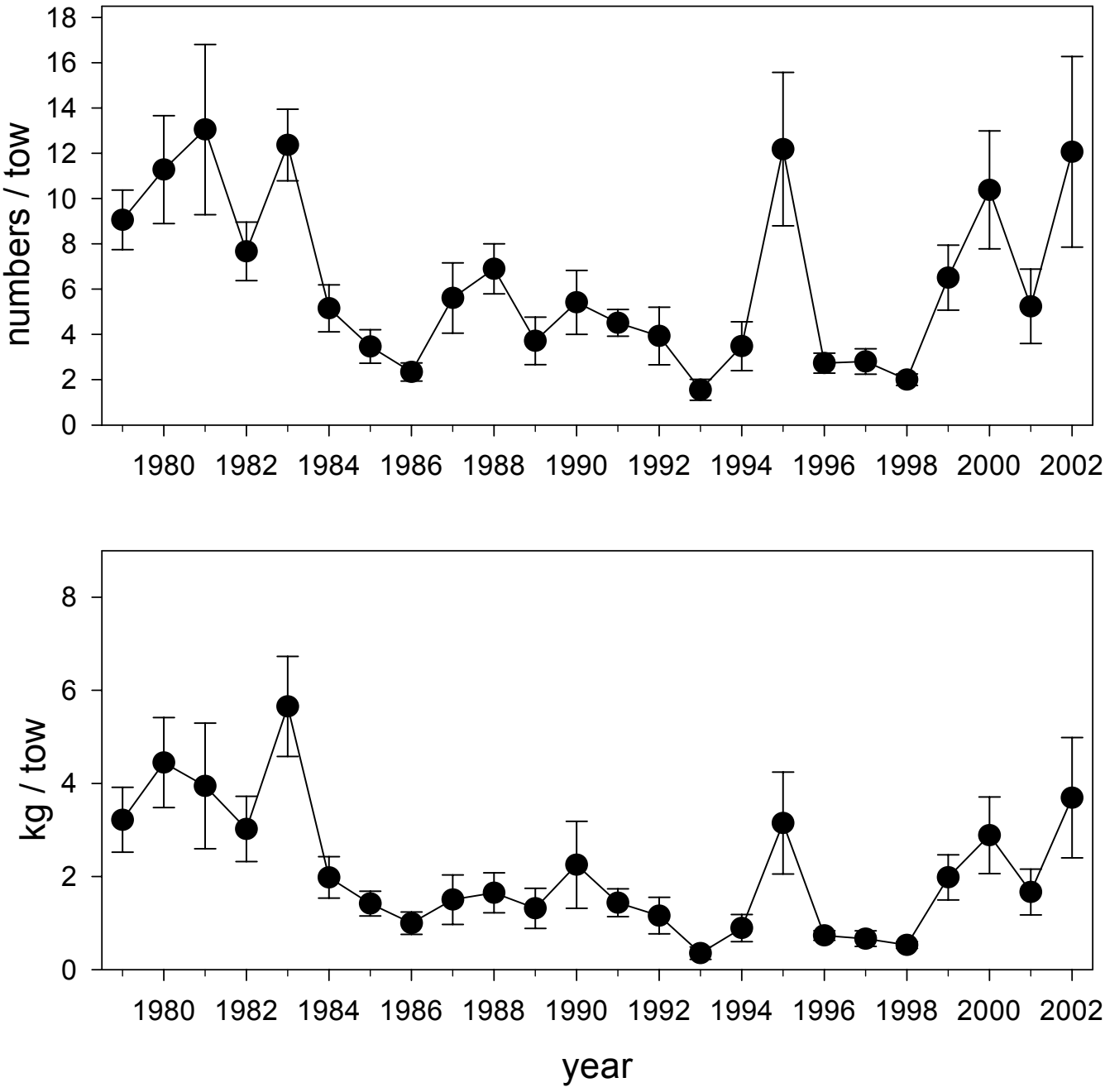

Figure T3. NEFSC Spring survey stratified mean numbers and mean weight (kg) per tow for Gulf of Maine winter flounder. Trawl door conversion factors are used where appropriate.

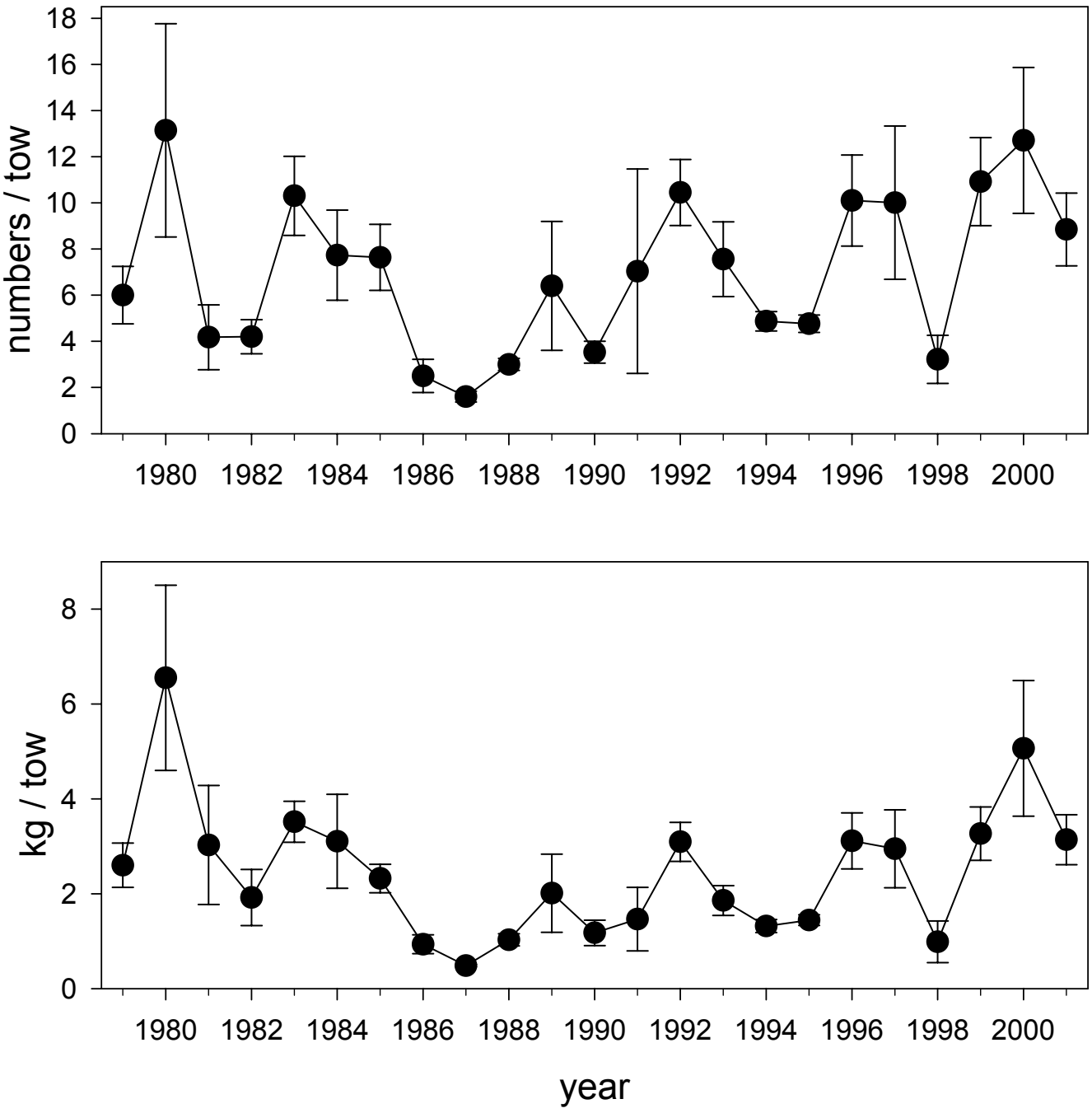

Figure T4. NEFSC Fall survey stratified mean numbers and mean weight (kg) per tow for Gulf of Maine winter flounder. Trawl door conversion factors are used where appropriate.

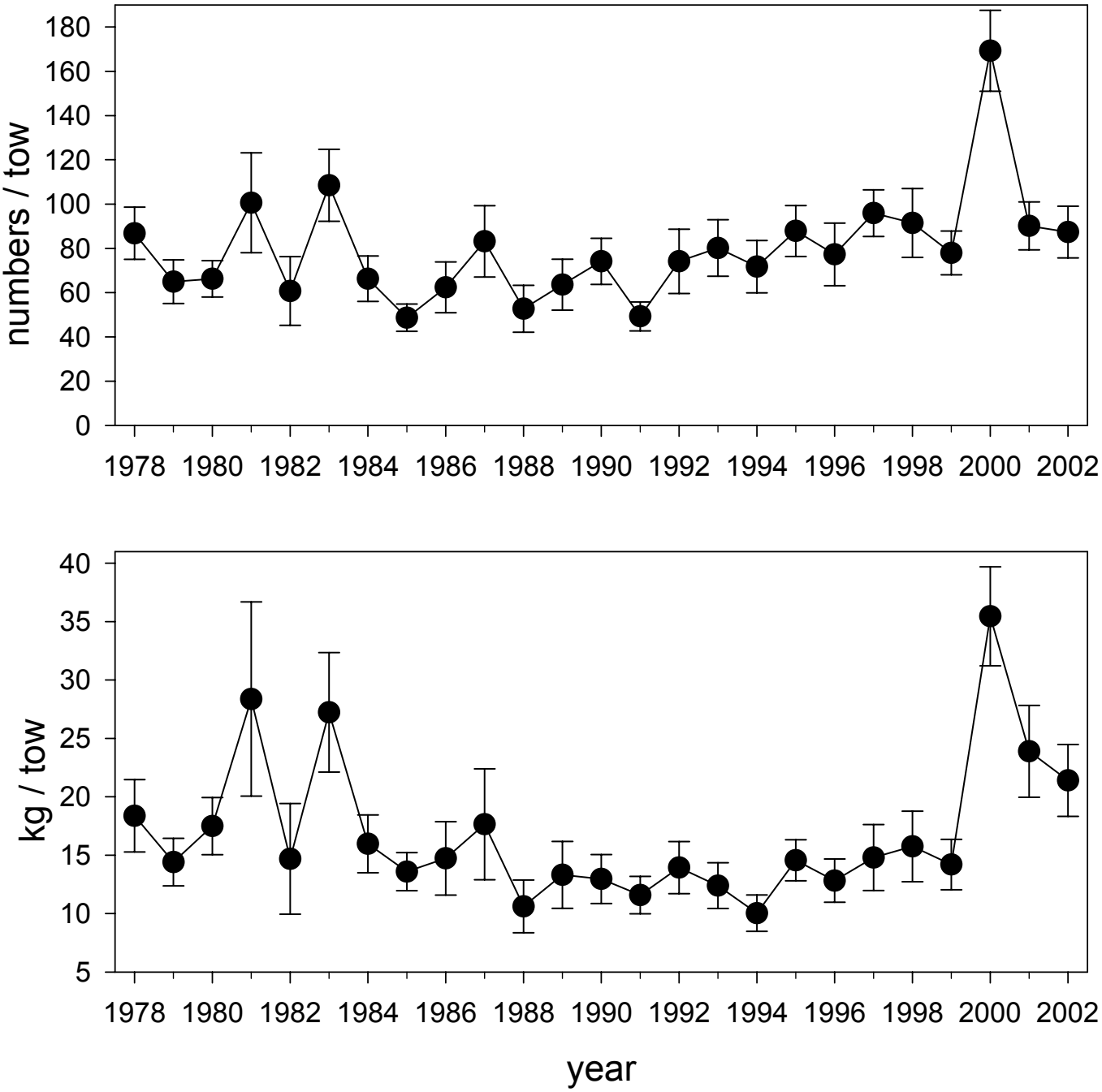

Figure T5. Massachusetts Division of Marine Fisheries (MA DMF) spring survey stratified mean numbers and mean weight (kg) per tow for Gulf of Maine winter flounder.

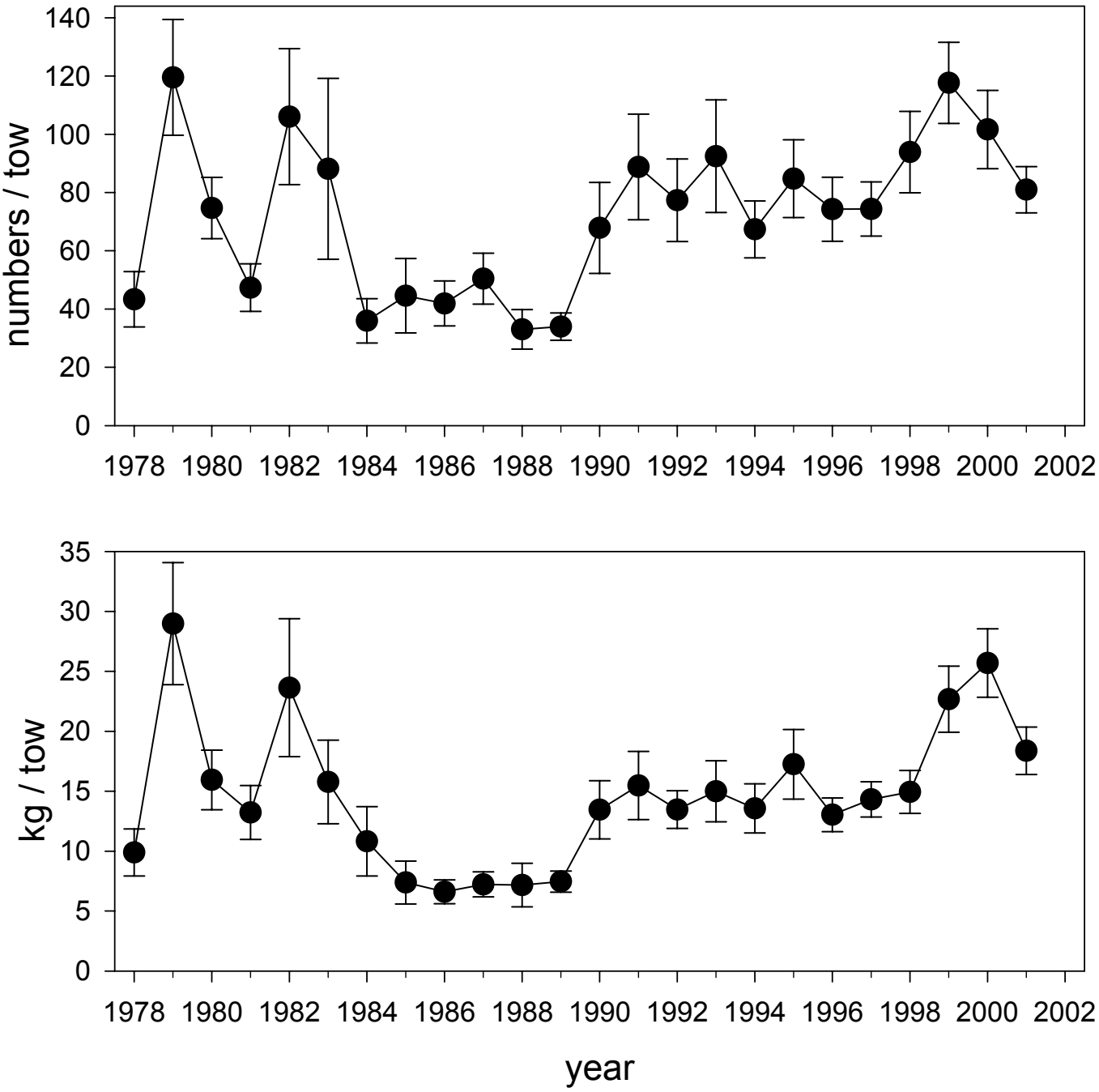

Figure T6. Massachusetts Division of Marine Fisheries (MA DMF) Fall survey stratified mean numbers and mean weight (kg) per tow for Gulf of Maine winter flounder.

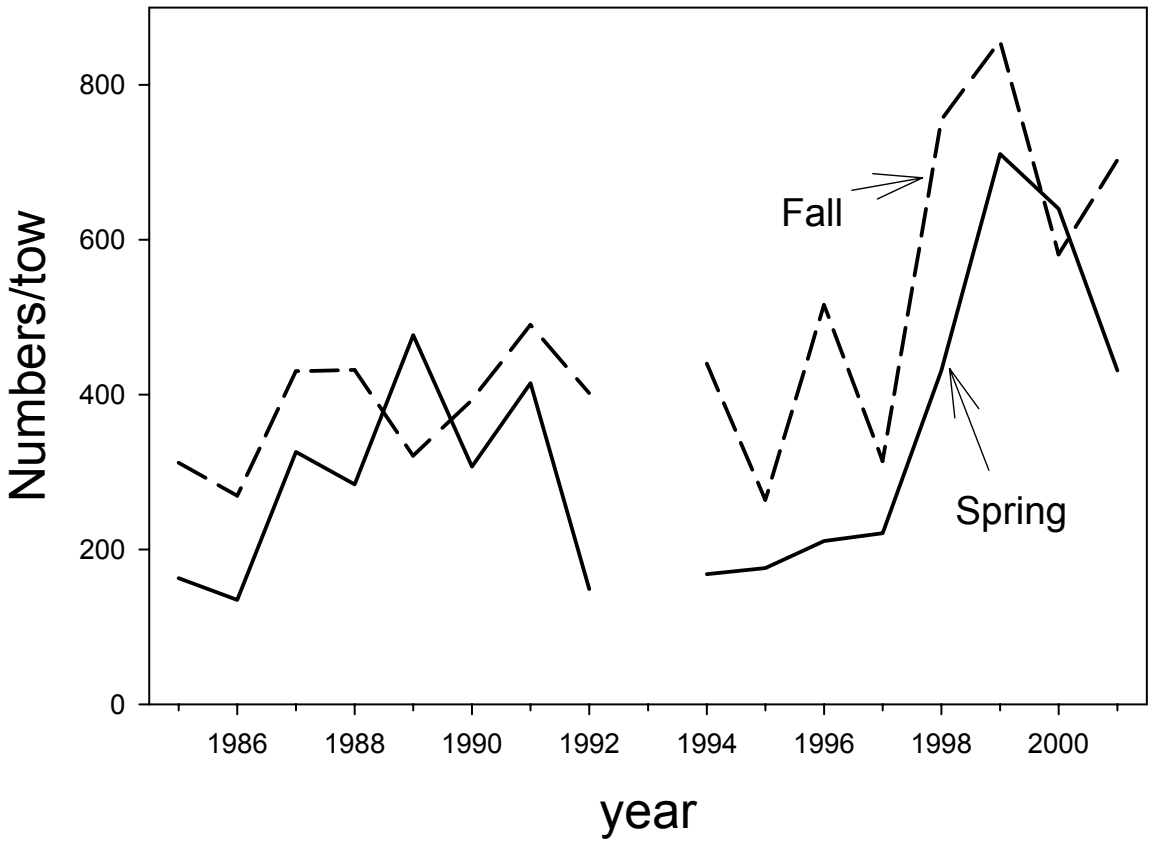

Figure T7. Seabrook Nuclear Power Plant in (New Hampshire) spring and fall survey mean numbers per tow for Gulf of Maine winter flounder. No survey was done in 1993.