

L. Georges Bank/Gulf of Maine White Hake by K.A. Sosebee

1.0 Background

This stock was last assessed and reviewed at the Groundfish Assessment Review Committee meeting in 2002 (NEFSC 2002a). The AIM method was used to develop reference points and to assess the status of the stock relative to these reference points (NEFSC 2002b). Landings and discards of fish greater than 60 cm, were used in the model as well as autumn survey indices of biomass. Relative fishing mortality in 2001 was estimated to be more than twice the value for F_{ref} . Biomass estimates were less than $1/2 B_{msy}$. NEFSC spring and autumn research vessel bottom trawl survey indices had declined to near record low levels in 1999 but increased through 2002 due to a moderate 1998 year class.

2.0 The Fishery

United States commercial landings of white hake increased from a low of 2,225 mt in 1997 to 4,435 mt in 2003 (Table L1; Figure L1). Landings subsequently declined to 3,505 mt (-21%). Canadian landings declined to a time-series low of 90 mt. Discard estimates were derived for 2002-2004 using the same method as in the previous assessment (Table L2; Figure L1). Discards decreased to 176 mt overall. Only otter trawl discards are used in the assessment and they decreased to 83 mt (Table L2).

3.0 2005 Assessment

Landings-at-length were estimated annually using port samples collected from 2002-2004. The sampling intensity was good (Table L3) and the coverage adequate, except for unclassified. As in the previous assessment, the unclassified landings were small and were added at the end.

Discards-at-length were estimated annually using length samples collected from 2002 through 2004. The otter trawl sampling in the observer program was low (zero samples in the first half) in 2002 so length data were pooled for the year (Table L4).

The possible mis-identification of species is particularly a problem for the discards. To determine the potential extent of this problem, the data from the Observer Program were compared to the Dealer data for 2003. There were 474 trips in the Observer Database which identified red or white hake in the catch. Out of these trips, 111 reported all hake were discarded. From the remaining trips, 151 were able to be matched to the Dealer Database. Twelve trips differed in the species identification which is less than 10% of the trips.

The length compositions of both the landings and discards were broken out into fish ≤ 60 cm and fish > 60 cm. This length cutoff ensures that most of the fish > 60 cm are white hake since red hake seldom reach this size. For years prior to 1985, an average proportion of fish > 60 cm for 1985-2000 was used to split the landings into two parts (75% > 60 cm). All discards prior to 1989 were assumed to be ≤ 60 cm. The NEFSC surveys were also split into two parts as in the

commercial length compositions. The AIM method using biomass estimates from the NEFSC autumn survey as well as catch of animals greater than 60 cm was used to estimate relative fishing mortality and biomass in 2004.

4.0 Assessment Results

NEFSC research vessel bottom trawl survey abundance and biomass indices for white hake remained relatively low through autumn 1999, increased through 2002/2003 and subsequently declined (Table L5; Figure L2). The rate of decline for the > 60 cm portion of the stock was apparently greater than that for the stock as a whole through 1999 (Table L6; Figure L3). The index increased through 2002 as the 1998 year class recruited into that size category. The catch of fish > 60 cm also increased through 2003 as this year class passed through (Table L7; Figure L3). Exploitation (catch/three year average of survey biomass) on the 60+ cm component has increased since the 1970s (Figure L4, Table L8).

Reference points for this stock were estimated at the previous GARM using the AIM model (NEFSC 2002a). The value for relative F to be used as a proxy for F_{msy} was estimated to be 0.55. This value was used along with the estimate of MSY (4,234 mt) from the last accepted ASPIC model to determine a value of 7.70 kg/tow for a B_{msy} proxy. The current value for biomass of 3.01 kg/tow, although an increase over the last assessment, remains below that of $\frac{1}{2} B_{msy}$ and indicates that the stock is still overfished (Figure L4). Likewise, the relative F value of 1.18 is above F_{msy} indicating that overfishing is still occurring (Figure L4).

5.0 Comparison with Amendment 13 Projections

Although the stock of white hake is still overfished, stock size has increased slightly since 2002. The Amendment 13 projections used a phased in fishing mortality and projected stock size to be lower than estimated in 2003 and 2004 (Figure L5). Therefore the stock is above the anticipated biomass in 2004.

6.0 Panel Comments

Small white hake may be misidentified as red hake in the commercial catch. Unlike white hake, red hake seldom reach sizes of 60 cm or larger. To eliminate this potential source of confusion, in the assessment total length is used to separate the two species of fish, whereby fish larger than 60 cm are assumed to be white hake and only these fish are included. An analysis of Observer and Dealer landings data for 2003 indicated that misidentification of the species landed occurred in 10% of the trips.

The Panel expressed concern about omitting fish smaller than 60 cm from the assessment since during some years, these smaller fish constitute a large portion of the landings and survey biomass indices. As a result, the Panel recommended the examination of methods to incorporate fish less than 60 cm in future stock assessments.

6.0 Sources of Uncertainty

- * Catch at age (and length) not well characterized due to possible mis-identification of species in the commercial and sea sampling data, low sampling of commercial landings in some years, and sparse discard data.
- * Catchability of older ages in the survey.
- * Only part of the population is represented in the current AIM model

7.0 References

NEFSC. 2002a. Assessment of 20 Northeast Groundfish Stocks through 2001. A Report of the Groundfish Assessment Review Meeting (GARM), Northeast Fisheries Science Center, Woods Hole, Massachusetts, October 8-11, 2002. NMFS/NEFSC, Woods Hole Laboratory Ref. Doc. 02-16.

NEFSC 2002b. Final Report of the Working Group on Re-Evaluation of Biological Reference Points for New England Groundfish. NMFS/NEFSC, Woods Hole Laboratory Ref. Doc. 02-04.

Table L1. Total Landings (mt, live) of white hake by country from the Gulf of Maine to Cape Hatteras (NAFO Subareas 5 and 6), 1964-2004.

	Canada	USA	Other	Grand Total
1964	29	3016	0	3045
1965	0	2617	0	2617
1966	0	1563	0	1563
1967	16	1126	0	1142
1968	85	1210	0	1295
1969	34	1343	6	1383
1970	46	1807	280	2133
1971	100	2583	214	2897
1972	40	2946	159	3145
1973	117	3279	5	3401
1974	232	3773	0	4005
1975	146	3672	0	3818
1976	195	4104	0	4299
1977	170	4976	338	5484
1978	155	4869	29	5053
1979	251	4044	4	4299
1980	305	4746	2	5053
1981	454	5969	0	6423
1982	764	6179	2	6945
1983	810	6408	0	7218
1984	1013	6757	0	7770
1985	953	7353	0	8306
1986	956	6109	0	7065
1987	555	5818	0	6373
1988	534	4783	0	5317
1989	583	4548	0	5131
1990	547	4927	0	5474
1991	552	5607	0	6159
1992	1138	8444	0	9582
1993	1681	7466	0	9147
1994	955	4737	0	5692
1995	481	4333	0	4814
1996	372	3287	0	3659
1997	290	2225	0	2515
1998	228	2364	0	2592
1999	174	2624	0	2798
2000	224	2990	0	3214
2001	203	3482	0	3685
2002	158	3266	0	3424
2003	128	4435	0	4563
2004	90	3505	0	3595

Table L2. White hake discards (mt) by half year and gear type. Only Otter trawl discards are used in the assessment.

	Jan-June		July-Dec		total		Total
	trawl	shrimp SGN	trawl	shrimp SGN	trawl	shrimp SGN	
1989	247	25 n/a	1804	18	2050	42	2143
1990	2114	9	2182	27	4297	37	4409
1991	111	20	1239	11	1350	31	1443
1992	350	14	364	<1	715	15	844
1993	42	n/a	561	n/a	603	n/a	707
1994	145	18	85	n/a	230	n/a	267
1995	33	n/a	101	n/a	134	n/a	188
1996	57	18	460	n/a	517	n/a	564
1997	89	15	133	n/a	222	n/a	253
1998	81	6	157	n/a	238	n/a	279
1999	24	16	2051	n/a	2076	n/a	2095
2000	187	6	93	n/a	280	n/a	318
2001	258	15	116	n/a	374	n/a	439
2002	40	154	68	n/a	108	n/a	342
2003	30	60	123	n/a	153	n/a	254
2004	39	n/a	44	n/a	83	n/a	176

Table L3. Summary of US commercial white hake landings (mt), number of length samples (n), and number of fish measured (#fish) by market category and quarter from the Gulf of Maine to the Mid-Atlantic (SA 464,465, 511-515,521-526,533-539,611-626) for all gear types, 1985-2004.

Year	mt	small				medium				large				unclassified				Sampling Intensity					
		Q1	Q2	Q3	Q4	sum	Q1	Q2	Q3	Q4	sum	Q1	Q2	Q3	Q4	sum	All	mt/ Total sample					
1985		129	162	235	167	694	63	78	181	124	446	237	433	1135	623	2428	367	737	1690	988	3782	7349	272
	#fish	-	2	4	3	9	-	-	-	-	-	-	5	5	3	13	-	1	3	1	5	27	
		-	233	323	317	873	-	-	-	-	-	-	632	519	271	1422	-	101	293	104	498	2793	
1986		59	134	105	100	398	86	89	55	54	284	274	422	835	417	1948	455	752	1578	694	3478	6107	235
	#fish	102	263	215	101	681	94	122	-	229	445	122	315	248	96	781	215	206	292	106	819	2726	
1987		98	300	641	576	1616	13	49	122	123	306	171	326	943	372	1813	262	482	1035	301	2080	5814	194
	#fish	-	2	4	5	11	-	2	1	1	4	-	1	6	3	10	2	1	1	1	5	30	
		-	240	291	507	1038	-	203	91	109	403	-	111	518	236	865	218	140	112	125	595	2901	
1988		181	549	893	397	2020	26	82	262	120	489	136	330	695	325	1486	73	137	437	134	782	4776	165
	#fish	558	764	240	478	2040	100	92	105	-	297	112	121	214	85	532	-	100	-	41	141	3010	
1989		149	221	404	358	1132	41	54	124	68	287	188	473	904	470	2035	33	190	774	96	1092	4547	350
	#fish	91	94	213	195	593	-	-	1	-	103	-	-	206	204	410	100	-	106	-	206	1312	
1990		207	411	885	450	1953	43	108	303	171	625	167	300	596	320	1382	24	182	580	176	962	4922	234
	#fish	309	408	399	151	1267	-	-	2	1	3	2	-	1	1	4	-	-	-	1	1	21	
1991		150	366	1215	612	2342	88	160	381	129	758	126	241	533	338	1238	52	358	714	138	1262	5601	156
	#fish	151	471	485	244	1351	103	100	382	100	685	375	99	96	539	1109	-	207	94	-	301	3446	
1992		424	626	1735	848	3633	102	202	766	358	1428	231	351	699	371	1651	60	280	1246	141	1727	8439	211
	#fish	329	432	655	240	1656	80	388	266	317	1051	-	194	325	297	816	97	-	237	-	334	3857	
1993		331	502	453	214	1500	161	397	1117	461	2136	173	476	795	416	1860	94	463	975	433	1965	7462	191
	#fish	150	504	275	50	979	184	309	196	95	784	199	262	676	175	1312	-	214	196	97	507	3582	
1994		63	82	116	56	317	154	374	593	265	1386	206	481	687	407	1782	193	352	457	251	1252	4737	144
	#fish	-	167	386	100	653	-	230	305	272	807	-	303	363	304	970	-	236	431	372	1039	3469	

Table L3.cont.

Year	mt	small				medium				large				unclassified				Sampling Intensity						
		Q1	Q2	Q3	Q4	sum	Q1	Q2	Q3	Q4	sum	Q1	Q2	Q3	Q4	sum	All	mt/ Total sample						
1995	mt	39	43	98	56	245	140	238	616	399	1393	197	398	595	374	1564	134	225	504	268	1130	4333	361	
	N	-	1	1	1	3	-	2	2	1	5	-	2	-	1	3	-	1	-	-	1	12		
	#fish	-	107	97	105	309	-	191	222	111	524	-	221	-	103	324	-	100	-	-	100	1257		
1996	mt	23	34	80	43	181	96	207	531	269	1103	208	331	416	280	1234	110	152	339	169	769	3287	122	
	N	-	-	-	-	-	1	-	4	4	9	-	2	4	5	11	1	1	3	2	7	27		
	#fish	-	-	-	-	-	101	-	435	541	1077	-	202	451	759	1412	127	72	326	220	745	3234		
1997	mt	31	58	124	83	295	76	113	369	193	751	146	146	438	335	1065	34	28	26	26	113	2225	32	
	N	4	2	4	2	12	3	7	6	13	29	5	7	7	9	28	-	-	-	-	1	70		
	#fish	458	206	430	261	1355	276	694	564	1200	2734	541	720	678	896	2835	-	-	-	-	58	6982		
1998	mt	31	54	128	105	318	55	77	218	152	502	159	311	571	407	1449	28	23	34	14	100	2370	74	
	N	1	2	1	1	5	3	-	3	2	8	7	2	8	1	18	-	-	-	1	1	32		
	#fish	53	220	120	59	452	327	-	402	305	1034	684	213	1311	110	2318	-	-	-	118	-	118	3922	
1999	mt	50	76	103	87	317	85	110	236	149	580	303	468	633	257	1661	11	14	25	16	66	2624	119	
	N	-	-	1	-	1	1	1	3	4	9	1	6	2	3	12	-	-	-	-	-	22		
	#fish	-	-	119	-	119	111	102	315	313	841	166	665	202	327	1360	-	-	-	-	-	2320		
2000	mt	55	70	81	81	286	118	202	289	201	811	293	497	596	446	1833	14	15	20	12	60	2990	120	
	N	4	-	-	1	5	5	1	5	4	15	1	1	-	3	5	-	-	-	-	-	25		
	#fish	428	-	-	123	551	527	106	573	450	1656	103	126	-	336	565	-	-	-	-	-	2772		
2001	mt	59	122	167	177	525	131	155	219	310	815	413	497	697	434	2041	10	22	57	12	101	3482	97	
	N	2	3	2	2	9	2	1	2	2	7	3	4	7	6	20	-	-	-	-	-	36		
	#fish	231	329	213	224	997	221	100	235	215	771	328	456	797	660	2241	-	-	-	-	-	4009		
2002	mt	125	58	51	31	264	330	186	234	163	912	454	378	640	576	2047	7	14	15	6	43	3266	58	
	N	-	2	1	11	14	6	4	4	7	21	7	4	7	3	21	-	-	-	-	-	56		
	#fish	-	154	103	968	1225	626	391	417	629	2063	768	372	665	335	2140	-	-	-	-	-	5428		
2003	mt	35	20	42	32	129	153	92	158	134	537	918	997	1066	743	3724	6	5	26	9	46	4435	46	
	N	3	6	6	4	19	4	8	4	8	24	6	14	17	17	54	-	-	-	-	-	97		
	#fish	249	424	306	208	1187	355	768	387	796	2306	576	1369	1620	1665	5230	-	-	-	-	-	8723		
2004	mt	17	17	44	38	116	113	87	180	122	503	869	632	721	420	2642	5	53	98	88	245	3505	42	
	N	2	3	-	7	12	5	5	2	6	18	20	14	5	15	54	-	-	-	-	-	84		
	#fish	83	162	-	445	690	383	456	211	579	1629	2062	1474	524	1213	5273	-	-	-	-	-	7592		

Table I4. Summary of Domestic Observer number of trips (trips) and number of length samples taken (len) by gear type, half year, and catch disposition, 1989-2004.

	Sink Gill Net						Otter Trawl						Grand Total			
	Half 1		Half 2		Total		Half 1		Half 2		Total		Total		Total	
	Kept	Disc	Kept	Disc	Kept	Disc	Kept	Disc	Kept	Disc	Kept	Disc	Kept	Disc	Kept	Disc
1989 trips	14	1	14	1	14	1	4	10	3	19	7	29	21	30		
len	512	2	512	2	512	2	123	916	154	1734	277	2650	789	2652		
1990 trips	6	8	14	1	14	1	3	4	1	5	4	9	18	10		
len	206	1197	32	32	1403	32	69	53	138	312	207	365	1610	397		
1991 trips	20	1	89	7	109	8	2	1	3	2	5	3	114	11		
len	2526	135	9973	30	12499	165	53	180	413	45	466	225	12965	390		
1992 trips	34	1	182	4	216	5	7	6	2	4	9	10	225	15		
len	1620	1	8473	4	10093	5	265	17	59	144	324	161	10417	166		
1993 trips	26	1	129	10	155	11	8	20	5	2	13	22	168	33		
len	1276	1	4001	13	5277	14	681	333	658	44	1339	377	6616	391		
1994 trips	10	81	3	3	91	3	12	37	8	7	20	44	111	47		
len	44	1835	12	12	1879	12	247	570	489	294	736	864	2615	876		
1995 trips	9	1	117	7	126	8	12	49	9	10	21	59	147	67		
len	167	1	2638	30	2805	31	1111	1375	697	372	1808	1747	4613	1778		
1996 trips	11	2	78	2	89	4	8	16	6	13	14	29	103	33		
len	70	13	826	3	896	16	284	526	331	381	615	907	1511	923		
1997 trips	8	24	2	2	32	2	5	9	6	6	11	15	43	17		
len	85	427	4	4	512	4	117	93	110	64	227	157	739	161		
1998 trips	8	31	1	1	39	1	3	2	1	1	4	3	43	4		
len	36	411	1	1	447	1	39	17	12	2	51	19	498	20		
1999 trips	6	17	3	3	23	3	1	7	7	17	8	17	31	20		
len	79	218	20	20	297	20	23	113	113	287	136	287	433	307		
2000 trips	7	2	5	2	12	2	7	5	15	10	22	15	34	17		
len	47	9	143	9	190	9	421	119	475	76	896	195	1086	204		
2001 trips	1	1	6	1	7	2	1	1	4	1	5	1	12	3		
len	15	3	4501	2	4516	5	46	43	2217		2263	43	6779	48		
2002 trips	1	10	1	1	11	1	4	35	35	15	39	15	50	16		
len	1	49	2	2	50	2	125	189	1050	189	1175	189	1225	191		

2003	trips	8	2	38	6	46	8	55	14	57	16	112	30	158	38
	len	16	5	362	24	378	29	2353	83	2477	246	4830	329	5208	358
2004	trips	5	4	125	17	130	21	50	26	80	49	130	75	260	96
	len	28	6	1826	67	1854	73	1733	336	2147	733	3880	1069	5734	1142

Table L5. Stratified mean catch per tow in numbers and weight (kg) for white hake from NEFSC offshore spring and autumn research vessel bottom trawl surveys (strata 21-30,33-40), 1963-2005.

Year	Spring			Autumn		
	No/Tow	Mean Wt/Tow	Mean Length (cm)	No/Tow	Mean Wt/Tow	Mean Length (cm)
1963				5.00	6.31	46.2
1964				1.77	4.14	56.3
1965				4.39	6.86	50.4
1966				6.79	7.67	45.1
1967				3.92	3.64	42.6
1968	1.60	1.74	44.1	4.24	4.54	44.9
1969	3.76	5.09	46.3	9.24	13.09	46.8
1970	5.84	11.86	52.9	8.05	12.82	51.3
1971	3.31	5.14	51.3	10.38	12.10	43.6
1972	10.18	12.66	47.3	12.52	13.10	45.2
1973	9.24	12.22	49.9	9.05	13.46	51.7
1974	8.08	13.99	55.0	5.35	11.00	54.5
1975	9.32	11.22	44.7	5.28	7.23	48.5
1976	9.98	17.01	52.7	6.04	10.56	54.7
1977	6.13	11.01	55.5	9.78	13.74	47.8
1978	3.22	6.14	51.8	7.87	12.54	50.2
1979	5.26	4.97	43.0	5.62	10.31	53.1
1980	10.38	13.96	49.7	10.86	16.66	48.8
1981	17.09	19.92	45.9	8.70	12.16	49.9
1982	6.06	8.91	51.0	1.96	2.11	46.7
1983	3.23	3.12	43.7	8.22	10.79	48.8
1984	2.75	4.17	51.4	5.32	8.23	51.9
1985	4.33	5.38	48.5	9.37	9.74	42.9
1986	8.24	5.61	40.0	14.42	11.56	41.9
1987	7.15	6.44	45.3	7.59	9.62	49.2
1988	4.52	3.69	41.9	8.12	9.88	46.1
1989	3.65	3.22	43.0	11.76	9.23	40.5
1990	11.11	18.37	53.3	13.09	10.58	41.5
1991	8.42	6.14	41.6	13.22	12.20	44.6
1992	7.59	7.11	45.1	10.16	11.24	47.7
1993	7.93	6.84	45.1	11.35	11.66	45.2
1994	4.59	3.17	40.1	8.44	7.02	42.3
1995	4.38	4.02	44.1	9.54	8.20	40.8
1996	2.87	3.07	45.9	4.52	6.35	51.2
1997	1.88	0.89	38.4	4.69	4.55	41.5
1998	2.25	1.09	37.7	4.41	4.27	44.5
1999	3.32	2.97	44.6	5.68	3.44	36.3
2000	5.19	3.33	40.4	7.57	6.72	43.8
2001	4.81	5.18	48.4	5.74	7.97	52.7
2002	5.13	6.32	49.0	6.91	6.73	42.0
2003	5.16	5.73	46.5	4.58	4.91	44.6
2004	4.91	5.19	46.0	3.55	3.72	44.8
2005	3.78	5.52	48.8			

Table L6. NEFSC autumn and spring survey indices (kg/tow) by size group.

Year	Autumn		Spring	
	> 60 cm	<= 60 cm	> 60 cm	<= 60 cm
1964	3.25	0.89		
1965	4.60	2.26		
1966	4.00	3.67		
1967	1.77	1.85		
1968	2.20	2.34	0.98	0.76
1969	8.38	4.71	3.58	1.52
1970	7.76	5.07	9.12	2.74
1971	8.00	4.10	3.62	1.52
1972	7.04	6.05	8.95	3.71
1973	8.22	5.23	7.01	5.21
1974	8.19	2.80	10.34	3.65
1975	4.46	2.77	7.48	3.74
1976	6.83	3.73	12.90	4.10
1977	9.07	4.67	7.97	3.04
1978	8.46	4.08	4.97	1.17
1979	6.97	3.34	2.83	2.14
1980	11.60	5.06	8.73	5.23
1981	8.44	3.72	13.47	6.45
1982			6.15	2.76
1983	6.06	4.73	1.54	1.58
1984	5.05	3.18	2.68	1.49
1985	5.49	4.24	3.06	2.32
1986	4.38	7.18	2.29	3.32
1987	4.56	5.06	2.56	3.88
1988	5.41	4.48	1.90	1.80
1989	3.84	5.39	1.80	1.42
1990	3.79	6.79	12.14	6.22
1991	4.83	7.37	2.76	3.38
1992	4.14	7.10	2.30	4.81
1993	4.90	6.76	2.68	4.16
1994	2.46	4.56	1.23	1.94
1995	2.96	5.23	1.96	2.06
1996	3.34	3.01	1.77	1.30
1997	2.60	1.95	0.14	0.75
1998	1.64	2.64	0.26	0.84
1999	1.26	2.17	1.43	1.53
2000	2.91	3.81	1.08	2.26
2001	2.89	5.08	2.16	3.02
2002	4.30	2.43	4.21	2.12
2003	2.83	2.08	4.00	1.72
2004	1.90	1.82	3.15	2.04

Table L7. Commercial catch (mt) of white hake by size group.

Year	> 60 cm			<= 60 cm		
	Landings	Discards	Total	Landings	Discards	Total
1964	2284	0	2284	761	664	1425
1965	1963	0	1963	654	408	1062
1966	1173	0	1173	391	298	689
1967	857	0	857	286	288	574
1968	971	0	971	324	325	649
1969	1037	0	1037	346	370	716
1970	1600	0	1600	533	582	1115
1971	2173	0	2173	724	760	1484
1972	2359	0	2359	786	678	1464
1973	2551	0	2551	850	767	1617
1974	3004	0	3004	1001	731	1732
1975	2864	0	2864	954	536	1490
1976	3224	0	3224	1075	634	1709
1977	4113	0	4113	1371	914	2285
1978	3790	0	3790	1263	862	2125
1979	3224	0	3224	1075	813	1888
1980	3790	0	3790	1263	1049	2312
1981	4817	0	4817	1606	1372	2978
1982	5209	0	5209	1736	1525	3261
1983	5414	0	5414	1805	1923	3728
1984	5828	0	5828	1943	2037	3980
1985	6306	0	6306	1987	2176	4163
1986	6405	0	6405	654	1845	2499
1987	5025	0	5025	1353	1895	3248
1988	3295	0	3295	2041	1444	3485
1989	3944	0	3944	1186	2050	3236
1990	3156	0	3156	2330	4297	6627
1991	3824	0	3824	2347	1350	3697
1992	6147	0	6147	3434	715	4149
1993	5576	0	5576	3583	603	4186
1994	3985	55	4040	1706	177	1883
1995	2185	2	2187	2625	133	2758
1996	2850	0	2850	806	517	1323
1997	2248	75	2323	270	147	417
1998	2421	78	2499	173	160	333
1999	2530	565	3095	269	1509	1778
2000	2999	17	3016	215	263	478
2001	3093	107	3200	593	264	857
2002	2987	78	3065	440	29	469
2003	4438	6	4444	126	65	191
2004	3549	11	3560	86	72	157

Table L8. Three-year moving average of the NEFSC autumn survey index (> 60 cm kg/tow) and the relative F values used in AIM.

	Survey Index	Relative F
1965	3.92	0.50
1966	3.95	0.30
1967	3.46	0.25
1968	2.66	0.36
1969	4.12	0.25
1970	6.11	0.26
1971	8.05	0.27
1972	7.60	0.31
1973	7.75	0.33
1974	7.82	0.38
1975	6.96	0.41
1976	6.49	0.50
1977	6.79	0.61
1978	8.12	0.47
1979	8.17	0.39
1980	9.01	0.42
1981	9.00	0.54
1982	9.09	0.57
1983	7.25	0.75
1984	6.12	0.95
1985	5.53	1.14
1986	4.97	1.29
1987	4.81	1.04
1988	4.78	0.69
1989	4.60	0.86
1990	4.35	0.73
1991	4.15	0.92
1992	4.25	1.44
1993	4.63	1.21
1994	3.84	1.05
1995	3.44	0.64
1996	2.92	0.98
1997	2.97	0.78
1998	2.52	0.99
1999	1.83	1.69
2000	1.94	1.56
2001	2.35	1.36
2002	3.37	0.91
2003	3.34	1.33
2004	3.01	1.18

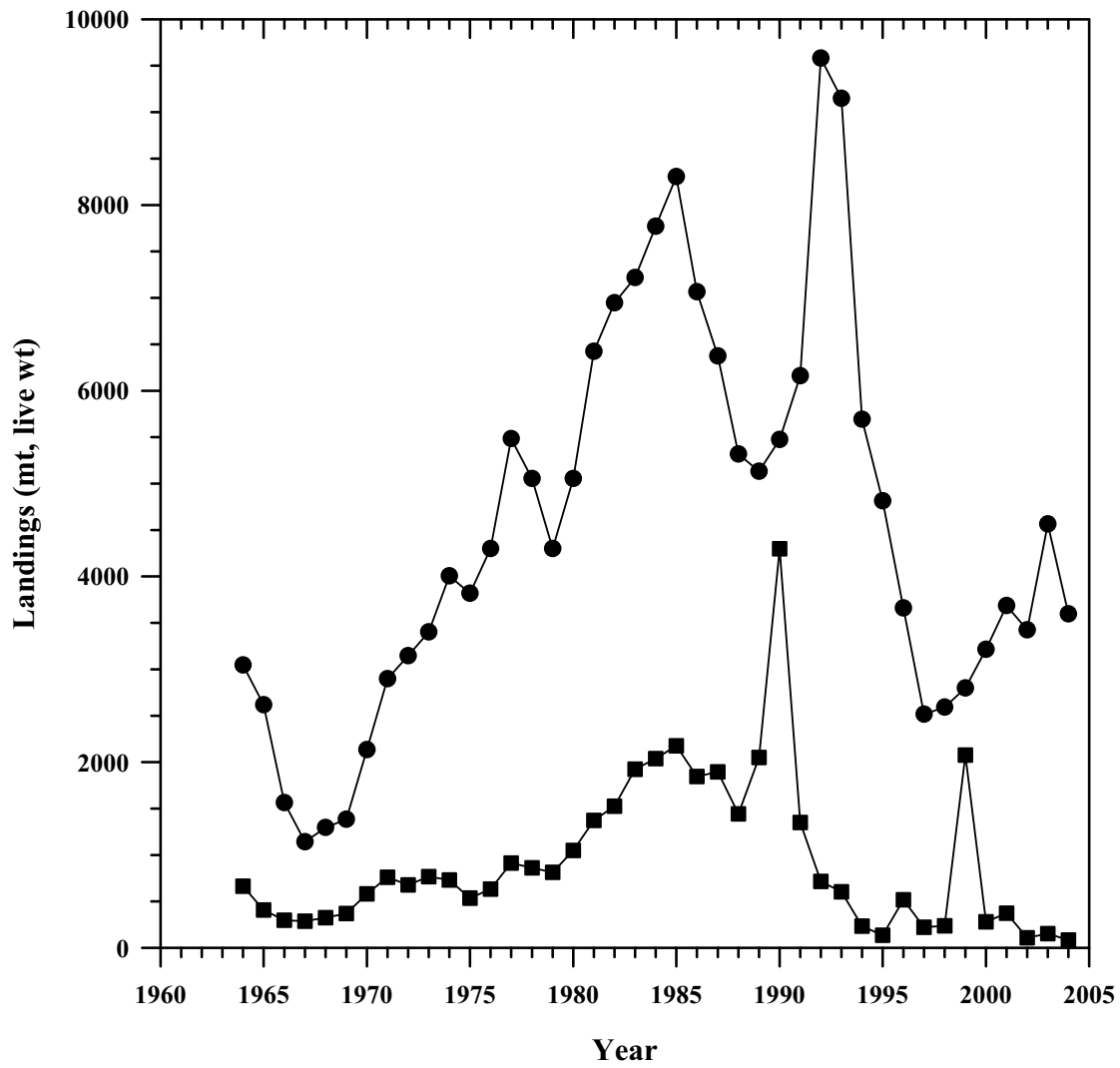


Figure L1. Total landings (circles) and discards (squares) of white hake from the Gulf of Maine to Mid-Atlantic region, 1964-2004.

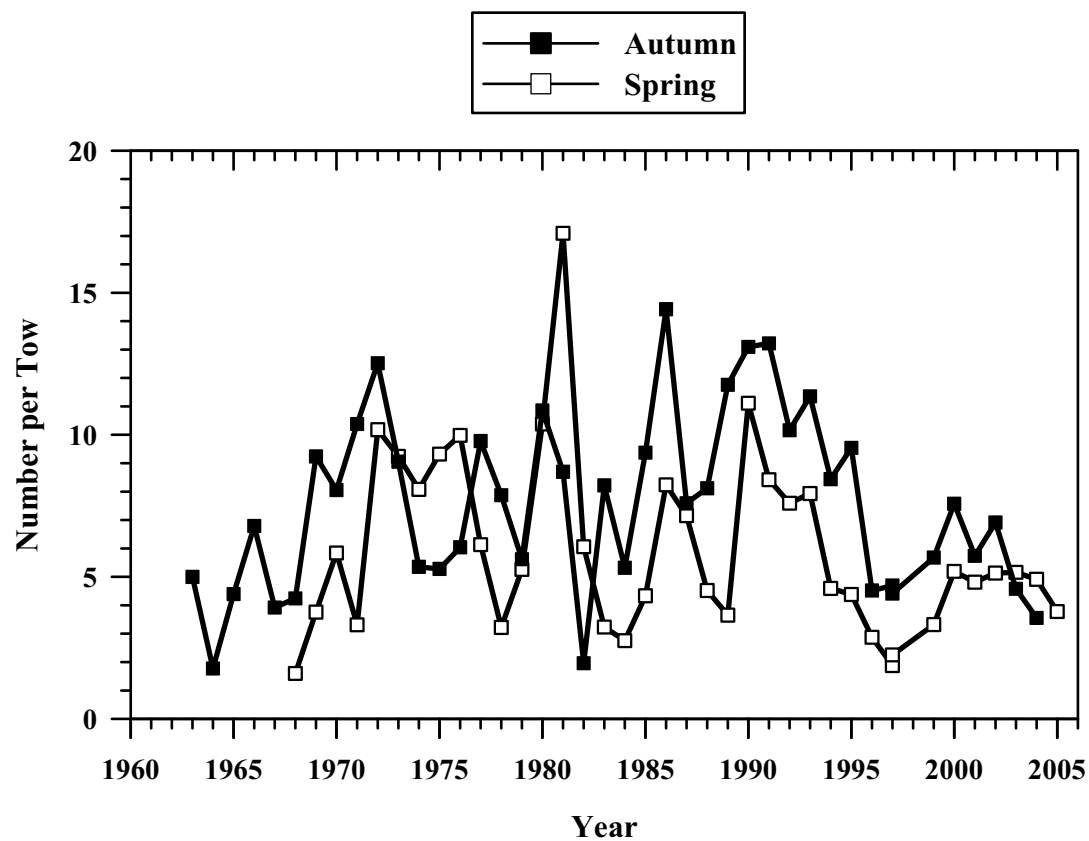
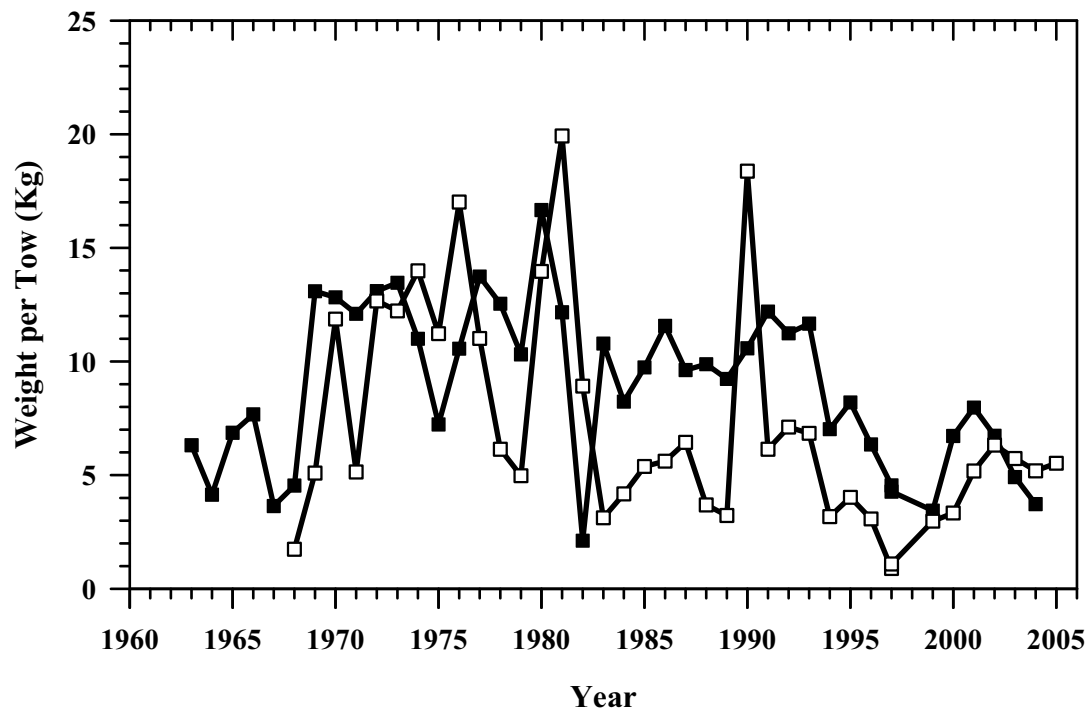


Figure L2. White hake indices of biomass (top panel) and abundance (bottom panel) from the NEFSC bottom trawl spring (solid line) and autumn (dashed line) surveys in the Gulf of Maine to Northern Georges Bank region (offshore strata 21-30, 33-40), 1963-2005.

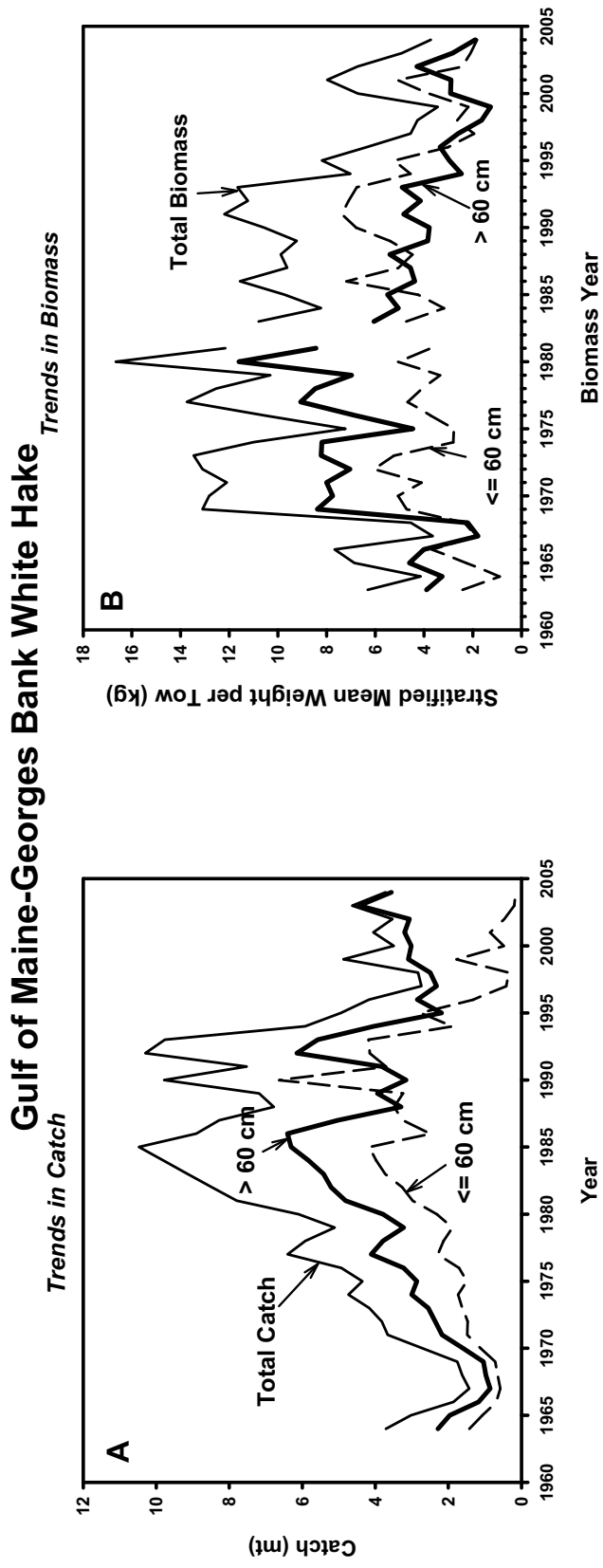


Figure L3. Trends in catch (Panel A) and survey indices of biomass (Panel B) by size class.

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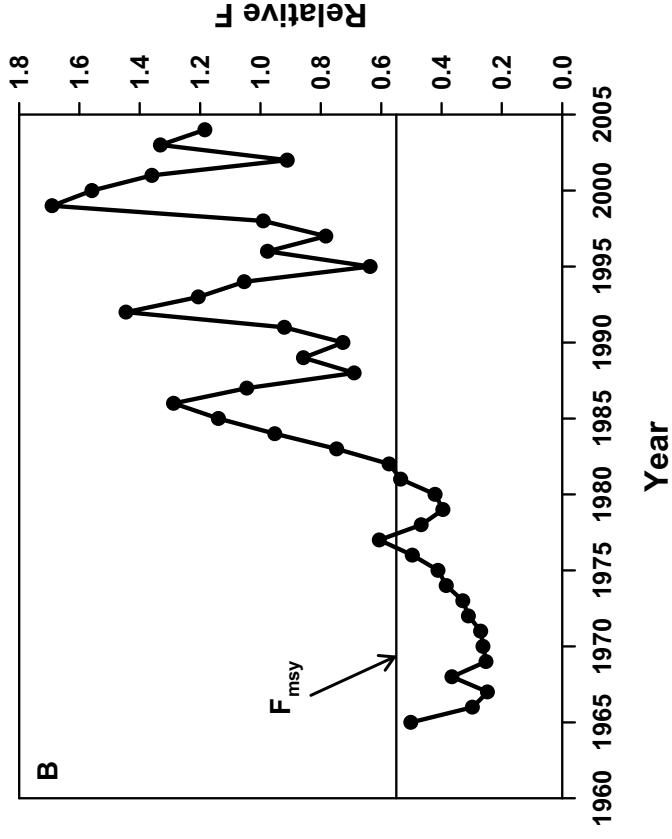
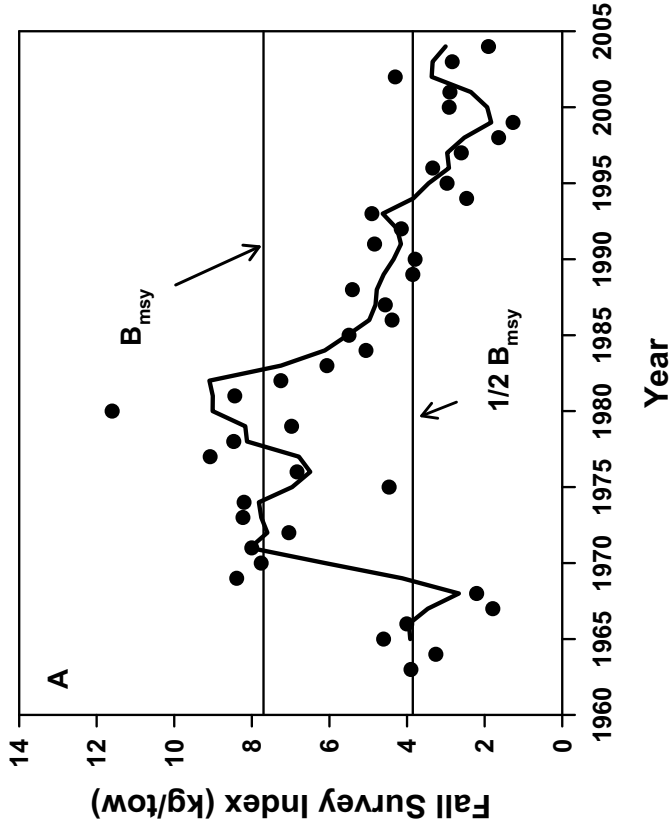


Figure L4. Trend in biomass (A) and trend in relative F (B).

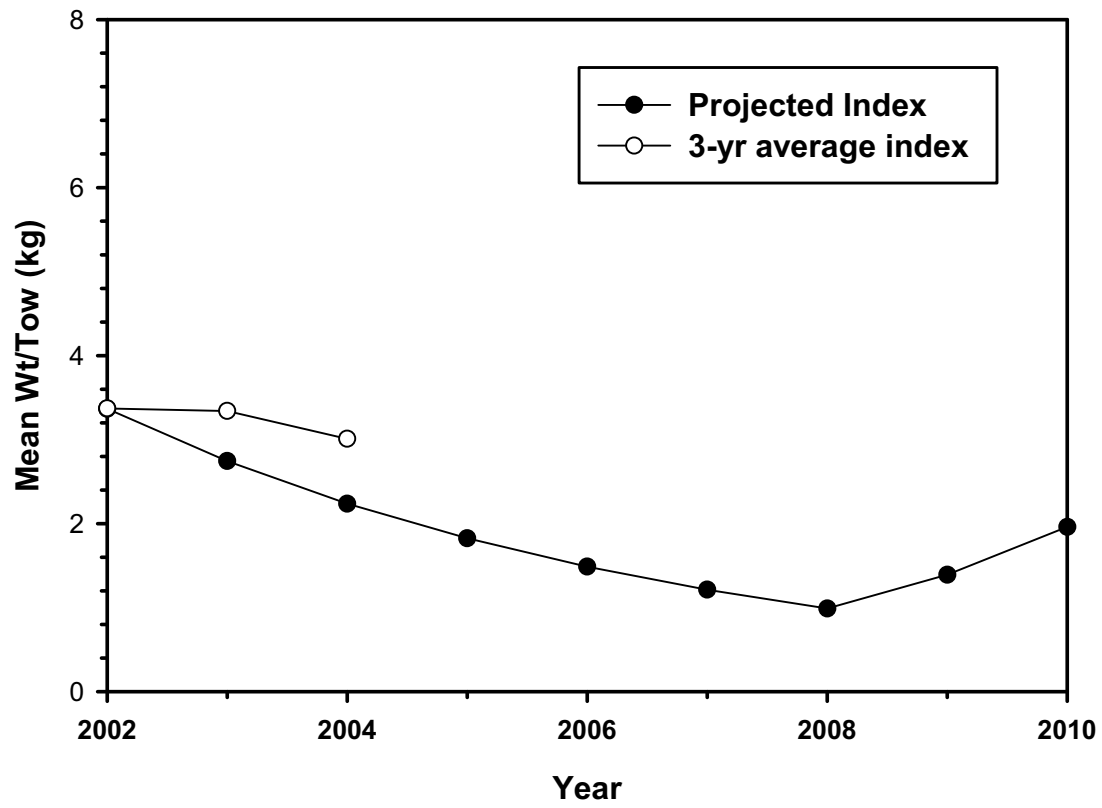


Figure L5. Amendment 13 projected indices for white hake through 2010 and realized indices through 2004.