

Gulf of Maine Haddock

2017 Assessment Update Report Supplemental Information

**U.S. DEPARTMENT OF COMMERCE
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Overview

This supplemental report is intended to augment the condensed assessment report. It contains more detailed information on assessment data preparations and inputs, in addition to providing detailed assessment model diagnostics and results. This report is not a substitute for the formal assessment report, but rather provides additional details that users of stock assessment information may find useful.

References

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Tables

Table 1. Summary of major regulatory actions that have affected the Gulf of Maine haddock fishery since 1973.

Date	Regulatory action	Cod end minimum mesh size (in)	Miscellaneous	Closures	Differential DAS Counting
01/01/73	Groundfish FMP	4.5			
01/01/77		5.125			
01/01/82					
01/01/83		5.5			
01/01/89					
04/01/92	Shrimp trawl fishery: Nordmore grate regulation, groundfish bycatch prohibited				
05/01/94	Amendment 5	6.0	500 lb trip limit		DAS monitory w/ reduction schedule, mandatory reporting
05/01/96	Amendment 7		Trip limit raised to 1,000 lb/trip		Accelerated DAS reduction
05/01/97	Framework 20		Trip limits raised to 1,000 lb/day with 10,000/trip maximum		
09/01/97				WGOM (Jeffreys Ledge, Stellwagen Bank)	
05/01/98	Framework 25				
06/25/98					
09/01/98			Trip limits raised to 3,000 lb/day with 30,000/trip maximum		
02/01/99	Framework 26			Additional month-block closures for February to April	
05/01/99	Framework 27	6.5 square/6.0 diamond	Trip limit lowered to 2,000 lb/day with 20,000 lb/trip		
05/28/99	Interim rule				
08/03/99					
11/05/99			Trip limit raised to 5,000 lb/day with 50,000 lb/trip		
01/05/00	Framework 31			Additional month-block closures for February	
06/01/00	Framework 33	6.5 square/6.5 diamond			
10/26/00			Daily trip limit removed, total trip limit of 50,000 lb/trip remains in effect		
11/01/00				One month closure of Cashes Ledge	
05/01/02	Interim rule		Trip limits lowered to 3,000 lb/day with 30,000/trip maximum	Additional month-block closures for May - June 2003; Cashes Ledge Closed year round	20% reduction in DAS
06/01/02	Revised interim rule				
07/01/02			Daily limit suspended, 30,000/trip through 9/30/2002 then 50,000/trip thereafter		
08/01/02	Emergency rule				
03/13/03			Haddock possession limit suspended until May 1		
05/01/03			Trip limits lowered to 3,000 lb/day with 30,000/trip maximum		
05/01/04	Amendment 13		Trip limits suspended for remainder of 2004	WGOM, Cashes Ledge and rolling closures continued	Further reduction in DAS
05/01/06	Emergency rule				
11/22/06	FW 42				DAS counted 2:1 in inshore GOM
08/15/06	FW 43		Haddock cap for herring fishery implemented (set at 0.2% of the combined GOM/GBK haddock TAC)		
05/01/09	Interim rule				
05/01/10	Amendment 16			Some changes to rolling closures for sector vessels	DAS counted in 24 -hour blocks; no differential DAS counting except as AMs
05/01/11	Framework 45			Whaleback closure April 1 - June 30 (commercial and recreational)	
09/14/11	Framework 46		Changes to herring haddock cap (1% GOM haddock ABC)		
05/01/12	Framework 47				
05/01/13	Framework 48		Changes to minimum sizes for both commercial and recreational fisheries (effective July 1)		
11/13/14	Interim rule		ABC revised from 341 mt to 677 mt	Seasonal cod closures	
05/01/15	Framework 53		Change to recreational minimum size, 3 fish/person/day recreational limit		

Table 2. Summary of Gulf of Maine haddock minimum retention size for the commercial and recreational fisheries since 1977.

Year	Commercial minimum size limit (total length, inches)	Recreational minimum size limit (total length, inches)	Management action
1977	16	15	Groundfish Fishery Management Plan
1978	16	15	
1979	16	15	
1980	16	15	
1981	16	15	
1982	16	15	
1983	17	15	Interim Groundfish Fishery Management Plan
1984	17	15	
1985	17	15	
1986	17	15	
1987	19	17	Amendment 1
1988	19	17	
1989	19	19	Amendment 5
1990	19	19	
1991	19	19	
1992	19	19	
1993	19	19	
1994	19	19	
1995	19	19	
1996	19	19	
1997	19	19	
1998	19	19	
1999	19	19	Amendment 13
2000	19	19	
2001	19	19	
2002	19	23	
2003	19	21	
2004	19	19	
2005	19	19	
2006	19	19	
2007	18	19	
2008	18	19	
2009	18	18	Amendment 16
2010	18	18	
2011	18	18	
2012	18	18	January 6, 2012-April 20, 2012 recreational set at 19 inches as part of AM
2013	16	21	Framework 48, implemented on July 1, 2013
2014	16	21	
2015	16	17	Agency action - Supplemental Action to FW 53
2016	16	17	

Table 3. Estimates of Gulf of Maine haddock catch (mt) by fleet (commercial, recreational) and disposition (landed, discarded) from 1977 to 2016. *Recreational discard amounts reflect application of 50% mortality assumption adopted for the SAW/SARC 95 assessment (NEFSC 2014) for years prior to 2004 and season and size-class specific discard mortality estimates (Mandelman et al. 2017) for 2004 to 2016.*

Year	US recreational discards (mt)	US recreational harvest (mt)	US commercial discards (mt)	US commercial landings (mt)	Foreign landings (mt)	Total removals (mt)
1977				3,230.1	26.0	3,256.1
1978				4,382.5	641.0	5,023.5
1979				4,130.6	257.0	4,387.6
1980				6,317.6	203.0	6,520.6
1981	0.0	38.2		5,713.3	513.0	6,264.5
1982	0.0	23.0	6.4	5,634.3	1,278.0	6,941.7
1983	0.0	52.7	6.5	5,593.4	2,003.0	7,655.6
1984	0.6	52.3	11.0	2,792.8	1,245.0	4,101.7
1985	0.0	21.6	16.5	2,259.1	791.0	3,088.2
1986	0.2	51.8	16.4	1,628.9	225.0	1,922.3
1987	0.0	39.2	23.9	846.3	0.0	909.4
1988	1.3	20.1		418.0	0.0	439.4
1989	2.6	13.1	5.0	265.1	0.0	285.9
1990	0.1	5.3	2.0	465.0	0.0	472.4
1991	0.0	0.3	2.8	443.5	0.0	446.6
1992	0.0	0.0	8.0	313.4	0.0	321.4
1993	0.0	0.6	13.3	193.0	0.0	206.9
1994	0.9	3.3	61.1	121.9	0.0	187.1
1995	27.4	124.1	87.7	178.2	0.0	417.4
1996	6.4	5.7	78.2	253.8	0.0	344.2
1997	10.5	30.2	378.7	623.7	0.0	1,043.2
1998	7.0	45.6	16.6	922.6	0.0	991.9
1999	9.8	17.8	2.3	569.1	0.0	599.0
2000	60.4	128.1	27.9	799.3	0.0	1,015.7
2001	86.8	169.3	12.9	1,006.8	0.0	1,275.8
2002	177.3	135.3	18.6	1,009.2	0.0	1,340.4
2003	257.4	173.9	17.7	1,026.4	0.0	1,475.4
2004	43.4	307.7	11.7	947.2	0.0	1,310.0
2005	43.3	538.1	25.0	977.7	0.0	1,584.0
2006	73.7	447.6	31.5	622.5	0.0	1,175.3
2007	48.7	575.2	46.9	677.9	0.0	1,348.7
2008	71.9	537.4	10.3	542.7	0.0	1,162.2
2009	26.7	409.2	12.3	500.3	0.0	948.4
2010	20.1	320.4	3.0	622.6	0.0	966.1
2011	10.7	230.2	5.6	498.6	0.0	745.1
2012	66.3	249.9	17.7	416.6	0.0	750.6
2013	273.4	298.3	32.3	212.0	0.0	816.0
2014	358.8	316.9	22.4	313.6	0.0	1,011.7
2015	175.8	237.9	41.5	650.5	0.0	1,105.7
2016	344.9	554.1	72.3	1,341.8	0.0	2,313.1

Table 4. Total numbers of Gulf of Maine haddock lengths sampled from commercial landings by quarter between 1969 and 2016. Sampling intensity is expressed as metric tons landings per 100 lengths sampled (*200 metric tons per 100 lengths is an unofficial NAFO/ICNAF standard*).

Year	Quarter				Total lengths	Commercial landings (mt)	Metric tons/100 lengths
	1	2	3	4			
1969		93	341	92	526	2,405	457.2
1970						1,436	
1971	86			183	269	1,190	442.5
1972			74	115	189	912	482.7
1973	99		627	205	931	526	56.5
1974	207	47			254	629	247.6
1975	64	100			164	1,180	719.6
1976	30		74	108	212	1,835	865.3
1977	382	708	839	569	2,498	3,230	129.3
1978	372	357	379	203	1,311	4,382	334.3
1979	309		124	166	599	4,131	689.6
1980	51	494	359	201	1,105	6,318	571.7
1981	53	410	771	1,019	2,253	5,713	253.6
1982	576	53	1,634	345	2,608	5,634	216.0
1983	561	1,176	1,759	699	4,195	5,593	133.3
1984	187	173	967	504	1,831	2,793	152.5
1985	700	799	871	735	3,105	2,259	72.8
1986	516	476	1,075	475	2,542	1,629	64.1
1987	376	181	689	591	1,837	846	46.1
1988	352	50	142	202	746	418	56.0
1989	291		65	247	603	265	44.0
1990	75	50		150	275	465	169.1
1991	57	146	395	425	1,023	443	43.4
1992	228		53	130	411	313	76.3
1993	103	110	125		338	193	57.1
1994		100	52	516	668	122	18.3
1995	256				256	178	69.6
1996	77	92	84	527	780	254	32.5
1997	120	379	855	613	1,967	624	31.7
1998	998	160	234	348	1,740	923	53.0
1999	117		514	313	944	569	60.3
2000	965	572	496	495	2,528	799	31.6
2001	881	201	379	1,573	3,034	1,007	33.2
2002	1,278	412	247	423	2,360	1,009	42.8
2003	1,277	564	1,998	1,556	5,395	1,026	19.0
2004	2,919	2,027	363	1,052	6,361	947	14.9
2005	2,137	774	1,462	1,521	5,894	978	16.6
2006	2,121	1,222	1,022	1,131	5,496	622	11.3
2007	1,598	708	1,784	1,016	5,106	678	13.3
2008	1,355	938	699	436	3,428	543	15.8
2009	1,816	715	277	419	3,227	500	15.5
2010	1,618	453	322	770	3,163	623	19.7
2011	1,664	832	453	652	3,601	499	13.8
2012	1,990	859	291	430	3,570	417	11.7
2013	1,898	1,457	883	929	5,167	212	4.1
2014	1,562	1,454	697	1,996	5,709	314	5.5
2015	1,489	636	911	1,315	4,351	651	15.0
2016	1,530	952	1,184	1,246	4,912	1,342	27.3

Table 5. Total numbers of Gulf of Maine haddock lengths sampled from commercial landings by market category and year between 1977 and 2016. Cells shaded in grey indicate where lengths were aggregated semi-annually. Cells shaded blue indicate where lengths were aggregated annually. Aggregation occurred when length sampling was insufficient; a general criterion of 100 lengths/block was used to determine sufficiency.

Year	Scrod (1475)				Large (1470)			
	1	2	3	4	1	2	3	4
1977	382	511	481	569		197	358	
1978	223	322	179	203	149	35	200	
1979	114			66	195		124	100
1980	51	175	257	201		319	102	
1981	53	358	514	381		52	257	638
1982	473	53	273	154	103		1,361	104
1983	312	308	340	203	249	868	1,317	496
1984	187	94	139	113		79	828	391
1985	353	202	298	84	347	597	573	651
1986	233	242	207	204	283	234	868	271
1987	162	79	75	186	214	102	614	405
1988	261	50	42		91		100	202
1989	99			129	192		65	118
1990	41	50		50	34			100
1991	57		179	212		146	216	213
1992	107		53	111	121			19
1993	103	56	125		Combined 1992 & 1994 and ran annual			
1994				219		100	52	297
1995	194				62			
1996		92		100	77		84	427
1997		124	358	258	120	255	497	355
1998	689	49	156	35	309	111	78	313
1999			214	102	117		300	211
2000	477	259	157	287	488	313	339	208
2001	353	108	66	847	528	93	313	726
2002	348	202	247	161	930	210		262
2003	485	216	716	513	792	348	1,282	1,043
2004	1,021	1,085	262	451	1,898	942	101	601
2005	716	449	787	769	1,421	325	675	752
2006	928	535	569	514	1,193	687	453	617
2007	781	360	768	400	817	348	1,016	616
2008	566	466	348	295	789	472	351	141
2009	568	306	135	176	1,248	409	142	243
2010	600	239	135	156	1,018	214	187	614
2011	614	470	216	308	1,050	362	237	344
2012	728	483	120	217	1,262	376	171	213
2013	690	751	538	516	1,208	706	345	413
2014	704	1,065	556	1,019	858	389	141	977
2015	834	464	493	816	655	172	418	499
2016	876	648	674	802	654	304	510	444

Table 6. Total numbers of Gulf of Maine haddock ages sampled from commercial landings by quarter between 1965 and 2016.

Year	Quarter				Total ages	Commercial landings (mt)	Metric tons/100 ages
	1	2	3	4			
1965		35	209	102	346	4,155	1,200.8
1966		35	84	14	133	4,524	3,401.5
1967	88	185		53	326	4,852	1,488.4
1968	50	59		35	144	3,417	2,373.1
1969		20	46	15	81	2,405	2,968.7
1970						1,436	
1971						1,190	
1972			20	20	40	912	2,280.6
1973	20		38	40	98	526	536.6
1974	40	20			60	629	1,048.0
1975	15	25			40	1,180	2,950.4
1976	19		20	35	74	1,835	2,479.1
1977	112	195	232	220	759	3,230	425.6
1978	120	135	89	49	393	4,382	1,115.1
1979	78		25	61	164	4,131	2,518.6
1980	17	97	88	46	248	6,318	2,547.4
1981	14	120	185	227	546	5,713	1,046.4
1982	123	14	359	91	587	5,634	959.9
1983	155	304	302	153	914	5,593	612.0
1984	47	52	276	125	500	2,793	558.6
1985	190	204	230	180	804	2,259	281.0
1986	118	136	232	116	602	1,629	270.6
1987	76	38	175	199	488	846	173.4
1988	104		32	39	175	418	238.9
1989	91		16	42	149	265	177.9
1990	43	16		37	96	465	484.3
1991	16	32	117	87	252	443	176.0
1992	40		15	83	138	313	227.1
1993	20	42	49		111	193	173.9
1994		26	21	196	243	122	50.2
1995	86				86	178	207.2
1996	25	13	22	109	169	254	150.2
1997	23	101	199	145	468	624	133.3
1998	127	45	64	166	402	923	229.5
1999	33		143	105	281	569	202.5
2000	303	181	171	168	823	799	97.1
2001	242	72	121	393	828	1,007	121.6
2002	555	138	24	158	875	1,009	115.3
2003	411	178	739	473	1,801	1,026	57.0
2004	783	348	33	82	1,246	947	76.0
2005	441	170	485	560	1,656	978	59.0
2006	1,078	433	581	480	2,572	622	24.2
2007	783	338	888	515	2,524	678	26.9
2008	685	535	373	218	1,811	543	30.0
2009	993	443	218	248	1,902	500	26.3
2010	941	192	184	339	1,656	623	37.6
2011	961	504	236	180	1,881	499	26.5
2012	880	533	214	243	1,870	417	22.3
2013	1,347	865	461	536	3,209	212	6.6
2014	896	995	462	960	3,313	314	9.5
2015	709	350	282	738	2,079	651	31.3
2016	587	542	599	504	2,232	1,342	60.1

Table 7. Total Gulf of Maine haddock commercial landings-at-age (numbers) from 1977 to 2016.

Year	Age0	Age1	Age2	Age3	Age4	Age5	Age6	Age7	Age8	Age9	Age10	Age11	Age12	Age13	Age14	Age15	Age16	Age17	Age18	Age19	Age20	Age21	Age22
1977	0	39,755	1,762,962	53,167	366,967	184,629	189,299	0	0	0	0	0	0	2,411	0	0	0	0	0	0	0	0	0
1978	0	0	374,650	2,291,417	172,388	363,003	208,654	10,580	0	0	0	5,290	0	0	0	0	0	0	0	0	0	0	0
1979	0	0	67,315	559,608	1,576,962	183,133	99,093	45,294	10,898	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1980	0	0	884,750	104,084	755,832	1,366,770	143,816	95,570	27,794	0	0	25,756	0	0	0	0	0	0	0	0	0	0	0
1981	0	2,068	1,598,228	717,686	292,045	340,692	541,941	91,639	116,490	13,327	0	0	0	3,433	9,995	0	0	0	0	0	0	0	0
1982	0	30,106	605,235	1,508,516	618,180	100,219	300,546	476,719	107,236	35,008	19,261	5,206	10,366	0	5,849	0	0	0	0	0	0	0	0
1983	0	0	7,577	818,079	967,850	786,711	147,856	252,137	346,411	54,803	38,544	16,725	5,117	0	0	0	0	0	0	0	0	0	0
1984	0	0	63,736	44,622	588,124	253,782	359,988	61,607	64,176	132,508	3,153	2,775	5,415	2,161	0	0	0	0	0	0	0	0	0
1985	0	0	22,128	319,344	82,516	354,183	151,463	241,319	47,220	19,629	33,631	492	589	0	0	0	0	0	0	0	0	0	0
1986	0	0	0	166,503	340,987	75,330	111,567	84,708	101,115	10,694	3,792	0	0	0	0	0	0	0	0	0	0	0	0
1987	0	0	3,745	25,377	95,767	46,124	33,013	55,332	32,964	10,723	4,387	252	0	0	0	0	0	0	0	0	0	0	0
1988	0	0	0	11,539	11,895	52,410	53,781	7,538	13,744	2,772	1,232	0	0	0	0	0	0	0	0	0	0	0	0
1989	0	0	15,537	2,643	40,660	18,301	22,676	13,959	707	943	0	0	0	0	0	0	0	0	0	0	0	0	0
1990	0	0	2,018	142,445	1,686	28,564	17,479	27,146	3,794	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1991	0	0	5,579	15,722	58,569	28,391	27,857	12,628	5,811	3,140	0	0	0	0	0	0	0	0	0	0	0	0	0
1992	0	0	7,753	92,057	36,323	19,083	2,246	1,134	0	1,895	0	0	0	0	0	0	0	0	0	0	0	0	0
1993	0	0	10,844	34,040	22,484	9,718	10,571	4,586	1,567	595	186	155	0	0	0	0	0	0	0	0	0	0	0
1994	0	0	6,274	30,211	10,445	1,674	7,045	3,469	1,138	206	83	153	0	0	0	0	0	0	0	0	0	0	0
1995	0	0	0	4,993	34,162	8,163	5,440	4,003	4,345	261	686	2,091	0	0	0	0	0	0	0	0	0	0	0
1996	0	0	3,273	57,790	46,874	14,339	3,775	6,579	5,240	990	0	0	0	0	0	0	0	0	0	0	0	0	0
1997	0	0	2,281	82,457	117,766	55,455	12,429	4,454	923	790	398	157	0	0	0	0	0	0	0	0	0	0	0
1998	0	0	11,630	21,006	115,275	180,018	51,089	16,925	8,321	5,514	1,299	547	0	0	0	0	0	0	0	0	0	0	0
1999	0	0	0	35,907	63,674	93,190	66,255	37,073	6,863	3,851	0	571	1,119	202	0	0	0	0	0	0	0	0	0
2000	0	0	3,872	36,032	85,996	54,166	108,783	62,046	27,905	14,516	3,111	1,835	1,944	824	1,616	0	0	0	0	0	0	0	0
2001	0	0	8,684	156,376	106,988	81,810	75,155	71,243	35,344	13,040	6,148	1,284	0	0	0	392	0	0	0	0	0	0	0
2002	0	0	0	12,751	185,844	92,068	92,509	28,044	60,738	41,761	13,112	3,282	181	0	287	0	0	0	0	0	0	0	0
2003	0	0	0	2,641	30,433	344,788	69,131	53,244	18,050	28,358	26,095	4,186	1,045	903	178	0	0	0	0	0	0	0	0
2004	0	0	0	1,847	18,877	42,616	357,654	41,117	24,824	7,245	13,814	17,603	2,279	157	0	0	0	0	0	0	0	0	0
2005	0	0	0	1,129	17,851	42,303	69,285	316,249	37,353	28,808	9,659	8,093	7,127	1,014	381	0	0	0	0	0	0	0	0
2006	0	0	0	8,099	294	20,587	36,028	39,908	202,196	23,052	9,071	1,915	3,875	2,126	606	79	0	0	0	0	0	0	0
2007	0	0	150	1,532	98,378	5,417	26,574	21,756	47,784	192,507	16,300	5,278	1,129	881	1,369	60	0	0	0	0	0	0	0
2008	0	0	705	21,476	9,102	187,543	1,793	19,203	13,666	20,349	76,643	3,202	3,071	122	0	0	0	0	0	0	0	0	0
2009	0	0	0	2,184	15,258	5,387	146,364	2,645	18,364	8,603	12,695	61,509	2,519	1,391	275	78	0	0	0	0	0	0	0
2010	0	0	576	1,600	20,417	28,718	10,619	191,506	2,415	11,366	8,332	10,475	58,600	2,617	292	106	0	81	0	0	0	0	0
2011	0	0	145	1,474	1,993	26,562	27,024	11,333	122,042	1,241	11,041	9,097	5,616	36,061	1,192	362	103	47	207	0	0	0	18
2012	0	0	200	8,048	5,398	6,047	33,255	23,118	8,336	92,765	1,506	6,613	5,131	6,442	22,413	944	468	36	123	0	0	0	0
2013	0	0	1,392	37,916	15,902	7,342	3,697	19,648	11,240	3,166	24,596	757	1,797	929	1,537	5,305	263	73	24	0	0	0	0
2014	0	0	19,306	24,745	167,031	11,870	4,528	1,932	10,677	4,454	1,807	10,053	134	731	462	502	1,865	142	33	0	0	0	0
2015	0	0	29,820	169,798	64,290	229,258	17,129	8,678	1,358	6,757	2,460	679	6,175	40	152	191	96	504	0	0	0	0	0
2016	0	0	325	427,668	271,450	78,540	369,359	11,196	3,085	2,106	5,367	3,064	871	4,432	0	0	91	142	283	0	0	0	0

Table 8. Coefficients of variation (CV) associated with the estimates of Gulf of Maine haddock commercial landings numbers-at-age from 1984 to 2016 (CVs greater than 0.3 are shaded grey). *Note that prior to 1984 CVs could not be calculated.*

Year	Age0	Age1	Age2	Age3	Age4	Age5	Age6	Age7	Age8	Age9	Age10	Age11	Age12	Age13	Age14	Age15	Age16	Age17	Age18	Age19	Age20	Age21	Age22
1984			0.25	0.11	0.08	0.09	0.03	0.09	0.13	0.09	0.19	0.33	0.20	0.26									
1985			0.18	0.11	0.15	0.07	0.08	0.04	0.12	0.17	0.16	1.27	0.79										
1986				0.08	0.06	0.05	0.04	0.05	0.08	0.21	0.26												
1987			0.35	0.14	0.06	0.07	0.07	0.06	0.10	0.13	0.25	0.68											
1988				0.32	0.26	0.18	0.26	0.27	0.46	0.60	0.72												
1989			0.60	0.75	0.23	0.29	0.19	0.19	0.91	0.87													
1990			0.84	0.23	0.87	0.33	0.55	0.47	0.80														
1991			0.58	0.37	0.13	0.14	0.15	0.16	0.26	0.67													
1992			0.84	0.17	0.34	0.52	0.71	0.97		1.06													
1993			0.17	0.15	0.15	0.37	0.37	0.31	0.45	0.85	0.88	1.22											
1994			0.16	0.08	0.15	0.27	0.28	0.19	0.34	1.03	0.87	1.00											
1995				0.70	0.13	0.42	0.32	0.38	0.32		0.82	0.46											
1996			0.61	0.25	0.25	0.26	0.33	0.35	0.63	0.69													
1997			1.10	0.14	0.12	0.13	0.26	0.17	0.39	0.29	0.64	1.10											
1998			0.83	0.23	0.12	0.12	0.18	0.35	0.32	0.59	1.23	1.38											
1999				0.26	0.11	0.13	0.18	0.24	0.37	0.51		1.18	0.93	1.23									
2000			0.49	0.23	0.16	0.12	0.14	0.17	0.21	0.46	0.51	0.91	0.65	1.01	0.58								
2001			0.43	0.09	0.09	0.16	0.10	0.13	0.20	0.35	0.57	0.90				1.01							
2002				0.38	0.08	0.13	0.10	0.20	0.13	0.18	0.22	0.42	1.37			1.39							
2003				0.70	0.17	0.04	0.11	0.14	0.19	0.13	0.18	0.44	0.35	0.71	1.27								
2004				0.65	0.47	0.14	0.03	0.12	0.18	0.23	0.23	0.18	0.41	0.94									
2005				0.61	0.25	0.14	0.09	0.03	0.13	0.14	0.24	0.28	0.23	0.68	0.95								
2006				0.26	0.76	0.16	0.13	0.09	0.03	0.12	0.17	0.30	0.22	0.34	0.51	1.34							
2007			1.36	0.51	0.08	0.36	0.14	0.14	0.10	0.04	0.19	0.26	0.50	0.57	0.60	1.28							
2008			1.20	0.34	0.31	0.06	0.44	0.15	0.19	0.17	0.08	0.25	0.50	1.02									
2009				0.55	0.22	0.33	0.05	0.37	0.13	0.18	0.14	0.09	0.29	0.50	0.85	1.35							
2010			1.29	0.97	0.21	0.16	0.25	0.06	0.38	0.18	0.19	0.21	0.13	0.39	0.64	1.38		1.32					
2011			1.35	0.76	0.46	0.15	0.11	0.22	0.05	0.42	0.18	0.17	0.22	0.12	0.45	0.65	1.47	1.48	0.96			1.69	
2012			0.77	0.26	0.27	0.25	0.13	0.13	0.21	0.07	0.38	0.22	0.23	0.22	0.14	0.45	0.68	1.43	1.40				
2013			0.50	0.10	0.09	0.13	0.16	0.07	0.09	0.16	0.05	0.32	0.18	0.27	0.22	0.12	0.46	0.83	1.26				
2014			0.21	0.17	0.04	0.12	0.19	0.26	0.12	0.16	0.27	0.12	0.51	0.36	0.50	0.36	0.27	0.57	0.99				
2015			0.34	0.13	0.11	0.06	0.17	0.27	0.39	0.19	0.28	0.45	0.21	1.43	0.77	0.78	0.97	0.61					
2016			1.42	0.13	0.09	0.14	0.07	0.26	0.35	0.52	0.30	0.44	0.41	0.35			1.08	1.08	0.76				
Average			0.69	0.33	0.21	0.18	0.19	0.21	0.27	0.37	0.38	0.56	0.44	0.61	0.68	0.87	0.82	1.05	1.07				1.69

Table 9. Mean weights-at-age (kg) of commercially landed Gulf of Maine haddock from 1977 to 2016.

Year	Age0	Age1	Age2	Age3	Age4	Age5	Age6	Age7	Age8	Age9	Age10	Age11	Age12	Age13	Age14	Age15	Age16	Age17	Age18	Age19	Age20	Age21	Age22
1977		0.113	0.757	1.163	2.008	2.558	3.358							4.686									
1978			0.777	1.234	1.684	2.438	3.108	4.642				6.088											
1979			0.774	1.155	1.805	2.261	2.659	2.775	3.587														
1980			0.76	1.168	1.852	2.389	3.354	3.602	4.562				4.204										
1981		0.56	0.685	1.516	1.978	2.64	3.024	3.657	4.18	3.841				3.95	3.984								
1982		0.376	0.623	0.995	2.139	2.598	3.107	3.647	4.13	4.347	4.09	4.642	4.81		3.412								
1983			0.862	1.205	1.728	2.377	2.969	3.372	3.717	4.152	4.316	4.397	3.528										
1984			0.949	1.305	1.809	2.324	3.165	3.928	4.505	4.11	3.95	5.138	2.527	4.642									
1985			1.139	1.102	1.901	2.342	2.653	3.588	4.09	4.479	3.917	6.226	4.976										
1986				1.233	1.464	2.353	2.498	3.061	3.636	4.745	4.191												
1987				1.111	1.805	2.064	2.424	2.608	3.27	4.239	5.007	5.646											
1988				1.123	1.614	2.558	2.577	3.868	4.606	4.893	5.821												
1989			1.34	2.067	1.835	2.319	2.865	3.548	4.666	4.244													
1990			0.833	1.541	3.331	2.456	3.044	3.734	3.547														
1991			1.637	1.916	2.657	3.027	2.958	3.35	4.433	3.881													
1992			1.415	1.783	1.978	2.656	3.067	2.079		3.45													
1993			1.085	1.635	2.043	2.44	3.015	3.393	3.358	2.948	4.662	3.95											
1994			1.188	1.712	2.162	2.927	2.644	3.254	3.273	2.985	4.707	3.907											
1995				1.854	2.083	2.553	3.614	4.357	5.209	4.825	4.286	6.222											
1996			1.696	1.451	1.884	2.213	3.202	2.494	2.404	3.252													
1997			1.245	2.166	1.975	2.631	3.275	3.168	3.969	4.048	4.508	2.488											
1998			1.225	1.528	1.909	2.25	2.856	3.358	3.162	2.834	2.947	4.871											
1999				1.34	1.615	1.773	1.932	2.294	3.052	3.246		3.368	3.299	4.329									
2000			1.266	1.223	1.547	1.775	2.022	2.421	2.735	2.821	3.625	2.924	3.584	4.514	3.901								
2001			1.153	1.379	1.532	1.825	2.233	2.259	2.467	2.378	2.729	2.24				3.517							
2002				1.227	1.413	1.667	2.179	2.625	2.361	2.597	2.8	3.589	5.788		3.144								
2003				1.028	1.359	1.551	1.851	2.197	2.541	2.593	2.572	2.46	2.843	2.134	4.073								
2004				1.036	1.407	1.429	1.774	1.897	2.11	2.366	2.146	2.295	2.35	3.501									
2005				1.053	1.236	1.591	1.555	1.809	2.047	2.192	2.594	2.316	2.839	2.497	2.488								
2006				1.146	1.329	1.493	1.778	1.638	1.814	2.01	2.164	2.437	2.248	2.332	2.344	2.611							
2007			0.812	1.162	1.236	1.238	1.625	1.681	1.671	1.755	1.864	2.123	3.029	2.398	2.11	3.004							
2008			1.061	1.164	1.238	1.39	1.489	1.792	1.772	1.658	1.786	1.982	2.074	2.987									
2009				1.132	1.242	1.385	1.728	1.677	1.968	2.14	1.986	2.031	2.343	1.775	2.662	2.814							
2010			1.13	0.883	1.16	1.456	1.651	1.762	2.155	2.163	2.237	2.077	2.089	2.253	3.512	2.488		3.745					
2011			0.812	1.165	1.212	1.494	1.696	1.885	2.006	1.987	2.165	2.14	2.023	2.243	2.145	2.521	2.611	2.869	3.198				5.061
2012			0.965	1.14	1.286	1.475	1.564	1.82	1.916	1.995	2.616	2.186	2.113	2.063	2.206	2.727	2.674	3.287	2.869				
2013			0.816	1.014	1.298	1.464	1.635	1.72	1.893	1.937	2.049	1.93	2.243	2.261	2.079	2.226	2.217	2.548	2.611				
2014			0.786	0.84	1.116	1.586	1.664	1.862	1.824	2.091	1.926	2.08	2.484	2.063	1.78	2.28	2.026	2.324	2.612				
2015			0.736	0.919	1.110	1.383	1.736	1.636	2.056	2.116	2.150	2.474	2.201	2.611	2.772	2.672	2.473	2.416					
2016			0.560	0.818	1.106	1.253	1.444	1.784	2.057	1.897	2.023	1.870	2.453	2.068			2.674	2.366	2.469				

Table 10. Total number of Gulf of Maine trips observed from 1989 to 2016, summarized by gear type. *The 2010-16 numbers include trips observed by both at-sea monitors and observers. The Gulf of Maine region is defined by statistical areas 464, 465, 467, 511-515.*

Year	Benthic longline	Otter trawl, large mesh (5.5" - 7.9")	Sink gillnet, large mesh (5.5" - 7.9")	Total
1989		38	105	143
1990		26	120	146
1991	3	48	801	852
1992	11	44	896	951
1993	3	17	560	580
1994		6	82	88
1995		24	62	86
1996		11	39	50
1997		5	31	36
1998		6	78	84
1999		27	70	97
2000		80	70	150
2001		112	39	151
2002	1	150	62	213
2003	18	251	254	523
2004	10	251	587	848
2005	58	499	505	1,062
2006	36	203	109	348
2007	36	225	92	353
2008	20	254	130	404
2009	35	410	271	716
2010	52	615	1,080	1,747
2011	80	1,014	1,382	2,476
2012	113	1,123	1,166	2,402
2013	33	642	495	1,170
2014	31	620	735	1,386
2015	3	397	269	669
2016	9	323	182	514

Table 11. Estimates of total Gulf of Maine haddock commercial discards (mt) by gear from 1977 to 2016, by gear. Discards from 1982 to 1988 were estimated using hindcast procedures and discards from 1989 to 2016 were estimated from observer data. See NEFSC (2013) for a full description of the estimation methodologies. *Note that prior to 1982 discards could not be reliably estimated by mesh category because this information was not included in the data collection programs.*

Year	Benthic longline (mt)	Otter trawl, large mesh (5.5" - 7.9") (mt)	Sink gillnet, large mesh (5.5" - 7.9") (mt)	Total (mt)
1977				
1978				
1979				
1980				
1981				
1982		0.5	5.9	6.4
1983		1.8	4.6	6.5
1984		4.4	6.6	11.0
1985		9.2	7.3	16.5
1986		8.5	7.9	16.4
1987		10.8	13.1	23.9
1988				
1989		2.1	2.9	5.0
1990		0.2	1.9	2.0
1991	0.4	1.0	1.4	2.8
1992	0.0	7.0	1.1	8.0
1993	0.0	9.9	3.4	13.3
1994		53.1	8.0	61.1
1995		82.0	5.8	87.7
1996		60.9	17.4	78.2
1997		378.5	0.3	378.7
1998		13.7	3.0	16.6
1999		1.1	1.2	2.3
2000		20.8	7.1	27.9
2001		7.1	5.8	12.9
2002		7.5	11.2	18.6
2003	5.3	7.9	4.6	17.7
2004	0.5	8.1	3.1	11.7
2005	15.5	6.8	2.7	25.0
2006	6.7	22.6	2.1	31.5
2007	18.5	3.7	24.7	46.9
2008	3.7	3.8	2.8	10.3
2009	4.0	2.3	6.0	12.3
2010	0.3	1.8	0.9	3.0
2011	1.0	2.3	2.2	5.6
2012	4.5	8.7	4.5	17.7
2013	1.3	28.4	2.6	32.3
2014	0.6	17.4	4.5	22.4
2015		37.3	4.2	41.5
2016	2.8	65.3	4.3	72.3

Table 12. Coefficients of variation (CV) for the Gulf of Maine haddock commercial discard (mt) estimates from 1989 to 2016 by gear; CVs greater than 0.3 are shaded in grey. *CVs are not available for hindcasted discards (pre-1989).*

Year	Benthic longline	Otter trawl, large mesh (5.5" - 7.9")	Sink gillnet, large mesh (5.5" - 7.9")	Total
1989		0.84	0.49	0.45
1990		1.05	0.43	0.40
1991	1.19	0.56	0.31	0.31
1992		0.66	0.24	0.58
1993		0.53	0.33	0.40
1994		0.38	0.43	0.33
1995		0.37	0.40	0.35
1996		0.66	0.54	0.53
1997		0.96	1.04	0.95
1998		0.37	0.66	0.32
1999		1.05	0.53	0.56
2000		0.54	0.50	0.42
2001		0.65	0.35	0.39
2002		0.33	0.39	0.27
2003	0.45	0.18	0.23	0.17
2004	0.37	0.25	0.20	0.18
2005	0.26	0.18	0.22	0.17
2006	0.36	0.49	0.24	0.36
2007	0.39	0.31	0.83	0.47
2008	0.47	0.41	0.28	0.24
2009	0.81	0.34	0.27	0.30
2010	0.40	0.28	0.25	0.19
2011	0.30	0.11	0.08	0.08
2012	0.34	0.11	0.06	0.10
2013	0.28	0.16	0.09	0.14
2014	0.55	0.13	0.06	0.11
2015		0.12	0.10	0.11
2016	0.46	0.15	0.17	0.14
Average	0.47	0.43	0.35	0.32

Table 13. Number of Gulf of Maine haddock lengths sampled from commercial discards between 1989 to 2016, by gear type and semester. Sampling intensity is expressed as metric tons discards per 100 lengths sampled (*200 metric tons per 100 lengths is an unofficial NAFO/ICNAF standard*). Cells shaded grey and blue indicate where discards at length were estimated using annual time blocks. Cells shaded green indicate where discards at length were estimated using semester time blocks. Blue shaded cells indicate where length sampling was determined to be insufficient and augmented with survey length frequencies. A general criterion of 30 lengths/block was used to determine sampling sufficiency.

Year	Benthic longline		Otter trawl, large mesh (5.5" - 7.9")		Sink gillnet, large mesh (5.5" - 7.9")		Total lengths	Total discards (mt)	Metric tons/100 lengths
	1	2	1	2	1	2			
1989			1	8			9	5.0	55.4
1990							0	2.0	
1991						1	1	2.8	280.0
1992			10	23		1	34	8.0	23.6
1993			8	44	2	1	55	13.3	24.2
1994			8	17	1	18	44	61.1	138.8
1995			217	218	7	6	448	87.7	19.6
1996			56	32	25	8	121	78.2	64.7
1997			946	3		2	951	378.7	39.8
1998			10		2	2	14	16.6	118.9
1999				5		18	23	2.3	10.1
2000				17	6	2	25	27.9	111.4
2001			24	18	5		47	12.9	27.5
2002			10	49	35	3	97	18.6	19.2
2003	105		96	116	39	43	399	17.7	4.4
2004	23		41	195	55	38	352	11.7	3.3
2005	207	7	223	237	5	72	751	25.0	3.3
2006	140		219	101		3	463	31.5	6.8
2007	299		124	125	13	10	571	46.9	8.2
2008	63		33	185	3	3	287	10.3	3.6
2009	127		80	27	91	1	326	12.3	3.8
2010	11		25	58	3	34	131	3.0	2.3
2011	36	17	78	451	53	101	736	5.6	0.8
2012	137	53	306	1,244	130	438	2,308	17.7	0.8
2013	22		1,636	720	84	116	2,578	32.3	1.3
2014	33		1,244	1,406	193	542	3,418	22.4	0.7
2015			1,374	1,576	151	393	3,494	41.5	1.2
2016	87	1	1,101	2,071	146	438	3,844	72.3	1.9

Table 14. Total Gulf of Maine haddock commercial discards-at-age (numbers) from 1977 to 2016.

Year	Age0	Age1	Age2	Age3	Age4	Age5	Age6	Age7	Age8	Age9	Age10	Age11	Age12	Age13	Age14	Age15	Age16	Age17	Age18
1977	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1978	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1979	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1980	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1981	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1982	0	301	12,883	1,385	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1983	110	10,807	4,266	5,183	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1984	0	1,070	18,321	4,267	1,585	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1985	0	881	7,054	19,572	2,549	47	0	0	0	0	0	0	0	0	0	0	0	0	0
1986	0	3,588	10,765	10,765	3,588	3,588	0	0	0	0	0	0	0	0	0	0	0	0	0
1987	0	0	15,705	7,437	4,657	632	0	0	0	0	0	0	0	0	0	0	0	0	0
1988	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1989	0	1,168	5,456	458	497	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1990	0	6,931	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1991	0	3,130	1,531	501	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1992	0	1,819	5,339	2,314	220	29	0	0	0	0	0	0	0	0	0	0	0	0	0
1993	0	3,654	9,207	2,175	422	129	351	0	146	95	0	0	0	95	32	0	0	0	0
1994	69	6,417	16,161	13,226	3,005	1,650	2,076	2,138	573	0	0	245	0	0	0	0	0	0	0
1995	406	1,983	42,355	32,723	11,912	1,283	530	350	0	0	0	0	0	0	0	0	0	0	0
1996	0	2,577	19,546	66,865	8,339	1,769	211	404	274	134	0	0	0	0	0	0	0	0	0
1997	0	821	3,970	75,257	128,867	32,670	5,881	2,145	1,776	553	50	173	0	0	0	0	0	0	0
1998	965	5,681	7,890	2,360	8,247	2,601	10	0	0	0	0	0	0	0	0	0	0	0	0
1999	95	3,127	825	632	121	174	128	41	23	12	4	0	0	0	0	0	0	0	0
2000	0	1,867	32,786	11,083	1,942	734	259	26	11	0	0	3	0	0	0	0	0	0	0
2001	0	250	4,587	10,752	1,031	209	248	126	2	0	0	0	0	0	0	0	0	0	0
2002	47	420	1,069	3,644	13,998	1,677	620	104	454	60	0	0	0	0	0	0	0	0	0
2003	0	112	1,606	2,283	3,959	11,282	1,117	180	123	57	46	4	1	0	0	0	0	0	0
2004	0	1,251	311	2,048	1,303	2,129	5,394	466	208	18	36	22	2	0	0	0	0	0	0
2005	0	193	7,692	728	5,858	4,022	4,445	6,986	591	81	10	8	1	0	0	0	0	0	0
2006	0	80	700	22,304	1,565	3,661	2,189	3,776	5,679	345	22	0	0	0	0	0	0	0	0
2007	0	7,838	15,443	7,320	37,095	455	1,380	919	1,019	2,022	37	15	0	0	0	0	0	0	0
2008	0	96	5,695	3,741	310	5,677	89	151	85	120	109	0	0	0	0	0	0	0	0
2009	0	62	396	3,720	2,895	629	4,774	100	412	22	115	281	3	3	0	0	0	0	0
2010	27	734	792	484	1,037	412	191	593	0	1	46	4	22	0	0	0	0	0	0
2011	19	3,040	4,516	1,033	82	1,003	290	41	491	1	0	13	4	5	2	0	0	0	0
2012	8	1,010	26,796	4,636	965	37	485	85	18	285	5	3	0	8	14	0	0	0	0
2013	1,175	18,376	12,217	31,242	1,521	232	17	127	42	4	36	2	1	0	1	5	0	0	0
2014	427	19,727	23,795	8,583	6,495	203	11	2	49	7	2	11	0	2	2	0	2	1	1
2015	157	2,585	82,259	14,639	3,717	2,038	4	5	0	1	0	0	1	0	0	0	0	0	0
2016	223	2,175	5,914	129,712	7,955	1,821	1,499	9	0	0	3	0	0	0	0	0	0	0	0

Table 15. Mean weights-at-age (kg) of commercially discarded Gulf of Maine haddock from 1977 to 2016.

Year	Age0	Age1	Age2	Age3	Age4	Age5	Age6	Age7	Age8	Age9	Age10	Age11	Age12	Age13	Age14	Age15	Age16	Age17	Age18
1977																			
1978																			
1979																			
1980																			
1981																			
1982		0.389	0.438	0.454															
1983	0.048	0.181	0.314	0.610															
1984		0.308	0.420	0.504	0.521														
1985		0.315	0.502	0.562	0.644	0.507													
1986		0.507	0.507	0.507	0.507	0.507													
1987			0.789	0.901	0.901	0.979													
1988																			
1989		0.240	0.713	0.799	0.911														
1990		0.295																	
1991		0.347	0.821	0.916															
1992		0.448	0.867	0.995	1.078	1.185													
1993		0.364	0.649	0.934	1.931	2.032	3.664		4.111	4.461				4.640	4.286				
1994	0.092	0.362	0.632	1.319	2.281	3.212	3.279	4.234	3.681			3.950							
1995	0.017	0.256	0.717	1.019	1.459	2.575	3.122	3.255											
1996		0.330	0.500	0.752	1.363	2.098	2.326	2.114	2.117	2.488									
1997		0.358	0.759	1.458	1.396	1.823	2.359	2.567	2.565	2.930	3.738	2.632							
1998	0.021	0.250	0.648	0.644	0.790	0.783	1.773												
1999	0.072	0.233	0.468	0.676	0.950	1.026	1.864	2.347	4.111	3.775	3.665								
2000		0.257	0.533	0.659	0.834	0.764	1.148	2.809	3.154			3.331							
2001		0.242	0.667	0.777	0.880	0.997	0.846	0.941	1.639										
2002	0.068	0.121	0.398	0.730	0.892	1.020	1.064	1.066	0.961	1.257									
2003		0.318	0.525	0.593	0.752	0.957	0.996	1.481	1.070	1.858	2.370	1.769	2.814						
2004		0.191	0.381	0.696	0.909	0.962	1.048	1.117	1.863	2.212	1.343	2.365	1.889						
2005		0.173	0.484	0.703	0.828	0.884	0.983	1.033	0.978	1.267	1.336	1.634	2.018						
2006		0.287	0.405	0.701	0.694	0.853	0.858	0.897	1.012	0.943	1.310								
2007		0.243	0.490	0.585	0.752	0.802	0.832	0.843	0.889	0.976	1.170	1.194							
2008		0.289	0.459	0.637	0.899	0.788	0.829	0.851	0.830	0.869	0.985								
2009		0.304	0.565	0.774	0.927	0.944	1.019	0.950	0.976	1.544	1.182	1.319	1.971	1.563					
2010	0.086	0.253	0.450	0.763	0.826	0.887	0.851	1.011		1.353	0.875	1.385	1.261						
2011	0.064	0.268	0.511	0.715	0.975	0.803	0.957	1.011	0.956	1.702	1.466	1.221	1.184	1.398	1.783				
2012	0.064	0.248	0.473	0.668	0.772	1.160	0.936	1.135	1.306	0.982	1.014	1.601		1.236	1.529				
2013	0.076	0.262	0.442	0.651	0.785	0.855	1.134	1.036	1.143	1.567	1.349	1.329	1.575		1.466	1.468			
2014	0.073	0.218	0.392	0.518	0.619	0.664	1.248	1.695	1.065	1.986	2.589	2.321		2.418	2.013	1.775	2.099	2.738	2.738
2015	0.069	0.180	0.362	0.526	0.579	0.678	0.964	1.050		0.994			1.061						
2016	0.084	0.164	0.332	0.486	0.591	0.612	0.721	1.010			1.178	1.303		1.303					

Table 16. Estimates of Gulf of Maine haddock recreational catch in numbers (000's) and weight (mt) from 1981 to 2016. Coefficients of variation (CVs) on the 2004-2016 harvest estimates (AB1) ranged from 0.04-0.19 and 0.07-0.42 for the releases (B2). **An assumption of 50% mortality has been applied to the releases as established in the SAW/SARC 59 assessment (NEFSC 2014) for years prior to 2004 and season and size-class specific discard mortality estimates (Mandelman et al. 2017) for 2004 to 2016.*

Year	Numbers (000s)					Biomass (mt)			
	Harvest (AB1)	Released (B2) w/ 100% discard mortality	Released (B2) w/ discard mortality*	Total catch w/ discard mortality*	Effective annual post-release mortality	Harvest (AB1)	Released (B2) w/ 100% discard mortality	Released (B2) w/ discard mortality*	Total catch w/discard mortality*
1981	19.2	0.0	0.0	19.2		38.2	0.0	0.0	38.2
1982	16.4	0.1	0.1	16.4	0.50	23.0	0.0	0.0	23.0
1983	30.5	0.0	0.0	30.5		52.7	0.0	0.0	52.7
1984	26.2	1.6	0.8	27.0	0.50	52.3	0.6	0.3	52.6
1985	16.2	0.1	0.0	16.3	0.50	21.6	0.0	0.0	21.6
1986	29.1	0.4	0.2	29.3	0.50	51.8	0.2	0.1	51.9
1987	15.7	0.0	0.0	15.7		39.2	0.0	0.0	39.2
1988	6.4	2.8	1.4	7.8	0.50	20.1	1.3	0.6	20.8
1989	5.0	4.9	2.4	7.5	0.50	13.1	2.6	1.3	14.4
1990	1.5	0.3	0.1	1.7	0.50	5.3	0.1	0.1	5.4
1991	0.2	0.0	0.0	0.2		0.3	0.0	0.0	0.3
1992	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0
1993	0.3	0.0	0.0	0.3		0.6	0.0	0.0	0.6
1994	2.0	1.6	0.8	2.8	0.50	3.3	0.9	0.4	3.7
1995	92.7	41.3	20.7	113.4	0.50	124.1	27.4	13.7	137.8
1996	3.5	8.2	4.1	7.6	0.50	5.7	6.4	3.2	8.9
1997	16.8	15.0	7.5	24.2	0.50	30.2	10.5	5.3	35.5
1998	23.6	9.1	4.5	28.1	0.50	45.6	7.0	3.5	49.1
1999	10.1	15.9	7.9	18.1	0.50	17.8	9.8	4.9	22.7
2000	67.6	96.1	48.0	115.6	0.50	128.1	60.4	30.2	158.3
2001	100.8	106.9	53.4	154.2	0.50	169.3	86.8	43.4	212.7
2002	69.7	163.6	81.8	151.5	0.50	135.3	177.3	88.7	224.0
2003	100.2	248.2	124.1	224.3	0.50	173.9	257.4	128.7	302.6
2004	199.0	80.4	51.2	250.2	0.64	307.7	69.7	43.4	351.1
2005	355.2	101.8	66.2	421.5	0.65	538.1	69.1	43.3	581.4
2006	296.8	175.1	95.2	392.0	0.54	447.6	133.9	73.7	521.3
2007	402.8	110.6	60.0	462.9	0.54	575.2	91.5	48.7	623.9
2008	342.7	178.4	88.3	431.0	0.50	537.4	144.6	71.9	609.3
2009	265.4	65.4	35.6	301.0	0.54	409.2	49.5	26.7	435.8
2010	190.3	47.0	26.0	216.3	0.55	320.4	39.0	20.1	340.5
2011	139.8	35.5	18.1	157.9	0.51	230.2	23.4	10.7	240.9
2012	167.5	189.7	118.1	285.5	0.62	249.9	106.9	66.3	316.2
2013	182.5	613.4	336.6	519.1	0.55	298.3	502.3	273.4	571.7
2014	193.8	882.5	438.4	632.2	0.50	316.9	742.0	358.8	675.7
2015	222.1	506.1	320.4	542.6	0.63	237.9	280.5	175.8	413.7
2016	516.7	1218.8	674.4	1191.1	0.55	554.1	633.2	344.9	899.0

Table 17. Number of lengths of Gulf of Maine haddock sampled from the recreational harvest (AB1) by semester and year from 1981 to 2016. Sampling intensity is expressed as metric tons of landings per 100 lengths sampled (*200 metric tons per 100 lengths is an unofficial NAFO/ICNAF standard*) and lengths per thousand fish released. In grey shaded years recreational length frequencies were supplemented using length observations from the Northeast Fisheries Science Center (NEFSC); see NEFSC (2014) for a description of the methods used to sub-sample from the survey length distributions.

Year	Semester		Total	AB1 estimated numbers (000s)	AB1 Landings (mt)	Lengths per 1000 fish	mt per 100 lengths
	1	2					
1981	0	13	13	19.2	38.2	0.7	293.9
1982	0	2	2	16.4	23.0	0.1	1,148.2
1983	4	6	10	30.5	52.7	0.3	527.4
1984	1	15	16	26.2	52.3	0.6	326.8
1985	2	5	7	16.2	21.6	0.4	308.4
1986	0	0	0	29.1	51.8	0.0	-
1987	1	5	6	15.7	39.2	0.4	652.9
1988	2	0	2	6.4	20.1	0.3	1,006.2
1989	1	2	3	5.0	13.1	0.6	436.9
1990	0	0	0	1.5	5.3	0.0	-
1991	0	0	0	0.2	0.3	0.0	-
1992	0	0	0	0.0	0.0	-	-
1993	0	0	0	0.3	0.6	0.0	-
1994	0	4	4	2.0	3.3	2.0	81.4
1995	70	83	153	92.7	124.1	1.6	81.1
1996	11	14	25	3.5	5.7	7.1	22.9
1997	6	15	21	16.8	30.2	1.3	143.9
1998	16	46	62	23.6	45.6	2.6	73.6
1999	25	7	32	10.1	17.8	3.2	55.6
2000	23	11	34	67.6	128.1	0.5	376.7
2001	15	10	25	100.8	169.3	0.2	677.4
2002	110	9	119	69.7	135.3	1.7	113.7
2003	23	187	210	100.2	173.9	2.1	82.8
2004	909	1,237	2,146	199.0	307.7	10.8	14.3
2005	1,627	1,642	3,269	355.2	538.1	9.2	16.5
2006	1,197	1,276	2,473	296.8	447.6	8.3	18.1
2007	808	1,274	2,082	402.8	575.2	5.2	27.6
2008	1,051	1,270	2,321	342.7	537.4	6.8	23.2
2009	1,034	1,332	2,366	265.4	409.2	8.9	17.3
2010	718	1,009	1,727	190.3	320.4	9.1	18.6
2011	591	893	1,484	139.8	230.2	10.6	15.5
2012	763	990	1,753	167.5	249.9	10.5	14.3
2013	571	453	1,024	182.5	298.3	5.6	29.1
2014	524	481	1,005	193.8	316.9	5.2	31.5
2015	1,003	972	1,975	222.1	237.9	8.9	12.0
2016	2,310	2,312	4,622	516.7	554.1	8.9	12.0

Table 18. Number of lengths of Gulf of Maine haddock sampled from the recreational releases (B2) by semester and year from 1981 to 2016. Length samples of recreationally discarded (i9 samples) haddock were unavailable prior to 2004. Sampling intensity is expressed as metric tons landings per 100 lengths sampled (*200 metric tons per 100 lengths is an unofficial NAFO/ICNAF standard*) and lengths per thousand fish released.

Year	Semester		Total	B2 releases (000s)	B2 releases (mt)	Lengths per thousand fish	Metric tons per 100 lengths
	1	2					
2004	50	51	101	80.4	69.7	1.3	69.0
2005	50	90	140	101.8	69.1	1.4	49.4
2006	149	79	228	175.1	133.9	1.3	58.7
2007	63	80	143	110.6	91.5	1.3	64.0
2008	69	37	106	178.4	144.6	0.6	136.4
2009	36	20	56	65.4	49.5	0.9	88.4
2010	3	11	14	47.0	39.0	0.3	278.3
2011	11	18	29	35.5	23.4	0.8	80.7
2012	103	436	539	189.7	106.9	2.8	19.8
2013	1,161	1,182	2,343	613.4	502.3	3.8	21.4
2014	760	728	1,488	882.5	742.0	1.7	49.9
2015	326	899	1,225	506.1	280.5	2.4	22.9
2016	861	1,101	1,962	1,218.8	633.2	1.6	32.3

Table 19. Total Gulf of Maine haddock recreational landings-at-age (numbers) from 1977 to 2016.

Year	Age0	Age1	Age2	Age3	Age4	Age5	Age6	Age7	Age8	Age9	Age10	Age11	Age12	Age13	Age14	Age15	Age16	Age17	Age18
1977	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1978	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1979	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1980	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1981	0	0	6,474	3,934	1,630	2,286	3,123	570	899	122	84	0	0	31	92	0	0	0	0
1982	0	0	2,454	9,499	2,497	363	426	805	116	76	94	0	16	0	5	0	0	0	0
1983	0	0	544	13,261	8,458	4,562	768	817	1,642	239	132	85	7	0	0	0	0	0	0
1984	0	0	6,301	936	8,287	2,876	4,986	591	637	1,507	0	30	19	0	0	0	0	0	0
1985	0	0	1,018	10,694	880	1,963	581	719	176	68	138	0	10	0	0	0	0	0	0
1986	0	539	0	6,263	14,207	2,418	2,461	1,644	1,367	204	0	0	0	0	0	0	0	0	0
1987	0	0	1,119	1,855	5,705	2,053	1,422	1,593	871	642	447	0	0	0	0	0	0	0	0
1988	0	0	0	266	445	2,342	1,783	97	1,305	145	0	0	0	0	0	0	0	0	0
1989	0	0	368	61	1,191	1,007	1,288	1,045	57	0	0	0	0	0	0	0	0	0	0
1990	0	0	0	576	256	128	320	256	0	0	0	0	0	0	0	0	0	0	0
1991	0	0	43	115	30	7	4	4	0	0	0	0	0	0	0	0	0	0	0
1992	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1993	0	0	43	78	59	71	35	0	0	0	0	0	0	0	0	0	0	0	0
1994	0	0	515	1,044	150	95	109	68	0	0	0	18	0	0	0	0	0	0	0
1995	0	0	13,408	48,402	29,610	718	303	303	0	0	0	0	0	0	0	0	0	0	0
1996	0	0	121	1,560	1,245	255	69	129	85	18	9	0	0	11	0	0	0	0	0
1997	0	0	202	5,490	7,938	2,012	586	279	89	114	35	10	0	0	0	0	0	0	0
1998	0	0	875	1,663	8,434	9,962	1,638	508	290	179	18	0	0	0	0	0	0	0	0
1999	0	0	0	1,484	1,576	3,072	2,461	1,173	263	85	8	0	27	0	0	0	0	0	0
2000	0	0	554	5,256	16,907	9,977	19,140	9,986	3,895	1,119	382	201	64	84	0	0	0	0	0
2001	0	0	3,395	34,438	21,048	13,816	10,855	8,892	5,101	2,026	916	191	0	0	0	94	0	0	0
2002	0	0	0	344	22,898	12,712	13,956	3,854	7,722	6,162	1,471	558	0	0	23	0	0	0	0
2003	0	0	18	352	4,326	64,000	12,713	7,466	2,564	4,205	3,682	516	273	133	0	0	0	0	0
2004	0	225	0	1,571	11,982	21,188	129,640	16,816	8,337	2,016	3,980	2,534	659	13	0	0	0	0	0
2005	0	0	1,651	1,882	21,587	34,874	59,627	203,309	15,696	9,322	2,129	3,263	1,643	200	47	0	0	0	0
2006	0	0	42	30,829	1,226	24,054	33,003	38,427	149,428	12,724	3,900	608	1,548	795	202	27	0	0	0
2007	0	0	561	3,136	160,876	5,440	24,998	20,516	38,282	134,916	9,284	3,529	187	568	487	27	0	0	0
2008	0	0	762	14,013	7,219	166,904	1,615	19,398	15,881	21,666	87,914	4,119	3,196	52	0	0	0	0	0
2009	0	0	624	12,316	27,874	8,186	141,509	2,557	13,219	5,016	9,505	41,980	1,087	1,374	156	15	0	0	0
2010	0	0	246	1,655	14,056	20,352	7,616	101,604	1,137	5,173	4,266	4,999	27,753	1,156	202	44	0	28	0
2011	0	0	2,546	2,000	2,550	22,106	19,640	4,749	57,972	719	4,242	3,987	2,971	15,579	553	131	21	11	26
2012	0	7	7,861	25,290	10,322	6,156	32,166	14,502	5,401	49,264	422	2,931	1,825	2,684	8,341	188	75	33	5
2013	0	11	1,342	42,145	21,336	10,598	5,066	30,714	16,109	4,744	36,235	1,161	2,358	980	2,329	6,903	317	96	36
2014	0	828	2,943	5,225	110,669	15,903	6,409	2,982	16,958	7,520	2,678	15,985	179	1,318	457	703	2,707	237	75
2015	0	180	14,015	75,122	27,102	96,343	3,740	1,681	219	1,541	578	98	1,292	13	19	16	72	112	0
2016	73	73	411	176,584	135,513	41,898	154,388	3,142	947	475	1,123	755	136	1,086	0	0	28	18	59

Table 20. Mean weights-at-age (kg) of recreationally landed Gulf of Maine haddock from 1977 to 2016.

Year	Age0	Age1	Age2	Age3	Age4	Age5	Age6	Age7	Age8	Age9	Age10	Age11	Age12	Age13	Age14	Age15	Age16	Age17	Age18
1977																			
1978																			
1979																			
1980																			
1981			0.747	1.424	1.943	2.771	3.346	3.729	4.647	3.299	7.943			3.950	3.479				
1982			0.836	1.144	1.691	2.559	2.728	3.143	3.289	4.701	4.040		4.310		2.654				
1983			0.725	1.109	1.619	2.136	3.034	3.803	4.138	4.186	4.630	4.074	2.782						
1984			0.662	1.141	1.638	2.344	3.204	3.415	4.182	3.903		4.825	2.531						
1985			0.855	0.971	1.396	1.824	2.366	3.479	4.171	4.730	3.960		5.014						
1986		0.507		1.287	1.514	2.141	2.379	3.126	3.647	3.998									
1987			0.951	1.447	1.978	2.353	2.624	3.344	4.108	5.329	7.276								
1988				1.442	1.875	2.633	2.735	4.115	5.141	5.208									
1989			1.238	1.994	1.889	2.788	2.845	3.476	3.048										
1990				2.097		1.773	2.654	4.697	6.945										
1991			1.081	1.178	2.099	2.296	2.296												
1992																			
1993			1.085	1.398	1.960	2.689	2.808												
1994			1.147	1.485	1.971	2.835	2.720	2.977				2.913							
1995			1.281	1.203	1.543	2.115	2.654	2.184											
1996			1.313	1.366	1.705	1.915	2.725	2.502	2.237	3.418	3.479			2.782					
1997			1.211	1.740	1.556	2.271	2.864	3.267	3.601	3.735	3.632	2.531							
1998			1.401	1.591	1.819	1.919	2.431	3.989	2.857	2.291	2.913								
1999				1.353	1.602	1.673	1.911	2.081	2.454	2.573	3.188		2.913						
2000			1.269	1.302	1.627	1.857	1.990	2.193	2.413	2.282	3.671	2.866	3.582	4.115					
2001			1.131	1.294	1.433	1.798	2.225	2.205	2.594	2.444	3.521	2.371				3.479			
2002				1.534	1.604	1.806	2.136	2.478	2.125	2.325	2.358	2.586			3.188				
2003			0.916	1.359	1.559	1.631	1.815	1.970	2.137	2.139	2.216	1.872	2.396	1.971					
2004		0.121		0.972	1.384	1.382	1.537	1.665	1.794	1.899	1.850	2.134	2.101	3.331					
2005			0.720	1.040	1.195	1.438	1.394	1.545	1.770	1.849	2.499	2.107	2.460	2.307	2.531				
2006			0.595	1.084	1.200	1.411	1.555	1.446	1.578	1.749	1.911	2.233	1.912	1.923	2.238	2.654			
2007			0.685	1.049	1.196	1.205	1.467	1.613	1.497	1.629	1.781	1.810	2.736	1.983	2.207	3.048			
2008			0.827	1.129	1.274	1.438	1.682	1.762	1.747	1.633	1.784	2.104	1.898	3.051					
2009			0.675	0.953	1.164	1.285	1.550	1.473	1.782	1.927	1.719	1.820	2.172	1.610	2.544	2.782			
2010			1.113	0.845	1.144	1.412	1.524	1.709	2.084	2.028	2.081	1.918	1.953	2.178	2.255	2.531		3.788	
2011			0.803	1.093	1.181	1.342	1.487	1.639	1.748	1.795	1.938	1.836	1.803	2.003	1.939	2.441	2.654	2.913	2.412
2012		0.393	0.855	1.075	1.162	1.344	1.362	1.620	1.650	1.770	2.332	1.957	1.988	1.755	1.972	2.671	2.724	3.331	2.913
2013		0.507	0.868	1.051	1.413	1.587	1.688	1.748	1.910	1.917	2.031	1.930	2.159	2.220	2.047	2.145	2.241	2.647	2.654
2014		0.317	0.683	1.248	1.484	1.733	1.778	1.896	1.916	2.098	2.027	2.088	2.374	2.084	2.079	2.268	2.130	2.408	2.605
2015		0.115	0.750	0.923	1.012	1.192	1.548	1.429	1.839	1.878	1.863	2.151	1.917	2.654	2.695	2.609	1.816	2.798	
2016	0.058	0.058	0.839	0.854	1.046	1.151	1.290	1.579	1.844	1.773	1.880	1.702	2.561	2.062			2.938	2.076	2.734

Table 21. Total Gulf of Maine haddock recreational discards-at-age (numbers) from 1977 to 2016. *These estimates include an assumption of 50% mortality has been applied to the releases as established in the SAW/SARC 59 assessment (NEFSC 2014) for years prior to 2004 and season and size-class specific discard mortality estimates (Mandelman et al. 2017) for 2004 to 2016.*

Year	Age0	Age1	Age2	Age3	Age4	Age5	Age6	Age7	Age8	Age9	Age10	Age11	Age12	Age13	Age14	Age15	Age16	Age17	Age18
1977	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1978	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1979	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1980	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1981	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1982	0	20	24	14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1983	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1984	0	132	623	48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1985	0	8	19	17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1986	0	151	54	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1987	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1988	0	305	471	637	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1989	0	222	1,826	315	80	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1990	0	76	15	41	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1991	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1992	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1994	0	38	731	50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1995	0	739	15,505	4,430	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1996	0	212	588	3,290	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1997	0	852	883	3,550	2,199	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1998	0	152	3,357	68	782	185	0	0	0	0	0	0	0	0	0	0	0	0	0
1999	0	2,198	2,963	1,447	477	339	341	165	0	0	0	0	0	0	0	0	0	0	0
2000	0	488	31,429	13,712	1,932	213	274	0	0	0	0	0	0	0	0	0	0	0	0
2001	0	0	12,866	33,558	4,495	935	1,090	483	0	0	0	0	0	0	0	0	0	0	0
2002	0	0	1,303	11,082	52,593	10,686	3,328	127	1,516	1,043	108	0	0	0	0	0	0	0	0
2003	0	0	9,192	1,671	15,388	86,835	7,525	2,077	814	580	0	0	0	0	0	0	0	0	0
2004	0	887	3,548	13,017	889	7,790	23,939	682	301	94	85	2	0	0	0	0	0	0	0
2005	0	0	40,990	4,592	4,240	3,724	4,732	7,915	32	4	0	0	0	0	0	0	0	0	0
2006	0	1,226	1,516	68,584	3,959	5,321	465	1,630	12,361	123	18	4	16	3	0	0	0	0	0
2007	0	0	9,762	5,984	38,235	69	1,613	127	699	3,521	17	13	0	4	0	0	0	0	0
2008	480	0	9,853	14,533	2,796	51,052	1,440	3,758	30	913	3,442	3	1	0	0	0	0	0	0
2009	0	0	2,717	23,467	5,592	880	2,317	45	48	0	138	390	0	14	0	0	0	0	0
2010	0	1,868	5,667	11,263	2,940	2,102	462	1,284	0	18	0	72	346	0	0	0	0	0	0
2011	0	3,369	12,771	59	108	1,217	131	91	268	1	13	30	0	62	0	0	0	0	0
2012	82	1,899	94,299	14,085	4,352	86	1,729	137	51	1,259	7	9	11	9	38	0	0	0	0
2013	0	8,013	34,933	243,788	24,482	8,593	1,857	7,431	3,317	351	3,363	165	4	83	12	225	1	0	0
2014	0	19,882	89,670	70,473	243,854	6,911	2,437	153	2,859	529	391	715	6	40	198	20	233	2	2
2015	79	2,467	196,829	79,463	17,726	22,483	350	236	13	165	66	6	523	0	0	0	6	2	0
2016	124	4,511	24,047	599,682	37,448	3,440	5,014	47	30	4	12	21	7	28	0	0	0	0	7

Table 22. Mean weights-at-age (kg) of recreationally discarded Gulf of Maine haddock from 1981 to 2016.

Year	Age0	Age1	Age2	Age3	Age4	Age5	Age6	Age7	Age8	Age9	Age10	Age11	Age12	Age13	Age14	Age15	Age16	Age17	Age18
1977																			
1978																			
1979																			
1980																			
1981																			
1982		0.357	0.428	0.429															
1983																			
1984		0.350	0.412	0.429															
1985		0.347	0.379	0.455															
1986		0.380	0.467																
1987																			
1988		0.331	0.412	0.540															
1989		0.307	0.520	0.741	0.865														
1990		0.403	0.621	0.765															
1991																			
1992																			
1993																			
1994		0.288	0.528	0.916															
1995		0.327	0.620	0.869															
1996		0.418	0.650	0.831															
1997		0.350	0.499	0.720	0.890														
1998		0.269	0.766	0.979	0.836	0.927													
1999		0.313	0.651	0.767	0.899	0.891	0.861	0.799											
2000		0.272	0.591	0.680	0.893	0.943	0.951												
2001			0.726	0.829	0.901	0.937	0.812	0.856											
2002			0.535	0.873	1.085	1.206	1.371	1.490	1.301	1.425	1.531								
2003			0.592	0.964	1.005	1.085	1.062	1.173	0.972	1.226									
2004		0.196	0.595	0.754	1.093	0.888	0.949	1.096	1.106	1.135	1.074	1.259							
2005			0.561	0.572	0.844	0.856	0.907	0.912	1.557	1.589									
2006		0.233	0.449	0.738	0.644	0.868	1.305	1.060	0.961	1.458	1.639	1.872	1.693	1.773					
2007			0.671	0.768	0.846	1.016	0.879	1.183	1.080	0.994	1.360	1.407		1.502					
2008	0.027		0.523	0.749	0.924	0.872	0.846	0.902	1.485	1.071	1.068	1.658	1.972						
2009			0.726	0.698	0.776	0.872	1.095	1.387	1.360		1.244	1.278		1.418					
2010		0.393	0.557	0.759	0.991	1.002	1.050	1.332		1.589		1.589	1.370						
2011		0.410	0.567	1.017	1.061	0.940	1.444	1.194	1.631	2.076	1.776		1.965						
2012	0.085	0.258	0.522	0.667	0.747	1.185	0.900	1.275	2.204	1.177	3.439	2.296	3.303	2.021	3.081				
2013		0.342	0.585	0.805	1.027	0.991	1.165	1.125	1.145	1.178	1.868	1.204	1.711	1.263	1.519	1.282	1.972		
2014		0.348	0.603	0.743	0.958	1.147	1.122	1.678	1.235	1.454	1.302	1.654	2.155	1.918	1.259	2.234	1.378	2.531	2.531
2015	0.076	0.186	0.435	0.659	0.736	0.975	1.398	1.193	1.566	1.436	1.280	1.860	3.934				1.589	2.076	
2016	0.105	0.197	0.363	0.508	0.656	0.835	1.110	1.566	2.023	1.594	1.939	1.707	2.654	1.861					2.654

Table 23. Total catch-at-age (numbers) of Gulf of Maine haddock from 1977 to 2016 with an age 9⁺ group. *Only ages 1 through the 9⁺ group are used as assessment model inputs.*

Year	Age0	Age1	Age2	Age3	Age4	Age5	Age6	Age7	Age8	Age9+
1977	0	39,755	1,762,962	53,167	366,967	184,629	189,299	0	0	2,411
1978	0	0	374,650	2,291,417	172,388	363,003	208,654	10,580	0	5,290
1979	0	0	67,315	559,608	1,576,962	183,133	99,093	45,294	10,898	0
1980	0	0	884,750	104,084	755,832	1,366,770	143,816	95,570	27,794	25,756
1981	0	2,068	1,604,702	721,620	293,675	342,978	545,064	92,209	117,389	27,084
1982	0	30,427	620,596	1,519,414	620,677	100,582	300,972	477,524	107,352	75,881
1983	110	10,807	12,387	836,523	976,308	791,273	148,624	252,954	348,053	115,652
1984	0	1,202	88,981	49,873	597,996	256,658	364,974	62,198	64,813	147,568
1985	0	889	30,219	349,627	85,945	356,193	152,044	242,038	47,396	54,557
1986	0	4,278	10,819	183,531	358,782	81,336	114,028	86,352	102,482	14,690
1987	0	0	20,569	34,669	106,129	48,809	34,435	56,925	33,835	16,451
1988	0	305	471	12,442	12,340	54,752	55,564	7,635	15,049	4,149
1989	0	1,390	23,187	3,477	42,428	19,308	23,964	15,004	764	943
1990	0	7,007	2,033	143,062	1,686	28,820	17,607	27,466	4,050	0
1991	0	3,130	7,153	16,338	58,599	28,398	27,861	12,632	5,811	3,140
1992	0	1,819	13,092	94,371	36,543	19,112	2,246	1,134	0	1,895
1993	0	3,654	20,094	36,293	22,965	9,918	10,957	4,586	1,713	1,158
1994	69	6,455	23,681	44,531	13,600	3,419	9,230	5,675	1,711	705
1995	406	2,722	71,268	90,548	75,684	10,164	6,273	4,656	4,345	3,038
1996	0	2,789	23,528	129,505	56,458	16,363	4,055	7,112	5,599	1,162
1997	0	1,673	7,336	166,754	256,770	90,137	18,896	6,878	2,788	2,280
1998	965	5,833	23,752	25,097	132,738	192,766	52,737	17,433	8,611	7,557
1999	95	5,325	3,788	39,470	65,848	96,775	69,185	38,452	7,149	5,879
2000	0	2,355	68,641	66,083	106,777	65,090	128,456	72,058	31,811	25,699
2001	0	250	29,532	235,124	133,562	96,770	87,348	80,744	40,447	24,091
2002	47	420	2,372	27,821	275,333	117,143	110,413	32,129	70,430	68,048
2003	0	112	10,816	6,947	54,106	506,905	90,486	62,967	21,551	70,262
2004	0	2,363	3,859	18,483	33,051	73,723	516,627	59,081	33,670	50,559
2005	0	193	50,333	8,331	49,536	84,923	138,089	534,459	53,672	71,790
2006	0	1,306	2,258	129,816	7,044	53,623	71,685	83,741	369,664	61,059
2007	0	7,838	25,916	17,972	334,584	11,381	54,565	43,318	87,784	372,151
2008	480	96	17,015	53,763	19,427	411,176	4,937	42,510	29,662	224,922
2009	0	62	3,737	41,687	51,619	15,082	294,964	5,347	32,043	147,169
2010	27	2,602	7,281	15,002	38,450	51,584	18,888	294,987	3,552	135,999
2011	19	6,409	19,978	4,566	4,733	50,888	47,085	16,214	180,773	93,356
2012	90	2,916	129,156	52,059	21,037	12,326	67,635	37,842	13,806	203,857
2013	1,175	26,400	49,884	355,091	63,241	26,765	10,637	57,920	30,708	97,859
2014	427	40,437	135,714	109,026	528,049	34,887	13,385	5,069	30,543	54,206
2015	236	5,232	322,923	339,022	112,835	350,122	21,223	10,600	1,590	21,565
2016	420	6,759	30,697	1,333,646	452,366	125,699	530,260	14,394	4,062	20,118

Table 24. Mean weights-at-age (kg) of the total catch Gulf of Maine haddock from 1977 to 2016 an age 9⁺ group. Mean catch weights-at-age in the 9⁺ group were estimated using a numbers weighted approach. Cells shaded blue were imputed with a time series average. Cell shaded grey were imputed using a 5-year centered moving average. *Only ages 1 through the 9⁺ group are used as assessment model inputs.*

Year	Age0	Age1	Age2	Age3	Age4	Age5	Age6	Age7	Age8	Age9+
1977	0.063	0.113	0.757	1.163	2.008	2.558	3.358	3.709	3.587	4.686
1978	0.063	0.113	0.777	1.234	1.684	2.438	3.108	4.642	4.075	6.088
1979	0.063	0.337	0.774	1.155	1.805	2.261	2.659	2.775	3.587	4.724
1980	0.063	0.468	0.760	1.168	1.852	2.389	3.354	3.602	4.562	4.204
1981	0.063	0.560	0.685	1.516	1.978	2.641	3.026	3.657	4.184	3.917
1982	0.063	0.376	0.620	0.995	2.137	2.598	3.106	3.646	4.129	4.293
1983	0.048	0.181	0.667	1.200	1.727	2.376	2.969	3.373	3.719	4.215
1984	0.063	0.313	0.816	1.233	1.803	2.324	3.166	3.923	4.502	4.073
1985	0.063	0.315	0.980	1.068	1.859	2.339	2.652	3.588	4.090	4.153
1986	0.063	0.503	0.507	1.192	1.456	2.265	2.495	3.062	3.636	4.592
1987	0.063	0.350	0.856	1.592	2.008	2.402	2.609	3.272	4.236	5.279
1988	0.063	0.331	0.412	1.100	1.623	2.561	2.582	3.871	4.652	5.180
1989	0.063	0.251	1.126	1.779	1.824	2.343	2.864	3.543	4.545	4.244
1990	0.063	0.296	0.831	1.543	3.331	2.450	3.041	3.745	3.762	4.189
1991	0.063	0.347	1.459	1.880	2.657	3.027	2.958	3.350	4.433	3.881
1992	0.063	0.448	1.192	1.764	1.973	2.654	3.067	2.079	3.757	3.450
1993	0.063	0.364	0.885	1.592	2.041	2.436	3.035	3.393	3.422	3.657
1994	0.092	0.362	0.787	1.589	2.186	3.062	2.788	3.620	3.410	3.721
1995	0.017	0.275	0.802	1.156	1.774	2.525	3.526	4.133	5.209	5.665
1996	0.063	0.337	0.674	1.073	1.803	2.196	3.148	2.473	2.387	3.164
1997	0.063	0.354	0.891	1.802	1.662	2.330	2.977	2.985	3.063	3.607
1998	0.021	0.250	0.975	1.448	1.827	2.212	2.843	3.376	3.152	2.988
1999	0.072	0.266	0.611	1.309	1.608	1.765	1.926	2.281	3.033	3.295
2000	0.063	0.260	0.607	1.022	1.535	1.773	2.013	2.390	2.696	3.101
2001	0.063	0.242	0.889	1.260	1.490	1.811	2.210	2.243	2.483	2.532
2002	0.068	0.121	0.473	1.025	1.340	1.631	2.143	2.598	2.303	2.644
2003	0.063	0.318	0.583	0.887	1.230	1.468	1.770	2.134	2.425	2.513
2004	0.063	0.186	0.577	0.792	1.370	1.343	1.668	1.815	2.021	2.205
2005	0.063	0.173	0.549	0.752	1.135	1.462	1.444	1.685	1.954	2.296
2006	0.063	0.249	0.433	0.845	0.797	1.350	1.644	1.505	1.677	2.008
2007	0.063	0.243	0.567	0.776	1.117	1.204	1.509	1.629	1.581	1.717
2008	0.027	0.289	0.550	1.011	1.199	1.336	1.353	1.694	1.755	1.757
2009	0.063	0.304	0.700	0.801	1.131	1.282	1.626	1.563	1.877	1.947
2010	0.086	0.353	0.603	0.781	1.130	1.414	1.577	1.740	2.132	2.073
2011	0.064	0.341	0.589	1.030	1.188	1.399	1.603	1.806	1.919	2.119
2012	0.083	0.249	0.538	0.939	1.090	1.406	1.446	1.739	1.810	1.975
2013	0.076	0.283	0.563	0.845	1.215	1.353	1.573	1.654	1.818	2.034
2014	0.073	0.283	0.591	0.763	1.106	1.557	1.616	1.878	1.816	2.063
2015	0.070	0.182	0.458	0.842	1.009	1.298	1.697	1.591	2.022	2.174
2016	0.086	0.181	0.365	0.650	1.040	1.197	1.393	1.738	2.010	2.010
2012-2016 average		0.236	0.503	0.808	1.092	1.362	1.545	1.720	1.895	2.051
2012-2016 stddev		0.051	0.092	0.108	0.079	0.134	0.124	0.108	0.110	0.076
2012-2016 CV		0.218	0.182	0.133	0.072	0.098	0.080	0.063	0.058	0.037

Table 25. January 1/SSB weights-at-age (kg) of Gulf of Maine haddock from 1977 to 2016 an age 9⁺ group. Weights were estimated from catch weights using Rivard-type approach (see NEFSC 2014) approach. Cells shaded blue were imputed with a time series average. *Only ages 1 through the 9⁺ group are used as assessment model inputs.*

Year	Age0	Age1	Age2	Age3	Age4	Age5	Age6	Age7	Age8	Age9+
1977	0.047	0.043	0.593	0.967	1.822	2.321	2.856	3.539	3.648	4.686
1978	0.027	0.084	0.296	0.967	1.400	2.213	2.820	3.948	3.888	6.088
1979	0.023	0.146	0.296	0.947	1.492	1.951	2.546	2.937	4.081	4.724
1980	0.021	0.172	0.506	0.951	1.463	2.077	2.754	3.095	3.558	4.204
1981	0.026	0.188	0.566	1.073	1.520	2.212	2.689	3.502	3.882	3.917
1982	0.037	0.154	0.589	0.826	1.800	2.267	2.864	3.322	3.886	4.293
1983	0.019	0.107	0.501	0.863	1.311	2.253	2.777	3.237	3.682	4.215
1984	0.028	0.123	0.384	0.907	1.471	2.003	2.743	3.413	3.897	4.073
1985	0.022	0.141	0.557	0.932	1.513	2.054	2.483	3.370	4.006	4.153
1986	0.027	0.177	0.400	1.081	1.247	2.052	2.416	2.850	3.612	4.592
1987	0.028	0.149	0.653	0.898	1.547	1.870	2.431	2.857	3.602	5.279
1988	0.031	0.144	0.380	0.958	1.607	2.268	2.490	3.178	3.902	5.180
1989	0.029	0.128	0.598	0.835	1.398	1.950	2.708	3.025	4.195	4.244
1990	0.027	0.137	0.464	1.292	2.375	2.113	2.669	3.275	3.651	4.189
1991	0.024	0.148	0.658	1.249	2.025	3.175	2.692	3.192	4.075	3.881
1992	0.026	0.168	0.643	1.604	1.926	2.656	3.047	2.480	3.548	3.450
1993	0.026	0.151	0.630	1.378	1.898	2.192	2.838	3.226	2.667	3.657
1994	0.052	0.151	0.533	1.186	1.866	2.500	2.606	3.315	3.402	3.721
1995	0.004	0.162	0.527	0.944	1.678	2.349	3.286	3.395	4.342	5.665
1996	0.027	0.076	0.439	0.906	1.436	1.974	2.819	2.953	3.141	3.164
1997	0.032	0.149	0.539	1.095	1.329	2.050	2.557	3.065	2.752	3.607
1998	0.006	0.126	0.579	1.108	1.800	1.914	2.574	3.170	3.067	2.988
1999	0.038	0.077	0.397	1.106	1.523	1.792	2.061	2.543	3.200	3.295
2000	0.032	0.137	0.411	0.778	1.402	1.685	1.882	2.143	2.477	3.101
2001	0.046	0.124	0.469	0.852	1.190	1.657	1.971	2.120	2.436	2.532
2002	0.031	0.087	0.346	0.908	1.252	1.532	1.955	2.385	2.258	2.624
2003	0.037	0.147	0.267	0.668	1.076	1.354	1.654	2.112	2.480	2.502
2004	0.038	0.109	0.430	0.678	1.110	1.247	1.526	1.760	2.058	2.200
2005	0.033	0.104	0.322	0.649	0.937	1.404	1.372	1.662	1.879	2.296
2006	0.032	0.122	0.277	0.671	0.724	1.215	1.539	1.464	1.669	2.006
2007	0.029	0.124	0.372	0.585	0.941	0.933	1.404	1.634	1.537	1.710
2008	0.008	0.135	0.359	0.745	0.953	1.189	1.215	1.565	1.690	1.744
2009	0.026	0.091	0.453	0.639	1.020	1.216	1.446	1.386	1.753	1.945
2010	0.042	0.151	0.426	0.741	0.928	1.240	1.400	1.678	1.825	2.070
2011	0.032	0.177	0.458	0.784	0.957	1.247	1.495	1.671	1.825	2.118
2012	0.044	0.128	0.440	0.724	1.043	1.289	1.413	1.669	1.807	1.975
2013	0.038	0.157	0.383	0.662	1.029	1.162	1.457	1.518	1.749	2.033
2014	0.046	0.152	0.420	0.659	0.938	1.318	1.399	1.679	1.675	2.027
2015	0.045	0.115	0.370	0.700	0.866	1.169	1.584	1.558	1.939	2.216
2016	0.068	0.116	0.258	0.527	0.912	1.082	1.337	1.715	1.784	2.008
2012-2016 average		0.134	0.374	0.654	0.958	1.204	1.438	1.628	1.791	2.052
2012-2016 stddev		0.020	0.071	0.076	0.076	0.097	0.092	0.085	0.097	0.095
2012-2016 CV		0.146	0.190	0.117	0.079	0.081	0.064	0.052	0.054	0.046

Table 26. Northeast Fisheries Science Center (NEFSC) spring and fall bottom trawl survey indices for Gulf of Maine haddock from 1963 to 2017. *Note: the NEFSC spring survey did not begin until 1968 and the 2017 fall survey has not been conducted at the time of this report.*

Year	Spring		Fall	
	Mean number/tow	Mean weight (kg)/tow	Mean number/tow	Mean weight (kg)/tow
1963			69.549	50.697
1964			14.176	18.386
1965			17.459	17.787
1966			10.742	13.103
1967			12.186	16.871
1968	6.066	8.107	8.564	17.307
1969	3.719	6.607	5.451	12.721
1970	0.906	1.784	2.918	7.354
1971	0.878	2.523	2.880	8.159
1972	0.862	0.867	1.984	3.036
1973	1.312	1.598	4.165	8.583
1974	1.437	1.059	2.687	3.347
1975	2.770	3.482	5.533	8.616
1976	8.326	6.350	6.035	8.040
1977	6.799	6.725	8.296	8.752
1978	1.356	1.434	9.775	21.658
1979	2.870	3.878	6.174	15.567
1980	2.212	2.673	7.152	9.835
1981	3.613	3.545	4.456	10.874
1982	2.047	2.555	2.627	4.164
1983	3.678	3.567	2.598	5.219
1984	1.095	1.144	1.697	3.893
1985	1.773	1.882	4.079	6.149
1986	0.707	1.284	0.623	1.392
1987	0.092	0.063	1.035	2.645
1988	0.187	0.301	0.335	1.476
1989	0.083	0.125	0.283	0.631
1990	0.024	0.000	0.145	0.432
1991	0.074	0.066	0.142	0.120
1992	0.193	0.271	0.211	0.091
1993	0.450	0.200	0.866	0.472
1994	0.402	0.253	0.325	0.217
1995	0.806	0.350	0.977	1.099
1996	0.305	0.338	2.407	3.543
1997	1.935	1.222	2.688	2.424
1998	0.197	0.112	3.130	2.917
1999	4.267	1.108	6.730	4.910
2000	3.610	1.815	16.589	14.032
2001	2.364	3.205	9.960	11.981
2002	5.704	2.793	3.920	4.835
2003	3.191	3.908	4.733	5.359
2004	1.061	1.199	5.704	7.171
2005	0.862	0.971	4.132	3.932
2006	3.151	2.661	3.910	3.945
2007	0.771	0.675	5.153	4.393
2008	1.689	1.394	2.266	3.147
2009	1.531	2.573	2.017	1.203
2010	1.630	3.713	2.662	1.339
2011	1.233	1.259	4.898	4.145
2012	2.978	2.926	5.397	2.880
2013	12.380	6.221	36.088	12.571
2014	11.048	8.646	51.819	37.651
2015	86.123	90.342	64.372	35.659
2016	53.879	55.042	81.434	54.222
2017	45.697	47.302		

Table 27. Coefficients of variation (CV) for the Northeast Fisheries Science Center (NEFSC) spring and fall bottom trawl survey indices for Gulf of Maine haddock from 1963 to 2017. *Note: the NEFSC spring survey did not begin until 1968 and the 2017 fall survey has not been conducted at the time of this report.*

Year	Spring		Fall	
	Mean number/tow	Mean weight (kg)/tow	Mean number/tow	Mean weight (kg)/tow
1963			0.26	0.15
1964			0.33	0.17
1965			0.31	0.20
1966			0.32	0.27
1967			0.22	0.23
1968	0.28	0.24	0.15	0.15
1969	0.19	0.20	0.22	0.22
1970	0.23	0.24	0.22	0.21
1971	0.45	0.43	0.31	0.32
1972	0.34	0.55	0.23	0.34
1973	0.24	0.36	0.20	0.31
1974	0.38	0.42	0.55	0.32
1975	0.28	0.44	0.25	0.30
1976	0.35	0.34	0.23	0.27
1977	0.31	0.38	0.32	0.28
1978	0.41	0.28	0.18	0.19
1979	0.22	0.22	0.20	0.22
1980	0.38	0.42	0.34	0.23
1981	0.24	0.22	0.18	0.23
1982	0.31	0.33	0.34	0.28
1983	0.39	0.41	0.27	0.27
1984	0.40	0.41	0.27	0.27
1985	0.38	0.30	0.39	0.29
1986	0.44	0.47	0.41	0.38
1987	0.35	0.47	0.32	0.27
1988	0.52	0.60	0.62	0.69
1989	0.71	0.79	0.40	0.50
1990	0.54		0.38	0.35
1991	0.52	0.60	0.57	0.71
1992	0.62	0.95	0.53	0.60
1993	0.46	0.71	0.72	0.85
1994	0.34	0.38	0.42	0.88
1995	0.46	0.45	0.52	0.39
1996	0.32	0.36	0.38	0.44
1997	0.40	0.51	0.36	0.28
1998	0.41	0.45	0.49	0.41
1999	0.39	0.35	0.29	0.25
2000	0.39	0.39	0.46	0.40
2001	0.59	0.65	0.27	0.26
2002	0.51	0.32	0.34	0.32
2003	0.24	0.28	0.22	0.23
2004	0.32	0.38	0.26	0.29
2005	0.40	0.47	0.19	0.16
2006	0.44	0.42	0.25	0.21
2007	0.37	0.35	0.30	0.25
2008	0.48	0.32	0.31	0.29
2009	0.37	0.37	0.36	0.27
2010	0.36	0.40	0.47	0.60
2011	0.35	0.38	0.46	0.41
2012	0.38	0.41	0.57	0.70
2013	0.45	0.33	0.24	0.38
2014	0.19	0.21	0.38	0.53
2015	0.58	0.67	0.21	0.20
2016	0.20	0.23	0.18	0.19
2017	0.29	0.29		
Average	0.38	0.41	0.34	0.34

Table 28. Northeast Fisheries Science Center (NEFSC) Gulf of Maine haddock spring survey abundance indices-at-age (numbers/tow) from 1968 to 2017.

Year	Age0	Age1	Age2	Age3	Age4	Age5	Age6	Age7	Age8	Age9	Age10	Age11	Age12	Age13	Age14	Age15	Age16	Age17	Age18
1968	0.000	0.000	0.000	0.047	0.241	4.342	0.954	0.126	0.216	0.079	0.000	0.061	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1969	0.000	0.000	0.000	0.054	0.020	0.250	2.635	0.686	0.038	0.037	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1970	0.000	0.000	0.000	0.000	0.000	0.000	0.141	0.640	0.105	0.020	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1971	0.000	0.000	0.000	0.000	0.000	0.000	0.029	0.029	0.629	0.097	0.094	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1972	0.000	0.584	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.174	0.062	0.018	0.025	0.000	0.000	0.000	0.000	0.000	0.000
1973	0.000	0.130	0.812	0.000	0.000	0.000	0.000	0.000	0.000	0.036	0.314	0.020	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1974	0.000	0.900	0.088	0.333	0.000	0.000	0.000	0.000	0.018	0.016	0.000	0.083	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1975	0.000	0.000	1.993	0.150	0.408	0.000	0.008	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.211	0.000	0.000	0.000	0.000
1976	0.000	5.113	0.139	1.734	0.140	0.946	0.059	0.055	0.000	0.000	0.000	0.000	0.000	0.125	0.000	0.000	0.000	0.000	0.015
1977	0.000	1.048	3.387	0.034	1.372	0.401	0.557	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1978	0.000	0.085	0.685	0.352	0.031	0.204	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1979	0.000	0.000	0.000	1.167	1.259	0.248	0.195	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1980	0.000	1.054	0.148	0.183	0.547	0.219	0.062	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1981	0.000	1.109	1.100	0.577	0.256	0.328	0.132	0.028	0.039	0.045	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1982	0.000	0.000	0.481	0.872	0.449	0.051	0.195	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1983	0.086	1.386	0.123	1.164	0.392	0.343	0.000	0.158	0.000	0.000	0.000	0.027	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1984	0.000	0.019	0.557	0.068	0.299	0.108	0.000	0.000	0.045	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1985	0.000	0.000	0.333	1.078	0.057	0.185	0.051	0.050	0.020	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1986	0.000	0.051	0.000	0.152	0.372	0.000	0.036	0.073	0.023	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1987	0.000	0.036	0.028	0.028	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1988	0.000	0.043	0.000	0.000	0.023	0.122	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1989	0.000	0.000	0.036	0.012	0.000	0.024	0.012	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1990	0.012	0.012	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1991	0.000	0.014	0.030	0.030	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1992	0.000	0.085	0.000	0.000	0.109	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1993	0.000	0.261	0.147	0.000	0.000	0.029	0.015	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1994	0.000	0.074	0.182	0.112	0.034	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1995	0.000	0.441	0.240	0.079	0.023	0.000	0.000	0.000	0.023	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1996	0.000	0.037	0.146	0.123	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1997	0.000	0.775	0.210	0.257	0.602	0.070	0.022	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1998	0.000	0.080	0.046	0.000	0.062	0.009	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1999	0.000	3.724	0.087	0.160	0.029	0.225	0.044	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2000	0.000	1.032	1.171	0.973	0.145	0.098	0.051	0.140	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2001	0.000	0.073	0.126	1.093	0.492	0.174	0.193	0.072	0.043	0.098	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2002	0.000	3.299	0.206	0.600	1.416	0.098	0.027	0.022	0.036	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2003	0.000	0.359	0.208	0.091	0.108	2.017	0.203	0.121	0.036	0.037	0.012	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2004	0.000	0.115	0.000	0.154	0.022	0.095	0.625	0.036	0.000	0.015	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2005	0.000	0.010	0.172	0.000	0.099	0.081	0.219	0.253	0.000	0.029	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2006	0.000	0.179	0.076	1.651	0.318	0.104	0.019	0.201	0.545	0.058	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2007	0.000	0.156	0.085	0.028	0.239	0.000	0.030	0.029	0.029	0.162	0.000	0.015	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2008	0.000	0.044	0.566	0.405	0.000	0.303	0.000	0.027	0.052	0.097	0.197	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2009	0.000	0.032	0.089	0.421	0.219	0.040	0.548	0.000	0.014	0.017	0.037	0.106	0.009	0.000	0.000	0.000	0.000	0.000	0.000
2010	0.000	0.103	0.013	0.008	0.131	0.130	0.051	0.788	0.000	0.035	0.046	0.063	0.247	0.000	0.016	0.000	0.000	0.000	0.000
2011	0.000	0.555	0.199	0.010	0.000	0.025	0.174	0.000	0.162	0.000	0.018	0.024	0.025	0.042	0.000	0.000	0.000	0.000	0.000
2012	0.000	0.530	1.592	0.193	0.049	0.000	0.163	0.084	0.043	0.194	0.000	0.029	0.000	0.032	0.070	0.000	0.000	0.000	0.000
2013	0.000	9.459	0.807	1.627	0.135	0.036	0.027	0.116	0.080	0.016	0.070	0.000	0.000	0.000	0.000	0.007	0.000	0.000	0.000
2014	0.000	5.048	2.062	0.688	2.686	0.217	0.133	0.000	0.088	0.048	0.010	0.052	0.000	0.000	0.000	0.000	0.017	0.000	0.000
2015	0.000	2.177	51.946	11.007	3.293	13.799	1.664	0.198	0.000	0.906	0.272	0.136	0.455	0.000	0.000	0.000	0.272	0.000	0.000
2016	0.000	2.342	1.897	40.145	4.112	1.499	3.594	0.107	0.027	0.000	0.128	0.000	0.028	0.000	0.000	0.000	0.000	0.000	0.000
2017	0.000	3.022	1.645	2.033	34.616	2.928	0.472	0.906	0.075	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Table 29. Northeast Fisheries Science Center (NEFSC) Gulf of Maine haddock fall survey abundance indices-at-age (numbers/tow) from 1963 to 2016. *The 2017 fall survey has not been conducted at the time of this report.*

Year	Age0	Age1	Age2	Age3	Age4	Age5	Age6	Age7	Age8	Age9	Age10	Age11	Age12	Age13	Age14	Age15
1963	35.432	12.300	1.770	2.954	7.037	4.850	1.721	1.287	1.067	0.686	0.362	0.000	0.000	0.085	0.000	0.000
1964	0.000	6.155	1.674	0.533	0.992	2.234	1.686	0.539		0.364	0.000	0.000	0.000	0.000	0.000	0.000
1965	0.000	0.379	8.084	4.988	0.328	1.369	1.316	0.682	0.245	0.069	0.000	0.000	0.000	0.000	0.000	0.000
1966	0.000	0.000	0.516	6.527	2.348	0.295	0.605	0.355	0.075	0.021	0.000	0.000	0.000	0.000	0.000	0.000
1967	0.000	0.000	0.000	1.382	8.115	1.822	0.489	0.093	0.219	0.066	0.000	0.000	0.000	0.000	0.000	0.000
1968	0.000	0.000	0.000	0.000	0.241	6.291	1.361	0.245	0.315	0.112	0.000	0.000	0.000	0.000	0.000	0.000
1969	0.000	0.000	0.000	0.043	0.029	0.034	4.081	0.875	0.186	0.015	0.031	0.000	0.000	0.000	0.158	0.000
1970	0.000	0.048	0.000	0.000	0.000	0.062	0.169	1.961	0.587	0.000	0.091	0.000	0.000	0.000	0.000	0.000
1971	0.000	0.000	0.000	0.000	0.307	0.000	0.177	0.273	1.909	0.167	0.047	0.000	0.000	0.000	0.000	0.000
1972	0.000	1.191	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.591	0.136	0.066	0.000	0.000	0.000	0.000
1973	1.122	0.029	0.960	0.000	0.320	0.019	0.000	0.063	0.015	0.149	1.203	0.171	0.000	0.023	0.093	0.000
1974	0.000	1.739	0.118	0.481	0.000	0.000	0.000	0.000	0.000	0.000	0.263	0.000	0.000	0.000	0.043	0.043
1975	0.000	1.131	1.834	0.499	1.494	0.000	0.085	0.035	0.000	0.000	0.041	0.064	0.288	0.062	0.000	0.000
1976	1.637	1.791	0.097	1.250	0.163	0.851	0.000	0.228	0.000	0.000	0.000	0.000	0.020	0.000	0.000	0.000
1977	0.000	3.285	3.329	0.127	1.077	0.126	0.235	0.000	0.000	0.000	0.000	0.022	0.000	0.096	0.000	0.000
1978	0.000	0.000	1.938	5.542	0.185	0.797	1.060	0.118	0.000	0.000	0.000	0.000	0.053	0.000	0.084	0.000
1979	0.784	0.424	0.109	1.078	2.741	0.505	0.401	0.113	0.000	0.000	0.000	0.018	0.000	0.000	0.000	0.000
1980	0.000	4.468	0.301	0.000	0.283	1.066	0.594	0.185	0.163	0.092	0.000	0.000	0.000	0.000	0.000	0.000
1981	0.000	0.000	0.000	2.045	0.320	0.864	1.021	0.000	0.205	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1982	0.000	0.440	0.671	0.823	0.352	0.053	0.000	0.102	0.070	0.000	0.116	0.000	0.000	0.000	0.000	0.000
1983	0.000	0.559	0.051	0.629	0.528	0.398	0.193	0.068	0.172	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1984	0.000	0.208	0.539	0.000	0.308	0.000	0.373	0.000	0.035	0.234	0.000	0.000	0.000	0.000	0.000	0.000
1985	0.000	0.100	0.377	2.803	0.017	0.204	0.148	0.371	0.000	0.000	0.061	0.000	0.000	0.000	0.000	0.000
1986	0.000	0.015	0.000	0.076	0.342	0.103	0.029	0.000	0.059	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1987	0.000	0.000	0.182	0.116	0.128	0.069	0.289	0.119	0.000	0.132	0.000	0.000	0.000	0.000	0.000	0.000
1988	0.000	0.000	0.000	0.048	0.023	0.082	0.000	0.059	0.122	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1989	0.000	0.059	0.060	0.019	0.015	0.047	0.066	0.019	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1990	0.000	0.032	0.000	0.074	0.000	0.000	0.000	0.020	0.019	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1991	0.054	0.052	0.000	0.000	0.037	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1992	0.043	0.145	0.000	0.023	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1993	0.099	0.468	0.223	0.032	0.030	0.015	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1994	0.207	0.046	0.000	0.000	0.000	0.000	0.000	0.036	0.000	0.000	0.000	0.036	0.000	0.000	0.000	0.000
1995	0.000	0.094	0.604	0.184	0.036	0.036	0.000	0.000	0.000	0.000	0.000	0.000	0.023	0.000	0.000	0.000
1996	0.044	0.127	0.196	1.063	0.619	0.068	0.114	0.071	0.036	0.000	0.036	0.000	0.000	0.036	0.000	0.000
1997	0.212	1.331	0.030	0.382	0.061	0.091	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1998	1.466	0.241	0.416	0.130	0.431	0.303	0.070	0.049	0.025	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1999	0.548	3.229	0.595	0.829	0.253	0.478	0.514	0.169	0.059	0.026	0.032	0.000	0.000	0.000	0.000	0.000
2000	0.333	0.662	11.306	1.686	1.303	0.425	0.580	0.221	0.074	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2001	0.196	0.241	2.297	4.862	0.719	0.809	0.301	0.193	0.293	0.051	0.000	0.000	0.000	0.000	0.000	0.000
2002	0.014	0.121	0.014	0.541	2.455	0.353	0.139	0.000	0.206	0.032	0.000	0.047	0.000	0.000	0.000	0.000
2003	0.853	0.000	0.267	0.072	0.504	2.468	0.352	0.053	0.000	0.124	0.040	0.000	0.000	0.000	0.000	0.000
2004	0.073	0.347	0.029	0.546	0.250	0.829	3.234	0.124	0.156	0.000	0.027	0.090	0.000	0.000	0.000	0.000
2005	0.188	0.110	1.593	0.067	0.147	0.300	0.407	1.143	0.088	0.058	0.000	0.019	0.013	0.000	0.000	0.000
2006	0.230	0.264	0.084	1.781	0.027	0.206	0.108	0.290	0.848	0.048	0.008	0.000	0.000	0.017	0.000	0.000
2007	0.015	1.065	0.848	0.221	2.128	0.061	0.014	0.163	0.114	0.500	0.000	0.025	0.000	0.000	0.000	0.000
2008	0.000	0.000	0.404	0.111	0.000	1.045	0.000	0.161	0.114	0.111	0.280	0.000	0.041	0.000	0.000	0.000
2009	0.888	0.258	0.092	0.188	0.012	0.040	0.340	0.000	0.053	0.000	0.031	0.115	0.000	0.000	0.000	0.000
2010	1.625	0.034	0.021	0.050	0.168	0.291	0.112	0.240	0.000	0.000	0.000	0.026	0.095	0.000	0.000	0.000
2011	0.508	1.191	0.835	0.196	0.097	0.850	0.221	0.136	0.743	0.000	0.055	0.000	0.000	0.066	0.000	0.000
2012	1.467	0.526	3.291	0.010	0.000	0.020	0.028	0.028	0.000	0.028	0.000	0.000	0.000	0.000	0.000	0.000
2013	21.582	5.057	1.815	6.762	0.415	0.260	0.090	0.028	0.000	0.000	0.080	0.000	0.000	0.000	0.000	0.000
2014	2.242	21.094	9.126	4.363	12.421	0.670	0.374	0.203	0.609	0.236	0.000	0.482	0.000	0.000	0.000	0.000
2015	3.718	1.308	52.984	3.089	0.769	2.390	0.044	0.000	0.000	0.070	0.000	0.000	0.000	0.000	0.000	0.000
2016	5.714	1.795	2.681	60.856	5.726	1.383	3.154	0.061	0.026	0.018	0.021	0.000	0.000	0.000	0.000	0.000

Table 30. Maine-New Hampshire spring and fall inshore bottom trawl survey indices and coefficients of variation (CV) for Gulf of Maine haddock from 2000 to 2016. Includes regions 1 through 5 and depth strata 1 through 4. The fall 2000- 2002 and spring 2001- 2002 indices were calculated using only three depth strata - a fourth depth stratum was added to the survey in 2003. Fixed stations have not been included in the calculation of the indices. *Data courtesy of Sally Sherman (ME DMR). Note that the ME NH survey is not used as an input to the assessment model.*

Year	Spring				Fall			
	Biomass (kg/tow)	CV	Abundance (numbers/tow)	CV	Biomass (kg/tow)	CV	Abundance (numbers/tow)	CV
2000					0.71	1.74	4.12	0.71
2001	0.00	2.00	0.02	2.00	0.15	1.06	3.14	1.02
2002	1.20	0.58	4.33	0.71	0.02	1.23	0.29	0.92
2003	0.49	1.04	0.70	0.92	0.55	0.73	5.94	0.94
2004	0.26	0.60	1.67	0.71	0.21	0.80	2.65	0.71
2005	0.37	0.71	0.77	0.66	0.76	1.34	5.75	0.18
2006	0.33	0.81	1.58	1.47	0.43	2.22	1.18	1.27
2007	0.38	0.66	0.63	0.50	0.02	0.53	0.44	1.08
2008	0.40	0.75	0.43	0.75	0.02	0.53	0.68	0.59
2009	0.10	0.70	0.61	0.60	0.17	0.56	3.99	0.67
2010	0.19	0.71	0.85	0.69	0.46	0.68	10.86	0.64
2011	0.52	0.88	6.54	1.00	0.30	0.71	8.02	0.78
2012	0.65	2.29	6.56	2.18	0.78	0.68	12.65	0.67
2013	0.26	0.60	1.88	0.41	1.37	0.57	24.44	0.46
2014	5.12	1.16	55.34	1.09	3.65	1.08	28.76	0.88
2015	0.83	0.58	7.48	0.77	1.32	0.68	17.20	0.49
2016	1.39	0.84	5.76	0.55	3.24	0.89	8.73	0.72

Table 31. Summary of Gulf of Maine haddock ASAP model diagnostics and terminal estimates from the ‘Base’ model. See NEFSC (2014) for a full description of model configurations - no changes have been made to the model configurations as part of the 2017 update.

Model		Base
Description		Base model
Maximum gradient (<i>conv. criteria < 1e-4</i>)		7.80E-05
Number of parameters		121
Objective function		7283
Components of objective function	Recruit devs	51
	Suvey age comps	2094
	Catch age comps	5204
	Index fit	22
	Catch fit	-77
RMSE	Catch	0.35
	NEFSC spring	1.24
	NEFSC fall	1.15
	Index total	1.19
	Recruit devs	1.71
SSB₁₉₇₇ (mt)		9,655
SSB₂₀₁₆ (mt)		47,821
F_{mult, 2016}		0.137
Median recruitment₁₉₇₇₋₂₀₁₄ (000s)		1,500
Geometric mean recruitment₁₉₇₇₋₂₀₁₆ (000s)		1,762
Mohn's rho (7 year peel)	SSB	-0.18
	F_{mult}	0.20
	Age 1 N	-0.38
Survey catchability (q)	NEFSC spring	0.25 (0.13)
	NEFSC fall	0.84 (0.14)

Table 32. Fleet and index selectivity and survey catchability (q) parameters and the corresponding coefficients of variation (CV) from the Gulf of Maine haddock ‘Base’ model.

Block/survey	Parameter	Base	
		Value	CV
Catch block1 (1977-1988)	Age1	0.00	0.72
	Age2	0.20	0.18
	Age3	0.35	0.17
	Age4	0.58	0.17
	Age5	0.55	0.17
	Age6	0.64	0.19
	Age7	0.78	0.21
	Age8	1.00	
	Age9 ⁺	1.00	
Catch block2 (1989-2004)	Age1	0.00	0.36
	Age2	0.05	0.23
	Age3	0.22	0.20
	Age4	0.39	0.19
	Age5	0.56	0.19
	Age6	0.81	0.19
	Age7	0.88	0.21
	Age8	1.00	
	Age9 ⁺	1.00	
Catch block3 (2005-2016)	Age1	0.00	0.28
	Age2	0.04	0.15
	Age3	0.17	0.13
	Age4	0.32	0.13
	Age5	0.51	0.13
	Age6	0.73	0.12
	Age7	0.84	0.12
	Age8	1.00	
	Age9 ⁺	0.78	0.15
NEFSC spring	Age1	0.60	0.13
	Age2	0.69	0.13
	Age3	0.97	0.13
	Age4	1.00	
	Age5	1.00	
	Age6	1.00	
	Age7	1.00	
	Age8	1.00	
	Age9 ⁺	1.00	
NEFSC fall	Age1	0.32	0.15
	Age2	0.47	0.15
	Age3	0.70	0.14
	Age4	0.74	0.15
	Age5	0.94	0.15
	Age6	1.00	
	Age7	1.00	
	Age8	1.00	
	Age9 ⁺	1.00	
Survey catchability (q)	NEFSC spring	0.25	0.13
	NEFSC fall	0.84	0.14

Table 33. Gulf of Maine haddock January 1 biomass and spawning stock biomass from 1977 to 2016 as estimated from the ‘Base’ model.

Year	Biomass (mt)		
	January 1	Spawning	Exploitable
1977	16,861	9,655	7,298
1978	18,041	13,582	9,747
1979	19,198	15,284	11,737
1980	20,278	14,617	12,291
1981	20,192	14,348	11,595
1982	18,701	14,044	11,618
1983	14,306	10,642	9,914
1984	9,394	7,140	6,636
1985	7,094	5,239	4,518
1986	4,186	2,912	2,823
1987	1,985	1,493	1,513
1988	1,390	1,066	944
1989	1,083	780	707
1990	1,153	823	655
1991	1,041	713	518
1992	1,059	662	366
1993	1,294	702	362
1994	2,203	1,158	570
1995	3,724	2,076	964
1996	4,611	3,340	1,567
1997	6,568	5,062	3,041
1998	8,049	6,265	3,822
1999	8,639	6,279	3,734
2000	12,014	7,593	4,768
2001	15,225	12,223	7,214
2002	16,421	14,558	8,563
2003	13,925	12,566	9,092
2004	12,629	10,775	9,539
2005	11,601	9,298	7,652
2006	10,269	8,756	6,573
2007	9,120	7,764	5,264
2008	8,009	6,876	4,842
2009	7,074	6,263	4,839
2010	6,332	5,401	4,342
2011	8,243	4,667	3,932
2012	10,794	5,733	3,176
2013	15,971	9,325	4,032
2014	35,584	14,775	6,082
2015	52,576	29,833	10,753
2016	57,041	47,821	19,135

Table 34. Gulf of Maine haddock fishing mortality-at-age from 1977 to 2016 as estimated from the 'Base' model.

Year	Age1	Age2	Age3	Age4	Age5	Age6	Age7	Age8	Age9 ⁺	F _{full}
1977	0.002	0.111	0.194	0.321	0.306	0.354	0.429	0.553	0.553	0.553
1978	0.003	0.126	0.221	0.366	0.349	0.403	0.488	0.630	0.630	0.630
1979	0.002	0.102	0.179	0.296	0.282	0.326	0.396	0.510	0.510	0.510
1980	0.003	0.146	0.255	0.423	0.403	0.465	0.564	0.728	0.728	0.728
1981	0.003	0.125	0.219	0.364	0.346	0.400	0.485	0.626	0.626	0.626
1982	0.003	0.140	0.246	0.407	0.388	0.448	0.543	0.701	0.701	0.701
1983	0.005	0.222	0.389	0.646	0.615	0.710	0.861	1.111	1.111	1.111
1984	0.004	0.173	0.303	0.502	0.478	0.552	0.669	0.864	0.864	0.864
1985	0.005	0.221	0.388	0.643	0.612	0.707	0.858	1.106	1.106	1.106
1986	0.007	0.319	0.559	0.926	0.883	1.020	1.236	1.595	1.595	1.595
1987	0.004	0.189	0.331	0.548	0.522	0.603	0.731	0.943	0.943	0.943
1988	0.003	0.153	0.269	0.445	0.424	0.490	0.594	0.766	0.766	0.766
1989	0.002	0.027	0.130	0.226	0.325	0.468	0.509	0.576	0.576	0.576
1990	0.005	0.051	0.248	0.432	0.622	0.894	0.973	1.102	1.102	1.102
1991	0.005	0.057	0.278	0.486	0.699	1.005	1.094	1.238	1.238	1.238
1992	0.005	0.056	0.272	0.474	0.683	0.982	1.068	1.209	1.209	1.209
1993	0.003	0.033	0.161	0.282	0.405	0.583	0.634	0.718	0.718	0.718
1994	0.002	0.018	0.088	0.153	0.220	0.317	0.345	0.390	0.390	0.390
1995	0.002	0.024	0.118	0.206	0.297	0.427	0.464	0.526	0.526	0.526
1996	0.001	0.012	0.057	0.099	0.143	0.205	0.224	0.253	0.253	0.253
1997	0.002	0.019	0.092	0.161	0.231	0.332	0.362	0.409	0.409	0.409
1998	0.001	0.014	0.068	0.119	0.171	0.245	0.267	0.302	0.302	0.302
1999	0.001	0.009	0.041	0.072	0.103	0.149	0.162	0.183	0.183	0.183
2000	0.001	0.011	0.055	0.095	0.137	0.197	0.215	0.243	0.243	0.243
2001	0.001	0.009	0.045	0.078	0.112	0.161	0.175	0.198	0.198	0.198
2002	0.001	0.008	0.038	0.067	0.096	0.138	0.150	0.170	0.170	0.170
2003	0.001	0.008	0.039	0.068	0.098	0.141	0.154	0.174	0.174	0.174
2004	0.001	0.008	0.036	0.064	0.092	0.132	0.143	0.162	0.162	0.162
2005	0.001	0.011	0.043	0.082	0.131	0.184	0.214	0.254	0.199	0.254
2006	0.001	0.009	0.037	0.069	0.111	0.156	0.181	0.215	0.168	0.215
2007	0.001	0.013	0.053	0.100	0.160	0.226	0.262	0.311	0.243	0.311
2008	0.001	0.012	0.048	0.090	0.144	0.203	0.236	0.280	0.219	0.280
2009	0.001	0.009	0.038	0.073	0.116	0.164	0.191	0.226	0.177	0.226
2010	0.001	0.011	0.045	0.085	0.136	0.192	0.223	0.264	0.207	0.264
2011	0.001	0.010	0.039	0.074	0.118	0.167	0.194	0.230	0.180	0.230
2012	0.001	0.012	0.050	0.094	0.150	0.212	0.246	0.293	0.229	0.293
2013	0.001	0.010	0.041	0.077	0.123	0.173	0.201	0.239	0.187	0.239
2014	0.001	0.008	0.033	0.062	0.098	0.139	0.161	0.191	0.150	0.191
2015	0.000	0.005	0.020	0.037	0.060	0.084	0.098	0.116	0.091	0.116
2016	0.000	0.006	0.023	0.044	0.070	0.099	0.115	0.137	0.107	0.137

Table 35. Gulf of Maine haddock January 1 numbers-at-age (000s) from 1977 to 2016 as estimated from the ‘Base’ model. Recruitment summary statistics reported (i.e., median and geometric mean) are provided for various time periods relevant to reference point determination and stock projections.

Year	Age1	Age2	Age3	Age4	Age5	Age6	Age7	Age8	Age9+	Total
1977	6,623	14,054	1,290	2,023	809	417	0	0	51	25,267
1978	1,581	5,409	10,302	870	1,201	488	240	0	24	20,115
1979	6,642	1,291	3,905	6,764	494	694	267	121	10	20,188
1980	7,324	5,427	954	2,673	4,117	305	410	147	64	21,422
1981	4,876	5,978	3,841	605	1,434	2,253	157	191	84	19,420
1982	990	3,981	4,319	2,526	345	830	1,236	79	120	14,426
1983	2,658	808	2,833	2,766	1,376	191	434	588	81	11,737
1984	1,114	2,166	530	1,572	1,188	609	77	150	180	7,586
1985	312	909	1,492	320	779	603	287	32	114	4,849
1986	294	254	596	829	138	346	243	100	40	2,840
1987	150	239	151	279	269	47	102	58	23	1,318
1988	441	122	162	89	132	131	21	40	26	1,163
1989	214	360	86	101	47	71	65	9	25	978
1990	276	175	287	62	66	28	36	32	16	977
1991	293	225	136	183	33	29	9	11	13	933
1992	761	239	174	84	92	13	9	3	6	1,381
1993	1,412	620	185	108	43	38	4	2	2	2,415
1994	3,091	1,153	491	129	67	23	17	2	2	4,975
1995	2,715	2,526	927	368	91	44	14	10	2	6,697
1996	1,181	2,218	2,019	674	245	55	24	7	6	6,429
1997	2,366	966	1,795	1,561	500	174	37	15	8	7,422
1998	2,470	1,934	776	1,340	1,089	325	102	21	13	8,069
1999	14,422	2,020	1,561	594	975	751	208	64	20	20,614
2000	2,774	11,799	1,640	1,226	452	720	530	145	58	19,343
2001	1,244	2,269	9,551	1,271	913	323	484	350	130	16,535
2002	1,384	1,017	1,841	7,479	963	668	225	332	322	14,231
2003	275	1,132	826	1,451	5,728	716	476	158	452	11,214
2004	7,433	225	919	651	1,109	4,250	509	334	420	15,850
2005	481	6,081	183	726	500	829	3,051	361	525	12,736
2006	1,419	393	4,926	143	548	359	564	2,017	582	10,951
2007	1,676	1,161	319	3,888	109	401	252	385	1,734	9,926
2008	314	1,371	938	248	2,880	76	262	158	1,344	7,591
2009	519	257	1,109	732	185	2,041	51	170	982	6,046
2010	1,590	424	208	874	557	135	1,418	34	784	6,026
2011	15,858	1,301	344	163	657	398	91	929	544	20,285
2012	5,496	12,974	1,055	271	124	478	276	62	977	21,712
2013	25,080	4,496	10,493	822	202	87	316	177	674	42,345
2014	93,341	20,518	3,644	8,249	623	146	60	212	572	127,364
2015	4,724	76,374	16,664	2,888	6,350	462	104	42	546	108,154
2016	3,638	3,866	62,226	13,377	2,278	4,898	348	77	439	91,148
1977-2014 median	1,500									
1977-2016 geomean	1,762									

Table 36. Inputs to the stochastic Gulf of Maine haddock yield per recruit (YPR) and projection analyses. Coefficients of variation are shown in italics. Grey shaded CV values were assumed.

Age	Jan1/SSB weights (kg)		Mid-year weights (kg)		Catch weights (kg)		Fishery selectivity		Maturity		Natural mortality	
1	0.134	<i>0.146</i>	0.245	<i>0.235</i>	0.236	<i>0.218</i>	0.003	<i>0.280</i>	0.045	<i>0.126</i>	0.200	<i>0.100</i>
2	0.374	<i>0.190</i>	0.503	<i>0.189</i>	0.503	<i>0.182</i>	0.042	<i>0.153</i>	0.338	<i>0.050</i>	0.200	<i>0.100</i>
3	0.654	<i>0.117</i>	0.785	<i>0.138</i>	0.808	<i>0.133</i>	0.170	<i>0.128</i>	0.847	<i>0.016</i>	0.200	<i>0.100</i>
4	0.958	<i>0.079</i>	1.058	<i>0.067</i>	1.092	<i>0.072</i>	0.323	<i>0.127</i>	0.984	<i>0.004</i>	0.200	<i>0.100</i>
5	1.204	<i>0.081</i>	1.328	<i>0.087</i>	1.362	<i>0.098</i>	0.514	<i>0.126</i>	0.998	<i>0.001</i>	0.200	<i>0.100</i>
6	1.438	<i>0.064</i>	1.512	<i>0.077</i>	1.545	<i>0.080</i>	0.726	<i>0.125</i>	1.000	<i>0.001</i>	0.200	<i>0.100</i>
7	1.628	<i>0.052</i>	1.706	<i>0.068</i>	1.720	<i>0.063</i>	0.842	<i>0.121</i>	1.000	<i>0.001</i>	0.200	<i>0.100</i>
8	1.791	<i>0.054</i>	1.869	<i>0.070</i>	1.895	<i>0.058</i>	1.000	<i>0.001</i>	1.000	<i>0.001</i>	0.200	<i>0.100</i>
9 ⁺	2.052	<i>0.046</i>	2.051	<i>0.046</i>	2.051	<i>0.037</i>	0.782	<i>0.152</i>	1.000	<i>0.001</i>	0.200	<i>0.100</i>

Table 37. Target fishing mortality, yield per recruit, spawning biomass per recruit and mean age for a range of fishing mortality reference points.

Reference point	F	YPR (kg)	SSB/R (kg)	Mean age (years)
F ₀	0.000	0.000	5.027	5.52
F _{0.1}	0.377 (0.10)	0.436	2.210	3.32
F _{MAX}	1.611 (0.45)	0.522	0.981	2.43
F _{40%}	0.455 (0.10)	0.457	2.018	3.17

Table 38. Biological reference points and recommended stock status for Gulf of Maine haddock based on the SAW/SARC59 benchmark assessment (NEFSC 2014) and the 2015 (NEFSC 2015) and 2017 assessment updates. Intervals shown are the 5th and 95th percentiles.

Assessment	Proxy reference points	Base
SAW/SARC 59	$F_{full, 2013}$	0.39 (0.24 - 0.60)
	F_{MSY}	0.46 (0.36 - 0.54)
	$F_{full, 2013}/F_{MSY}$	0.85
	Overfishing	No
	SSB_{2013} (mt)	4,153 (2,960 - 6,043)
	SSB_{MSY} (mt)	4,108 (1,774 - 7,861)
	SSB_{2013}/SSB_{MSY}	1.01
	Overfished	No
	MSY (mt)	955 (421 - 1,807)
	Median age1 recruitment (000s)	1,121 (205 - 6,500)
2015 update	$F_{full, 2014}$	0.257 (0.164 - 0.373)
	F_{MSY}	0.468 (0.391 - 0.547)
	$F_{full, 2014}/F_{MSY}$	0.55
	Overfishing	No
	SSB_{2014} (mt)	10,325 (7,229 - 14,453)
	SSB_{MSY} (mt)	4,623 (2,036 - 9,283)
	SSB_{2014}/SSB_{MSY}	2.23
	Overfished	No
	MSY (mt)	1,083 (489 - 2,148)
	Median age1 recruitment (000s)	1,335 (253 - 8,198)
2017 update	$F_{full, 2016}$	0.137 (0.076 - 0.198)
	F_{MSY}	0.455 (0.380 - 0.538)
	$F_{full, 2016}/F_{MSY}$	0.30
	Overfishing	No
	SSB_{2016} (mt)	47,821 (31,571 - 64,071)
	SSB_{MSY} (mt)	6,769 (2,525 - 27,545)
	SSB_{2016}/SSB_{MSY}	7.06
	Overfished	No
	MSY (mt)	1,547 (584 - 6,160)
	Median age1 recruitment (000s)	1,498 (275 - 17,307)

Table 39. Short-term projections (2018-2020) of total fishery yield and spawning stock biomass for Gulf of Maine haddock based on $F_{MSY-proxy}$ ($F_{40\%}$) harvest strategies using the ‘Base’ model. These projections have assumed the geometric mean recruitment of the 1977-2016 period for estimating 2017 age-1 recruitment (~1.7 million fish). For age-1 recruitment in 2018 and beyond, the projections assume 1977-2014 median recruitment (~ 1.5 million fish). Catch in 2017 has been assumed to be 2,306 mt (*J Cournane, NEFMC PDT*).

Harvest strategy	Year	Input	Base		
			Catch (mt)	Spawning stock biomass (mt)	F_{full}
F_{MSY}	2016	Model result	2,313	47,821	0.137
	2017	Assumed catch	2,306	68,429	0.077
	2018	Projection	16,954	65,130	0.455
	2019	Projection	15,023	49,069	0.455
	2020	Projection	11,289	34,123	0.455

Figures

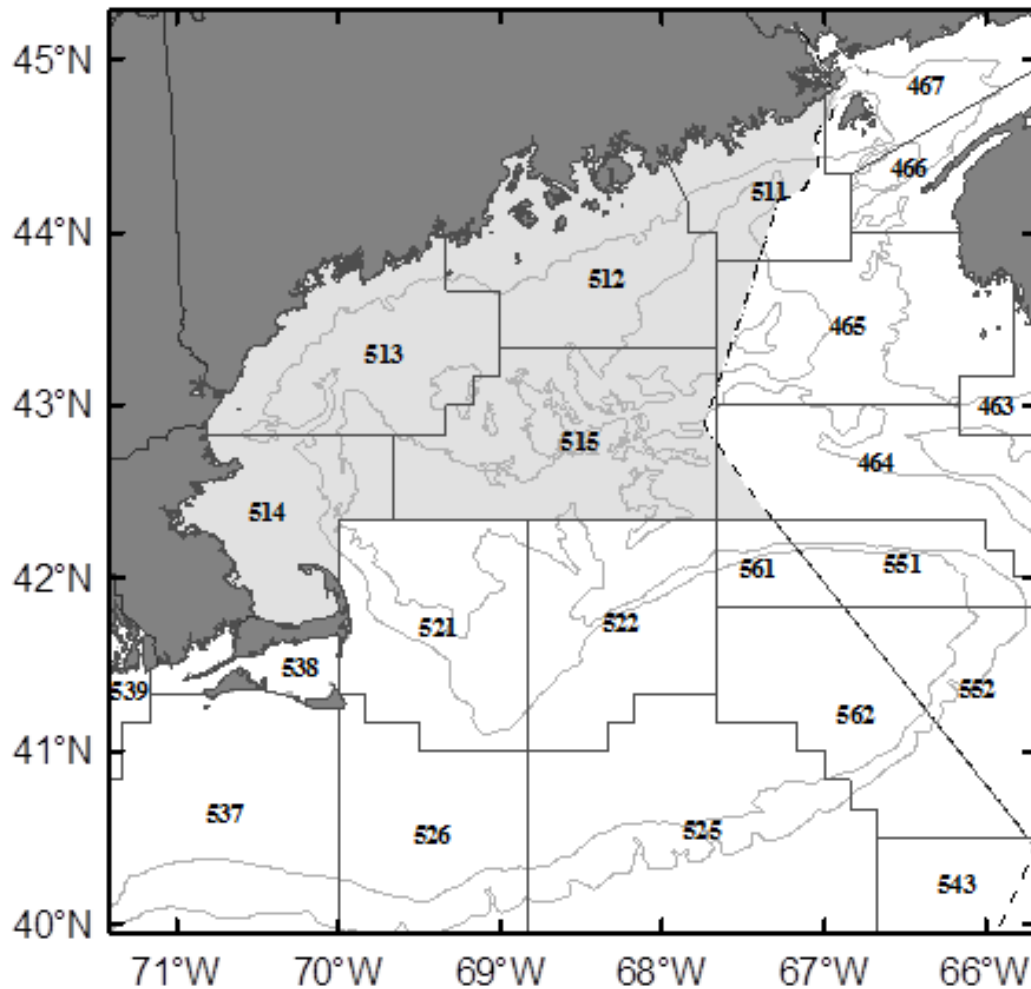


Figure 1. Map of the Gulf of Maine haddock (*Melanogrammus aeglefinus*) management and assessment area (shaded grey). The United States exclusive economic zone (EEZ) is defined by the dashed line.

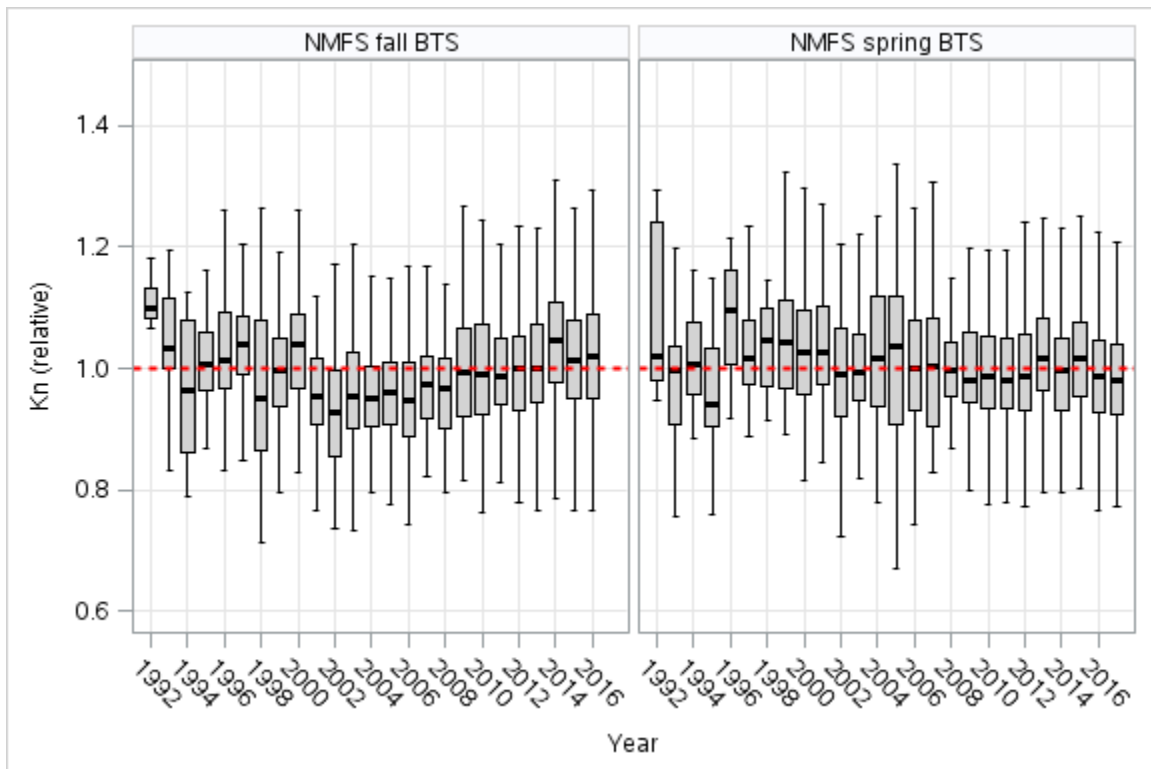


Figure 2. Annual trends in relative condition factor of Gulf of Maine haddock based on length and weight data collected from the Northeast Fisheries Science Center (NEFSC) bottom trawl surveys.

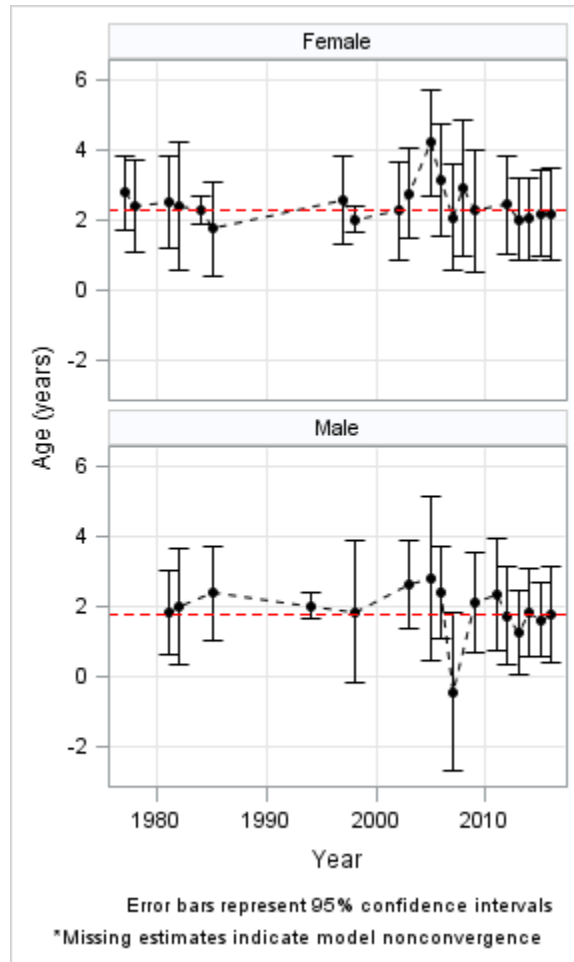


Figure 3. Annual average age-at-50% maturity ($A_{50\%}$) and corresponding 95% confidence intervals for female and male Gulf of Maine haddock from 1977 to 2016. Maturity has been estimated from data collected from the Northeast Fisheries Science Center (NEFSC) spring bottom trawl survey. *Missing years indicate when samples were insufficient to fit a logistic regression.*



Figure 4. Average stock weights-at-age of ages 0 to 9⁺ Gulf of Maine haddock from 1977 to 2016. See NEFSC (2014) for a full description of the methods used to determine stock weights. Average weights are presented as z-scores ($[x-\mu]/\sigma$). *Only ages 1 through the 9⁺ group are used as assessment model inputs.*

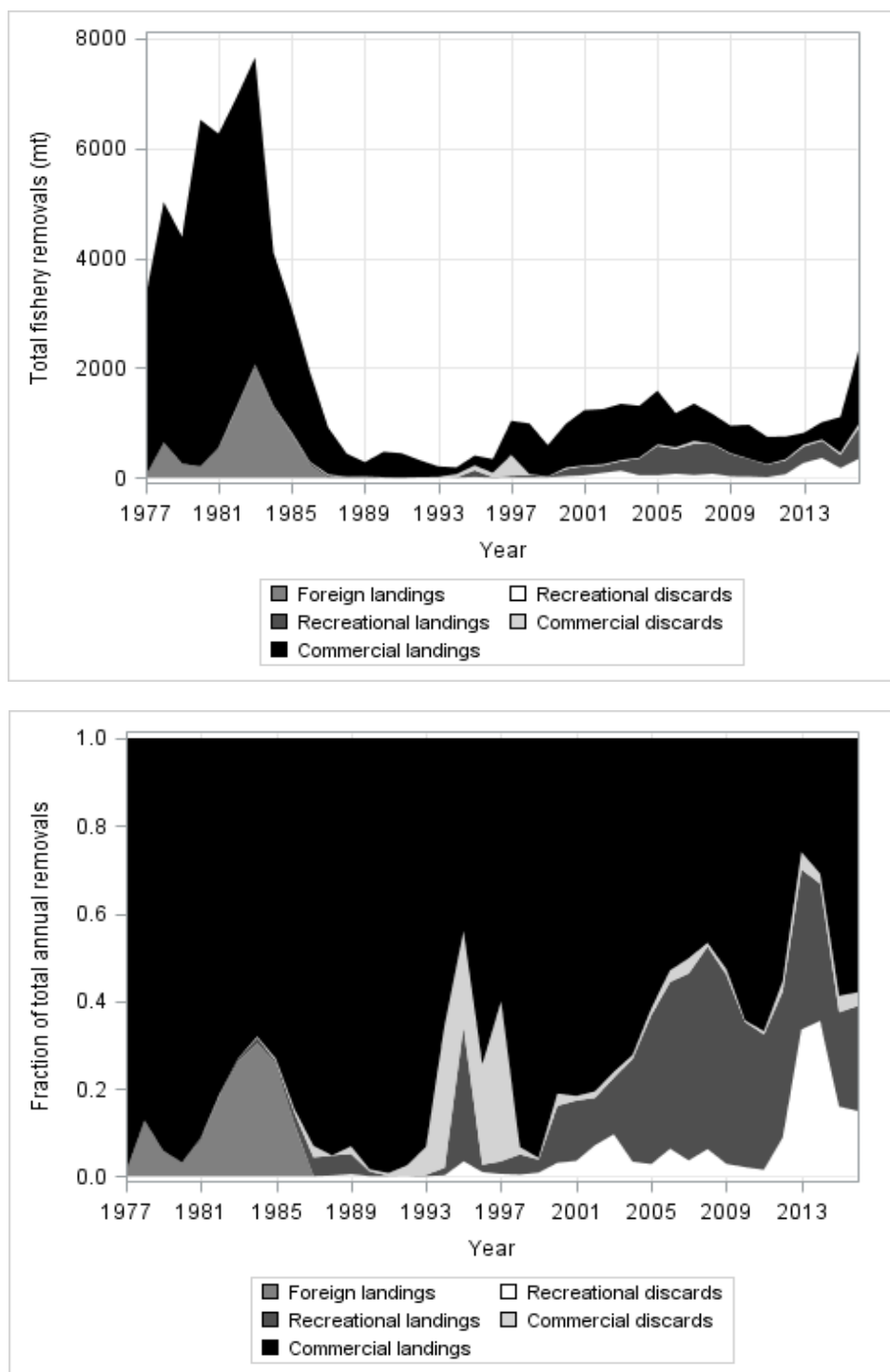


Figure 5. Total fishery removals of Gulf of Maine haddock between 1977 and 2016 by fleet (commercial and recreational) and disposition (landings and discards) in both absolute (top) and relative (bottom) scales. *Note that recreational discard amounts reflect application of 50% mortality assumption adopted for the SAW/SARC 95 assessment (NEFSC 2014) for years prior to 2004 and season and size-class specific discard mortality estimates (Mandelman et al. 2017) for 2004 to 2016.*

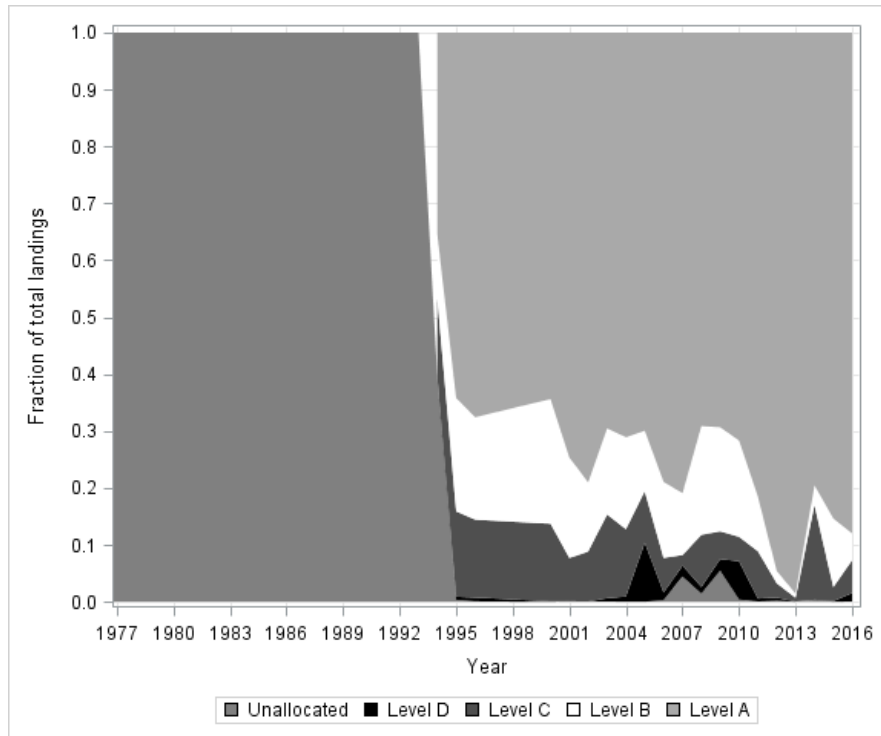


Figure 6. Fraction of the Gulf of Maine haddock commercial landings by allocation level between 1977 and 2016. Prior to 1994 landings were allocated based on a port interview process. From 1994 onward landings were allocated to statistical area and gear type based on a standardized allocation scheme (see NEFSC, 2014 for additional details).

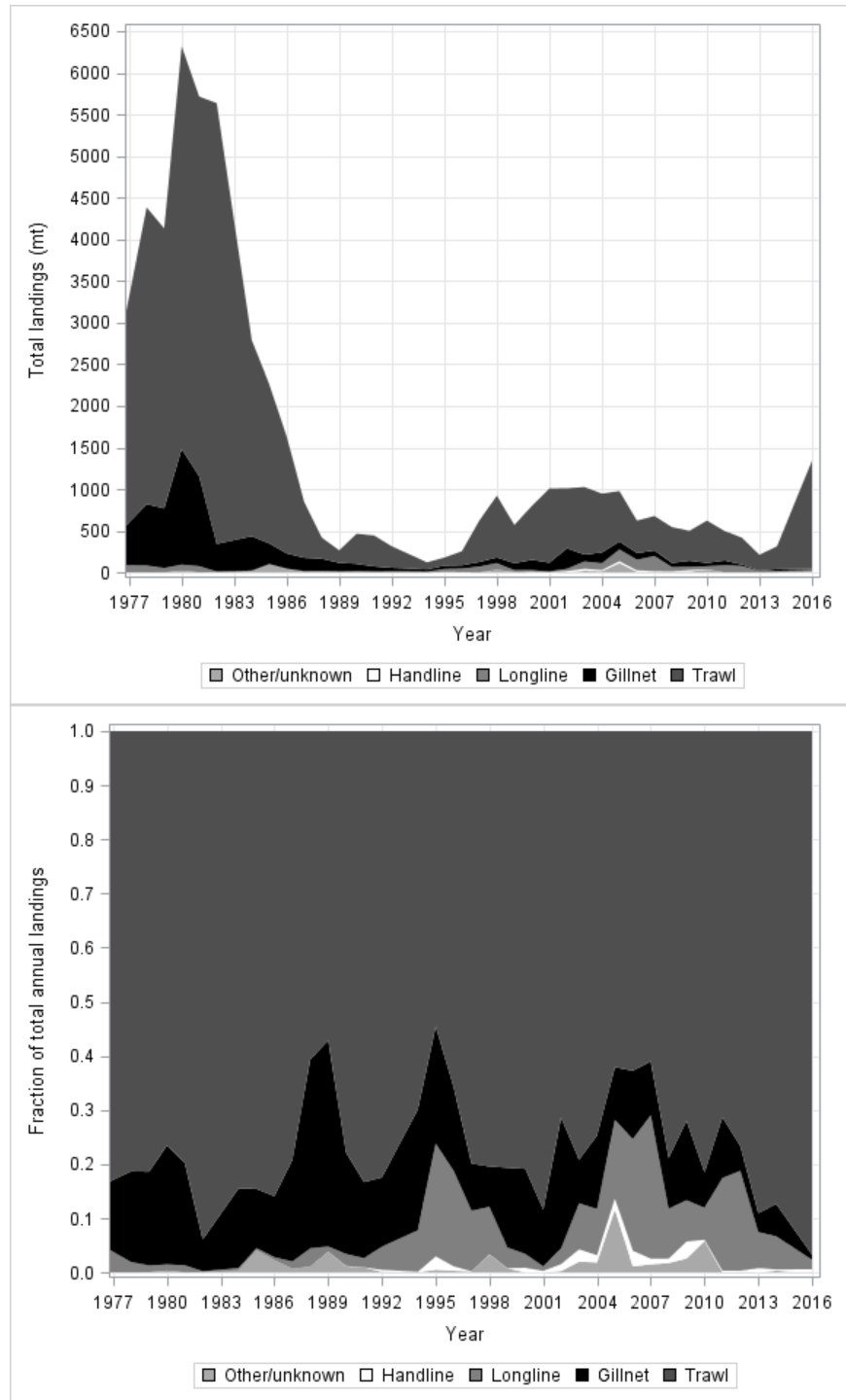


Figure 7. Total (top) and fractional (as a fraction of the total, bottom) commercial landings of Gulf of Maine haddock by gear type from 1977 to 2016.

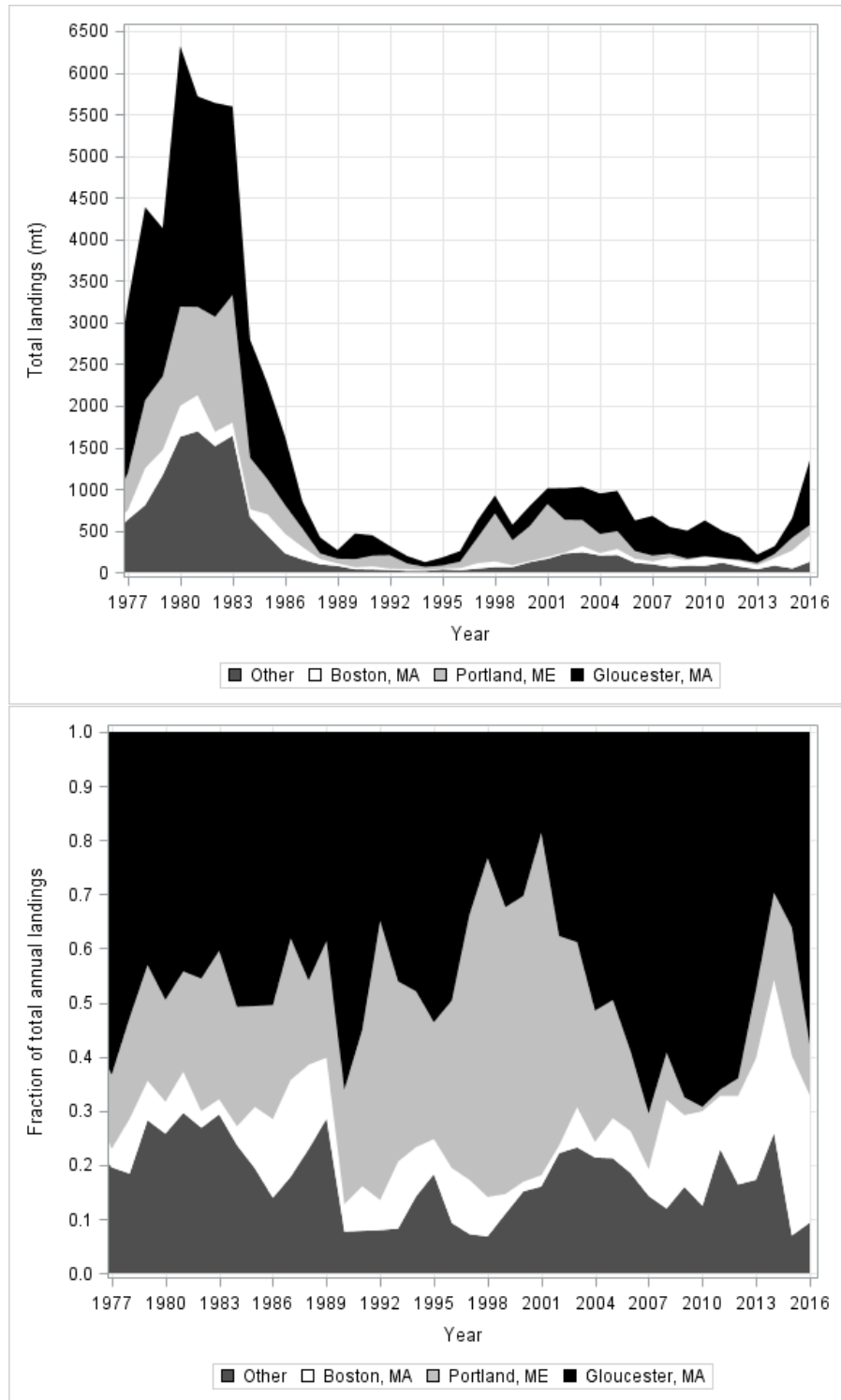


Figure 8. Total (top) and fractional (as a fraction of the total, bottom) commercial landings of Gulf of Maine haddock by port from 1977 to 2016.

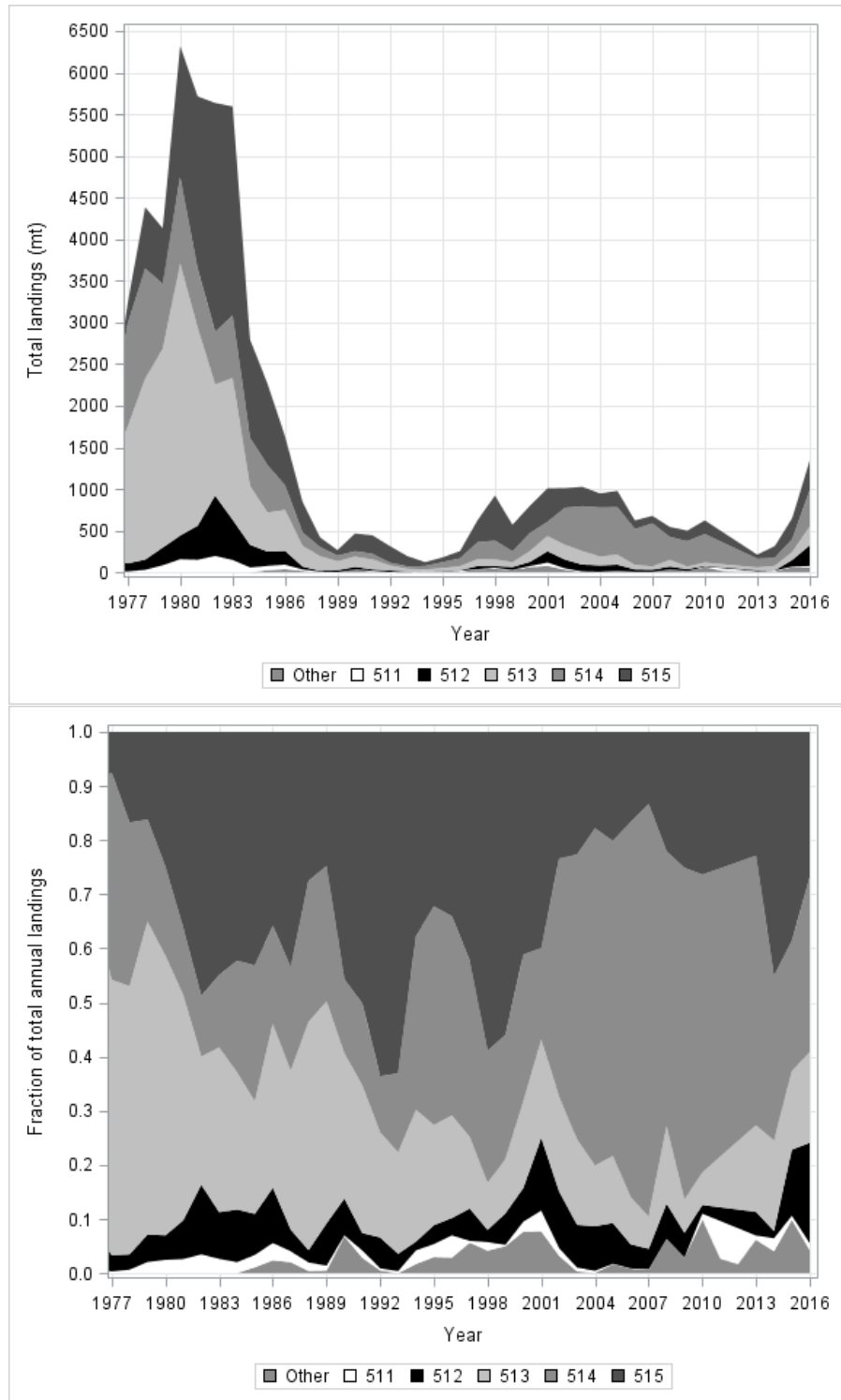


Figure 9. Total (top) and fractional (as a fraction of the total, bottom) commercial landings of Gulf of Maine haddock by statistical area from 1977 to 2016.

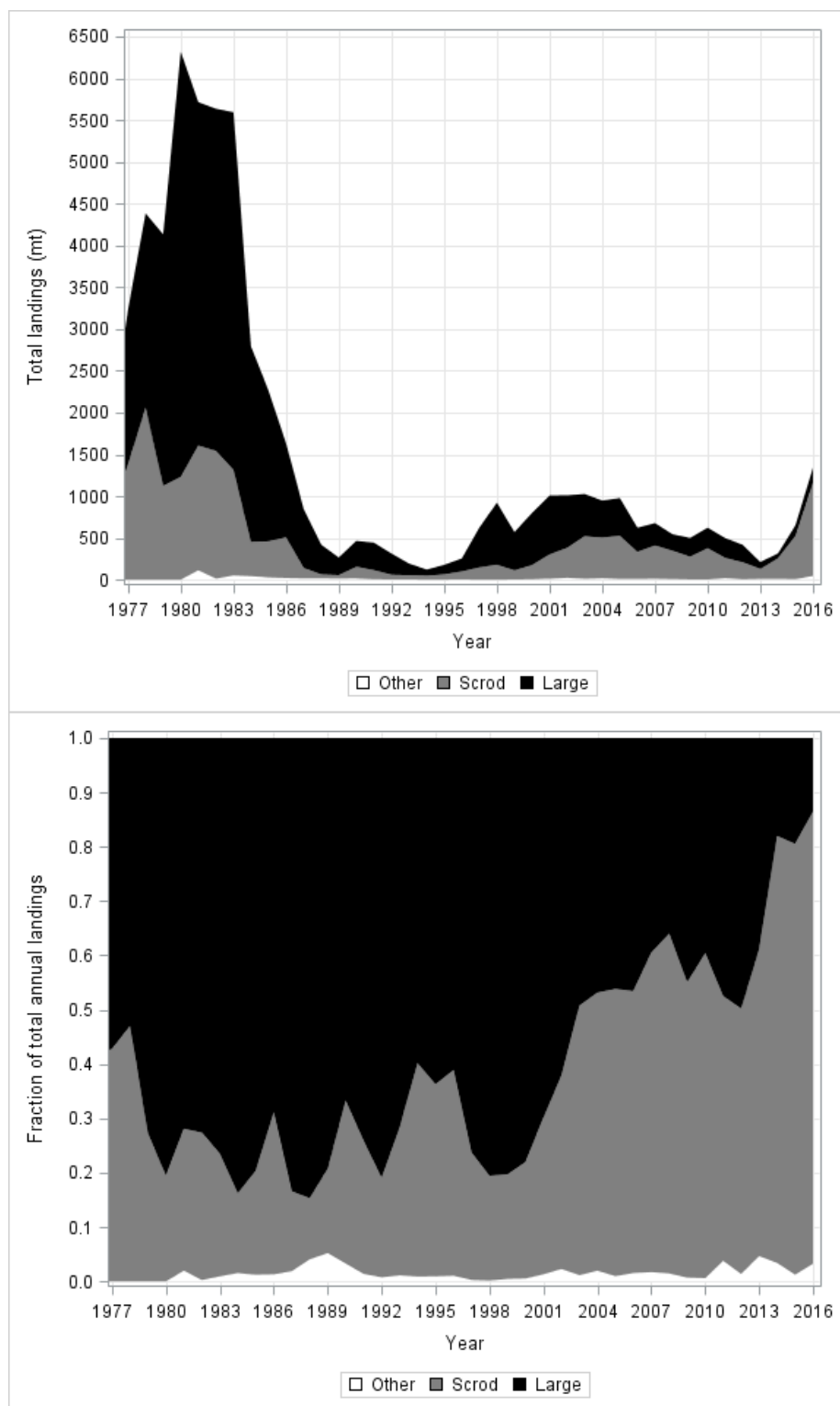


Figure 10. Total (top) and fractional (as a fraction of the total, bottom) commercial landings of Gulf of Maine haddock by market category from 1977 to 2016.

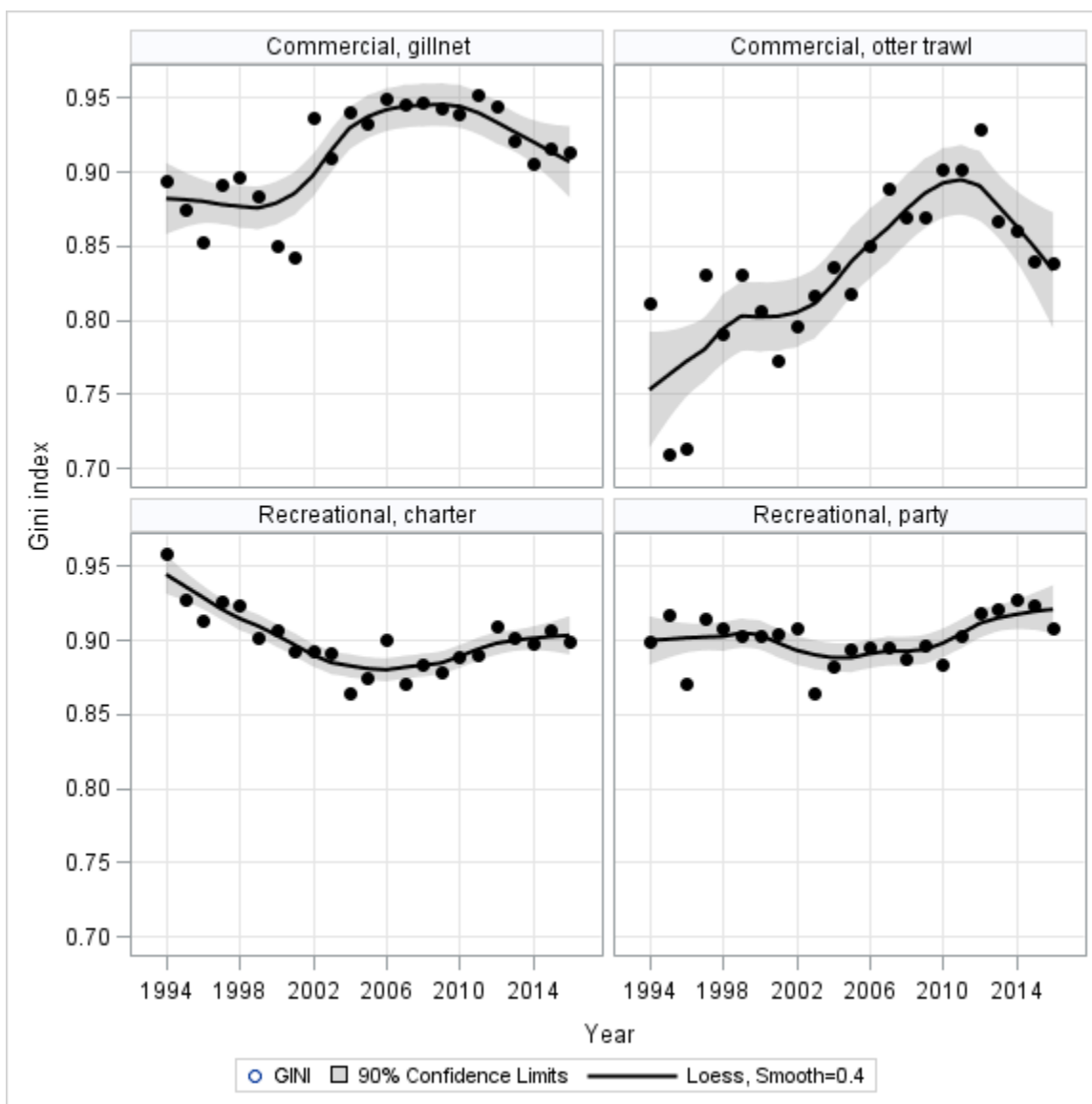


Figure 11. Gini indices of Gulf of Maine haddock landings by the commercial otter trawl and sink gillnet fleets and the recreational party and charter fleets from 1994-2016. Indices are based on the spatial distribution of the retained catch reported on vessel trip reports.

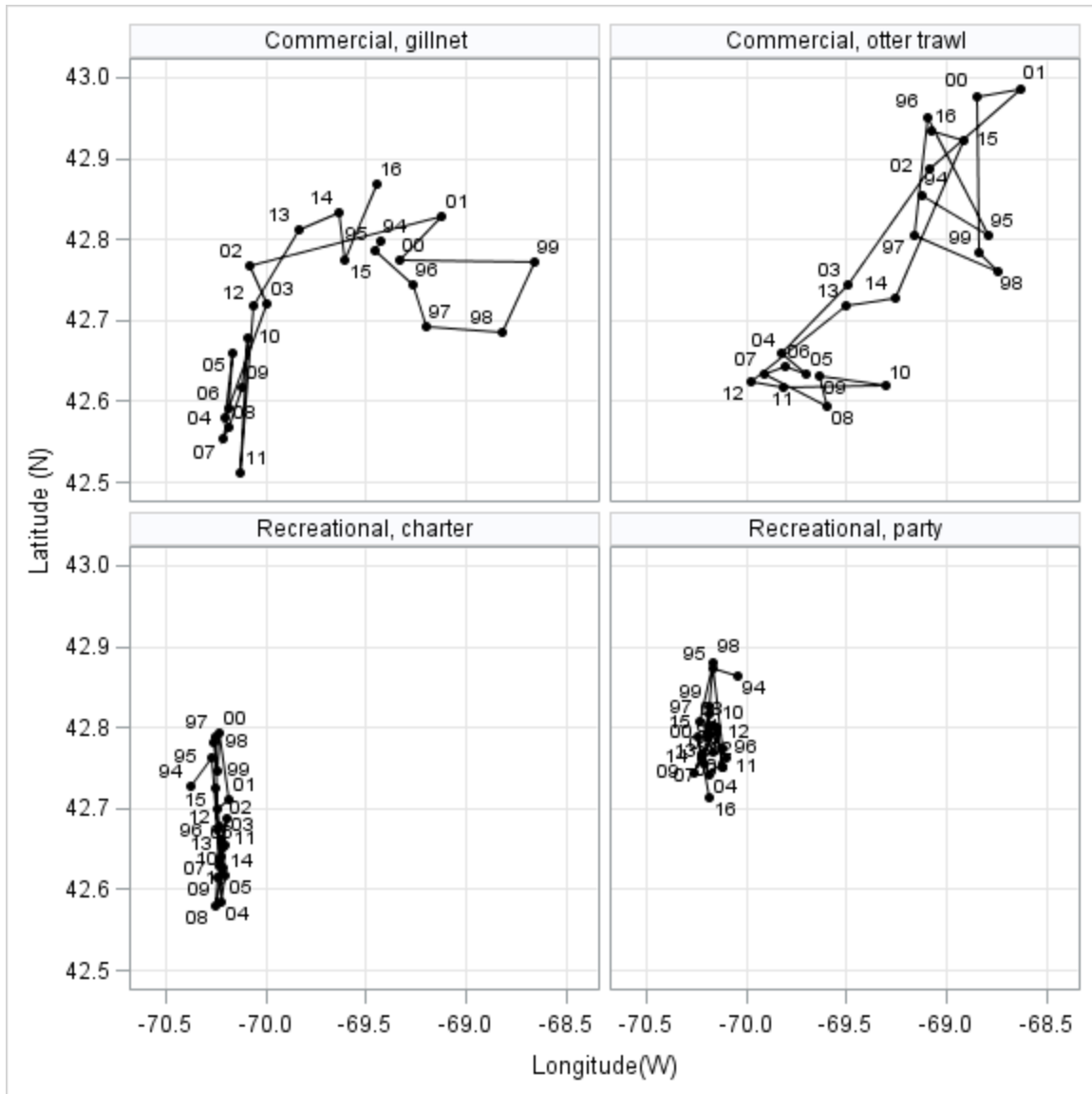


Figure 12. Landings-weighted mean location (centroid) of Gulf of Maine haddock landings by the commercial otter trawl and sink gillnet fleets and the recreational party and charter fleets from 1994-2016. Centroids are based on the spatial distribution of the retained catch reported on vessel trip reports.

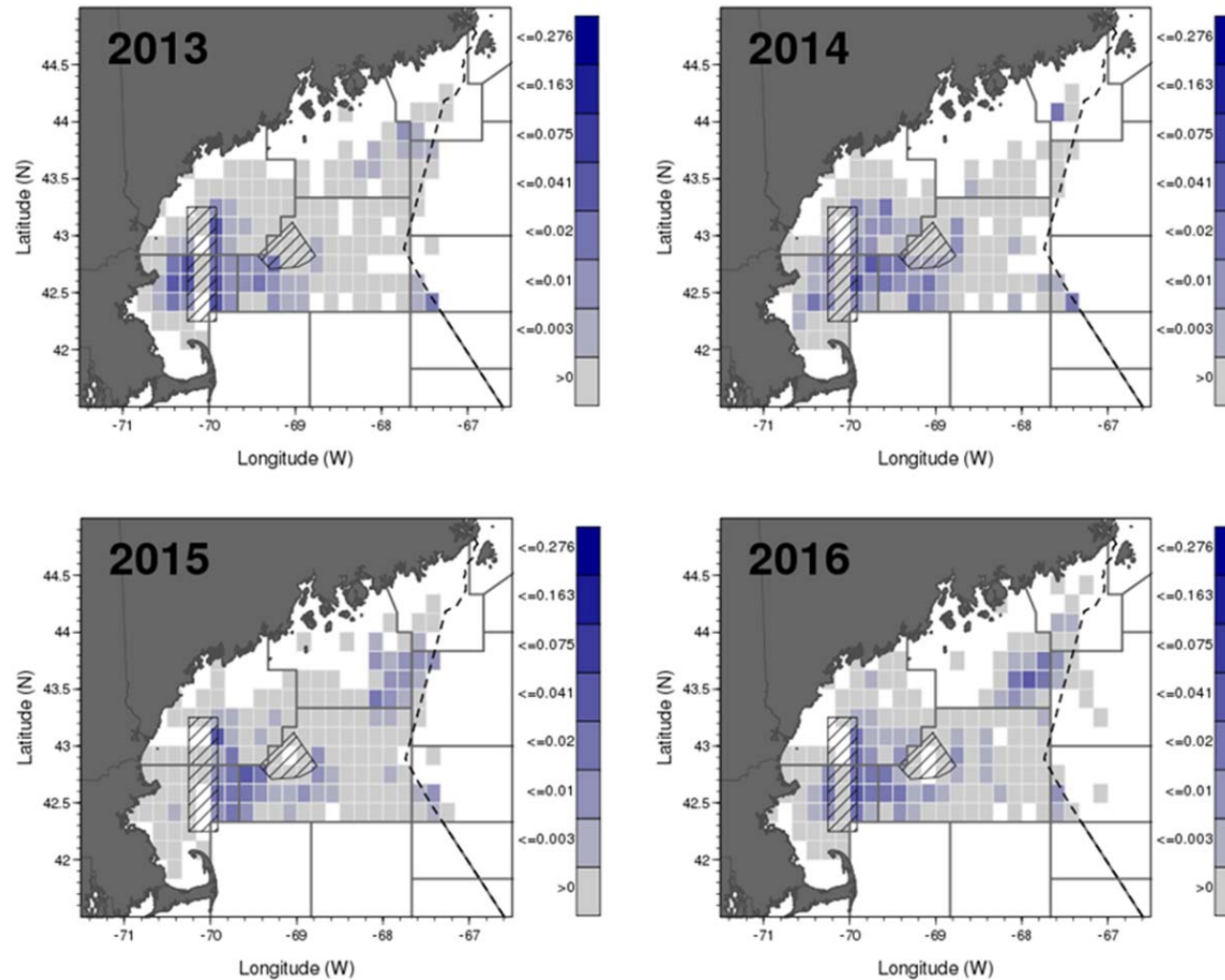


Figure 13. Fraction of total Gulf of Maine haddock commercial landings by ten minute square based on retained catch reported on vessel trip reports (VTRs) from 2013 through 2016.

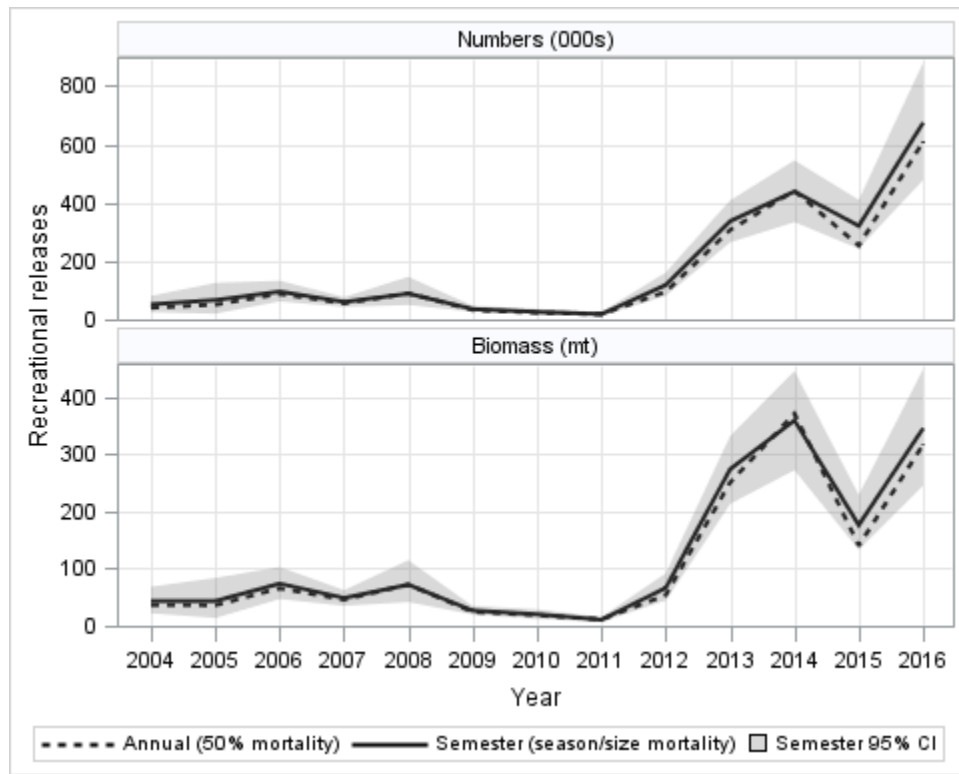


Figure 14. Comparison of the Marine Recreational Information Program (MRIP) Gulf of Maine haddock aggregate recreational dead release estimates used in the 2015 assessment update (NEFSC 2015) to the revised estimates used in the 2017 update. Please see Palmer (2017) for a full description of the re-estimation of recreation releases for the 2017 assessment update.

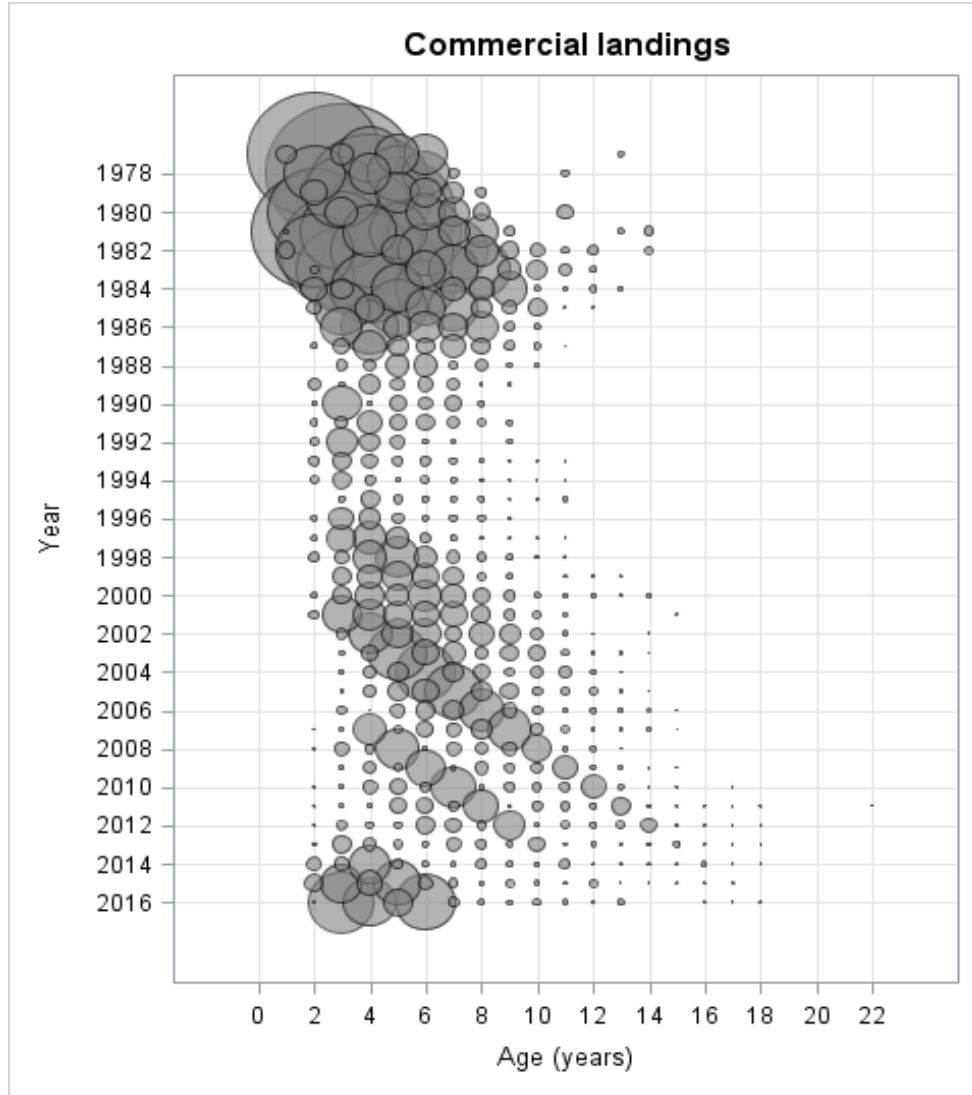


Figure 15. Commercial landings-at-age of Gulf of Maine haddock from 1977 to 2016. *Note that scale has been adjusted to maximize visibility of catch-at-age (i.e., size of bubbles is not comparable between plots).*

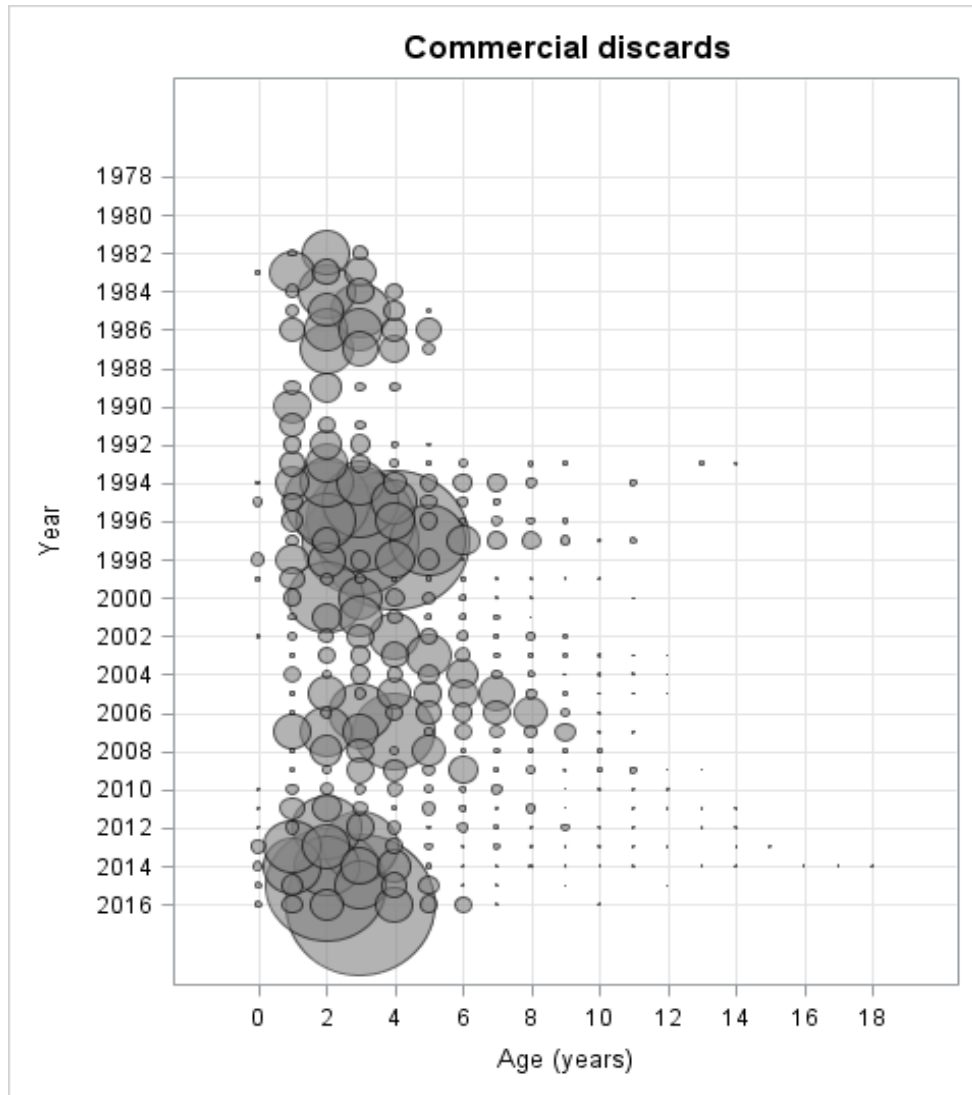


Figure 16. Commercial discards-at-age of Gulf of Maine haddock from 1977 to 2016. *Note that scale has been adjusted to maximize visibility of catch-at-age (i.e., size of bubbles is not comparable between plots).*

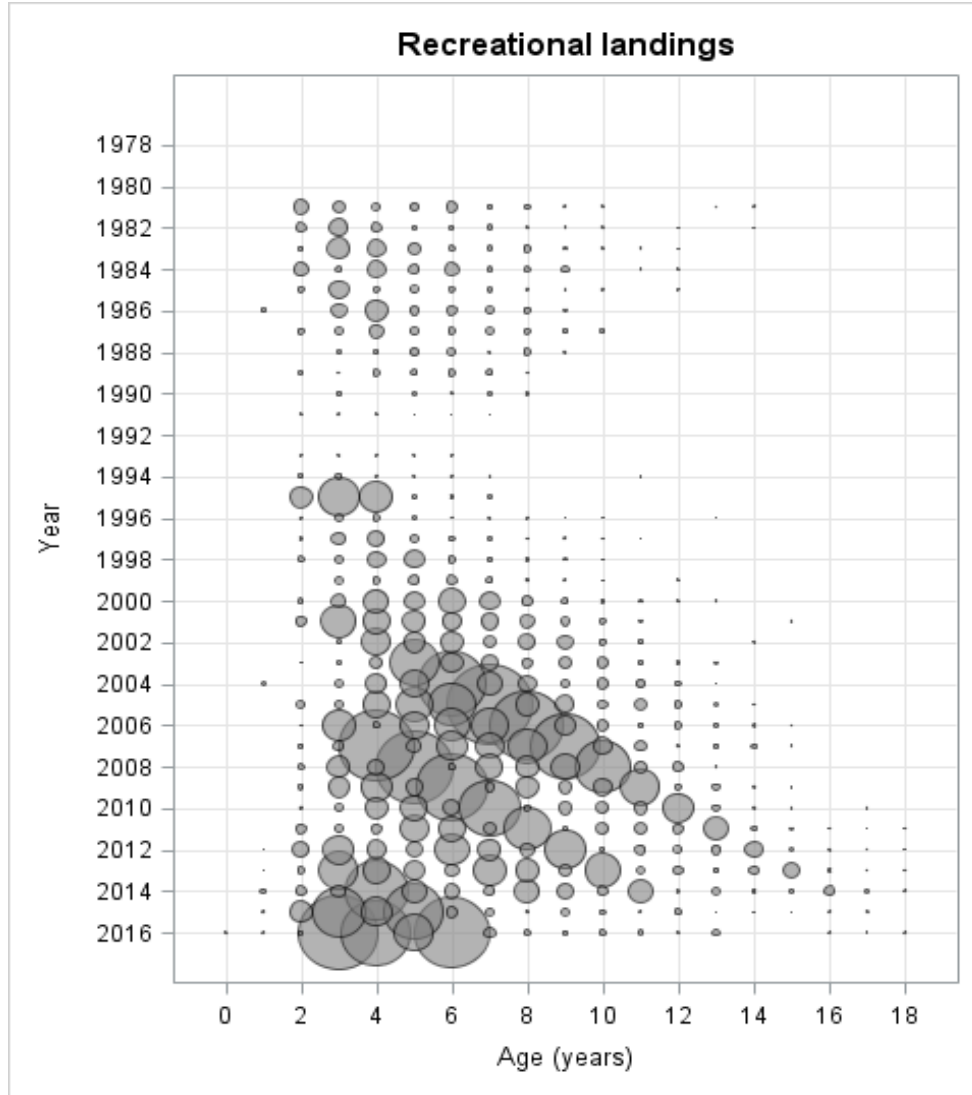


Figure 17. Recreational landings-at-age of Gulf of Maine haddock from 1977 to 2016. Recreational catch estimates are not available prior to 1981. *Note that scale has been adjusted to maximize visibility of catch-at-age (i.e., size of bubbles is not comparable between plots).*

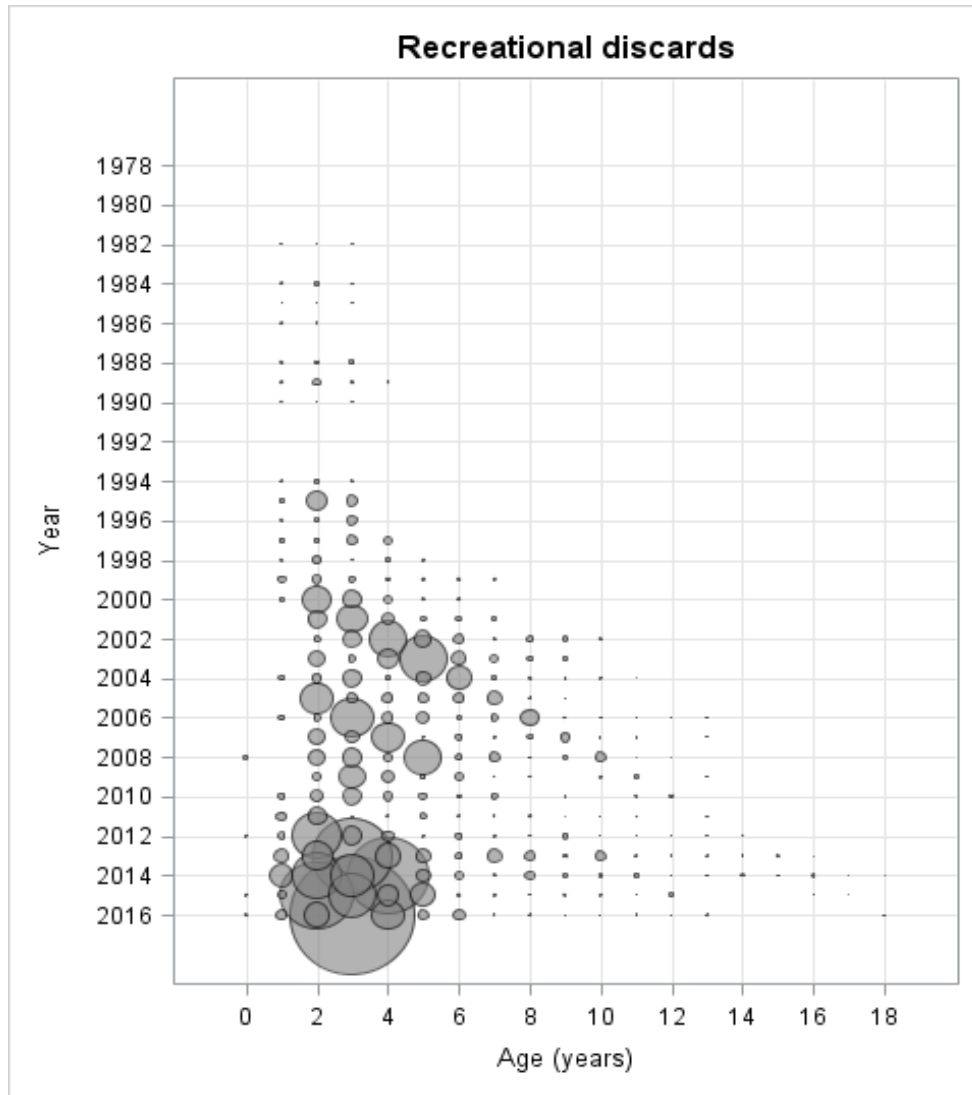


Figure 18. Recreational discards-at-age of Gulf of Maine haddock from 1977 to 2016. Recreational catch estimates are not available prior to 1981. *Note that scale has been adjusted to maximize visibility of catch-at-age (i.e., size of bubbles is not comparable between plots).*

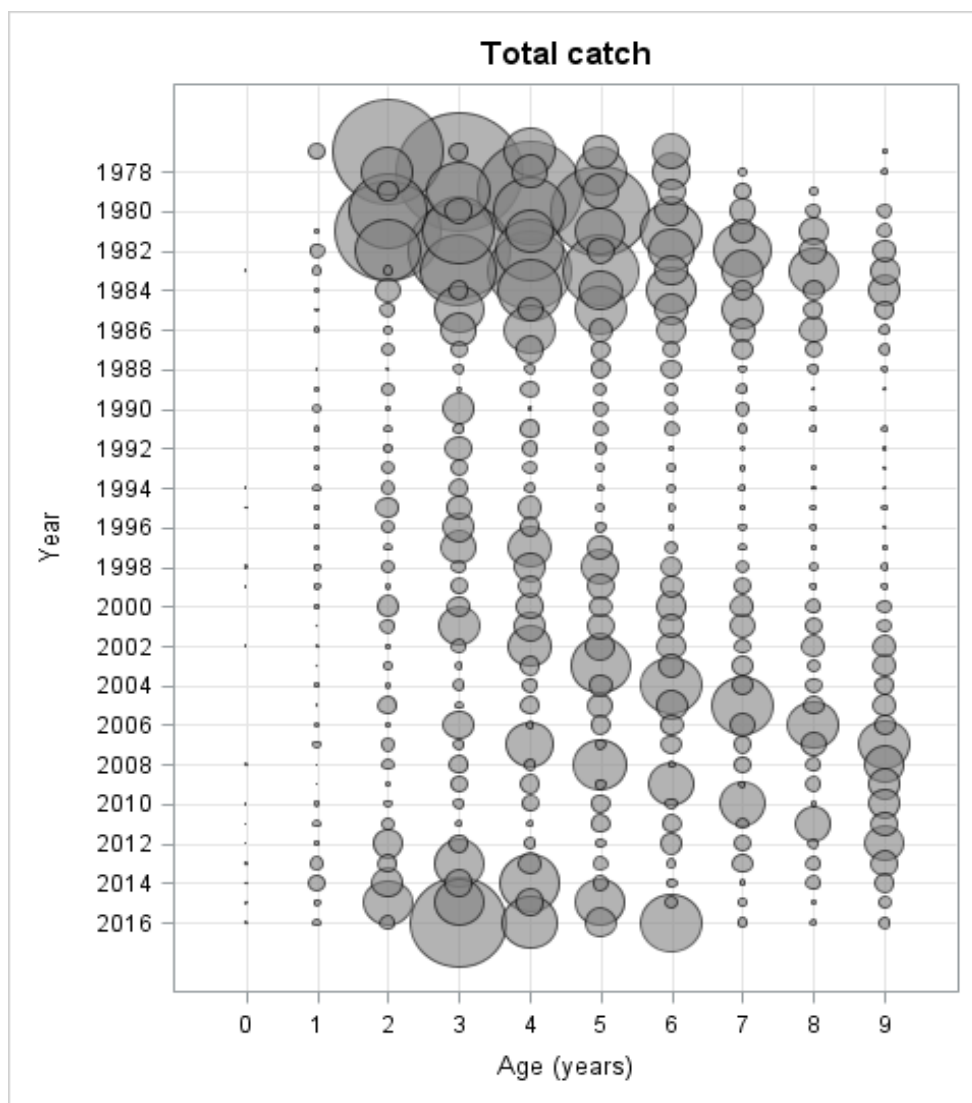


Figure 19. Total catch-at-age of Gulf of Maine haddock from 1977 to 2016. *Only ages 1 through the 9⁺ group are used as assessment model inputs. The scale has been adjusted to maximize visibility of catch-at-age (i.e., size of bubbles is not comparable between plots).*

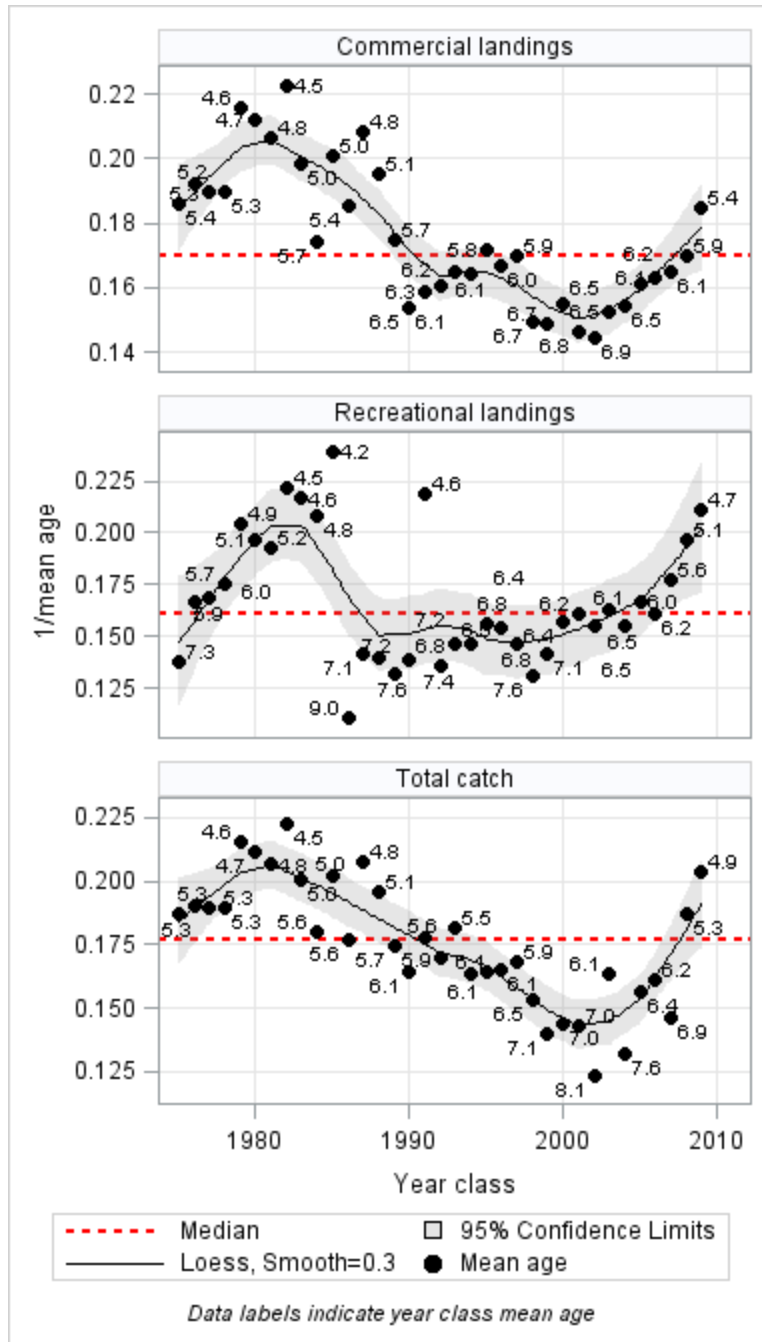


Figure 20. Trends in the inverse of the mean age of Gulf of Maine haddock in the commercial landings, recreational landings and total catch (landings and discards) for the 1975 to 2009 year classes. Mean age is estimated using ages approximating the range of full selectivity (ages 4-8).

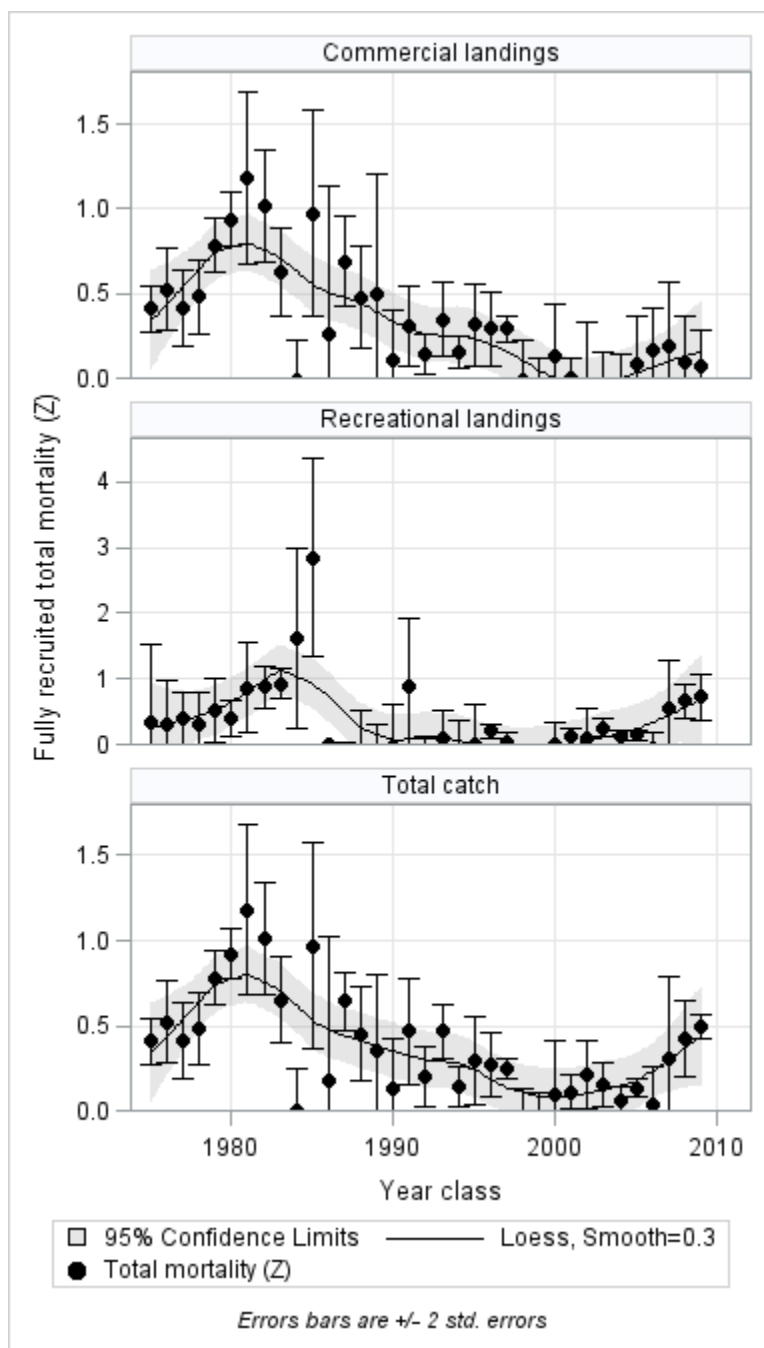


Figure 21. Trends in total mortality (Z) of Gulf of Maine haddock in the commercial landings, recreational landings and total catch (landings and discards) for the 1975 to 2009 year classes. Total mortality has been estimated using a catch curve analysis fit to the ages approximating the range of full selectivity (ages 4-8).

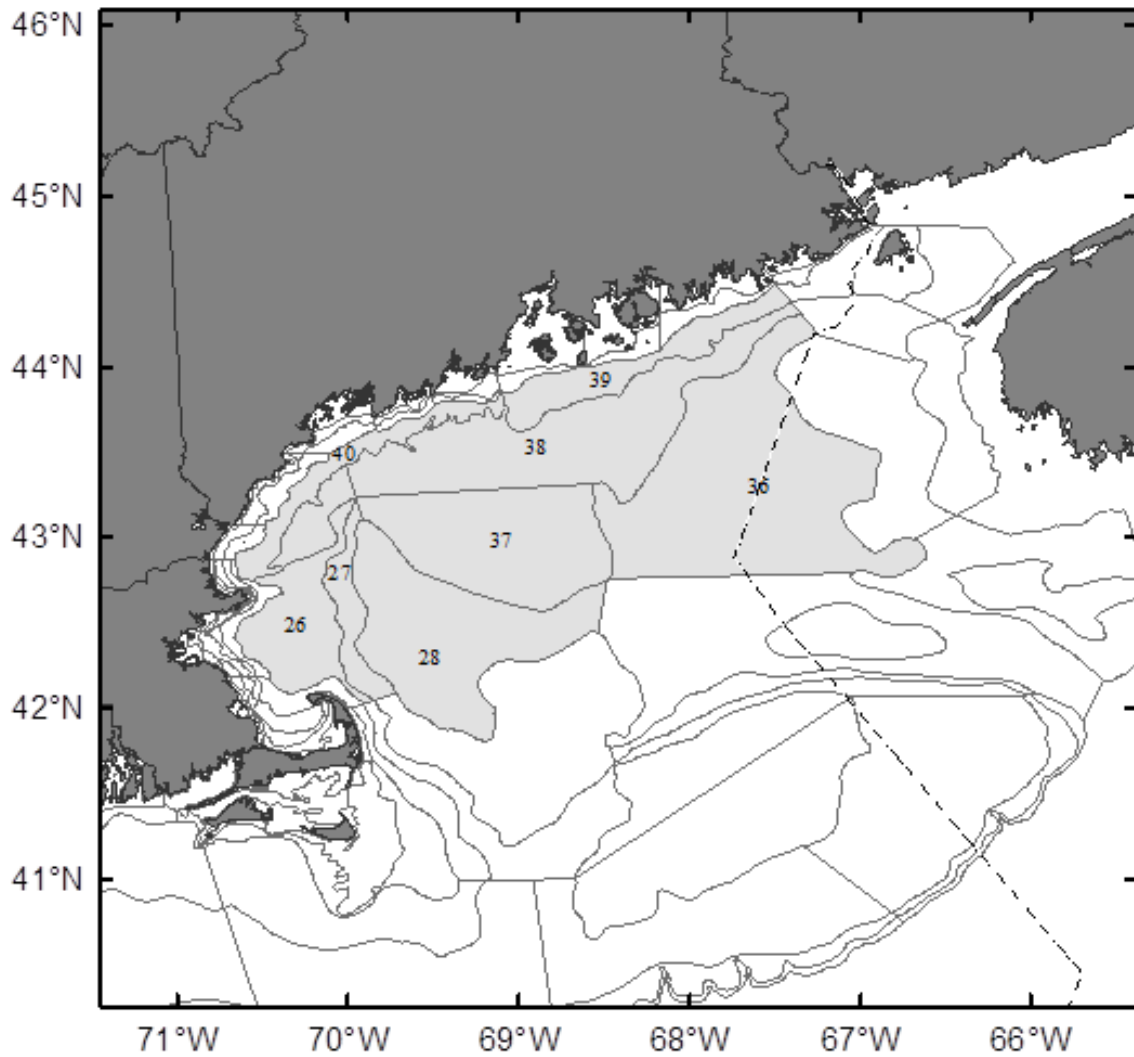


Figure 22. Map of the Northeast Fisheries Science Center (NEFSC) bottom trawl offshore survey strata used in the Gulf of Maine haddock stock assessment (light grey).

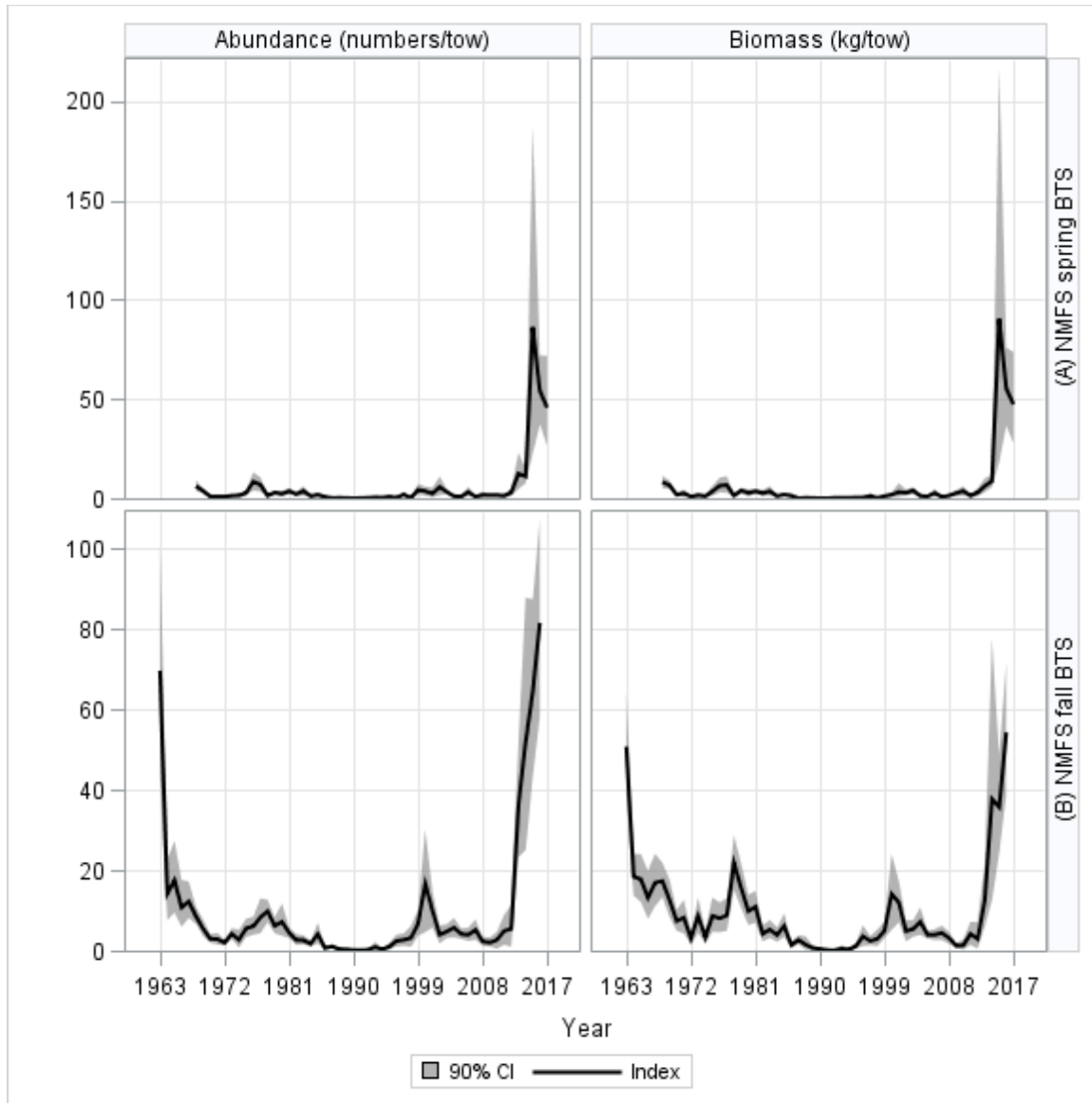


Figure 23. Northeast Fisheries Science Center (NEFSC) spring and fall bottom trawl surveys and abundance (left) and biomass (right) indices for Gulf of Maine haddock from 1963 to 2017. *Note, the NEFSC spring survey did not begin until 1968 and the NEFSC fall 2017 survey has not been conducted at the time of this report.*



Figure 24. Mean day of the year of sampling in the Gulf of Maine by the Northeast Fisheries Science Center (NEFSC) spring and fall bottom trawl surveys. Grey bands indicate the minimum and maximum for each survey/year. Day of the year is expressed as Julian days (e.g., January 1 is day 1 and December 31 is day 365/66). Years marked with circles in the mean temperature plot indicate years when not all survey stratum were sampled and therefore the mean temperature may not be representative of the entire survey area.

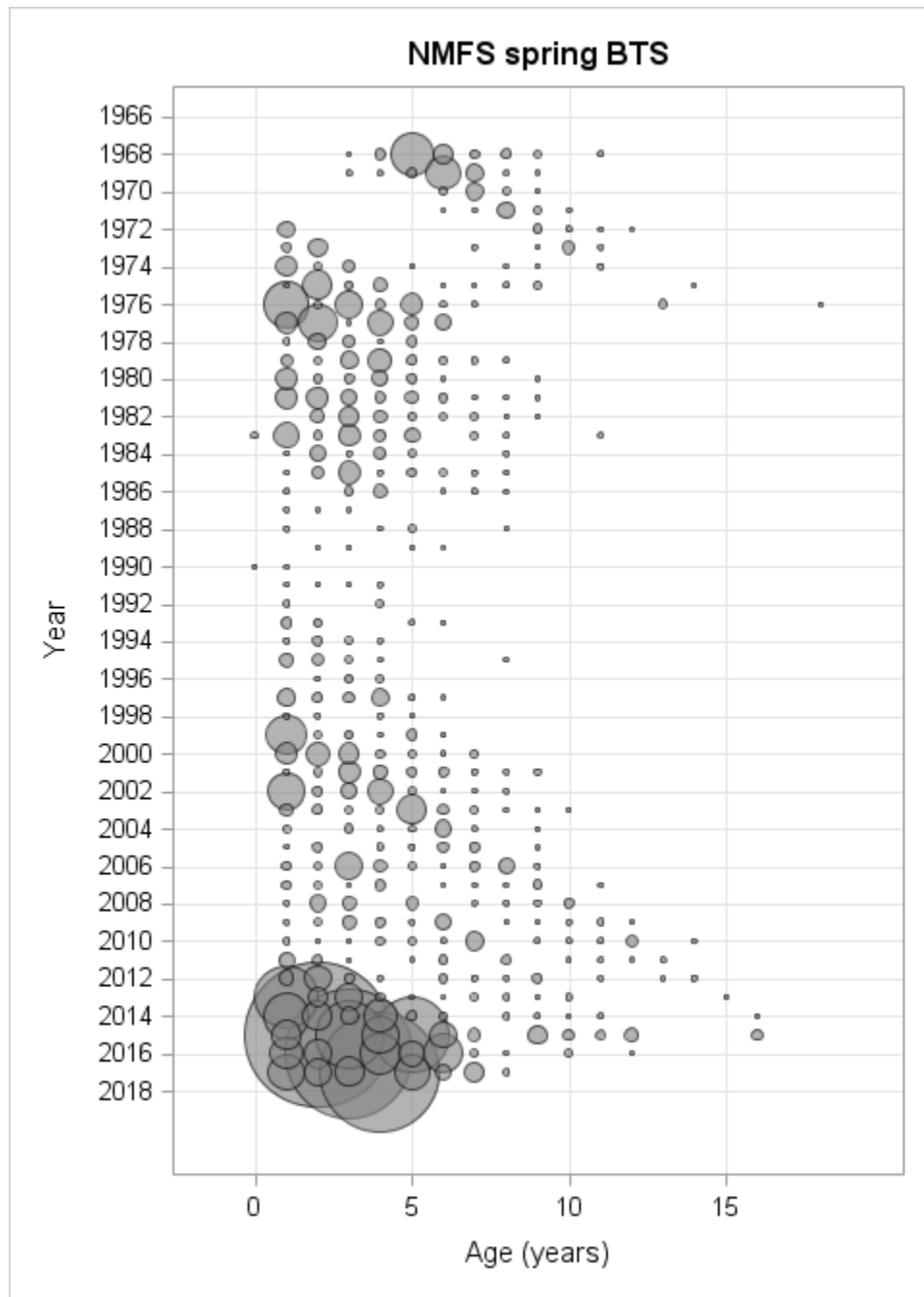


Figure 25. Gulf of Maine haddock abundance (numbers/tow) indices-at-age from Northeast Fisheries Science Center (NEFSC) spring bottom trawl survey from 1968 to 2017. *Note that scale has been adjusted to maximize visibility of indices-at-age (i.e., size of bubbles is not comparable between plots).*

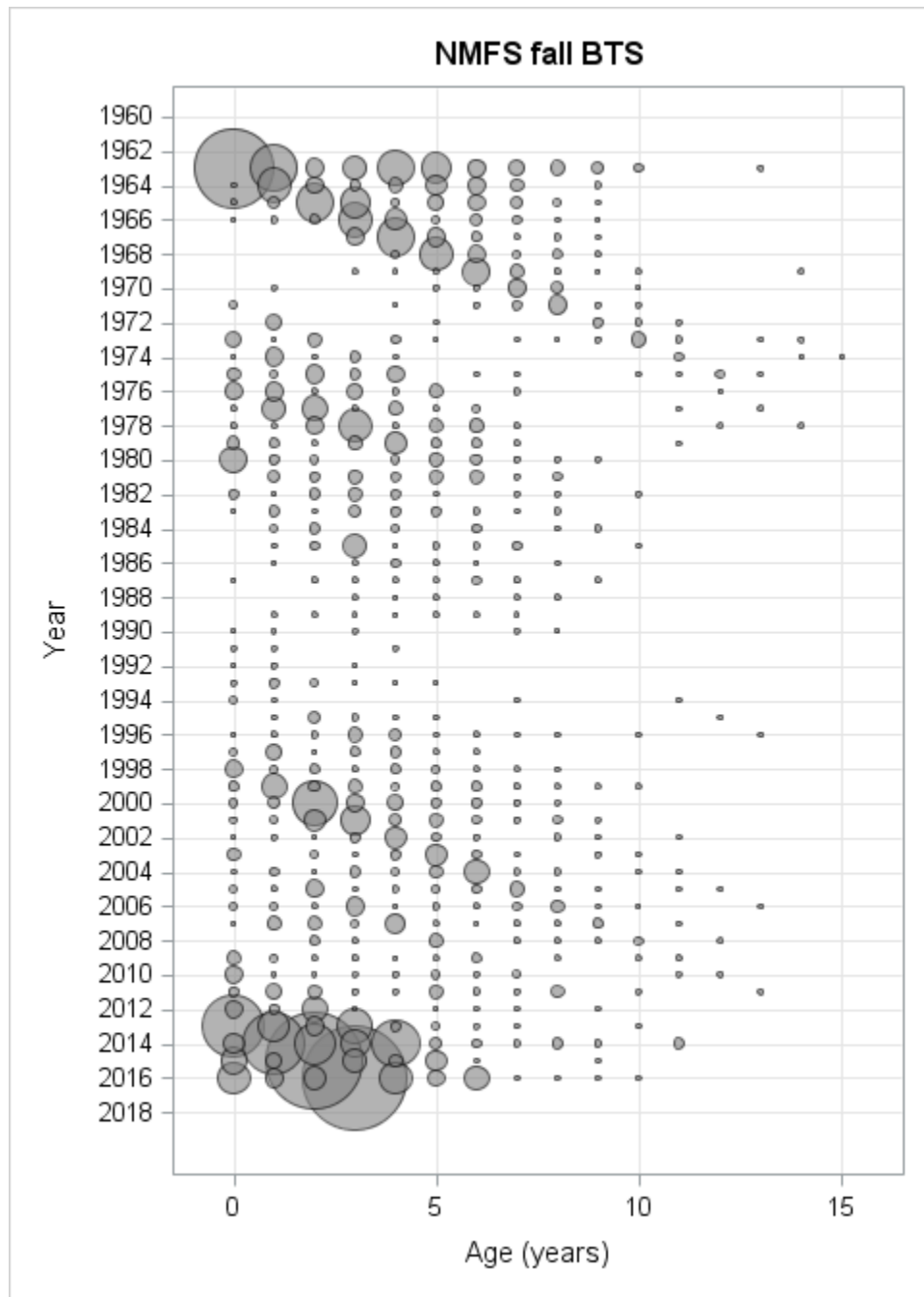


Figure 26. Gulf of Maine haddock abundance (numbers/tow) indices-at-age from Northeast Fisheries Science Center (NEFSC) fall bottom trawl survey from 1963 to 2016. *Note that scale has been adjusted to maximize visibility of indices-at-age (i.e., size of bubbles is not comparable between plots).*

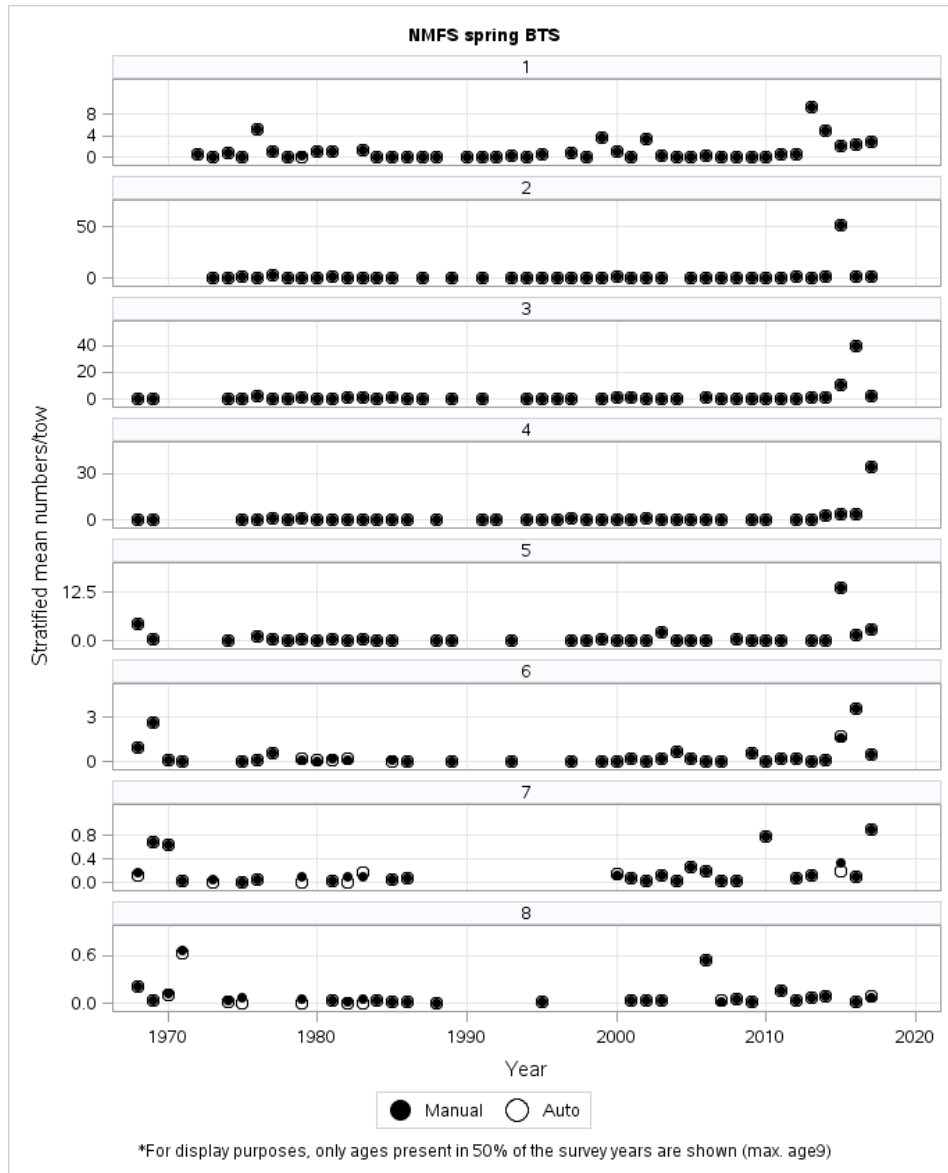


Figure 27. Comparison of the Gulf of Maine haddock abundance (numbers/tow) indices-at-age from the Northeast Fisheries Science Center (NEFSC) spring bottom trawl survey from 1970 to 2017 generated using a manual process to fill holes in the age-length key to that using an automated multinomial approach (see Gerritsen *et al.* 2006). The age classes shown are restricted to only those ages that are present in $\geq 50\%$ of the survey years examined.

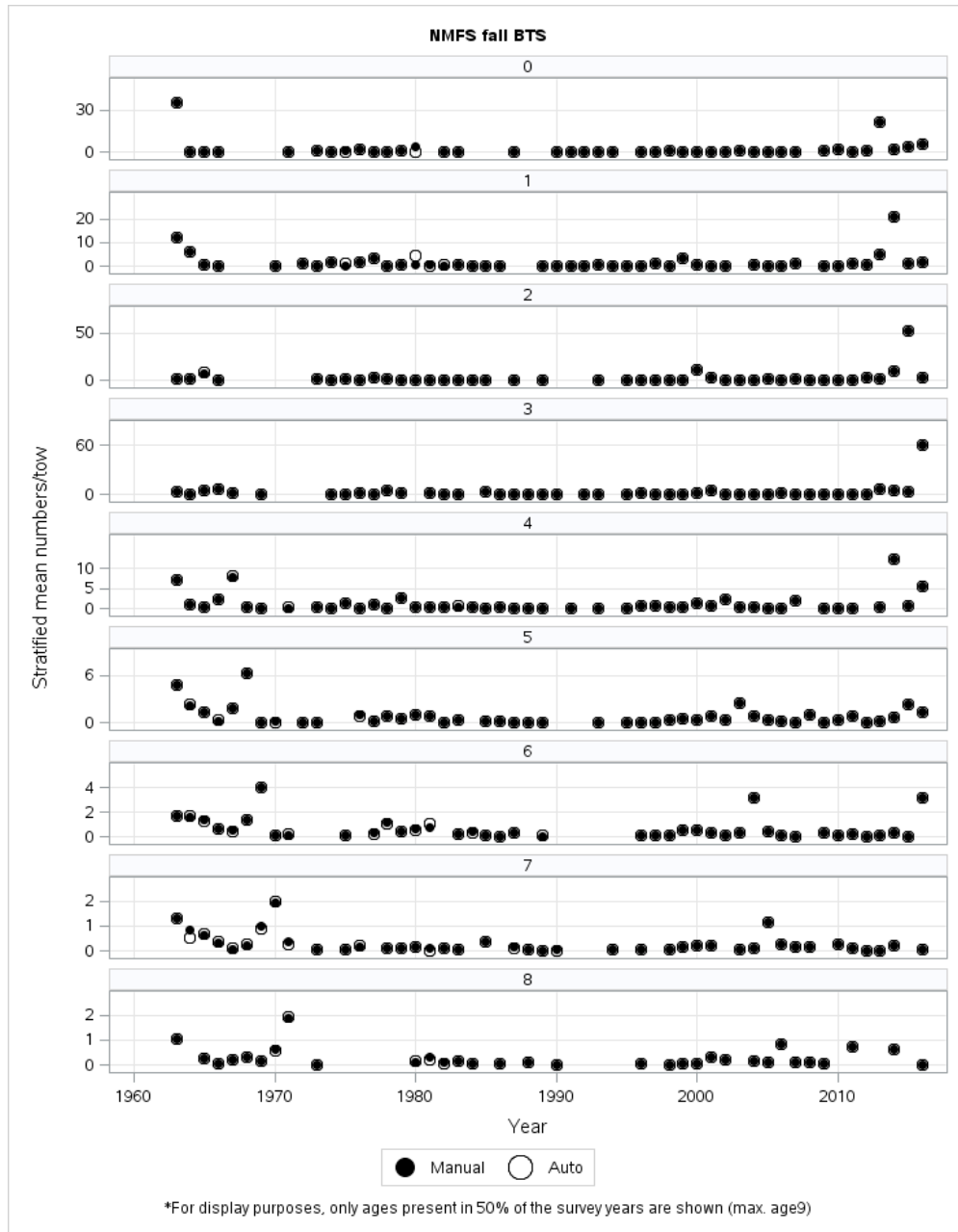


Figure 28. Comparison of the Gulf of Maine haddock abundance (numbers/tow) indices-at-age from the Northeast Fisheries Science Center (NEFSC) fall bottom trawl survey from 1970 to 2016 generated using a manual process to fill holes in the age-length key to that using an automated multinomial approach (see Gerritsen *et al.* 2006). The age classes shown are restricted to only those ages that are present in $\geq 50\%$ of the survey years examined.

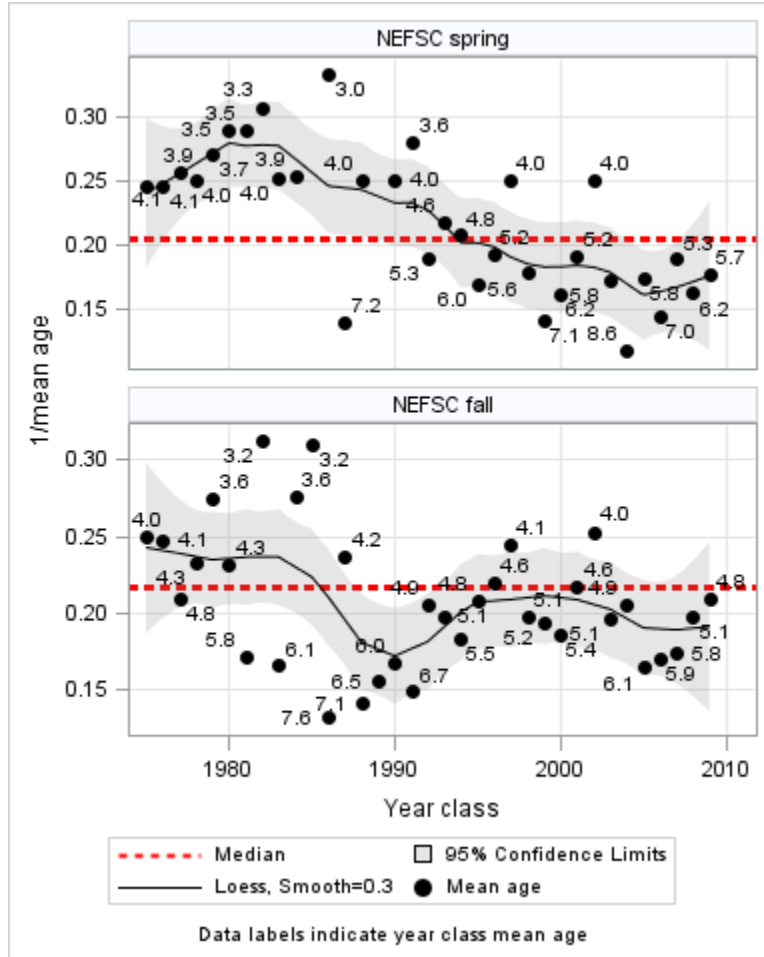


Figure 29. Trends in the inverse of the mean age of Gulf of Maine haddock in the Northeast Fisheries Science Center (NEFSC) spring and fall bottom trawl survey for the 1975 to 2009 year classes. Mean age is estimated using ages 3-8 in the NEFSC spring survey and ages 4-9 in the NEFSC fall survey.

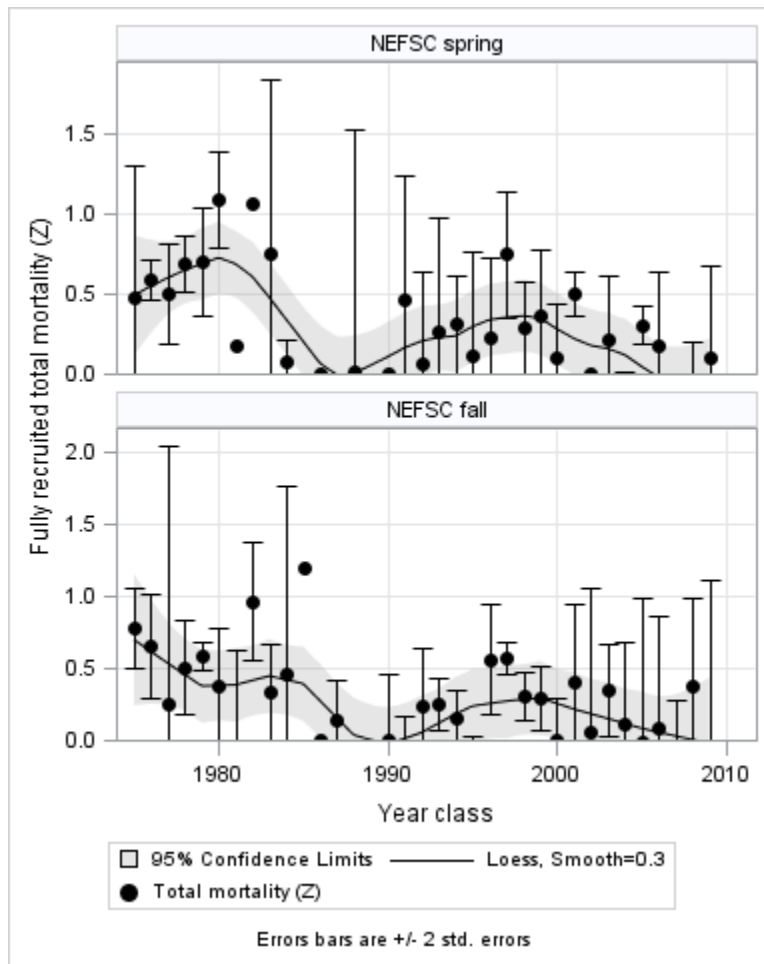


Figure 30. Trends in total mortality (Z) of Gulf of Maine haddock in the Northeast Fisheries Science Center (NEFSC) spring and fall bottom trawl survey for the 1975 to 2009 year classes. Total mortality has been estimated using a catch curve analysis fit to ages 3-8 in the NEFSC spring survey and ages 4-9 in the NEFSC fall survey.

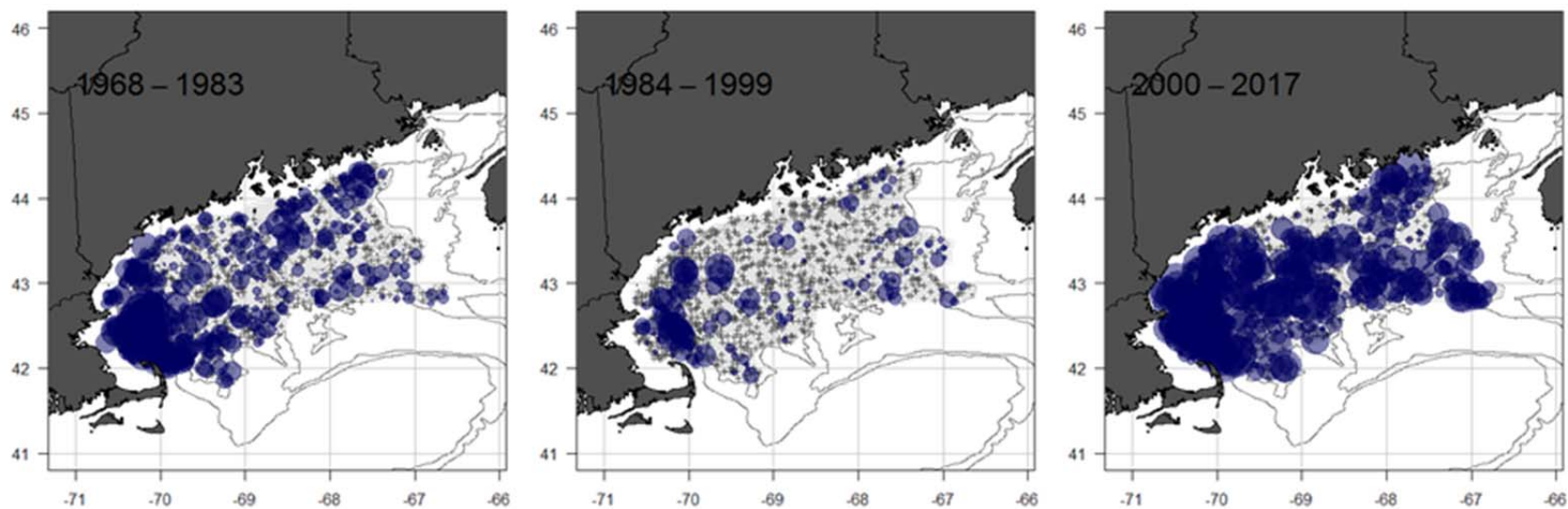


Figure 31. Spatial distribution of Gulf of Maine haddock catches (numbers/tow) from the Northeast Fisheries Science Center spring and fall bottom trawl survey from 1968 – 2017 in approximate fifteen year increments. *Note that the last panel does not include the 2017 NEFSC fall survey.*

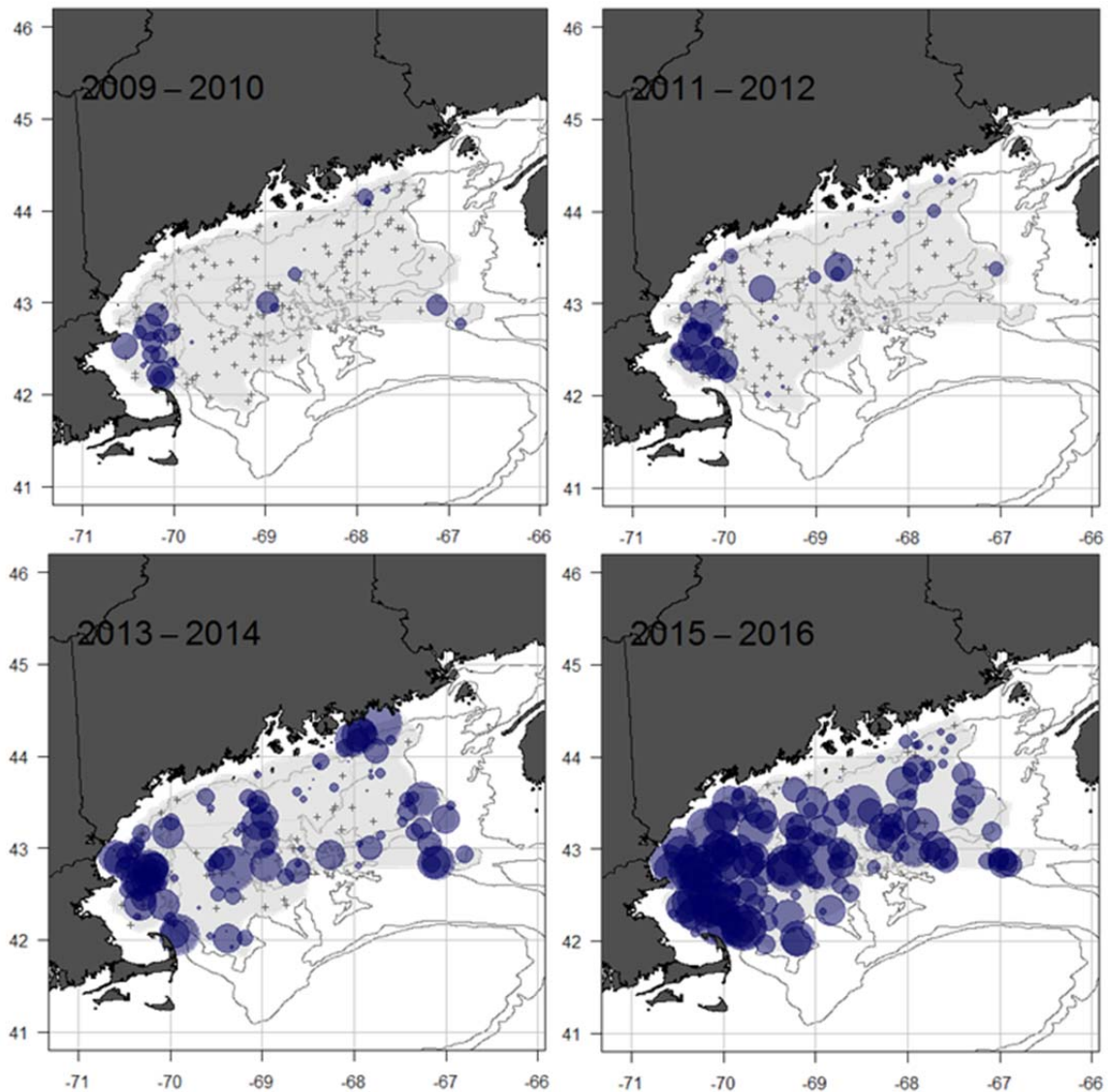


Figure 32. Spatial distribution of Gulf of Maine haddock catches (numbers/tow) from the Northeast Fisheries Science Center spring and fall bottom trawl surveys from 2009 to 2016 in two year increments.

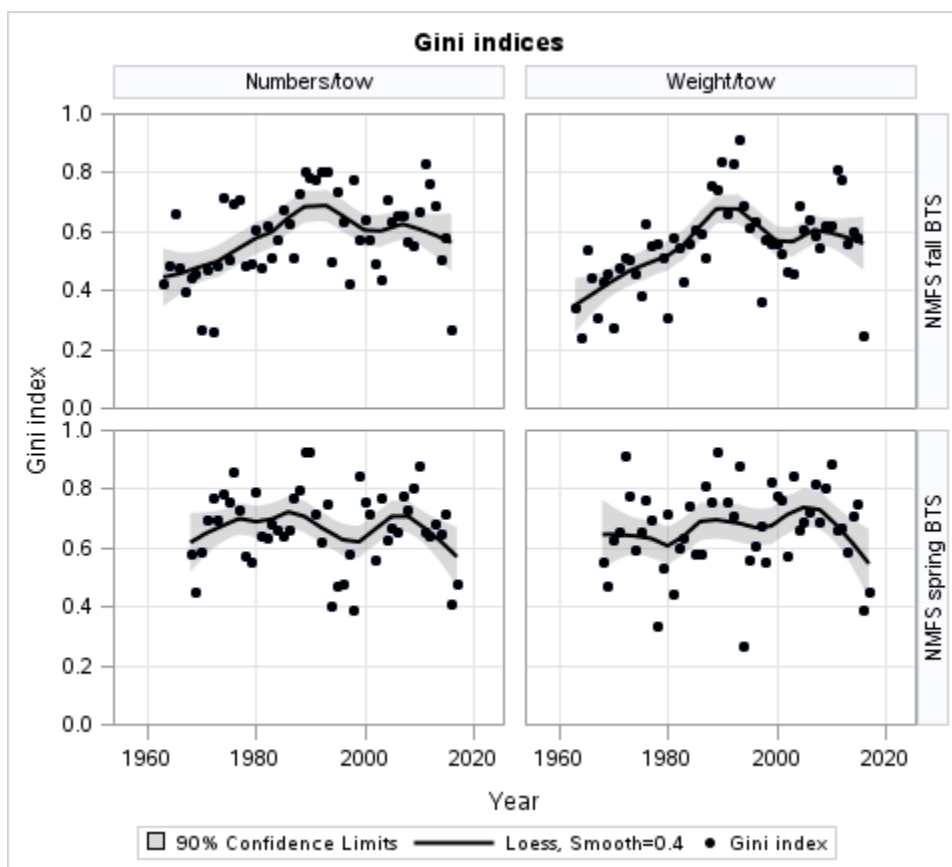


Figure 33. Gini indices for Gulf of Maine haddock from the Northeast Fisheries Science Center (NEFSC) spring and fall bottom trawl surveys in terms of abundance (numbers/tow) and biomass (kg/tow). *Note that the NEFSC spring survey did not begin until 1968 and the 2017 NEFSC fall survey had not been conducted at the time of this report.*

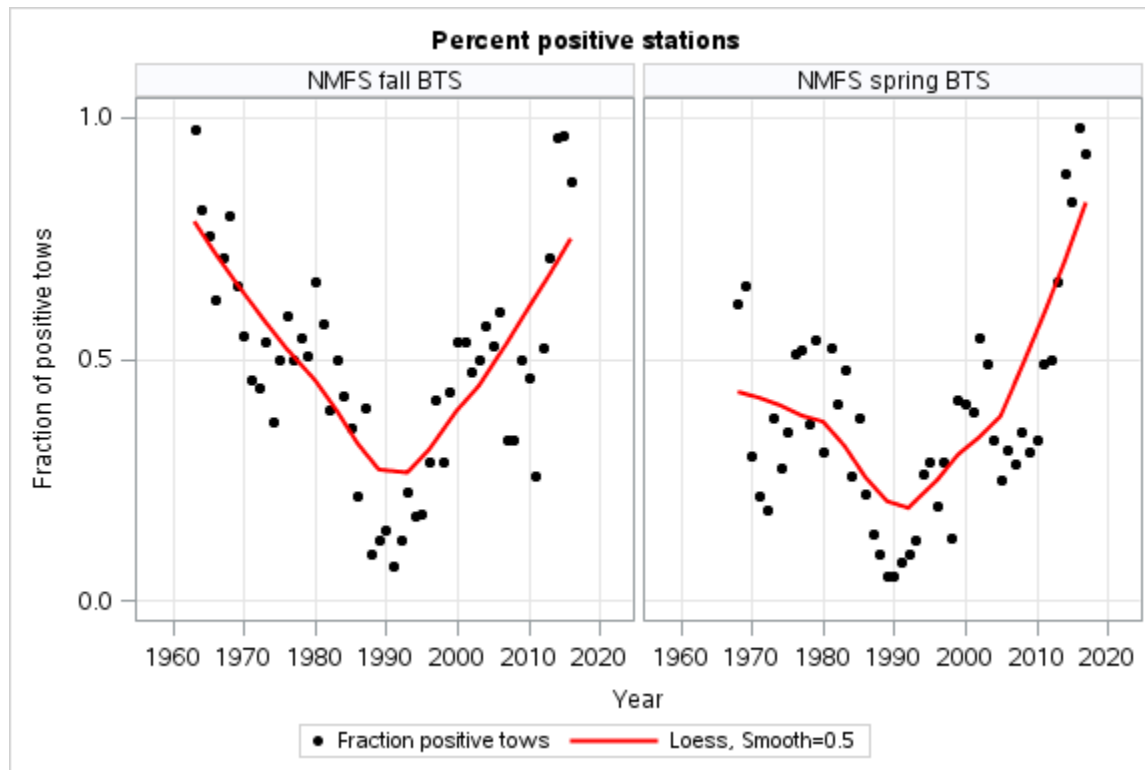


Figure 34. Fraction of Northeast Fisheries Science Center (NEFSC) spring and fall bottom trawl survey tows with positive catches of Gulf of Maine haddock from 1963 to 2017. *Note that the NEFSC spring survey did not begin until 1968 and the 2017 NEFSC fall survey had not been conducted at the time of this report.*

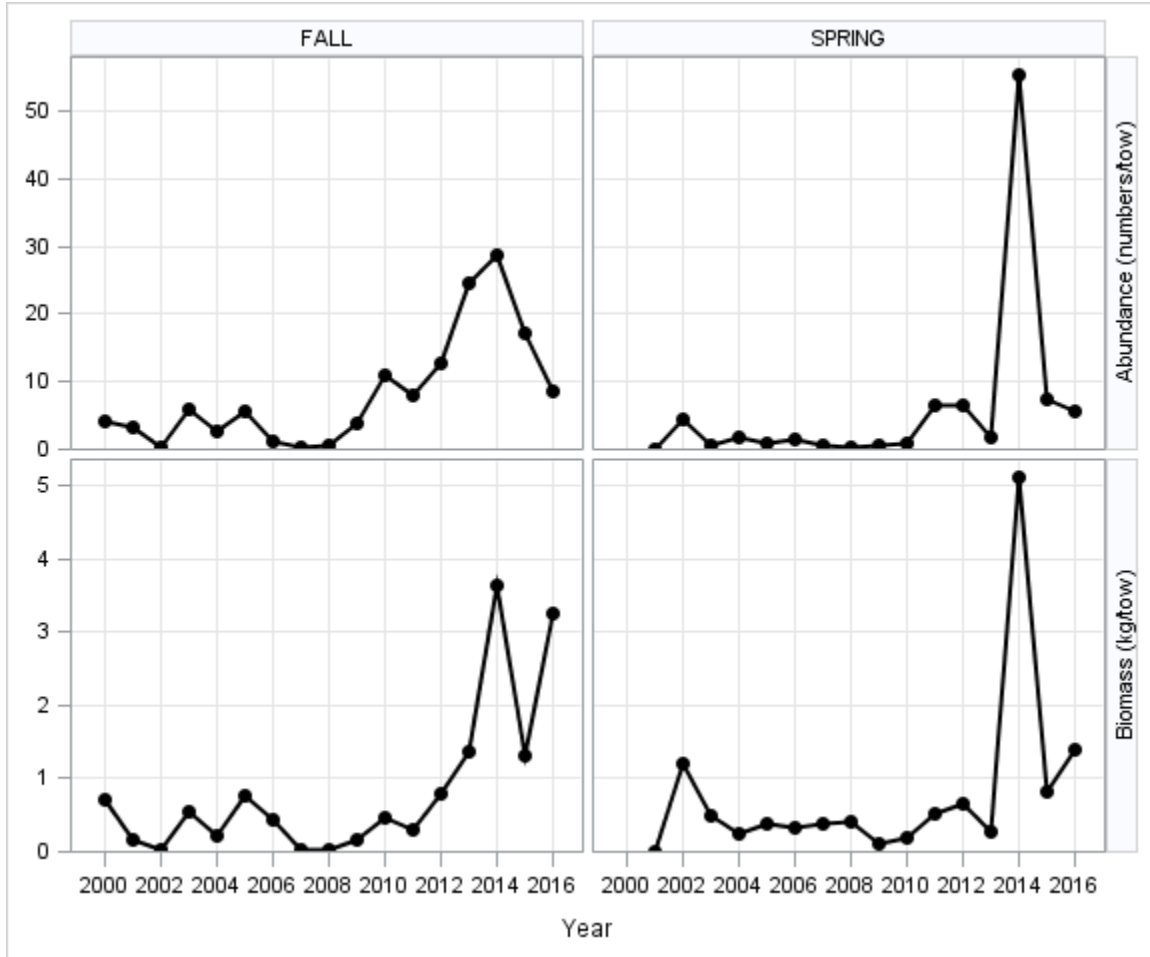


Figure 35. Maine-New Hampshire (ME-NH) spring and fall inshore bottom trawl survey abundance (top) and biomass (bottom) indices for Gulf of Maine haddock from 2000 to 2016. *Note, the ME-NH spring survey did not begin until 2001.*

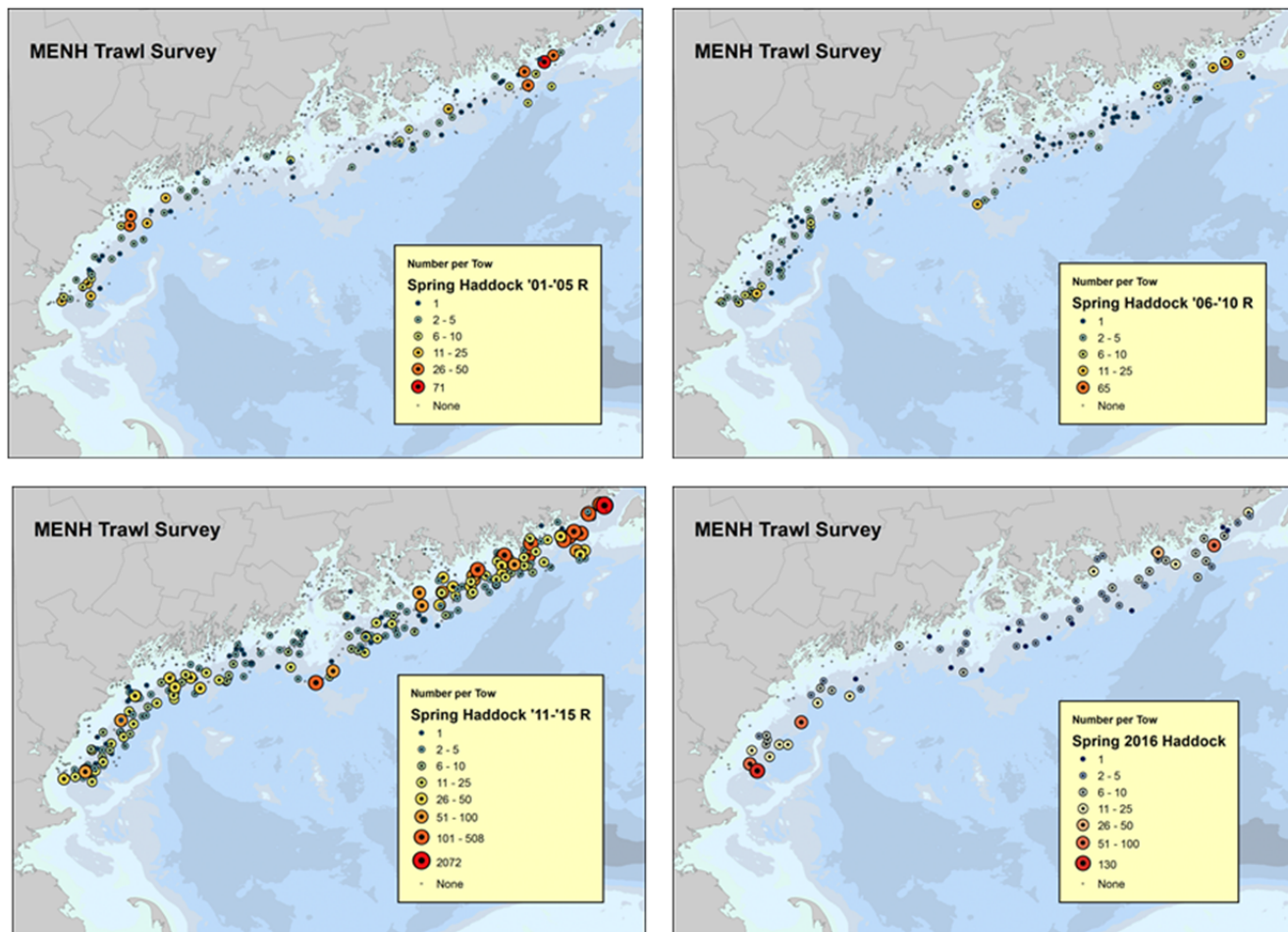


Figure 36. Spatial distribution of Gulf of Maine haddock catches (numbers/tow) from the Maine-New Hampshire (ME-NH) spring inshore bottom trawl survey from 2001 to 2016. *Figures courtesy of Sally Sherman (ME DMR). Note that the ME NH survey is not used as an input to the assessment model.*

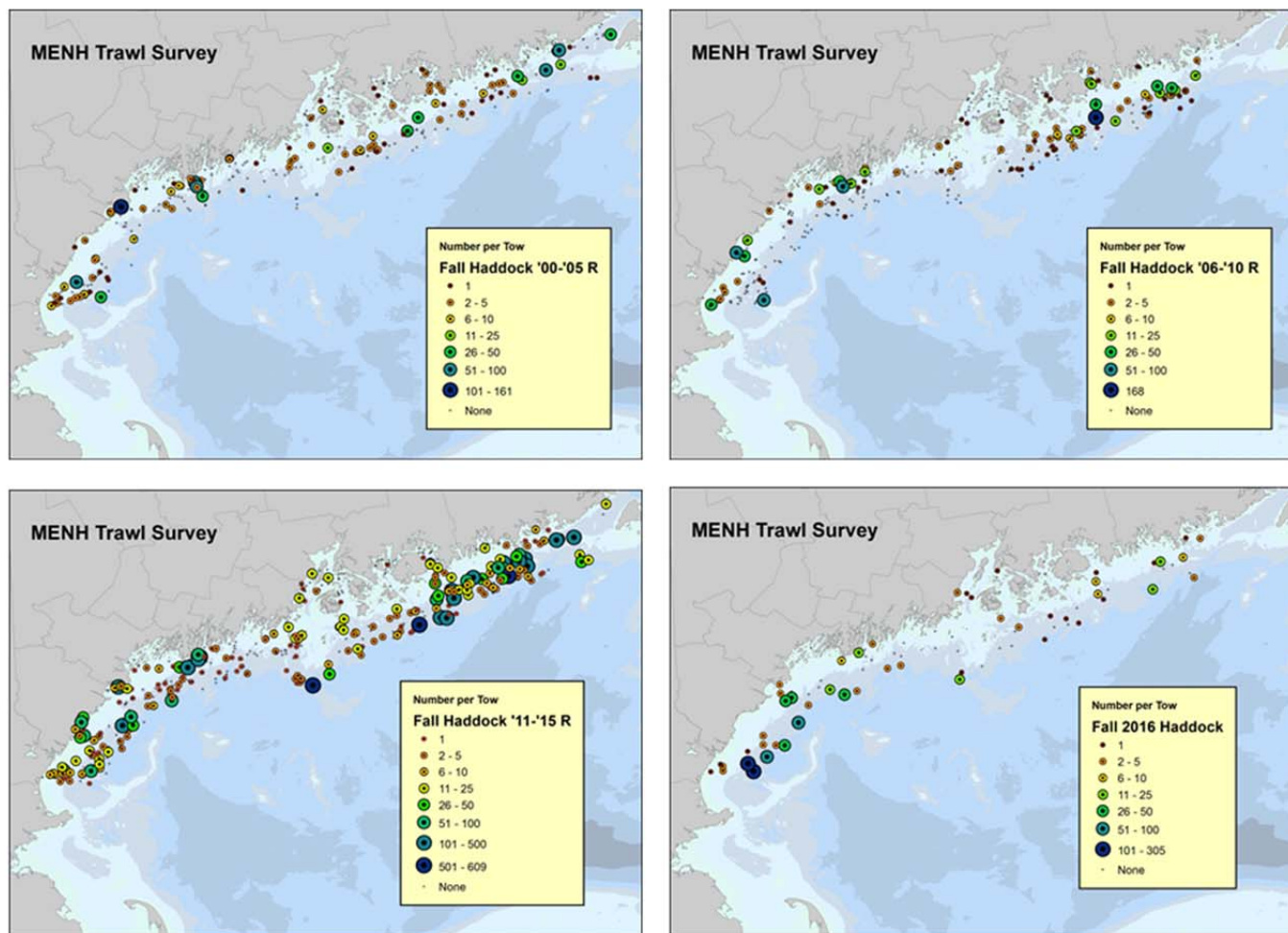


Figure 37. Spatial distribution of Gulf of Maine haddock catches (numbers/tow) from the Maine-New Hampshire (ME-NH) fall inshore bottom trawl survey from 2000 to 2016. *Figures courtesy of Sally Sherman (ME DMR). Note that the ME NH survey is not used as an input to the assessment model.*

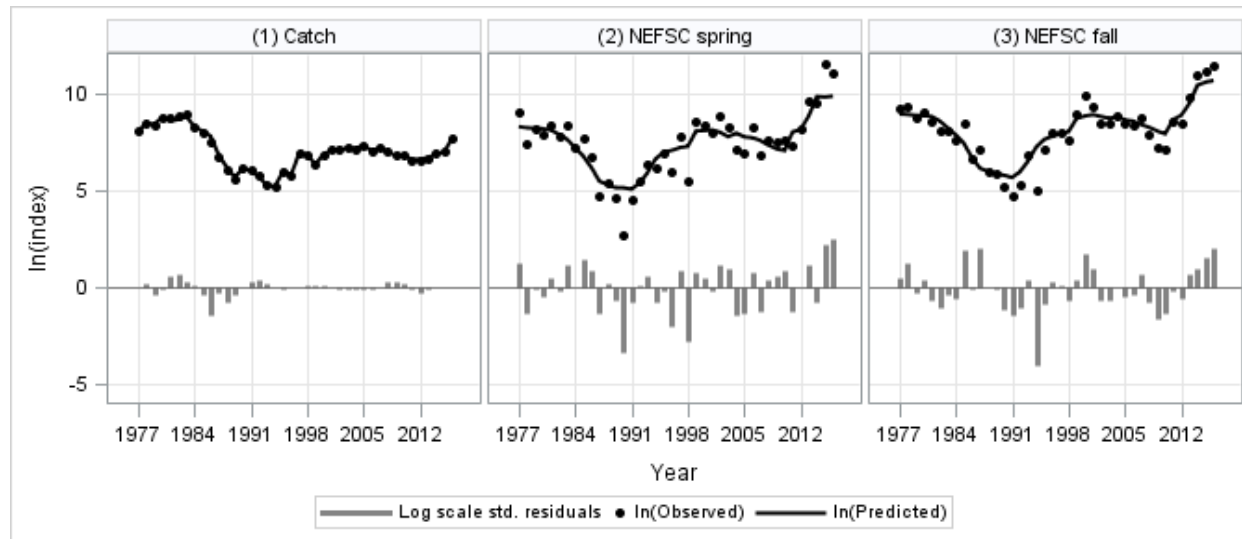


Figure 38. Comparison of model fits to aggregate catch and survey indices and the corresponding standardized residuals from the 'Base' Gulf of Maine haddock assessment model.

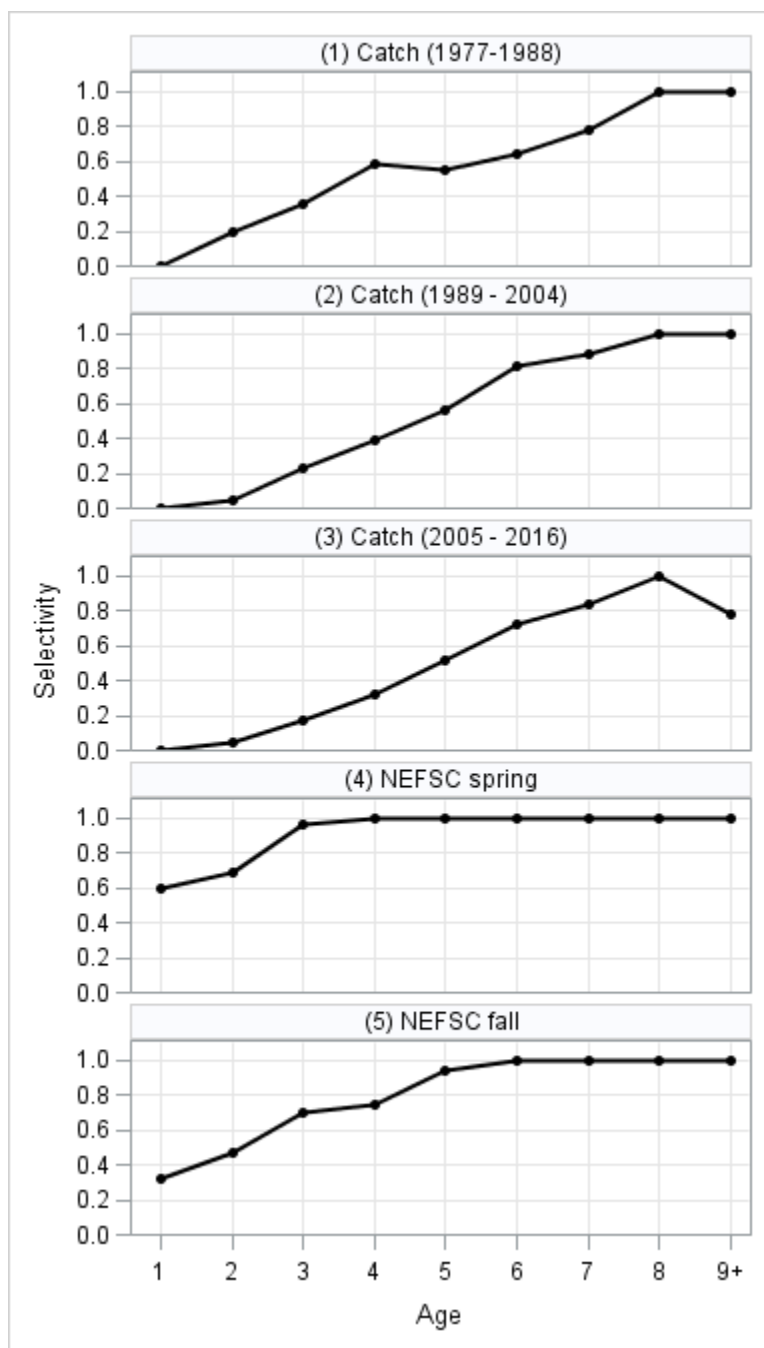


Figure 39. Estimated fishery selectivities for Gulf of Maine haddock from the 'Base' assessment model.

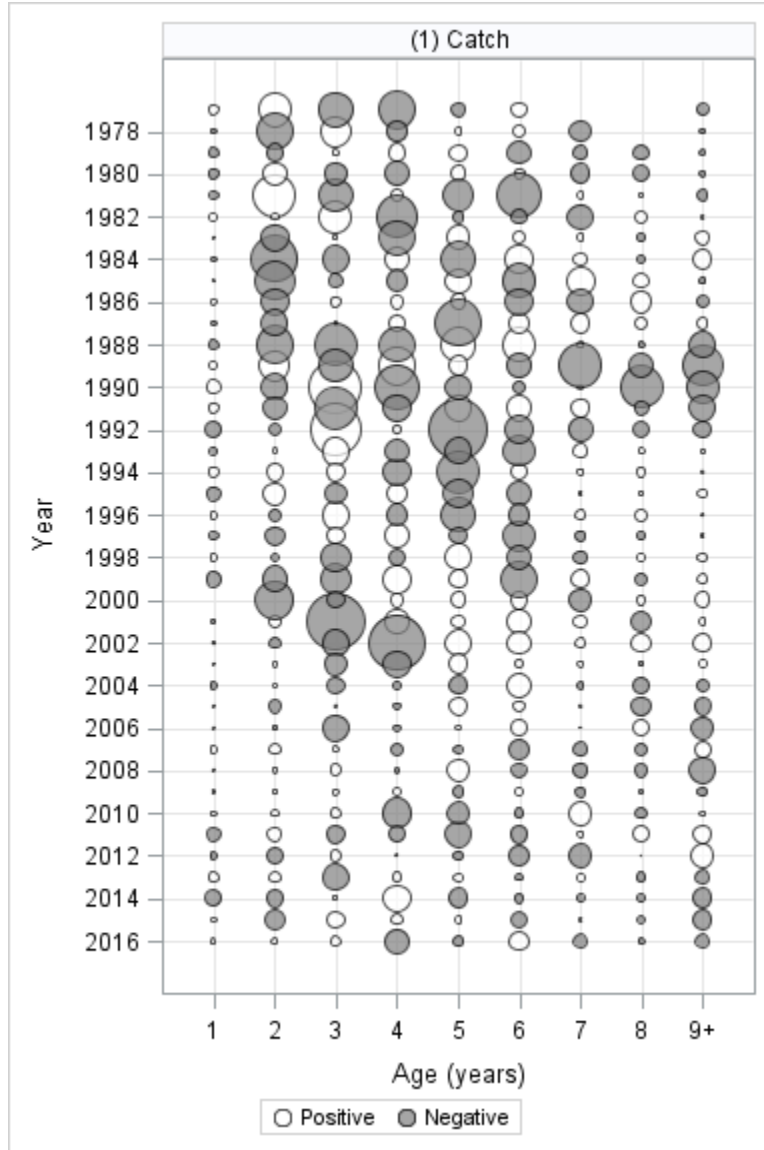


Figure 40. Model residuals of the fits to the Gulf of Maine haddock fishery catch-at-age for the 'Base' assessment model.

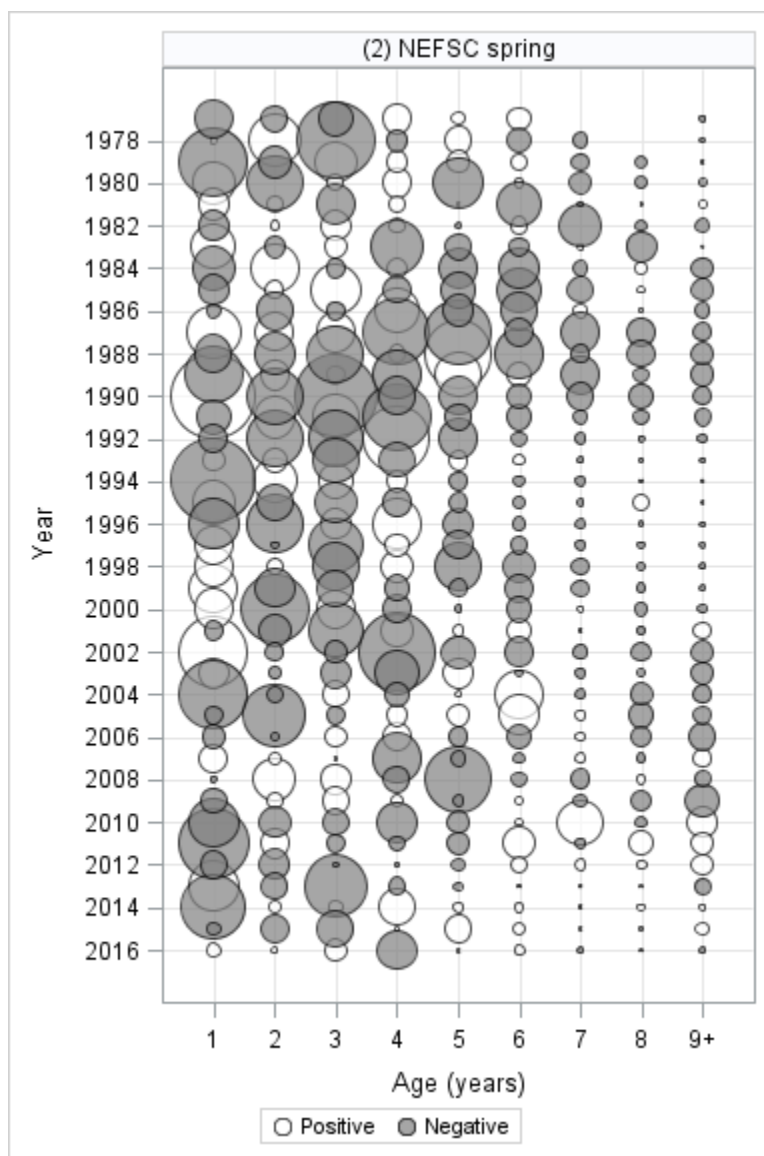


Figure 41. Model residuals of the fits to the NEFSC spring survey Gulf of Maine haddock indices-at-age for the 'Base' assessment model.

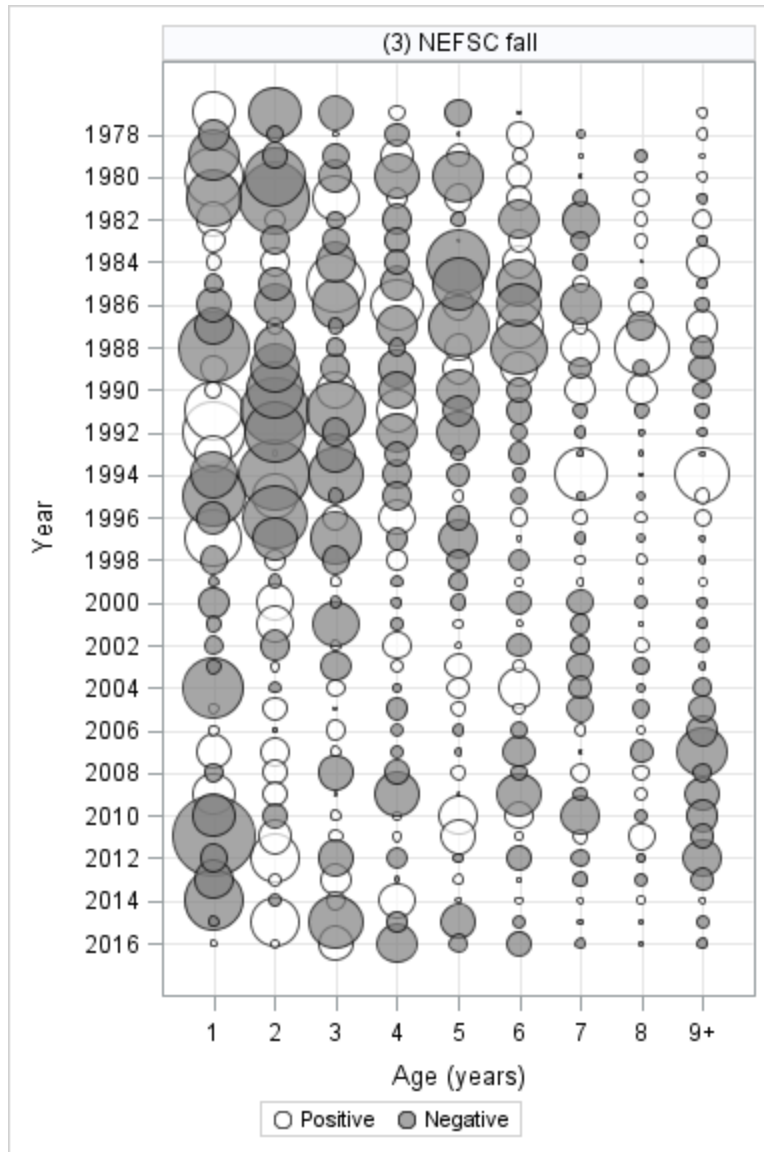


Figure 42. Model residuals of the fits to the NEFSC fall survey Gulf of Maine haddock indices-at-age for the 'Base' assessment model.

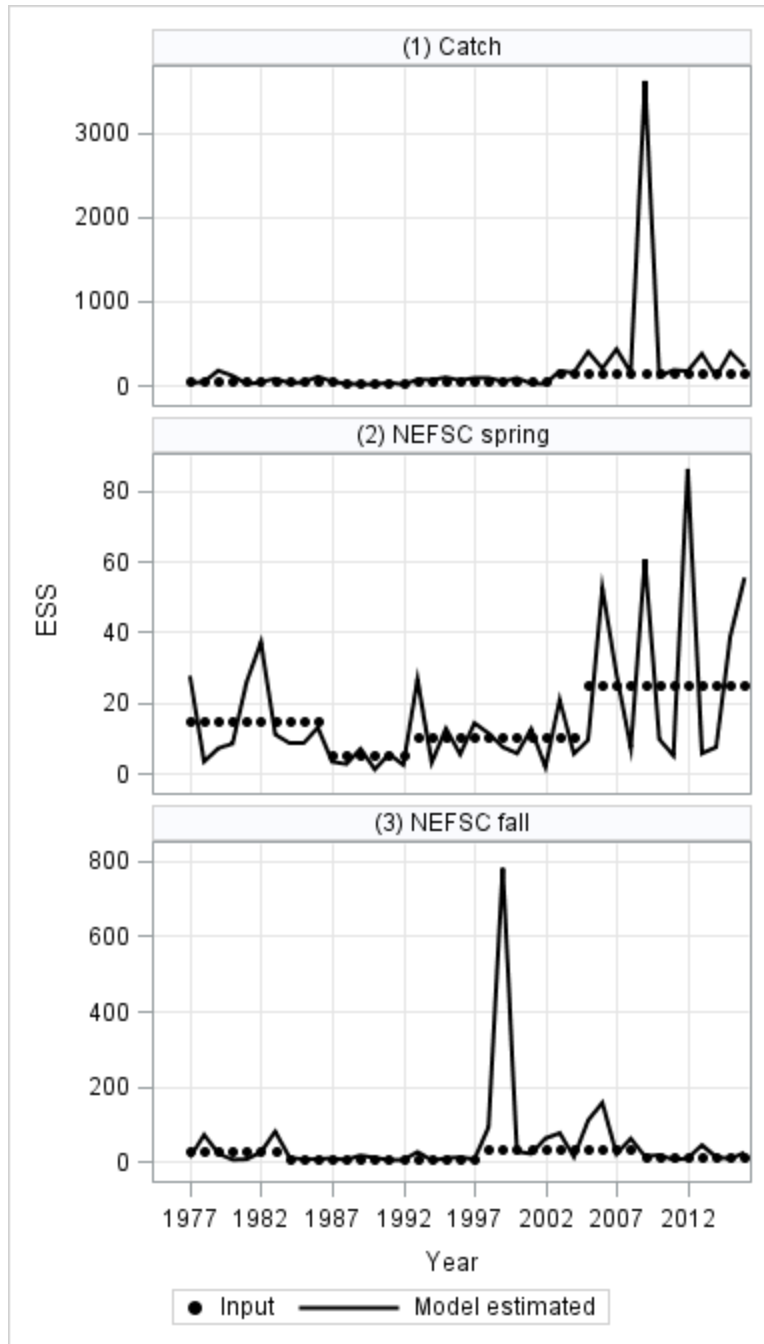


Figure 43. Comparison of the input and model estimated effective sample sizes (ESS) from the Gulf of Maine haddock 'Base' assessment model. See NEFSC (2014) for a full description of the methods used to determine input ESS.

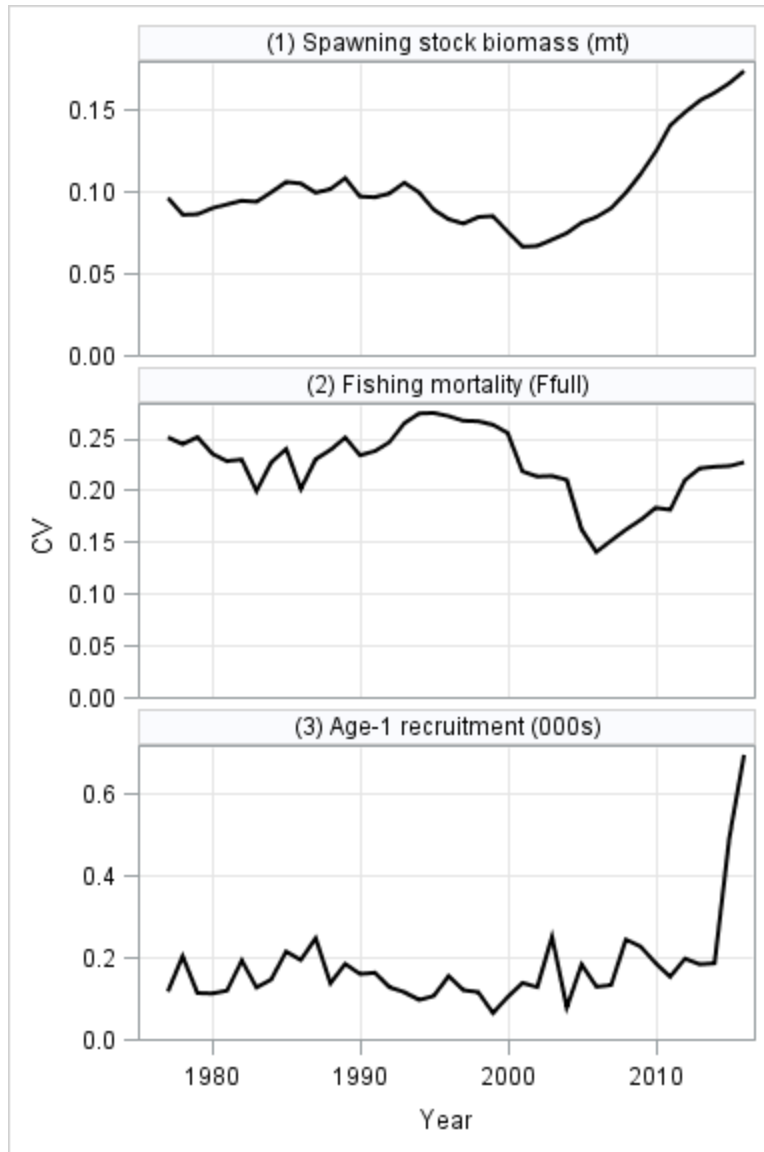


Figure 44. Coefficients of variation (CV) for the ‘Base’ assessment model estimates of Gulf of Maine haddock spawning stock biomass (SSB), fully recruited fishing mortality and age-1 recruitment.

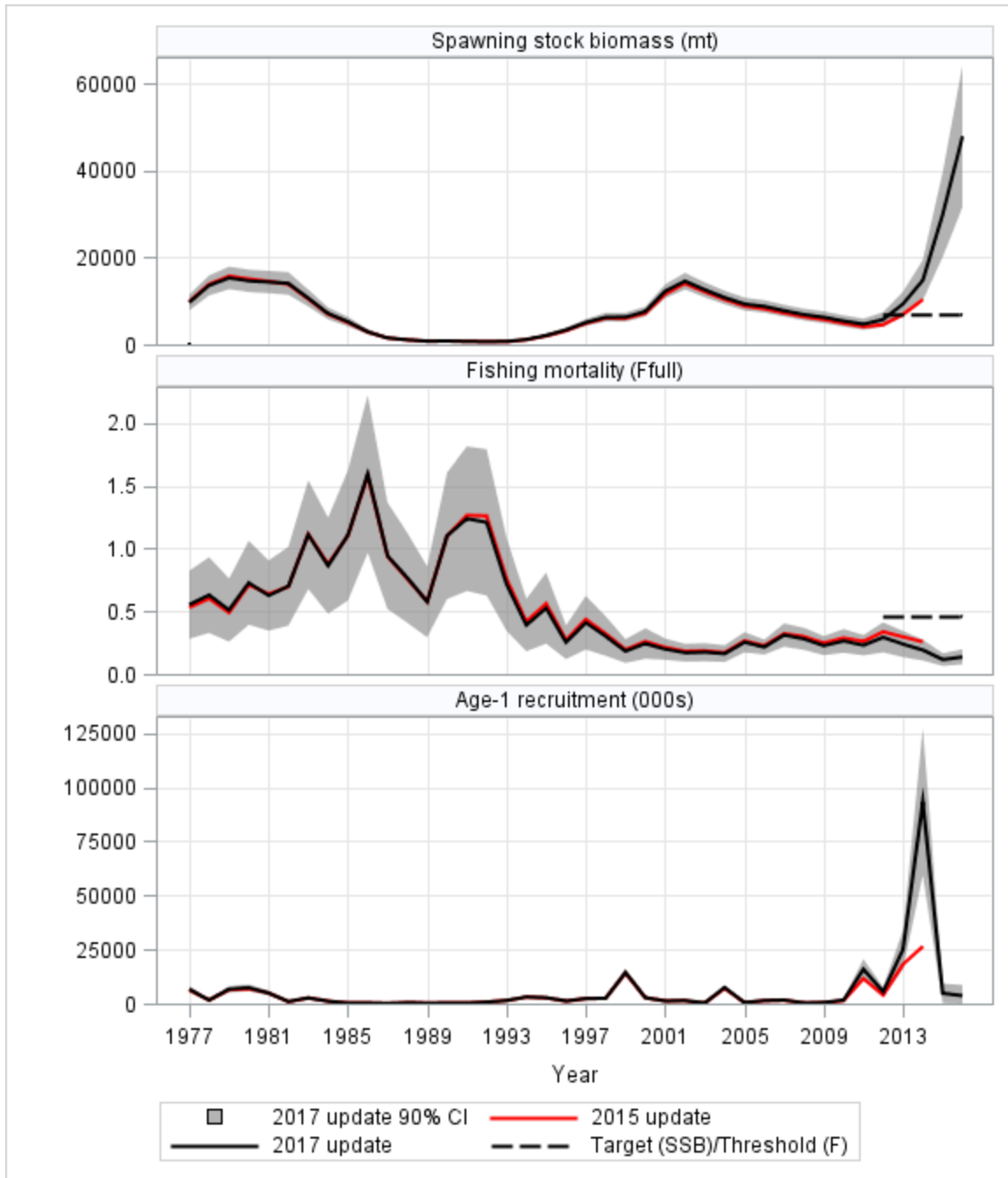


Figure 45. Estimated trends in the spawning stock biomass, fishing mortality and age-1 recruitment of Gulf of Maine haddock from 1977 to 2016 based on the 'Base' assessment model. The 90% confidence intervals are derived from Hessian-based asymptotic variances. The 2015 assessment model results (NEFSC 2015) are shown in red for comparison.

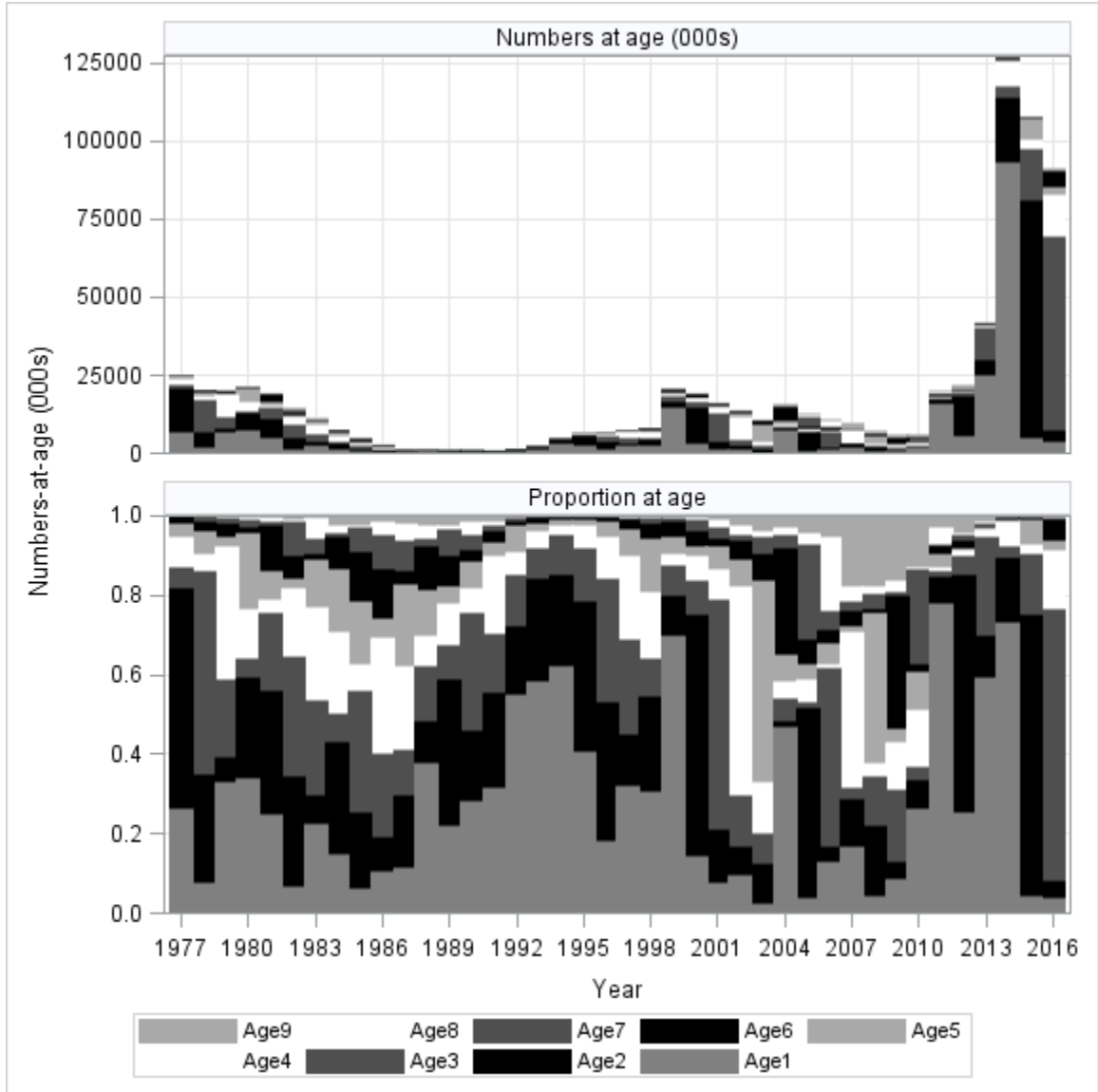


Figure 46. Model estimates of Gulf of Maine haddock numbers-at-age from 1977 to 2016 in absolute (top) numbers (000s) and relative (bottom) term as estimated by the ‘Base’ assessment model.

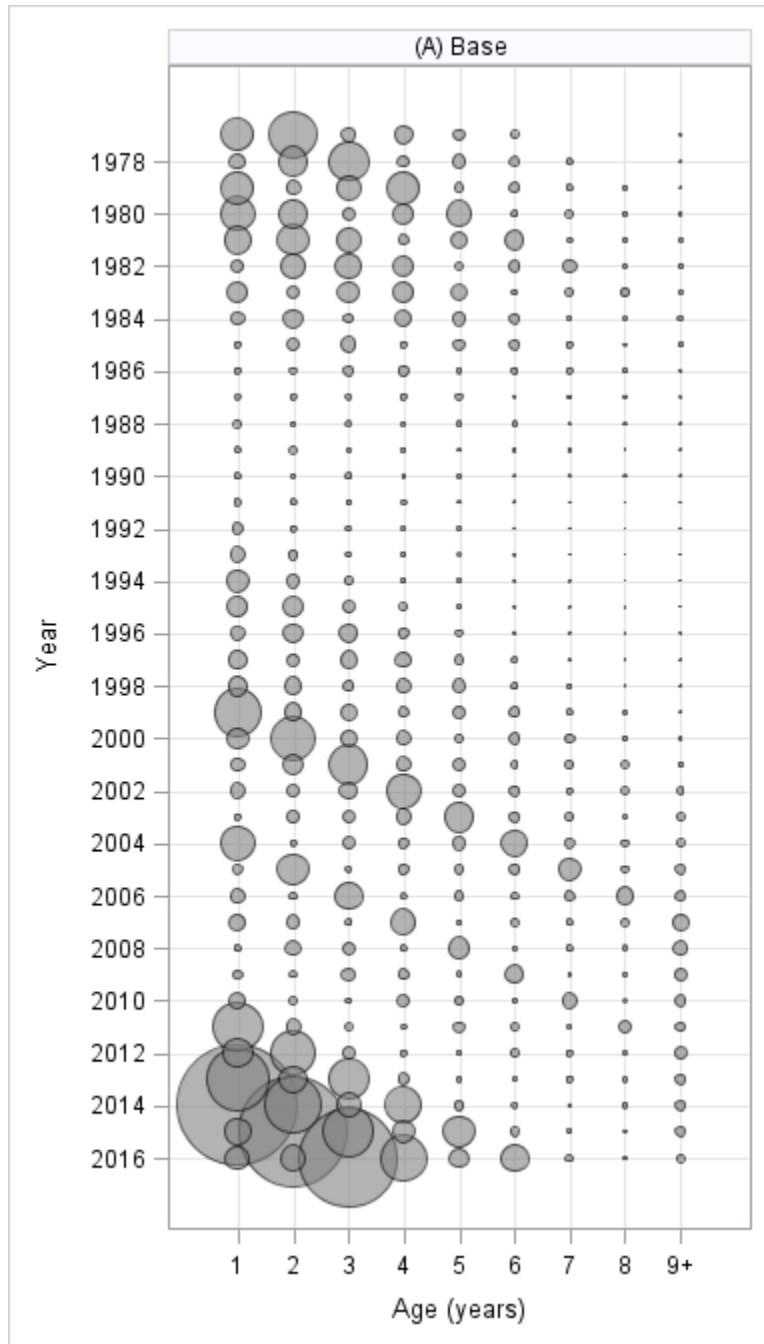


Figure 47. Estimated population numbers-at-age of Gulf of Maine haddock from 1977 to 2016 based on the 'Base' assessment model. *Note that the maximum age is a plus group.*

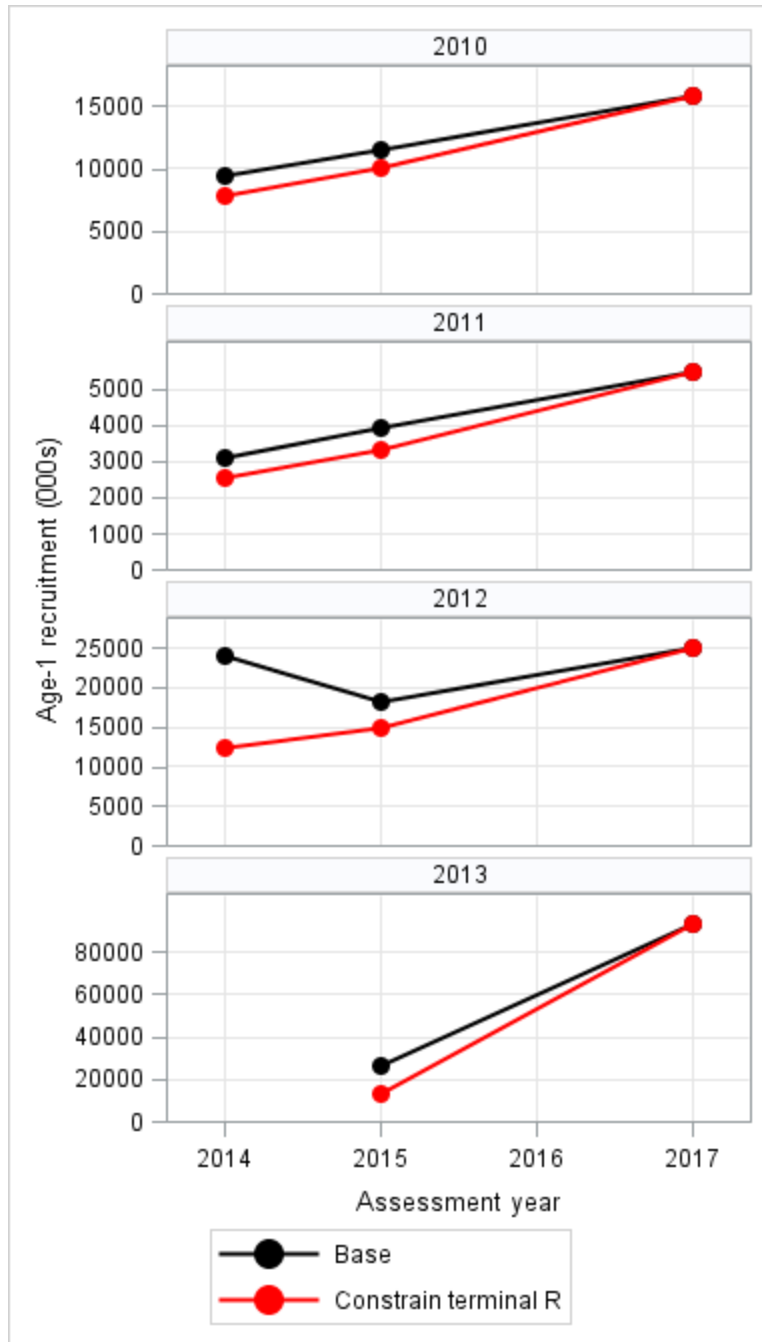


Figure 48. Comparison of the estimated Gulf of Maine haddock age-1 population size for the 2010-2013 year classes between the 'Base' assessment model and an alternative model that constrains the estimate of terminal recruitment, 'Constrain terminal R'. The alternative model was introduced at the SAW/SARC 59 benchmark assessment (NEFSC 2014) and brought forward for the 2015 update (NEFSC 2015), though it has not been used to inform catch advice.

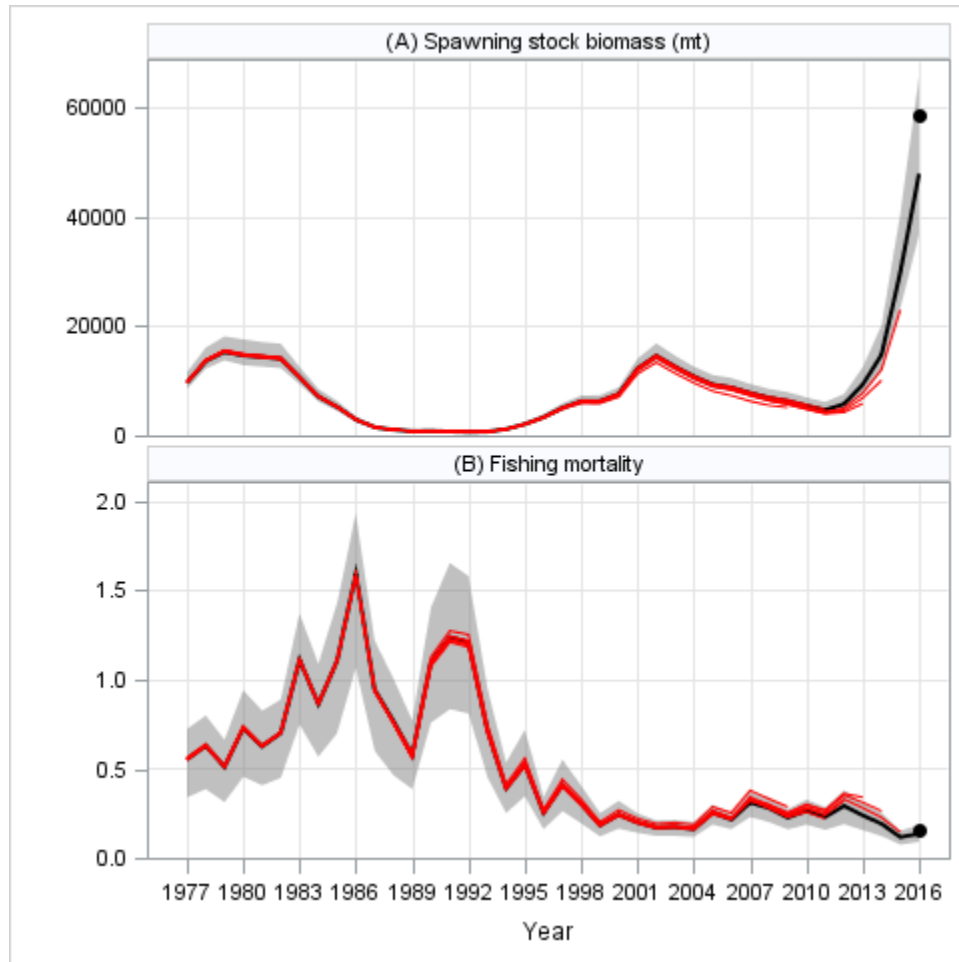


Figure 49. Model retrospective patterns (7-year peel) for sensitivity runs of the Gulf of Maine haddock 'Base' assessment model. The 90% posterior probability intervals (from MCMC) of the terminal (2016) model run are indicated by the grey band and the rho adjusted value is indicated by the black circle.

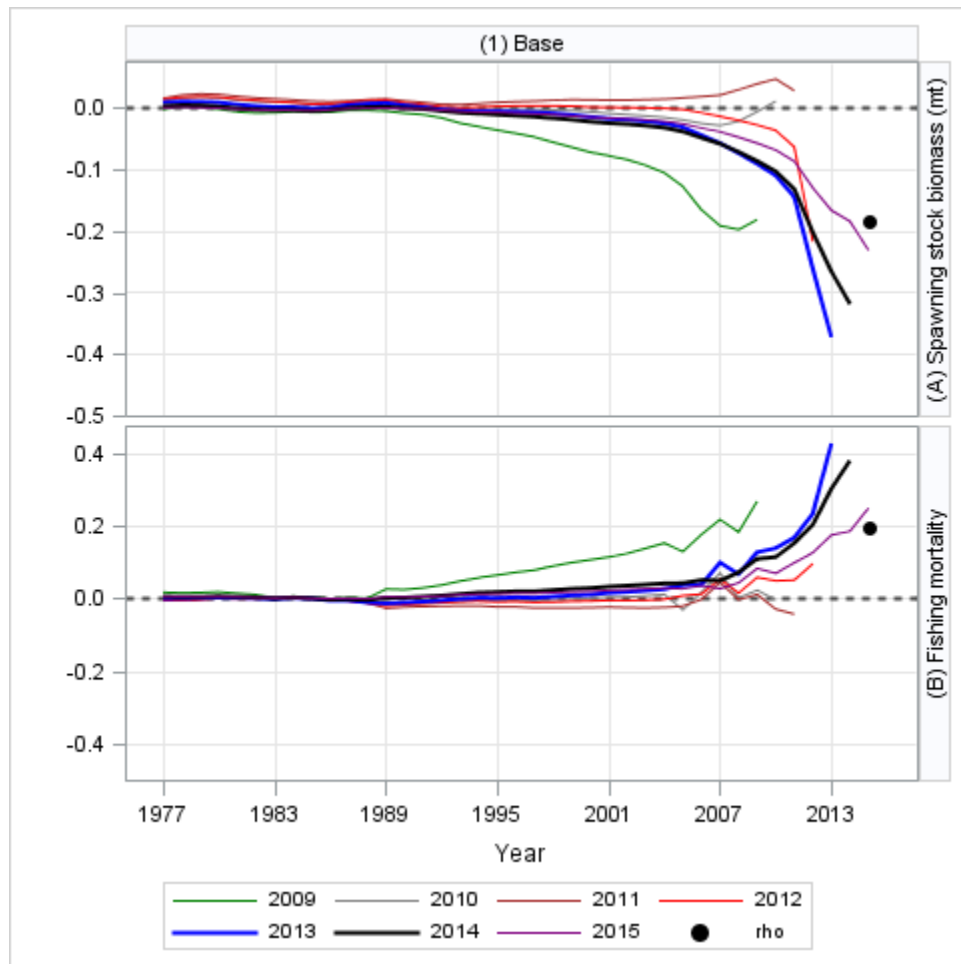


Figure 50. Relative model retrospective error for the Gulf of Maine haddock 'Base' assessment model peels compared to the 2016 peels. The black circles indicate the Mohn's rho value based on a seven year retrospective peel.

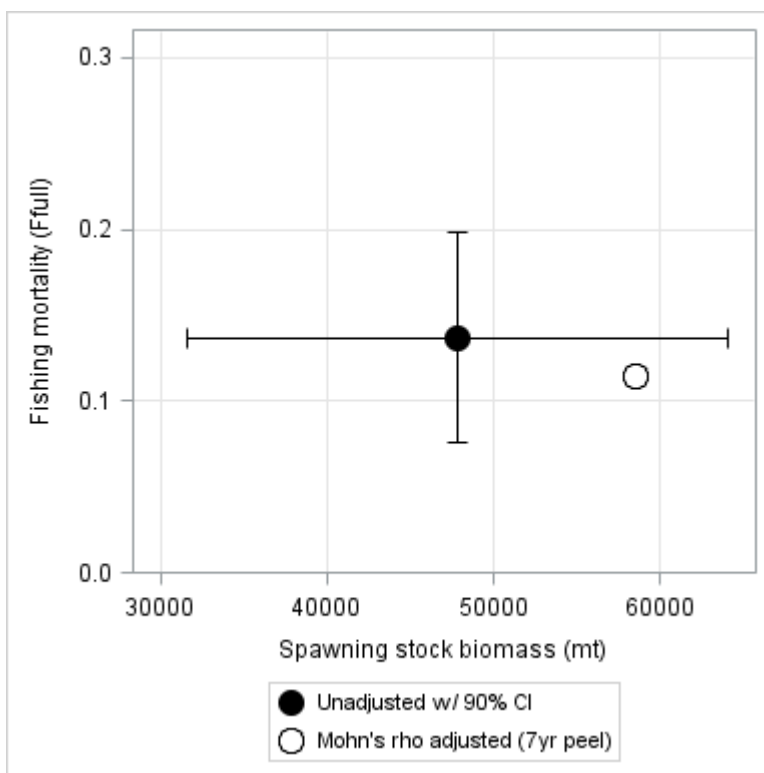


Figure 51. Cross plot of the Gulf of Maine haddock terminal (2016) fully selected fishing mortality and spawning stock biomass for the 'Base' assessment model. The error bars indicate the 90% posterior probability intervals on the terminal estimates. The rho adjusted value (7-year peel) is indicated by the open circle.

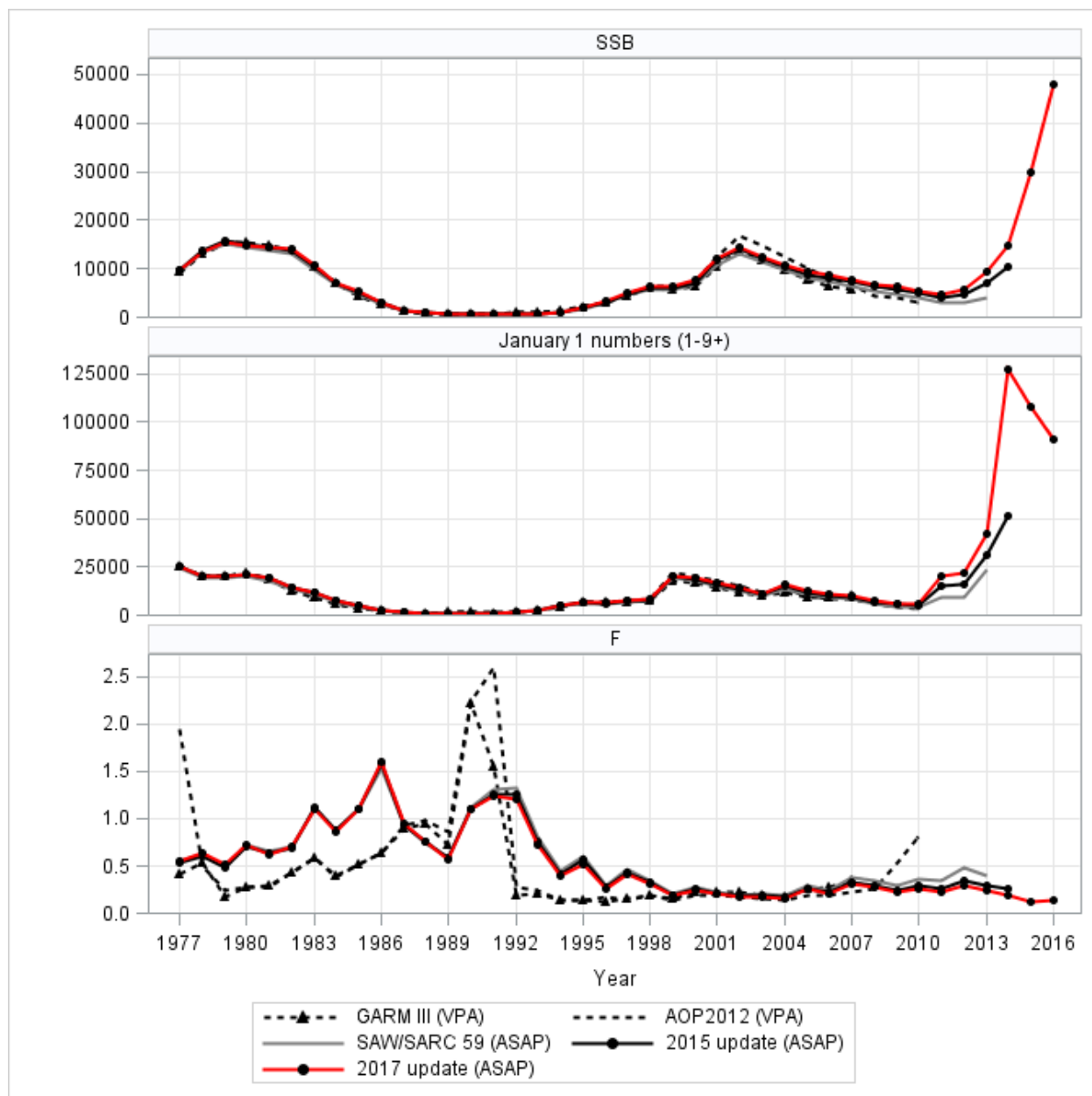


Figure 52. Historical model retrospective analysis comparing the model results (spawning stock biomass, January 1 population numbers and fishing mortality) of the GARM III (2008), 2012 AOP, SARC 59 (2014), 2015 update (NEFSC 2015), and 2017 update assessments of the Gulf of Maine haddock. *Note that for the GARM III and 2012 AOP assessments were conducted using a VPA model. Results are only shown for the 'Base' model formulations.*

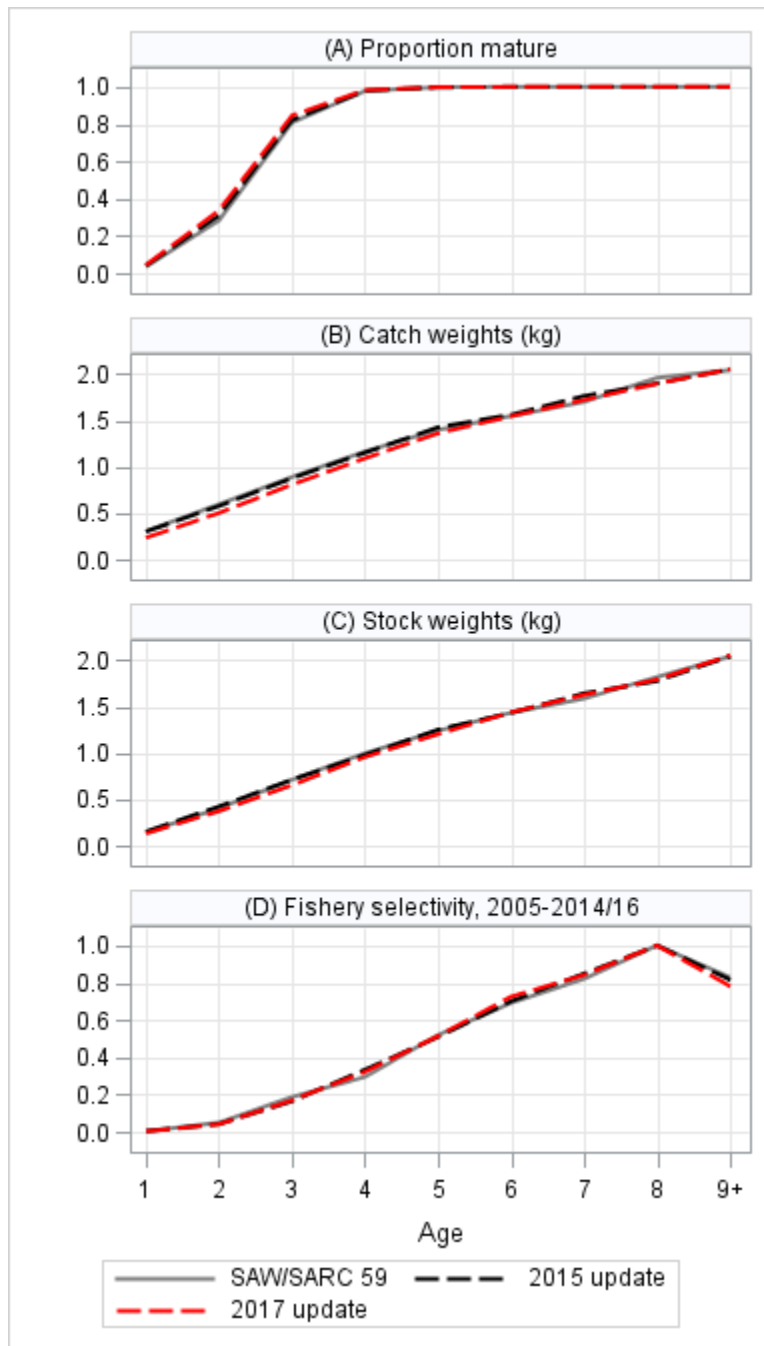


Figure 53. Comparison of the yield-per-recruit/projection inputs used for the 2015 update (NEFSC 2015) and the current 2017 update of the Gulf of Maine haddock stock assessment.

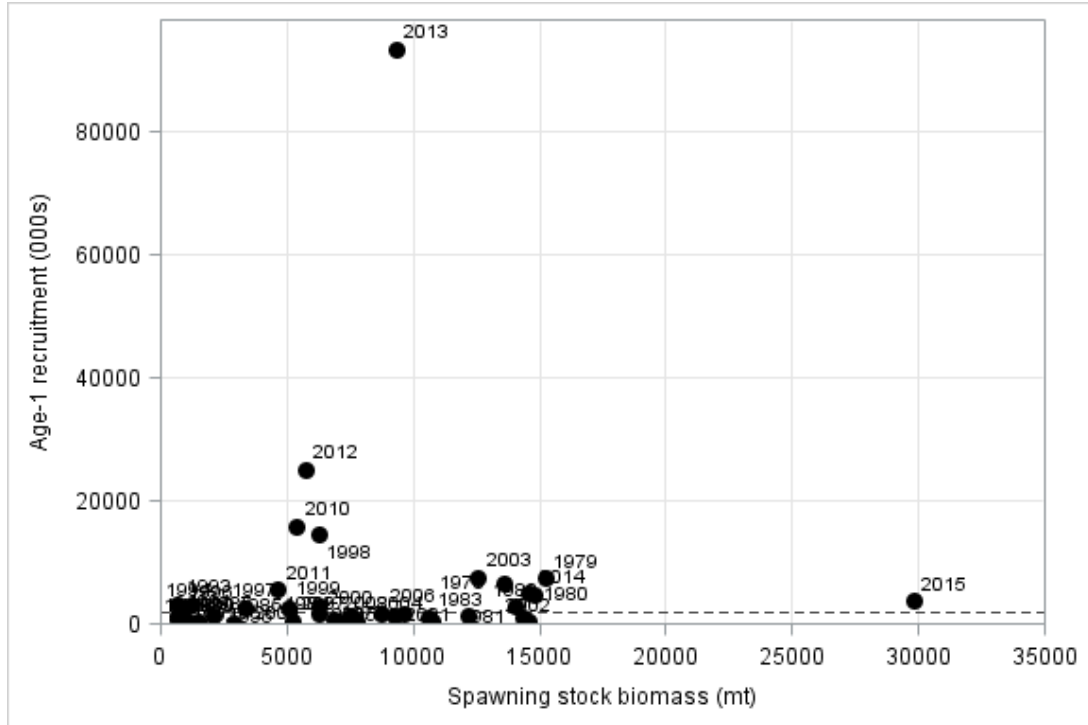


Figure 54. Scatterplot of Gulf of Maine haddock age-1 recruitment and spawning stock biomass as estimated from the ‘Base’ assessment model. The 1977-2014 median recruitment used in the projection models is indicated by the dashed line.