

Tables

Table A.1. Summary of model inputs and formulations used to assess the Gulf of Maine Atlantic cod stock over the last ten years. *Notes: ¹1999-2000 commercial landings raised to account for commercial discards, ²1999-2001 commercial landings raised to account for commercial discards, ³Not known with certainty that MADMF time series included the spring 2002 survey, ⁴1999-2004 commercial landings were raised to account for commercial discards.*

Year	Meeting	Model	Starting year	Catch data series				Survey series			Plus group
				Commercial landings	Commercial discards	Recreational landings	Recreational discards	NEFSC	MADMF	Commercial LPUE	
2001	SAW 33	VPA	1982	1982-2000 ¹		1982-2000		1982-2000	1982-2000	1982-1993	7+
2002	GARM I	VPA	1982	1982-2001 ²		1982-2001		1982-2002	1982-2002 ³	1982-1993	7+
2005	GARM II	VPA	1982	1982-2004 ⁴		1982-2004		1982-2005	1982-2005	1982-1993	7+
2008	GARM III	VPA	1982	1982-2007	1999-2007	1982-2007		1982-2008	1982-2008	1982-1993	11+

Table A.2. Summary of the results of the Gulf of Maine Atlantic cod assessments over the last ten years and the resulting stock status determinations based on the existing biological reference points at the time of the assessment. Notes: ¹SR (BH) = Beverton-Holt stock recruitment; ²Stock status was determined using a different basis in 2001 (total biomass, 25% of BMSY; Applegate et al. 1998); ³YPR = Yield per recruit, based on 5-year averages of weights-at-age, maturity-at-age and selectivity-at-age, $F_{MSY}=F_{40\%}$.

Year	Meeting	SSB (mt) _{terminal}	F _{terminal}	F note	Reference point basis	SSB _{msy} (mt)	F _{msy}	MSY (mt)	Stock status
2001	SAW 33	13,100 (B=24,400)	0.73	F _{avg4-5}	SR (BH) ¹	78,000 (B _{MSY} =90,300 mt)	0.230	N/A	Not overfished, overfishing is occurring ²
2002	GARM I	22,040	0.47	F _{avg4-5}	SR (BH) ¹	82,830	0.225	16,600	Overfished, overfishing is occurring
2005	GARM II	18,800	0.63	F _{avg4-5}	SR (BH) ¹	82,830	0.225	16,600	Overfished, overfishing is occurring
2008	GARM III	33,877	0.46	F _{avg5-7}	YPR ³	58,248	0.237	10,014	Not overfished, overfishing is occurring

Table A.3. Summary of major regulatory actions that have affected the Gulf of Maine Atlantic cod fishery since 1973. For a more detailed summary of recent regulatory actions see Nies (2011).

Date	Regulatory action	Cod end minimum mesh size (in)	Minimum fish size (in)		Commercial trip limits	Recreational trip limits	Closures	Differential DAS Counting
			Commercial	Recreational				
01/01/73		4.5	?	?				
01/01/77	Groundfish FMP	5.125	16	16				
01/01/82			17	15				
01/01/83		5.5						
01/01/89			19	19				
04/01/92 Shrimp trawl fishery: Nordmore grate regulation, groundfish bycatch prohibited								
05/01/94	Amendment 5	6.0						DAS monitory w/ reduction schedule, mandatory reporting
05/01/96	Amendment 7			20				Accelerated DAS reduction
05/01/97	Framework 20			21	1000 lbs day, 1500 lbs/day			
05/01/98	Framework 25				700 lbs/day		WGOM (Jeffreys Ledge, Stellwagen Bank)	
06/25/98					400 lbs/day			
02/01/99	Framework 26						Additional month-block closures for February to April	
05/01/99	Framework 27	6.5 square/6.0 diamond			200 lbs/day			
05/28/99					30 lbs/day			
08/03/99	Interim rule				100 lbs/day			
01/05/00	Framework 31				400 lbs/day (4000 lb/trip)		Additional month-block closures for February	
06/01/00	Framework 33	6.5 square/6.5 diamond					One month closure of Cashes Ledge	
11/01/00							Additional month-block closures for May - June 2003; Cashes Ledge	
05/01/02	Interim rule		22	23	500 lb/day (4000 lb/trip)	10 cod/person	Closed year round	20% reduction in DAS
	Revised interim rule							
06/01/02			19					
08/01/02	Emergency rule		22			5 - 10 cod/person (seasonal)		
05/01/04	Amendment 13				800 lb/day (4000 lb/trip)		WGOM, Cashes Ledge and rolling closures continued	Further reduction in DAS
11/22/06	FW 42			24		Possession prohibited November to March 31st		DAS counted 2:1 in inshore GOM
05/01/09	Interim rule					Possession prohibited November to April 15		
05/01/10	Amendment 16				Common pool: 800 lb/day (4000 lb/trip)	10 cod/person, Possession prohibited November to April 15	Some changes to rolling closures for sector vessels	DAS counted in 24 -hour blocks; no differential DAS counting except as AMs
07/30/10					Common pool: 200 lb/day (1000 lb/trip)			
09/22/10					Common pool: 100 lb/day (1000 lb/trip)			
10/18/10					Handgear A: 50 lb/trip			

Table A.4. Summary of the number of Atlantic cod otoliths sampled from Northeast Fisheries Science Center (NEFSC) surveys from 1970 to 2011 by stock, survey and age. Otoliths that have not been aged are not included in this summary.

Age	Gulf of Maine		Georges Bank	
	Spring	Fall	Spring	Fall
0	5	175	140	519
1	403	935	1177	2014
2	996	1499	2966	2394
3	1308	1429	2816	1755
4	1325	1037	2183	964
5	830	526	1341	342
6	480	278	672	186
7	251	118	322	84
8	97	69	171	53
9	74	41	76	16
10	36	23	43	19
11	19	14	26	6
12	21	9	12	7
13	11	5	4	4
14	12	6	5	
15	1	2	3	
16	2	1	1	
18	1		1	

Table A.5. Summary of the number of Atlantic maturity samples taken from Northeast Fisheries Science Center (NEFSC) spring survey from 1970 to 2011 by year.

Year	Males	Females
1970	47	57
1971	23	40
1972	33	52
1973	0	0
1974	36	67
1975	45	78
1976	78	74
1977	70	88
1978	37	64
1979	109	132
1980	35	56
1981	117	111
1982	78	95
1983	79	68
1984	41	66
1985	47	81
1986	45	57
1987	79	48
1988	96	91
1989	70	76
1990	57	58
1991	63	71
1992	52	62
1993	45	63
1994	62	46
1995	39	36
1996	58	60
1997	60	63
1998	73	55
1999	85	76
2000	87	79
2001	47	80
2002	124	138
2003	156	121
2004	25	42
2005	52	52
2006	70	66
2007	85	127
2008	61	80
2009	154	235
2010	118	130
2011	46	58

Table A.6. Estimates of total catch (mt) of Atlantic cod from the Gulf of Maine stock complex by fleet (commercial, recreational) and disposition (landed, discarded). Estimates of both United States (US) and foreign fleet catch are shown.

Year	US recreational landings (mt)	US recreational discards (mt)	US commercial discards (mt)	US commercial landings (mt)	Foreign fleet landings (mt)	Foreign fleet discards (mt)	Total catch (mt)
1964	--	--	--	3217.4	25.0	--	3242.4
1965	--	--	--	3611.5	148.0	--	3759.5
1966	--	--	--	3841.1	384.0	--	4225.1
1967	--	--	--	5526.6	297.0	--	5823.6
1968	--	--	--	6076.0	61.0	--	6137.0
1969	--	--	--	7828.4	327.0	--	8155.4
1970	--	--	--	7511.7	449.0	--	7960.7
1971	--	--	--	7192.5	282.0	--	7474.5
1972	--	--	--	6786.1	141.0	--	6927.1
1973	--	--	--	6061.1	77.0	--	6138.1
1974	--	--	--	7425.4	125.0	--	7550.4
1975	--	--	--	8676.1	112.0	--	8788.1
1976	--	--	--	9877.7	16.0	--	9893.7
1977	--	--	--	11992.8	0.0	0.0	11992.8
1978	--	--	--	11890.1	0.0	0.0	11890.1
1979	--	--	--	10972.3	0.0	0.0	10972.3
1980	--	--	--	12514.9	0.0	0.0	12514.9
1981	5417.5	83.0	--	12381.6	0.0	0.0	17882.2
1982	3805.7	35.9	1135.2	13465.9	0.0	0.0	18442.6
1983	2379.5	77.5	1169.4	13867.4	0.0	0.0	17493.8
1984	1699.3	73.1	1209.9	10725.3	0.0	0.0	13707.7
1985	3727.1	74.3	1360.5	10645.3	0.0	0.0	15807.1
1986	2607.3	44.5	1359.5	9669.6	0.0	0.0	13681.0
1987	4788.7	211.7	1245.0	7526.2	0.0	0.0	13771.5
1988	2277.7	59.7	957.2	7948.2	0.0	0.0	11242.8
1989	2635.9	335.4	1101.1	10550.7	0.0	0.0	14623.1
1990	3027.5	294.0	2198.2	15439.7	0.0	0.0	20959.4
1991	3080.4	299.8	933.5	17959.0	0.0	0.0	22272.7
1992	841.2	156.3	943.8	11019.4	0.0	0.0	12960.8
1993	1364.9	449.4	812.4	8366.7	0.0	0.0	10993.4
1994	972.8	443.5	280.8	8030.2	0.0	0.0	9727.3
1995	844.3	423.9	314.9	6606.8	0.0	0.0	8189.9
1996	672.3	357.2	200.4	7019.8	0.0	0.0	8249.8
1997	314.7	259.1	115.0	5432.1	0.0	0.0	6120.9
1998	475.6	318.5	99.5	4074.3	0.0	0.0	4967.9
1999	777.7	315.9	1382.1	1407.4	0.0	0.0	3883.1
2000	1301.4	606.9	1281.3	3771.8	0.0	0.0	6961.4
2001	2651.6	1002.9	2040.9	4314.4	0.0	0.0	10009.8
2002	1691.5	1264.6	1772.0	3638.3	0.0	0.0	8366.5
2003	2166.1	1245.0	1037.6	3865.6	0.0	0.0	8314.4
2004	1613.1	816.0	860.6	3782.3	0.0	0.0	7072.0
2005	1775.1	1081.7	431.0	3557.6	0.0	0.0	6845.4
2006	844.7	623.9	498.4	3029.4	0.0	0.0	4996.5
2007	1054.1	1128.1	275.7	3989.8	0.0	0.0	6447.8
2008	1575.7	1283.8	514.5	5443.5	0.0	0.0	8817.5
2009	1676.1	1247.4	1041.8	5952.9	0.0	0.0	9918.2
2010	3506.0	2288.9	241.1	5356.4	0.0	0.0	11392.4

Table A.7. Estimates of total United States landings of Gulf of Maine Atlantic cod from 1994 to 2010 and the coefficient of variation (CV) associated with the landings allocation procedure (AA tables, Wigley et al. 2008).

Year	Landings (mt)	CV
1994	8030.2	0.003
1995	6606.8	0.012
1996	7019.8	0.003
1997	5432.1	0.003
1998	4074.3	0.003
1999	1407.4	0.007
2000	3771.8	0.003
2001	4314.4	0.002
2002	3638.3	0.003
2003	3865.6	0.002
2004	3782.3	0.003
2005	3557.6	0.002
2006	3029.4	0.002
2007	3989.8	0.001
2008	5443.5	0.001
2009	5952.9	0.001
2010	5356.4	0.003

Table A.8. Estimates of total United States landings of Gulf of Maine Atlantic cod utilized for home consumption from 1994 to 2010. These estimates are obtained from information reported on Vessel Trip Reports (VTRs).

Year	Commerical landings (mt)	VTR home consumption (mt)	Percentage of total commercial landings (%)
1994	8030.2	0.9	0.01
1995	6606.8	3.5	0.05
1996	7019.8	8.3	0.12
1997	5432.1	3.2	0.06
1998	4074.3	3.3	0.08
1999	1407.4	4.0	0.29
2000	3771.8	5.3	0.14
2001	4314.4	6.7	0.16
2002	3638.3	6.6	0.18
2003	3865.6	6.3	0.16
2004	3782.3	4.0	0.10
2005	3557.6	3.1	0.09
2006	3029.4	2.4	0.08
2007	3989.8	1.6	0.04
2008	5443.5	2.0	0.04
2009	5952.9	1.2	0.02
2010	5356.4	3.6	0.07

Table A.9. Total number of Gulf of Maine Atlantic cod biological samples taken from the commercial landings by market category and year from 1969 to 2010.

Year	Large (0811)				Market (0813)				0814				Total
	Quarter				Quarter				Quarter				
	1	2	3	4	1	2	3	4	1	2	3	4	
1969													
1970					1								1
1971													
1972													
1973													
1974								1	1				2
1975										1		1	2
1976													
1977		1	1			1	2	1	1	1	3	3	14
1978			1		2	2	2	1	3	2	1		14
1979						1	2	1	1		1	2	8
1980									3	1	1		5
1981			1				1	3	1	1	1	3	11
1982		2	1	2	2	2	3	1	2	3	3	2	23
1983	1	2	2	2	3	3	3	1	3	3	3	3	29
1984	1	6	3	2	4	3	5	6	7	5	6	7	55
1985	7	5	3	6	9	6	7	4	5	6	7	5	70
1986	1	5	4	3	5	6	8	3	5	5	6	3	54
1987	4	2	3	1	4	5	3	5	5	4	3	4	43
1988	1	2	2		1	5	3	5	4	2	4	4	33
1989	2	1	1	1	4	2	5	4	3	3	4	3	33
1990		2	1		4	7	4	3	3	7	3	5	39
1991		3	3	1	5	11	12	3	2	10	4	4	58
1992	3	1	1	4	6	7	7	3	2	8	6	3	51
1993	1	1	2	1	1	2	4	1	3	3	3	1	23
1994		2	3	2	1	6	3	5		2	2	4	30
1995		3		1	2	8	2	2	4	3	2	4	31
1996	1	2	3	3	6	9	11	11	5	4	7	9	71
1997	2	8	2	2	12	11	10	9	7	13	3	10	89
1998	1		2	1	9	9	9	5	4	7		3	50
1999	2				3	1	1		6				13
2000				1	16	14	5	9	13	6	5	7	76
2001	2	15	18	20	4	10	8	16	4	4	4	7	112
2002	50	8	16	19	16	3	6	5	3	2		1	129
2003	50	34	34	33	14	8	25	19	5	1	17	8	248
2004	37	20	11	27	18	23	15	15	17	11	6	22	222
2005	21	41	72	64	14	15	22	19	23	29	33	16	369
2006	48	49	62	63	17	21	18	12	15	8	8	3	324
2007	43	73	102	60	7	14	18	17	10	6	11	8	371
2008	58	72	73	71	12	15	13	11	13	7	5	7	357
2009	61	97	114	135	10	17	20	37	9		2	14	516
2010	79	52	77	33	30	22	42	21	4	2		9	371

Table A.10. Total number of Gulf of Maine Atlantic cod lengths sampled from the commercial landings by market category and year from 1969 to 2010. Sampling intensity is expressed as metric tons landings per 100 lengths sampled (*200 metric tons per 100 lengths is an unofficial NAFO/ICNAF standard*). Cells shaded in grey indicate where lengths were aggregated semi-annually. Cells shaded orange 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 (0814)				Market (0813)				Large (0811)				Unclassified (0815)				Total lengths	Landings (mt)	Metric tons/100 lengths	
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4				
1969																	114	114	7828.4	6867.0
1970					100									287				387	7511.7	1941.0
1971																			7192.5	
1972																			6786.1	
1973																			6061.1	
1974	102											101						203	7425.4	3657.8
1975		186		62													101	248	8676.1	3498.4
1976																		157	9877.7	6291.5
1977	101	66	402	1012		277	371	64		80	152							2525	11992.8	475.0
1978	407	455	65		370	304	500	100			55							2256	11890.1	527.0
1979	56		58	116		100	237	188										755	10972.3	1453.3
1980	213	100	51											212				576	12514.9	2172.7
1981	52	57	81	236			82	471			210							1189	12381.6	1041.3
1982	401	488	484	308	418	309	665	345		208	64	158		97	102	122		4169	13465.9	323.0
1983	712	626	578	253	396	1021	583	200		56	205	514	97		53			5294	13867.4	261.9
1984	344	271	342	378	396	264	443	551		75	552	204	105				94	4019	10725.3	266.9
1985	263	352	449	241	837	565	677	351		542	341	263	403					5284	10645.3	201.5
1986	229	264	319	160	520	608	834	329		75	279	269	183					4069	9669.6	237.6
1987	281	232	165	271	344	490	351	399		157	150	258	90					3188	7526.2	236.1
1988	298	99	215	249	59	539	291	481		59	194	135						2619	7948.2	303.5
1989	154	170	201	174	401	204	506	409		195	102	104	98					2718	10550.7	388.2
1990	156	362	165	260	409	715	370	300			136	108						2981	15439.7	517.9
1991	100	533	192	215	514	1034	1137	275			302	273	101					4676	17959.0	384.1
1992	118	443	320	180	633	725	592	263		297	142	75	298					4086	11019.4	269.7
1993	159	173	174	55	97	173	393	106		65	87	141	63		67			1753	8366.7	477.3
1994		102	107	181	97	576	324	567			184	322	198					2658	8030.2	302.1
1995	211	196	107	249	170	807	215	224			280		98					2557	6606.8	258.4
1996	278	275	491	691	596	961	1165	1178		68	200	303	280					6486	7019.8	108.2
1997	520	848	188	751	1235	1071	991	880		190	539	201	145					7559	5432.1	71.9
1998	295	383		101	911	951	1103	436		99		175	82					4536	4074.3	89.8
1999	385				311	108	58			211								1073	1407.4	131.2
2000	694	304	294	426	1588	1167	409	924					113					5921	3771.8	63.7
2001	189	215	216	404	428	984	697	1548		172	474	892	898					7117	4314.4	60.6
2002	106	80		39	1365	260	411	395		1192	397	524	494					5263	3638.3	69.1
2003	254	66	214	73	1121	705	1762	1402		1179	1432	1583	1688					11479	3865.6	33.7
2004	361	299	233	73	1384	1887	1288	994		2049	1419	283	940		25			11235	3782.3	33.7
2005	73	193	324	506	919	1095	1384	1362		790	709	1330	1478					10404	3557.6	34.2
2006	494	167	294	125	1291	1412	1075	753		1552	871	1348	1388		61	180		10770	3029.4	28.1
2007	291	174	315	293	584	1188	1521	1488		654	811	1887	1417					10702	3989.8	37.3
2008	536	251	203	83	969	1403	1196	927		712	1314	1753	1573			66		10922	5443.5	49.8
2009	407		62	141	800	1601	1791	2601		954	1656	2304	2554					14871	5952.9	40.0
2010	150	53		199	2679	1762	2788	1741		1428	2106	2561	1984					17451	5356.4	30.7

Table A.11. Total number of Gulf of Maine Atlantic cod ages sampled from the commercial landings by quarter from 1977 to 2010.

Year	Quarter				Total	Landings (mt)	Metric tons/100 ages
	1	2	3	4			
1977	20	114	229	205	568	11992.8	2111.4
1978	124	124	115	20	383	11890.1	3104.5
1979	10	20	48	52	130	10972.3	8440.2
1980	35	27	15		77	12514.9	16253.1
1981	12	15	67	170	264	12381.6	4690.0
1982	194	237	251	183	865	13465.9	1556.7
1983	277	513	400	158	1348	13867.4	1028.7
1984	245	350	296	337	1228	10725.3	873.4
1985	446	377	397	323	1543	10645.3	689.9
1986	243	360	398	173	1174	9669.6	823.6
1987	252	229	226	228	935	7526.2	804.9
1988	131	223	187	196	737	7948.2	1078.5
1989	206	129	203	165	703	10550.7	1500.8
1990	140	302	171	150	763	15439.7	2023.6
1991	126	447	385	152	1110	17959.0	1617.9
1992	220	298	264	178	960	11019.4	1147.9
1993	72	130	186	49	437	8366.7	1914.6
1994	21	195	149	308	673	8030.2	1193.2
1995	144	311	101	126	682	6606.8	968.7
1996	190	315	426	449	1380	7019.8	508.7
1997	395	632	331	285	1643	5432.1	330.6
1998	192	325	276	199	992	4074.3	410.7
1999	227	27	11		265	1407.4	531.1
2000	639	481	205	396	1721	3771.8	219.2
2001	280	574	674	950	2478	4314.4	174.1
2002	1320	301	437	347	2405	3638.3	151.3
2003	1046	1111	1948	1525	5630	3865.6	68.7
2004	1880	1011	425	228	3544	3782.3	106.7
2005	494	644	1117	1287	3542	3557.6	100.4
2006	1109	806	1225	1197	4337	3029.4	69.9
2007	719	1020	1138	1030	3907	3989.8	102.1
2008	858	1225	1213	1173	4469	5443.5	121.8
2009	947	1407	1684	2222	6260	5952.9	95.1
2010	1335	1235	1856	1103	5529	5356.4	96.9

Table A.12. Percent of Gulf of Maine Atlantic cod length observations missing corresponding age information by market category and quarter. Cells shaded in grey indicate where lengths were aggregated semi-annually. Cells where the imputation percentage exceeded 5% are highlighted in bold italics. Cells where no imputation was required are null.

Year	Scrod (0814)				Market (0813)				Large (0811)			
	Quarter				Quarter				Quarter			
	1	2	3	4	1	2	3	4	1	2	3	4
1982	0.5	0.4	3.3	0.3					22.6		12.2	
1983		0.2							1.1		0.2	
1984			0.3	0.3							0.5	1.0
1985									0.4		1.1	0.2
1986									0.8			3.8
1987									0.6		0.6	
1988	1.3							0.8			2.2	
1989								18.8		19.6	2.5	
1990												
1991	44.0		4.7	0.9	2.5		4.3		4.3		11.4	33.7
1992	1.7								5.4	12.0	10.2	
1993			0.4		8.1		0.5	12.3	2.6		9.3	
1994			0.9				0.3		19.6		7.5	1.0
1995	21.3				1.2				0.7		28.6	
1996	3.6				0.2						1.0	5.0
1997		0.7		0.3	0.5				14.7	0.4		2.1
1998		5.7							4.8			
1999											2.8	
2000	0.1										2.6	
2001									1.7	0.6	0.2	0.1
2002									0.3	1.0		
2003				1.0					0.4	0.1	0.1	0.1
2004		0.7							0.1		1.1	0.7
2005									0.4	0.1	0.3	0.1
2006									0.2	0.9	0.3	0.5
2007									0.6	0.1	0.7	0.4
2008										0.1	0.2	
2009			0.5				0.2			0.2		
2010											0.0	0.1

Table A.13. Total commercial landings-at-age (numbers) of Gulf of Maine Atlantic cod from 1982 to 2010.

Year	Age 0	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10	Age 11	Age 12	Age 13	Age 14	Age 15	Age 16	Total
1982	0	27,609	1,335,509	1,634,173	1,116,072	619,571	51,241	69,146	59,375	43,415	32,683	6,285	898					4,995,977
1983	0	0	833,083	2,413,843	1,067,910	627,331	407,393	44,212	57,669	25,845	12,747	3,800	3,515	1,719	2,599			5,501,666
1984	0	2,782	425,538	1,227,232	1,504,575	396,710	195,918	96,402	9,105	16,794	14,229	11,957	2,335	3,863	1,235			3,908,675
1985	0	0	387,614	1,440,985	1,002,193	615,000	123,315	73,198	32,430	3,962	10,619	2,438	4,573	1,583	470			3,698,380
1986	0	0	85,363	2,187,322	818,717	239,742	161,736	38,700	27,497	19,813	4,745	1,497	3,940	2,434	306			3,591,812
1987	0	442	193,735	627,766	1,116,907	267,706	64,579	45,981	5,481	8,410	9,270	182	607	0	2,129			2,343,195
1988	0	0	167,468	1,356,369	907,960	400,942	58,792	21,864	20,247	3,257	2,438	1,213	0	0	606			2,941,156
1989	0	0	322,130	1,486,592	1,354,890	451,857	70,570	58,876	7,931	2,238	9,000	3,945	0	1,127	1,127			3,770,283
1990	0	0	210,618	3,403,626	2,227,578	452,797	151,887	25,246	24,675	7,680	16,034	11,764	2,353	3,597				6,537,855
1991	0	0	198,915	609,915	4,543,525	904,421	138,556	42,961	25,983	7,877	4,698	2,571						6,479,422
1992	0	0	302,552	527,720	432,280	1,969,905	213,021	77,420	5,837	4,488	1,042							3,534,265
1993	0	0	25,866	1,543,228	729,548	92,745	464,198	37,780	11,264									2,904,629
1994	0	0	29,014	1,055,313	1,170,244	240,940	63,586	69,917	28,114	6,108	384	1,008						2,664,628
1995	0	0	183,724	938,703	1,056,404	207,195	28,494	6,521	17,992	580	2,228							2,441,841
1996	0	0	55,763	507,349	1,763,068	375,559	35,144	3,903	413	845								2,742,044
1997	0	0	77,455	434,378	435,036	800,750	67,415	5,368	2,080	393	636							1,823,511
1998	0	0	87,919	391,916	544,744	139,369	187,088	27,507	4,853	1,495	762							1,385,653
1999	0	0	2,858	179,688	191,438	66,127	23,995	22,398	7,504	1,035								495,043
2000	0	0	102,341	258,469	501,545	124,105	66,295	9,007	6,465									1,068,227
2001	0	0	43,737	471,763	326,442	206,475	65,902	38,490	5,509	8,803	1,006							1,168,127
2002	0	0	1,439	111,287	433,957	170,415	102,971	41,667	12,019	3,750	4,055	434	80	0	40			882,114
2003	0	0	8,113	47,543	198,476	380,859	120,697	52,001	19,769	9,173	4,250	2,812	472					844,165
2004	0	0	492	142,749	130,172	220,142	170,502	52,305	26,442	13,941	6,789	1,414	620					765,568
2005	0	0	1,217	37,890	423,154	64,419	178,040	83,220	21,459	12,366	5,056	3,125	1,817	500				832,263
2006	0	0	777	115,306	181,958	300,653	21,412	62,692	29,111	10,477	5,994	2,537	1,242	953	180			733,292
2007	0	0	5,209	95,694	629,852	99,105	178,429	5,952	15,582	7,698	3,753	1,468	1,323	1,174	126	345		1,045,710
2008	0	0	4,142	283,069	465,757	600,316	53,944	82,494	2,490	6,652	3,224	986	473	367	234	104	21	1,504,273
2009	0	0	2,700	283,610	718,934	333,800	199,827	16,653	20,518	857	2,311	1,072	952	224	127	61	49	1,581,695
2010	0	0	1,683	121,449	578,192	463,641	114,076	59,845	8,069	2,947	446	476	162	112	17	28		1,351,143

Table A.14. Coefficients of variation (CV) associated with the Gulf of Maine Atlantic cod commercial landings estimates of numbers-at-age from 1982 to 2010. CVs greater than 0.3 are shaded grey.

Year	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10	Age 11	Age 12	Age 13	Age 14	Age 15	Age 16
1984	0.7443	0.12	0.04	0.02	0.04	0.06	0.06	0.17	0.16	0.22	0.20	0.39	0.29	0.69		
1985		0.08	0.06	0.04	0.03	0.05	0.05	0.10	0.25	0.14	0.27	0.35	0.48	0.76		
1986		0.18	0.05	0.04	0.06	0.08	0.14	0.13	0.20	0.44	0.56	0.37	0.65	0.89		
1987	1.3501	0.19	0.07	0.04	0.07	0.09	0.15	0.29	0.28	0.43	0.90	0.44		0.68		
1988		0.29	0.06	0.05	0.06	0.09	0.15	0.24	0.48	0.81	0.81			1.32		
1989		0.38	0.08	0.09	0.07	0.14	0.24	0.33	0.56	0.23	0.34		0.68	0.69		
1990		0.26	0.07	0.08	0.13	0.24	0.47	0.36	0.41	0.26	0.28	0.67	0.70			
1991		0.23	0.15	0.04	0.11	0.12	0.23	0.31	0.27	1.02	0.64					
1992		0.18	0.20	0.13	0.06	0.11	0.18	0.62	0.56	0.88						
1993		0.89	0.09	0.18	0.29	0.11	0.34	0.41								
1994		0.49	0.10	0.07	0.27	0.25	0.21	0.22	0.64	1.02	0.89					
1995		0.25	0.12	0.09	0.10	0.35	0.23	0.21	1.05	0.61						
1996		0.27	0.10	0.04	0.14	0.20	0.28	0.95	0.69							
1997		0.20	0.09	0.07	0.06	0.14	0.32	0.27	0.62	0.60						
1998		0.16	0.11	0.07	0.15	0.15	0.27	0.37	0.49	0.99						
1999			0.19	0.12	0.31	0.36	0.23	0.17	0.58							
2000		0.14	0.08	0.06	0.12	0.23	0.49	0.55								
2001		0.24	0.06	0.07	0.08	0.11	0.14	0.30	0.28	0.59						
2002		1.11	0.22	0.05	0.09	0.07	0.11	0.15	0.29	0.26	0.48	1.21		1.38		
2003		0.35	0.17	0.05	0.03	0.06	0.07	0.10	0.17	0.19	0.23	0.46				
2004		1.38	0.11	0.07	0.07	0.06	0.09	0.13	0.21	0.23	0.49	0.75				
2005		0.66	0.15	0.05	0.08	0.09	0.08	0.12	0.12	0.15	0.21	0.26	0.42			
2006		1.02	0.17	0.06	0.04	0.14	0.09	0.09	0.14	0.11	0.17	0.22	0.27	0.56		
2007		0.49	0.13	0.04	0.08	0.10	0.27	0.19	0.12	0.15	0.25	0.23	0.27	0.69	0.46	
2008		0.72	0.10	0.05	0.05	0.13	0.08	0.39	0.16	0.17	0.29	0.38	0.44	0.56	0.80	1.43
2009		0.52	0.10	0.05	0.09	0.07	0.18	0.12	0.25	0.17	0.26	0.26	0.40	0.59	0.90	1.01
2010		0.50	0.12	0.04	0.04	0.08	0.10	0.13	0.16	0.38	0.34	0.66	0.67	1.38	1.42	
Average		0.43	0.11	0.07	0.10	0.14	0.19	0.27	0.37	0.44	0.42	0.47	0.48	0.85	0.90	1.22

Table A.15. Relative differences in the estimates of Gulf of Maine Atlantic cod numbers-at-age from the 2008 Groundfish Assessment Review Meeting (GARM) assessment compared to the current assessment (through 2007). Differences are expressed relative to the 2008 assessment numbers-at-age (*negative differences indicate fewer numbers-at-age in the updated assessment*). The current assessment uses a 9⁺ group.

Year	Age 0	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10	Age 11+	Total
1982		-0.08	-0.03	0.00	-0.02	-0.02	-0.26	-0.24	-0.03	0.06	7.17	-0.78	-0.02
1983			-0.04	0.02	0.01	-0.02	-0.03	-0.06	-0.05	0.12	0.42	-0.22	0.00
1984		-0.30	-0.05	-0.01	0.00	-0.09	0.01	0.30	-0.52	0.12	0.29	0.14	-0.01
1985			-0.05	0.00	0.01	-0.02	-0.04	-0.06	0.01	-0.01	-0.03	-0.18	-0.01
1986			0.02	0.01	0.01	-0.04	-0.09	-0.01	0.15	-0.01	0.19	0.02	0.00
1987		-0.78	-0.10	0.06	0.01	-0.03	-0.02	-0.10	-0.39	0.05	0.16	-0.03	0.00
1988			0.05	-0.06	-0.05	-0.01	0.37	1.43	0.19	2.26	0.22	0.82	-0.03
1989			-0.04	-0.06	-0.07	0.01	-0.13	0.68	0.32	-0.25	0.80	-0.11	-0.05
1990			0.03	-0.01	0.08	0.05	-0.03	-0.06	-0.18	-0.23	0.07	0.04	0.02
1991			-0.42	-0.35	0.09	0.06	-0.03	0.05	-0.13	0.31	3.70	1.57	-0.01
1992			-0.03	0.00	-0.11	-0.02	0.05	0.25	-0.17	-0.63	-0.65		-0.03
1993			-0.66	0.04	0.14	-0.28	0.02	0.35	0.88	-1.00			0.03
1994			-0.23	-0.04	0.05	-0.21	-0.09	-0.17	-0.04	-0.07	-0.36	-0.16	-0.03
1995		-1.00	-0.17	0.06	0.02	-0.07	0.06	-0.53	-0.02	-0.28	0.39	-1.00	0.00
1996			-0.19	-0.01	0.01	0.03	-0.04	-0.11	-0.17	-0.30			0.00
1997			-0.02	-0.02	0.02	0.00	-0.01	0.07	-0.20	0.31	-0.09	-1.00	0.00
1998			-0.06	-0.01	0.03	-0.05	0.06	0.09	0.28	2.74	-0.31	-1.00	0.01
1999			-0.01	-0.02	0.09	-0.19	0.48	0.00	2.26		-1.00		0.02
2000			0.01	0.01	0.00	0.02	-0.04	-0.19	0.18				0.00
2001			-0.05	-0.02	0.01	-0.03	-0.03	0.00	-0.03	-0.05	0.12	-1.00	-0.02
2002			-0.10	-0.03	-0.01	-0.01	-0.03	-0.03	-0.01	-0.06	-0.03	0.39	-0.02
2003			0.16	-0.01	-0.03	-0.03	-0.03	-0.03	-0.04	-0.02	-0.11	-0.03	-0.03
2004			-0.02	-0.08	-0.02	-0.02	-0.04	-0.03	-0.05	-0.05	-0.13	-0.03	-0.04
2005			0.01	-0.04	-0.03	-0.01	-0.02	-0.02	-0.05	-0.06	-0.08	-0.01	-0.03
2006			-0.22	-0.04	-0.05	-0.02	-0.04	-0.05	-0.05	-0.05	-0.05	-0.02	-0.04
2007			-0.04	-0.05	-0.02	-0.02	-0.05	-0.06	-0.08	-0.05	-0.08	-0.04	-0.03

Table A.16. Mean weights-at-age (kg) of commercially landed Gulf of Maine Atlantic cod from 1982 to 2010. The current assessment uses a 9⁺ group.

Year	Age 0	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10	Age 11	Age 12	Age 13	Age 14	Age 15	Age 16
1982		0.831	1.177	1.669	2.790	5.006	7.097	9.580	9.945	12.789	19.365	16.480	22.443				
1983			1.172	1.621	2.428	3.812	6.058	5.982	10.480	11.548	11.138	18.890	12.669	24.552	22.224		
1984		0.569	1.179	1.656	2.679	3.568	5.563	8.541	10.290	13.711	14.485	14.318	15.430	17.886	19.285		
1985			1.312	1.740	2.820	4.528	5.610	8.436	11.238	12.479	14.280	13.394	16.112	16.739	22.012		
1986			1.392	1.819	2.905	4.691	6.272	7.994	9.826	13.592	13.496	15.888	15.808	20.232	16.834		
1987		0.998	1.369	1.719	3.252	4.805	6.912	9.318	10.769	14.810	16.101	13.418	8.066		22.379		
1988			1.293	1.943	2.448	5.282	5.315	6.374	9.951	10.434	17.787	9.857			21.886		
1989			1.314	1.763	3.055	4.242	5.943	9.379	13.425	16.500	20.410	22.606		27.911	27.896		
1990			1.247	1.660	2.238	4.380	7.816	11.229	12.270	15.999	16.344	22.690	23.134	22.138			
1991			1.489	1.834	2.412	4.031	7.164	9.689	12.261	15.093	6.203	24.937					
1992			1.608	1.941	2.899	3.070	5.699	10.984	10.766	13.418	19.072						
1993			1.356	1.930	2.350	4.595	5.802	9.649	13.673								
1994			1.434	1.955	3.186	3.349	6.350	7.787	12.422	10.012	22.008	22.643					
1995			1.588	1.774	2.838	5.187	7.054	11.466	13.223	19.756	23.143						
1996			1.746	2.258	2.337	3.532	7.523	11.759	14.795	16.331							
1997			1.846	2.291	3.093	3.162	4.829	9.027	12.177	15.625	17.749						
1998			1.396	2.020	2.726	4.025	4.376	7.235	12.111	17.500	15.060						
1999			1.545	1.741	2.539	3.390	5.049	7.563	10.220	12.279							
2000			1.736	2.608	3.635	4.678	6.158	5.600	8.939								
2001			1.937	2.556	3.400	5.036	6.544	7.684	9.213	8.945	17.660						
2002			1.326	2.706	3.378	4.269	6.300	7.072	8.965	10.167	10.786	15.353	17.249		18.746		
2003			1.871	2.475	3.279	4.321	5.544	7.584	8.892	10.909	12.121	13.709	14.362				
2004			1.648	2.689	3.686	4.261	5.976	7.590	9.902	12.654	14.059	11.423	22.553				
2005			1.926	2.274	3.118	4.584	4.793	6.447	8.066	11.054	13.942	14.901	15.362	19.605			
2006			2.671	2.540	3.437	3.877	4.905	5.673	7.605	9.709	12.724	16.000	15.761	20.480	20.326		
2007			2.090	2.616	3.317	4.053	5.014	6.518	7.182	10.140	12.199	13.344	14.213	17.126	21.784	21.757	
2008			1.848	2.768	3.145	3.811	4.777	6.036	6.106	8.583	11.258	13.800	16.189	19.251	19.918	18.735	25.984
2009			1.939	2.766	3.532	3.972	4.775	6.007	8.367	11.208	10.805	12.934	15.971	15.803	22.452	22.459	22.812
2010			2.228	2.731	3.528	4.268	4.874	5.55	8.478	10.152	11.016	13.209	12.519	16.891	20.103	16.834	

Table A.17. Fraction of observed Gulf of Maine Atlantic cod discarded by gear from the commercial fishery from 1989 to 2010. Gears contributing greater than 5% of the total observed discards in any year are shaded grey.

Year	Total observed landings (mt)	Fraction of total observed landings								
		Longline	Handline	Otter trawl (mt)		Shrimp trawl	Sink Gillnet (mt)			Other
				Small mesh (< 5.5")	Large mesh (>= 5.5")		Small mesh (< 5.5")	Large mesh (5.5 - 7.99")	Extra large mesh (>= 8.0")	
1989	4.1	0.00	0.00	0.03	0.37	0.37	0.00	0.23	0.00	0.00
1990	5.7	0.00	0.00	0.00	0.37	0.34	0.00	0.29	0.00	0.00
1991	11.3	0.00	0.00	0.00	0.23	0.14	0.00	0.63	0.00	0.00
1992	9.7	0.01	0.00	0.00	0.35	0.06	0.00	0.58	0.00	0.00
1993	4.6	0.01	0.00	0.00	0.21	0.02	0.00	0.76	0.00	0.00
1994	1.0	0.00	0.00	0.00	0.24	0.10	0.00	0.62	0.04	0.01
1995	2.0	0.00	0.00	0.10	0.50	0.02	0.00	0.33	0.06	0.00
1996	1.1	0.00	0.01	0.10	0.12	0.01	0.00	0.65	0.11	0.01
1997	0.4	0.00	0.00	0.06	0.21	0.02	0.00	0.62	0.07	0.03
1998	0.9	0.00	0.00	0.00	0.01	0.00	0.00	0.96	0.02	0.01
1999	11.3	0.00	0.00	0.02	0.07	0.00	0.00	0.91	0.00	0.00
2000	11.3	0.00	0.00	0.00	0.68	0.00	0.00	0.31	0.01	0.00
2001	14.5	0.00	0.00	0.00	0.66	0.00	0.00	0.32	0.01	0.00
2002	21.3	0.00	0.00	0.04	0.65	0.00	0.00	0.28	0.03	0.00
2003	36.5	0.02	0.00	0.04	0.63	0.00	0.00	0.24	0.06	0.00
2004	34.0	0.00	0.00	0.02	0.34	0.00	0.00	0.43	0.21	0.00
2005	28.1	0.16	0.00	0.07	0.36	0.00	0.00	0.31	0.09	0.00
2006	14.3	0.17	0.00	0.04	0.61	0.00	0.00	0.16	0.02	0.00
2007	13.2	0.14	0.00	0.01	0.67	0.00	0.00	0.14	0.03	0.00
2008	33.3	0.06	0.00	0.01	0.86	0.00	0.00	0.05	0.02	0.00
2009	80.9	0.02	0.00	0.00	0.86	0.00	0.00	0.10	0.01	0.00
2010	33.8	0.03	0.00	0.01	0.61	0.00	0.00	0.26	0.07	0.01

Table A.18. Total number of Gulf of Maine trips (statistical areas 464, 465, 467, 511-515) observed by gear from 1989 to 2010. *In 2010, the number of observed trips includes trips observed by both at-sea monitors and observers.*

Year	Longline	Otter trawl		Shrimp trawl	Sink Gillnet		Total
		Small mesh (< 5.5")	Large mesh (>= 5.5")		Large mesh (5.5" - 7.99")	Extra large mesh (>= 8.0")	
1989		23	44	40	84		191
1990		8	26	31	120		185
1991	2	29	53	52	801		937
1992	9	15	45	82	896		1049
1993	2	6	17	81	560		666
1994			9	77	82	7	175
1995		30	29	73	62	14	208
1996		40	19	35	39	10	143
1997		3	7	16	31	5	62
1998			7		78	6	91
1999		11	25		70	8	114
2000			122		70	19	211
2001		4	136	3	39	21	203
2002		34	199		62	25	320
2003	14	19	278	15	254	95	675
2004	8	68	321	12	587	340	1339
2005	58	69	534	17	505	251	1438
2006	36	24	209	20	109	35	435
2007	36	16	234	14	92	46	443
2008	20	12	260	19	130	49	490
2009	35	22	428	12	271	30	801
2010	52	30	685	15	1080	379	2250

Table A.19. Estimates of total Gulf of Maine Atlantic cod commercial discards (mt) by gear from 1982 to 2010 by gear. Estimates from 1989 to 2010 were estimated using an approach consistent with the Standardized Bycatch Report Methodology (Wigley et al., 2007). Estimates from 1982 to 1989 were hindcasted using an approach documented in this report.

Year	Longline	Otter trawl		Shrimp trawl	Sink Gillnet		Total
		Small mesh (< 5.5")	Large mesh (>= 5.5")		Large mesh (5.5" - 7.99")	Extra large mesh (>= 8.0")	
1982			882.9	144.0	108.3		1135.2
1983			904.5	160.1	104.9		1169.4
1984			861.4	228.6	120.0		1209.9
1985			943.4	311.2	105.9		1360.5
1986			853.5	380.6	125.5		1359.5
1987			774.1	345.9	125.1		1245.0
1988			612.0	216.7	128.5		957.2
1989		6.1	677.3	256.4	161.2		1101.1
1990		0.9	1567.6	410.7	219.0		2198.2
1991	0.3	0.8	621.1	205.2	106.0		933.5
1992	8.0	0.0	778.7	48.9	108.2		943.8
1993	281.7	0.0	370.8	6.3	153.6		812.4
1994			163.8	7.5	105.1	4.3	280.8
1995		8.3	152.5	4.0	129.7	20.3	314.9
1996		3.3	25.1	3.0	145.2	23.7	200.4
1997		16.6	27.9	4.7	59.1	6.8	115.0
1998			11.6		82.4	5.5	99.5
1999		11.6	826.5		536.0	8.1	1382.1
2000			789.0		473.8	18.5	1281.3
2001		0.2	873.0	0.0	1113.5	54.2	2040.9
2002		16.4	868.6		828.6	58.4	1772.0
2003	66.4	22.0	553.8	2.6	321.8	71.0	1037.6
2004	7.9	2.9	532.4	0.9	231.8	84.6	860.6
2005	123.9	3.8	166.0	1.1	109.5	26.7	431.0
2006	47.7	2.6	337.7	0.3	94.3	15.8	498.4
2007	67.3	2.0	102.6	0.9	83.6	19.3	275.7
2008	58.4	6.1	343.1	0.2	84.8	21.8	514.5
2009	19.1	2.1	719.9	0.1	263.2	37.4	1041.8
2010	11.6	6.3	159.6	0.3	52.6	10.6	241.1

Table A.20. Coefficients of variation (CV) of the Gulf of Maine Atlantic cod commercial discard (mt) estimates from 1982 to 2010 by gear; CVs greater than 0.3 are shaded in grey. CVs are not available for hindcasted discards (pre-1989).

Year	Longline	Otter trawl		Shrimp trawl	Sink Gillnet		Total
		Small mesh (< 5.5")	Large mesh (>= 5.5")		Large mesh (5.5" - 7.99")	Extra large mesh (>= 8.0")	
1989		0.67	0.34	0.25	0.29		0.22
1990		0.79	0.37	0.42	0.23		0.28
1991	0.40	0.60	0.37	0.32	0.10		0.26
1992	0.64	3.72	0.33	0.24	0.07		0.27
1993	0.20		0.44	0.13	0.09		0.22
1994			0.63	0.15	0.32	0.75	0.38
1995		0.24	0.59	0.24	0.26	0.45	0.31
1996		2.84	0.91	0.34	0.30	0.28	0.25
1997		0.25	0.44	0.41	0.42	0.85	0.25
1998			0.55		0.28	0.95	0.25
1999		0.62	0.56		0.37	0.51	0.36
2000			0.28		0.27	0.31	0.20
2001		1.84	0.27		0.52	0.58	0.31
2002		0.55	0.34		0.24	0.59	0.20
2003	0.30	0.72	0.29	0.42	0.14	0.28	0.16
2004	0.48	0.44	0.34	0.37	0.13	0.12	0.22
2005	0.24	0.27	0.19	0.38	0.13	0.12	0.11
2006	0.29	0.27	0.39	0.44	0.38	0.32	0.28
2007	0.17	0.43	0.22	0.70	0.29	0.31	0.13
2008	0.42	0.37	0.21	0.55	0.18	0.49	0.16
2009	0.17	0.28	0.14	0.64	0.19	0.49	0.11
2010	0.33	0.28	0.19	0.90	0.11	0.17	0.13

Table A.21. Length sampling of commercially discarded Gulf of Maine Atlantic cod from 1989 to 2010 by gear type and semester. Sampling intensity is expressed as metric tons landings per 100 lengths sampled (*200 metric tons per 100 lengths is an unofficial NAFO/ICNAF standard*). Colors denote specific gear/mesh sizes; in all years except 2003-2005 and 2007/08 the length frequency distributions from large mesh gillnet were applied to extra large mesh gillnet due to insufficient sampling. A general criterion of 50 lengths/block was used to determine sufficiency.

Year	Longline		Otter trawl - small mesh		Otter trawl - large mesh		Shrimp trawl		Gillnet - large mesh		Gillnet - extra large mesh		Total	Total discards (mt)	mt/100 lengths		
	Semi 1	Semi 2	Semi 1	Semi 2	Semi 1	Semi 2	Semi 1	Semi 2	Semi 1	Semi 2	Semi 1	Semi 2					
1989			125	14	542	1053	2011	77		104			3926	1191.4	30.3		
1990			**		587	818	607	31	138	3			2184	2065.5	94.6		
1991	*		**		706	124	397		65	30			1322	882.2	66.7		
1992	*		**		924	924	401	10	78	130			2467	786.2	31.9		
1993	48		**		68	866	591		90	223			1886	808.7	42.9		
1994					194		563	40	274	112		7	1190	331.8	27.9		
1995				69	225	473	377	3	60	147	20	3	1377	303.8	22.1		
1996				52	19	15	73		44	21	109	31	16	20	400	205.4	51.3
1997				7***		104	1	17*****		34	11	1	2	177	113.1	63.9	
1998						5****				43	40	9	3	100	98.9	98.9	
1999				6***			220			130	1156		14	1526	1359.5	89.1	
2000					248	85			125	157	6	6	627	1317.2	210.1		
2001				***	61	647			223	144	3	4	1082	2062.8	190.6		
2002					192	104	1162		412	845	1	39	2759	1775.0	64.3		
2003	718		173	131	1109	234	192		603	1352	38	205	4755	1022.1	21.5		
2004	197		103	519	385	771	76		1165	1524	27	536	5303	783.1	14.8		
2005	2283	147	180	183	986	2939	70		190	663	47	104	7792	493.3	6.3		
2006	880	3	43	9	1899	339	96		44	59	6	15	3393	465.1	13.7		
2007	817	327	1	62	1172	1103	12*****		91	310	53	164	4112	278.3	6.8		
2008	958			18	2316	1639	42*****		142	73	72	26	5286	512.1	9.7		
2009	552	187		22	2219	1744	2*****		502	112	7	15	5362	1114.4	20.8		
2010	153	16		51	502	291	5*****		140	91	5	5	1259	262.1	20.8		
*Borrowed from 1993 LF																	
**Used 1989-1995 aggregate LF																	
***Used 1996-2002 aggregate LF																	
****Borrowed from 1997 LF																	
*****Used 1996-1997 aggregate LF																	
*****Used 2007 - 2010 aggregate LF																	

Table A.22. Comparison of the survey-filter discard estimates to direct observed based discard estimates for large mesh otter trawl, shrimp trawl and large mesh gillnet between 1989 and 1993 for Gulf of Maine Atlantic cod.

Year	Otter trawl, large mesh ($\geq 5.5''$)		Shrimp trawl		Sink gillnet, large mesh (5.5'' - 7.99'')	
	Discard estimate (mt)	Survey-filter estimate (mt)	Discard estimate (mt)	Survey-filter estimate (mt)	Discard estimate (mt)	Survey-filter estimate (mt)
1989	677.3	499.8	256.4	215.6	161.2	70.9
1990	1567.6	722.0	410.7	273.2	219.0	80.5
1991	621.1	917.3	205.2	243.8	106.0	71.4
1992	778.7	769.4			108.2	62.4
1993	370.8	572.6			153.6	73.1

Table A.23. Total commercial discards-at-age (numbers) of Gulf of Maine Atlantic cod from 1982 to 2010.

Year	Age 0	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10	Age 11	Age 12	Age 13	Age 14	Age 15	Age 16	Total
1982	774	460,286	1,531,482	297,532	67,450	0	0	0	0	0	0	0	0	0	0	0	0	2,357,524
1983	18,159	744,885	1,699,037	210,576	7,181	0	0	0	0	0	0	0	0	0	0	0	0	2,679,838
1984	24,361	460,440	1,914,404	290,974	0	0	0	0	0	0	0	0	0	0	0	0	0	2,690,179
1985	89,337	610,285	1,542,183	685,210	0	0	0	0	0	0	0	0	0	0	0	0	0	2,927,015
1986	23,683	969,318	2,017,781	275,912	63,622	0	0	0	0	0	0	0	0	0	0	0	0	3,350,316
1987	134,239	334,731	1,822,277	538,068	0	0	0	0	0	0	0	0	0	0	0	0	0	2,454,648
1988	4,593	536,739	1,518,625	363,884	30,807	0	0	0	0	0	0	0	0	0	0	0	0	2,454,648
1989	57	209,741	977,661	552,886	66,761	6,435	1,737	628	136	0	0	0	0	0	0	0	0	1,816,042
1990	0	81,184	713,847	2,142,719	245,748	1,583	288	0	0	0	0	0	0	0	0	0	0	3,185,369
1991	4,335	154,094	326,022	208,120	362,857	31,219	1,185	264	0	618	27	0	0	0	0	0	0	1,088,742
1992	31,737	486,120	641,320	371,300	42,957	122,173	3,704	149	18	0	0	0	0	0	0	0	0	1,699,477
1993	35,427	132,795	494,162	376,468	111,699	59	853	234	0	0	0	0	0	0	0	0	0	1,151,695
1994	15,645	158,501	121,606	183,292	18,866	1,022	292	337	0	0	0	0	0	0	0	0	0	499,562
1995	15,429	99,830	75,644	136,776	55,399	4,938	516	0	0	0	0	0	0	0	0	0	0	388,532
1996	29,423	42,167	28,696	31,258	48,465	8,716	824	127	97	678	0	0	0	0	0	0	0	190,451
1997	1,963	87,725	43,264	36,158	6,794	17,807	973	155	0	0	0	0	0	0	0	0	0	194,839
1998	874	3,211	45,521	26,513	17,262	2,019	1,920	103	0	0	0	0	0	0	0	0	0	97,424
1999	84	77,765	46,795	101,460	101,444	84,261	25,772	29,390	4,940	42	0	0	0	0	0	0	0	471,951
2000	0	14,578	255,521	161,043	178,505	33,596	10,391	1,887	403	0	0	0	0	0	0	0	0	655,924
2001	0	779	221,436	238,047	151,127	114,237	29,397	12,083	1,821	1,633	0	0	0	0	0	0	0	770,560
2002	0	13,780	35,005	124,276	195,369	74,510	46,563	19,469	12,574	4,998	4,246	355	289	0	0	0	0	531,434
2003	30,493	40,583	83,948	68,681	189,556	130,314	24,613	7,147	2,550	1,056	405	260	20	0	0	0	0	579,627
2004	249	174,381	96,238	312,825	55,809	54,352	24,355	5,413	2,414	715	290	112	14	0	0	0	0	727,167
2005	1,980	26,156	105,365	48,176	154,881	4,379	10,928	3,603	758	584	195	221	100	54	0	0	0	357,379
2006	272	14,287	41,688	225,318	53,609	75,277	3,367	2,818	2,565	117	43	6	0	1	0	0	0	419,369
2007	543	14,198	70,560	89,836	78,281	6,614	4,329	65	70	8	0	2	0	0	0	0	0	264,506
2008	560	12,761	86,808	150,817	84,695	57,850	2,229	1,752	96	24	34	33	0	0	0	0	0	397,659
2009	108	7,594	69,851	223,112	190,796	74,844	35,721	967	1,689	17	45	9	0	11	0	0	0	604,762
2010	265	7,836	35,552	73,500	36,932	21,035	4,396	1,234	20	0	0	0	0	0	0	0	0	180,771

Table A.24. Mean weights-at-age (kg) of commercially discarded Gulf of Maine Atlantic cod from 1982 to 2010.

Year	Age 0	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10	Age 11	Age 12	Age 13	Age 14	Age 15	Age 16
1982	0.000	0.315	0.500	0.608	0.648												
1983	0.024	0.218	0.509	0.649	0.752												
1984	0.001	0.225	0.485	0.610													
1985	0.039	0.194	0.541	0.589													
1986	0.005	0.274	0.439	0.621	0.573												
1987	0.004	0.143	0.492	0.559													
1988	0.003	0.121	0.442	0.554	0.615												
1989	0.046	0.224	0.490	0.751	1.751	4.112	5.534	9.336	6.408								
1990		0.195	0.645	0.703	0.846	4.340	4.564										
1991	0.014	0.238	0.859	0.917	0.993	1.401	6.746	8.389		18.191	3.705						
1992	0.023	0.053	0.680	0.773	1.082	1.154	1.614	5.239	2.425								
1993	0.021	0.073	0.684	0.944	0.926	1.953	4.309	7.342									
1994	0.022	0.049	0.629	0.827	1.798	3.872	12.083	9.439									
1995	0.027	0.093	0.809	0.925	1.637	4.928	4.682										
1996	0.033	0.067	0.676	1.126	1.840	3.752	6.768	11.559	12.656	17.406							
1997	0.017	0.058	0.590	0.928	1.984	1.785	4.381	8.657									
1998	0.007	0.200	0.603	1.093	1.686	3.316	3.287	3.285									
1999	0.052	0.201	0.595	1.940	3.353	4.626	6.586	6.605	9.634	12.279							
2000		0.292	0.962	1.843	3.041	3.882	4.881	4.279	6.121								
2001		0.316	0.669	2.023	3.777	4.898	5.908	6.594	7.159	8.790							
2002		0.203	0.923	1.415	2.987	4.222	6.258	7.030	9.453	12.322	10.912	10.519	14.222				
2003	0.038	0.133	0.804	1.364	1.672	2.772	4.085	6.911	9.868	8.622	11.658	10.100	12.774				
2004	0.025	0.106	0.455	1.128	1.879	2.800	4.834	6.755	8.763	11.588	11.820	10.579	11.694				
2005	0.027	0.109	0.564	1.170	1.400	3.246	3.573	5.707	7.370	10.673	15.830	16.405	17.950	23.098			
2006	0.069	0.276	0.665	1.066	1.494	1.604	1.871	3.857	2.822	7.902	8.238	13.434		13.434			
2007	0.024	0.227	0.658	1.063	1.394	1.710	2.171	4.447	5.197	6.529		7.736					
2008	0.078	0.203	0.770	1.273	1.572	1.741	3.047	6.283	6.021	5.514	10.341	10.660					
2009	0.026	0.356	0.913	1.515	2.010	2.109	2.402	3.970	3.288	8.250	8.733	7.259		10.510			
2010	0.022	0.281	0.989	1.218	1.718	1.880	1.935	2.106	3.476								

Table A.25. Proportion of recreationally caught (Type A, B1 and B2) Gulf of Maine Atlantic cod by mode and area as estimated by the Marine Recreational Fishing Statistical Survey from 1981 to 2010. **The summary only includes catch from Maine, New Hampshire and Massachusetts. The 'Shore' category includes man-made and beach catch.*

Year	Party/charter			Private/rental			Shore	
	Inland	Ocean <= 3 miles	Ocean > 3 miles	Inland	Ocean <= 3 miles	Ocean > 3 miles	Inland	Ocean <= 3 miles
1981	4.1	6.0	53.7	3.1	27.5	5.3	0.2	0.1
1982	0.0	2.4	46.1	10.3	31.8	8.9	0.1	0.3
1983	1.2	1.5	34.6	1.4	40.0	20.1	0.5	0.7
1984	0.6	5.4	35.6	3.2	28.1	26.4	0.5	0.2
1985	0.0	7.4	26.9	12.8	25.6	26.6	0.6	0.2
1986	0.2	8.5	59.2	4.6	12.4	9.6	0.1	5.4
1987	0.0	18.5	52.5	0.9	14.3	13.8	0.0	0.0
1988	1.0	3.3	35.6	3.0	8.5	46.9	0.0	1.7
1989	5.1	5.3	36.7	22.5	7.8	22.5	0.0	0.1
1990	0.7	5.4	53.4	2.0	10.0	26.8	0.2	1.4
1991	0.0	0.1	33.7	5.3	9.6	51.2	0.0	0.1
1992	0.0	0.0	38.9	2.4	8.7	47.3	0.2	2.6
1993	0.0	0.8	66.3	3.1	10.5	19.4	0.0	0.0
1994	0.3	1.7	36.7	17.3	15.6	28.4	0.0	0.0
1995	0.0	3.9	69.0	4.2	5.4	17.4	0.0	0.0
1996	1.6	2.7	55.5	1.0	5.5	33.7	0.0	0.0
1997	1.4	8.7	65.5	2.4	4.5	17.4	0.0	0.1
1998	0.0	4.6	56.8	1.7	8.6	28.3	0.0	0.0
1999	0.0	3.1	51.3	0.5	11.1	33.9	0.0	0.1
2000	0.6	0.6	50.6	4.4	16.0	27.7	0.0	0.1
2001	2.4	0.7	24.1	12.1	19.6	40.8	0.1	0.1
2002	0.0	0.3	16.8	2.9	23.2	56.6	0.0	0.1
2003	0.1	0.0	26.5	0.2	10.7	62.5	0.0	0.0
2004	0.3	0.9	20.9	5.8	10.3	61.8	0.2	0.0
2005	0.0	0.2	28.6	2.5	12.2	56.5	0.1	0.0
2006	0.0	0.2	52.0	3.2	13.9	30.6	0.0	0.1
2007	0.0	0.5	34.6	18.5	1.7	44.5	0.2	0.0
2008	0.2	0.0	34.0	13.0	1.9	50.9	0.0	0.0
2009	1.6	0.0	37.9	4.9	0.5	55.0	0.0	0.0
2010	0.5	0.0	14.3	7.8	0.8	76.6	0.0	0.0

Table A.26. Proportion of recreationally landed Gulf of Maine Atlantic cod reported on Vessel Trip Reports (VTRs) by month from 1994 to 2010. Recreational vessels are prohibited from possessing Gulf of Maine Atlantic cod in the months shaded grey. Since May 1, 2006 recreational possession was prohibited from November 1st to March 31st. In 2009 the prohibition period was extended to November 1st to April 15th.

Year	Month											
	1	2	3	4	5	6	7	8	9	10	11	12
1994	0.00	0.00	0.00	0.01	0.02	0.17	0.15	0.22	0.13	0.16	0.03	0.11
1995	0.02	0.02	0.02	0.10	0.16	0.16	0.12	0.16	0.10	0.05	0.06	0.01
1996	0.00	0.00	0.02	0.14	0.22	0.18	0.14	0.15	0.09	0.05	0.00	0.00
1997	0.00	0.00	0.01	0.14	0.23	0.16	0.15	0.15	0.10	0.05	0.01	0.00
1998	0.00	0.00	0.01	0.15	0.21	0.19	0.17	0.12	0.10	0.04	0.01	0.00
1999	0.00	0.00	0.02	0.20	0.24	0.14	0.13	0.12	0.09	0.05	0.01	0.00
2000	0.00	0.01	0.03	0.18	0.22	0.15	0.13	0.12	0.11	0.05	0.01	0.00
2001	0.01	0.03	0.06	0.15	0.18	0.16	0.16	0.12	0.09	0.04	0.01	0.00
2002	0.01	0.02	0.05	0.25	0.19	0.14	0.14	0.10	0.07	0.02	0.01	0.00
2003	0.00	0.00	0.02	0.12	0.24	0.16	0.15	0.15	0.09	0.04	0.01	0.01
2004	0.00	0.01	0.01	0.14	0.27	0.17	0.13	0.12	0.09	0.04	0.02	0.00
2005	0.00	0.00	0.03	0.15	0.17	0.21	0.13	0.14	0.10	0.03	0.03	0.00
2006	0.01	0.02	0.09	0.19	0.18	0.18	0.13	0.09	0.08	0.03	0.00	0.00
2007	0.00	0.00	0.00	0.16	0.23	0.17	0.14	0.12	0.12	0.05	0.00	0.00
2008	0.00	0.00	0.00	0.20	0.26	0.17	0.13	0.11	0.08	0.06	0.00	0.00
2009	0.00	0.00	0.00	0.17	0.29	0.18	0.10	0.09	0.11	0.06	0.00	0.00
2010	0.00	0.00	0.00	0.14	0.26	0.24	0.12	0.13	0.08	0.04	0.00	0.00
Average	0.00	0.01	0.02	0.15	0.21	0.17	0.14	0.13	0.10	0.05	0.01	0.01

Table A.27. Proportion of recreationally caught (Type A, B1 and B2) Gulf of Maine Atlantic cod by sampling wave as estimated by the Marine Recreational Fishing Statistical Survey from 1981 to 2010.

Year	Wave				
	2	3	4	5	6
1981	0.16	0.63	0.11	0.10	0.00
1982	0.33	0.29	0.22	0.16	0.01
1983	0.11	0.29	0.26	0.32	0.02
1984	0.08	0.40	0.39	0.12	0.01
1985	0.19	0.53	0.16	0.09	0.02
1986	0.22	0.13	0.21	0.26	0.18
1987	0.41	0.26	0.11	0.12	0.11
1988	0.04	0.41	0.12	0.41	0.02
1989	0.04	0.35	0.25	0.29	0.06
1990	0.11	0.46	0.15	0.25	0.03
1991	0.14	0.49	0.06	0.20	0.10
1992	0.26	0.24	0.19	0.29	0.03
1993	0.17	0.39	0.17	0.20	0.07
1994	0.05	0.31	0.20	0.14	0.31
1995	0.18	0.23	0.08	0.41	0.10
1996	0.12	0.32	0.19	0.21	0.15
1997	0.31	0.28	0.18	0.07	0.16
1998	0.30	0.26	0.23	0.06	0.16
1999	0.33	0.22	0.16	0.23	0.06
2000	0.22	0.37	0.16	0.20	0.04
2001	0.12	0.31	0.22	0.23	0.12
2002	0.17	0.28	0.19	0.17	0.19
2003	0.19	0.40	0.18	0.15	0.09
2004	0.03	0.36	0.09	0.28	0.24
2005	0.27	0.33	0.20	0.11	0.09
2006	0.20	0.33	0.26	0.16	0.05
2007	0.19	0.29	0.22	0.13	0.16
2008	0.17	0.52	0.18	0.13	0.01
2009	0.11	0.49	0.13	0.11	0.16
2010	0.50	0.28	0.11	0.10	0.01

Table A.28. Proportion of recreationally landed Gulf of Maine Atlantic cod reported on Vessel Trip Reports (VTRs) by statistical area from 1994 to 2010.

Year	Area								
	464	465	510	511	512	513	514	515	
1994	0.00	0.00	0.00	0.00	0.00	0.02	0.29	0.43	0.26
1995	0.00	0.00	0.00	0.00	0.00	0.00	0.36	0.51	0.12
1996	0.00	0.00	0.00	0.00	0.00	0.00	0.38	0.59	0.03
1997	0.00	0.00	0.00	0.00	0.00	0.00	0.48	0.51	0.01
1998	0.00	0.00	0.00	0.00	0.00	0.00	0.49	0.50	0.01
1999	0.00	0.00	0.00	0.00	0.00	0.01	0.39	0.58	0.02
2000	0.00	0.00	0.00	0.00	0.00	0.00	0.34	0.61	0.05
2001	0.00	0.00	0.00	0.00	0.00	0.00	0.31	0.66	0.03
2002	0.00	0.00	0.00	0.00	0.00	0.00	0.37	0.60	0.03
2003	0.00	0.00	0.00	0.00	0.00	0.00	0.36	0.54	0.10
2004	0.00	0.00	0.00	0.00	0.00	0.00	0.33	0.62	0.04
2005	0.00	0.00	0.00	0.00	0.00	0.00	0.39	0.57	0.04
2006	0.00	0.00	0.00	0.00	0.00	0.00	0.42	0.54	0.05
2007	0.00	0.00	0.00	0.00	0.00	0.01	0.45	0.52	0.01
2008	0.00	0.00	0.00	0.00	0.00	0.00	0.44	0.54	0.02
2009	0.00	0.00	0.00	0.00	0.00	0.00	0.42	0.58	0.00
2010	0.00	0.00	0.00	0.00	0.00	0.00	0.49	0.46	0.05
Average	0.00	0.00	0.00	0.00	0.00	0.00	0.39	0.55	0.05

Table A.29. Proportion of recreationally landed Gulf of Maine Atlantic cod reported on Vessel Trip Reports (VTRs) by state from 1994 to 2010.

Year	State									
	CT	MA	ME	NH	NJ	NK	NY	RI	VA	
1994	0.00	0.59	0.32	0.08	0.00	0.00	0.00	0.00	0.00	0.00
1995	0.00	0.72	0.18	0.10	0.00	0.00	0.00	0.00	0.00	0.00
1996	0.00	0.69	0.21	0.10	0.00	0.00	0.00	0.00	0.00	0.00
1997	0.00	0.63	0.25	0.12	0.00	0.00	0.00	0.00	0.00	0.00
1998	0.00	0.59	0.27	0.14	0.00	0.00	0.00	0.00	0.00	0.00
1999	0.00	0.67	0.19	0.14	0.00	0.00	0.00	0.01	0.00	0.00
2000	0.00	0.67	0.17	0.16	0.00	0.00	0.00	0.00	0.00	0.00
2001	0.00	0.71	0.13	0.16	0.00	0.00	0.00	0.00	0.00	0.00
2002	0.00	0.64	0.11	0.24	0.00	0.00	0.00	0.00	0.00	0.00
2003	0.00	0.66	0.14	0.19	0.00	0.00	0.00	0.00	0.00	0.00
2004	0.00	0.60	0.12	0.26	0.00	0.00	0.00	0.00	0.01	0.00
2005	0.00	0.56	0.10	0.33	0.00	0.00	0.00	0.00	0.01	0.00
2006	0.00	0.55	0.13	0.32	0.00	0.00	0.00	0.00	0.00	0.00
2007	0.00	0.48	0.17	0.34	0.00	0.00	0.00	0.01	0.00	0.00
2008	0.00	0.52	0.15	0.34	0.00	0.00	0.00	0.00	0.00	0.00
2009	0.00	0.50	0.17	0.33	0.00	0.00	0.00	0.00	0.00	0.00
2010	0.00	0.50	0.12	0.37	0.00	0.00	0.00	0.00	0.00	0.00
Average	0.00	0.60	0.17	0.22	0.00	0.00	0.00	0.00	0.00	0.00

Table A.30. Length sampling intensity of recreationally landed (Type A, and B1) Gulf of Maine Atlantic cod by semester and year as estimated by the Marine Recreational Fishing Statistical Survey from 1981 to 2010. 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	Semester		Total	A,B1 estimated numbers (000s)	AB1 Landings (mt)	Lengths per 1000 fish	mt per 100 lengths
	1	2					
1981	355	366	721	2650.0	5417.5	0.3	751.4
1982	320	276	596	1849.2	3805.7	0.3	638.5
1983	609	560	1169	1257.8	2379.5	0.9	203.6
1984	394	391	785	910.8	1699.3	0.9	216.5
1985	272	155	427	1633.9	3727.1	0.3	872.8
1986	77	90	167	990.1	2607.3	0.2	1561.2
1987	167	367	534	2031.1	4788.7	0.3	896.8
1988	325	213	538	1272.3	2277.7	0.4	423.4
1989	208	352	560	1203.0	2635.9	0.5	470.7
1990	160	210	370	1254.5	3027.5	0.3	818.2
1991	377	83	460	1377.8	3080.4	0.3	669.7
1992	710	268	978	321.6	841.2	3.0	86.0
1993	136	200	336	766.6	1364.9	0.4	406.2
1994	333	485	818	529.6	972.8	1.5	118.9
1995	663	434	1097	509.6	844.3	2.2	77.0
1996	585	515	1100	350.6	672.3	3.1	61.1
1997	190	392	582	139.8	314.7	4.2	54.1
1998	447	215	662	194.3	475.6	3.4	71.8
1999	111	117	228	248.9	777.7	0.9	341.1
2000	70	77	147	1233.1	1301.4	0.1	885.3
2001	124	121	245	1018.3	2651.6	0.2	1082.3
2002	181	196	377	551.4	1691.5	0.7	448.7
2003	361	322	683	613.0	2166.1	1.1	317.2
2004	422	473	895	531.9	1613.1	1.7	180.2
2005	391	382	773	589.0	1775.1	1.3	229.6
2006	681	155	836	227.0	844.7	3.7	101.0
2007	479	220	699	307.0	1054.1	2.3	150.8
2008	590	231	821	475.7	1575.7	1.7	191.9
2009	852	488	1340	477.9	1676.1	2.8	125.1
2010	621	508	1129	1004.8	3506.0	1.1	310.5

Table A.31. Percentage of recreationally discarded (Type B2) Gulf of Maine Atlantic cod by mode and area as estimated by the Marine Recreational Fishing Statistical Survey from 1981 to 2010. **The summary only includes catch from Maine, New Hampshire and Massachusetts. The 'Shore' category includes man-made and beach catch.*

Year	Party/charter			Private/rental			Shore	
	Inland	Ocean <= 3 miles	Ocean > 3 miles	Inland	Ocean <= 3 miles	Ocean > 3 miles	Inland	Ocean <= 3 miles
1981	0.0	0.0	15.8	11.2	63.2	9.7	0.1	0.0
1982	0.0	0.0	44.3	1.1	26.1	28.6	0.0	0.0
1983	0.0	0.5	14.5	10.0	54.4	16.9	0.0	3.7
1984	0.0	2.5	26.3	0.0	45.0	24.6	1.1	0.5
1985	0.0	22.6	35.3	2.0	3.3	35.8	1.0	0.0
1986	0.7	16.4	36.5	5.8	19.4	21.2	0.0	0.0
1987	0.0	28.7	47.3	2.0	8.4	13.7	0.0	0.0
1988	1.9	4.2	49.1	1.1	12.5	31.1	0.0	0.2
1989	3.5	6.5	37.2	13.8	8.2	30.4	0.0	0.3
1990	1.7	6.0	43.8	2.3	7.9	37.7	0.2	0.5
1991	0.0	0.1	35.4	3.8	9.3	50.9	0.0	0.4
1992	0.0	0.0	34.2	5.2	7.3	49.9	0.5	2.9
1993	0.0	0.8	65.0	4.1	13.9	16.2	0.0	0.0
1994	0.4	1.2	36.6	21.7	13.4	26.7	0.0	0.0
1995	0.0	5.0	67.8	4.2	6.1	16.7	0.0	0.0
1996	0.6	2.5	55.5	1.5	5.7	34.1	0.0	0.0
1997	2.6	9.7	56.4	3.5	6.0	21.8	0.0	0.0
1998	0.0	5.9	51.9	2.2	11.5	28.4	0.0	0.0
1999	0.0	2.6	43.6	0.8	10.9	41.9	0.0	0.2
2000	0.6	0.7	48.0	2.9	18.5	29.2	0.0	0.1
2001	3.3	0.7	21.3	13.0	22.0	39.2	0.2	0.3
2002	0.0	0.2	13.8	2.9	25.0	57.9	0.0	0.2
2003	0.1	0.0	22.9	0.2	11.9	64.9	0.0	0.0
2004	0.0	0.9	15.9	6.4	10.7	65.8	0.3	0.0
2005	0.0	0.2	26.5	2.9	13.1	57.3	0.1	0.0
2006	0.0	0.1	49.3	3.9	13.3	33.2	0.0	0.1
2007	0.0	0.1	32.8	15.2	1.7	50.0	0.2	0.0
2008	0.2	0.0	33.1	14.1	2.2	50.4	0.0	0.0
2009	1.3	0.0	35.3	5.3	0.3	57.7	0.0	0.0
2010	0.4	0.1	13.3	9.1	0.9	76.3	0.0	0.0

Table A.32. Length sampling intensity of recreationally discarded (Type B2) Gulf of Maine Atlantic cod by semester and year as estimated by the Marine Recreational Fishing Statistical Survey from 2005 to 2010. Length samples of recreationally discarded (i9 samples) Atlantic cod were unavailable prior to 2005. 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	Semester		Total	B2 releases (000s)	B2 releases (mt)	Lengths per thousand fish	Metric tons per 100 lengths
	1	2					
2005	577	624	1201	1260.3	1849.3	1.0	208.1
2006	952	599	1551	683.4	910.4	2.3	162.9
2007	728	846	1574	1030.1	1337.1	1.5	216.2
2008	1258	709	1967	1162.8	1638.5	1.7	156.4
2009	765	889	1654	1057.0	1534.9	1.6	216.2
2010	715	1024	1739	1874.3	2879.1	0.9	243.2

Table A.33. Estimates of Gulf of Maine Atlantic cod recreational catch in numbers (000's) and weight (mt).

Year	Landings (000s)			Discards (000s)	Total catch (000s)	Landings (mt)		Discards (mt)	Total catch (mt)	Discard/landings ratio
	Type A	Type B1	Total			Types A+B1	Type B2			
1981	2059.9	590.1	2650.0	191.8	2841.9	5417.5	83.0	5500.6	0.07	
1982	512.1	1337.2	1849.2	94.7	1943.9	3805.7	35.9	3841.6	0.05	
1983	499.7	758.1	1257.8	230.3	1488.2	2379.5	77.5	2457.0	0.18	
1984	465.1	445.7	910.8	196.7	1107.5	1699.3	73.1	1772.5	0.22	
1985	439.5	1194.4	1633.9	199.6	1833.5	3727.1	74.3	3801.4	0.12	
1986	38.4	951.6	990.1	121.5	1111.6	2607.3	44.5	2651.8	0.12	
1987	520.6	1510.5	2031.1	566.7	2597.8	4788.7	211.7	5000.3	0.28	
1988	179.2	1093.1	1272.3	176.4	1448.7	2277.7	59.7	2337.4	0.14	
1989	563.8	639.1	1203.0	572.1	1775.1	2635.9	335.4	2971.3	0.48	
1990	172.7	1081.7	1254.5	472.7	1727.1	3027.5	294.0	3321.5	0.38	
1991	268.5	1109.3	1377.8	410.4	1788.2	3080.4	299.8	3380.2	0.30	
1992	171.2	150.5	321.6	239.1	560.7	841.2	156.3	997.5	0.74	
1993	210.2	556.4	766.6	751.2	1517.8	1364.9	449.4	1814.3	0.98	
1994	176.9	352.8	529.6	718.9	1248.6	972.8	443.5	1416.2	1.36	
1995	332.9	176.7	509.6	682.7	1192.3	844.3	423.9	1268.2	1.34	
1996	144.0	206.6	350.6	450.8	801.4	672.3	357.2	1029.5	1.29	
1997	34.9	104.9	139.8	300.2	440.0	314.7	259.1	573.8	2.15	
1998	36.0	158.3	194.3	383.0	577.3	475.6	318.5	794.1	1.97	
1999	94.8	154.1	248.9	475.8	724.7	777.7	315.9	1093.6	1.91	
2000	66.6	456.2	522.8	921.0	1443.8	1301.4	606.9	1908.3	1.76	
2001	186.6	831.7	1018.3	1312.0	2330.3	2651.6	1002.9	3654.4	1.29	
2002	120.9	430.5	551.4	1089.1	1640.6	1691.5	1264.6	2956.1	1.98	
2003	199.0	413.9	613.0	1108.0	1721.0	2166.1	1245.0	3411.2	1.81	
2004	156.8	375.0	531.9	895.7	1427.6	1613.1	816.0	2429.1	1.68	
2005	81.2	507.8	589.0	1260.3	1849.3	1775.1	1081.7	2856.8	2.14	
2006	82.0	144.9	227.0	683.4	910.4	844.7	623.9	1468.6	3.01	
2007	65.8	241.2	307.0	1030.1	1337.1	1054.1	1128.1	2182.3	3.36	
2008	106.3	369.4	475.7	1162.8	1638.5	1575.7	1283.8	2859.6	2.44	
2009	131.1	346.7	477.9	1057.0	1534.9	1676.1	1247.4	2923.5	2.21	
2010	68.1	936.7	1004.8	1874.3	2879.1	3506.0	2288.9	5794.9	1.87	

Table A.34. Percent standard error (PSE) of recreation catch (A, B1 and B2) number estimates by state as estimated by the Marine Recreational Fishing Statistical Survey from 1991 to 2010 for Gulf of Maine Atlantic cod. **Note: due to the proration step that is required to split Massachusetts landed fish between the Gulf of Maine and Georges Bank, these estimates of PSE are not directly translatable to the aggregate estimates of Gulf of Maine recreational catch. The PSEs are provided for informational purposes only.*

Year	Maine	New Hampshire	Massachusetts
1981	35.7	24.6	23.4
1982	22.0	47.1	39.1
1983	20.6	18.5	13.6
1984	16.7	14.7	13.9
1985	24.2	26.3	23.3
1986	18.4	24.0	22.6
1987	40.4	36.1	14.3
1988	75.4	25.6	10.6
1989	21.1	19.6	14.6
1990	29.8	24.9	11.2
1991	33.9	36.5	9.5
1992	43.3	31.1	13.5
1993	33.6	30.2	13.1
1994	32.2	31.3	9.2
1995	34.9	16.3	11.2
1996	38.6	20.2	13.2
1997	36.3	23.8	17.6
1998	47.0	17.9	17.4
1999	43.7	14.7	17.7
2000	21.9	12.6	14.5
2001	26.1	10.6	8.0
2002	20.3	11.9	9.1
2003	28.1	11.7	9.5
2004	26.2	13.6	10.3
2005	11.1	13.3	12.9
2006	8.1	8.5	8.3
2007	19.7	11.4	15.7
2008	13.2	7.2	9.3
2009	20.3	7.0	15.2
2010	16.5	11.7	21.7

Table A.35. Total recreational landings-at-age (numbers) of Gulf of Maine Atlantic cod from 1982 to 2010.

Year	Age 0	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10	Age 11	Age 12	Age 13	Age 14	Age 15	Age 16	Total
1981	0	210,719	822,198	819,693	562,058	92,170	56,148	9,740	38,693		33,079	0	5,513	0	0	0	0	2,650,011
1982	1,034	91,749	568,082	577,515	355,926	174,538	19,778	33,649	17,805	5,275	776	0	3,103	0	0	0	0	1,849,230
1983	0	20,032	423,731	455,861	172,162	102,920	60,785	7,798	6,540	2,385	1,865	1,076	2,690	0	0	0	0	1,257,845
1984	0	15,749	301,723	303,427	186,475	54,654	31,802	12,404	523	563	470	840	0	580	1,547	0	0	910,757
1985	0	47,383	496,811	590,776	201,619	165,874	51,269	45,808	21,465	2,973	7,424	425	1,354	717	0	0	0	1,633,898
1986	0	28,604	161,182	475,797	168,493	53,476	55,436	12,599	14,459	8,495	4,840	1,170	4,330	1,170	0	0	0	990,051
1987	0	22,785	470,809	699,099	617,743	104,822	33,528	47,319	12,120	11,411	8,558	2,536	380	0	0	0	0	2,031,110
1988	0	4,228	266,933	606,546	304,394	63,112	11,652	4,986	8,093	0	0	2,365	0	0	0	0	0	1,272,309
1989	0	4,874	157,121	587,640	327,141	86,361	20,468	14,695	1,790	2,864	0	0	0	0	0	0	0	1,202,954
1990	0	3,789	54,176	606,059	398,543	117,733	49,813	6,006	15,822	2,543	0	0	0	0	0	0	0	1,254,484
1991	0	4,867	47,573	205,657	944,862	142,988	15,043	16,657	0	0	193	0	0	0	0	0	0	1,377,840
1992	0	2,834	28,937	58,851	47,476	166,030	13,683	3,565	261	0	0	0	0	0	0	0	0	321,637
1993	0	2,580	57,738	463,710	179,997	14,210	43,481	4,848	0	0	0	0	0	0	0	0	0	766,564
1994	0	640	18,822	327,802	139,397	33,069	3,240	5,352	809	498	0	0	0	0	0	0	0	529,629
1995	0	33	47,779	251,839	194,943	13,413	1,378	0	258	0	0	0	0	0	0	0	0	509,643
1996	0	0	16,148	87,181	219,140	26,632	1,146	46	0	319	0	0	0	0	0	0	0	350,612
1997	0	104	6,758	42,394	28,364	57,024	4,835	46	256	0	0	0	0	0	0	0	0	139,781
1998	293	0	12,541	71,242	71,385	15,554	21,353	1,491	424	0	0	0	0	0	0	0	0	194,283
1999	0	744	7,142	72,122	82,218	52,603	13,003	19,558	1,489	0	0	0	0	0	0	0	0	248,879
2000	0	0	70,791	175,323	220,497	34,113	14,359	2,701	5,035	0	0	0	0	0	0	0	0	522,819
2001	0	0	57,044	520,864	288,724	113,637	23,149	12,505	1,778	625	0	0	0	0	0	0	0	1,018,326
2002	0	0	417	77,874	315,043	98,889	32,135	12,971	8,151	1,059	1,959	0	2,925	0	0	0	0	551,423
2003	0	0	6,580	50,108	201,240	253,366	55,395	24,393	10,064	6,835	1,576	2,323	1,101	0	0	0	0	612,981
2004	0	0	136	138,126	101,929	180,992	82,273	16,548	6,553	2,472	1,656	315	854	0	0	0	0	531,854
2005	0	0	4,192	62,854	369,984	26,230	76,351	30,524	8,436	6,029	2,110	1,094	855	330	0	0	0	588,989
2006	0	0	201	35,969	57,035	94,415	6,201	17,180	8,975	3,445	2,108	765	414	222	49	0	0	226,979
2007	0	0	1,782	36,186	188,443	25,996	42,834	1,959	3,639	2,813	1,410	746	396	602	98	110	0	307,014
2008	0	0	4,906	115,771	153,245	126,610	34,762	33,064	1,835	2,607	2,897	0	0	0	0	0	0	475,697
2009	0	0	1,888	91,438	201,011	82,381	81,770	4,107	10,406	259	2,081	1,150	1,129	238	0	0	0	477,858
2010	0	0	20,250	186,460	408,587	282,673	74,903	18,879	6,230	2,818	445	0	3,560	0	0	0	0	1,004,805

Table A.36. Mean weights-at-age (kg) of recreationally landed Gulf of Maine Atlantic cod from 1982 to 2010.

Year	Age 0	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10	Age 11	Age 12	Age 13	Age 14	Age 15	Age 16
1981		0.341	0.995	1.524	2.915	4.715	5.645	5.861	8.359		12.340		18.100				
1982	0.022	0.372	0.848	1.401	2.209	5.362	6.956	9.733	8.989	11.010	11.547		21.416				
1983		0.378	0.791	1.398	2.401	3.772	6.032	6.748	8.395	9.633	15.186	19.306	19.183				
1984		0.372	0.775	1.365	2.668	4.005	5.348	6.560	6.551	8.958	11.746	13.514		17.785	27.100		
1985		0.346	0.752	1.281	2.811	5.310	6.770	8.646	11.256	11.851	12.244	8.049	9.298	8.332			
1986		0.376	0.672	1.589	2.771	5.308	7.418	8.583	11.188	11.842	14.268	14.577	22.392	14.577			
1987		0.243	0.900	1.472	2.696	4.196	8.163	10.977	11.302	12.674	13.143	13.835	8.332				
1988		0.170	0.787	1.528	2.188	4.549	4.413	5.123	10.615			10.175					
1989		0.539	0.989	1.500	2.700	4.579	6.191	8.716	7.610	17.137							
1990		0.132	0.916	1.439	2.261	4.966	7.351	8.500	10.659	13.166							
1991		0.180	1.088	1.499	2.025	3.388	6.934	13.033			3.838						
1992		0.106	1.361	1.716	2.541	2.923	4.437	9.321	2.516								
1993		0.184	0.805	1.566	1.827	2.890	3.791	11.707									
1994		0.136	1.169	1.514	2.262	2.270	5.377	5.753	18.163	2.156							
1995		0.509	1.432	1.514	1.769	3.382	2.481		4.238								
1996			1.483	1.809	1.863	2.502	9.643	8.622		13.434							
1997		0.302	1.626	1.924	2.389	2.396	2.966	6.149	11.932								
1998	0.010		1.600	2.071	2.435	3.491	3.179	4.597	12.196								
1999		0.290	1.296	1.943	2.951	3.687	5.492	5.562	7.639								
2000			1.561	1.961	2.718	3.199	5.102	5.022	10.275								
2001			1.709	2.199	2.659	3.732	5.019	6.260	10.563	5.812							
2002			1.278	2.135	2.581	3.048	5.265	6.429	7.920	8.986	10.569		21.428				
2003			1.954	2.237	2.525	3.225	4.823	8.064	9.803	11.164	11.121	15.396	21.529				
2004			1.545	2.045	2.612	2.829	3.911	5.746	9.387	12.103	13.597	13.197	20.148				
2005			1.510	1.968	2.374	3.567	3.904	6.089	7.851	9.762	13.577	14.618	16.371	17.539			
2006			2.326	2.270	2.969	3.301	4.685	5.472	8.335	10.100	12.470	15.117	15.100	18.191	17.759		
2007			2.229	2.503	2.965	3.535	4.419	5.156	7.858	11.708	12.736	14.450	14.284	16.547	15.964	19.820	
2008			1.922	2.746	2.910	3.415	2.747	5.123	10.005	12.290	18.929						
2009			2.196	2.506	3.066	3.518	4.444	6.379	8.036	9.776	10.021	12.265	18.750	19.711			
2010			2.563	2.728	3.151	3.771	4.115	7.441	9.409	9.586	9.850		15.000				

Table A.37. Total recreational discards-at-age (numbers) of Gulf of Maine Atlantic cod from 1982 to 2010.

Year	Age 0	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10	Age 11	Age 12	Age 13	Age 14	Age 15	Age 16	Total
1981	0	59,850	108,357	23,641	0	0	0	0	0	0	0	0	0	0	0	0	0	191,848
1982	0	24,740	64,077	4,637	1,223	0	0	0	0	0	0	0	0	0	0	0	0	94,677
1983	0	88,294	138,076	3,971	0	0	0	0	0	0	0	0	0	0	0	0	0	230,341
1984	0	35,742	148,378	12,589	0	0	0	0	0	0	0	0	0	0	0	0	0	196,709
1985	0	47,682	111,590	40,340	0	0	0	0	0	0	0	0	0	0	0	0	0	199,612
1986	0	34,936	81,442	2,170	2,974	0	0	0	0	0	0	0	0	0	0	0	0	121,522
1987	0	53,899	440,307	72,518	0	0	0	0	0	0	0	0	0	0	0	0	0	566,724
1988	0	29,483	123,603	23,272	0	0	0	0	0	0	0	0	0	0	0	0	0	176,358
1989	0	24,149	330,477	205,909	11,579	0	0	0	0	0	0	0	0	0	0	0	0	572,114
1990	0	5,609	97,866	330,733	38,455	0	0	0	0	0	0	0	0	0	0	0	0	472,663
1991	0	10,368	90,813	104,551	188,769	15,883	0	0	0	0	0	0	0	0	0	0	0	410,384
1992	0	15,194	108,711	80,221	10,784	23,310	872	0	0	0	0	0	0	0	0	0	0	239,092
1993	0	16,715	431,310	218,026	85,168	0	0	0	0	0	0	0	0	0	0	0	0	751,219
1994	0	19,069	290,361	383,364	26,143	0	0	0	0	0	0	0	0	0	0	0	0	718,937
1995	0	16,967	188,067	402,380	72,699	2,551	0	0	0	0	0	0	0	0	0	0	0	682,664
1996	0	25,642	94,423	137,687	176,953	16,056	0	0	0	0	0	0	0	0	0	0	0	450,761
1997	0	13,006	93,180	111,984	27,228	51,919	2,911	0	0	0	0	0	0	0	0	0	0	300,228
1998	0	14,884	166,469	116,843	77,385	1,274	6,164	0	0	0	0	0	0	0	0	0	0	383,019
1999	0	65,141	208,315	163,899	26,475	10,206	1,380	371	0	0	0	0	0	0	0	0	0	475,787
2000	0	60,773	605,093	200,757	48,814	5,047	492	0	0	0	0	0	0	0	0	0	0	920,976
2001	0	0	623,824	547,600	116,012	22,696	1,864	0	0	0	0	0	0	0	0	0	0	1,311,996
2002	0	28,442	58,267	487,548	415,152	96,907	1,076	0	1,738	0	0	0	0	0	0	0	0	1,089,130
2003	0	64,684	231,504	152,218	451,807	182,405	25,396	0	0	0	0	0	0	0	0	0	0	1,108,014
2004	0	75,961	136,696	543,033	59,109	67,118	13,803	0	0	0	0	0	0	0	0	0	0	895,720
2005	0	15,375	416,173	186,450	620,454	8,290	13,140	320	37	58	0	0	0	0	0	0	0	1,260,297
2006	86	28,069	91,470	391,882	72,015	92,050	4,400	1,704	1,742	15	0	0	0	0	0	0	0	683,433
2007	82	5,164	185,316	393,489	392,873	29,572	23,506	31	40	0	0	0	0	0	0	0	0	1,030,073
2008	448	18,556	262,177	478,304	239,076	152,243	11,504	532	0	0	0	0	0	0	0	0	0	1,162,840
2009	75	20,725	189,483	414,621	289,384	90,045	50,598	786	1,291	0	0	0	0	0	0	0	0	1,057,008
2010	0	21,147	287,186	757,344	465,188	279,427	55,749	8,230	0	0	0	0	0	0	0	0	0	1,874,271

Table A.38. Mean weights-at-age (kg) of recreationally discarded Gulf of Maine Atlantic cod from 1982 to 2010.

Year	Age 0	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10	Age 11	Age 12	Age 13	Age 14	Age 15	Age 16
1981		0.367	0.456	0.492													
1982		0.307	0.400	0.450	0.509												
1983		0.260	0.386	0.326													
1984		0.288	0.387	0.436													
1985		0.272	0.395	0.426													
1986		0.319	0.380	0.429	0.498												
1987		0.221	0.393	0.371													
1988		0.185	0.357	0.438													
1989		0.395	0.524	0.692	0.867												
1990		0.231	0.528	0.637	0.786												
1991		0.234	0.536	0.776	0.819	0.818											
1992		0.217	0.590	0.724	0.836	0.902	0.868										
1993		0.252	0.487	0.769	0.794												
1994		0.283	0.470	0.740	0.683												
1995		0.302	0.520	0.635	0.870	0.931											
1996		0.277	0.655	0.827	0.902	0.918											
1997		0.196	0.685	0.915	1.095	1.092	1.294										
1998		0.203	0.630	1.007	1.072	1.211	1.365										
1999		0.301	0.535	0.869	1.078	1.157	1.097	1.456									
2000		0.275	0.574	0.911	1.109	1.003	1.211										
2001			0.581	0.886	1.098	1.105	1.290										
2002		0.156	0.468	1.035	1.406	1.444	1.371		1.937								
2003		0.345	0.544	1.223	1.327	1.507	1.422										
2004		0.142	0.523	0.963	1.429	1.528	1.721										
2005		0.213	0.509	1.012	1.050	1.034	1.316	1.939	2.516	1.734							
2006	0.087	0.304	0.565	0.869	1.216	1.346	1.262	1.773	1.655	2.837							
2007	0.048	0.167	0.642	1.062	1.289	1.603	1.548	2.736	3.953								
2008	0.105	0.320	0.817	1.119	1.296	1.285	1.744	5.263									
2009	0.057	0.314	0.803	1.194	1.338	1.381	1.544	2.141	1.739								
2010		0.282	0.952	1.059	1.448	1.528	1.449	3.198									

Table A.39. Total catch-at-age (numbers, 000s of fish) of Gulf of Maine Atlantic cod from 1982 to 2010 with both age 9 and age 11 plus groups. **Only ages 1 through plus group are used as model inputs.*

Year	Age 0	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9 ⁺	Age 9	Age 10	Age 11 ⁺
1982	1.8	604.4	3499.2	2513.9	1540.7	794.1	71.0	102.8	77.2	92.4	48.7	33.5	10.3
1983	18.2	853.2	3093.9	3084.3	1247.3	730.3	468.2	52.0	64.2	58.2	28.2	14.6	15.4
1984	24.4	514.7	2790.0	1834.2	1691.1	451.4	227.7	108.8	9.6	54.4	17.4	14.7	22.4
1985	89.3	705.4	2538.2	2757.3	1203.8	780.9	174.6	119.0	53.9	36.5	6.9	18.0	11.6
1986	23.7	1032.9	2345.8	2941.2	1053.8	293.2	217.2	51.3	42.0	52.7	28.3	9.6	14.8
1987	134.2	411.9	2927.1	1937.5	1734.7	372.5	98.1	93.3	17.6	43.5	19.8	17.8	5.8
1988	4.6	570.5	2076.6	2350.1	1243.2	464.1	70.4	26.9	28.3	9.9	3.3	2.4	4.2
1989	0.1	238.8	1787.4	2833.0	1760.4	544.7	92.8	74.2	9.9	20.3	5.1	9.0	6.2
1990	0.0	90.6	1076.5	6483.1	2910.3	572.1	202.0	31.3	40.5	44.0	10.2	16.0	17.7
1991	4.3	169.3	663.3	1128.2	6040.0	1094.5	154.8	59.9	26.0	16.0	8.5	4.9	2.6
1992	31.7	504.1	1081.5	1038.1	533.5	2281.4	231.3	81.1	6.1	5.5	4.5	1.0	0.0
1993	35.4	152.1	1009.1	2601.4	1106.4	107.0	508.5	42.9	11.3	0.0	0.0	0.0	0.0
1994	15.6	178.2	459.8	1949.8	1354.7	275.0	67.1	75.6	28.9	8.0	6.6	0.4	1.0
1995	15.4	116.8	495.2	1729.7	1379.4	228.1	30.4	6.5	18.3	2.8	0.6	2.2	0.0
1996	29.4	67.8	195.0	763.5	2207.6	427.0	37.1	4.1	0.5	1.8	1.8	0.0	0.0
1997	2.0	100.8	220.7	624.9	497.4	927.5	76.1	5.6	2.3	1.0	0.4	0.6	0.0
1998	1.2	18.1	312.5	606.5	710.8	158.2	216.5	29.1	5.3	2.3	1.5	0.8	0.0
1999	0.1	143.7	265.1	517.2	401.6	213.2	64.2	71.7	13.9	1.1	1.1	0.0	0.0
2000	0.0	75.4	1033.7	795.6	949.4	196.9	91.5	13.6	11.9	0.0	0.0	0.0	0.0
2001	0.0	0.8	946.0	1778.3	882.3	457.0	120.3	63.1	9.1	12.1	11.1	1.0	0.0
2002	0.0	42.2	95.1	801.0	1359.5	440.7	182.7	74.1	34.5	24.2	9.8	10.3	4.1
2003	30.5	105.3	330.1	318.6	1041.1	946.9	226.1	83.5	32.4	30.3	17.1	6.2	7.0
2004	0.2	250.3	233.6	1136.7	347.0	522.6	290.9	74.3	35.4	29.2	17.1	8.7	3.3
2005	2.0	41.5	526.9	335.4	1568.5	103.3	278.5	117.7	30.7	34.5	19.0	7.4	8.1
2006	0.4	42.4	134.1	768.5	364.6	562.4	35.4	84.4	42.4	28.6	14.1	8.1	6.4
2007	0.6	19.4	262.9	615.2	1289.4	161.3	249.1	8.0	19.3	22.1	10.5	5.2	6.4
2008	1.0	31.3	358.0	1028.0	942.8	937.0	102.4	117.8	4.4	17.7	9.3	6.2	2.2
2009	0.2	28.3	263.9	1012.8	1400.1	581.1	367.9	22.5	33.9	10.6	1.1	4.4	5.0
2010	0.3	29.0	344.7	1138.8	1488.9	1046.8	249.1	88.2	14.3	11.0	5.8	0.9	4.4

Table A.40. Mean weights-at-age (kg) of the total catch Gulf of Maine Atlantic cod from 1982 to 2010 with both age 9 and age 11 plus groups. Mean catch weights-at-age were estimated using a numbers weighted approach. Cells shaded grey were imputed using a 5-year centered moving average, cells shaded red were imputed using a time series average. **Only ages 1 through plus group are used as model inputs.*

Year	Age 0	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9 ⁺	Age 9	Age 10	Age 11 ⁺
1982	0.013	0.347	0.813	1.480	2.560	5.084	7.058	9.630	9.724	15.637	12.596	19.184	18.490
1983	0.024	0.226	0.720	1.520	2.415	3.806	6.055	6.097	10.268	13.399	11.386	11.655	18.745
1984	0.001	0.236	0.617	1.434	2.678	3.621	5.533	8.315	10.087	14.898	13.557	14.397	16.269
1985	0.039	0.210	0.694	1.336	2.818	4.694	5.951	8.517	11.245	13.476	12.210	13.442	14.287
1986	0.005	0.278	0.488	1.668	2.736	4.803	6.565	8.139	10.295	14.686	13.067	13.886	18.289
1987	0.004	0.160	0.600	1.257	3.054	4.634	7.340	10.159	11.136	14.354	13.580	14.681	15.981
1988	0.003	0.124	0.550	1.606	2.339	5.182	5.166	6.142	10.141	12.818	10.434	17.787	11.779
1989	0.046	0.248	0.689	1.433	2.925	4.294	5.990	9.247	12.272	20.776	16.858	20.410	24.532
1990	0.021	0.195	0.766	1.271	2.104	4.500	7.697	10.705	11.641	18.635	15.294	16.344	22.637
1991	0.014	0.236	1.020	1.506	2.216	3.825	7.138	10.613	12.261	14.028	15.318	6.096	24.937
1992	0.023	0.058	0.949	1.416	2.679	2.935	5.541	10.900	10.389	14.483	13.418	19.072	23.502
1993	0.021	0.095	0.624	1.625	2.001	4.367	5.628	9.869	13.673	15.661	14.478	17.580	23.790
1994	0.022	0.074	0.601	1.536	3.023	3.221	6.328	7.650	12.583	11.691	9.420	22.008	22.643
1995	0.027	0.123	1.048	1.404	2.535	5.028	6.806	11.466	13.096	22.443	19.756	23.143	23.025
1996	0.033	0.146	1.038	1.902	2.164	3.374	7.572	11.717	14.388	16.225	16.225	19.490	22.643
1997	0.017	0.076	1.103	1.941	2.928	2.973	4.570	8.993	12.150	16.938	15.625	17.749	17.822
1998	0.008	0.203	0.881	1.790	2.491	3.941	4.163	7.086	12.118	16.676	17.500	15.060	17.822
1999	0.052	0.247	0.577	1.532	2.733	3.845	5.671	6.593	9.736	12.279	12.279	16.823	17.822
2000	0.030	0.278	0.853	1.882	3.181	4.192	5.821	5.302	9.409	12.704	12.415	14.506	19.237
2001	0.045	0.316	0.733	1.866	2.919	4.482	6.014	7.193	9.066	9.488	8.745	17.660	17.323
2002	0.032	0.171	0.652	1.433	2.535	3.366	6.078	6.948	8.542	12.374	11.138	10.797	19.237
2003	0.038	0.263	0.671	1.600	1.994	3.273	4.745	7.666	9.252	12.116	10.870	11.838	15.409
2004	0.025	0.117	0.498	1.357	2.696	3.262	5.094	7.118	9.729	13.320	12.530	13.897	15.875
2005	0.027	0.148	0.531	1.356	1.955	3.984	4.337	6.319	7.983	12.490	10.605	13.887	15.653
2006	0.073	0.295	0.611	1.243	2.639	3.062	4.125	5.493	7.226	12.131	9.782	12.635	16.669
2007	0.027	0.211	0.685	1.389	2.531	3.424	4.535	6.153	7.295	12.400	10.557	12.346	15.478
2008	0.090	0.272	0.833	1.779	2.496	3.219	3.710	5.780	7.723	12.267	9.616	14.863	16.157
2009	0.039	0.326	0.854	1.823	2.804	3.266	4.027	5.852	7.760	12.895	10.836	10.416	15.550
2010	0.022	0.281	1.057	1.521	2.730	3.354	3.828	5.687	8.876	11.865	9.875	10.434	14.792
Average ₁₉₈₂₋₂₀₁₀	0.028	0.206	0.750	1.548	2.582	3.897	5.624	7.978	10.347	14.247	12.758	15.244	18.496
Average ₁₉₈₂₋₁₉₉₁	0.017	0.226	0.696	1.451	2.585	4.444	6.449	8.756	10.907	15.271	13.430	14.788	18.595

Table A.41. Relative differences in the estimates of Gulf of Maine Atlantic cod weights-at-age from the 2008 Groundfish Assessment Review Meeting (GARM) assessment compared to the current assessment (through 2007). Differences are expressed relative to the 2008 assessment weights-at-age (*negative differences indicate lighter fish-at-age in the updated assessment*).

Year	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10	Age 11 ⁺
1982	-0.46	-0.27	-0.09	-0.05	0.08	0.07	0.10	0.00	-0.03	0.87	0.00
1983	-0.49	-0.32	-0.06	-0.01	0.01	0.00	0.06	-0.01	0.14	-0.09	0.03
1984	-0.53	-0.40	-0.11	-0.01	-0.01	-0.05	0.03	0.04	0.06	0.03	0.09
1985	-0.55	-0.30	-0.17	0.02	0.07	0.10	0.08	-0.01	-0.04	0.05	0.03
1986	-0.30	-0.57	-0.07	-0.05	0.05	0.09	0.00	-0.05	-0.04	0.02	-0.07
1987	-0.22	-0.37	-0.19	-0.02	-0.04	0.02	0.07	0.11	0.03	0.12	0.20
1988	-0.61	-0.43	-0.08	-0.02	0.02	-0.20	-0.31	-0.08	-0.05	-0.01	-0.16
1989	-0.64	-0.43	-0.17	0.00	0.12	0.39	0.03	0.11	0.18	0.17	0.05
1990	-0.53	-0.29	-0.25	-0.09	0.07	0.04	0.00	-0.01	0.00	0.15	0.10
1991	-0.43	-0.14	-0.02	-0.09	-0.05	-0.04	0.10	0.00	0.09	-0.76	0.47
1992	-0.86	-0.39	-0.27	-0.02	-0.05	0.11	0.15	-0.14	0.00	0.17	0.34
1993	-0.77	-0.48	-0.11	-0.17	0.03	-0.08	-0.02	0.04	0.07	0.19	0.35
1994	-0.44	-0.57	-0.15	0.02	-0.04	0.01	0.06	0.20	-0.09	0.19	0.10
1995	-0.55	-0.26	-0.22	-0.05	0.00	0.22	0.07	0.14	0.05	0.15	0.13
1996	-0.75	-0.33	-0.11	-0.06	-0.03	0.03	0.12	0.03	0.10	0.32	0.29
1997	-0.82	-0.38	-0.12	-0.04	-0.05	-0.05	0.07	0.05	0.06	0.12	-0.19
1998	-0.51	-0.36	-0.14	-0.12	-0.05	-0.01	0.37	0.07	-0.07	0.01	-0.12
1999	-0.26	-0.57	-0.17	0.07	0.00	-0.02	-0.08	-0.02	-0.05	0.26	0.01
2000	-0.33	-0.47	-0.18	-0.07	-0.05	0.02	-0.12	0.10	-0.04	-0.02	0.09
2001	-0.24	-0.59	-0.22	-0.09	-0.05	-0.04	-0.01	0.09	0.01	0.42	-0.29
2002	-0.59	-0.52	-0.42	-0.22	-0.16	0.03	0.04	-0.26	0.09	0.01	0.34
2003	-0.37	-0.65	-0.34	-0.35	-0.18	-0.10	0.02	0.06	0.00	-0.04	0.18
2004	-0.72	-0.66	-0.42	-0.16	-0.11	-0.03	0.03	0.04	0.06	0.07	0.20
2005	-0.65	-0.66	-0.34	-0.31	-0.07	-0.04	0.01	0.02	0.02	0.03	0.09
2006	-0.29	-0.73	-0.49	-0.19	-0.18	-0.15	0.00	-0.05	0.01	0.04	0.06
2007	-0.49	-0.66	-0.45	-0.21	-0.13	-0.05	-0.03	0.03	0.04	0.05	0.08

Table A.42. Mean January 1/spawning stock weights-at-age (kg) of Gulf of Maine Atlantic cod from 1982 to 2010 with both age 9 and age 11 plus groups. Weights were estimated from catch weights using Rivard (1980, 1982) approach.

Year	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9 ⁺	Age 9	Age 10	Age 11 ⁺
1982	0.241	0.595	1.159	2.100	4.659	7.594	9.326	9.677	15.637	13.095	15.545	18.490
1983	0.137	0.500	1.112	1.891	3.121	5.548	6.560	9.944	13.399	10.522	12.116	18.745
1984	0.138	0.373	1.016	2.018	2.957	4.589	7.096	7.842	14.898	11.798	12.803	16.269
1985	0.138	0.405	0.908	2.010	3.546	4.642	6.865	9.670	13.476	11.098	13.499	14.287
1986	0.189	0.320	1.076	1.912	3.679	5.551	6.960	9.364	14.686	12.122	13.021	18.289
1987	0.086	0.408	0.783	2.257	3.561	5.938	8.167	9.520	14.354	11.824	13.851	15.981
1988	0.053	0.297	0.982	1.715	3.978	4.893	6.714	10.150	12.818	10.779	15.542	11.779
1989	0.141	0.292	0.888	2.167	3.169	5.571	6.912	8.682	20.776	13.075	14.593	24.532
1990	0.085	0.436	0.936	1.736	3.628	5.749	8.008	10.375	18.635	13.700	16.599	22.637
1991	0.118	0.446	1.074	1.678	2.837	5.668	9.038	11.457	14.028	13.354	9.656	24.937
1992	0.018	0.473	1.202	2.009	2.550	4.604	8.821	10.500	14.483	12.827	17.092	23.502
1993	0.038	0.190	1.242	1.683	3.420	4.064	7.395	12.208	15.661	12.264	15.359	23.790
1994	0.020	0.239	0.979	2.216	2.539	5.257	6.562	11.144	11.691	11.349	17.850	22.643
1995	0.042	0.279	0.919	1.973	3.899	4.682	8.518	10.009	22.443	15.767	14.765	23.025
1996	0.053	0.357	1.412	1.743	2.925	6.170	8.930	12.844	16.225	14.577	19.623	22.643
1997	0.022	0.401	1.419	2.360	2.536	3.927	8.252	11.932	16.938	14.994	16.970	17.822
1998	0.120	0.259	1.405	2.199	3.397	3.518	5.691	10.439	16.676	14.582	15.340	17.822
1999	0.133	0.342	1.162	2.212	3.095	4.728	5.239	8.306	12.279	12.198	17.158	17.822
2000	0.171	0.459	1.042	2.208	3.385	4.731	5.483	7.876	12.704	10.994	13.346	19.237
2001	0.220	0.451	1.262	2.344	3.776	5.021	6.471	6.933	9.488	9.071	14.807	17.323
2002	0.086	0.454	1.025	2.175	3.135	5.219	6.464	7.839	12.374	10.049	9.717	19.237
2003	0.191	0.339	1.021	1.690	2.881	3.997	6.826	8.018	12.116	9.636	11.483	15.409
2004	0.055	0.362	0.954	2.077	2.550	4.083	5.812	8.636	13.320	10.767	12.291	15.875
2005	0.073	0.249	0.822	1.629	3.277	3.761	5.674	7.538	12.490	10.158	13.191	15.653
2006	0.194	0.301	0.812	1.892	2.447	4.054	4.881	6.757	12.131	8.837	11.576	16.669
2007	0.106	0.450	0.921	1.774	3.006	3.726	5.038	6.330	12.400	8.734	10.990	15.478
2008	0.154	0.419	1.104	1.862	2.854	3.564	5.120	6.893	12.267	8.376	12.526	16.157
2009	0.181	0.482	1.232	2.234	2.855	3.600	4.660	6.697	12.895	9.148	10.008	15.550
2010	0.135	0.587	1.140	2.231	3.067	3.536	4.786	7.207	11.865	8.754	10.633	14.792
Average ₁₉₈₂₋₂₀₁₀	0.115	0.385	1.069	2.000	3.198	4.758	6.768	9.131	14.247	11.533	13.860	18.496
Average ₁₉₈₂₋₁₉₉₁	0.133	0.407	0.993	1.948	3.513	5.574	7.564	9.668	15.271	12.137	13.723	18.595

Table A.43. Summary of vessels and trawl doors used in the Northeast Fisheries Science Center (NEFSC) spring and fall surveys from 1963 to 2011. All survey indices are standardized to Albatross IV, Polyvalent door equivalents. *Spring survey did not begin until 1968, 2011 fall survey data not available at time of this report.

Year	Spring	Autumn	Door
1963		Albatross IV	BMV
1964		Albatross IV	BMV
1965		Albatross IV	BMV
1966		Albatross IV	BMV
1967		Albatross IV	BMV
1968	Albatross IV	Albatross IV	BMV
1969	Albatross IV	Albatross IV	BMV
1970	Albatross IV	Albatross IV	BMV
1971	Albatross IV	Albatross IV	BMV
1972	Albatross IV	Albatross IV	BMV
1973	Albatross IV	Albatross IV	BMV
1974	Albatross IV	Albatross IV	BMV
1975	Albatross IV	Albatross IV	BMV
1976	Albatross IV	Albatross IV	BMV
1977	Albatross IV	Delaware II	BMV
1978	Albatross IV	Delaware II	BMV
1979	Albatross IV/Delaware II	Albatross IV/Delaware II	BMV
1980	Albatross IV/Delaware II	Delaware II	BMV
1981	Delaware II	Albatross IV/Delaware II	BMV
1982	Delaware II	Albatross IV	BMV
1983	Albatross IV	Albatross IV	BMV
1984	Albatross IV	Albatross IV	BMV
1985	Albatross IV	Albatross IV	Polyvalent
1986	Albatross IV	Albatross IV	Polyvalent
1987	Albatross IV/Delaware II	Albatross IV	Polyvalent
1988	Albatross IV	Albatross IV/Delaware II	Polyvalent
1989	Delaware II	Delaware II	Polyvalent
1990	Delaware II	Delaware II	Polyvalent
1991	Delaware II	Delaware II	Polyvalent
1992	Albatross IV	Albatross IV	Polyvalent
1993	Albatross IV	Delaware II	Polyvalent
1994	Delaware II	Albatross IV	Polyvalent
1995	Albatross IV	Albatross IV	Polyvalent
1996	Albatross IV	Albatross IV	Polyvalent
1997	Albatross IV	Albatross IV	Polyvalent
1998	Albatross IV	Albatross IV	Polyvalent
1999	Albatross IV	Albatross IV	Polyvalent
2000	Albatross IV	Albatross IV	Polyvalent
2001	Albatross IV	Albatross IV	Polyvalent
2002	Albatross IV	Albatross IV	Polyvalent
2003	Delaware II	Albatross IV	Polyvalent
2004	Albatross IV	Albatross IV	Polyvalent
2005	Albatross IV	Albatross IV	Polyvalent
2006	Albatross IV	Albatross IV	Polyvalent
2007	Albatross IV	Albatross IV	Polyvalent
2008	Albatross IV	Albatross IV	Polyvalent
2009	Henry B. Bigelow	Henry B. Bigelow	PolyIce oval
2010	Henry B. Bigelow	Henry B. Bigelow	PolyIce oval
2011	Henry B. Bigelow		PolyIce oval

Table A.44. Summary of survey calibration coefficients for converting survey index values to Albatross IV, Polyvalent door equivalent units.

Calibration type	Index	Length (cm)	Calibration coefficient	Source
Deleware II to Albatross IV	Biomass (weight)	NA	0.670	Forrester et al., 1997
	Abundance (numbers)	NA	0.790	
BMV door to Polyvalent door	Biomass (weight)	NA	1.620	
	Abundance (numbers)	NA	1.560	
Bigelow to Albatross IV	Abundance (numbers)	Biomass (weight)	1.580	Miller et al. 2010
		≤ 20	5.724	Brooks et al. 2010
		21	5.600	
		22	5.477	
		23	5.353	
		24	5.230	
		25	5.106	
		26	4.983	
		27	4.859	
		28	4.736	
		29	4.612	
		30	4.489	
		31	4.365	
		32	4.242	
		33	4.118	
		34	3.995	
		35	3.871	
		36	3.748	
		37	3.624	
		38	3.501	
		39	3.377	
		40	3.254	
		41	3.130	
		42	3.007	
		43	2.883	
		44	2.760	
		45	2.636	
		46	2.513	
		47	2.389	
		48	2.266	
		49	2.142	
		50	2.019	
		51	1.895	
		52	1.772	
		53	1.648	
		≥ 54	1.602	

Table A.45. Summary of differences in survey protocol from the FSV Albatross IV survey (2008 and earlier) and FSV Henry B. Bigelow (2009 - present). Adapted from Brooks et al. (2010).

Measure	FSV Henry B Bigelow	FSV Albatross IV
Tow speed	3.0 knots SOG	3.8 knots SOG
Tow duration	20min	30 mins
Headrope height	3.5-4m	1-2m
Ground gear	Rockhopper Sweep	Roller Sweep
(cookies, rock hoppers, etc.)	Total Length-25.5m	Total Length-24.5m
	Center- 8.9m length, 16” rockhoppers.	Center-5m length, 16” rollers.
	Wings- 8.2m each	Wings- 9.75m each, 4” cookies.
	14” rockhoppers	
Mesh	Poly webbing	Nylon webbing
	Forward Portion of trawl (jibs, upper and lower wing ends, 1 st &2 nd side panels, 1 st bottom belly)12cm,4mm	Body of trawl= 12.7cm
	Square aft to codend:6cm, 2.5mm	Codend- 11.5cm
	Codend: 12cm, 4mm dbl.	Liner (codend and aft portion of top belly)- 1.27cm knotless
	Codend Liner: 2.54cm, knotless	
Net design	4 Seam, 3 Bridle	Yankee 36 (recent years)
Door type	550 kg PolyIce oval	450 kg polyvalent
Other comments	Wing End to Door distance= 36.5m	Wing End to Door Distance= 9m

Table A.46. Summary of the Northeast Fisheries Science Center (NEFSC) Gulf of Maine offshore survey strata and number of tows sampled broken down by survey (spring/fall) and time of day (day/night). The day/night classification is based on sunrise/sunset (zenith angle of 90°50'). *Spring survey did not begin until 1968, 2011 fall survey data not available at time of this report.

Year	Strata sampled				Tows sampled			
	Spring		Fall		Spring		Fall	
	Day	Night	Day	Night	Day	Night	Day	Night
1963			8	9			22	35
1964			10	9			15	32
1965			10	9			25	23
1966			9	9			22	21
1967			8	10			19	30
1968	8	10	9	10	27	23	19	31
1969	9	9	9	10	25	26	18	33
1970	6	9	10	10	17	35	21	32
1971	10	9	10	10	28	29	20	35
1972	10	9	8	9	28	27	24	31
1973	10	9	8	10	23	25	20	34
1974	10	8	9	9	29	18	28	29
1975	8	7	8	9	25	27	27	38
1976	8	9	7	10	30	34	17	38
1977	10	10	8	10	37	30	26	45
1978	10	10	10	9	37	29	54	66
1979	9	9	10	10	44	28	56	73
1980	10	8	10	10	26	24	23	28
1981	10	9	10	10	34	18	27	26
1982	9	9	10	10	32	21	21	33
1983	10	7	8	9	34	19	19	29
1984	9	10	7	9	31	19	20	31
1985	9	9	9	10	27	20	17	33
1986	9	10	7	9	25	27	19	34
1987	8	7	9	9	28	19	23	28
1988	10	9	8	9	35	19	23	29
1989	8	10	8	8	27	24	20	31
1990	9	10	8	10	23	29	23	29
1991	10	9	9	10	29	21	20	33
1992	10	9	9	10	29	23	21	30
1993	9	9	9	9	27	23	24	27
1994	10	9	8	10	35	18	18	32
1995	10	9	9	10	27	26	20	37
1996	10	9	10	9	27	25	25	27
1997	10	10	8	10	30	23	24	28
1998	10	10	9	10	39	36	33	34
1999	9	10	9	10	29	23	33	37
2000	9	9	9	10	30	22	21	31
2001	10	9	9	9	33	19	27	27
2002	10	10	10	10	29	26	27	22
2003	7	9	10	9	23	29	19	32
2004	10	8	8	9	32	18	21	27
2005	10	6	9	9	32	19	21	30
2006	10	10	8	9	33	26	25	33
2007	10	10	9	9	27	23	23	30
2008	10	9	10	10	30	21	21	32
2009	10	9	9	8	39	31	22	31
2010	8	10	9	9	34	30	22	29
2011	8	9			28	25		

Table A.47. Northeast Fisheries Science Center (NEFSC) spring and fall survey indices and coefficients of variation (CV) from 1963 to 2011 for Gulf of Maine Atlantic cod. CVs greater than 0.5 are shaded grey. *Spring survey did not begin until 1968, 2011 fall survey data not available at time of this report.

Year	Spring				Fall			
	Mean number/tow	CV	Mean weight/tow (kg)	CV	Mean number/tow	CV	Mean weight/tow (kg)	CV
1963					5.914	0.250	17.950	0.391
1964					4.015	0.412	22.799	0.496
1965					4.500	0.274	12.089	0.273
1966					3.720	0.217	12.838	0.227
1967					2.602	0.223	9.313	0.219
1968	5.329	0.127	17.480	0.153	4.374	0.181	19.437	0.198
1969	3.215	0.328	13.100	0.329	2.758	0.152	15.154	0.217
1970	2.191	0.214	11.089	0.237	4.905	0.318	16.442	0.248
1971	1.429	0.190	7.004	0.211	4.361	0.205	16.529	0.307
1972	2.057	0.208	8.031	0.233	9.301	0.535	12.988	0.199
1973	7.525	0.328	18.807	0.415	4.452	0.151	8.764	0.267
1974	2.902	0.188	7.419	0.199	4.328	0.260	8.959	0.201
1975	2.512	0.222	6.039	0.249	6.143	0.226	8.619	0.153
1976	2.782	0.181	7.556	0.166	2.148	0.197	6.740	0.214
1977	3.872	0.269	8.541	0.208	3.073	0.124	10.199	0.126
1978	2.050	0.191	7.697	0.207	5.773	0.188	12.899	0.151
1979	3.644	0.234	7.555	0.176	3.142	0.112	13.927	0.128
1980	2.155	0.171	6.232	0.182	7.035	0.261	14.202	0.153
1981	4.832	0.194	10.650	0.205	2.349	0.224	7.533	0.233
1982	3.763	0.219	8.616	0.223	7.769	0.636	15.919	0.670
1983	3.912	0.263	10.962	0.225	2.786	0.170	8.416	0.188
1984	3.667	0.443	6.143	0.324	2.449	0.220	8.735	0.334
1985	2.517	0.202	7.645	0.223	2.821	0.176	8.264	0.354
1986	1.957	0.314	3.476	0.197	1.950	0.230	4.715	0.228
1987	1.083	0.257	1.976	0.314	2.996	0.308	3.394	0.234
1988	3.127	0.211	3.603	0.281	5.903	0.349	6.616	0.232
1989	2.112	0.184	2.424	0.207	4.553	0.223	4.535	0.181
1990	2.362	0.249	3.077	0.280	2.986	0.190	4.912	0.204
1991	2.393	0.251	2.891	0.240	1.252	0.267	2.782	0.246
1992	2.435	0.317	8.627	0.374	1.434	0.213	2.448	0.243
1993	2.507	0.223	5.875	0.347	1.232	0.259	1.003	0.263
1994	1.271	0.223	2.428	0.216	2.130	0.309	2.737	0.292
1995	1.930	0.273	2.432	0.257	2.008	0.301	3.665	0.325
1996	2.465	0.240	5.427	0.275	1.327	0.254	2.352	0.249
1997	2.192	0.168	5.616	0.192	0.872	0.299	1.872	0.307
1998	1.710	0.344	4.180	0.324	0.843	0.346	1.501	0.287
1999	2.301	0.242	5.090	0.320	1.807	0.181	3.505	0.193
2000	3.083	0.221	3.211	0.155	2.604	0.306	4.652	0.332
2001	2.147	0.311	6.215	0.327	1.980	0.271	7.324	0.279
2002	3.724	0.203	10.934	0.215	5.328	0.578	24.659	0.686
2003	3.677	0.223	9.495	0.368	2.529	0.307	5.988	0.251
2004	0.981	0.256	2.412	0.293	3.533	0.327	4.906	0.214
2005	1.765	0.241	2.701	0.248	1.338	0.065	2.897	0.228
2006	1.363	0.203	2.702	0.249	3.594	0.301	4.229	0.188
2007	12.393	0.665	15.811	0.540	1.992	0.368	2.714	0.277
2008	7.990	0.716	10.823	0.609	3.460	0.389	5.307	0.285
2009	3.599	0.531	7.161	0.491	3.447	0.535	5.845	0.429
2010	1.296	0.243	3.336	0.264	0.948	0.233	2.572	0.304
2011	0.894	0.279	2.133	0.201				

Table A.48. Northeast Fisheries Science Center (NEFSC) spring survey abundance indices-at-age (numbers/tow) with both age 9 and age 11 plus groups from 1970 to 2011 for Gulf of Maine Atlantic cod. Age data are not available prior to 1970. The current assessment uses age 9+ group.

Year	Age 0	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9+	Age 9	Age 10	Age 11+
1970	0.000	0.159	0.124	0.053	0.098	0.290	0.475	0.589	0.073	0.330	0.045	0.076	0.210
1971	0.000	0.069	0.109	0.099	0.280	0.086	0.096	0.280	0.207	0.204	0.142	0.050	0.013
1972	0.053	0.300	0.153	0.499	0.208	0.205	0.052	0.083	0.119	0.386	0.300	0.027	0.059
1973	0.000	0.053	4.273	0.917	0.614	0.384	0.144	0.106	0.186	0.848	0.276	0.186	0.386
1974	0.164	0.311	0.081	1.534	0.177	0.231	0.082	0.000	0.064	0.258	0.038	0.089	0.131
1975	0.012	0.094	0.707	0.095	1.139	0.246	0.073	0.000	0.006	0.140	0.025	0.028	0.088
1976	0.000	0.052	0.253	1.114	0.150	0.870	0.131	0.056	0.038	0.117	0.000	0.036	0.081
1977	0.000	0.068	0.264	0.460	2.015	0.139	0.775	0.000	0.114	0.038	0.000	0.000	0.038
1978	0.000	0.070	0.083	0.297	0.383	0.764	0.084	0.226	0.013	0.131	0.108	0.000	0.022
1979	0.044	0.426	1.407	0.186	0.470	0.301	0.549	0.094	0.104	0.064	0.013	0.031	0.020
1980	0.070	0.037	0.500	0.436	0.123	0.294	0.226	0.337	0.000	0.132	0.105	0.026	0.000
1981	0.000	1.091	0.619	0.850	1.335	0.318	0.304	0.080	0.144	0.091	0.091	0.000	0.000
1982	0.014	0.357	1.040	0.498	0.737	0.848	0.083	0.135	0.000	0.050	0.040	0.010	0.000
1983	0.013	0.610	0.968	1.042	0.453	0.336	0.250	0.060	0.000	0.181	0.071	0.033	0.077
1984	0.000	0.151	1.309	0.987	0.853	0.229	0.047	0.090	0.000	0.000	0.000	0.000	0.000
1985	0.000	0.029	0.238	0.676	0.612	0.707	0.094	0.109	0.026	0.026	0.026	0.000	0.000
1986	0.000	0.537	0.259	0.767	0.218	0.075	0.046	0.038	0.000	0.018	0.000	0.000	0.018
1987	0.000	0.030	0.471	0.191	0.222	0.075	0.000	0.068	0.011	0.015	0.000	0.000	0.015
1988	0.029	0.719	0.926	0.791	0.283	0.205	0.099	0.036	0.020	0.020	0.020	0.000	0.000
1989	0.000	0.025	0.609	0.712	0.630	0.069	0.068	0.000	0.000	0.000	0.000	0.000	0.000
1990	0.000	0.009	0.233	1.325	0.669	0.076	0.032	0.018	0.000	0.000	0.000	0.000	0.000
1991	0.000	0.028	0.077	0.233	1.750	0.247	0.041	0.018	0.000	0.000	0.000	0.000	0.000
1992	0.000	0.050	0.247	0.223	0.248	1.368	0.213	0.073	0.000	0.012	0.012	0.000	0.000
1993	0.000	0.201	0.507	0.804	0.364	0.084	0.446	0.055	0.023	0.023	0.000	0.023	0.000
1994	0.000	0.015	0.316	0.407	0.201	0.083	0.053	0.142	0.009	0.045	0.027	0.018	0.000
1995	0.000	0.037	0.187	1.165	0.321	0.147	0.034	0.000	0.011	0.028	0.000	0.028	0.000
1996	0.000	0.057	0.022	0.586	1.355	0.385	0.060	0.000	0.000	0.000	0.000	0.000	0.000
1997	0.000	0.159	0.139	0.390	0.271	0.874	0.244	0.115	0.000	0.000	0.000	0.000	0.000
1998	0.000	0.018	0.228	0.359	0.513	0.143	0.408	0.021	0.020	0.000	0.000	0.000	0.000
1999	0.000	0.166	0.342	0.726	0.351	0.305	0.134	0.266	0.000	0.011	0.000	0.000	0.011
2000	0.026	1.173	0.737	0.438	0.485	0.099	0.092	0.011	0.022	0.000	0.000	0.000	0.000
2001	0.000	0.029	0.355	0.683	0.510	0.342	0.065	0.097	0.055	0.011	0.000	0.011	0.000
2002	0.000	0.340	0.045	0.548	1.584	0.606	0.342	0.185	0.057	0.017	0.017	0.000	0.000
2003	0.000	0.075	0.825	0.059	0.718	1.072	0.387	0.340	0.081	0.122	0.082	0.030	0.011
2004	0.000	0.136	0.045	0.230	0.116	0.208	0.213	0.011	0.011	0.010	0.010	0.000	0.000
2005	0.000	0.029	0.739	0.081	0.623	0.011	0.138	0.128	0.015	0.000	0.000	0.000	0.000
2006	0.028	0.184	0.237	0.434	0.049	0.197	0.023	0.126	0.069	0.015	0.000	0.015	0.000
2007	0.000	0.100	3.422	3.077	4.446	0.437	0.796	0.075	0.041	0.000	0.000	0.000	0.000
2008	0.000	0.079	1.165	3.930	1.582	1.099	0.053	0.082	0.000	0.000	0.000	0.000	0.000
2009	0.000	0.063	0.279	1.050	1.135	0.600	0.438	0.008	0.022	0.004	0.000	0.004	0.000
2010	0.000	0.059	0.279	0.335	0.197	0.229	0.113	0.043	0.016	0.025	0.010	0.005	0.010
2011	0.000	0.005	0.024	0.140	0.383	0.189	0.086	0.033	0.035	0.000	0.000	0.000	0.000

Table A.49. Northeast Fisheries Science Center (NEFSC) fall survey abundance indices-at-age (numbers/tow) with both age 9 and age 11 plus groups from 1970 to 2011 for Gulf of Maine Atlantic cod. Age data are not available prior to 1970. The current assessment uses age 9⁺ group.

Year	Age 0	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9 ⁺	Age 9	Age 10	Age 11 ⁺
1970	0.743	0.938	0.254	0.520	0.336	0.487	0.424	0.836	0.130	0.236	0.090	0.037	0.110
1971	1.334	0.207	0.224	0.190	0.607	0.444	0.509	0.222	0.280	0.345	0.193	0.031	0.121
1972	0.031	5.663	1.118	1.595	0.181	0.072	0.122	0.031	0.121	0.367	0.351	0.000	0.016
1973	0.638	0.327	2.146	0.179	0.540	0.191	0.055	0.018	0.039	0.319	0.182	0.122	0.016
1974	0.265	1.131	0.267	1.922	0.125	0.276	0.000	0.052	0.036	0.255	0.066	0.000	0.189
1975	0.006	0.223	3.028	0.139	2.354	0.250	0.105	0.020	0.000	0.018	0.000	0.000	0.018
1976	0.000	0.209	0.216	0.578	0.104	0.835	0.044	0.099	0.000	0.063	0.000	0.063	0.000
1977	0.000	0.046	0.446	0.456	1.151	0.133	0.604	0.024	0.083	0.130	0.021	0.061	0.048
1978	0.241	1.411	0.359	1.141	0.661	1.450	0.101	0.269	0.012	0.129	0.082	0.000	0.047
1979	0.000	0.364	0.617	0.131	0.696	0.319	0.754	0.056	0.135	0.070	0.000	0.053	0.018
1980	0.027	1.319	2.558	1.664	0.518	0.236	0.402	0.192	0.022	0.097	0.012	0.000	0.085
1981	0.010	0.581	0.399	0.469	0.509	0.092	0.081	0.081	0.099	0.028	0.000	0.028	0.000
1982	0.000	0.835	3.264	2.476	0.971	0.222	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1983	0.000	0.305	0.905	0.757	0.267	0.250	0.219	0.000	0.000	0.083	0.000	0.018	0.065
1984	0.000	0.513	0.418	0.586	0.384	0.196	0.194	0.062	0.000	0.096	0.016	0.000	0.080
1985	0.218	0.445	0.917	0.627	0.201	0.246	0.064	0.000	0.034	0.070	0.070	0.000	0.000
1986	0.000	0.394	0.404	0.626	0.368	0.073	0.041	0.000	0.000	0.045	0.045	0.000	0.000
1987	0.128	0.570	1.388	0.586	0.198	0.125	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1988	0.000	1.889	2.366	1.069	0.367	0.146	0.000	0.044	0.000	0.023	0.011	0.011	0.000
1989	0.000	0.145	2.468	1.458	0.283	0.138	0.053	0.000	0.009	0.000	0.000	0.000	0.000
1990	0.000	0.057	0.218	1.788	0.611	0.255	0.048	0.010	0.000	0.000	0.000	0.000	0.000
1991	0.009	0.144	0.151	0.230	0.621	0.075	0.000	0.023	0.000	0.000	0.000	0.000	0.000
1992	0.059	0.289	0.448	0.144	0.041	0.327	0.126	0.000	0.000	0.000	0.000	0.000	0.000
1993	0.031	0.210	0.575	0.361	0.017	0.000	0.038	0.000	0.000	0.000	0.000	0.000	0.000
1994	0.032	0.184	0.909	0.816	0.093	0.051	0.000	0.045	0.000	0.000	0.000	0.000	0.000
1995	0.008	0.068	0.308	1.226	0.304	0.082	0.011	0.000	0.000	0.000	0.000	0.000	0.000
1996	0.029	0.122	0.379	0.231	0.516	0.050	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1997	0.000	0.297	0.091	0.165	0.168	0.151	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1998	0.050	0.085	0.342	0.110	0.185	0.041	0.031	0.000	0.000	0.000	0.000	0.000	0.000
1999	0.025	0.432	0.375	0.590	0.244	0.122	0.019	0.000	0.000	0.000	0.000	0.000	0.000
2000	0.008	0.540	0.981	0.399	0.492	0.140	0.010	0.000	0.034	0.000	0.000	0.000	0.000
2001	0.018	0.000	0.171	0.720	0.478	0.356	0.124	0.092	0.000	0.023	0.023	0.000	0.000
2002	0.000	0.269	0.104	0.333	2.683	1.070	0.750	0.077	0.043	0.000	0.000	0.000	0.000
2003	0.542	0.461	0.186	0.216	0.518	0.451	0.071	0.062	0.000	0.023	0.011	0.000	0.011
2004	1.369	0.661	0.172	0.577	0.254	0.250	0.149	0.057	0.023	0.021	0.010	0.011	0.000
2005	0.034	0.153	0.378	0.078	0.456	0.023	0.090	0.082	0.023	0.021	0.021	0.000	0.000
2006	0.064	1.241	0.599	1.007	0.252	0.293	0.037	0.053	0.036	0.014	0.000	0.000	0.014
2007	0.011	0.136	0.863	0.395	0.496	0.023	0.067	0.000	0.000	0.000	0.000	0.000	0.000
2008	0.165	0.650	1.227	1.060	0.189	0.139	0.000	0.000	0.000	0.031	0.010	0.021	0.000
2009	0.020	0.660	2.096	0.314	0.277	0.045	0.035	0.000	0.000	0.000	0.000	0.000	0.000
2010	0.008	0.094	0.132	0.290	0.288	0.092	0.023	0.013	0.000	0.006	0.000	0.000	0.006

Table A.50. Comparison of the timing of the Northeast Fisheries Science Center (NEFSC) and Massachusetts Department of Marine Fisheries (MADMF) surveys based on the mean day of year from 1978 to 2011. *2011 fall survey data not available at time of this report.

Year	Average day of the year					
	MADMF Spring	NEFSC Spring	$\Delta_{\text{MADMF-NEFSC}}$	MADMF Fall	NEFSC Fall	$\Delta_{\text{MADMF-NEFSC}}$
1978	148	133	15	254	303	-49
1979	125	115	10	261	311	-50
1980	130	118	12	255	310	-55
1981	129	135	-6	274	307	-33
1982	127	121	6	255	306	-51
1983	132	114	18	255	308	-53
1984	131	109	22	258	302	-44
1985	129	98	31	250	309	-59
1986	130	111	19	254	304	-50
1987	129	114	15	254	297	-43
1988	133	102	31	253	296	-43
1989	134	98	36	256	299	-43
1990	131	98	33	250	291	-41
1991	129	99	30	250	289	-39
1992	132	101	31	256	294	-38
1993	127	113	14	254	288	-34
1994	133	109	24	253	292	-39
1995	131	111	20	252	289	-37
1996	130	113	17	250	294	-44
1997	129	102	27	255	293	-38
1998	130	103	27	255	303	-48
1999	134	108	26	253	307	-54
2000	133	116	17	253	288	-35
2001	131	113	18	251	289	-38
2002	130	109	21	250	293	-43
2003	129	109	20	248	297	-49
2004	127	105	22	254	294	-40
2005	134	105	29	252	297	-45
2006	135	101	34	253	288	-35
2007	130	108	22	250	294	-44
2008	130	113	17	249	298	-49
2009	127	117	10	255	314	-59
2010	126	110	16	253	319	-66
2011	127	122	5			
Average	130.6	110.4	20.3	253.8	298.9	-45.1

Table A.51. Summary of age structures sampled from the Massachusetts Department of Marine Fisheries (MADMF) and the inshore strata of the Northeast Fisheries Science Center (NEFSC) spring and fall surveys between 1978 to 2011 for Gulf of Maine Atlantic cod. *2011 fall survey data not available at time of this report.

Year	Spring			Fall		
	MADMF	NEFSC	Total	MADMF	NEFSC	Total
1979		20	20		41	41
1980		110	110		36	36
1981		87	87		24	24
1982	162	101	263	35	47	82
1983	80	87	167	6	66	72
1984	130	62	192	23	38	61
1985	84	75	159	14	41	55
1986	60	65	125	33	26	59
1987	99	81	180	113	80	193
1988	47	105	152	50	59	109
1989	199		199	14	33	47
1990	148	72	220	41	73	114
1991	252	109	361	33	5	38
1992	204	72	276	62	61	123
1993	196	71	267	59	25	84
1994	133	50	183	30	13	43
1995	155	65	220	27	4	31
1996	172	22	194	8	81	89
1997	153	57	210		91	91
1998	165	49	214	53	42	95
1999	243	177	420	16	112	128
2000	278	83	361	32	75	107
2001	308	96	404	16	27	43
2002	270	123	393	51	44	95
2003	191	67	258	67	102	169
2004	218	53	271	112	64	176
2005	274	73	347	99	99	198
2006	327	60	387	64	77	141
2007	232	144	376	12	35	47
2008	304	116	420	100	57	157
2009	204	251	455	70	275	345
2010	132	130	372	47	171	171
2011	110	144	144			

Table A.52. Massachusetts Department of Marine Fisheries (MADMF) spring and fall survey indices and coefficients of variation (CV) from 1963 to 2011 for Gulf of Maine Atlantic cod. *Spring survey did not begin until 1968, 2011 fall survey data not available at time of this report.

Year	Spring				Fall			
	Mean numbers/tow	CV	Mean weight/tow	CV	Mean numbers/tow	CV	Mean weight/tow	CV
1978	47.887	0.147	11.058	0.138	156.060	0.322	1.515	0.555
1979	96.559	0.278	14.276	0.219	8.924	0.260	1.052	0.377
1980	65.979	0.124	14.509	0.128	12.531	0.266	1.286	0.345
1981	69.406	0.207	18.689	0.265	9.291	0.422	3.638	0.453
1982	25.842	0.217	12.162	0.178	6.125	0.321	0.662	0.700
1983	54.850	0.155	18.746	0.159	1.676	0.335	0.094	0.533
1984	10.330	0.281	7.241	0.250	10.548	0.190	0.139	0.416
1985	8.455	0.206	4.765	0.202	2.871	0.300	0.071	0.390
1986	24.089	0.549	7.842	0.369	2.750	0.299	0.250	0.803
1987	17.206	0.219	7.866	0.289	313.148	0.182	0.353	0.184
1988	22.242	0.205	7.705	0.231	8.872	0.239	0.368	0.429
1989	52.244	0.270	17.346	0.331	4.150	0.065	0.222	0.422
1990	32.409	0.283	15.880	0.342	12.708	0.271	0.761	0.440
1991	13.699	0.218	8.730	0.123	7.483	0.266	0.485	0.516
1992	16.924	0.273	8.766	0.321	27.496	0.077	0.286	0.314
1993	92.659	0.354	5.866	0.278	51.500	0.249	1.358	0.235
1994	16.358	0.233	4.338	0.250	48.997	0.490	2.003	0.783
1995	23.364	0.265	3.994	0.234	4.658	0.297	0.810	0.658
1996	12.961	0.217	3.153	0.309	7.007	0.366	0.096	0.375
1997	17.887	0.239	2.505	0.256	1.456	0.242	0.015	0.404
1998	27.570	0.259	3.254	0.475	4.335	0.264	0.363	0.499
1999	161.058	0.366	8.998	0.254	8.005	0.554	0.310	0.454
2000	50.771	0.380	20.605	0.447	0.679	0.360	0.272	0.386
2001	41.844	0.428	26.446	0.533	49.555	0.460	0.760	0.552
2002	24.338	0.092	11.160	0.404	3.299	0.571	3.996	0.768
2003	1120.371	0.509	10.986	0.222	122.284	0.478	1.859	0.446
2004	131.589	0.453	8.151	0.258	57.620	0.292	5.582	0.400
2005	193.262	0.231	10.402	0.195	40.350	0.411	0.212	0.389
2006	1077.030	0.329	9.178	0.180	7.505	0.392	1.940	0.460
2007	61.576	0.271	8.432	0.243	7.918	0.268	0.082	0.613
2008	482.100	0.198	12.231	0.220	7.549	0.406	2.380	0.462
2009	480.516	0.366	4.490	0.189	5.042	0.426	0.811	0.416
2010	8.075	0.238	5.645	0.471	2.022	0.439	1.400	0.488
2011	59.064	0.522	4.519	0.428				

Table A.53. Massachusetts Department of Marine Fisheries (MADMF) spring survey abundance indices-at-age (numbers/tow) with both age 9 and age 11 plus groups from 1982 to 2011 for Gulf of Maine Atlantic cod. Age data are not available prior to 1982. The current assessment uses age 9⁺ group.

Year	Age 0	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9 ⁺	Age 9	Age 10	Age 11 ⁺
1982	1.691	13.261	6.765	2.830	0.943	0.221	0.046	0.035	0.050	0.000	0.000	0.000	0.000
1983	0.718	34.471	14.940	2.775	1.641	0.151	0.081	0.073	0.000	0.000	0.000	0.000	0.000
1984	0.257	2.038	4.916	2.304	0.582	0.147	0.086	0.000	0.000	0.000	0.000	0.000	0.000
1985	1.319	1.517	2.828	2.205	0.449	0.038	0.000	0.100	0.000	0.000	0.000	0.000	0.000
1986	1.075	8.694	12.316	0.948	0.935	0.099	0.023	0.000	0.000	0.000	0.000	0.000	0.000
1987	0.725	8.325	4.795	2.903	0.182	0.154	0.053	0.000	0.000	0.070	0.070	0.000	0.000
1988	1.881	9.997	6.867	1.852	1.574	0.000	0.038	0.033	0.000	0.000	0.000	0.000	0.000
1989	0.265	21.496	22.947	6.879	0.497	0.113	0.048	0.000	0.000	0.000	0.000	0.000	0.000
1990	4.942	4.485	6.206	14.159	2.263	0.282	0.072	0.000	0.000	0.000	0.000	0.000	0.000
1991	0.355	5.208	2.778	1.717	3.323	0.307	0.012	0.000	0.000	0.000	0.000	0.000	0.000
1992	1.506	4.461	5.526	3.419	0.576	1.290	0.102	0.044	0.000	0.000	0.000	0.000	0.000
1993	80.115	2.739	6.197	2.248	1.171	0.101	0.087	0.000	0.000	0.000	0.000	0.000	0.000
1994	4.627	5.142	3.907	1.901	0.632	0.149	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1995	11.998	5.890	2.153	2.689	0.583	0.050	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1996	8.843	0.777	0.497	1.091	1.482	0.272	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1997	12.445	2.917	0.967	0.948	0.200	0.380	0.030	0.000	0.000	0.000	0.000	0.000	0.000
1998	23.481	1.531	0.823	0.772	0.707	0.034	0.205	0.017	0.000	0.000	0.000	0.000	0.000
1999	143.000	11.967	2.248	2.279	0.706	0.645	0.075	0.126	0.013	0.000	0.000	0.000	0.000
2000	2.151	35.402	7.197	2.592	2.048	0.712	0.523	0.059	0.087	0.000	0.000	0.000	0.000
2001	25.987	0.084	4.560	4.812	3.375	2.145	0.516	0.258	0.106	0.000	0.000	0.000	0.000
2002	0.924	19.299	0.255	1.352	1.287	0.526	0.270	0.104	0.235	0.086	0.025	0.049	0.012
2003	0.000	15.767	6.834	0.444	1.968	0.909	0.185	0.068	0.014	0.039	0.025	0.000	0.014
2004	116.149	8.955	1.799	2.661	0.351	1.000	0.534	0.098	0.029	0.014	0.000	0.014	0.000
2005	179.479	5.274	4.243	0.864	1.963	0.302	0.706	0.252	0.094	0.085	0.085	0.000	0.000
2006	0.000	10.634	6.601	3.844	0.566	1.464	0.106	0.077	0.000	0.036	0.009	0.028	0.000
2007	49.323	4.211	2.907	2.220	1.980	0.344	0.527	0.033	0.031	0.000	0.000	0.000	0.000
2008	456.954	7.181	10.018	3.920	2.097	1.588	0.187	0.155	0.000	0.000	0.000	0.000	0.000
2009	466.098	8.588	2.610	1.558	1.056	0.409	0.168	0.000	0.028	0.000	0.000	0.000	0.000
2010	1.165	2.626	1.261	1.398	0.680	0.656	0.231	0.007	0.000	0.052	0.000	0.052	0.000
2011	55.378	0.347	0.895	0.604	1.114	0.436	0.212	0.077	0.000	0.000	0.000	0.000	0.000

Table A.54. Massachusetts Department of Marine Fisheries (MADMF) fall survey abundance indices-at-age (numbers/tow) with age 9 plus group from 1981 to 2011 for Gulf of Maine Atlantic cod. Age information is not available prior to 1981. **Note absence of any fish older than age 9 in this survey.*

Year	Age 0	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9 ⁺
1981	1.402	4.996	1.974	0.884	0.034	0.000	0.000	0.000	0.000	0.000
1982	4.593	1.009	0.334	0.131	0.046	0.000	0.000	0.011	0.000	0.000
1983	1.317	0.300	0.043	0.016	0.000	0.000	0.000	0.000	0.000	0.000
1984	10.228	0.244	0.060	0.016	0.000	0.000	0.000	0.000	0.000	0.000
1985	2.479	0.337	0.042	0.012	0.000	0.000	0.000	0.000	0.000	0.000
1986	1.883	0.447	0.392	0.000	0.029	0.000	0.000	0.000	0.000	0.000
1987	312.050	1.072	0.026	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1988	5.396	3.230	0.236	0.011	0.000	0.000	0.000	0.000	0.000	0.000
1989	3.877	0.099	0.138	0.008	0.028	0.000	0.000	0.000	0.000	0.000
1990	7.660	4.286	0.443	0.269	0.024	0.028	0.000	0.000	0.000	0.000
1991	5.019	1.916	0.462	0.013	0.060	0.013	0.000	0.000	0.000	0.000
1992	26.311	1.093	0.054	0.000	0.000	0.038	0.000	0.000	0.000	0.000
1993	49.322	1.618	0.387	0.148	0.026	0.000	0.000	0.000	0.000	0.000
1994	39.877	5.624	2.977	0.507	0.012	0.000	0.000	0.000	0.000	0.000
1995	2.809	1.203	0.350	0.288	0.007	0.000	0.000	0.000	0.000	0.000
1996	6.921	0.059	0.003	0.006	0.018	0.000	0.000	0.000	0.000	0.000
1997	1.429	0.027	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1998	3.248	0.644	0.332	0.071	0.039	0.000	0.000	0.000	0.000	0.000
1999	7.515	0.372	0.102	0.008	0.008	0.000	0.000	0.000	0.000	0.000
2000	0.046	0.383	0.198	0.036	0.016	0.000	0.000	0.000	0.000	0.000
2001	49.171	0.035	0.135	0.125	0.063	0.027	0.000	0.000	0.000	0.000
2002	0.913	1.126	0.046	0.326	0.269	0.335	0.166	0.086	0.034	0.000
2003	119.971	0.731	1.168	0.110	0.164	0.092	0.048	0.000	0.000	0.000
2004	40.322	14.121	0.650	1.428	0.248	0.624	0.211	0.016	0.000	0.000
2005	39.189	0.785	0.355	0.021	0.000	0.000	0.000	0.000	0.000	0.000
2006	1.609	3.947	1.217	0.514	0.074	0.101	0.043	0.000	0.000	0.000
2007	7.573	0.217	0.096	0.031	0.000	0.000	0.000	0.000	0.000	0.000
2008	0.899	3.300	2.382	0.645	0.151	0.172	0.000	0.000	0.000	0.000
2009	2.908	1.046	0.733	0.298	0.041	0.008	0.009	0.000	0.000	0.000
2010	0.209	0.446	0.639	0.486	0.171	0.034	0.037	0.000	0.000	0.000

Table A.55. Indices of Gulf of Maine Atlantic cod commercial landings (numbers, 000s) per days fished (LPUE) by age from 1982 to 1993 (from Mayo et al. 2009).

Year	LPUE (numbers, 000s fish/days fished)					
	Age2	Age3	Age4	Age5	Age6	Aggregate
1982	0.074	0.074	0.045	0.022	0.003	0.218
1983	0.048	0.110	0.042	0.021	0.012	0.233
1984	0.033	0.045	0.044	0.012	0.006	0.139
1985	0.014	0.042	0.029	0.018	0.004	0.106
1986	0.004	0.069	0.023	0.007	0.004	0.106
1987	0.007	0.019	0.026	0.006	0.002	0.060
1988	0.015	0.049	0.024	0.009	0.002	0.099
1989	0.017	0.064	0.040	0.011	0.002	0.133
1990	0.011	0.160	0.078	0.012	0.005	0.266
1991	0.019	0.040	0.136	0.022	0.004	0.221
1992	0.015	0.017	0.014	0.052	0.005	0.103
1993	0.003	0.050	0.023	0.004	0.014	0.094

Table A.56. Correlation matrices comparing commercial landings per unit effort (LPUE) indices-at-age (from Mayo et al. 2009) to Northeast Fisheries Science Center (NEFSC) spring and fall indices-at-age for Gulf of Maine Atlantic cod. Relationships significant at $\alpha = 0.05$ are shown in bold. The ‘_AGG’ notation refers to the aggregate survey indices (i.e., includes all ages).

Variable	LPUE_AGE2	LPUE_AGE3	LPUE_AGE4	LPUE_AGE5	LPUE_AGE6	LPUE_AGG
SPRING_AGE2	0.647	0.054	-0.274	-0.181	0.134	0.068
SPRING_AGE3	0.041	0.795	-0.033	-0.413	0.382	0.406
SPRING_AGE4	0.240	0.042	0.921	0.086	-0.106	0.566
SPRING_AGE5	0.367	-0.311	-0.224	0.899	-0.087	-0.015
SPRING_AGE6	-0.043	-0.047	-0.331	0.126	0.857	-0.130
SPRING_AGG	0.741	0.266	0.199	0.290	0.308	0.484
Variable	LPUE_AGE2	LPUE_AGE3	LPUE_AGE4	LPUE_AGE5	LPUE_AGE6	LPUE_AGG
FALL_AGE1	0.154	0.094	-0.240	-0.215	-0.173	-0.070
FALL_AGE2	0.148	0.755	0.048	-0.210	0.217	0.486
FALL_AGE3	0.256	0.558	0.608	-0.002	0.202	0.721
FALL_AGE4	0.545	0.112	0.268	0.618	0.115	0.492
FALL_AGE5	-0.265	0.010	0.207	-0.413	0.586	-0.020
FALL_AGG	0.265	0.633	0.221	-0.104	0.182	0.554

Table A.57. Summary of the Gulf of Maine Atlantic cod ADAPT-VPA model formulation used to build a ‘bridge’ from the GARM III ADAPT-VPA model to the 2010 update. The model runs highlighted in grey indicate major runs and are summarized in more depth elsewhere in the report. The (+1) notation indicates that the survey index was lagged forward a year and an age in the model (e.g., Age 1 in 1981 become Age 2 in 1982). **Note: the model run numbers were used for internal tracking only and don’t necessarily indicate sequential model runs.*

Run	Type	Software version	Population estimation	Years	Catch	Selectivity blocks	Plus group handling	Time of spawning	Survey selectivity	Survey indices	NEFSC		MADMF		LPUE
											Spring	Fall	Spring	Fall	
											1	VPA	v2.7	Pope's approximation	
2b	VPA	v3.1.1	Exact	1982-2007	GARM III		Backward	Feb/March	N/A	Unadjusted	2-8	1-7 (+1)	2-4	1 (+1)	2-6
3a	VPA	v3.1.1	Exact	1982-2007	Updated commercial landings, discards (excluded DAA pre 1999), rec landings, catch WAA		Backward	Feb/March	N/A	Unadjusted (original)	2-8	1-7 (+1)	2-4	1 (+1)	2-6
3b	VPA	v3.1.1	Exact	1982-2007	Updated commercial landings, discards (excluded DAA pre 1999), rec landings, stock/SSB WAA		Backward	Feb/March	N/A	Unadjusted (original)	2-8	1-7 (+1)	2-4	1 (+1)	2-6
4	VPA	v3.1.1	Exact	1982-2007	Updated commercial landings, discards, rec landings		Backward	Feb/March	N/A	Unadjusted (original)	2-8	1-7 (+1)	2-4	1 (+1)	2-6
5	VPA	v3.1.1	Exact	1982-2007	Full catch update (includes rec discards)		Backward	Feb/March	N/A	Unadjusted (original)	2-8	1-7 (+1)	2-4	1 (+1)	2-6
6	VPA	v3.1.1	Exact	1982-2007	Full catch update (includes rec discards)		Backward	Feb/March	N/A	Survey update (LPUE left untouched)	2-8	1-7 (+1)	2-4	1 (+1)	2-6
7	VPA	v3.1.1	Exact	1982-2007	Full catch update (includes rec discards)		Backward	Feb/March	N/A	Survey update (LPUE dropped)	2-8	1-7 (+1)	2-4	1 (+1)	N/A
8	VPA	v3.1.1	Exact	1982-2007	Full catch update (includes rec discards)		Combined	Feb/March	N/A	Survey update (LPUE dropped)	2-8	1-7 (+1)	2-4	1 (+1)	N/A
10	VPA	v3.1.1	Exact	1982-2010	Full catch update (includes rec discards)		Combined	Feb/March	N/A	Survey update (LPUE dropped)	2-8	1-7 (+1)	2-4	1 (+1)	N/A
10f	VPA	v3.1.1	Exact	1982-2010	Full catch update (includes rec discards)		Combined	Feb/March	N/A	Survey update (LPUE dropped), downweight of NEFSC spring indices	2-8	1-7 (+1)	2-4	N/A	N/A
10g	VPA	v3.1.1	Exact	1982-2010	Full catch update (includes rec discards)		Combined	March/April	N/A	Survey update (LPUE dropped)	2-8	1-7 (+1)	2-4	N/A	N/A

Table A.58. Summary Gulf of Maine Atlantic cod model results from the ‘bridge building’ exercise performed to update the GARM III ADAPT-VPA model to the 2010 update. Differences in model formulations are summarized in Table 56. The model runs highlighted in grey indicate major runs and are summarized in more depth elsewhere in the report. **Note: the model run numbers were used for internal tracking only and don’t necessarily indicate sequential model runs.*

Run	1	2b	3a	3b	4	5	6	7	8	10	10f	10g	
Model description	GARM III	Software update (catch equation)	Updated commercial landings, discards (excluded DAA pre 1999), rec landings, update only catch WAA	Updated commercial landings, discards (excluded DAA pre 1999), rec landings, update stock/SSB WAA	Updated commercial landings, discards, rec landings	Full catch update (includes rec discards)	Update survey indices and maturity ogive	Drop LPUE	Combined plus group treatment	Full update through 2010	Remove MADMF Fall survey, downweight NEFSC Spring 2008/9 indices	Update time of spawning from end of February (0.167) to end of March (0.25)	
RSS	279.7	291.9	279.9	279.9	281.4	276.6	256.1	239.2	239.2	284.9	198.2	215.2	
Terminal year N CVs	Age 2	0.44	0.45	0.44	0.44	0.44	0.44	0.37	0.38	0.38	0.39	0.39	0.40
	Age 3	0.31	0.32	0.31	0.31	0.31	0.31	0.28	0.29	0.29	0.31	0.29	0.30
	Age 4	0.26	0.27	0.27	0.27	0.27	0.28	0.25	0.26	0.26	0.30	0.27	0.30
	Age 5	0.26	0.27	0.27	0.27	0.26	0.29	0.27	0.28	0.28	0.46	0.41	0.43
	Age 6	0.39	0.40	0.39	0.39	0.38	0.43	0.43	0.44	0.44	0.52	0.46	0.48
	Age 7	0.44	0.45	0.43	0.43	0.43	0.46	0.45	0.47	0.47	0.54	0.45	0.49
	Age 8	0.55	0.56	0.53	0.53	0.53	0.54	0.51	0.52	0.52	0.54	0.45	0.48
	Age 9	0.69	0.73	0.61	0.61	0.60	0.64	0.65	0.67	0.65	7.26	7.17	1.64
	Age 10	0.72	0.78	0.61	0.61	0.59	0.67	0.78	0.80	0.78	19.38	17.53	5.26
Terminal estimates	F_{5-7, 2007}	0.46	0.47	0.42	0.42	0.39	0.52	0.56	0.56	0.56	0.68	0.68	0.65
	F_{5-7, 2010}	NA	NA	NA	NA	NA	NA	NA	NA	NA	1.48	1.56	1.56
	SSB₂₀₀₇	33,877	33,172	33,454	23,577	25,547	21,838	19,370	19,370	19,449	10,714	10,691	10,207
	SSB₂₀₁₀	NA	NA	NA	NA	NA	NA	NA	NA	NA	12,270	11,698	10,548
Retrospective (Mohns Rho) *7 year 'peels'	F5-7	0.16	0.13	0.00	0.00	-0.03	0.01	0.05	0.05	0.05	-0.06	0.41	0.14
	SSB	0.19	0.20	0.22	0.22	0.30	0.17	0.14	0.14	0.14	0.39	0.12	0.25
	Age1 N	0.71	0.71	0.54	0.54	0.75	0.49	0.38	0.38	0.38	1.24	0.61	0.86

Table A.59. Summary of individual station catches of Gulf of Maine Atlantic cod from the Northeast Fisheries Science Center spring bottom trawl survey in 2007 and 2008. Anomalously large catches are shaded in grey.

Year	Cruise	Strata	Tow	Numbers caught	Total catch wt. (kg)
2007	200703	1280	6	1	5.98
2007	200703	1360	7	1	3.26
2007	200703	1290	5	1	2.62
2007	200703	1380	2	1	2.42
2007	200703	1370	5	1	2.04
2007	200703	1370	2	1	1.14
2007	200703	1290	7	1	1
2007	200703	1280	3	1	0.74
2007	200703	1400	2	2	5.06
2007	200703	1270	3	3	18.26
2007	200703	1370	4	3	11.18
2007	200703	1280	2	3	10.26
2007	200703	1390	3	4	0.42
2007	200703	1270	2	15	41.38
2007	200703	1400	1	15	28.88
2007	200703	1260	1	15	10.88
2007	200703	1290	6	25	74.48
2007	200703	1260	3	29	11.32
2007	200703	1270	4	33	66.88
2007	200703	1290	8	53	81.8
2007	200703	1260	2	800	834.29

Year	Cruise	Strata	Tow	Numbers caught	Total catch wt. (kg)
2008	200803	1370	5	1	5.1
2008	200803	1360	2	1	4.96
2008	200803	1270	4	1	4.84
2008	200803	1260	2	1	4.3
2008	200803	1280	6	1	3.44
2008	200803	1370	3	1	2.46
2008	200803	1270	1	1	2.22
2008	200803	1290	4	1	0.96
2008	200803	1400	1	1	0.72
2008	200803	1290	6	2	3
2008	200803	1270	3	2	1.46
2008	200803	1380	4	3	6.12
2008	200803	1290	3	6	16.46
2008	200803	1290	7	7	26.88
2008	200803	1260	5	8	19.88
2008	200803	1400	3	9	25.86
2008	200803	1260	1	15	37.88
2008	200803	1260	6	42	41.8
2008	200803	1260	4	578	674.56

Table A.60. Ratio of NEFSC spring and fall survey proportions-at-age to fishery proportions-at-age. Cells shaded red indicate where the survey proportion-at-age was greater than the fishery proportion-at-age. Cells shaded grey indicates where no survey-at-age information existed. Non-shaded cells indicate where the fishery proportions-at-age were greater than survey proportions-at-age.

NEFSC spring survey proportion at age/fishery proportion at age						NEFSC fall survey proportion at age/fishery proportion at age					
Year	Age					Year	Age				
	5	6	7	8	9+		5	6	7	8	9+
1982	1.1	1.2	1.3	0.0	0.6	1982	1.4	0.0	0.0	0.0	0.0
1983	0.8	0.9	1.9	0.0	5.2	1983	0.9	1.2	0.0	0.0	3.5
1984	1.2	0.5	1.9	0.0	0.0	1984	0.7	1.3	0.9	0.0	2.7
1985	1.1	0.7	1.1	0.6	0.9	1985	0.9	1.0	0.0	1.8	5.4
1986	1.0	0.8	2.7	0.0	1.3	1986	1.0	0.8	0.0	0.0	3.5
1987	0.7	0.0	2.7	2.4	1.3	1987	1.7	0.0	0.0	0.0	0.0
1988	0.7	2.2	2.1	1.1	3.2	1988	0.9	0.0	4.6	0.0	6.4
1989	0.7	4.0	0.0	0.0	0.0	1989	0.9	2.1	0.0	3.4	0.0
1990	0.9	1.1	4.0	0.0	0.0	1990	1.3	0.7	0.9	0.0	0.0
1991	1.0	1.2	1.3	0.0	0.0	1991	0.9	0.0	5.2	0.0	0.0
1992	0.9	1.4	1.4	0.0	3.3	1992	0.8	3.1	0.0	0.0	0.0
1993	0.8	0.9	1.4	2.1	NA	1993	0.0	1.3	0.0	0.0	NA
1994	0.4	1.1	2.6	0.4	7.7	1994	0.9	0.0	2.8	0.0	0.0
1995	0.8	1.4	0.0	0.8	13.2	1995	1.1	1.1	0.0	0.0	0.0
1996	1.0	1.7	0.0	0.0	0.0	1996	1.1	0.0	0.0	0.0	0.0
1997	0.8	2.6	16.9	0.0	0.0	1997	1.1	0.0	0.0	0.0	0.0
1998	0.6	1.3	0.5	2.7	0.0	1998	1.5	0.8	0.0	0.0	0.0
1999	0.7	1.1	1.9	0.0	5.2	1999	1.5	0.8	0.0	0.0	0.0
2000	0.7	1.4	1.2	2.6	NA	2000	1.2	0.2	0.0	4.9	NA
2001	0.9	0.6	1.8	7.0	1.1	2001	0.9	1.1	1.6	0.0	2.1
2002	0.9	1.2	1.6	1.0	0.4	2002	0.9	1.6	0.4	0.5	0.0
2003	0.7	1.1	2.7	1.6	2.7	2003	1.0	0.7	1.6	0.0	1.6
2004	0.8	1.5	0.3	0.7	0.7	2004	0.9	1.0	1.5	1.2	1.4
2005	0.2	1.0	2.1	0.9	0.0	2005	0.5	0.8	1.6	1.7	1.5
2006	0.6	1.2	2.6	2.8	0.9	2006	0.9	1.8	1.1	1.5	0.8
2007	0.9	1.1	3.2	0.7	0.0	2007	0.7	1.4	0.0	0.0	0.0
2008	1.1	0.5	0.7	0.0	0.0	2008	1.0	0.0	0.0	0.0	12.1
2009	1.0	1.1	0.3	0.6	0.3	2009	1.0	1.2	0.0	0.0	0.0
2010	0.7	1.5	1.6	3.7	7.6	2010	0.9	1.0	1.6	0.0	6.0

Table A.61. Summary of Gulf of Maine Atlantic cod ASAP model configurations including the base (BASE) and various sensitivity models.

Run	Type	Software version	Years	Catch	Selectivity blocks	Time of spawning	Stock recruit	Survey selectivity	Survey indices	NEFSC		MADMF		LPUE
										Spring	Fall	Spring	Fall	
										BASE	ASAP	v2.0.21	1982-2010	
BASE_11	ASAP	v2.0.21	1982-2010	Single fleet (full catch update)	1982-1990, 1991-2010	March/April	Mean	NEFSC, flat topped (6+), MADMF double logistic	Survey updated (LPUE dropped)	1-11	1-11	1-11	N/A	N/A
BASE_DOME	ASAP	v2.0.21	1982-2010	Single fleet (full catch update)	1982-1990, 1991-2010	March/April	Mean	NEFSC flexible, MADMF double logistic	Survey updated (LPUE dropped)	1-9	1-9	1-9	N/A	N/A
BASE_1964	ASAP	v2.0.21	1964-2010	Single fleet (full catch update)	1964-1990, 1991-2010	March/April	Mean	NEFSC, flat topped (6+), MADMF double logistic	Survey updated (LPUE dropped)	1-9	1-9	1-9	N/A	N/A
BASE_1970	ASAP	v2.0.21	1970-2010	Single fleet (full catch update)	1970-1990, 1991-2010	March/April	Mean	NEFSC, flat topped (6+), MADMF double logistic	Survey updated (LPUE dropped)	1-9	1-9	1-9	N/A	N/A

Table A.62. Summary of the Gulf of Maine Atlantic cod model fit diagnostics from the ASAP base (BASE) and various sensitivity runs.

Run	BASE	BASE_11	BASE_DOME	BASE_1964	BASE_1970	
Model description	Starting year in 1982, uses 9 ⁺ age group w/ 2 feet selectivity blocks and flat top NEFSC survey selectivity, mean (geo) recruitment	Starting year in 1982, uses 11 ⁺ age group w/ 2 feet selectivity blocks and flat top NEFSC survey selectivity, mean (geo) recruitment	Starting year in 1982, uses 9 ⁺ age group w/ 2 feet selectivity blocks and NEFSC survey selectivity is allowed to be flexible, mean (geo) recruitment	Starting year in 1964, uses 9 ⁺ age group w/ 2 feet selectivity blocks and flat top NEFSC survey selectivity, mean (geo) recruitment	Starting year in 1970, uses 9 ⁺ age group w/ 2 feet selectivity blocks and flat top NEFSC survey selectivity, mean (geo) recruitment	
Number of parameters	99	105.0	105.0	135	123.0	
Objective function	2467	2492.0	2464.0	3391	3235.0	
Components of objective function	Recruit devs	286.0	286.0	286.0	468.0	410.0
	Survey age comps	831.0	846.0	829.0	1102.0	1102.0
	Catch age comps	378.0	388.0	378.0	369.0	378.0
	Index fit	764.0	764.0	764.0	1116.0	1049.0
	Catch fit	208.0	208.0	207.0	335.0	296.0
RMSE	Fleet 1	0.24	0.24	0.23	0.23	0.26
	Index 1	1.05	1.05	1.04	1.05	1.33
	Index 2	0.91	0.91	0.92	1.21	1.28
	Index 3	1.07	1.08	1.07	1.26	1.35
	Recruit devs	1.28	1.28	1.26	1.37	1.35
SSB₁₉₈₂ (mt)	23,675	23,075	32,556	23,790	23,887	
SSB₂₀₁₀ (mt)	11,868	11,777	14,476	10,346	9,664	
F_{mult, 2010}	1.14	1.15	1.04	1.34	1.46	

Table A.63. Summary Gulf of Maine Atlantic cod catch and survey selectivities from the ASAP base model (BASE) and the various sensitivity runs. Fleet block 1=starting year – 1990, fleet block 2=1991-2010, Index 1= NEFSC spring, Index 2= NEFSC fall, Index 3=MADMF spring.

Run		BASE		BASE_11		BASE_DOME		BASE_1964		BASE_1970		BASE_1970_BH	
		Selectivity	CV	Selectivity	CV	Selectivity	CV	Selectivity	CV	Selectivity	CV	Selectivity	CV
Fleet block 1	1	0.05	0.17	0.05	0.17	0.05	0.17	0.04	0.20	0.04	0.19	0.05	0.19
	2	0.28	0.10	0.28	0.10	0.29	0.10	0.27	0.14	0.27	0.14	0.28	0.14
	3	0.58	0.10	0.58	0.10	0.59	0.10	0.55	0.14	0.56	0.13	0.57	0.13
	4	1.00	0.00	1.00	0.00	1.00	0.00	0.95	0.15	0.95	0.15	0.96	0.15
	5	1.00				1.00		1.00		1.00		1.00	
	6	0.77	0.26	0.74	0.26	0.74	0.27	0.75	0.29	0.79	0.28	0.79	0.28
	7	0.99	0.39	0.83	0.37	0.88	0.42	1.00	0.00	1.00	0.00	1.00	0.00
	8	1.00	0.00	0.69	0.54	1.00	0.00	1.00	0.00	1.00	0.00	1.00	0.00
	9	0.31	0.47	0.53	0.79	0.14	0.69	0.26	0.38	0.28	0.38	0.26	0.39
	10	n/a		1.00	0.01	n/a		n/a		n/a		n/a	
	11	n/a		0.27	0.82	n/a		n/a		n/a		n/a	
Fleet block 2	1	0.02	0.17	0.02	0.17	0.02	0.17	0.02	0.18	0.02	0.16	0.02	0.16
	2	0.11	0.10	0.11	0.10	0.12	0.11	0.11	0.10	0.11	0.10	0.11	0.10
	3	0.40	0.08	0.39	0.08	0.42	0.10	0.39	0.09	0.39	0.08	0.39	0.08
	4	0.84	0.08	0.84	0.08	0.89	0.09	0.84	0.08	0.84	0.08	0.84	0.08
	5	1.00	0.00	1.00	0.00	1.00	0.00	1.00	0.00	1.00	0.00	1.00	0.00
	6	1.00				1.00							
	7	0.90	0.20	0.89	0.19	0.69	0.26	0.90	0.21	0.90	0.20	0.91	0.20
	8	0.88	0.33	0.85	0.31	0.52	0.45	0.88	0.35	0.88	0.33	0.89	0.33
	9	0.67	0.54	0.61	0.52	0.18	0.79	0.71	0.55	0.69	0.53	0.72	0.53
	10	n/a		0.84	0.72	n/a		n/a		n/a		n/a	
	11	n/a		0.95	1.08	n/a		n/a		n/a		n/a	
Index 1	1	0.04	0.19	0.04	0.19	0.04	0.21	0.04	0.17	0.04	0.17	0.04	0.17
	2	0.12	0.16	0.12	0.16	0.12	0.19	0.13	0.15	0.13	0.15	0.13	0.14
	3	0.26	0.16	0.26	0.16	0.27	0.18	0.26	0.15	0.27	0.14	0.27	0.14
	4	0.46	0.15	0.46	0.15	0.49	0.18	0.49	0.14	0.50	0.13	0.50	0.13
	5	0.71	0.15	0.71	0.15	0.73	0.17	0.75	0.14	0.76	0.13	0.76	0.13
	6	1.00		1.00		1.00		1.00		1.00		1.00	
	7	1.00		1.00		1.00	0.00	1.00		1.00		1.00	
	8	1.00		1.00		0.59	0.44	1.00		1.00		1.00	
	9	1.00		1.00		0.22	0.65	1.00		1.00		1.00	
	10	n/a		1.00		n/a		n/a		n/a		n/a	
	11	n/a		1.00		n/a		n/a		n/a		n/a	
Index 2	1	0.14	0.22	0.14	0.21	0.15	0.26	0.12	0.19	0.13	0.17	0.13	0.17
	2	0.33	0.21	0.33	0.21	0.36	0.25	0.28	0.19	0.28	0.16	0.28	0.16
	3	0.51	0.21	0.51	0.21	0.55	0.25	0.41	0.18	0.42	0.16	0.42	0.16
	4	0.82	0.21	0.82	0.20	0.87	0.24	0.71	0.19	0.73	0.16	0.72	0.16
	5	0.97	0.21	0.97	0.21	0.98	0.24	0.94	0.17	0.94	0.16	0.93	0.16
	6	1.00		1.00		1.00		1.00		1.00		1.00	
	7	1.00		1.00		0.73	0.41	1.00		1.00		1.00	
	8	1.00		1.00		0.41	0.74	1.00		1.00		1.00	
	9	1.00		1.00		0.29	0.72	1.00		1.00		1.00	
	10	n/a		1.00		n/a		n/a		n/a		n/a	
	11	n/a		1.00		n/a		n/a		n/a		n/a	
Index 3	A50 ascend	0.00	3000.09	0.00	3316.79	0.00	3000.05	0.00	2999.97	0.00	3000.00	0.00	3000.01
	Slope ascend	10.00		10.00		10.00		10.00		10.00		10.00	
	A50 descend	0.00	3000.42	0.00	3316.18	0.00	2999.78	0.00	3001.28	0.00	3000.00	0.00	3000.09
	Slope descend	4.22	0.22	4.24	0.22	3.81	0.20	4.19	0.22	4.09	0.21	4.08	0.21

Table A.64. Gulf of Maine Atlantic cod January 1 biomass (mt) and spawning stock biomass (SSB, mt) from 1982 to 2010 as estimated from the ASAP base model (BASE).

Year	January 1 biomass (mt)	SSB (mt)
1982	41,575	23,675
1983	31,859	17,476
1984	25,931	14,588
1985	24,729	13,241
1986	23,515	12,118
1987	22,494	11,449
1988	22,443	11,719
1989	30,842	16,941
1990	37,990	22,761
1991	31,341	19,304
1992	20,744	12,172
1993	15,674	8,472
1994	14,244	7,506
1995	14,517	8,576
1996	14,745	9,041
1997	12,564	7,889
1998	11,885	7,270
1999	13,899	8,216
2000	19,191	11,070
2001	24,221	14,854
2002	22,151	15,083
2003	18,569	12,353
2004	15,723	10,420
2005	13,958	8,874
2006	14,463	8,427
2007	17,757	10,778
2008	20,899	12,561
2009	22,468	13,559
2010	20,589	11,868

Table A.65. Gulf of Maine Atlantic cod total (F_{full}) and average (ages 5-7) fishing mortality from 1982 to 2010 as estimated from the ASAP base model (BASE).

Year	Total F (F_{full})	Average $F_{5.7}$		
		Unweighted	N-weighted	B-weighted
1982	0.90	0.83	0.89	0.88
1983	1.11	1.02	1.02	0.99
1984	0.93	0.85	0.87	0.86
1985	1.13	1.04	1.09	1.08
1986	1.04	0.96	0.97	0.96
1987	1.08	0.99	1.03	1.02
1988	0.80	0.73	0.75	0.75
1989	0.66	0.60	0.62	0.61
1990	0.84	0.78	0.81	0.80
1991	1.14	1.10	1.14	1.13
1992	1.22	1.18	1.21	1.20
1993	1.49	1.44	1.48	1.47
1994	1.42	1.37	1.38	1.36
1995	0.98	0.95	0.98	0.97
1996	0.97	0.94	0.97	0.97
1997	0.84	0.81	0.84	0.84
1998	0.75	0.72	0.74	0.74
1999	0.51	0.49	0.50	0.49
2000	0.60	0.58	0.59	0.59
2001	0.72	0.69	0.71	0.71
2002	0.61	0.59	0.61	0.60
2003	0.75	0.72	0.74	0.74
2004	0.72	0.70	0.72	0.71
2005	0.87	0.84	0.85	0.84
2006	0.64	0.62	0.63	0.63
2007	0.62	0.59	0.61	0.61
2008	0.77	0.74	0.76	0.75
2009	0.80	0.77	0.80	0.80
2010	1.14	1.10	1.13	1.12

Table A.66. Gulf of Maine Atlantic cod fishing mortality-at-age from 1982 to 2010 as estimated from the ASAP base model (BASE).

Year	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9 ⁺
1982	0.04	0.26	0.52	0.90	0.90	0.69	0.89	0.90	0.28
1983	0.05	0.31	0.64	1.11	1.11	0.85	1.10	1.11	0.35
1984	0.04	0.26	0.54	0.93	0.93	0.71	0.92	0.93	0.29
1985	0.05	0.32	0.65	1.13	1.13	0.86	1.12	1.13	0.35
1986	0.05	0.30	0.60	1.04	1.04	0.80	1.03	1.04	0.33
1987	0.05	0.31	0.63	1.08	1.08	0.83	1.07	1.08	0.34
1988	0.04	0.23	0.46	0.80	0.80	0.61	0.79	0.80	0.25
1989	0.03	0.19	0.38	0.66	0.66	0.50	0.65	0.66	0.21
1990	0.04	0.24	0.49	0.84	0.84	0.65	0.84	0.84	0.26
1991	0.02	0.13	0.45	0.96	1.14	1.14	1.02	1.01	0.77
1992	0.02	0.13	0.48	1.03	1.22	1.22	1.09	1.07	0.82
1993	0.03	0.16	0.59	1.26	1.49	1.49	1.34	1.32	1.01
1994	0.03	0.16	0.56	1.20	1.42	1.42	1.27	1.25	0.96
1995	0.02	0.11	0.39	0.83	0.98	0.98	0.88	0.86	0.66
1996	0.02	0.11	0.38	0.82	0.97	0.97	0.87	0.86	0.65
1997	0.02	0.09	0.33	0.71	0.84	0.84	0.76	0.74	0.57
1998	0.01	0.08	0.30	0.63	0.75	0.75	0.67	0.66	0.50
1999	0.01	0.06	0.20	0.43	0.51	0.51	0.45	0.45	0.34
2000	0.01	0.07	0.24	0.51	0.60	0.60	0.54	0.53	0.40
2001	0.01	0.08	0.28	0.60	0.72	0.72	0.64	0.63	0.48
2002	0.01	0.07	0.24	0.52	0.61	0.61	0.55	0.54	0.41
2003	0.01	0.08	0.30	0.63	0.75	0.75	0.67	0.66	0.50
2004	0.01	0.08	0.29	0.61	0.72	0.72	0.65	0.64	0.49
2005	0.02	0.10	0.34	0.74	0.87	0.87	0.78	0.77	0.59
2006	0.01	0.07	0.25	0.54	0.64	0.64	0.57	0.56	0.43
2007	0.01	0.07	0.24	0.52	0.62	0.62	0.55	0.54	0.41
2008	0.02	0.08	0.30	0.65	0.77	0.77	0.69	0.67	0.51
2009	0.02	0.09	0.32	0.68	0.80	0.80	0.72	0.71	0.54
2010	0.02	0.13	0.45	0.97	1.14	1.14	1.02	1.01	0.77

Table A.67. Gulf of Maine Atlantic cod January 1 numbers-at-age (000s) from 1982 to 2010 as estimated from the ASAP base model (BASE).

Year	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9+
1982	11968	13226	5638	3316	1847	153	198	91	309
1983	13159	9402	8379	2736	1101	613	63	66	221
1984	12509	10241	5619	3611	740	298	215	17	146
1985	10463	9816	6445	2691	1171	240	120	70	95
1986	16376	8134	5831	2743	712	310	83	32	73
1987	18049	12782	4951	2608	791	205	114	24	53
1988	33085	14064	7699	2167	725	220	73	32	37
1989	5308	26119	9185	3975	801	268	98	27	36
1990	4677	4217	17741	5138	1687	340	133	42	35
1991	8069	3684	2717	8909	1810	594	146	47	37
1992	8890	6459	2661	1416	2779	472	155	43	28
1993	11635	7106	4629	1347	415	673	114	43	22
1994	3917	9249	4941	2100	312	76	124	25	16
1995	4124	3118	6483	2308	518	62	15	28	11
1996	3218	3312	2294	3605	827	159	19	5	14
1997	5874	2584	2438	1279	1299	256	49	7	8
1998	5299	4730	1929	1430	514	457	90	19	6
1999	10927	4275	3568	1175	622	199	177	38	11
2000	7136	8857	3311	2392	628	307	98	92	26
2001	1745	5774	6791	2139	1180	282	138	47	59
2002	7446	1409	4371	4189	957	472	113	59	50
2003	2798	6023	1079	2812	2049	425	210	53	56
2004	8570	2257	4543	657	1222	793	165	88	50
2005	5405	6917	1707	2794	292	485	315	70	63
2006	8950	4350	5148	990	1096	100	166	118	56
2007	6748	7236	3320	3271	472	472	43	77	84
2008	6679	5458	5538	2131	1592	209	209	20	82
2009	5281	5386	4110	3351	914	606	79	86	49
2010	4286	4256	4039	2451	1394	336	223	32	58
Average	8710	7257	5073	2749	1051	348	129	48	62
Geometric mean	7226	6043	4351	2404	908	294	108	39	41
Median	7136	6023	4629	2608	914	307	120	43	50

Table A.68. Retrospective rho statistics for Gulf of Maine Atlantic cod F_{mult} , F_{5-7} , and SSB calculated using both 5 and 7 year peels. The NDMBRPWG consensus opinion was that the 5 year peels more accurately characterizes the retrospective patterns.

Year	2003	2004	2005	2006	2007	2008	2009	Mohn's rho (7 year peel, 2003)	Mohn's rho (5 year peel, 2005)	Retrospective adjustment factor (5 year peel)
F_{full}	-0.52	-0.40	-0.20	-0.27	-0.27	-0.24	-0.10	-0.29	-0.22	1.28
F_{5-7}	-0.52	-0.40	-0.21	-0.28	-0.28	-0.24	-0.10	-0.29	-0.22	1.28
SSB	0.90	0.55	0.19	0.29	0.28	0.26	0.09	0.37	0.22	0.82
Numbers Age1	4.32	1.02	-0.07	0.34	-0.23	0.09	0.62	0.87	0.15	0.87
Numbers Age2	0.56	1.50	0.20	0.01	0.26	0.22	0.23	0.43	0.19	0.84
Numbers Age3	0.62	0.24	0.28	0.12	0.13	0.23	0.06	0.24	0.16	0.86
Numbers Age4	0.63	0.49	0.07	0.25	0.19	0.12	0.05	0.26	0.14	0.88
Numbers Age5	0.71	0.39	0.11	0.23	0.27	0.20	0.06	0.28	0.18	0.85
Numbers Age6	0.84	0.50	0.13	0.35	0.33	0.28	0.11	0.36	0.24	0.81
Numbers Age7	0.95	0.59	0.18	0.40	0.42	0.32	0.12	0.43	0.29	0.78
Numbers Age8	0.97	0.63	0.24	0.45	0.45	0.35	0.12	0.46	0.32	0.76
Numbers Age9	1.00	0.75	0.33	0.48	0.46	0.36	0.07	0.49	0.34	0.75

Table A.69. Inputs to the Gulf of Maine Atlantic cod yield per recruit (YPR) analysis.

Age	Catch weights (kg)	Stock weights (kg)	Fishery selectivity	Fraction mature	Natural mortality
1	0.29	0.16	0.02	0.09	0.20
2	0.91	0.50	0.11	0.29	0.20
3	1.71	1.16	0.40	0.61	0.20
4	2.68	2.11	0.84	0.86	0.20
5	3.28	2.93	1.00	0.96	0.20
6	3.85	3.57	1.00	0.99	0.20
7	5.77	4.85	0.90	1.00	0.20
8	8.12	6.93	0.88	1.00	0.20
9	12.34	12.34	0.67	1.00	0.20

Table A.70. Ratio of 2010 F_{full} to the F_{MSY} proxy $F_{F40\%}$ and 2010 SSB to the SSB_{MSY} for Gulf of Maine Atlantic cod.

Reference points		ASAP base model			Ratio 2010/reference point		Retrospective adjusted	
		2010 point estimate	90% probability interval		Ratio	90% probability interval	Point estimate	Ratio
$F_{MSY(F40\%)}$	0.20	F_{full}	1.14	(0.79 - 1.54)	5.83	(4.03 - 7.86)	1.47	7.33
SSB_{MSY}	61,218	SSB	11,868	(9,479 - 16,301)	0.19	(0.15 - 0.27)	9,728	0.16

Table A.71. Summary of median (50th percentile) short term yield and spawning stock projections for Gulf of Maine Atlantic cod under three different assumptions of F (F₀, 75% F_{MSY}, F_{40%}). Projections have not been adjusted for retrospective bias.

Total fishery yield (mt)			
Year	F₀	75% F_{MSY} (0.15)	F_{MSY} (F_{40%} = 0.20)
	<i>Unadjusted</i>	<i>Unadjusted</i>	<i>Unadjusted</i>
2011	11,392	11,392	11,392
2012	0	1,001	1,313
2013	0	1,746	2,232
2014	0	2,780	3,482
2015	0	3,740	4,584
2016	0	4,629	5,562
2017	0	5,526	6,541
2018	0	6,399	7,469
2019	0	7,115	8,213
2020	0	7,682	8,777
2021	0	8,133	9,202
2022	0	8,508	9,560
2023	0	8,781	9,811
2024	0	8,972	9,981
2025	0	9,116	10,100
Spawning stock biomass (mt)			
Year	F₀	75% F_{MSY} (0.15)	F_{MSY} (F_{40%} = 0.20)
	<i>Unadjusted</i>	<i>Unadjusted</i>	<i>Unadjusted</i>
2011	8,178	8,178	8,178
2012	7,069	6,894	6,834
2013	13,073	11,838	11,463
2014	21,656	18,311	17,363
2015	31,565	24,809	23,014
2016	42,701	31,286	28,405
2017	55,765	38,067	33,884
2018	70,054	44,968	39,337
2019	85,801	51,811	44,599
2020	99,450	57,382	48,761
2021	110,811	61,576	51,821
2022	121,689	65,347	54,534
2023	130,611	68,136	56,370
2024	138,032	70,219	57,820
2025	144,000	71,759	58,819