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Supplemental Tables

Georges Bank Haddock Stock
2017 Update Assessment

Elizabeth N. Brooks

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Table 1. Georges Bank haddock total catch biomass (mt) by country, 1960-2016.

Year	USA	Canada	USSR	Spain	Other	Total
1960	40800	77	0	0	0	40877
1961	46384	266	0	0	0	46650
1962	49409	3461	1134	0	0	54004
1963	44150	8379	2317	0	0	54846
1964	46512	11625	5483	2	464	64086
1965	52823	14889	81882	10	758	150362
1966	52918	18292	48409	1111	544	121274
1967	34728	13040	2316	1355	30	51469
1968	25469	9323	1397	3014	1720	40923
1969	16456	3990	65	1201	540	22252
1970	8415	1978	103	782	22	11300
1971	7306	1630	374	1310	242	10862
1972	3869	742	137	1098	20	5866
1973	2777	1661	602	386	3	5429
1974	2396	622	109	764	559	4450
1975	3989	1544	8	61	4	5606
1976	2904	1521	4	46	9	4484
1977	7934	3060	0	0	0	10994
1978	12160	10356	0	0	0	22516
1979	14279	5368	0	0	0	19647
1980	17470	10168	0	0	0	27638
1981	19176	5835	0	0	0	25011
1982	12625	5002	0	0	0	17627
1983	8682	3327	0	0	0	12009
1984	8807	1587	0	0	0	10394
1985	4273	3670	0	0	0	7943
1986	3339	3507	0	0	0	6846
1987	2156	4841	0	0	0	6997
1988	2492	4197	0	0	0	6689
1989	1718	3197	0	0	0	4915
1990	2106	3468	0	0	0	5574
1991	1434	5563	0	0	0	6997
1992	2053	4191	0	0	0	6244
1993	827	3841	0	0	0	4668
1994	2302	2525	0	0	0	4827
1995	309	2133	0	0	0	2442
1996	436	3695	0	0	0	4131
1997	1151	2682	0	0	0	3833
1998	2192	3473	0	0	0	5665
1999	2628	3729	0	0	0	6357
2000	3280	5431	0	0	0	8711
2001	5037	6751	0	0	0	11788
2002	6741	6517	0	0	0	13258
2003	5954	6873	0	0	0	12827

Table 1 (cont.)

2004	8415	9838	0	0	0	18253
2005	7278	14536	0	0	0	21814
2006	3938	12051	0	0	0	15989
2007	4855	11951	0	0	0	16815
2008	6207	14814	0	0	0	21021
2009	5477	17648	0	0	0	23126
2010	9310	16592	0	0	0	25903
2011	5422	11248	0	0	0	16670
2012	1871	5064	0	0	0	6935
2013	2197	4631	0	0	0	6828
2014	5649	12953	0	0	0	18602
2015	6313	14374	0	0	0	20687
2016	5562	11713	0	0	0	17275

Table 2. US and Canadian landings (mt) by gear of Georges Bank haddock for years 1989-2016.

YEAR	US GILLNET	US HOOK/LINE	US OTHER	US TRAWL	Total US	CAN TRAWL	CAN LONGLINE	CAN SCALLOP	CAN OTHER	Total CAN	**US + CAN TOTAL**	US % of TOTAL
1989	42	25	8	1356	1431	1976	977	12	95	3060	4490	0.32
1990	24	16	12	1953	2005	2411	853	7	69	3340	5345	0.38
1991	19	27	9	1341	1396	4028	1309	8	111	5456	6851	0.2
1992	11	17	3	1974	2005	2583	1384	4	87	4058	6063	0.33
1993	6	16	6	659	687	2489	1143	2	93	3727	4414	0.16
1994	9	35	1	162	207	1597	714	9	91	2411	2618	0.08
1995	14	61	0	156	231	1647	390	7	21	2065	2296	0.1
1996	39	69	0	213	321	2689	947	0	26	3662	3982	0.08
1997	40	68	1	772	881	1991	722	0	36	2749	3629	0.24
1998	80	68	1	1767	1916	2422	921	0	28	3371	5286	0.36
1999	128	35	0	2411	2574	2761	887	0	32	3680	6254	0.41
2000	133	25	1	3044	3203	4146	1186	0	70	5402	8605	0.37
2001	131	49	9	4631	4820	5112	1633	0	29	6774	11594	0.42
2002	186	38	14	6294	6532	4954	1521	0	12	6487	13019	0.5
2003	51	164	4	5541	5760	4985	1776	0	14	6775	12535	0.46
2004	40	783	120	6433	7376	7744	2000	0	1	9745	17120	0.43
2005	29	865	91	5618	6603	12115	2368	0	1	14484	21088	0.31
2006	26	297	56	2265	2644	10088	1896	0	1	11985	14628	0.18
2007	9	240	5	2695	2948	10034	1854	0	1	11889	14819	0.2
2008	27	402	25	5397	5851	12615	2164	0	2	14781	20632	0.28
2009	41	415	0	4879	5335	15407	2185	0	3	17595	22930	0.23
2010	28	361	43	8748	9180	14100	2476	0	2	16578	25759	0.36
2011	7	86	31	5087	5210	9665	1566	0	1	11232	16442	0.32
2012	6	6	75	1464	1550	4201	832	0	1	5034	6584	0.24
2013	11	1	43	1604	1659	4349	272	0	1	4621	6280	0.26
2014	4	3	39	4194	4240	12707	228	0	1	12936	17176	0.25
2015	8	0	15	4739	4762	14357	282	0	1	14640	19401	0.25
2016	7	1	8	3666	3682	11704	96	0	1	11801	15483	0.24

Table 3. US discards (mt) by gear, and CV (in parentheses), of Georges Bank haddock for years 2007-2016.

Year	Hook/Line	*CV*	OT-lg	*CV*	OT-sm	*CV*	OT-separator	*CV*	GN-lg	*CV*	GN-xlg	*CV*
2007	74	*0.33*	1812	*0.17*	9	*0.39*	--	--	3	*0.51*	0	
2008	43	*0.14*	303	*0.23*	3	*1.26*	--	--	3	*0.33*	0.1	*0.70*
2009	27	*0.17*	108	*0.22*	3	*0.70*	--	--	4	*0.45*	0.1	*0.80*
2010	13	*0.28*	74	*0.11*	37	*0.85*	--	--	4	*0.22*	0.2	*0.46*
2011	9	*0.51*	82	*0.09*	118	*0.48*	--	--	0	*0.42*	0.0	--
2012	1	*2.18*	201	*0.09*	99	*0.34*	--	--	5	*0.17*	0.0	*0.80*
2013	0	--	477	*0.21*	35	*0.38*	--	--	4	*0.24*	0.0	--
2014	0	--	283	*0.11*	979	*0.21*	139	*0.09*	1.33	*0.22*	0.02	*0.71*
2015	0.0	--	444	*0.24*	643	*0.64*	457	*0.21*	3	*1.32*	0.1	*1.18*
2016	0.0	*2.62*	756	*0.50*	347	*0.84*	766	*0.31*	13	*0.62*	0.1	*2.26*

Year	Scallop	*CV*	Midw Trw	*CV*	Lobster	*CV*
2007	3	*0.22*				
2008	2	*0.23*				
2009	1	*0.32*	0	*0.49*	0	--
2010	2	*0.88*	4	*0.56*	0	--
2011	3	*0.23*	0	*0.65*	0	--
2012	3	*0.20*	11	*0.11*	0	--
2013	3	*0.20*	20	*0.50*	0	*0.61*
2014	6	*0.30*	0	*0.86*	0.2	*0.39*
2015	12	*0.42*	0.5	*3.10*	0.8	*0.82*
2016	7	*0.57*	2.9	*1.65*	0.0	--

Table 4. Number of observed trips by gear for US discards of haddock on Georges Bank for years 1989-2016.

YEAR	Hook/ Line	Trawl	Separator Trawl	Gillnet	Scallop	Midwtrawl	Lobster	Total
1989	0	104		0	0			105
1990	0	73		0	0			73
1991	17	107		0	1			126
1992	25	85		0	15			127
1993	0	44		0	18			63
1994	1	49		58	7			115
1995	0	86		76	9			171
1996	0	58		30	19			107
1997	0	47		34	14			96
1998	0	20		49	12			81
1999	0	34		48	33			115
2000	0	59		70	273			402
2001	0	82		43	18			143
2002	8	141		49	11			211
2003	5	288		169	15			477
2004	113	487		318	51			970
2005	244	1198		299	118			1859
2006	65	556		76	157			855
2007	58	554		162	191			965
2008	63	694		109	231			1097
2009	59	839		94	97	46		1089
2010	126	876		626	100	111		1728
2011	39	1133		677	149	96	0	1998
2012	106	828		553	248	155	8	1735
2013	3	831		360	292	93	11	1486
2014	7	1000	81	624	201	84	22	1913
2015	3	834	66	495	190	11	80	1588
2016	9	669	32	220	189	33	4	1119

Table 5. Recreational landings and discards of Georges Bank haddock.

There are none.

Table 6. US commercial biological sampling by half-year period and by market category for Georges Bank haddock (1989-2016).

Year	Period	Market	Landings (kg)	Length Samples	Sampled Fish	Age Samples	Sampled Fish	Len.Samp/ Landings	Age.Samp/ Landings
1989	1	Large	628399	6	620	6	303	1.0	0.5
	2	Large	182561	1	99	1	38	0.5	0.2
	1	Scrod	388134	6	338	6	256	0.9	0.7
	2	Scrod	226427	9	491	9	259	2.2	1.1
1990	1	Large	792474	8	826	8	235	1.0	0.3
	2	Large	302752	2	218	2	130	0.7	0.4
	1	Scrod	743206	12	669	12	368	0.9	0.5
	2	Scrod	154775	5	288	5	212	1.9	1.4
1991	1	Large	666397	2	206	2	81	0.3	0.1
	2	Large	173355	4	338	4	118	1.9	0.7
	1	Scrod	492017	6	359	6	181	0.7	0.4
	2	Scrod	56409	1	62	1	42	1.1	0.7
1992	1	Large	1122592	14	1325	14	407	1.2	0.4
	2	Large	157002	2	221	2	44	1.4	0.3
	1	Scrod	663373	12	646	12	314	1.0	0.5
	2	Scrod	59310	4	264	4	157	4.5	2.6
1993	1	Large	373746	4	407	4	143	1.1	0.4
	2	Large	81512	2	145	2	74	1.8	0.9
	1	Scrod	172013	9	488	9	267	2.8	1.6
	2	Scrod	55997	2	100	2	49	1.8	0.9
1994	1	Large	51812	3	170	3	94	3.3	1.8
	2	Large	54984	1	76	1	22	1.4	0.4
	1	Scrod	37428	1	66	1	25	1.8	0.7
	2	Scrod	60519	2	141	2	50	2.3	0.8
1995	1	Large	63716	1	104	1	22	1.6	0.3
	2	Large	83844	1	81	1	26	1.0	0.3
	1	Scrod	45166	1	57	1	15	1.3	0.3
	2	Scrod	35270	1	49	1	21	1.4	0.6
1996	1	Large	226244	3	310	3	86	1.4	0.4
	1	Scrod	90409	2	147	2	86	1.6	1.0
	1	Large	170473	2	200	2	42	1.2	0.2
	2	Large	467916	15	1473	15	306	3.1	0.7
1997	1	Scrod	61179	1	50	1	49	0.8	0.8
	2	Scrod	161770	7	555	7	195	3.4	1.2
	1	Large	777823	8	706	7	204	0.9	0.3
	2	Large	735946	4	259	4	129	0.4	0.2
1998	1	Scrod	155305	7	345	8	209	2.2	1.3
	2	Scrod	199221	3	137	3	80	0.7	0.4
	1	Large	863663	8	712	8	190	0.8	0.2
	2	Large	1148341	6	621	6	169	0.5	0.1
1999	1	Scrod	253496	2	183	2	39	0.7	0.2
	2	Scrod	275861	13	761	13	230	2.8	0.8
	1	Large	1538191	10	932	10	313	0.6	0.2
	2	Large	857488	9	934	9	379	1.1	0.4

Table 6 (cont.)

2000	1	Scrod	487740	10	507	10	201	1.0	0.4
	2	Scrod	299435	14	826	14	283	2.8	0.9
	1	Large	1850629	23	2145	23	753	1.2	0.4
	2	Large	1063648	21	2144	21	707	2.0	0.7
2001	1	Scrod	856432	11	647	11	233	0.8	0.3
	2	Scrod	935665	14	874	14	273	0.9	0.3
	1	Large	2506455	11	932	11	362	0.4	0.1
	2	Large	1615059	16	1657	16	493	1.0	0.3
2002	1	Scrod	1428733	7	409	7	169	0.3	0.1
	2	Scrod	806907	9	573	9	197	0.7	0.2
	1	Large	2255111	18	1846	17	517	0.8	0.2
	2	Large	879281	21	2208	19	613	2.5	0.7
2003	1	Scrod	1683556	20	1220	19	384	0.7	0.2
	2	Scrod	809636	13	765	12	204	0.9	0.3
	1	Large	1639086	20	2216	19	545	1.4	0.3
	2	Large	1085046	19	1918	16	353	1.8	0.3
2004	1	Scrod	2542608	16	1156	16	307	0.5	0.1
	2	Scrod	1843139	23	1600	19	282	0.9	0.2
	1	Large	1655434	21	1848	18	383	1.1	0.2
	2	Large	1123669	32	2815	31	1072	2.5	1.0
2005	1	Scrod	2631612	20	1136	19	264	0.4	0.1
	2	Scrod	1122887	25	1390	22	436	1.2	0.4
	1	Large	557172	40	3306	36	1631	5.9	2.9
	2	Large	482089	29	2432	28	1209	5.0	2.5
2006	1	Scrod	1119984	33	1607	32	773	1.4	0.7
	2	Scrod	411924	30	1489	29	676	3.6	1.6
	1	Large	557172	40	3306	36	1631	5.9	2.9
	2	Large	482089	29	2432	28	1209	5.0	2.5
2007	1	Scrod	994414	29	1449	29	618	1.5	0.6
	2	Scrod	1240913	40	1997	37	849	1.6	0.7
	1	Large	327839	27	1873	27	1046	5.7	3.2
	2	Large	336784	38	2671	35	1335	7.9	4.0
2008	1	Scrod	2541463	42	2049	42	981	0.8	0.4
	2	Scrod	2190639	36	1876	35	862	0.9	0.4
	1	Large	369581	47	3450	45	1653	9.3	4.5
	2	Large	693611	32	2852	32	1456	4.1	2.1
2009	1	Scrod	2393773	44	2188	40	975	0.9	0.4
	2	Scrod	2022335	46	2346	46	1085	1.2	0.5
	1	Large	374001	30	2542	28	1169	6.8	3.1
	2	Large	515613	31	2615	30	1283	5.1	2.5
2010	1	Scrod	4662461	68	3391	62	1550	0.7	0.3
	2	Scrod	2445521	51	2659	47	1148	1.1	0.5
	1	Large	1130560	56	5465	53	2611	4.8	2.3
	2	Large	813924	46	4027	44	2042	4.9	2.5

Table 6 (cont.)

2011	1	Scrod	3534833	58	3073	48	1196	0.9	0.3
	2	Scrod	636435	42	1979	31	745	3.1	1.2
	1	Large	568962	47	4234	39	1818	7.4	3.2
	2	Large							
2012	1	Scrod	892794	31	1375	21	471	1.5	0.5
	2	Scrod	188651	32	1178	31	641	6.2	3.4
	1	Large	237035	31	2042	24	962	8.6	4.1
	2	Large	149897	30	1690	29	1047	11.3	7.0
2013	1	Snapper	0	0	0	0	0		
	2	Snapper	341700	19	1359	17	644	4.0	1.9
	1	Scrod	238211	30	1395	26	609	5.9	2.6
	2	Scrod	787213	22	1038	17	407	1.3	0.5
	1	Large	104112	29	1703	25	846	16.4	8.1
	2	Large	74016	18	751	14	394	10.1	5.3
2014	1	Snapper	423582	17	1682	16	790	4.0	1.9
	2	Snapper	178817	10	799	8	263	4.5	1.5
	1	Scrod	1391369	26	1304	25	642	0.9	0.5
	2	Scrod	1561097	15	815	13	308	0.5	0.2
	1	Large	93181	20	1117	18	703	12.0	7.5
	2	Large	134762	14	1039	10	456	7.7	3.4
2015	1	Snapper	586103	24	1230	20	483	2.1	0.8
	2	Snapper	175297	16	803	11	252	4.6	1.4
	1	Scrod	2505843	33	1673	30	722	0.7	0.3
	2	Scrod	1043731	22	1168	15	365	1.1	0.3
	1	Large	173172	25	1817	22	819	10.5	4.7
	2	Large	158148	15	1086	11	416	6.9	2.6
2016	1	Snapper	347608	22	1087	20	466	3.1	1.3
	2	Snapper	348375	16	814	14	342	2.3	1.0
	1	Scrod	1738648	31	1514	28	671	0.9	0.4
	2	Scrod	852219	15	756	13	321	0.9	0.4
	1	Large	168791	23	1703	23	934	10.1	5.5
	2	Large	130138	8	704	8	381	5.4	2.9

Table 7. Total landings at age (thousands) of Georges Bank haddock for years 1989-2016. The extremely strong year classes (2003, 2010, and 2013) are in bold.

Year	1	2	3	4	5	6	7	8	9	**Total**
1989	0	1322	97	997	215	466	60	36	56	3248
1990	2	11	1648	264	1119	153	217	55	49	3518
1991	6	464	120	2366	144	517	128	171	65	3981
1992	7	250	405	196	1952	181	426	47	100	3563
1993	7	295	376	338	118	739	63	169	82	2188
1994	1	247	793	162	61	55	140	30	40	1529
1995	2	70	592	459	57	28	7	58	15	1288
1996	1	39	550	899	435	65	22	7	73	2092
1997	3	92	219	695	534	207	17	16	43	1826
1998	1	185	455	527	738	555	167	23	44	2694
1999	1	36	884	536	602	562	382	160	46	3207
2000	0	391	608	1563	583	525	374	256	97	4395
2001	2	130	2319	969	1266	649	433	356	259	6382
2002	1	288	299	3137	915	1101	397	304	549	6992
2003	2	8	1849	446	2644	597	711	210	385	6851
2004	**178**	3	67	4677	671	2861	675	546	399	10077
2005	2	**114**	34	319	8373	763	1815	311	341	12072
2006	6	4	**2205**	43	341	5233	301	802	215	9150
2007	1	29	186	**8350**	158	191	1708	162	304	11089
2008	2	28	378	298	**12491**	112	106	912	226	14552
2009	12	117	188	860	283	**12864**	83	75	513	14994
2010	2	51	409	380	1432	443	**13373**	58	335	16483
2011	**5**	86	175	551	358	983	167	**8023**	142	10490
2012	1	**303**	216	142	370	223	482	150	**2441**	4328
2013	7	186	**4243**	267	116	247	97	138	718	6019
2014	**237**	418	1222	**14857**	533	105	80	87	337	17876
2015	1	**1101**	1117	2914	**12368**	203	58	25	241	18029
2016	2	101	**4726**	993	1126	**7061**	357	10	111	14487

Table 8. Total discard at age (thousands) of Georges Bank haddock for years 1989-2016. The extremely strong year classes (2003, 2010, and 2013) are in bold.

	Age									
Year	1	2	3	4	5	6	7	8	9	Total
1989	2	140	26	22	2	12	2	1	1	208
1990	61	1	49	5	5	1	1	0	0	123
1991	1	22	3	4	0	1	0	1	0	32
1992	77	15	3	1	8	0	0	0	0	104
1993	26	68	63	2	2	2	0	0	0	163
1994	26	291	399	80	81	18	173	25	70	1163
1995	15	24	22	12	2	1	2	3	1	82
1996	6	17	16	20	15	1	0	0	5	80
1997	12	51	54	50	27	11	1	2	6	214
1998	5	45	16	31	29	16	2	0	5	149
1999	2	7	22	5	4	4	2	3	2	51
2000	2	16	18	8	5	3	3	2	2	59
2001	12	15	74	27	15	7	5	3	3	161
2002	2	109	46	40	11	4	5	2	2	221
2003	3	10	94	15	42	8	8	2	4	186
2004	**468**	30	55	439	58	74	12	17	9	1162
2005	18	**498**	8	20	132	15	28	4	2	725
2006	158	14	**959**	28	34	185	26	40	13	1457
2007	19	151	45	**1703**	19	26	127	15	50	2156
2008	6	13	58	6	**285**	3	2	7	5	387
2009	6	16	12	25	3	**99**	1	1	2	165
2010	33	9	11	5	9	2	**65**	0	3	136
2011	**486**	48	15	10	5	6	2	45	1	619
2012	48	**626**	21	5	8	3	6	1	**56**	774
2013	46	80	**689**	27	10	6	5	4	17	883
2014	**5096**	276	150	**553**	8	3	3	3	51	6143
2015	131	**4700**	134	58	**285**	4	0	1	3	5316
2016	252	84	**3685**	50	40	**245**	1	0	5	4360

Table 9. Total catch at age (thousands) for Georges Bank haddock, 1989-2016. The extremely strong year classes (2003, 2010, and 2013) are in bold.

Year	1	2	3	4	5	6	7	8	9+	Total
1989	2	1462	123	1019	217	478	62	37	57	3456
1990	63	12	1697	269	1124	154	218	55	49	3641
1991	7	486	123	2370	144	518	128	172	65	4013
1992	84	265	408	197	1960	181	426	47	100	3667
1993	33	363	439	340	120	741	63	169	82	2351
1994	27	538	1192	242	142	73	313	55	110	2692
1995	17	94	614	471	59	29	9	61	16	1370
1996	7	56	566	919	450	66	22	7	78	2172
1997	15	143	273	745	561	218	18	18	49	2040
1998	6	230	471	558	767	571	169	23	49	2843
1999	3	43	906	541	606	566	384	163	48	3258
2000	2	407	626	1571	588	528	377	258	99	4454
2001	14	145	2393	996	1281	656	438	359	262	6543
2002	3	397	345	3177	926	1105	402	306	551	7213
2003	5	18	1943	461	2686	605	719	212	389	7037
2004	**646**	33	122	5116	729	2935	687	563	408	11239
2005	20	**612**	42	339	8505	778	1843	315	343	12797
2006	164	18	**3164**	71	375	5418	327	842	228	10607
2007	19	181	232	**10054**	176	217	1835	177	353	13244
2008	8	41	436	304	**12776**	116	108	919	232	14939
2009	18	133	199	885	286	**12962**	84	76	515	15159
2010	35	60	420	384	1442	444	**13438**	58	338	16618
2011	**491**	134	190	560	363	990	169	**8069**	143	11109
2012	49	**930**	237	147	377	226	487	151	**2497**	5102
2013	53	266	**4931**	294	126	253	102	142	735	6903
2014	**5333**	694	1372	**15411**	541	108	82	89	388	24019
2015	132	**5801**	1252	2971	**12653**	208	59	26	244	23345
2016	254	185	**8411**	1042	1166	**7306**	358	11	116	18848

Table 10. Weights at age for the catch and SSB for Georges Bank haddock (1989-2016). The extremely strong year classes (2003, 2010, and 2013) are in bold.

Catch weights at age

Year	1	2	3	4	5	6	7	8	9+
1989	0.53	0.89	1.48	1.79	2.21	2.57	3.24	3.56	3.82
1990	0.64	0.97	1.48	1.78	2.12	2.55	2.81	2.99	4.16
1991	0.58	1.20	1.31	1.82	2.18	2.65	2.85	3.05	4.34
1992	0.54	1.18	1.64	1.77	2.19	2.52	2.97	3.37	4.27
1993	0.66	1.17	1.73	2.17	2.12	2.63	2.65	3.12	4.01
1994	0.45	1.09	1.64	2.21	2.63	2.73	2.90	3.78	4.55
1995	0.43	0.97	1.49	2.03	2.54	2.82	3.28	3.09	3.98
1996	0.46	1.10	1.50	1.84	2.33	2.54	3.42	3.52	3.71
1997	0.42	1.00	1.69	1.89	2.21	2.55	3.14	3.38	3.66
1998	0.51	0.97	1.49	1.92	2.33	2.69	3.03	3.04	4.07
1999	0.68	1.10	1.53	1.83	2.11	2.34	2.70	2.97	3.68
2000	0.66	1.13	1.46	1.89	2.25	2.37	2.73	2.99	3.30
2001	0.36	1.17	1.46	1.75	2.16	2.53	2.63	2.73	3.41
2002	0.31	0.91	1.34	1.74	1.95	2.47	3.13	3.07	3.34
2003	0.26	0.65	1.36	1.61	1.86	2.05	2.52	3.09	3.17
2004	**0.21**	0.39	1.00	1.50	1.67	1.95	2.07	2.47	2.91
2005	0.18	**0.57**	1.05	1.45	1.67	1.83	2.03	2.13	2.63
2006	0.19	0.48	**0.95**	1.06	1.61	1.78	1.89	2.06	2.31
2007	0.19	0.41	0.94	**1.15**	1.36	1.64	1.83	1.70	2.11
2008	0.36	0.75	1.00	1.22	**1.37**	1.58	1.70	1.94	2.14
2009	0.53	0.84	1.00	1.24	1.40	**1.54**	1.66	2.12	2.13
2010	0.23	0.71	1.06	1.22	1.36	1.51	**1.60**	1.73	2.19
2011	**0.22**	0.81	1.00	1.21	1.33	1.42	1.54	**1.63**	2.05
2012	0.17	**0.43**	1.01	1.22	1.33	1.45	1.52	1.57	**1.72**
2013	0.29	0.60	**0.84**	1.20	1.23	1.31	1.51	1.62	1.72
2014	**0.15**	0.48	0.75	**0.95**	1.19	1.30	1.51	1.47	1.77
2015	0.10	**0.30**	0.72	1.02	**1.12**	1.22	1.43	1.85	1.82
2016	0.16	0.53	**0.60**	0.95	1.15	**1.24**	1.47	1.94	1.76

Table 10 (cont.)

	SSB weights at age								
	1	2	3	4	5	6	7	8	9+
1989	0.39	0.61	1.20	1.55	1.93	2.30	2.82	3.25	3.82
1990	0.47	0.72	1.15	1.62	1.95	2.37	2.69	3.11	4.16
1991	0.41	0.88	1.13	1.64	1.97	2.37	2.70	2.93	4.34
1992	0.37	0.83	1.40	1.52	1.99	2.35	2.80	3.10	4.27
1993	0.51	0.79	1.42	1.89	1.94	2.40	2.58	3.04	4.01
1994	0.30	0.85	1.39	1.95	2.39	2.40	2.76	3.17	4.55
1995	0.27	0.66	1.28	1.82	2.37	2.72	2.99	3.00	3.98
1996	0.31	0.69	1.20	1.65	2.17	2.54	3.10	3.39	3.71
1997	0.27	0.67	1.36	1.68	2.02	2.43	2.83	3.40	3.66
1998	0.35	0.63	1.22	1.80	2.10	2.44	2.78	3.09	4.07
1999	0.52	0.75	1.22	1.65	2.01	2.34	2.69	3.00	3.68
2000	0.50	0.88	1.27	1.70	2.03	2.24	2.53	2.84	3.30
2001	0.22	0.88	1.29	1.60	2.02	2.39	2.50	2.73	3.41
2002	0.21	0.57	1.25	1.59	1.85	2.31	2.81	2.84	3.34
2003	0.21	0.44	1.11	1.47	1.79	2.00	2.50	3.11	3.17
2004	**0.13**	0.32	0.80	1.43	1.64	1.90	2.06	2.49	2.91
2005	0.11	**0.35**	0.64	1.21	1.58	1.75	1.99	2.10	2.63
2006	0.13	0.29	**0.73**	1.06	1.53	1.72	1.86	2.05	2.31
2007	0.09	0.28	0.67	**1.04**	1.20	1.62	1.80	1.79	2.11
2008	0.24	0.37	0.64	1.07	**1.25**	1.47	1.67	1.88	2.14
2009	0.46	0.55	0.87	1.11	1.31	**1.45**	1.62	1.89	2.13
2010	0.12	0.61	0.95	1.11	1.30	1.45	**1.57**	1.70	2.19
2011	**0.16**	0.43	0.84	1.14	1.27	1.39	1.52	**1.61**	2.05
2012	0.09	**0.31**	0.90	1.11	1.27	1.39	1.47	1.56	**1.72**
2013	0.22	0.32	**0.60**	1.10	1.23	1.32	1.48	1.57	1.72
2014	**0.11**	0.37	0.67	**0.90**	1.19	1.26	1.41	1.49	1.77
2015	0.06	**0.22**	0.59	0.87	**1.03**	1.21	1.36	1.67	1.82
2016	0.15	0.18	**0.47**	0.83	1.06	**1.18**	1.34	1.66	1.74

Table 11. Mean number/tow and mean kg/tow from the NEFSC spring and fall bottom trawl survey, and the DFO winter bottom trawl survey. CV is expressed as a %.

	NEFSC Spring				**NEFSC Fall**				**DFO Winter**			
YEAR	Mean Num/ tow	*CV*	Mean kg/ tow	*CV*	Mean Num/tow	*CV*	Mean kg/ tow	*CV*	Mean Num/ tow	*CV*	Mean kg/ tow	*CV*
1963	---	---	---	---	144.9	*16*	79.8	*17*				
1964	---	---	---	---	193.2	*19*	96.6	*18*				
1965	---	---	---	---	101.7	*15*	72.8	*15*				
1966	---	---	---	---	34.0	*19*	30.4	*19*				
1967	---	---	---	---	17.0	*29*	24.9	*21*				
1968	13.6	*27*	20.6	*22*	7.5	*33*	16.8	*32*				
1969	7.2	*25*	16.9	*29*	3.0	*26*	8.5	*27*				
1970	5.9	*55*	17.1	*69*	7.6	*52*	13.2	*38*				
1971	2.9	*28*	5.0	*24*	3.6	*25*	5.6	*30*				
1972	6.5	*40*	7.5	*20*	10.8	*21*	8.5	*20*				
1973	37.5	*69*	15.4	*34*	14.8	*35*	9.8	*27*				
1974	19.0	*36*	17.7	*34*	3.8	*26*	4.0	*27*				
1975	6.2	*41*	8.2	*43*	29.9	*25*	15.1	*52*				
1976	83.2	*48*	15.7	*33*	70.8	*48*	35.8	*43*				
1977	36.9	*38*	26.6	*36*	23.2	*33*	27.6	*34*				
1978	19.4	*28*	31.3	*28*	25.1	*21*	18.1	*19*				
1979	49.7	*28*	20.3	*19*	52.2	*57*	32.1	*46*				
1980	59.8	*37*	53.8	*35*	30.4	*22*	22.0	*22*				
1981	31.2	*23*	38.1	*23*	13.4	*31*	14.3	*21*				
1982	8.9	*22*	13.1	*20*	5.4	*32*	7.3	*22*				
1983	5.6	*18*	13.2	*26*	8.0	*38*	5.8	*23*				
1984	6.3	*29*	7.4	*26*	5.4	*39*	4.5	*30*				
1985	8.9	*34*	11.1	*32*	13.2	*33*	3.7	*18*				
1986	5.9	*23*	5.9	*27*	6.8	*45*	5.0	*26*				
1987	5.0	*53*	5.6	*49*	3.6	*38*	2.6	*42*	8.3	*28*	12.5	*28*
1988	3.4	*20*	3.4	*17*	5.3	*24*	5.3	*27*	14.0	*23*	17.9	*24*
1989	5.3	*26*	4.7	*20*	4.3	*33*	4.5	*33*	9.2	*21*	9.0	*15*
1990	7.7	*51*	7.6	*36*	2.9	*30*	2.6	*35*	15.9	*16*	21.7	*15*
1991	4.0	*44*	4.4	*42*	2.9	*38*	0.9	*23*	13.9	*27*	23.1	*31*
1992	1.2	*26*	1.4	*28*	5.9	*37*	3.2	*35*	13.1	*27*	16.8	*30*
1993	2.7	*29*	2.5	*44*	8.0	*40*	4.3	*38*	14.7	*29*	12.6	*30*
1994	4.9	*64*	3.6	*63*	3.5	*39*	2.9	*45*	43.1	*37*	30.3	*42*
1995	5.6	*45*	5.7	*44*	17.1	*39*	10.7	*37*	13.1	*36*	16.0	*41*
1996	23.4	*73*	25.7	*70*	4.4	*23*	4.1	*36*	22.9	*23*	22.9	*20*
1997	12.9	*68*	18.5	*79*	6.1	*57*	6.5	*42*	11.2	*25*	15.8	*36*
1998	7.3	*44*	6.1	*40*	10.8	*22*	5.8	*26*	26.4	*38*	33.2	*42*

Table 11 (cont.)

1999	16.6	*45*	7.7	*43*	23.1	*43*	33.1	*46*	37.0	*61*	22.3	*48*
2000	14.3	*49*	17.9	*62*	18.0	*40*	15.4	*45*	112.5	*64*	70.6	*43*
2001	14.9	*23*	6.1	*30*	22.7	*35*	20.0	*43*	48.7	*22*	41.5	*34*
2002	32.2	*36*	22.3	*32*	42.1	*35*	36.3	*34*	76.0	*35*	86.0	*54*
2003	14.8	*37*	15.6	*38*	169.5	*30*	23.0	*37*	100.8	*29*	109.8	*26*
2004	140.5	*63*	41.4	*30*	187.0	*36*	55.8	*29*	203.5	*31*	79.5	*17*
2005	59.8	*34*	17.7	*24*	90.5	*23*	39.4	*24*	104.3	*21*	95.3	*18*
2006	37.3	*29*	17.3	*28*	57.0	*25*	37.4	*26*	255.8	*25*	115.2	*23*
2007	57.3	*34*	34.6	*36*	53.9	*45*	43.9	*45*	90.6	*19*	61.7	*20*
2008	27.7	*45*	23.8	*53*	16.0	*36*	18.0	*37*	95.8	*24*	92.2	*26*
2009	19.5	*23*	29.1	*23*	32.1	*29*	35.5	*32*	50.2	*30*	58.4	*32*
2010	25.8	*19*	43.1	*21*	75.5	*17*	18.3	*20*	69.9	*21*	83.1	*23*
2011	66.2	*31*	20.9	*19*	115.5	*20*	36.4	*19*	254.2	*52*	46.4	*19*
2012	84.5	*30*	46.7	*25*	70.6	*35*	35.0	*33*	522.6	*28*	102.4	*26*
2013	55.0	*21*	47.6	*21*	790.9	*30*	95.1	*24*	237.2	*31*	105.9	*31*
2014	673.7	*43*	210.1	*45*	409.5	*14*	98.0	*14*	792.1	*41*	64.9	*24*
2015	394.4	*20*	186.0	*19*	311.2	*33*	137.9	*39*	1809.3	*36*	415.6	*33*
2016	151.7	*14*	114.9	*14*	557.7	*48*	152.2	*24*	434.8	*16*	168.3	*16*
2017	130.9	*15*	112.2	*17*					351.7	*18*	148.3	*21*

Table 12. Minimum swept area abundance indices at age for NEFSC spring survey. The extremely strong year classes (1963, 2003, 2010, and 2013) are in bold.

	Age 1	**Age 2**	**Age 3**	**Age 4**	**Age 5**	**Age 6**	**Age 7**	**Age 8**
1968	1298	9185	1493	2272	**21811**	5453	811	1461
1969	0	227	1883	811	1363	**13729**	3343	909
1970	2175	811	0	1071	1493	1493	**6491**	3181
1971	0	3765	811	0	389	389	292	**2661**
1972	13048	292	1980	389	97	130	422	97
1973	99579	15709	0	1753	292	0	584	32
1974	6913	43136	9283	0	779	0	32	325
1975	3051	3148	10776	2045	0	422	292	32
1976	262221	974	1947	2986	1396	0	130	0
1977	1980	108439	1363	3960	1947	1461	0	130
1978	227	3148	51704	1168	3051	2661	519	195
1979	117235	5128	3668	18533	1071	519	1201	195
1980	16878	151575	1655	3376	15807	2175	1201	1493
1981	10711	10678	63259	7108	2467	5777	779	357
1982	2467	4966	3051	13210	1363	909	1980	0
1983	1396	1785	1883	714	7822	32	130	3765
1984	6784	3830	2077	2045	1883	2337	227	130
1985	0	16099	2467	1298	2824	1104	3797	325
1986	8082	584	6686	779	357	682	389	1071
1987	0	11749	195	2629	260	325	162	714
1988	5031	130	3213	422	1039	389	357	389
1989	65	11328	1461	2304	454	1331	195	162
1990	2791	0	18565	1071	1883	195	422	0
1991	1753	3473	779	6005	292	325	65	130
1992	1298	584	357	227	1071	97	97	97
1993	3797	2110	584	454	389	1201	195	65
1994	2269	8708	3254	481	330	214	503	49
1995	1627	4172	7528	2969	536	370	93	578
1996	3525	14908	28744	16894	8497	1133	237	243
1997	5826	3319	10885	11871	6522	2887	409	228
1998	2673	9582	4049	3437	2773	696	196	18
1999	33135	6581	6950	2328	2085	1646	663	652
2000	5937	7692	13322	6521	3604	3591	3292	1543
2001	32502	2789	7910	2707	977	682	374	265
2002	593	62469	21807	10459	3546	1548	1969	552
2003	32	811	17689	3927	15742	3116	3700	2791
2004	**363974**	6005	3895	29406	7076	8666	1396	3116
2005	2597	**173126**	519	1233	10873	1461	3278	617
2006	6532	1850	**93249**	1644	2058	12006	1684	1537

2007	2813	22645	5946	**146829**	1139	829	4489	367
2008	5956	2817	8334	895	**65429**	1385	478	3342
2009	4948	4187	3384	9695	1526	**36747**	749	596
2010	1340	1663	8233	3968	11103	1434	**54438**	0
2011	**187898**	2613	2007	1958	1532	2256	588	**15559**
2012	83199	**174677**	2414	870	1731	1444	2075	173
2013	11555	40806	**120602**	1239	679	645	611	445
2014	**1954938**	26338	50719	**149572**	1745	214	252	497
2015	116669	**1070179**	24096	12383	**54998**	1053	0	184
2016	56323	19549	**390677**	3845	3358	**18097**	85	26
2017	60752	31680	6434	**307902**	5261	1997	**10522**	135

Table 13. Minimum swept area abundance indices at age for NEFSC fall survey (lagged by 1 age and 1 year). The extremely strong year classes (1963, 2003, 2010, and 2013) are in bold.

Year	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6
1964	**272418**	82407	29936	22101	27082	19296
1965	7689	**366336**	206889	18909	5803	12380
1966	1064	32982	**251188**	31483	3482	2612
1967	19925	3095	9382	**59678**	10881	1693
1968	97	21811	1161	3240	**21956**	5271
1969	290	193	3095	435	1064	**12526**
1970	1257	97	0	919	435	532
1971	145	13396	677	48	919	871
1972	7883	0	1016	242	48	725
1973	21908	8173	0	1693	290	0
1974	10494	29210	5223	0	629	145
1975	2418	5755	3192	1016	0	48
1976	76217	2031	2321	15766	2998	0
1977	14025	208291	1693	1741	2660	967
1978	436	6941	60803	1824	1864	2062
1979	42915	2737	3371	30104	595	833
1980	4284	147902	119	2935	12375	833
1981	37917	8805	41289	1467	595	5513
1982	1229	19911	6743	12018	674	1349
1983	4401	0	4304	1112	4546	435
1984	18812	774	677	871	967	3047
1985	97	10785	2853	774	919	193
1986	36839	2110	4966	714	162	325
1987	0	16586	292	3927	195	422
1988	5842	0	2564	325	2499	195
1989	227	9802	584	4219	389	1298
1990	1517	160	8783	639	2156	293
1991	2502	2182	80	3859	160	559
1992	7000	665	772	160	719	53
1993	9250	6751	747	779	0	1525
1994	4924	13121	6521	985	0	186
1995	2955	2506	2622	2166	402	147
1996	7377	23168	15917	7519	1222	39
1997	4256	1765	3005	3370	1583	463
1998	1049	8003	4762	2431	1777	1056
1999	14008	9050	8028	2348	1338	571
2000	5922	2728	10934	26130	11429	7536
2001	13433	9161	17791	10077	3562	2143
2002	2774	28471	5459	24147	6877	3774

2003	377	6203	72276	17673	27709	6075
2004	**501602**	231	1464	27761	5759	10893
2005	5288	**531168**	711	2741	44206	3814
2006	13818	5745	**250707**	904	2260	15370
2007	3051	14742	2374	**156979**	1282	1404
2008	2744	4196	22493	3596	**137796**	1067
2009	3140	2947	1811	5933	789	**35977**
2010	4431	1541	2966	3256	11191	1241
2011	**194283**	2521	1188	2548	1748	4773
2012	64142	**276128**	2643	1111	1747	2163
2013	11840	40624	**169995**	1782	423	700
2014	**2345040**	11064	24855	**177055**	2626	789
2015	69956	**1189107**	14363	8107	**45901**	780
2016	105435	16580	**812952**	6950	9007	**58346**

Table 14. Minimum swept area abundance indices at age for DFO spring survey. The extremely strong year classes (2003, 2010, and 2013) are in bold. Note: not all GB strata were sampled in years 2012, 2013, 2015, and 2017.

Year	**Age 1**	**Age 2**	**Age 3**	**Age 4**	**Age 5**	**Age 6**	**Age 7**	**Age 8**
1986	5714	310	8515	1506	267	408	479	521
1987	42	4278	971	3533	943	113	422	141
1988	2069	70	12005	239	4011	253	239	155
1989	42	7515	1013	2984	267	591	42	42
1990	1309	155	13891	183	4729	324	1534	183
1991	1056	2350	197	12652	155	2252	127	619
1992	4644	4152	1590	239	5376	42	1492	56
1993	5573	3040	774	633	56	1801	28	450
1994	4673	16213	5742	591	338	28	985	14
1995	2730	3687	6052	3124	788	42	0	676
1996	8599	4067	6812	7093	4110	366	338	56
1997	2449	1633	1393	3293	3336	2393	324	127
1998	3392	11512	4335	3617	5292	5165	2787	338
1999	27796	4799	10077	3110	1970	1900	1773	464
2000	25797	96547	13117	12540	2970	2181	2730	1604
2001	31357	3983	15312	4349	5813	1816	1618	1984
2002	2787	44614	9359	21617	6080	7487	2238	1858
2003	1922	3582	97567	7229	18640	4133	3779	1697
2004	**207872**	580	2807	55692	5541	10384	1739	1023
2005	0	0	0	0	0	0	0	0
2006	0	0	0	0	0	0	0	0
2007	4215	15001	4419	**80460**	1121	178	4177	299
2008	3923	1248	4813	5204	**109124**	1009	195	8595
2009	2466	4439	2981	7907	891	**49461**	696	140
2010	7002	1078	4770	3913	10468	2852	**66009**	490
2011	**315264**	2127	1708	3104	1332	2987	735	**29975**
2012	29469	**376610**	4002	740	1055	407	679	399
2013	4445	27350	**282387**	4919	761	1398	585	903
2014	**1039529**	8016	16486	**54857**	844	121	44	239
2015	8962	**1026970**	24496	9435	**66629**	0	319	54
2016	17337	12618	**543725**	6055	4096	**27576**	264	0
2017	53538	22344	14391	**329642**	3377	2420	**8989**	36

Table 15. Calibration factors at length applied to 2009 and 2010 NEFSC surveys.

Length (cm)	Estimate	CV
1-18	2.626169	0.070962
19	2.580551	0.069482
20	2.534933	0.067956
21	2.489315	0.066384
22	2.443697	0.064765
23	2.398079	0.063096
24	2.352461	0.061376
25	2.306843	0.059606
26	2.261226	0.057785
27	2.215608	0.055912
28	2.16999	0.053989
29	2.124372	0.052019
30	2.078754	0.050004
31	2.033136	0.047951
32	1.987518	0.045868
33	1.9419	0.043767
34	1.896282	0.041668
35	1.850664	0.039594
36	1.805047	0.037583
37	1.759429	0.035684
38	1.713811	0.033963
39	1.668193	0.032508
40	1.622575	0.031427
41	1.576957	0.030848
42	1.531339	0.030902
43	1.485721	0.031704
44	1.440103	0.033337
45	1.394485	0.035839
46	1.348868	0.039209
47	1.30325	0.043428
48	1.257632	0.048471
49	1.212014	0.054326
50	1.166396	0.060995
>=51	1.16399	0.06137

Table 16. Estimates of spawning stock biomass (SSB) and January 1 total biomass. Note, SSB is calculated to correspond to spawning date (0.25 of the year).

Year	SSB	January 1 Biomass
1931	95,164	178,917
1932	91,793	159,477
1933	79,343	136,671
1934	69,708	115,530
1935	74,431	128,360
1936	76,207	133,264
1937	73,039	147,376
1938	80,664	166,966
1939	96,442	173,516
1940	96,422	189,729
1941	103,394	211,183
1942	106,388	194,729
1943	108,848	163,113
1944	99,288	163,564
1945	93,727	159,258
1946	90,348	171,384
1947	84,819	166,009
1948	80,573	134,785
1949	69,510	154,986
1950	69,499	139,713
1951	75,572	159,389
1952	78,392	143,623
1953	79,120	168,761
1954	86,182	161,422
1955	100,705	180,423
1956	108,320	180,406
1957	107,600	174,727
1958	106,202	179,128
1959	114,614	214,766
1960	137,525	261,928
1961	171,975	266,177
1962	179,431	246,772
1963	163,737	290,348
1964	167,402	447,882
1965	217,565	427,380
1966	186,839	265,251
1967	106,435	137,889
1968	71,846	91,653

1969	47,766	57,663
1970	34,913	43,090
1971	24,771	31,422
1972	23,222	30,466
1973	15,889	29,101
1974	29,694	44,727
1975	22,061	32,702
1976	28,597	68,126
1977	49,853	94,990
1978	76,789	99,296
1979	72,404	116,110
1980	71,220	115,186
1981	61,529	79,607
1982	49,494	59,305
1983	38,672	45,575
1984	26,965	35,597
1985	20,028	27,925
1986	20,992	30,591
1987	20,804	28,796
1988	19,729	29,449
1989	20,470	28,796
1990	24,275	30,314
1991	21,911	27,644
1992	16,369	24,314
1993	14,619	27,838
1994	19,815	32,743
1995	26,025	36,333
1996	34,539	45,323
1997	42,030	55,196
1998	48,722	64,214
1999	56,606	89,511
2000	69,096	98,038
2001	81,172	112,267
2002	90,206	120,055
2003	104,172	119,130
2004	91,256	132,642
2005	91,684	140,979
2006	142,283	166,297
2007	151,258	166,613
2008	135,032	149,779
2009	109,334	123,477
2010	75,519	88,753
2011	45,732	98,695

2012	41,227	95,161
2013	107,671	137,539
2014	150,185	366,946
2015	212,734	467,071
2016	549,938	709,734
2017		1,115,569

Table 17. Estimated number at age for Georges Bank haddock for ages 1-9+. The extremely strong year classes (1963, 2003, 2010, and 2013) are in bold.

Year	1	2	3	4	5	6	7	8	9+
1960	122245	106224	34088	21407	13203	10239	3725	1965	1685
1961	54312	99853	72550	22399	13424	8053	6770	2342	3182
1962	39050	44411	72117	45973	14561	8367	4925	4403	3337
1963	188241	31905	32344	44439	28253	8822	4974	2627	3994
1964	**460816**	151491	22475	19812	26363	15773	5242	2811	3642
1965	32513	**368163**	109665	14304	11929	13764	7724	2428	3032
1966	4155	18003	**188650**	49979	6915	5833	5300	2959	2023
1967	14013	3299	8612	**64678**	23760	3185	2461	2256	1717
1968	542	10436	2549	4459	**34417**	10213	1525	1126	2094
1969	1111	437	5856	1451	1934	**15196**	5225	652	1653
1970	4616	908	348	3271	786	997	**7112**	2866	1782
1971	267	3737	601	270	2165	476	624	**3753**	2371
1972	8526	217	1828	292	185	1512	171	256	**4801**
1973	19498	6836	176	1083	165	122	1127	68	2036
1974	10577	13615	3701	141	535	87	73	852	4001
1975	7930	8616	7129	2417	114	372	69	57	1276
1976	105344	6313	6091	4105	1630	90	266	53	1495
1977	13982	86114	4726	4472	2540	1132	73	196	558
1978	6124	11446	52652	3698	3041	1610	602	56	270
1979	83883	5013	8679	30080	2751	1975	851	367	176
1980	10932	68671	4081	5539	18123	1775	1245	412	218
1981	7362	8943	28381	3026	3652	9380	918	529	315
1982	2579	6027	5743	13323	1726	2142	5354	453	470
1983	3281	2111	3878	3225	7531	1059	1239	3370	320
1984	18070	2686	1533	2437	2014	4137	620	845	1719
1985	2515	14793	2114	985	1335	1287	2043	296	576
1986	16764	2059	9894	1225	628	670	844	1189	268
1987	2603	13719	1636	5543	800	381	391	554	706
1988	19933	2131	9400	1221	3062	543	245	238	395
1989	1358	16316	1697	5505	876	1652	308	150	230
1990	3378	1110	12040	1279	3590	522	924	196	173
1991	2688	2709	898	8329	805	1931	289	561	212
1992	10528	2194	1781	625	4691	529	1116	122	261
1993	15190	8544	1558	1091	335	2088	271	533	259
1994	14941	12407	6667	881	588	166	1045	166	329
1995	12203	12208	9673	4386	505	354	71	574	152
1996	11300	9976	9911	7365	3167	360	263	50	569
1997	22259	9246	8116	7603	5202	2187	235	196	519
1998	13777	18211	7440	6399	5553	3753	1594	177	367

1999	45218	11274	14702	5667	4736	3855	2559	1153	336
2000	10206	37018	9191	11220	4152	3332	2647	1750	668
2001	78083	8354	29941	6961	7771	2870	2253	1828	1336
2002	4391	63916	6709	22355	4802	5209	1760	1451	2609
2003	2079	3593	51972	5181	15440	3098	3271	1080	1978
2004	**249145**	1698	2926	40797	3826	10224	1992	2031	1473
2005	5318	**203399**	1360	2285	28792	2476	5735	1016	1106
2006	12866	4336	**165976**	1076	1566	15940	1330	3043	823
2007	4175	10385	3533	**133032**	817	945	8193	795	1582
2008	4380	3401	8339	2684	**99849**	510	578	5058	1275
2009	1773	3579	2748	6435	1923	**70237**	314	376	2548
2010	6366	1435	2811	2070	4471	1317	**45840**	181	1065
2011	**278296**	5181	1121	1923	1349	2368	680	**25470**	451
2012	41319	**227406**	4121	747	1071	778	1053	405	**6695**
2013	23598	33784	**185344**	3160	479	539	434	427	2214
2014	**1839273**	19272	27421	**147295**	2322	279	215	264	1145
2015	48629	**1501052**	15152	21212	**106702**	1414	131	102	956
2016	88436	39695	**1223718**	11277	14690	**75957**	971	55	599
2017	132496	72176	32333	**994299**	8293	10976	**55601**	474	422

Table 18. Estimated fishing mortality at age, F on fully selected fish (Full F), the average F on ages 5-7 (F5-7), and the numbers-weighted average F on ages 5-7 (N-wtd F5-7).

Year	1	2	3	4	5	6	7	8	9	Full F	F5-7	N-wtdF5-7
1960	0.00	0.18	0.22	0.27	0.29	0.21	0.26	0.26	0.26	0.29	0.26	0.26
1961	0.00	0.13	0.26	0.23	0.27	0.29	0.23	0.26	0.26	0.29	0.26	0.27
1962	0.00	0.12	0.28	0.29	0.30	0.32	0.43	0.35	0.35	0.43	0.35	0.33
1963	0.02	0.15	0.29	0.32	0.38	0.32	0.37	0.36	0.36	0.38	0.36	0.37
1964	0.02	0.12	0.25	0.31	0.45	0.51	0.57	0.51	0.51	0.57	0.51	0.48
1965	0.39	0.47	0.59	0.53	0.52	0.75	0.76	0.68	0.68	0.76	0.68	0.67
1966	0.03	0.54	0.87	0.54	0.58	0.66	0.65	0.63	0.63	0.87	0.63	0.63
1967	0.09	0.06	0.46	0.43	0.64	0.54	0.58	0.59	0.59	0.64	0.59	0.63
1968	0.02	0.38	0.36	0.64	0.62	0.47	0.65	0.58	0.58	0.65	0.58	0.59
1969	0.00	0.03	0.38	0.41	0.46	0.56	0.40	0.47	0.47	0.56	0.47	0.51
1970	0.01	0.21	0.05	0.21	0.30	0.27	0.44	0.34	0.34	0.44	0.34	0.41
1971	0.00	0.51	0.52	0.18	0.16	0.83	0.69	0.56	0.56	0.83	0.56	0.36
1972	0.02	0.01	0.32	0.37	0.22	0.09	0.71	0.34	0.34	0.71	0.34	0.16
1973	0.16	0.41	0.02	0.51	0.44	0.32	0.08	0.28	0.28	0.51	0.28	0.14
1974	0.00	0.45	0.23	0.02	0.16	0.03	0.03	0.07	0.07	0.45	0.07	0.13
1975	0.03	0.15	0.35	0.19	0.04	0.14	0.07	0.08	0.08	0.35	0.08	0.11
1976	0.00	0.09	0.11	0.28	0.16	0.00	0.10	0.09	0.09	0.28	0.09	0.15
1977	0.00	0.29	0.05	0.19	0.26	0.43	0.06	0.25	0.25	0.43	0.25	0.31
1978	0.00	0.08	0.36	0.10	0.23	0.44	0.29	0.32	0.32	0.44	0.32	0.30
1979	0.00	0.01	0.25	0.31	0.24	0.26	0.53	0.34	0.34	0.53	0.34	0.29
1980	0.00	0.68	0.10	0.22	0.46	0.46	0.66	0.52	0.52	0.68	0.52	0.47
1981	0.00	0.24	0.56	0.36	0.33	0.36	0.51	0.40	0.40	0.56	0.40	0.36
1982	0.00	0.24	0.38	0.37	0.29	0.35	0.26	0.30	0.30	0.38	0.30	0.29
1983	0.00	0.12	0.26	0.27	0.40	0.33	0.18	0.31	0.31	0.40	0.31	0.36
1984	0.00	0.04	0.24	0.40	0.25	0.51	0.54	0.43	0.43	0.54	0.43	0.43
1985	0.00	0.20	0.35	0.25	0.49	0.22	0.34	0.35	0.35	0.49	0.35	0.35
1986	0.00	0.03	0.38	0.23	0.30	0.34	0.22	0.29	0.29	0.38	0.29	0.28
1987	0.00	0.18	0.09	0.39	0.19	0.24	0.29	0.24	0.24	0.39	0.24	0.23
1988	0.00	0.03	0.34	0.13	0.42	0.37	0.29	0.36	0.36	0.42	0.36	0.40
1989	0.00	0.10	0.08	0.23	0.32	0.38	0.25	0.32	0.32	0.38	0.32	0.35
1990	0.02	0.01	0.17	0.26	0.42	0.39	0.30	0.37	0.37	0.42	0.37	0.40
1991	0.00	0.22	0.16	0.37	0.22	0.35	0.66	0.41	0.41	0.66	0.41	0.34
1992	0.01	0.14	0.29	0.42	0.61	0.47	0.54	0.54	0.54	0.61	0.54	0.59
1993	0.00	0.05	0.37	0.42	0.50	0.49	0.29	0.43	0.43	0.50	0.43	0.47
1994	0.00	0.05	0.22	0.36	0.31	0.66	0.40	0.45	0.45	0.66	0.45	0.39
1995	0.00	0.01	0.07	0.13	0.14	0.10	0.14	0.13	0.13	0.14	0.13	0.12
1996	0.00	0.01	0.07	0.15	0.17	0.23	0.10	0.16	0.16	0.23	0.16	0.17
1997	0.00	0.02	0.04	0.11	0.13	0.12	0.09	0.11	0.11	0.13	0.11	0.12
1998	0.00	0.01	0.07	0.10	0.16	0.18	0.12	0.16	0.16	0.18	0.16	0.17

1999	0.00	0.00	0.07	0.11	0.15	0.18	0.18	0.17	0.17	0.18	0.17	0.17
2000	0.00	0.01	0.08	0.17	0.17	0.19	0.17	0.18	0.18	0.19	0.18	0.18
2001	0.00	0.02	0.09	0.17	0.20	0.29	0.24	0.24	0.24	0.29	0.24	0.23
2002	0.00	0.01	0.06	0.17	0.24	0.27	0.29	0.26	0.26	0.29	0.26	0.26
2003	0.00	0.01	0.04	0.10	0.21	0.24	0.28	0.24	0.24	0.28	0.24	0.23
2004	0.00	0.02	0.05	0.15	0.24	0.38	0.47	0.36	0.36	0.47	0.36	0.36
2005	0.00	0.00	0.03	0.18	0.39	0.42	0.43	0.42	0.42	0.43	0.42	0.40
2006	0.01	0.00	0.02	0.08	0.31	0.47	0.31	0.36	0.36	0.47	0.36	0.44
2007	0.01	0.02	0.08	0.09	0.27	0.29	0.28	0.28	0.28	0.29	0.28	0.28
2008	0.00	0.01	0.06	0.13	0.15	0.29	0.23	0.22	0.22	0.29	0.22	0.15
2009	0.01	0.04	0.08	0.16	0.18	0.23	0.35	0.25	0.25	0.35	0.25	0.23
2010	0.01	0.05	0.18	0.23	0.44	0.46	0.39	0.43	0.43	0.46	0.43	0.39
2011	0.00	0.03	0.21	0.39	0.35	0.61	0.32	0.43	0.43	0.61	0.43	0.49
2012	0.00	0.00	0.07	0.24	0.49	0.38	0.70	0.52	0.52	0.70	0.52	0.54
2013	0.00	0.01	0.03	0.11	0.34	0.72	0.30	0.45	0.45	0.72	0.45	0.47
2014	0.00	0.04	0.06	0.12	0.30	0.55	0.54	0.46	0.46	0.55	0.46	0.34
2015	0.00	0.00	0.10	0.17	0.14	0.18	0.67	0.33	0.33	0.67	0.33	0.14
2016	0.00	0.01	0.01	0.11	0.09	0.11	0.52	0.24	0.24	0.52	0.24	0.11

Table 19. Estimates of catchability for indices used in the model. NEFSC_S41 is the NEFSC spring index for years 1973-1981, which was treated as a separate index.

Index	**Estimate**	***CV***
NEFSC_Spring_1	0.46	*0.18*
NEFSC_Spring_2	0.67	*0.12*
NEFSC_Spring_3	0.75	*0.12*
NEFSC_Spring_4	0.66	*0.09*
NEFSC_Spring_5	0.72	*0.11*
NEFSC_Spring_6	0.60	*0.14*
NEFSC_Spring_7	0.61	*0.14*
NEFSC_Spring_8	0.70	*0.14*
NEFSC_S41_1	0.72	*0.51*
NEFSC_S41_2	0.90	*0.35*
NEFSC_S41_3	0.78	*0.31*
NEFSC_S41_4	0.84	*0.22*
NEFSC_S41_5	0.89	*0.16*
NEFSC_S41_6	0.88	*0.28*
NEFSC_S41_7	0.91	*0.26*
NEFSC_S41_8	0.86	*0.32*
NEFSC_Fall_1	0.54	*0.13*
NEFSC_Fall_2	0.76	*0.13*
NEFSC_Fall_3	0.66	*0.11*
NEFSC_Fall_4	0.73	*0.09*
NEFSC_Fall_5	0.65	*0.10*
NEFSC_Fall_6	0.67	*0.12*
DFO_Spring_1	0.40	*0.22*
DFO_Spring_2	0.47	*0.18*
DFO_Spring_3	0.77	*0.11*
DFO_Spring_4	0.73	*0.13*
DFO_Spring_5	0.75	*0.14*
DFO_Spring_6	0.60	*0.17*
DFO_Spring_7	0.74	*0.16*
DFO_Spring_8	0.72	*0.15*

Table 20. Input and output for the yield per recruit analysis for reference points (recent 5-year averages of weights, selectivity, and maturity at age).

2017 update

Age	Stock wt	Catch wt	SSB wt	Selectivity	M	Maturity
1	0.12	0.18	0.12	0.01	0.20	0.03
2	0.28	0.42	0.28	0.03	0.20	0.32
3	0.65	0.81	0.65	0.09	0.20	0.87
4	0.96	1.07	0.96	0.27	0.20	0.99
5	1.16	1.19	1.16	0.48	0.20	1.00
6	1.27	1.31	1.27	0.69	0.20	1.00
7	1.41	1.49	1.41	1.00	0.20	1.00
8	1.59	1.69	1.59	0.72	0.20	1.00
9+	1.75	1.75	1.75	0.72	0.20	1.00

	F	YPR	SSB/R	F[5-7]	N-wtd F[5-7]
F40%	0.57	0.42	1.80	0.41	0.35

2015 update

Age	Stock wt	Catch wt	SSB wt	Selectivity	M	Maturity
1	0.13	0.21	0.13	0.01	0.20	0.04
2	0.41	0.61	0.41	0.07	0.20	0.38
3	0.79	0.93	0.79	0.24	0.20	0.91
4	1.07	1.16	1.07	0.49	0.20	0.99
5	1.25	1.29	1.25	0.89	0.20	1.00
6	1.36	1.40	1.36	1.00	0.20	1.00
7	1.49	1.54	1.49	0.81	0.20	1.00
8	1.58	1.60	1.58	0.90	0.20	1.00
9+	1.89	1.89	1.89	0.90	0.20	1.00

	F	YPR	SSB/R	F[5-7]
F40%	0.39	0.45	1.98	0.35

2012 update

Age	Stock wt	Catch wt	SSB wt	Selectivity	M	Maturity
1	0.20	0.30	0.20	0.02	0.20	0.06
2	0.42	0.64	0.42	0.06	0.20	0.47
3	0.77	0.99	0.77	0.22	0.20	0.92
4	1.08	1.18	1.08	0.38	0.20	0.99
5	1.32	1.42	1.32	0.71	0.20	1.00
6	1.54	1.61	1.54	1.00	0.20	1.00
7	1.70	1.73	1.70	1.00	0.20	1.00
8	1.86	1.91	1.86	1.00	0.20	1.00
9+	2.17	2.17	2.17	1.00	0.20	1.00

	F	YPR	SSB/R	F[5-7]
F40%	0.39	0.49	2.21	0.35

Table 21. Updated reference point estimates compared to the previous 3 estimates for Georges Bank haddock. SSB_{MSY} and MSY are in thousands of metric tons; recruitment is in millions of age-1 fish.

2017 update

	Median	**5th**	**95th**
SSBmsy	104.3	52.2	209.4
MSY	24.4	12.4	48.3
Recruitment	52.2	2.4	174.4

2015 update

	Median	**5th**	**95th**
SSBmsy	108.3	58.2	167.9
MSY	24.9	13.6	38.4
Recruitment	53.4	3.5	130.0

2012 update

	Median	**5th**	**95th**
SSBmsy	124.9	71.8	187.8
MSY	28	16.3	41.9
Recruitment	54.2	4	130

GARM-III

	Median	**5th**	**95th**
SSBmsy	158.9	96.4	229.7
MSY	32.7	19.5	48.9
Recruitment	59	4	130

Table 22. Input for short-term projections (2017-2020) for Georges Bank Haddock. (Note: "t.s. min" stands for time series minimum). The 5-year average selectivity was used (red arrow) instead of year-specific values because of the very low selectivity at age 5 in year 2018 and age 6 in 2019 for the 2013 year class. Weights at age used the year specific values (2017-2020).

Selectivity

	age1	age2	age3	age4	age5	age6	age7	age8	age9
2010	0.01	0.10	0.39	0.49	0.94	1.00	0.84	0.93	0.93
2011	0.00	0.05	0.34	0.63	0.57	1.00	0.52	0.70	0.70
2012	0.00	0.01	0.09	0.35	0.69	0.55	1.00	0.75	0.75
2013	0.00	0.01	0.04	0.15	0.47	1.00	0.41	0.63	0.63
2014	0.01	0.07	0.10	0.22	0.54	1.00	0.98	0.84	0.84
2015	0.004	0.006	0.143	0.250	0.209	0.263	1.000	0.491	0.491
2016	0.006	0.010	0.015	0.208	0.177	0.217	1.000	0.465	0.465
scaled.5 yr ave	0.005	0.025	0.090	0.268	0.475	0.688	1.000	0.721	0.721
scaled.2yr.ave	0.005	0.008	0.079	0.229	0.193	0.240	1.000	0.478	0.478

	age1	age2	age3	age4	age5	age6	age7	age8	age9	ave 5 to 7
2017	0.005	0.025	0.090	0.22	0.475	0.688	1	0.721	0.721	0.721
2018	0.005	0.025	0.090	0.268	0.209	0.688	1	0.633	0.633	0.633
2019	0.005	0.025	0.090	0.268	0.475	0.217	1	0.564	0.564	0.564
2020	0.005	0.025	0.090	0.268	0.475	0.688	1	0.721	0.721	0.721

Catch WAA

	age1	age2	age3	age4	age5	age6	age7	age8	age9	
2010	0.23	0.71	1.06	1.22	1.36	1.51	1.60	1.73	2.19	
2011	0.22	0.81	1.00	1.21	1.33	1.42	1.54	1.63	2.05	
2012	0.17	0.43	1.01	1.22	1.33	1.45	1.52	1.57	1.72	
2013	0.29	0.60	0.84	1.20	1.23	1.31	1.51	1.62	1.72	
2014	0.15	0.48	0.75	0.95	1.19	1.30	1.51	1.47	1.77	
2015	0.10	0.30	0.72	1.02	1.12	1.22	1.43	1.85	1.82	
2016	0.16	0.53	0.60	0.95	1.15	1.24	1.47	1.94	1.76	
2017	*0.13*	*0.42*	*0.66*	*0.73*	*1.14*	*1.23*	*1.43*	*1.89*	*1.79*	
2018	*0.13*	*0.42*	*0.66*	*0.99*	*0.87*	*1.23*	*1.45*	*1.47*	*1.79*	*use 2yr ave for other ages/yc*
2019	*0.13*	*0.42*	*0.66*	*0.99*	*1.14*	*1.00*	*1.45*	*1.89*	*1.72*	*use slope to predict to age 7; t.s. min for 8 and 9+*
2020	*0.13*	*0.42*	*0.66*	*0.99*	*1.14*	*1.23*	*1.14*	*1.89*	*1.72*	*use slope to predict to ages 4-7;*

SSB WAA

	age1	age2	age3	age4	age5	age6	age7	age8	age9	
2010	0.12	0.61	0.95	1.11	1.30	1.45	1.57	1.70	2.19	
2011	0.16	0.43	0.84	1.14	1.27	1.39	1.52	1.61	2.05	
2012	0.09	0.31	0.90	1.11	1.27	1.39	1.47	1.56	1.72	
2013	0.22	0.32	0.60	1.10	1.23	1.32	1.48	1.57	1.72	
2014	0.11	0.37	0.67	0.90	1.19	1.26	1.41	1.49	1.77	
2015	0.06	0.22	0.59	0.87	1.03	1.21	1.36	1.67	1.82	
2016	0.15	0.18	0.47	0.83	1.06	1.18	1.34	1.66	1.74	
2017	*0.10*	*0.20*	*0.53*	*0.51*	*1.05*	*1.19*	*1.40*	*1.67*	*1.78*	
2018	*0.10*	*0.20*	*0.53*	*0.85*	*0.70*	*1.19*	*1.35*	*1.49*	*1.78*	*us 2yr ave for other ages/yc*
2019	*0.10*	*0.20*	*0.53*	*0.85*	*1.05*	*1.08*	*1.35*	*1.67*	*1.72*	*use slope to predict to age 7; t.s. min for 8 and 9+*
2020	*0.10*	*0.20*	*0.53*	*0.85*	*1.05*	*1.19*	*1.26*	*1.67*	*1.72*	*use slope to predict to ages 4-7;*

Table 23. Short term projections at F_{MSY} for Georges Bank haddock. Catch in 2017 was based on catches through July, and projections on likely catch through the end of 2017 (Groundfish PDT, pers. comm.). The extremely high recruitments (1963, 2003, and 2010) were included in the sampled recruitment set. All starting numbers at age were adjusted for the retrospective pattern (multiplied by 0.528).

Rho adjustment, keeping high recruitments

Catch (mt)				SSB (mt)			
Year	**5%**	**Median**	**95%**	**Year**	**5%**	**Median**	**95%**
2017	18,920	**18,920**	18,920	2017	214,535	**308,304**	454,442
2018	64,109	**94,274**	141,160	2018	220,458	**324,547**	481,224
2019	62,519	**93,569**	138,829	2019	221,969	**329,516**	487,070
2020	57,025	**85,292**	127,046	2020	163,125	**246,774**	382,012

Table 24. Influence of 2010 and 2013 year classes on short term projections for Georges Bank haddock. For comparison, the observed proportion at age of 2011-2016 catch and SSB are shown.

Rho adjustment, keeping high recruitments

Proportion of CAA

Year	1	2	3	4	5	6	7	8	9
2017	0.00	0.00	0.01	0.67	0.02	0.03	0.27	0.00	0.00
2018	0.00	0.00	0.01	0.02	0.82	0.01	0.03	0.10	0.00
2019	0.00	0.00	0.02	0.03	0.03	0.83	0.01	0.01	0.07
2020	0.00	0.00	0.01	0.06	0.05	0.03	0.79	0.01	0.05
									0.04

Proportion of SSB

Year	1	2	3	4	5	6	7	8	9
2017	0.02	0.02	0.03	0.77	0.01	0.02	0.12	0.00	0.00
2018	0.02	0.03	0.05	0.03	0.76	0.01	0.01	0.08	0.00
2019	0.02	0.02	0.08	0.06	0.03	0.73	0.01	0.01	0.05
2020	0.02	0.03	0.07	0.13	0.07	0.03	0.61	0.01	0.05

Output from 2017 VPA update

proportion CAA

	Age1	Age2	Age3	Age4	Age5	Age6	Age7	Age8	Age9
2011	0.04	0.01	0.02	0.05	0.03	0.09	0.02	0.73	0.01
2012	0.01	0.18	0.05	0.03	0.07	0.04	0.10	0.03	0.49
2013	0.01	0.04	0.71	0.04	0.02	0.04	0.01	0.02	0.11
2014	0.22	0.03	0.06	0.64	0.02	0.00	0.00	0.00	0.02
2015	0.01	0.25	0.05	0.13	0.54	0.01	0.00	0.00	0.01
2016	0.01	0.01	0.45	0.06	0.06	0.39	0.02	0.00	0.01

proportion SSB

	Age1	Age2	Age3	Age4	Age5	Age6	Age7	Age8	Age9
2011	0.03	0.02	0.02	0.04	0.03	0.06	0.02	0.77	0.02
2012	0.00	0.58	0.08	0.02	0.03	0.02	0.03	0.01	0.23
2013	0.00	0.03	0.88	0.03	0.00	0.01	0.01	0.01	0.03
2014	0.04	0.02	0.10	0.81	0.02	0.00	0.00	0.00	0.01
2015	0.00	0.40	0.03	0.08	0.48	0.01	0.00	0.00	0.01
2016	0.00	0.00	0.80	0.02	0.03	0.15	0.00	0.00	0.00