2 Tables

Table 4: Annual ocean quahog landings (excluding Maine) and quotas in metric tons of meats.

Year	EEZ	Quota	Proportion
1980	12134	15880	0.76
1981	12121	18140	0.67
1982	13205	18140	0.73
1983	14586	18140	0.8
1984	17975	18140	0.99
1985	20726	22230	0.93
1986	18902	27220	0.69
1987	21514	27220	0.79
1988	20273	27220	0.74
1989	22359	23590	0.95
1990	20965	24040	0.87
1991	22064	24040	0.92
1992	22477	24040	0.93
1993	21876	24490	0.89
1994	20985	24490	0.86
1995	21108	22230	0.95
1996	20061	20180	0.99
1997	19628	19580	1
1998	17897	18140	0.99
1999	17381	20410	0.85
2000	14723	20410	0.72
2001	17069	20410	0.84
2002	17947	20410	0.88
2003	18815	20410	0.92
2004	17655	22680	0.78
2005	13635	24190	0.56
2006	14273	24190	0.59
2007	15564	24190	0.64
2008	15727	24190	0.65
2009	15710	24190	0.65
2010	16289	24190	0.67
2011	14332	24190	0.59
2012	15864	24190	0.66
2013	14721	24190	0.61
2014	14498	24190	0.6
2015	13639	24190	0.56
2016	9542	24190	0.39
min	9542	15880	0.39
max	22477	27220	1
mean	17250	22491	1

Table 5: Annual ocean quahog landings and quotas in metric tons of meats. Landings from unknown areas in each year were prorated to known areas based on logbook proportions of landings in known areas. Totals are for the EEZ area and do not include Maine (MNE). Summary statisitics ignore years without landings.

Year	SVA	DMV	NJ	LI	SNE	GBK	MNE	Total
1980	0	4284	7844	6	0	0		12134
1981	56	3644	8418	3	0	0		12121
1982	6	4627	8572	0	0	0		13205
1983	0	5506	8417	21	642	0		14586
1984	6	7650	9442	0	877	0		17975
1985	177	7951	11789	44	765	0		20726
1986	0	8529	9381	410	582	0		18902
1987	0	10554	9082	1182	697	0		21514
1988	42	11727	7022	641	842	0		20273
1989	0	6444	14112	606	1197	0		22359
1990	14	3686	15592	739	934	0	3	20965
1991	0	4863	14649	1682	869	0	110	22064
1992	0	2386	6965	11979	1147	0	75	22477
1993	0	1958	10231	8664	1023	0	56	21876
1994	0	996	6967	12064	958	0	65	20985
1995	0	703	5386	9578	5441	0	114	21108
1996	0	742	4905	5993	8421	0	142	20061
1997	0	1084	4276	5199	9069	0	218	19628
1998	0	1385	2723	6955	6834	0	218	17897
1999	0	1109	3093	6442	6736	0	279	17381
2000	0	1083	3430	4905	5254	51	357	14723
2001	0	963	4910	6129	5054	14	326	17069
2002	0	1775	2850	9340	3981	0	387	17947
2003	0	917	3770	11900	2228	0	359	18815
2004	0	635	2810	10879	3331	0	307	17655
2005	0	932	685	9948	2070	0	301	13635
2006	0	507	479	11392	1895	0	365	14273
2007	0	102	1597	11507	2357	0	306	15564
2008	0	267	1738	11437	2284	0	201	15727
2009	0	213	2442	8687	4350	17	167	15710
2010	0	432	2339	9996	3508	13	169	16289
2011	0	294	1894	10380	1764	0	196	14332
2012	0	167	1427	11848	2315	106	226	15864
2013	0	0	363	10035	4157	166	176	14721
2014	0	14	541	10448	2814	681	137	14498
2015	0	0	683	10667	2208	81	125	13639
2016	0	62	843	6723	1821	92	69	9542

Table 5 continued.

min	0	0	363	0	0	0	3	9542
max	177	11727	15592	12064	9069	681	387	22477
mean	8	2598	5352	6338	2610	32	147	17250

Table 6: EEZ fishing effort (hours fished by all vessels) for ocean quahog, by stock assessment area and year based on logbook data. The fraction of logbook effort from unknown areas in each year was prorated to known areas based on effort in known areas. Effort data prior to 1981 are less reliable due to restrictions on hours fished per day. Summary statistics ignore years without effort.

Year	SVA	DMV	NJ	LI	SNE	GBK	MNE	Total
1982	7	7137	14603					21747
1983		7149	13971	50	1538			22708
1984	16	11575	16131		2630			30352
1985	224	11039	19634	95	2267			33260
1986		12701	14877	374	1179			29131
1987		15841	14720	807	1342			32710
1988	64	19137	11620	616	1641			33079
1989		12139	24293	798	2330			39560
1990	25	8166	29327	1282	1838		286	40924
1991		12048	30397	1844	1433		17110	62832
1992		5513	15998	13148	1964		13424	50047
1993		4622	25457	12883	1783		5720	50465
1994		2263	20566	19187	2084		5062	49162
1995		1621	13598	16015	8561		5731	45526
1996		1523	9352	10252	11881		8415	41424
1997		2742	9382	8295	13515		11734	45668
1998		3231	6996	10528	10659		11652	43066
1999		2601	7639	9151	12284		10844	42519
2000		2555	8087	7178	10702	64	12400	40986
2001		2240	11192	8063	11770	23	13533	46820
2002		4298	6695	11626	7811		16809	47239
2003		2622	10772	16147	4611		17869	52021
2004		2495	7905	14608	6642		19000	50650
2005		3448	1974	12533	4048		16920	38923
2006		1811	1386	14511	3314		14641	35663
2007		346	3719	15607	4286		13821	37779
2008		934	4710	15243	4182		10749	35818
2009		790	5335	10868	7045	30	9634	33703
2010		1709	6416	12827	5141	20	9423	35536
2011		970	4776	14163	3712		9058	32679
2012		581	3480	16583	4648	154	7580	33027
2013			848	16168	7643	190	6306	31155
2014		85	1424	17422	5372	511	5032	29846
2015			2025	17268	4546	92	5704	29636
2016		220	1659	11969	3844	61	3158	20910
min	7	85	848	50	1179	20	286	20910
max	224	19137	30397	19187	13515	511	19000	62832
mean	10	4768	11011	9108	4785	31	7586	38473

Table 7: Nominal landings per unit effort (LPUE, bushels h^{-1}) for ocean quahog fishing (all vessels) in the US EEZ from logbooks. LPUE is total landings in bushels divided by total hours fished. Landings and fishing effort from unknown areas were prorated to area before LPUE was calculated. Summary statistics ignore years without fishing.

Year	SVA	DMV	NJ	LI	SNE	GBK	MNE	Total
1982	85.7	64.8	58.7					60.7
1983		77	60.2	42	41.7			64.2
1984	37.5	66.1	58.5		33.3			59.2
1985	79	72	60	46.3	33.7			62.3
1986		67.2	63.1	109.6	49.4			64.9
1987		66.6	61.7	146.5	51.9			65.8
1988	65.6	61.3	60.4	104.1	51.3			61.3
1989		53.1	58.1	75.9	51.4			56.5
1990	56	45.1	53.2	57.6	50.8		1	51.2
1991		40.4	48.2	91.2	60.6		0.6	35.1
1992		43.3	43.5	91.1	58.4		0.6	44.9
1993		42.4	40.2	67.3	57.4		1	43.3
1994		44	33.9	62.9	46		1.3	42.7
1995		43.4	39.6	59.8	63.6		2	46.4
1996		48.7	52.4	58.5	70.9		1.7	48.4
1997		39.5	45.6	62.7	67.1		1.9	43
1998		42.9	38.9	66.1	64.1		1.9	41.6
1999		42.6	40.5	70.4	54.8		2.6	40.9
2000		42.4	42.4	68.3	49.1	79.7	2.9	35.9
2001		43	43.9	76	42.9	60.9	2.4	36.5
2002		41.3	42.6	80.3	51		2.3	38
2003		35	35	73.7	48.3		2	36.2
2004		25.5	35.5	74.5	50.2		1.6	34.9
2005		27	34.7	79.4	51.1		1.8	35
2006		28	34.6	78.5	57.2		2.5	40
2007		29.5	42.9	73.7	55		2.2	41.2
2008		28.6	36.9	75	54.6		1.9	43.9
2009		27	45.8	79.9	61.7	56.7	1.7	46.6
2010		25.3	36.5	77.9	68.2	65	1.8	45.8
2011		30.3	39.7	73.3	47.5		2.2	43.9
2012		28.7	41	71.4	49.8	68.8	3	48
2013			42.8	62.1	54.4	87.4	2.8	47.3
2014		16.5	38	60	52.4	133.3	2.7	48.6
2015			33.7	61.8	48.6	88	2.2	46
2016		28.2	50.8	56.2	47.4	150.8	2.2	45.6
min	37.5	16.5	33.7	42	33.3	56.7	0.6	34.9
max	85.7	77	63.1	146.5	70.9	150.8	3	65.8
mean	64.8	42.9	45.5	73.8	52.8	87.8	2	47

Table 8: Real and nominal exvessel prices and revenues (millions of dollars) for ocean quahog based on dealer data. Average price (dollar per bu) was computed as total revenues divided by total landed meat weight during each year, rather than as annual averages of prices for individual trips, to reduce effects of small deliveries at relatively high prices. The consumer price index (CPI) used to convert nominal dollars to 2009 equivalent dollars is for unprocessed and packaged fish, which includes shellfish and finfish (Eric Thunberg, NEFSC, pers. comm.).

Year	CPI	Nominal_Prices	Real_Prices	Nominal_Revenue	Real_Revenue
1982	0.45	3.06	6.80	11.12	24.72
1983	0.46	3.06	6.58	10.91	23.50
1984	0.48	3.06	6.31	12.10	24.97
1985	0.50	3.07	6.12	14.91	29.73
1986	0.51	3.46	6.78	15.72	30.76
1987	0.53	3.30	6.23	16.51	31.17
1988	0.55	3.22	5.84	14.92	27.05
1989	0.58	3.21	5.56	16.39	28.35
1990	0.61	3.47	5.70	16.25	26.68
1991	0.63	3.67	5.78	17.89	28.17
1992	0.65	3.83	5.85	19.30	29.51
1993	0.67	4.15	6.16	22.71	33.72
1994	0.69	4.02	5.83	18.77	27.17
1995	0.71	4.31	6.07	22.10	31.11
1996	0.73	4.51	6.16	20.98	28.68
1997	0.75	4.54	6.06	19.93	26.63
1998	0.76	4.60	6.05	18.36	24.16
1999	0.78	4.79	6.17	18.54	23.86
2000	0.80	5.17	6.44	16.98	21.15
2001	0.83	6.28	7.61	23.87	28.91
2002	0.84	6.37	7.60	25.49	30.39
2003	0.86	6.22	7.25	26.03	30.34
2004	0.88	6.02	6.84	23.65	26.85
2005	0.91	6.10	6.70	18.56	20.38
2006	0.94	6.09	6.48	19.42	20.66
2007	0.97	5.94	6.15	20.61	21.32
2008	1.00	5.92	5.90	20.35	20.28
2009	1.00	6.28	6.28	21.92	21.92
2010	1.02	6.43	6.32	23.18	22.80
2011	1.05	6.95	6.63	22.09	21.07
2012	1.07	7.37	6.88	25.87	24.17
2013	1.09	7.33	6.75	23.65	21.78
2014	1.10	7.59	6.88	23.84	21.60
2015	1.10	7.89	7.15	23.67	21.46

Table 9: Numbers of commercial trips sampled and numbers of ocean quahog measured in port samples from landings during 1982-2016, by region.

	DMV		NJ		LI		SNE		GBK	
Year	Lengths	Trips	Lengths	Trips	Lengths	Trips	Lengths	Trips	Lengths	Trips
1982										
1983										
1984										
1985										
1986										
1987										
1988							30	1		
1989							310	10		
1990							796	25		
1991							634	21		
1992					240	13	822	27		
1993							761	25		
1994	180	6	30	1	1845	100				
1995	570	19								
1996	390	13	420	14	1496	77	540	31		
1997	960	32	420	14	1145	64	839	46		
1998	690	23	600	20	1713	100	582	33		
1999	660	22	780	26	3003	156	820	47		
2000	120	4	510	17	2167	109	1584	84		
2001	390	13	390	13	1862	97	1813	96		
2002	360	21	15	1	1705	92	2021	110		
2003	368	20	77	4	2074	113	1177	66		
2004			53	3	1276	73	781	43		
2005	75	4	188	10			812	46		
2006	40	2	181	10			595	33	33	2
2007	164	9	384	21	30	1	541	30		
2008	107	6	477	26	1012	32	705	40		
2009	144	7	394	20	480	16				
2010	23	1	411	20	1440	48			10	1
2011			117	6	390	13			41	2
2012			162	9	180	6				
2013			168	9	150	5			33	2
2014			65	4	990	33			161	8
2015					240	13	30	1	17	1
2016					1166	64	310	10	19	1
min	23	1	15	1	30	1	30	1	10	1
max	960	32	780	26	3003	156	2021	110	161	8
mean	328	13	292	12	1172	58	786	39	45	2

Table 10: Number of successful random tows in NEFSC clam surveys used for survey trends and efficiency corrected swept area biomass. 'Holes' (unsampled survey strata in some years) were filled by borrowing from adjacent surveys where possible (borrowed totals are negative numbers in gray shaded boxes). Holes that could not be filled are shown by black boxes. Survey strata are grouped by region. Starting in 2012 not all regions were sampled in each survey year. Instead the survey was conducted more often, but over less of the stock area. Areas intentionally not sampled are left blank in those years. For example, 2014 was not intended to be a survey year, but some strata were sampled in order to fill holes left over from 2013. SNE was surveyed in 2013 (except stratum 96, which was surveyed in 2014), but the survey results were borowed to 2012 and not used in 2013. Survey strata not used for ocean quahogs are not shown.

Strata	1982	1983	1984	1986	1989	1992	1994	1997	1999	2002	2005	2008	2011	2012	2013	2014	2015	2016
SVA																		
5	4	9	13	8	8	8	7	8	-16	8	8	-17	9	8			6	
6	1	1	1	1	1	1	1	1	-3	2	1	-1	0	0			0	
DMV																		
9	30	26	35	29	37	37	39	39	38	39	36	26	15	9			9	
10	2	2	3	3	3	3	3	3	3	3	3	1	4	3			4	
11	2	2	-4	2	2	2	2	2	2	2	2	-6	4	4			2	
13	19	18	25	20	20	20	21	22	19	20	18	14	6	5			4	
14	2	2	2	3	3	3	5	3	3	3	3	-25	22	6			8	
15	4	4	-8	4	4	4	5	4	5	4	4	-9	5	5			3	
NJ																		
17	11	11	17	12	12	12	12	14	12	12	12	11	5	5			4	
18	3	3	-6	3	3	3	3	3	3	3	3	3	5	4			3	
19	3	3	-6	3	2	3	3	3	3	3	3	0	4	5			3	
21	16	18	21	19	20	20	23	26	38	29	20	26	15	9			8	
22	3	3	-6	3	3	3	5	3	3	3	3	2	5	4			3	
23	7	6	-11	5	4	5	5	5	5	5	5	1	4	5			-5	
25	9	9	13	8	9	9	9	12	8	9	8	13	8	4			24	
26	2	2	-5	3	3	3	3	3	3	3	3	3	2	3			3	
27	4	4	-8	4	4	4	4	4	4	4	3	2	4	5			2	
87	8	7	10	9	9	9	9	9	8	16	7	8	5	10			3	
88	15	15	24	17	20	20	19	21	23	20	15	17	6	7			4	
89	14	15	21	15	18	17	17	19	18	18	8	14	4	5			11	
90	2	2	3	2	2	2	2	2	2	2	2	1	4	3			12	
LI																		
29	10	10	-20	10	10	10	10	10	11	10	10	15	9	5			2	
30	6	8	-14	6	6	6	6	6	7	6	7	10	4	5			3	

Table 10 Continued

31	9	7	-12	5	7	8	8	8	9	8	10	5	8	4			3	
33	4	4	-8	4	4	4	5	4	4	4	4	10	4	4			3	
34	2	2	-4	2	2	2	5	2	2	2	2	8	6	6			3	
35	4	2	-4	2	5	6	6	6	6	6	6	6	5	4			-4	
91	2	2	4	4	3	3	3	3	3	3	2	4	11	4			13	
92	2	2	3	2	2	2	2	2	2	2	2	5	11	7			5	
93	1	1	2	1	1	1	1	1	1	2	1	4	6	4			7	
SNE																		
37	7	4	-7	3	-6	3	5	4	4	3	-3	-2	2	-2	2		2	
38	3	2	-5	3	3	3	5	3	3	3	2	3	6	-6	6		2	
39	6	4	-6	2	5	5	5	5	5	5	5	5	8	-4	4		0	
41	6	5	7	5	6	6	6	6	5	6	6	6	4	-3	3		3	
45	3	7	9	4	4	4	4	4	4	3	3	4	7	-4	4		3	
46	2	5	5	3	2	3	5	3	3	2	3	3	6	-4	4		-3	3
47	4	3	4	2	2	4	5	4	3	1	7	4	8	-10	10		-3	3
94	1	2	-2	0	-1	1	2	2	-4	2	-2	-3	3	0	0		0	
95	4	14	11	4	4	4	4	4	4	4	-7	3	5	-6	6		2	
96	-12	12	-13	1	1	3	2	4	-4	0	-1	1	-1	-2	0	2	-5	5
GBK																		
54	0	-3	3	3	-6	3	3	3	-3	0	-1	1	2		-5	5		8
55	3	-3	-3	3	1	3	3	3	2	2	-4	2	3		7			9
56	0	0	0	0	0	0	0	-4	4	-4	0	0	0		3			2
57	0	0	-2	2	1	2	5	2	2	2	-4	2	8		11			7
58	0	0	0	0	0	0	0	-5	5	-5	0	0	0		6			2
59	1	3	-4	1	2	6	5	5	4	5	-9	4	15		9			14
60	0	0	-2	2	2	-4	2	5	5	5	-9	4	5		3			2
61	8	1	-6	5	-12	7	6	6	6	6	-11	5	5		5			17
62	0	0	-1	1	-1	-4	4	4	4	4	-7	3	4		3			3
65	0	0	-2	2	-4	2	4	3	-4	1	-1	-3	3		4			8
67	0	-5	5	5	7	7	7	7	-7	0	0	0	1		-9	9		7
68	1	-8	7	3	6	6	5	5	-5	0	-6	6	-6		-5	5		13
69	2	5	-11	6	6	6	7	6	7	-7	-2	2	1		3			13
70	1	2	-6	4	-8	4	4	4	3	2	-6	4	19		9			14
71	0	-1	1	3	1	2	3	3	1	2	-3	1	3		3			5

Table 10 Continued

72	2	-10	8	1	8	7	8	8	6	-6	-3	3	4	3	11
73	1	1	-4	3	6	6	6	6	5	6	-8	2	4	6	9
74	3	-4	1	3	-7	4	4	4	3	3	-6	3	10	4	11

Table 11: Trends in abundance and biomass for ocean quahogs > 50 mm SL during 1982-2016 based on NEFSC clam survey data. Survey values are the quahogs caught in the survey dredge. Stock values are the survey values adjusted to account for the selectivity and efficiency of the survey dredge. Fishable values are the stock values adjusted to account for the selectivity of a commercial dredge. Figures include original plus borrowed tows. 'N strata surveyed' includes strata sampled by tows borrowed from the previous and subsequent surveys if needed. Surveys after 2011 were conducted from a commercial platform using a more efficiency dredge and have been italicized to reflect the change in survey gear.

	Survey				**Stock**				**Fishable**						
Year	$\frac{N}{tow}$	CV	$\frac{kg}{tow}$	CV	$\frac{N}{tow}$	CV	$\frac{kg}{tow}$	CV	$\frac{N}{tow}$	CV	$\frac{kg}{tow}$	CV	N tows	Pos. tows	N strata
							SVA								
1982	0	0	0	0	0	0	0	0	0	0	0	0	5	1	2
1983	0	0.58	0	0.58	0	0.58	0	0.58	0	0.58	0	0.58	10	3	2
1984	0	0.85	0	0.87	0	0.84	0	0.87	0	0.85	0	0.87	14	2	2
1986	0	0	0	0	0	0	0	0	0	0	0	0	9	1	2
1989	0	0	0	0	0	0	0	0	0	0	0	0	9	1	2
1992	0		0		0	0	0	0	0	0	0	0	9	0	2
1994	0.01	0.79	0	0.81	0.01	0.78	0	0.8	0.01	0.79	0	0.81	8	2	2
1997	0	0	0	0	0	0	0	0	0	0	0	0	9	1	2
1999	0	0.55	0	0.61	0	0.5	0	0.54	0	0.56	0	0.61	19	2	2
2002	0	1	0	1	0	1	0	1	0	1	0	1	10	1	2
2005	0		0		0	0	0	0	0	0	0	0	9	0	2
2008	0		0		0	0	0	0	0	0	0	0	18	0	2
2011	0		0		0	0	0	0	0	0	0	0	9	0	1
2012	*0*	*0.752*	*0*	*0.752*	*0*	*0.753*	*0*	*0.753*	*0*	*0.751*	*0*	*0.753*	*8*	*2*	*1*
2015	*0*		*0*		*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*6*	*0*	*1*
							DMV								
1982	0.19	0.32	0.01	0.34	0.2	0.31	0.01	0.33	0.18	0.32	0.01	0.34	59	24	6
1983	0.2	0.49	0.01	0.42	0.25	0.52	0.01	0.45	0.2	0.49	0.01	0.42	54	28	6
1984	0.13	0.38	0	0.32	0.16	0.4	0	0.34	0.13	0.37	0	0.32	77	33	6
1986	0.18	0.23	0.01	0.22	0.2	0.24	0.01	0.22	0.17	0.23	0.01	0.22	61	28	6
1989	0.15	0.58	0	0.46	0.2	0.62	0	0.51	0.14	0.56	0	0.45	69	31	6
1992	0.17	0.36	0	0.31	0.2	0.4	0.01	0.33	0.16	0.36	0	0.3	69	25	6
1994	0.09	0.25	0	0.23	0.11	0.27	0	0.24	0.09	0.25	0	0.23	75	28	6
1997	0.11	0.21	0	0.21	0.13	0.22	0	0.21	0.11	0.21	0	0.21	73	28	6
1999	0.07	0.29	0	0.27	0.08	0.29	0	0.27	0.06	0.29	0	0.26	70	23	6

Table 11 Continued

2002	0.08	0.25	0	0.23	0.09	0.26	0	0.23	0.07	0.25	0	0.22	71	19	6
2005	0.05	0.49	0	0.53	0.06	0.45	0	0.5	0.04	0.5	0	0.53	66	21	6
2008	0.04	0.3	0	0.34	0.05	0.26	0	0.32	0.04	0.31	0	0.35	81	43	6
2011	0.04	0.33	0	0.38	0.06	0.29	0	0.35	0.04	0.34	0	0.39	56	36	6
2012	*0.1*	*0.36*	*0*	*0.38*	*0.1*	*0.35*	*0*	*0.37*	*0.1*	*0.37*	*0*	*0.38*	*32*	*22*	*6*
2015	*0.1*	*0.32*	*0*	*0.31*	*0.1*	*0.32*	*0*	*0.31*	*0.1*	*0.32*	*0*	*0.31*	*30*	*21*	*6*
NJ															
1982	0.27	0.2	0.01	0.2	0.31	0.2	0.01	0.2	0.26	0.2	0.01	0.2	97	49	13
1983	0.2	0.21	0.01	0.21	0.23	0.21	0.01	0.21	0.2	0.21	0.01	0.21	98	55	13
1984	0.35	0.24	0.01	0.24	0.4	0.24	0.01	0.24	0.34	0.24	0.01	0.24	151	79	13
1986	0.34	0.23	0.01	0.22	0.38	0.24	0.01	0.22	0.33	0.23	0.01	0.22	103	52	13
1989	0.17	0.22	0	0.22	0.21	0.22	0.01	0.21	0.16	0.22	0	0.22	109	52	13
1992	0.21	0.18	0.01	0.17	0.23	0.18	0.01	0.17	0.2	0.18	0.01	0.17	110	52	13
1994	0.56	0.22	0.02	0.2	0.64	0.22	0.02	0.21	0.54	0.22	0.02	0.2	114	59	13
1997	0.29	0.16	0.01	0.15	0.32	0.16	0.01	0.15	0.28	0.16	0.01	0.15	124	59	13
1999	0.14	0.15	0	0.14	0.17	0.16	0	0.14	0.14	0.15	0	0.14	130	60	13
2002	0.21	0.24	0.01	0.24	0.24	0.22	0.01	0.23	0.21	0.24	0.01	0.24	127	60	13
2005	0.11	0.15	0	0.14	0.15	0.15	0	0.14	0.11	0.15	0	0.14	92	53	13
2008	0.1	0.26	0	0.23	0.14	0.26	0	0.23	0.1	0.26	0	0.23	101	53	12
2011	0.18	0.15	0	0.14	0.24	0.16	0.01	0.14	0.17	0.15	0	0.14	71	51	13
2012	*0.3*	*0.2*	*0*	*0.19*	*0.3*	*0.2*	*0*	*0.19*	*0.3*	*0.19*	*0*	*0.19*	*69*	*41*	*13*
2015	*0.3*	*0.17*	*0*	*0.16*	*0.3*	*0.17*	*0*	*0.16*	*0.3*	*0.17*	*0*	*0.15*	*85*	*60*	*13*
LI															
1982	0.66	0.16	0.02	0.16	1.03	0.16	0.02	0.16	0.61	0.16	0.02	0.16	40	34	9
1983	0.44	0.21	0.01	0.21	0.6	0.22	0.02	0.21	0.42	0.21	0.01	0.21	38	36	9
1984	0.56	0.17	0.02	0.16	0.76	0.18	0.02	0.16	0.53	0.17	0.02	0.16	71	63	9
1986	0.76	0.22	0.02	0.2	1.01	0.22	0.02	0.21	0.71	0.21	0.02	0.2	36	31	9
1989	0.53	0.34	0.01	0.29	0.87	0.38	0.02	0.33	0.49	0.33	0.01	0.28	40	36	9
1992	0.76	0.18	0.02	0.16	1.1	0.2	0.02	0.17	0.71	0.18	0.02	0.16	42	36	9
1994	1.4	0.16	0.04	0.16	1.96	0.18	0.05	0.16	1.31	0.16	0.04	0.16	46	44	9
1997	0.95	0.16	0.03	0.16	1.23	0.17	0.03	0.16	0.9	0.16	0.02	0.16	42	35	9
1999	0.55	0.17	0.02	0.15	0.73	0.19	0.02	0.16	0.52	0.17	0.01	0.14	45	41	9
2002	0.6	0.21	0.02	0.2	0.78	0.21	0.02	0.2	0.57	0.21	0.02	0.2	43	40	9
2005	0.35	0.18	0.01	0.19	0.51	0.19	0.01	0.18	0.33	0.19	0.01	0.2	44	39	9

Table 11 Continued

2008	0.36	0.19	0.01	0.18	0.48	0.21	0.01	0.18	0.35	0.19	0.01	0.18	67	60	9
2011	0.47	0.19	0.01	0.2	0.7	0.2	0.02	0.2	0.44	0.19	0.01	0.2	64	53	9
2012	*1.2*	*0.26*	*0*	*0.24*	*1.3*	*0.27*	*0*	*0.24*	*1*	*0.25*	*0*	*0.22*	*43*	*38*	*9*
2015	*1.2*	*0.27*	*0*	*0.26*	*1.4*	*0.27*	*0*	*0.26*	*1.1*	*0.26*	*0*	*0.25*	*43*	*36*	*9*
SNE															
1982	0.66	0.27	0.02	0.25	0.82	0.28	0.02	0.26	0.63	0.27	0.02	0.25	48	30	10
1983	0.41	0.29	0.01	0.3	0.56	0.31	0.01	0.29	0.39	0.29	0.01	0.3	58	37	10
1984	0.44	0.27	0.01	0.29	0.55	0.26	0.01	0.28	0.43	0.27	0.01	0.29	69	38	10
1986	0.68	0.31	0.02	0.3	0.93	0.35	0.02	0.32	0.65	0.3	0.02	0.3	27	23	9
1989	0.65	0.19	0.02	0.18	0.83	0.2	0.02	0.19	0.62	0.19	0.02	0.18	34	29	10
1992	0.79	0.19	0.02	0.2	0.94	0.19	0.02	0.19	0.76	0.19	0.02	0.2	36	31	10
1994	1.25	0.22	0.03	0.2	1.58	0.25	0.04	0.21	1.19	0.22	0.03	0.2	43	32	10
1997	0.69	0.54	0.01	0.45	1.06	0.61	0.02	0.52	0.64	0.53	0.01	0.43	39	27	10
1999	0.6	0.54	0.02	0.48	0.74	0.56	0.02	0.51	0.57	0.53	0.01	0.48	39	30	10
2002	0.43	0.22	0.01	0.22	0.49	0.22	0.01	0.22	0.42	0.22	0.01	0.22	29	28	9
2005	0.37	0.26	0.01	0.23	0.79	0.42	0.01	0.27	0.34	0.25	0.01	0.22	39	33	10
2008	0.58	0.34	0.01	0.3	1.67	0.64	0.02	0.39	0.51	0.31	0.01	0.3	34	29	10
2011	0.33	0.28	0.01	0.24	0.54	0.32	0.01	0.27	0.31	0.28	0.01	0.23	50	39	10
2012	*0.6*	*0.36*	*0*	*0.31*	*0.7*	*0.38*	*0*	*0.32*	*0.5*	*0.33*	*0*	*0.29*	*41*	*36*	*9*
2015	*0.3*	*0.39*	*0*	*0.39*	*0.3*	*0.39*	*0*	*0.39*	*0.3*	*0.39*	*0*	*0.39*	*23*	*12*	*8*
GBK															
1982	0.62	0.12	0.02	0.11	0.77	0.13	0.02	0.12	0.59	0.12	0.02	0.11	22	16	9
1983	1.07	0.2	0.03	0.2	1.35	0.2	0.03	0.2	1.02	0.2	0.03	0.2	46	18	12
1984	0.61	0.28	0.01	0.26	0.92	0.31	0.02	0.28	0.57	0.27	0.01	0.26	66	29	16
1986	0.66	0.19	0.02	0.18	1.02	0.23	0.02	0.2	0.6	0.18	0.01	0.18	47	21	16
1989	0.22	0.26	0.01	0.25	0.3	0.24	0.01	0.25	0.21	0.26	0	0.26	78	38	16
1992	0.82	0.21	0.02	0.21	1.15	0.19	0.03	0.2	0.77	0.21	0.02	0.21	73	41	16
1994	0.96	0.2	0.03	0.2	1.37	0.19	0.03	0.19	0.91	0.2	0.02	0.2	76	40	16
1997	0.64	0.19	0.02	0.18	0.92	0.19	0.02	0.18	0.6	0.19	0.02	0.19	83	44	18
1999	0.65	0.17	0.02	0.19	0.86	0.16	0.02	0.18	0.61	0.17	0.02	0.19	76	47	18
2002	0.78	0.18	0.02	0.19	1.13	0.15	0.03	0.18	0.73	0.18	0.02	0.19	60	38	15
2005	0.78	0.2	0.02	0.19	1.42	0.22	0.03	0.2	0.71	0.2	0.02	0.19	80	55	15
2008	0.77	0.3	0.02	0.28	1.64	0.31	0.03	0.29	0.68	0.29	0.01	0.27	45	30	15
2011	0.72	0.23	0.02	0.22	1.39	0.22	0.02	0.22	0.65	0.23	0.01	0.22	93	66	16

Table 11 Continued

2013	*0.9*	*0.17*	*0*	*0.18*	*1.1*	*0.17*	*0*	*0.18*	*0.8*	*0.18*	*0*	*0.18*	*98*	*64*	*18*
2016	*1.5*	*0.14*	*0*	*0.12*	*1.8*	*0.15*	*0*	*0.12*	*1.2*	*0.13*	*0*	*0.1*	*155*	*100*	*18*
SVAtoSNE															
1982	0.42	0.12	0.01	0.12	0.56	0.12	0.01	0.12	0.4	0.12	0.01	0.12	249	138	40
1983	0.3	0.14	0.01	0.14	0.39	0.15	0.01	0.14	0.28	0.14	0.01	0.14	258	159	40
1984	0.36	0.12	0.01	0.13	0.46	0.12	0.01	0.12	0.35	0.12	0.01	0.13	382	215	40
1986	0.47	0.14	0.01	0.13	0.6	0.16	0.02	0.14	0.44	0.14	0.01	0.13	236	135	39
1989	0.35	0.15	0.01	0.13	0.49	0.18	0.01	0.14	0.33	0.15	0.01	0.13	261	149	40
1992	0.45	0.11	0.01	0.1	0.57	0.12	0.02	0.11	0.43	0.11	0.01	0.1	266	144	40
1994	0.79	0.12	0.02	0.11	1.02	0.13	0.03	0.11	0.76	0.11	0.02	0.11	286	165	40
1997	0.48	0.2	0.01	0.15	0.64	0.25	0.02	0.18	0.46	0.19	0.01	0.14	287	150	40
1999	0.32	0.25	0.01	0.21	0.4	0.26	0.01	0.22	0.3	0.25	0.01	0.21	303	156	40
2002	0.31	0.12	0.01	0.12	0.38	0.13	0.01	0.12	0.3	0.12	0.01	0.12	280	148	39
2005	0.21	0.13	0.01	0.12	0.36	0.23	0.01	0.14	0.2	0.13	0.01	0.12	250	146	40
2008	0.26	0.19	0.01	0.15	0.56	0.46	0.01	0.22	0.24	0.18	0.01	0.15	301	185	39
2011	0.25	0.13	0.01	0.11	0.37	0.14	0.01	0.12	0.23	0.12	0.01	0.11	250	179	39
2012	*0.5*	*0.17*	*0*	*0.14*	*0.6*	*0.18*	*0*	*0.15*	*0.4*	*0.16*	*0*	*0.14*	*193*	*139*	*38*
2013	*0.6*	*0.36*	*0*	*0.31*	*0.7*	*0.38*	*0*	*0.32*	*0.6*	*0.33*	*0*	*0.29*	*39*	*36*	*8*
2015	*0.4*	*0.18*	*0*	*0.16*	*0.5*	*0.18*	*0*	*0.16*	*0.4*	*0.17*	*0*	*0.16*	*187*	*129*	*37*
2016	*0.2*	*0.77*	*0*	*0.81*	*0.3*	*0.76*	*0*	*0.8*	*0.2*	*0.78*	*0*	*0.82*	*11*	*3*	*3*

Table 12: Shell length composition data used to estimate dredge selectivity for ocean quahog between 2012 and 2016. Number of animals caught (no.) and positive stations (pos.) for the modified commercial dredge used for the NEFSC survey and a lined dredge presumed to catch all animals available.

SL group	Lined no.	Survey no.	Lined pos.	Survey pos.
0-10	4	0	2	0
10-20	24	0	5	0
20-30	119	0	9	0
30-40	342	4	12	1
40-50	541	51	16	3
50-60	1805	265	18	9
60-70	7772	2822	20	19
70-80	4287	6153	20	20
80-90	3985	11465	20	20
90-100	2556	9638	20	20
100-110	916	3354	18	20
110-120	205	685	14	15

Table 13: Numbers of ocean quahogs in survey dredge selectivity experiments by length bin and station between 2012 and 2016. For example, 3:8 in the row corresponding to SL bin 40−50, 3 ocean quahogs between 40 and 50 mm were caught in the survey dredge and 8 ocean quahogs were caught in the selectivity dredge at that station. Column labels identify the selectivity experiment.

SL bin	2012108	2012117	2012127	2012136	2012150	2012162
0-10	0:0	0:0	0:0	0:0	0:0	0:0
10-20	0:0	1:0	6:0	0:0	0:0	0:0
20-30	0:0	1:0	5:0	0:0	0:0	0:0
30-40	0:0	5:0	15:0	0:0	3:0	0:0
40-50	0:5	5:0	39:14	4:0	12:0	1:0
50-60	1:0	1:5	15:56	12:0	4:0	3:0
60-70	13:50	13:20	19:126	92:42	23:16	19:1
70-80	41:525	10:105	35:644	144:372	18:28	186:113
80-90	224:655	34:240	125:1820	62:102	83:192	300:170
90-100	342:780	89:580	104:1778	162:333	102:576	121:87
100-110	98:560	19:305	24:294	152:381	28:324	31:17
110-120	4:115	0:20	2:42	40:162	2:88	9:2

SL bin	2012170	2012178	2012182	2012184	2013013	2013046	2013059
0-10	0:0	0:0	1:0	0:0	0:0	0:0	0:0
10-20	0:0	0:0	9:0	0:0	0:0	0:0	0:0
20-30	2:0	2:0	33:0	0:0	0:0	0:0	0:0
30-40	7:0	1:0	88:0	2:0	0:0	2:0	27:0
40-50	3:0	1:0	43:0	12:0	0:0	3:0	56:0
50-60	1:0	0:0	15:6	11:4	4:0	5:0	66:0
60-70	2:20	5:16	11:91	43:40	4:28	32:72	195:15
70-80	58:240	48:206	63:139	148:328	8:42	49:296	353:370
80-90	157:460	76:302	209:452	234:624	66:427	174:732	731:1205
90-100	139:615	48:166	172:364	134:340	146:1176	86:276	287:380
100-110	65:245	14:86	57:246	32:80	46:287	13:32	20:35
110-120	5:15	0:10	3:31	1:4	3:21	1:0	4:20

SL bin	2013067	2015059	2015113	2016077	2016116	2016117	2016175
0-10	0:0	3:0	0:0	0:0	0:0	0:0	0:0
10-20	0:0	6:0	0:0	0:0	0:0	0:0	2:0
20-30	1:0	10:0	0:0	0:0	1:0	0:0	64:0
30-40	8:0	32:0	0:0	0:0	0:0	0:0	152:4
40-50	25:0	86:0	0:0	0:0	28:0	134:0	89:32
50-60	21:0	87:10	0:0	15:6	195:12	1116:160	233:6
60-70	36:33	55:30	1:0	303:138	660:188	5112:1880	1134:16
70-80	126:270	84:150	6:2	840:666	363:364	960:1180	747:113
80-90	361:924	102:195	33:20	168:810	204:572	525:1360	117:203
90-100	111:421	305:590	44:55	54:588	68:296	24:180	18:57

Table 13 Continued

100-110	9:28	132:265	122:67	6:78	0:12	48:10	0:2
110-120	3:0	27:25	101:118	0:12	0:0	0:0	0:0

Table 14: Results from generalized additive model fits to selectivity data. The response variable is number of ocean quahogs caught in the survey dredge (a modified commercial dredge) compared to the number of ocean quahogs caught in a lined dredge. The predictors are length bin (L), and year−station (YrSta). Some models included an offset based on the tow distance at each station. The s indicates a smooth function and RE indicates random effects. The best model by AIC included random effects for each year−station combination in both intercept and length.

Model	AIC	BIC
s(L)+s(YrSta,RE)+s(YrSta,L,RE)	2173	2318
s(L)+s(YrSta,RE)	2913	2999
s(L)+s(YrSta,RE)+offset	2913	2999
s(L)	7766	7792
s(L)+offset	9545	9570

Table 15: The selectivity coefficients estimated using the best (by AIC) selectivity model.

Length	Selx	se	uci	lci
5	0.000	1.000	0.036	0.000
11	0.000	0.999	0.024	0.000
16	0.000	0.992	0.018	0.000
22	0.001	0.967	0.016	0.000
27	0.002	0.908	0.021	0.000
33	0.010	0.839	0.051	0.002
38	0.044	0.791	0.148	0.012
44	0.139	0.755	0.332	0.050
49	0.273	0.719	0.489	0.128
55	0.397	0.678	0.581	0.239
61	0.523	0.639	0.660	0.382
66	0.653	0.609	0.746	0.548
72	0.767	0.596	0.829	0.691
77	0.835	0.607	0.886	0.766
83	0.863	0.636	0.916	0.783
88	0.871	0.672	0.933	0.767
94	0.875	0.710	0.945	0.741
99	0.888	0.747	0.959	0.727
105	0.909	0.782	0.973	0.735
111	0.932	0.814	0.984	0.759

Table 16: Results from model fits to predict meat weight. Predictors are ln(shell length) (L), ln(depth) (D), density (ρ) and region (R). Random effects are enclosed in parentheses. Regional coefficients are shown. DMV is assumed to have coefficient equal to 0.

Formula	int	L	D	ρ	R	AIC	BIC
L+D+Density+R+(L+St)+(L+Year)	-7.68 (0.041)	2.57 (0.07)	0.01 (0.024)	-0.009 (0.004)	X	24600	24686
L+R+(L+St)+(L+Year)	-7.68 (0.041)	2.57 (0.069)			X	24602	24676
L+D+R+(L+St)+(L+Year)	-7.61 (0.041)	2.57 (0.069)	-0.02 (0.022)		X	24604	24684
L+R+(L+St)	-7.67 (0.029)	2.58 (0.034)			X	24684	24739
L+D+R+(L+St)	-7.6 (0.029)	2.58 (0.034)	-0.02 (0.024)		X	24685	24747
L+D+(L+St)+(L+Year)	-7.59 (0.036)	2.58 (0.077)	-0.05 (0.018)			29739	29796
L+(L+St)+(L+Year)	-7.83 (0.038)	2.59 (0.076)				29746	29797
L+Density+(L+St)	-7.7 (0.007)	2.59 (0.031)		-0.02 (0.003)		29933	29972
L+D+(L+St)	-7.77 (0.008)	2.57 (0.031)	-0.12 (0.019)			29949	29987
L+(L+St)	-7.83 (0.008)	2.59 (0.031)				29984	30016
L+D+(St)	-7.2 (0.007)	2.55 (0.017)	-0.12 (0.021)			30721	30747
L+(St)	-7.72 (0.007)	2.56 (0.017)				30753	30772

Formula	NJ	LI	SNE	GBK
L+D+Density+R+(L+St)+(L+Year)	-0.02 (0.029)	-0.05 (0.031)	-0.04 (0.032)	-0.09 (0.035)
L+R+(L+St)+(L+Year)	-0.02 (0.029)	-0.06 (0.031)	-0.05 (0.032)	-0.11 (0.034)
L+D+R+(L+St)+(L+Year)	-0.02 (0.029)	-0.06 (0.031)	-0.05 (0.032)	-0.1 (0.035)
L+R+(L+St)	-0.05 (0.031)	-0.09 (0.032)	-0.1 (0.032)	-0.2 (0.031)
L+D+R+(L+St)	-0.05 (0.031)	-0.09 (0.032)	-0.1 (0.032)	-0.2 (0.032)
L+D+(L+St)+(L+Year)				
L+(L+St)+(L+Year)				
L+Density+(L+St)				
L+D+(L+St)				
L+(L+St)				
L+D+(St)				
L+(St)				

Table 17: Predictor variables used in random forest regression trees for ocean quahog. NAMERA is the Northwest Atlantic Marine Ecoregional Assessment project.

Variable name	Full name	Description
depth	Depth at station or lat/lon position	Measured at station for model fitting, raster derived for predictions
fallBT	Fall bottom temperatures	Interpolated from bottom trawl survey data
springBT	Spring bottom temperatures	Interpolated from bottom trawl survey data
rugosity	Rugosity	Ratio of real to geometric area (Friedman et al. 2012)
namera vrm	Vector ruggedness measure	Variation around plane fit to bathymetry (NAMERA , Sappington et al. (2007))
namera bpi	Bathmetric position index	Ratio elevation of inner 5 m circular area to surrounding 50 m circular area (NAMERA , Lundblad et al. (2006))
soft sed	Soft sediments	Classify soft sediments ($<$ 2 mm) by grain size (500 m resolution)
seabedforms	Topography	Seabed position and slope (NAMERA)
sst9kmfronts	SST fronts	Mean gradient magnitude sea surface temperature based on MODIS-terra 9km monthly data
chl9km	Chlorophyl concentration	Mean chlorophyll concentration based on MODIS-aqua 9km monthly data
chl9kmfronts	Chlorophyl fronts	Mean gradient magnitude chlorophyll concentration based on MODIS-aqua 9km monthly data

Table 18: Correlations among predictor variables in tree models for ocean quahog survey catches in the GBK (top) and SNE+LI (bottom) regions during 1997-2011. Correlations with absolute value > 0.3 are highlighted.

Variable	lat	lon	depth	namera vrm	namera bpi	rugosity	mab sed	soft sed	fallBT	
					GBK					
fallBT	-0.70									
springBT	0.27	-0.27								
rugosity	0.03	-0.07	0.18							
namera vrm	-0.36	0.30	0.04	0.06						
namera bpi	-0.06	-0.35	0.31	0.17	0.09					
soft sed	-0.44	0.28	0.09	-0.03	0.30	-0.02				
seabedforms	-0.08	-0.09	0.09	-0.04	0.28	0.53	-0.01			
sst9kmfronts	0.34	-0.23	0.23	0.13	-0.24	0.21	-0.23	-0.02		
chl9km	-0.81	0.61	-0.04	-0.01	0.47	-0.02	0.50	0.00	-0.56	
chl9kmfronts	-0.58	0.37	0.05	0.08	0.05	0.20	0.19	-0.04	0.11	0.48
					SNE+LI					
fallBT	-0.85									
springBT	0.82	-0.80								
rugosity	-0.25	0.27	-0.16							
namera vrm	-0.11	0.06	-0.04	0.13						
namera bpi	-0.04	-0.09	0.18	0.17	0.12					
soft sed	-0.13	0.12	-0.12	0.10	0.16	-0.04				
seabedforms	0.15	-0.21	0.23	0.04	0.31	0.55	0.05			
sst9kmfronts	-0.19	0.31	-0.23	0.28	0.23	0.00	0.12	0.08		
chl9km	-0.63	0.65	-0.45	0.22	0.06	-0.03	0.02	-0.17	0.11	
chl9kmfronts	-0.63	0.69	-0.48	0.24	0.02	-0.04	-0.01	-0.20	0.12	0.94

Table 19: Random forest regression tree results for models fit to ocean quahog survey data from the GBK and SNE+LI regions during 1997-2011.

Statistic	GBK	SNE+LI
N	381	669
Number trees	500	500
Cross validated %Deviance explained	67%	44%
R^2	94%	89%
Predictor variable	Importance	
depth	2	3
fallBT	4	7
springBT	7	5
rugosity	9	8
namera vrm	8	2
namera bpi	10	10
soft sed	3	9
seabedforms	11	11
sst9kmfronts	5	4
chl9km	1	1
chl9kmfronts	6	6

Table 20: Structure of SS3 models used for ocean quahog.

Model aspect	Value	Note
M	0.02	Constant for all ages and years
Age bins	0–300	
Length bins	1–12 cm	
Time	1982–2016	
Seasons/morphs/areas	1/1/2	
Recruitment allocation to areas	Proportion followed a random walk	
Growth	Von Bert.	Priors from field estimates, publications
Commercial fleets	1 per area	
Fishery selectivity	Logistic	Priors from field estimates
Surveys (trend)	3	RD (trend), RD (scale), MCD (scale and trend)
Survey selectivity (RD)	Logistic	Priors from field estimates
Survey selectivity (MCD)	Logistic	Priors from field estimates
Survey catchability (RD-SWAN)	Estimated	Priors from field estimates
Survey catchability (MCD)	Estimated	Priors from field estimates
Recruitment model	Beverton-Holt	Fixed steepness, estimated R_0 and variance
Recruit dev years	1900–2016	
Bias adjustment parameters	1900,1990,2011,2015,0.0001	Not used due to lack of data
F method	Hybrid	6 iterations (exact F)

Table 21: Selected parameters estimated internally and externally in SS3 base model for ocean quahog. S and N refer to southern and northern areas. Numbers of parameters are summarized in the last rows.

Parameter	Value	Note
M	0.02	Fixed
Length at age 10	5.268	Fixed at prelim. solution
Length at age 300	8.651	Estimated with prior
Von Bertalanffy K	0.083	Fixed at prelim. solution
CV of size at age 10 y	0.106	Estimated with prior
CV of size at age 300 y	0.201	Estimated with prior
Shell length to meat weight multiplier	0.00011	Fixed
Shell length to meat weight exponent	2.733	Fixed
Age at 50% maturity	6	Fixed
Slope of maturity curve	-1.5	Fixed
Spawner recruit R_0	14.975	Estimated
Spawner recruit steepness	0.95	Fixed
Spawner recruit sd	0.907	Estimated with prior
Catchability (RD) S	0.36	Estimated with prior
Catchability (MCD) S	0.906	Estimated with prior
Catchability (RD) N	0.213	Estimated with prior
Catchability (MCD) N	0.642	Estimated with prior
Fishery selectivity inflection S	8	Estimated with prior
Fishery selectivity width S	1.913	Estimated with prior
Fishery selectivity inflection N	8	Estimated with prior
Fishery selectivity width N	1.47	Estimated with prior
Survey (RD) selectivity inflection S	7.982	Estimated with prior
Survey (RD) selectivity width S	3.555	Estimated with prior
Survey (RD) selectivity inflection N	6.103	Estimated with prior
Survey (RD) selectivity width N	2.229	Estimated with prior
Survey (MCD) selectivity inflection S	7.642	Estimated with prior
Survey (MCD) selectivity width S	1.787	Estimated with prior
Survey (MCD) selectivity inflection N	6.843	Estimated with prior
Survey (MCD) selectivity width N	1.176	Estimated with prior
Initial F S	0.01	Fixed (0.0 in N)
Total estimated (-recruit deviations)	57	
Recruit deviations	35	
Total estimated	92	

Table 22: Likelihood profile over unfished recruitment parameter (R0). The values in the table are the differences, in likelihood units, between each profile run and the minimum likelihood for that row (likelihood component). Conflicts within the data are apparent when the minimum likelihood values (gray cells) occur in different columns for each row. That is, different likelihood components within the model were minimized at different values of R0. Because R0 is important for setting the scale of estimated biomass in the model (Relative B; last row), data conflicts around R0 tend to increase uncertainty in scale. The coloumn corresponding to the minimum total likelihood is shown in italics.

ln(R0)	14.5	14.75	*15.1*	15.25	15.50	16.00
Total	178.9	33.3	*0*	1.2	5.0	10.8
Parm priors	29.5	16.3	*0*	1.1	4.5	5.6
ComLen	41	1.7	*0*	0.2	0.8	1.6
Relative B	1	1.2	*3.9*	5.5	9.4	22.4

Table 23: Fishing mortality estimates from the ocean quahog assessment base model, including lower and upper 95% confidence bounds.

Year	F	CV	Lower	Upper
1982	0.004	0.147	0.003	0.005
1983	0.004	0.147	0.003	0.005
1984	0.005	0.146	0.003	0.006
1985	0.005	0.146	0.004	0.007
1986	0.005	0.146	0.004	0.006
1987	0.006	0.146	0.004	0.007
1988	0.005	0.146	0.004	0.007
1989	0.006	0.146	0.004	0.008
1990	0.006	0.145	0.004	0.007
1991	0.006	0.145	0.004	0.008
1992	0.006	0.145	0.004	0.008
1993	0.006	0.145	0.004	0.008
1994	0.006	0.145	0.004	0.007
1995	0.006	0.145	0.004	0.007
1996	0.006	0.145	0.004	0.007
1997	0.005	0.144	0.004	0.007
1998	0.005	0.144	0.004	0.006
1999	0.005	0.144	0.004	0.006
2000	0.004	0.144	0.003	0.005
2001	0.005	0.144	0.004	0.006
2002	0.005	0.143	0.004	0.007
2003	0.006	0.143	0.004	0.007
2004	0.005	0.143	0.004	0.007
2005	0.004	0.143	0.003	0.005
2006	0.004	0.143	0.003	0.005
2007	0.005	0.143	0.003	0.006
2008	0.005	0.143	0.003	0.006
2009	0.005	0.143	0.003	0.006
2010	0.005	0.143	0.004	0.006
2011	0.004	0.144	0.003	0.006
2012	0.005	0.144	0.004	0.006
2013	0.005	0.144	0.003	0.006
2014	0.005	0.145	0.003	0.006
2015	0.004	0.147	0.003	0.005
2016	0.005	0.148	0.003	0.006

Table 24: Spawning stock biomass estimates from the ocean quahog assessment base model in mt, including lower and upper 95% confidence bounds.

Year	SSB	CV	Lower	Upper
1982	3525900	0.131	2624026	4427774
1983	3516750	0.130	2619127	4414373
1984	3506110	0.130	2612948	4399272
1985	3491540	0.130	2602999	4380081
1986	3473650	0.130	2589884	4357416
1987	3456320	0.130	2577517	4335123
1988	3435970	0.130	2562241	4309699
1989	3415900	0.130	2547375	4284425
1990	3393490	0.130	2530226	4256754
1991	3371730	0.130	2513783	4229677
1992	3348660	0.130	2496015	4201305
1993	3324960	0.130	2477560	4172360
1994	3301580	0.130	2459333	4143827
1995	3278840	0.130	2441606	4116074
1996	3256000	0.130	2423592	4088408
1997	3234190	0.131	2406384	4061996
1998	3213090	0.131	2389610	4036570
1999	3194050	0.131	2374578	4013522
2000	3176370	0.131	2360520	3992220
2001	3162170	0.131	2349505	3974835
2002	3147930	0.131	2337838	3958022
2003	3135610	0.132	2327331	3943889
2004	3126270	0.132	2318775	3933765
2005	3122830	0.132	2314681	3930979
2006	3128620	0.132	2317950	3939290
2007	3139720	0.132	2324382	3955058
2008	3154130	0.133	2332698	3975562
2009	3170180	0.133	2341923	3998437
2010	3187620	0.134	2351592	4023648
2011	3205130	0.134	2360646	4049614
2012	3224030	0.135	2370715	4077345
2013	3240820	0.136	2378508	4103132
2014	3257400	0.136	2386172	4128628
2015	3272450	0.137	2392555	4152345
2016	3287300	0.138	2399158	4175502

Table 25: Recruitment estimates (000's) from the ocean quahog assessment base model, including lower and upper 95% confidence bounds.

Year	Recruits	CV	Lower	Upper
1980	3187600	0.110	2571852	3950769
1981	3187600	0.110	2571852	3950769
1982	2198530	0.765	581291	8315178
1983	2224500	0.771	583537	8480018
1984	2242940	0.773	586058	8584104
1985	2254470	0.777	586469	8666507
1986	2242700	0.779	581538	8648969
1987	2254460	0.781	582571	8724408
1988	2311800	0.790	590376	9052572
1989	2447260	0.803	613988	9754399
1990	2631030	0.823	642294	10777484
1991	2801130	0.847	662579	11842109
1992	3017060	0.872	690640	13180032
1993	3325120	0.914	722231	15308698
1994	3847200	0.984	766897	19299784
1995	4708490	1.110	813371	27256782
1996	6313770	1.454	781996	50976822
1997	7711710	2.539	479758	123959345
1998	8693030	2.525	544270	138844393
1999	5079540	1.239	767324	33625581
2000	3692050	0.972	746818	18252409
2001	3199810	0.903	704053	14542632
2002	2989080	0.882	676118	13214559
2003	2926690	0.873	669063	12802256
2004	2970910	0.880	673632	13102559
2005	3015440	0.889	676078	13449448
2006	3060550	0.893	682178	13730965
2007	3080050	0.897	683063	13888485
2008	3115900	0.903	685629	14160478
2009	3156150	0.910	688842	14460917
2010	3164900	0.912	689194	14533772
2011	3167950	0.912	689471	14555959
2012	3176470	0.913	690229	14618278
2013	3177350	0.913	690348	14623864
2014	3177580	0.913	690409	14624691
2015	3178000	0.913	690479	14627065
2016	3178140	0.913	690523	14627433

Table 26: Potential $F_{Threshold}$ bounding values derived from MSE, where $SSB_{Cease} = 0.1$, and $SSB_{Target} = 0.4$. The columns are: the number of years of simulated fishing (Years), the growth curve used (Growth), F_{MSY} the F_{Target} that resulted in maximum average yield, and F_{LB} the F_{Target} that resulted in average biomasses closest to the theoretical $SSB_{MSY} = \frac{1}{2} SSB_0$.

	Years	Growth	F_{MSY}	F_{LB}
3	1000	VB	0.019	0.010
4	1000	Tanaka	0.023	0.012

Table 27: Summary stock biomass (mt) and fishing mortality status estimates with cv and approximate 95% confidence intervals, using the current reference points from the previous assessment. The current F reference point was a point estimate with no uncertainty. The current F reference reflected only the exploited stock, which was the southern area only. The northern area has been fished since 2012 and is considered part of the exploited stock here.

	Estimate	CV	LCI	UCI
SSB_{2016}	3287300	0.138	2512199	4301546
SSB Threshold	1410360	0.131	1093237	1819473
F_{2016}	0.005	0.148	0.003	0.006
F Threshold	0.022			

Table 28: Comparison of reference points estimated in an earlier assessment and from the current assessment update. The recommended F reference point is based on an MSE analysis (Hennen 2015) adapted to include new information on growth. MSY values are not based on per recruit modeling, but rather applying F_{MSY} to the unfished biomass, while accounting for natural mortality. Note that biomass values between the two assessments are not directly comparable as the previous assessment used a summary biomass, while the 2017 assessment used spawning biomass (See Figure 122).

	2013	2017
F_{MSY} *proxy*	0.022	0.019 (0.011 - 0.032)
SSB_0 (mt)	3460000	4027170 (3276220 - 4778120)
SSB_{MSY} (mt)	1730000	2013585 (1638110 - 2389060)
$SSB_{Threshold}$ (mt)	1384000	1610868 (1310488 - 1911248)
MSY (mt)		73298
Overfishing	No	No
Overfished	No	No

Table 29: Spawning stock ocean quahog fishing mortality status estimates (based on recommended reference points) with cv and approximate 95% confidence intervals.

	Ratio	CV	LCI	UCI
$\frac{F_{2016}}{F_{Threshold}}$	0.246	0.315	0.134	0.449

Table 30: Spawning stock ocean quahog biomass status estimates (based on recommended reference points) with cv and approximate 95% confidence intervals.

	Ratio	CV	LCI	UCI
$\frac{SSB_{2016}}{SSB_{Threshold}}$	2.04	0.089	1.72	2.43

Table 31: Projected spawning stock biomass (mt) and biomass status ($\frac{SSB}{SSB_{Threshold}}$, where $SSB_{Threshold} = 0.4 * SSB_0$) during 2017-2066 for ocean quahog.

Year	Status Quo	Quota	OFL
	SSB (mt)		
2017	3299930	3299930	3299930
2018	3310860	3302630	3270880
2019	3320590	3304210	3241460
2020	3329230	3304800	3211770
2021	3336870	3304480	3181920
2022	3343620	3303360	3152030
2023	3349560	3301530	3122190
2024	3354780	3299070	3092500
2025	3359330	3296060	3063050
2026	3363300	3292570	3033920
2027	3366730	3288660	3005160
2028	3369690	3284380	2976850
2029	3372210	3279790	2949030
2030	3374350	3274920	2921730
2031	3376150	3269820	2895010
2032	3377630	3264530	2868870
2033	3378840	3259070	2843350
2034	3379790	3253480	2818470
2035	3380530	3247780	2794230
2036	3381060	3242000	2770640
2037	3381430	3236160	2747710
2038	3381630	3230270	2725440
2039	3381700	3224360	2703830
2040	3381650	3218430	2682860
2041	3381490	3212500	2662550
2042	3381230	3206580	2642870
2043	3380890	3200690	2623820
2044	3380480	3194820	2605390
2045	3380010	3188990	2587560
2046	3379480	3183210	2570320
2047	3378900	3177470	2553670
2048	3378280	3171780	2537580
2049	3377620	3166160	2522040
2050	3376940	3160590	2507040
2051	3376230	3155090	2492560
2052	3375500	3149660	2478580
2053	3374750	3144290	2465100
2054	3373990	3138990	2452090
2055	3373210	3133760	2439550
2056	3372430	3128600	2427450
2057	3371640	3123520	2415790

Table 31 Continued

2058	3370850	3118500	2404550
2059	3370050	3113560	2393710
2060	3369260	3108690	2383260
2061	3368460	3103890	2373200
2062	3367660	3099160	2363500
2063	3366870	3094490	2354150
2064	3366080	3089900	2345140
2065	3365290	3085380	2336460
2066	3364510	3080920	2328100

	$\frac{SSB}{SSB_{Threshold}}$		
2017	2.05	2.05	2.05
2018	2.06	2.05	2.03
2019	2.06	2.05	2.01
2020	2.07	2.05	1.99
2021	2.07	2.05	1.98
2022	2.08	2.05	1.96
2023	2.08	2.05	1.94
2024	2.08	2.05	1.92
2025	2.09	2.05	1.90
2026	2.09	2.04	1.88
2027	2.09	2.04	1.87
2028	2.09	2.04	1.85
2029	2.09	2.04	1.83
2030	2.09	2.03	1.81
2031	2.10	2.03	1.80
2032	2.10	2.03	1.78
2033	2.10	2.02	1.77
2034	2.10	2.02	1.75
2035	2.10	2.02	1.73
2036	2.10	2.01	1.72
2037	2.10	2.01	1.71
2038	2.10	2.01	1.69
2039	2.10	2.00	1.68
2040	2.10	2.00	1.67
2041	2.10	1.99	1.65
2042	2.10	1.99	1.64
2043	2.10	1.99	1.63
2044	2.10	1.98	1.62
2045	2.10	1.98	1.61
2046	2.10	1.98	1.60
2047	2.10	1.97	1.59
2048	2.10	1.97	1.58
2049	2.10	1.97	1.57
2050	2.10	1.96	1.56

Table 31 Continued

2051	2.10	1.96	1.55
2052	2.10	1.96	1.54
2053	2.09	1.95	1.53
2054	2.09	1.95	1.52
2055	2.09	1.95	1.51
2056	2.09	1.94	1.51
2057	2.09	1.94	1.50
2058	2.09	1.94	1.49
2059	2.09	1.93	1.49
2060	2.09	1.93	1.48
2061	2.09	1.93	1.47
2062	2.09	1.92	1.47
2063	2.09	1.92	1.46
2064	2.09	1.92	1.46
2065	2.09	1.92	1.45
2066	2.09	1.91	1.45

Table 32: Projected catch (landings + incidental mortality; mt) and fishing mortality status ratio $\frac{F}{F_{Threshold}}$ during 2017-2066 for ocean quahog.

Year	Status Quo	Quota	OFL
	Catch (mt)		
2017	15341	25400	64708
2018	15341	25400	64167
2019	15341	25400	63636
2020	15341	25400	63107
2021	15341	25400	62576
2022	15341	25400	62042
2023	15341	25400	61502
2024	15341	25400	60958
2025	15341	25400	60410
2026	15341	25400	59859
2027	15341	25400	59307
2028	15341	25400	58756
2029	15341	25400	58206
2030	15341	25400	57661
2031	15341	25400	57121
2032	15341	25400	56587
2033	15341	25400	56061
2034	15341	25400	55544
2035	15341	25400	55036
2036	15341	25400	54539
2037	15341	25400	54052
2038	15341	25400	53576
2039	15341	25400	53112
2040	15341	25400	52660
2041	15341	25400	52220
2042	15341	25400	51792
2043	15341	25400	51376
2044	15341	25400	50973
2045	15341	25400	50581
2046	15341	25400	50201
2047	15341	25400	49834
2048	15341	25400	49478
2049	15341	25400	49133
2050	15341	25400	48800
2051	15341	25400	48477
2052	15341	25400	48166
2053	15341	25400	47864
2054	15341	25400	47574
2055	15341	25400	47293
2056	15341	25400	47022
2057	15341	25400	46760

Table 32 Continued

2058	15341	25400	46507
2059	15341	25400	46264
2060	15341	25400	46029
2061	15341	25400	45802
2062	15341	25400	45583
2063	15341	25400	45373
2064	15341	25400	45169
2065	15341	25400	44973
2066	15341	25400	44784

	$\frac{F}{F_{Threshold}}$		
2017	0.251	0.416	1.027
2018	0.249	0.415	1.027
2019	0.248	0.413	1.026
2020	0.246	0.412	1.025
2021	0.245	0.410	1.024
2022	0.243	0.409	1.023
2023	0.242	0.407	1.021
2024	0.240	0.406	1.019
2025	0.239	0.404	1.016
2026	0.237	0.402	1.010
2027	0.235	0.400	1.004
2028	0.233	0.398	0.997
2029	0.233	0.398	0.997
2030	0.233	0.400	0.998
2031	0.234	0.401	1.000
2032	0.234	0.403	1.002
2033	0.234	0.404	1.004
2034	0.234	0.405	1.006
2035	0.234	0.406	1.007
2036	0.234	0.406	1.008
2037	0.234	0.407	1.009
2038	0.234	0.407	1.010
2039	0.234	0.408	1.010
2040	0.234	0.408	1.011
2041	0.233	0.408	1.011
2042	0.233	0.409	1.011
2043	0.233	0.409	1.011
2044	0.233	0.409	1.011
2045	0.233	0.410	1.011
2046	0.233	0.410	1.011
2047	0.232	0.410	1.011
2048	0.232	0.411	1.011
2049	0.232	0.411	1.011
2050	0.232	0.411	1.011

Table 32 Continued

2051	0.232	0.411	1.011
2052	0.232	0.412	1.011
2053	0.232	0.412	1.010
2054	0.231	0.412	1.010
2055	0.231	0.412	1.010
2056	0.231	0.412	1.010
2057	0.231	0.413	1.010
2058	0.231	0.413	1.010
2059	0.231	0.413	1.009
2060	0.231	0.413	1.009
2061	0.230	0.413	1.009
2062	0.230	0.413	1.009
2063	0.230	0.413	1.009
2064	0.230	0.413	1.008
2065	0.230	0.413	1.008
2066	0.230	0.413	1.008

Table 33: Cumulative probability of being in overfished status in any of the years from 2017-2066 under a variety of catch scenarios for ocean quahog.

Catch scenario	$P[Overfished]$	$P[Overfishing]$
Status Quo	0.000	0.000
Quota	0.000	0.000
OFL	0.009	0.680

Table 34: Projected stock status ($\frac{SSB}{SSB_{Threshold}}$ and $\frac{F}{F_{Threshold}}$) during 2017-2066 for ocean quahog from projections based on the entire quota being caught in the southern or northern area, high and low natural mortality, and high and low recruitment scenarios with status quo catch. The results indicate that projected stock status is robust to biomass scale uncertainty.

Year	Quota N	Quota S	High M	Low M	High R	Low R
2017	2.049	2.049	2.194	1.785	2.051	2.051
2018	2.051	2.050	2.202	1.791	2.058	2.058
2019	2.052	2.051	2.210	1.796	2.065	2.065
2020	2.052	2.051	2.216	1.801	2.070	2.070
2021	2.052	2.051	2.221	1.806	2.075	2.075
2022	2.052	2.051	2.226	1.810	2.080	2.080
2023	2.051	2.049	2.230	1.814	2.084	2.084
2024	2.050	2.048	2.233	1.817	2.087	2.087
2025	2.048	2.046	2.236	1.820	2.091	2.089
2026	2.046	2.044	2.238	1.823	2.095	2.091
2027	2.043	2.041	2.240	1.825	2.099	2.092
2028	2.041	2.039	2.241	1.827	2.103	2.092
2029	2.038	2.036	2.242	1.829	2.109	2.091
2030	2.035	2.033	2.243	1.831	2.115	2.089
2031	2.032	2.030	2.243	1.832	2.121	2.086
2032	2.028	2.026	2.243	1.833	2.128	2.083
2033	2.025	2.023	2.243	1.834	2.136	2.078
2034	2.021	2.020	2.243	1.835	2.144	2.073
2035	2.018	2.016	2.243	1.836	2.153	2.068
2036	2.014	2.012	2.243	1.836	2.162	2.061
2037	2.010	2.009	2.242	1.837	2.172	2.055
2038	2.006	2.005	2.242	1.837	2.181	2.048
2039	2.002	2.001	2.241	1.837	2.192	2.040
2040	1.999	1.998	2.240	1.838	2.202	2.032
2041	1.995	1.994	2.239	1.838	2.213	2.024
2042	1.991	1.990	2.239	1.838	2.223	2.016
2043	1.987	1.987	2.238	1.838	2.234	2.008
2044	1.983	1.983	2.237	1.838	2.245	1.999
2045	1.979	1.980	2.236	1.837	2.256	1.990
2046	1.975	1.976	2.235	1.837	2.267	1.982
2047	1.972	1.972	2.234	1.837	2.278	1.973
2048	1.968	1.969	2.233	1.837	2.289	1.964
2049	1.964	1.965	2.232	1.836	2.300	1.955
2050	1.960	1.962	2.231	1.836	2.311	1.946
2051	1.957	1.959	2.230	1.835	2.322	1.937
2052	1.953	1.955	2.229	1.835	2.332	1.928
2053	1.950	1.952	2.228	1.835	2.343	1.920
2054	1.946	1.949	2.227	1.834	2.354	1.911
2055	1.943	1.945	2.226	1.834	2.364	1.902
2056	1.939	1.942	2.225	1.833	2.374	1.894

Table 34 Continued

2057	1.936	1.939	2.225	1.833	2.385	1.885
2058	1.932	1.936	2.224	1.832	2.395	1.877
2059	1.929	1.933	2.223	1.832	2.405	1.868
2060	1.926	1.930	2.222	1.831	2.415	1.860
2061	1.923	1.927	2.221	1.830	2.424	1.852
2062	1.920	1.924	2.220	1.830	2.434	1.844
2063	1.916	1.921	2.219	1.829	2.443	1.836
2064	1.913	1.918	2.219	1.829	2.453	1.828
2065	1.910	1.915	2.218	1.828	2.462	1.821
2066	1.908	1.912	2.217	1.828	2.471	1.813
			$\frac{F}{F_{Threshold}}$			
2017	0.313	0.355	0.222	0.198	0.211	0.211
2018	0.312	0.354	0.221	0.197	0.210	0.210
2019	0.311	0.353	0.219	0.196	0.209	0.209
2020	0.311	0.351	0.217	0.195	0.207	0.207
2021	0.311	0.350	0.216	0.194	0.206	0.206
2022	0.310	0.348	0.214	0.193	0.205	0.205
2023	0.310	0.346	0.213	0.193	0.203	0.203
2024	0.309	0.345	0.211	0.192	0.202	0.202
2025	0.308	0.343	0.210	0.191	0.201	0.201
2026	0.306	0.342	0.208	0.190	0.199	0.199
2027	0.304	0.340	0.207	0.184	0.197	0.198
2028	0.302	0.338	0.205	0.184	0.195	0.195
2029	0.302	0.338	0.205	0.184	0.195	0.195
2030	0.301	0.340	0.205	0.184	0.195	0.196
2031	0.301	0.341	0.206	0.184	0.195	0.196
2032	0.302	0.342	0.206	0.184	0.196	0.196
2033	0.302	0.343	0.206	0.184	0.196	0.197
2034	0.303	0.344	0.206	0.184	0.195	0.197
2035	0.304	0.344	0.206	0.184	0.195	0.197
2036	0.305	0.345	0.206	0.184	0.195	0.198
2037	0.306	0.345	0.206	0.184	0.194	0.198
2038	0.307	0.345	0.206	0.184	0.194	0.198
2039	0.308	0.345	0.206	0.184	0.193	0.198
2040	0.309	0.345	0.205	0.184	0.192	0.199
2041	0.310	0.345	0.205	0.184	0.191	0.199
2042	0.311	0.346	0.205	0.184	0.191	0.199
2043	0.312	0.346	0.205	0.184	0.190	0.200
2044	0.313	0.346	0.204	0.184	0.189	0.200
2045	0.314	0.346	0.204	0.184	0.188	0.201
2046	0.314	0.346	0.204	0.184	0.187	0.201
2047	0.315	0.346	0.204	0.184	0.186	0.202
2048	0.316	0.346	0.203	0.184	0.184	0.203
2049	0.317	0.346	0.203	0.184	0.183	0.204

Table 34 Continued

2050	0.318	0.346	0.203	0.184	0.182	0.205
2051	0.319	0.346	0.203	0.184	0.180	0.206
2052	0.320	0.346	0.203	0.184	0.179	0.207
2053	0.321	0.346	0.202	0.184	0.178	0.208
2054	0.321	0.346	0.202	0.184	0.177	0.209
2055	0.322	0.346	0.202	0.184	0.176	0.210
2056	0.323	0.346	0.202	0.184	0.175	0.211
2057	0.324	0.346	0.201	0.184	0.174	0.212
2058	0.324	0.346	0.201	0.184	0.173	0.213
2059	0.325	0.345	0.201	0.184	0.172	0.214
2060	0.326	0.345	0.201	0.184	0.171	0.215
2061	0.327	0.345	0.201	0.184	0.170	0.215
2062	0.327	0.345	0.200	0.184	0.169	0.216
2063	0.328	0.345	0.200	0.184	0.168	0.217
2064	0.329	0.345	0.200	0.184	0.167	0.218
2065	0.329	0.344	0.200	0.184	0.166	0.219
2066	0.330	0.344	0.200	0.184	0.165	0.220

Table 35: Estimated catch (landings + incidental mortality; mt) at the Overfishing Limit (OFL) from selected years between 2017-2066 for ocean quahog.

Year	Mean	Median	CV	LCI	UCI
2017	65293	64702	0.14	50173	84969
2018	64755	64167	0.14	49760	84269
2019	64225	63642	0.14	49352	83580
2020	63693	63116	0.14	48849	83048
2021	63138	62573	0.14	48423	82324
2026	60410	59846	0.14	46152	79072
2041	52689	52202	0.14	40410	68700
2066	45066	44785	0.11	36138	56199