ATLANTIC SEA SCALLOP TABLES

Table B4-1. US sea scallop landings (mt meats) 1964-2006.

	Gulf of Maine				Georges Bank				S. New England				Mid Atlantic Bight				Total			
Year	dredge	trawl	other	sum	dredge	trawl	other	sum	dredge	trawl	other	sum	dredge	trawl	other	sum	dredge	trawl	other	sum
1964		0	208	208		0	6,241	6,241		52	3	55		0	137	137		52	6,590	6,642
1965		0	117	117		3	1,478	1,481		2	24	26		0	3,974	3,974		5	5,592	5,598
1966		0	102	102		0	883	884		0	8	8		0	4,061	4,061		1	5,055	5,056
1967		0	80	80		4	1,217	1,221		0	8	8		0	1,873	1,873		4	3,178	3,182
1968		0	113	113		0	993	994		0	56	56		0	2,437	2,437		0	3,599	3,599
1969		1	122	123		8	1,316	1,324		0	18	19		5	846	851		14	2,302	2,317
1970		0	132	132		5	1,410	1,415		0	6	6		14	459	473		19	2,006	2,026
1971		4	358	362		18	1,311	1,329		0	7	7		0	274	274		22	1,949	1,971
1972		1	524	525		5	816	821		0	2	2		5	653	658		11	1,995	2,006
1973		0	460	460		15	1,065	1,080		0	3	3		4	245	249		19	1,773	1,792
1974		0	223	223		15	911	926		0	4	5		0	937	938		16	2,076	2,091
1975		6	741	746		13	844	857		8	42	50		52	1,506	1,558		80	3,132	3,212
1976		3	364	366		38	1,723	1,761		4	3	7		819	2,972	3,791		361	5,061	5,422
1977		4	254	258		27	4,709	4,736		1	10	11		255	2,564	2,819		58	7,536	7,595
1978	242	1	0	243	5,532	37	0	5,569	25	2	0	27	4,435	207	0	4,642	10,234	247	0	10,481
1979	401	5	1	407	6,253	25	7	6,285	61	5	0	66	2,857	29	1	2,888	9,572	64	9	9,645
1980	1,489	122	3	1,614	5,382	34	2	5,419	130	3	0	133	2,202	85	79	2,366	9,204	245	83	9,532
1981	1,225	73	7	1,305	7,787	56	0	7,843	68	1	0	69	772	14	2	788	9,852	144	9	10,005
1982	631	28	5	664	6,204	119	0	6,322	126	0	0	126	1,602	6	2	1,610	8,562	153	7	8,723
1983	815	72	7	895	4,247	32	4	4,284	243	1	0	243	3,092	19	10	3,121	8,398	124	21	8,542
1984	651	18	10	678	3,011	29	3	3,043	161	3	0	164	3,695	53	2	3,750	7,518	103	14	7,635
1985	408	3	10	421	2,860	34	0	2,894	77	4	0	82	3,230	49	2	3,281	6,575	90	12	6,677
1986	308	2	6	316	4,428	10	0	4,438	76	2	0	78	3,407	386	6	3,799	8,218	400	12	8,631
1987	373	0	9	382	4,821	30	0	4,851	67	1	0	68	7,639	1,168	1	8,808	12,900	1,199	10	14,109
1988	506	7	13	526	6,036	18	0	6,054	65	4	0	68	6,071	938	8	7,017	12,678	966	21	13,666
1989	600	0	44	644	5,637	25	0	5,661	127	11	0	138	7,894	534	5	8,433	14,258	570	49	14,876
1990	545	0	28	574	9,972	10	0	9,982	110	6	0	116	6,364	541	10	6,915	16,991	558	38	17,587
1991	527	3	75	605	9,235	77	0	9,311	55	16	0	71	6,408	878	14	7,300	16,225	973	89	17,288
1992	676	2	45	722	8,230	7	0	8,238	119	5	0	124	4,562	570	5	5,137	13,587	584	50	14,221
1993	763	2	32	797	3,637	18	0	3,655	65	1	0	66	2,412	393	3	2,808	6,878	413	36	7,327
1994	375	17	0	392	1,191	13	1	1,205	34	1	0	35	5,180	792	0	5,972	6,780	822	1	7,603
1995	446	3	6	455	1,175	17	7	1,199	44	4	0	48	5,750	317	1	6,069	7,416	341	15	7,772
1996	634	9	3	646	1,992	69	0	2,061	78	3	0	82	4,156	759	3	4,918	6,860	840	6	7,706
1997	601	9	12	622	2,030	23	0	2,053	85	2	0	87	2,391	337	0	2,728	5,107	370	13	5,489
1998	474	7	2	483	2,021	18	0	2,039	98	2	0	100	2,356	531	5	2,891	4,948	558	7	5,514
1999	239	2	2	243	5,079	6	0	5,085	80	1	0	80	3,516	890	8	4,414	8,913	899	10	9,822
2000	139	5	1	144	5,016	20	3	5,039	73	2	0	74	7,652	1,200	0	8,852	12,879	1,227	4	14,110
2001	251	8	1	260	4,563	35	0	4,597	28	1	1	29	13,989	1,621	0	15,611	18,830	1,665	2	20,497
2002	492	6	1	499	5,478	63	0	5,541	19	1	0	20	15,435	1,616	5	17,056	21,424	1,687	5	23,117
2003	394	8	1	403	4,799	23	0	4,823	101	2	0	103	18,796	1,292	1	20,089	24,091	1,324	2	25,417
2004	125	9	0	134	4,343	14	0	4,357	102	18	0	120	23,082	1,402	13	24,497	27,652	1,443	14	29,109
2005	134	9	0	143	9,381	118	3	9,502	381	21	1	403	14,588	1,040	6	15,634	24,485	1,187	10	25,682
2006	227	1	1	229	17,239	47	0	17,286	365	4	0	370	8,232	584	3	8,819	26,063	636	5	26,704

Table B4-2. Estimated discards on directed scallop trips 1992-2006 (mt meats).

	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Mid-Atlantic	143	13	853	324	24	8	60	11	871	854	1637	2417	2644	579	213
Georges Bank	448	282	3	38	135	29	5	162	1129	865	128	313	91	286	628
Total	**591**	**295**	**856**	**363**	**159**	**37**	**65**	**173**	**2000**	**1719**	**1765**	**2729**	**2735**	**864**	**842**

Table B4-3. Estimated scallop landings and discards in non-scallop otter trawl fisheries, 1994-2006 (mt meats, "*" indicates < 1 mt meats)

	1994	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**
longfin squid	32	26	42	51	42	47	46	1	9	22	42	86	115
summer flounder	7	13	20	12	10	11	12	*	3	10	18	31	34
scup	2	3	5	3	3	2	1	*	1	4	4	10	13
yellowtail flounder	2	1	2	3	3	5	7	*	1	4	7	7	4
haddock	*	*	*	1	1	2	2	*	1	2	4	7	3
cod	1	1	2	2	1	1	1	*	*	1	*	1	1
monkfish	*	*	1	1	*	*	*	*	*	*	*	*	*

Scallops discarded by otter trawl fisheries (mt):

	1994	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	
longfin squid	52	58	33	38	68	65	60	112	108	57	68	42	13	
summer flounder	12	28	15	9	17	15	16	26	33	26	30	15	4	
scup	4	6	4	2	4	2	2	4	8	10	7	5	1	
yellowtail flounder	4	2	2	2	5	6	9	17	11	9	12	4	*	
haddock	*	*	*	*	2	2	3	7	9	6	6	3	*	
cod	2	2	1	1	1	1	1	3	2	2	1	*	*	
monkfish	1	1	1	*	*	1	1	1	1	*	*	*	*	
prop landed	0.38	0.31	0.56	0.57	0.38	0.42	0.43	0.01	0.08	0.28	0.38	0.67	0.90	
														mean
total landings (mt)	46	43	72	72	60	67	69	2	15	42	76	142	172	68
														mean
total discards (mt)	74	97	57	54	98	93	92	170	171	109	124	70	19	94

Table B5-1. NEFSC survey stratified mean indices for (a) Mid-Atlantic sea scallop survey, (b) Georges Bank sea scallop dredge survey, (c) combined Mid-Atlantic and Georges Bank sea scallop dredge survey, and (d) winter bottom trawl survey (Mid-Atlantic only). Unlike previous assessments, no adjustments were made to sea scallop dredge survey data for the liner. Holes were filled with imputed data (Appendix B6).

(a) Mid-Atlantic Bight

Year	Abundance index (mean N/tow)	CV	Biomass index (kg/tow)	CV	N tows	N positive tows	Proportion Positive Tows	N Strata Surveyed	Area Surveyed (nm2)	Mean Julian Date	Mean Meat Weight (g / scallop)
1979	30.7	0.09	0.571	0.11	166	152	0.92	30	8,350	141	18.6
1980	41.1	0.11	0.498	0.08	167	157	0.94	30	8,350	149	12.1
1981	30.8	0.16	0.390	0.12	167	152	0.91	29	8,316	169	12.7
1982	30.7	0.11	0.408	0.08	185	168	0.91	30	8,350	174	13.3
1983	27.7	0.09	0.358	0.08	193	171	0.89	30	8,350	216	12.9
1984	29.4	0.11	0.341	0.09	204	186	0.91	29	8,172	213	11.6
1985	67.0	0.12	0.541	0.08	201	188	0.94	30	8,350	210	8.1
1986	117.9	0.10	0.954	0.09	226	210	0.93	30	8,350	218	8.1
1987	122.3	0.09	0.843	0.07	226	211	0.93	30	8,350	195	6.9
1988	131.2	0.10	1.281	0.07	227	206	0.91	29	8,229	200	9.8
1989	166.6	0.09	1.166	0.07	244	226	0.93	30	8,350	170	7.0
1990	205.6	0.22	1.254	0.17	216	192	0.89	30	8,350	214	6.1
1991	75.7	0.10	0.729	0.12	229	211	0.92	30	8,350	216	9.6
1992	40.6	0.11	0.414	0.07	229	200	0.87	30	8,350	218	10.2
1993	127.5	0.10	0.573	0.07	214	205	0.96	30	8,350	217	4.5
1994	125.8	0.11	0.772	0.08	227	214	0.94	30	8,350	181	6.1
1995	168.7	0.13	1.160	0.10	227	217	0.96	30	8,350	179	6.9
1996	55.8	0.08	0.564	0.07	211	188	0.89	30	8,350	217	10.1
1997	41.3	0.13	0.428	0.06	225	209	0.93	30	8,350	208	10.4
1998	157.6	0.18	0.808	0.14	226	208	0.92	30	8,350	208	5.1
1999	234.0	0.22	1.708	0.18	226	209	0.92	30	8,350	204	7.3
2000	283.6	0.15	2.979	0.13	229	201	0.88	30	8,350	203	10.5
2001	306.3	0.13	3.322	0.13	227	205	0.90	30	8,350	188	10.8
2002	301.0	0.11	3.743	0.12	206	184	0.89	30	8,350	206	12.4
2003	641.3	0.16	5.678	0.10	201	181	0.90	30	8,350	217	8.9
2004	468.8	0.11	5.232	0.07	248	220	0.89	30	8,350	194	11.2
2005	360.1	0.09	6.045	0.09	241	223	0.93	30	8,350	203	16.8
2006	378.1	0.10	5.883	0.07	230	215	0.93	30	8,350	201	15.6

(b) Georges Bank

Year	Abundance index (mean N/tow)	CV	Biomass index (kg/tow)	CV	N tows	N positive tows	Proportion Positive Tows	N Strata Surveyed	Area Surveyed (nm2)	Mean Julian Date	Mean Meat Weight (g / scallop)
1982	133.4	0.56	0.847	0.32	129	103	0.80	28	7,250	204	6.4
1983	50.7	0.29	0.600	0.24	138	117	0.85	29	7,216	232	11.8
1984	30.1	0.12	0.411	0.10	138	114	0.83	29	7,172	227	13.7
1985	53.8	0.19	0.560	0.18	170	144	0.85	30	7,281	235	10.4
1986	90.4	0.18	0.689	0.12	194	164	0.85	29	7,029	234	7.6
1987	106.6	0.21	0.903	0.17	190	156	0.82	30	7,281	214	8.5
1988	81.8	0.18	0.715	0.15	192	150	0.78	30	7,281	217	8.7
1989	39.6	0.26	0.364	0.17	254	209	0.82	30	7,281	217	9.2
1990	175.9	0.29	1.093	0.23	194	155	0.80	30	7,281	226	6.2
1991	241.2	0.48	1.160	0.28	194	170	0.88	30	7,281	228	4.8
1992	247.1	0.55	1.683	0.47	191	165	0.86	30	7,281	230	6.8
1993	62.5	0.30	0.427	0.19	182	150	0.82	30	7,281	230	6.8
1994	38.0	0.18	0.357	0.13	194	156	0.80	30	7,281	195	9.4
1995	109.7	0.25	0.672	0.17	193	164	0.85	30	7,281	213	6.1
1996	113.5	0.18	1.124	0.16	189	164	0.87	30	7,281	234	9.9
1997	80.6	0.14	1.273	0.15	206	175	0.85	30	7,281	224	15.8
1998	271.2	0.28	3.703	0.35	230	197	0.86	30	7,281	222	13.7
1999	159.8	0.15	2.559	0.16	198	186	0.94	30	7,281	215	16.0
2000	715.5	0.29	6.336	0.21	188	168	0.89	30	7,281	222	8.9
2001	357.8	0.15	5.128	0.15	225	211	0.94	30	7,281	217	14.3
2002	297.9	0.14	5.976	0.13	229	207	0.90	30	7,281	221	20.1
2003	225.8	0.12	5.419	0.14	225	206	0.92	30	7,281	233	24.0
2004	269.9	0.10	7.132	0.11	230	212	0.92	30	7,281	210	26.4
2005	210.5	0.12	5.698	0.11	227	211	0.93	30	7,281	213	27.1
2006	151.0	0.10	4.502	0.11	231	212	0.92	30	7,281	216	29.8

(c) Whole stock

Year	Abundance index (mean N/tow)	CV	Biomass index (kg/tow)	CV	N tows	N positive tows	Proportion Positive Tows	N Strata Surveyed	Area Surveyed (nm2)	Mean Julian Date	Mean Meat Weight (g / scallop)
1982	78.6	0.44	0.613	0.21	314	271	0.86	58	15,600	188	7.8
1983	38.4	0.18	0.471	0.15	331	288	0.87	59	15,566	224	12.3
1984	29.7	0.08	0.374	0.06	342	300	0.88	58	15,344	220	12.6
1985	60.8	0.11	0.550	0.10	371	332	0.89	60	15,631	222	9.0
1986	105.1	0.09	0.831	0.07	420	374	0.89	59	15,378	226	7.9
1987	115.0	0.10	0.871	0.09	416	367	0.88	60	15,631	204	7.6
1988	108.2	0.09	1.017	0.07	419	356	0.85	59	15,510	208	9.4
1989	107.4	0.09	0.792	0.07	498	435	0.87	60	15,631	192	7.4
1990	191.8	0.18	1.179	0.14	410	347	0.85	60	15,631	219	6.1
1991	152.8	0.36	0.930	0.17	423	381	0.90	60	15,631	222	6.1
1992	136.8	0.46	1.006	0.36	420	365	0.87	60	15,631	224	7.4
1993	97.3	0.12	0.505	0.09	396	355	0.90	60	15,631	223	5.2
1994	84.9	0.10	0.579	0.07	421	370	0.88	60	15,631	187	6.8
1995	141.2	0.12	0.932	0.09	420	381	0.91	60	15,631	195	6.6
1996	82.7	0.12	0.825	0.10	400	352	0.88	60	15,631	225	10.0
1997	59.6	0.10	0.822	0.11	431	384	0.89	60	15,631	215	13.8
1998	210.5	0.18	2.157	0.28	456	405	0.89	60	15,631	214	10.2
1999	199.4	0.15	2.104	0.12	424	395	0.93	60	15,631	209	10.6
2000	484.8	0.21	4.542	0.14	417	369	0.88	60	15,631	212	9.4
2001	330.3	0.10	4.163	0.10	452	416	0.92	60	15,631	201	12.6
2002	299.6	0.09	4.783	0.09	435	391	0.90	60	15,631	213	16.0
2003	447.7	0.12	5.557	0.08	426	387	0.91	60	15,631	224	12.4
2004	376.1	0.08	6.117	0.07	478	432	0.90	60	15,631	201	16.3
2005	290.4	0.07	5.883	0.07	468	434	0.93	60	15,631	208	20.3
2006	272.3	0.08	5.240	0.06	461	427	0.93	60	15,631	208	19.2

(d) Winter trawl survey (Mid-Atlantic only)

Year	Abundance index (mean N/tow)	CV	N tows	N positive tows	Proportion Positive Tows	N Bottom Trawl Strata Surveyed	Area Surveyed (nm2)	Mean Julian Date
1992	50.4	0.49	79	40	0.506	18	22,118	50
1993	25.8	0.25	84	46	0.548	18	22,092	43
1994	84.5	0.56	54	41	0.759	18	22,118	37
1995	43.9	0.30	81	42	0.519	20	22,536	46
1996	49.9	0.31	91	44	0.484	18	22,118	43
1997	4.7	0.21	83	40	0.482	22	22,701	41
1998	57.3	0.22	90	38	0.422	23	22,625	45
1999	71.3	0.49	91	46	0.505	24	22,813	38
2000	96.7	0.32	103	39	0.379	23	22,583	49
2001	22.6	0.24	118	50	0.424	24	22,813	37
2002	101.9	0.43	118	48	0.407	23	22,753	47
2003	158.0	0.82	86	24	0.279	24	22,813	47
2004	53.3	0.35	106	36	0.340	24	22,813	45
2005	81.0	0.44	82	41	0.500	23	22,753	43
2006	65.1	0.29	106	57	0.538	24	22,813	45

Table B5-2. SMAST large camera video survey data for sea scallops 40+ mm SL in the Mid-Atlantic Bight and Georges Bank regions, 2003-2006. Four camera images were taken at each station.

Year	Density (N/m^2)	SE	CV	N stations	Area surveyed (km^2)
		Mid-Atlantic Bight			
2003	0.4420	0.0756	16.5	851	26,270
2004	0.2236	0.0219	9.8	840	25,930
2005	0.2038	0.0246	11.9	868	26,794
2006	0.1897	0.0188	9.9	903	27,875
		Georges Bank			
2003	0.1474	0.0124	8.4	924	28,523
2004	0.1202	0.0143	11.8	941	29,048
2005	0.1115	0.0121	10.8	943	29,110
2006	0.1060	0.0112	10.6	943	29,110
		Georges Bank - Open Areas			
2003	0.0900	0.0085	9.3	513	15,836
2004	0.0711	0.0091	12.6	531	16,392
2005	0.0621	0.0073	11.6	536	16,546
2006	0.0597	0.0084	14.1	531	16,546
		Georges Bank – Closed Areas			
2003	0.2191	0.0253	11.5	411	12,687
2004	0.1838	0.0304	16.5	410	12,656
2005	0.1767	0.0259	14.6	407	12,564
2006	0.1658	0.0230	13.8	412	12,564

Table B5-3. SMAST small camera video survey data for sea scallops 40+ mm SL in the Mid-Atlantic Bight and Georges Bank regions, 2003-2006. Four camera images were taken at each station.

Year	Density (N/m^2)	SE	CV	N stations	Area surveyed (km^2)
		Mid-Atlantic Bight			
2003	0.4899	0.1179	20.2	845	26,084
2004	0.2119	0.0242	11.3	837	25,837
2005	0.1957	0.0248	12.2	866	26,733
2006	0.1896	0.0200	10.5	895	27,628
		Georges Bank			
2003	0.1538	0.0163	10.3	905	27,937
2004	0.1155	0.0136	11.2	929	28,677
2005	0.0975	0.0125	12.7	917	28,307
2006	0.1348	0.0138	10.0	939	28,986
		Georges Bank - Open Areas			
2003	0.0798	0.0103	12.1	503	15,527
2004	0.0743	0.0129	16.0	521	16,083
2005	0.0549	0.0084	14.8	526	16,237
2006	0.0936	0.0125	13.1	531	16,392
		Georges Bank - Closed Areas			
2003	0.2468	0.0338	13.5	402	12,409
2004	0.1679	0.0260	15.1	408	12,595
2005	0.1557	0.0268	17.2	391	12,070
2006	0.1885	0.0270	14.0	408	12,595

Table B5-4. Survey and rescaled fishing mortality estimates for (a) Mid-Atlantic, (b) Georges Bank, (c) overall.

(a) Mid-Atlantic

	80-98	98+	SurveyF	*SE*	Landings	MinEBms	EBms	*CV*	CBI	*CV*	RescaledF	*CV*
1979	7.2	14.2			2,888	3,003	7,150	*0.10*	0.40	*0.14*	**0.58**	*0.15*
1980	4.8	11.7	0.50	0.12	1,975	2,471	5,884	*0.07*	0.34	*0.12*	**0.48**	*0.13*
1981	6.6	7.5	0.69	0.12	731	1,853	4,411	*0.10*	0.17	*0.14*	**0.24**	*0.15*
1982	7.9	7.9	0.48	0.15	1,610	1,953	4,649	*0.08*	0.35	*0.13*	**0.50**	*0.13*
1983	4.4	7.9	0.58	0.14	3,109	1,713	4,077	*0.08*	0.76	*0.13*	**1.09**	*0.13*
1984	10.0	6.2	0.60	0.11	3,675	1,674	3,985	*0.09*	0.92	*0.13*	**1.32**	*0.14*
1985	11.6	9.0	0.49	0.15	3,276	2,210	5,263	*0.07*	0.62	*0.12*	**0.89**	*0.13*
1986	30.8	12.5	0.40	0.13	3,359	3,846	9,158	*0.07*	0.37	*0.12*	**0.53**	*0.13*
1987	28.8	11.1	1.26	0.12	7,803	3,355	7,989	*0.06*	0.98	*0.12*	**1.40**	*0.12*
1988	46.6	18.8	0.65	0.10	6,178	5,829	13,878	*0.07*	0.45	*0.12*	**0.64**	*0.13*
1989	36.3	13.3	1.49	0.12	7,973	4,482	10,670	*0.07*	0.75	*0.12*	**1.07**	*0.13*
1990	35.6	9.7	1.54	0.11	6,435	4,034	9,606	*0.10*	0.67	*0.14*	**0.96**	*0.15*
1991	22.9	11.7	1.25	0.18	7,011	3,237	7,707	*0.11*	0.91	*0.15*	**1.30**	*0.15*
1992	10.8	8.5	1.30	0.13	4,955	1,939	4,616	*0.07*	1.07	*0.12*	**1.54**	*0.13*
1993	9.5	6.0	1.08	0.11	2,778	1,596	3,800	*0.07*	0.73	*0.12*	**1.05**	*0.13*
1994	31.4	5.8	0.88	0.12	5,912	3,010	7,166	*0.08*	0.82	*0.13*	**1.18**	*0.13*
1995	38.1	10.8	1.13	0.11	5,976	4,140	9,858	*0.09*	0.61	*0.13*	**0.87**	*0.14*
1996	27.8	8.5	1.65	0.11	4,828	2,668	6,353	*0.06*	0.76	*0.12*	**1.09**	*0.13*
1997	8.9	10.3	1.16	0.10	2,728	2,110	5,024	*0.06*	0.54	*0.11*	**0.78**	*0.12*
1998	21.5	8.0	0.78	0.09	2,891	2,453	5,840	*0.14*	0.50	*0.17*	**0.71**	*0.17*
1999	61.4	22.0	0.19	0.23	4,414	6,826	16,251	*0.15*	0.27	*0.18*	**0.39**	*0.18*
2000	121.5	57.1	0.28	0.21	8,852	14,163	33,720	*0.13*	0.26	*0.16*	**0.38**	*0.17*
2001	93.5	94.3	0.54	0.22	15,611	16,137	38,422	*0.14*	0.41	*0.17*	**0.58**	*0.18*
2002	102.5	110.7	0.43	0.22	17,056	19,003	45,246	*0.12*	0.38	*0.16*	**0.54**	*0.16*
2003	107.7	146.5	0.28	0.17	20,089	25,929	61,736	*0.09*	0.33	*0.14*	**0.47**	*0.14*
2004	133.0	90.8	0.93	0.13	24,497	23,419	55,760	*0.06*	0.44	*0.12*	**0.63**	*0.12*
2005	97.4	182.4	0.10	0.11	15,634	32,115	76,464	*0.09*	0.20	*0.13*	**0.29**	*0.14*
2006	91.5	163.6	0.21	0.13	8,819	29,905	71,203	*0.08*	0.12	*0.13*	**0.18**	*0.13*
Mean7906	*43.2*	*38.1*	*0.77*	*0.03*	*7,181*	*8,038*	*19,139*	*0.03*	*0.54*	*0.03*	*0.77*	*0.03*
Mean7994	*19.1*	*10.1*	*0.88*	*0.03*	*4,354*	*2,888*	*6,876*	*0.02*	*0.64*	*0.02*	*0.92*	*0.04*
Mean9506	*75.4*	*75.4*	*0.6*	*0.05*	*10,950*	*14,906*	*35,490*	*0.03*	*0.40*	*0.04*	*0.57*	*0.05*

Table B5-4 continued
(b) Georges Bank

	80-100.8	100.8+	SurveyF	*SE*	Landings	MinEBms	Ebms	*CV*	CBI	*CV*	RescaledF	*CV*
1982	7.2	7.7			6,322	2,429	6,747	*0.12*	0.94	*0.15*	**0.87**	*0.17*
1983	5.7	7.1	0.64	*0.24*	4,284	2,509	6,970	*0.10*	0.61	*0.14*	**0.57**	*0.16*
1984	6.9	8.7	0.29	*0.31*	3,043	1,958	5,439	*0.10*	0.56	*0.14*	**0.52**	*0.16*
1985	6.4	6.4	0.79	*0.40*	2,894	2,272	6,310	*0.14*	0.46	*0.17*	**0.43**	*0.19*
1986	8.2	7.6	0.42	*0.29*	4,438	2,384	6,621	*0.09*	0.67	*0.13*	**0.62**	*0.16*
1987	18.2	7.3	0.67	*0.18*	4,851	3,461	9,614	*0.13*	0.50	*0.16*	**0.47**	*0.18*
1988	18.9	6.4	1.28	*0.21*	6,054	2,812	7,812	*0.10*	0.77	*0.14*	**0.72**	*0.16*
1989	5.1	6.9	1.20	*0.22*	5,661	1,401	3,891	*0.32*	1.46	*0.34*	**1.35**	*0.35*
1990	38.1	7.0	0.45	*0.18*	9,982	3,511	9,753	*0.22*	1.02	*0.24*	**0.95**	*0.25*
1991	18.8	21.6	0.63	*0.28*	9,311	2,997	8,326	*0.09*	1.12	*0.14*	**1.04**	*0.16*
1992	18.2	15.4	0.87	*0.16*	8,238	3,764	10,457	*0.17*	0.79	*0.19*	**0.73**	*0.21*
1993	6.4	15.0	0.70	*0.21*	3,655	1,297	3,604	*0.10*	1.01	*0.14*	**0.94**	*0.16*
1994	8.9	17.6	0.10	*0.15*	1,205	1,522	4,229	*0.12*	0.28	*0.16*	**0.27**	*0.17*
1995	6.3	28.0	-0.15	*0.24*	1,199	1,955	5,430	*0.12*	0.22	*0.15*	**0.21**	*0.17*
1996	18.7	21.5	0.36	*0.23*	2,061	4,568	12,688	*0.14*	0.16	*0.17*	**0.15**	*0.19*
1997	41.5	30.6	0.17	*0.24*	2,053	6,084	16,900	*0.14*	0.12	*0.17*	**0.11**	*0.19*
1998	45.9	70.6	-0.08	*0.41*	2,039	17,818	49,493	*0.39*	0.04	*0.40*	**0.04**	*0.41*
1999	46.1	55.3	0.65	*0.40*	5,085	12,928	35,911	*0.31*	0.14	*0.32*	**0.13**	*0.33*
2000	83.3	227.6	-0.91	*0.30*	5,039	23,790	66,084	*0.20*	0.08	*0.23*	**0.07**	*0.24*
2001	84.9	82.7	1.22	*0.26*	4,597	24,426	67,849	*0.15*	0.07	*0.18*	**0.06**	*0.20*
2002	83.5	128.7	0.16	*0.21*	5,541	31,380	87,166	*0.13*	0.06	*0.17*	**0.06**	*0.18*
2003	20.2	136.2	0.34	*0.20*	4,823	28,510	79,195	*0.13*	0.06	*0.17*	**0.06**	*0.18*
2004	50.0	162.4	-0.14	*0.18*	4,357	38,419	106,721	*0.11*	0.04	*0.15*	**0.04**	*0.17*
2005	31.0	141.7	0.00	*0.16*	9,502	30,882	85,783	*0.11*	0.11	*0.15*	**0.10**	*0.17*
2006	22.4	99.5	0.66	*0.16*	17,286	24,271	67,418	*0.11*	0.26	*0.15*	**0.24**	*0.17*
Mean8206	*28.0*	*52.8*	*0.43*	*0.05*	*5,341*	*11,094*	*30,816*	*0.05*	*0.46*	*0.06*	*0.43*	*0.06*
Mean8294	*12.8*	*10.4*	*0.64*	*0.07*	*5,380*	*2,486*	*6,905*	*0.04*	*0.78*	*0.06*	*0.71*	*0.07*
Mean9506	*44.5*	*98.8*	*0.19*	*0.08*	*5,299*	*20,419*	*56,720*	*0.05*	*0.11*	*0.06*	*0.11*	*0.07*

Table B5-4 continued
(c) Whole stock

	SurveyF	Landings	Ebms	CBI	RescaledF	CV
1982		7933	11396	0.70	**0.74**	*0.08*
1983	0.63	7392	11047	0.67	**0.72**	*0.07*
1984	0.44	6718	9424	0.71	**0.91**	*0.07*
1985	0.65	6170	11573	0.53	**0.64**	*0.08*
1986	0.41	7797	15779	0.49	**0.56**	*0.07*
1987	0.95	12654	17603	0.72	**0.91**	*0.08*
1988	0.87	12232	21690	0.56	**0.67**	*0.07*
1989	1.43	13634	14561	0.94	**1.13**	*0.13*
1990	1.02	16417	19358	0.85	**0.96**	*0.10*
1991	0.92	16323	16034	1.02	**1.16**	*0.08*
1992	0.96	13192	15073	0.88	**0.91**	*0.09*
1993	0.89	6433	7404	0.87	**1.00**	*0.07*
1994	0.64	7116	11395	0.62	**0.90**	*0.08*
1995	0.79	7175	15288	0.47	**0.69**	*0.08*
1996	0.87	6889	19041	0.36	**0.52**	*0.08*
1997	0.42	4780	21924	0.22	**0.28**	*0.08*
1998	0.09	4930	55334	0.09	**0.17**	*0.15*
1999	0.43	9499	52162	0.18	**0.25**	*0.13*
2000	-0.43	13891	99805	0.14	**0.19**	*0.10*
2001	0.92	20208	106272	0.19	**0.29**	*0.09*
2002	0.28	22597	132412	0.17	**0.27**	*0.09*
2003	0.30	24911	140932	0.18	**0.31**	*0.08*
2004	0.43	28855	162481	0.18	**0.35**	*0.07*
2005	0.43	25136	162481	0.15	**0.22**	*0.08*
2006	0.06	26105	162247	0.16	**0.20**	*0.07*
Mean8206	*0.60*	*13160*	*52509*	*0.48*	*0.75*	
Mean8294	*0.82*	*10506*	*14245*	*0.74*	*0.87*	
Mean9506	*0.38*	*16248*	*94198*	*0.21*	*0.33*	

Table B5-5. CASA model estimates for sea scallop recruitment, stock biomass, stock abundance (*top panel*), catch numbers, fishable biomass and fully recruited fishing mortality (*lower pane*l)on Georges Bank (1982-2006), in the Mid-Atlantic Bight (1975-2006), and for the whole stock (1982-2006). CVs for all estimates are given in a separate table.

Year	Recruitment (January 1, millions)			Stock biomass (January 1, 40+ mm SL, mt)			Stock abundance (January 1, 40+ mm SL, millions)		
	Georges Bank	Mid-Atlantic Bight	Whole stock	Georges Bank	Mid-Atlantic Bight	Whole stock	Georges Bank	Mid-Atlantic Bight	Whole stock
1975	--	--	--	--	11,318	--	--	571	--
1976	--	413	--	--	11,865	--	--	753	--
1977	--	250	--	--	11,319	--	--	824	--
1978	--	109	--	--	11,897	--	--	750	--
1979	--	71	--	--	9,546	--	--	528	--
1980	--	164	--	--	8,061	--	--	469	--
1981	--	136	--	--	7,664	--	--	473	--
1982	--	135	--	10,966	8,907	19,873	1,828	524	2,351
1983	181	208	388	11,457	9,221	20,678	1,141	582	1,723
1984	269	305	574	9,465	8,130	17,595	752	654	1,406
1985	369	780	1,149	10,898	7,739	18,637	832	1,044	1,875
1986	826	732	1,558	13,078	10,508	23,585	1,237	1,446	2,684
1987	640	984	1,624	14,782	15,503	30,284	1,445	1,921	3,365
1988	478	647	1,125	16,623	15,698	32,321	1,413	1,823	3,236
1989	1,111	837	1,948	17,453	17,491	34,944	1,720	1,894	3,614
1990	859	423	1,281	20,955	16,211	37,166	2,005	1,600	3,605
1991	1,004	231	1,235	18,876	14,837	33,713	1,941	1,206	3,147
1992	243	217	460	14,476	10,366	24,842	1,317	804	2,121
1993	315	1,145	1,460	7,894	8,780	16,674	736	1,293	2,029
1994	265	682	947	5,923	13,632	19,554	587	1,747	2,334
1995	658	303	960	9,249	14,359	23,608	967	1,435	2,402
1996	352	103	455	14,989	12,177	27,167	1,220	925	2,146
1997	418	500	918	19,500	10,027	29,526	1,313	881	2,194
1998	752	2,048	2,800	24,385	14,202	38,587	1,641	2,257	3,898
1999	752	1,695	2,447	31,783	27,069	58,852	2,054	3,599	5,653
2000	1,850	1,451	3,302	39,549	44,664	84,212	3,093	4,418	7,511
2001	470	1,444	1,915	52,681	59,007	111,688	3,366	4,825	8,191
2002	367	1,121	1,488	64,628	64,744	129,372	3,174	4,657	7,831
2003	744	3,211	3,956	72,724	70,580	143,305	3,186	6,014	9,200
2004	262	312	575	78,623	78,448	157,071	2,987	5,563	8,550
2005	453	1,776	2,229	84,106	78,387	162,493	2,935	5,360	8,295
2006	225	370	594	81,047	85,161	166,208	2,637	4,833	7,469

Table B5-5 continued

Year	Catch numbers (all sizes, millions)			Fishable mean abundance (all sizes, millions)			Fully recruited fishing mortality (F, annual)		
	Georges Bank	Mid-Atlantic Bight	Whole stock	Georges Bank	Mid-Atlantic Bight	Whole stock	Georges Bank	Mid-Atlantic Bight	Whole stock
1975	--	67	--	--	393	--	--	0.171	--
1976	--	138	--	--	349	--	--	0.395	--
1977	--	134	--	--	424	--	--	0.316	--
1978	--	230	--	--	437	--	--	0.526	--
1979	--	145	--	--	341	--	--	0.427	--
1980	--	90	--	--	266	--	--	0.339	--
1981	--	36	--	--	290	--	--	0.125	--
1982	298	75	373	127	300	427	2.346	0.249	0.873
1983	431	142	573	455	271	726	0.947	0.525	0.789
1984	149	180	330	383	220	603	0.390	0.819	0.547
1985	153	196	349	354	216	569	0.432	0.909	0.613
1986	239	262	501	342	401	742	0.701	0.653	0.675
1987	300	585	885	475	490	964	0.631	1.196	0.918
1988	371	499	870	557	591	1,148	0.667	0.843	0.758
1989	322	599	921	520	589	1,109	0.619	1.018	0.831
1990	592	500	1,092	560	590	1,150	1.057	0.847	0.949
1991	619	496	1,115	465	503	968	1.331	0.987	1.152
1992	586	312	898	363	328	691	1.614	0.952	1.300
1993	268	174	442	223	251	474	1.201	0.696	0.934
1994	74	499	573	234	439	673	0.317	1.136	0.851
1995	57	512	569	346	555	900	0.166	0.922	0.632
1996	125	343	468	344	469	813	0.363	0.731	0.576
1997	138	136	275	452	270	722	0.306	0.504	0.380
1998	111	140	250	470	274	744	0.236	0.510	0.337
1999	185	259	444	603	544	1,147	0.308	0.475	0.387
2000	167	536	703	747	1,201	1,948	0.223	0.447	0.361
2001	185	838	1,023	1,048	1,629	2,677	0.177	0.515	0.382
2002	224	745	969	999	1,251	2,250	0.224	0.596	0.431
2003	206	812	1,019	1,068	1,331	2,399	0.193	0.610	0.425
2004	129	955	1,084	1,576	1,305	2,881	0.082	0.731	0.376
2005	250	685	935	1,580	1,678	3,258	0.158	0.408	0.287
2006	431	368	799	1,390	2,105	3,495	0.310	0.175	0.229

Table B5-6. Coefficients of variation for CASA model estimates of sea scallop recruitment, stock biomass, stock abundance (top panel), catch numbers, fishable biomass and fully recruited fishing mortality (bottom panel) on Georges Bank (1982-2006), in the Mid-Atlantic Bight (1975-2006), and for the whole stock (1982-2006).

Year	Recruitment (January 1, millions)			Stock biomass (January 1, 40+ mm SL, mt)			Stock abundance (January 1, 40+ mm SL, millions)		
	Georges Bank	Mid-Atlantic Bight	Whole stock	Georges Bank	Mid-Atlantic Bight	Whole stock	Georges Bank	Mid-Atlantic Bight	Whole stock
1975	--	--	--	--	0.042	--	--	0.042	--
1976	--	0.116	--	--	0.043	--	--	0.037	--
1977	--	0.137	--	--	0.037	--	--	0.034	--
1978	--	0.169	--	--	0.032	--	--	0.031	--
1979	--	0.165	--	--	0.033	--	--	0.031	--
1980	--	0.097	--	--	0.037	--	--	0.033	--
1981	--	0.125	--	--	0.040	--	--	0.036	--
1982	--	0.148	--	0.030	0.037	0.024	0.030	0.037	0.025
1983	0.173	0.126	0.105	0.042	0.039	0.029	0.038	0.039	0.029
1984	0.145	0.143	0.102	0.048	0.045	0.033	0.043	0.051	0.033
1985	0.163	0.111	0.092	0.051	0.050	0.036	0.051	0.054	0.038
1986	0.119	0.151	0.095	0.047	0.046	0.033	0.048	0.044	0.032
1987	0.151	0.113	0.091	0.044	0.039	0.029	0.044	0.038	0.029
1988	0.189	0.152	0.119	0.044	0.039	0.030	0.046	0.038	0.030
1989	0.125	0.112	0.086	0.042	0.038	0.028	0.047	0.035	0.029
1990	0.159	0.137	0.116	0.035	0.036	0.025	0.046	0.036	0.030
1991	0.092	0.147	0.080	0.035	0.037	0.025	0.039	0.035	0.027
1992	0.185	0.137	0.117	0.037	0.038	0.027	0.038	0.038	0.028
1993	0.109	0.059	0.052	0.040	0.040	0.028	0.039	0.036	0.027
1994	0.123	0.090	0.073	0.044	0.034	0.027	0.042	0.032	0.026
1995	0.071	0.128	0.063	0.041	0.036	0.027	0.034	0.032	0.023
1996	0.113	0.200	0.098	0.037	0.036	0.026	0.033	0.035	0.024
1997	0.101	0.108	0.074	0.037	0.043	0.029	0.036	0.048	0.029
1998	0.080	0.059	0.048	0.039	0.039	0.028	0.038	0.036	0.026
1999	0.098	0.081	0.064	0.040	0.030	0.026	0.041	0.029	0.024
2000	0.069	0.101	0.059	0.044	0.028	0.025	0.042	0.027	0.023
2001	0.210	0.102	0.093	0.047	0.027	0.026	0.046	0.026	0.024
2002	0.181	0.122	0.102	0.051	0.028	0.029	0.050	0.028	0.026
2003	0.102	0.061	0.053	0.056	0.030	0.032	0.055	0.034	0.029
2004	0.183	0.240	0.155	0.061	0.036	0.035	0.061	0.039	0.033
2005	0.134	0.088	0.075	0.065	0.047	0.041	0.065	0.047	0.038
2006	0.226	0.256	0.181	0.075	0.057	0.047	0.074	0.056	0.045

Table B5-6 continued

Year	Catch numbers (all sizes, millions)			Fishable mean abundance (all sizes, millions)			Fully recruited fishing mortality (F, annual)		
	Georges Bank	Mid-Atlantic Bight	Whole stock	Georges Bank	Mid-Atlantic Bight	Whole stock	Georges Bank	Mid-Atlantic Bight	Whole stock
1975	--	0.050	--	--	0.046	--	--	0.065	--
1976	--	0.050	--	--	0.055	--	--	0.069	--
1977	--	0.050	--	--	0.058	--	--	0.065	--
1978	--	0.050	--	--	0.045	--	--	0.055	--
1979	--	0.050	--	--	0.039	--	--	0.056	--
1980	--	0.050	--	--	0.043	--	--	0.062	--
1981	--	0.050	--	--	0.046	--	--	0.067	--
1982	0.050	0.050	0.041	0.072	0.044	0.038	0.070	0.065	0.190
1983	0.050	0.050	0.040	0.056	0.050	0.040	0.077	0.066	0.103
1984	0.050	0.050	0.036	0.060	0.068	0.046	0.082	0.084	0.138
1985	0.050	0.050	0.036	0.068	0.094	0.055	0.087	0.112	0.178
1986	0.050	0.050	0.035	0.083	0.082	0.058	0.099	0.098	0.139
1987	0.050	0.050	0.037	0.070	0.077	0.052	0.089	0.095	0.138
1988	0.050	0.050	0.036	0.065	0.065	0.046	0.082	0.087	0.121
1989	0.050	0.050	0.037	0.074	0.060	0.047	0.090	0.080	0.118
1990	0.050	0.050	0.035	0.065	0.048	0.040	0.075	0.068	0.103
1991	0.050	0.050	0.036	0.057	0.044	0.035	0.060	0.056	0.084
1992	0.050	0.050	0.037	0.051	0.051	0.036	0.050	0.063	0.078
1993	0.050	0.050	0.036	0.054	0.070	0.045	0.060	0.089	0.102
1994	0.050	0.050	0.044	0.061	0.063	0.046	0.076	0.078	0.108
1995	0.050	0.050	0.045	0.054	0.047	0.035	0.072	0.064	0.095
1996	0.050	0.050	0.039	0.066	0.043	0.037	0.079	0.062	0.093
1997	0.050	0.050	0.035	0.063	0.071	0.047	0.086	0.084	0.131
1998	0.050	0.050	0.036	0.074	0.078	0.055	0.098	0.094	0.158
1999	0.050	0.050	0.036	0.082	0.079	0.057	0.084	0.091	0.130
2000	0.050	0.050	0.040	0.089	0.065	0.053	0.091	0.077	0.111
2001	0.050	0.050	0.042	0.092	0.052	0.048	0.093	0.065	0.097
2002	0.050	0.050	0.040	0.180	0.071	0.089	0.189	0.078	0.146
2003	0.050	0.050	0.041	0.188	0.067	0.092	0.203	0.074	0.141
2004	0.050	0.050	0.044	0.082	0.070	0.055	0.091	0.075	0.147
2005	0.050	0.050	0.039	0.083	0.082	0.058	0.093	0.091	0.139
2006	0.050	0.050	0.035	0.098	0.076	0.060	0.109	0.092	0.164

Table B5-7. Configuration of basecase CASA models for sea scallops in the Mid-Atlantic Bight and Georges Bank.

Category	Mid-Atlantic Bight (MAB)	Georges Bank (GBK)	Explanation
Model configuration			
Modeled years	1975-2006	1982-2006	Models start in first year with dredge survey data; Unlined dredge survey for MAB starts in 1975; Lined dredge survey for GBK with complete coverage starts 1982
L-infinity (mm SH)	131.6	147	New growth studies based on shell increments (used only to define plus group in model)
Population shell height bins (mm SH)	5	5	Same as resolution of shell height composition data for lined dredge survey
First size in model (mm SH)	20	20	Biomass and fishing mortality estimates are for 40+ mm SH; Starting model at 20 mm SH allows for 20 mm of "burn-in" before recruits enter size groups (40+ mm SH) used to calculate biomass and fishing mortality
Size range new recruits (mm)	20-69.9 (shell height size groups 1-10)	20-69.9 (shell height size groups 1-10)	Based on inspection of trawl survey shell height composition data for years with strong recruitment; model estimates a unimodal beta distribution with two parameters to represent the shell height distribution for new recruits across this range of sizes
Population dynamics			
Stock shell height/meat weight parameters	a= -10.7; b =2.942	a = -12.2484; b = 3.2641	Same as previous assessment; based on dredge survey data collected during June
Incidental mortality multiplier	0.04	0.15	Total mortality of all size groups is increased by this proportion of full recruited F; based on published studies although available information is limited and uncertain; assumed same for all size groups
Population shell height composition in 1st year	1975 unlined dredge survey, adjusted for selectivity	1982 lined dredge survey, no adjustments	Not estimable in model
Natural mortality rate (y-1)	0.1	0.1	Same for all years and shell height groups
Growth matrix method	Observed increments (n=2,244)	Observed increments (n=2,692)	Observed increment from each are used to form growth transition matrix; Different increment data sets and transition matrices for GBK and MAB
Size range used to summarize stock biomass and mortality rates	40-130+	40-145+	Survey data reliable for 40+ mm SH
Fecundity at size			Annual fecundity at size parameters from McGarvey et al. (1992)

Table B5-7 continued.

Commercial			
Fishery shell height/meat weight parameters			Population shell height/meat weight are modified by annual anomalies based on observer data and seasonal landings patterns to account for seasonal patterns in shell height/meat weight relationships, meat loss during shucking and absorption of water during storage
Commercial LPUE	1992-2006	1975-2006	Predicted values are a nonlinear function of abundance and biomass
Fishery selectivity periods	1975-1981; 1982-1995; 1997-2001; 2002-2006 (all logistic)	1982-1995 (logistic); 1996-1998 (domed); 1999-2001 (logistic); 2002-2003 (domed); 2004-2006 (logistic)	Logistic patterns used for MAB in all years and GBK when fishery had access to entire scallop size range; Dome (double logistic) pattern used for GBK when substantial numbers of large scallops were in closed areas not open to fishing
Shell height-meat weight			The average weight of scallops in the commercial catch was calculated in the model based on predicted shell heights and survey shell-height meat weight relationships, with adjustments based on annual mean meat weight anomalies.
Survey trends			
NEFSC lined dredge	1979-2006	1982-2006	Likelihood calculations use CV for stratified random means; 40+ mm SH; Flat selectivity pattern (not estimated)
SMAST video (small camera)	2003-2006	2003-2006	Likelihood calculations use CV for stratified random means; 40+ mm SH; Flat selectivity pattern; Assumed 100% efficiency; Densities (N/m^2) converted to swept area biomass based on area covered by dredge survey, then multiplied by 0.5 for use with prior (see below)
Winter bottom trawl	1992-2006	1992-2006	Likelihood calculated based on internally estimated variance; 40+ mm SH; Logistic selectivity pattern
Fall and spring bottom trawl	1964-2006 (fall); 1968-2006 (spring)	1964-2006 (fall); 1968-2006 (spring)	Less reliable than dredge or video surveys (particularly for GBK); Used only for comparison, did not affect model estimates; Likelihood calculated based on internally estimated variance; 40+ mm SH; Domed (double logistic) selectivity pattern
10 ft unlined dredge	1975-1976, 1978	NA	Likelihood calculations use CV for stratified random means; 40+ mm SH; Logistic selectivity pattern fixed per reanalysis of paired tow experiments in Serchuk and Smolowicz (1980) using Millars (1980) SELECT model

Table B5-7 continued.

Shell height composition data			
Dredge and video survey shell height composition	All years with trend data	All years with trend data	Five mm shell height groups; Assumed effective sample size used in likelihood calculations was adjusted based on preliminary model fits; Assumed standard deviation for shell height measurement errors = 1.6 mm for dredge survey and 6 mm for video survey
Bottom trawl shell height composition	All years with trend data	All years with trend data	Ten mm shell height groups; Assumed effective sample size used in likelihood calculations was adjusted based on preliminary model fits; Assumed standard deviation for shell height measurement errors = 1.6 mm
Commercial shell height composition	1969-1984 (port samples); 1992-2006 (observers)	1982-1984 (port samples); 1992-2006 (observers)	Five mm shell height groups; Assumed effective sample size used in likelihood calculations was adjusted based on preliminary model fits; Assumed standard deviation for shell height measurement errors = 6 mm
Prior information			
Prior on SMAST survey scaling parameter (catchability coefficient)	Beta distribution with mean 0.5 and CV=20%	Beta distribution with mean 0.5 and CV=20%	Video survey trend data were scaled up to swept area biomass and then multiplied by 0.5 before use in model assuming 100% sampling efficiency, a flat survey selectivity pattern and areas of grounds covered in dredge survey (see above); Under these conditions, the expected survey scaling parameter is 0.5; 20% CV is ad-hoc but based on standard deviation of eight video-dredge survey comparisons and meant to imply a moderate level of uncertainty

Table B5-8. Parameters, standard errors, and CVs estimated in the basecase model for sea scallops on Georges Bank during 1982-2006.

ID	Parameter	Estimate	Standard error	CV
1	Log N first year	21.3870	0.0299	0.00
2	Log beta distribution parameter for shell height distribution of new recruits	-0.6388	0.4253	0.67
3	Log beta distribution parameter for shell height distribution of new recruits	-1.9992	0.6445	0.32
4	Log mean recruitment	20.0020	0.0306	0.00
5	Log survey scaling parameter for lined dredge survey	-2.4385	0.0517	0.02
6	Log survey scaling parameter for video small camera survey	-0.4984	0.0795	0.16
7	Log mean F	-0.8534	0.0365	0.04
8	Log LPUE scaling parameter	-2.9814	0.0624	0.02
9	Log LPUE shape parameter	-2.8181	1.3191	0.47
10	Log fishery selectivity parameter 1982-1995 (logistic)	3.5776	0.1877	0.05
11	Log fishery selectivity parameter 1982-1995 (logistic)	-0.7623	0.1916	0.25
12	Log fishery selectivity parameter 1996-1998 (domed, double logistic)	3.1260	0.0973	0.03
13	Log fishery selectivity parameter 1996-1998 (domed, double logistic)	-1.3862	0.1090	0.08
14	Log fishery selectivity parameter 1996-1998 (domed, double logistic)	-4.9991	2.8192	0.56
15	Log fishery selectivity parameter 1996-1998 (domed, double logistic)	-3.1237	0.1567	0.05
16	Log fishery selectivity parameter 1999-2001 (logistic)	2.8067	0.1696	0.06
17	Log fishery selectivity parameter 1999-2001 (logistic)	-1.7953	0.1876	0.10
18	Log fishery selectivity parameter 2002-2003 (domed, double logistic)	4.0713	0.6400	0.16
19	Log fishery selectivity parameter 2002-2003 (domed, double logistic)	-0.5435	0.6571	1.21
20	Log fishery selectivity parameter 2002-2003 (domed, double logistic)	2.6844	0.5917	0.22
21	Log fishery selectivity parameter 2002-2003 (domed, double logistic)	-2.1137	0.4999	0.24
22	Log fishery selectivity parameter 2004-2006 (logistic)	3.2284	0.2959	0.09
23	Log fishery selectivity parameter 2004-2006 (logistic)	-1.4596	0.3071	0.21
24	Log F deviation 1982	1.7063	0.0736	0.04
25	Log F deviation 1983	0.7985	0.0754	0.09
26	Log F deviation 1984	-0.0893	0.0781	0.87
27	Log F deviation 1985	0.0146	0.0807	5.53
28	Log F deviation 1986	0.4978	0.0903	0.18
29	Log F deviation 1987	0.3929	0.0815	0.21
30	Log F deviation 1988	0.4486	0.0771	0.17
31	Log F deviation 1989	0.3733	0.0858	0.23
32	Log F deviation 1990	0.9088	0.0749	0.08
33	Log F deviation 1991	1.1395	0.0655	0.06
34	Log F deviation 1992	1.3323	0.0580	0.04
35	Log F deviation 1993	1.0368	0.0629	0.06
36	Log F deviation 1994	-0.2955	0.0744	0.25
37	Log F deviation 1995	-0.9403	0.0707	0.08
38	Log F deviation 1996	-0.1595	0.0755	0.47

Table B5-8 continued.

39	Log F deviation 1997	-0.3299	0.0809	0.25
40	Log F deviation 1998	-0.5921	0.0927	0.16
41	Log F deviation 1999	-0.3259	0.0753	0.23
42	Log F deviation 2000	-0.6465	0.0804	0.12
43	Log F deviation 2001	-0.8802	0.0815	0.09
44	Log F deviation 2002	-0.6432	0.1731	0.27
45	Log F deviation 2003	-0.7901	0.1868	0.24
46	Log F deviation 2004	-1.6484	0.0768	0.05
47	Log F deviation 2005	-0.9907	0.0780	0.08
48	Log F deviation 2006	-0.3177	0.0921	0.29
49	Log recruitment deviation 1983	-0.9893	0.1688	0.17
50	Log recruitment deviation 1984	-0.5931	0.1437	0.24
51	Log recruitment deviation 1985	-0.2772	0.1613	0.58
52	Log recruitment deviation 1986	0.5302	0.1225	0.23
53	Log recruitment deviation 1987	0.2751	0.1528	0.56
54	Log recruitment deviation 1988	-0.0176	0.1863	10.57
55	Log recruitment deviation 1989	0.8262	0.1300	0.16
56	Log recruitment deviation 1990	0.5687	0.1566	0.28
57	Log recruitment deviation 1991	0.7252	0.0985	0.14
58	Log recruitment deviation 1992	-0.6924	0.1815	0.26
59	Log recruitment deviation 1993	-0.4355	0.1112	0.26
60	Log recruitment deviation 1994	-0.6060	0.1202	0.20
61	Log recruitment deviation 1995	0.3021	0.0732	0.24
62	Log recruitment deviation 1996	-0.3227	0.1121	0.35
63	Log recruitment deviation 1997	-0.1527	0.0973	0.64
64	Log recruitment deviation 1998	0.4361	0.0763	0.17
65	Log recruitment deviation 1999	0.4364	0.0920	0.21
66	Log recruitment deviation 2000	1.3361	0.0640	0.05
67	Log recruitment deviation 2001	-0.0337	0.2072	6.14
68	Log recruitment deviation 2002	-0.2821	0.1729	0.61
69	Log recruitment deviation 2003	0.4255	0.0946	0.22
70	Log recruitment deviation 2004	-0.6168	0.1725	0.28
71	Log recruitment deviation 2005	-0.0713	0.1244	1.75
72	Log recruitment deviation 2006	-0.7711	0.2133	0.28

Table B5-9. Parameters, standard errors, and CVs estimated in the basecase model for sea scallop sin the Mid-Atlantic Bight during 1975-2006.

ID	Parameter	Estimate	Standard error	CV
1	Log N first year	20.1720	0.0420	0.00
2	Log beta distribution parameter for shell height distribution of new recruits	0.4947	0.1284	0.26
3	Log beta distribution parameter for shell height distribution of new recruits	0.1924	0.1167	0.61
4	Log mean recruitment	19.9660	0.0197	0.00
5	Log survey scaling parameter for lined dredge survey	-2.4483	0.0261	0.01
6	Log survey scaling parameter for video small camera survey	-0.4457	0.0686	0.15
7	Log survey scaling parameter for winter bottom trawl survey	-3.8376	0.0878	0.02
8	Log survey scaling parameter for unlined dredge survey	-1.6114	0.1289	0.08
9	Log selectivity parameter for winter bottom trawl survey (logistic)	2.1731	0.2215	0.10
10	Log selectivity parameter for winter bottom trawl survey (logistic)	-1.8471	0.2392	0.13
11	Log mean F	-0.6134	0.0266	0.04
12	Log LPUE scaling parameter	-2.4049	0.1715	0.07
13	Log LPUE shape parameter	0.0779	0.2555	3.28
14	Log fishery selectivity parameter 1975-1981 (logistic)	2.9808	0.2115	0.07
15	Log fishery selectivity parameter 1975-1981 (logistic)	-1.2975	0.2258	0.17
16	Log fishery selectivity parameter 1982-1995 (logistic)	3.1507	0.1119	0.04
17	Log fishery selectivity parameter 1982-1995 (logistic)	-1.2083	0.1189	0.10
18	Log fishery selectivity parameter 1997-2001 (logistic)	3.0164	0.0871	0.03
19	Log fishery selectivity parameter 1997-2001 (logistic)	-1.5086	0.0943	0.06
20	Log fishery selectivity parameter 2002-2006 (logistic)	3.0759	0.1205	0.04
21	Log fishery selectivity parameter 2002-2006 (logistic)	-1.5409	0.1304	0.08
22	Log F deviation 1975	-1.1534	0.0661	0.06
23	Log F deviation 1976	-0.3152	0.0693	0.22
24	Log F deviation 1977	-0.5374	0.0645	0.12
25	Log F deviation 1978	-0.0289	0.0552	1.91
26	Log F deviation 1979	-0.2376	0.0554	0.23
27	Log F deviation 1980	-0.4680	0.0593	0.13
28	Log F deviation 1981	-1.4691	0.0629	0.04
29	Log F deviation 1982	-0.7775	0.0606	0.08
30	Log F deviation 1983	-0.0312	0.0614	1.97
31	Log F deviation 1984	0.4141	0.0758	0.18
32	Log F deviation 1985	0.5184	0.1025	0.20
33	Log F deviation 1986	0.1876	0.0892	0.48
34	Log F deviation 1987	0.7921	0.0891	0.11
35	Log F deviation 1988	0.4431	0.0816	0.18
36	Log F deviation 1989	0.6315	0.0766	0.12
37	Log F deviation 1990	0.4471	0.0672	0.15
38	Log F deviation 1991	0.5999	0.0563	0.09
39	Log F deviation 1992	0.5641	0.0610	0.11
40	Log F deviation 1993	0.2510	0.0852	0.34
41	Log F deviation 1994	0.7407	0.0745	0.10
42	Log F deviation 1995	0.5324	0.0618	0.12
43	Log F deviation 1996	0.3007	0.0590	0.20
44	Log F deviation 1997	-0.0719	0.0769	1.07
45	Log F deviation 1998	-0.0603	0.0864	1.43

Table B5-9 continued

46	Log F deviation 1999	-0.1305	0.0835	0.64
47	Log F deviation 2000	-0.1924	0.0721	0.37
48	Log F deviation 2001	-0.0511	0.0617	1.21
49	Log F deviation 2002	0.0952	0.0735	0.77
50	Log F deviation 2003	0.1194	0.0690	0.58
51	Log F deviation 2004	0.3004	0.0692	0.23
52	Log F deviation 2005	-0.2832	0.0837	0.30
53	Log F deviation 2006	-1.1299	0.0860	0.08
54	Log recruitment deviation 1976	-0.1280	0.1159	0.91
55	Log recruitment deviation 1977	-0.6291	0.1383	0.22
56	Log recruitment deviation 1978	-1.4576	0.1678	0.12
57	Log recruitment deviation 1979	-1.8824	0.1627	0.09
58	Log recruitment deviation 1980	-1.0493	0.0984	0.09
59	Log recruitment deviation 1981	-1.2355	0.1246	0.10
60	Log recruitment deviation 1982	-1.2455	0.1465	0.12
61	Log recruitment deviation 1983	-0.8155	0.1268	0.16
62	Log recruitment deviation 1984	-0.4310	0.1423	0.33
63	Log recruitment deviation 1985	0.5085	0.1145	0.23
64	Log recruitment deviation 1986	0.4442	0.1509	0.34
65	Log recruitment deviation 1987	0.7404	0.1151	0.16
66	Log recruitment deviation 1988	0.3209	0.1502	0.47
67	Log recruitment deviation 1989	0.5787	0.1134	0.20
68	Log recruitment deviation 1990	-0.1046	0.1367	1.31
69	Log recruitment deviation 1991	-0.7094	0.1461	0.21
70	Log recruitment deviation 1992	-0.7706	0.1345	0.17
71	Log recruitment deviation 1993	0.8925	0.0623	0.07
72	Log recruitment deviation 1994	0.3743	0.0900	0.24
73	Log recruitment deviation 1995	-0.4386	0.1283	0.29
74	Log recruitment deviation 1996	-1.5190	0.1952	0.13
75	Log recruitment deviation 1997	0.0643	0.1067	1.66
76	Log recruitment deviation 1998	1.4737	0.0627	0.04
77	Log recruitment deviation 1999	1.2844	0.0826	0.06
78	Log recruitment deviation 2000	1.1293	0.1015	0.09
79	Log recruitment deviation 2001	1.1245	0.1030	0.09
80	Log recruitment deviation 2002	0.8712	0.1189	0.14
81	Log recruitment deviation 2003	1.9235	0.0609	0.03
82	Log recruitment deviation 2004	-0.4066	0.2325	0.57
83	Log recruitment deviation 2005	1.3312	0.0861	0.06
84	Log recruitment deviation 2006	-0.2387	0.2479	1.04

Table B5-10. Likelihood profile analysis for the basecase Georges Bank CASA model. For ease of interpretation, the likelihood for each type of data and constraint in the basecase model was subtracted from the likelihoods for the same type of data or constraint at each point.

Data type or constraint	Survey scaling parameter for small camera video survey								
	0.31	0.41	0.51	0.60	Basecase 0.61	0.70	0.80	0.90	0.98
Fishing mortality 2006	***0.18***	0.22	0.27	0.31	0.31	0.35	0.39	0.43	0.46
Stock biomass 2006 (mt)	132,919	108,337	92,633	81,798	81,088	73,374	66,930	61,843	***58,486***
Neg. log likelihood for major components									
Commercial catch weight	0.07	***-0.07***	-0.07	-0.01	0.00	0.09	0.21	0.34	0.46
Commercial LPUE	***-0.05***	-0.03	-0.02	0.00	0.00	0.01	0.03	0.04	0.05
Recruitment deviations	0.24	***-0.30***	-0.29	-0.03	0.00	0.40	0.89	1.43	1.86
Efficiency prior - camera survey	1.18	-0.15	***-0.52***	-0.07	0.00	1.39	4.36	10.62	26.79
Total for survey trends	20.13	6.98	1.39	***-0.01***	0.00	1.21	4.24	8.52	12.59
Total for shell height composition	8.07	4.56	2.02	0.13	0.00	-1.40	-2.58	-3.49	-4.08
Total major components (unweighted)	29.63	10.98	2.51	0.01	0.00	1.70	7.16	17.46	37.68
Survey trends									
Dredge survey	12.37	4.21	0.84	0.00	***0.00***	0.63	2.19	4.32	6.28
Camera survey	7.76	2.77	0.55	***-0.01***	0.00	0.58	2.05	4.20	6.31
Shell height composition data									
Commercial fishery	1.09	0.65	0.30	0.02	0.00	-0.22	-0.43	-0.61	***-0.73***
Dredge survey	6.54	3.66	1.61	0.10	0.00	-1.11	-2.03	-2.74	***-3.19***
Camera survey	0.43	0.24	0.11	0.01	0.00	-0.07	-0.12	-0.15	***-0.16***

Table B5-11. Likelihood profile analysis for the basecase Mid-Atlantic Bight CASA model. For ease of interpretation, the likelihood for each type of data and constraint in the basecase model was subtracted from the likelihoods for the same type of data or constraint at each point. The table includes likelihoods for NEFSC fall and winter bottom trawl surveys which were included for information only and did not affect model estimates.

Data type or constraint	Survey scaling parameter for small camera video survey								
	0.30	0.40	0.50	0.60	Basecase 0.64	0.70	0.80	0.90	1.00
Fishing mortality 2006	***0.34***	0.38	0.41	0.43	0.44	0.45	0.47	0.49	0.50
Stock biomass 2006 (mt)	107,515	96,247	88,483	82,709	80,771	78,193	74,534	71,490	***68,905***
Neg. log likelihood for major components									
Commercial catch weight	1.171	0.482	0.155	0.020	0.000	***-0.003***	0.046	0.141	0.268
Commercial LPUE	0.37	0.24	0.13	0.03	0.00	-0.05	-0.12	-0.19	***-0.25***
Recruitment deviations	5.69	3.30	1.64	0.41	0.00	-0.54	-1.31	-1.93	***-2.45***
Efficiency prior - camera survey	0.98	-0.47	***-0.90***	-0.45	0.00	1.01	3.98	10.23	55.01
Total for survey trends	50.89	22.20	7.82	1.22	0.00	***-0.71***	0.36	3.42	7.86
Total for shell height composition	***-7.26***	-5.06	-2.88	-0.80	0.00	1.16	3.01	4.75	6.40
Total major components (unweighted)	51.84	20.70	5.96	0.43	***0.00***	0.87	5.96	16.41	66.84
Survey trends used to fit model									
Dredge survey	13.73	5.48	1.65	0.17	***0.00***	0.07	0.81	2.11	3.78
Camera survey	32.27	13.93	4.80	0.71	0.00	***-0.33***	0.59	2.84	6.00
Winter bottom trawl survey	4.90	2.79	1.37	0.34	0.00	-0.44	-1.05	-1.53	***-1.92***
Unlined 10 ft scallop dredge survey	***-0.02***	-0.01	-0.01	0.00	0.00	0.00	0.01	0.01	0.01
Survey trends that did not affect model estimates									
Fall bottom trawl survey	15.10	9.01	4.59	1.17	0.00	-1.58	-3.87	-5.81	***-7.49***
Spring bottom trawl survey	15.43	9.26	4.74	1.22	0.00	-1.65	-4.04	-6.09	***-7.87***
Shell height composition data									
Commercial fishery	***-3.36***	-2.16	-1.16	-0.31	0.00	0.44	1.10	1.71	2.26
Dredge survey	0.49	-0.06	***-0.18***	-0.08	0.00	0.14	0.44	0.77	1.13
Camera survey	***-3.35***	-2.17	-1.17	-0.31	0.00	0.44	1.12	1.74	2.31
Winter bottom trawl survey	***-1.16***	-0.75	-0.40	-0.11	0.00	0.15	0.38	0.58	0.77
Unlined 10 ft scallop dredge survey	0.11	0.07	0.03	0.01	0.00	-0.01	-0.03	-0.05	***-0.06***

Table B5-12. Sensitivity analysis runs using the CASA model for sea scallops in the Mid-Atlantic Bight.

Scenario	Estimates for 2006	
	Biomass (mt)	Fishing mortality (y^{-1})
Basecase	85,161	0.18
Eliminate prior on video survey efficiency	83,061	0.18
Drop anomalous 2003 dredge and video trend observations	83,520	0.18
No constraint on recruitment variability	88,815	0.17
Use spring and fall bottom trawl surveys	69,440	0.22
Start 1979	85,870	0.17

Table B6-1. Biological reference points and stock status measures for the whole stock of sea scallops from CASA model runs.

Estimate	Value
F_{MSY} proxy (F_{MAX}, y-1)	0.29
Current F (y^{-1})	0.23
BPR at F_{MAX} (g)	86.3
Median 83-06 recruitment (millions)	1,258
B_{MSY} proxy	108,628
Biomass threshold (mt)	54,314
Current biomass (mt)	166,208