

B. *Loligo*-Tables

Table B1. History summary of the Atlantic Mackerel, Squid and Butterfish Fishery Management Plan.

Year	Document	Management Action
1978-1980	Original FMPs (3) and individual amendments	Established and continued management of Atlantic mackerel, squid, and butterfish fisheries
1983	Merged FMP	Consolidated management of Atlantic mackerel, squid, and butterfish fisheries under a single FMP
1984	Amendment 1	Implemented squid OY adjustment mechanism Revised Atlantic mackerel mortality rate
1986	Amendment 2	Equated fishing year with calendar year Revised squid bycatch TALFF allowances Implemented framework adjustment process Converted expiration of fishing permits from indefinite to annual
1991	Amendment 3	Established overfishing definitions for all four species
1991	Amendment 4	Limited the activity of directed foreign fishing and joint venture transfers to foreign vessels Allowed for specification of OY for Atlantic mackerel for up to three years
1996	Amendment 5	Adjusted <i>Loligo</i> MSY; established 1 7/8" minimum mesh size Eliminated directed foreign fisheries for <i>Loligo</i> , <i>Illex</i> , and butterfish Instituted a dealer and vessel reporting system; Instituted operator permitting Implemented a limited access system for <i>Loligo</i> , <i>Illex</i> and butterfish Expanded management unit to include all Atlantic mackerel, <i>Loligo</i> , <i>Illex</i> , and butterfish under U.S. jurisdiction.
1997	Amendment 6	Established directed fishery closure at 95% of DAH for <i>Loligo</i> , <i>Illex</i> and butterfish with post-closure trip limits for each species Established a mechanism for seasonal management of the <i>Illex</i> fishery to improve the yield-per recruit Revised the overfishing definitions for <i>Loligo</i> , <i>Illex</i> and butterfish
1997	Amendment 7	Established consistency among FMPs in the NE region of the U.S. relative to vessel permitting, replacement and upgrade criteria
1998	Amendment 8	Brought the FMP into compliance with new and revised National Standards and other required provisions of the Sustainable Fisheries Act. Added a framework adjustment procedure.
2001	Framework 1	Established research set-asides (RSAs).

Table B1 (cont.)		
Year	Document	Management Action
2002	Framework 2	Established that previous year specifications apply when specifications for the management unit are not published prior to the start of the fishing year (excluding TALFF specifications)
		Extended the <i>Illex</i> moratorium for one year; Established <i>Illex</i> seasonal exemption from <i>Loligo</i> minimum mesh;
		Specified the <i>Loligo</i> control rule; Allowed <i>Loligo</i> specs to be set for up to 3 years
2003	Framework 3	Extended the moratorium on entry to the <i>Illex</i> fishery for an additional year
2004	Framework 4	Extended the moratorium on entry to the <i>Illex</i> fishery for an additional 5 years
2009	Amendment 9	Extended the moratorium on entry into the <i>Illex</i> fishery, without a sunset provision
		Adopted biological reference points for <i>Loligo</i> recommended by the stock assessment review committee (SARC).
		Designated EFH for <i>Loligo</i> eggs based on available information
		Prohibited bottom trawling by MSB-permitted vessels in Lydonia and Oceanographer Canyons
2010	Amendment 10	Authorized specifications to be set for all four MSB species for up to 3 years
		Implemented a butterflyfish rebuilding program. (cap to begin in 2011)
		Increased the <i>Loligo</i> minimum mesh in Trimesters 1 and 3.
		Implemented a 72-hour trip notification requirement for the <i>Loligo</i> fishery (2011).

¹In 2000, a 2,500-pound trip limit was implemented during fishery closures.

²During 2000 and 2007-2009, the *Loligo* DAH was divided up into trimesters. Quarterly quotas were implemented during 2001-2006. The fishery closes during each seasonal time period when the threshold of the seasonal quota allocation is reached.

Table B2. *Loligo* fishery closure dates (prohibition on *Loligo* landings \geq 2,500 lbs per trip), during 2000-2009, when in-season quotas were in effect. Quotas were trimester-based during 2000 and 2007-2009 and quarterly during 2001-2006.

Year	Quota period I	Quota period II	Quota period III	Quota period IV
2000	Mar 25 – Apr 30	Jul 1- Aug 31	Sep 7 – Oct 6, Oct 26 - Dec 31	
2001		May 29 – Jun 30		
2002		May 28 – Jun 30	Aug 16 – Sep 30	Nov 2 - Dec 11 Dec 24 – Dec 31
2003	Mar 25 - Mar 31			
2004	Mar 5 - Mar 31			
2005	Feb 20 - Mar 31	Apr 25 - Jun 30		Dec 18 - Dec 31
2006	Feb 13 - Mar 31	Apr 21 - Apr 27 May 23 - Jun 30	Sep 2 - Sep 30	
2007	Apr 13 - Apr 30			
2008		July 17 - Aug 31		
2009		Aug 6 - Aug 31		

Table B3. *Loligo pealeii* landings during 1963-2010 and Total Allowable Catches (TACs) during 1974-2010. The 2010 landings are preliminary and incomplete.

Year	U.S.	Foreign	Total	Annual TAC	% Foreign
1963	1,294	0	1,294		0.0%
1964	576	2	578		0.3%
1965	709	99	808		12.3%
1966	722	226	948		22.6%
1967	547	1,130	1,677		67.4%
1968	1,084	2,327	3,411		68.2%
1969	899	8,643	9,542		90.6%
1970	653	16,732	17,385		96.2%
1971	727	17,442	18,169		96.0%
1972	725	29,009	29,734		97.6%
1973	1,105	36,508	37,613		97.1%
1974	2,274	32,576	34,850	71,000	93.5%
1975	1,621	32,180	33,801	71,000	95.2%
1976	3,602	21,682	25,284	44,000	85.8%
1977	1,088	15,586	16,674	44,000	93.5%
1978	1,476	9,355	10,831	44,000	87.9%
1979	4,252	13,068	17,320	44,000	75.5%
1980	3,996	19,750	23,746	44,000	83.2%
1981	2,316	20,212	22,528	44,000	89.7%
1982	2,848	15,805	18,653	44,000	84.7%
1983	10,867	11,720	22,587	44,000	51.9%
1984	7,689	11,031	18,720	44,000	58.9%
1985	6,899	6,549	13,448	44,000	48.7%
1986	11,525	4,598	16,123	44,000	28.5%
1987	10,367	2	10,369	44,000	<0.1%
1988	18,593	3	18,596	44,000	<0.1%
1989	23,733	5	23,738	44,000	<0.1%
1990	15,399	0	15,399	44,000	
1991	20,299	0	20,299	44,000	
1992	19,018	0	19,018	44,000	
1993	23,020	0	23,020	44,000	
1994	23,480	0	23,480	44,000	
1995	18,880	0	18,880	36,000	
1996	12,503	0	12,503	25,000	
1997	16,270	0	16,270	21,000	

Table B3. (cont.)

Year	U.S.	Foreign	Total	Annual TAC	% Foreign
1998	19,145	0	19,145	21,000	
1999	19,173	0	19,173	21,000	
2000	17,540	0	17,540	15,000	
2001	14,345	0	14,345	17,000	
2002	16,868	0	16,868	17,000	
2003	11,941	0	11,941	17,000	
2004	15,629	0	15,629	17,000	
2005	16,978	0	16,978	17,000	
2006	15,920	0	15,920	17,000	
2007	12,342	0	12,342	17,000	
2008	11,418	0	11,418	17,000	
2009	9,306	0	9,306	19,000	
2010	5,256	0	5,256	19,000	

¹ Landings during 1963-1978 were not reported by species, but are proration-based estimates by Lange and Sissenwine (1980)

² Landings during 1979-2010 are from the NEFSC Commercial Fisheries Database

³ Domestic landings during 1982-1991 include Joint-Venture landings

⁴ Domestic landings include unclassified squid which were pro-rated by month and 2-digit Statistical Area (1982-1995) or additive (since 1996)

⁵ The source of the landings data for 1963-1995 is NEFSC CRD 02-06.

⁶ Since May of 2004, landings have been reported electronically by dealers

⁷ Landings during 2010 are preliminary and incomplete

⁸ TACs for 1974 and 1975 are for *Illex* and *Loligo* combined

Table B4. Numbers of trips sampled, by month, for landings length composition during 1987-2009.

Year	Month												Total
	1	2	3	4	5	6	7	8	9	10	11	12	
1987	1	3	7	4	5	11	1	2	3	1	5	5	48
1988	1	3	5	5	15	7	6	3	1	3	3	2	54
1989	4	2	11	2	17	10	5	2	8	10	7	4	82
1990	6	7	11	5	16	11	3	5	6	13	8	3	94
1991	3	5	9	8	11	4	1	5	6	5	7	9	73
1992	8	3	8	8	7	3	6	6	3	6	10	3	71
1993	4	4	10	4	3	5	2	4	1	9	5	2	53
1994	4	2	7	0	1	6	3	3	7	7	4	2	46
1995	4	5	6	3	5	0	3	3	0	3	0	2	34
1996	1	2	16	1	3	3	5	4	0	11	13	13	72
1997	10	12	16	12	12	8	7	9	4	15	6	1	112
1998	7	18	24	15	2	3	3	9	3	13	18	16	131
1999	18	14	13	31	11	15	36	25	12	12	14	13	214
2000	18	17	15	1	10	28	10	7	2	6	5	7	126
2001	7	16	17	21	10	9	16	9	6	22	24	6	163
2002	25	13	18	21	6	5	20	16	1	22	3	5	155
2003	9	20	16	10	9	2	6	14	7	14	20	4	131
2004	7	21	13	10	15	10	14	8	1	17	10	19	145
2005	20	25	15	21	21	4	4	7	4	21	36	14	192
2006	38	9	22	34	14	6	14	18	3	27	32	10	227
2007	16	10	25	20	4	6	30	25	4	38	9	6	193
2008	23	24	3	19	13	7	32	2	4	37	6	4	174
2009	12	16	18	18	16	4	29	7	4	21	9	10	164

Table B5. Numbers of *Loligo* sampled for landings length composition, by market category, during 1987-2009.

Year	Unclassified	Lg	Sm	Med	SS	Total
1987	2,449	49				2,498
1988	3,153					3,153
1989	4,455					4,455
1990	4,903	152				5,055
1991	3,626	252				3,878
1992	3,852	50				3,902
1993	2,718	151				2,869
1994	3,462	316				3,778
1995	2,370	1,100				3,470
1996	5,071	1,183				6,254
1997	8,850	1,765	1,136	100	200	12,051
1998	9,650	2,944	451	195	888	14,128
1999	12,659	7,210	1,258	956	1,701	23,784
2000	8,381	3,904	118	161	430	12,994
2001	9,884	4,538	8,080	2,033	1,807	26,342
2002	6,638	5,632	18,598	7,373	8,680	46,921
2003	7,457	1,740	8,210	2,381	12,638	32,426
2004	11,090	3,322	699		1,983	17,094
2005	12,966	4,867	3,738	1,051	10,392	33,014
2006	14,123	8,664	1,614	109	2,138	26,648
2007	14,145	5,282	603	269	548	20,847
2008	12,020	5,649	200	100		17,969
2009	9,605	6,197	305	400		16,507

Table B6. Number of *Loligo* length samples from the landings, by market category and month, during 1996-2009.

Year	Market category	Month												Total
		1	2	3	4	5	6	7	8	9	10	11	12	
1996	8010	1	2	12	1	3	2	5	3		8	12	8	57
	8011			4			1		1		3	1	5	15
Total		1	2	16	1	3	3	5	4		11	13	13	72
1997	8010	10	9	10	7	12	8	5	7	1	12	5	1	87
	8011		3	5	2			2	2	2	1	1		18
	8012			1	1					1	1			4
	8013				1									1
	8014				1						1			2
Total		10	12	16	12	12	8	7	9	4	15	6	1	112
1998	8010	4	12	19	10	2	3	2	7	3	7	14	11	94
	8011	3	5	5	5			1	2		3	2	3	29
	8012		1								1		1	3
	8013										1	1		2
	8014										1	1	1	3
Total		7	18	24	15	2	3	3	9	3	13	18	16	131
1999	8010	12	8	4	17	7	12	14	17	7	9	10	3	120
	8011	4	2	5	12	4	3	19	7	5	3	4	4	72
	8012	1	2	1	1			1					2	8
	8013	1		2				2	1				2	8
	8014		2	1	1								2	6
Total		18	14	13	31	11	15	36	25	12	12	14	13	214
2000	8010	9	15	12	1	9	12	8	3	1	4	3	5	82
	8011	6	2	3		1	14	2	4	1	2	2	2	39
	8012	1												1
	8013	1												1
	8014	1					2							3
Total		18	17	15	1	10	28	10	7	2	6	5	7	126
2001	8010	6	9	11	11	8	5	13	6	5	14	5	2	95
	8011	1	6	6	9	2	4	3	3	1	5	5		45
	8012										1	7	2	10
	8013		1		1						1	6	2	11
	8014										1	1		2
Total		7	16	17	21	10	9	16	9	6	22	24	6	163
2002	8010	8	7	5	11	2	1	5	5		10	2	5	61
	8011	7	2	6	4	1	2	6	7		5			40
	8012	4	2	3	2	1	1	3	3	1	3	1		24
	8013	4	2	3	2	1	1	3			3			19
	8014	2		1	2	1		3	1		1			11
Total		25	13	18	21	6	5	20	16	1	22	3	5	155
2003	8010	3	10	9	4	5	2	6	13	4	4	11	4	75
	8011	1	4	2	1	1			1		5	3		18
	8012	2	2	2	2	1				1	1	2		13
	8013	1	2	1	1	1				1	2	2		11
	8014	2	2	2	2	1				1	2	2		14
Total		9	20	16	10	9	2	6	14	7	14	20	4	131

Table B6 (cont.)		Month												Total
Year	Market category	1	2	3	4	5	6	7	8	9	10	11	12	
2004	8010	6	14	9	3	11	8	12	7	1	15	10	13	109
	8011	1	7	4	7	4	2	2	1		2		2	32
	8012												2	2
	8014												2	2
Total		7	21	13	10	15	10	14	8	1	17	10	19	145
2005	8010	10	14	11	11	16	3	3	6	4	8	21	10	117
	8011	3	5	4	10	4	1	1	1		5	9	4	47
	8012	2	2								3	1		8
	8013	2	1			1					2	2		8
	8014	3	3								3	3		12
Total		20	25	15	21	21	4	4	7	4	21	36	14	192
2006	8010	22	7	15	19	9	5	13	12		14	15	6	137
	8011	11	2	7	15	5	1	1	6	3	13	17	4	85
	8012	2												2
	8013	1												1
	8014	2												2
Total		38	9	22	34	14	6	14	18	3	27	32	10	227
2007	8010	12	7	14	12	3	5	18	18	4	32	7	5	137
	8011	4	3	8	8	1	1	12	7		6	2		52
	8012			1										1
	8013			1									1	2
	8014			1										1
Total		16	10	25	20	4	6	30	25	4	38	9	6	193
2008	8010	19	22	3	11	10	5	16	1	1	21	5	2	116
	8011	4	2		7	3	2	16	1	3	14	1	2	55
	8012				1						1			2
	8013										1			1
Total		23	24	3	19	13	7	32	2	4	37	6	4	174
2009	8010	6	11	14	8	11	4	12	5	2	10	5	7	95
	8011	5	5	4	9	5		17	2	2	9	3	1	62
	8012	1			1								1	3
	8013										2	1	1	4
Total		12	16	18	18	16	4	29	7	4	21	9	10	164

Table B7. *Loligo* discard estimates (mt) and CVs, by fleet, and number of observer trips per year during 1989-2009.

<i>Loligo</i> Discards (mt)									
Bottom trawls by codend mesh size									
	>= 5.5 in.	2.5-5.49 in.	<= 2.49 in.	Total	MW trawls	Scallop dredges/trawls	Grand Total	CV	Total N obs. trips
1989	134	479	183	796	2.11	8.79	806	0.22	178
1990	285	164	698	1,147	2.11	8.79	1,158	0.59	139
1991	98	155	254	506	28.94	8.79	544	0.78	269
1992	113	353	303	770	0.01	10.26	780	0.64	213
1993	8	149	195	352	0.02	15.02	367	0.02	110
1994	284	703	85	1,072	0.29	14.19	1,086	0.49	119
1995	28	39	1,121	1,187	2.11	19.46	1,209	0.29	288
1996	6	264	19	288	2.11	2.67	293	0.90	224
1997	3	89	99	191	2.11	10.34	204	1.14	130
1998	5	45	161	211	2.11	18.15	232	0.87	82
1999	12	27	2,099	2,139	0.06	1.24	2,140	0.64	124
2000	113	6	12	131	2.11	3.51	137	0.28	452
2001	4	3	40	47	2.11	5.04	54	0.43	380
2002	3	3	348	354	2.11	16.61	373	0.64	450
2003	18	3	134	156	2.11	10.94	169	0.79	690
2004	7	3	266	277	0.04	6.58	283	0.30	1,431
2005	4	7	682	692	0.02	3.62	696	0.25	2,343
2006	20	50	119	189	0.00	10.47	199	0.52	1,180
2007	10	3	112	125	0.08	5.23	130	0.42	1,463
2008	17	5	81	103	0.05	2.63	106	0.59	1,799
2009	73	3	175	251	0.07	2.25	254	0.40	2,075
Average 1989-2009	59	122	342	523	2	9	534	0.53	673

Table B8. Number of NEFOP observer trips, *Loligo* discard estimates (mt) and CVs, by fleet and region, during 1989-2009.

Bottom trawls with codend mesh size \geq 5.5 in.									
YEAR	MA			NE			Total		
	N Obs trips	Discards (mt)	CV	N Obs trips	Discards (mt)	CV	N Obs trips	Discards (mt)	CV
1989	1	66.9	0.72	56	66.9	0.72	57	133.8	0.72
1990	0	142.7	0.43	54	142.7	0.43	54	285.4	0.43
1991	4	64.0	2.41	78	34.0	0.38	82	98.0	1.58
1992	14	8.8	1.36	68	104.6	1.09	82	113.4	1.01
1993	7	3.8	1.98	31	4.1	1.50	38	7.8	1.23
1994	13	13.8	0.86	27	269.7	0.57	40	283.5	0.54
1995	52	9.1	0.75	67	18.7	0.53	119	27.8	0.43
1996	16	1.4	3.68	39	4.5	4.75	55	5.8	3.75
1997	5	2.7	0.63	24	0.2	0.63	29	2.9	0.63
1998	13	4.1	0.90	11	1.2	0.44	24	5.3	0.69
1999	5	3.1	1.09	32	9.3	0.25	37	12.4	0.33
2000	27	105.0	0.33	99	8.3	0.37	126	113.3	0.31
2001	44	0.1	0.97	156	3.7	0.40	200	3.7	0.40
2002	37	0.1	0.45	214	2.8	0.30	251	2.8	0.30
2003	11	16.1	0.89	386	2.4	0.57	397	18.5	0.78
2004	91	5.6	0.40	527	1.7	0.37	618	7.3	0.32
2005	87	1.1	0.62	1346	2.4	0.26	1,433	3.5	0.27
2006	62	4.5	0.88	613	15.1	0.16	675	19.6	0.68
2007	160	4.8	0.41	619	4.9	0.30	779	9.7	0.25
2008	127	7.6	0.89	750	9.1	0.26	877	16.6	0.43
2009	164	68.7	0.40	868	4.1	0.31	1,032	72.7	0.38

Table B8 (cont.)

Bottom trawls with codend mesh size 2.5-5.49 in.										
YEAR	MA			NE			Total			
	N Obs trips	Discards (mt)	CV	N Obs trips	Discards (mt)	CV	N Obs trips	Discards (mt)	CV	
1989	23	282.49	0.41	68	196.12	0.32	91	479	0.28	
1990	36	120.91	0.51	30	42.71	1.30	66	164	0.51	
1991	47	95.44	0.50	67	59.30	0.33	114	155	0.33	
1992	26	215.61	0.48	33	137.85	0.60	59	353	0.38	
1993	7	123.03	0.67	17	26.20	0.64	24	149	0.56	
1994	8	23.63	0.80	9	679.64	0.69	17	703	0.67	
1995	21	31.33	1.37	4	7.27	0.75	25	39	1.12	
1996	28	24.86	0.61	8	239.27	1.08	36	264	0.98	
1997	15	5.43	1.26	9	83.97	1.01	24	89	0.95	
1998	5	0.46	1.10	1	44.78	1.10	6	45	1.10	
1999	10	1.87	0.93	9	25.19	0.93	19	27	0.93	
2000	16	0.45	1.58	12	5.60	1.39	28	6	1.29	
2001	19	0.03	6.68	14	3.46	0.76	33	3	0.75	
2002	19	2.84	0.35	44	0.45	0.57	63	3	0.31	
2003	54	0.67	0.65	45	2.27	0.56	99	3	0.46	
2004	158	2.75	0.34	120	0.72	0.87	278	3	0.32	
2005	111	5.42	0.37	199	1.39	0.49	310	7	0.31	
2006	59	49.40	0.71	46	0.38	2.04	105	50	0.70	
2007	157	2.28	0.43	42	0.90	0.81	199	3	0.39	
2008	95	5.03	0.48	25	0.09	1.57	120	5	0.47	
2009	142	1.93	0.37	75	1.16	0.52	217	3	0.30	

Table B8 (cont.)

YEAR	Bottom trawls with codend mesh size \leq 2.49 in.								
	MA			NE			Total		
N Obs trips	Discards (mt)	CV	N Obs trips	Discards (mt)	CV	N Obs trips	Discards (mt)	CV	
1989	11	125	0.56	19	58	0.62	30	183	0.43
1990	12	581	0.98	7	117	0.95	19	698	0.83
1991	33	171	2.24	31	82	0.46	64	254	1.52
1992	21	295	1.57	24	8	2.02	45	303	1.53
1993	1	182		4	12		5	195	0.00
1994	3	70	2.47	1	15		4	85	2.47
1995	42	1104	0.32	36	17	0.89	78	1,121	0.31
1996	51	15	0.56	42	4	1.32	93	19	0.52
1997	36	92	2.25	12	7	5.53	48	99	2.13
1998	22	54	1.27	4	106	1.37	26	161	1.00
1999	24	124	0.65	10	1975	0.69	34	2,099	0.65
2000	20	7	0.68	5	5	2.65	25	12	1.14
2001	36	23	0.52	4	17	1.08	40	40	0.55
2002	14	328	0.73	21	20	0.56	35	348	0.68
2003	18	50	0.93	27	84	1.45	45	134	0.97
2004	96	207	0.40	49	59	0.26	145	266	0.32
2005	63	559	0.29	54	123	0.55	117	682	0.26
2006	89	88	1.11	38	32	0.29	127	119	0.51
2007	64	45	0.98	36	66	0.45	100	112	0.48
2008	57	27	1.37	37	54	0.92	94	81	0.77
2009	145	160	0.62	146	16	0.53	291	175	0.56

¹ Values shown in bold were interpolated either because there were fewer than 2 trips per year or all trips occurred in one quarter

Table B9. Numbers of *Loligo* length measurements used to characterize the kept and discarded portions of the catches and numbers of trips sampled by NEFOP observers during 1994-2009.

Year	N <i>Loligo</i> sampled		N trips sampled	
	Kept	Discarded	Kept	Discarded
1994	3,162	224	3	2
1995	5,398	2,958	36	14
1996	5,310	1,138	22	7
1997	10,803	884	29	5
1998	8,030	0	18	0
1999	18,463	2,442	34	9
2000	8,898	1,163	25	5
2001	15,126	1,579	31	10
2002	9,278	1,075	31	4
2003	3,060	108	18	1
2004	20,653	1,082	81	9
2005	17,082	1,127	71	9
2006	9,715	637	51	9
2007	3,407	628	28	7
2008	5,875	309	36	5
2009	12,810	1,432	88	17

Table B10. *Loligo pealeii* landings (mt), during 1963-2010, and discards (mt) and catches (mt) during 1963-2009.

Year	Landings (mt)			Discards (mt)	Catch (mt)
	U.S.	Foreign	Total		
1963	1,294	0	1,294	44	1,338
1964	576	2	578	20	598
1965	709	99	808	27	835
1966	722	226	948	32	980
1967	547	1,130	1,677	57	1,734
1968	1,084	2,327	3,411	116	3,527
1969	899	8,643	9,542	324	9,866
1970	653	16,732	17,385	591	17,976
1971	727	17,442	18,169	618	18,787
1972	725	29,009	29,734	1,011	30,745
1973	1,105	36,508	37,613	1,279	38,892
1974	2,274	32,576	34,850	1,185	36,035
1975	1,621	32,180	33,801	1,149	34,950
1976	3,602	21,682	25,284	860	26,144
1977	1,088	15,586	16,674	567	17,241
1978	1,476	9,355	10,831	368	11,199
1979	4,252	13,068	17,320	589	17,909
1980	3,996	19,750	23,746	807	24,553
1981	2,316	20,212	22,528	766	23,294
1982	2,848	15,805	18,653	634	19,287
1983	10,867	11,720	22,587	768	23,355
1984	7,689	11,031	18,720	636	19,356
1985	6,899	6,549	13,448	457	13,905
1986	11,525	4,598	16,123	548	16,671
1987	10,367	2	10,369	353	10,722
1988	18,593	3	18,596	632	19,228
1989	23,733	5	23,738	806	24,544
1990	15,399	0	15,399	1,158	16,557
1991	20,299	0	20,299	544	20,843
1992	19,018	0	19,018	780	19,798
1993	23,020	0	23,020	367	23,387
1994	23,480	0	23,480	1,086	24,566
1995	18,880	0	18,880	1,207	20,087
1996	12,503	0	12,503	293	12,796
1997	16,270	0	16,270	204	16,474
1998	19,145	0	19,145	232	19,377
1999	19,173	0	19,173	2,140	21,313
2000	17,540	0	17,540	135	17,674
2001	14,345	0	14,345	54	14,399
2002	16,868	0	16,868	373	17,241
2003	11,941	0	11,941	167	12,107
2004	15,738	0	15,738	283	16,022
2005	16,720	0	16,720	696	17,416
2006	15,920	0	15,920	1,138	17,058
2007	12,342	0	12,342	130	12,472
2008	11,418	0	11,418	106	11,524
2009	9,307	0	9,307	254	9,560
2010	5,256	0	5,256		

¹ Landings during 1963-1978 were not reported by species, but are proration-based estimates by Lange and Sissenwine (1980)

² Landings during 1979-2010 are from the NEFSC Commercial Fisheries Database

³ Domestic landings during 1982-1991 include Joint-Venture landings

⁴ Domestic landings include unclassified squid which were pro-rated by month and 2-digit Statistical Area (1982-1995) or additive (1996-2008)

⁵ Since May of 2004, landings have been reported electronically by dealers

⁶ Landings during 2010 are preliminary and incomplete

Table B11. Nominal effort (days fished), landings (mt), and nominal LPUE (mt/day fished) for bottom trawl trips with *Loligo* landings $\geq 2,500$ lbs during January-June and July-December, 1996-2009.

Year	Jan-June fishery			July-Dec fishery		
	Days fished	Landings (mt)	Nominal LPUE (mt/day fished)	Days fished	Landings (mt)	Nominal LPUE (mt/day fished)
1996	1064	5162	4.85	373	866	2.32
1997	800	2936	3.67	1322	6016	4.55
1998	1277	7466	5.85	999	3364	3.37
1999	1141	4265	3.74	1350	5729	4.24
2000	1045	5516	5.28	521	4117	7.91
2001	642	3620	5.64	775	4394	5.67
2002	872	4433	5.08	796	4890	6.14
2003	727	3892	5.35	585	3848	6.57
2004	828	5889	7.11	458	3719	8.12
2005	715	6320	8.84	430	2761	6.43
2006	832	5459	6.56	870	4717	5.42
2007	690	4633	6.71	427	3018	7.06
2008	692	3971	5.74	777	3715	4.78
2009	582	2647	4.55	626	2712	4.33

Table B12. Relative catch rates during the day, versus night and dawn/dusk, for *Loligo* pre-recruits (≤ 8 cm DML) and recruits (> 8 cm DML), during NEFSC fall and spring surveys. For example, the relative catch rate of fall nighttime catches of pre-recruits, on average, is 11.5 times higher than for daytime tows. These diel conversion factors, estimated from a GLM, were used in the previous assessment.

NEFSC survey	Time period	≤ 8 cm DML	> 8 cm DML
Fall ¹	Night (8PM-4AM)	11.5	2.9
	Dawn/Dusk (4-7:59AM and 4-7:59PM)	2.2	1.2
	Day (8AM-3:59PM)	1.0	1.0
Spring ²	Night (8PM-4AM)	2.0	0.8
	Dawn/Dusk (4-7:59AM and 4-7:59PM)	1.2	0.9
	Day (8AM-3:59PM)	1.0	1.0

¹ Source: Brodziak and Hendrickson (1999)

² Source: Hatfield and Cadrin (2002)

Table B13. Comparison of *Loligo* relative abundance indices, pre-recruits (≤ 8 cm DML) and recruits (> 8 cm DML), for all times of day versus daytime only (solar zenith = 43-80°) during 1975-2008 NEFSC fall surveys.

Year	Pre-recruits (≤ 8 cm DML)					Recruits (> 8 cm DML)					
	Mean number per tow		CV		CV difference	Mean number per tow		CV		CV difference	
	All	Day	All	Day	All-Day	All	Day	All	Day	All-Day	
1975	415	902	22	15	6	85	103	16	14	2	
1976	304	562	15	13	2	102	144	22	19	3	
1977	259	404	13	17	-4	71	101	19	23	-4	
1978	101	193	15	21	-6	41	72	16	12	4	
1979	149	297	14	13	1	30	69	13	14	-1	
1980	297	432	14	16	-1	67	115	13	10	3	
1981	137	269	16	14	1	51	119	14	8	6	
1982	226	427	22	14	7	49	91	17	21	-4	
1983	281	595	15	19	-4	112	192	15	24	-9	
1984	154	407	22	7	15	135	196	17	21	-4	
1985	240	482	18	20	-1	105	201	14	12	2	
1986	295	554	17	16	1	77	146	14	8	6	
1987	38	72	14	10	4	25	30	16	7	9	
1988	397	565	13	16	-3	82	105	13	19	-6	
1989	230	490	14	21	-7	116	312	22	40	-19	
1990	216	364	16	14	2	74	109	11	16	-5	
1991	177	245	11	16	-5	95	126	14	11	3	
1992	698	1919	28	27	1	36	56	13	18	-4	
1993	102	117	31	39	-8	52	62	8	11	-3	
1994	308	564	12	11	1	155	314	15	15	-1	
1995	142	269	21	18	2	45	53	15	13	1	
1996	155	253	22	19	3	30	42	20	32	-12	
1997	259	436	16	22	-7	67	105	21	20	1	
1998	153	310	16	15	1	43	62	14	12	2	
1999	572	1139	14	11	2	96	150	10	11	-1	
2000	529	643	15	17	-2	128	372	19	6	12	
2001	268	318	20	13	7	69	102	13	10	3	
2002	642	1659	26	4	22	129	236	13	5	9	
2003	332	730	27	11	16	56	175	24	13	11	
2004	468	968	24	15	9	43	66	15	12	3	
2005	185	389	19	13	5	74	127	16	27	-11	
2006	820	1572	27	11	16	92	155	11	14	-3	
2007	562	988	17	18	-1	71	110	19	24	-5	
2008	308	530	18	17	1	57	112	17	23	-6	
% years with reduction in CV					65						50

¹ Pre-1985 data multiplied by door conversion factors (nos.= 0, wt.= 1.24) and data from R/V *DE II* tows multiplied by vessel conversion factors (nos.= 0.83, wt. = 0.85) during 1975-2008.

Table B14. Comparison of *Loligo* relative abundance indices, pre-recruits (≤ 8 cm DML) and recruits (> 8 cm DML), for all times of day versus daytime only (solar zenith = 29-84°) during 1976-2008 NEFSC spring surveys.

Year	Pre-recruits (≤ 8 cm DML)					Recruits (> 8 cm DML)						
	Mean number per tow		CV		CV difference	Mean number per tow		CV		CV difference		
	All	Day	All	Day	All-Day	All	Day	All	Day	All-Day		
1976	116	185	19	18	1	34	54	14	12	2		
1977	7	11	24	20	4	7	9	46	51	-4		
1978	31	27	44	22	22	11	18	34	6	29		
1979	68	128	38	17	22	13	19	18	8	10		
1980	28	71	44	27	18	11	20	20	9	11		
1981	20	25	30	32	-3	14	16	31	32	-1		
1982	34	70	37	5	32	16	25	19	12	7		
1983	15	20	24	9	15	25	24	31	50	-20		
1984	45	71	34	37	-3	20	37	37	11	26		
1985	54	65	25	16	9	19	29	27	7	19		
1986	59	70	31	39	-8	24	23	15	11	4		
1987	11	13	14	16	-2	16	19	23	32	-9		
1988	81	164	37	26	11	30	31	13	14	-1		
1989	66	112	43	39	4	44	53	20	9	11		
1990	75	124	27	22	6	24	19	25	23	3		
1991	93	179	30	23	8	36	45	16	12	4		
1992	59	118	36	6	30	17	25	23	4	20		
1993	26	36	40	47	-7	17	16	23	18	5		
1994	15	18	19	18	2	7	7	15	12	3		
1995	38	70	18	28	-10	17	21	12	17	-5		
1996	17	33	30	18	12	5	9	32	33	-1		
1997	57	85	42	40	2	22	38	35	12	23		
1998	38	38	17	13	4	13	10	25	36	-12		
1999	160	282	25	26	-1	25	36	15	18	-3		
2000	81	68	30	13	17	26	24	19	9	10		
2001	80	127	28	27	1	14	19	13	16	-3		
2002	251	336	10	10	-1	34	41	13	12	1		
2003	25	33	50	60	-10	9	9	18	16	2		
2004	31	46	25	9	16	9	9	25	7	18		
2005	63	152	45	11	34	17	18	21	26	-5		
2006	115	134	15	16	-1	44	39	20	19	1		
2007	112	181	19	17	2	30	45	24	18	6		
2008	121	191	30	16	14	8	8	14	12	2		
% years with reduction in CV						70						67

¹ Pre-1985 data multiplied by door conversion factors (nos.= 0, wt.= 1.24) and data from R/V *DE II* tows multiplied by vessel conversion factors (nos.= 0.83, wt. = 0.85) during 1976-2008.

Table B15. Summary of NEFSC fall bottom trawl surveys during 1975-2009. Mean Julian date and N stations pertain to stations sampled in the *Loligo* strata set during the daytime (solar zenith 43-80°) and area sampled also pertains to the *Loligo* strata set. The 1975-2008 strata set includes offshore strata 1-23, 25-26, and 61-76 plus inshore strata 2-46, 58-61, and 65-66. The 2009 strata set is the same but without strata ≤ 18 m.

Year	Mean Julian Date	Trawl Type	Research Vessels	Trawl Doors	N stations sampled during "day"	Area Sampled (km ²)
1975	294	Yankee 36	Albatross IV, Delaware II	BMV	103	129,866
1976	290	Yankee 36	Albatross IV	BMV	104	149,547
1977	287	Yankee 36	Delaware II	BMV	100	135,989
1978	280	Yankee 36	Delaware II	BMV	114	147,102
1979	286	Yankee 36	Albatross IV, Delaware II	BMV	113	133,578
1980	284	Yankee 36	Delaware II	BMV	90	112,233
1981	283	Yankee 36	Albatross IV, Delaware II	BMV	95	137,539
1982	279	Yankee 36	Albatross IV	BMV	85	130,312
1983	279	Yankee 36	Albatross IV	BMV	95	140,527
1984	273	Yankee 36	Albatross IV	BMV	78	124,255
1985	284	Yankee 36	Albatross IV, Delaware II	Polyvalent	97	144,498
1986	277	Yankee 36	Albatross IV, Delaware II	Polyvalent	89	134,459
1987	272	Yankee 36	Albatross IV	Polyvalent	77	131,479
1988	275	Yankee 36	Albatross IV, Delaware II	Polyvalent	77	130,412
1989	274	Yankee 36	Delaware II	Polyvalent	84	126,526
1990	270	Yankee 36	Delaware II	Polyvalent	86	133,821
1991	267	Yankee 36	Delaware II	Polyvalent	85	135,999
1992	273	Yankee 36	Albatross IV	Polyvalent	87	135,323
1993	266	Yankee 36	Delaware II	Polyvalent	89	140,040
1994	271	Yankee 36	Albatross IV	Polyvalent	82	129,541
1995	265	Yankee 36	Albatross IV	Polyvalent	84	130,998
1996	270	Yankee 36	Albatross IV	Polyvalent	87	120,678
1997	270	Yankee 36	Albatross IV	Polyvalent	89	143,730
1998	279	Yankee 36	Albatross IV	Polyvalent	80	126,066
1999	280	Yankee 36	Albatross IV	Polyvalent	84	128,374
2000	266	Yankee 36	Albatross IV	Polyvalent	89	123,360
2001	265	Yankee 36	Albatross IV	Polyvalent	81	127,421
2002	269	Yankee 36	Albatross IV	Polyvalent	82	136,020
2003	271	Yankee 36	Albatross IV	Polyvalent	79	119,981
2004	273	Yankee 36	Albatross IV	Polyvalent	83	139,319
2005	274	Yankee 36	Albatross IV	Polyvalent	82	135,258
2006	267	Yankee 36	Albatross IV	Polyvalent	87	130,690
2007	274	Yankee 36	Albatross IV	Polyvalent	87	129,174
2008	270	Yankee 36	Albatross IV	Polyvalent	88	134,559
2009	281	400x12 cm 4-seam	Henry H. Bigelow	Polyice Oval	84	132,271

Table B16. Summary of NEFSC spring bottom trawl surveys during 1976-2010. Mean Julian date and N stations pertain to stations sampled in the *Loligo* strata set during the daytime (solar zenith 29-84°) and area sampled also pertains to the *Loligo* strata set. The 1976-2008 strata set includes offshore strata 1-23, 25-26, and 61-76 plus inshore strata 2-46, 58-61, and 65-66. The 2009-2010 strata set is the same but without strata ≤ 18 m.

Year	Mean Julian Date	Trawl Type	Research Vessels	Type Trawl Doors	N stations sampled during "day"	Area Sampled (km ²)
1976	82	Yankee No. 41	Albatross IV, Delaware II	BMV	127	152,785
1977	98	Yankee No. 41	Albatross IV, Delaware II	BMV	133	155,008
1978	97	Yankee No. 41	Albatross IV	BMV	118	150,652
1979	102	Yankee No. 41	Albatross IV, Delaware II	BMV	152	154,099
1980	101	Yankee No. 41	Albatross IV, Delaware II	BMV	155	132,610
1981	102	Yankee No. 41	Delaware II	BMV	119	145,476
1982	97	Yankee No. 36	Delaware II	BMV	125	151,022
1983	90	Yankee No. 36	Albatross IV	BMV	118	152,223
1984	82	Yankee No. 36	Albatross IV	BMV	125	152,123
1985	76	Yankee No. 36	Albatross IV	Polyvalent	111	138,500
1986	85	Yankee No. 36	Albatross IV	Polyvalent	115	131,513
1987	98	Yankee No. 36	Albatross IV, Delaware II	Polyvalent	113	147,277
1988	79	Yankee No. 36	Albatross IV	Polyvalent	110	136,887
1989	72	Yankee No. 36	Delaware II	Polyvalent	92	145,984
1990	81	Yankee No. 36	Delaware II	Polyvalent	102	145,510
1991	81	Yankee No. 36	Delaware II	Polyvalent	102	145,994
1992	80	Yankee No. 36	Albatross IV	Polyvalent	104	145,123
1993	88	Yankee No. 36	Albatross IV	Polyvalent	115	133,560
1994	82	Yankee No. 36	Delaware II	Polyvalent	104	143,466
1995	89	Yankee No. 36	Albatross IV	Polyvalent	107	136,256
1996	89	Yankee No. 36	Albatross IV	Polyvalent	121	146,477
1997	80	Yankee No. 36	Albatross IV	Polyvalent	111	144,649
1998	78	Yankee No. 36	Albatross IV	Polyvalent	107	136,706
1999	85	Yankee No. 36	Albatross IV	Polyvalent	113	133,807
2000	91	Yankee No. 36	Albatross IV	Polyvalent	112	151,396
2001	83	Yankee No. 36	Albatross IV	Polyvalent	117	141,676
2002	85	Yankee No. 36	Albatross IV	Polyvalent	109	128,964
2003	85	Yankee No. 36	Delaware II	Polyvalent	113	151,132
2004	82	Yankee No. 36	Albatross IV	Polyvalent	108	148,371
2005	81	Yankee No. 36	Albatross IV	Polyvalent	110	132,370
2006	81	Yankee No. 36	Albatross IV	Polyvalent	109	150,912
2007	82	Yankee No. 36	Albatross IV	Polyvalent	125	142,564
2008	87	Yankee No. 36 400x12 cm	Albatross IV	Polyvalent	125	146,772
2009	88	4-seam 400x12 cm	Henry H. Bigelow	Polyice Oval	140	149,016
2010	82	4-seam	Henry H. Bigelow	Polyice Oval	123	147,431

Table B17. Coefficients (ρ) used to convert SRV *H. B. Bigelow* catches of *Loligo pealeii* to SRV *Albatross IV* equivalents for the fall 2009 and spring 2009-2010 NEFSC bottom trawl surveys.

Size range (DML)	Spring Surveys			Fall Surveys		
	ρ	SE	CV	ρ	SE	CV
≤ 8 cm	1.29	0.204	16	1.26	0.088	7
> 8 cm	2.11	0.325	15	1.70	0.090	5
All sizes combined	1.53	0.171	11	1.51	0.064	4

Table B18. Stratified mean numbers and weight (kg) per tow for *Loligo pealeii* pre-recruits (≤ 8 cm DML) and recruits (> 8 cm) caught in NEFSC fall surveys during 1975-2009. The 1975-2008 survey strata set includes offshore strata 1-23, 25-26, and 61-76 plus inshore strata 2-46, 58-61, and 65-66. The 2009 strata set is the same except strata ≤ 18 m were not included because they are too shallow to be sampled by the new survey vessel, the FRV *Henry B. Bigelow*.

Year	Number per tow				Kg per tow			
	Pre-recruits	CV	Recruits	CV	All sizes	CV	All sizes	CV
1975	902	15	103	14	1,004	14	14.4	11
1976	562	13	144	19	707	12	18.8	15
1977	404	17	101	23	505	14	11.5	18
1978	193	21	72	12	265	16	7.6	11
1979	297	13	69	14	366	12	8.2	12
1980	432	16	115	10	547	13	14.2	8
1981	269	14	119	8	388	10	12.5	6
1982	427	14	91	21	518	13	12.4	15
1983	595	19	192	24	787	14	23.7	20
1984	407	7	196	21	603	9	20.8	17
1985	482	20	201	12	683	15	19.6	11
1986	554	16	146	8	700	13	14.8	4
1987	72	10	30	7	101	8	2.8	9
1988	565	16	105	19	670	14	9.3	13
1989	490	21	312	40	803	25	21.5	34
1990	364	14	109	16	474	12	10.4	14
1991	245	16	126	11	371	12	11.5	10
1992	1,919	27	56	18	1,975	27	10.4	20
1993	117	39	62	11	179	26	4.9	10
1994	564	11	314	15	878	11	27.5	15
1995	269	18	53	13	322	15	5.8	8
1996	253	19	42	32	295	18	3.8	20
1997	436	22	105	20	541	21	10.3	22
1998	310	15	62	12	372	14	5.3	14
1999	1,139	11	150	11	1,289	10	15.4	10
2000	643	17	372	6	1,014	12	30.4	7
2001	318	13	102	10	421	11	8.5	8
2002	1,659	4	236	5	1,895	4	23.4	5
2003	730	11	175	13	904	8	14.0	11
2004	968	15	66	12	1,034	14	8.6	10
2005	389	13	127	27	515	14	9.9	20
2006	1,572	11	155	14	1,727	10	22.9	6
2007	988	18	110	24	1,097	17	10.1	18
2008	530	17	112	23	642	18	11.3	25
2009	437	8	49	18	419	8	6.4	12
Median								
1976-2008	436	16	112	14	603	13	11	12

¹ Pre-1985 indices were multiplied by door conversion factors (nos.=0, wt.=1.24) and data from R/V *DE II* tows multiplied by vessel conversion factors (nos.=0.83, wt.=0.85) during 1975-2008.

² Only daytime tows (solar zenith of 43-80 degrees) were used to compute the above indices

³ Bigelow conversion factors of 1.26 for pre-recruits, 1.70 for recruits, and 1.51 for all sizes were applied to the 2009 number and weight indices

Table B19. Stratified mean numbers and weight (kg) per tow for *Loligo pealeii* pre-recruits (≤ 8 cm DML) and recruits (> 8 cm) caught in NEFSC spring surveys during 1976-2010. The 1976-2008 survey strata set includes offshore strata 1-23, 25-26, and 61-76 plus inshore strata 2-46, 58-61, and 65-66. The 2009-2010 strata set is the same except strata ≤ 18 m were not included because they are too shallow to be sampled by the new survey vessel, the FRV *Henry B. Bigelow*.

Year	Number per tow				Kg per tow			
	Pre-recruits	CV	Recruits	CV	All sizes	CV	All sizes	CV
1976	185	18	54	12	239	15	7.5	11
1977	11	20	9	51	20	30	1.0	41
1978	27	22	18	6	45	15	2.2	9
1979	128	17	19	8	147	15	3.2	8
1980	71	27	20	9	91	22	3.2	12
1981	25	32	16	32	40	29	2.0	26
1982	70	5	25	12	95	6	2.9	12
1983	20	9	24	50	44	29	2.2	46
1984	71	37	37	11	107	28	4.5	15
1985	65	16	29	7	94	12	2.9	6
1986	70	39	23	11	93	31	2.5	17
1987	13	16	19	32	32	21	2.1	27
1988	164	26	31	14	195	23	4.0	16
1989	112	39	53	9	165	28	4.8	12
1990	124	22	19	23	143	19	2.8	15
1991	179	23	45	12	223	18	4.3	9
1992	118	6	25	4	143	5	3.6	4
1993	36	47	16	18	52	35	1.6	25
1994	18	18	7	12	25	15	0.7	13
1995	70	28	21	17	91	25	2.2	22
1996	33	18	9	33	42	17	0.9	28
1997	85	40	38	12	122	28	2.7	13
1998	38	13	10	36	48	16	0.9	30
1999	282	26	36	18	318	24	4.1	16
2000	68	13	24	9	92	10	2.0	10
2001	127	27	19	16	145	25	2.5	17
2002	336	10	41	12	376	10	5.0	12
2003	33	60	9	16	42	47	0.9	21
2004	46	9	9	7	55	8	0.8	5
2005	152	11	18	26	170	12	1.8	21
2006	134	16	39	19	173	13	3.2	14
2007	181	17	45	18	226	14	3.7	15
2008	191	16	8	12	199	15	1.4	8
2009	38	22	10	26	46	22	1.1	22
2010	38	25	7	19	42	22	0.8	17
Median								
1976-2008	71	18	21	12	95	18	3	15

¹ Pre-1985 indices were multiplied by door conversion factors (nos.= 0, wt.= 1.24) and data from R/V *DE II* tows multiplied by vessel conversion factors (nos.= 0.83, wt. = 0.85) during 1976-2008.

² Only daytime tows (solar zenith of 29-84 degrees) were used to compute the above indices

³ Bigelow conversion factors of 1.29 for pre-recruits, 2.11 for recruits, and 1.53 for all sizes were applied to the 2009-2010 number and weight indices

Table B20. Comparison of the previous and current assessments for *Loligo*, with a stepwise demonstration of effects on mean catch and mean survey kg/tow and mean survey biomass, in NEFSC surveys, during 1987-2000 (the time period of overlap). Effects on a simple average exploitation index (mean catch/mean survey biomass) are also shown. Note that the mean catch/mean survey biomass is a ratio of averages, not the average of annual exploitation indices. Values in the table are meant to show effects of changes in data, methodology and assumptions and should not be used for management purposes. Boxes indicating parameter changes are shaded.

Step	Notes and explanation	<i>q</i> -prior			<i>q</i> used	Estimates for 1987-2000			
		Lower bound	Median	Upper bound		Mean catch (000s mt/year)	Mean survey kg/tow	Mean survey biomass (<i>q</i> x kg/tow, 000s mt)	Mean catch / mean survey biomass
Previous assessment	Note: a <i>q</i> -prior was calculated in the last assessment and used in the PDQ model but not used directly for status determination.	0.022	0.187	0.556	0.450	19.436	11.1	24.59	0.790
1	Update all factors in <i>q</i> -prior except capture efficiency	0.019	0.154	0.423	0.450	19.436	11.1	24.59	0.790
2	Update capture efficiency in <i>q</i> -prior	0.038	0.092	0.185	0.450	19.436	11.1	24.59	0.790
3	Use median <i>q</i> from <i>q</i> -prior distribution	0.038	0.092	0.185	0.092	19.436	11.1	120.17	0.162
4	Fall survey data for expanded strata set; vessel correction factors for SRVs <i>Albatross IV</i> and <i>Delaware II</i> ; daytime tows only	0.038	0.092	0.185	0.092	19.436	12.1	131.31	0.148
5	Average fall and spring survey data	0.038	0.092	0.185	0.092	19.436	7.4	79.96	0.243
Current assessment	Improved discard information	0.038	0.092	0.185	0.092	19.098	7.4	79.96	0.239

Table B21. Bounds for factors affecting catchability of *Loligo* in NEFSC fall and spring bottom trawl surveys, during 1975-2010, for the current assessment and the previous assessment. Survey biomass indices for the previous assessment were adjusted to daytime equivalents based on diel correction factors from a GLM. Indices for the current assessment were computed using "daytime" tows (solar zenith angle = 43-80° for fall surveys and 29-84° for spring surveys) to account for diel catchability effects.

Previous assessment (SARC 34)				Current assessment (SARC 51)		
Factor	Lower Bound	Upper Bound	Basis	Lower Bound	Upper Bound	Basis
Tow distance (<i>d</i>)	5% < nominal <i>d</i> = 3.34 km	10% > nominal <i>d</i> = 3.87 km	Based on information from clam and scallop studies; Nominal <i>d</i> = 3.52 km	Mean of SRV <i>Albatross IV</i> (<i>AL</i>) doppler tow distance for 30 min. at 3.2 kts = 2.96 km	Mean of <i>AL</i> GPS tow distance for 30 min. at 3.8 kts = 3.57 km	Lower bound is mode of <i>AL</i> doppler distance (LRD 78-08) Upper bound is mean of <i>AL</i> GPS distances between net touchdown and liftoff based on plots of speed over ground, tow duration, and wingspread and doorspread for 2007 fall and 2008 spring surveys
Effective survey trawl width (<i>w</i>)	Mean wing spread = 0.01164 km	Mean door spread = 0.02380 km	Based on <i>AL</i> wingspread and doorspread sensor measurements	Yankee 36 mean wingspread = 0.01069 km	Yankee 36 mean doorspread = 0.02192 km	<i>AL</i> mean wingspread and doorspread measurements for the Yankee 36 trawl during 2006-2008 fall and spring surveys
Survey bottom trawl efficiency (<i>e</i>)	0.1	0.9	0 < <i>e</i> ≤ 1 based on arbitrary guestimates	0.20	0.39 (CV=4%)	Lower bound based on videos of daytime <i>Loligo</i> behavior in front of sweep and in trawl; upper bound based on wingspread area swept ratio of <i>Bigelow</i> to <i>AL</i> (= 0.625) x 1/rho x <i>Bigelow</i> max <i>e</i> rho = 1.51 and <i>Bigelow</i> max <i>e</i> = 0.95
Effective stock area (<i>A</i>)	5% > <i>Loligo</i> strata set = 146,324 km ²	30% > <i>Loligo</i> strata set = 181,163 km ²	Fall surveys (offshore strata 1-25, 61-76)	Expanded <i>Loligo</i> strata set 1975-2008 = 166,007 km ² 2009-2010 <i>Bigelow</i> strata set = 155,896 km ²		1975-2008 fall and spring surveys (inshore strata 2-46, 58-61, 65-66 and offshore strata 1-23, 25-26, 61-76) 2009-2010 <i>Bigelow</i> strata set is same, but without strata ≤ 18 m
Weight units (<i>u</i>)	100,000	100,000	Survey data in kg/tow, biomass in 1000 MT	100,000	100,000	Survey data in kg/tow, biomass in 1000 MT
Survey daytime catchability (<i>q</i>)	$q_{min} = 0.02149$	$q_{max} = 0.5569$	$q_{min} = [d_{min} w_{min} e_{min}] / A_{max}$ $q_{max} = [d_{max} w_{max} e_{max}] / A_{min}$	q_{min} 1975-2009 = 0.038 q_{min} 2009-2010 = 0.041	q_{max} 1975-2008 = 0.185 q_{max} 2009-2010 = 0.197	$q_{min} = [d_{min} w_{min} e_{min}] / A$ $q_{max} = [d_{max} w_{max} e_{max}] / A$

Table B22. Minimum biomass estimates of *Loligo* for inshore strata (≤ 18 m) no longer sampled during NEFSC surveys as of 2009, but sampled during the NEAMAP spring and fall surveys (2007-2010). NEFSC fall survey biomass estimates were based on day tows which occurred during 6:30 AM-4:30 PM (2007-2008). Area swept by the trawl during NEAMAP surveys is 0.025 km² and is 0.038 km² during NEFSC surveys based on mean wingspread and tow distance measurements for the *Albatross IV*. Inestimable CVs were a result of too few daytime *Albatross IV* tows in strata ≤ 18 m deep. Therefore, the 2007 and 2008 minimum biomass estimates for the NEFSC fall surveys are not reliable.

Season	Year	NEAMAP				NEFSC			
		Area sampled (km ²)	N tows	Min. biomass (mt)	CV	Area sampled (km ²)	N tows	Min. biomass (mt)	CV
fall	2007	14,666	150	2,951	3.9	2,909	12	7,071	inestimable
fall	2008	15,191	150	1,720	4.5	5,388	16	1,076	inestimable
fall	2009	15,191	160	3,482	3.5				
spring	2008	14,666	150	1,420	5.4				
spring	2009	15,191	160	966	5.6				
spring	2010	15,191	160	389	9.3				

¹ NEAMAP standardized tows are 20 min. tow at 3.0 kts with sampling between sunrise and sunset

² NEFSC standardized tows for *AL IV* are 30 min. at 3.8 kts with sampling round-the-clock, but include only daytime tows (6:30-4:30 PM)

Table B23. Minimum, maximum and quantiles (Q25, Q50 and Q75) for the composite *q*-priors for *Loligo* catches in NEFSC spring and fall surveys, 1975-2010. The median values were used in the assessment.

Survey years	Minimum	Q25	Q50	Q75	Maximum
1975-2008	0.038	0.075	0.092	0.113	0.185
2009-2010	0.041	0.080	0.098	0.121	0.197

Table B24. Biomass estimates (000s mt) for the spring survey *Loligo* cohort (1976-2009) in relation to exploitation indices for the Jan-June fishery (1987-2009) and biomass estimates for the fall survey cohort in relation to exploitation indices for the July-Dec fishery. Spring and fall biomass estimates are for March-April and September-October, respectively.

Year	Spring biomass (000s mt)	Jan-June catch (000s mt)	Exploitation Indices Jan-June fishery (Jan-June catch/Spring biomass)	Fall biomass (000s mt)	July-Dec catch (000s mt)	Exploitation Indices July-Dec fishery (July-Dec catch/Fall biomass)
1976	81.734			204.483		
1977	10.842			124.730		
1978	23.709			82.372		
1979	34.657			89.006		
1980	34.948			154.830		
1981	21.293			135.505		
1982	31.449			135.185		
1983	23.719			257.470		
1984	48.822			226.068		
1985	31.270			212.810		
1986	27.578			160.412		
1987	22.304	6.990	0.313	30.304	3.716	0.123
1988	43.315	11.352	0.262	101.390	7.841	0.077
1989	52.510	16.629	0.317	233.315	7.106	0.030
1990	29.904	8.529	0.285	112.536	7.406	0.066
1991	46.615	9.044	0.194	125.268	10.881	0.087
1992	39.402	10.692	0.271	113.255	8.260	0.073
1993	17.875	17.582	0.984	52.983	8.379	0.158
1994	8.116	7.224	0.890	298.443	16.411	0.055
1995	23.652	9.780	0.414	62.885	9.774	0.155
1996	10.133	10.196	1.006	41.480	2.508	0.060
1997	29.379	6.247	0.213	112.203	10.064	0.090
1998	10.229	12.897	1.261	57.658	6.411	0.111
1999	44.192	8.927	0.202	167.873	12.296	0.073
2000	21.639	10.010	0.463	330.148	7.600	0.023
2001	26.917	6.468	0.240	92.460	7.821	0.085
2002	54.622	8.619	0.158	253.946	8.458	0.033
2003	9.393	5.926	0.631	151.733	6.175	0.041
2004	8.976	9.300	1.036	93.264	5.779	0.062
2005	19.843	12.272	0.618	107.945	5.405	0.050
2006	34.397	9.820	0.285	249.422	7.225	0.029
2007	40.325	7.731	0.192	109.552	4.741	0.043
2008	15.486	5.814	0.375	122.699	5.691	0.046
2009	10.795	4.648	0.431	68.788	4.912	0.071
Median						
1976-2008	27.578			124.730		
1987-2008		9.172	0.315		7.503	0.064

Table B25. Annualized biomass estimates (000s mt), during 1976-2009, and annualized exploitation indices, during 1987-2009, for *Loligo pleaeii*. Annualized biomass estimates are the means of the annual estimates from the NEFSC spring and fall surveys. The two-year moving averages were only used for the 2009 stock status determination.

Year	Annual biomass (000s mt)	Two-year moving average of biomass (000s mt)	Annual exploitation index		
			Annual catch (000s mt)	Catch/biomass (000s mt)	Catch/2yr moving avg. of biomass (000s mt)
1976	143.108				
1977	67.786	105.447			
1978	53.041	60.413			
1979	61.832	57.436			
1980	94.889	78.360			
1981	78.399	86.644			
1982	83.317	80.858			
1983	140.594	111.956			
1984	137.445	139.020			
1985	122.040	129.743			
1986	93.995	108.018			
1987	26.304	60.150	10.722	0.408	0.178
1988	72.353	49.328	19.228	0.266	0.390
1989	142.912	107.633	24.544	0.172	0.228
1990	71.220	107.066	16.557	0.232	0.155
1991	85.942	78.581	20.843	0.243	0.265
1992	76.329	81.135	19.798	0.259	0.244
1993	35.429	55.879	23.387	0.660	0.419
1994	153.280	94.354	24.566	0.160	0.260
1995	43.269	98.274	20.087	0.464	0.204
1996	25.806	34.538	12.796	0.496	0.370
1997	70.791	48.299	16.474	0.233	0.341
1998	33.944	52.367	19.377	0.571	0.370
1999	106.032	69.988	21.313	0.201	0.305
2000	175.894	140.963	17.674	0.100	0.125
2001	59.688	117.791	14.399	0.241	0.122
2002	154.284	106.986	17.241	0.112	0.161
2003	80.563	117.423	12.107	0.150	0.103
2004	51.120	65.841	16.022	0.313	0.243
2005	63.894	57.507	17.416	0.273	0.303
2006	141.909	102.902	17.058	0.120	0.166
2007	74.939	108.424	12.472	0.166	0.115
2008	69.092	72.015	11.524	0.167	0.160
2009	39.792	54.442	9.560	0.240	0.176
Median					
1976-2008	76.329	83.890			
1987-2008			17.328	0.237	0.236

Table B26. Historical retrospective analysis covering the current and previous four assessments. Start year and end year are for the survey data used in making status determinations. The primary approach or model for status determination is identified for each assessment but a variety of auxiliary data or calculations were usually considered as well.

SARC/ SAW	Citation	Start year	End year	Primary approach for status determination	Type of F threshold	Fishing mortality status	Over- fishing?	Type biomass reference points	Biomass status	Over- fished?
17	NEFSC (1994)	1967	1994	Relative fall survey trends for prerecruits	Three-year average of prerecruits from the NEFSC fall survey falls below the first quartile of the time series	3-year moving average for 1992 (mean for 1991- 1993)/first quartile of same = 412 / 123=3.3	No	Overfishing and overfished stock conditions not distinguished. Only overfishing status was evaluated.		
21	NEFSC (1996)	1987	1999 for biomass, 1998 for F	Shaeffer surplus production model (semester time steps but K and r are constant) using spring and fall survey data	F / Fmsy (threshold value is 1)	F / Fmsy=1.7 (average of estimates for 4 qtrs in 1998)	Yes	January biomass / Bmsy in January 1999 (threshold is 0.5)	0.57	No
29	NEFSC (1999)	1987	1999 for biomass, 1998 for F	Shaeffer surplus production model (quarterly time steps but K and r are constant) using spring and fall survey data, and two season CPUE indices	F / Fmsy (threshold value is 1)	F/Fmsy=1.7 on January 1, 1999	Yes	B/Bmsy during spring 2009 (threshold value is 0.5)	0.57	No
34	NEFSC (2002)	1967	2001	Fall survey and exploitation index trends. Survey data were scaled by a catchability parameter estimated from the PDQ model, but status determination would be the same without scaling.	F proxy/ Fmsy (threshold value is 1)	F proxy / Fmsy proxy=0.2 / 0.31 (F proxy is the mean of quarterly estimates in 2000)	No	No satisfactory reference point available	NA	NA
51	In prep.	1976	2009	Average spring & fall survey biomass and exploitation index. Survey data were scaled by the median catchability of a prior, but status determination would be the same without scaling.	No satisfactory reference point available	Not model based, uses a wide range of data and judgement	Probably not	Mean biomass during 2008-2009 / Bmsy	1.28	No

Table B27. Summary of weekly natural mortality rate estimates for *Loligo* spp. (published and new estimates for *Loligo pealeii* from this assessment). The estimate $M=0.069$ for lifetime natural mortality (juvenile through spawner) used for the SARC 21 assessment (NEFSC 1996) and Cadrin and Hatfield (1999) is the average of the three estimates from Brodziak (1998) which are shown in the table below. Non-spawning estimates (M_{ns}) are for juvenile through pre-spawning stages. Spawning estimates (M_{sp}) are for actively spawning squid. Estimates in the first row (labeled NEFSC 2002) are from the last assessment.

Source	Lifestages/cohort assumptions	Winter-hatched cohort (per week)		Summer-hatched cohort (per week)		Details
		Non-spawning (M_{ns})	Spawning (M_{sp})	Non-spawning (M_{ns})	Spawning (M_{sp})	
NEFSC (2002) Previous assessment	Juvenile through spawner, by cohort	0.076		0.058		Observed maximum size; 3/M rule; assumed to double at maturity
Brodziak (1998)	Juvenile through spawner, both cohorts	0.078		0.060		Hoening's (1983) method assuming maximum age 296 days Rosenberg's (1990) estimate for <i>Illex argentinus</i> Peterson and Wroblewski (1984) , bioenergetics
		0.069				
Macewicz (2004) for California market squid (<i>Loligo opalescens</i>)	Spawners, cohort not specified		3.15 *			Reproductive biology assuming maximum life of spawners = 8 days; implies an average spawning lifespan of 1.67 days
Gnomonic method for M_{ns} ; Maturation-natural mortality model for M_{sp} (this assessment)	Separate estimates for non-spawning and spawning stages, winter-hatched cohort only	0.110	0.19-0.48 *			The gnomonic estimate $M_{ns} = 0.11$ is for lifestages up to maturity; estimates for M_{sp} from maturity-mortality model assume gnomonic estimate of $M_{ns}=0.11$
Min **				0.058		
Average **	Non-spawning			0.075		Excludes M_{sp} estimates
Max **				0.110		

* Includes some fishing mortality

** Non-spawning natural mortality estimated from all sources listed in the above table

Table B28. Current and proposed biological reference points for the *Loligo pealeii* stock and the 2009 exploitation index and biomass estimate used to determine stock status.

Biomass Reference Points				Fishing Mortality Reference Points		
	Current	Proposed	Mean 2008-2009 Biomass (mt) ³	Current	Proposed	2009 Exploitation Index ⁴
Target	Bmsy ¹	Bmsy proxy = 42,405 mt (50% of carrying capacity) ²		Mean quarterly exploitation rate during 1987-2000 = 0.96/yr	None	
Threshold	50% of Bmsy	50% of Bmsy proxy = 21,203 mt	54,442 mt 80% CI (38,452-71,783)	FMSY proxy = 75 th percentile of exploitation rates during 1987-2000 = 1.24/yr	None	0.176

¹ Amendment 9 to the SMB FMP states that the previous biomass reference points were rejected at SARC34 and new ones were not proposed

² Based on averages of the annual NEFSC spring and fall swept-area biomass estimates, at the median q -prior level, and assumes that the stock is lightly exploited and that the median biomass during 1976-2008 (76,329 mt) represents 90% of carrying capacity (K), so $K = 84,810$ mt

³ Based on annual mean of the NEFSC 2008-2009 spring and fall survey swept area biomass estimates

⁴ Computed as the 2009 catch / mean of 2008-2009 spring and fall survey swept area biomass estimates