

## SURFCLAM TABLES

Table C1. Length-weight parameters for Atlantic surfclam, by region. Parameters are for the relationship  $W=e^aL^b$ , where  $W$  is meat weight in grams,  $L$  is shell length in mm, and  $a$  and  $b$  are parameters in the table.

Region	a	b
SVA	-7.05830	2.30330
DMV	-9.48913	2.86018
NJ	-9.31210	2.86371
LI	-7.98370	2.58020
SNE	-7.98370	2.58020
GBK	-8.27443	2.65422

Table C2. Discard estimates for surfclam in the commercial fishery during 1982-1994 from Table D4 in NEFSC (1995).

Year	Discard (mt meats)					Landings (mt meats)	Discards / Landings	Catch	Size limit (mm)
	NNJ	SNJ	NJ	DMV	Total				
1982	3,684	215	3,899	2,295	6,194	16,688	37%	22,882	140
1983	2,122	385	2,507	2,127	4,634	18,592	25%	23,226	140
1984	2,266	458	2,724	2,015	4,739	22,888	21%	27,627	133
1985	1,938	248	2,186	1,725	3,911	22,480	17%	26,391	127
1986	2,328	233	2,561	239	2,800	24,520	11%	27,320	127
1987	1,414	61	1,475	415	1,890	21,744	9%	23,634	127
1988	1,317	13	1,330	106	1,436	23,377	6%	24,813	127
1989	1,048	6	1,054	258	1,312	21,887	6%	23,199	127
1990	1,089	57	1,146	123	1,269	24,018	5%	25,287	127
1991	495	36	531	5	536	20,615	3%	21,151	--
1992	918	102	1,020	4	1,024	21,685	5%	22,709	--
1993	0	0	0	0	0	21,859	0%	21,859	--
1994	0	0	0	0	0	21,942	0%	21,942	--

Table C3. Atlantic surfclam landings in state waters and the EEZ with EEZ surfclam quotas (mt meat weights). Total landings for 2002-2005 from dealer records. EEZ landings for 2002-2005 from MAFMC (2006). Other figures from logbooks or NEFSC (2003). Landings for state waters + unknown areas were estimated as total landings - EEZ landings.

Year	Total Landings	EEZ Landings	State Waters + Unknown Area Landings	Percent from EEZ	EEZ Quota
1965	19,998	14,968	5,030	75	
1966	20,463	14,696	5,767	72	
1967	18,168	11,204	6,964	55	
1968	18,394	9,072	9,322	49	
1969	22,487	7,212	15,275	32	
1970	30,535	6,396	24,139	21	
1971	23,829	22,704	1,125	95	
1972	28,744	25,071	3,673	87	
1973	37,362	32,921	4,441	88	
1974	43,595	33,761	9,834	77	
1975	39,442	20,080	19,362	51	
1976	22,277	19,304	2,973	87	
1977	23,149	19,490	3,659	84	
1978	17,798	14,240	3,558	80	13,880
1979	15,836	13,186	2,650	83	13,880
1980	17,117	15,748	1,369	92	13,882
1981	20,910	16,947	3,963	81	13,882
1982	22,552	16,688	5,864	74	18,506
1983	25,373	18,592	6,781	73	18,892
1984	31,862	22,888	8,974	72	18,892
1985	32,894	22,480	10,414	68	21,205
1986	35,720	24,520	11,200	69	24,290
1987	27,553	21,744	5,809	79	24,290
1988	28,824	23,377	5,447	81	24,290
1989	30,424	21,887	8,537	72	25,184
1990	32,556	24,018	8,538	74	24,282
1991	30,037	20,615	9,422	69	21,976
1992	33,831	21,685	12,146	64	21,976
1993	33,527	21,859	11,668	65	21,976
1994	31,048	21,942	9,106	71	21,976
1995	28,733	19,627	9,106	68	19,779
1996	28,775	19,771	9,004	69	19,779
1997	26,298	18,611	7,687	71	19,779
1998	24,509	18,240	6,269	74	19,779
1999	26,685	19,570	7,115	73	19,779
2000	31,093	19,749	11,344	64	19,779
2001	31,237	22,017	9,220	70	21,976
2002	32,645	24,006	8,639	99	24,174
2003	31,526	25,017	6,509	100	25,061
2004	28,327	24,197	4,130	92	26,218
2005	26,911	21,163	5,748	81	26,218
Min	15,836	6,396	1,125	21	13,880
Max	43,595	33,761	24,139	100	26,218
Mean	27,635	19,787	7,848	73	20,914

Table C4. EEZ surfclam landings (mt meats) by stock assessment area and year based on NEFSC (2003) for 1979 and logbook data for 1980-2005. Logbook landings from unknown areas in each year were prorated to known areas based on proportions of landings in known areas.

Year	SVA	DMV	NJ	LI	SNE	Other	Total EEZ
1979	0	11,836	1,350	0	0	0	13,186
1980	64	12,788	2,878	17	0	0	15,748
1981	568	7,472	8,820	88	0	0	16,947
1982	1,705	6,679	8,086	94	125	0	16,688
1983	2,225	7,173	8,095	264	836	0	18,592
1984	1,796	5,978	11,904	7	382	2,819	22,888
1985	741	7,856	11,246	0	452	2,185	22,480
1986	529	2,853	17,730	17	1,223	2,168	24,520
1987	378	1,302	18,017	0	1,140	907	21,744
1988	557	1,149	19,420	0	1,512	739	23,377
1989	439	3,123	16,531	0	1,361	433	21,887
1990	1,502	3,546	17,887	0	998	86	24,018
1991	0	1,634	18,913	15	33	21	20,615
1992	0	1,221	20,398	61	5	0	21,685
1993	0	3,414	18,365	62	3	14	21,859
1994	0	3,454	18,417	71	0	0	21,942
1995	0	2,752	16,497	0	378	0	19,627
1996	0	2,233	17,430	26	82	0	19,771
1997	0	1,540	16,998	73	0	0	18,611
1998	0	484	17,517	117	121	0	18,240
1999	0	648	18,749	157	16	0	19,570
2000	0	2,039	17,487	121	102	0	19,749
2001	0	3,282	17,719	935	81	0	22,017
2002	64	4,489	18,271	1,130	52	0	24,006
2003	0	1,432	21,693	1,625	267	0	25,017
2004	0	1,482	19,197	906	2,612	0	24,197
2005	0	1,668	16,850	759	1,885	0	21,163
Min	0	484	1,350	0	0	0	13,186
Max	2,225	12,788	21,693	1,625	2,612	2,819	25,017
Mean	391	3,834	15,425	242	506	347	20,746

Table C5. EEZ fishing effort (all vessels, hours fished) for surfclam by stock assessment area and year based on logbook data. The fraction of logbook effort from unknown areas in each year was prorated to known areas based on fishing effort in known areas.

Year	SVA	DMV	NJ	LI	SNE	Other	Total EEZ
1991	0	1,254	17,243	21	107	293	18,917
1992	0	797	21,379	67	0	0	22,243
1993	0	2,423	18,232	57	15	5	20,732
1994	0	1,930	21,494	70	0	0	23,494
1995	0	1,560	18,625	0	1,059	0	21,244
1996	0	1,577	20,995	40	287	0	22,899
1997	0	1,098	20,383	77	0	0	21,558
1998	0	289	19,609	134	518	0	20,550
1999	0	734	18,146	151	149	0	19,179
2000	0	1,859	16,787	115	368	0	19,128
2001	0	2,536	18,462	962	148	0	22,108
2002	112	5,505	19,825	1,241	62	0	26,746
2003	0	2,367	25,071	1,827	176	0	29,441
2004	0	3,161	26,453	1,267	1,108	0	31,989
2005	0	2,654	24,335	1,206	1,340	0	29,534
Min	0	289	16,787	0	0	0	18,917
Max	112	5,505	26,453	1,827	1,340	293	31,989
Mean	7	1,983	20,469	482	356	20	23,317

Table C6. Nominal landings per unit effort (LPUE, bushels h<sup>-1</sup>) for surfclam fishing (all vessels) in the US EEZ based on logbooks. Nominal LPUE is the ratio of total reported landings and total hours fished. Landings and fishing effort from unknown areas were prorated to area before LPUE was calculated.

Year	SVA	DMV	NJ	LI	SNE	Other	All areas
1991			142	95	40	9	141
1992		199	124	119			126
1993		183	131	143	28	390	137
1994		232	111	132			121
1995		229	115		46		120
1996		184	108	85	37		112
1997		182	108	122			112
1998		217	116	114	30		115
1999		115	134	135	14		132
2000		142	135	137	36		134
2001		168	124	126	71		129
2002	74	106	120	118	108		116
2003		78	112	115	197		110
2004		61	94	93	306		98
2005		82	90	82	183		93
Min	74	61	90	82	14	9	93
Max	74	232	142	143	306	390	141
Mean	74	155	118	115	91	199	120

Table C7. Standardized annual LPUE (bushels per hour) based on log-linear GLM models. Results are scaled to LPUE during June for an arbitrary vessel that fished in all areas.

Year	DMV		NJ		LI		SNE	
	LPUE	CV	LPUE	CV	LPUE	CV	LPUE	CV
1990	241	0.69	138	0.05				
1991	206	0.69	107	0.05				
1992	232	0.69	101	0.05				
1993	237	0.69	110	0.05				
1994	322	0.69	98	0.05				
1995	287	0.69	96	0.05			8	0.59
1996	215	0.69	91	0.05			6	0.66
1997	202	0.69	88	0.05	157	0.49		
1998	210	0.70	97	0.05	105	0.50	24	0.83
1999	185	0.69	101	0.05	119	0.48	39	0.99
2000	185	0.69	93	0.05	130	0.49	28	0.97
2001	200	0.69	78	0.05	116	0.47	44	0.62
2002	119	0.69	85	0.05	104	0.47	83	0.64
2003	86	0.69	75	0.05	91	0.47	109	0.56
2004	69	0.69	63	0.05	71	0.47	72	0.54
2005	85	0.69	54	0.04	60	0.46	81	0.53
Min	69	0.69	54	0.04	60	0.46	6	0.53
Max	322	0.70	138	0.05	157	0.50	109	0.99
Average	193	0.69	92	0.05	106	0.48	50	0.69

Table C8. Numbers of commercial trips sampled and numbers of surfclam measured in port samples from landings during 1982-2005, by region. Numbers of measurements for 1982-1999 are from NEFSC (2003, Table C5) and numbers of trips during 1982-1999 were estimated assuming 30 individuals sampled per trip, as specified in port sample instructions.

Year	DMV		NJ		LI		SNE	
	Trips	Lengths	Trips	Lengths	Trips	Lengths	Trips	Lengths
1982	259	7,756	249	7,477			1	30
1983	197	5,923	375	11,253			1	30
1984	102	3,066	425	12,751			3	90
1985	61	1,832	256	7,674			5	150
1986	42	1,260	171	5,130			11	330
1987	24	730	30	900			19	569
1988	14	420	30	900			27	810
1989	29	866	31	919			15	449
1990	30	892	30	901			7	209
1991	36	1,080	76	2,272				
1992	39	1,170	57	1,710				
1993	46	1,392	31	928				
1994	4	119	30	900				
1995	24	720	17	510				
1996	38	1,154	37	1,117				
1997	54	1,622	32	957				
1998	52	1,560	23	690				
1999	57	1,720	29	856				
2000	20	600	111	3,315	1	30		
2001	33	970	42	1,260				
2002	7	210	37	1,111				
2003	2	60	80	2,455	5	150		
2004			36	1,080	2	60		
2005	19	581	61	1,834	11	330		
Min	2	60	17	510	1	30	1	30
Max	259	7,756	425	12,751	11	330	27	810
Mean	52	1,552	96	2,871	5	143	10	296

Table C9. Numbers of random survey stations in NEFSC and cooperative clam surveys by stratum, region and survey year. The 2004 survey was cooperative and carried out on a commercial vessel. All others were NEFSC clam surveys carried out on the *R/V Delaware II*. Numbers of NEFSC clam survey stations for 2005 include a few tows with poor dredge performance used to trends but not for swept area biomass. For NEFSC surveys, figures in plain text are the number of original random tows (without borrowing). Bold and outlined figures are for NEFSC survey data are "holes" (strata in with no stations), which were filled by borrowing data from the same stratum during previous and/or subsequent cruises. Black cells are remaining zeroes for NEFSC survey data that could not be filled by borrowing. Only SVA, DMV and NJ were sampled during 2004 (cells for strata not sampled are crosshatched). Survey data for GBK during 1982-1984 and 2005 (stippled) should not be used in most analyses due to limited sampling.

Region	Stratum	Survey Year											
		1982	1983	1984	1986	1989	1992	1994	1997	1999	2002	2004	2005
SVA	1	<b>10</b>	10	14	7	10	10	11	10	<b>10</b>			
	2				<b>1</b>	1	2	1	1	<b>1</b>			
	5	4	9	13	8	8	8	7	8	<b>16</b>	8	8	8
	6	1	1	1	1	1	1	1	1	<b>3</b>	2	2	1
	80	<b>6</b>	6	9	3	7	7	8	7	<b>7</b>			
	81	<b>4</b>	4	7	3	5	5	5	5	<b>5</b>	5		<b>5</b>
DMV	9	30	26	35	29	37	37	39	39	38	39	37	36
	10	2	2	3	3	3	3	3	3	3	3	3	3
	13	19	18	25	20	20	20	21	22	19	20	20	18
	14	2	2	3	3	3	3	5	3	3	3	3	3
	82	1	1	1	1	1	1	1	1	2	2	2	<b>2</b>
	83	2	2	2	2	2	2	2	2	2	2	2	2
	84	4	3	3	4	4	4	4	4	3	4	4	4
	85	6	5	4	5	5	5	5	5	5	5	3	3
	86	2	2	3	3	3	2	3	3	3	3	3	3
NJ	17	11	11	18	12	12	12	12	14	12	12	12	12
	18	3	3	<b>6</b>	3	3	3	3	3	3	3	3	3
	21	18	18	22	19	20	20	23	26	39	29	27	20
	22	3	3	<b>6</b>	3	3	3	5	3	3	3	3	3
	25	9	9	13	8	9	9	9	12	8	9	9	9
	26	2	2	<b>5</b>	3	3	3	3	3	3	3	3	3
	87	8	7	10	9	9	9	9	9	9	16	14	8
	88	15	15	24	17	20	20	20	21	23	20	20	17
	89	15	15	21	15	18	17	17	19	18	18	17	15
	90	2	2	3	2	2	2	2	2	2	2	2	2
LI	29	11	10	<b>20</b>	10	10	10	10	10	11	10		10
	30	7	8	<b>14</b>	6	6	6	6	6	7	6		7
	33	4	4	<b>8</b>	4	4	4	5	4	4	4		4
	34	2	2	<b>4</b>	2	2	2	5	2	2	2		2
	91	3	2	4	4	3	3	3	3	3	3		3
	92	2	2	3	2	2	2	2	2	2	2		2
	93	1	1	2	1	1	1	1	1	1	2		1

Table C9. (continued)

Region	Stratum	Survey Year											
		1982	1983	1984	1986	1989	1992	1994	1997	1999	2002	2004	2005
SNE	37	7	4	7	3	6	3	5	4	4	3		3
	38	3	2	5	3	3	3	5	3	3	3		2
	41	6	5	7	5	6	6	6	6	5	6		6
	45	3	7	9	4	4	4	4	4	4	3		3
	46	2	5	5	3	2	3	5	3	3	2		3
	47	4	3	4	2	2	4	5	4	3	1		7
	94	1	2	2		1	1	2	2	4	2		2
	95	4	14	11	4	4	4	4	4	4	4		4
	96	12	12	13	1	1	3	2	4	4			
GBK	54		3	3	3	6	3	3	3	3			
	55	3	3	3	3	1	3	3	3	2	2		2
	57			2	2	1	2	5	2	2	2		2
	59	1	4	5	1	2	6	5	5	4	5		5
	61	8	1	6	5	12	7	6	6	6	6		6
	65			3	3	5	2	4	3	4	1		1
	67		5	5	5	7	7	7	7	7			
	68	1	8	7	3	6	6	5	5	5			
	69	2	5	11	6	6	6	7	6	8	8		
	70	1	2	6	4	8	4	4	4	3	2		2
	71		2	2	3	1	2	3	3	1	2		2
	72	2	10	8	1	8	8	8	8	8	6		
	73	1	1	4	3	6	6	6	6	5	6		6
	74	3	4	1	3	7	4	4	4	4	3		3

Table C10. Bad tows identified using objective criteria in the 2005 survey and by eye in the 2002 survey using sensor data.

Statistic	2005	2002
<i>All tows</i>		
Total	433	556
N examined	399	213
% examined	92%	38%
Number w/poor dredge performance	33	32
Proportion w/poor dredge performance	0.08	0.15
<i>Depletion tows only</i>		
Total	30	75
N examined (estimate)	28	29
Number bad	8	10
Proportion w/poor dredge performance		
Assuming 100% examined*	27%	13%
Expanded based on % reviewed	29%	35%

\* Minimal estimate assuming that all depletion tows were examined



Table C11. NEFSC clam survey data for surfclam abundance (mean N/tow) and biomass (mean KG/tow). Data are for two size groups: small recruits (50-119 mm SL) and large fishable (120+ mm SL). Survey holes (strata with no sampling) were filled by borrowing but no imputed survey data were used.

Region	Year	Small recruits (50-119 mm SL)				Large fishable (120+ mm SL)				N Tows	N Positive Tows	N Strata Sampled
		N / Tow	CV	KG / Tow	CV	N / Tow	CV	KG / Tow	CV			
SVA	1982	3.529	0.88	0.134	0.91	0.920	1.00	0.257	0.87	25	5	5
SVA	1983	6.600	0.62	0.249	0.64	0.620	1.00	0.405	0.60	30	9	5
SVA	1984	7.849	0.37	0.303	0.40	0.310	1.00	1.609	0.30	44	16	5
SVA	1986	1.498	0.35	0.058	0.41	0.750	1.00	1.553	0.74	23	11	6
SVA	1989	3.109	0.75	0.083	0.71	0.830	1.00	0.758	0.82	32	10	6
SVA	1992	18.151	0.86	0.760	0.90	0.770	1.00	0.812	0.79	33	17	6
SVA	1994	43.379	0.46	0.784	0.31	0.440	1.00	0.427	0.38	33	19	6
SVA	1997	10.309	0.44	0.294	0.46	0.460	1.00	0.030	0.44	32	14	6
SVA	1999	9.317	0.41	0.234	0.35	0.460	1.00	0.084	0.47	47	19	6
SVA	2002	13.693	0.61	0.360	0.62	0.550	1.00	0.399	0.55	15	5	3
SVA	2005	3.646	0.66	0.051	0.57	.	0.00	0.000	.	14	4	3
DMV	1982	157.134	0.46	6.621	0.44	21.360	0.23	2.687	0.29	68	37	9
DMV	1983	30.679	0.54	1.534	0.61	31.205	0.46	3.168	0.35	61	30	9
DMV	1984	184.102	0.74	5.247	0.61	34.911	0.28	3.555	0.28	79	47	9
DMV	1986	58.771	0.43	3.120	0.46	74.792	0.38	6.703	0.32	70	44	9
DMV	1989	16.705	0.54	0.813	0.55	31.237	0.26	3.065	0.24	78	37	9
DMV	1992	13.494	0.28	0.580	0.38	28.855	0.29	2.918	0.24	77	52	9
DMV	1994	68.704	0.33	2.787	0.43	60.964	0.21	5.958	0.20	83	63	9
DMV	1997	77.184	0.17	3.346	0.20	54.528	0.24	4.928	0.22	82	61	9
DMV	1999	29.612	0.28	1.543	0.28	26.363	0.22	2.406	0.20	78	44	9
DMV	2002	16.467	0.28	0.594	0.28	20.698	0.21	2.235	0.19	81	50	9
DMV	2005	6.437	0.42	0.252	0.43	4.757	0.26	0.508	0.28	74	40	9
NJ	1982	33.102	0.30	1.787	0.31	32.777	0.22	4.084	0.20	85	50	10
NJ	1983	27.780	0.51	1.627	0.55	25.382	0.22	3.147	0.20	85	54	10
NJ	1984	15.932	0.23	0.714	0.22	29.970	0.20	3.731	0.18	126	68	10
NJ	1986	10.335	0.21	0.493	0.20	29.677	0.18	4.172	0.18	91	59	10
NJ	1989	9.877	0.29	0.489	0.31	31.527	0.15	4.160	0.13	99	60	10
NJ	1992	16.462	0.33	0.849	0.42	23.221	0.16	3.193	0.15	98	62	10
NJ	1994	67.394	0.20	2.664	0.18	82.766	0.17	11.014	0.16	103	84	10
NJ	1997	17.910	0.16	1.012	0.17	83.720	0.13	11.442	0.12	112	83	10
NJ	1999	8.021	0.25	0.389	0.28	50.578	0.21	6.903	0.17	120	77	10
NJ	2002	10.678	0.16	0.464	0.16	35.035	0.17	5.503	0.17	115	94	10
NJ	2005	7.808	0.20	0.397	0.22	19.090	0.18	2.818	0.17	92	60	10
LI	1982	0.032	1.00	0.002	1.00	3.994	0.61	0.641	0.62	29	1	7
LI	1983	0.175	0.61	0.005	0.60	0.407	0.72	0.055	0.72	29	3	7
LI	1984	0.561	0.30	0.021	0.36	1.635	0.34	0.248	0.34	55	12	7
LI	1986	0.581	0.39	0.022	0.40	1.715	0.61	0.285	0.61	29	7	7
LI	1989	2.237	0.87	0.089	0.88	3.484	0.72	0.475	0.74	28	4	7
LI	1992	5.733	0.44	0.301	0.47	2.544	0.33	0.275	0.32	28	9	7
LI	1994	4.232	0.17	0.213	0.20	7.243	0.19	0.901	0.21	32	11	7
LI	1997	1.444	0.49	0.082	0.53	4.171	0.64	0.563	0.63	28	6	7
LI	1999	1.608	0.64	0.047	0.50	10.710	0.65	1.433	0.61	30	8	7
LI	2002	0.854	0.45	0.034	0.44	1.944	0.67	0.304	0.67	29	7	7
LI	2005	1.415	0.34	0.060	0.38	12.624	0.50	1.658	0.47	29	7	7
SNE	1982	2.584	0.29	0.112	0.35	12.402	0.41	1.776	0.42	42	14	9
SNE	1983	0.839	0.40	0.040	0.44	7.883	0.39	1.267	0.39	54	18	9
SNE	1984	0.810	0.36	0.034	0.43	10.838	0.34	1.676	0.34	63	18	9
SNE	1986	1.115	0.14	0.027	0.26	4.125	0.68	0.644	0.69	25	8	8
SNE	1989	1.178	0.43	0.044	0.44	4.569	0.33	0.687	0.33	29	10	9
SNE	1992	1.147	0.56	0.032	0.51	2.491	0.58	0.399	0.58	31	9	9
SNE	1994	1.265	0.52	0.061	0.58	1.693	0.53	0.265	0.54	38	10	9
SNE	1997	2.947	0.31	0.120	0.35	12.279	0.30	1.913	0.30	34	13	9
SNE	1999	2.601	0.42	0.089	0.47	4.296	0.66	0.725	0.66	34	15	9
SNE	2002	1.006	0.69	0.057	0.72	3.852	0.27	0.601	0.22	24	5	8
SNE	2005	0.261	0.49	0.008	0.51	1.986	0.19	0.355	0.19	30	6	8
GBK	1986	19.998	0.79	0.719	0.78	4.967	0.52	0.708	0.55	44	20	14
GBK	1989	5.214	0.34	0.285	0.42	24.858	0.73	3.004	0.73	75	36	14
GBK	1992	15.535	0.40	0.706	0.46	7.894	0.33	0.956	0.34	66	43	14
GBK	1994	30.010	0.33	1.610	0.34	45.843	0.39	5.853	0.41	70	47	14
GBK	1997	58.550	0.31	3.002	0.33	23.517	0.25	2.730	0.25	65	45	14
GBK	1999	24.014	0.41	1.340	0.41	29.590	0.31	3.385	0.30	59	34	14
GBK	2002	22.093	0.52	1.163	0.54	27.052	0.43	3.250	0.41	43	21	11

C:\Assessments\Surfclam2006\Surveys\Trends[SurveyTrends-20.xls]Table 1.

Table C12. Original mean kg/tow for surfclam in regions that had strata with remaining holes and mean kg/tow with remaining holes filled. Remaining holes were filled with imputed values from a negative binomial GLM model. Estimates of mean kg/tow for swept area biomass were computed from estimates for trends using the mean ratio of doppler and sensor distances during 1997-2005 for each region.

Cruise	Region	Mean kg/tow for trends		Mean kg/tow for swept-area biomass		CV for trends	
		Imputed	Original	Imputed	Original	Imputed	Original
198204	GBK	0.059				0.219	
198204	SVA	0.243	0.257			0.874	0.870
198305	GBK	0.485				0.678	
198305	SVA	0.383	0.405			0.597	0.600
198403	SVA	1.522	1.609			0.296	0.300
198604	SNE	0.609	0.680			0.688	0.690
200206	GBK	3.411	3.250	1.847	1.890	0.349	0.410
200206	SNE	0.715	0.601	0.418	0.396	0.264	0.220
200206	SVA	0.263	0.399	0.157	0.268	0.517	0.550
200507	SNE	0.317	0.355	0.185	0.224	0.190	0.190
200507	SVA	0.000	0.000	0.000	0.000	310	

Table C13. Summary of commercial dredge efficiency, population density and negative binomial parameter  $k$  estimates from the Patch model, setup tow densities and NEFSC survey dredge efficiency estimates from setup tows, by year. All estimates are for surfclam 150+ mm SL.

Statistic	N successful experiments	Population Density (N ft <sup>-2</sup> )	Depletion Vessel Efficiency	$k$	Setup Density (N ft <sup>-2</sup> )	NEFSC Dredge Efficiency
<b>1997</b>						
Mean		0.023	0.79	4.758	0.0061	0.317
Median		0.017	0.89	3.261	0.0069	0.27
Lower 80% bound		0.012	0.613	3.134	0.0049	0.225
Upper 80% bound		0.033	0.967	6.382	0.0072	0.409
SE		0.007	0.115	1.059	0.0008	0.06
CV (SE / Mean)	5	0.296	0.146	0.223	0.1281	0.189
<b>1999</b>						
Mean		0.035	0.652	20.534	0.0061	0.189
Median		0.025	0.726	12.841	0.0058	0.199
Lower 80% bound	6	0.024	0.469	10.137	0.0051	0.13
Upper 80% bound	commercial depletion, 5	0.046	0.835	30.93	0.007	0.248
SE	with setup	0.007	0.124	7.044	0.0006	0.039
CV (SE / Mean)	tows	0.211	0.19	0.343	0.1012	0.205
<b>2002</b>						
Mean		0.014	0.584	16.792	0.007	0.516
Median		0.014	0.584	16.792	0.007	0.516
Lower 80% bound		0.012	-0.268	-26.157	-0.0032	-0.282
Upper 80% bound		0.016	1.437	59.74	0.0173	1.313
SE		0.001	0.277	13.955	0.0033	0.259
CV (SE / Mean)	2	0.038	0.474	0.831	0.474	0.503
<b>2004</b>						
Mean		0.024	0.736	5.939	NA	NA
Median		0.024	0.736	5.939	NA	NA
Lower 80% bound	2	0.004	0.517	0.22	NA	NA
Upper 80% bound	commercial	0.043	0.955	11.658	NA	NA
SE	depletion	0.006	0.071	1.858	NA	NA
CV (SE / Mean)	experiments	0.268	0.097	0.313	NA	NA
<b>2005</b>						
Mean		0.037	0.717	4.078	0.005	0.158
Median		0.034	0.676	4.593	0.005	0.158
Lower 80% bound		0.023	0.551	3.121	0.004	0.105
Upper 80% bound		0.051	0.882	5.035	0.006	0.21
SE		0.008	0.101	0.584	0	0.032
CV (SE / Mean)	4	0.229	0.141	0.143	0.084	0.203
<b>All years</b>						
Mean		0.029	0.704	10.988	0.006	0.262
Median		0.025	0.765	5.676	0.006	0.226
Lower 80% bound	19	0.024	0.628	7.073	0.005	0.203
Upper 80% bound	commercial	0.033	0.779	14.903	0.007	0.32
SE	depletion,	0.004	0.057	2.943	0	0.044
CV (SE / Mean)	16 with setup tows	0.128	0.081	0.268	0.076	0.168

Table C14. Summary of depletion experiments, setup tows, Patch model estimates, and survey dredge efficiency estimates for surfclam. All depletion results are for surfclam 150+ mm SL. Depletion experiments by *R/V Delaware II* are not shown.

Experiment Name	Experiment and Study Area			Depletion Tows			Patch Model			Survey Setup Tows			NEFSC survey dredge efficiency (e, fully recruited)	Notes					
	Original Name	Region	Approx. latitude (decimal degrees)	Approx. longitude (decimal degrees)	Mean Sediment Size (microns)	Depletion Study Vessel	Depletion Date	Ship Position Data (source/ nominal accuracy/ time interval)	Depletion vessel efficiency (E, fully recruited, >= 150 mm SL)	Population Density (D, >= 150 mm SL, N ft <sup>2</sup> )	Negative binomial parameter (K)	Gamma (indirect effects, γ)			Goodness of fit (-log likelihood)	Survey id, station id (N tows) (N length data)	Catch density (d, >= 150 mm SL, N ft <sup>2</sup> )	CV for catch density (see / mean)	
SC1997-2 PP-1	NNJ (Pt. Pleasant)	40.05317	73.69917	26	Sherril Ann	6/9/1997	Loran / 9-12 M / 1 Minute	39 [9]	8.33	16.67	0.0492	0.3540	7.5313	0.5	210.3	199703 [183-190] (8) (4)	0.0081	0.1498	Forty depletion tows total but tow 1 (and samples) omitted. Setup tows during calibration survey 199703 prior to 199704 clam survey.
SC1997-3 AC2-1	NNJ (Atlantic City)	38.39317	73.91033	30	Jersey Girl	6/10/1997	Loran / 9-12 M / 1 Minute	13 [4]	10.83	21.67	0.0172	0.7646	2.6272	0.5	66.1	199703 [189-175-181] (8) (8)	0.0042	0.1011	Setup tows during calibration survey 199703, prior to 199704 clam survey.
SC1997-4 AC2-2	NNJ (Atlantic City)	38.39317	73.91033	30	Jersey Girl	6/10/1997	Loran / 9-12 M / 1 Minute	31 [4]	10.83	21.67	0.0157	0.9900	3.2968	0.5	95.8	Same as SC1997-2	0.0042	0.1011	Setup tows during calibration survey 199703, prior to 199704 clam survey.
SC1997-5 AC1-1	NNJ (Atlantic City)	31.36500	73.89633	30	Judy Marie	6/11/1997	Loran / 9-12 M / 1 Minute	17 [4]	8.33	16.67	0.0137	0.9500	3.2606	0.5035	86.9	199703 [186-168, 170-174] (8) (8)	0.0069	0.1173	Same as above plus -> Previous analyses at SAW-26 (NEFSC 1998) omitted depletion tow 10, which was included here
SC1997-6 AC1-2	NNJ (Atlantic City)	39.36500	73.89633	30	Judy Marie	6/11/1997	Loran / 9-12 M / 1 Minute	19 [4]	8.33	16.67	0.0171	0.8902	7.1339	0.5	99.2	Same as SC1997-5	0.0069	0.1173	Same as above plus -> Previous analyses at SAW-26 (NEFSC 1998) omitted depletion tows 17 and 19, which were included here
SC1999-2 JS-1 (S89-5)	NNJ	38.68133	73.74667	24	Jersey Girl	9/14/1999	Loran / 9-12 M / 1 Minute	4 [1]	10.83	21.67	0.0249	0.9453	10.2855	0.5	21.5	Same as SC1997-5	0.0075	0.2273	
SC1999-3 JS-2 (S89-5)	NNJ	38.68133	73.74667	24	Jersey Girl	9/14/1999	Loran / 9-12 M / 1 Minute	5 [2]	10.83	21.67	0.0631	0.4625	9.3468	0.5	30.0	Same as SC1997-5	0.0075	0.2273	
SC1999-4 JS-3 (S89-6)	NNJ	38.52133	73.77867	26	Jersey Girl	9/14/1999	Loran / 9-12 M / 1 Minute	6 [2]	10.83	21.67	0.0251	0.9900	15.3974	0.5	31.5	199903 [112-115] (4) (4)	0.0050	0.1398	
SC1999-5 CH-1 (S89-DE1)	DMV	36.90200	74.97583	35	Christy	9/25/1999	Loran / 9-12 M / 1 Minute	28 [6]	10.83	21.67	0.0193	0.1641	5.6765	0.5	92.8	19903 [87-370] (4) (6)			No length data for setup tows
SC1999-6 3, NJ Inshore Site 1)	NNJ	38.56333	73.91167	26	Melissa J	9/28/1999	Loran / 9-12 M / 1 Minute	4 [1]	10.83	21.67	0.0245	0.8557	32.4987	0.5	18.7	199903 [82-85] (4) (4)	0.0058	0.4363	Sarc31 list Blade at 13
SC1999-7 3, NJ Inshore Site 2)	NNJ	39.76900	73.91633	24	Melissa J	9/28/1999	Loran / 9-12 M / 1 Minute	10 [2]	10.83	21.67	0.0513	0.6164	49.9988	0.5	52.2	199903 [88-90] (3) (3)	0.0046	0.1742	Sarc31 list Blade at 13
SC2002-2 SC02-2	NNJ	40.10908	73.84423	38	Jersey Girl	8/20/2002	GPS-D/3M/2 sec.	16 [3]	10.83	21.67	0.0144	0.8610	30.7464	0.5	74.1	202026 [87-91] (5) (1)	0.0037	0.2774	
SC2002-3 SC02-3	SNJ	38.28923	73.78116	31	Jersey Girl	8/19/2002	GPS-D/3M/2 sec.	19 [see footnote]	10.83	21.67	0.0134	0.3071	2.8966	0.5	88.3	202026 [202-206] (5) (4)	0.0104	0.6116	Depletion tows: 1) bushel count for tow 1 only (tows 2-19 had catch < 1 bu); 2) clams counted for all tows because catches were low; and 3) lengths measured for 10 for tows. Setup tows; zero clams caught at setup tow (station 206), only two clams measured at station 205
SC2002-4 SC02-4	DMV	38.85791	74.40888	31	Jersey Girl	8/20/2002	GPS-D/3M/2 sec.	18 [4]	10.83	21.67						202026 [335-338] (5) (1)			Zero clams >= 150 mm in tows 1-3, very low and variable catches in other tows.
SC2004-1 SC04-1	NJ	39.28611	73.87778	35	Lisa Kim	4/8/2004	GPS-D/3M/2 sec.	24 [5] (see note)	10	20.00	0.0301241	0.8072	4.0610	0.9000	130.753				200416 Cooperative Survey (shakedown leg) stations 15-39
SC2004-2 SC04-2	NJ	39.58278	74.02778	21	Lisa Kim	4/8/2004	GPS-D/3M/2 sec.	20 [4] (see note)	10	20.00	0.017376	0.6646	7.7973	0.9000	102.320				200416 Cooperative Survey (shakedown leg) stations 49-66
SC2004-3 SC04-3	DMV	38.27075	74.37920	38	Lisa Kim	7/3/2004	GPS-D/3M/10 sec.	20 [4] (see note)	10	20.00									200416 Cooperative Survey stations 146-165; zero clams >= 150 mm in tow 1, very low and variable catches in other tows.
SC2005-2 SC05-02	NNJ	38.56383	73.90364	24	Lisa Kim	9/7/2005	GPS / 6 ft / 6 sec.	17 [3]	10.00	20.00	0.0407	0.7633	4.7110	0.5	98.5	200507 [137-139] (3) (6)	0.004	0.3635	
SC2005-3 SC05-03	NNJ	38.89733	73.90591	38	Lisa Kim	9/8/2005	GPS / 6 ft / 6 sec.	20 [4]	10.00	20.00	0.0590	0.9879	4.7863	0.5	120.6	200507 [21-37] (3) (6)	0.006	0.2999	
SC2005-4 SC05-04	DMV	38.56972	73.54946	41	Lisa Kim	9/9/2005	GPS / 6 ft / 6 sec.	20 [4]	10.00	20.00	0.0284	0.5341	4.4756	0.5	104.5	200507 [41-39] (3) (3)	0.006	0.2597	
SC2005-5 SC05-05	NNJ	38.43615	73.37320	33	Lisa Kim	9/10/2005	GPS / 6 ft / 6 sec.	17 [4]	10.00	20.00	0.0212	0.9823	2.3360	0.5	96.1	200507 [143-397-402] (7) (5)	0.004	0.1809	
SC2005-6 SC05-01	NNJ	38.26530	74.37947	26	Lisa Kim	9/7/2005	GPS / 6 ft / 6 sec.	20 [4]	10.00	20.00						200507 [123-127, 354] (6) (6)			Low catches >= 150 mm SL in setup and depletion tows (less than 6% of total).

Table C15. Sensitivity analysis to determine effects of smoothing position data on Patch model estimates for surfclam 150+ mm SL. Model runs were preliminary.

Smoothing	Density	Efficiency	K	Gamma	Goodness of fit to catch data (-log-likelihood)	Area swept (ft <sup>2</sup> )	Effective area swept (ft <sup>2</sup> )	Number stations	Number position observations	Mean Observations per station	Shape of tow tracks based on original position data	Type Smooth
<b>SC1997-4</b>												
No	0.0147	0.99	3.42	0.50	95.38	296,196	134,886	18	107	5.9	Curved, stair step	Linear or cubic polynomial
Yes	0.0157	0.99	3.24	0.50	95.82	288,202	133,535					
% Difference	-7%	0%	6%	0%	0%	3%	1%					
<b>SC1999-2</b>												
No	0.0206	0.95	21.53	0.50	20.22	53,854	35,480	4	46	11.5	Linear, stair step	Quadratic polynomial
Yes	0.0249	0.85	10.29	0.50	21.54	52,268	30,236					
% Difference	-17%	12%	109%	0%	-6%	3%	17%					
<b>SC2002-2</b>												
No	0.0134	0.94	30.21	0.50	74.42	279,668	162,865	16	2664	166.5	Linear or curved,	Spline
Yes	0.0144	0.86	30.75	0.50	74.13	276,021	152,182					
% Difference	-7%	9%	-2%	0%	0%	1%	7%					
<b>SC2005-2</b>												
No	0.0350	0.93	5.35	0.50	97.55	287,369	117,195	17	905	53.2	Curved, wavy	Spline
Yes	0.0407	0.76	4.71	0.50	98.55	283,682	100,759					
% Difference	-14%	22%	14%	0%	-1%	1%	16%					

Table C16. NEFSC survey dredge efficiency estimates for surfclam in the 1997-2005 NEFSC clam surveys (revised and values used in the last assessment). CVs are the standard error / mean. "NA" means not available. Efficiency estimates shown in the table are averages, not medians.

Survey year	Revised (Patch model & setup tows)		From previous assessment (various types of estimates, NEFSC 2003)	
	Efficiency	CV	Efficiency	CV
1997	0.317	0.19	0.460	0.471
1999	0.189	0.20	0.276	0.349
2002	0.516	0.50	0.389	0.523
2005	0.158	0.20	NA	NA
All	0.262	0.17	0.370	0.492

Table C17. Efficiency corrected swept-area biomass estimates (1000 mt) and CVs for the fishable stock of surfclam during 1997-2005 by stock assessment region. Figures for SVA and GBK during 2005 were taken from 2003 because no data were available for 2005.

INPUT: Nominal tow distance ( $d_n$ , nm)	Estimate	CV						
	0.15							
	0.0008225							
INPUT: Dredge width (nm)								
Area swept per standard tow ( $a$ , nm <sup>2</sup> )	1.23375E-04	10%						
<b>Area of assessment region (<math>A</math>, nm<sup>2</sup>) - no correction for stations with unsuitable clam habitat</b>								
S. Virginia and N. Carolina (SVA)	3,119	10%						
Delmarva (DMV)	4,660	10%						
New Jersey (NJ)	5,078	10%						
Long Island (LI)	2,917	10%						
Southern New England (SNE)	4,321	10%						
Georges Bank (GBK)	5,772	10%						
Total	25,867							
<b>INPUT: Fraction suitable habitat (<math>u</math>)</b>								
S. Virginia and N. Carolina (SVA)	100%	10%						
Delmarva (DMV)	100%	10%						
New Jersey (NJ)	100%	10%						
Long Island (LI)	100%	10%						
Southern New England (SNE)	100%	10%						
Georges Bank (GBK)	88%	10%						
<b>Habitat area in assessment region (<math>A'</math>, nm<sup>2</sup>)</b>								
S. Virginia and N. Carolina (SVA)	3,119	14%						
Delmarva (DMV)	4,660	14%						
New Jersey (NJ)	5,078	14%						
Long Island (LI)	2,917	14%						
Southern New England (SNE)	4,321	14%						
Georges Bank (GBK)	5,079	14%						
<b>INPUT: Biomass fraction in unsurveyed deep water</b>								
S. Virginia and N. Carolina (SVA)	0%	10%						
Delmarva (DMV)	0%	10%						
New Jersey (NJ)	0%	10%						
Long Island (LI)	0%	10%						
Southern New England (SNE)	0%	10%						
Georges Bank (GBK)	0%	10%						
<b>INPUT: Original survey mean catch from fishable stock (kg/tow, for tows adjusted to nominal tow distance using sensors)</b>								
	Estimates for		Estimates for		Estimates for		Estimates for	
	1997	CV	1999	CV	2002	CV	2005	CV
S. Virginia and N. Carolina (SVA) 120+ mm	0.0142	43%	0.0532	52%	0.2676	58%	0.2676	58%
Delmarva (DMV) 120+ mm	2.3751	22%	1.4130	20%	2.2406	20%	0.4038	30%
New Jersey (NJ) 120+ mm	5.8453	12%	4.0036	17%	3.5823	16%	2.1776	17%
Long Island (LI) 120+ mm	0.3179	66%	0.7895	53%	0.1849	64%	1.9644	37%
Southern New England (SNE) 120+ mm	0.8868	32%	0.4839	67%	0.4180	26%	0.1851	19%
Georges Bank (GBK) 120+ mm	1.5228	25%	2.0445	31%	1.8469	35%	1.8469	35%
<b>Swept-area biomass without efficiency correction (<math>B'</math>, 1000 mt):</b>								
S. Virginia and N. Carolina (SVA) 120+ mm	0.3597	47%	1.3447	56%	6.7651	61%	6.7651	61%
Delmarva (DMV) 120+ mm	89.7081	30%	53.3720	28%	84.6301	28%	15.2519	36%
New Jersey (NJ) 120+ mm	240.5850	23%	164.7861	26%	147.4441	26%	89.6280	26%
Long Island (LI) 120+ mm	7.5155	69%	18.6664	57%	4.3707	67%	46.4441	42%
Southern New England (SNE) 120+ mm	31.0590	38%	16.9471	70%	14.6411	33%	6.4817	28%
Georges Bank (GBK) 120+ mm	62.6950	32%	84.1714	37%	76.0380	40%	76.0380	40%
Total fishable biomass less GBK	369	17%	255	19%	258	18%	165	19%
Total fishable biomass	432	15%	339	17%	334	16%	241	18%
<b>INPUT: Survey dredge efficiency (<math>e</math>)</b>								
	0.226	17%	0.226	17%	0.226	17%	0.226	17%
<b>Efficiency adjusted swept area fishable biomass (<math>B</math>, 1000 mt)</b>								
S. Virginia and N. Carolina (SVA) 120+ mm	1.593	50%	5.955	58%	29.961	64%	29.961	64%
Delmarva (DMV) 120+ mm	397	34%	236	33%	375	33%	68	40%
New Jersey (NJ) 120+ mm	1,065	29%	730	31%	653	31%	397	31%
Long Island (LI) 120+ mm	33	71%	83	59%	19	69%	206	45%
Southern New England (SNE) 120+ mm	138	41%	75	72%	65	37%	29	32%
Georges Bank (GBK) 120+ mm	278	36%	373	41%	337	44%	337	44%
Total fishable biomass less GBK	1,635	24%	1,130	25%	1,142	24%	729	25%
Total fishable biomass	1,913	23%	1,503	24%	1,479	23%	1,066	25%
<b>Lower bound for 80% confidence intervals on fishable biomass (1000 mt, for lognormal distribution with no bias correction)</b>								
	Estimates for	Estimates for	Estimates for	Estimates for				
	1997	1999	2002	2005				
S. Virginia and N. Carolina (SVA) 120+ mm	0.867	2.983	14.208	14.208				
Delmarva (DMV) 120+ mm	260	157	249	41				
New Jersey (NJ) 120+ mm	743	494	445	269				
Long Island (LI) 120+ mm	15	41	9	118				
Southern New England (SNE) 120+ mm	83	33	41	19				
Georges Bank (GBK) 120+ mm	177	226	197	197				
Total fishable biomass less GBK	1,207	821	840	529				
Total fishable biomass	1,434	1,112	1,100	780				
<b>Upperbound for 80% confidence intervals on fishable biomass (1000 mt, for lognormal distribution with no bias correction)</b>								
S. Virginia and N. Carolina (SVA) 120+ mm	2.926	11.888	63.180	63.180				
Delmarva (DMV) 120+ mm	608	356	565	110				
New Jersey (NJ) 120+ mm	1,528	1,078	958	586				
Long Island (LI) 120+ mm	75	167	43	358				
Southern New England (SNE) 120+ mm	229	172	103	43				
Georges Bank (GBK) 120+ mm	435	614	574	574				
Total fishable biomass less GBK	2,215	1,555	1,552	1,004				
Total fishable biomass	2,551	2,031	1,988	1,456				

Table C18. Fishing mortality estimates for surfclams based on catch and efficiency corrected swept-area biomass for fishable surfclams during 1997, 1999, 2002 and 2005.

INPUT: Upper bound incidental mortality allowance	12%							
INPUT: Assumed CV for catch	10%							
INPUT: Landings (1000 mt, discard ~ 0)	Estimates for 1997	Estimates for 1999	Estimates for 2002	Estimates for 2005				
S. Virginia and N. Carolina (SVA)	0.000	0.000	0.064	0.000				
Delmarva (DMV)	1.540	0.648	4.489	1.668				
New Jersey (NJ)	16.998	18.749	18.271	16.850				
Long Island (LI)	0.073	0.157	1.130	0.759				
Southern New England (SNE)	0.000	0.016	0.052	1.885				
Georges Bank (GBK)	0.000	0.000	0.000	0.000				
Total	18.611	19.570	24.006	21.163				
Catch (1000 mt, landings + upper bound incidental mortality allowance)	Estimates for 1997	Estimates for 1999	Estimates for 2002	Estimates for 2005				
S. Virginia and N. Carolina (SVA)	0.000	0.000	0.072	0.000				
Delmarva (DMV)	1.725	0.726	5.028	1.868				
New Jersey (NJ)	19.038	20.999	20.463	18.872				
Long Island (LI)	0.081	0.176	1.265	0.850				
Southern New England (SNE)	0.000	0.018	0.058	2.112				
Georges Bank (GBK)	0.000	0.000	0.000	0.000				
Total	20.844	21.919	26.886	23.702				
INPUT: Efficiency Corrected Swept Area Biomass for Fishable Stock (1000 mt)	Estimates for 1997	CV	Estimates for 1999	CV	Estimates for 2002	CV	Estimates for 2005	CV
S. Virginia and N. Carolina (SVA) 120+ mm	2	50%	6	58%	30	64%	30	64%
Delmarva (DMV) 120+ mm	397	34%	236	33%	375	33%	68	40%
New Jersey (NJ) 120+ mm	1,065	29%	730	31%	653	31%	397	31%
Long Island (LI) 120+ mm	33	71%	83	59%	19	69%	206	45%
Southern New England (SNE) 120+ mm	138	41%	75	72%	65	37%	29	32%
Georges Bank (GBK) 120+ mm	278	36%	373	41%	337	44%	337	44%
Total fishable biomass less GBK	1,635	24%	1,130	25%	1,142	24%	729	25%
Total fishable biomass	1,913	23%	1,503	24%	1,479	23%	1,066	25%
Fishing mortality (y <sup>-1</sup> )	Estimates for 1997	CV	Estimates for 1999	CV	Estimates for 2002	CV	Estimates for 2005	CV
S. Virginia and N. Carolina (SVA) 120+ mm	0.0000	51%	0.0000	59%	0.0024	64%	0.0000	64%
Delmarva (DMV) 120+ mm	0.0043	36%	0.0031	34%	0.0134	34%	0.0277	41%
New Jersey (NJ) 120+ mm	0.0179	30%	0.0288	33%	0.0313	32%	0.0475	33%
Long Island (LI) 120+ mm	0.0024	72%	0.0021	60%	0.0654	70%	0.0041	46%
Southern New England (SNE) 120+ mm	0.0000	42%	0.0002	73%	0.0009	38%	0.0736	34%
Georges Bank (GBK) 120+ mm	0.0000	NA	0.0000	NA	0.0000	NA	0.0000	NA
Total fishable biomass less GBK	0.0127	26%	0.0194	27%	0.0235	26%	0.0325	27%
Total fishable biomass	0.0109	25%	0.0146	26%	0.0182	25%	0.0222	27%
Lower bound for 80% confidence intervals for fishing mortality (y <sup>-1</sup> , for lognormal distribution with no bias correction)	Estimates for 1997	Estimates for 1999	Estimates for 2002	Estimates for 2005				
S. Virginia and N. Carolina (SVA) 120+ mm	NA	NA	0.0011	NA				
Delmarva (DMV) 120+ mm	0.0028	0.0020	0.0087	0.0167				
New Jersey (NJ) 120+ mm	0.0122	0.0191	0.0210	0.0316				
Long Island (LI) 120+ mm	0.0011	0.0010	0.0292	0.0023				
Southern New England (SNE) 120+ mm	NA	0.0001	0.0006	0.0483				
Georges Bank (GBK) 120+ mm	NA	NA	NA	NA				
Total fishable biomass less GBK	0.0092	0.0138	0.0169	0.0231				
Total fishable biomass	0.0080	0.0105	0.0132	0.0159				
Upper bound for 80% confidence intervals for fishing mortality (y <sup>-1</sup> , for lognormal distribution with no bias correction)	Estimates for 1997	Estimates for 1999	Estimates for 2002	Estimates for 2005				
S. Virginia and N. Carolina (SVA) 120+ mm	NA	NA	0.0051	NA				
Delmarva (DMV) 120+ mm	0.0068	0.0047	0.0206	0.0458				
New Jersey (NJ) 120+ mm	0.0262	0.0433	0.0469	0.0715				
Long Island (LI) 120+ mm	0.0056	0.0043	0.1465	0.0073				
Southern New England (SNE) 120+ mm	NA	0.0006	0.0014	0.1121				
Georges Bank (GBK) 120+ mm	NA	NA	NA	NA				
Total fishable biomass less GBK	0.0177	0.0273	0.0328	0.0458				
Total fishable biomass	0.0149	0.0202	0.0251	0.0311				

Table C19. Patch model estimates for surfclam depletion experiments carried out by the F/V Lisa Kim during 2004-2005.

Statistic	N successful experiments	Population Density (N ft <sup>-2</sup> )	Depletion Vessel Efficiency	k	Setup Density (N ft <sup>-2</sup> )	NEFSC Dredge Efficiency
<b><i>F/V Lisa Kim (2004-2005)</i></b>						
Mean		0.032	0.723	4.698	0.0051	0.158
Median	6 commercial	0.028	0.714	4.593	0.0051	0.158
Lower 80% bound	depletion, 4	0.023	0.625	3.633	0.0044	0.1051
Upper 80% bound	with setup	0.042	0.822	5.763	0.0058	0.2101
SE	tows	0.006	0.067	0.722	0.0004	0.032
CV (SE / Mean)		0.192	0.092	0.154	0.0839	0.203

Table C20. Revised surfclam efficiency corrected swept-area abundance and biomass estimates (120+ SL) from the cooperative 2004 clam survey and assuming dredge efficiency  $E=0.714$ . Estimates from Weinberg et al. (2005) assuming  $E=0.792$  are shown for comparison.

Statistics	SVA	DMV	NJ
<i>Revised</i>			
N tows	15	77	110
Mean n/tow	0.143	23.253	71.079
Var	0.012	35.412	82.763
CV	0.78	0.26	0.13
Mean kg/tow	0.011	2.365	10.863
Var	0.000	0.348	1.907
CV	0.81	0.25	0.13
Area (sq nm)	1,074	4,660	5,078
Efficiency	0.714	0.714	0.714
Swept area abundance (10 <sup>6</sup> clams)	1.7	1230.3	4098.1
Swept area biomass (mt)	128	125,139	626,302
<i>Weinberg et al. (2005)</i>			
Swept area biomass (mt)	300	143,000	535,000



Table C21. Efficiency corrected swept-area biomass estimates (1,000 mt) for SVA, DMV and NJ, which were covered during the 2004 cooperative surfclam survey.

Region	1997	1999	2002	2004	2005
SVA	1.59	5.96	29.96	0.13	29.96
DMV	397	236	375	125	68
NJ	1,065	730	653	626	397
Total	1,464	972	1,058	752	494

Table C22. Von Bertalanffy growth model parameters for surfclam weight at age in the DMV and NJ regions during 1982-1992 and 1994-2005 based on NEFSC survey data with estimates of meat weight ( $W$ , grams) and shell length ( $L$ , mm) at the age of recruitment ( $k$ ), one year before recruitment ( $k-1$ ) and one year after recruitment ( $k+1$ ). The parameters for NJ were also used for the whole stock.

Parameter	NJ		DMV	
	1982-1992	1994-2005	1982-1992	1994-2005
$K (y^{-1})$	0.1449		0.1258	
$r$	0.8651		0.8818	
$t0 (y)$	1.5365	1.6919	1.5176	1.6026
$W_{max}$	240.5	206.8	197.4	138.0
Age at recruitment $k (y)$	4.4	5.1	4.8	6.9
$W_{k-1}$	56.4	61.7	49.5	57.4
$W_k$	81.3	81.3	66.9	66.9
$W_{k+1}$	102.8	98.2	82.4	75.3
$L_{k-1}$	105.7	109.0	107.9	113.7
$L_k$	120.0	120.0	120.0	120.0
$L_{k+1}$	130.2	128.2	129.0	125.1
$J$	0.6945	0.7592	0.7388	0.8578

Table C23. NEFSC survey index trend data (doppler tow distance measurements) used in KLAMZ models for surfclam recruits and for fishable biomass in the whole stock..

	DMV recruit index			NJ recruit index			Whole stock recruit index			Whole stock fishable biomass index			
	Kg/Tow	CV	Size groups (mm SL)	Kg/Tow	CV	Size groups (mm SL)	Kg/Tow	CV	Size groups (mm SL)	Mean kg/tow	Approx. swept area biomass (mt)	CV	Size groups (mm SL)
1982	0.598	0.34	120-129	0.976	0.24	120-129	0.350	0.19	120-129	1.756	1,069	0.15	120+
1983	1.177	0.78	120-129	0.882	0.34	120-129	0.448	0.45	120-129	1.615	983	0.18	120+
1984	0.846	0.3	120-129	0.776	0.27	120-129	0.396	0.18	120-129	2.149	1,308	0.13	120+
1986	3.165	0.53	120-129	0.493	0.29	120-129	0.815	0.43	120-129	2.695	1,641	0.19	120+
1989	0.745	0.31	120-129	0.508	0.2	120-129	0.352	0.22	120-129	2.290	1,395	0.22	120+
1992	0.730	0.57	120-129	0.399	0.28	120-129	0.313	0.3	120-129	1.601	975	0.14	120+
1994	1.328	0.33	120-125	1.536	0.23	120-129	0.792	0.16	120-129	4.613	2,809	0.14	120+
1997	1.933	0.34	120-125	1.060	0.22	120-129	0.790	0.19	120-129	3.989	2,429	0.09	120+
1999	0.989	0.29	120-125	0.707	0.58	120-129	0.550	0.21	120-129	2.717	1,654	0.13	120+
2002	0.380	0.34	120-125	0.242	0.24	120-129	0.296	0.28	120-129	2.481	1,510	0.14	120+
2005	0.075	0.26	120-125	0.193	0.24	120-129	0.101	0.24	120-129	1.339	815	0.17	120+

Table C24. Estimated biomass, recruitment biomass and fishing mortality for the entire surfclam stock from the KLAMZ model. CVs are from 1000 bootstrap iterations.

Year	Biomass (1000 mt)	CV	Recruitment (1000 mt)	CV	Fishing mortality ( $y^{-1}$ )	CV
1981	1,020	0.26	NA		0.0173	0.25
1982	1,036	0.23	96	0.17	0.0231	0.22
1983	1,059	0.20	110	0.20	0.0229	0.19
1984	1,083	0.18	109	0.17	0.0266	0.17
1985	1,141	0.16	147	0.26	0.0241	0.15
1986	1,225	0.15	170	0.20	0.0231	0.15
1987	1,271	0.14	130	0.30	0.0193	0.15
1988	1,290	0.15	106	0.28	0.0200	0.15
1989	1,289	0.14	93	0.15	0.0187	0.15
1990	1,285	0.15	96	0.31	0.0205	0.15
1991	1,283	0.15	102	0.32	0.0172	0.15
1992	1,290	0.15	109	0.15	0.0184	0.15
1993	1,476	0.13	289	0.30	0.0153	0.14
1994	1,613	0.12	231	0.13	0.0141	0.13
1995	1,709	0.09	201	0.33	0.0119	0.09
1996	1,780	0.07	185	0.32	0.0115	0.08
1997	1,842	0.07	189	0.14	0.0105	0.07
1998	1,824	0.05	116	0.35	0.0104	0.05
1999	1,799	0.04	121	0.17	0.0114	0.04
2000	1,723	0.04	76	0.36	0.0120	0.04
2001	1,628	0.04	62	0.36	0.0142	0.04
2002	1,531	0.04	63	0.18	0.0166	0.04
2003	1,415	0.05	43	0.24	0.0187	0.05
2004	1,292	0.05	32	0.22	0.0199	0.05
2005	1,170	0.06	27	0.16	0.0192	0.06

Table C25. Factors used to scale NEFSC survey trend data (mean kg/tow, 120+ mm, doppler tow distances) to approximate efficiency corrected swept-area biomass (based on sensor distance data and efficiency estimates).

<i>SVA</i> 68.462	<i>DMV</i> 119.917	<i>NJ</i> 114.584
<i>LI</i> 76.107	<i>SNE</i> 89.164	<i>GBK</i> 103.414

Table C26. Proportions of total fishable surfclam biomass during 1980-2005 at a range of survey biomass density levels, by region.

Years	Fishable biomass density levels (kg/tow) from survey data						Sum of Proportions (check)	Total Number of Tows	Total Number of Surveys
	0 to 4	5 to 9	10 to 14	15 to 19	20 to 24	25+			
<b>Proportions of tows (and stock area) at each survey catch rate level:</b>									
<i>Southern Virginia (SVA)</i>									
1980-1989	0.94	0.03	0.01	0.02	0.01		1.00	154	5
1990-1999	0.99			0.01			1.00	107	3
2000-2005	1.00						1.00	29	2
<i>Delmarva (DMV)</i>									
1980-1989	0.81	0.10	0.03	0.01	0.01	0.04	1.00	355	5
1990-1999	0.78	0.11	0.05	0.03	0.02	0.02	1.00	237	3
2000-2005	0.90	0.05	0.03	0.01		0.01	1.00	152	2
<i>New Jersey (NJ)</i>									
1980-1989	0.71	0.12	0.06	0.04	0.02	0.05	1.00	484	5
1990-1999	0.56	0.13	0.10	0.05	0.05	0.11	1.00	330	3
2000-2005	0.69	0.11	0.11	0.03	0.01	0.04	1.00	206	2
<i>Long Island (LI)</i>									
1980-1989	0.97	0.02	0.01				1.00	170	5
1990-1999	0.95	0.02	0.01		0.01		1.00	86	3
2000-2005	0.93	0.02	0.02	0.04			1.00	57	2
<i>Southern New England (SNE)</i>									
1980-1989	0.87	0.03	0.05	0.02	0.01	0.02	1.00	202	5
1990-1999	0.90	0.02	0.04		0.01	0.02	1.00	90	3
2000-2005	0.96	0.04					1.00	48	2
<i>Georges Bank (GBK)</i>									
1986-1992	0.87	0.05	0.03	0.02	0.01	0.02	1.00	126	3
1997-2002	0.79	0.04	0.04	0.02	0.01	0.10	1.00	119	3
All years	0.83	0.04	0.04	0.02	0.01	0.06	1.00	245	6
<b>Mean survey catch rate (kg/tow) at each survey catch rate level (<math>p_L</math>):</b>									
<i>Southern Virginia (SVA)</i>									
1980-1989	0.267	6.206	11.779	16.929	21.086				
1990-1999	0.119			17.468					
2000-2005	0.171								
<i>Delmarva (DMV)</i>									
1980-1989	0.853	7.528	11.999	16.412	21.738	50.956			
1990-1999	0.820	7.348	12.039	17.431	22.697	50.709			
2000-2005	0.518	6.800	11.471	17.350		25.869			
<i>New Jersey (NJ)</i>									
1980-1989	1.018	7.559	12.270	17.662	22.426	52.603			
1990-1999	0.939	7.343	12.017	17.518	22.016	45.320			
2000-2005	1.216	7.215	12.195	15.867	22.468	32.093			
<i>Long Island (LI)</i>									
1980-1989	0.095	6.554	13.132						
1990-1999	0.240	6.216	11.010		23.237				
2000-2005	0.121	7.404	10.151	17.446					
<i>Southern New England (SNE)</i>									
1980-1989	0.311	8.573	11.768	18.272	22.628	43.811			
1990-1999	0.118	7.898	12.033		20.543	30.708			
2000-2005	0.640	6.301							
<i>Georges Bank (GBK)</i>									
1986-1992	0.223	8.360	10.987	17.530	21.017	85.534			
1997-2002	0.500	7.110	10.928	17.167	22.838	40.544			
All years	0.351	7.792	10.954	17.385	21.927	46.971			
<b>Proportions of stock biomass at each survey catch rate level (<math>X_L</math>):</b>									
<i>Southern Virginia (SVA)</i>									
1980-1989	0.242	0.156	0.148	0.320	0.133		1.00		
1990-1999	0.431			0.569			1.00		
2000-2005	1.000						1.00		
<i>Delmarva (DMV)</i>									
1980-1989	0.164	0.187	0.072	0.055	0.044	0.478	1.00		
1990-1999	0.162	0.197	0.142	0.131	0.097	0.271	1.00		
2000-2005	0.311	0.233	0.197	0.149		0.111	1.00		
<i>New Jersey (NJ)</i>									
1980-1989	0.118	0.146	0.119	0.100	0.060	0.457	1.00		
1990-1999	0.055	0.102	0.129	0.094	0.104	0.516	1.00		
2000-2005	0.168	0.161	0.272	0.108	0.044	0.249	1.00		
<i>Long Island (LI)</i>									
1980-1989	0.255	0.319	0.426				1.00		
1990-1999	0.296	0.187	0.166		0.350		1.00		
2000-2005	0.109	0.126	0.172	0.593			1.00		
<i>Southern New England (SNE)</i>									
1980-1989	0.101	0.095	0.218	0.135	0.126	0.325	1.00		
1990-1999	0.062	0.102	0.310		0.132	0.395	1.00		
2000-2005	0.700	0.300					1.00		
<i>Georges Bank (GBK)</i>									
1986-1992	0.067	0.138	0.121	0.145	0.058	0.471	1.00		
1997-2002	0.069	0.052	0.080	0.050	0.034	0.715	1.00		
All years	0.068	0.082	0.094	0.083	0.042	0.630	1.00		

Table C27. Proportions of total 2005 stock biomass at a range of survey density levels, by region.

Region	Survey catch rate level (kg/tow)						Total
	0 to 4	5 to 9	10 to 14	15 to 19	20 to 24	25+	
<i>Total 2005 biomass (mt meats)</i>							
Southern Virginia (SVA)	36	0	0	0	0	0	36
Delmarva (DMV)	29	21	18	14	0	10	92
New Jersey (NJ)	61	59	99	39	16	91	365
Long Island (LI)	18	21	29	99	0	0	167
Southern New England (SNE)	28	12	0	0	0	0	40
Georges Bank (GBK)	33	25	38	24	16	336	471
Total	205	138	184	176	32	437	1,170
<i>Total 2005 biomass (bushels)</i>							
Southern Virginia (SVA)	4,678	0	0	0	0	0	4,678
Delmarva (DMV)	3,713	2,786	2,350	1,777	0	1,325	11,951
New Jersey (NJ)	7,959	7,598	12,843	5,085	2,058	11,755	47,299
Long Island (LI)	2,354	2,721	3,731	12,823	0	0	21,628
Southern New England (SNE)	3,615	1,548	0	0	0	0	5,162
Georges Bank (GBK)	4,218	3,188	4,900	3,079	2,048	43,632	61,065
Total	26,537	17,841	23,823	22,764	4,106	56,712	151,783
<i>Percent of total 2005 biomass</i>							
Southern Virginia (SVA)	3.082%	0.000%	0.000%	0.000%	0.000%	0.000%	3.082%
Delmarva (DMV)	2.45%	1.84%	1.55%	1.17%	0.00%	0.87%	7.87%
New Jersey (NJ)	5.24%	5.01%	8.46%	3.35%	1.36%	7.74%	31.16%
Long Island (LI)	1.55%	1.79%	2.46%	8.45%	0.00%	0.00%	14.25%
Southern New England (SNE)	2.38%	1.02%	0.00%	0.00%	0.00%	0.00%	3.40%
Georges Bank (GBK)	2.78%	2.10%	3.23%	2.03%	1.35%	28.75%	40.23%
Total	17.48%	11.75%	15.70%	15.00%	2.70%	37.36%	100.00%

Table C28. Example projection results for surfclam showing projected average biomass, and fishing mortality during 2006-2015 under three possible scenarios: i) constant landings at the minimum quota; ii) status-quo landings (i.e. mean landings during 2003 to 2005); iii) constant landings at the maximum quota; and iv) constant fishing mortality at the  $F_{MSY}$  proxy =  $M= 0.15 \text{ y}^{-1}$ . CVs measure variability between simulation runs in the projection analysis for a scenario. CVs were similar for each scenario in the same year and the CVs shown in the table are averages for simplicity in presentation.

Year	Landings = min quota = 1.85 million bu	Status quo landings = mean 2003-2005 = 3.042 million bu	Landings = max quota = 3.4 million bu	$F = F_{MSY}$ = $M = 0.15$	CV
All	16.0	<i>Catch (landings + 12%, 1000 mt)</i> 49.7		variable	NA
		<i>Biomass (1000 mt)</i>			
2005	1,198	1,198	1,198	1,198	251%
2006	1,093	1,093	1,093	1,093	275%
2007	1,010	1,001	998	889	322%
2008	944	925	920	739	417%
2009	892	866	858	632	560%
2010	856	823	813	559	744%
2011	832	793	781	512	944%
2012	820	776	762	485	1150%
2013	819	769	754	472	1350%
2014	826	772	755	470	1532%
2015	839	781	763	474	1679%
		<i>Fishing mortality (annual rate)</i>			
2005	0.0188	0.0188	0.0188	0.0188	255%
2006	0.0156	0.0258	0.0288	0.1500	279%
2007	0.0169	0.0282	0.0317	0.1500	327%
2008	0.0181	0.0306	0.0345	0.1500	412%
2009	0.0193	0.0329	0.0372	0.1500	531%
2010	0.0202	0.0349	0.0396	0.1500	676%
2011	0.0210	0.0367	0.0418	0.1500	836%
2012	0.0216	0.0381	0.0435	0.1500	1009%
2013	0.0220	0.0392	0.0449	0.1500	1187%
2014	0.0222	0.0399	0.0458	0.1500	1369%
2015	0.0223	0.0403	0.0465	0.1500	1551%