

**United States Department of Interior  
Fish and Wildlife Service  
Region 5  
Wildlife and Sport Fish Restoration Program**



**2016 Annual Performance Report**

State: Massachusetts

Agency: Division of Marine Fisheries

Project Title: Massachusetts Fishery Resource Assessment

FA Grant Agreement: F-56-R

Segment Number: 24

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Date Submitted:

Sport Fish Program  
Massachusetts Fishery Resource Assessment: F-56-R-24  
2016 Performance Report

List of Active Jobs:

[Job No. 1: Fishery Resource Assessment, Coastal Massachusetts](#)

The Massachusetts Division of Marine Fisheries Resource Assessment Project completed the thirty-ninth annual spring and fall bottom trawl surveys of Massachusetts territorial waters in 2016. Detailed reports of the activities of each cruise follow.

[Job No. 2: Winter Flounder Year-Class Strength](#)

The Massachusetts Division of Marine Fisheries Resource Assessment Project completed the forty-first annual seine survey of Nantucket Sound estuaries on the south shore of Cape Cod to assess southern New England stock winter flounder yoy cohort abundance. A report of the 2016 seine survey follows.

[Appendix A:](#) Indices of biomass, abundance, and recruitment for select species.

[Appendix B:](#) Trends in observed bottom temperatures - Massachusetts bottom trawl survey, 1978 - 2016.

[Appendix C:](#) Corrections to the trawl survey database in 2016.

## CRUISE RESULTS

### R/V GLORIA MICHELLE

2016 Massachusetts Inshore Spring  
Bottom Trawl Survey  
Cruise No. 201691

### CRUISE PERIOD AND AREA

From May 9 through May 26, 2016 the Massachusetts Division of Marine Fisheries conducted its 39th spring bottom trawl survey. The survey extended from New Hampshire to Rhode Island boundaries seaward to three nautical miles including Cape Cod Bay and Nantucket Sound.

### OBJECTIVES

Cruise objectives were 1) to determine the spring distribution, relative abundance, and size composition of fish and select invertebrate species; and 2) to collect biological samples. Requested special collections were also undertaken.

### METHODS

The study area is stratified based on five bio-geographic regions and six depth zones (Fig. 1). Trawl sites are allocated in proportion to stratum area and randomly chosen in advance within each sampling stratum. Randomly chosen stations in locations known to be untowable due to hard bottom are reassigned. Sampling intensity is approximately 1 station per 19 square nautical miles. A minimum of two stations are assigned to each stratum.

A standard tow of 20-minute duration at 2.5 knots was attempted at each station during daylight hours with a 3/4 size North Atlantic type two seam otter trawl (11.9 m headrope/15.5 m footrope) rigged with a 7.6 cm rubber disc sweep; 19.2 m, 9.5 mm chain bottom legs; 18.3 m, 9.5 mm wire top legs; and 1.8 X 1.0 m, 147 kg wooden trawl doors. The codend contains a 6.4 mm knotless liner to retain small fish. Prior to setting the net at each station, NOAA Corps officers surveyed the site by visually scanning for buoys marking fixed gear as well as determining the suitability of the bottom for towing the net based on the sounder image. Whenever necessary, sites were relocated due to untowable bottom or concentrations of fixed gear. Abbreviated tows of 13-19 minute duration were accepted as valid and expanded to the 20 minute standard.

Standard bottom trawl survey techniques were used when processing the catch. The total weight and length-frequency of each species were recorded directly into Fisheries Scientific Computer System (FSCS) data tables. Collections of age and growth material, and biological observations were undertaken during the measuring operation. Specimens were also saved to fulfill requests. Bottom temperatures were continuously recorded with an Onset Water Temp Pro v2 attached to the net's headrope.

Twenty-seven MADMF employees participated in the survey as part of the scientific party, joined by one fisheries professional from the National Marine Fisheries Service, and two research scientists from Rhode Island College (Table 1).

## CRUISE SUMMARY

104 stations were attempted in 17 sampling days (Figs 1 and 2, Table 2). Ninety-eight completed stations are considered acceptable for assessment of all species, SHG  $\leq 136$  (Table 3). Two days were lost due to weather. Six station assignments were not completed with acceptable trawl hauls. Fixed gear at station 26 resulted in an abort and lost station in stratum 35. One station in stratum 17 was lost due to hard bottom. A large catch of weed at station 82 resulted in an abort and lost station in stratum 15. Two additional stations were lost in stratum 15 due to sandwaves, shoals, and current. A large catch of weed at station 96 resulted in an abort and lost station in stratum 11. There were no sub-standard (SHG between 141 and 166) tows accepted (Table 4). Six attempted tows were aborted due to fixed gear, hard bottom, and weed (Table 5, Fig. 3).

The primary goal of tallying weight, number, and a representative length frequency of each fish species in the catches was accomplished (Tables 6a and 6b). Two interesting records were set on the 2016 spring survey, the two largest survey catches of haddock (1,250kg and 490kg) were recorded west of Race Point and the largest abundance of spotted hake (676 individuals) was recorded South of Nantucket. Small monkfish were encountered at several stations north and east of Cape Cod and outer Vineyard Sound. Relatively large catches of winter flounder, yellowtail flounder and American lobster were taken in Mass Bay. Age 1+ scup were highly abundant throughout Nantucket Sound, Vineyard Sound and Buzzard's Bay.

Additional sampling goals were achieved (Table 7). To aid cooperative fisheries assessments, over 1,900 scale/otolith/operculum samples, as well as sex and maturity observations, were taken from Atlantic cod, haddock, summer flounder, yellowtail flounder, winter flounder, windowpane flounder, black sea bass, scup, weakfish, tautog, American lobster and Jonah crabs. Additional samples were collected to assist ongoing research by fisheries scientists from MADMF and other labs in the region.

For further information on this survey or others in the time series, contact Matthew Camisa at (508) 990-2860 ext. 139.

Table 1. MADMF Spring Cruise 2016 Staffing List

Scientific Party		
Name	Affiliation	Num. Days
Vincent Manfredi	MADMF	10
Matthew Camisa	MADMF	9
Mark Szymanski	MADMF	9
Steve Voss	MADMF	8
Greg Decelles	MADMF	5
Brad Schondelmeier	MADMF	5
Collin Farrell	MADMF	4
Ross Kessler	MADMF	4
John Logan	MADMF	4
Kim Trull	MADMF	4
Theresa Burnham	MADMF	3
Bob Glenn	MADMF	3
Mike Trainor	MADMF	3
Derek Perry	MADMF	2
Ricky Alexander	MADMF	2
Mike Bednarski	MADMF	1
Melissa Campbell	MADMF	1
Jill Carr	MADMF	1
Scott Elzey	MADMF	1
Liz Morrissey	MADMF	1
Kate Ostrakis	MADMF	1
Emily Pholke	NMFS-WH	1
Mike Pol	MADMF	1
Mark Rousseau	MADMF	1
Sara Schaal	MADMF	1
Jared Silva	MADMF	1
Steve Wilcox	MADMF	1
Matt Roux	MADMF	1
Rebeka Merson	RI COLLEGE	1
Christopher Rei-Mohammed	RI COLLEGE	1
		90
R/V Gloria Michelle Crew		
Name	Affiliation	Num. Days
<i>Officers</i>		
Doug Paulishen	NOAA OIC	17
Andrew Reynaga	NOAA JOIC	17
Steve Hall	NOAA-CORPS	12
Mike Ball	NOAA-CORPS	5
<i>Deck Crew</i>		
George Morton	Contract Fisherman	17
Harvey Walsh	NMFS-Narrangansett	12
Peter Plantamura	NMFS-Sandy Hook	5

Table 2. Station Information for the 2016 Massachusetts Spring Inshore Bottom Trawl Survey  
Cruise No. 201691

Station	Stratum	Date	Time (est)	Depth (m)	Latitude	Longitude	Course	Distance (nmi)	Bottom temp °C
1	26	5/9/2016	5:36	12	41°48.77	-70°30.11	141	0.83	N/A
2	25	5/9/2016	6:50	8	41°51.07	-70°30.72	185	0.83	N/A
3	28	5/9/2016	8:26	31	41°55.94	-70°28.58	350	0.85	N/A
4	28	5/9/2016	9:56	34	41°59.65	-70°32.39	355	0.82	N/A
5	29	5/9/2016	11:01	48	41°60.00	-70°25.28	2	0.84	N/A
6	29	5/9/2016	13:29	44	41°56.93	-70°24.24	7	0.84	N/A
7	28	5/9/2016	15:00	38	41°54.98	-70°21.91	53	0.83	N/A
8	27	5/9/2016	16:42	26	41°50.57	-70°24.82	190	0.70	N/A
9	26	5/9/2016	17:55	17	41°46.62	-70°26.16	106	0.85	N/A
10	25	5/10/2016	6:25	7	41°44.95	-70°17.10	265	0.86	9.7
11	26	5/10/2016	7:41	13	41°46.49	-70°16.47	199	0.86	9.5
12	26	5/10/2016	9:04	9	41°46.95	-70°09.70	236	0.75	10.0
13	25	5/10/2016	10:39	7	41°49.52	-70°02.38	216	0.84	10.5
14	25	5/10/2016	12:55	9	41°50.52	-70°09.43	26	0.85	9.4
15	26	5/10/2016	13:56	19	41°51.25	-70°11.44	41	0.84	9.2
16	27	5/10/2016	15:11	29	41°50.72	-70°16.71	79	0.84	8.7
17	27	5/10/2016	16:44	27	41°49.69	-70°18.97	248	0.82	8.7
18	29	5/11/2016	7:20	41	42°04.85	-70°31.43	150	0.84	6.7
19	32	5/11/2016	9:44	13	42°14.11	-70°44.68	132	0.77	9.2
20	35	5/11/2016	11:18	41	42°19.11	-70°43.12	75	0.75	6.2
21	34	5/11/2016	12:47	40	42°18.95	-70°43.45	164	0.73	6.3
22	33	5/11/2016	14:11	22	42°18.21	-70°48.90	25	0.82	8.4
23	32	5/11/2016	15:14	17	42°17.99	-70°50.39	72	0.85	8.9
24	31	5/11/2016	16:27	11	42°17.48	-70°51.84	140	0.55	9.8
25	33	5/12/2016	6:28	23	42°26.91	-70°53.38	110	0.75	7.1
26	35	5/12/2016	8:49	52	42°28.75	-70°43.88	209	0.34	5.9
27	36	5/12/2016	10:37	73	42°28.32	-70°38.81	180	0.22	N/A
28	36	5/12/2016	11:47	79	42°28.54	-70°37.73	190	0.82	5.6
29	34	5/12/2016	13:39	38	42°32.74	-70°43.36	255	0.82	6.1
30	35	5/12/2016	15:49	55	42°33.62	-70°37.46	129	0.55	5.7
31	34	5/13/2016	7:38	34	42°51.47	-70°45.28	231	0.53	5.6
32	31	5/13/2016	8:56	9	42°49.64	-70°48.15	355	0.85	7.1
33	33	5/13/2016	10:26	25	42°47.29	-70°45.82	286	0.09	N/A
34	33	5/13/2016	10:53	25	42°47.12	-70°45.71	154	0.83	6.3
35	32	5/13/2016	12:05	17	42°46.10	-70°46.70	159	0.85	6.7
36	31	5/13/2016	13:11	9	42°44.33	-70°46.70	162	0.84	7.6
37	33	5/13/2016	14:30	27	42°41.99	-70°40.01	269	0.83	6.5
38	34	5/13/2016	16:17	38	42°41.44	-70°34.89	309	0.84	5.8
39	35	5/14/2016	6:37	54	42°39.73	-70°32.59	341	0.60	5.7
40	35	5/14/2016	8:18	42	42°41.96	-70°35.12	300	0.84	6.0
41	36	5/14/2016	10:08	81	42°42.26	-70°32.49	335	0.82	5.4
42	29	5/15/2016	7:47	57	42°06.49	-70°27.39	334	0.55	5.8
43	30	5/15/2016	8:54	59	42°04.64	-70°24.40	311	0.80	5.8
44	27	5/17/2016	5:48	27	41°59.74	-70°09.16	177	0.83	10.8
45	29	5/17/2016	7:30	56	42°02.06	-70°15.67	359	0.80	7.2
46	30	5/17/2016	8:57	62	42°05.22	-70°15.63	230	0.84	6.2
47	28	5/17/2016	11:31	35	41°56.48	-70°14.86	40	0.83	9.0
48	28	5/17/2016	12:57	32	41°54.25	-70°16.29	182	0.84	9.7
49	27	5/17/2016	14:17	25	41°53.87	-70°10.58	225	0.82	10.2
50	17	5/18/2016	4:36	6	42°05.35	-70°09.59	104	0.84	9.8
51	20	5/18/2016	5:51	36	42°05.90	-70°05.85	273	0.59	7.1
52	21	5/18/2016	7:43	45	42°05.64	-70°03.07	126	0.87	6.3

Table 2 continued.

Station	Stratum	Date	Time (est)	Depth (m)	Latitude	Longitude	Course	Distance (nmi)	Bottom temp °C
53	18	5/18/2016	10:47	18	41°52.36	-70°56.44	348	0.63	9.7
54	20	5/18/2016	12:34	35	41°49.68	-70°53.33	349	0.85	8.4
55	21	5/18/2016	13:46	40	41°48.93	-70°52.41	349	0.83	7.3
56	20	5/18/2016	15:31	37	41°47.16	-70°52.09	178	0.84	8.9
57	18	5/18/2016	17:24	19	41°41.86	-70°52.33	222	0.76	9.3
58	17	5/19/2016	4:58	8	41°36.36	-70°55.98	220	0.84	9.7
59	18	5/19/2016	6:07	13	41°39.36	-70°54.72	211	0.85	9.5
60	16	5/19/2016	9:06	19	41°27.71	-70°03.37	266	0.84	10.2
61	18	5/19/2016	10:30	13	41°25.47	-70°01.53	87	0.83	10.7
62	17	5/19/2016	11:53	10	41°23.85	-70°58.79	45	0.84	10.5
63	16	5/19/2016	15:30	12	41°22.91	-70°03.70	138	0.85	12.0
64	11	5/20/2016	8:20	8	41°17.74	-70°23.90	213	0.84	10.9
65	17	5/20/2016	10:02	9	41°17.29	-70°17.00	302	0.83	11.2
66	19	5/20/2016	11:17	20	41°13.74	-70°13.81	300	0.84	11.0
67	18	5/20/2016	12:28	16	41°14.28	-70°12.50	116	0.83	11.4
68	18	5/20/2016	13:39	14	41°14.30	-70°09.46	95	0.85	12.5
69	19	5/20/2016	15:01	23	41°12.36	-70°08.41	79	0.75	11.8
70	11	5/20/2016	18:19	8	41°20.63	-70°32.84	273	0.82	12.5
71	12	5/21/2016	4:59	16	41°19.68	-70°35.04	18	0.82	11.8
72	13	5/21/2016	6:08	21	41°18.72	-70°36.53	82	0.85	10.7
73	12	5/21/2016	7:19	12	41°20.08	-70°39.42	88	0.84	11.1
74	13	5/21/2016	8:42	22	41°17.55	-70°44.02	37	0.85	10.0
75	14	5/21/2016	10:37	33	41°19.48	-70°54.26	121	0.83	9.0
76	14	5/21/2016	12:15	28	41°22.38	-70°00.89	143	0.84	10.4
77	13	5/21/2016	14:00	25	41°22.59	-70°53.51	84	0.83	10.1
78	13	5/21/2016	15:00	23	41°24.03	-70°54.17	65	0.86	10.6
79	16	5/23/2016	7:43	12	41°31.32	-70°13.36	332	0.84	12.7
80	16	5/23/2016	9:04	11	41°32.02	-70°07.21	336	0.62	12.8
81	16	5/23/2016	10:12	11	41°36.21	-70°04.28	225	0.83	13.2
82	15	5/23/2016	11:20	7	41°37.72	-70°02.80	234	0.32	13.6
83	15	5/23/2016	13:11	10	41°34.86	-70°02.49	89	0.84	12.6
84	16	5/23/2016	15:27	12	41°26.72	-70°10.43	115	0.83	11.8
85	15	5/24/2016	4:46	9	41°19.25	-70°09.15	94	0.82	13.9
86	16	5/24/2016	5:41	11	41°19.77	-70°09.49	82	0.84	13.6
87	15	5/24/2016	7:05	7	41°23.61	-70°11.01	259	0.54	13.3
88	16	5/24/2016	9:41	22	41°25.92	-70°15.14	306	0.83	13.5
89	15	5/24/2016	12:19	8	41°25.63	-70°25.68	135	0.50	13.5
90	16	5/24/2016	13:45	16	41°27.57	-70°28.24	277	0.84	13.4
91	15	5/24/2016	14:48	9	41°25.61	-70°31.84	63	0.53	13.7
92	15	5/24/2016	16:00	9	41°26.27	-70°30.33	79	0.53	13.5
93	12	5/25/2016	5:05	14	41°33.83	-70°41.97	20	0.83	12.3
94	11	5/25/2016	6:30	8	41°41.01	-70°41.76	199	0.54	14.2
95	11	5/25/2016	7:39	7	41°39.34	-70°43.68	169	0.75	14.5
96	11	5/25/2016	9:58	8	41°34.82	-70°54.35	164	0.36	14.4
97	12	5/25/2016	11:38	18	41°30.28	-70°53.97	34	0.84	12.3
98	13	5/25/2016	13:50	19	41°27.86	-70°06.64	191	0.53	11.0
99	12	5/25/2016	16:11	17	41°29.93	-70°49.98	243	0.82	12.4
100	12	5/25/2016	17:19	16	41°31.58	-70°48.78	229	0.82	12.4
101	12	5/26/2016	6:29	14	41°31.25	-70°46.50	33	0.63	12.4
102	16	5/26/2016	8:22	17	41°31.54	-70°36.66	85	0.84	14.9
103	16	5/26/2016	10:17	13	41°29.49	-70°24.14	314	0.82	14.4
104	15	5/26/2016	11:56	9	41°33.59	-70°25.73	269	0.74	15.8

Table 3. Sampling Effort Assigned and Accomplished by Stratum, Cruise 201691.

Stratum	Region	Assigned Stations	Number of Stations Completed			Aborted Tows
			All Accepted	Sub-Standard	Standard	
11	1	5	4		4	1
12	1	7	7		7	
13	1	5	5		5	
14	1	2	2		2	
15	2	10	7		7	1
16	2	11	11		11	
17	3	5	4		4	1
18	3	5	6		6	
19	3	2	2		2	
20	3	2	2		2	
21	3	2	2		2	
25	4	4	4		4	
26	4	5	5		5	
27	4	5	5		5	
28	4	5	5		5	
29	4	5	5		5	
30	4	2	2		2	
31	5	3	3		3	1
32	5	3	3		3	
33	5	4	4		4	
34	5	4	4		4	
35	5	5	4		4	
36	5	2	2		2	
TOTALS		103	98	0	98	6

Note:

Standard Tows. SHG <=136. Recommended for use in all indices of abundance.

Sub-Standard Tows. SHG 141-166. Not recommended for use in indices other than spiny dogfish.

Aborted Tows. Catch data not recommended for use.



Table 4. Sub-Standard Tows (SHG 141 - 166) Completed on Cruise 201691.  
Not Advised for Indices of Abundance other than Spiny Dogfish.

Station	Stratum	SHG Location	Description
No sub-standard tows on cruise 201691.			

Table 5. Attempted Tows Aborted During Cruise 201691.

Station	Stratum	SHG Location	Description
26	9350	176 Outer Mass Bay	Fixed gear intercepted
27	9360	176 Outer Mass Bay	Fixed gear intercepted
33	9330	171 East of Plum Island	Hard Bottom
51	9200	179 Northeast of Provincetown	Hard Bottom
82	9150	174 West of Monomoy	Meshes plugged with weed
96	9110	174 South of New Bedford	Meshes plugged with weed

Table 6a. Total Catch Numbers and Weights Observed on the 2016  
Massachusetts Spring Inshore Bottom Trawl Survey - Cruise 201691- Sorted by Number

Species Code	Common Name	Count	Weight (kg)
143	SCUP	144,239	8,271.839
181	NORTHERN SAND LANCE	25,054	153.735
106	WINTER FLOUNDER	8,775	963.876
72	SILVER HAKE	7,408	612.873
313	ATLANTIC ROCK CRAB	6,671	755.039
163	LONGHORN SCULPIN	5,752	945.667
74	HADDOCK	5,289	2,393.924
171	NORTHERN SEAROBIN	5,274	886.848
131	BUTTERFISH	5,250	250.750
77	RED HAKE	4,665	419.964
105	YELLOWTAIL FLOUNDER	4,324	854.337
503	LONGFIN SQUID	3,254	80.661
26	LITTLE SKATE	3,087	1,782.470
301	AMERICAN LOBSTER	1,997	575.376
322	LADY CRAB	1,859	123.804
317	SPIDER CRAB UNCL	1,437	229.532
193	OCEAN POUT	1,424	253.433
78	SPOTTED HAKE	1,387	20.165
108	WINDOWPANE	1,180	231.000
102	AMERICAN PLAICE	1,168	170.893
33	ALEWIFE	837	38.138
104	FOURSPOT FLOUNDER	701	147.601
141	BLACK SEA BASS	535	302.409
73	ATLANTIC COD	520	60.499
103	SUMMER FLOUNDER	449	258.440
23	WINTER SKATE	395	310.947
312	JONAH CRAB	385	63.844
177	TAUTOG	190	134.836
348	NORTHERN MOONSNAIL	172	17.069
401	SEA SCALLOP	139	11.759
197	GOOSEFISH	113	33.705
172	STRIPED SEAROBIN	81	32.381
336	CHANNELED WHELK	79	13.810
337	KNOBBED WHELK	70	25.203
318	HORSESHOE CRAB	56	54.733
164	SEA RAVEN	48	24.842
117	SMALLMOUTH FLOUNDER	47	0.663
45	RAINBOW SMELT	46	0.708
176	CUNNER	42	2.273
35	AMERICAN SHAD	40	1.637
76	WHITE HAKE	35	4.528
403	ATLANTIC SURFCLAM	29	6.107
109	GULF STREAM FLOUNDER	28	0.538

Table 6a continued.

Species Code	Common Name	Count	Weight (kg)
34	BLUEBACK HERRING	25	0.669
75	POLLOCK	20	2.782
182	SNAKEBLenny	19	0.743
13	SMOOTH DOGFISH	18	56.400
107	WITCH FLOUNDER	17	5.769
183	DAUBED SHANNY	16	0.055
409	OCEAN QUAHOG	16	3.699
43	BAY ANCHOVY	14	0.050
331	SEA URCHIN AND SAND DOLLAR UNCL	14	0.013
15	SPINY DOGFISH	12	24.660
180	ROCK GUNNEL	11	0.086
155	ACADIAN REDFISH	10	1.323
402	BAY SCALLOP	10	0.716
32	ATLANTIC HERRING	9	0.526
191	WRYMOUTH	6	2.162
146	NORTHERN KINGFISH	6	0.897
343	BLUE MUSSEL	5	0.891
24	CLEARNOSE SKATE	4	9.700
121	ATLANTIC MACKEREL	4	0.938
166	GRUBBY	4	0.018
139	STRIPED BASS	4	6.140
28	THORNY SKATE	4	3.187
116	NORTHERN PIPEFISH	3	0.007
22	BARNDOR SKATE	3	2.842
83	FOURBEARD ROCKLING	2	0.055
323	MANTIS SHRIMP UNCL	2	0.105
196	NORTHERN PUFFER	2	0.311
63	CONGER EEL	2	0.971
413	NORTHERN QUAHOG	1	0.251
145	WEAKFISH	1	0.357
2	SEA LAMPREY	1	0.060
314	BLUE CRAB	1	0.191
192	ATLANTIC WOLFFISH	1	11.770
20	SKATE UNCL	1	0.025
306	NORTHERN SHRIMP		0.531
520	LONGFIN SQUID EGG MOPS		37.282
Totals		244,799	21,699.038

Table 6b. Total Catch Numbers and Weights Observed on the 2016  
Massachusetts Spring Inshore Bottom Trawl Survey - Cruise 201691- Sorted by Weight

Species Code	Common Name	Count	Weight (kg)
143	SCUP	144,239	8,271.839
74	HADDOCK	5,289	2,393.924
26	LITTLE SKATE	3,087	1,782.470
106	WINTER FLOUNDER	8,775	963.876
163	LONGHORN SCULPIN	5,752	945.667
171	NORTHERN SEAROBIN	5,274	886.848
105	YELLOWTAIL FLOUNDER	4,324	854.337
313	ATLANTIC ROCK CRAB	6,671	755.039
72	SILVER HAKE	7,408	612.873
301	AMERICAN LOBSTER	1,997	575.376
77	RED HAKE	4,665	419.964
23	WINTER SKATE	395	310.947
141	BLACK SEA BASS	535	302.409
103	SUMMER FLOUNDER	449	258.440
193	OCEAN POUT	1,424	253.433
131	BUTTERFISH	5,250	250.750
108	WINDOWPANE	1,180	231.000
317	SPIDER CRAB UNCL	1,437	229.532
102	AMERICAN PLAICE	1,168	170.893
181	NORTHERN SAND LANCE	25,054	153.735
104	FOURSPOT FLOUNDER	701	147.601
177	TAUTOG	190	134.836
322	LADY CRAB	1,859	123.804
503	LONGFIN SQUID	3,254	80.661
312	JONAH CRAB	385	63.844
73	ATLANTIC COD	520	60.499
13	SMOOTH DOGFISH	18	56.400
318	HORSESHOE CRAB	56	54.733
33	ALEWIFE	837	38.138
520	LONGFIN SQUID EGG MOPS		37.282
197	GOOSEFISH	113	33.705
172	STRIPED SEAROBIN	81	32.381
337	KNOBBED WHELK	70	25.203
164	SEA RAVEN	48	24.842
15	SPINY DOGFISH	12	24.660
78	SPOTTED HAKE	1,387	20.165
348	NORTHERN MOONSNAIL	172	17.069
336	CHANNELED WHELK	79	13.810
192	ATLANTIC WOLFFISH	1	11.770
401	SEA SCALLOP	139	11.759
24	CLEARNOSE SKATE	4	9.700
139	STRIPED BASS	4	6.140
403	ATLANTIC SURFCLAM	29	6.107

Table 6b continued.

Species Code	Common Name	Count	Weight (kg)
107	WITCH FLOUNDER	17	5.769
76	WHITE HAKE	35	4.528
409	OCEAN QUAHOG	16	3.699
28	THORNY SKATE	4	3.187
22	BARNDOR SKATE	3	2.842
75	POLLOCK	20	2.782
176	CUNNER	42	2.273
191	WRYMOUTH	6	2.162
35	AMERICAN SHAD	40	1.637
155	ACADIAN REDFISH	10	1.323
63	CONGER EEL	2	0.971
121	ATLANTIC MACKEREL	4	0.938
146	NORTHERN KINGFISH	6	0.897
343	BLUE MUSSEL	5	0.891
182	SNAKEBLENNY	19	0.743
402	BAY SCALLOP	10	0.716
45	RAINBOW SMELT	46	0.708
34	BLUEBACK HERRING	25	0.669
117	SMALLMOUTH FLOUNDER	47	0.663
109	GULF STREAM FLOUNDER	28	0.538
306	NORTHERN SHRIMP		0.531
32	ATLANTIC HERRING	9	0.526
145	WEAKFISH	1	0.357
196	NORTHERN PUFFER	2	0.311
413	NORTHERN QUAHOG	1	0.251
314	BLUE CRAB	1	0.191
323	MANTIS SHRIMP UNCL	2	0.105
180	ROCK GUNNEL	11	0.086
2	SEA LAMPREY	1	0.060
183	DAUBED SHANNY	16	0.055
83	FOURBEARD ROCKLING	2	0.055
43	BAY ANCHOVY	14	0.050
20	SKATE UNCL	1	0.025
166	GRUBBY	4	0.018
331	SEA URCHIN AND SAND DOLLAR UNCL	14	0.013
116	NORTHERN PIPEFISH	3	0.007
Totals		244,799	21,699.038

Table 7. Number of individuals obtained for age, growth, maturity and special studies during Massachusetts DMF Cruise 201691.

Species	Maturity Observation	Age and Growth Collection			YOY
		Scales	Otoliths	Opercula	
Atlantic Cod	44		44		
Haddock	129		129		
Summer Flounder	290	290			
Yellowtail Flounder	382	382			
Winter Flounder	567		567		
Windowpane Flounder	74	74	74		
Black Sea Bass	237		237		
Scup	107	107			
Weakfish	1		1		
Tautog	40		40	40	
American Lobster	47				
Jonah crab (Female)	31				
 TOTAL	 1,949	 853	 1,092	 40	 0

#### OTHER COLLECTIONS:

Both summer flounder and yellowtail flounder were separated by sex at all stations.

Female j Jonah crabs measured to 0.1 cm carapace width and egg bearing status recorded for size at maturity study (D. Perry).

341 river herring for age and growth study (Armstrong).

99 YOY Atlantic cod for age and growth study (Dean).

27 individual fish from 17 species frozen for Ocean Genome Project (Seid)

15 species of fish frozen for academic purposes (Armstrong).







~8 Little Skates saved live for New Bedford contaminant study (Merson).

Figure 1.

# Massachusetts Division of Marine Fisheries Inshore Bottom Trawl Survey

## MDMF Trawl Survey Depth Strata

### Depth (feet)

	Deleted
	0 to 30
	31 to 60
	61 to 90
	91 to 120
	121 to 180
	181 +

○ Indicates stratum number

A or B Indicates subregion

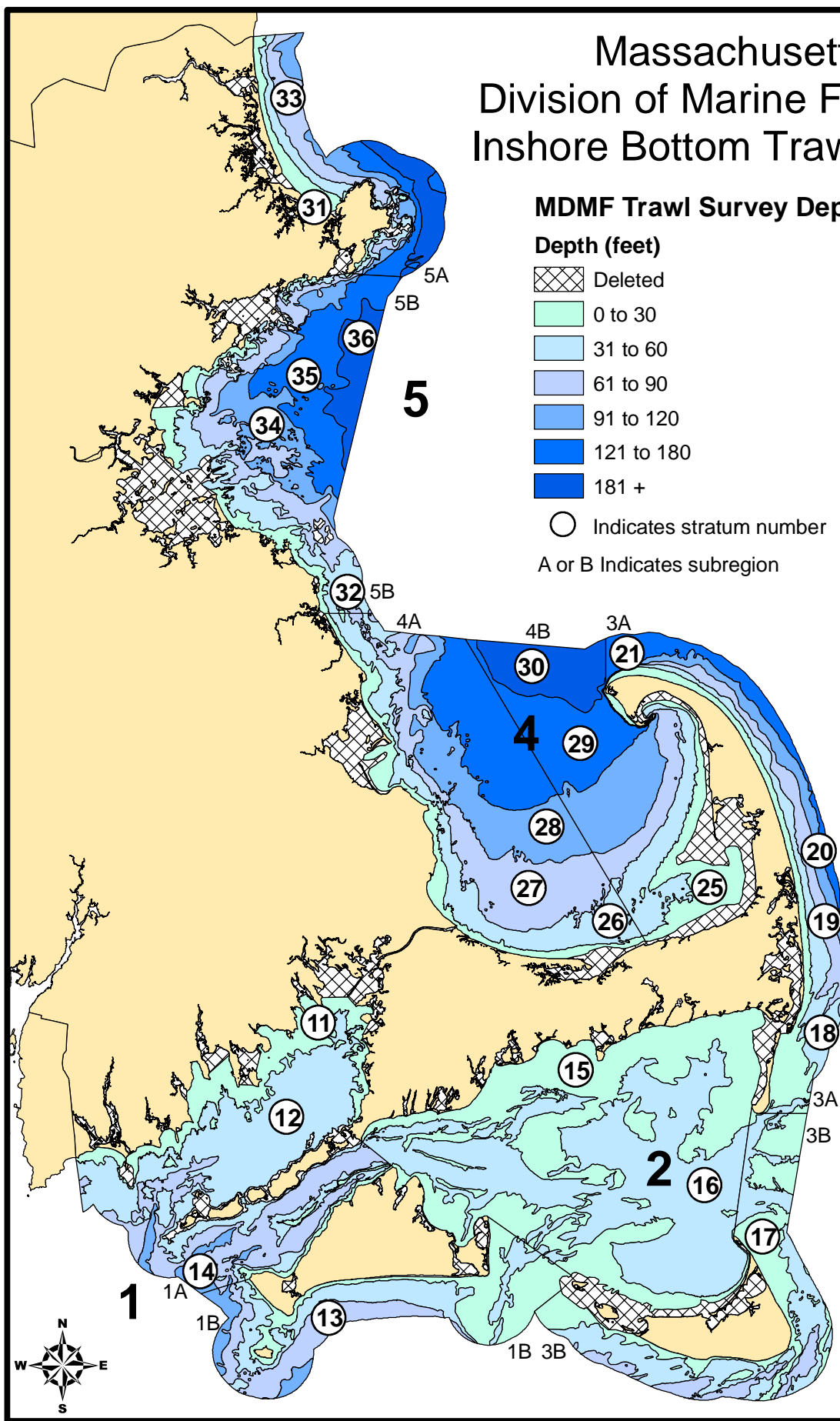


Figure 2.

# Spring 2016 Mass Division of Marine Fisheries Bottom Trawl Survey Tow Locations

- Proposed Tow Circles (1.5nm)
- 201691 Completed Tow Tracks mc
- ✖ 201691 Aborted Tows

Data label indicates day of month (May)

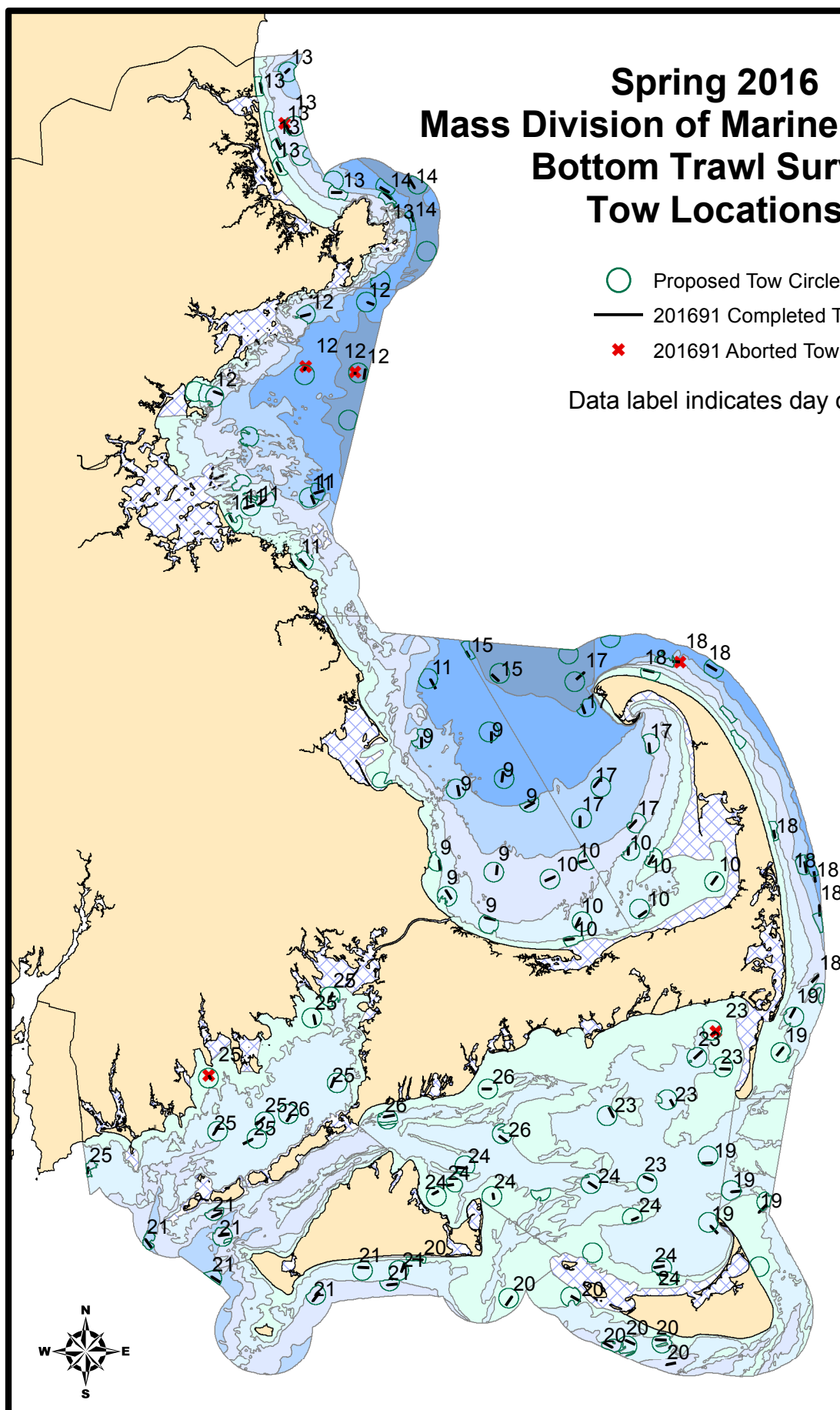


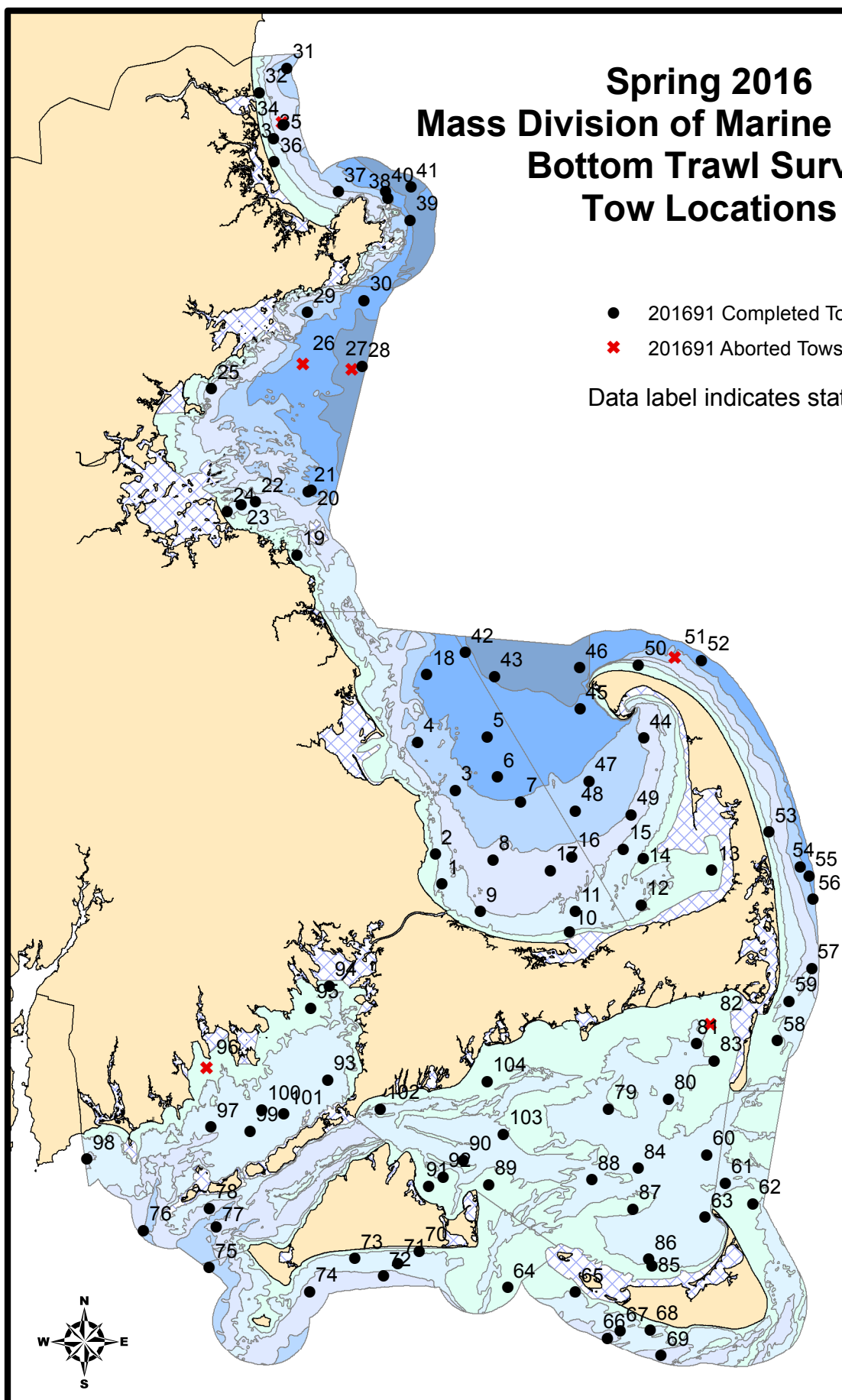


Figure 3.

# Spring 2016 Mass Division of Marine Fisheries Bottom Trawl Survey Tow Locations

- 201691 Completed Tows
- ✖ 201691 Aborted Tows

Data label indicates station number



## CRUISE RESULTS

### R/V GLORIA MICHELLE

2016 Massachusetts Inshore Fall  
Bottom Trawl Survey  
Cruise No. 201692

### CRUISE PERIOD AND AREA

From September 7 through September 23, 2016 the Massachusetts Division of Marine Fisheries conducted its 39th fall bottom trawl survey. The survey extended from New Hampshire to Rhode Island boundaries seaward to three nautical miles including Cape Cod Bay and Nantucket Sound.

### OBJECTIVES

Cruise objectives were 1) to determine the fall distribution, relative abundance, and size composition of fish and select invertebrate species; and 2) to collect biological samples. Requested special collections were also undertaken.

### METHODS

The study area is stratified based on five bio-geographic regions and six depth zones (Fig. 1). Trawl sites are allocated in proportion to stratum area and randomly chosen in advance within each sampling stratum. Randomly chosen stations in locations known to be untowable due to hard bottom are reassigned. Sampling intensity is approximately 1 station per 19 square nautical miles. A minimum of two stations are assigned to each stratum.

A standard tow of 20-minute duration at 2.5 knots was attempted at each station during daylight hours with a 3/4 size North Atlantic type two seam otter trawl (11.9 m headrope/15.5 m footrope) rigged with a 7.6 cm rubber disc sweep; 19.2 m, 9.5 mm chain bottom legs; 18.3 m, 9.5 mm wire top legs; and 1.8 X 1.0 m, 147 kg wooden trawl doors. The codend contains a 6.4 mm knotless liner to retain small fish. Prior to setting the net at each station, NOAA Corps officers surveyed the site by visually scanning for buoys marking fixed gear as well as determining the suitability of the bottom for towing the net based on the sounder image. Whenever necessary, sites were relocated due to untowable bottom or concentrations of fixed gear. Abbreviated tows of 13-19 minute duration were accepted as valid and expanded to the 20 minute standard.

Standard bottom trawl survey techniques were used when processing the catch. The total weight and length-frequency of each species were recorded directly into Fisheries Scientific Computer System (FSCS) data tables. Collections of age and growth material, and biological observations were undertaken during the measuring operation. Specimens were also saved to fulfill requests. Bottom temperatures were continuously recorded with an Onset Water Temp Pro v2 attached to the net's headrope.

Twenty-nine MADMF employees participated in the survey as part of the scientific party, joined by one fisheries professional from the US Environmental Protection Agency, one research scientist from the University of Connecticut, one research scientist from Rhode Island College, and one member from the Massachusetts Lobstermen's Association (Table 1).

## CRUISE SUMMARY

The start of the survey was delayed by 1.25 days due to tropical storm Hermine. 96 stations were attempted in 17 sampling days (Figs 1 and 2, Table 2). Eighty-nine completed stations are considered acceptable for assessment of all species, SHG  $\leq 136$  (Table 3). Thirteen station assignments were not completed with acceptable trawl hauls, largely due to fixed gear set in the proposed circles. One station in each strata, 18, 27, 34, and 35 were dropped due to fixed gear set on towable bottom, as well as two stations in stratum 29. One station each in strata 26 and 31 was dropped due to R/V time constraints. One station was dropped in stratum 19 due to dogfish and hard bottom and two stations were dropped in stratum 16 due to hard bottom and sand waves. Six attempted tows were aborted due to fixed gear, ghost gear, hard bottom, spiny dogfish, and sulfur sponge (Table 5, Fig. 3).

The primary goal of tallying weight, number, and a representative length frequency of each fish species in the catches was accomplished (Tables 6a and 6b). Two interesting records were set on the 2016 fall survey, the two largest survey catches of horseshoe crabs (77 and 51) were recorded at stations 86 and 87 West of Monomoy Island and the largest abundance (4) of clearnose skate was recorded at station 91 South of Hyannis in Nantucket Sound. Small monkfish were encountered again at several Cape Cod Bay and Mass Bay stations. Moderate catches of winter flounder, American lobster, red hake and juvenile longfin squid were taken North of Cape Cod. YOY longfin squid, scup, butterfish, bay anchovy and black sea bass were abundant throughout Nantucket Sound, Vineyard Sound and Buzzard's Bay.

Additional sampling goals were achieved (Table 7). To aid cooperative fisheries assessments, over 1,180 scale/otolith/operculum samples, as well as sex and maturity observations, were taken from Atlantic cod, haddock, summer flounder, yellowtail flounder, winter flounder, windowpane flounder, black sea bass, scup, weakfish, tautog, American lobster and jonah crabs. Additional samples were collected to assist ongoing research by fisheries scientists from MADMF and other labs in the region.

For further information on this survey or others in the time series, contact Matthew Camisa at (508) 990-2860 ext. 139.

Table 1. MADMF Fall Cruise 2016 Staffing List

Scientific Party		
Name	Affiliation	Num. Days
Matthew Camisa	MADMF	10
Vincent Manfredi	MADMF	9
Mark Szymanski	MADMF	8
Steve Voss	MADMF	8
Collin Farrell	MADMF	6
Ross Kessler	MADMF	4
John Logan	MADMF	4
Jake Snyder	UCONN	4
Brad Schondelmeier	MADMF	3
Mike Trainor	MADMF	3
Elise Koob	MADMF	3
Kim Trull	MADMF	2
Bob Glenn	MADMF	2
Mark Rousseau	MADMF	2
Steve Wilcox	MADMF	2
John Shepherd	MADMF	2
Chrissy Petitpas	MADMF	2
Ken Hughes	RI COLLEGE	2
Greg Decelles	MADMF	1
Derek Perry	MADMF	1
Brad Chase	MADMF	1
Melissa Campbell	MADMF	1
Jill Carr	MADMF	1
Scott Elzey	MADMF	1
Liz Morrissey	MADMF	1
Eric Nelson	EPA	1
Mike Pol	MADMF	1
Erich Druskat	MADMF	1
Jared Silva	MADMF	1
Tracy Pugh	MADMF	1
Beth Casoni	MLA	1
Brendan Reilly	MADMF	1
Nicole Ward	MADMF	1
		91
R/V Gloria Michelle Crew		
Name	Affiliation	Num. Days
<i>Officers</i>		
Doug Paulishen	NOAA OIC	11
Andrew Reynaga	NOAA JOIC	17
Eric Estrella	NOAA-CORPS	4
Mike Ball	NOAA-CORPS	5
Chris Gallagher	NOAA-CORPS	9
Ryan Belcher	NOAA-CORPS	17
<i>Deck Crew</i>		
George Morton	Contract Fisherman	17
Adam Poquette	NMFS-WH	5

Table 2. Station Information for the 2016 Massachusetts Fall Inshore Bottom Trawl Survey  
Cruise No. 201692

Station	Stratum	Date	Time (est)	Depth (m)	Latitude	Longitude	Course	Distance (nmi)	Bottom temp °C
1	26	9/7/2016	8:48	16	41°46.74	-70°26.77	111	0.85	19.3
2	25	9/7/2016	10:17	9	41°44.70	-70°20.19	88	0.85	18.9
3	27	9/7/2016	12:31	23	41°47.62	-70°20.26	256	0.82	16.2
4	27	9/7/2016	13:56	26	41°50.02	-70°26.81	137	0.83	15.9
5	26	9/7/2016	15:42	20	41°51.37	-70°29.28	185	0.83	18.1
6	25	9/8/2016	7:22	9	41°58.11	-70°36.17	193	0.84	17.9
7	26	9/8/2016	8:44	15	41°58.20	-70°34.67	331	0.83	16.8
8	32	9/8/2016	13:28	12	42°13.98	-70°44.77	141	0.53	18.0
9	33	9/8/2016	16:56	24	42°18.58	-70°48.41	248	0.53	17.6
10	32	9/9/2016	6:23	12	42°17.02	-70°51.33	331	0.52	17.8
11	33	9/9/2016	9:28	25	42°26.88	-70°52.72	281	0.54	14.5
12	31	9/9/2016	10:25	6	42°26.49	-70°55.33	15	0.83	18.7
13	35	9/9/2016	13:47	53	42°28.38	-70°44.18	140	0.52	9.8
14	36	9/9/2016	16:44	77	42°28.34	-70°38.39	344	0.54	7.6
15	35	9/10/2016	7:57	51	42°35.33	-70°34.99	50	0.80	10.0
16	36	9/10/2016	10:32	81	42°39.35	-70°31.17	355	0.80	19.1
17	35	9/10/2016	12:33	39	42°43.37	-70°38.18	155	0.80	10.5
18	34	9/10/2016	15:08	33	42°42.81	-70°40.13	127	0.83	10.8
19	31	9/11/2016	8:31	8	42°47.25	-70°47.89	156	0.80	17.9
20	34	9/11/2016	10:48	35	42°49.89	-70°44.41	324	0.82	10.9
21	33	9/11/2016	12:22	21	42°44.27	-70°44.33	306	0.83	12.5
22	32	9/11/2016	13:51	11	42°43.19	-70°45.08	321	0.74	17.2
23	33	9/11/2016	15:20	25	42°42.44	-70°42.14	313	0.82	12.7
24	34	9/12/2016	7:06	35	42°32.54	-70°44.05	86	0.76	10.9
25	35	9/12/2016	10:55	55	42°22.56	-70°41.80	313	0.62	9.8
26	35	9/12/2016	13:08	40	42°19.21	-70°43.36	89	0.55	10.4
27	28	9/13/2016	6:55	30	41°51.87	-70°22.03	11	0.84	14.5
28	28	9/13/2016	8:03	31	41°52.61	-70°18.42	253	0.83	14.4
29	28	9/13/2016	9:22	30	41°52.59	-70°13.90	240	0.83	14.1
30	27	9/13/2016	10:56	24	41°52.59	-70°11.68	223	0.83	15.8
31	25	9/13/2016	12:24	8	41°50.08	-70°09.98	207	0.82	19.5
32	25	9/13/2016	13:51	9	41°49.66	-70°06.82	110	0.83	20.7
33	26	9/13/2016	16:56	14	41°55.92	-70°06.82	206	0.36	16.5
34	30	9/14/2016	6:36	63	42°06.29	-70°18.06	22	0.84	9.5
35	30	9/14/2016	8:19	62	42°06.22	-70°22.63	211	0.83	9.2
36	29	9/14/2016	10:05	55	42°02.47	-70°18.77	156	0.83	9.5
37	28	9/14/2016	13:32	35	41°55.80	-70°19.39	224	0.83	10.9
38	29	9/14/2016	14:59	40	41°56.67	-70°24.69	197	0.82	10.5
39	11	9/15/2016	7:29	9	41°39.98	-70°42.16	15	0.55	22.4
40	12	9/15/2016	8:35	12	41°36.80	-70°44.71	59	0.70	22.3
41	12	9/15/2016	9:41	13	41°34.83	-70°46.42	19	0.83	22.1
42	11	9/15/2016	11:21	7	41°34.46	-70°54.24	161	0.55	22.2
43	12	9/15/2016	12:58	15	41°28.81	-71°00.58	61	0.84	21.3
44	11	9/15/2016	14:26	8	41°30.02	-71°03.96	133	0.57	21.3
45	12	9/15/2016	15:22	18	41°28.41	-71°06.06	92	0.83	19.4
46	14	9/16/2016	8:40	32	41°20.84	-70°55.76	312	0.54	16.7
47	13	9/16/2016	9:51	26	41°21.06	-70°58.27	338	0.84	17.4
48	13	9/16/2016	11:24	27	41°22.44	-71°01.12	327	0.84	18.2

Table 2 continued.

Station	Stratum	Date	Time (est)	Depth (m)	Latitude	Longitude	Course	Distance (nmi)	Bottom temp °C
49	13	9/16/2016	13:15	24	41°22.60	-70°53.14	81	0.65	18.2
50	12	9/16/2016	14:53	17	41°22.15	-70°46.20	41	0.84	19.4
51	14	9/17/2016	7:27	30	41°13.20	-70°46.13	38	0.84	16.8
52	13	9/17/2016	9:04	22	41°18.51	-70°40.89	261	0.63	18.6
53	11	9/17/2016	10:30	9	41°20.36	-70°40.86	268	0.84	19.8
54	12	9/17/2016	11:55	10	41°20.58	-70°36.28	262	0.84	19.3
55	12	9/17/2016	13:08	15	41°19.69	-70°36.09	87	0.84	19.1
56	13	9/17/2016	14:19	19	41°18.31	-70°33.06	89	0.83	19.2
57	11	9/17/2016	15:25	7	41°17.68	-70°29.60	154	0.85	19.7
58	18	9/18/2016	5:49	16	41°13.70	-70°03.63	270	0.81	20.0
59	18	9/18/2016	7:09	13	41°13.78	-70°07.90	238	0.80	20.6
60	17	9/18/2016	8:27	9	41°13.93	-70°07.15	297	0.69	20.7
61	19	9/18/2016	10:15	20	41°14.37	-70°15.71	286	0.82	18.8
62	15	9/18/2016	14:00	8	41°26.28	-70°30.13	75	0.83	21.4
63	17	9/19/2016	9:24	8	41°35.12	-69°56.36	236	0.84	16.2
64	18	9/19/2016	11:25	15	41°42.01	-69°54.12	3	0.63	14.2
65	20	9/19/2016	12:41	37	41°46.70	-69°52.05	358	0.09	N/A
66	19	9/19/2016	13:33	24	41°49.00	-69°54.54	343	0.09	N/A
67	21	9/20/2016	6:29	40	42°04.72	-70°01.52	314	0.85	10.1
68	17	9/20/2016	8:53	7	42°05.34	-70°09.36	101	0.83	17.5
69	20	9/20/2016	10:16	34	42°06.12	-70°10.34	89	0.76	12.5
70	21	9/20/2016	11:55	64	42°06.44	-70°14.43	59	0.83	10.6
71	29	9/20/2016	13:43	53	42°00.86	-70°16.16	322	0.83	9.8
72	28	9/20/2016	15:24	32	41°57.62	-70°10.61	185	0.85	11.1
73	27	9/20/2016	16:23	27	41°57.99	-70°08.47	192	0.55	11.0
74	16	9/21/2016	8:04	15	41°28.77	-70°24.15	108	0.54	22.4
75	16	9/21/2016	9:03	17	41°27.36	-70°18.47	261	0.74	21.5
76	16	9/21/2016	10:26	17	41°25.56	-70°16.25	196	0.55	21.0
77	16	9/21/2016	11:38	14	41°29.16	-70°12.78	215	0.54	21.9
78	15	9/21/2016	12:50	9	41°28.10	-70°15.34	328	0.84	21.9
79	15	9/21/2016	16:17	9	41°31.99	-70°36.14	102	0.83	22.3
80	15	9/22/2016	9:16	9	41°19.48	-70°11.18	291	0.78	21.5
81	16	9/22/2016	10:40	13	41°22.08	-70°05.75	205	0.83	20.9
82	17	9/22/2016	12:43	10	41°24.11	-69°58.54	235	0.83	19.0
83	18	9/22/2016	14:18	17	41°26.15	-69°57.53	275	0.67	17.9
84	17	9/22/2016	15:29	11	41°27.54	-70°00.60	350	0.82	17.6
85	15	9/23/2016	5:24	9	41°34.77	-70°01.77	251	0.46	18.3
86	15	9/23/2016	6:00	9	41°34.75	-70°02.11	247	0.83	18.7
87	16	9/23/2016	6:56	11	41°34.76	-70°04.07	77	0.84	18.4
88	15	9/23/2016	7:54	8	41°37.12	-70°01.33	240	0.84	19.1
89	15	9/23/2016	8:50	9	41°36.90	-70°06.33	262	0.27	20.1
90	15	9/23/2016	9:23	8	41°37.68	-70°04.94	225	0.74	19.8
91	15	9/23/2016	10:41	9	41°36.10	-70°09.74	239	0.82	22.4
92	16	9/23/2016	11:51	11	41°33.05	-70°06.57	262	0.82	19.4
93	15	9/23/2016	13:14	9	41°31.46	-70°10.78	254	0.83	22.3
94	16	9/23/2016	14:26	14	41°32.65	-70°14.02	283	0.84	22.5
95	15	9/23/2016	15:36	9	41°32.06	-70°17.83	253	0.84	22.7
96	16	9/23/2016	16:47	14	41°33.12	-70°19.69	73	0.83	22.7

Table 3. Sampling Effort Assigned and Accomplished by Stratum, Cruise 201692.

Stratum	Region	Assigned Stations	Number of Stations Completed			Aborted Tows
			All Accepted	Sub-Standard	Standard	
11	1	5	5		5	
12	1	7	7		7	
13	1	5	5		5	
14	1	2	2		2	
15	2	10	10		10	2
16	2	11	9		9	
17	3	5	5		5	
18	3	5	4		4	
19	3	2	1		1	1
20	3	2	2	1	1	
21	3	2	2		2	
25	4	4	4		4	
26	4	5	4		4	
27	4	5	3		3	1
28	4	5	5		5	
29	4	5	3		3	
30	4	2	2		2	
31	5	3	2		2	
32	5	3	3		3	
33	5	4	4		4	
34	5	4	3		3	
35	5	5	3		3	2
36	5	2	2		2	
TOTALS		103	90	1	89	6

Note:

Standard Tows. SHG <=136. Recommended for use in all indices of abundance.

Sub-Standard Tows. SHG 141 - 166. Not recommended for use in indices other than spiny dogfish.

Aborted Tows. Catch data not recommended for use.

Table 4. Sub-Standard Tows (SHG 141 - 166) Completed on Cruise 201692.  
Not Advised for Indices of Abundance other than Spiny Dogfish.

Station	Stratum	SHG Location	Description
65	20	141 East of Chatham	2 minute spiny dogfish tow

Table 5. Attempted Tows Aborted During Cruise 201692.

Station	Stratum	SHG Location	Description
13	9350	176 Outer Mass Bay	Fixed gear intercepted
26	9350	176 Outer Mass Bay	Large catch of ghost gear
66	9190	179 East of Nauset Harbor	Large catch of spiny dogfish
73	9270	176 South of Provincetown harbor	Large catch of sulfur sponge
85	9150	171 West of Monomoy	Hung down
89	9150	171 South of Harwich	Hung down



Table 6a. Total Catch Numbers and Weights Observed on the 2016  
Massachusetts Fall Inshore Bottom Trawl Survey - Cruise 201692- Sorted by Number

Species Code	Common Name	Count	Weight (kg)
143	SCUP	115,725	1,677.948
43	BAY ANCHOVY	61,940	61.540
503	LONGFIN SQUID	29,929	221.252
131	BUTTERFISH	20,089	347.920
141	BLACK SEA BASS	17,372	130.442
15	SPINY DOGFISH	8,384	11,634.318
313	ATLANTIC ROCK CRAB	7,044	523.974
72	SILVER HAKE	4,868	629.247
77	RED HAKE	4,708	527.855
301	AMERICAN LOBSTER	3,210	854.623
106	WINTER FLOUNDER	3,045	593.900
322	LADY CRAB	2,497	194.395
181	NORTHERN SAND LANCE	2,475	5.062
26	LITTLE SKATE	2,285	1,203.362
105	YELLOWTAIL FLOUNDER	1,645	326.941
132	ATLANTIC MOONFISH	1,309	4.319
401	SEA SCALLOP	1,271	10.183
74	HADDOCK	993	308.579
145	WEAKFISH	808	20.322
102	AMERICAN PLAICE	696	95.366
23	WINTER SKATE	634	754.866
108	WINDOWPANE	620	105.641
103	SUMMER FLOUNDER	602	385.081
163	LONGHORN SCULPIN	588	62.395
117	SMALLMOUTH FLOUNDER	541	2.676
317	SPIDER CRAB UNCL	501	48.317
176	CUNNER	476	1.240
171	NORTHERN SEAROBIN	420	22.118
312	JONAH CRAB	410	60.186
343	BLUE MUSSEL	399	2.128
13	SMOOTH DOGFISH	384	383.859
135	BLUEFISH	226	6.288
172	STRIPED SEAROBIN	171	32.943
318	HORSESHOE CRAB	167	185.270
193	OCEAN POUT	138	19.721
104	FOURSPOT FLOUNDER	131	21.519
337	KNOBBED WHELK	128	32.119
78	SPOTTED HAKE	124	10.604
146	NORTHERN KINGFISH	109	11.909
45	RAINBOW SMELT	97	2.917
107	WITCH FLOUNDER	79	22.475
116	NORTHERN PIPEFISH	54	0.130
34	BLUEBACK HERRING	54	3.374
33	ALEWIFE	44	3.054

Table 6a continued.

Species Code	Common Name	Count	Weight (kg)
76	WHITE HAKE	42	9.752
197	GOOSEFISH	42	15.169
336	CHANNELED WHELK	30	4.660
177	TAUTOG	27	8.093
348	NORTHERN MOONSNAIL	22	2.364
164	SEA RAVEN	19	3.898
435	INSHORE LIZARDFISH	17	0.756
306	NORTHERN SHRIMP	14	0.077
35	AMERICAN SHAD	14	0.344
196	NORTHERN PUFFER	14	0.596
331	SEA URCHIN AND SAND DOLLAR UNCL	11	0.044
83	FOURBEARD ROCKLING	10	0.554
323	MANTIS SHRIMP UNCL	10	0.188
185	OYSTER TOADFISH	9	5.774
403	ATLANTIC SURFCLAM	9	3.040
155	ACADIAN REDFISH	9	0.420
32	ATLANTIC HERRING	9	0.715
24	CLEARNOSE SKATE	8	15.980
439	SNAKEFISH	8	0.010
36	ATLANTIC MENHADEN	8	1.296
489	RED CORNETFISH	7	0.088
180	ROCK GUNNEL	6	0.009
402	BAY SCALLOP	6	0.344
118	HOGCHOKER	5	0.722
28	THORNY SKATE	5	3.886
409	OCEAN QUAHOG	5	1.168
314	BLUE CRAB	4	0.666
502	NORTHERN SHORTFIN SQUID	4	0.536
212	ROUGH SCAD	3	0.074
73	ATLANTIC COD	3	0.078
191	WRYMOUTH	2	0.942
657	DWARF GOATFISH	2	0.032
213	SILVER RAG	2	0.050
149	SPOT	1	0.120
121	ATLANTIC MACKEREL	1	0.292
202	GRAY TRIGGERFISH	1	0.460
344	WAVED WHELK	1	0.092
557	SHORT BIGEYE	1	0.008
338	MOON SNAIL, SHARK EYE, AND BABY-EAR	1	0.122
120	BLUESPOTTED CORNETFISH	1	0.008
44	STRIPED ANCHOVY	1	0.004
166	GRUBBY	1	0.008
133	LOOKDOWN	1	0.001
520	LONGFIN SQUID EGG MOPS		25.295
Totals		297,786	21,661.113

Table 6b. Total Catch Numbers and Weights Observed on the 2016  
Massachusetts Fall Inshore Bottom Trawl Survey - Cruise 201692- Sorted by Weight

Species Code	Common Name	Count	Weight (kg)
15	SPINY DOGFISH	8,384	11,634.318
143	SCUP	115,725	1,677.948
26	LITTLE SKATE	2,285	1,203.362
301	AMERICAN LOBSTER	3,210	854.623
23	WINTER SKATE	634	754.866
72	SILVER HAKE	4,868	629.247
106	WINTER FLOUNDER	3,045	593.900
77	RED HAKE	4,708	527.855
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131	BUTTERFISH	20,089	347.920
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74	HADDOCK	993	308.579
503	LONGFIN SQUID	29,929	221.252
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312	JONAH CRAB	410	60.186
317	SPIDER CRAB UNCL	501	48.317
172	STRIPED SEAROBIN	171	32.943
337	KNOBBED WHELK	128	32.119
520	LONGFIN SQUID EGG MOPS		25.295
107	WITCH FLOUNDER	79	22.475
171	NORTHERN SEAROBIN	420	22.118
104	FOURSPOT FLOUNDER	131	21.519
145	WEAKFISH	808	20.322
193	OCEAN POUT	138	19.721
24	CLEARNOSE SKATE	8	15.980
197	GOOSEFISH	42	15.169
146	NORTHERN KINGFISH	109	11.909
78	SPOTTED HAKE	124	10.604
401	SEA SCALLOP	1,271	10.183
76	WHITE HAKE	42	9.752
177	TAUTOG	27	8.093
135	BLUEFISH	226	6.288
185	OYSTER TOADFISH	9	5.774
181	NORTHERN SAND LANCE	2,475	5.062
336	CHANNELED WHELK	30	4.660
132	ATLANTIC MOONFISH	1,309	4.319

Table 6b continued.

Species Code	Common Name	Count	Weight (kg)
164	SEA RAVEN	19	3.898
28	THORNY SKATE	5	3.886
34	BLUEBACK HERRING	54	3.374
33	ALEWIFE	44	3.054
403	ATLANTIC SURFCLAM	9	3.040
45	RAINBOW SMELT	97	2.917
117	SMALLMOUTH FLOUNDER	541	2.676
348	NORTHERN MOONSNAIL	22	2.364
343	BLUE MUSSEL	399	2.128
36	ATLANTIC MENHADEN	8	1.296
176	CUNNER	476	1.240
409	OCEAN QUAHOG	5	1.168
191	WRYMOUTH	2	0.942
435	INSHORE LIZARDFISH	17	0.756
118	HOGCHOKER	5	0.722
32	ATLANTIC HERRING	9	0.715
314	BLUE CRAB	4	0.666
196	NORTHERN PUFFER	14	0.596
83	FOURBEARD ROCKLING	10	0.554
502	NORTHERN SHORTFIN SQUID	4	0.536
202	GRAY TRIGGERFISH	1	0.460
155	ACADIAN REDFISH	9	0.420
35	AMERICAN SHAD	14	0.344
402	BAY SCALLOP	6	0.344
121	ATLANTIC MACKEREL	1	0.292
323	MANTIS SHRIMP UNCL	10	0.188
116	NORTHERN PIPEFISH	54	0.130
338	MOON SNAIL, SHARK EYE, AND BABY-EAR	1	0.122
149	SPOT	1	0.120
344	WAVED WHELK	1	0.092
489	RED CORNETFISH	7	0.088
73	ATLANTIC COD	3	0.078
306	NORTHERN SHRIMP	14	0.077
212	ROUGH SCAD	3	0.074
213	SILVER RAG	2	0.050
331	SEA URCHIN AND SAND DOLLAR UNCL	11	0.044
657	DWARF GOATFISH	2	0.032
439	SNAKEFISH	8	0.010
180	ROCK GUNNEL	6	0.009
557	SHORT BIGEYE	1	0.008
120	BLUESPOTTED CORNETFISH	1	0.008
166	GRUBBY	1	0.008
44	STRIPED ANCHOVY	1	0.004
133	LOOKDOWN	1	0.001
Totals		297,786	21,661.113

Table 7. Number of individuals obtained for age, growth, maturity and special studies during Massachusetts DMF Cruise 201692.

Species	Maturity Observation	Age and Growth Collection			YOY
		Scales	Otoliths	Opercula	
Atlantic Cod	3		2		1
Haddock	56		56		
Summer Flounder	360	359			
Yellowtail Flounder	153	153			
Winter Flounder	347		347		
Windowpane Flounder	54	54	54		
Black Sea Bass	112		111		
Scup	58	58			
Weakfish	9		9		
Tautog	5			5	
American Lobster	25				
Jonah crab (Female)	1				
TOTAL	1,183	624	579	5	1

#### OTHER COLLECTIONS:

Both summer flounder and yellowtail flounder were separated by sex at all stations.

Female j Jonah crabs measured to 0.1 cm carapace width and egg bearing status recorded for size at maturity study (D. Perry).

1 YOY Atlantic cod for age and growth study (Dean).

24 individual fish from 12 species frozen for Ocean Genome Project (Seid)

24 Sandlance saved for spawning study (Snyder)

3 Atlantic Herring saved for monitoring study (Schondlemeyer)








15 Longfin squid frozen for DMF hook and line study (Glenn).


Figure 1.

# Massachusetts Division of Marine Fisheries Inshore Bottom Trawl Survey

## MDMF Trawl Survey Depth Strata

### Depth (feet)

-  Deleted
-  0 to 30
-  31 to 60
-  61 to 90
-  91 to 120
-  121 to 180
-  181 +

 Indicates stratum number

A or B Indicates subregion

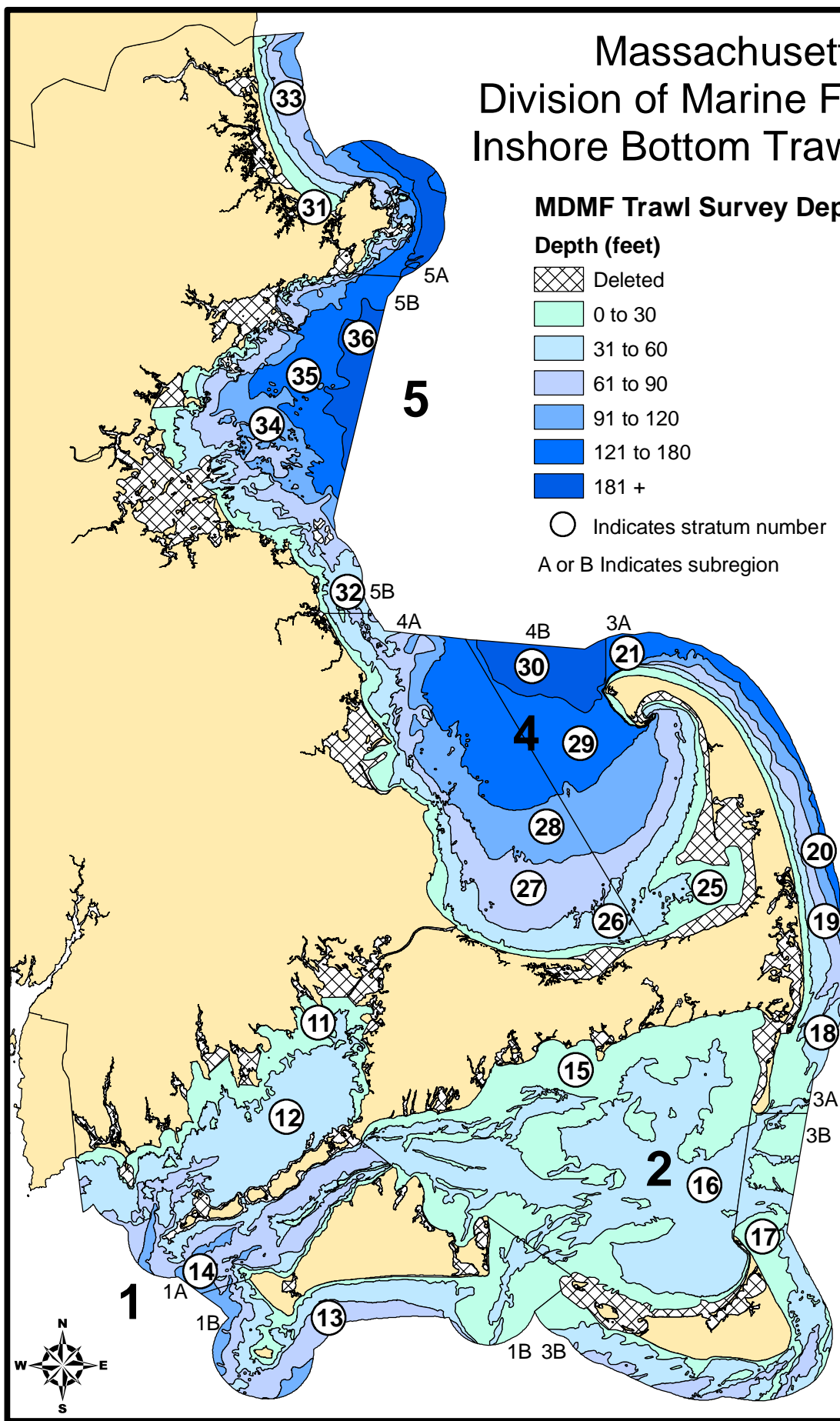


Figure 2.

## Fall 2016 Mass Division of Marine Fisheries Bottom Trawl Survey Tow Locations

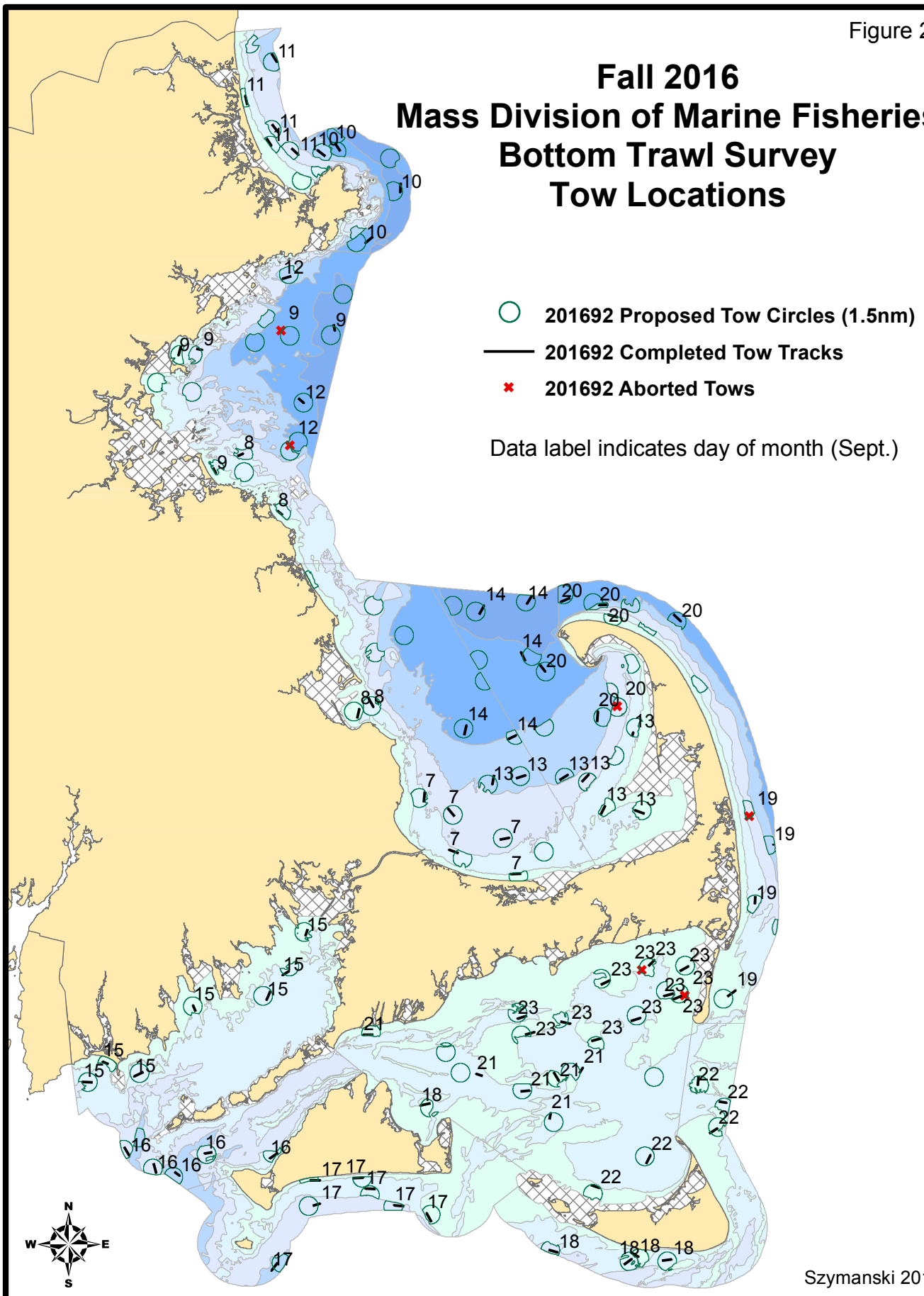




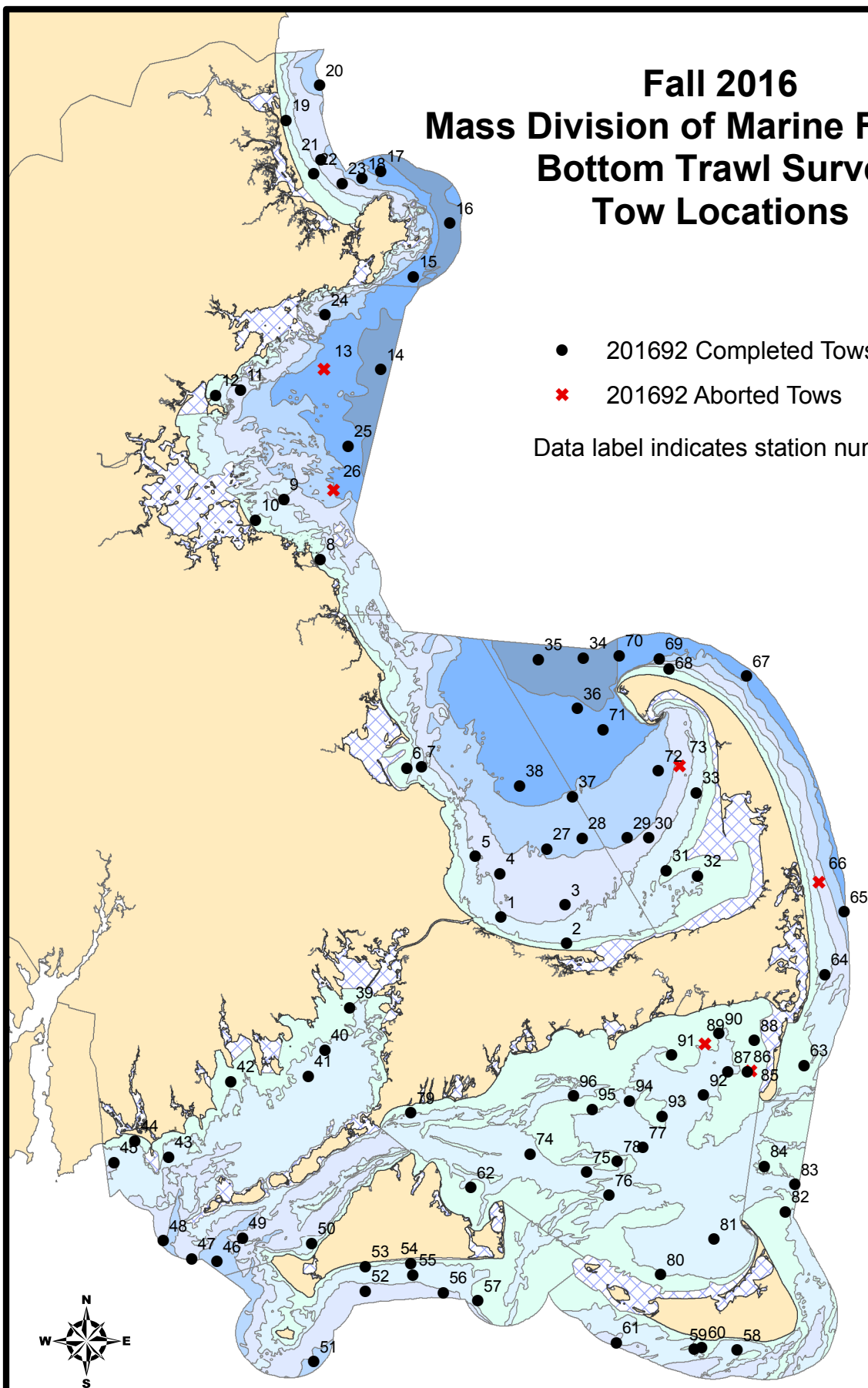
Figure 3.

# Fall 2016 Mass Division of Marine Fisheries Bottom Trawl Survey Tow Locations

● 201692 Completed Tows

✖ 201692 Aborted Tows

Data label indicates station number





## SURVEY REPORT

### 2016 Nantucket Sound Estuarine Winter Flounder Young of the Year (YOY) Seine Survey

#### SURVEY PERIOD, AREA, AND PARTICIPANTS

From June 15 – July 1, 2016 the Massachusetts Division of Marine Fisheries (MDMF) conducted the 41<sup>st</sup> Nantucket Sound Estuarine Winter Flounder YOY Seine Survey. The survey covers six Nantucket Sound estuaries on the south side of Cape Cod – Great Pond, Waquoit Bay, Cotuit Bay, Lewis Bay, Bass River and Stage Harbor (Figure 1). The survey, led by project members Vincent Manfredi and Mark Szymanski, was assisted by a list of volunteers from the MA DMF offices (Table 1).

#### OBJECTIVES

The primary objective of this survey is to provide a winter flounder YOY abundance index for the Southern New England Stock. All commercially and recreationally important finfish and invertebrates are counted. All species not counted are noted for presence.

#### METHODS

Seining of intertidal and shallow subtidal zones occurs from two hours before until two hours after high tide. Forty-nine fixed stations, originally chosen for efficient seining (i.e., smooth sediment bottom generally devoid of attached vegetation) and historic availability of 0-group winter flounder, were proportionately allocated by each estuary's littoral perimeter. A 6.4 meter straight seine of 4.8 mm nylon mesh equipped with a weighted lead line footrope to minimize escapement was set and hauled perpendicular to shore from depths between 0.9 to 1.2 meters. Winter flounder density (# YOY per square meter) is determined by aggregating catch from three replicate hauls at each station. Consistent area swept is maintained using a fixed-length spreader rope. Haul distance is calculated as the hypotenuse of a right triangle, using the measurements of distance over the water's surface and depth at the beginning of the seine haul. Distance over the water's surface is measured with a sonic digital rangefinder (SONIN Multi-Measure Combo Pro<sup>TM</sup>) and water depth at the beginning of the seine haul was measured with a weighted and marked line. When inclement weather, prevents use of the rangefinder, distance over ground was measured by pacing. Statistical analysis of seine data employs stratification techniques; each estuary is considered a stratum and each station's three replicate hauls are treated as one individual sample. Stratified mean density and confidence limits were derived from standard and modified formulae for mean and variance.

#### SURVEY RESULTS

The 2016 pooled (all estuaries combined) winter flounder YOY index (0.187 YOY / m<sup>2</sup>) is below the timeseries median for the 14<sup>th</sup> time since 2000 (Figure 2, Table 3). All estuary specific indices for YOY winter flounder increased in 2016 with the exception of Lewis Bay (Figure 4). The Age 1+ winter flounder index remains below the timeseries median for the 7<sup>th</sup> consecutive year (Figure 3). The YOY Fluke index increased markedly, to the third highest observation in the timeseries (Figure 5). The blue crab index increased just above the timeseries median in 2016 (Figure 6). Forty-one species were encountered in 2016 (Table 4). All bottom temperature monitors were collected and successfully downloaded at all locations (Figure 7). For further information on this survey, others in the time series, or temperature data, please contact Vincent M. Manfredi (508)-990-2860 ext. 110.

Table 1. Survey Volunteers

Name	Days Contributed
Elaine Brewer	1
Lauren Carter	1
Dr. Greg Decelles	2
Robert Glenn	1
Brendan Riley	1
Jared Silva	1
Holly Williams	1

Table 2. 2016 MDMF Seine Survey Station Data

Estuary	Station Name	Sample Date	Longitude	Latitude	Haul Temp. °C
Bass River	Aunt Julia Ann	6/27/2016	70°10.382	41°40.215	22.0
Bass River	Follins Pond	6/27/2016	70°10.504	41°42.293	24.0
Bass River	Goosebay Point	6/27/2016	70°09.777	41°40.681	22.0
Bass River	Harbor Haven	6/27/2016	70°09.772	41°40.912	23.0
Bass River	Heirs Landing	6/27/2016	70°09.570	41°40.381	24.0
Bass River	High Bank	6/27/2016	70°09.518	41°41.125	24.0
Bass River	Uncle Freeman	6/28/2016	70°11.183	41°39.618	24.0
Bass River	West Dennis Beach 1	6/28/2016	70°11.157	41°39.018	24.0
Bass River	West Dennis Beach 2	6/28/2016	70°11.645	41°39.039	24.0
Bass River	Windmill	6/28/2016	70°11.738	41°39.297	23.0
Bass River	Wrinkle Point	6/28/2016	70°11.246	41°39.266	23.0
Cotuit Bay	Bluff Point 1	6/30/2016	70°25.846	41°36.628	24.0
Cotuit Bay	Bluff Point 2	6/30/2016	70°25.986	41°36.758	24.5
Cotuit Bay	Little Island	6/30/2016	70°24.349	41°37.560	25.0
Cotuit Bay	North Point	6/30/2016	70°24.434	41°37.677	25.5
Cotuit Bay	Ropes 1	6/29/2016	70°25.981	41°37.246	24.0
Cotuit Bay	Ropes 2	6/29/2016	70°25.915	41°37.279	23.5
Cotuit Bay	Ropes 3	6/29/2016	70°25.751	41°37.316	24.0
Cotuit Bay	Ropes 4	6/29/2016	70°25.632	41°37.321	23.5
Cotuit Bay	Seapuit River 1	6/30/2016	70°24.179	41°36.478	23.5
Cotuit Bay	Seapuit River 2	6/30/2016	70°25.222	41°36.578	23.5
Cotuit Bay	Tims Cove 1	6/28/2016	70°25.031	41°37.342	24.5
Cotuit Bay	Tims Cove 2	6/28/2016	70°25.050	41°37.308	24.5
Cotuit Bay	Tims Cove 3	6/28/2016	70°25.109	41°37.272	24.5
Great Pond	Boston St	6/20/2016	70°35.014	41°32.925	22.0
Great Pond	Montauk Ave	6/20/2016	70°35.145	41°33.558	24.0
Great Pond	Narragansett Ave	6/20/2016	70°35.037	41°33.295	23.5
Great Pond	Stower St	6/20/2016	70°35.000	41°33.815	24.5
Lewis Bay	Baxter Ave	7/1/2016	70°15.574	41°38.744	24.0
Lewis Bay	Bayshore Rd	7/1/2016	70°16.602	41°38.773	23.5
Lewis Bay	Bayview St	7/1/2016	70°16.459	41°38.857	24.0
Lewis Bay	Crowell Rd	7/1/2016	70°14.554	41°38.372	25.5
Lewis Bay	Kennedy Park	7/1/2016	70°16.620	41°38.495	23.5
Stage Harbor	Mill Pond	6/15/2016	69°57.239	41°40.473	20.5
Stage Harbor	Oyster Pond	6/15/2016	69°57.830	41°40.829	19.0
Stage Harbor	Point Fortune	6/15/2016	69°58.365	41°40.052	19.0
Stage Harbor	Sears Point	6/15/2016	69°58.928	41°39.944	18.0
Stage Harbor	Vineyard Ave	6/15/2016	69°58.880	41°40.650	18.5
Stage Harbor	Wildlife Reserve	6/15/2016	69°58.664	41°39.436	18.5
Waquoit Bay	Fairfield St	6/17/2016	70°32.427	41°33.390	22.5
Waquoit Bay	Great River	6/16/2016	70°30.929	41°33.390	21.0
Waquoit Bay	Moonakiss	6/16/2016	70°30.960	41°34.218	21.0
Waquoit Bay	Washburn Island 1	6/16/2016	70°32.006	41°33.476	23.0
Waquoit Bay	Washburn Island 2	6/16/2016	70°31.857	41°33.766	23.0
Waquoit Bay	Washburn Island 3	6/16/2016	70°31.641	41°33.822	23.0
Waquoit Bay	Washburn Island 4	6/17/2016	70°32.002	41°33.894	23.0
Waquoit Bay	Washburn Island 5	6/17/2016	70°32.641	41°33.166	21.5
Waquoit Bay	Washburn Island 6	6/17/2016	70°32.224	41°33.608	23.0
Waquoit Bay	Washburn Island A	6/16/2016	70°32.143	41°33.267	21.5

Table 3. YOY Winter Flounder Index, All Estuaries.  
MDMF Seine Survey: 1976-2016

Year	Stratified Mean	Standard Error	Lower CI	Upper CI
1976	0.344	0.042	0.236	0.452
1977	0.641	0.062	0.508	0.774
1978	0.366	0.057	0.235	0.498
1979	0.507	0.060	0.366	0.648
1980	0.432	0.057	0.306	0.559
1981	0.340	0.056	0.208	0.471
1982	0.370	0.055	0.246	0.494
1983	0.231	0.027	0.176	0.287
1984	0.323	0.036	0.248	0.399
1985	0.335	0.039	0.254	0.415
1986	0.325	0.039	0.244	0.406
1987	0.274	0.032	0.208	0.340
1988	0.184	0.024	0.133	0.234
1989	0.421	0.046	0.325	0.518
1990	0.325	0.038	0.247	0.402
1991	0.267	0.038	0.188	0.346
1992	0.294	0.047	0.196	0.392
1993	0.067	0.009	0.047	0.086
1994	0.148	0.019	0.108	0.188
1995	0.154	0.023	0.107	0.201
1996	0.221	0.027	0.165	0.277
1997	0.392	0.053	0.278	0.506
1998	0.165	0.029	0.104	0.226
1999	0.201	0.028	0.143	0.258
2000	0.347	0.043	0.258	0.435
2001	0.214	0.028	0.157	0.272
2002	0.100	0.011	0.077	0.122
2003	0.197	0.032	0.128	0.267
2004	0.095	0.012	0.070	0.120
2005	0.075	0.010	0.054	0.096
2006	0.164	0.018	0.126	0.202
2007	0.167	0.021	0.125	0.210
2008	0.092	0.011	0.069	0.115
2009	0.083	0.013	0.056	0.109
2010	0.092	0.014	0.063	0.122
2011	0.247	0.026	0.194	0.301
2012	0.135	0.014	0.106	0.163
2013	0.250	0.025	0.198	0.302
2014	0.186	0.028	0.130	0.242
2015	0.127	0.018	0.090	0.163
2016	0.187	0.020	0.146	0.228

Timeseries Median = 0.221

Table 4. Catch observations of all species recorded during the 2016 seine survey  
(for species marked present counts are not taken but presence is noted at all hauls)

Common Name	Taxonomic Name	Total Number	% Occurrence
YOY Winter Flounder	<i>Pseudopleuronectes americanus</i>	1949	97.9
Atlantic Silverside	<i>Menidia menidia</i>	Present	87.3
Mud Snail	<i>Nassarius obsoletus</i>	Present	72.5
Striped Killifish	<i>Fundulus majalis</i>	Present	72.5
Sand Shrimp	<i>Crangon septemspinosa</i>	Present	56.3
Mummichog	<i>Fundulus heteroclitus</i>	Present	50.7
Blue Crab	<i>Callinectes sapidus</i>	199	45.8
Northern Pipefish	<i>Syngnathus fuscus</i>	Present	43.7
Grass Shrimp	<i>Paelmonetes pugio</i>	Present	33.1
YOY Summer Flounder	<i>Paralichthys dentatus</i>	58	24.6
Lady Crab	<i>Ovalipes ocellatus</i>	94	18.3
Green Crab	<i>Carcinus maenus</i>	35	17.6
Spider Crab Uncl.	<i>Majidae</i>	89	15.5
Fourspine Stickleback	<i>Apeltes quadracus</i>	3	12.7
Rainwater Killifish	<i>Lucania parva</i>	56	9.2
Atlantic Needlefish	<i>Strongylura marina</i>	16	8.5
Northern Quahog	<i>Mercenaria mercenaria</i>	5	5.6
Ribbed Mussel	<i>Guekensia demissus</i>	18	4.2
White Mullet	<i>Mugil curema</i>	29	4.2
Northern Kingfish	<i>Menticirrhitis saxatilis</i>	5	3.5
Sheepshead Minnow	<i>Cyprinodon variegatus</i>	25	3.5
Alewife	<i>Alosa pseudoharengus</i>	7	2.8
Bay Scallop	<i>Argopecten irradians</i>	10	2.8
Northern Puffer	<i>Sphoeroides maculatus</i>	4	2.8
Striped Searobin	<i>Prionotus evolans</i>	6	2.8
Bay Anchovy	<i>Anchoa mitchilli</i>	8	2.1
Grubby	<i>Myoxocephalus aeneus</i>	5	2.1
Horseshoe Crab	<i>Limulus polyphemus</i>	4	2.1
Mud Crab	<i>Scylla serrata</i>	Present	2.1
Oyster	<i>Crassostrea virginica</i>	4	2.1
Age 1+ Winter Flounder	<i>Pseudopleuronectes americanus</i>	2	1.4
Atlantic Rock Crab	<i>Cancer irroratus</i>	3	1.4
Bluefish	<i>Pomatomus saltatrix</i>	2	1.4
Mottled Dog Whelk	<i>Nassa vibex</i>	2	1.4
Scup	<i>Stenotomus chrysops</i>	2	1.4
Spot	<i>Leiostomus xanthurus</i>	6	1.4
Age 1+ Summer Flounder	<i>Paralichthys dentatus</i>	1	0.7
American Eel	<i>Anguilla rostrata</i>	1	0.7
Blue Mussel	<i>Mytilus edulis</i>	1	0.7
Channeled Whelk	<i>Busycon canniculata</i>	1	0.7
Ocean Quahog	<i>Arctica islandica</i>	Present	0.7
Smallmouth flounder	<i>Etropus microstomus</i>	1	0.7
Threespine Stickleback	<i>Gasterosteus aculeatus</i>	Present	0.7

**Figure 1. Station Locations  
MDMF Seine Survey.**

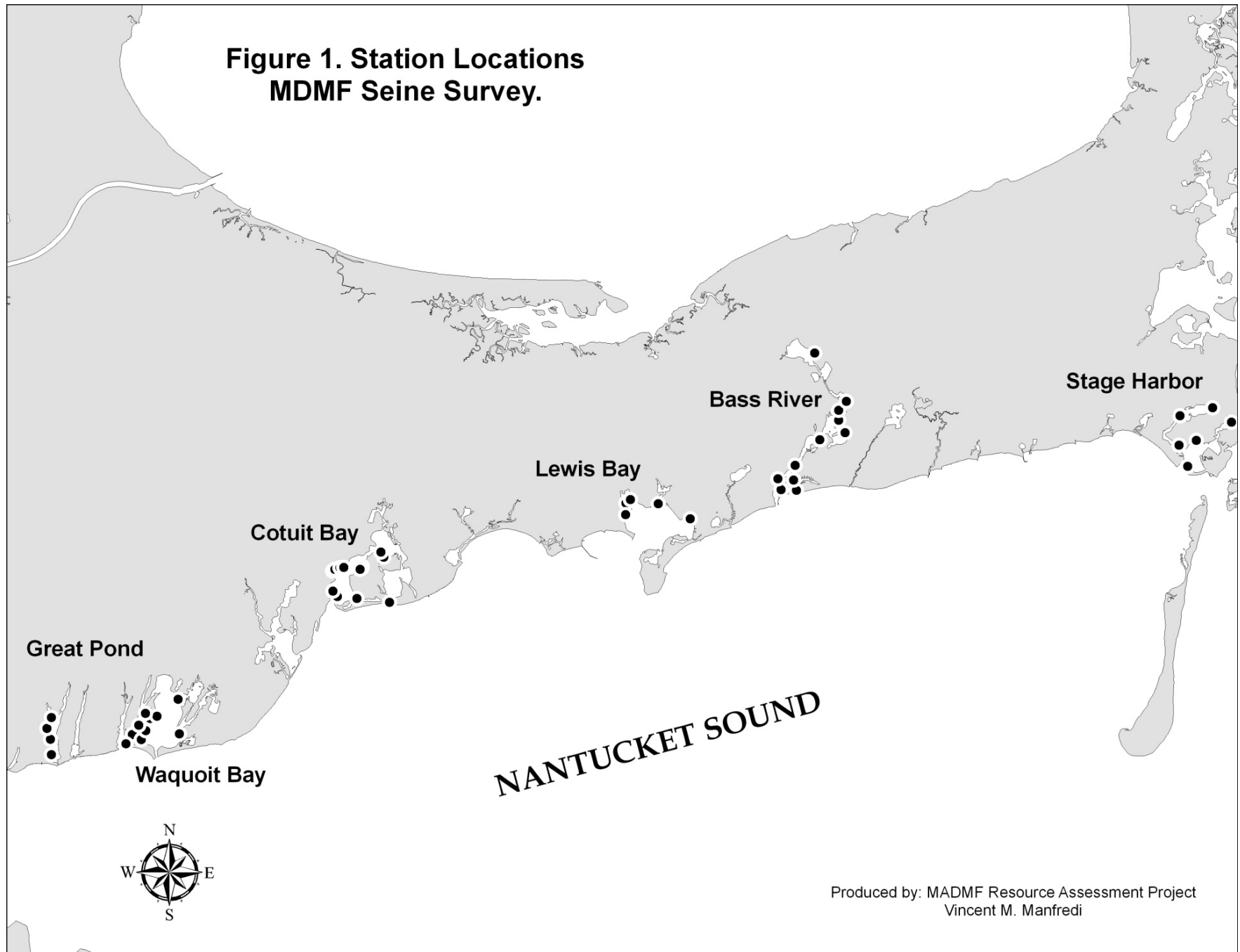


Figure 2. YOY Winter Flounder Indices MDMF Seine Survey.

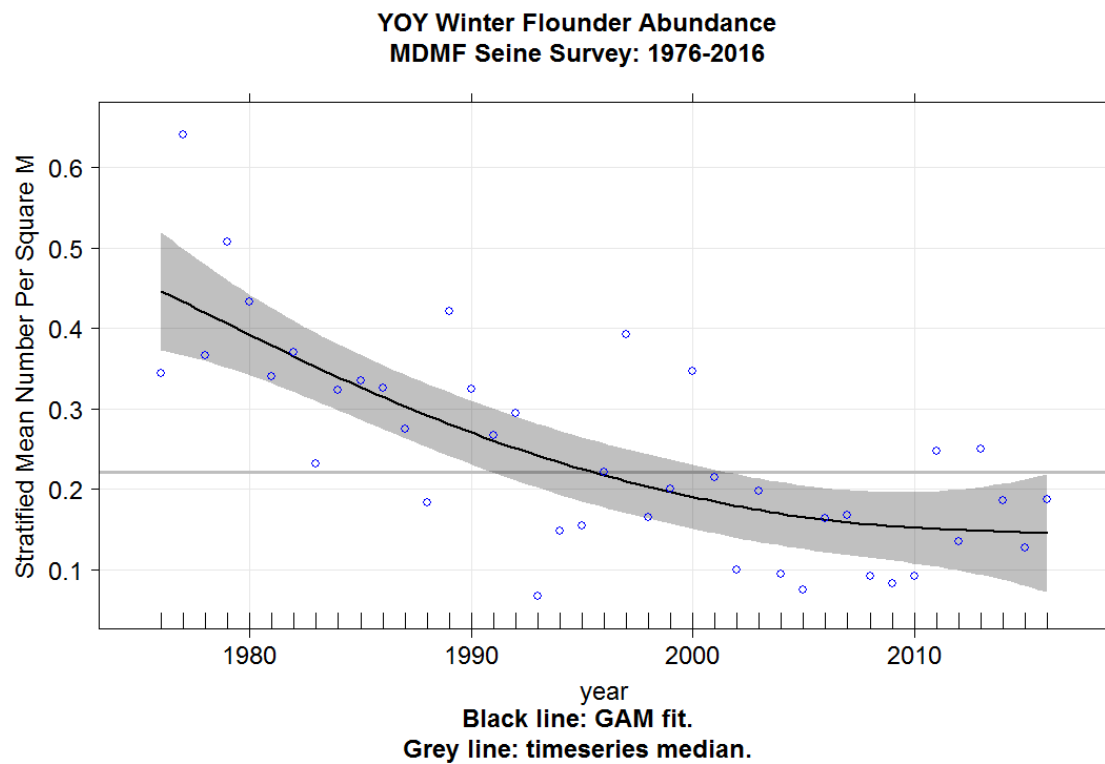


Figure 3. Age 1+ Winter Flounder Index MDMF Seine Survey

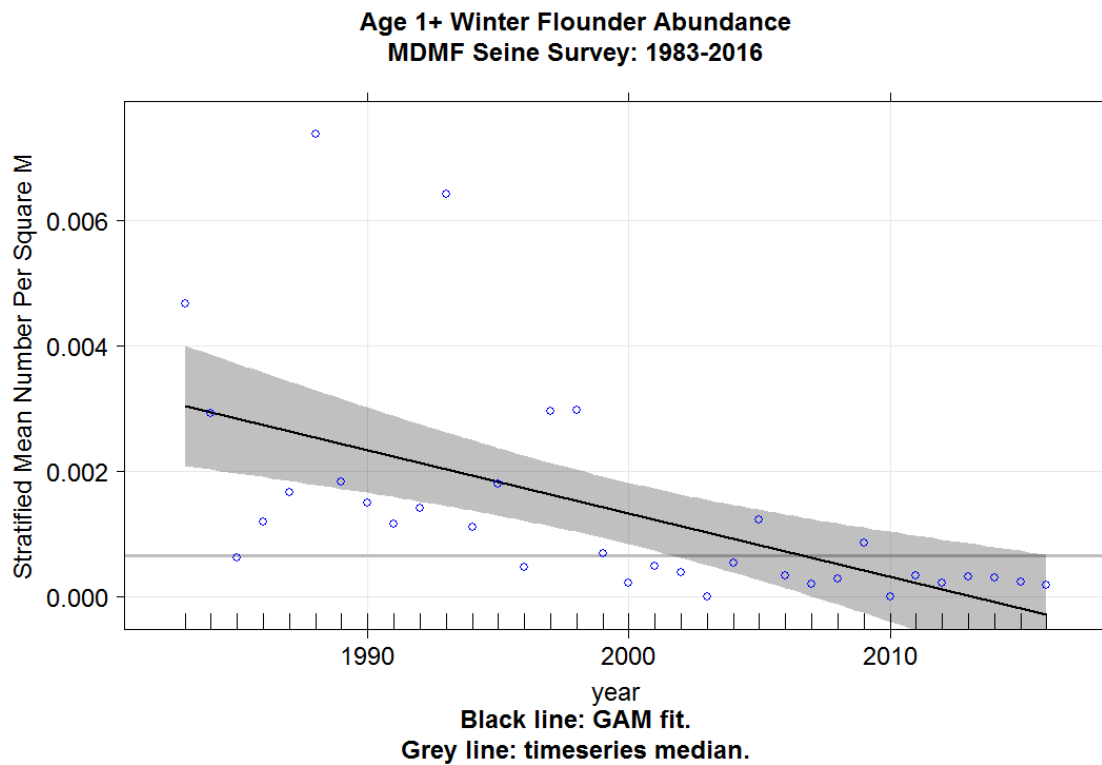
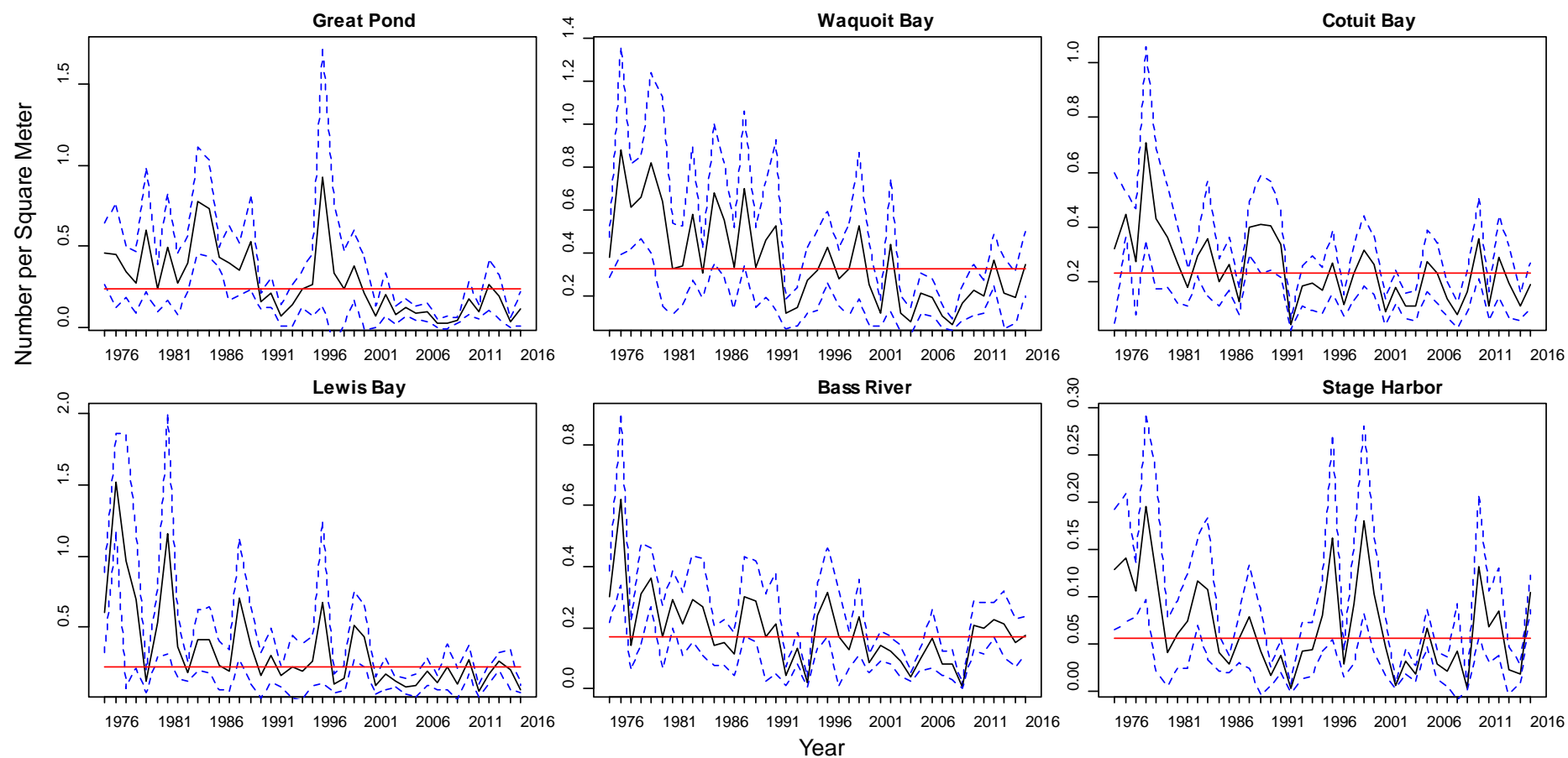


Figure 4. YOY Winter Flounder Abundance by Estuary, MDMF Seine Survey 1976 – 2016.



Dashed Lines = 95% Confidence Intervals  
 Horizontal Line = Timeseries Median for each Estuary  
 Note: y-axis scales differ in magnitude.



Figure 5. YOY Summer Flounder (Fluke) Index MDMF Seine Survey

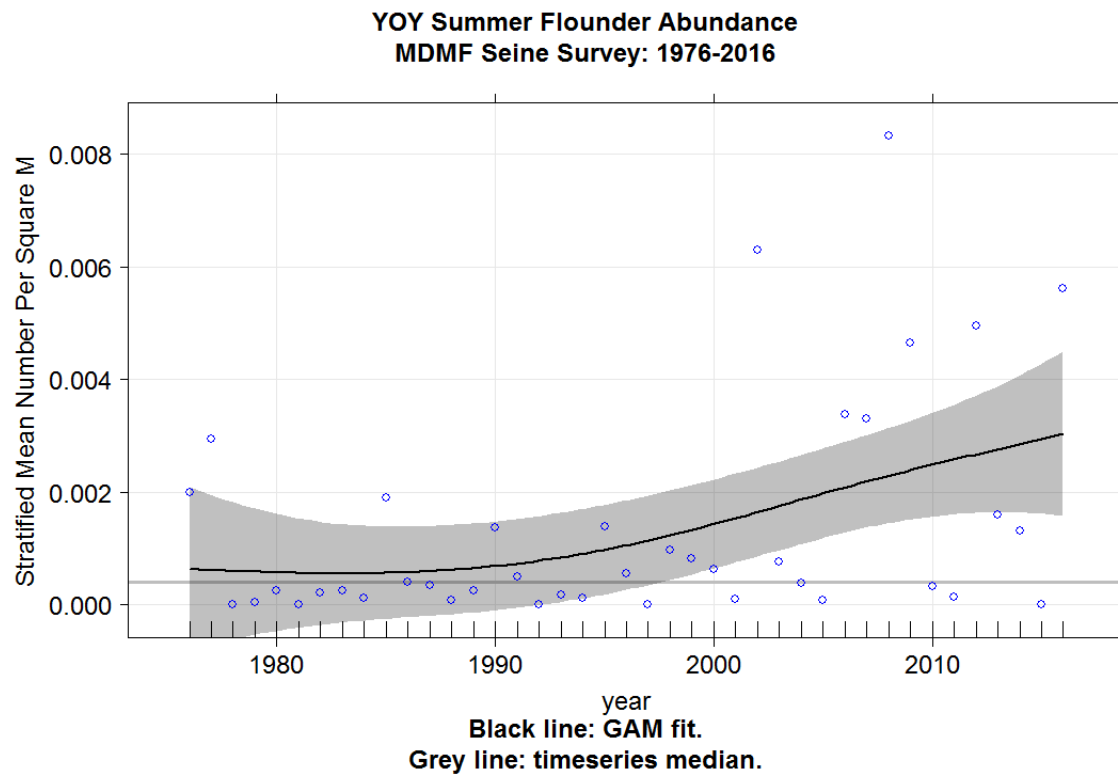
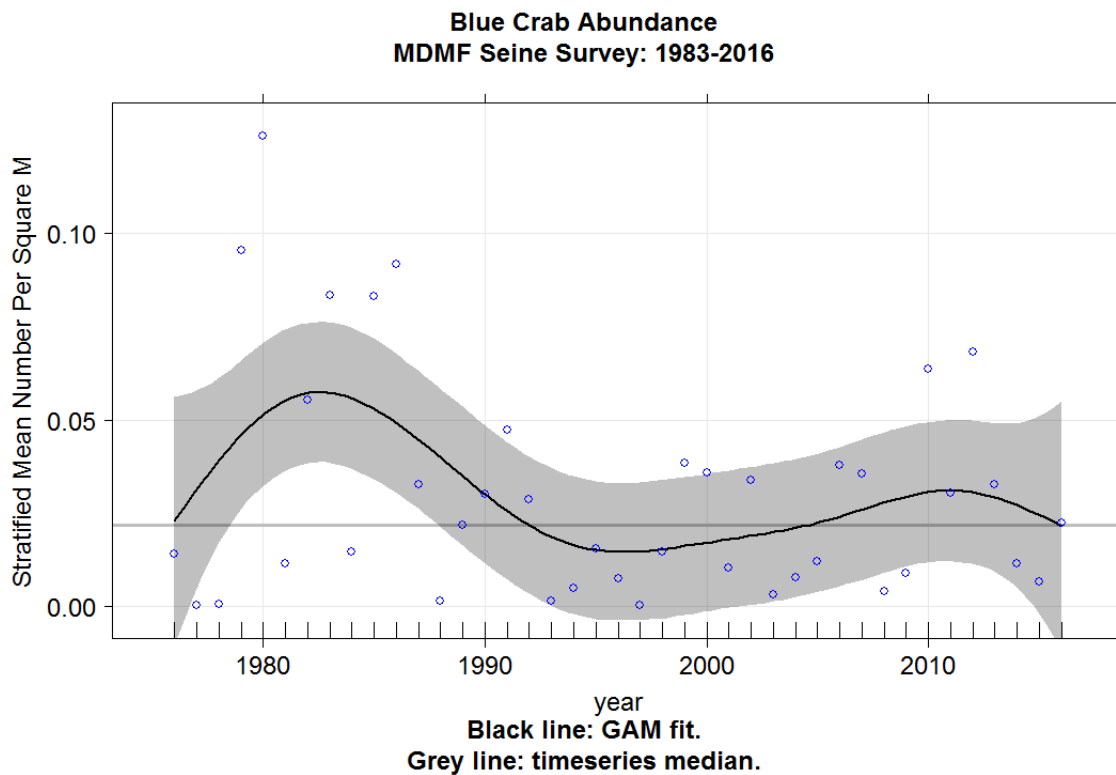
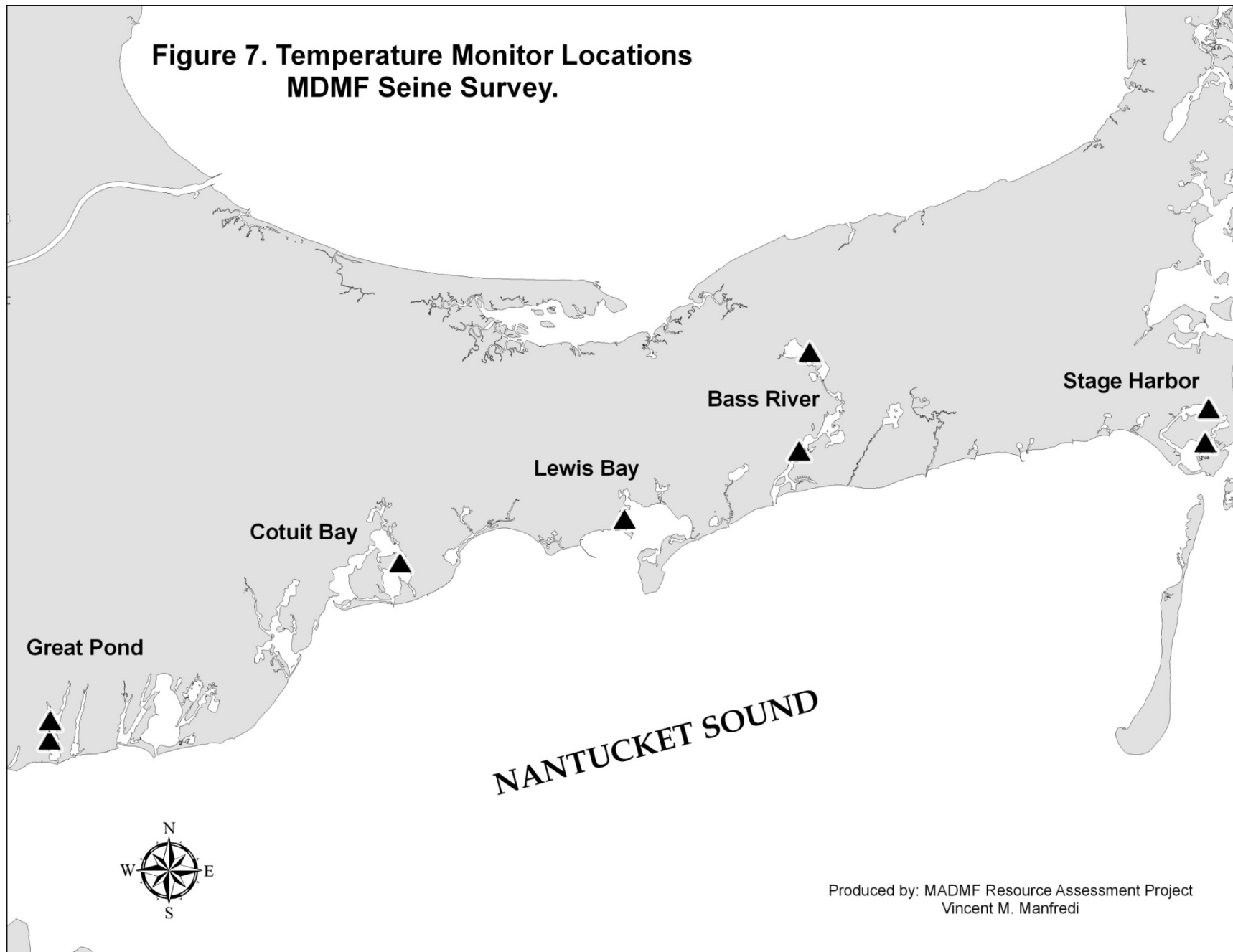


Figure 6. Blue Crab Index MDMF Seine Survey



**Figure 7. Temperature Monitor Locations  
MDMF Seine Survey.**



## Appendix A. Massachusetts Inshore Bottom Trawl Survey Indices of Biomass, Abundance, Recruitment, and Abundance at Age for Select Species

The Massachusetts Division of Marine Fisheries has been conducting a bottom trawl survey of Massachusetts territorial waters every spring and fall since 1978. Survey indices provide a useful fishery-independent metric for tracking the relative abundance or biomass of many demersal fish and invertebrates in the survey area. Updated survey indices are presented here for 1) species or stocks routinely requested by staff from within the Massachusetts Division of Marine Fisheries as well as by other governmental and non-governmental scientific bodies, academic researchers and consultants and/or 2) those species which have been a large part of the survey biomass and/or demonstrate a particularly strong trend over the time series.

Additional survey data can be requested by contacting Matthew Camisa at 508-990-2860 ext. 139.

Contents:

Figure 1. Massachusetts trawl survey regions.

Figure 2 (a-ff). Stratified mean weight per tow (kg) with GAM smoothed trend line. 1978–2016 Massachusetts DMF trawl survey.

- (a.) Spring **Winter Flounder** Regions 1 - 3
- (b.) Spring **Yellowtail Flounder** Regions 3-5
- (c.) Spring **Winter Flounder** Regions 4 - 5
- (d.) Fall **Winter Flounder** Regions 4 - 5
- (e.) Spring **Summer Flounder** Regions 1 - 5
- (f.) Fall **Summer Flounder** Regions 1 - 5
- (g.) Spring **Windowpane** Regions 1 – 3
- (h.) Fall **Windowpane** Regions 1 – 3
- (i.) Spring **Windowpane** Regions 4 - 5
- (j.) Fall **Windowpane** Regions 4 – 5
- (k.) Spring **Little Skate** Regions 1 - 3
- (l.) Fall **Little Skate** Regions 1 - 3
- (m.) Spring **Little Skate** Regions 4 - 5
- (n.) Fall **Little Skate** Regions 4 - 5
- (o.) Spring **Winter Skate** Regions 1 - 3
- (p.) Fall **Winter Skate** Regions 1 - 3
- (q.) Spring **Winter Skate** Regions 4 - 5
- (r.) Fall **Winter Skate** Regions 4 – 5
- (s.) Spring **Atlantic Cod** Regions 4 – 5
- (t.) Fall **Red Hake** Regions 4 – 5
- (u.) Spring **Ocean Pout** Regions 1 - 5
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- (y.) Spring **Scup** Regions 1 - 3
- (z.) Spring **Black Sea Bass** Regions 1 - 3
- (aa.) Spring **Tautog** Regions 1 - 3
- (bb.) Fall **Tautog** Regions 1 - 3
- (cc.) Fall **Butterfish** Regions 1 - 2
- (dd.) Fall **Lady Crab** Regions 4 - 5
- (ee.) Fall **Lobster** Regions 4 - 5
- (ff.) Spring **Haddock** Regions 4 - 5

Figure 3 (a – b). Stratified mean number per tow with GAM smoothed trend line. 1978 – 2016 Massachusetts DMF trawl survey.

- (a) Spring **Channeled Whelk** Regions 1 - 2
- (b) Fall **Channeled Whelk** Regions 1 - 2
- (c) Fall **Knobbed Whelk** Regions 1 – 2
- (d) Spring **Atlantic Wolffish** Regions 3 – 5

Figure 4 (a & b). Pre-recruit stratified mean number per tow with GAM smoothed trend line. 1978 – 2016 Massachusetts DMF trawl survey.

- (a) Fall **Age-0 Scup** (<13 cm) Regions 1 – 3
- (b) Fall **Age-0 Black Sea Bass** (<12 cm) Regions 1 - 3

Figure 1. Massachusetts trawl survey regions

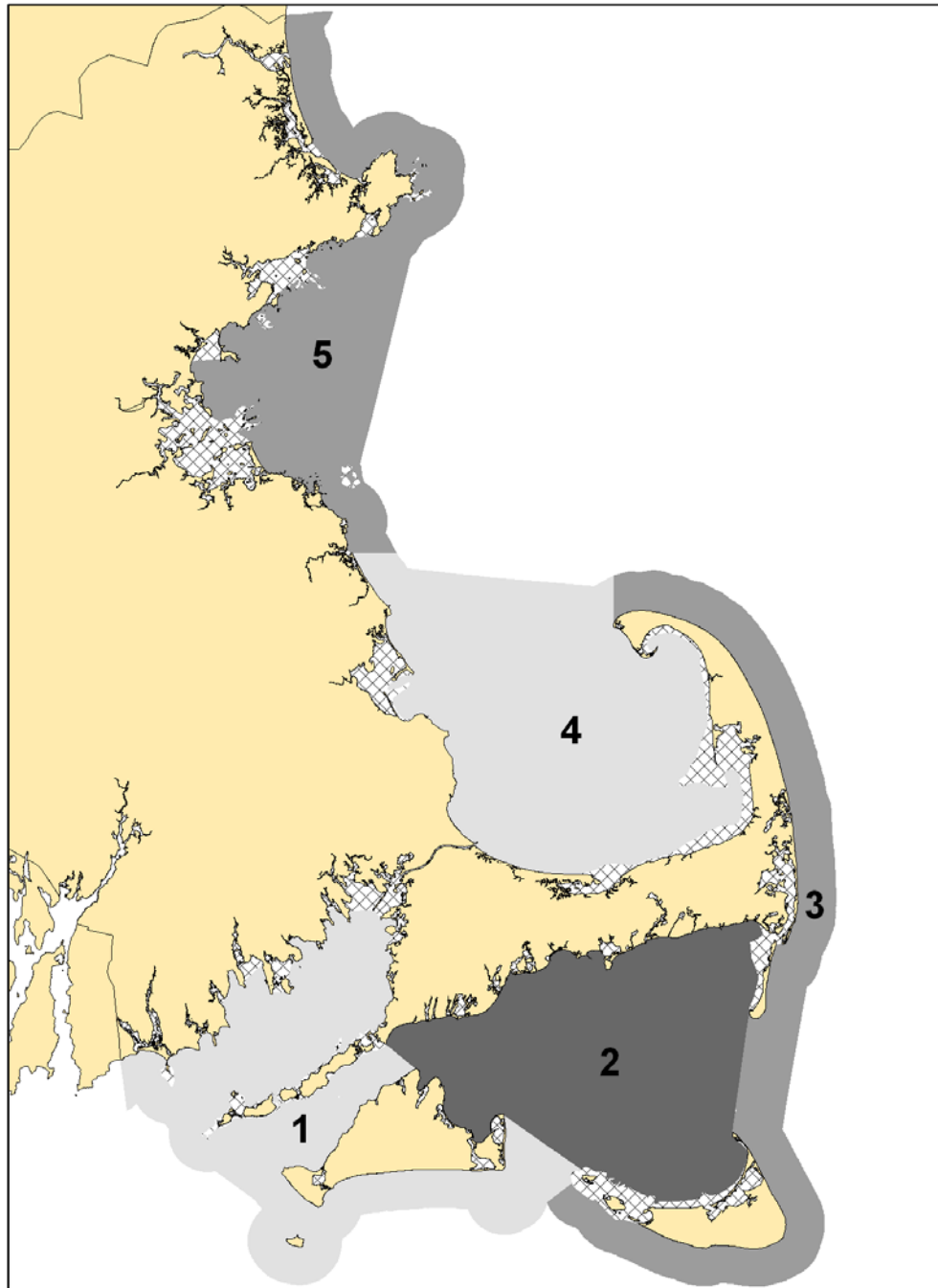


Figure 2. (a & b) Stratified mean weight per tow (kg) with GAM smoothed trend line. 1978 – 2016 Massachusetts DMF Trawl survey.

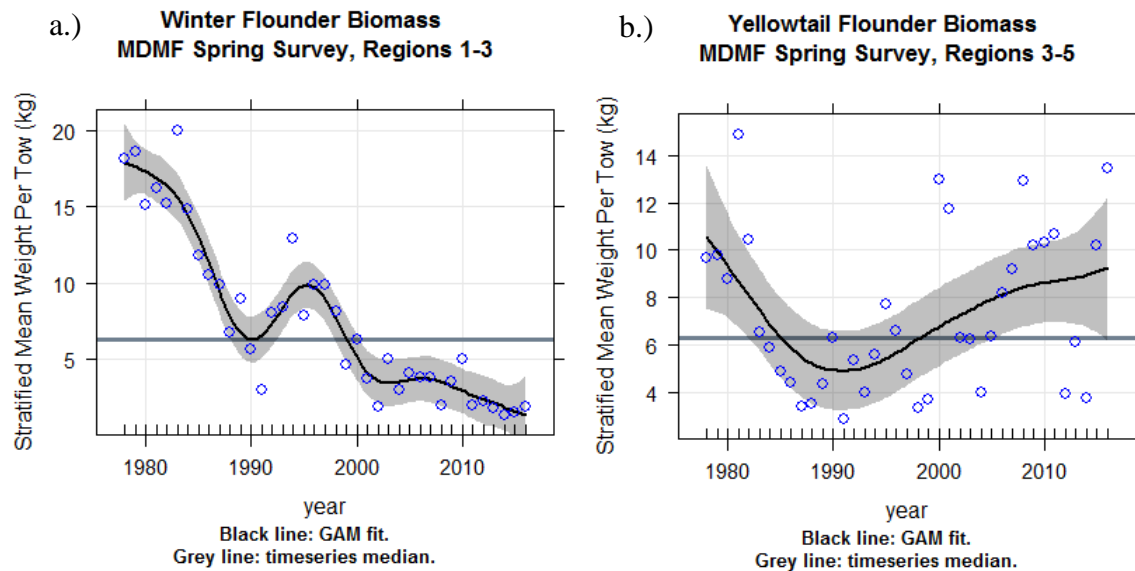


Figure 2. (c & d) Stratified mean weight per tow (kg) with GAM smoothed trend line. 1978 – 2016 Massachusetts DMF Trawl survey.

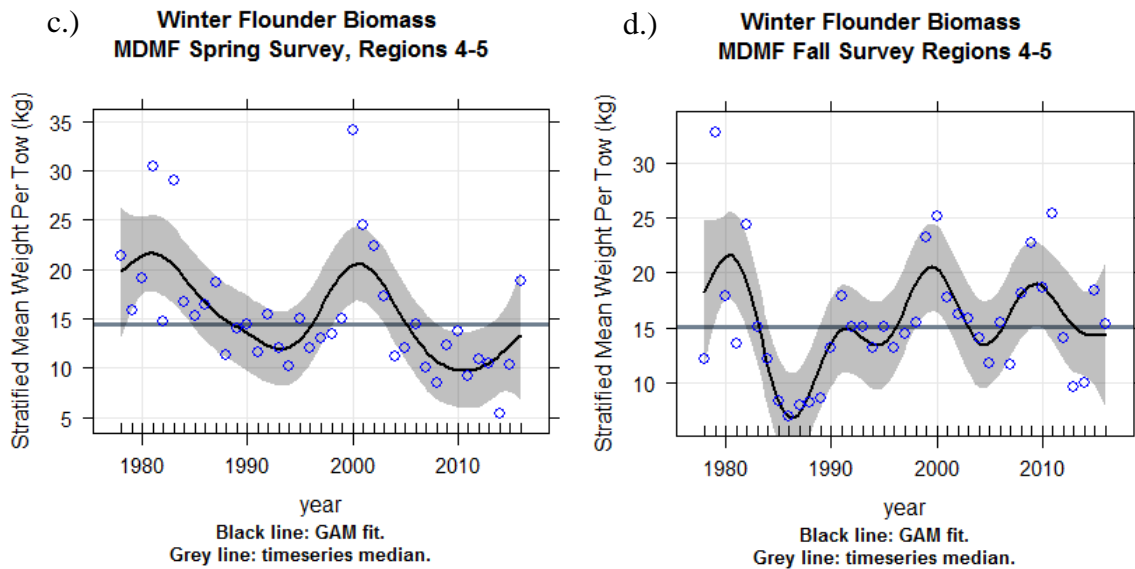


Figure 2. (e & f). Stratified mean weight per tow (kg) with GAM smoothed trend line. 1978 – 2016 Massachusetts DMF Trawl survey.

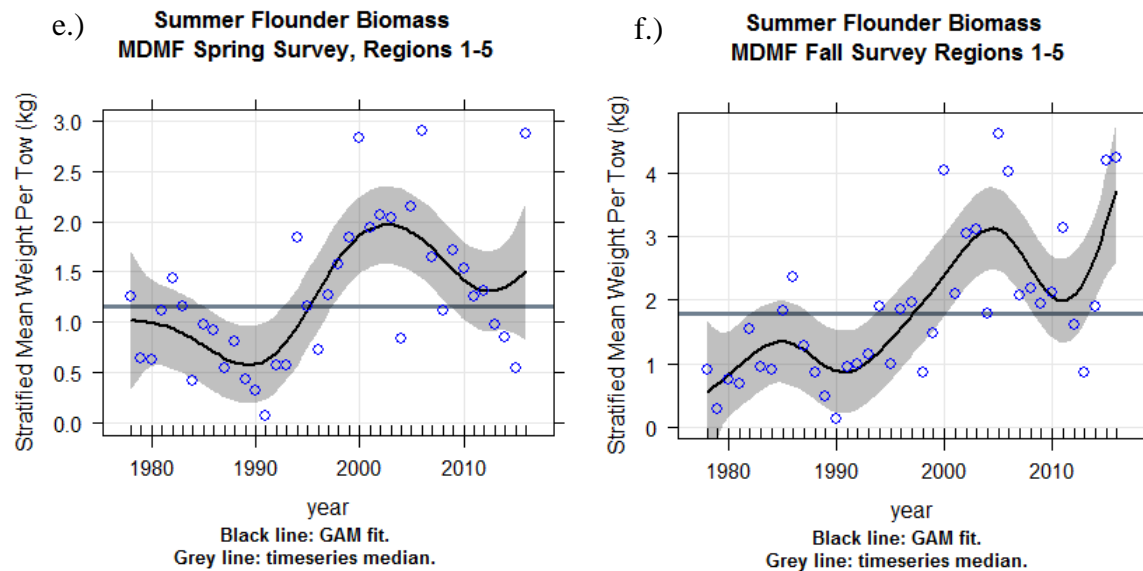


Figure 2. (g & h). Stratified mean weight per tow (kg) with GAM smoothed trend line. 1978 – 2016 Massachusetts DMF Trawl survey.

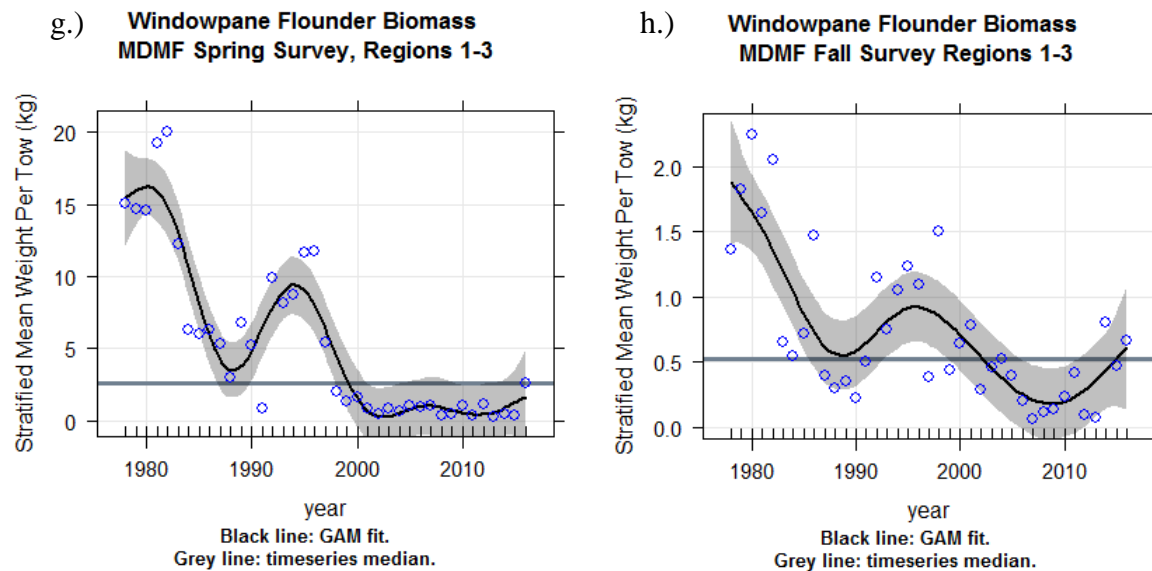




Figure 2. (i & j). Stratified mean weight per tow (kg) with GAM smoothed trend line. 1978 – 2016 Massachusetts DMF Trawl survey.

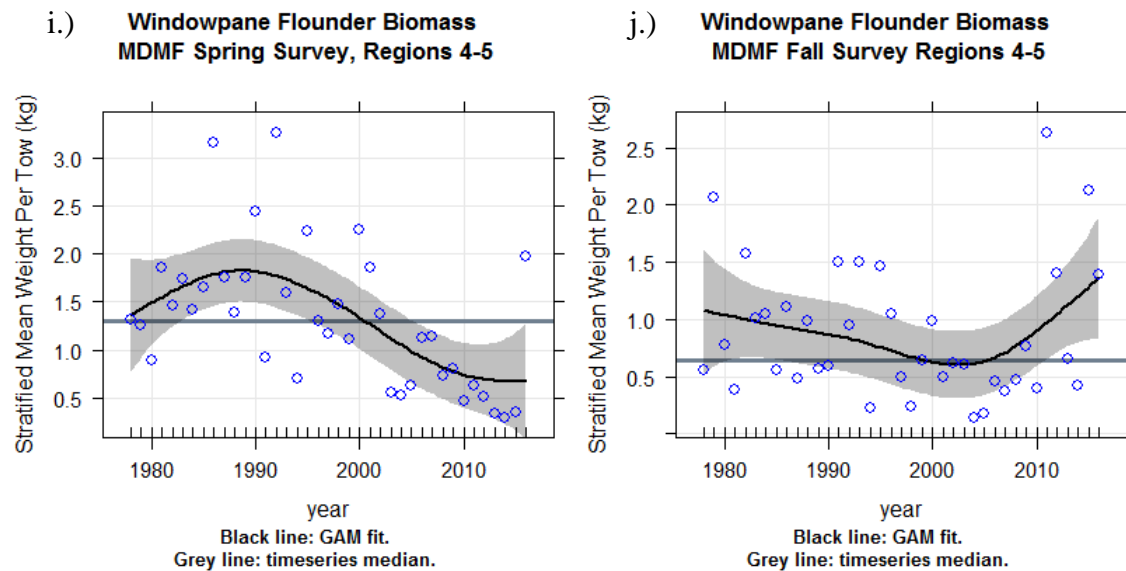


Figure 2. (k & l). Stratified mean weight per tow (kg) with GAM smoothed trend line. 1978 – 2016 Massachusetts DMF Trawl survey.

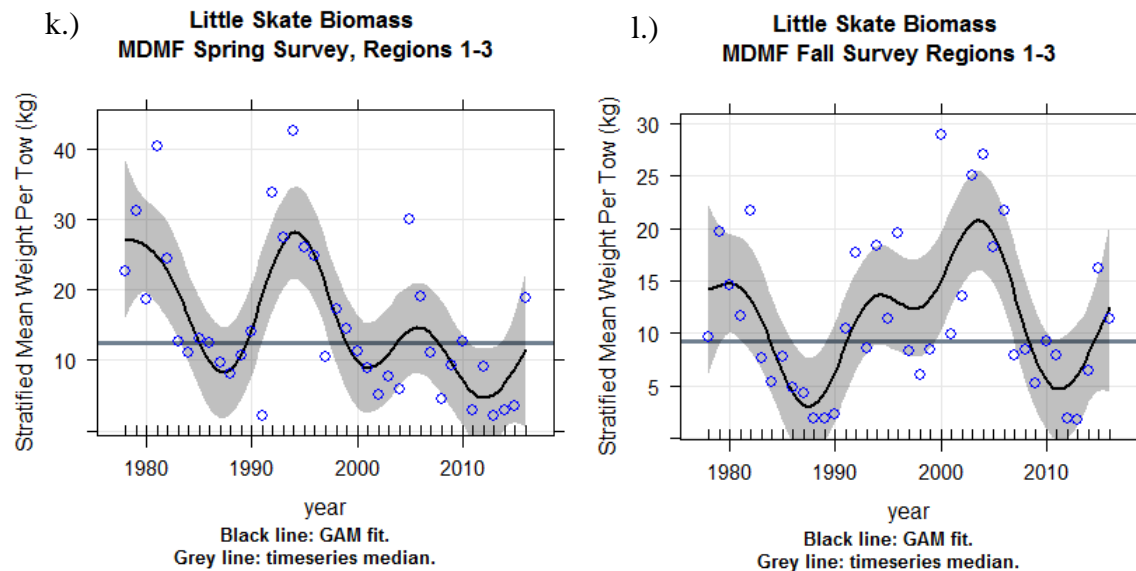


Figure 2. (m & n). Stratified mean weight per tow (kg) with GAM smoothed trend line. 1978 – 2016 Massachusetts DMF Trawl survey.

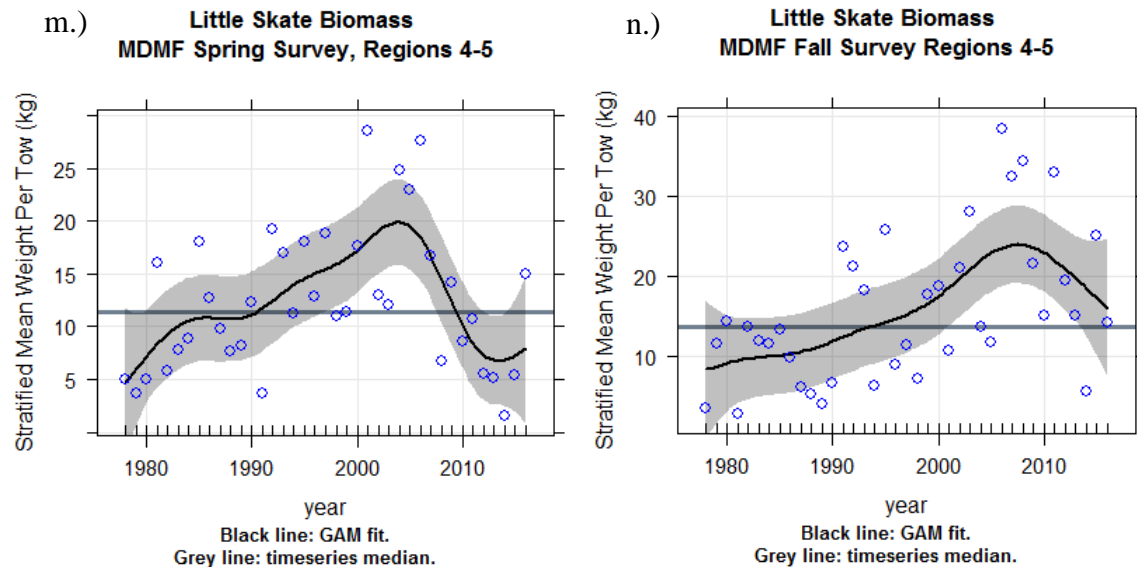


Figure 2. (o & p). Stratified mean weight per tow (kg) with GAM smoothed trend line. 1978 – 2016 Massachusetts DMF Trawl survey.

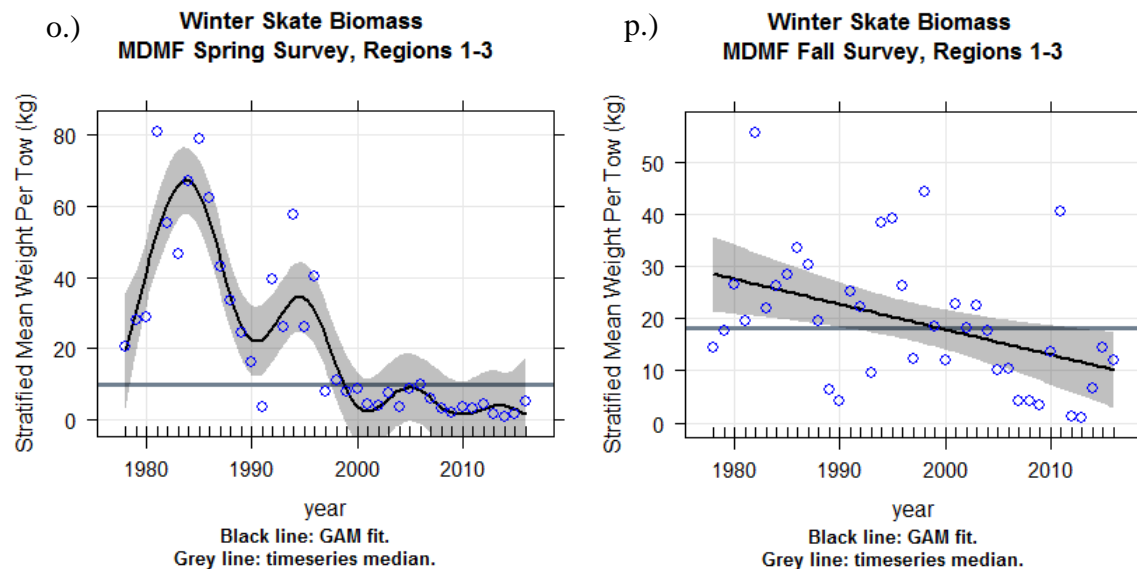


Figure 2. (q & r). Stratified mean weight per tow (kg) with GAM smoothed trend line. 1978 – 2016 Massachusetts DMF Trawl survey.

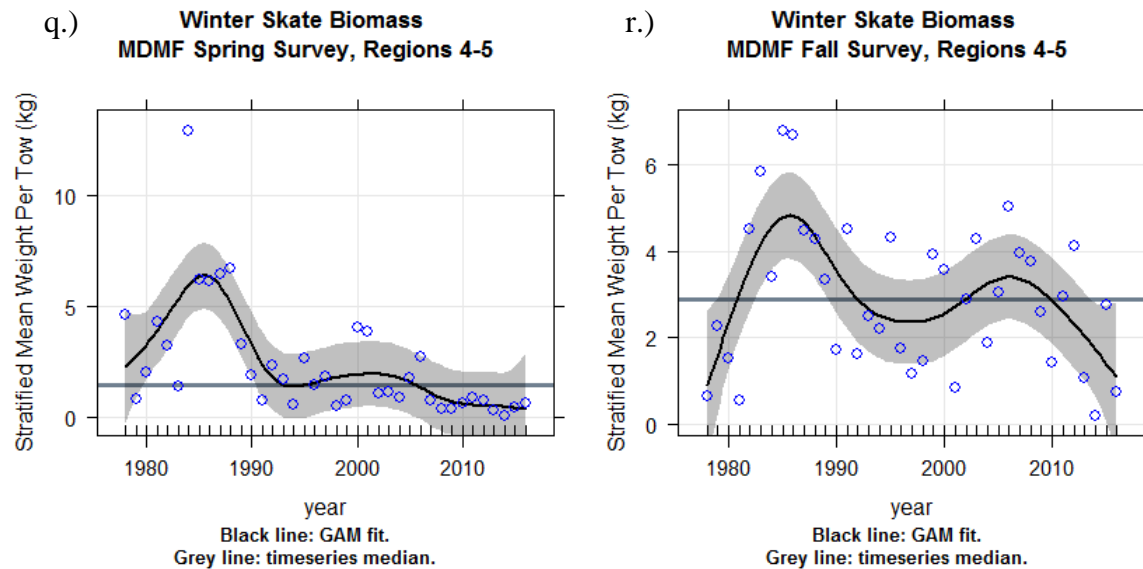


Figure 2. (s & t). Stratified mean weight per tow (kg) with GAM smoothed trend line. 1978 – 2016 Massachusetts DMF Trawl survey.

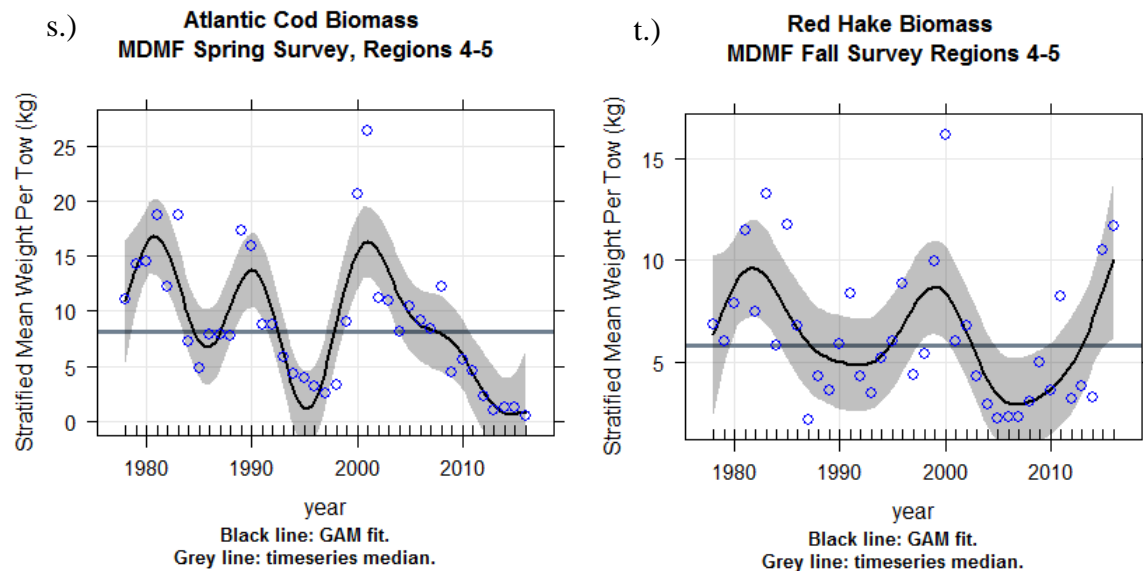


Figure 2. (u & v). Stratified mean weight per tow (kg) with GAM smoothed trend line. 1978 – 2016 Massachusetts DMF Trawl survey.

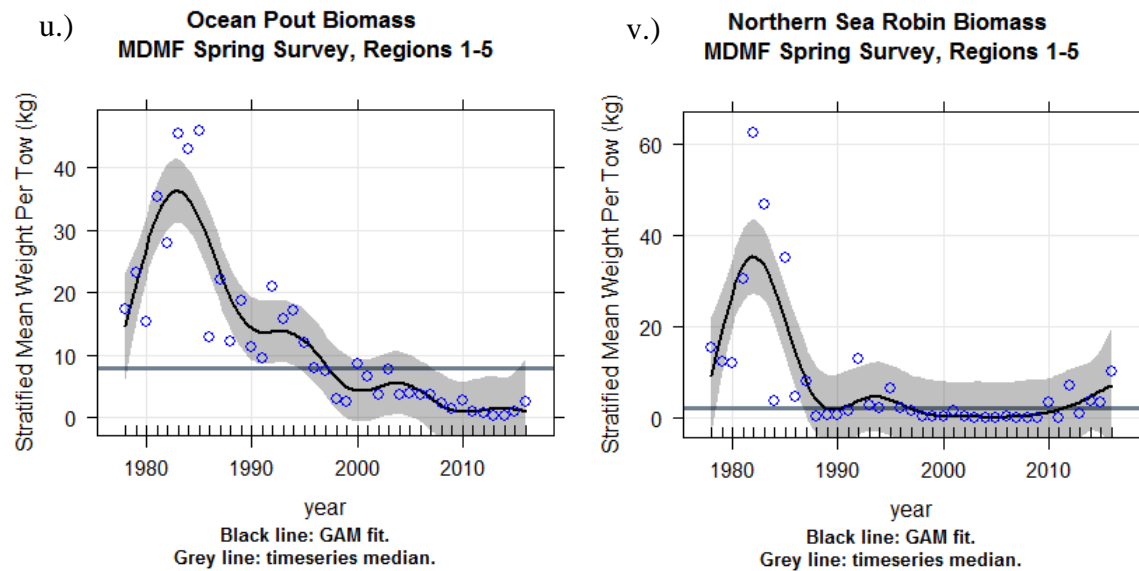


Figure 2. (w & x). Stratified mean weight per tow (kg) with GAM smoothed trend line. 1978 – 2016 Massachusetts DMF Trawl survey.

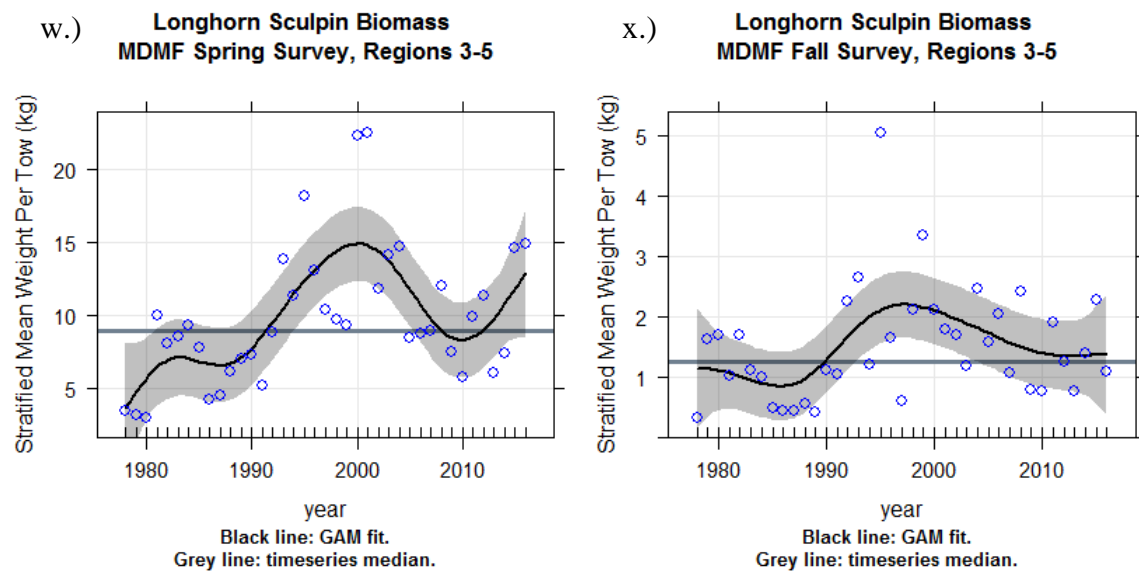


Figure 2. (y & z). Stratified mean weight per tow (kg) with GAM smoothed trend line. 1978 – 2016 Massachusetts DMF Trawl survey.

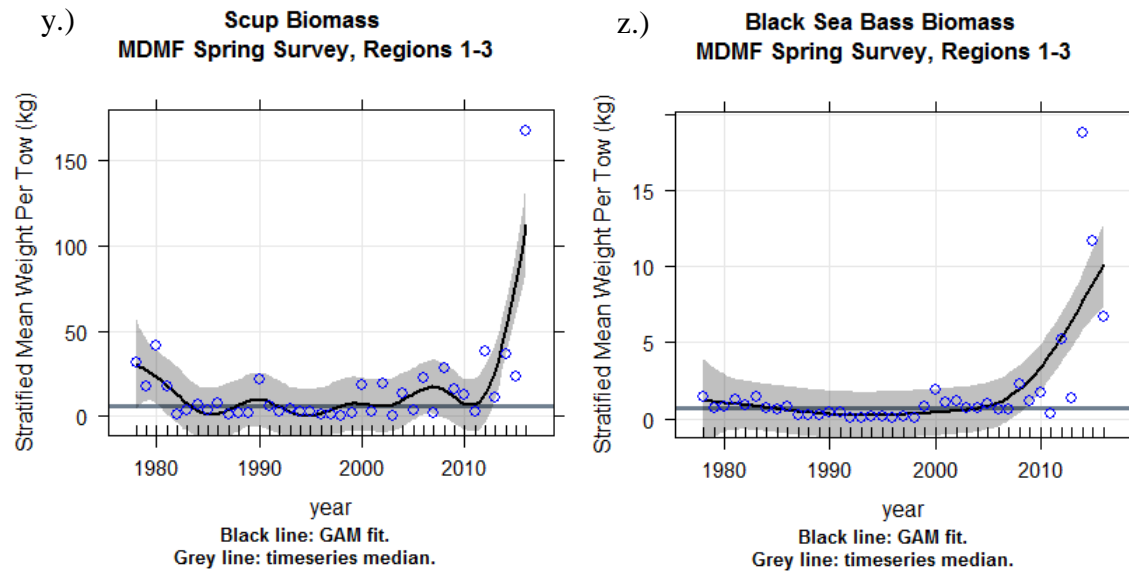


Figure 2. (aa & bb). Stratified mean weight per tow (kg) with GAM smoothed trend line. 1978 – 2016 Massachusetts DMF Trawl survey.

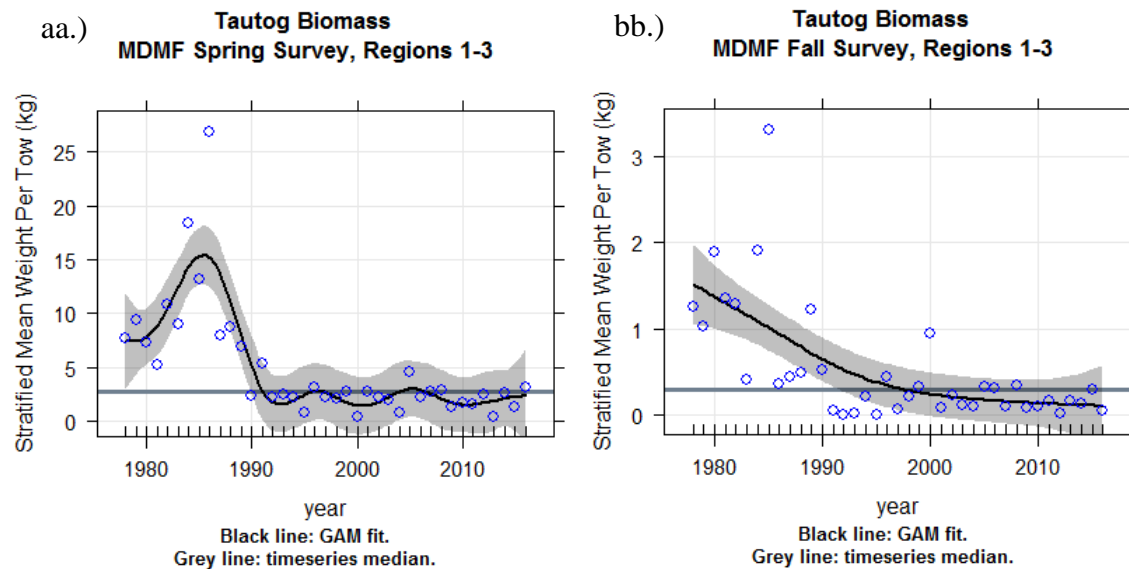


Figure 2. (cc & dd). Stratified mean weight per tow (kg) with GAM smoothed trend line. 1978 – 2016 Massachusetts DMF Trawl survey.

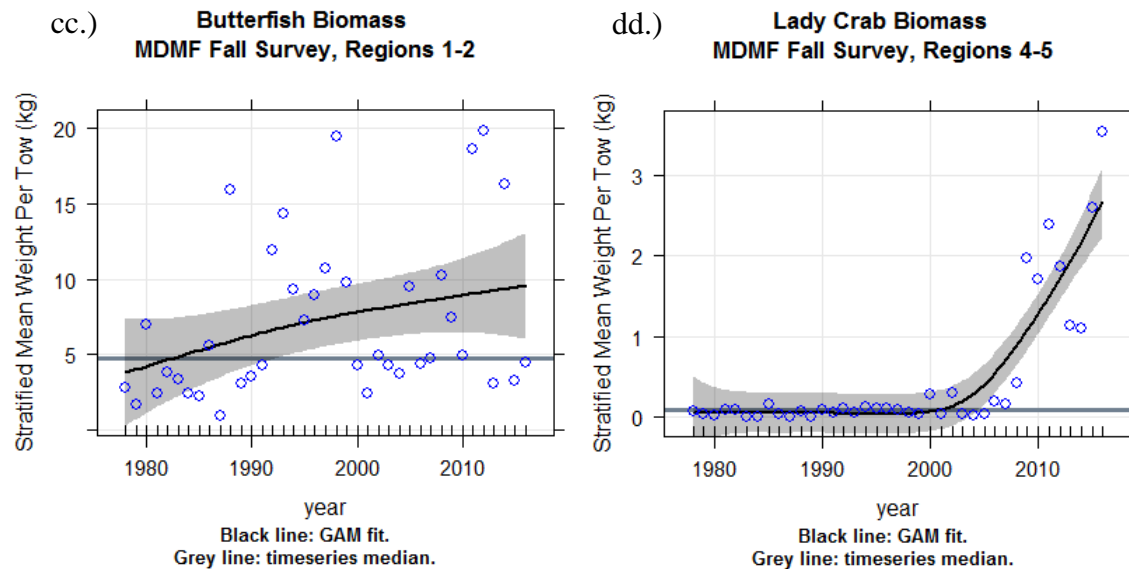


Figure 2. (ee & ff). Stratified mean weight per tow (kg) with GAM smoothed trend line. 1978 – 2016 Massachusetts DMF Trawl survey.

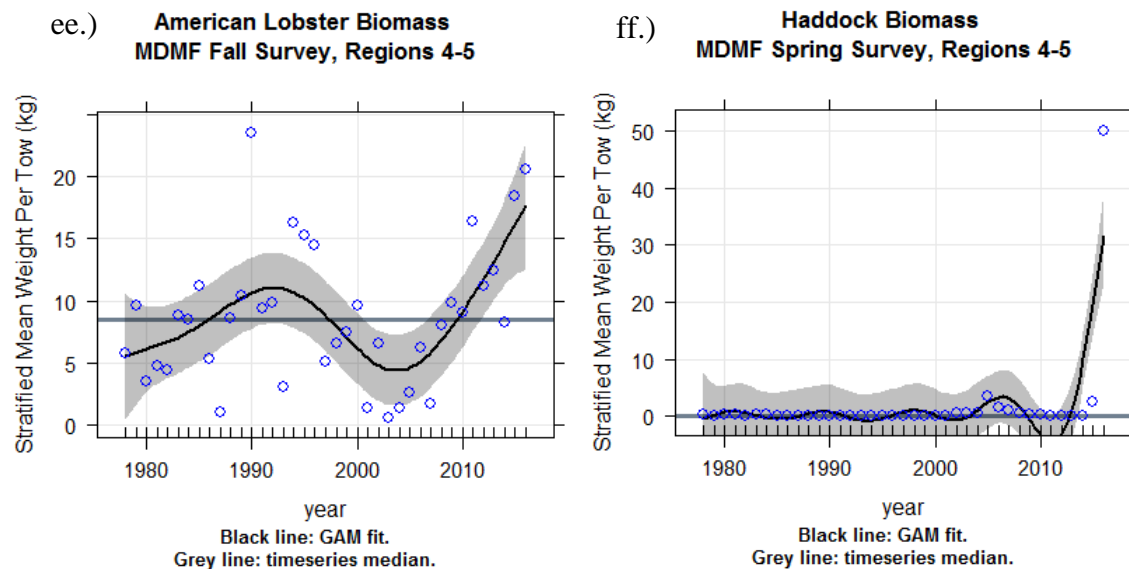


Figure 3. (a & b). Stratified mean number per tow with GAM smoothed trend line. 1978 – 2016 Massachusetts DMF Trawl survey.

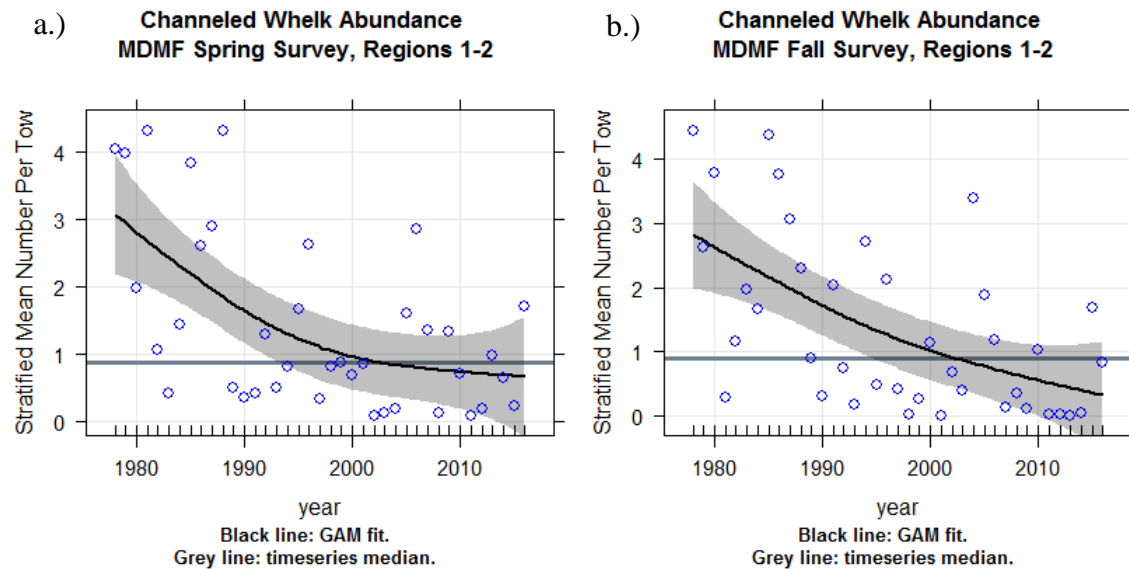


Figure 3. (c & d). Stratified mean number per tow with GAM smoothed trend line. 1978 – 2016 Massachusetts DMF Trawl survey.

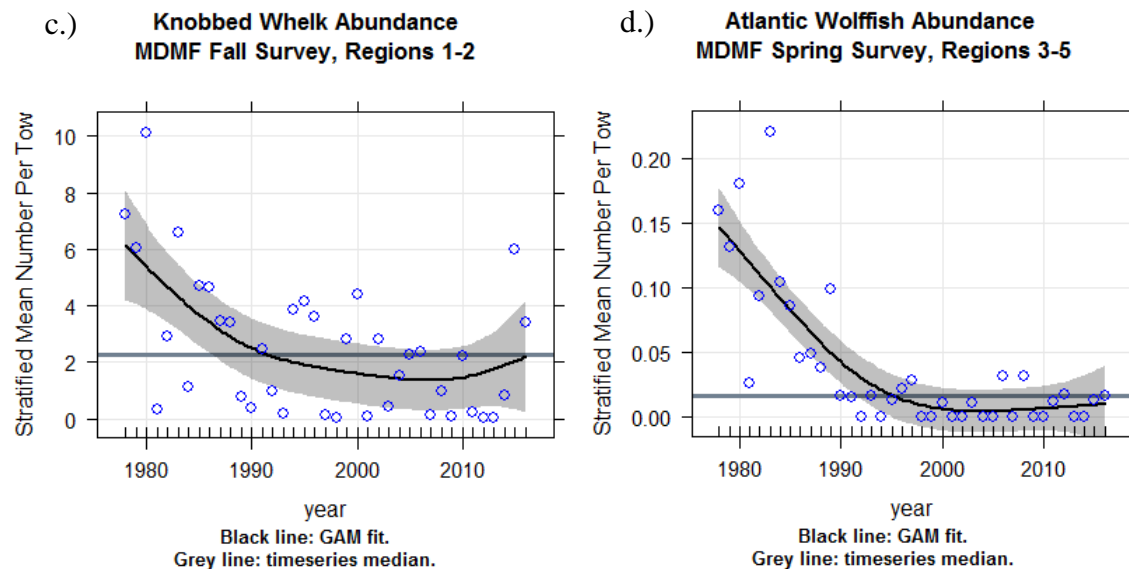
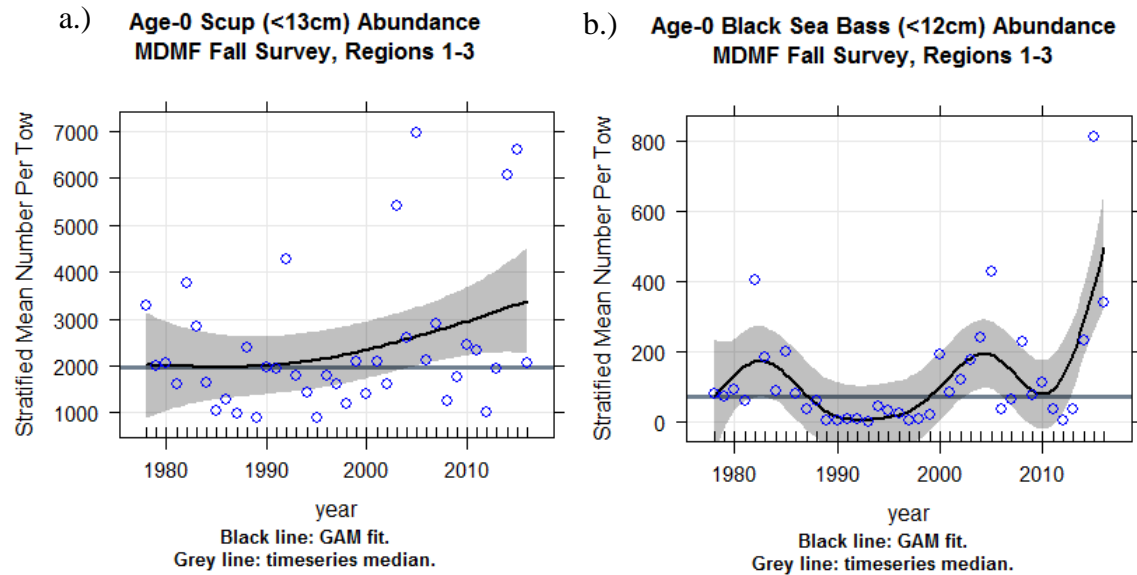


Figure 4. (a & b). Pre-recruit stratified mean number per tow with GAM smoothed trend line. 1978 – 2016 Massachusetts DMF Trawl survey.





## Appendix B: Trends in Observed Bottom Temperatures on the Massachusetts Bottom Trawl Surveys, 1978 – 2016

A timeseries analysis of bottom temperatures recorded during spring and fall bottom trawl surveys is updated here to include 2016 observations. For a detailed interpretation and description of methods used in data preparation and analysis, refer to the 2006 annual report, (2006 Annual Performance Report, F-56-R, Massachusetts Fishery Resource Assessment, Appendix E).

There is one difference between the methods employed in 2006 and the methods reported here. Temperature observations from non-representative stations (SHG >136) are included in the dataset beginning in Fall 2004 as long as the tow duration is at least 5 minutes (the minimum time necessary for the temperature logger to acclimate). Some of these observations were omitted from the 2006 analysis. Elimination of temperature observations from non-representative stations had the effect of producing fall temperature data gaps in Region 3 where large dogfish catches frequently result in hauls of less than 13 minutes duration. These tows, though non-representative for generation of abundance and biomass indices for most species, are used when generating spiny dogfish indices. The temperature data collected at these ‘dogfish tows’ since 2004 is consistent with temperature data collected at all other stations utilizing the Onset Computer Corporation Tidbit<sup>TM</sup> temperature logger and is therefore included in the following temperature summaries. Please refer to Table 1 and 2 for a listing of data gaps.

# Stratum Mean Bottom Water Temperature Observations MDMF Spring Survey, 1978-2016

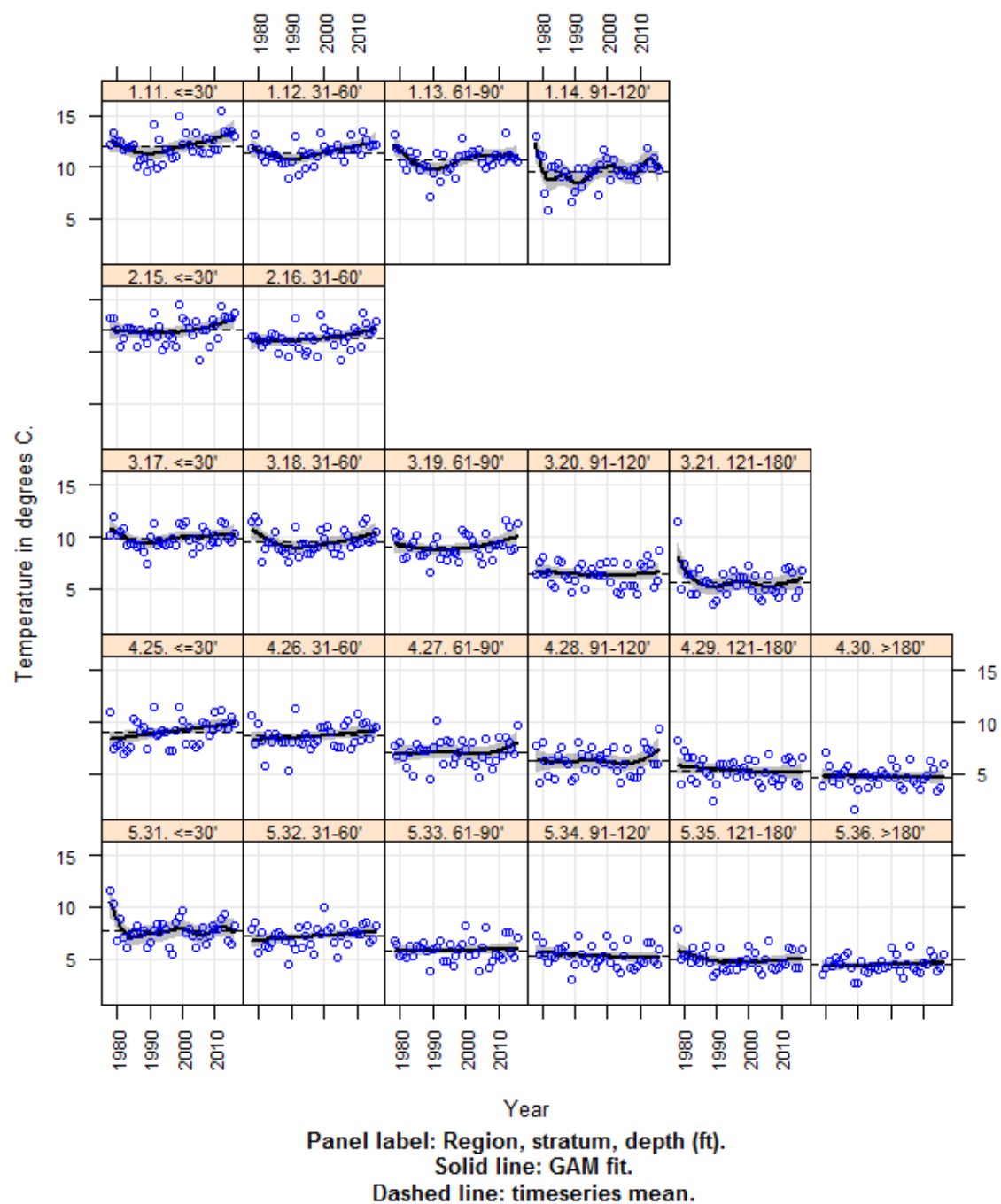


Figure 1.

# **Stratified Mean Bottom Temperature by Region. MDMF Spring Trawl Survey, 1978 - 2016.**

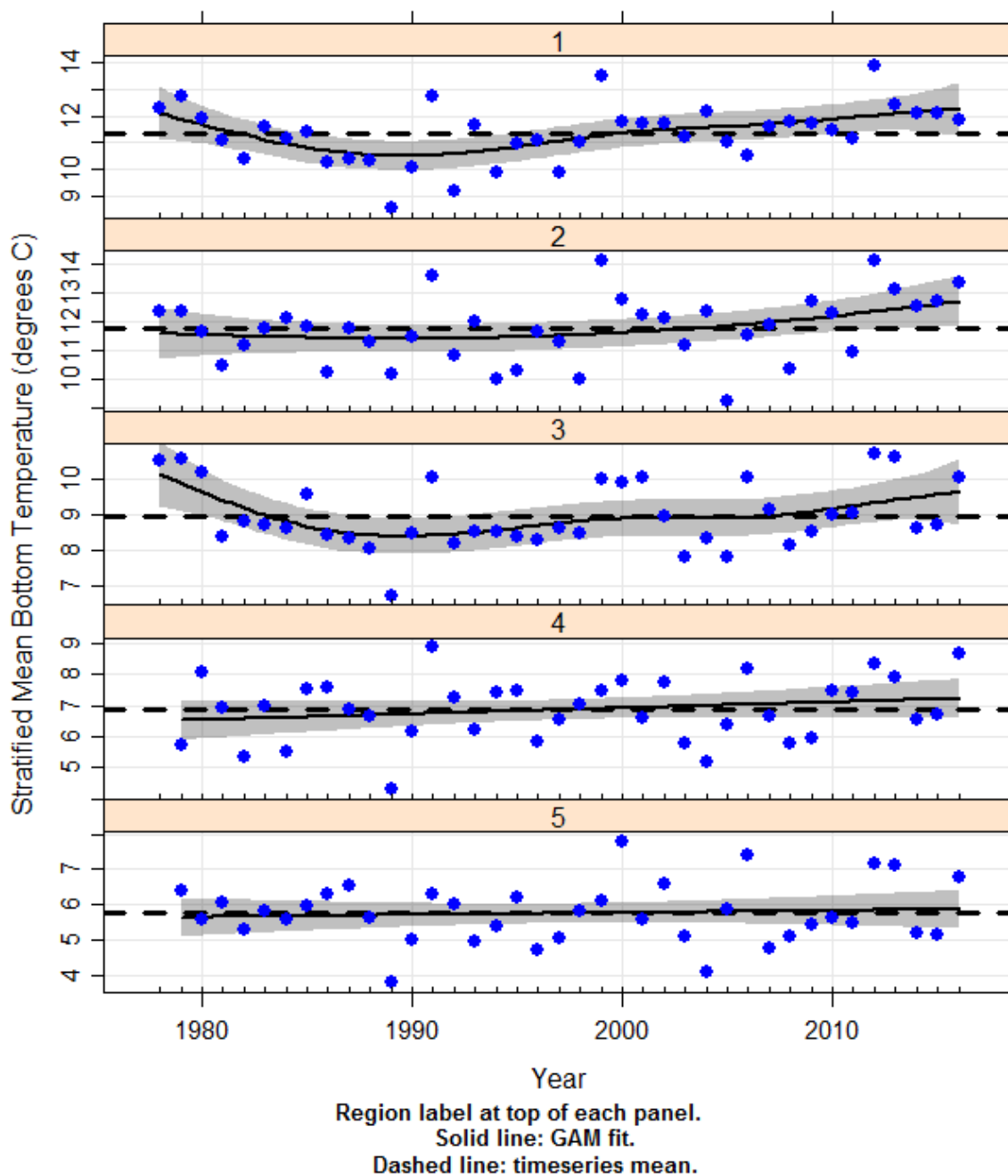


Figure 2.

# Stratum Mean Bottom Water Temperature Observations MDMF Fall Survey, 1978-2016

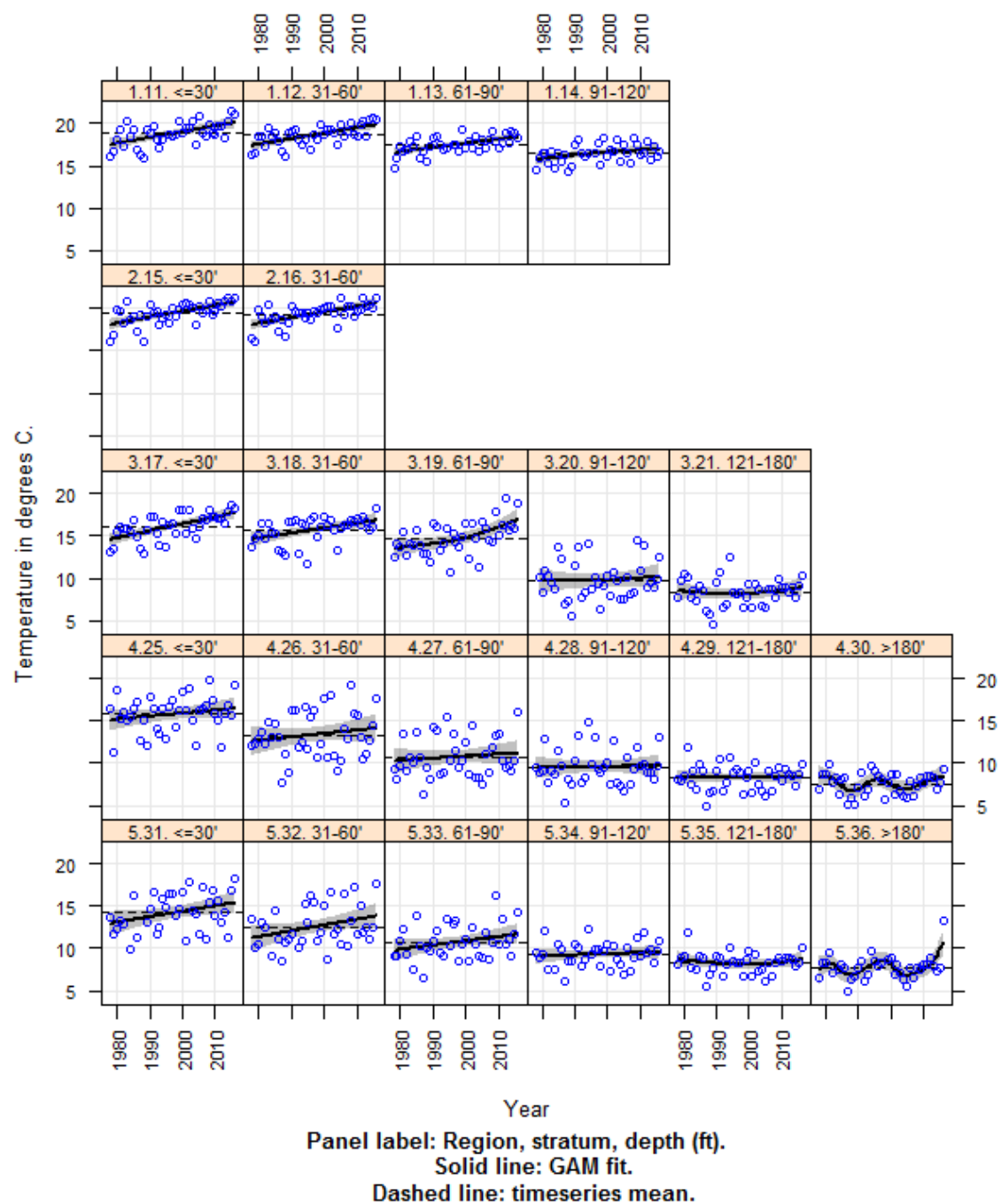


Figure 3.

# Stratified Mean Bottom Temperature by Region. MDMF FALL Trawl Survey, 1978 - 2016.

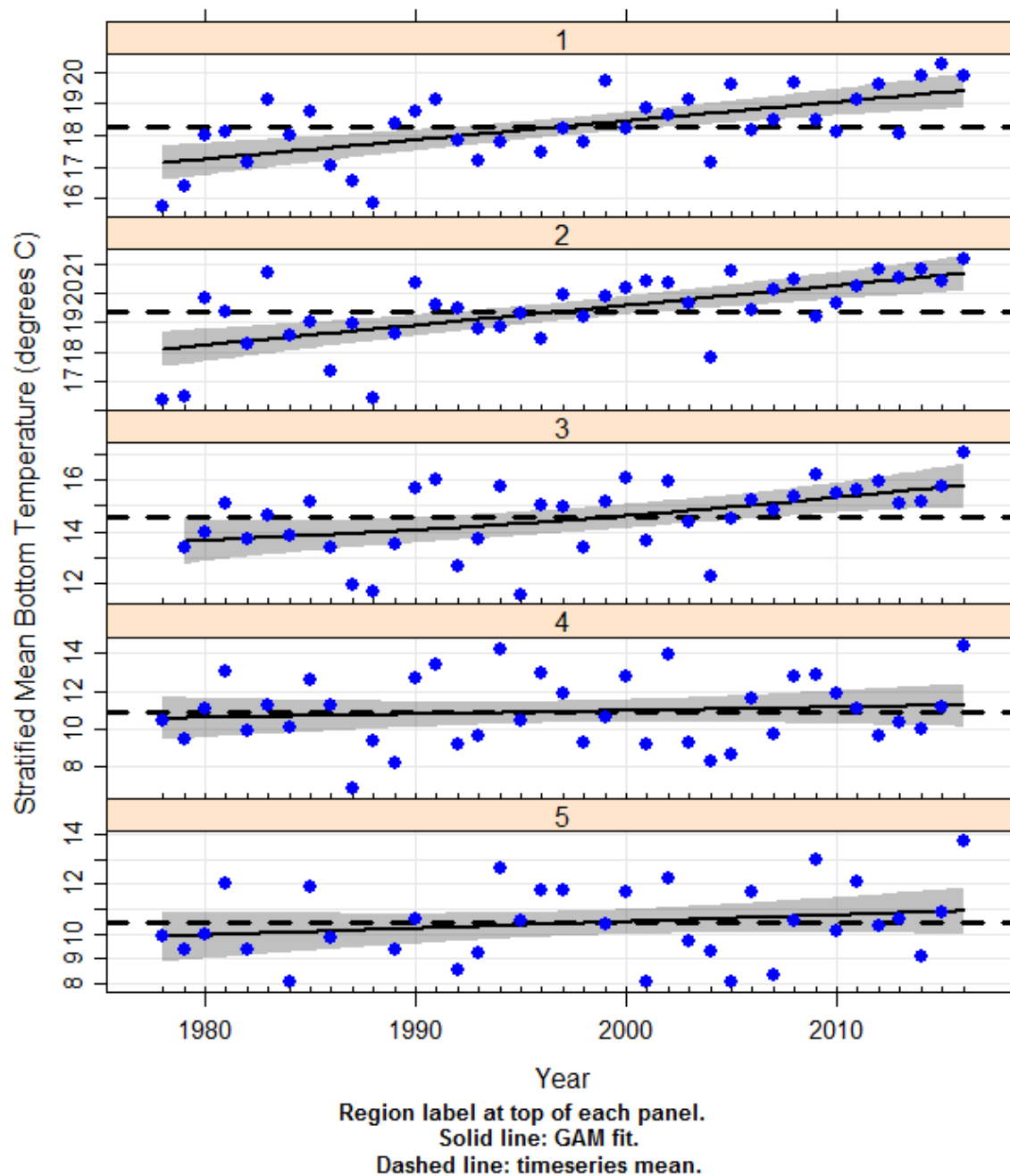


Figure 4.

## Appendix C: Corrections to the trawl survey database in 2016.

The TOWDATE corrections from 201691 were a result of using old SCS files to station initialize during the first 22 stations of the survey. Old SCS files were used as a work-around to some networking issues between our server and NEFSC workstation computers.

The SVCAT corrections resulted from a tow duration expansion script issue. In seven instances, the length frequencies were expanded appropriately for a short tow but the expcatchwt and expcatchnum were not.

UNION\_FSCS\_SVCAT DB corrections from tow duration expansion script issue

12/28/2016 M.Camisa

Updated 12/31/16 by PK

### UNION\_FSCS\_SVCAT READS

CRUISE6 STATION SVSPP CATCHSEX EXPCATCHNUM EXPCATCHWT

201692	15	105	2	74	17.251
201692	40	141	0	14	0.072
201692	52	141	0	18	1.708
201692	52	313	1	8	0.008
201692	90	117	0	9	0.052
201692	90	131	0	20	0.127
201692	90	171	0	8	0.05

### UNION\_FSCS\_SVCAT SHOULD READ

CRUISE6 STATION SVSPP CATCHSEX EXPCATCHNUM EXPCATCHWT

201692	15	105	2	75	17.998
201692	40	141	0	16	0.085
201692	52	141	0	24	2.277
201692	52	313	1	11	0.011
201692	90	117	0	10	0.058
201692	90	131	0	22	0.141
201692	90	171	0	9	0.056

UNION\_FSCS\_SVSTA TOWDATE CORRECTIONS  
201691 STATIONS 1-22 M.CAMISA 12/2/2016

UNION_FSCS_SVSTA READS							
CRUISE	STATION	BEGIN_EST_TOWDATE	END_EST_TOWDATE	EST_DAY	EST_JULIAN_DAY	EST_TIME	GMT_TIME
201691	1	8-May-16	8-May-16	8	2457517	19:00:00	0:00:00
201691	2	8-May-16	8-May-16	8	2457517	19:00:00	0:00:00
201691	3	8-May-16	8-May-16	8	2457517	19:00:00	0:00:00
201691	4	8-May-16	8-May-16	8	2457517	19:00:00	0:00:00
201691	5	8-May-16	8-May-16	8	2457517	19:00:00	0:00:00
201691	6	8-May-16	8-May-16	8	2457517	19:00:00	0:00:00
201691	7	8-May-16	8-May-16	8	2457517	19:00:00	0:00:00
201691	8	8-May-16	8-May-16	8	2457517	19:00:00	0:00:00
201691	9	8-May-16	8-May-16	8	2457517	19:00:00	0:00:00
201691	10	9-May-16	9-May-16	9	2457518	19:00:00	0:00:00
201691	11	9-May-16	9-May-16	9	2457518	19:00:00	0:00:00
201691	12	9-May-16	9-May-16	9	2457518	19:00:00	0:00:00
201691	13	9-May-16	9-May-16	9	2457518	19:00:00	0:00:00
201691	14	9-May-16	9-May-16	9	2457518	19:00:00	0:00:00
201691	15	9-May-16	9-May-16	9	2457518	19:00:00	0:00:00
201691	16	9-May-16	9-May-16	9	2457518	19:00:00	0:00:00
201691	17	9-May-16	9-May-16	9	2457518	19:00:00	0:00:00
201691	18	10-May-16	10-May-16	10	2457519	19:00:00	0:00:00
201691	19	10-May-16	10-May-16	10	2457519	19:00:00	0:00:00
201691	20	10-May-16	10-May-16	10	2457519	19:00:00	0:00:00
201691	21	10-May-16	10-May-16	10	2457519	19:00:00	0:00:00
201691	22	10-May-16	10-May-16	10	2457519	19:00:00	0:00:00
UNION_FSCS_SVSTA SHOULD READ							
CRUISE	STATION	BEGIN_EST_TOWDATE	END_EST_TOWDATE	EST_DAY	EST_JULIAN_DAY	EST_TIME	GMT_TIME
201691	1	9-May-16	9-May-16	9	2457518	06:36:28	10:36:28
201691	2	9-May-16	9-May-16	9	2457518	07:50:50	11:50:50
201691	3	9-May-16	9-May-16	9	2457518	09:27:01	13:27:01
201691	4	9-May-16	9-May-16	9	2457518	10:56:40	14:56:40
201691	5	9-May-16	9-May-16	9	2457518	13:02:02	17:02:02
201691	6	9-May-16	9-May-16	9	2457518	14:29:45	18:29:45
201691	7	9-May-16	9-May-16	9	2457518	16:00:44	20:00:44
201691	8	9-May-16	9-May-16	9	2457518	17:42:39	21:42:39
201691	9	9-May-16	9-May-16	9	2457518	18:55:37	22:55:37
201691	10	10-May-16	10-May-16	10	2457519	07:25:54	11:25:54
201691	11	10-May-16	10-May-16	10	2457519	08:41:25	12:41:25
201691	12	10-May-16	10-May-16	10	2457519	10:07:34	14:07:34
201691	13	10-May-16	10-May-16	10	2457519	11:39:32	15:39:32
201691	14	10-May-16	10-May-16	10	2457519	13:55:29	17:55:29
201691	15	10-May-16	10-May-16	10	2457519	14:56:39	18:56:39
201691	16	10-May-16	10-May-16	10	2457519	16:12:07	20:12:07
201691	17	10-May-16	10-May-16	10	2457519	17:44:53	21:44:53
201691	18	11-May-16	11-May-16	11	2457520	08:20:33	12:20:33
201691	19	11-May-16	11-May-16	11	2457520	10:44:35	14:44:35
201691	20	11-May-16	11-May-16	11	2457520	12:15:37	16:15:37
201691	21	11-May-16	11-May-16	11	2457520	13:47:21	17:47:21
201691	22	11-May-16	11-May-16	11	2457520	15:11:42	19:11:42