30 June 2016

CRUISE RESULTS
NOAA Research Vessel GORDON GUNTER
Cruise No. GU 17-01
Spring Northeast Ecosystem Monitoring Survey

CRUISE PERIOD AND AREA

The NOAA research vessel *GORDON GUNTER* sampled a total of 241 stations from 16 May to 7 June 2017 in 2 legs. Leg 1 covered the Mid-Atlantic Bight, Southern New England and part of Georges Bank. Leg 2 covered the remainder of Georges Bank and part of the Gulf of Maine.

OBJECTIVES

The principal objective of the survey was to assess the pelagic components of the Northeast U.S. Continental Shelf Ecosystem from water currents to plankton, pelagic fishes, marine mammals, sea turtles, and seabirds. The spatial distribution of the following parameters was quantified: water properties, phytoplankton, microzooplankton, mesozooplankton, pelagic fish and invertebrates. Both traditional and novel techniques and instruments were used.

Other operational objectives of the first two legs of this cruise were to:

(1) collect underway data using TSG, SCS, and ADCP;

(2) complete CTD and bongo operations at stations throughout area,

(3) conduct acoustic surveys using the EK60,

(4) collect samples for the Census of Marine Zooplankton (CMarZ) genetics studies.

(5) collect samples for aging and genetic analyses of fish larvae and eggs.

(6) collect near-surface underway data and imagery from the entire cruise track using a TSG, fluorometer, SCS, EK-60 Scientific Sounder, ADCP and an Imaging FlowCytoBot unit.

(7) gather data on trends in ocean acidification and nutrient levels by collecting seawater samples at various depths with a rosette water sampler at predetermined fixed locations.

(8) collect stable isotope data from phytoplankton taken at various depths with a rosette water sampler at six fixed locations.

METHODS

The survey consisted of 158 stations at which the vessel stopped to lower instruments over the port side of the vessel from a J-frame and two conductive-wire winches. Of these, 41 were in the Middle Atlantic Bight (MAB), 51 were in Southern New England (SNE), 36 were on Georges Bank (GB), and 30 were in the Gulf of Maine (GOM) (Figure 1).

Plankton and hydrographic sampling was conducted with double oblique tows using the 61-cm bongo sampler and a Seabird CTD. The tows were extended to approximately 5 meters above the bottom, or to a maximum depth of 200 meters. All plankton tows were conducted at a ship speed of 1.5 – 2.0 knots. Plankton sampling gear consisted of a 61-centimeter diameter aluminum bongo frame with two 335-micron nylon mesh nets equipped with analog flowmeters that recorded number of revolutions during the tow. At the 22 randomly designated Census of Marine Zooplankton (CMarZ) stations a 20-cm diameter PVC bongo frame fitted with paired 165-micron nylon mesh nets was put on the towing wire one half meter above the Seabird CTD with a wire stop and towed together with the large aluminum bongo frame (Figure 2). No flowmeters were used in the 20-cm bongos. A similar array, with 20 cm 335 micron mesh nets deployed above the 61 cm 335 micron mesh nets, was fished for larval fish and egg samples for NOAA researcher David Richardson at 105 other plankton stations. These samples were saved for genetics and otolith analysis to be carried out at the Narragansett NEFSC Lab. A 45-kilogram bell-shaped lead weight was attached by a 20-centimeter length of 3/8-inch diameter chain below the aluminum bongo frame to depress the sampler. The flat bottomed configuration of the depressor weight made for safer deployment and retrieval of the sampling gear when the boat was rolling in rough seas. The plankton sampling gear was deployed off the port side of the vessel using a J-frame and a conducting cable winch. Tow depth was monitored in real time with a Seabird CTD profiler. The Seabird CTD profiler was hard-wired to the conductive towing cable, providing simultaneous depth, temperature, and salinity for each plankton tow. A Power Data Interface Module (PDIM) signal booster was also used to allow the data transfer at high baud rate from the Seabird 19+ CTD profiler over the great length of wire (>1600 meters) on the *GORDON* GUNTER oceanic winch. After retrieval, both the large and small bongo nets were washed down with seawater on a table set up on the deck of the sampling area to obtain the plankton samples. The 61-centimeter bongo plankton samples were preserved in a 5% solution of formalin in seawater. The CMarZ genetics samples and the genetics and otolith larval fish and egg samples from the 20-centimeter bongo nets were preserved in 95% ethanol, which was changed once, 24 hours after the initial preservation.

A Seabird 911+ CTD was deployed on a rosette frame with a carousel water sampling system (SBE32) and 11 10-liter Niskin bottles at all fixed stations. The package was deployed on vertical casts, collecting profiles of water temperature, salinity, chlorophyll-a and oxygen levels. Water samples were collected by the Niskin sampling bottles at multiple depths along the upcast to be processed ashore for nutrients, carbonate chemistry and stable isotope analysis of phytoplankton (Figure 3).

Salinity, temperature and chlorophyll-*a* levels were monitored continuously from a depth of about 3 meters along the entire cruise track using a thermosalinograph, and a fluorometer hooked up to the ship's scientific flow-through seawater system. The Scientific Computer System (SCS) recorded the output from both the thermosalinograph, and fluorometer at 10-second intervals. Records were given a time-date stamp by the GPS unit. In addition, an ImagingFlowCytobot unit was plumbed into the flow-through seawater system in the CTD lab (Figure 4**).** The device captured images of diatoms, dinoflagellates and marine ciliates on an independent computer provided by the Woods Hole Oceanographic Institution (WHOI) (Figure 5).

Chlorophyll calibration samples were collected and analyzed from the surface, chlorophyll-max depth and below chlorophyll max water depths during rosette casts as a check on the in-situ fluorometer mounted ton the rosette frame. The water from these depths was filtered through glass fiber filters to collect the phytoplankton. The filters were immersed in 90% acetone in glass cuvettes placed in a portable cooler for approximately 24 hours to extract the chlorophyll. The dissolved chlorophyll levels in the acetone were then read using a Turner Designs 10AU fluorometer.

Marine mammal and seabird observations and photography were conducted from the bridge and flying bridge of the *GORDON GUNTER* by John Loch and Nick Metheny on Leg 1 (Figure 6) and Nick Metheny and Glen Davis on Leg 2.

RESULTS

Leg 1

A summary of routine survey activities is presented in Table 1. Areal coverage for the cruise is shown in Figure 1. The NOAA vessel *GORDON GUNTER* sailed from the Naval Station in Newport, RI on Tuesday, May 16. Sampling was started just south of Narragansett Bay as the vessel proceeded south, going offshore to work on 8 stations before changing course and heading west and inshore towards more protected waters to continue working as winds and seas increased. The Gordon Gunter continued on this inshore track, reaching the southernmost station of the cruise on the evening of May 19, then started back north, surveying stations along the outer edge of the continental shelf. Sea conditions were better, but strong headwinds slowed the progress of the vessel as it worked its way back into Southern New England waters. A favorable forecast for Georges Bank allowed sampling at 10 stations on the southwest corner of Georges in the time remaining before the vessel needed to head back towards Newport, RI. Ten more stations were completed in the Southern New England area as the Gordon Gunter made its way towards Narragansett Bay to end Leg 1 of the survey back at Naval Station Newport on May 26.

Leg 2

The Gordon Gunter sailed through the Great Round Shoals Channel from the Naval Station in Newport, RI on leg 2 of the GU1701 cruise on Monday, May 29, 2016, onto Georges Bank to complete sampling in the shoals and northeast part of this survey area. With good weather, the vessel was able to sample all of the remaining area of Georges Bank, and move on into the central and northern part of the Gulf of Maine. With weather threatening to curtail operations in the Gulf of Maine, the Gordon Gunter did not complete sampling in the eastern Gulf of Maine, but turned west and headed through the Cape Cod Canal to continue working on inshore Southern New England stations until it returned to the Newport Naval Station on June 7, marking the end of the 2017 Spring Ecosystem Monitoring Survey.

DISPOSITION OF SAMPLES AND DATA

All samples and data, except for the CMarZ zooplankton genetics samples, the University of Maine nutrient samples, and the Seabird CTD data, were delivered to the Ecosystem Monitoring Group of the NEFSC, Narragansett, RI, for quality control processing and further analysis. The CMarZ samples were delivered to Nancy Copley at the Woods Hole Oceanographic Institution. The nutrient samples were taken by LeeAnn Conlon to the University of Maine. The CTD data were delivered to the Oceanography Branch of the NEFSC, Woods Hole, MA. Marine mammal observation data and the seabird observation data went to Timothy White, Bureau of Ocean Energy Management.

SCIENTIFIC PERSONNEL

Leg 1

National Marine Fisheries Service, NEFSC, Narragansett, RI

Jerome Prezioso, Chief Scientist
Christopher Taylor

National Marine Fisheries Service, NEFSC, Woods Hole, MA

Tamara Holzwarth-Davis
Maureen Taylor

Stony Brook University

Lis Meghan Henderson

Suffolk County Community College, NY

Maira Gomes

Integrated Statistics

John Loch
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Leg 2

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Table 1. Summary of sample activities conducted at 241 stations at which the *GORDON GUNTER* stopped to lower instruments over the side during Cruise No. GU 1701. Latitude and Longitude are shown in decimal degrees.
Std BON/CTD = 61 cm bongo Standard Protocol, CTD 911 = fixed station,
2B3 D = 333 mesh 20 cm bongo Dave R. samples, 2B1 C = 165 mesh 20 cm bongo CMARZ samples, SAL=salt,
NUT=nutrients, DIC=Dissolved Inorganic Carbon, CHL=chlorophyll samples

CTD CAST	SiteID/ STA#	Date GMT	Longitude (dd)	Latitude (dd)	Bottom Depth	Operation
1	1	16-May-2017	41.2633	-71.4567	39	BON/CTD, 2B1 C
2	2	16-May-2017	41.0767	-71.4183	37	BON/CTD, 2B3 D
3	3	17-May-2017	40.9967	-71.58	45	BON/CTD, 2B1 C
4	4	17-May-2017	40.8267	-71.4083	60	BON/CTD, 2B3 D
5	5	17-May-2017	40.6617	-71.4133	62	BON/CTD, 2B3 D
6	6	17-May-2017	40.5783	-71.4983	69	BON/CTD, 2B3 D
7	7	17-May-2017	40.4967	-71.58	76	BON/CTD, 2B3 D
8	8	17-May-2017	40.245	-71.7483	80	BON/CTD, 2B3 D
9	9	17-May-2017	40.245	-72.065	63	BON/CTD, 2B1 C
10	10	17-May-2017	40.1783	-72.4533	66	BON/CTD, 2B3 D
11	11	17-May-2017	40.355	-73.3817	32	BON/CTD, 2B1 C
12	12	17-May-2017	40.2517	-73.6583	27	BON/CTD, 2B3 D
13	13	17-May-2017	40.17	-73.575	36	BON/CTD, 2B3 D
14	14	17-May-2017	39.9133	-73.2517	58	BON/CTD, 2B3 D
15	15	17-May-2017	39.66	-73.3333	38	BON/CTD, 2B1 C
16	16	18-May-2017	39.83	-73.6683	30	BON/CTD, 2B3 D
17	17	18-May-2017	40.0833	-73.8367	29	BON/CTD, 2B1 C
1	18	18-May-2017	39.72	-73.9933	23	**CTD PROFILE 911+ WATER,SAL,DIC,CHL,NUT**
18	19	18-May-2017	39.5817	-74	25	BON/CTD, 2B3 D
19	20	18-May-2017	39.2467	-74.0833	26	BON/CTD, 2B3 D
20	21	18-May-2017	39.165	-74.1667	21	BON/CTD, 2B3 D
21	22	18-May-2017	38.925	-74.51	23	BON/CTD, 2B3 D
22	23	18-May-2017	38.7483	-74.585	29	BON/CTD, 2B1 C
23	24	18-May-2017	38.5783	-74.6733	23	BON/CTD, 2B3 D
24	25	18-May-2017	38.3317	-74.825	21	BON/CTD, 2B3 D
25	26	18-May-2017	38.2483	-74.5817	40	BON/CTD, 2B1 C
26	27	18-May-2017	38.0817	-74.83	33	BON/CTD, 2B3 D
2	28	18-May-2017	38.0017	-74.9517	22	**CTD PROFILE 911+ WATER,SAL,DIC,CHL,NUT**
3	29	19-May-2017	37.8433	-74.58	54	**CTD PROFILE 911+ WATER,SAL,DIC,CHL,NUT**
27	30	19-May-2017	37.665	-74.755	49	BON/CTD, 2B3 D

28	31	19-May-2017	37.335	-75.3317	28	BON/CTD, 2B3 D
29	32	19-May-2017	37.1117	-75.5117	24	BON/CTD, 2B1 C
30	33	19-May-2017	36.75	-75.5833	22	BON/CTD, 2B3 D
31	34	19-May-2017	36.5833	-75.7517	18	BON/CTD, 2B3 D
32	35	19-May-2017	36.335	-75.7483	17	BON/CTD, 2B3 D
4	36	19-May-2017	36.0017	-75.4733	24	**CTD PROFILE 911+ WATER, DIC,CHL,NUT**
5	37	19-May-2017	36.0083	-75.1717	35	**CTD PROFILE 911+ WATER,SAL,DIC,CHL,NUT**
33	38	20-May-2017	35.415	-75.3283	24	BON/CTD, 2B3 D
6	39	20-May-2017	36.005	-74.775	397	**CTD PROFILE 911+ WATER,DIC,CHL,NUT**
7	40	20-May-2017	35.9983	-74.6683	1243	**CTD PROFILE 911+ WATER,SAL,DIC,CHL,NUT**
34	41	20-May-2017	36.0583	-74.8317	102	BON/CTD, 2B3 D
35	42	20-May-2017	36.3267	-75.0883	39	BON/CTD, 2B3 D
36	43	20-May-2017	36.5	-74.9183	34	BON/CTD, 2B1 C
37	44	20-May-2017	36.665	-74.9167	31	BON/CTD, 2B3 D
38	45	20-May-2017	36.9133	-74.915	40	BON/CTD, 2B3 D
39	46	20-May-2017	37.3317	-74.6667	72	BON/CTD, 2B3 D
8	47	20-May-2017	37.7	-74.2567	115	**CTD PROFILE 911+ WATER,DIC,CHL,NUT**
40	48	20-May-2017	37.745	-74.17	280	BON/CTD, 2B3 D
41	48	21-May-2017	37.75	-74.16	420	CTD PROFILE 19/19+
42	49	21-May-2017	37.9167	-74.1667	104	BON/CTD, 2B3 D
43	50	21-May-2017	38.6617	-73.17	144	BON/CTD, 2B1 C
44	51	21-May-2017	38.9183	-73.085	78	BON/CTD, 2B3 D
45	52	21-May-2017	39.165	-73.4167	50	BON/CTD, 2B3 D
9	53	21-May-2017	39.3583	-73.3917	49	**CTD PROFILE 911+ WATER,SAL,DIC,CHL,NUT**
46	54	21-May-2017	39.25	-73.25	62	BON/CTD, 2B3 D
10	55	21-May-2017	39.0483	-72.7467	225	**CTD PROFILE 911+ WATER,SALDIC,CHLNUT**
11	56	21-May-2017	39.015	-72.585	1200	**CTD PROFILE 911+ WATER,SAL,DIC,CHL,NUT**
47	57	22-May-2017	39.3333	-72.2517	292	BON/CTD, 2B1 C
48	57	22-May-2017	39.3333	-72.2517	284	CTD PROFILE 19/19+
49	58	22-May-2017	39.4967	-72.755	66	BON/CTD, 2B3 D
50	59	22-May-2017	39.915	-72	97	BON/CTD, 2B3 D
51	60	22-May-2017	40.4967	-71.3333	72	BON/CTD, 2B3 D
52	61	22-May-2017	40.4933	-71.0867	79	BON/CTD, 2B3 D
53	62	22-May-2017	40.0933	-70.9983	177	BON/CTD, 2B3 D
12	63	22-May-2017	39.835	-70.6233	884	**CTD PROFILE 911+ WATER,SAL,DIC,CHL,NUT**
13	64	23-May-2017	40.04	-70.6	166	**CTD PROFILE 911+ WATER,SAL,DIC,CHL,NUT**

54	65	23-May-2017	39.995	-69.6733	131	BON/CTD, 2B3 D
55	66	23-May-2017	40.1667	-70.085	110	BON/CTD, 2B3 D
56	67	23-May-2017	40.25	-70.5	111	BON/CTD, 2B3 D
57	68	23-May-2017	40.39	-70.4233	82	BON/CTD, 2B3 D
58	69	23-May-2017	40.4817	-69.535	65	BON/CTD, 2B3 D
59	70	23-May-2017	40.4983	-69.0917	80	BON/CTD, 2B3 D
60	71	23-May-2017	40.1667	-68.6667	163	BON/CTD, 2B1 C
61	72	24-May-2017	40.4233	-67.8533	155	BON/CTD, 2B3 D
14	73	24-May-2017	40.3833	-67.6883	300	**CTD PROFILE 911+ WATER,DIC,CHL,NUT**
15	74	24-May-2017	40.245	-67.6883	1003	**CTD PROFILE 911+ WATER,DIC,CHL,NUT**
62	75	24-May-2017	40.4383	-67.33	316	BON/CTD, 2B3 D
63	75	24-May-2017	40.435	-67.3217	330	CTD PROFILE 19/19+
64	76	24-May-2017	40.735	-67.31	98	BON/CTD, 2B1 C
16	77	24-May-2017	40.9233	-67.7033	67	**CTD PROFILE 911+ WATER,SAL,DIC,CHL,NUT**
65	78	24-May-2017	40.745	-67.835	72	BON/CTD, 2B3 D
66	79	24-May-2017	40.83	-68.42	51	BON/CTD, 2B3 D
67	80	24-May-2017	40.585	-68.425	82	BON/CTD, 2B3 D
68	81	25-May-2017	40.7483	-69.0017	72	BON/CTD, 2B3 D
17	82	25-May-2017	40.8967	-69.1567	68	**CTD PROFILE 911+ WATER,SAL,DIC,CHL,NUT**
69	83	25-May-2017	40.9167	-70.17	28	BON/CTD, 2B3 D
70	84	25-May-2017	40.9983	-70.3383	42	BON/CTD, 2B3 D
18	85	25-May-2017	40.6733	-70.6217	61	**CTD PROFILE 911+ WATER,DIC,CHL,NUT**
71	86	25-May-2017	40.85	-70.8417	53	BON/CTD, 2B3 D
72	87	25-May-2017	40.9967	-70.8333	49	BON/CTD, 2B3 D
73	88	25-May-2017	41.075	-70.6733	42	BON/CTD, 2B3 D
19	89	25-May-2017	41.1017	-70.625	43	**CTD PROFILE 911+ WATER,SAL,DIC,CHL,NUT**
74	90	25-May-2017	41.1967	-70.7833	31	BON/CTD, 2B3 D
75	91	25-May-2017	41.375	-71.2283	27	BON/CTD, 2B3 D
76	92	25-May-2017	41.3333	-71.3333	29	BON/CTD, 2B3 D
77	93	31-May-2017	41.5783	-69.665	38	BON/CTD, 2B3 D
78	94	31-May-2017	41.58	-69.335	131	BON/CTD, 2B3 D
79	95	31-May-2017	41.6667	-69	158	BON/CTD, 2B1 C
80	96	31-May-2017	40.9117	-68.7517	63	BON/CTD, 2B3 D
81	97	31-May-2017	40.9983	-68.58	51	BON/CTD, 2B3 D
82	98	31-May-2017	41.1667	-68.3367	48	BON/CTD, 2B1 C
83	99	31-May-2017	41.1633	-67.5867	53	BON/CTD, 2B3 D
84	100	31-May-2017	41.4167	-67.5817	41	BON/CTD, 2B3 D
20	101	31-May-2017	41.47	-67.6867	40	**CTD PROFILE 911+ WATER,SAL,DIC,CHL,NUT**

85	102	31-May-2017	41.7133	-67.93	32	BON/CTD, 2B1 C
86	103	1-Jun-2017	41.8317	-68.0017	60	BON/CTD, 2B3 D
21	104	1-Jun-2017	42.0233	-67.695	84	**CTD PROFILE 911+ WATER,DIC,CHL,NUT**
87	105	1-Jun-2017	42.1617	-67.335	171	BON/CTD, 2B3 D
88	106	1-Jun-2017	42.03	-67.4083	48	BON/CTD, 2B3 D
89	107	1-Jun-2017	41.935	-67.3317	49	BON/CTD, 2B1
90	108	1-Jun-2017	41.7467	-67.335	49	BON/CTD, 2B3 D
91	109	1-Jun-2017	41.4117	-67.25	48	BON/CTD, 2B3 D
92	110	1-Jun-2017	40.9133	-67.0933	84	BON/CTD, 2B3 D
93	111	1-Jun-2017	41.3533	-66.83	73	BON/CTD, 2B3 D
94	112	1-Jun-2017	41.505	-66.7533	72	BON/CTD, 2B3 D
95	113	1-Jun-2017	41.5017	-66.665	78	BON/CTD, 2B3 D
96	114	1-Jun-2017	41.585	-66.7517	73	BON/CTD, 2B1 C
97	115	1-Jun-2017	41.4133	-66.335	95	BON/CTD, 2B3 D
98	116	2-Jun-2017	41.4117	-66.17	130	BON/CTD, 2B3 D
99	117	2-Jun-2017	41.58	-66.4233	89	BON/CTD, 2B3 D
100	118	2-Jun-2017	41.7483	-66.585	72	BON/CTD, 2B3 D
101	119	2-Jun-2017	41.8317	-66.5067	75	BON/CTD, 2B3 D
102	120	2-Jun-2017	41.9117	-65.7833	175	BON/CTD, 2B3 D
22	121	2-Jun-2017	41.755	-65.4433	1983	**CTD PROFILE 911+ WATER,DIC,CHL,NUT**
103	122	2-Jun-2017	42.225	-65.77	223	BON/CTD, 2B3 D
23	122	2-Jun-2017	42.225	-65.77	221	CTD PROFILE 911+ WATER
104	123	2-Jun-2017	42.3317	-65.675	109	BON/CTD, 2B3 D
105	124	2-Jun-2017	42.4183	-65.67	96	BON/CTD, 2B1 C
106	125	2-Jun-2017	42.2483	-66.495	247	BON/CTD, 2B3 D
107	125	3-Jun-2017	42.2483	-66.495	249	CTD 19/19+ WATER CAST PROFILE
108	126	3-Jun-2017	42.41	-66.9167	362	BON/CTD, 2B3 D
109	126	3-Jun-2017	42.4133	-66.925	362	CTD 19/19+ WATER CAST PROFILE
110	127	3-Jun-2017	42.3717	-67.0433	335	BON/CTD, 2B1 C
24	127	3-Jun-2017	42.375	-67.0517	336	CTD PROFILE 911+ WATER
111	128	3-Jun-2017	42.7417	-67.3333	227	BON/CTD, 2B3 D
112	128	3-Jun-2017	42.7433	-67.35	224	CTD 19/19+ WATER CAST PROFILE
25	129	3-Jun-2017	42.6983	-67.7017	191	CTD PROFILE 911+ WATER
113	130	3-Jun-2017	42.4967	-67.7533	236	BON/CTD, 2B3 D
114	130	3-Jun-2017	42.5	-67.75	236	CTD PROFILE 19/19+

115	131	3-Jun-2017	42.8317	-68.1683	179	BON/CTD, NO SAMPLES
116	131	3-Jun-2017	42.8433	-68.18	175	BON/CTD, 2B3 D
117	132	3-Jun-2017	43.0817	-67.7517	171	BON/CTD, 2B3 D
118	133	3-Jun-2017	43.39	-67.67	245	BON/CTD, 2B1 C
26	133	3-Jun-2017	43.4	-67.685	247	CTD PROFILE 911+ WATER
119	134	4-Jun-2017	43.8317	-67.67	218	BON/CTD, 2B3 D
27	135	4-Jun-2017	43.7733	-68.6683	115	CTD PROFILE 911+ WATER
120	136	4-Jun-2017	43.65	-68.9633	120	BON/CTD, 2B3 D
121	137	4-Jun-2017	43.5767	-68.9967	120	BON/CTD, 2B3 D
122	138	4-Jun-2017	42.91	-68.8333	180	BON/CTD, 2B3 D
123	139	4-Jun-2017	42.8333	-69.0867	180	BON/CTD, 2B3 D
124	140	4-Jun-2017	42.8317	-69.255	139	BON/CTD, 2B3 D
125	141	4-Jun-2017	42.4983	-68.5833	203	BON/CTD, 2B3 D
126	142	5-Jun-2017	42.335	-68.9983	219	BON/CTD, 2B1 C
127	143	5-Jun-2017	42.1617	-69.42	181	BON/CTD, 2B3 D
128	144	5-Jun-2017	42.5	-69.6633	252	BON/CTD, 2B3 D
28	144	5-Jun-2017	42.495	-69.675	258	CTD PROFILE 911+ WATER
129	145	5-Jun-2017	42.3167	-70.2867	33	BON/CTD, 2B3 D
29	145	5-Jun-2017	42.31	-70.2867	35	CTD PROFILE 911+ WATER
30	146	5-Jun-2017	42.3733	-70.46	86	CTD PROFILE 911+ WATER
130	147	5-Jun-2017	42.425	-70.6183	88	BON/CTD, 2B3 D
31	147	5-Jun-2017	42.42	-70.6133	86	CTD PROFILE 911+ WATER
131	148	5-Jun-2017	42.2467	-70.6683	28	BON/CTD, 2B3 D
132	149	6-Jun-2017	41.1633	-71.0017	37	BON/CTD, 2B3 D
133	150	6-Jun-2017	41.2467	-70.59	28	BON/CTD, 2B3 D
134	151	6-Jun-2017	40.915	-70.5833	51	BON/CTD, 2B3 D
135	152	6-Jun-2017	40.8283	-71.0883	57	BON/CTD, 2B3 D
136	153	6-Jun-2017	40.745	-71.3333	61	BON/CTD, 2B3 D
137	154	6-Jun-2017	40.58	-71.7567	68	BON/CTD, 2B3 D
138	154	6-Jun-2017	40.58	-71.7517	68	CTD 19/19+ WATER CAST PROFILE
139	155	6-Jun-2017	40.5817	-72.335	47	BON/CTD, 2B3 D
140	156	6-Jun-2017	40.5817	-72.955	25	BON/CTD, 2B3 D
141	157	6-Jun-2017	40.7467	-72.4083	37	BON/CTD, 2B3 D
142	158	7-Jun-2017	40.9083	-71.9233	35	BON/CTD, 2B3 D

TOTALS:	**Std BON/CTD Casts**	**=**	**188**
	2B3 D Bongo Casts	**=**	**89**
	2B1 C (CMarZ) Bongo Casts	**=**	**22**
	CTD PROFILE 911+ Casts	**=**	**39**
	Nutrient Casts	**=**	**39**
	Chlorophyll Casts	**=**	**37**
	Dissolved Inorganic Carbon Samples (DIC)	**=**	**35**
	Salinity samples	**=**	**20**

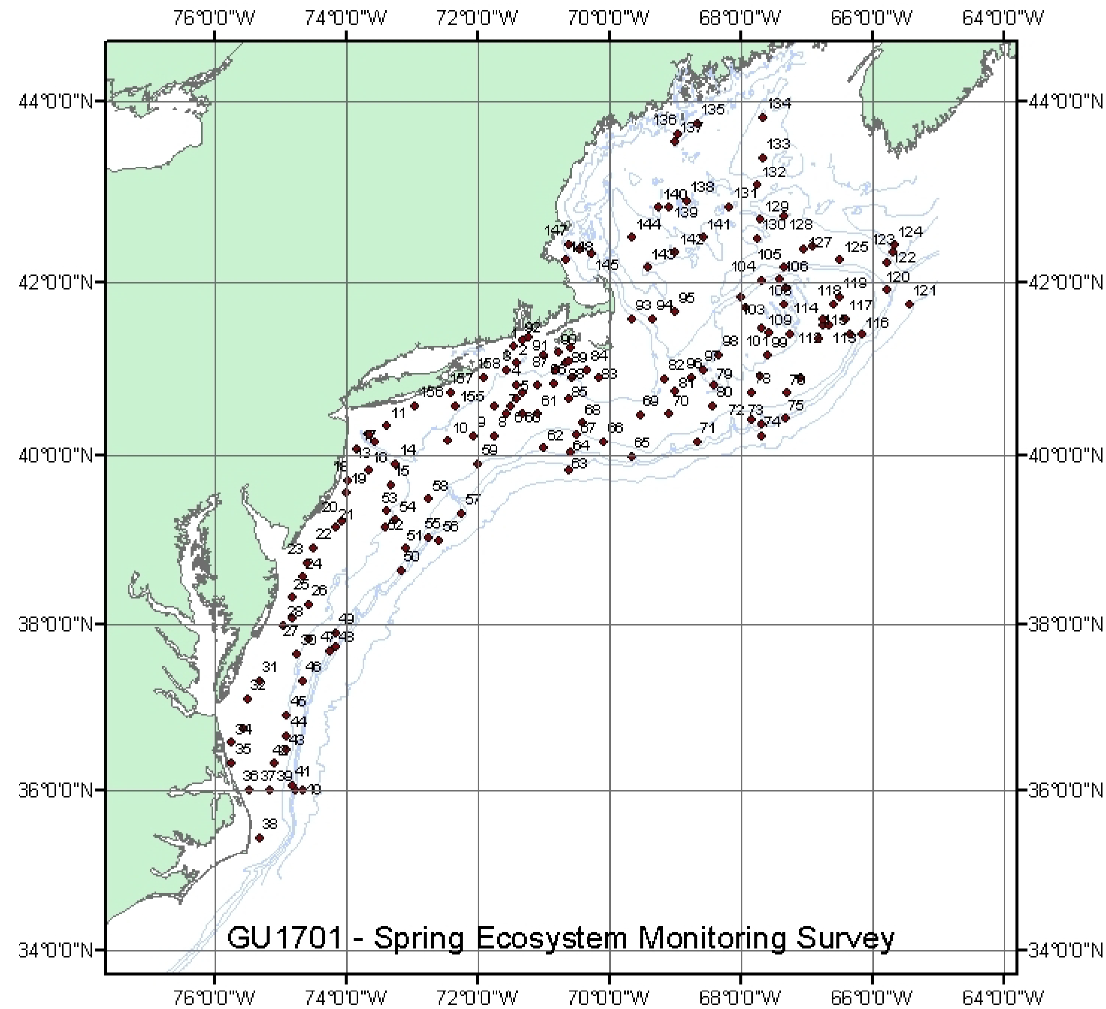

Figure 1. Station locations numbered consecutively for Spring Ecosystem Monitoring Survey GU 1701.

Figure 2. Bongo net array, showing 61 and 20 cm bongo nets being deployed from the port port side of the *FSV Gordon Gunter.*

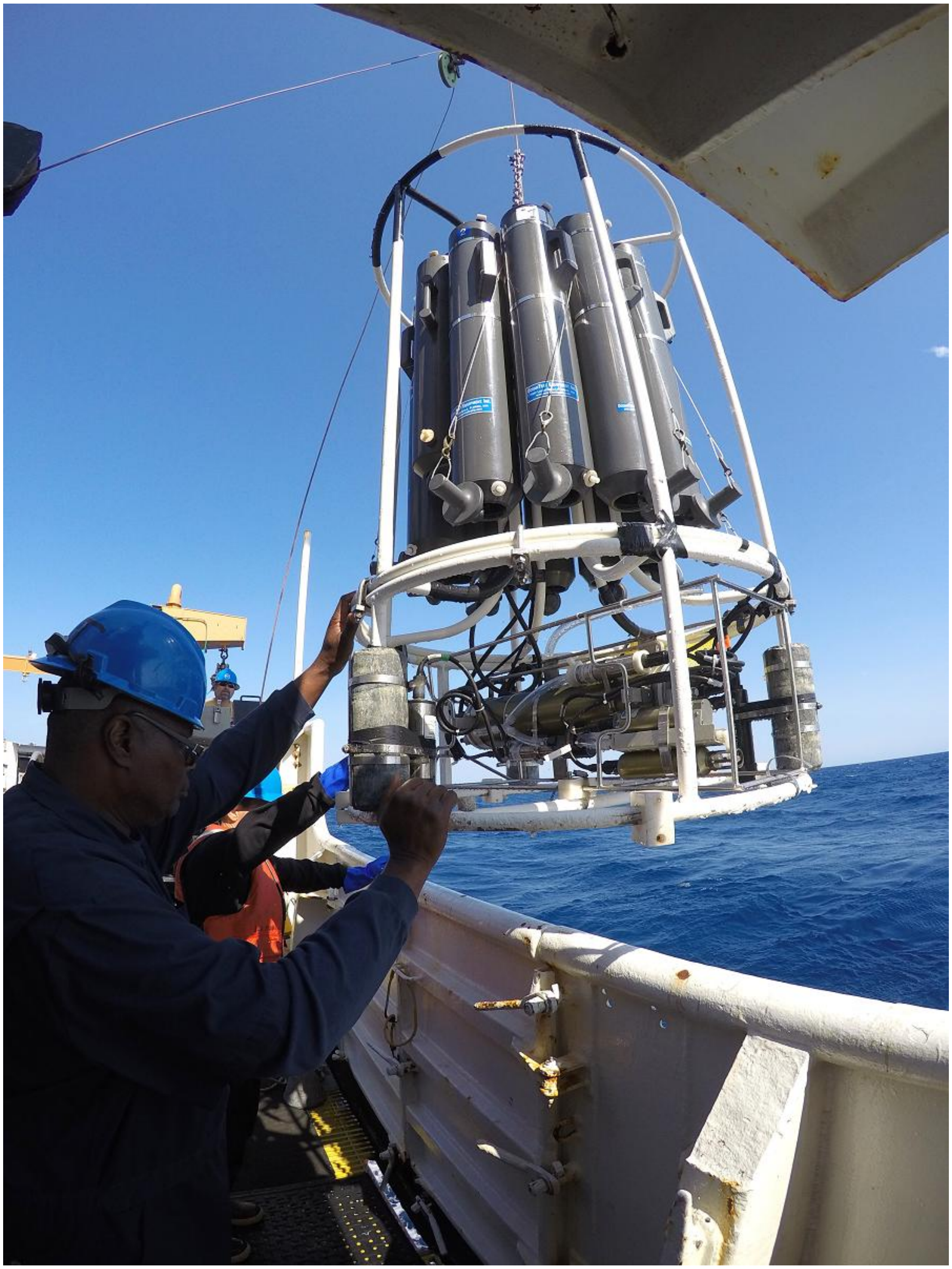

Figure 3. Niskin bottle and CTD 911 rosette being deployed aboard the FSV *Gordon Gunter.*

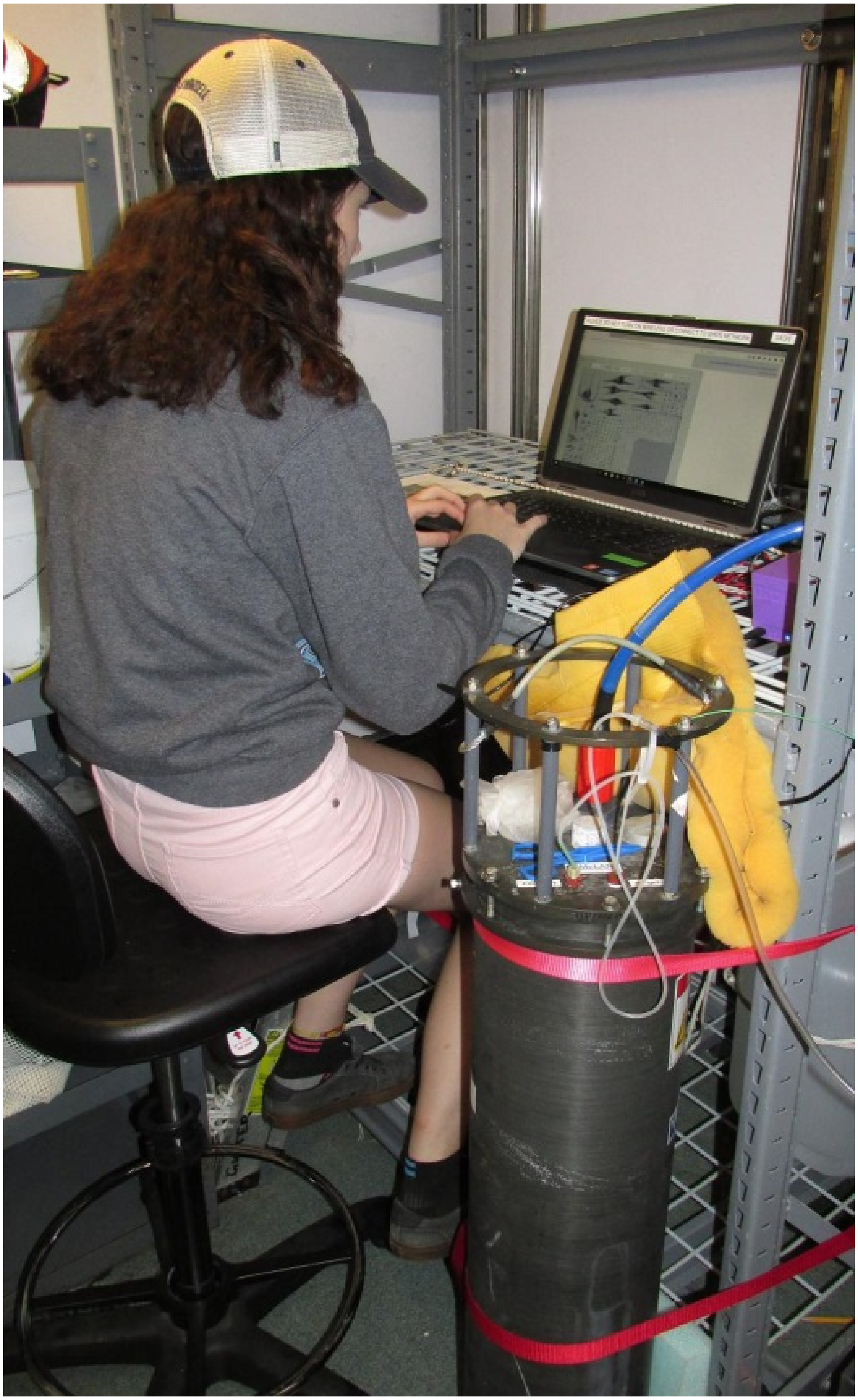

Figure 4. A photograph of the Imaging FlowCytobot and associated laptop from a previous year aboard the Gordon Gunter on cruise GU 1608

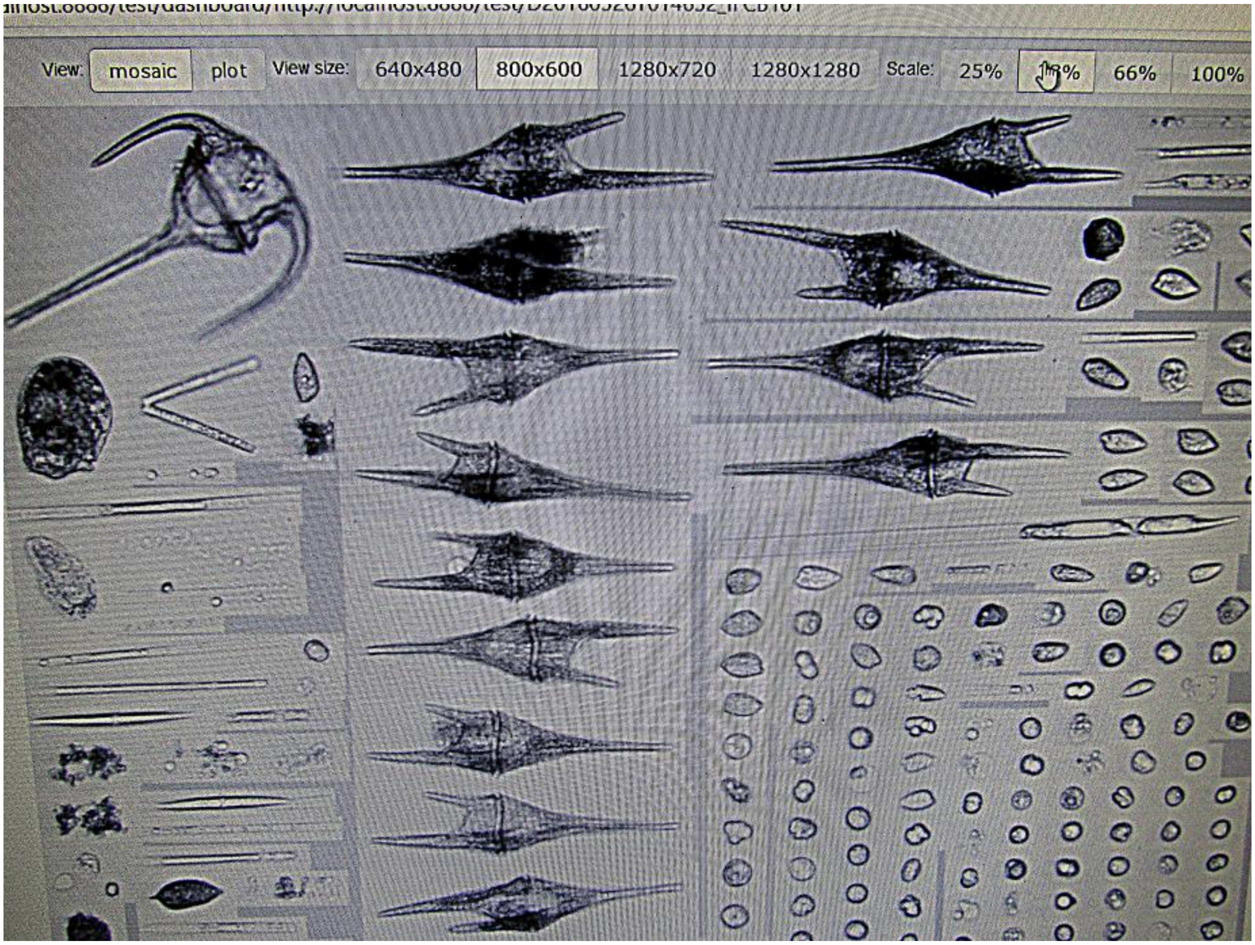

Figure 5. Images of dinoflagellates from the imaging FlowCytobot Unit.

Figure 6. John Loch and Nick Metheny observing seabirds and marine mammals from the flying bridge of the Gordon Gunter during Leg 1 of the GU1701 Ecomon Survey.

Appendix A.

Seabird Survey Report
16-26 May/ 30 May-7 June 2017

Integrated Statistics, Northeast Fisheries Science Center Contractor

16 Sumner St, Woods Hole, MA, 02543

Nicholas Metheny: *procellateryx@gmail.com*

Marine Species Observers:

Leg 1: John Loch and Nicholas Metheny

Leg 2: Nicholas Metheny and Glen Davis

Objective

The primary goal of conducting seabird surveys aboard the Gordon Gunter in May/June 2017 was to gather data on the abundance and distribution of seabirds as a part of longer term monitoring efforts for these far-ranging apex predators. Our secondary objective in conducting theses surveys was to also collect data, when possible, on the abundance and distribution of other marine megafauna including, marine mammals, sea turtles, sharks, and other large pelagic fishes.

Collecting this data in conjunction with other biological data and abiotic factors will help better complete our "picture" of possible changes occurring in the marine ecosystem in the Northwest Atlantic from the Outer Banks to the Bay of Fundy.

Methods

The protocol used for this survey is based on a standardized 300 meter strip transect survey, one that is used by various agencies in North America and Europe (e.g., Anon 2011, Ballance 2011; Tasker 2004).

The survey strip is 300 meters wide, with observers collecting data on all seabirds within that strip, from the bow to 90 degrees to either the port or the starboard side (depending on viewing conditions). Observations can be made in seas up to a Beaufort 7, in light rain, fog, and ship speeds between 8-12 knots (below 8 knots, the data becomes questionable to use for abundance estimates).

Surveys were conducted on the flying bridge (13.7 m) of the Gordon Gunter when possible, however, if limited visibility necessitated the use of the foghorn, then observation were made from the bridge wings (10.97 m) on either side of the wheelhouse.

The software used to collect survey data was, SeeBird version 4.3.7. This program draws GPS coordinates, as well as time from the ship's navigation through a NMEA data feed, so each observation received a Lat/Long, time stamp, and ship's course. However, when observations were made from the bridge wings, a GPS puck was used to replace the ship's navigation feed. The standard data collected for observations included, species, distance, number of individuals, association, behavior, flight direction, flight height, and if possible or applicable, age, sex, and plumage status. Furthermore, a sub-module of SeeBird allows for the collection of data on seabird flocks that fall outside the survey zone. For the purposes of this cruise a flock was deemed an aggregation of seven birds or more. For flocks, Lat/Long, time, bearing, reticle distance, species composition and number, association, behavior, age, and sex were recorded. While SeeBird was not specifically designed to collect data on other marine megafauna, other such observations were recorded anytime an animal was seen, both in or outside of the survey zone.

During surveys, individual observers took two-hour shifts, to prevent observer fatigue. Observers utilized binoculars (10x42 or 8x42) for general scanning purposes within the survey strip, however, if an animal proved elusive a pair of 20x60 Zeiss imaged-stabilized binoculars were used to attain positive identifications. To aide in approximating distance observers used custome made range finders based on height above water and the observers personal body measurement (Heinemann 1981).

Results

Seabird Sightings

Over the course of the two legs of the cruise approximately 500_km^2 were surveyed. A total of 3,856 birds were observed on survey, within an additional 1,269 birds observed over a total of 36 detected flocks; a total of 46 species of birds were identified (Table 1). Average bird densities were 2.29_birds/km^2, ranging from 0 birds/km^2 to 44_birds/km^2. The highest densities of birds occurred in the vicinity of the mid-Atlantic shelf break, east of Cape May, NJ.

Marine Mammal, Sea Turtle, and Large Fishes Sighting

A total of 67 whales were seen, with five species of whale positively identified among them. Of these eight whales were Northern Right Whales (*Eubaleana glacialis*) in a concentrated area that triggered a Dynamic Management Area (DMA) to be created until June 1st. Dolphins numbered 338, with four species of dolphin positively identified; approximately 85% of dolphins sighted were Common Dolphin (*Delphinus delphi*). A total of 12 sea turtles were sighted, composed of Leatherbacks and Loggerheads; with one unidentified sea turtle. For large fishes, Basking sharks and Sunfish each tallied eight individuals each, with an additional one unidentified shark.

Table 1. List of seabirds seen on survey

Common Bird Name	Scientific Name	Number Observed in Zone	Number Observed in Flock*	Total Observed
Atlantic Puffin	*Fratercula arctica*	18		18
Black Guillemote	*Cepphus grylle*	1		1
Dovekie	*Alle alle*	2		2
Common Murre	*Uria aalge*	1		1
Razorbill	*Alca torda*	5		5
Unidentified Alcid		3		3
Common Loon	*Gavia immer*	48	8 (1)	56
Red-throated Loon	*Gavia stellata*	2		2
Common Eider	*Somateria mollissima*	5		5
Audubon Shearwater	*Puffinus lherminieri*	1		1
Cory's Shearwater	*Calonectris borealis*	13		13
Great Shearwater	*Puffinus gravis*	403	209 (12)	612
Sooty Shearwater	*Ardenna grisea*	563	151 (5)	714
Manx Shearwater	*Puffinus puffinus*	17	33 (2)	50
Unidentified Shearwater		4		4
Wilson's Storm Petrel	*Oceanites oceanicus*	999	539 (13)	1538
Leach's Storm Petrel	*Leach's Storm Petrel*	156		156
Unidentified Storm Petrel		7		7
Northern Fulmar	*Fulmarus glacialis*	331	37 (2)	368
Arctic Tern	*Sterna paradisaea*	44		44
Common Tern	*Sterna hirundo*	138	25 (2)	163
Roseate Tern	*Sterna dougallii*	13		13
Royal Tern	*Thalasseus maximus*	9		9
Least Tern	*Sternula antillarum*	11		11
Unidentified Tern		2	111 (5)	113
Great Black-backed Gull	*Larus marinus*	170		170
Herring Gull	*Larus argentatus*	268	139 (4)	407
Laughing Gull	*Leucophaeus atricilla*	29	1 (1)	30
Lesser Blaack-backed Gull	*Larus fuscus*	2		2
Black-legged Kittiwake	*Rissa tridactyla*	2		2
Sabine's Gull	*Xema sabini*	1		1
Unidentified Large Gull		1		1
Parasitic Jaeger	*Stercorarius parasiticus*	3		3
Pomarine Jaeger	*Stercorarius pomarinus*	3	2 (1)	5
Unidentified Jaeger		1	3 (1)	4
South Polar Skua	*Stercorarius maccormicki*	12		12
Unidentified Skua		3		3
Double Crested Comorant	*Phalacrocorax auritus*	24	38 (1)	62
Northern Gannet	*Morus bassanus*	241		241
Red Phalarope	*Phalaropus fulicarius*	208		208

Red-necked Phalarope	*Phalaropus lobatus*	39		39
Unidentified Phalarope		2		2
Ruddy Turnstone	*Arenaria interpres*	4		4
Sanderling	*Calidris alba*	5		5
Semipalmated Sandpiper	*Calidris pusilla*	1		1
Unidentified Sandpiper		24		24
American Oystercatcher	*Haematopus palliatus*	3		3
Unidentified Shorebird		3		3
Great Egret	*Ardea alba*	1		1
Barn Swallow	*Hirundo rustica*	3		3
Chimney Swift	*Chaetura pelagica*	1		1
Cedar Waxwing	*Bombycilla cedrorum*	1		1
Common Yellowthroat	*Geothlypis trichas*	1		1
Northern Parula	*Setophaga americana*	1		1
Purple Martin	*Progne subis*	2		2
Osprey	*Pandion haliaetus*	1		1

Table 2. List of other marine mammals, sea turtles, and fishes seen on survey.

Common Name	**Scienctific Name**	**Number Observed**
Fin Whale	*Balaenoptera physalus*	14
Sei Whale	*Balaenoptera borealis*	2
Fin/Sei Whale		5
Humpback Whale	*Megaptera novaeangliae*	13
Minke Whale	*Balaenoptera acutorostrata*	1
Northern Right Whale	*Eubalaena glacialis*	8
Unidentified Whale		24
Risso's Dolphin	*Grampus griseus*	16
Common Dolphin	*Delphinus delphis*	288
Atlantic Spotted Dolphin	*Stenella frontalis*	14
Bottlenose Dolphin	*Tursiops truncatus*	13
Unidentified Dolphin		7
Leatherback Sea Turtle	*Dermochelys coriacea*	1
Loggerhead Sea Turtle	*Caretta caretta*	10
Unidentified Sea Turtle		1
Ocean Sunfish	*Mola mola*	8
Basking Shark	*Cetorhinus maximus*	8
Unidentified Shark		2

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