11 February 2022

CRUISE RESULTS
NOAA Research Vessel ***GORDON GUNTER***
Cruise No. GU 21-02
Spring Northeast Ecosystem Monitoring Survey

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CRUISE PERIOD AND AREA

The NOAA research vessel *GORDON GUNTER* sampled a total of 106 stations on the Spring Ecosystem Monitoring Survey (EcoMon). The vessel sailed from Pier 2 at the Naval Station in Newport RI at 10 AM on 14 May and returned on 27 May, having sampled In the mid-Atlantic Bight area as far south as Delaware Bay, the entire Southern New England area, only one third of Georges Bank due to harsh sea conditions there, and much of the Gulf of Maine (GOM), although not the northernmost stations due to lack of time. However this cruise did achieve better GOM coverage than several past Ecomon cruises.

OBJECTIVES

The principal objective of this 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 this cruise were to:

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

2) complete CTD and bongo operations at stations throughout area.

(3) collect acoustic data using the ES60 and 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, ES-60 and EK-60 Scientific Sounders, ADCP and an Imaging FlowCytoBot unit.

(7) gather data on trends in ocean acidification and nutrient levels by collecting seawater samples at three depths (surface, midwater and bottom) with a rosette water sampler at predetermined fixed locations for the NOAA Ocean Acidification Program.

(8) collect pteropods for shell thickness analysis by Amy Maas at the Bermuda Institute of Ocean Sciences (BIOS).

(9) have an outreach component with students from the Banner Academy in Tempe, AZ where Styrofoam cups they decorated are shrunk at depth with our sampling gear to illustrate the effects of water pressure.

METHODS

The survey originally consisted of **155** stations at which the vessel planned to stop and lower instruments over the port side of the vessel from an A-frame and two conductive-wire winches. Due to time constraints imposed by having only 14 days for the survey and a vessel with a maximum speed of 10 knots, only **106** stations were able to be sampled. Prior to sailing a decision was made to not visit the southern-most part of the Middle Atlantic Bight area, to allow more time to cover the Gulf of Maine, an area which had sparse coverage on past Ecomon surveys. (Figure 1).

Plankton and hydrographic sampling was conducted with double oblique tows using the 61-cm bongo sampler and a Seabird CTD. The tows 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 the number of revolutions during the tow. One of these nets, designated the "I" net for ichthyoplankton analysis, will have fish larvae and eggs removed, enumerated and identified from the entire sample. The other net, designated the "Z" net for zooplankton, will be split down to an aliquot of approximated 300 to 500 organisms, which will be enumerated and identified. At 14 randomly designated Census of Marine Zooplankton (CMarZ) stations, a 20-cm diameter PVC bongo frame fitted with paired 165-micron nylon mesh nets was added to the towing wire one half meter above the Seabird CTD and towed together with the large aluminum bongo frame (Figure 2). No flowmeters were deployed with the 20-cm bongos. At all other plankton stations, 20 cm 335 micron mesh nets were deployed above the standard CTD/61-cm Bongo sampler in order to collect larval fish and egg samples for NOAA researcher David Richardson. These samples were preserved for genetics and otolith analysis to be carried out at the Narragansett NEFSC Lab. A 45-kilogram 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 plankton sampling gear was deployed off the port side of the vessel at the side-sampling station using an A-frame. and a conducting cable winch. Tow depth was monitored in real time with a Seabird CTD profiler. The Seabird CTD profiler provided simultaneous depth, temperature, and salinity during each plankton tow. A Power Data Interface Module (PDIM) signal booster was used to facilitate data transfer at high

baud rates over more than 1600 meters of conducting wire spooled onto the 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 (Figure 3).

Pteropods were picked from the 61 centimeter "I" net, with up to 10 of them being rinsed with deionized water, placed in glass vials and put into a 55 degree Celsius drying oven (Figure 4). These samples will be sent to the Bermuda Institute for Oceanographic Sciences (BIOS), for shoreside analysis of their shell composition as an indicator of ocean acidity.

A Seabird 911+ CTD was deployed on a rosette frame with a carousel water sampling system (SBE32) and 12 10-liter Niskin bottles at all fixed stations. The package was deployed from the port side-sampling station, with the same A-frame used for bongo net tows but a second conducting cable winch (Figure 5). This SBE9/11+ CTD and rosette 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 and carbonate chemistry. Analysis for chlorophyll-a levels from these water samples was conducted onboard the vessel in the chemistry lab, using a Turner Designs 10-AU fluorometer and a filtration setup. Water samples for the chlorophyll-a analysis were drawn from the surface, chlorophyll-max layer and from one depth below the chlorophyll-max layer. These were taken as a check for the submersible fluorometer mounted on the rosette. Care was taken to draw a nutrient sample from the same bottle that each Dissolved Inorganic Carbon (DIC) sample had been drawn from, (surface, mid-water and bottom) to ensure the best possible correlation between the DIC and nutrient parameters. In addition to nutrient samples taken from those depths a fourth nutrient sample was collected from the chlorophyll max layer.

One other objective of the water casts made with the carousel water sampling system was to carry Styrofoam cups in a mesh bag strapped to the rosette frame. These cups, colorfully hand decorated by elementary and middle school students from the Banner Academy in Tempe,Arizona, were part of an outreach project to involve school students in our oceanography fieldwork (Figure 6). The cups were returned to them after the cruise in a much reduced size, demonstrating the effects of water pressure at depth.

Near-surface (~3 meters depth) salinity, temperature and pCO2 levels were monitored continuously along the entire cruise track using a thermosalinograph, and a partial pressure of carbon dioxide (pCO2) system hooked up to the ship's scientific flow-through seawater system. The Scientific Computer System (SCS) recorded the output from the thermosalinograph at 10-second intervals. Records were given a time-date stamp by the GPS unit. Data from the pCO2 system were logged independently on dedicated computers hooked up to that sensor. The dedicated, independent computer for pCO2 did receive correlated data from the SCS system onboard. In addition, an ImagingFlowCytobot unit was plumbed into the flow-through seawater system in the CTD lab**.** This device captured images of diatoms, dinoflagellates and marine ciliates on an independent computer provided by the Woods Hole Oceanographic Institution (WHOI)

(Figure 7). This system was monitored daily by Elisabeth Broughton who oversaw the operation of the ImagingFlowCytobot during the cruise.

Marine mammal and seabird observations and photography were conducted from the bridge and flying bridge of the *GORDON GUNTER* by seabird and marine mammal observers Alison Black and Douglas Gochfeld (Figure 8).

RESULTS

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 Newport, RI on Friday 14 May at 1000 hours EDT. Sampling started south of Martha's Vineyard, with the vessel sailing south and offshore through calm Southern New England waters that allowed work on offshore stations. Sampling was carried out as far south as Delaware Bay, which was reached two days later on 16 May. At that point the vessel moved inshore and started sampling inshore stations on its way back north, reaching the Southern New England area a couple of days later on 18 May. Extended good weather allowed for this rapid progress on the southern portion of the cruise. Pteropods were found at many of these southern stations, and were rinsed and dried in the drying oven for later shipment to Amy Maas at BIOS.

Georges Bank was the next area to be sampled after Southern New England. The shoal area of Georges had large numbers of 10 cm sand lance, which were not only caught in our plankton nets, but also sucked up into the diesel engine cooling water intakes, clogging the strainers in the engine room (Figure 9). A change in the weather cut our sampling in this area short after only one third of the stations were sampled. This necessitated a turn into the Gulf of Maine (GOM) where the remainder of the cruise time was spent. A total of 106 stations were sampled for the entire cruise. Although weather and time did not allow for sampling the entire GOM area, the vessel was able to reach most of it, plus several supplemental sampling sites in the western GOM to augment the capture of mackerel larvae and eggs. After reaching the 106th station 60 nautical miles east of Cape Cod, the *GORDON GUNTER* returned to Newport on the morning of Thursday 27 May, marking the end of the 2021 Spring Ecosystem Monitoring Survey. This was the first of our Ecomon surveys to be completed since the cessation of at-sea coverage due to the Covid-19 pandemic. Many precautions were taken to prevent the spread of the virus onboard.. All personnel were shown to have a negative covid test prior to embarking. Masks were worn at all times while on board, both inside the vessel and out on deck. Social distancing was maintained as best as possible within the limited confines of the vessel. Railings in passageways were sprayed with disinfectant and wiped down daily (Figure 10). An isolation room was set up in the event of anyone exhibiting Covid symptoms. Fortunately, no one developed any Covid symptoms, and the cruise was successfully completed without incident.

DISPOSITION OF SAMPLES AND DATA

All samples and data, except for the CMarZ zooplankton genetics samples, the University of Rhode Island nutrient samples, and the Seabird CTD data, were delivered to the NEFSC Ecosystem Monitoring Group in Narragansett, RI for quality control processing and further analysis. The CMarZ samples and associated data were delivered to Peter Wiebe at the Woods

Hole Oceanographic Institution. The nutrient samples were sent to Dawn Outram at the Graduate School of Oceanography at URI The ImagingFlowCytobot unit and the images and data it collected were delivered to Emily Peacock at WHOI. The CTD data were delivered to NEFSC Oceans and Climate Branch staff in Woods Hole, MA. Marine mammal observation data and the seabird observation data went to Tim White at the Bureau of Ocean Energy Management (BOEM) in Reedsville, MD and Beth Josephson, NEFSC Protected Species Branch, Woods Hole, MA.

SCIENTIFIC PERSONNEL

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Table 1. Summary of sample activities conducted at 106 stations at which the *GORDON GUNTER* stopped to lower instruments over the side during Cruise No. GU 2102. Latitude and Longitude are shown in degrees and minutes. BON/CTD = 61 cm bongo Standard Protocol, CTD 911+WATER= water cast at a fixed station, SAL=salinity sample, 2B3 D = 333 mesh 20 cm bongo Dave R. samples, NUT = Nutrients, CHL = Chlorophyll 2B1 C = 165 mesh 20 cm bongo CMARZ samples, DIC = Dissolved Inorganic Carbon, CTD 19/19+ WATER = Seabird 19+ Profiler+water sample, PTE = Pteropod sample LTER = Long Term Eco Research Station

S	STA	Date (GMT)	Latitude	Longitude	Btm depth (M)	Operation
1	1	5/14/2021	4106.2	7036.8	43	BON 6B1-6B3/CTD, 2B3 D, LTER
1	1	5/14/2021	4106.4	7037.4	44	CTD PROFILE 911+ WATER, CHL, NUT, DIC
2	2	5/15/2021	4050.2	7049.4	58	BON/CTD, 2B1 C
3	3	5/15/2021	4034.9	7054.2	73	BON/CTD, 2B3 D
4	4	5/15/2021	4029.7	7049.8	79	BON/CTD, 2B3 D, PTE 1
5	5	5/15/2021	4009.5	7105	142	BON/CTD, 2B3 D
6	6	5/15/2021	4014.3	7114.4	98	BON/CTD, 2B3 D, PTE 2
7	7	5/15/2021	4004.9	7214.9	77	BON/CTD, 2B1 C, PTE 3
8	8	5/15/2021	3945.4	7200.3	150	BON/CTD, 2B3 D
9	9	5/15/2021	3939.8	7220.1	115	BON/CTD, 2B3 D, PTE 4
10	10	5/15/2021	3949.3	7230	66	BON/CTD, 2B3 D, PTE 5
11	11	5/15/2021	3924.9	7250.1	70	BON/CTD, 2B3 D, PTE 6
2	12	5/16/2021	3900.9	7234.8	969	CTD PROFILE 911+ WATER, CHL, SAL, NUT, DIC
3	13	5/16/2021	3903.4	7243.6	288	CTD PROFILE 911+ WATER, CHL, SAL, NUT, DIC
12	14	5/16/2021	3919.9	7309.7	65	BON/CTD 2B3 D, PTE 7
4	15	5/16/2021	3921.4	7322.8	49	CTD PROFILE 911+ WATER, CHL, SAL, NUT, DIC
13	16	5/16/2021	3854.9	7315	73	BON/CTD, 2B3 D, PTE 8
14	17	5/16/2021	3854.7	7344.9	49	BON/CTD, 2B1 C
15	18	5/16/2021	3850.5	7349.7	47	BON/CTD, 2B3 D, PTE 9
16	19	5/16/2021	3840.4	7340.4	62	BON/CTD, 2B3 D, PTE 10
17	20	5/16/2021	3831.5	7410.1	52	BON/CTD, 2B3 D
18	21	5/17/2021	3844.8	7450.4	17	BON/CTD, 2B3 D
19	22	5/17/2021	3845	7434.9	29	BON/CTD, 2B1 C
20	23	5/17/2021	3849.9	7425.3	30	BON/CTD, 2B3 D
21	24	5/17/2021	3913.9	7359.6	29	BON/CTD, 2B3 D
22	25	5/17/2021	3924.5	7350.5	30	BON/CTD, 2B3 D
23	26	5/17/2021	3929.5	7413.9	15	BON/CTD, 2B1 C
24	27	5/17/2021	3939.9	7405.2	19	BON/CTD, 2B3 D
5	28	5/17/2021	3941.6	7400.1	22	CTD PROFILE 911+ WATER, CHL, SAL, NUT, DIC
25	29	5/17/2021	3944.8	7325.8	35	BON/CTD, 2B3 D

CTDcast	STA	Date (GMT)	Latitude	Longitude	Btm depth(M)	Operation
26	30	5/17/2021	4009.9	7340.1	54	BON/CTD, 2B1 C
27	31	5/17/2021	4019.8	7330.3	28	BON/CTD, 2B3 D
28	32	5/18/2021	4034.8	7324.2	15	BON/CTD, 2B3 D
29	33	5/18/2021	4024.9	7225.2	52	BON/CTD, 2B3 D
30	34	5/18/2021	4040	7200.8	51	BON/CTD, 2B3 D
31	35	5/18/2021	4039.9	7209.4	49	BON/CTD, 2B1 C
32	36	5/18/2021	4049.2	7219.4	30	BON/CTD, 2B3 D
33	37	5/18/2021	4054.4	7110.7	54	BON/CTD, 2B3 D, PTE 11
34	38	5/18/2021	4040	7037.2	62	6B3&6B1 BON/CTD, 2B3 D, LTER
6	38	5/18/2021	4040.2	7037.4	62	CTD PROFILE 911+ WATER, CHL, SAL, NUT, DIC
35	39	5/19/2021	4019.4	7039.7	103	BON/CTD, 2B3 D, PTE 12
36	40	5/19/2021	4001.8	7035.9	187	6B3&6B1 BON/CTD, 2B3 D, PTE 13 LTER
7	40	5/19/2021	4001.9	7035.9	180	CTD PROFILE 911+ WATER, CHL, SAL, NUT, DIC
37	41	5/19/2021	3949.9	7036.2	917	6B3&6B1 BON/CTD, 2B3 D-28, 2B3 D, PTE 14, LTER
8	41	5/19/2021	3950	7037	883	CTD PROFILE 911+ WATER, CHL, SAL, NUT, DIC
38	42	5/19/2021	4004.9	7009.3	170	BON/CTD, 2B1 C, LTER
39	43	5/19/2021	4009.5	6955.1	104	BON/CTD, 2B3 D, PTE 15
40	44	5/19/2021	4005.1	6945.1	110	BON/CTD, 2B3 D
41	45	5/19/2021	4019.9	6954.9	84	BON/CTD, 2B3 D
42	46	5/19/2021	4024.5	6945.9	76	BON/CTD, 2B3 D
43	47	5/19/2021	4020.2	6935.9	74	BON/CTD, 2B3 D
44	48	5/19/2021	4044.6	6955.4	35	BON/CTD, 2B3 D
45	49	5/19/2021	4044.5	7000.1	37	BON/CTD, 2B3 D
46	50	5/19/2021	4054.9	7005.4	25	BON/CTD, 2B3 D
9	51	5/20/2021	4054	6909.5	69	CTD PROFILE 911+ WATER, CHL, SAL, NUT, DIC
47	52	5/20/2021	4059.6	6914.8	63	BON/CTD, 2B3 D, PTE 16
48	53	5/20/2021	4104.6	6905.7	88	BON/CTD, 2B3 D, PTE 17
49	54	5/20/2021	4035.2	6850.1	69	BON/CTD, 2B1 C
50	54	5/20/2021	4035	6849.9	67	BON/CTD
51	55	5/20/2021	4020.1	6816	150	BON/CTD, 2B3 D
52	56	5/20/2021	4014.9	6742	968	BON/CTD, 2B3 D
10	56	5/20/2021	4014.9	6740.8	1500	CTD PROFILE 911+ WATER, CHL, SAL, NUT, DIC
53	57	5/20/2021	4023	6742.1	188	BON/CTD, 2B3 D
11	57	5/20/2021	4022.6	6741.1	353	CTD PROFILE 911+ WATER, CHL, SAL, NUT, DIC
12	58	5/21/2021	4055.4	6742.9	67	CTD PROFILE 911+ WATER, CHL, SAL, NUT, DIC
54	59	5/21/2021	4059.8	6750.2	51	BON/CTD, 2B3 D
55	60	5/21/2021	4104.9	6759.8	52	BON/CTD, 2B3 D

CTDcast	STA	Date (GMT)	Latitude	Longitude	Btm depth(M)	Operation
56	61	5/21/2021	4128.5	6741.1	39	BON/CTD, 2B3 D
13	61	5/21/2021	4128.4	6741.3	45	CTD PROFILE 911+ WATER, CHL, SAL, NUT, DIC
57	62	5/21/2021	4154.9	6735.3	36	BON/CTD, 2B1 C, PTE 18
58	63	5/21/2021	4159.9	6741.2	57	BON/CTD, 2B3 D, PTE 19
14	63	5/21/2021	4200.2	6741.5	60	CTD PROFILE 911+ WATER, CHL, SAL, NUT, DIC
59	64	5/21/2021	4224.9	6720.3	344	BON/CTD, 2B3 D
60	64	5/21/2021	4225.3	6721.7	340	CTD 19/19+ WATER CAST PROFILE
62	65	5/21/2021	4223	6702.9	341	BON/CTD, 2B3 D
15	65	5/21/2021	4221.9	6702.9	342	CTD PROFILE 911+ WATER, CHL, SAL, NUT, DIC
63	66	5/22/2021	4210	6640.5	154	BON/CTD, 2B3 D
64	66	5/22/2021	4209.2	6639.3	111	BON/CTD, 2B3 D
65	67	5/22/2021	4213.3	6545.3	232	BON/CTD, 2B3 D
16	67	5/22/2021	4213.9	6546.4	231	CTD PROFILE 911+ WATER, CHL, SAL, NUT, DIC
66	68	5/22/2021	4224.4	6540.4	98	BON/CTD, 2B3 D
67	69	5/22/2021	4229.4	6559.7	182	BON/CTD, 2B1 C, PTE 20
68	70	5/22/2021	4239.8	6625.1	141	BON/CTD, 2B3 D
17	71	5/22/2021	4301.1	6620.3	141	CTD PROFILE 911+ WATER, CHL, SAL, NUT, DIC
69	72	5/22/2021	4259.9	6630.1	118	BON/CTD, 2B3 D
70	73	5/22/2021	4255.2	6649.6	180	BON/CTD, 2B3 D
71	74	5/23/2021	4310	6717.6	199	BON/CTD, 2B3 D
72	75	5/23/2021	4323.6	6740.7	249	BON/CTD, 2B3 D, PTE 21
18	75	5/23/2021	4323.7	6742	254	CTD PROFILE 911+ WATER, CHL, SAL, NUT, DIC
73	76	5/23/2021	4310.3	6804.5	194	BON/CTD, 2B3 D
74	77	5/23/2021	4309.9	6814.5	186	BON/CTD, 2B3 D, PTE 22
75	78	07:18.0	4319.8	6825.2	190	BON/CTD, 2B3 D
76	79	5/23/2021	4349.4	6809.5	192	BON/CTD, 2B1 C
77	80	5/23/2021	4346.2	6840.6	115	BON/CTD, 2B3 D
19	80	5/23/2021	4346.3	6840	108	CTD PROFILE 911+ WATER, CHL, SAL, NUT, DIC
78	81	5/23/2021	4341.2	6857	74	BON/CTD, 2B3 D
79	82	5/24/2021	4335.6	6919.1	134	BON/CTD, 2B3 D
80	83	5/24/2021	4330	6940	119	BON/CTD, 2B3 D
81	84	5/24/2021	4329.8	7004.9	49	BON/CTD, 2B3 D, PTE 23
82	85	5/24/2021	4318.8	6948.5	178	BON/CTD, 2B3 D
83	86	5/24/2021	4310	6936.4	95	BON/CTD, 2B1 C
84	87	5/24/2021	4259.4	6919.6	189	BON/CTD, 2B3 D, PTE 24
85	88	5/24/2021	4255.2	6932.6	170	BON/CTD, 2B3 D

CTDcast	STA	Date (GMT)	Latitude	Longitude	Btm depth(M)	Operation
86	89	5/24/2021	4250.7	6944.7	225	BON/CTD, 2B3 D
87	90	5/24/2021	4245.1	6959.9	183	BON/CTD, 2B3 D
88	91	5/24/2021	4234.6	6956.3	161	BON/CTD, 2B1 C
89	92	5/24/2021	4230.1	6940.4	264	BON/CTD, 2B3 D, PTE 25
20	92	5/24/2021	4229.6	6940.5	265	CTD PROFILE 911+ WATER, CHL, SAL, NUT, DIC
90	93	5/24/2021	4225.1	6954.7	192	BON/CTD, 2B3 D
91	94	5/25/2021	4237.1	7004.9	121	BON/CTD, 2B3 D
92	95	5/25/2021	4248.7	7014.4	65	BON/CTD, 2B3 D
93	96	5/25/2021	4300	7024.6	109	BON/CTD, 2B3 D, PTE 26
21	96	5/25/2021	4300.1	7024.9	107	CTD PROFILE 911+ WATER, CHL, SAL, NUT, DIC
94	97	5/25/2021	4252.9	7031.1	96	BON/CTD, 2B3 D
95	98	5/25/2021	4244.7	7037.4	66	BON/CTD, 2B3 D, PTE 30
96	99	5/25/2021	4240	7029.9	87	BON/CTD, 2B3 D
22	100	5/25/2021	4225.1	7037.2	86	CTD PROFILE 911+ WATER, CHL, SAL, NUT, DIC
97	101	5/25/2021	4221.8	7028.8	84	BON/CTD, 2B3 D, PTE 31
23	101	5/25/2021	4221.9	7029.6	93	CTD PROFILE 911+ WATER, CHL, SAL, NUT, DIC
98	102	5/25/2021	4219.1	7016.5	37	BON/CTD, 2B3 D, PTE 32
24	102	5/25/2021	4219.1	7016.7	37	CTD PROFILE 911+ WATER, CHL, SAL, NUT, DIC
99	103	5/25/2021	4219.8	6900.7	221	BON/CTD, 2B3 D
25	103	5/25/2021	4220.2	6901.9	222	CTD PROFILE 911+ WATER, SAL
100	104	5/26/2021	4219.9	6844.9	177	BON/CTD, 2B3 D
101	105	5/26/2021	4210.1	6835.1	189	BON/CTD, 2B3 D, PTE 33
102	106	5/26/2021	4129.7	6839.6	121	BON/CTD, 2B3 D

TOTALS:	**Std BON/CTD Casts**	**=**	**102**
	2B3 D Bongo Casts	**=**	**74**
	2B1 C (CMarZ) Bongo Casts	**=**	**14**
	CTD PROFILE 911 Casts	**=**	**25**
	Nutrient Casts	**=**	**25**
	Chlorophyll Casts	**=**	**25**
	Dissolved Inorganic Carbon casts (DIC)	**=**	**25**
	Salinity Sample Casts	**=**	**25**
	Pteropod samples	**=**	**33**

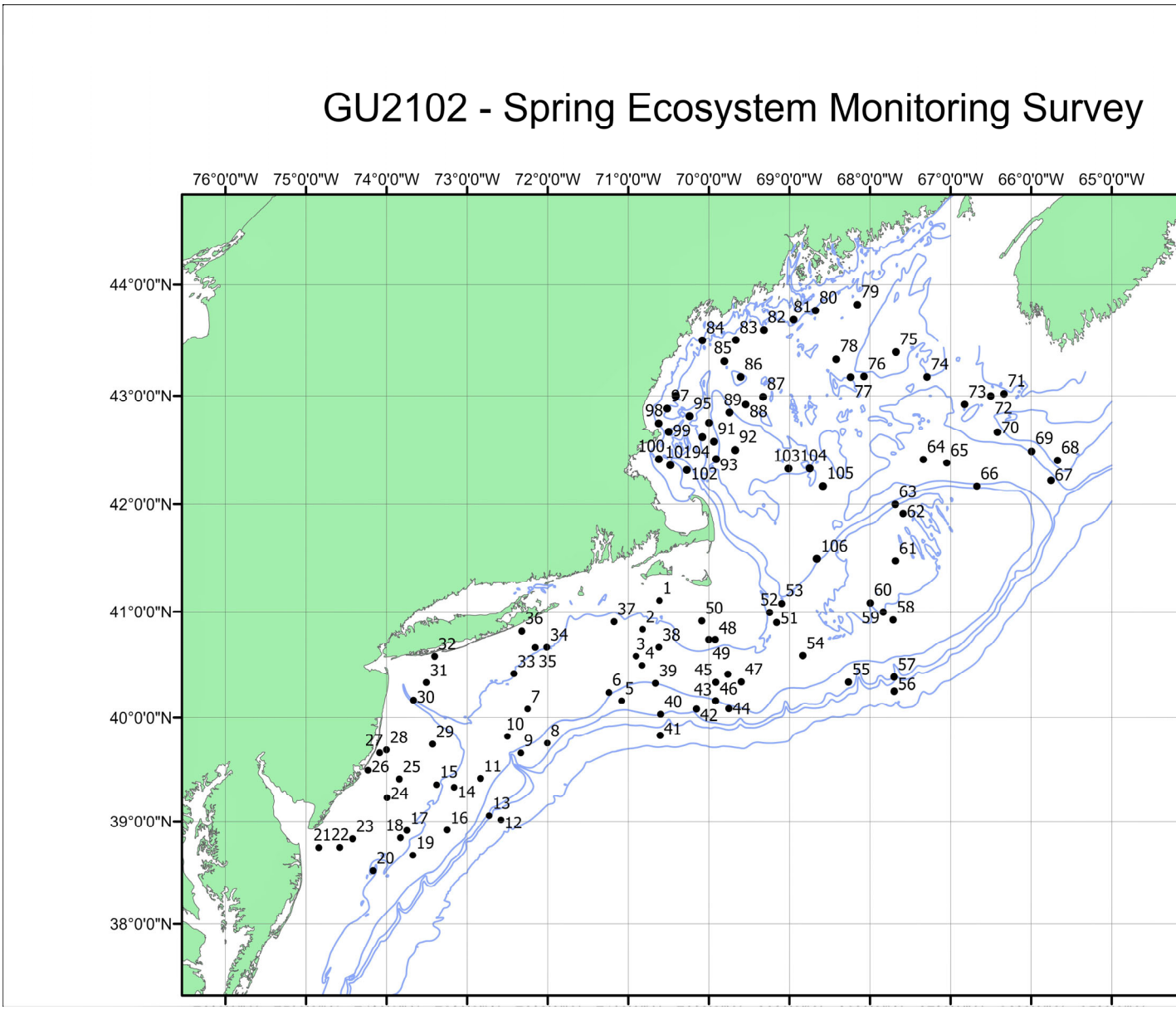

Figure 1. Station locations numbered consecutively for Spring Ecosystem Monitoring Survey GU 2102, 14 - 27 May 2102.

Figure 2. Bongo net array showing 61 and 20 cm bongo nets being deployed from the side sampling station on the Gordon Gunter.

Figure 3. Paula Fratantoni changing the ethanol on a 20 cm. CMarZ bongo sample.

Figure 4. Tamara Holzwarth-Davis picking out pteropods from the 6B3 I plankton net sample.

Figure 5. Niskin bottle rosette on the deck of the port side sampling Station aboard the FSV Gordon Gunter.

Figure 6. Styrofoam cups decorated by students from the Banner Academy in Tempe, Arizona. After repeated submersions with the Niskin bottle water sampling array they have shrunk to a fraction of their former size, as seen from the 12 inch ruler below them.

Figure 7. Betsy Broughton monitoring data from the Imaging FlowCytobot unit seen as the Black vertical cylinder in foreground.

Figure 8. Seabird and marine mammal observer Alison Black on the flying bridge of the Gordon Gunter.

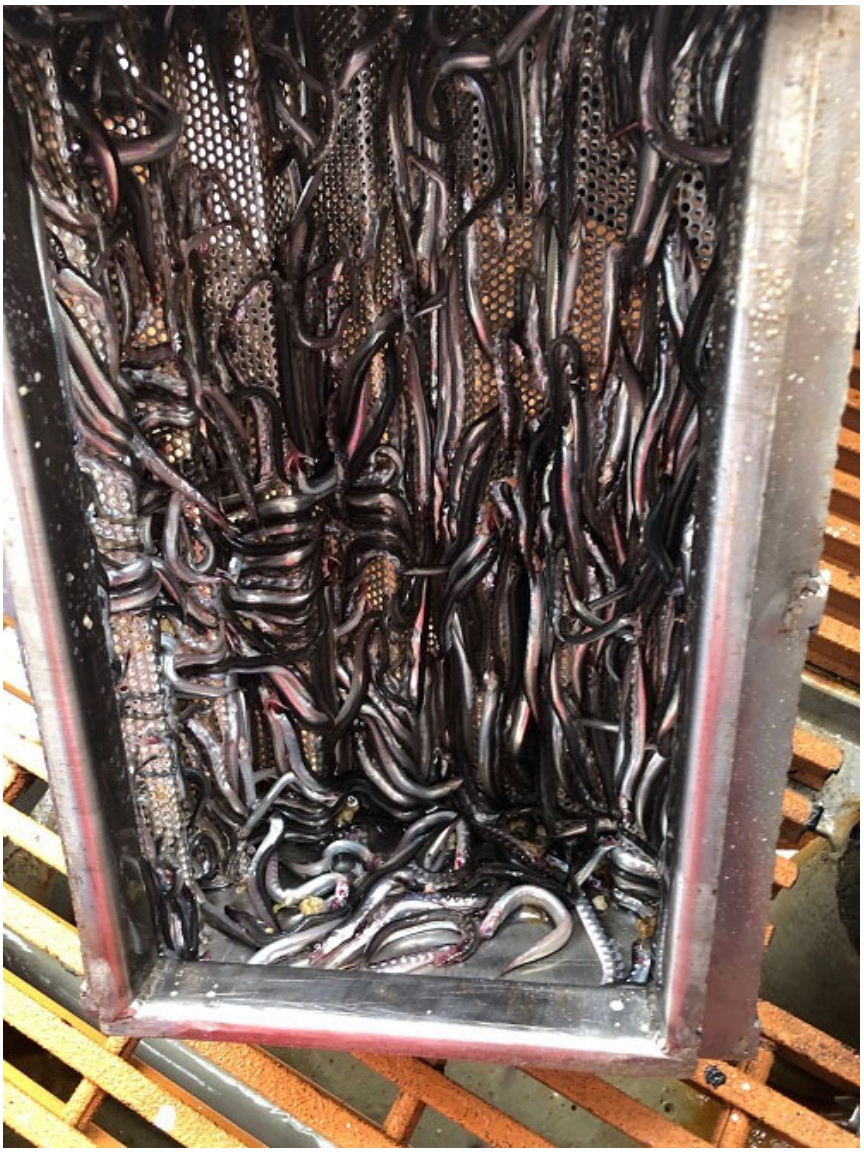

Figure 9. Large numbers of sand lance clogged the strainer of the cooling water intake for the diesel engines of of the Gordon Gunter.

Figure 10. Disinfectant being applied to stairwell railings during the GU2102 Spring Ecosystem Monitoring Cruise.

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