CRUISE RESULTS
NOAA Research Vessel DELAWARE II
Cruise No. DE 12-02
Winter-Ecosystem Monitoring Survey

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CRUISE PERIOD AND AREA

The NOAA research vessel *Delaware II* sampled at a total of 151 stations from 2 - 21 February 2012. Despite the time of the year, the *Delaware II* was able to cover most of the survey area.

OBJECTIVES

The principal objective of the survey was to conduct a routine monitoring survey of the Northeast U.S. Continental Shelf Ecosystem, including hydrography, Ocean Acidification, dissolved inorganic carbon (DIC), chlorophyll maxima depths and particulate counts and measurements. Plankton samples were collected over the entire survey area, and several midwater trawls were done in the western Gulf of Maine to collect larval and juvenile herring. Marine mammals, sea turtles, and seabirds were identified, counted and documented over the entire survey area.

Operational objectives of this cruise were to:

- (1) Complete CTD and bongo operations at stations throughout area.
- (2) Collect samples for the Census of Marine Zooplankton (CMarZ) genetics studies.
- (3) Analyze the size spectrum of water column particles using the Laser In-Situ Scattering and Transmissometry (LISST) instrument.
- (4) Collect samples for aging and genetic analyses of fish larvae and eggs.
- (5) Collect underway data using a TSG, fluorometer, SCS, EK-60 Scientific Sounder and ADCP.
- (6) 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.

METHODS

The survey consisted of 151 stations at which the vessel stopped to lower instruments over the port side of the vessel from an A-frame and a conductive-wire winch. Of these, 29 were on Georges Bank, 46 were in the Gulf of Maine, 34 were in Southern New England and the remaining 42 stations were in the Middle Atlantic Bight (Figure 1).

Plankton and hydrographic sampling was conducted by making double oblique tows using the 61-cm bongo sampler and a Seabird CTD. The tows were made 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 and equipped with digital flowmeters that recorded number of revolutions during the tow, both visually and electronically. At the 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). 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. No flowmeters were used in the 20-cm bongos. The plankton sampling gear was deployed off the port side of the vessel using an A-frame and a conducting cable winch. After retrieval all the bongo nets, both large and small, were washed down on a table set up in the covered work area on the port side of the vessel. Both the large and small bongos were washed down with seawater. 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 were preserved in 95% ethanol, which was changed once 24 hours after the initial preservation. 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 CTD 9/11 Niskin bottle rosette sampler cast was made at all the fixed stations to obtain water samples for nutrient analysis, as well as profiles of water temperatures, salinities, and chlorophyll-a and oxygen levels. A Laser In-Situ Scattering and Transmissometry (LISST) instrument mounted underneath the Niskin bottles at the bottom of the rosette provided size spectrum analysis of suspended particles in the water column (Figure 4)**.** This unit recorded its data internally, and was periodically connected to a laptop between stations for downloading.

Continuous monitoring of the seawater salinity, temperature and chlorophyll-*a* level, from a depth of 3.7 meters along the entire cruise track was done by means of a thermosalinograph, and a flow-through 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 the fluorometer at 10-second intervals. The data records were given a time-date stamp by the GPS unit.

Midwater trawling was conducted using a small (6 foot wide) Isaacs-Kidd Midwater Trawl at one station on Georges Bank (GB) and eight stations in the western Gulf of Maine (GOM) 5at the end of the cruise to capture herring larvae and juveniles. These same stations were also

sampled with a 61 cm bongo frame equipped with 335 and 505 micron mesh nets. All samples collected from these 9 "Special" western GB and GOM stations were preserved in ethanol. The net was equipped with a Seabird CTD 19+ unit to provide real-time depth measurement so the IKMT could be fished to within 10 meters of the bottom. This net was fished from the stern ramp of the vessel (Figure 3.)

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 *DELAWARE II* sailed on 2 February from its berth at NMFS dock in Woods Hole. Favorable weather allowed the vessel to sail out to Georges Bank, followed by the Gulf of Maine, where an unscheduled port call was made in Portland to disembark one crew member. The vessel then proceeded south, headed through the Cape Cod Canal, and worked its way south along the inshore portion of the Southern New England (SNE) area, into the Mid-Atlantic Bight (MAB) before heading offshore again. The weather permitted work to be continued to the southernmost part of the survey area, off of Cape Hatteras, NC where the vessel then looped back and completed sampling the portions of the MAB and SNE that had been missed on the way south. With some time remaining at the end of the cruise, 9 IKMT tows were made to collect herring larvae and juveniles from the western part of Georges Bank and the Gulf of Maine, before returning to Woods Hole 21 February 2012.

DISPOSITION OF SAMPLES AND DATA

All samples and data, except for the 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 zooplankton genetics samples were delivered to Nancy Copley of the Woods Hole Oceanographic Institute. The nutrient samples were sent to Maura Thomas at the University of Maine in Orono. The CTD data were delivered to the Oceanography Branch of the NEFSC, Woods Hole, MA.

SCIENTIFIC PERSONNEL

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Table 1. Summary of sample activities conducted at 155 stations at which the *DELAWARE II* stopped To lower instruments over the side during Cruise No. DE 1202. Latitude and longitude are shown in degrees, minutes and tenths of minutes. B=61 cm bongo Standard Protocol, 2B3=335 micron mesh 20 cm bongo 2B1=165 micron mesh 20 cm bongo. NUT=nutrients. Data in bold =911 CTD W=water sampling

DEL1202 ECOMON						
3 - 21 February, 2012						
Cast #	**Sta #**	**Lat (deg N)**	**Long (deg W)**	**Date**	**Btm Depth (m)**	**Operations**
2	1	4053.6	6905.6	2/3/2012	73	B
3	2	4107.6	6903.2	2/3/2012	102	B
4	3	4115.1	6827.9	2/3/2012	57	B
5	4	4057.7	6838.3	2/3/2012	47	B
7	5	4045.5	6842.7	2/3/2012	65	B
9	7	4031.2	6843.3	2/3/2012	72	B
10	8	4026.4	6841.0	2/3/2012	84	B
11	9	4028.4	6831.8	2/4/2012	91	B
12	10	4018.5	6818.7	2/4/2012	148	B
13	11	4019.9	6813.6	2/4/2012	150	B
14	12	4047.4	6704.0	2/4/2012	97	B
15	13	4045.5	6725.4	2/4/2012	91	B, 2B1
16	14	4110.6	6725.2	2/4/2012	53	B
17	15	4105.2	6652.6	2/4/2012	75	B, 2B1
18	16	4122.3	6631.6	2/5/2012	93	B
19	17	4126.9	6622.9	2/5/2012	99	B
20	18	4140.9	6610.0	2/5/2012	93	B
21	19	4154.8	6551.0	2/5/2012	137	B, 2B1
22	20	4148.9	6544.0	2/5/2012	250	B, 2B1
23	20	4148.7	6543.7	2/5/2012	262	W
24	21	4203.4	6538.5	2/5/2012	258	B
25	21	4203.5	6539.0	2/5/2012	270	W
26	22	4159.7	6615.7	2/5/2012	80	B
27	23	4145.0	6638.9	2/5/2012	66	B
28	24	4200.3	6700.2	2/5/2012	64	B
29	25	4144.1	6709.5	2/6/2012	52	B
30	26	4141.8	6711.3	2/6/2012	55	B, 2B1
31	27	4141.6	6716.5	2/6/2012	52	B
32	28	4131.4	6719.3	2/6/2012	40	B
1	**29**	**4128.2**	**6741.5**	**2/6/2012**	**39**	**W,NUT**
33	30	4137.5	6745.8	2/6/2012	38	B
34	31	4139.7	6752.5	2/6/2012	33	B
35	32	4237.6	6858.5	2/7/2012	180	B
36	33	4255.8	6906.8	2/7/2012	168	B
37	34	4248.8	6948.8	2/7/2012	270	B
38	34	4248.1	6949.3	2/7/2012	249	W

39	35	4325.9	7016.6	2/7/2012	66	B, 2B1
2	**36**	**4351.3**	**6906.4**	**2/8/2012**	**62**	**W, NUT**
3	**37**	**4339.8**	**6806.9**	**2/8/2012**	**119**	**W, NUT**
Cast #	**Sta #**	**Lat (deg N**	**Long (deg W)**	**Date**	**Btm Depth (m)**	**Operations**
40	38	4312.0	6849.8	2/8/2012	178	B
41	39	4306.4	6857.0	2/8/2012	162	B, 2B1
42	40	4257.8	6808.5	2/8/2012	163	B
43	41	4257.9	6744.6	2/8/2012	170	B
44	42	4308.1	6741.1	2/8/2012	186	B, 2B1
45	43	4323.9	6741.9	2/8/2012	250	B
4	**43**	**4323.9**	**6742.0**	**2/8/2012**	**250**	**W, NUT**
46	44	4356.5	6735.1	2/9/2012	214	B
47	45	4415.5	6742.4	2/9/2012	87	B
48	46	4418.0	6707.1	2/9/2012	155	B
49	47	4400.3	6656.3	2/9/2012	168	B, 2B1
50	48	4324.4	6629.4	2/9/2012	113	B
5	**49**	**4303.2**	**6621.2**	**2/9/2012**	**120**	**W, NUT**
51	50	4253.2	6601.3	2/9/2012	161	B, 2B1
52	51	4220.2	6540.0	2/10/2012	108	B
53	52	4013.8	6546.2	2/10/2012	228	B
6	**52**	**4213.7**	**6546.4**	**2/10/2012**	**227**	**W, NUT**
54	53	4207.8	6616.9	2/10/2012	114	B
55	54	4231.8	6649.0	2/10/2012	267	B
56	54	4230.7	6649.5	2/10/2012	271	W
57	55	4225.2	6659.6	2/10/2012	366	B
7	**55**	**4225.0**	**6659.4**	**2/10/2012**	**366**	**W**
58	56	4223.6	6715.8	2/10/2012	357	B
59	56	4222.8	6715.5	2/10/2012	344	W
60	57	4221.1	6745.0	2/10/2012	212	B, 2B1
61	58	4231.1	6836.5	2/10/2012	204	B
62	59	4219.5	6829.4	2/10/2012	188	B
63	60	4150.4	6905.7	2/11/2012	181	B
64	61	4138.4	6908.2	2/11/2012	169	B
65	62	4229.6	6938.9	2/11/2012	246	B
9	**62**	**4229.5**	**6939.4**	**2/11/2012**	**254**	**W, NUT**
66	63	4212.3	6958.0	2/11/2012	148	B
67	64	4227.4	7005.6	2/11/2012	84	B
10	**65**	**4219.1**	**7016.9**	**2/11/2012**	**35**	**W, NUT**
11	**66**	**4221.4**	**7027.9**	**2/11/2012**	**78**	**W, NUT**
68	67	4225.3	7036.7	2/11/2012	89	B
69	68	4202.2	7030.4	2/11/2012	46	B
70	69	4115.1	7114.8	2/12/2012	39	B
71	70	4056.2	7103.8	2/12/2012	53	B
72	71	4104.1	7131.9	2/12/2012	33	B
73	72	4049.2	7144.1	2/12/2012	56	B
74	73	4051.9	7149.9	2/12/2012	45	B

75	74	4045.4	7237.7	2/12/2012	25	B
76	75	4008.2	7359.6	2/13/2012	18	B
77	76	3954.9	7346.4	2/13/2012	29	B
12	**77**	**3942.5**	**7400.0**	**2/13/2012**	**22**	**W, NUT**
78	78	3934.7	7410.2	2/13/2012	16	B
79	79	3917.0	7339.5	2/13/2012	41	B, 2B1
13	**80**	**3921.7**	**7323.7**	**2/13/2012**	**50**	**W, NUT**
80	81	3916.5	7252.1	2/13/2012	80	B, 2B1
81	82	3910.7	7248.4	2/13/2012	93	B, 2B1
82	82	3910.3	7248.8	2/13/2012	92	V
14	**83**	**3903.2**	**7244.6**	**2/13/2012**	**208**	**W, NUT**
15	**84**	**3900.6**	**7235.4**	**2/13/2012**	**1248**	**W, NUT**
83	85	3836.2	7317.5	2/14/2012	108	B
84	86	3841.0	7349.4	2/14/2012	50	B, 2B1
85	87	3812.0	7424.0	2/14/2012	37	B
86	88	3800.7	7418.2	2/14/2012	60	B
16	**89**	**3750.6**	**7434.7**	**2/14/2012**	**55**	**W**
87	90	3750.4	7414.0	2/14/2012	97	B
17	**91**	**3742.2**	**7415.3**	**2/14/2012**	**113**	**W, NUT**
88	92	3721.3	7432.0	2/14/2012	104	B
89	93	3658.2	7501.0	2/15/2012	43	B
90	94	3641.7	7510.1	2/15/2012	30	B
91	95	3608.1	7503.9	2/15/2012	34	B, 2B1
92	96	3603.0	7450.6	2/15/2012	100	B
18	**97**	**3600.3**	**7441.9**	**2/15/2012**	**1233**	**W, NUT**
19	**98**	**3600.0**	**7446.8**	**2/15/2012**	**367**	**W, NUT**
20	**99**	**3600.3**	**7510.4**	**2/15/2012**	**35**	**W, NUT**
93	100	3603.6	7512.7	2/15/2012	30	B
94	101	3553.2	7526.6	2/15/2012	26	B
21	**102**	**3559.3**	**7532.0**	**2/15/2012**	**22**	**W, NUT**
95	103	3628.8	7538.7	2/15/2012	25	B
96	104	3641.0	7542.2	2/16/2012	17	B
97	105	3703.9	7534.3	2/16/2012	23	B
98	106	3711.3	7523.6	2/16/2012	29	B
99	107	3715.9	7538.0	2/16/2012	20	B
100	108	3725.3	7522.4	2/16/2012	26	B
22	**109**	**3800.0**	**7457.4**	**2/16/2012**	**23**	**W, NUT**
101	110	3814.8	7455.1	2/16/2012	22	B, 2B1
102	111	3823.7	7433.7	2/16/2012	28	B
103	112	3842.4	7446.8	2/16/2012	19	B
104	113	3848.7	7425.6	2/16/2012	26	B
105	114	3900.0	7415.4	2/16/2012	32	B
106	115	3856.4	7350.4	2/17/2012	41	B
107	116	3902.3	7323.3	2/17/2012	59	B

108	117	3934.5	7245.0	2/17/2012	68	B
109	118	3935.5	7208.9	2/17/2012	152	B, 2B1
110	119	3948.3	7235.1	2/17/2012	59	B
Cast	**Sta #**	**Lat (deg N**	**Long (deg W)**	**Date**	**Btm Depth (m**	**Operations**
111	120	3953.9	7317.5	2/17/2012	49	B
112	121	3958.2	7322.0	2/17/2012	63	B, 2B1
113	122	4004.8	7305.8	2/17/2012	47	B
114	123	3957.5	7258.9	2/17/2012	53	B
115	124	4014.3	7202.2	2/18/2012	62	B
116	125	4030.2	7145.5	2/18/2012	69	B
117	126	4045.5	7118.9	2/18/2012	61	B
118	127	4040.1	7116.8	2/18/2012	62	B
119	128	4020.3	7121.8	2/18/2012	83	B, 2B1
120	128	4020.3	7122.2	2/18/2012	83	V
122	129	4004.6	7107.5	2/18/2012	189	B, 2B1
23	**130**	**4002.4**	**7036.8**	**2/18/2012**	**163**	**W, NUT**
24	**131**	**3950.2**	**7037.3**	**2/18/2012**	**845**	**W, NUT**
123	132	4003.4	7013.6	2/18/2012	176	B
124	133	4006.2	6944.0	2/18/2012	103	B
125	134	4004.5	6920.7	2/19/2012	100	B
126	135	4015.7	7006.2	2/19/2012	95	B
127	136	4016.7	7014.1	2/19/2012	95	B
128	137	4042.1	7017.1	2/19/2012	49	B
25	**138**	**4040.3**	**7037.4**	**2/19/2012**	**62**	**W, NUT**
129	139	4102.4	7043.4	2/19/2012	48	B
26	**140**	**4106.4**	**7037.5**	**2/19/2012**	**44**	**W, NUT**
130	141	4111.0	7007.2	2/19/2012	24	B
131	142	4049.9	6943.0	2/19/2012	36	B
132	143	4109.9	6842.3	2/20/2012	68	B
133	143	4109.9	6842.3	2/20/2012	68	O
134	144	4129.8	6832.1	2/20/2012	101	B
135	144	4129.7	6832.1	2/20/2012	101	IKMT
136	145	4140.2	6936.9	2/20/2012	94	B
137	145	4140.6	6937.1	2/20/2012	100	IKMT
138	146	4150.2	6951.9	2/20/2012	53	B
139	146	4150.4	6951.9	2/20/2012	52	IKMT
140	147	4206.2	6950.2	2/20/2012	144	B
141	147	4206.2	6950.0	2/20/2012	142	IKMT
142	148	4216.6	7025.1	2/20/2012	86	B
143	148	4216.5	7024.9	2/20/2012	86	IKMT
144	149	4216.6	7030.0	2/21/2012	77	B
145	149	4216.6	7030.0	2/21/2012	77	IKMT
146	150	4201.6	7022.6	2/21/2012	55	B
147	150	4201.9	7023.0	2/21/2012	54	IKMT
148	151	4201.6	7032.3	2/21/2012	28	B
149	151	4201.7	7032.5	2/21/2012	28	IKMT

TOTALS:	**Std BON/CTD Casts**	**=**	**131**
	2B3 Bongo Casts	**=**	**89**
	2B1 Bongo Casts	**=**	**21**
	CTD PROFILE 911 Casts	**=**	**26**
	Nutrient Casts	**=**	**23**
	Isaacs Kidd Midwater Trawl (IKMT)	**=**	**9**

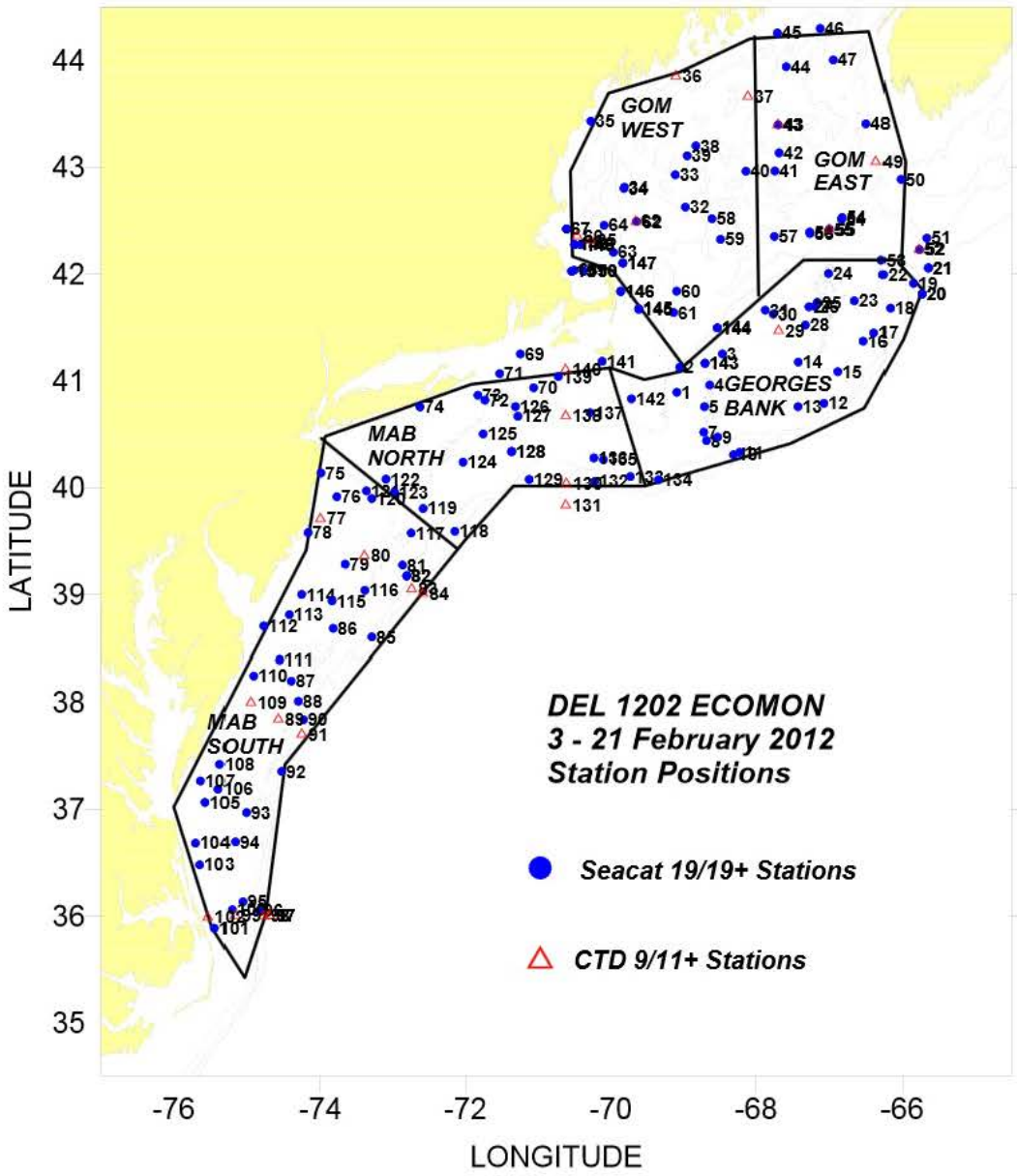

Figure 1. Station locations numbered consecutively for Winter Northeast Pelagic-Ecosystem Monitoring Survey DE 1202, 2-21 February 2012.

Figure 2. Bongo net array being retrieved aboard from the starboard A-frame of the Delaware II, showing 61 and 20 cm bongo nets, CTD unit and bell shaped depressor weight.

Figure 3. Isaacs Kidd Midwater Trawl being retrieved up the stern ramp aboard the Delaware II. Note CTD 19 unit on spreader bar.

Figure 4. LISST unit (black cylinder) mounted underneath Niskin bottles on bottom of rosette.