

20 December 2002

CRUISE RESULTS  
Fisheries Research Vessel DELAWARE II  
Cruise No. DE 02-10  
Ecosystems Monitoring Survey

CRUISE PERIOD AND AREA

The cruise period was from 28 October to 14 November 2002. The research vessel DELAWARE II covered the Mid-Atlantic Bight, Southern New England, Georges Bank and Gulf of Maine regions (Figure 1) for the Late Fall Ecosystems Monitoring Survey.

OBJECTIVES

The primary objective of the cruise was to assess the changing biological and physical properties of the Mid-Atlantic Bight, Southern New England, Georges Bank and Gulf of Maine portions of the Northeast Continental Shelf ecosystem which influence the sustainable productivity of the living marine resources.

Secondary objectives of this cruise were:

- collection of phytoplankton samples for nitrogen stable isotope ratios,
- collection of samples for zooplankton genetics (genome) studies,
- examination of plankton samples at sea for concentrations of Calanus finmarchicus to correlate with right whale sightings.

METHODS

The survey consisted of 109 randomly distributed stations at which the vessel slowed or stopped to lower instruments over the side.

Key parameters which were measured included water column temperature and salinity, ichthyo- and zooplankton composition, abundance and distribution; along-track temperature, salinity, chlorophyll-a fluorescence and standard weather observations.

A double oblique tow using the 61-centimeter Bongo sampler and a CTD

was made at all stations. The tow was made to approximately 5 meters above the bottom, or to a maximum depth of 200 meters, at a ship speed of 1.5 knots. Plankton sampling gear consisted of a 61-centimeter mouth diameter aluminum bongo frame with two 333-micron nylon mesh nets. A 45-kilogram lead ball was attached by an 80-centimeter length of 3/8-inch diameter chain below the aluminum Bongo frame to depress the sampler. A digital flowmeter was suspended within the mouth of each sampler to determine the amount of water filtered by each net. The plankton sampling gear was deployed over the port stern quarter of the vessel by means of a conducting-cable winch and a boom. Plankton samples were preserved in a 5 percent solution of formalin in seawater. Tow depth was monitored in real time with a Seabird CTD profiler, which was hard-wired to the conductive towing cable, providing simultaneous depth, temperature and salinity data for each plankton tow.

Continuous monitoring of the seawater temperature, salinity, and chlorophyll-a level, at a depth of 2 meters was done along all of the cruise track by means of a thermosalinograph, and a flow-through fluorometer.

The thermosalinograph and flow-through fluorometer were connected to the Scientific Computing System installed in the laboratory area of the vessel by Atlantic Marine Center personnel. This system recorded output from the thermosalinograph, and the fluorometer every ten seconds, and gave the data records a time-date stamp from the GPS unit.

Samples for Seabird salinity data calibration were obtained on the 12-6 watch by taking a water sample from 30 or more meters depth using a 1.7 liter Niskin bottle at every fifth or sixth station. Calibration of the thermosalinograph and fluorometer from the surface flow-through system was undertaken on the 6-12 watch following the protocol outlined in the Ecosystem Monitoring Program Operations Manual.

Phytoplankton samples for nitrogen and carbon stable isotope ratio analysis were collected from the discharge water of the near-surface flow-through system. Six hundred to one thousand milliliters of seawater were pre-filtered through 300 micron mesh nitex gauze to remove most zooplankton, then filtered through a Whatman GFF glass-fiber filter and immediately frozen for analysis ashore.

Zooplankton genetics samples were collected at five randomly selected stations within each of the four regions by means of a 20 cm bongo frame equipped with two 165 micron mesh nets attached to the towing wire 30 cm above the CTD with a wire stop. The samples were preserved in 95% ethanol which was changed once after 24 hours.

## RESULTS

A summary of routine survey activities is presented in Table 1.

Figure 1 shows the areal coverage achieved during the cruise. The DELAWARE II sailed at 1600 hours EST on Monday, October 28, 2002 and proceeded south to commence sampling operations in the Mid-Atlantic Bight. The DELAWARE II reached the first station at the northern edge of the Mid-Atlantic Bight by 0800 EST on the following day. The vessel proceeded south, under deteriorating weather conditions, picking up stations on the offshore portion of the continental shelf. By the time the DELAWARE II reached the latitude of the Chesapeake Bay, the rapidly growing seas forced the vessel to turn inshore in order to continue working. The poor weather conditions forced the boat to slow down between stations but at no time was it necessary to heave-to and stop working. The vessel finished sampling in the Mid-Atlantic Bight area on 1 November 2002 and proceeded on to the Southern New England area, hampered by continuing bad weather, which however, slowly improved by 3 November. A decision was made to postpone the planned 4 November port call to 5 November to take advantage of this window of calm weather, permitting the vessel to complete sampling at all stations in the Southern New England area, as well as two stations on Georges Bank. The DELAWARE II docked in Woods Hole at 1340 EST on 5 November. A large coastal storm forced the vessel to remain in port until 8 November, when it sailed at 0900 to resume operations on Georges Bank. Despite windy (20+ knots) conditions, the Delaware II was able to steam out via Great Round Shoals, picking up two Gulf of Maine stations prior to arriving on Georges Bank by late evening that same day. Shortly after leaving Woods Hole, a routine equipment check led to the discovery of a termination problem which prevented communication with the CTD unit via the conductive cable. Electronics technician Stephen Macri corrected this by changing the watertight electrical connector pigtail on the termination. The following day, however, the problem re-occurred and required that the mechanical portion of the termination be removed, checked and replaced. It was discovered that the Electroline termination had chafed through one of the conducting wires, eventually severing it completely. The replacement of this fitting was time consuming, taking 6 hours of labor before we were able to continue working. Fortunately at this time weather had improved dramatically, allowing the work to proceed at a faster pace. However, due to the previous loss of time from inclement weather, and the additional down time from the termination problems, it was decided to drop two outlying stations on Georges Bank, and 9 stations in the Gulf of Maine, in an effort to complete the survey with nearly complete coverage of Georges Bank, and reasonably representative coverage of the Gulf of Maine. Operations on Georges Bank were completed by 12 November and the Delaware II proceeded on into the Gulf of Maine. Coverage of this area was in a counter-clockwise direction, with 6 stations to the east and northeast not being visited due to lack of time. Two offshore stations in the central Gulf of Maine area and one inshore station off of New Hampshire were also dropped, for the total of 9 stations missed in the Gulf of Maine. Another termination problem cropped up on 13 November. This time, in an effort to keep the survey going while the electronics technician re-terminated the Electroline fitting, a decision was made to work off

the forward A-frame, which has an independent set-up, with its own conductivity cable, termination, and meter-block system. While working up forward we encountered 3 problems:

1. The wire-out block became twisted upon deployment of the bongo gear, causing the wire that carries the signal from this block to the readout to get fouled in the sheave of the towing cable, and subsequently break.
2. We learned that there was not enough conductive cable on the drum for a bongo tow of more than 130 meters in depth.
3. The winch operator was unable to watch the deployment and retrieval operation from his vantage point and had to depend on information relayed to him from the A-frame operator. This is awkward under good conditions, and dangerous in rough seas.

We were fortunate in being inshore for two stations while working from the forward area. This meant shallower depths and calmer seas, making problems 2 and 3 less of an issue. By the time the vessel was proceeding offshore to the next group of stations, the termination at the aft work area had been repaired, and the remaining 6 stations were done from there. Some problems still persisted however. CTD unit #0853 which had worked flawlessly for almost the entire cruise, (including up forward) would not work with the new termination in the aft area, while CTD unit 1468 worked fine. Interestingly, that same unit had not worked with the previous termination on that same cable. Most perplexing was the fact that both units checked out perfectly using the TERM19 routine. Stephen Macri, the electronics technician, suggested that these perplexing problems may have been due to some irregularities in the cable's conductivity caused by water wicking into the winch end of the cable. The last two stations were done off of Boston Harbor early on Thursday, 14 November and the DELAWARE II returned to Woods Hole via the Cape Cod Canal and docked at the NMFS dock later that same day at 1230 EST.

#### DISPOSITION OF SAMPLES AND DATA

All samples and data, except for the nitrogen isotope samples, the zooplankton genetics samples and the CTD data, were delivered to the Ecosystems Monitoring Group of the NEFSC, Narragansett, RI, for quality control processing and further analysis. The nitrogen and carbon isotope samples were kept frozen and delivered to Rick McKinney at the US EPA Lab in Narragansett, RI. The zooplankton genetics samples were picked up from the DELAWARE II by Nancy Copley of the Woods Hole Oceanographic Institute, and the CTD data was delivered to the Oceanography Branch of the NEFSC, Woods Hole, MA with copies of the CTD logs and header file going to the Ecosystems Monitoring Group in Narragansett.

SCIENTIFIC PERSONNEL

National Marine Fisheries Service, NEFSC, Narragansett, RI

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Table 1. STATION OPERATION REPORT FOR CRUISE DE0210

CAST	STA.	Date (GMT)			TIME (GMT)		LAT	LONG	DEPTH (m)	OPER.  (b=bongo w=water Z=zoogen C=carbon N=nitrogen CO/=Calanus observed/vol)
		mm	dd	yy	hr	min				
1	1	10	29	02	12	1	3921.8	7312.2	58	b
2	2	10	29	02	14	39	3929.3	7331.3	37	b, Z# 1
3	3	10	29	02	16	32	3911.4	7331.0	38	b
4	4	10	29	02	19	17	3905.0	7300.0	80	w
5	4	10	29	02	19	26	3905.0	7300.1	79	b (salps)
6	5	10	29	02	22	22	3839.6	7316.4	95	b (salps)
7	6	10	30	02	0	17	3853.2	7330.5	59	b
8	7	10	30	02	2	23	3850.7	7357.7	41	b
9	8	10	30	02	3	47	3838.9	7356.7	46	b, Z# 2
10	9	10	30	02	6	46	3811.3	7406.5	61	w
11	9	10	30	02	6	53	3811.2	7406.7	61	b, Z# 3
12	10	10	30	02	9	44	3755.1	7437.4	43	b
13	11	10	30	02	12	15	3738.4	7447.3	44	b, Z# 3

14	12	10	30	02	14	53	3741.7	7427.7	64	b, N# 1, C# 1
15	13	10	30	02	19	10	3717.5	7458.4	39	w
16	13	10	30	02	19	19	3717.7	7458.3	39	b
17	14	10	30	02	22	5	3700.7	7513.6	35	b
18	15	10	31	02	1	49	3652.9	7555.9	11	b, N# 2
19	16	10	31	02	3	42	3634.1	7546.9	19	b
20	17	10	31	02	5	45	3637.9	7525.9	21	b
21	18	10	31	02	8	23	3612.8	7536.7	23	w
22	18	10	31	02	8	28	3612.6	7536.7	21	b, N# 3
23	19	10	31	02	11	3	3551.2	7515.1	34	b
24	20	10	31	02	14	6	3554.4	7504.5	34	b
25	21	10	31	02	18	38	3619.5	7507.6	31	b
26	22	10	31	02	22	40	3639.5	7446.5	66	w
27	22	10	31	02	22	48	3639.3	7446.6	65	b
28	23	11	1	02	0	49	3653.9	7442.5	81	b
29	24	11	1	02	8	8	3756.5	7512.9	16	b
30	25	11	1	02	11	9	3816.6	7446.8	22	b, N# 4
31	26	11	1	02	14	33	3849.4	7443.8	20	b, N# 5, Z# 4
32	27	11	1	02	18	13	3914.1	7412.2	27	w
33	27	11	1	02	18	19	3913.9	7412.3	27	b, Z# 5
34	28	11	1	02	20	3	3929.2	7407.6	18	b
35	29	11	1	02	22	22	3943.2	7345.2	20	b
36	30	11	2	02	0	53	4005.7	7353.0	23	b
37	31	11	2	02	1	58	4010.2	7343.6	40	b, N# 6, Z# 6
38	32	11	2	02	3	34	4009.6	7325.6	35	b
39	33	11	2	02	6	23	3943.3	7316.7	39	w
40	33	11	2	02	6	30	3943.3	7316.9	39	b

Table 1. STATION OPERATION REPORT FOR CRUISE DE0210 (continued)

CAST	STA.	Date (GMT)			TIME (GMT)		LAT	LONG	DEPTH (m)	OPER.
		mm	dd	yy	hr	min				
41	34	11	2	02	8	43	3936.6	7253.2	61	b
42	35	11	2	02	11	53	3913.5	7239.5	126	b, Z# 7
43	36	11	2	02	16	45	3942.2	7213.7	116	w
44	36	11	2	02	16	53	3942.2	7213.9	116	b, N# 7
45	37	11	2	02	19	49	4003.1	7221.1	69	b
46	38	11	2	02	22	7	3956.5	7242.5	55	b, Z# 8
47	39	11	3	02	1	44	4029.5	7230.8	42	b
48	40	11	3	02	3	34	4036.1	7248.7	33	b, N# 8, C# 2
49	41	11	3	02	7	34	4047.1	7157.9	40	w
50	41	11	3	02	7	41	4047.0	7158.0	41	b
51	42	11	3	02	10	57	4032.8	7120.5	66	b, Z# 9
52	43	11	3	02	13	21	4014.3	7136.9	82	b
53	44	11	3	02	18	20	4002.7	7107.5	218	b

(b=bongo w=water Z=zoogen  
C=carbon N=nitrogen  
CO=Calanus observed/vol

54	45	11	3	02	21	3	4021.5	7047.8	92	w
55	45	11	3	02	21	16	4021.8	7048.1	91	b
56	46	11	3	02	23	56	3958.7	7039.4	280	b
57	46	11	4	02	0	35	3959.2	7040.5	280	v
58	47	11	4	02	3	24	4013.1	7011.8	97	b, Z# 10
59	48	11	4	02	7	32	3957.9	6925.1	112	w
60	48	11	4	02	7	40	3958.1	6925.0	111	b, N# 9
61	49	11	4	02	9	44	4015.3	6934.5	77	b
62	50	11	4	02	11	58	4031.9	6915.8	65	b
63	51	11	4	02	14	22	4014.8	6857.8	111	b
64	52	11	4	02	15	55	4022.8	6842.5	87	b
65	53	11	4	02	17	36	4036.2	6836.5	64	w
66	53	11	4	02	17	41	4036.1	6836.4	64	b
67	54	11	4	02	20	39	4052.7	6901.3	79	b
68	55	11	4	02	22	24	4100.3	6919.0	46	b
69	56	11	5	02	0	5	4056.4	6936.3	37	b
70	57	11	5	02	2	34	4040.4	6952.1	50	b
71	58	11	5	02	5	41	4101.7	7018.7	37	w
72	58	11	5	02	5	46	4101.6	7018.8	37	b
73	59	11	5	02	8	29	4036.8	7036.3	61	b
74	60	11	5	02	10	51	4056.0	7050.8	51	b
75	61	11	5	02	13	1	4115.1	7038.6	27	b
76	62	11	5	02	15	13	4113.3	7105.0	37	b, N# 10
77	63	11	8	02	20	28	4121.7	6922.3	51	b, Z# 11
78	64	11	8	02	22	52	4111.4	6851.9	92	b
79	65	11	9	02	1	42	4110.2	6823.1	52	b
80	66	11	9	02	4	47	4100.0	6835.2	48	b

Table 1. STATION OPERATION REPORT FOR CRUISE DE0210 (continued)

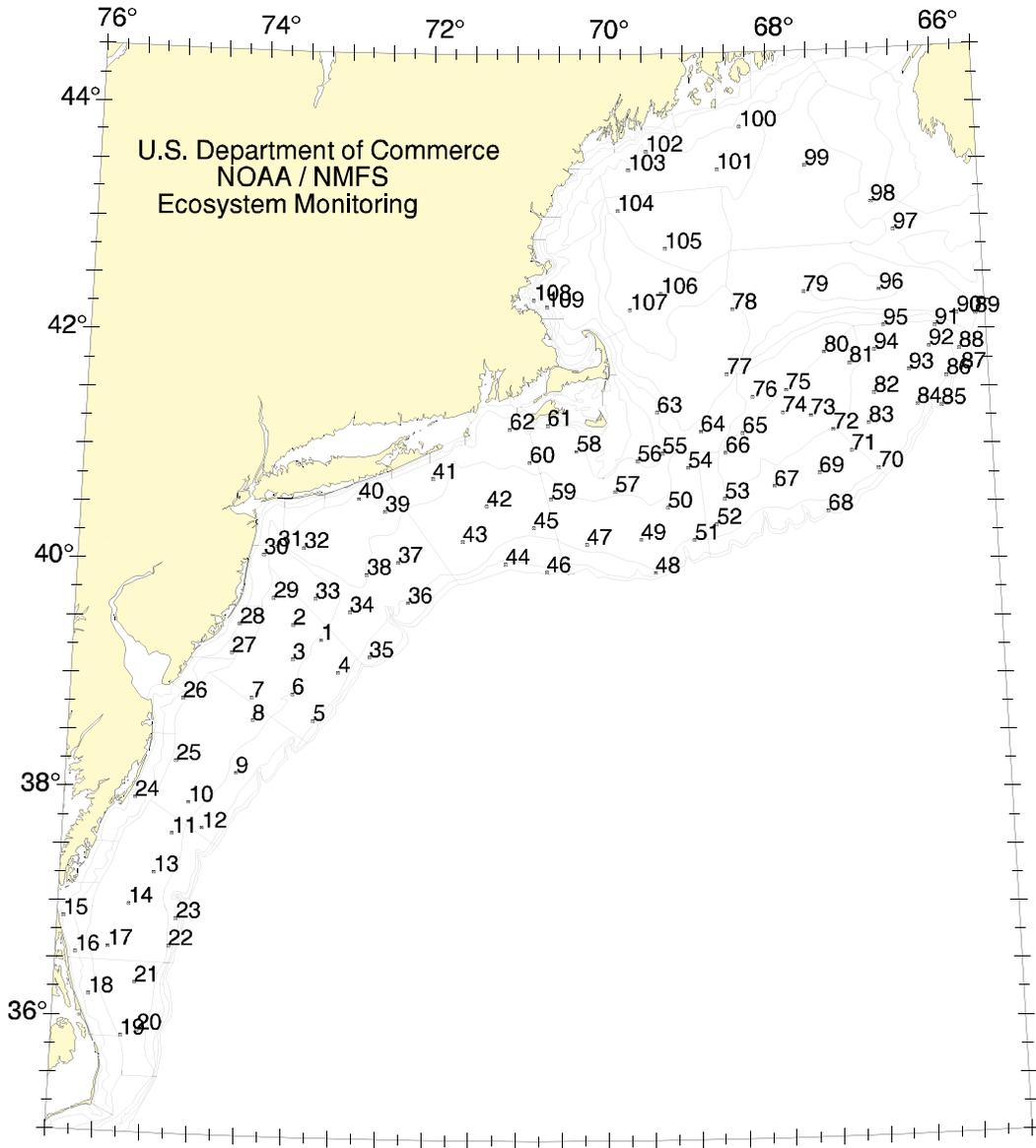
CAST	STA.	Date (GMT)			TIME (GMT)		LAT	LONG	DEPTH (m)	OPER.  (b=bongo w=water Z=zoogen C=carbon N=nitrogen CO/=Calanus observed/vol)
		mm	dd	yy	hr	min				
81	67	11	9	02	9	37	4042.0	6802.1	77	b
82	68	11	9	02	13	8	4029.3	6725.0	290	v
83	68	11	9	02	13	19	4028.5	6725.4	189	b, Z# 12
84	69	11	9	02	17	52	4048.3	6730.7	80	b
85	70	11	9	02	21	4	4049.9	6649.3	100	b (salps)
86	71	11	9	02	23	7	4059.4	6707.8	74	b
87	72	11	10	02	9	33	4110.9	6719.8	53	b
88	73	11	10	02	11	21	4118.9	6735.4	41	w
89	73	11	10	02	11	25	4118.6	6735.3	40	b, (medusae) N# 12
90	74	11	10	02	13	8	4120.4	6754.7	32	b
91	75	11	10	02	14	36	4132.2	6751.9	32	b, N# 13, C# 3
92	76	11	10	02	16	20	4128.9	6815.3	46	b
93	77	11	10	02	18	4	4141.1	6833.6	171	w
94	77	11	10	02	18	23	4141.1	6833.0	170	b, CO/ 317cm <sup>3</sup> N# 14

95	78	11 10 02	21 55	4214.8	6828.0	180	b, CO/238 cm <sup>3</sup>
96	79	11 11 02	2 0	4222.9	6737.6	253	v
97	79	11 11 02	2 21	4223.1	6737.4	255	b
98	80	11 11 02	6 28	4151.4	6724.5	52	b
99	81	11 11 02	8 19	4145.2	6707.0	59	b, Z# 13
100	82	11 11 02	10 25	4129.2	6650.5	67	b
101	83	11 11 02	12 6	4113.7	6655.0	67	b, Z# 14
102	84	11 11 02	14 57	4122.3	6620.7	91	b, Z# 15
103	85	11 11 02	17 12	4121.1	6603.7	175	w
104	85	11 11 02	17 22	4121.2	6603.8	388	b
105	86	11 11 02	19 25	4136.6	6559.4	101	b, (salps) Z# 16
106	87	11 11 02	20 33	4139.5	6548.9	574	b
107	88	11 11 02	22 5	4150.4	6549.5	129	b, N# 15
108	89	11 12 02	0 20	4208.5	6537.2	284	v
109	89	11 12 02	0 40	4208.2	6536.9	292	b, Z# 17
110	90	11 12 02	2 13	4209.3	6550.4	244	v
111	90	11 12 02	2 29	4209.0	6549.9	247	b
112	91	11 12 02	4 18	4203.2	6605.7	94	b
113	92	11 12 02	6 3	4152.4	6610.6	86	b
114	93	11 12 02	8 10	4140.6	6625.3	81	b
115	94	11 12 02	10 42	4151.7	6649.1	61	b
116	95	11 12 02	12 17	4204.3	6642.2	73	b
117	96	11 12 02	14 25	4223.1	6643.9	339	b
118	97	11 12 02	18 2	4254.0	6631.8	190	w
119	97	11 12 02	18 14	4254.1	6632.1	176	b
120	98	11 12 02	20 9	4309.3	6647.2	115	b, CO/185 cm <sup>3</sup>

Table 1. STATION OPERATION REPORT FOR CRUISE DE0210 (continued)

CAST	STA.	Date (GMT)			TIME (GMT)		LAT	LONG	DEPTH (m)	OPER.
		mm	dd	yy	hr	min				
121	99	11	13	02	0	8	4329.3	6733.8	222	b, N# 16, C# 4, Z# 18
122	100	11	13	02	4	21	4350.6	6820.0	128	b, N# 17, Z# 19
123	101	11	13	02	7	1	4328.5	6835.8	134	w
124	101	11	13	02	7	10	4328.4	6836.8	140	b, CO/185 cm <sup>3</sup>
125	102	11	13	02	14	19	4338.3	6927.8	136	b
126	103	11	13	02	16	12	4328.7	6940.3	102	b
127	104	11	13	02	19	26	4307.7	6948.3	168	w
128	104	11	13	02	19	26	4307.4	6948.5	168	b, CO/211 cm <sup>3</sup> N# 18
129	105	11	13	02	23	10	4247.4	6915.1	128	b, CO/79 cm <sup>3</sup>
130	106	11	14	02	1	51	4223.8	6918.4	255	b, CO/211 cm <sup>3</sup> Z# 20
131	107	11	14	02	4	5	4215.5	6940.2	236	b, CO/211 cm <sup>3</sup>
132	108	11	14	02	9	52	4220.8	7048.1	33	b
133	109	11	14	02	10	22	4217.1	7039.2	34	b

TOTALS: Bongo Casts = 109  
Bongo Samples = 218  
Water Samples = 19  
CTD Casts = 133  
Nitrogen samples = 18  
Carbon samples = 4  
Zoogen samples = 20  
Calanus observations = 8



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