

*Oceanography Branch CTD Data Report
Northeast Shelf Ecosystem Monitoring
Late Summer Survey – Cruise No. DE0808*

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DATE: 13 to 27 August 2008

CRUISE RESULTS
NOAA Fisheries Research Vessel *Delaware II*
Cruise No. DE 08-08
Northeast Shelf Ecosystem Monitoring Late Summer Survey

CRUISE PERIOD AND AREA

The cruise period was 13 to 27 August 2008. The NOAA fisheries research vessel *Delaware II* sampled at a total of 137 stations. Of these, 37 were located in the Gulf of Maine (GOM), 30 were located on Georges Bank (GB), 30 were in the Southern New England (SNE) area and 40 in the Mid-Atlantic Bight (MAB).

OBJECTIVES

The primary objective of the cruise was to assess changing biological and physical properties that influence the sustainable productivity of the living marine resources of the northeast continental shelf ecosystem. Key parameters measured for the Ecosystem Monitoring Program included ichthyoplankton and zooplankton composition, abundance and distribution, plus water column temperature and salinity. Near-surface along-track chlorophyll-*a* fluorescence, water temperature and salinity were measured while underway with the vessel's flow-through sampling system. Secondary objectives of this cruise included the following:

- Vertical CTD casts to within 5 meters of the bottom in Gulf of Maine deep basin areas to provide hydrographic data detailing the incursion of Labrador Current water into this region.
- Sampling at the site of a proposed liquefied natural gas (LNG) terminal east of Boston Harbor, to collect baseline data.
- Collection of zooplankton for the Census of Marine Zooplankton Project, CMarZ based at University of Connecticut, Avery Point.
- Collection of near-surface water samples for detection of the dinoflagellates *Dinophysis norwegica*, and *Alexandrium fundyense* as part of the Woods Hole Oceanographic Institution (WHOI) GOMTOX2008 Project.
- Capture of fish larvae near the entrance to Chesapeake Bay for age analysis from their otoliths.
- Launch of a drifter buoy equipped with an Argos transmitter and a thermistor for the on-board NOAA Teacher-at Sea and her class to monitor upon returning to school in the fall.
- Collection of euphausiid samples for analysis of their gut contents by a GSO/URI graduate student.
- Collection of scallop larvae in areas of high density scallop beds for research into a method of determining their presence using PCR DNA analysis at GSO/URI.
- Identifications and counts of marine birds along the cruise track by observer Marie Martin, a graduate student from Staten Island University. Neuston tows to be made near large bird aggregations.

METHODS

The survey consisted of 137 stations at which the vessel stopped to lower instruments over the side (Figure 1). All stations sampled were at randomly stratified locations except for seven stations in the GOM, and ten in the MAB. Five of the non-random GOM stations were at fixed positions visited on all Ecosystem Monitoring cruises: Wilkinson Basin, Georges Basin, Jordan Basin, a proposed Liquefied Natural Gas terminal site east of Boston and the Northeast Channel. Two non-random stations were sampled in the GOM to improve areal coverage and ten non-random stations in the Mid-Atlantic Bight, near the mouth of the Chesapeake Bay, was sampled to capture fish larvae for age analysis.

Plankton and hydrographic sampling was conducted at all stations by making double oblique tows using the 61-cm bongo sampler and a Seabird CTD. The tows were made to approximately 5 m above the bottom, or to a maximum depth of 200 m. All plankton tows were conducted at a ship speed of 1.5 – 2.0 knots. Plankton sampling gear consisted of a 61-cm diameter aluminum bongo frame with two 335-micron nylon mesh nets. At the randomly designated 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 (Figure 2.). The 20 cm bongo sampler was also used to collect samples for scallop larvae at stations near large scallop beds as determined by the previous year's scallop survey. A bell-shaped 45-kg lead weight was attached by an 80-cm 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. A digital flowmeter was suspended within the mouth of each 61-cm sampler to determine the amount of water filtered by each net. No flowmeters were used in the 20-cm bongos. The plankton sampling gear was deployed off the starboard stern quarter of the vessel using an A-frame and a Sea-Mac winch that was placed on the aft deck specifically for this cruise. After retrieval, the bongo frames were carried into a covered work area on the port side of the aft deck and placed on tables for wash down of the nets to obtain the plankton samples. This workspace allowed for much easier removal of the samples, particularly during inclement weather. The 61-cm bongo plankton samples were preserved in a 5% solution of formalin in seawater, as were the neuston samples. The CMarZ samples and scallop larvae samples from the 20-cm diameter bongos were preserved in 95% ethanol, which was changed once at 24 hours after the initial preservation. Fish larvae samples collected near the entrance of the Chesapeake Bay had one bongo net preserved in 95% ethanol, while samples from the other net were preserved in 5% formalin. 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 cast to within 5 m of the bottom was made in the Wilkinson, Jordan and Georges basins and the Northeast Channel to provide hydrographic data from below the 200 m limit set for bongo tows. A one half by one meter neuston frame equipped with a 500 micron mesh net was deployed near large congregations of sea birds to provide samples of possible food items. This was deployed from the same A-frame used for the bongo tows.

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 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.

Samples for Seabird CTD salinity data calibration were obtained twice a day using a 1.7 liter Niskin

bottle taking a water sample from an isohaline portion of the water column. Calibration of the CTD salinities and chlorophyll-*a* from the surface flow-through system was undertaken twice daily while the ship was underway. Sample analysis for these calibrations followed the protocol outlined in the Ecosystem Monitoring Program Operations Manual.

Census of Marine Zooplankton samples were collected using the 20-cm diameter bongos described above at 5 randomly designated stations in each of the four regions sampled: Mid-Atlantic Bight, Southern New England, Georges Bank and Gulf of Maine.

Twenty GOMTOX2008 samples were collected at random stations on Georges Bank and the Gulf of Maine to test for the presence of two dinoflagellates that can cause shellfish poisoning, *Dinophysis norvegica*, and *Alexandrium fundyense*. These samples were collected by filtering two liters of seawater from the discharge of the flow-through sampling system through a 20 micron mesh sieve, and then rinsing the captured organisms into a 15 ml centrifuge tube. These samples were preserved in a 5% solution of formalin and kept chilled in a refrigerator until taken ashore.

Eight sea scallop larvae samples were collected from areas that had been determined to have large scallop beds on the previous year's scallop survey and preserved in 90% ethanol which was changed once after 24 hours.

Euphausiids were collected from the ichthyoplankton net side of the 61-cm bongos at 22 stations and preserved in 80% ethanol, which was changed once after 24 hours.

Drifter Buoy #59844, equipped with a thermistor and ARGOS satellite transmitter was deployed in Georges Basin (Figure 3).

Presence and volume of *Calanus finmarchicus* was noted in the samples after completion of the cruise by measuring the settled height of the samples in mm, and then converting it to cc's using the method listed in Prezioso and Kane (in prep).

RESULTS

A summary of routine survey activities is presented in Table 1. Areal coverage for the cruise is shown in Figure 1. Excellent weather for the entire cruise period made it possible for sampling to be completed in 15 days, instead of the originally scheduled 16. This included extra sampling in the Mid-Atlantic Bight and the Gulf of Maine.

The *Delaware II* sailed at 1400 hours EDT on Wednesday, 13 August 2008, and proceeded southeast and west to sample inshore stations of the Southern New England area, ahead of an approaching coastal storm. On the following day, the *Delaware II* headed offshore and south, working its way into the Mid-Atlantic Bight. By Saturday, 16 August the vessel had reached the southernmost station off of Cape Hatteras and turned north to start sampling the inshore stations of the Mid-Atlantic Bight. Later on this same day, the closely-spaced ten extra ichthyoplankton samples off the mouth of the Chesapeake Bay were reached. Sampling in this area progressed at a good pace, thanks in part to the Delaware having two hoses available in the wash down area, enabling two people to wash both bongo nets down simultaneously and have the sampler ready prior to reaching the next station.

All sampling in the Mid-Atlantic Bight was completed on the morning of Monday, 18 August and by noontime the vessel was back in the Southern New England area sampling its offshore stations. By

Tuesday, 19 August, the *Delaware II* had finished the Southern New England area and was working its way east along the southern flank of Georges Bank. The continuation of excellent weather made for rapid progress and by 21 August the vessel crossed the Hague Line to sample stations on the northeast peak of Georges Bank. On Friday, 22 August Georges Basin was reached, where NOAA Teacher-at-Sea Rebecca Bell and graduate student Alison Cleary launched drifter buoy #59844. It was also at this station that styrofoam coffee cups were placed in a mesh bag below the CTD unit and compressed at depth to return to students for demonstrating the effects of water pressure at 350 meters. One interesting observation made from this experiment was that subsequent immersions to lesser depths would continue to further compress the cups, suggesting that time at depth, not just depth, was responsible for compressing the styrofoam material. Shortly after departing this station the first neuston tow was made near a large aggregation of seabirds spotted by bird observer Marie Martin. The catch consisted mainly of macro algae, salps, juvenile fish (some of them hakes), copepods and amphipods. Following this station sampling continued along the northern flank of Georges Bank, as the vessel headed west across the shoal area. Georges Bank sampling was completed late on 22 August and sampling of the last region, the Gulf of Maine commenced on 23 August. This region was sampled in a counter-clockwise direction, heading northeast across the middle towards the Bay of Fundy and then west along inshore Gulf of Maine towards Wilkinson Basin, towards the New England coastline and eventually to Cape Cod Bay. Plankton catches in the Gulf of Maine were the only ones to remain fairly free of large numbers of salps, which dominated many of the plankton tows from Georges Bank, Southern New England and the Mid-Atlantic Bight. It was in the GOM where the majority of euphausiid samples were collected by graduate student Alison Cleary for shore-side analysis of their gut contents. Sampling for harmful algae bloom organisms took place in the Georges Bank and Gulf of Maine areas as time permitted at random stations. Weather continued to be sunny and calm, and rapid progress was made across this region. Two more neuston tows were made, on the 24th and 25th of August, and by the 26th all sampling was completed in the Gulf of Maine area.

The *Delaware II* proceeded through the Cape Cod Canal on the morning of 27 August, and docked in Woods Hole by 1000 hours EDT, where all equipment and samples were offloaded, marking the end of the Late Summer Ecosystem Monitoring Survey.

DISPOSITION OF SAMPLES AND DATA

The plankton samples and data were delivered to the Ecosystem Monitoring Group of the NEFSC, Narragansett, RI for quality control processing and further analysis. The sea scallop larvae and euphausiid samples were delivered to the Graduate School of Oceanography at the University of Rhode Island Bay Campus in Narragansett. The neuston samples were retained by Marie Martin for delivery to the University of Staten Island, NY. The GOMTOX2008 samples and the Census of Marine Zooplankton were retrieved from the vessel by Woods Hole Oceanographic Institute researchers Nancy Copley and Bruce Keafer. The Fisheries Oceanography Investigation of the NEFSC, Woods Hole, retained the CTD data and original log sheets.

SCIENTIFIC PERSONNEL

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Table 1. STATION OPERATION REPORT FOR CRUISE DE0808

| CAST | STA. | Date(GMT) | | TIME(GMT) | | LAT | LONG | DEPTH | OPERATION | |
|------|------|-----------|-----|-----------|----|-----|--------|--------|-----------|-----------|
| | | mm | did | yy | hr | | | | | min |
| 1 | 1 | 8 | 13 | 2008 | 20 | 34 | 4120.9 | 7104.8 | 25 | B |
| 2 | 2 | 8 | 13 | 2008 | 21 | 21 | 4116.3 | 7058.7 | 41 | B |
| 3 | 3 | 8 | 14 | 2008 | 0 | 23 | 4053.7 | 7032.6 | 52 | B |
| 4 | 4 | 8 | 14 | 2008 | 1 | 49 | 4041 | 7034.6 | 59 | B |
| 5 | 5 | 8 | 14 | 2008 | 4 | 58 | 4051.1 | 7110.5 | 57 | B |
| 6 | 6 | 8 | 14 | 2008 | 8 | 3 | 4046.3 | 7150.9 | 50 | B, C1 |
| 7 | 7 | 8 | 14 | 2008 | 9 | 50 | 4041.2 | 7212.5 | 46 | B |
| 8 | 8 | 8 | 14 | 2008 | 11 | 6 | 4031.1 | 7218.7 | 53 | B |
| 9 | 9 | 8 | 14 | 2008 | 12 | 15 | 4031.2 | 7230.6 | 45 | W1 |
| 10 | 9 | 8 | 14 | 2008 | 12 | 23 | 4031.3 | 7230.8 | 45 | B |
| 11 | 10 | 8 | 14 | 2008 | 15 | 40 | 4035.2 | 7312.8 | 20 | B |
| 12 | 11 | 8 | 14 | 2008 | 19 | 55 | 3956.1 | 7252.7 | 52 | B |
| 13 | 12 | 8 | 14 | 2008 | 21 | 49 | 3938.1 | 7252.5 | 65 | B |
| 14 | 13 | 8 | 14 | 2008 | 22 | 59 | 3928.8 | 7252.6 | 66 | B |
| 15 | 14 | 8 | 15 | 2008 | 2 | 18 | 3858.5 | 7258.6 | 85 | B |
| 16 | 15 | 8 | 15 | 2008 | 3 | 48 | 3846.5 | 7302.7 | 215 | B, E1 |
| 17 | 15 | 8 | 15 | 2008 | 4 | 8 | 3846.3 | 7302.1 | 240 | W2 |
| 18 | 16 | 8 | 15 | 2008 | 5 | 28 | 3838.9 | 7310.3 | 145 | B |
| 19 | 17 | 8 | 15 | 2008 | 7 | 29 | 3829.1 | 7322.3 | 115 | B |
| 20 | 17 | 8 | 15 | 2008 | 7 | 33 | 3828.9 | 7322.3 | 114 | W3 |
| 21 | 18 | 8 | 15 | 2008 | 11 | 58 | 3821.4 | 7410.9 | 55 | B |
| 22 | 18 | 8 | 15 | 2008 | 12 | 30 | 3820.9 | 7410.8 | 53 | B |
| 23 | 19 | 8 | 15 | 2008 | 14 | 11 | 3816.1 | 7424.4 | 42 | B, C2, S1 |
| 24 | 20 | 8 | 15 | 2008 | 17 | 57 | 3741.4 | 7430.7 | 59 | B, C3 |
| 25 | 21 | 8 | 15 | 2008 | 22 | 8 | 3728.7 | 7517.8 | 27 | B |
| 26 | 22 | 8 | 15 | 2008 | 23 | 13 | 3723.6 | 7508.7 | 30 | B |
| 27 | 23 | 8 | 15 | 2008 | 23 | 58 | 3718.8 | 7504.4 | 36 | B, C4 |
| 28 | 24 | 8 | 16 | 2008 | 1 | 51 | 3706.4 | 7448.4 | 63 | B |
| 29 | 25 | 8 | 16 | 2008 | 3 | 36 | 3653.7 | 7458.9 | 35 | B |
| 30 | 25 | 8 | 16 | 2008 | 3 | 45 | 3653.7 | 7458.9 | 35 | W4 |
| 31 | 26 | 8 | 16 | 2008 | 6 | 22 | 3631.3 | 7512.6 | 25 | B |
| 32 | 27 | 8 | 16 | 2008 | 7 | 0 | 3626.2 | 7512.7 | 33 | B, C5 |
| 33 | 28 | 8 | 16 | 2008 | 10 | 1 | 3603.6 | 7448.7 | 117 | B |
| 34 | 29 | 8 | 16 | 2008 | 14 | 14 | 3531.4 | 7520.9 | 24 | B, C6 |
| 35 | 30 | 8 | 16 | 2008 | 18 | 33 | 3608.6 | 7525 | 29 | B |
| 36 | 30 | 8 | 16 | 2008 | 18 | 40 | 3608.7 | 7525.2 | 31 | W5 |
| 37 | 31 | 8 | 16 | 2008 | 19 | 45 | 3606.4 | 7536.5 | 21 | B |
| 38 | 32 | 8 | 16 | 2008 | 23 | 52 | 3646.8 | 7538.1 | 21 | B, IA |
| 39 | 33 | 8 | 17 | 2008 | 0 | 48 | 3646.5 | 7545.6 | 20 | B, IA |
| 40 | 34 | 8 | 17 | 2008 | 1 | 33 | 3646.4 | 7552.8 | 14 | B, IA |

B=bongo W=water C=CMarZ
V=vertical cast (CTD only), IA= ichthyo aging
m CO=Calanus observed / vol S=scallop larvae
G=WHOI GOMTox E=euphausiid sample

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| CAST | STA. | Date(GMT) | | TIME(GMT) | | LAT | LONG | DEPTH | OPERATION | |
|------|------|-----------|----|-----------|----|-----|--------|--------|---|--------|
| | | mm | dd | yy | hr | | | | | min |
| | | | | | | | | | B=bongo W=water C=CMarZ V=vertical cast (CTD only) IA=ichthyo aging m CO=Calanus observed / vol S=scallop larvae G=WHOI GOMTox E=euphausiid sample | |
| 41 | 35 | 8 | 17 | 2008 | 2 | 31 | 3653.6 | 7548.5 | 16 | B, IA |
| 42 | 36 | 8 | 17 | 2008 | 3 | 26 | 3700.5 | 7551.8 | 12 | B, IA |
| 43 | 37 | 8 | 17 | 2008 | 4 | 13 | 3700.8 | 7544 | 15 | B, IA |
| 44 | 38 | 8 | 17 | 2008 | 4 | 53 | 3700.8 | 7536.8 | 23 | B, IA |
| 45 | 39 | 8 | 17 | 2008 | 6 | 16 | 3711.1 | 7542.7 | 14 | B, IA |
| 46 | 39 | 8 | 17 | 2008 | 6 | 37 | 3711.3 | 7542.4 | 12 | B |
| 47 | 40 | 8 | 17 | 2008 | 7 | 38 | 3717.8 | 7539.5 | 14 | B, IA |
| 48 | 41 | 8 | 17 | 2008 | 8 | 19 | 3718 | 7532.6 | 16 | B, IA |
| 49 | 42 | 8 | 17 | 2008 | 9 | 9 | 3718 | 7524.7 | 24 | B, IA |
| 50 | 43 | 8 | 17 | 2008 | 10 | 43 | 3728.7 | 7535.1 | 13 | B |
| 51 | 44 | 8 | 17 | 2008 | 12 | 32 | 3741.7 | 7528.7 | 17 | B |
| 52 | 45 | 8 | 17 | 2008 | 18 | 57 | 3831.4 | 7446.7 | 29 | B |
| 53 | 45 | 8 | 17 | 2008 | 19 | 12 | 3831.6 | 7446.4 | 29 | W6 |
| 54 | 46 | 8 | 17 | 2008 | 21 | 14 | 3849.5 | 7436.9 | 19 | B |
| 55 | 47 | 8 | 17 | 2008 | 22 | 19 | 3853.3 | 7444.5 | 16 | B |
| 56 | 48 | 8 | 18 | 2008 | 1 | 26 | 3858.8 | 7408.9 | 34 | B |
| 57 | 49 | 8 | 18 | 2008 | 4 | 13 | 3913.6 | 7338.8 | 46 | B |
| 58 | 50 | 8 | 18 | 2008 | 5 | 15 | 3921 | 7334.9 | 48 | B |
| 59 | 50 | 8 | 18 | 2008 | 5 | 25 | 3921 | 7335.1 | 47 | W7 |
| 60 | 51 | 8 | 18 | 2008 | 8 | 43 | 3936.9 | 7410.5 | 16 | B |
| 61 | 52 | 8 | 18 | 2008 | 10 | 18 | 3946.2 | 7356.7 | 24 | B |
| 62 | 53 | 8 | 18 | 2008 | 12 | 0 | 3949 | 7337.5 | 37 | B |
| 63 | 54 | 8 | 18 | 2008 | 13 | 56 | 3953.8 | 7315.7 | 50 | B |
| 64 | 55 | 8 | 18 | 2008 | 17 | 1 | 4001.2 | 7238.4 | 60 | B, C7 |
| 65 | 55 | 8 | 18 | 2008 | 17 | 14 | 4001.2 | 7238.4 | 60 | W8 |
| 66 | 56 | 8 | 18 | 2008 | 18 | 52 | 4010.9 | 7223 | 65 | B |
| 67 | 57 | 8 | 18 | 2008 | 22 | 40 | 3944.1 | 7153.1 | 275 | B |
| 68 | 57 | 8 | 18 | 2008 | 23 | 3 | 3943.6 | 7152.8 | 283 | W9 |
| 69 | 58 | 8 | 19 | 2008 | 1 | 43 | 4009 | 7152.7 | 80 | B |
| 70 | 59 | 8 | 19 | 2008 | 2 | 59 | 4003.5 | 7140.2 | 92 | B, C8 |
| 71 | 60 | 8 | 19 | 2008 | 4 | 30 | 4016.2 | 7138.6 | 83 | B |
| 72 | 61 | 8 | 19 | 2008 | 6 | 20 | 4003.9 | 7126.8 | 92 | B, C9 |
| 73 | 62 | 8 | 19 | 2008 | 10 | 33 | 4001.3 | 7032.8 | 228 | W10 |
| 74 | 62 | 8 | 19 | 2008 | 10 | 49 | 4001.3 | 7032.5 | 240 | B |
| 75 | 63 | 8 | 19 | 2008 | 13 | 5 | 4018.6 | 7030.5 | 98 | B |
| 76 | 64 | 8 | 19 | 2008 | 14 | 25 | 4019 | 7017.4 | 89 | B, C10 |
| 77 | 65 | 8 | 19 | 2008 | 18 | 59 | 3958.7 | 6926.6 | 114 | B |
| 78 | 66 | 8 | 19 | 2008 | 21 | 59 | 4023.2 | 6931 | 68 | B |
| 79 | 67 | 8 | 20 | 2008 | 0 | 46 | 4034 | 7002.9 | 59 | B |
| 80 | 68 | 8 | 20 | 2008 | 1 | 13 | 4036.4 | 7004.9 | 55 | B |

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| CAST | STA. | Date(GMT) | | TIME(GMT) | | LAT | LONG | DEPTH | OPERATION | |
|------|------|-----------|----|-----------|----|-----|--------|--------|---|--------------------|
| | | mm | dd | yy | hr | | | | | min |
| | | | | | | | | | B=bongo W=water C=CMarZ V=vertical cast (CTD only) IA=ichthyo aging m CO=Calanus observed / vol S=scallop larvae G=WHOI GOMTox E=euphausiid sample | |
| 81 | 69 | 8 | 20 | 2008 | 3 | 44 | 4051.7 | 6939.5 | 39 | B |
| 82 | 69 | 8 | 20 | 2008 | 3 | 57 | 4051.8 | 6939.6 | 39 | W11 |
| 83 | 70 | 8 | 20 | 2008 | 5 | 28 | 4054.5 | 6918.8 | 41 | B |
| 84 | 71 | 8 | 20 | 2008 | 8 | 7 | 4048.7 | 6850.7 | 68 | B |
| 85 | 72 | 8 | 20 | 2008 | 10 | 15 | 4026.3 | 6846.8 | 80 | B |
| 86 | 73 | 8 | 20 | 2008 | 11 | 55 | 4036.3 | 6836.9 | 63 | B, C11 |
| 87 | 74 | 8 | 20 | 2008 | 13 | 57 | 4052.1 | 6835.3 | 57 | B |
| 88 | 74 | 8 | 20 | 2008 | 14 | 23 | 4051.7 | 6835.5 | 60 | B |
| 89 | 75 | 8 | 20 | 2008 | 15 | 28 | 4056.3 | 6826.9 | 50 | B |
| 90 | 76 | 8 | 20 | 2008 | 16 | 23 | 4103.7 | 6822.9 | 45 | B |
| 91 | 76 | 8 | 20 | 2008 | 16 | 42 | 4104.3 | 6823.3 | 33 | W12 |
| 92 | 77 | 8 | 20 | 2008 | 17 | 52 | 4103.6 | 6808.9 | 49 | B, C12 |
| 93 | 78 | 8 | 20 | 2008 | 20 | 4 | 4043.7 | 6756.7 | 77 | B |
| 94 | 79 | 8 | 21 | 2008 | 0 | 44 | 4108.4 | 6721.1 | 58 | B, S2 |
| 95 | 80 | 8 | 21 | 2008 | 3 | 14 | 4046.5 | 6724.9 | 90 | B |
| 96 | 80 | 8 | 21 | 2008 | 3 | 26 | 4046.4 | 6725.4 | 89 | W14 (No sample 13) |
| 97 | 81 | 8 | 21 | 2008 | 5 | 23 | 4033.7 | 6710.8 | 157 | B, E2 |
| 98 | 82 | 8 | 21 | 2008 | 7 | 41 | 4043.8 | 6646.8 | 275 | B, S3, E3, G1 |
| 99 | 82 | 8 | 21 | 2008 | 8 | 2 | 4043.3 | 6647 | 292 | W15 |
| 100 | 83 | 8 | 21 | 2008 | 13 | 2 | 4123.7 | 6656.9 | 67 | B, C13, S4 |
| 101 | 84 | 8 | 21 | 2008 | 15 | 3 | 4141.5 | 6659 | 62 | B, G2 |
| 102 | 85 | 8 | 21 | 2008 | 16 | 12 | 4143.9 | 6648.8 | 66 | B |
| 103 | 86 | 8 | 21 | 2008 | 17 | 7 | 4146.2 | 6642.8 | 66 | B |
| 104 | 87 | 8 | 21 | 2008 | 18 | 23 | 4143.9 | 6629 | 76 | B |
| 105 | 88 | 8 | 21 | 2008 | 19 | 58 | 4131.3 | 6620.8 | 91 | B, C14, G3 |
| 106 | 89 | 8 | 21 | 2008 | 21 | 51 | 4121.7 | 6605.4 | 286 | W16 |
| 107 | 89 | 8 | 21 | 2008 | 22 | 7 | 4121.5 | 6605 | 391 | B |
| 108 | 90 | 8 | 22 | 2008 | 0 | 39 | 4138.7 | 6552.8 | 135 | B, E4 |
| 109 | 91 | 8 | 22 | 2008 | 2 | 38 | 4154 | 6558.7 | 94 | B, C15, E5 |
| 110 | 92 | 8 | 22 | 2008 | 4 | 39 | 4211.3 | 6556.2 | 223 | W17 |
| 111 | 92 | 8 | 22 | 2008 | 4 | 58 | 4211.6 | 6557.1 | 224 | B, E6, G4 |
| 112 | 93 | 8 | 22 | 2008 | 6 | 21 | 4213.5 | 6546 | 222 | V |
| 113 | 93 | 8 | 22 | 2008 | 6 | 35 | 4213.4 | 6545.9 | 222 | B, E7 |
| 114 | 94 | 8 | 22 | 2008 | 13 | 14 | 4225 | 6659.9 | 360 | W18 |
| 115 | 94 | 8 | 22 | 2008 | 13 | 42 | 4224.9 | 6659.5 | 360 | B, S5 |
| 116 | 95 | 8 | 22 | 2008 | 17 | 20 | 4201.4 | 6648.8 | 69 | B, G5 |
| 117 | 96 | 8 | 22 | 2008 | 18 | 46 | 4158.8 | 6704.3 | 65 | B |
| 118 | 97 | 8 | 22 | 2008 | 22 | 20 | 4131.4 | 6730.6 | 44 | B |
| 119 | 98 | 8 | 23 | 2008 | 0 | 26 | 4126.4 | 6756.7 | 41 | B |
| 120 | 99 | 8 | 23 | 2008 | 1 | 9 | 4126.8 | 6805.1 | 39 | B |

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| CAST | STA. | Date(GMT) | | TIME(GMT) | | LAT | LONG | DEPTH | OPERATION | |
|------|------|-----------|-----|-----------|----|-----|--------|--------|-----------|----------------------|
| | | mm | did | yy | hr | | | | | min |
| 121 | 100 | 8 | 23 | 2008 | 1 | 48 | 4124.2 | 6810.8 | 44 | B |
| 122 | 101 | 8 | 23 | 2008 | 2 | 31 | 4123.9 | 6818.9 | 50 | B |
| 123 | 102 | 8 | 23 | 2008 | 3 | 35 | 4123.8 | 6830.7 | 78 | W19 |
| 124 | 102 | 8 | 23 | 2008 | 3 | 41 | 4124 | 6830.6 | 79 | B, G6 |
| 125 | 103 | 8 | 23 | 2008 | 8 | 8 | 4116.3 | 6924.3 | 49 | B, C16 |
| 126 | 104 | 8 | 23 | 2008 | 11 | 11 | 4133.6 | 6850.9 | 153 | B, G7 |
| 127 | 105 | 8 | 23 | 2008 | 14 | 28 | 4201.4 | 6858.6 | 129 | B, S6 |
| 128 | 106 | 8 | 23 | 2008 | 17 | 30 | 4221.3 | 6832.7 | 177 | B, C17 |
| 129 | 107 | 8 | 23 | 2008 | 19 | 46 | 4218.7 | 6806.8 | 184 | B, G8 |
| 130 | 108 | 8 | 23 | 2008 | 21 | 22 | 4206.9 | 6800.8 | 232 | W20 |
| 131 | 108 | 8 | 23 | 2008 | 21 | 43 | 4206.5 | 6800.6 | 228 | B, E8 |
| 132 | 109 | 8 | 23 | 2008 | 23 | 26 | 4154 | 6802.4 | 113 | B, E9 |
| 133 | 110 | 8 | 24 | 2008 | 1 | 19 | 4208.8 | 6749.1 | 205 | B, E10 |
| 134 | 111 | 8 | 24 | 2008 | 3 | 33 | 4221.2 | 6728.8 | 307 | W21 |
| 135 | 111 | 8 | 24 | 2008 | 3 | 55 | 4221.1 | 6728.8 | 308 | B, E11, G9 |
| 136 | 112 | 8 | 24 | 2008 | 6 | 31 | 4243.6 | 6728.7 | 201 | B, E12 |
| 137 | 113 | 8 | 24 | 2008 | 8 | 24 | 4248.7 | 6748.4 | 193 | B, C18, E13, G10 |
| 138 | 114 | 8 | 24 | 2008 | 10 | 27 | 4303.5 | 6748.8 | 197 | B |
| 139 | 115 | 8 | 24 | 2008 | 12 | 10 | 4313.3 | 6735.1 | 211 | B, G11 |
| 140 | 116 | 8 | 24 | 2008 | 13 | 6 | 4316.3 | 6740.7 | 238 | W22 |
| 141 | 116 | 8 | 24 | 2008 | 13 | 22 | 4316.2 | 6740.4 | 239 | B |
| 142 | 117 | 8 | 24 | 2008 | 14 | 28 | 4323.6 | 6741.9 | 246 | V |
| 143 | 117 | 8 | 24 | 2008 | 14 | 44 | 4323.6 | 6741.7 | 245 | B, S7 |
| 144 | 118 | 8 | 24 | 2008 | 20 | 45 | 4308.9 | 6635.1 | 108 | B |
| 145 | 119 | 8 | 24 | 2008 | 22 | 44 | 4328.7 | 6638.8 | 120 | B |
| 146 | 120 | 8 | 25 | 2008 | 3 | 34 | 4413.4 | 6654.8 | 174 | B, E14 |
| 147 | 121 | 8 | 25 | 2008 | 7 | 42 | 4346.2 | 6722.7 | 198 | B, C19, E15, G12 |
| 148 | 122 | 8 | 25 | 2008 | 10 | 2 | 4403.4 | 6748.6 | 137 | B |
| 149 | 123 | 8 | 25 | 2008 | 14 | 38 | 4350.9 | 6850.9 | 68 | B |
| 150 | 124 | 8 | 25 | 2008 | 18 | 6 | 4325.7 | 6922.4 | 167 | B, C20, E16, G13 |
| 151 | 124 | 8 | 25 | 2008 | 18 | 27 | 4325.7 | 6922.4 | 167 | W23 |
| 152 | 125 | 8 | 25 | 2008 | 19 | 49 | 4313.8 | 6914.8 | 178 | B, E17 |
| 153 | 126 | 8 | 25 | 2008 | 21 | 36 | 4303.8 | 6906.9 | 147 | B, C21, G14 |
| 154 | 127 | 8 | 25 | 2008 | 23 | 16 | 4248.8 | 6906.8 | 169 | B, E18, G15 |
| 155 | 128 | 8 | 26 | 2008 | 1 | 11 | 4233.8 | 6918.7 | 228 | W24 |
| 156 | 128 | 8 | 26 | 2008 | 1 | 26 | 4233.6 | 6918.7 | 230 | B, E19, G16 |
| 157 | 129 | 8 | 26 | 2008 | 3 | 33 | 4216.6 | 6927.6 | 224 | V |
| 158 | 129 | 8 | 26 | 2008 | 3 | 45 | 4216.4 | 6927.5 | 222 | B |
| 159 | 129 | 8 | 26 | 2008 | 4 | 20 | 4216.3 | 6928 | 226 | B, E20 |
| 160 | 130 | 8 | 26 | 2008 | 6 | 31 | 4158.6 | 6937 | 207 | B, S8, E21, E22, G17 |

B=bongo W=water C=CMarZ
V=vertical cast (CTD only) IA=ichthyo aging
m CO=Calanus observed / vol S=scallop larvae
G=WHOI GOMTox E=euphausiid sample

Table 1. STATION OPERATION REPORT FOR CRUISE DE0808

| CAST | STA. | Date(GMT) | | TIME(GMT) | | LAT | LONG | DEPTH | OPERATION | |
|------|------|-----------|----|-----------|----|-----|--------|--------|-----------|--------|
| | | mm | dd | yy | hr | min | | | | |
| 161 | 131 | 8 | 26 | 2008 | 11 | 5 | 4229.9 | 6940.1 | 253 | W25 |
| 162 | 131 | 8 | 26 | 2008 | 11 | 23 | 4229.8 | 6940.1 | 9999 | B |
| 163 | 132 | 8 | 26 | 2008 | 13 | 57 | 4249.5 | 6950.6 | 254 | V |
| 164 | 132 | 8 | 26 | 2008 | 14 | 16 | 4249.3 | 6950.7 | 252 | B, G18 |
| 165 | 133 | 8 | 26 | 2008 | 16 | 56 | 4308.5 | 7000.7 | 72 | B, C22 |
| 166 | 134 | 8 | 26 | 2008 | 18 | 33 | 4318.5 | 7014.7 | 89 | B, G19 |
| 167 | 135 | 8 | 26 | 2008 | 20 | 57 | 4256.5 | 7020.7 | 138 | B |
| 168 | 135 | 8 | 26 | 2008 | 21 | 15 | 4256.1 | 7021 | 145 | W26 |
| 169 | 136 | 8 | 27 | 2008 | 0 | 39 | 4225.1 | 7036.6 | 86 | B, G20 |
| 170 | 137 | 8 | 27 | 2008 | 4 | 43 | 4151.2 | 7012.9 | 21 | B |

B=bongo W=water C=CMarZ
V=vertical cast (CTD only) IA=ichthyo aging
m CO=Calanus observed / vol S=scallop larvae
G=WHOI GOMTox E=euphausiid sample

TOTALS: Bongo Casts = 137
Bongo 6B3Z Samples = 137
Bongo 6B3I Samples = 137
Ichthyoplankton aging samples = 11
Water Samples (no #13) = 25
Vertical Casts = 7
CTD Casts = 170
Larval scallop samples = 8
CMarZ samples = 22
GOMTOX samples = 20
Euphausiid samples = 22

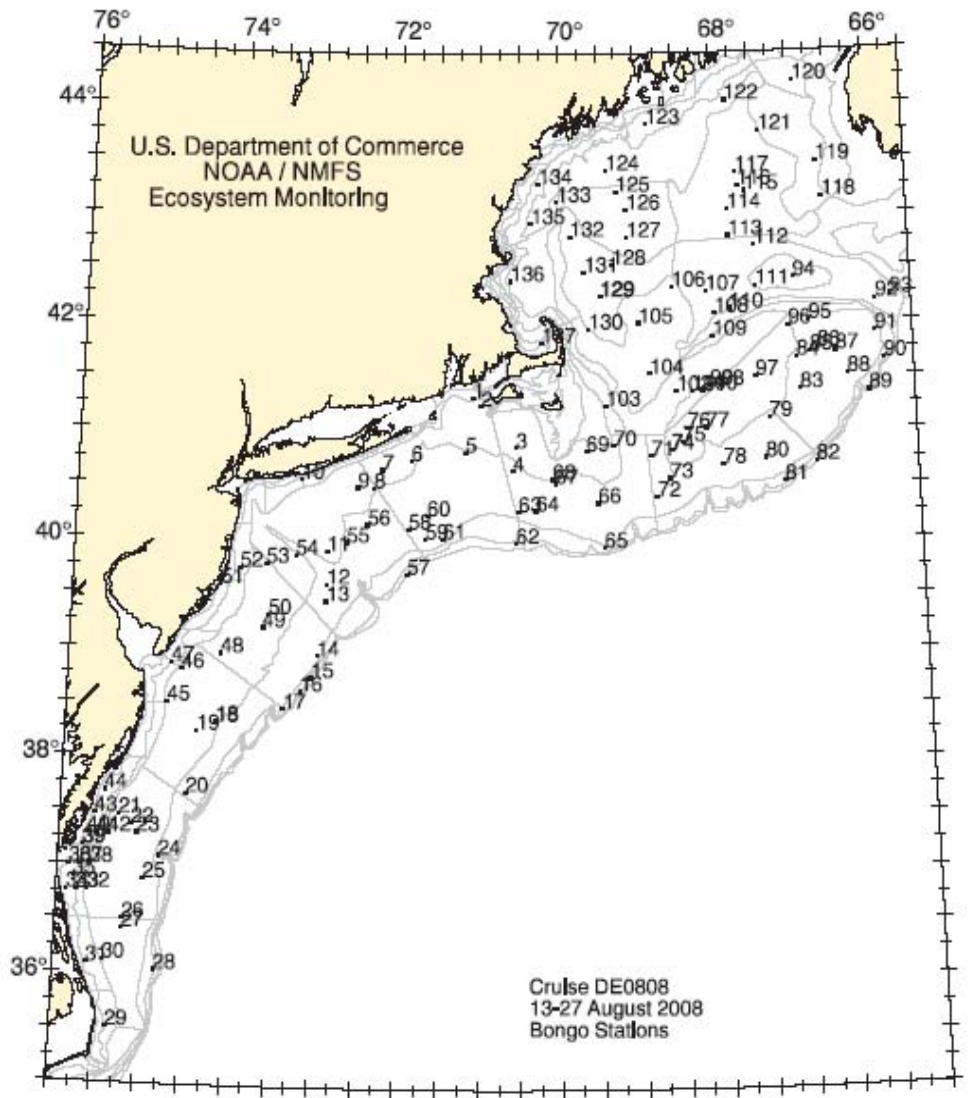


Figure 1. Station locations numbered consecutively for Late Summer Ecosystem Monitoring Cruise DE 08-08, 13 - 27 August 2008.



Figure 2. NOAA Teacher-at-Sea Rebecca Bell and URI/GSO student Alison Cleary launching drifter buoy from *DELAWARE II*.



Figure 3. Sampling array of 61 and 20 cm bongo nets being deployed from Delaware II.