CRUISE RESULTS
NOAA Fisheries Research Vessel Delaware II
Cruise No. DE 10-09
Ecosystems Monitoring Survey and RSMAS ISIIS Cruise

For further information, contact Jerome Prezioso
National Marine Fisheries Service, Northeast Fisheries
Science Center, Woods Hole, Massachusetts 02543-1097.

DATE: 27 September 2010

27 September 2010

CRUISE RESULTS
NOAA Fisheries Research Vessel *Delaware II*
Cruise No. DE 10-09
Ecosystems Monitoring Survey and RSMAS ISIIS Cruise

CRUISE PERIOD AND AREA

The cruise period was 18 August to 1 September 2010. Loading of the *Delaware II* took place on 16 and 17 August. Two days were lost to bad weather near the beginning of the cruise, and one day to an emergency medical evacuation in mid-cruise. This cruise worked from north to south unlike the typical ecosystem monitoring cruise, the rational being to improve coverage in the Gulf of Maine area which has been poor on several recent Ecosystem Monitoring Surveys. A total of 78 ecosystem monitoring stations were sampled; 34 in the Gulf of Maine (GOM), 30 on Georges Bank (GB), and 14 in Southern New England (SNE). An additional 12 stations were sampled in the Gulf of Maine and Georges Bank for comparison with the In Situ Ichthyoplankton Imaging System (ISIIS) which was used on Stellwagen Bank and on Georges Bank. There was not enough time remaining in the allotted schedule to complete sampling in the western portion of the Southern New England area and the Mid-Atlantic Bight.

OBJECTIVES

This cruise was done in collaboration with the Rosenstiel School of Marine Science (RSMAS), using a towed video system, the In-Situ Ichthyoplankton Imaging System (ISIIS) to investigate larval fish transport across Jeffreys Ledge and Georges Bank. As always, 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. However, we worked with our colleagues from RSMAS to apply their video technology to document the presence of larval fish at selected areas on Jeffreys Ledge and Georges Bank and to compare this data with bongo tows taken along the ISIIS transects.

Secondary objectives of this cruise included:

- 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.
- Collection of zooplankton for the Census of Marine Zooplankton Project (CMarZ), based at University of Connecticut, Avery Point.
- Identifications and counts of marine birds and mammals along the cruise track by observers Marie Martin and Tim White, from the Graduate Center of the City University of New York (CUNY).
- Provide a berth to Teacher-at Sea Scott Sperber of the Sherman Oaks Center for Enriched Studies in Tarzana, CA to participate and assist in collecting data. This experience will then be shared with his students upon returning to class in September.
- .Deployment of a NOAA drifter buoy by the Teacher-at-Sea for tracking of ocean currents and near surface temperatures by his students

METHODS

The survey consisted of 90 stations (Figure 1) at which the vessel stopped to lower instruments over the side. All ecosystem monitoring stations sampled were at randomly stratified locations except for five stations in the GOM that are routinely visited on all Ecosystem Monitoring cruises. These stations were Wilkinson Basin, Georges Basin, Jordan Basin, the Northeast Channel, and the Boston Harbor Liquefied Natural Gas (LNG) terminal. ISIIS operations were conducted on Stellwagen Bank and Georges Bank. These operations consisted of transects where the ISIIS unit was towed followed by bongo tows made along the same transects for comparison purposes.

Plankton and hydrographic sampling was conducted at most 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 biomass analysis from the different regions surveyed. 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 mechanical 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 to the covered work area for washing the plankton samples into sieves.

A small container (11 ½ ft L x 7 ½ ft W x 7 ½ ft H) was brought on board, which was set up as a plankton lab, complete with a fume hood for sample preservation, a sink with running seawater, stainless steel worktables, a small space heater and ventilation fans for the fume hood and the container inside area. This was secured to the port side of the stern deck, just aft of the covered work area. On this cruise we used the space saved in the wet lab as additional office space for researchers to set up laptops for communication and writing (Figure 3).

The trawlway on the stern was dedicated to launching and retrieval of the ISIIS towed body video system (Figure 4). Comparison bongo tows were made after each ISIIS transect using the same 61 cm bongo frames and nets that were used for the Ecosystem Monitoring stations. The drylab area of the *Delaware II* was set up as the real-time control area for "flying" the ISIIS towed body behind the vessel (Figure 5). The in-water unit was towed at a speed of 5 knots using its optical fiber tow cable to send images from its camera at 17 frames per second, (Figure 6) along with data from its sensors to a computer in the drylab.

The 61-cm bongo plankton samples were preserved in a 5% solution of formalin in seawater. The CMarZ samples from the 20-cm diameter bongos were preserved in 95% ethanol, which was changed once at 24 hours after the initial preservation. The ISIIS comparison bongo tow plankton samples were also preserved in 95% ethanol, and changed once after 24 hours.

Plankton bongo 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 and Georges basins and the Northeast Channel to provide hydrographic data from below the 200 m limit set for bongo tows. Four ISIIS tows were made, two on Stellwagen Bank and two on Georges Bank. At each location, the tows were made as replicates of each other, followed by comparison bongo tows taken at points along the transect.

A drifter buoy, WMO # 44554, from the NOAA Adopt-a-Drifter Buoy program was deployed by the on-board Teacher-at-Sea on this trip. This unit was equipped with a cylindrical drogue and a float containing a thermistor and radio transmitter for daily communications with the ARGOS satellite system. Surface water temperature and position data are logged on a website:
http://www.aoml.noaa.gov/phod/trinanes/xbt.html

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 the thermosalinograph at 10-second intervals. The data records were given a time-date stamp by the GPS unit. The fluorometer malfunctioned shortly after sailing and no data from it was recorded on this cruise.

Samples for Seabird CTD salinity data calibration were obtained at intervals using a 1.7 liter Niskin bottle taking a water sample from an isohaline portion of the water column.

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

RESULTS

A summary of routine survey activities is presented in Table 1. Areal coverage for the cruise is shown in Figure 1. Bad weather and the evacuation of an ill crewmember caused a 3 day delay that prevented coverage of the Mid-Atlantic Bight and the western portion of the Southern New England areas.

The *Delaware II* sailed at 1400 hours EDT on Wednesday, 18 August 2010. The vessel headed north through the Cape Cod Canal to start work in the Gulf of Maine, a departure from the usual south to north progression. This marked an attempt to guarantee full coverage of the Gulf of Maine area, which has received reduced coverage on several earlier cruises due to lack of time. The first station, the LNG terminal outside of Boston Harbor was reached in the evening of the first day. From there two more EcoMon stations were sampled. On the morning of the following day, a scouting run for fixed gear was made on Stellwagen Bank, followed by the first ISIIS tow. Two comparison bongo tows were made after that, and then a second ISIIS tow was made along the same transect, again followed by two comparison bongo tows. Work with the ISIIS system was completed on Thursday evening and the *Delaware II* proceeded to Wilkinson Basin and then to the remainder of the Gulf of Maine. On Saturday afternoon, 21 August our NOAA drifter buoy equipped with a thermistor, a drogue and a radio transmitter was launched at consecutive station #21, the easternmost station of the entire cruise, by the Teacher-at-Sea Scott Sperber. His students will be tracking "their" buoy, WMO#44554, emblazoned with their school name and mascot, at the website: http://www.aoml.noaa.gov/phod/trinanes/xbt.html (Figure 7).
Examination of the buoy's track following the cruise showed it to be traveling in a clockwise gyre around

the point of launch. After the buoy launch the vessel worked its way westward across Browns Bank, Georges Basin and Jordan Basin on Sunday 22 August. With deteriorating weather on Monday 23 August, work was halted in the morning and the vessel anchored in Provincetown by 1400, where it remained until 0615 Wednesday, 25 August after the passage of a large nor'easter through the area. As seas diminished the vessel resumed working later that day, completing operations in the Gulf of Maine and continuing on to Georges Bank. After completing 11 stations on Georges Bank ISIIS operations were resumed on Friday. After completing one ISIIS transect and comparison bongo tows, a run was made to Chatham, MA to rendezvous with a Coast Guard vessel for the evacuation of an ill crew member. The transfer was completed successfully on the morning of Saturday 28 August in calm seas, and the *Delaware II* returned to the northern flank of Georges Bank, and resumed working on the evening of that same day. Eleven EcoMon stations were sampled on the northeast peak as well as the fixed Northeast Channel station and by Sunday, 29 August the vessel had returned to the site of the first ISIIS transect on the southern flank of Georges. A second transect was run on the same coordinates, followed by 4 comparison bongo tows, exactly as had been done for the first transect. The ISIIS tow was run from 1700 to 2300 EDT on 29 August, and the comparison bongo tows were completed early the next morning at 0200 EDT on 30 August. Regular EcoMon sampling continued after this and Georges Bank sampling was completed by 2300 EDT this same day. Enough time remained in the cruise schedule for sampling at 14 stations in the eastern portion of the Southern New England area. All sampling operations were completed by 0730 EDT on Wednesday 1 September and the *Delaware II* docked at the NMFS dock in Woods at 1030 EDT that same morning.

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 Census of Marine Zooplankton samples were retrieved from the vessel by Woods Hole Oceanographic Institute researcher Nancy Copley. The Oceanography Branch of the NEFSC, Woods Hole, retained the CTD data and original log sheets. The ISIIS equipment was packed up and shipped to RSMAS at University of Miami by Cedric Guigand and Adam Greer. The ISIIS bongo samples were delivered to the Ecosystem Monitoring Group in Narragansett. The Ecosystems Monitoring Laboratory Container was stored next to the Woods Hole NEFSC storage building.

SCIENTIFIC PERSONNEL

<u>National Marine Fisheries Service, NEFSC, Narragansett, RI</u>

Jerome Prezioso Chief Scientist
David Richardson

<u>Rosenstiel School of Marine Science, University of Miami</u>

Cedric Guigand
Adam Greer

CUNY Graduate Center, Staten Island, NY

Marie Caroline Martin
Timothy White

Sherman Oaks Center for Enriched Studies, Tarzana, CA

Scott Sperber

****

For further information contact:
Jon Hare, Oceanography Branch Chief
National Marine Fisheries Service, Northeast Fisheries Science Center
Narragansett, RI 02882.
Tel(401)782-3295 FAX(401)782-3201;
INTERNET “Jon.Hare@noaa.gov”.

****

Table 1. STATION OPERATION REPORT FOR CRUISE DE1009

CAST	STA.	Date(GMT) mm	did	yy	TIME(GMT) hr	min	LAT	LONG	DEPTH m	OPERATION B=bongo W=water C=CMarZ V=vertical cast(CTD only)
1	1	8	19	2010	2	26	4225	7037	84	B
2	2	8	19	2010	4	4	4238	7031.2	78	B
3	3	8	19	2010	6	19	4231.1	7007.1	85	B
4	4	8	19	2010	18	33	4213	7024.6	67	ISIIS BONGO
5	5	8	19	2010	19	12	4214.6	7019.9	55	ISIIS BONGO
6	6	8	20	2010	0	37	4212.7	7023.2	66	ISIIS BONGO
7	7	8	20	2010	1	7	4213.7	7020.1	52	ISIIS BONGO
8	8	8	20	2010	4	31	4230	6939.9	245	B
9	8	8	20	2010	4	58	4230.1	6938.8	251	V1
10	9	8	20	2010	9	22	4311	6946.8	170	B
11	10	8	20	2010	11	13	4313.7	7004.8	158	B, C 1
12	11	8	20	2010	13	25	4326.2	6950.9	142	B
13	12	8	20	2010	14	48	4336.2	6958.9	64	B
14	13	8	20	2010	17	36	4336.3	6929.1	127	B
15	13	8	20	2010	17	55	4336.3	6929.8	134	W 1
16	14	8	20	2010	21	42	4346.2	6846.6	97	B
17	15	8	20	2010	23	48	4348.9	6822.4	137	B
18	16	8	21	2010	3	32	4353.9	6736.8	211	B, C 2
19	17	8	21	2010	5	24	4358.8	6719	229	B
20	17	8	21	2010	5	50	4359	6720.1	202	W2
21	18	8	21	2010	8	13	4403.8	6652.7	167	B
22	19	8	21	2010	12	11	4343.9	6620.8	64	B, C 3
23	20	8	21	2010	17	36	4251.2	6602.8	88	B
24	21	8	21	2010	21	2	4236.2	6525.2	94	B
25	21	8	21	2010	21	15	4236.2	6525.2	95	W 3
26	22	8	22	2010	2	40	4226	6626.3	270	B
27	22	8	22	2010	3	8	4225.5	6627.3	275	V 2
28	23	8	22	2010	5	13	4241	6636.9	170	B
29	24	8	22	2010	7	55	4224.9	6659.9	364	B
30	24	8	22	2010	8	21	4225.1	6700.4	364	W 4
31	25	8	22	2010	10	33	4219.8	6721.4	297	B, C 4
32	25	8	22	2010	11	4	4219.5	6722.5	297	V 3
33	26	8	22	2010	13	25	4213.9	6745	226	B
34	26	8	22	2010	13	50	4213.4	6744.3	222	V 4
35	27	8	22	2010	15	9	4223.9	6745.3	203	B, C 5
36	28	8	22	2010	21	5	4311.4	6726.7	193	B
37	29	8	22	2010	23	4	4324.4	6741.4	249	B
38	29	8	22	2010	23	26	4324.4	6741.4	245	W 5
39	30	8	23	2010	2	35	4306.3	6806.5	169	B
40	31	8	23	2010	4	24	4256.4	6818.7	183	B

Table 1. STATION OPERATION REPORT FOR CRUISE DE1009

CAST	STA.	Date(GMT) mm	did	yy	TIME(GMT) hr	min	LAT	LONG	DEPTH m	OPERATION (B=bongo W=water C=CMarZ V=vertical cast(CTD only
41	32	8	23	2010	7	54	4246.3	6854.7	98	B
42	32	8	23	2010	8	19	4246	6854.8	93	B
43	33	8	23	2010	10	44	4228.9	6908.8	228	B
44	33	8	23	2010	11	13	4229.6	6908.3	221	V 5
45	34	8	25	2010	21	19	4206.3	6918.1	206	B
46	35	8	26	2010	0	54	4143.7	6910.7	180	B
47	36	8	26	2010	3	15	4126.2	6908.8	151	B
48	37	8	26	2010	5	18	4119	6853.2	131	B
49	37	8	26	2010	5	38	4119	6853.2	132	W-lost
50	38	8	26	2010	7	29	4118.6	6832.7	65	B
51	39	8	26	2010	8	53	4111	6826.1	50	B
52	40	8	26	2010	10	37	4103.7	6808.8	49	B, C 6
53	41	8	26	2010	13	52	4109	6732.8	54	B
54	42	8	26	2010	15	50	4111.2	6710.8	61	B
55	43	8	26	2010	18	46	4125.9	6734.6	40	B, C 7
56	44	8	26	2010	20	43	4131.1	6750.7	37	B
57	45	8	26	2010	23	28	4151.4	6808.7	157	B
58	46	8	27	2010	1	43	4156.3	6746.8	53	B
60	47	8	27	2010	3	36	4148.7	6734.5	51	B
61	47	8	27	2010	3	46	4148.7	6734.4	47	W 6
62	48	8	27	2010	4	56	4148.7	6720.3	60	B
63	49	8	27	2010	6	13	4146.1	6704.6	56	B
64	50	8	27	2010	8	27	4128.4	6640.6	79	ISIIS BONGO
65	51	8	27	2010	18	13	4113.1	6608.3	100	ISIIS BONGO
66	52	8	27	2010	19	26	4118	6619.3	99	ISIIS BONGO
67	53	8	27	2010	20	49	4123.7	6630.9	90	ISIIS BONGO
68	54	8	29	2010	1	20	4156.3	6706.8	58	B
69	55	8	29	2010	2	59	4208.9	6656.8	87	B
70	56	8	29	2010	4	56	4156.1	6647.1	65	B
71	56	8	29	2010	5	8	4156.1	6647.1	64	W 77
72	57	8	29	2010	7	58	4201.1	6808.6	93	B, C 8
73	58	8	29	2010	9	13	4203.5	6555.8	214	B
74	59	8	29	2010	10	55	4213.6	6545.9	226	B
75	59	8	29	2010	11	18	4213.1	6546.1	225	W 8
76	60	8	29	2010	13	19	4156.4	6552.9	131	B
77	61	8	29	2010	13	58	4156.4	6556.5	106	B
78	62	8	29	2010	15	55	4141.3	6604.6	101	B
79	63	8	29	2010	17	29	4143.7	6622.7	76	B
80	64	8	29	2010	19	47	4128	6640.8	79	B

Table 1. STATION OPERATION REPORT FOR CRUISE DE1009

CAST	STA.	Date(GMT)			TIME(GMT)		LAT	LONG	DEPTH	OPERATION B=bongo W=water C=CMarZ V=vertical cast(CTD only)
		mm	did	yy	hr	min			m	
81	64	8	29	2010	20	5	4128	6640.8	80	ISIIS BONGO
82	65	8	30	2010	3	10	4112.1	6608.5	1253	ISIIS BONGO
83	66	8	30	2010	4	15	4118.1	6619.4	97	ISIIS BONGO
84	67	8	30	2010	5	29	4123.7	6630.7	91	ISIIS BONGO
85	68	8	30	2010	7	49	4103.6	6632.7	92	B, C 9
86	69	8	30	2010	11	25	4041	6707.7	110	B
87	69	8	30	2010	11	40	4041.3	6707.3	107	W 9
88	70	8	30	2010	13	57	4026.2	6728.4	186	B, C 10
89	71	8	30	2010	16	25	4024.5	6756.2	180	B
90	72	8	30	2010	17	29	4031.3	6755	103	B
91	73	8	30	2010	20	51	4033.5	6836.5	70	B
92	74	8	30	2010	22	20	4023.6	6848.8	83	B
93	75	8	31	2010	0	51	4043.5	6847.6	65	B
94	75	8	31	2010	1	1	4043.5	6847.6	65	W 10
95	76	8	31	2010	2	47	4058.9	6851	71	B
96	77	8	31	2010	3	52	4058.8	6902.8	79	B
97	78	8	31	2010	5	0	4051.4	6906.7	77	B
98	79	8	31	2010	6	46	4101.2	6922.4	42	B, C 11
99	80	8	31	2010	9	49	4033.6	6912.8	66	B, C 12
100	80	8	31	2010	10	3	4033.2	6913.1	69	W 11
101	81	8	31	2010	13	43	4033.7	7002.8	60	B, C 13
102	82	8	31	2010	15	48	4016.3	6955	89	B, C 14
103	83	8	31	2010	17	45	3959.9	7002.2	162	B, C 15
104	84	8	31	2010	22	24	4016.2	7055	119	B
105	85	9	1	2010	1	27	4041.4	7058.7	64	B
106	86	9	1	2010	3	39	4058.4	7051.2	52	B
107	86	9	1	2010	3	51	4058.4	7051.2	52	W 12
108	87	9	1	2010	4	55	4053.6	7040.8	51	B
109	88	9	1	2010	7	22	4106.1	7015	29	B
110	89	9	1	2010	8	47	4116.2	7022.9	15	B
111	90	9	1	2010	10	39	4107.8	7043	39	B

TOTALS:

Bongo Casts	= 90
Bongo 6B3Z Samples	= 77
Bongo 6B3I Samples	= 78
ISIIS Bongo Samples	= 12
CTD 19 Water Samples	= 12
Vertical CTD 19 Casts	= 5
CTD 19 Casts	= 111
CMarZ samples	= 15
ISIIS Deployments	= 4

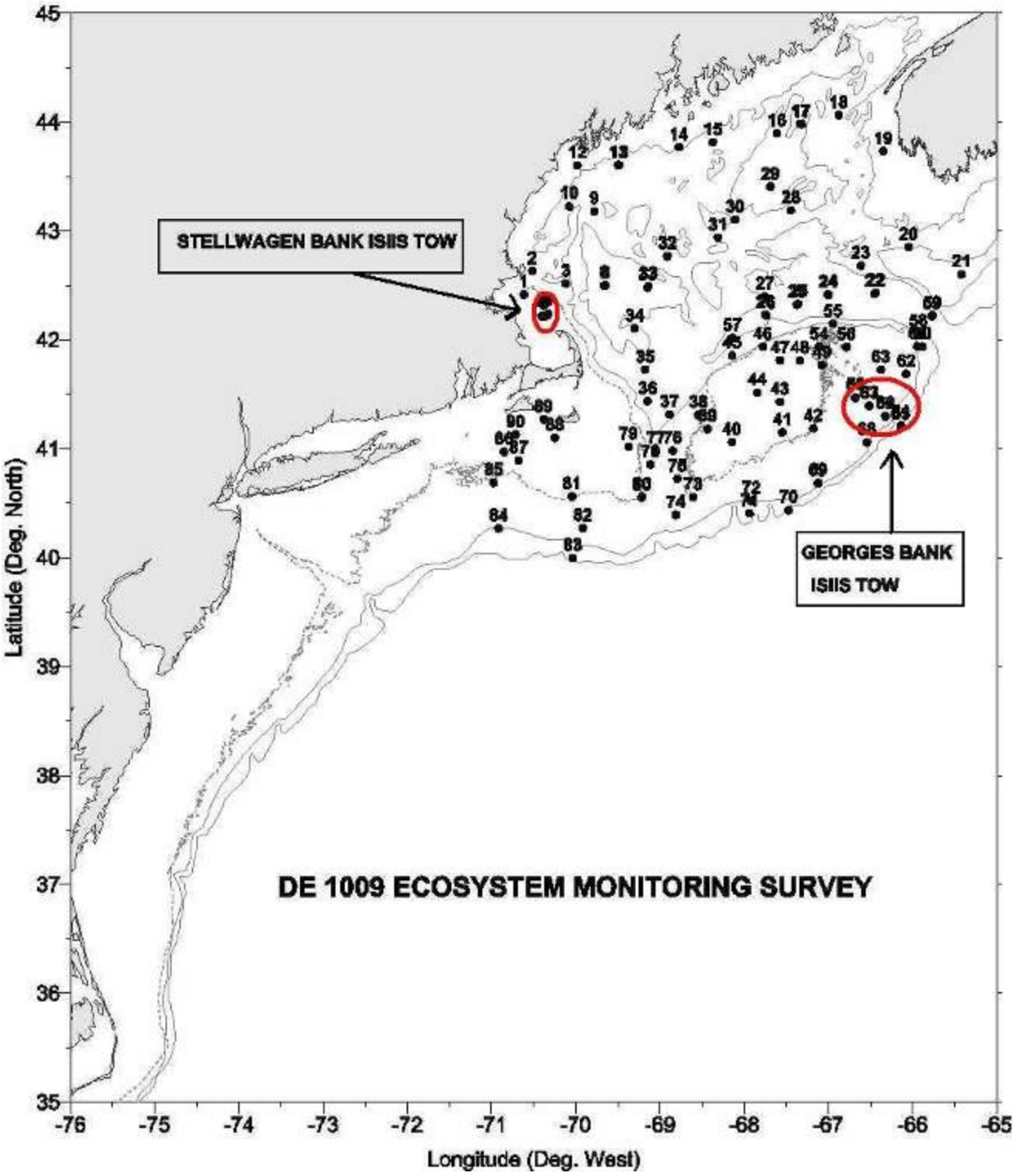

Figure 1. Station locations numbered consecutively for Ecosystems Monitoring Survey Cruise DE 10-09, 18 August – 1 September 2010.

Figure 2. 20 cm + 61 cm bongo sampling array used for collecting CMarZ samples simultaneously with Ecosystem Monitoring samples.

Figure 3. ISIIS towed body being retrieved up the trawlway of *Delaware II*.

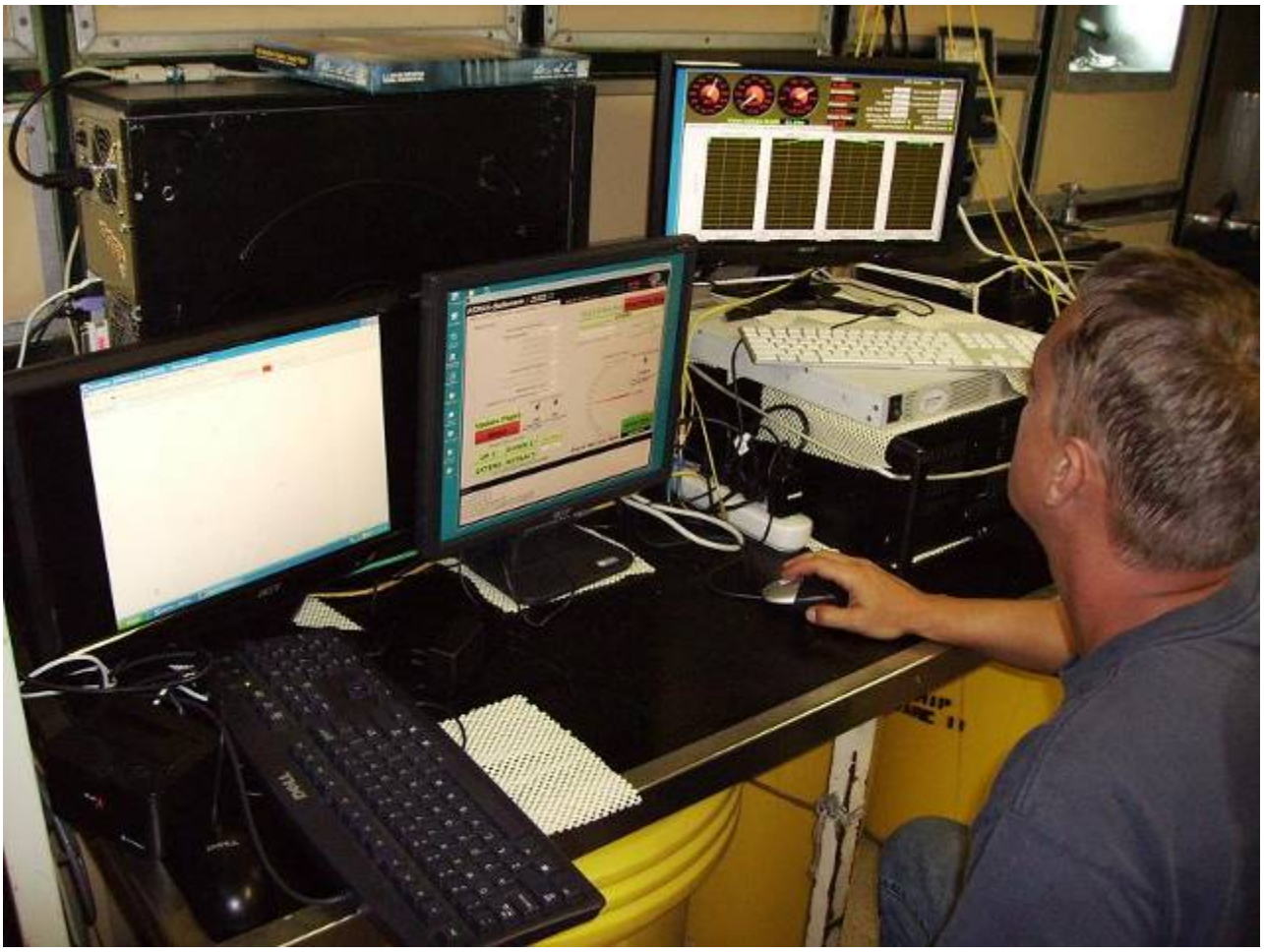

Figure 4. ISIIS control center in drylab area of *Delaware II*.

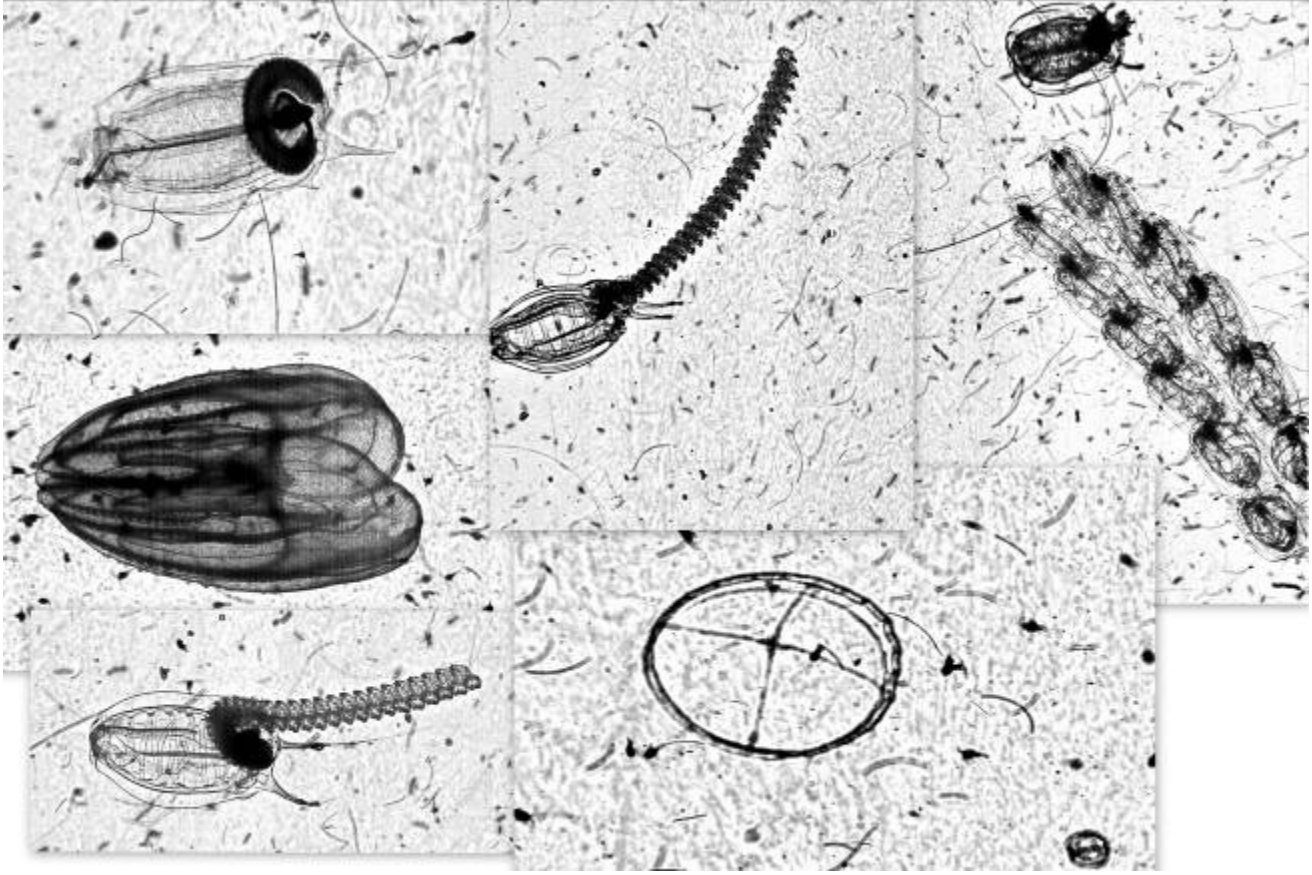

Figure 5. Images of gelatinous zooplankton photographed by ISIIS.

Figure 6. *Delaware II* wetlab set up as office space for researcher Marie Martin and others.

Figure 7. Teacher-at-Sea Scott Sperber with his NOAA drifter buoy.