BITMAXII Cruise BM0702 Report

Project title: Dynamic stability and particle transformations: tracing pathways of production in Estuarine Turbidity Maxima (NSF-OCE-0453905)

9-15 April 2007

Research Vessel

R/V Hugh R. Sharp (Captain: William Byam)

Scientists

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Sampling Area

Upper Chesapeake Bay from the southern extent of the Susquehanna River flats (Lat. 39.439) to the Chesapeake Bay Bridge (Lat 38.998).

Cruise Report Contents

I. Activities

Objectives of this cruise were to sample the estuarine turbidity maximum (ETM) region of the Chesapeake Bay with CTD casts, Niskin bottles, MOCNESS zooplankton nets, Tucker Trawl ichthyoplankton/zooplankton nets, and video-equipped bottom withdrawal tubes. The ETM in this system is most prominent in deeper waters of the shipping channel near the freshwater/saltwater interface. Our sampling strategy included 1) axial surveys of the region with CTD casts and Niskin bottles conducted at 11 stations, 2) axial surveys to sample zooplankton and ichthyoplankton with MOCNESS and Tucker Trawl net tows, 3) time course sampling at three anchor stations, 4) time course sampling at two alternating stations with MOCNESS net tows, and 5) channel vs. shoal comparisons of ichthyoplankton and zooplankton abundance with Tucker Trawl net tows.

The ship was loaded at the Sailwinds dock in Cambridge, MD on 8 April, and departed that evening. Operations began at 1112 UTC on 9 April[1] with an axial survey of the study area (campaign "axial-1") (Figure 1) consisting of CTD casts at 11 stations (Table 1) to measure conductivity, temperature, dissolved oxygen, fluorescence, optical backscatter, and particle scattering and transmission with a Laser In-Situ Scattering and Transmissometry device (LISST 100C). At each station, water samples were collected at selected depths with a small well pump to directly measure total suspended solids for calibration of optical devices. At five stations (as03, as05, as08, as10, as13c), water samples were collected with 10L Niskin bottles from surface, middle and bottom depths, poured from one end of the Niskins into 6 gallon buckets, stirred with stir bars to homogenize suspended particles, and sampled for multiple biological and chemical analyses (Table 2). At each axial station (and at all stations during daylight hours), a PRR-600 irradiance sensor was deployed after CTD casts to measure subsurface irradiance. In addition, surface PAR was recorded at each daytime station using a Li-Cor LI-1400 DataLogger equipped with a LI-190SA-50 quantum sensor. During this first CTD survey the water column was strongly stratified. We found the ETM centered at station as09 (station 7 in the consecutive station log), and the tip of the salt wedge at station as10 (Figure 2). We also found a high concentration of copepods in the water, particularly in the ETM region.

Two mooring arrays were deployed between 2220 and 2250 UTC on 9 April at a location between Stations as09 and as10 (vicinity 39 19.65 N and 76 12.30 W), to the west of the main shipping channel in approximately 10.5 meters water depth. This area was considered the middle of the ETM region. One of the mooring arrays consisted of a string of 5 temperature and salinity recorders on a taut wire mooring, for the purpose of resolving the time series of the density structure at the site. The 2 lowest sensors were also equipped with an OBS to measure turbidity. The second mooring was a bottom landing 1200 KHz ADCP that was set to sample at a high ping rate for the purpose of calculating the Reynolds stresses in addition to the profiled water velocities. The moorings were recovered on 15 April between 1830 and 1930 UTC. All data was recovered from these moorings.

The mooring site was used for the first anchor station series. CTD casts were conducted hourly for 22 hours starting at 0032 UTC on 10 April with all equipment described above except for the well pump. During this time a Digital Imaging Particle Settling Tube with In-situ Capture (DIPSTIC) was deployed several times with the A-frame to observe particle size and settling speed. Water samples for biological and chemical analyses were collected from a near-bottom depth at 0830 UTC on 10 April, and from three depth at 1728 UTC. The two bottom water samples were sequentially fractionated with a series of screens (63, 20 & 10 micron Nitex mesh, and a 3 micron polycarbonate filter), and sub-sampled for biological and chemical analyses. The surface water sample was also fractionated, and analyzed for primary production and respiration rates, chlorophyll concentration, and pigment composition. Water samples were collected from the DIPSTIC after three deployments for biological and chemical analysis of particles fractionated by settling velocity (DIPSTIC cast numbers 06, 07, and 09). Zooplankton were collected using a 50 cm diameter net fitted with 200 micron mesh, which was towed vertically from near the bottom to the surface. Samples collected from these nets were either frozen for subsequent CHN and stable isotope analysis, or were used in incubation experiments to determine the egg production, egg hatching, and development rates of copepods, in particular *Eurytemora affinis*. Briefly, the entire copepod sample was divided among 27 250 ml

[1] Times/dates are in Universal Time Code

polycarbonate bottles and incubated in a running seawater bath (at ambient surface temperature) for 48 hours. Triplicate jars were preserved (4% buffered formaldehyde) at 6 hour intervals for analysis in the lab after the cruise.

A second anchor station survey (anchor-2) was conducted at a site up-estuary of the ETM region near station as13c. Water at this station was completely fresh throughout the water column during this survey. CTD casts were conducted hourly from 0028 to 1030 UTC on 11 April. The DIPSTIC was deployed several times as described above. One surface water sample was collected at 0936 UTC for particle fractionation and biological and chemical analyses including primary production and respiration rates, chlorophyll concentration, and pigment composition. Water samples were also collected from the DIPSTIC after two deployments for biological and chemical analyses of particles fractionated by settling velocity (DIPSTIC cast numbers 11 and 19).

A third anchor station survey (anchor-3) was conducted at a site down-estuary of the ETM region between station as04 and as05. CTD casts were conducted hourly from 1340 to 2027 UTC on 11 April. The DIPSTIC was cast several times as described above. One bottom water sample was collected at 1931 UTC for particle fractionation and biological and chemical analyses. Water samples were also collected from the DIPSTIC after two deployments for biological and chemical analyses of particles fractionated by settling velocity (DIPSTIC cast numbers 23 and 24).

A scientific crew change was conducted at Sandy Point State Park at 2200 on 11 April. The ship then moved to station as03 to begin a nighttime axial survey of zooplankton using a multiple opening closing net sampling system (MOCNESS) equipped with one 333 and four 200 micron mesh nets and temperature, salinity, and pressure sensors. Between 0020 and 0629 UTC on 12 April the MOCNESS was fished at six stations (as03, as05, as07, as09, as11, as13c) to within 3 m of the bottom. The 333 micron mesh net was fished first, between the surface and near-bottom, and the three to four 200 micron mesh nets were fished in 3-5 m depth intervals between the surface and bottom, depending on the depth and structure of the water column. All samples were preserved in 4% buffered (sodium borate) formaldehyde within thirty minutes of collection. CTD casts preceded each net tow.

The ship then moved down-estuary to begin a daytime axial survey of zooplankton using the MOCNESS as described above with the following modifications. CTD casts were conducted at all eleven stations (rather than just six), and water samples were collected at five stations (as05, as07, as09, as11, as13c) with 10L Niskin bottles from surface, middle and bottom depths and were processed as during the first axial survey, except that water for chemical and microbiological analyses was pre-screened with a 200 micron pore size Nitex net to remove copepods. This survey was conducted between 1120 and 1929 UTC on 12 April.

The ship then moved to the ETM region to initiate a 26 hour ETM survey during which zooplankton and ichthyoplankton were collected with the MOCNESS every hour at two alternating stations. The “down” station was between Stations as09 and as10, and the “up” station was between Stations as10 and as11 (Table 1). Water samples were collected at four time points (1053, 1529, 2010, and 0005 UTC) with 10L Niskin bottles from surface, middle and bottom depths and were processed as during the first axial survey, except that water for chemical and microbiological analyses was pre-screened with a 200 micron pore size Nitex net to remove copepods. This time series ran from 2220 UTC on 12 April to 0005 UTC on 14 April.

Tucker Trawl surveys for ichthyoplankton and zooplankton near the ETM began at 0554 UTC, 14 April. Initial deployments were “Channel vs. Shoal” comparisons (TT#01-TT#08) at

four stations near the locations of the "down" and "up" MOCNESS 26-hr survey (Table1). Each station was sampled twice during this survey, which was completed by 1815 UTC, 14 April. The 1-m^2 TT has two nets with 280-µm meshes, a flowmeter in each net, and a time-depth-temperature recorder to document the tow. The gear was deployed and fished obliquely for 2 min in two depth strata (near bottom to pycnocline and pycnocline to surface). CTD casts preceded each TT tow. Samples were preserved in ethanol.

A bathymetric survey of the shipping channel between stations as09 and as07 was conducted from 1840 to 2030 UTC on 14 April.

The ship then returned to the mooring station and conducted several CTD casts until an ETM particle-resuspension event occurred. During an ETM event at 2201 on 14 April a set of water samples was collected from three depths for biological and chemical analyses including primary production in surface waters.

The ship then steamed to a station located in the Elk River tributary (designated Station "as14"), and began an axial survey of ichthyoplankton and zooplankton using the Tucker Trawl at 2352 UTC on 14 April. Seven stations were sampled at stations as14, as13c, as12, as10, as08, as06, and as04 (Tucker Trawl casts TT#09 to TT#15). CTD casts preceded each net tow. Deployment and sample preservation procedures were as described above for the "Channel vs. Shoal" TT survey. The TT axial survey was completed at 0600 UTC, 15 April.

A scientific crew change was conducted at Sandy Point State Park at 0900 on 15 April. Then a final axial survey (axial-2) identical to the first axial was conducted beginning at 1100 on 15 April. Water samples for chemical and microbiological analyses were pre-screened with a 200 micron pore size Nitex net to remove copepods.

Following the final axial survey the ship moved to the mooring site and the mooring was de-installed at 1900 on 15 April. Then the ship returned to the Sailwinds Dock at Cambridge, MD and offloading commenced.

All cruise objectives were met. A total of 132 stations were occupied (Table 3) and all major physical and biological measurements and collections were completed. The crew of the ship was very supportive and helped facilitate a successful cruise.

II. Weather

The cruise began under fair conditions with light winds and cool temperatures until the morning of April 12 when winds became stronger and remained that way periodically throughout the rest of the cruise. Air temperatures averaged 7.5ºC, and ranged from 2ºC to 12.5ºC (data from Thomas Point, 38.90N 76.44W, http://www.ndbc.noaa.gov/hmd.shtml).

III. Contact Information

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Table 1. Sampling locations

StationID	Campaign	Latitude	Longitude	Water Depth
as03	Axial	38.998	-76.360	21
as04	Axial	39.059	-76.328	12.4
as05	Axial	39.107	-76.305	5.3
as06	Axial	39.164	-76.304	9
as07	Axial	39.208	-76.256	7.5
as08	Axial	39.260	-76.236	9.1
as09	Axial	39.311	-76.220	9.8
as10	Axial	39.346	-76.173	7.5
as11	Axial	39.374	-76.119	10
as12	Axial	39.399	-76.050	9.1
as13c	Axial	39.440	-76.023	3.4
as14 (Elk River)	TUCKER	39.471	-76.965	13.1
anchor1 (btw as09 & as10)	Anchor	39.328	-76.208	12
anchor2 (as13c)	Anchor	39.440	-76.023	6.5
anchor3 (near as04)	Anchor	39.069	-76.321	13
MOCNESS (up)	MOCNESS	39.363	-76.140	14.6
MOCNESS (down)	MOCNESS	39.325	-76.204	12.8
Tucker Trawl #1	TUCKER	39.333	-76.194	12.0
Tucker Trawl #2	TUCKER	39.339	-76.199	10.5
Tucker Trawl #3	TUCKER	39.365	-76.137	14.2
Tucker Trawl #4	TUCKER	39.367	-76.143	8.1
Tucker Trawl #5	TUCKER	39.367	-76.133	13.7
Tucker Trawl #6	TUCKER	39.368	-76.141	7.8
Tucker Trawl #7	TUCKER	39.327	-76.202	12.3
Tucker Trawl #8	TUCKER	39.332	-76.205	11.9

Table 2. Biological and Chemical analyses

Measurements	Axial samples	Particle fractions	DIPSTIC fractions	Abbreviation description
NH4	X			Ammonia
SRP	X			Inorganic Dissolved P
NO3+NO2, DSi	X			Nitrate+Nitrite, dissolved silica
DOC	X			Dissolved Organic Carbon
TDN, TDP	X			Dissolved Nitrogen, Dissolved Phosphorous
TSS	X			Total Suspended Sediment
ChlA	X	X	X	Chlorophyll a
POC, PON	X	X	X	Carbon, Hydrogen, Nitrogen
TPP	X	X	X	Total Particulate Phosphorous
IPP	X	X	X	Inorganic Particulate Phosphorous
TEP	X	X	X	Transparent Extracellular Polysaccharide
HPLC pigments	X			
BSi	X			Particulate silica, biogenic silica
Tcarb	X	X	X	Total carbohydrates
DCarb	X	X	X	Dissolved carbohydrates
Tprot	X	X	X	Total protein
Dprot	X	X	X	Dissolved protein
Tlipid	X	X	X	Total lipids
Dlipid	X	X	X	Dissolved lipids
BP	X	X	X	Bacterial production
PP	X			Primary production
Respiration	X	X		Oxygen Respiration rate
OM bioavailability				Organic Matter bioavailability
Preserved bacteria	X	X	X	
Preserved phytoplankton	X			
Preserved protists				
DNA	X	X		

Table 3. Consecutive Station Log.

BITMAX-II Consecutive Station Log

BM0702, 9-15 April 2007

Station	Date	Time (UTC)	Time (LMT)	Latitude (degree)	Latitude (degree)	Latitude (minutes)	Longitude (degree)	Longitude (degree)	Longitude (minutes)	Depth (m)	CTD #	Water Sample #s	MOC #	Other Activities
1	4/9/07	11:12	07:12	38.997	38	59.79	-76.360	-76	21.57	24.3	1	39-41		
2	4/9/07	12:02	08:02	39.059	39	03.51	-76.328	-76	19.66	16.0	2			
3	4/9/07	12:39	08:39	39.107	39	06.43	-76.302	-76	18.14	12.1	3	42-44		
4	4/9/07	13:23	09:23	39.165	39	09.88	-76.302	-76	18.14	12.8	4			
5	4/9/07	13:53	09:53	39.205	39	12.31	-76.257	-76	15.44	12.9	5			
6	4/9/07	14:33	10:33	39.260	39	15.60	-76.237	-76	14.20	13.8	6	45-47		
7	4/9/07	15:12	11:12	39.310	39	18.57	-76.220	-76	13.19	13.7	7			
8	4/9/07	15:48	11:48	39.347	39	20.79	-76.175	-76	10.52	12.1	8	48-50		
9	4/9/07	16:36	12:36	39.376	39	22.57	-76.116	-76	06.98	13.9	9			
10	4/9/07	17:09	13:09	39.397	39	23.81	-76.055	-76	03.32	13.2	10			
11	4/9/07	17:52	13:52	39.440	39	26.41	-76.024	-76	01.44	6.8	11	51-53		
12	4/9/07	19:27	15:27	39.340	39	20.41	-76.190	-76	11.37	11.7	12			
13	4/9/07	20:01	16:01	39.328	39	19.65	-76.208	-76	12.46	12.3	13			
14	4/9/07	20:59	16:59	39.261	39	15.67	-76.234	-76	14.02	10.3	14			
15	4/9/07	23:15	19:15	39.328	39	19.68	-76.208	-76	12.47	12.3	15			
16	4/10/07	00:32	20:32	39.328	39	19.67	-76.208	-76	12.49	12.6	16			
17	4/10/07	01:35	21:35	39.328	39	19.67	-76.208	-76	12.49	12.5	17			
18	4/10/07	02:36	22:36	39.328	39	19.68	-76.207	-76	12.44	11.9	18			
19	4/10/07	03:35	23:35	39.328	39	19.68	-76.207	-76	12.43	11.9	19			
20	4/10/07	04:30	00:30	39.328	39	19.69	-76.207	-76	12.44	11.9	20			
21	4/10/07	05:30	01:30	39.328	39	19.70	-76.208	-76	12.45	12.2	21			
22	4/10/07	06:30	02:30	39.328	39	19.70	-76.208	-76	12.46	12.2	22			
23	4/10/07	07:30	03:30	39.328	39	19.68	-76.208	-76	12.45	12.0	23			
24	4/10/07	08:30	04:30							12.0	24	size 5		
25	4/10/07	09:41	05:41							12.5	25			
26	4/10/07	10:30	06:30	39.328	39	19.67	-76.208	-76	12.49	12.6	26			
27	4/10/07	11:34	07:34	39.328	39	19.66	-76.208	-76	12.48	12.4	27			
28	4/10/07	12:30	08:30	39.328	39	19.67	-76.208	-76	12.49	12.5	28			
29	4/10/07	13:30	09:30	39.328	39	19.66	-76.208	-76	12.48	12.3	29			
30	4/10/07	14:30	10:30	39.328	39	19.67	-76.208	-76	12.45	12.1	30			
31	4/10/07	15:29	11:29	39.328	39	19.67	-76.207	-76	12.44	12.0	31			
32	4/10/07	16:29	12:29	39.328	39	19.70	-76.207	-76	12.44	12.3	32			
33	4/10/07	17:28	13:28	39.328	39	19.70	-76.207	-76	12.43	12.1	33	55, 56 size 6		
34	4/10/07	18:30	14:30	39.328	39	19.70	-76.207	-76	12.44	12.1	34			
35	4/10/07	19:28	15:28	39.328	39	19.69	-76.207	-76	12.43	12.0	35			
36	4/10/07	20:27	16:27	39.328	39	19.67	-76.208	-76	12.45	12.3	36			
37	4/10/07	21:32	17:32	39.328	39	19.66	-76.208	-76	12.48	12.5	37			
38	4/10/07	22:27	18:27	39.328	39	19.66	-76.208	-76	12.48	12.5	38			
39	4/11/07	00:28	20:28	39.440	39	26.38	-76.024	-76	01.44	6.4	39			
40	4/11/07	01:37	21:37	39.440	39	26.38	-76.024	-76	01.44	6.3	40			
41	4/11/07	02:32	22:32	39.440	39	26.38	-76.024	-76	01.44	6.3	41			
42	4/11/07	03:34	23:34	39.440	39	26.38	-76.024	-76	01.44	6.3	42			
43	4/11/07	04:30	00:30	39.440	39	26.38	-76.024	-76	01.44	6.4	43			
44	4/11/07	05:27	01:27	39.440	39	26.40	-76.024	-76	01.42	6.5	44			
45	4/11/07	06:28	02:28	39.440	39	26.40	-76.024	-76	01.42	6.5	45			
46	4/11/07	07:28	03:28	39.440	39	26.41	-76.024	-76	01.42	6.6	46			

Table 3 (cont.). Consecutive Station Log.

Station	Date	Time (UTC)	Time (LMT)	Latitude (degree)	Latitude (minutes)	Longitude (degree)	Longitude (degree)	Longitude (minutes)	Depth (m)	CTD #	Water Sample #s	MOC #	Other Activities
47	4/11/07	08:34	04:34	39.440	26.41	-76.024	-76	01.43	6.8	47			
48	4/11/07	09:36	05:36	39.440	26.40	-76.024	-76	01.45	6.8	48	size 7		
49	4/11/07	10:30	06:30	39.440	26.40	-76.024	-76	01.45	6.8	49			
50	4/11/07	13:40	09:40	39.069	04.15	-76.321	-76	19.28	13.2	50			
51	4/11/07	14:30	10:30	39.069	04.15	-76.321	-76	19.27	13.0	51			
52	4/11/07	15:30	11:30	39.069	04.15	-76.321	-76	19.27	13.3	52			
53	4/11/07	16:28	12:28	39.069	04.15	-76.321	-76	19.25	13.2	53			
54	4/11/07	17:27	13:27	39.069	04.15	-76.321	-76	19.25	13.2	54			
55	4/11/07	18:28	14:28	39.069	04.15	-76.321	-76	19.25	13.5	55			
56	4/11/07	19:31	15:31	39.069	04.15	-76.321	-76	19.28	13.0	56	ws 60, size 8		
57	4/11/07	20:27	16:27	39.069	04.14	-76.322	-76	19.29	13.0	57			
58	4/12/07	00:20	20:20	39.003	00.17	-76.360	-76	21.58	20.0	59		1	MOCNESS night axial
59	4/12/07	01:54	21:54	39.101	06.06	-76.304	-76	18.22	12.6	60		2	MOCNESS night axial
60	4/12/07	03:08	23:08	39.206	12.37	-76.257	-76	15.39	12.8	61		3	MOCNESS night axial
61	4/12/07	04:18	00:18	39.312	18.74	-76.219	-76	13.15	14.7	62		4	MOCNESS night axial
62	4/12/07	05:21	01:21	39.375	22.52	-76.114	-76	06.85	16.6	63		5	MOCNESS night axial
63	4/12/07	06:29	02:30	39.441	26.43	-76.022	-76	01.33	6.8	64		6	MOCNESS night axial
64	4/12/07	11:20	07:20	38.996	59.75	-76.359	-76	21.55	25.0	65		7	MOCNESS day axial
65	4/12/07	12:26	08:26	39.059	03.55	-76.329	-76	19.71	14.7	66			
66	4/12/07	12:52	08:52	39.107	06.42	-76.303	-76	18.16	12.1	67	61-63	8	MOCNESS day axial
67	4/12/07	13:49	09:49	39.164	09.81	-76.302	-76	18.13	10.6	68			
68	4/12/07	14:20	10:20	39.206	12.37	-76.256	-76	15.36	13.2	69	64-66	9	MOCNESS day axial
69	4/12/07	15:18	11:18	39.263	15.79	-76.237	-76	14.22	14.2	70			
70	4/12/07	15:47	11:47	39.312	18.74	-76.218	-76	13.07	13.8	71	67-69	10	
71	4/12/07	17:35	13:35	39.347	20.83	-76.174	-76	10.41	13.3	72			
72	4/12/07	17:59	13:59	39.374	22.45	-76.115	-76	06.89	15.6	73	70-72	11	recast CTD, no filename change
73	4/12/07	19:04	15:04	39.398	23.86	-76.052	-76	03.09	15.3	74			
74	4/12/07	19:29	15:29	39.442	26.50	-76.022	-76	01.34	7.4	75	73-75	12	recast CTD, no filename change
75	4/12/07	22:20	18:20	39.324	19.45	-76.205	-76	12.27	12.6	76		13	26 Time Series
76	4/12/07	23:22	19:22	39.363	21.80	-76.140	-76	08.40	14.6	77		14	26 Time Series (Up)
77	4/13/07	00:22	20:22	39.325	19.47	-76.204	-76	12.25	12.8	78		15	26 Time Series (Down)
78	4/13/07	01:19	21:19	39.365	21.90	-76.136	-76	08.17	14.5	79		16	26 Time Series (Up)
79	4/13/07	02:20	22:20	39.324	19.46	-76.205	-76	12.29	12.8	80		17	26 Time Series (Down)
80	4/13/07	03:19	23:19	39.353	21.19	-76.137	-76	08.21	14.3	81		18	26 Time Series (Up)
81	4/13/07	04:20	00:20	39.326	19.53	-76.203	-76	12.20	12.4	82		19	26 Time Series (Down)
82	4/13/07	05:21	01:21	39.367	21.99	-76.136	-76	08.13	11.7	83		20	26 Time Series (Up)
83	4/13/07	06:41	02:41	39.327	19.64	-76.202	-76	12.12	12.0	84		21	26 Time Series (Down) Ship Traffic
84	4/13/07	07:29	03:29	39.366	21.96	-76.136	-76	08.13	14.1	85		22	26 Time Series (Up)
85	4/13/07	08:34	04:34	39.325	19.50	-76.206	-76	12.33	11.2	86		23	26 Time Series (Down) Ship Traffic
86	4/13/07	10:01	06:01	39.365	21.89	-76.137	-76	08.19	14.3	87		24	26 Time Series (Up) Ship Traffic
87	4/13/07	10:53	06:53	39.325	19.52	-76.204	-76	12.23	12.7	88/89	76-79	25	26 Time Series (Down)
88	4/13/07	11:51	07:51	39.365	21.91	-76.135	-76	08.07	13.2	90		26	26 Time Series (Up)
89	4/13/07	12:50	08:50	39.324	19.45	-76.205	-76	12.27	12.3	91		27	26 Time Series mudbags (Down)
90	4/13/07	14:21	10:21	39.365	21.88	-76.138	-76	08.30	14.0	92		28	26 Time Series (Up) Ship Traffic
91	4/13/07	15:29	11:29	39.324	19.44	-76.204	-76	12.25	11.7	93	80-83	29	26 Time Series (Down)
92	4/13/07	16:50	12:50	39.365	21.88	-76.139	-76	08.34	13.1	94		30	26 Time Series (Up)
93	4/13/07	18:13	14:13	39.325	19.49	-76.205	-76	12.28	12.5	95		31	26 Time Series (Down)
94	4/13/07	19:09	15:09	39.366	21.97	-76.136	-76	08.17	13.6	96		32	26 Time Series (Up)

Table 3 (cont.). Consecutive Station Log.

Station	Date	Time (UTC)	Time (LMT)	Latitude (degree)	Latitude (degree)	Latitude (minutes)	Longitude (degree)	Longitude (degree)	Longitude (minutes)	Depth (m)	CTD #	Water Sample #s	MOC #	Other Activities
95	4/13/07	20:10	16:10	39.326	39	19.55	-76.202	-76	12.14	13.0	97	84-87	33	26 Time Series (Down)
96	4/13/07	21:25	17:25	39.366	39	21.94	-76.137	-76	08.23	12.6	98		34	26 Time Series (Up)
97	4/13/07	22:27	18:27	39.326	39	19.55	-76.204	-76	12.23	12.3	99		35	26 Time Series (Down)
98	4/13/07	23:24	19:24	39.365	39	21.88	-76.137	-76	08.22	14.6	100		36	26 Time Series (Up)
99	4/14/07	00:05	20:05	39.326	39	19.58	-76.202	-76	12.13	12.7	101	88-91	37	26 Time Series (Down)
100	4/14/07	03:21	23:21	39.326	39	19.58	-76.204	-76	12.25	12.3	102		38	CTD (Down Station)
101	4/14/07	04:45	00:46	39.323	39	19.39	-76.207	-76	12.41	12.3	103			CTD (Down Station)
102	4/14/07	05:54	01:54	39.333	39	19.96	-76.194	-76	11.66	12.0	104			Tucker Trawl (TT01)
103	4/14/07	06:26	02:26	39.339	39	20.33	-76.199	-76	11.93	10.5	105			TT#02
104	4/14/07	07:29	03:29	39.365	39	21.88	-76.137	-76	08.21	14.2	106			TT#03
105	4/14/07	08:11	04:11	39.367	39	21.99	-76.143	-76	08.60	8.1	107			TT#04
106	4/14/07	15:09	11:09	39.367	39	22.04	-76.133	-76	07.97	13.7	108			TT#05
107	4/14/07	15:56	11:56	39.368	39	22.10	-76.141	-76	08.46	7.8	109			TT#06
108	4/14/07	17:15	13:15	39.327	39	19.62	-76.202	-76	12.10	12.3	110			TT#07
109	4/14/07	17:46	13:46	39.332	39	19.89	-76.205	-76	12.32	11.9	111			TT#08
110	4/14/07	18:40	14:39	39.335	39	20.11	-76.192	-76	11.51					Bathymetric Survey as09-as07
111	4/14/07	20:31	16:31	39.326	39	19.54	-76.203	-76	12.17	12.4	112			CTD
112	4/14/07	21:01	17:01	39.325	39	19.49	-76.205	-76	12.27	12.5	113			CTD
113	4/14/07	21:30	17:30	39.326	39	19.55	-76.203	-76	12.17	12.5	114			CTD
114	4/14/07	22:01	18:01	39.326	39	19.56	-76.203	-76	12.15	12.7	115	92-94		Water Sample CTD
115	4/14/07	23:52	19:52	39.471	39	28.24	-76.965	-76	57.87	13.1	116			TT#09
116	4/15/07	01:03	21:03	39.441	39	26.43	-76.023	-76	01.36	6.9	117			TT#10
117	4/15/07	01:39	21:39	39.399	39	23.94	-76.050	-76	03.02	13.5	118			TT#11
118	4/15/07	02:30	22:30	39.345	39	20.72	-76.176	-76	10.57	13.1	119			TT#12
119	4/15/07	03:24	23:24	39.259	39	15.53	-76.236	-76	14.16	13.0	120			TT#13
120	4/15/07	04:24	00:24	39.163	39	09.77	-76.304	-76	18.22	12.0	121			TT#14
121	4/15/07	05:23	01:23	39.057	39	03.39	-76.328	-76	19.69	18.6	122			TT#15
122	4/15/07	11:00	07:00	38.996	38	59.76	-76.358	-76	21.48	24.5	123	95-97		
123	4/15/07	11:40	07:40	39.057	39	03.40	-76.331	-76	19.87	14.2	124			
124	4/15/07	12:15	08:15	39.107	39	06.39	-76.303	-76	18.18	12.2	125	98-100		
125	4/15/07	12:54	08:54	39.163	39	09.77	-76.305	-76	18.27	13.4	126			
126	4/15/07	13:29	09:29	39.208	39	12.45	-76.257	-76	15.39	11.5	127			
127	4/15/07	14:00	10:00	39.262	39	15.70	-76.237	-76	14.22	14.2	128	101-103		
128	4/15/07	14:31	10:31	39.308	39	18.45	-76.221	-76	13.24	13.4	129			
129	4/15/07	15:01	11:01	39.347	39	20.79	-76.174	-76	10.41	13.4	130	104-106		
130	4/15/07	15:34	11:34	39.377	39	22.59	-76.116	-76	06.94	14.2	131			
131	4/15/07	16:26	12:26	39.398	39	23.86	-76.054	-76	03.23	13.4	132			
132	4/15/07	17:05	13:05	39.441	39	26.44	-76.024	-76	01.44	6.9	133	107-109		

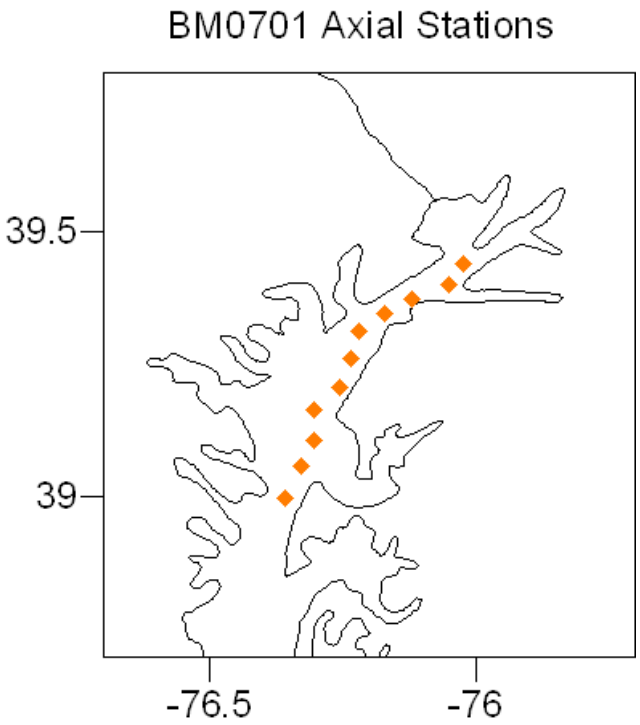

Figure 1. Axial stations occupied during BM0701 in upper Chesapeake Bay.

Figure 2. CTD results from first axial survey, 29April2007.