

Fixed Station Bivalve TRANSPORT (FSBT-11) Cruise Report

November, 2011

Jacob Goodwin and Elizabeth North

Project title: Integrating field methods and numerical models to quantify the links between oyster larval transport, connectivity, and population dynamics

Cruise dates: July 14-17, 2011

Research Vessel: *R/V Hugh R. Sharp* (Captain: Sean McNulty)

Scientists:

Chief Scientist: Elizabeth North

Scientific crew: Lenise Goggins, Jacob Goodwin, Kayla Hinson, Sarah Kwon, Hilary Staver, Christine Thompson, Tom Wazniak, Daniel Yeager

Sampling Area: Mouth of Choptank River at two locations: station 1 (38.6134, -76.3084) and station 2 (38.6400, -76.3314).

Cruise Report Contents

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I. Activities

Our objective of the cruise was to enhance our understanding of physical and biological factors that influence bivalve larval transport and their distribution. Data was collected to help identify factors that influence vertical distribution of bivalve larvae. Salinity, temperature, dissolved oxygen, current velocities, turbulence and food concentrations (phytoplankton) are all factors that may influence vertical distributions.

This 96-hr cruise initiated the first of two cruises of this endeavor (summer 2011 and 2012). On this cruise, two stations near the Choptank River mouth were occupied (Fig. 1), one with stratified conditions and one with well mixed conditions. At each station bivalve larvae were sampled while the ship was at anchor. Depth-specific plankton samples were obtained during day and night and on ebb and flood tides with accompanying physical measurements to characterize larval distributions and the physical and biological factors that could cue larval swimming behavior.

The ship was loaded at the Sailwinds dock in Cambridge, MD, on 13-July, and departed that afternoon under warm sunny conditions. Two stations were occupied during this cruise. Operations for station 1 began around 20:00 on July 13, 2011 with the deployment of an

Acoustic Doppler Current Profiler (ADCP, TRDI Workhorse sentinel 1200 KHz, with mode 12 (high ping rate). One hour after the ADCP deployment, CTD casts and plankton sample collections commenced and were made every 1.5 hr. On July 15 at approximately 18:00, the ADCP was deployed at station 2, with CTD casts and plankton samples starting shortly thereafter. We returned to port and unloaded the ship at 16:00 on July 17, 2011. The consecutive station log for the cruise is in Appendix A.

Upon arrival at each station, a CTD cast was conducted to determine if the water column was stratified or well mixed. A second CTD cast was made to pump water for an oblique plankton sample which was inspected immediately to confirm the presence of bivalve larvae. Next, the 1200 KHz ADCP was moored in close proximity to the station to measure turbulence and current velocity profiles. In addition, the ADCP in the hull of the *R/V Hugh R. Sharp* (RDI Workhorse 600 KHz) was used to collect current velocity information. After the moored ADCP was deployed, a time series of plankton samples commenced. Before each plankton sample, the *R/V Hugh R. Sharp's* CTD, which was equipped with a hose attached to the frame, was lowered to measure profiles of temperature, salinity, fluorescence, and dissolved oxygen on the down-cast. Water for plankton samples was pumped up to the deck of the ship with a Bellows pump using the hose attached to the CTD frame as the CTD was raised up through the water column. Approximately 200 liters of seawater, per interval, was filtered by pumping water for ~ 3 min through a 64 micron plankton net immersed in a bucket (Fig. 2). Four to 5 depth intervals were sampled, depending upon the station (Tables 1 and 2). For each depth interval, the CTD started at the bottom of the interval and was moved upwards to one or more target depths every 30 or 60 s depending on the height of the interval (Tables 1 and 2) to ensure consistent collections within each depth interval over time. The CTD cast and plankton sample collections occurred every 90 min at each station. All pumped samples were filtered and stored in 4% Sodium borate buffered formaldehyde.

Station 1 was 6 m deep and had well mixed conditions initially. Station 1 was occupied for 37.5 hours; 30 CTD casts were made and 104 plankton samples were collected. Station 2 was 10 m deep and had stratified conditions initially. Station 2 was occupied for 40.5 hr; 31 CTD casts were made and 147 plankton samples were collected.

Water samples from nine CTD casts were collected and used for total suspended solids (TSS) and chlorophyll (Chl) analysis. Samples for TSS were filtered through pre-processed 934-AH Whatman 2.5 cm filters from 200 ml of seawater. The chlorophyll samples were taken from 20 ml of seawater filtered through 25-mm diameter GF/F filters. All TSS and Chl samples were processed by the Horn Point laboratory analytical services using their standard protocols.

II. Weather

The high temperatures were initially in the 90s for July 13 but then fluctuated around the 80s for the remainder of the cruise. Barometric pressure increased as a high pressure system moved through the region. Wind speeds were generally no more than 15 mph but reached higher speeds Wednesday night into early Thursday morning (25 mph). Weather did not impede the objectives of the cruise.

III. Contact Information

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Table 1. Depth intervals at station 1 as well as the target depths which were used to guide the CTD up through the interval during the 2-min sample collection.

	Interval (m)	Target depths (m)
Bottom	6.0-4.5	6.0, 5.0
Middle	4.5-3.0	4.5, 3.5
Mid-Surface	3.0-1.5	3.0, 2.0
Surface	1.5-0	1.5, 0.5

Table 2. Depth intervals at station 2 as well as the target depths which were used to guide the CTD up through the interval during the 2-min sample collection.

	Interval (m)	Target depths (m)
Bottom	10.0-8.0	10, 9.25, 8.5
Mid-Bottom	8.0-6.0	8, 7.25, 6.5
Bottom	6.0-4.0	6, 5.25, 4.5
Mid-Surface	4.0-2.0	4, 3.5, 2.5
Surface	2.0-0.0	2, 1.25, 0.5

Fig. 1. Location of station 1 and station 2 in the Choptank River, a tributary of Chesapeake Bay.

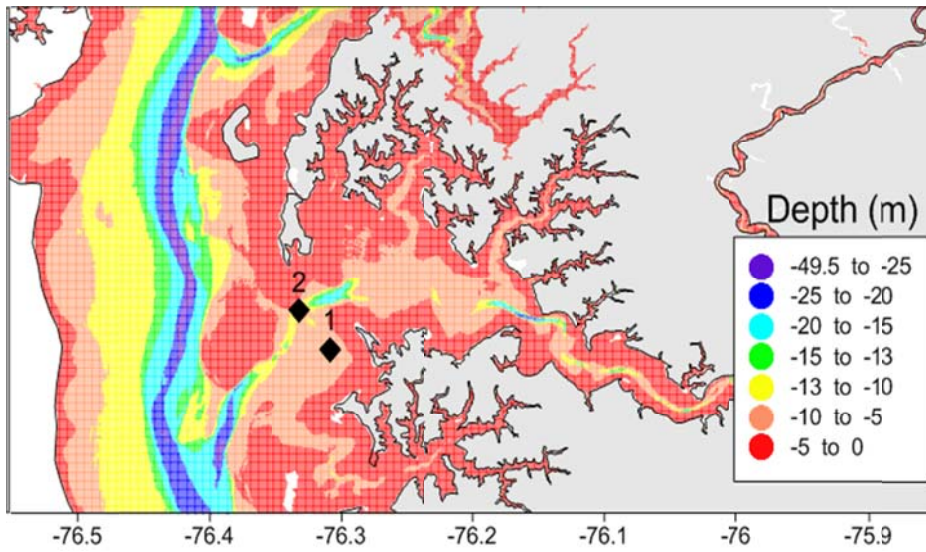




Fig. 2. Jake Goodwin directing hose into plankton net which was suspended inside a 50 gallon drum filled with water ($\frac{3}{4}$ full) to ensure the plankton were cushioned and not forced through the mesh by the high-volume pump. A series of small holes above the duct tape allowed water to drain out and maintain the drum $\frac{3}{4}$ full.

Appendix A. Consecutive Station Log.

FSBT-11 Consecutive Station Log

Station	Date	Time (GMT)	Time (EDT)	Longitude	Latitude	Station depth (m)	Surface salinity	Surface Temp (C)	CTD cast #	TSS sample depth (m)	Secchi depth (m)	Pycnocline type	Pump samples	Notes
1	7/13/2011	23:55	19:55	76° 18.5	38° 36.67		9.13	28.75	001			well mixed		CTD to check profile, looks good
2	7/13/2011	0:55	20:55	76° 18.73	38° 36.33		9.34	28.54	002				oblique	test for bivalves w/ LIHDAT-yes
3	7/13/2011	1:49	21:49	76° 18.72	38° 36.34		9.36	28.45	004					
4	7/13/2011	2:50	10:50	76° 18.732	38° 36.340	7.4	9.26	28.33	004			slightly stratified	B,M,MS,S	
5	7/14/2011	4:25	0:25	76° 18.77	38° 36.26	7.4	9.14	28.01	005			stratified	B,M,MS,S	
6	7/14/2011	5:58	1:58	76° 18.74	38° 36.23		9.36	27.85	006				B,M,MS,S	
7	7/14/2011	7:30	3:30	76° 18.81	38° 36.00		9.48	27.65	007				B,M,MS,S	
8	7/14/2011	9:15	5:15	76° 18.83	38° 36.14	7.4	9.68	27.3	008			well mixed	B,M,MS,S	
9	7/14/2011	11:01	7:03	76° 19.25	38° 36.67	6.8	9.28	27.12	009		1.0	mixed	B,M,MS,S	
10	7/14/2011	12:05	8:07	76° 19.25	38° 36.67		9.08	27	010	1.5	1.0		B,M,MS,S	LIHDAT sample taken, TSS & Chl
11	7/14/2011	13:35	9:35	76° 19.25	38° 36.67		9.109	27.08	011		1.0		B,M,MS,S	
12	7/14/2011	15:52	11:54	76° 18.647	38° 36.847		9.496	27.33	012	6.0	1.0		B,M,MS,S	TSS & Chl
13	7/14/2011	16:45	12:45	76° 18.62	38° 36.85		9.78	27.18	013			stratified	B,M,MS,S	
14	7/14/2011	17:51	13:51	76° 18.62	38° 36.88		9.84	27.32	014			stratified near bottom	B,M,MS,S	
15	7/14/2011	18:19	15:19	76° 18.64	38° 36.88		9.38	27.63	015	4.5	1.5	stratified near bottom	B,M,MS,S	TSS & Chl
16	7/14/2011	20:55	16:54	76° 18.60	38° 36.85		9.92	27.13	016			stratified near bottom	B,M,MS,S	*bottom sample pump rate =19s/50L; rest of samples 15s/50L
17	7/14/2011	22:18	18:18	76° 18.61	38° 36.84		9.43	27.89	017			stratified @ 4m	B,M,MS,S	
18	7/14/2011	23:51	19:51	76° 18.62	38° 36.84		9.39	28	018	1.3	1.3	weakly stratified	B,M,MS,S	TSS & Chl
19	7/14/2011	1:23	21:23	76° 18.64	38° 36.88		9.73	27.59	.	.	.		.	.
20	7/14/2011	2:31	22:51	76° 18.65	38° 36.88		9.88	27.34	.	.	.		.	.
21	7/14/2011	4:19	0:19	76° 18.64	38° 36.88		9.81	26.98	.	.	.		.	.
22	7/15/2011	5:51	1:51	76° 18.64	38° 36.88		9.9	26.73	.	.	.		.	.
23	15-Jul	7:22	3:22	76° 18.64	38° 36.88		10.03	26.72	.	.	.		.	.
24	7/15/2011	5:03:50	5:00	76° 18.63	38° 36.88		10.23	26.4	024			stratified	B,M,MS,S	
25	7/15/2011	10:25	6:25	76° 18.61	38° 36.88		10.4	26.4	025	6.0			B,M,MS,S	TSS & Chl bottom
26	7/15/2011	11:50	7:50	76° 18.60	38° 36.87		10.18	26.5	026			well mixed	B,M,MS,S	
27	7/15/2011	13:20	9:20	76° 18.61	38° 36.85		9.77	26.36	027		1		B,M,MS,S	TSS & Chl surface
28	7/15/2011	14:50	10:50	.	.	.	.	.	028	.	.		B,M,MS,S	
29	7/15/2011	16:17	12:17	76° 18.61	38° 36.85		9.79	26.6	029		0.9	stratified	B,M,MS,S	
30	7/15/2011	17:51	13:51	76° 18.62	38° 36.88		9.87	26.66	030	1.6	0.9	stratified	B,M,MS,S	TSS & Chl surface
31	7/15/2011	19:55	15:55	76° 19.83	38° 38.43		9.99	26.73	031					check profile before mooring; oblique pump
32	7/15/2011	21:21	17:21	76° 19.83	38° 38.54	11	9.99	25.78	032		1	stratified	B,MB,M,MS,S	
33	7/15/2011	23:04	19:04	76° 19.86	38° 38.54		10.05	26.54	033			stratified	B,MB,M,MS,S	
34	7/15/2011	0:20	20:20	76° 19.86	38° 38.51	11.1	9.72	26.92	034	1.6		stratified	B,MB,M,MS,S	TSS & Chl
35	7/15/2011	1:49	21:49	76° 19.85	38° 38.50		8.95	26.95	035			stratified	B,MB,M,MS,S	
36	7/15/2011	3:19	23:19	76° 19.83	38° 38.54		8.93	26.87	036			stratified	B,MB,M,MS,S	
37	7/16/2011	4:50	0:50	76° 19.83	38° 38.55		9.09	26.6	037			well mixed	B,MB,M,MS,S	
38	7/16/2011	6:19	2:19	76° 19.82	38° 38.54		9.34	26.39	038			stratified	B,MB,M,MS,S	low bottom DO
39	7/16/2011	7:50	3:50	76° 19.82	38° 38.54		9.59	26.33	039	?		stratified	B,MB,M,MS,S	TSS & Chl bottom
40	7/16/2011	9:20	5:20	76° 19.83	38° 38.55		10.22	26.22	040			stratified	B,MB,M,MS,S	
41	7/16/2011	10:50	6:50	76° 19.82	38° 38.55		10.23	26.16	041		1.4	stratified	B,MB,M,MS,S	
42	7/16/2011	12:20	8:20	76° 19.83	38° 38.51		10.11	26.13	042	?	1.3	stratified	B,MB,M,MS,S	TSS & Chl surface
43	7/16/2011	13:50	9:50	76° 19.85	38° 38.50		9.84	26.21	043		1	stratified	B,MB,M,MS,S	the MS cod end bottom loose
44	7/16/2011	15:20	11:20	76° 19.85	38° 38.51		8.99	26.56	044		1	stratified	B,MB,M,MS,S	
45	7/16/2011	16:50	12:50	76° 19.86	38° 38.51		9.22	26.06	045			weakly stratified, mixed til 9m	B,MB,M,MS,S	
46	7/16/2011	18:30	14:30	76° 19.85	38° 38.54	11.1	9.21	26.5	046	1.2	0.8	well mixed	B,MB,M,MS,S	TSS & Chl surface
47	7/16/2011	19:50	15:50	76° 19.83	38° 38.55	9.5	9.48	26.78	047	9.5	0.9	well mixed to 9.5-stratified	B,MB,M,MS,S	TSS & Chl bottom
48	7/16/2011	21:25	17:25	76° 19.84	38° 38.55	11.4	9.85	27.11	048		0.9	stratified, pyc @ 7m	B,MB,M,MS,S	
49	7/16/2011	22:53	18:53	76° 19.84	38° 38.54	11.2	9.83	27.21	049	9.65	0.9	stratified	B,MB,M,MS,S	TSS & Chl bottom
50	7/16/2011	0:24	20:24	76° 19.85	38° 38.54	11	9.89	26.58	050			stratified	B,MB,M,MS,S	
51	7/16/2011	1:50	21:50	76° 19.85	38° 38.55	11	10.04	26.69	051			stratified	B,MB,M,MS,S	
52	7/16/2011	3:17	23:17	76° 19.83	38° 38.55	11	9.33	26.58	052			weak stratified	B,MB,M,MS,S	
53	7/17/2011	4:51	0:51	76° 19.84	38° 38.55	11	9.41	26.45	053			well mixed	B,MB,M,MS,S	
54	7/17/2011	6:24	2:24	76° 19.83	38° 38.55	11.2	9.49	26.41	054			well mixed	B,MB,M,MS,S	
55	7/17/2011	7:52	3:52	76° 19.81	38° 38.56	11.5	9.78	26.35	055	0.5		well mixed except for bottom meter	B,MB,M,MS,S	TSS & Chl surface
56	7/17/2011	9:20	5:20	76° 19.82	38° 38.60	10.5	10.35	26.16	056			slight pycnocline	B,MB,M,MS,S	
57	7/17/2011	10:50	6:50	76° 19.82	38° 38.60	11.2	10.42	26.18	057		1.1		B,MB,M,MS,S	
58	7/17/2011	12:25	8:25	76° 19.82	38° 38.60	11.5	10.26	26.24	058		1.1	mixed	B,MB,M,MS,S	
59	7/17/2011	13:50	9:50	76° 19.84	38° 38.56	11.1	10.04	26.29	059		1.1	mixed	B,MB,M,MS,S	
60	7/17/2011	15:20	11:20	76° 19.83	38° 38.57	10.9	9.45	26.76	060			mixed	B,MB,M,MS,S	
61	7/17/2011	15:45	11:45	76° 19.83	38° 38.59	10.9	9.45	26.76	061		1	mixed		oblique
62	7/17/2011	15:48	11:58	76° 19.83	38° 38.59	10.9	9.45	26.76	062		1	mixed		oblique