DeZoZoo 1001

R/V Hugh R. Sharp
May 25-31, 2010

Cruise Report for NSF Project: 0961942
Hypoxia in Coastal Ecosystems: Implications for Neritic Copepods
(DeZoZoo: Dead Zone Zoopalnkton)

Area of Operations: Middle Chesapeake Bay between the Chesapeake Bay Bridge (northern end) and the Rappahannock Shoals in the (southern end).

	Name, Institution		Watch	Boarding location 5/25	Departure location 5/25
1	James Pierson	PI	N, CS	Cambridge	Cambridge
2	Michael Roman	PI	D	Cambridge	Cambridge
3	Diane Stoecker	PI	-	Cambridge	Cambridge
4	Mary Beth Decker	PI	D	Solomons	Solomons
5	Ginger Jahn	FRA	D, WL	Cambridge	Cambridge
6	Aidan Fischer	FRA	N	Cambridge	Cambridge
7	Ali Barba	Student	N	Cambridge	Cambridge
8	Allison Chandler-Shideler,	Student	D	Solomons	Solomons
9	Jim Seuberling	FRA	N	Solomons	Solomons
10	Allison Weigel	FRA	-	Cambridge	Cambridge
	Ed Houde	PI	Not On Board		

Table 1. Scientific personnel. CS: chief scientist, WL: watch leader, D: day watch 06:00 – 18:00, N: night watch 18:00 – 06:00.

Activities
The objective of this cruise was to determine the effects of hypoxia on the behavior and fitness of planktonic organisms in the middle reaches (mesohaline portion) of Chesapeake Bay (see the cruise track, Fig. 1). Although the focus is on copepods, we sampled phytoplankton, microzooplankton, ichthyoplankton, and jellyfish in addition to copepods.

The cruise was largely successful, though a number of technical problems arose with various pieces of equipment that caused delay. In addition, episodic thunderstorms caused some delay and cancellation of certain operations.

Loading and Mobilization
The *R/V Hugh R. Sharp* arrived in Cambridge, MD at 21:30 and docked at Sailwinds Park. Loading was completed by approximately 23:00. Roman and Pierson had to return to HPL to retrieve a deck box for the Scanfish OPC, so the ship departed Sailwinds at approximately 00:30 on 25 May 2010.

Scanfish survey

The ship proceeded to the start of the Scanfish survey, located in the approximate vicinity of Chesapeake Bay Program monitoring station CB3.3C (38° 59.8, 76° 22.1'W). The Scanfish was deployed on 25 May 2010 at approximately 06:00 and the survey proceeded southward in the deep channel of the Chesapeake Bay to a location west of the Patuxent River (38° 20.5'N, 76° 18.7'W). At 13:00 the Scanfish was retrieved and the ship proceeded to dock at the Chesapeake Biological Laboratory to pick up three scientists and ichthyoplankton-sampling equipment. At 15:20 the Scanfish was redeployed (38° 20.4'N, 76°18.3'W) and the survey continued to the south, ending at 00:30 on 26 May 2010, at a location west of the Rappahannock River mouth (37° 33.5'N, 76° 09.7'W).

South Anchor Station

Following the Scanfish survey we proceeded to a station north of the Rappahannock River mouth 37° 43.7'N, 76° 11.9'W), and set the anchor in approximately 25 m of water. An initial CTD cast was conducted on 26 May 2010 at 02:19, from which we collected water samples for chlorophyll and microplankton analysis. Periodically through the 24 hour anchor station, samples were again collected for these analyses. Following the initial CTD cast, we commenced a 24 hour period of repeated CTD casts and Z-Trap series. Z-Trap series consisted of a CTD cast, followed by two net tows using the Z-Traps as closing nets, sampling above and below the pycnocline, followed by a deployment of the Z-Trap as a trap for 45 minutes. Two Z-Trap series were conducted shortly after anchor, two more bracketing midday, and four more commenced at 21:00 and continued into 27 May. Individual *Acartia tonsa* females were sorted from selected Z-Trap deployments at night, and the animals were imaged and placed into acetone for shore-based gut pigment analyses.

After the second Z-Trap series, we conducted a grazing experiment with individual *Acartia tonsa* sorted and placed into 500 ml polycarbonate jars. The jars were placed on a rotating wheel in the dark in a water bath, and were sampled after 24 hours.

An egg production experiment was also conducted by sorting individual females into six-well tissue culture plates, fitted with polycarbonate towers having 200 μm mesh floors. These towers allowed eggs to fall through the mesh, separated from the females.

During the South anchor station, we tested the MOCNESS and found that we were unable to communicate with it. We were able to arrange replacement parts to be shipped to Chesapeake Biological Laboratory (CBL) in Solomons, MD. In addition, we found a problem with the Percival incubator – it was low on refrigerant, which we purchased during our stop at CBL.
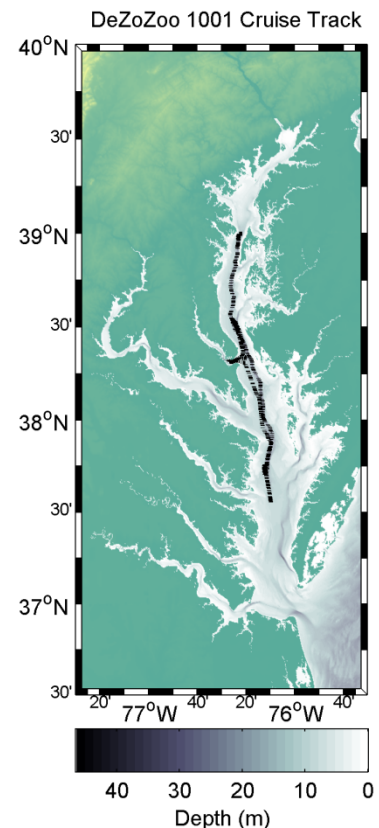

Figure 1. Cruise track from DZZ 1001.

South Trawl Survey

After completing the anchor station, we began a 27-hour period of trawling. Due to problems communicating with the 0.25 m^2 MOCNESS, we were unable to use it at this station. Instead of the MOCNESS, we deployed a 1 m^2 Tucker Trawl fitted with 280 μm mesh. This net was unable to sample the smallest stages of copepods, but was the best possible option under the circumstances. Every three hours for 27 hours, we did four Tucker trawls to sample four separate depths; each depth interval was sampled twice. The first four samples were preserved in 4% formaldehyde and the second four samples were preserved in 95% ethanol. We had a 45-minute delay at 02:15 due to a passing lightning storm, but we were able to collect all samples.

Intermission

Although we had a second Scanfish survey scheduled, we took the time instead to dock at CBL to pick up replacement parts for the MOCNESS and repair the Percival incubator. Unfortunately we did not have the correct tools to fix the Percival, but we were able to get it working well enough for our purposes. The MOCNESS parts arrived safely and we were able to use the MOCNESS again with an underwater unit that was borrowed from BESS, the manufacturer of the MOCNESS system. Subsequent analysis by BESS Inc. showed that we caused some damage to the underwater unit when it was plugged into the sea cable with some charge still in the cable – likely from the Seabird deck unit still turned on.

North Anchor Station

Sampling commenced at the North anchor station on 28 May at 13:05. CTDs were completed every hour for nearly 20 hours. During that time the wind was variable, causing some high angles for the Z-Traps during the afternoon of 28 May. Trapping was conducted but the data may not be of the highest quality. The remainder of the anchor station proceeded without many incidents, and more grazing experiments were conducted.

North Trawl Survey

The MOCNESS was repaired and operating for the second trawl survey, at the North station, and we were able to complete 9 tows throughout the survey, with six nets fished for each deployment. The deployment scheme was such that net 0 was the drogue, nets 1 and 2 were fished in approximately equal depth layers from the bottom the pycnocline, net 3 was fished from the pycnocline to bottom and back to the pycnocline, net 4 was fished in the pycnocline, net 5 was fished above the pycnocline to the surface, and net 6 was fished from surface to the pycnocline and back to the surface. Samples from nets 3 and 6 were preserved in EtOH for fish larvae otolith analysis, and nets 1-2 and 4-5 were preserved in 4% formaldehyde for zooplankton taxonomic analysis and fish larvae stomach analysis. In addition, two Tucker trawls were conducted for each MOCNESS tow, with nets fished over 4 depths (bottom layer; bottom layer to pycnocline; pycnocline, pycnocline to surface). No major problems occurred during the trawling at the North station.

Unloading and Demobilization
The scientific crew that embarked from the CBL dock at Solomons, MD were disembarked there at approximately 05:00 on 31 May, and the ship arrived at Sailwinds Park in Cambridge, MD at approximate 09:00 on 31 May. Unloading was completed within 2 hours.

Preliminary Findings
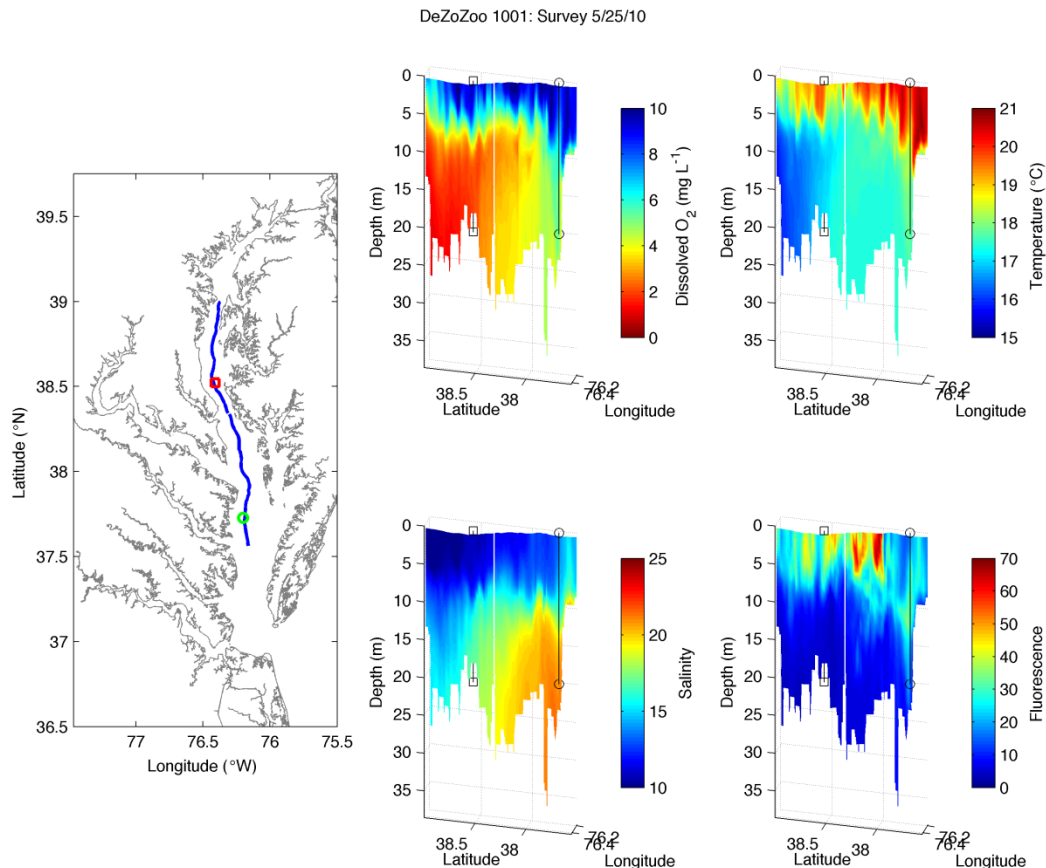
Figure 2. Map of the Scanfish survey (blue line) during DeZooZo 1001 (left panel) with South (green circle) and North (red square) station locations marked. Hydrographic data from the Scanfish survey are also shown in the four panels at right: dissolved oxygen (mg L^{-1}, upper left), temperature (ºC, upper right), salinity (lower left), and fluorescence (RFU, lower right panel). On each of these four panels the station locations are also plotted.
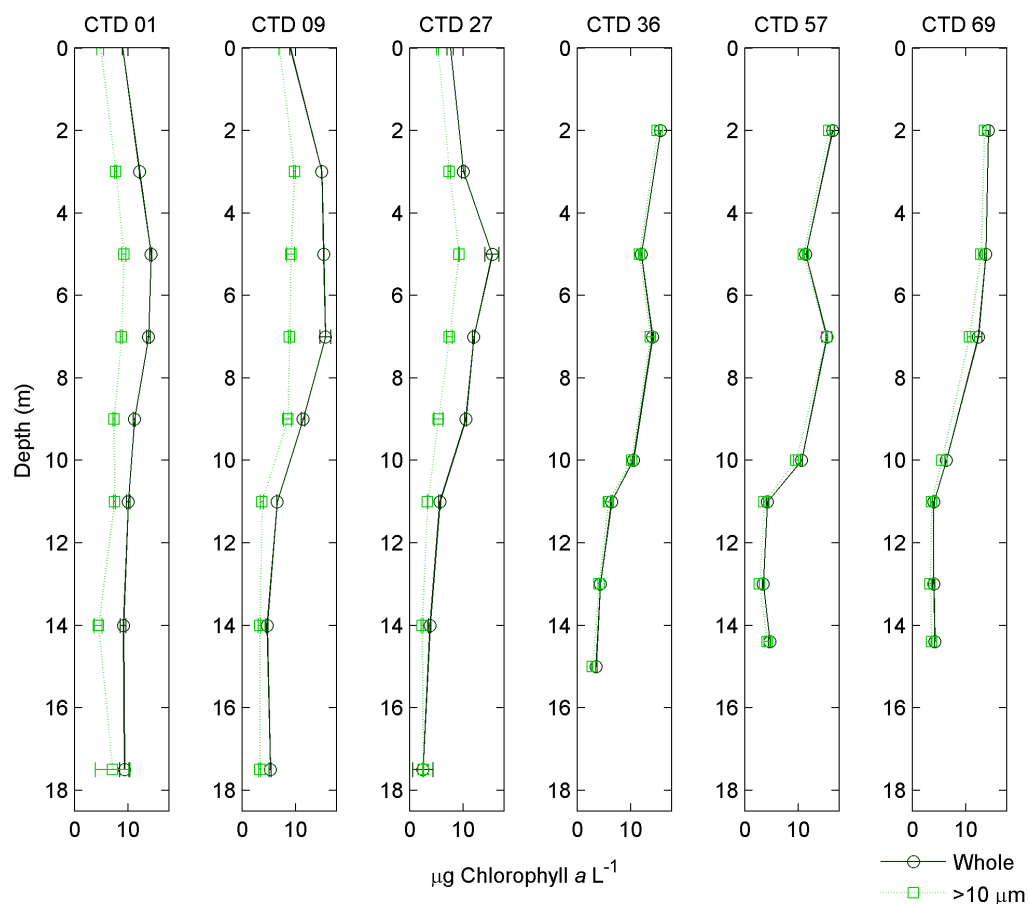
Figure 3. Size-fractionated chlorophyll *a* profiles from 6 CTD casts throughout the cruise.
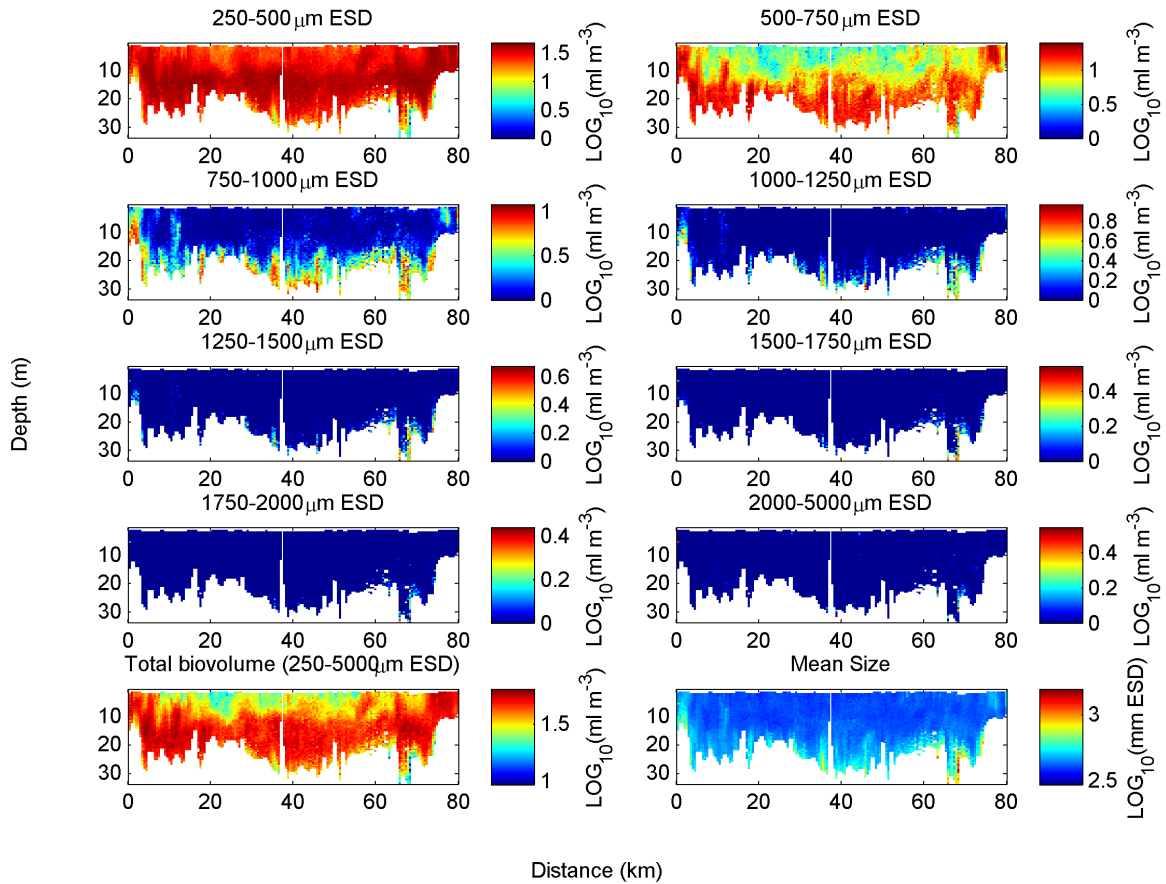
Figure 4. Particle distributions in various size classes, as calculated from the OPC mounted on the Scanfish. In addition, total particle counts from the OPC and the mean size of particles in each bin is shown in the lower two panels. All data are averaged into 0.5 m vertical and 0.5 km horizontal bins. Data are all shown as $\log_{10}(x+1)$ transformed.

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Operations and Objectives List

Adjusted from the proposal

	Behavior / Abundance / Distribution	Organismal Fitness	Copepod Mortality	PI
Field Samples				
SCANFISH	X			Roman/Pierson
CTD	X	X	X	Pierson
Niskin	X	X	X	Stoecker
MOCNESS	X	X	X	Roman/Decker
Tucker trawl	X	X	X	Houde/Decker
Pumps	X	X	X	Roman
Traps	X	X	X	Pierson
Experiments and Analyses				
Copepod grazing		X		Roman/Stoecker
Copepod gut fullness		X	X	Pierson
Neutral Red	X		X	Roman/Pierson
Egg development rate		X	X	Pierson
Egg hatching and mortality		X	X	Pierson
Egg production rate		X	X	Roman/Pierson
Condition factor		X		Roman
Gelatinous gut contents			X	Decker
Fish larvae gut contents			X	Houde
Fish larvae growth and condition		X	X	Houde

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Consecutive Station Log

Station #	Instrument	Cast #	Month	Day	hhmm	DoY	Degrees (N)	Minutes	Degrees (W)	Minutes	Depth (m)	Depth (m)	Campaign
1	Scanfish	1	5	25	06:13	144.25903	38	59.8	76	22.1			Survey
1	Scanfish	1	5	25	12:54	144.53750	38	20.5	76	18.7			Survey
2	Scanfish	2	5	25	15:23	144.64097	38	20.4	76	18.3			Survey
2	Scanfish	2	5	26	00:34	145.02361	37	33.5	76	9.7			Survey
South	CTD	1	5	26	02:19	145.09653	37	43.7	76	11.9	23.0	17.5	Anchor
South	CTD	2	5	26	04:06	145.17083	37	43.7	76	11.9	22.9	17	Anchor
South	Z-Net	1	5	26	04:35	145.19097	37	43.7	76	12.0	23.0	17	Anchor
South	Z-Net	2	5	26	04:48	145.20000	37	43.7	76	12.0	23.0	10	Anchor
South	Z-Trap	1	5	26	05:00	145.20833	37	43.7	76	12.0	23.0	10	Anchor
South	CTD	3	5	26	05:54	145.24583	37	43.7	76	12.0	23.5	18.6	Anchor
South	Z-Net	3	5	26	06:04	145.25278	37	43.7	76	12.0	23.5	17	Anchor
South	Z-Net	4	5	26	06:22	145.26528	37	43.7	76	12.0	23.5	6	Anchor
South	Z-Trap	2	5	26	06:32	145.27222	37	43.7	76	12.0	23.5	6	Anchor
South	CTD	4	5	26	07:28	145.31111	37	43.7	76	12.0	23.3	18.4	Anchor
South	Z-Net	5	5	26	07:40	145.31944	37	43.7	76	12.0	23.3	3	Anchor
South	CTD	5	5	26	08:33	145.35625	37	43.7	76	12.0	23.0	17.9	Anchor
South	Z-Net	6	5	26	09:08	145.38056	37	43.7	76	12.0	23.0	15	Anchor
South	CTD	6	5	26	09:33	145.39792	37	43.7	76	12.0	23.1	18.5	Anchor
South	CTD	7	5	26	10:30	145.43750	37	43.7	76	12.0	22.9		Anchor
South	CTD	8	5	26	11:28	145.47778	37	43.8	76	12.0	23.1	17.2	Anchor
South	Z-Net	7	5	26	11:38	145.48472	37	43.8	76	12.0	23.1	17	Anchor
South	Z-Net	8	5	26	11:45	145.48958	37	43.8	76	12.0	23.0	8	Anchor
South	Z-Trap	3	5	26	11:52	145.49444	37	43.8	76	12.0	23.0	8	Anchor
South	CTD	9	5	26	12:33	145.52292	37	43.7	76	12.0	23.0		Anchor
South	Z-Net	9	5	26	12:48	145.53333	37	43.7	76	12.0	23.0	17	Anchor
South	Z-Net	10	5	26	12:56	145.53889	37	43.7	76	12.0	23.7	8	Anchor
South	Z-Trap	4	5	26	13:02	145.54306	37	43.7	76	12.0	23.7	8	Anchor
South	CTD	10	5	26	13:40	145.56944	37	43.8	76	12.0	23.7	18	Anchor
South	Z-Net	11	5	26	13:55	145.57986	37	43.8	76	12.0	24.1	17	Anchor
South	Z-Net	12	5	26	14:03	145.58542	37	43.8	76	12.0	23.7	8	Anchor
South	CTD	11	5	26	14:32	145.60556	37	43.7	76	12.0	24.1	17.2	Anchor
South	CTD	12	5	26	15:31	145.64653	37	43.7	76	12.0	23.7	17.9	Anchor
South	CTD	13	5	26	16:30	145.68750	37	43.7	76	12.0	23.6	18.2	Anchor
South	CTD	14	5	26	17:32	145.73056	37	43.7	76	12.0	23.7	19.9	Anchor
South	CTD	15	5	26	18:28	145.76944	37	43.7	76	11.9	23.3		Anchor
South	CTD	16	5	26	19:25	145.80903	37	43.7	76	11.9	23.5	19.5	Anchor
South	CTD	17	5	26	20:23	145.84931	37	43.8	76	11.9	24.4	19.7	Anchor
South	Z-Net	13	5	26	20:48	145.86667	37	43.8	76	11.9	27.4	22	Anchor
South	Z-Net	14	5	26	20:55	145.87153	37	43.8	76	11.9	27.4	20	Anchor
South	Z-Trap	5	5	26	21:00	145.87500	37	43.8	76	11.9	27.4	10	Anchor
South	CTD	18	5	26	21:28	145.89444	37	43.8	76	11.9	27.0	10	Anchor
South	Z-Net	15	5	26	21:50	145.90972	37	43.8	76	11.9	27.4	20	Anchor
South	Z-Net	16	5	26	21:59	145.91597	37	43.8	76	11.9	27.4	10	Anchor
South	Z-Trap	6	5	26	22:08	145.92222	37	43.8	76	11.9	27.4	10	Anchor
South	CTD	19	5	26	22:25	145.93403	37	43.8	76	11.9	27.5	22.8	Anchor
South	CTD	20	5	26	23:26	145.97639	37	43.8	76	11.9	27.6	22.8	Anchor
South	Z-Net	17	5	27	23:12	146.96667	37	43.8	76	11.9	27.6	20	Anchor
South	Z-Net	17	5	27	00:08	146.00556	37	43.8	76	11.9	27.6	20	Anchor
South	Z-Net	18	5	27	00:21	146.01458	37	43.8	76	11.9	27.6	10	Anchor
South	Z-Trap	7	5	27	00:33	146.02292	37	43.8	76	11.9	27.6	10	Anchor
South	CTD	21	5	27	00:42	146.02917	37	43.8	76	11.9	27.5	24.8	Anchor
South	Z-Net	19	5	27	01:30	146.06250	37	43.8	76	11.8	27.7	20	Anchor
South	Z-Net	20	5	27	01:40	146.06944	37	43.8	76	11.8	27.7	10	Anchor
South	Z-Trap	8	5	27	01:48	146.07500	37	43.8	76	11.8	27.7	10	Anchor
South	CTD	22	5	27	01:57	146.08125	37	43.8	76	11.8	27.7	24.8	Anchor
South	CTD	23	5	27	02:37	146.10903	37	43.6	76	11.9	26.6	24.7	Anchor
South	Z-Net	21	5	27	02:48	146.11667	37	43.6	76	11.9	26.6	20	Anchor
South	Z-Net	22	5	27	02:54	146.12083	37	43.6	76	11.9	26.6	10	Anchor
South	TT	S1	5	27	04:37	146.19236	37	43.6	76	12.0	24.0	20	Trawl
South	CTD	24	5	27	06:55	146.28819	37	43.6	76	12.0	22.0	16.8	Trawl
South	TT	S2	5	27	07:15	146.30208	37	43.6	76	12.0	22.0	19	Trawl
South	CTD	25	5	27	09:10	146.38194	37	43.6	76	12.0	22.1	17	Trawl
South	CTD	26	5	27	10:01	146.41736	37	43.5	76	12.0	25.2	20.4	Trawl
South	TT	S3	5	27	10:13	146.42569	37	43.5	76	12.0	25.2	21	Trawl
South	CTD	27	5	27	12:43	146.52986	37	43.5	76	12.0	24.2	19.3	Trawl
South	CTD	28	5	27	13:04	146.54444	37	43.4	76	11.9	25.2	19.5	Trawl
South	TT	S4	5	27	13:15	146.55208	37	43.4	76	11.9	25.2	20	Trawl
South	CTD	29	5	27	15:55	146.66319	37	43.5	76	12.0	24.8	17.6	Trawl
South	TT	S5	5	27	16:10	146.67361	37	43.5	76	12.0	24.8	20	Trawl
South	CTD	30	5	27	18:54	146.78750	37	43.7	76	11.9	24.2	19	Trawl

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Station #	Instrument	Cast #	Month	Day	hhmm	DoY	Degrees (N)	Minutes	Degrees (W)	Minutes	Depth (m)	Depth (m)	Campaign
South	TT	S6	5	27	19:07	146.79653	37	43.9	76	12.1	20.2	17	Trawl
South	CTD	31	5	27	21:56	146.91389	37	43.7	76	11.9	27.3	22	Trawl
South	TT	S7	5	27	22:10	146.92361	37	44.5	76	11.9	25.4	18	Trawl
South	CTD	32	5	28	01:11	147.04931	37	43.7	76	12.0	22.8	19.5	Trawl
South	TT	S8	5	28	01:25	147.05903	37	43.5	76	11.9	26.2	18	Trawl
South	CTD	33	5	28	03:27	147.14375	37	43.4	76	11.9	25.6	20	Trawl
South	TT	S9	5	28	03:40	147.15278	37	43.3	76	11.9	23.0	18	Trawl
Transit						-31.00000							
North	CTD	34	5	28	13:11	147.54931	38	31.3	76	24.5	20.2	15	Anchor
North	CTD	35	5	28	14:03	147.58542	38	31.3	76	24.3	20.0	14.6	Anchor
North	CTD	36	5	28	15:02	147.62639	38	31.3	76	24.3	20.1	14.2	Anchor
North	CTD	37	5	28	16:04	147.66944	38	31.3	76	24.3	20.1	14.4	Anchor
North	CTD	38	5	28	17:02	147.70972	38	31.3	76	24.3	20.0	14.7	Anchor
North	CTD	39	5	28	17:59	147.74931	38	31.3	76	24.3	20.0	15	Anchor
North	CTD	40	5	28	18:59	147.79097	38	31.3	76	24.4	20.0	15	Anchor
North	CTD	41	5	28	19:59	147.83264	38	31.3	76	24.3	19.9	15	Anchor
North	Z-Net	23	5	28	20:16	147.84444	38	31.3	76	24.3	20.7	15	Anchor
North	Z-Net	26	5	28	20:25	147.85069	38	31.3	76	24.3	20.7	7	Anchor
North	Z-Trap	9	5	28	20:37	147.85903	38	31.3	76	24.3	20.7	7	Anchor
North	CTD	42	5	28	21:01	147.87569	38	31.3	76	24.3	19.8	15	Anchor
North	Z-Net	25	5	28	21:47	147.90764	38	31.3	76	24.4	19.7	15	Anchor
North	Z-Net	26	5	28	21:58	147.91528	38	31.3	76	24.4	19.7	7	Anchor
North	Z-Trap	10	5	28	22:04	147.91944	38	31.3	76	24.4	19.7	10	Anchor
North	CTD	43	5	28	22:12	147.92500	38	31.3	76	24.4	19.7	15	Anchor
North	CTD	44	5	28	22:55	147.95486	38	31.3	76	24.4	20.4	15.7	Anchor
North	CTD	45	5	28	23:55	147.99653	38	31.3	76	24.3	19.8	15	Anchor
North	CTD	46	5	29	00:56	148.03889	38	31.3	76	24.3	19.9	15	Anchor
North	CTD	47	5	29	01:58	148.08194	38	31.3	76	24.3	19.9	15	Anchor
North	CTD	48	5	29	02:56	148.12222	38	31.3	76	24.3	20.1	14.2	Anchor
North	Z-Net	27	5	29	03:33	148.14792	38	31.3	76	24.3	20.3	15	Anchor
North	Z-Net	28	5	29	03:47	148.15764	38	31.3	76	24.3	20.3	8	Anchor
North	Z-Trap	11	5	29	03:55	148.16319	38	31.3	76	24.3	20.3	15	Anchor
North	CTD	49	5	29	04:02	148.16806	38	31.3	76	24.3	20.3	16	Anchor
North	Z-Net	29	5	29	04:56	148.20556	38	31.3	76	24.3	20.3	15	Anchor
North	Z-Net	30	5	29	05:03	148.21042	38	31.3	76	24.3	20.3	8	Anchor
North	Z-Trap	12	5	29	05:15	148.21875	38	31.3	76	24.3	20.2	15	Anchor
North	CTD	50	5	29	05:17	148.22014	38	31.3	76	24.3	20.2	14	Anchor
North	CTD	51	5	29	06:04	148.25278	38	31.3	76	24.3	20.1	14.8	Anchor
North	Z-Net	31	5	29	06:10	148.25694	38	31.3	76	24.3	20.1	15	Anchor
North	Z-Net	32	5	29	06:17	148.26181	38	31.3	76	24.3	20.1	8	Anchor
North	Z-Trap	13	5	29	06:26	148.26806	38	31.3	76	24.3	20.1	10	Anchor
North	CTD	52	5	29	06:58	148.29028	38	31.3	76	24.3	20.0	15	Anchor
North	Z-Net	33	5	29	07:19	148.30486	38	31.3	76	24.3	20.0	15	Anchor
North	Z-Net	34	5	29	07:26	148.30972	38	31.3	76	24.3	20.0	8	Anchor
North	CTD	53	5	29	07:59	148.33264	38	31.3	76	24.3	20.0	15.5	Anchor
North	CTD	54	5	29	08:57	148.37292	38	31.3	76	24.3	19.9	14.7	Anchor
North	CTD	55	5	29	09:57	148.41458	38	31.3	76	24.4	19.9	15	Anchor
North	CTD	56	5	29	10:57	148.45625	38	31.2	76	24.4	19.7	15.4	Anchor
North	Z-Net	35	5	29	11:04	148.46111	38	31.2	76	24.4	19.7	15	Anchor
North	Z-Net	36	5	29	11:11	148.46597	38	31.2	76	24.4	19.7	8	Anchor
North	Z-Trap	14	5	29	11:31	148.47986	38	31.2	76	24.4	19.7	8	Anchor
North	CTD	57	5	29	11:58	148.49861	38	31.2	76	24.4	19.8		Anchor
North	Z-Net	37	5	29	12:26	148.51806	38	31.2	76	24.4	19.8	15	Anchor
North	Z-Net	38	5	29	12:36	148.52500	38	31.2	76	24.4	19.8	8	Anchor
North	CTD	58	5	29	12:59	148.54097	38	31.3	76	24.3	19.8	14.2	Anchor
North	CTD	59	5	29	13:57	148.58125	38	31.3	76	24.3	19.8	14.5	Anchor
North	CTD	60	5	29	14:56	148.62222	38	31.3	76	24.3	19.9	15.25	Anchor
North	CTD	61	5	29	15:59	148.66597	38	31.3	76	24.3	20.0	14.7	Anchor
North	CTD	62	5	29	16:58	148.70694	38	31.3	76	24.3	19.9	14.4	Anchor
North	CTD	63	5	29	17:56	148.74722	38	31.3	76	24.3	19.9	15	Anchor
North	CTD	64	5	29	18:54	148.78750	38	31.3	76	24.3	19.9	15	Anchor
North	CTD	65	5	29	19:53	148.82847	38	31.3	76	24.4	19.8	15	Anchor
North	Z-Net	39	5	29	20:08	148.83889	38	31.3	76	24.3	19.8	15	Anchor
North	Z-Net	40	5	29	20:18	148.84583	38	31.3	76	24.3	19.8	8	Anchor
North	Z-Trap	15	5	29	20:23	148.84931	38	31.3	76	24.2	19.8	8	Anchor
North	CTD	66	5	29	20:59	148.87431	38	31.3	76	24.3	19.7	15	Anchor
North	Z-Net	41	5	29	21:22	148.89028	38	31.2	76	24.3	19.7	15	Anchor
North	Z-Net	42	5	29	21:28	148.89444	38	31.2	76	24.3	19.7	8	Anchor
North	Z-Trap	16	5	29	21:32	148.89722	38	31.2	76	24.3	19.7	8	Anchor
North	CTD	67	5	29	21:55	148.91319	38	31.2	76	24.3	19.5	15	Anchor
North	CTD	68	5	29	22:56	148.95556	38	31.1	76	24.3	19.8	15	Trawl
North	MOCNESS	1	5	29	23:15	148.96875	38	33.4	76	20.6	20.4	20	Trawl
North	CTD	69	5	30	00:11	149.00764	38	33.4	76	20.6	19.9	15	Trawl

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Station #	Instrument	Cast #	Month	Day	hhmm	DoY	Degrees (N)	Minutes	Degrees (W)	Minutes	Depth (m)	Depth (m)	Campaign
North	TT	10	5	30	00:15	149.01042	38	31.1	76	20.6	19.9	17	Trawl
North	CTD	70	5	30	01:58	149.08194	38	31.1	76	24.3	20.0	15	Trawl
North	TT	11	5	30	02:08	149.08889	38	31.1	76	24.4	19.9	17	Trawl
North	MOCNESS	2	5	30	02:50	149.11806	38	31.3	76	24.4	19.8		Trawl
North	CTD	71	5	30	05:00	149.20833	38	31.5	76	24.6	19.7	14	Trawl
North	TT	12	5	30	05:15	149.21875	38	31.5	76	24.3	19.7		Trawl
North	MOCNESS	3	5	30	05:45	149.23958	38	30.9	76	24.4	20.3		Trawl
North	CTD	72	5	30	07:56	149.33056	38	31.4	76	24.4	19.8	14.6	Trawl
North	TT	13	5	30	08:11	149.34097	38	31.4	76	24.4	19.8	15	Trawl
North	MOCNESS	4	5	30	08:38	149.35972	38	31.4	76	24.6	19.8	16	Trawl
North	CTD	73	5	30	10:58	149.45694	38	31.3	76	24.6	20.8	15.4	Trawl
North	TT	14	5	30	11:11	149.46597	38	31.3	76	24.4	20.8	18	Trawl
North	MOCNESS	5	5	30	11:46	149.49028	38	30.9	76	24.5	20.0	18	Trawl
North	CTD	74	5	30	13:59	149.58264	38	31.3	76	24.5	20.0	15.2	Trawl
North	TT	15	5	30	14:19	149.59653	38	31.3	76	24.4	20.0	18	Trawl
North	MOCNESS	6	5	30	14:51	149.61875	38	31.3	76	25.2	20.5	18	Trawl
North	MOCNESS	6B	5	30	16:05	149.67014	38	32.1	76	24.3	22.0	16	Trawl
North	CTD	75	5	30	17:00	149.70833	38	31.1	76	24.3	19.9	15.5	Trawl
North	TT	16	5	30	17:15	149.71875	38	31.1	76	24.3	19.9		Trawl
North	MOCNESS	7	5	30	18:05	149.75347	38	31.2	76	24.8	22.0		Trawl
North	CTD	76	5	30	20:01	149.83403	38	31.6	76	24.7	19.5	14.5	Trawl
North	TT	17	5	30	20:10	149.84028	38	31.6	76	24.7	19.5		Trawl
North	MOCNESS	8	5	30	20:45	149.86458	38	31.6	76	24.2	19.5		Trawl
North	CTD	77	5	30	22:53	149.95347	38	30.9	76	24.2	19.9	15.5	Trawl
North	TT	18	5	30	23:03	149.96042	38	31.1	76	24.5	19.9		Trawl
North	MOCNESS	9	5	30	23:56	149.99722	38	31.0	76	24.3	20.0	17	Trawl

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Sample Logs

Z-Nets

Cast #	Date	Time	Depth (m)	Red Codend	Green Codend	Comments
1	26-May	4:35	17-10	5% Form	EPR	
2	26-May	4:45	10-0	5% Form	EPR	
3	26-May	6:04	17-6	5% Form	None	
4	26-May	6:22	6-0	5% Form	None	
5	26-May	7:40	3-0	Graze	Graze	Grazing Experiment
6	26-May	9:08	15-10	Graze	Graze	Grazing Experiment
7	26-May	11:38	17-8	5% Form	None	
8	26-May	11:48	8-0	5% Form	None	
9	26-May	12:48	17-8	5% Form	None	
10	26-May	12:56	8-0	5% Form	None	
11	26-May	13:55	17-8	5% Form	None	
12	26-May	14:03	8-0	5% Form	None	
13	26-May	20:48	20-10	5% Form	None	
14	26-May	20:55	10-0	5% Form	None	
15	26-May	21:50	20-10	5% Form	None	
16	26-May	21:59	10-0	5% Form	None	
17	27-May	0:08	20-10	Didn't work	5% Form	Red Trap was open
18	27-May	0:21	10-0	5% Form	None	
19	27-May	1:30	20-10	5% Form	None	
20	27-May	1:40	10-0	5% Form	Live Sort	
21	27-May	2:48	20-10	5% Form	Live Sort	
22	27-May	2:54	10-0	5% Form	Live Sort	
23	28-May	20:16	15-7	None	5% Form	
24	28-May	20:25	7-0	5% Form	None	
25	28-May	21:47	15-7	None	5% Form	
26	28-May	21:58	7-0	5% Form	None	
27	29-May	3:33	15-8	5% Form	None	
28	29-May	3:37	8-0	5% Form	None	
29	29-May	4:55	15-8	None	5% Form	
30	29-May	5:03	8-0	5% Form	None	
31	29-May	6:10	15-8	None	5% Form	
32	29-May	6:17	8-0	None	5% Form	
33	29-May	7:19	15-8	None	5% Form	
34	29-May	7:26	8-0	5% Form	None	
35	29-May	11:04	15-8	None	5% Form	
36	29-May	11:11	8-0	5% Form	None	
37	29-May	12:26	15-8	None	5% Form	
38	29-May	12:36	8-0	5% Form	None	Holes found in Green net
39	29-May	20:12	15-8	5% Form	Live Sort	
40	29-May	20:18	8-0	None	Live Sort -> Form	2 mls of 70 mls removed
41	29-May	21:22	15-8	5% Form	Live Sort/ RNA later	
42	29-May	21:28	8-0	5% Form	Live Sort/ RNA later	
43	29-May	22:08	15-8	None	5% Form	
44	29-May	22:14	8-0	5% form	None	

Z-Traps

Cast #	Date	Time	Time End	Depth (m)	Red Codend	Green Codend
1	26-May	5:00	5:45	10	Formalin (5%)	Pictures/Acetone
2	26-May	6:32	7:17	6	Formalin (5%)	Pictures/Acetone
3	26-May	11:52	12:37	8	Formalin (5%)	None
4	26-May	13:02	13:47	8	Formalin (5%)	None
5	26-May	21:00	21:45	10	Formalin (5%)	None
6	26-May	22:08	22:53	10	Didn't Close	Formalin (5%)
7	27-May	0:33	1:17	10	Didn't Close	Formalin (5%)
8	27-May	1:48	2:33	10	Formalin (5%)	Live Sort
9	28-May	20:37	21:22	7	None	Formalin (5%)
10	28-May	22:04	22:49	10	Live Sort	Formalin (5%)
11	29-May	3:55	4:40	15	None	Live Sort/preserve remaining
12	29-May	5:14	5:59	15	Formalin (5%)	Formalin (5%)
13	29-May	6:26	7:11	10	None	Formalin (5%)
14	29-May	11:31	12:16	8	Formalin (5%)	None
15	29-May	20:23	21:08	8	Formalin (5%)	Live Sort
16	29-May	21:32	22:02	8		

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Tucker Trawl Tows

Date	Tow #	Net #	Start Time	Depths (m)	Date	Tow #	Net #	Start Time	Depths (m)
27-May	T1	1	4:37	17-13	29-May	T10	1	23:00	17-14
		2		12-9			2		14-11
		3		13-8.5			3		11-10
		4		8.5-0			4		9-0
27-May	T2	1	7:15	19-15	30-May	T11	1	2:00	
		2		15-11			2		
		3		11-7			3		
		4		7-0			4		
27-May	T3	1	10:13	18-15	30-May	T12	1	5:00	
		2		15-13			2		
		3		13-8			3		
		4		8-0			4		
27-May	T4	1	13:15	22-15	30-May	T13	1	8:08	
		2		15-11			2		
		3		11-5			3		
		4		5-0			4		
27-May	T5	1	16:10	20-15	30-May	T14	1	11:02	
		2		15-10			2		
		3		10-5			3		
		4		5-0			4		
27-May	T6	1	19:07	18-15	30-May	T15	1	14:00	
		2		15-10			2		
		3		10-7			3		
		4		7-0			4		
27-May	T7	1	22:10	22-15	30-May	T16	1	17:20	
		2		15-10			2		
		3		10-6			3		
		4		6-0			4		
28-May	T8	1	1:25	25-14	30-May	T17	1	20:00	
		2		14-8			2		
		3		8-4			3		
		4		4-0			4		
28-May	T9	1	3:40	22-12	30-May	T18	1	23:00	
		2		12-7			2		
		3		7-4			3		
		4		4-0			4		

MOCNESS Net Tows

Date	Tow #	Net #	Start Time	End Time	Depths (m)	Wire Out (m)	Start Angle	End Angle	Vol. Filtered
29-May	1	0	23:16		15				
		1			15-12	23-17	49	45	39.3
		2			12-8	17-13	49	51	
		3			15-8	13-22		51	61.4
		4		23:36	8-4	12-8	51	54	34.3
		5			4-0	8-1	52		27.7
		6			8-0	1-12-0	46		60.1
30-May	2	0	2:51		15				
		1		2:58	15-12	18			37.2

Date	Tow #	Net #	Start Time	End Time	Depths (m)	Wire Out (m)	Start Angle	End Angle	Vol. Filtered
		2	2:58	3:02	12-9	12.7	55		30.9
		3	3:02	3:08	15-9	12.2	52		66.4
		4	3:08	3:11	9-6	11	51		34.9
		5	3:11	3:14	6-0	1	45		34.1
		6	3:14	3:20	9-0	14			60.5
30-May	3	0	5:45	5:51	15				
		1	5:51	5:55	15-12	18	50	39	32.7
		2	5:55	5:58	12-10	12			35
		3	5:58	6:03	15-10	12	51		55
		4	6:03	6:06	10-5	6	49		32.1
		5	6:06	6:10	5-0	0	45		34.3
		6	6:10	6:15	10-0	12-0	48		60.8
30-May	4	0	8:38	8:43	16				
		1	8:43	8:46	16-12	25-19	51	53	36.1
		2	8:46	8:50	12-9	19-14	52	50	32.8
		3	8:50	8:55	16-9	14-25-15	52-51	56	60
		4	8:55	8:59	9-4	15-8	52	56	36.8
		5	8:59	9:02	4-0	8-0	57	50	30.7
		6	9:02	9:07	9-0	0-15-0	50-54	48	57.4
30-May	5	0	11:46	11:52	18				
		1	11:52	11:55	18-14	25-21	48	52	35.7
		2	11:55	11:58	14-11	20-17	51	50	35.8
		3	11:58	12:04	18-11	16-25-16	51-48	49	60
		4	12:04	12:07	11-6	15-10	50	50	37.5
		5	12:07	12:10	6-0	9-0	50	50	33.7
		6	12:10	12:16	11-0	0-17-0	50-55	46	60.6
30-May	6	0	14:51	15:03	18				
		1	15:03	15:06	18-15	26-23	58	50	34.4
		2	15:06	15:10	15-12	22-19	50	52	34.1
		3	15:10	15:15	18-12	18-25-20	52-50	57	57.6
		4	15:15	15:18	12-7	19-14	57	56	34.5
		5	15:18	15:21	7-0	13-0	56	54	33.2
		6	15:21	15:27	12-0	0-18-0	54-58	53	58.8
30-May	6B	0	16:05	16:12	16				
		1	16:12	16:15	16-14	25-24	55	56	34
		2	16:15	16:18	14-10	23-19	56	50	30.6
		3	16:18	16:21	10-5	18-8	50	46	34.3
		4	16:21	16:25	5-0	7-0	54	52	31.8
30-May	7	0	18:05	18:11	0-17	20			
		1	18:11	18:14	17-12	20			32.2
		2	18:14	18:17	12-9	16-14	51		31.9
		3	18:17	18:22	17-9	14-20	48		52.2
		4	18:22	18:25	9-4	14-6	52-46		33.7
		5	18:25	18:34	4-0	1	45		32.2
		6	18:34		9-0	12			60.6
30-May	8	0	20:45	20:49	0-17	20			
		1	20:49	20:52	17-12	16	56		33.1
		2	20:52	20:55	12-9	14			30.1
		3	20:55	21:00	17-9	20-14	48		60
		4	21:00	21:03	9-4	14	49		33.6
		5	21:03	21:06	4-0	6-0	46		30.1
		6	21:06	21:12	9-0	0-14	50		58.5
30-May	9	0	23:56	0:00	17	18	49		
		1	0:00	0:03	17-11	20	49		34
		2	0:03	0:06	11-7	14-11	46		33 (?)
		3	0:06	0:11	17-7	11-20	55		57.5
		4	0:11	0:15	7-4	10-7	53		33.1
		5	0:15	0:18	4-0	5-0	55		28.5
		6	0:18	0:23	7-0	10-0	50		56.8

Pump Casts

Date	Time	CTD #	Depths
28-May	16:00	37	14.41
29-May	15:00	60	15.251

Niskin Bottle Samples for Zooplankton

Date	Time	CTD #	Depths	# samples per depth
27-May	7:00	24	16.7	1
			11	1
			6	1
			2	1
27-May	10:00	26	20	1
			11	1
			6	1
			2	1
27-May	13:00	28	19.5	1
			11	1
			6	1
			2	1
27-May	16:00	29	18	1
			11	1
			6	1
			2	1
27-May	19:00	30	19	1
			11	1
			6	1
			2	1
27-May	22:00	31	22	1
			11	1
			6	1
			2	1
28-May	1:00	32	19.5	1
			11	1
			6	1
			2	1
28-May	3:30	33	20	1
			11	1
			6	1
			2	1
28-May	23:55	45	14	1
			9	1
			1	1
29-May	3:00	48	15	1
			7	1
			2	1
29-May	13:00	58	14	2
			9	2
			1	2
30-May	2:00	70	15	1
			11	1
			6	1
			2	1
30-May	5:00	71	15	1
			11	1
			6	1
			2	1
30-May	8:00	72	15	1
			11	1
			6	1
			2	1
30-May	11:00	73	15	1
			12	1
			6	1
			2	1
30-May	14:00	74	15	5
			10	1

Date	Time	CTD #	Depths	# samples per depth
			6	1
			2	1
30-May	17:00	75	15	1
			10	1
			6	1
			2	1
30-May	20:00	76	13	1
			10	1
			6	1
			2	1
30-May	23:00	77	13	1
			10	1
			6	1
			2	1