Cruise report for the NIOZ NorthSea cruise 64PE460, with RV Pelagia (NIOZ Northsea monitoring, 4-11 September 2019).

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first version: 5 September 2019 - current version: 08 oktober 2019

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Introduction

This report gives a day-by day account of the activities during the first part of the NIOZ Northsea cruise with the Pelagia (64PE460) from 4 to 11th September 2019, starting in the Friessche Front area, via the Oystergrounds, Doggerbank, Devil's Hole, Fischer Banks, and German Bight.

The scientific crew consisted of: Karline Soetaert (PI), Jacco Kromkamp, Anton Tramper, Jeroen van Dalen, Dunia Rios Yunes (NIOZ), Helena Klip (AWI), Mareike Paul (University Helsinki), David Riedinger, Tom Bastiaan, Matteo Mikos (Utrecht University).

The sampling locations are in the figure below.
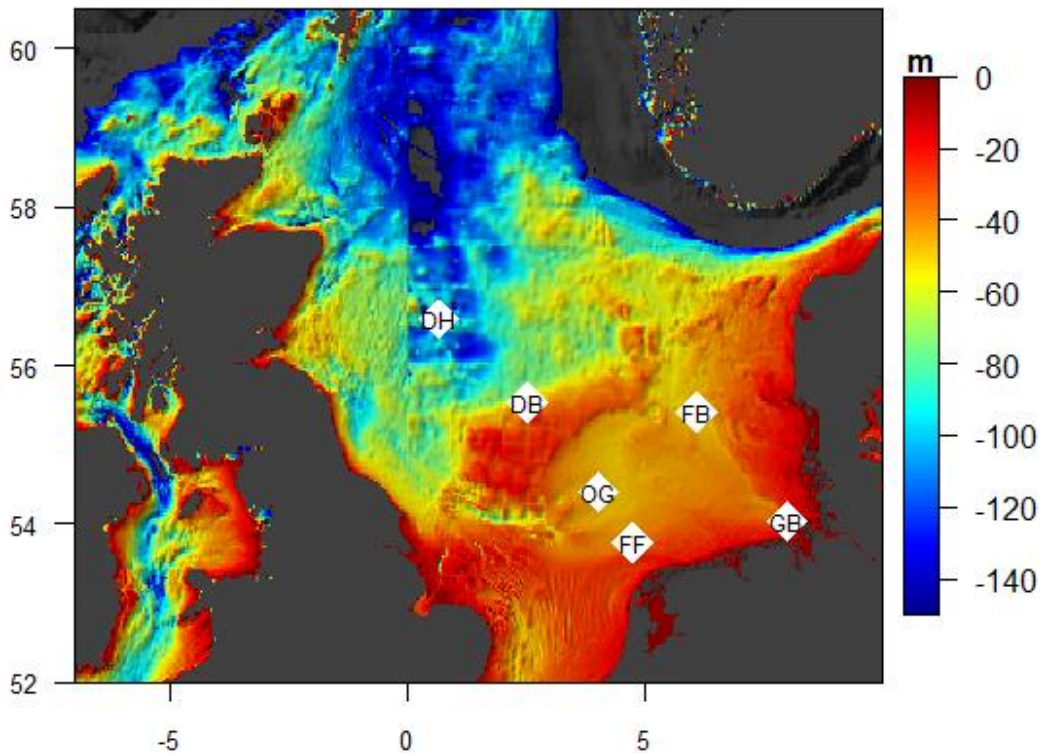
location of the sampling area

The ship's log

The Pelagia stores the events in a database system called CASINO, which records the coordinates, time, type of events, and also logs the ships position, and weather information during the cruise.

The events (called *station* in CASINO) are logged by the captain and each event receives an increasing number - this means that failed events are also included.

It should be noted that the positions recorded in the CASINO system are from the middle of the ship.

The main activities per day

In principle, the following activities were performed (weather permitting):

• To start a CTD cast was taken. The CTD rozette contained also a SUNA nitrate sensor and a LISST200X.
• A CTD casts with (butterfly) bottles was taken. Eight bottles each were filled at three depths:
  – 3 metres above the bottom,
  – mid-depth or in the deep chlorophyll maximum
  – 3 meter below the surface
• Two vertical hauls with a zooplankton net (16.5 cm inner diameter, 150 um mesh size) were taken from the bottom to the surface or from mid-depth to the surface. Every other day, three hauls were taken.
• Two deployments were performed with the multicorer.
• Three incubation box cores were taken and put in three large, tanks on deck. The water in the tanks was kept at ambient temperature by three coolers.

List of activities

Here is a table summarising the various activities during this cruise, including the number of deployments:

Event	number
Boxcore	19
CTD	12
CTD with samples	9
Multi Corer	15
MultiNet	16

The ship track during the cruise is represented here, indicating the main stations (FF: Frisian Front, OG: Oystergrounds, DB: Doggerbank, FB: Fisher Bank, GB: German Bight).

64PE460 - ship track per day
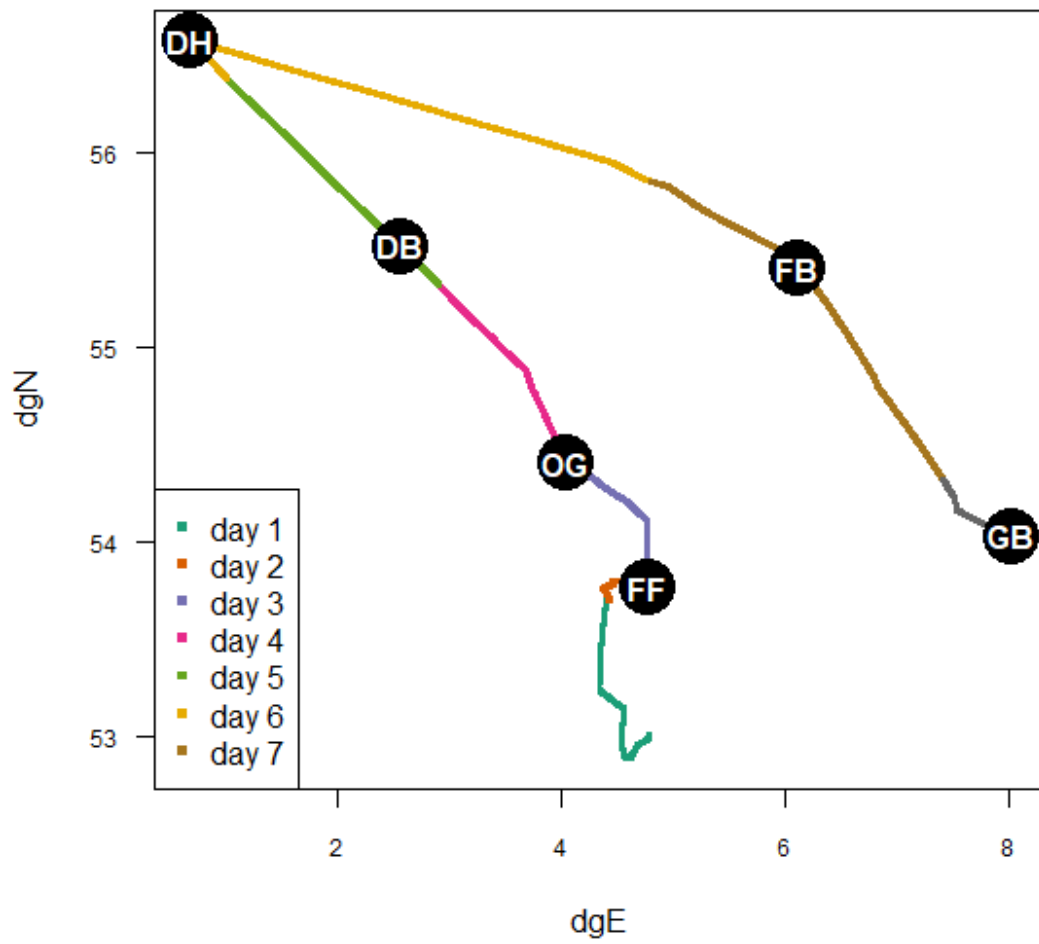
The events per day are represented here:

Events ordered per day
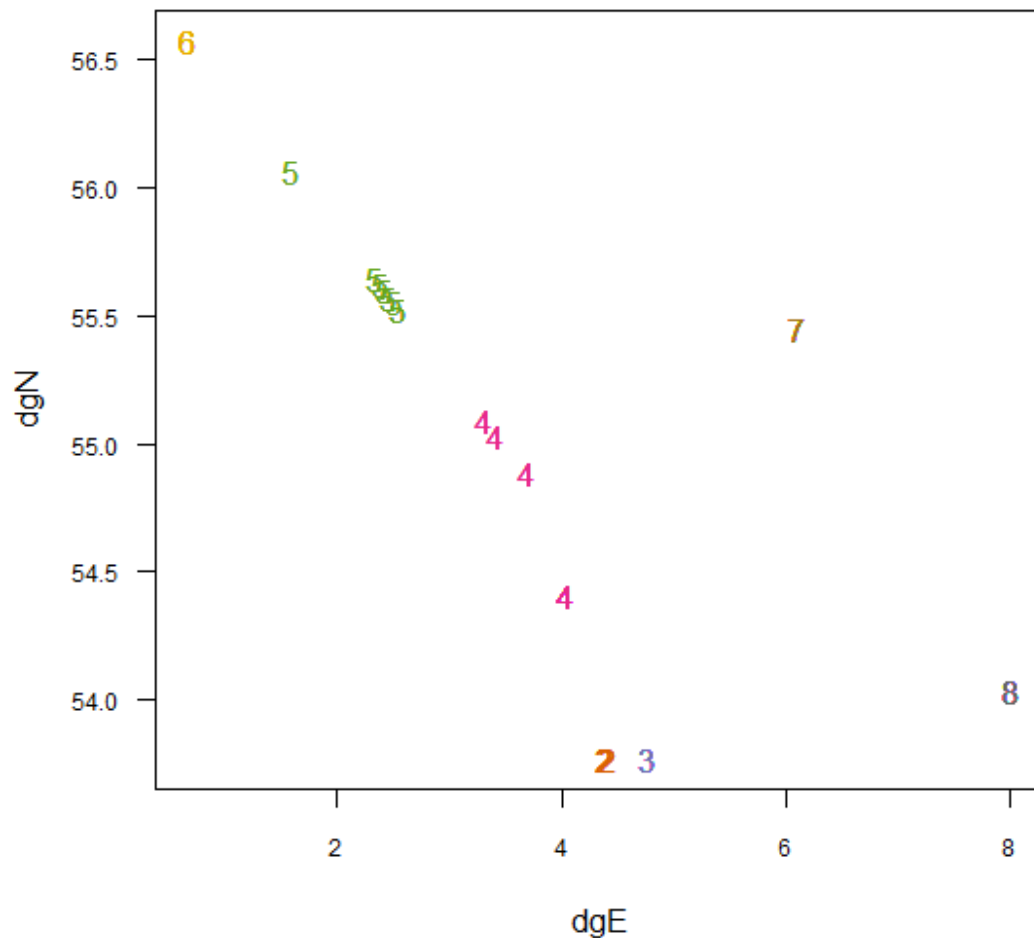
Verbal account of the activities.

Day 1 - 4th September 2019 - start of the cruise.

Due to a number of calamities with the ship's engine and the chiller (for cooling the incubation boxes), and because of the rough weather, the Pelagia departed from the harbor of Texel only after lunch. As no sampling was possible that day, the ship sailed at low speed to save fuel. We arrived at the Frisian Front around 10 o'clock in the evening.

Day 2 - 5 September 2019 - the Frisian Front.

Notwithstanding the rough weather, a CTD cast was taken around 9 o'clock with 24 bottles filled at three water depths (CASINO event 1). The second CTD cast was taken 2 hours later, no bottles were filled (event 2).

The weather was too bad that day for sampling zooplankton or taking benthic samples.

Day 3 - 6 September 2019 - the Frisian Front.

The third day started with reasonably calm weather, but the forecast was that it would get worse. So we started with three incubation boxcores (events 3-5), that were put in the cooled blue tanks on deck. The first boxcore had only about 10-15 cm of water on top of the sediment, which is rather little, so it was decided to lower the next boxcorers with reduced speed.

After that a multicorer was taken (event 6). This multicorer contains 12 large cores, 12 cm inner diameter. People from Utrecht/Helsinki used one core for anoxic slicing, one core for oxic slicing, one for rhizome sampling, one for freezing. Another core was frozen for Peter Kraal (NIOZ). The rest was subsampled for chlorophyll slicing (three small cores), and for microprofiling (3 large subcores), processed by NIOZ-EDS. It was decided to sample the cores used for microprofiling later for meiofauna, so that no extra multicorer needed to be taken.

Three vertical hauls with the plankton net followed (events 7-9). The plankton net had been made heavier by adding an extra weight. It was lowered to very near the bottom and then slowly uphauled. The first haul was fixed in formaldehyde (4%); the second haul was size-fractionated, using stacked sieves of 1 mm (top), 500 micrometer and 150 um. The last haul was used for the grazing experiment.

After lunch, a CTD cast was taken (event 10); two bottles were filled near the bottom, the rest of the bottles were filled 3 m below the surface, and this water was used for the zooplankton grazing experiment.

It was decided to go to the Oysterground station Terschelling135 (rather than Terschelling100 as originally planned). This station is inbetween the Frisian Front and the Dogger Bank station. This reduces the transit from the Oysterground to Dogger Bank.

Day 4 - 7 September 2019 - the Oystergrounds.

As the day before, the sea in the morning was relatively calm. The first event of the day (event 11) consisted of a CTD without bottles, followed by a CTD with 8 bottles each in 3 depths, 3 m above the bottom, mid-depth (18 m) and 3 m below the surface (event 12). Then two zooplankton tows were taken (events 13, 14).

The first 3 multicorer deployments were unsuccesful (events 15-17), as they contained no sediment at all, so it was decided to move the ship 500 metres from the original station. Here the first deployment (event 18) was succesful, although the sampled sediment was rather undeep. Also, some cores visibly had their surface disturbed, or there were clear signs of benthic life (mainly Chaetopterus), a worm that can be up to 25 cm long, and that lives in a self-made U-shaped tube.

The Utrecht crew selected the deepest cores and the ones with least disturbance or least benthic traces. Three cores were taken for chlorophyll slicing, but later discarded and replaced with cores from the next multicore deployment.

Another multicorer was taken (event 19) and subsampled for microprofiling, chlorophyll slicing and meiofauna.

Three incubation boxcorers were taken before lunch (event 20-22), but the second failed. The final incubation boxcorer was taken after lunch (event 23).

At that time the sea had become quite rough, and the currents were unfavorable so that the Pelagia could not sail full speed to the Dogger Bank station, to be sampled the next day.

Three CTDs were taken to end the day, one at station Terschelling235 (event 24), one immediately south of Doggerbank (event 25) and one on Doggerbank (event 26).

Day 5 - 8 September 2019 - the Doggerbank.

The first activity of the day consisted of two CTD casts, one with two bottles fired a few metres above the bottom, the other bottles taken below the surface (event 27), used for the zooplankton grazing experiment. The second CTD cast (event 28) had bottles filled at three depths again. As there was a small deep chlorophyll maximum (DCM), the mid-depth bottles were taken at this DCM.

Three zooplankton nets were towed after that (events 29, 30, 31), one of those to perform another grazing experiment.

The multicorer (events 32-33) retrieved only one or two decimeter of sediment, as the sediment was quite sandy. The deeper cores from the two deployments were used for meiofauna sampling, and chlorophyll sampling. The porewater of one core was sampled with rhizomes on deck (!). It was not possible to take cores for slicing, nor for microprofiling.

The three incubation boxcores (events 34-36) were the last action before lunch.

After lunch several CTDs (no bottles) were taken along a transect descending from Dogger Bank to the Fladen Ground (events 37-41). For the last CTD at around 8 o'clock (local time) in the evening, the SUNA and the LISST were removed (event 42).

In all previous CTD profiles, the oxygen and salinity profiles in the upper meters were suspicious, and had to be removed. The upward cast did not show this behaviour, proving that the first measurements of the downward cast were an artefact. To get rid of these erroneous values, it was decided that -for the next CTD profiles- the instrument would first be lowered to about 20 meter and then brought back to the surface to start the actual profile.

Day 6 - 9 September 2019 - Devil's Hole

The day started with calm weather. Devil's hole sediments being more than 200 meter below the surface, only one CTD cast was taken (event 43), with bottles fired at a few meters above the bottom, near the deep chlorophyll maximum and near the surface. The rozette was also equipped with the LISST but not with the nitrate sensor (which would probably not have survived the depth). (note that this event was labeled as "CTD", not as "CTD with samples" in CASINO). The CTD was lowered at a speed of 15 m per minute, and uphauled at 30 m per minute.

Two zooplankton hauls were then taken from 60m deep up to the surface (events 44, 45). The first multicorer (event 46) retrieved samples that were not too deep (20-30 cm), but they were used nonetheless for the work of UU, and for the microprofiling, and chlorophyll.

Incubation boxcore deployments were all succesful (events 47-49). One more multicore deployment was done (event 50) for meiofauna and permeability measurements. Immediately after that the ship set sail to the next station. The transit Devil's Hole - Fisher Bank was the largest distance to be covered during the cruise. The sea was incredibly calm (and beautiful!) during the evening.

Day 7 - 10 September 2019 - South of Fisher Bank.

The station south of Fisher Bank, some 50 m deep, and 500 m into Danish waters, was first probed with two CTDs, the first sampling mainly surface water, except for two bottles filled with bottom water (event 51), the last filled with water at 3 depths (event 52).

The first zooplankton sampling (event 53) failed, but the next 3, sampling from above the bottom to the surface were succesful (events 54-56).

The first multicorer sample (event 57) partly failed. The good cores were used to sample for meiofauna (one sample) and chlorophyll (3 samples).

Then the winch used to take the sediment samples broke and it could not be repaired, so the multicorer and boxcorer had to be deployed from the rear deck from that moment on.

The next multicorer (event 58), after lunch, had several good cores but also some less good ones. They were used for the Utrecht samples - except for the rhizon core that was later replaced.

The last multicorer (event 59) was subsampled for meiofauna, permeability and for the rhizon sampling.

The three boxcores (events 60-62) were taken well into the afternoon.

Day 8 - 11 September 2019 - German Bight.

The clearance to take sediment samples from the German Bight was only obtained the day before - after a telephone call by Mareike Paul. Also the coordinates where we were allowed to sample had slightly changed from what we originally requested.

As the weather promised to get worse during the day, it was decided to start earlier, at 7:00 rather than at 8:00, the first deployment to be the multicorer, followed by the boxcorers and then the zooplankton deployment. The CTD could still be taken from the side and was scheduled later.

Everything went as planned: the first multicorer (event 63), and the three incubation boxcorers (events 64-66) were all taken within the hour. A second multicorer (event 67) was taken for 2 more meiofauna samples, the microprofile samples and one more Chlorophyll sample. The zooplankton samples (events 68-69) were also taken promptly. Following this were two CTDs. The first CTD took 2 bottles above the bottom and the rest near the surface, although this was not necessary as no grazing experiment was performed. The second CTD took bottles at the three depths, as every day.

The entire sampling was finished in 2 hours and 30 minutes.

Then the Pelagia set sail to Texel.

APPENDIX I. The weather, water properties and navigation data

The following figures show meteorological information, data from the water throughflow system and some navigational data, as extracted from the CASINO system.

air pressure and wind speed

64PE460 - air pressure
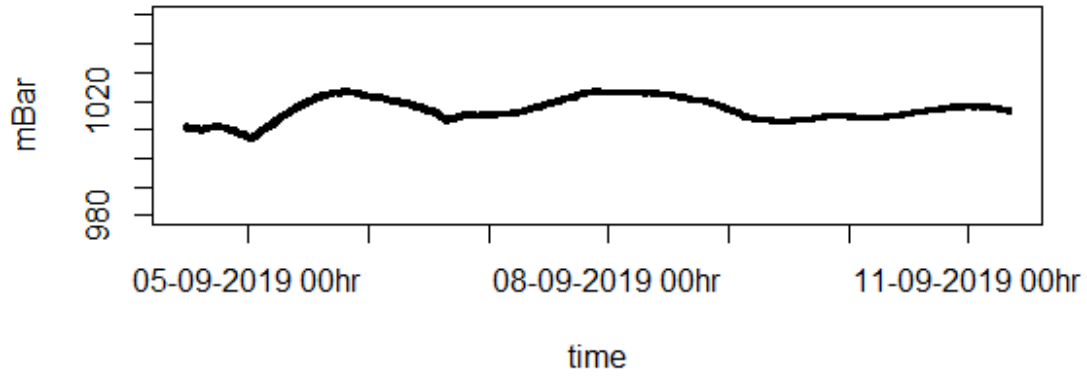
64PE460 - wind speed (uncorrected)
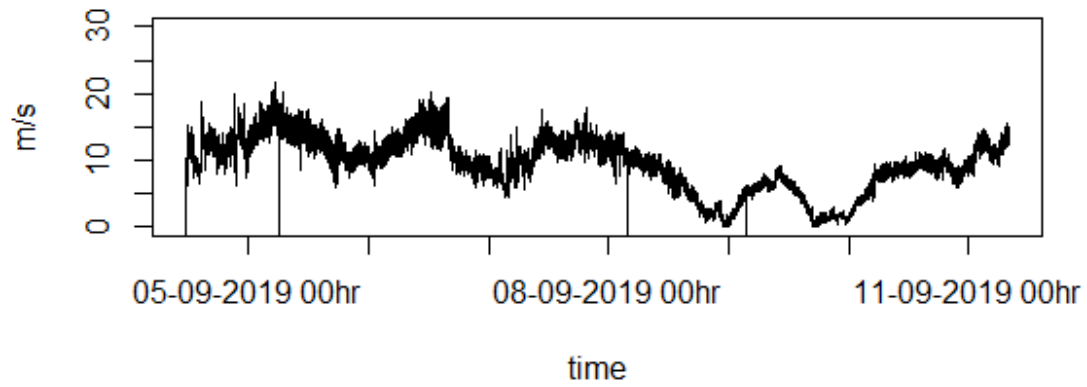
The temperature and salinity of the water.

64PE460 - water temperature
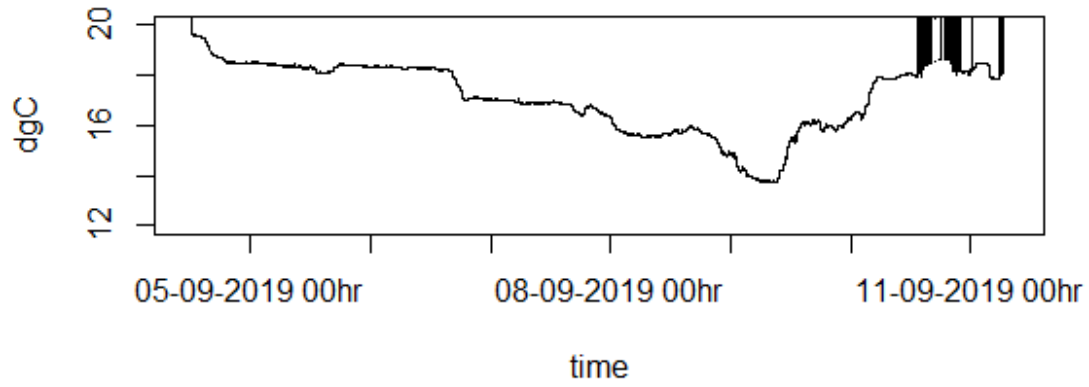
64PE460 - salinity
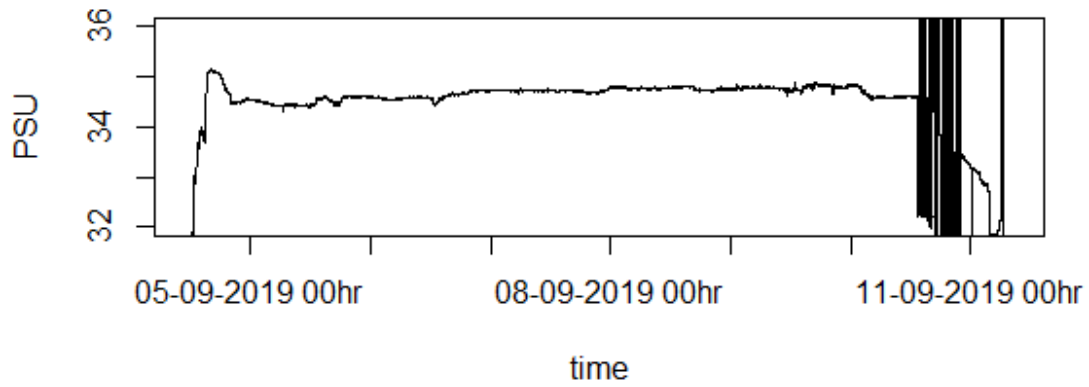
The ship navigation data

64PE460 - speed of ship
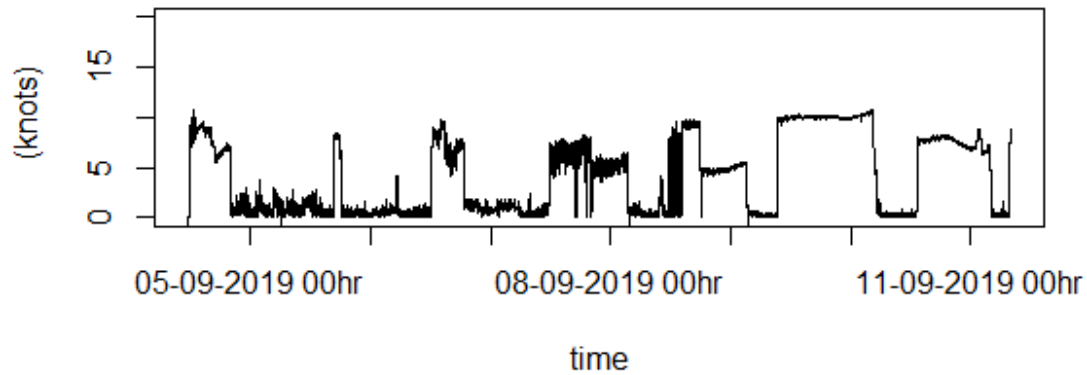
64PE460 - bottom depth
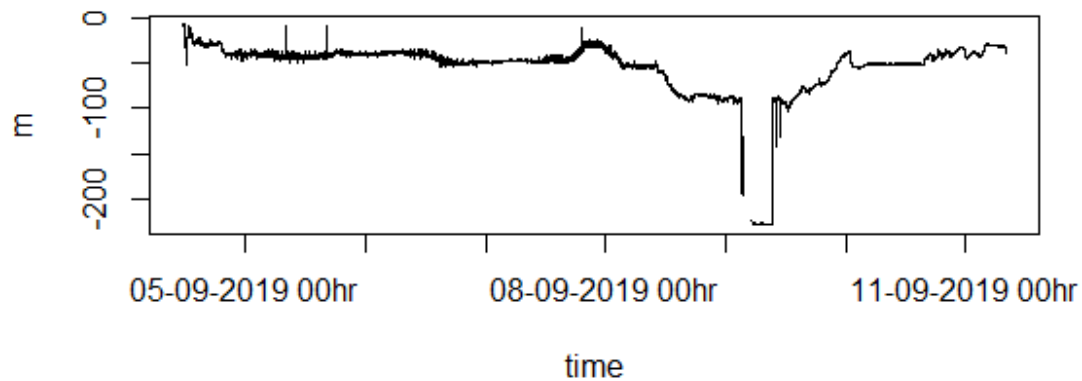
APPENDIX II - Details of the sampling events

date	time	lat	lon	device	action	station	depth
05/09/2019	06:45:13	53.7652	4.3921	CTD with samples	Bottom	1	40.34
05/09/2019	07:02:21	53.7654	4.3929	CTD with samples	End	1	41.50
05/09/2019	08:42:24	53.7667	4.4167	CTD	Begin		42.49
05/09/2019	08:45:57	53.7674	4.4174	CTD	Bottom		42.71
05/09/2019	08:49:07	53.7675	4.4180	CTD	End		44.12

06/09/2019	06:34:57	53.7700	4.7700	Boxcore	Bottom	3	39.10
06/09/2019	07:11:59	53.7700	4.7699	Boxcore	Bottom	4	38.31
06/09/2019	07:36:00	53.7699	4.7703	Boxcore	Bottom	5	38.53
06/09/2019	08:49:41	53.7703	4.7704	Multi Corer	Bottom	6	39.06
06/09/2019	09:40:06	53.7697	4.7693	MultiNet	Begin	7	38.70
06/09/2019	09:44:27	53.7697	4.7694	MultiNet	Start Heave	7	39.42
06/09/2019	09:47:43	53.7697	4.7696	MultiNet	End	7	39.03
06/09/2019	09:51:55	53.7700	4.7701	MultiNet	Begin	8	39.53
06/09/2019	09:54:55	53.7699	4.7698	MultiNet	Start Heave	8	38.56
06/09/2019	09:58:33	53.7699	4.7697	MultiNet	End	8	39.11
06/09/2019	10:00:46	53.7699	4.7699	MultiNet	Begin	9	39.16
06/09/2019	10:03:37	53.7700	4.7704	MultiNet	Start Heave	9	40.91
06/09/2019	10:07:33	53.7700	4.7702	MultiNet	End	9	40.15
06/09/2019	11:28:03	53.7700	4.7700	CTD with samples	Begin	10	39.23
06/09/2019	11:31:53	53.7698	4.7702	CTD with samples	Bottom	10	38.66
06/09/2019	11:42:14	53.7695	4.7704	CTD with samples	End	10	40.78
07/09/2019	06:20:04	54.4099	4.0398	CTD	Begin	11	47.24
07/09/2019	06:24:55	54.4101	4.0400	CTD	Bottom	11	47.13
07/09/2019	06:28:33	54.4099	4.0399	CTD	End	11	48.16
07/09/2019	06:30:06	54.4097	4.0398	CTD with samples	Begin	12	47.83
07/09/2019	06:31:39	54.4097	4.0398	CTD with samples	Bottom	12	46.28
07/09/2019	06:46:41	54.4102	4.0400	CTD with samples	End	12	47.14
07/09/2019	06:52:32	54.4101	4.0401	MultiNet	Begin	13	47.28
07/09/2019	06:56:05	54.4101	4.0399	MultiNet	Start Heave	13	46.52
07/09/2019	06:59:51	54.4100	4.0400	MultiNet	End	13	46.92
07/09/2019	07:04:09	54.4101	4.0399	MultiNet	Begin	14	47.14
07/09/2019	07:07:21	54.4101	4.0398	MultiNet	Start Heave	14	47.08
07/09/2019	07:11:10	54.4099	4.0399	MultiNet	End	14	47.37

07/09/2019	07:24:16	54.4101	4.0404	Multi Corer	Bottom	15	46.78
07/09/2019	07:31:21	54.4100	4.0402	Multi Corer	Bottom	16	47.02
07/09/2019	07:38:24	54.4100	4.0398	Multi Corer	Bottom	17	47.54
07/09/2019	08:17:51	54.4053	4.0428	Multi Corer	Bottom	18	47.98
07/09/2019	08:51:50	54.4050	4.0421	Multi Corer	Bottom	19	46.50
07/09/2019	09:25:37	54.4051	4.0429	Boxcore	Bottom	20	48.17
07/09/2019	09:46:35	54.4053	4.0427	Boxcore	Bottom	21	47.78
07/09/2019	09:58:16	54.4052	4.0426	Boxcore	Bottom	22	47.98
07/09/2019	11:23:52	54.4044	4.0433	Boxcore	Bottom	23	48.23
07/09/2019	17:02:20	54.8857	3.6919	CTD	Begin	24	46.20
07/09/2019	17:07:24	54.8858	3.6921	CTD	Bottom	24	45.76
07/09/2019	17:11:43	54.8861	3.6921	CTD	End	24	46.71
07/09/2019	19:06:46	55.0287	3.4248	CTD	Begin	25	36.16
07/09/2019	19:09:24	55.0288	3.4245	CTD	Bottom	25	37.91
07/09/2019	19:13:28	55.0289	3.4246	CTD	End	25	36.34
07/09/2019	20:07:23	55.0946	3.3066	CTD	Begin	26	30.61
07/09/2019	20:10:27	55.0950	3.3068	CTD	Bottom	26	31.05
07/09/2019	20:12:34	55.0952	3.3067	CTD	End	26	31.35
08/09/2019	06:04:15	55.5270	2.5562	CTD with samples	Begin	27	52.59
08/09/2019	06:09:58	55.5269	2.5562	CTD with samples	Bottom	27	52.52
08/09/2019	06:24:08	55.5270	2.5562	CTD with samples	End	27	53.48
08/09/2019	06:44:33	55.5271	2.5560	CTD with samples	Begin	28	53.55
08/09/2019	06:49:17	55.5271	2.5560	CTD with samples	Bottom	28	52.48
08/09/2019	07:05:08	55.5270	2.5560	CTD with samples	End	28	53.83
08/09/2019	07:09:57	55.5271	2.5559	MultiNet	Begin	29	54.65
08/09/2019	07:13:29	55.5270	2.5559	MultiNet	Start Heave	29	53.42
08/09/2019	07:18:15	55.5271	2.5558	MultiNet	End	29	53.10
08/09/2019	07:20:54	55.5271	2.5558	MultiNet	Begin	30	55.10
08/09/2019	07:24:31	55.5271	2.5560	MultiNet	Start Heave	30	54.72
08/09/2019	07:29:21	55.5271	2.5562	MultiNet	End	30	53.84

08/09/2019	07:32:47	55.5271	2.5559	MultiNet	Begin	31	53.07
08/09/2019	07:36:07	55.5272	2.5559	MultiNet	Start Heave	31	53.99
08/09/2019	07:41:18	55.5271	2.5559	MultiNet	End	31	53.78
08/09/2019	07:50:33	55.5268	2.5559	Multi Corer	Bottom	32	52.83
08/09/2019	08:03:08	55.5270	2.5558	Multi Corer	Bottom	33	53.17
08/09/2019	08:59:00	55.5269	2.5558	Boxcore	Bottom	34	52.37
08/09/2019	09:15:19	55.5269	2.5559	Boxcore	Bottom	35	53.93
08/09/2019	09:30:22	55.5270	2.5558	Boxcore	Bottom	36	52.35
08/09/2019	11:23:43	55.5519	2.5109	CTD	Begin	stn 37	58.26
08/09/2019	11:29:46	55.5521	2.5108	CTD	Bottom	stn 37	57.83
08/09/2019	11:36:03	55.5521	2.5107	CTD	End	stn 37	58.02
08/09/2019	12:05:12	55.5739	2.4718	CTD	Begin	38	66.33
08/09/2019	12:10:28	55.5742	2.4721	CTD	Bottom	38	67.53
08/09/2019	12:15:11	55.5740	2.4721	CTD	End	38	66.83
08/09/2019	12:45:53	55.5990	2.4267	CTD	Begin	39	73.58
08/09/2019	12:51:55	55.5993	2.4273	CTD	Bottom	39	73.43
08/09/2019	12:58:32	55.5996	2.4278	CTD	End	39	73.97
08/09/2019	13:19:34	55.6216	2.3873	CTD	Begin	40	78.12
08/09/2019	13:26:02	55.6221	2.3875	CTD	Bottom	40	78.96
08/09/2019	13:30:09	55.6222	2.3877	CTD	End	40	78.01
08/09/2019	13:53:47	55.6442	2.3460	CTD	Begin	41	81.27
08/09/2019	13:59:38	55.6445	2.3460	CTD	Bottom	41	82.20
08/09/2019	14:06:05	55.6442	2.3457	CTD	End	41	82.04
08/09/2019	18:07:19	56.0647	1.5963	CTD	Begin	42	83.31
08/09/2019	18:10:11	56.0648	1.5961	CTD	Bottom	42	84.17
08/09/2019	18:21:17	56.0675	1.5934	CTD	End	42	83.58
09/09/2019	06:18:28	56.5791	0.6820	CTD	Begin	43	228.78
09/09/2019	06:35:49	56.5790	0.6818	CTD	Bottom	43	228.34
09/09/2019	06:58:13	56.5791	0.6821	CTD	End	43	228.23
09/09/2019	07:01:29	56.5790	0.6820	MultiNet	Begin	44	227.72
09/09/2019	07:07:28	56.5790	0.6822	MultiNet	Start Heave	44	228.05
09/09/2019	07:13:28	56.5791	0.6822	MultiNet	End	44	228.38
09/09/2019	07:17:37	56.5791	0.6823	MultiNet	Begin	45	228.04
09/09/2019	07:23:26	56.5789	0.6823	MultiNet	Start Heave	45	227.81

09/09/2019	07:29:44	56.5790	0.6822	MultiNet	End	45	228.24
09/09/2019	07:40:51	56.5790	0.6821	Multi Corer	Bottom	46	228.37
09/09/2019	08:02:05	56.5791	0.6821	Boxcore	Bottom	47	228.56
09/09/2019	08:24:11	56.5790	0.6819	Boxcore	Bottom	48	228.63
09/09/2019	08:46:34	56.5790	0.6819	Boxcore	Bottom	49	228.72
09/09/2019	09:15:04	56.5791	0.6819	Multi Corer	Bottom	50	228.55
10/09/2019	06:13:09	55.4517	6.1069	CTD with samples	Begin	51	51.03
10/09/2019	06:22:03	55.4517	6.1068	CTD with samples	Bottom	51	50.98
10/09/2019	06:36:59	55.4517	6.1068	CTD with samples	End	51	50.94
10/09/2019	06:58:04	55.4518	6.1070	CTD with samples	Begin	52	50.98
10/09/2019	07:00:02	55.4519	6.1069	CTD with samples	Bottom	52	50.80
10/09/2019	07:15:47	55.4517	6.1069	CTD with samples	End	52	51.20
10/09/2019	07:20:55	55.4518	6.1068	MultiNet	Begin	53	51.08
10/09/2019	07:24:15	55.4518	6.1068	MultiNet	Start Heave	53	50.72
10/09/2019	07:30:11	55.4518	6.1069	MultiNet	End	53	51.00
10/09/2019	07:34:13	55.4518	6.1069	MultiNet	Begin	54	51.17
10/09/2019	07:36:48	55.4519	6.1069	MultiNet	Start Heave	54	50.92
10/09/2019	07:42:18	55.4517	6.1069	MultiNet	End	54	50.97
10/09/2019	07:43:45	55.4517	6.1069	MultiNet	Start Heave	55	51.00
10/09/2019	07:44:14	55.4517	6.1069	MultiNet	Begin	55	50.61
10/09/2019	07:52:17	55.4516	6.1067	MultiNet	End	55	51.10
10/09/2019	07:57:42	55.4516	6.1068	MultiNet	Begin	56	50.70
10/09/2019	08:00:47	55.4516	6.1068	MultiNet	Start Heave	56	51.00
10/09/2019	08:06:00	55.4517	6.1070	MultiNet	End	56	50.98
10/09/2019	08:14:44	55.4517	6.1068	Multi Corer	Bottom	57	50.89
10/09/2019	11:14:00	55.4517	6.1070	Multi Corer	Bottom	58	51.20
10/09/2019	11:39:37	55.4516	6.1071	Multi Corer	Bottom	59	51.14
10/09/2019	11:57:12	55.4516	6.1068	Boxcore	Bottom	60	51.28

10/09/2019	12:14:45	55.4518	6.1071	Boxcore	Bottom	61	50.94
10/09/2019	12:32:51	55.4517	6.1073	Boxcore	Bottom	62	50.66
11/09/2019	05:08:57	54.0366	8.0173	Multi Corer	Bottom	63	29.81
11/09/2019	05:27:46	54.0367	8.0175	Boxcore	Bottom	64	29.87
11/09/2019	05:41:31	54.0367	8.0172	Boxcore	Bottom	65	30.09
11/09/2019	05:55:09	54.0366	8.0170	Boxcore	Bottom	66	30.58
11/09/2019	06:12:54	54.0366	8.0171	Multi Corer	Bottom	67	30.54
11/09/2019	06:21:03	54.0366	8.0167	MultiNet	Begin	68	30.25
11/09/2019	06:23:09	54.0366	8.0167	MultiNet	Start Heave	68	30.46
11/09/2019	06:26:15	54.0365	8.0166	MultiNet	End	68	30.56
11/09/2019	06:31:37	54.0366	8.0165	MultiNet	Begin	69	31.04
11/09/2019	06:35:14	54.0367	8.0165	MultiNet	Start Heave	69	30.69
11/09/2019	06:38:07	54.0367	8.0166	MultiNet	End	69	30.85
11/09/2019	06:49:07	54.0362	8.0151	CTD with samples	Begin	70	31.08
11/09/2019	06:52:35	54.0362	8.0151	CTD with samples	Bottom	70	30.73
11/09/2019	07:05:23	54.0361	8.0151	CTD with samples	End	70	30.97
11/09/2019	07:22:27	54.0364	8.0151	CTD with samples	Begin	71	30.70
11/09/2019	07:25:39	54.0362	8.0149	CTD with samples	Bottom	71	31.23
11/09/2019	07:39:50	54.0364	8.0152	CTD with samples	End	71	31.02