

AlterEco cruise#6: Cruise report
RV Princess Royal September 2018

1. Project overview:

An Alternative Framework to Assess Marine Ecosystem Functioning in Shelf Seas (AlterEco)

The overarching aim of AlterEco is to develop a novel monitoring framework to deliver improved spatio-temporal understanding of key shelf sea ecosystem drivers. To achieve this, AlterEco will use marine autonomous vehicles to provide long-term, multi-variable ocean measurements that will help develop greater understanding of the physical and biogeochemical functioning of the continental shelf system. The project will enable a series of missions over a 14-month period with multiple vehicles on a region in the North Sea that undergoes considerable spatial and temporal variability.

The project has the following deliverables:

1. utilise the latest autonomous technology to provide sufficiently high temporal and spatial resolution of meso and sub-mesoscale processes to better understand the impacts of inter-annual variability on the functioning of the shelf sea ecosystem,
2. provide the tools necessary for informing operational forecast models of the stressors on and consequences of the environmental status of shelf seas,
3. provide a modular, integrated framework for an efficient, diagnostic monitoring regime for continental shelf seas that has global transferability.

2. Personnel on board:

Crew: Neil Armstrong (captain), Barry Pearson (engineer)

Science personnel (affiliation): Matthew Palmer (PSO, NOC), David White (NOC), Jared Marlam (NOC), Adeniyi Adenaya (NOC), Sarah Breimann (Southampton)

3. Cruise objectives:

This is the 6th of 8 planned AlterEco deployment/recovery cruises. Cruise objectives were to,

1. Deploy 1 submarine glider; NOC-MARS Slocum unit 444 (OMG-Kelvin)
2. Recover 2 submarine gliders; NOC-MARS Seagliders SG550 and SG602.
3. Collect CTD profiles and discrete water samples for calibration of glider sensors following deployment and prior to recovery.

Unit 444 for deployment is a specialist glider and is longer and heavier than the standard Slocum glider; ~80kg in air and 2.1m long. This additional bulk is to accommodate an integrated ADCP and externally mounted microstructure package. Seagliders SG550 and SG602 were also specialist gliders, equipped with nutrient sensors measuring nitrate and phosphate respectively.

Unit444 is to be deployed remotely (within the 60nm limit of the vessel) and transit to waypoint WPM (56°12'N 2°00'E) to commence sampling.

Deployment, recovery, transect and waypoint locations are shown in figure 1.

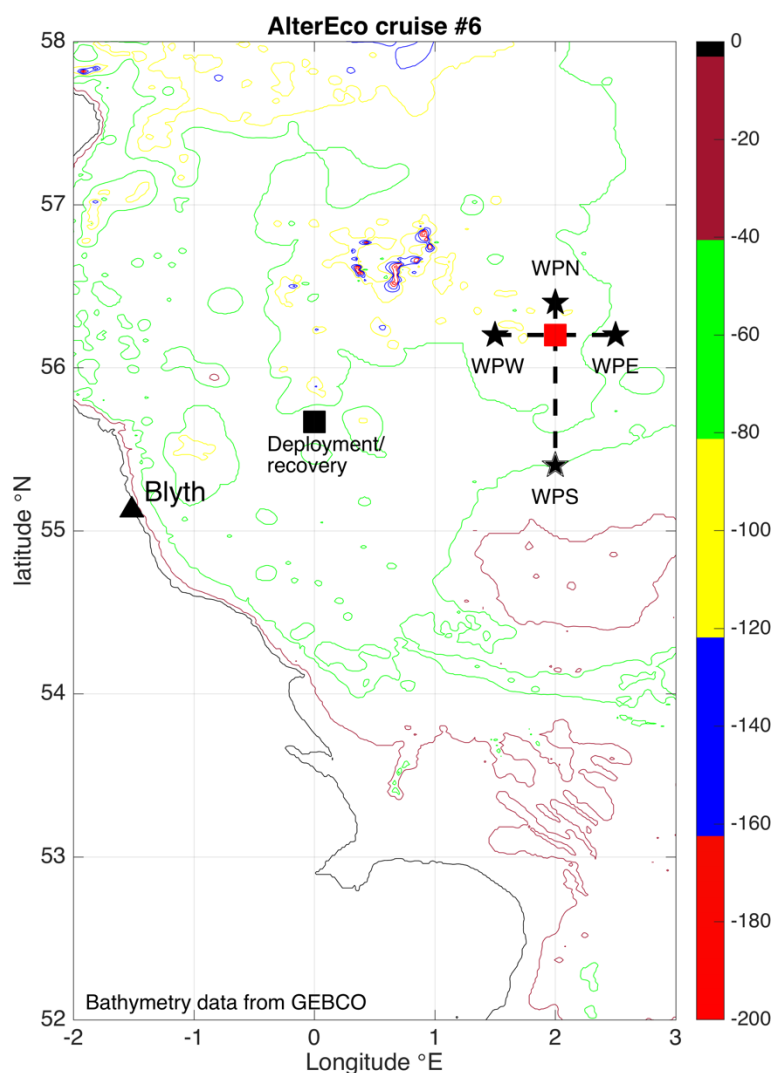


Figure 1: Nominal deployment/recovery site (black square) and planned survey location WPM (red square) for deployed glider unit444. Previous and ongoing AlterEco waypoint locations (black stars) and transect lines (dashed) are included for reference. Bathymetry (metres depth) indicates the coastline in black.

4. Cruise narrative (all times GMT 2018):

Due to poor weather and rough sea state the original cruise date (27th) was moved back one day.

Thursday 27th September

The vessel was loaded ready for sailing early Friday 28th September. The CTD hydrographic winch was not operable so automatic firing was tested on the CTD unit and found to be successful in timed closure mode.

Friday 28th September

Gliders SG550 and SG602 had not managed to make the designated recovery site 55°40'N 0°0'E and so the decision was made to deploy Unit444 close to the furthest glider, SG550 before recovery and then recover SG602 on the return journey.

0700 left Blyth for SG550 location approx. 55°22'N 00°29'W, a distance of approximately 45NM. The sea state was moderate with swell from the north producing wave heights approaching 1.5m. Progress was good but bumpy, with the vessel traveling at approximately 17 knots.

1000 55°22'N 0°29'W On station for deployment.

Event#1

1020 55°22'N 0°29'W Deployed unit444 from aft deck direct from the trolley. This quick method was used to avoid lifting in the moderate swell. Deployment was successful.

Event#2

1057 CTD001: in the water for soak at 5-10m set to close 2 bottle at 50m, 2 bottles at 10m in automatic pressure firing mode.

1102 CTD001 start profile at 55°22.357'N 0°29.227'W. Water depth 73.4m. CTD sent to approximately 60m.

1115 CTD001 at surface. Bottles not fired. Sent to depth again.

1130 CTD001 at surface. Bottles not fired. Recovered on deck. Reprogrammed to fire at time intervals.

1135 CTD001: in the water commenced profile.

1150 CTD001 at surface. Bottle fire successful. On deck.

Water samples collected for salinity, oxygen, nutrients on deck. Fixing of nutrients done whilst stationary due to continued swell.

1300 Search of SG550. Repositioned numerous times until spotted.

Event#3

1407 Commence recovery of SG550 using tail lift method from deck crane.

1416 SG550 on deck. Considerable biofouling clearly evident. No obvious signs of damage.

1500 on location for SG602 55°22.3'N 0°52.6'W. Glider easily spotted.

Event#4

1507 Sea state markedly improved. Swell <1m, state calm to moderate. Commence recovery of SG602. Decision to recover prior to CTD to avoid loss from recommencing dives and since the glider had now stopped collecting nutrient data.

1509 SG602 on deck. Some biofouling, but not as bad as SG550. No obvious signs of damage.

Event#5

1514 CTD002 in the water for 5 minute soak at 5-10m. 55°22.336'N 0°52.647'W. Set in time firing mode. Water depth 98.0m. Cast depth approximately 80m. 2 bottles at depth, 2 near surface.

1529 CTD002, all bottles fired. Recovered on deck. Sampling for nutrients only.

1545 off station.

1800 returned to Blyth. Demobilised and washed down gliders and CTD.

Data collected:

CTD001:

Station	1	CTD No	CTD001	Date	28/09/2018
Latitude	55 22.336'N	Event No	2	Time I/W (GMT)	10:57
Longitude	0 52.647'W	Depth	73.6	Time bottom (GMT)	11:41
Filename	AE45_CTD001	Cast Depth	60m	Time O/W (GMT)	11:50

Fire Seq	Rosette Pos ⁿ	Bot. No.	Depth (m)	Time (GMT)	DO	Nuts	Sal
1	1	1	~60m	11:40	177,268,165		
2	2	2	~60m	11:41		AE012,013,014	126
3	3	3	~10m	11:46			
4	4	4	~10m	11:47	247,183,208	AE015,016,017	125

CTD002:

Station	2	CTD No	CTD002	Date	28/09/2018
Latitude	55 22.336'N	Event No	5	Time I/W (GMT)	15:14
Longitude	0 52.647'W	Depth	98.0	Time bottom (GMT)	15:20
Filename	AE45_CTD002	Cast Depth	80m	Time O/W (GMT)	15:29

Fire Seq	Rosette Pos ⁿ	Bot. No.	Depth (m)	Time (GMT)	DO	Nuts	Sal
1	1	1	~75m	15:21		AE021,022,023	122
2	2	2	~75m	15:22			
3	3	3	~10m	15:27			
4	4	4	~10m	15:28		AE018,019,020	124

Preliminary checks of the glider data (figure 2) show the water column was thermally stratified during both CTD profiles and that chosen bottle depths were within upper and lower mixed layers.

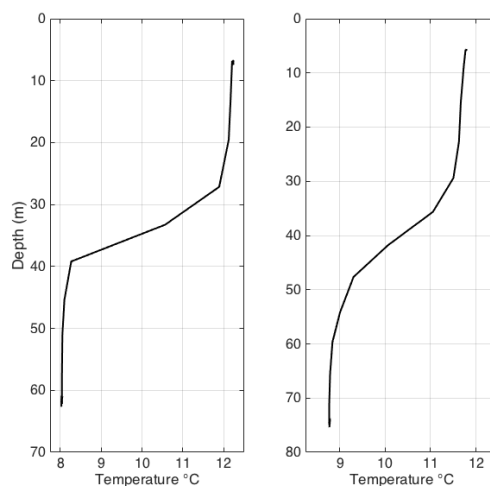


Figure 2: uncalibrated temperature/depth profiles from (left) CTD001 and (right) CTD002