DY197 Cruise Report

eSWEETS^3

PSO: Jonathan Sharples University of Liverpool

11th August – 9th September 2025

Southampton - Dundee

Contents:

Introduction

Cruise DY197 provided core measurements for the NERC strategic highlight project Enabling Sustainable Wind Energy Expansion in Seasonally Stratified Seas (ESWEETS[3]). The focus of the project is the oceanographic impact of the new floating offshore wind turbines. These large structures are designed for wind energy in deeper shelf sea regions, where waters stratify seasonally and biological productivity is supported by a spring bloom and summer subsurface chlorophyll maximum. Turbulent mixing inside the seasonal thermocline exerts a fundamental control of nutrient supplies and primary production, and the large, floating turbine structures are likely to introduce extra turbulence at the thermocline depth as the tidal currents sweep past them.

DY197 worked around the Kincardine floating offshore wind farm, about 16 km east of Aberdeen. The field work was a two-ship operation. The RV *Prince Madog*, from Bangor University (PSO Ben Lincoln) started work a few days before RRS *Discovery's* arrival, surveying turbulence and stratification across the tidal wakes generated by the wind turbines. The RV *Prince Madog* completed their work on August 16th.

RV *Prince Madog* measuring turbulence in a tidal wake.

The work on RRS *Discovery* was designed around measuring the potential changes to stratification and water column biogeochemistry around and downstream in the mean flow south of the wind farm. Water column structure was determined using two moorings (temperature and CTD loggers, bottom water dissolved oxygen, full-depth currents), one just north and one south of the wind farm, CTD sections and 25-hour stations, and Scanfish CTD box surveys around the wind farm. The project has had gliders in the area since May 2025, and these were replaced during DY197. An additional Seaglider (UEA) was operated during DY197. Water samples were collected and analysed for inorganic nutrients, dissolved oxygen, salinity, POC, DOC, HPLC. Experiments for phytoplankton growth rates and nutrient requirements (nutrient

addition incubations) were carried out. Zooplanktons samples were collected at stations north and south of the wind farm, during the night and during daylight.

Weather during the cruise was remarkably calm. Winds did not increase until late August as the remnants of hurricane Erin reached this side of the Atlantic. Winds and sea state caused an early recovery of Scanfish during one of the box surveys but otherwise had little impact on work.

Personnel

Captain: Stewart Mackay

Jonathan Sharples PSO, University of Liverpool

Sophie Durston, University of Liverpool

Xin Meng, University of Liverpool

Lucie Marsh (leg 1) Lucy Shirt (leg 2), University of Liverpool

Jacob Dickens (leg 1) Daniel Stutt (leg 2), University of Liverpool

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Kay Ihle (leg 1), Scottish Association for Marine Science

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Mark Moore, University of Southampton

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Juliane Wihsgott (leg 1), Plymouth Marine Laboratory

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Megan O'Hara (leg 2), Bangor University

Rory Murray (leg 1), Marine Scotland

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Dougal Mountifield, National Marine Facilities

Paul Henderson, National Marine Facilities

Finn Sougioultzoglou, National Marine Facilities

Simon Jones, National Marine Facilities

Howard King, National Marine Facilities

Alex Cerra, National Marine Facilities

Zoltan Nemeth, National Marine Facilities

Station Positions

<u>Hornsea</u> (during transit north from Southampton)

CTD stations

Station	Latitude north	Longitude east
HS1	53° 55.485’	2° 9.232’
HS2	53° 56.309’	2° 8.374’
HS3	53° 59.529’	2° 6.909’
HS4	53° 59.416’	2° 1.139’
HS5	53° 59.469’	1° 59.753’
HS6	53° 59.608’	1° 58.288’

<u>Kincardine</u>

Moorings

Station	Latitude north	Longitude west
K1	57° 03.50’	1° 48.50’
K3	56° 57.0’	1° 54.00’

Scanfish Outer Box A

Station	Latitude north	Longitude west
A1	57° 02.48’	1° 45.00’
A2	56° 56.13’	1° 50.80’
A3	56° 57.87’	1° 57.23’
A4	57° 04.25’	1° 51.30’

Total length: 41 km 22 Nm

Scanfish Inner Box B

Station	Latitude north	Longitude west
B1	57° 01.60’	1° 47.15’
B2	56° 57.90’	1° 50.60’
B3	56° 59.15’	1° 55.05’
B4	57° 02.80’	1° 51.50’

Total length: 24.3 km 13.1 Nm

Scanfish North Box N

Station	Latitude north	Longitude west
N1	57° 02.05’	1° 39.45’
N2	57° 00.57’	1° 40.80’
N3	57° 03.30’	1° 51.12’
N4	57° 04.80’	1° 49.75’

Total length: 29.1 km 15.7 Nm

Tidal Cycle CTD Stations

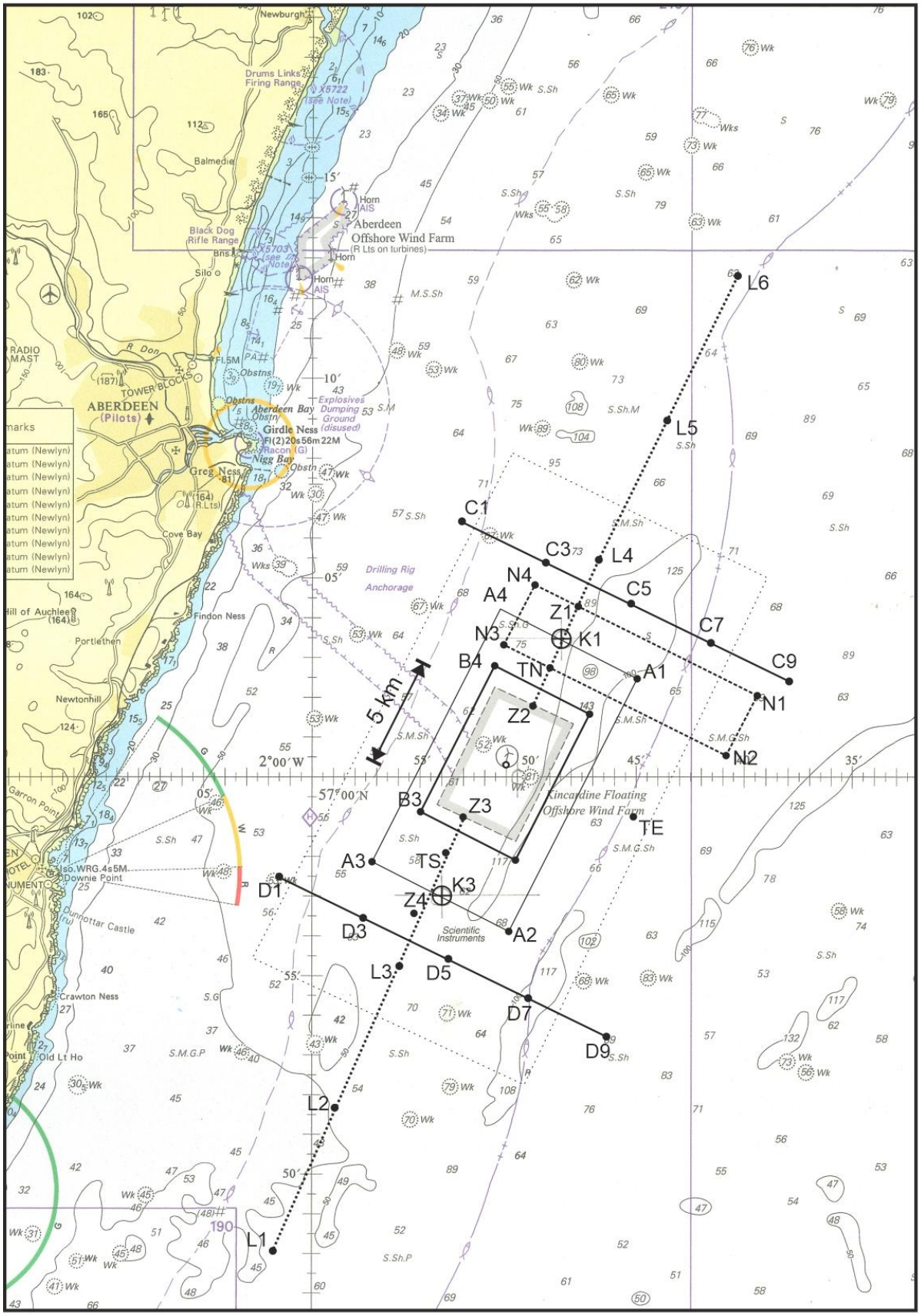
Station	Latitude north	Longitude west
TN	57° 02.78’	1° 49.00’
TS	56° 58.10’	1° 53.85’
TE	56° 59.00’	1° 45.10’

Other CTD Stations

Station	Latitude north	Longitude west
Z1	57° 04.30’	1° 47.70’
Z2	57° 01.80’	1° 49.80’
Z3	56° 59.00’	1° 53.00’
Z4	56° 56.57’	1° 55.30’
C1	57° 06.43’	1° 53.10’
C3	57° 05.43’	1° 49.30’
C5	57° 04.43’	1° 45.50’
C7	57° 03.43’	1° 41.70’
C9	57° 02.43’	1° 37.90’
D1	56° 57.50’	2° 01.50’
D3	56° 56.50’	1° 57.70’
D5	56° 55.50’	1° 53.90’
D7	56° 54.50’	1° 50.10’
D9	56° 53.50’	1° 46.30’

CTD Stations and Scanfish L-line

Station	**Latitude north**	**Longitude west**
L1	56° 48.10’	2° 01.80’
L2	56° 51.65’	1° 58.90’
L3	56° 55.25’	1° 56.00’
Z3	56° 59.00’	1° 53.00’
Z2	57° 01.80’	1° 49.80’
L4	57° 05.50’	1° 46.75’
L5	57° 08.90’	1° 43.60’
L6	57° 12.60’	1° 40.30’


Aberdeen
Offshore Wind Farm
(R Lts on turbines)
Kincardine Floating
Offshore Wind Farm
Scientific
Instruments
5 km
2°00′W
57°00′N
ABERDEEN
(Pilots)
Girdle Ness
Fl(2)20s56m22M
Racon (G)
Aberdeen Bay
Explosives
Dumping
Ground
(disused)
Drilling Rig
Anchorage
Drums Links
Firing Range
Black Dog
Rifle Range
Balmedie
Newburgh
Cove Bay
Findon Ness
Portlethen
Newtonhill
Greg Ness
Nigg Bay
Garron Point
Downie Point
Dunnottar Castle
Crawton Ness
Old Lt Ho
Hill of Auchlee
L1
L2
L3
L4
L5
L6
C1
C3
C5
C7
C9
N1
N2
N3
N4
A1
A2
A3
A4
B3
B4
D1
D3
D5
D7
D9
K1
K3
Z1
Z2
Z3
Z4
TN
TS
TE

Cruise Narrative

Date and time	Activity	Weather, notes
11th August		
09:00 BST	Depart NOC Southampton Transit includes several wind farms to gather underway data.	Light winds, calm sea.
12th August		
21:00 BST (UTC+1)	CTD001 at HS1 Hornsea wind farm	Light winds, calm sea.
23:00 BST (UTC+1)	CTD002 at HS1 [Event 2]	
13th August		
00:00 BST (UTC+1)	CTD003 at HS2	Light winds, calm sea. Bright moon overnight.
02:00 BST (UTC+1)	CTD004 at HS3	
04:00 BST (UTC+1)	CTD005 at HS4 [event 5]	
05:00 BST (UTC+1)	CTD006 at HS5	
06:00 BST (UTC+1)	CTD007 at HS6	
06:30 BST (UTC+1)	CTD008 at HS6	
07:00 BST (UTC+1)	CTD009 at HS5	
08:00 BST (UTC+1)	CTD010 at HS4 [event 10] Transit to Seagreen South	
14th August		Dense fog by 06:30. No wind, very calm sea.
03:15 BST (UTC+1)	CTD011 at Seagreen South	
09:30 BST (UTC+1)	K1 mooring deployment begins	Decision made to do moorings first, then gliders if the fog has cleared.
11:45 BST	K1 mooring deployed. [Event 12]	
12:10 BST	CTD012 by K1 57.0568°N; 1.807966°W	
13:50 BST	K3 mooring deployment begins	
14:50 BST	K3 mooring deployed. [Event 14]	
15:05 BST	CTD013 by K3 56.947523°N; 1.899401°W	Fog clearing
16:24 BST	M3 lander deployed [Event 16] 56.989897°N; 1.882947°W	
17:45 BST	M4 lander deployed 57.018289°N; 1.838832°W	
18:30 BST	M1 lander deployed [event 18] 57.027483°N; 1.851606°W	

19:13 BST	M2 lander deployed [event 18 – duplicate in bridge event log] 57.036289°N; 1.847676 °W	Several problems with the bridge event log numbers.
19:45 BST	CTD014 at M4 [event 19&18 – bridge event log error] 57.019004°N; 1.836559 °W	
20:55 BST	CTD015 at Z1 [event 19] 57.071633°N; 1.795278 °W	
21:40 BST	Z1 net1 to 90m [event 20] Z1 net2 to 95m [event 20]	
22:15 BST	Z1 net3 to 60m [event 20]	
22:57 BST	Z1 net4 to 40m [event 20]	
23:10 BST	Z1 net5 to 20m [event 20]	
23:20 BST		
15th August		
00:26 BST	CTD016 at Z2 [event 21] 57.030689°N; 1.829496°W	Light winds, very calm sea.
01:03 BST	Z2 net1 to 80m [event 22]	
01:21 BST	Z2 net2 to 80m	
01:42 BST	Z2 net3 to 60m	
01:56 BST	Z2 net4 to 40m	
02:07 BST	Z2 net5 to 20m [event 26]	
	Wait at Z3 as Prince Madog on station	
03:36 BST	CTD017 at Z3 [event 27] 56.982707°N; 1.882688°W	
04:14 BST	Z3 net1 to 70m	
04:33 BST	Z3 net2 to 70m	
04:51 BST	Z3 net3 to 70m	
05:05 BST	Z3 net4 to 60m	
05:18 BST	Z3 net5 to 40m	
05:30 BST	Z3 net6 to 20m [event 33]	
06:29 BST	CTD018 at TE [event 34] 56.982989°N; 1.752962°W	
	Move to glider recovery.	
08:18 BST	Glider recovered [event 35]	
08:32 BST	Glider deployed [event 36]	
09:48 BST	Seaglider deployed [event 37]	
10:10 BST	Glider deployed [event 38]	
	Wait on station for glider profiling checks.	

14:15 BST	Proceed to transit around Scanfish Box A to check for hazards.	
14:45 BST	Scanfish deployed [event 39] Scanfish Box A begins	Problems with the altimeter on Scanfish mean it is instead set to dive 6m to 50m based on pressure sensor only.
16th August		
	Scanfish continues	Very light winds, very smooth sea.
02:30 BST	Surface samples taken every 15 minutes around 1 box A	
09:00 BST	Surface samples taken every 15 minutes around 1 box A	
15:15 BST	Scanfish recovery begins.	
15:45 BST	Scanfish on deck. [event 39]	
16:30 BST	Boat transfer of samples from RV *Prince Madog*. [event 40]	
	Transit to leave the 12-mile limit so that we can release food waste. [event 41]	
20:00 BST	Start of 25 hour tidal station at TS CTD019 at TS [event 42] 56.968337°N, 1.897797°W	
21:30 BST	CTD020 at TS [event 43] 56.968337°N, 1.897796°W	
23:00 BST	CTD021 at TS [event 44] 56.968336°N, 1.8978°W	
17th August		
00:30 BST	CTD022 at TS [event 45] 56.969197°N, 1.896907°W	Light wind, calm sea.
02:00 BST	CTD023 at TS [event 46] 56.968585°N, 1.897428°W	
03:30 BST	CTD024 at TS [event 47] 56.968588°N, 1.897429°W	
05:00 BST	CTD025 at TS [event 48] 56.968173°N, 1.897648°W	
06:30 BST	CTD026 at TS [event 49] 56.968172°N, 1.897644°W	
08:00 BST	CTD027 at TS [event 50] 56.968173°N, 1.897646°W	

09:30 BST	CTD028 at TS [event 51] 56.968178°N, 1.897681°W	Low-level cloud/fog over tops of wind turbines.
11:00 BST	CTD029 at TS [event 52] 56.968179°N, 1.897678°W	
12:30 BST	CTD030 at TS [event 53] 56.968712°N, 1.897046°W	
14:00 BST	CTD031 at TS [event 54] 56.96876°N, 1.89752°W	
15:30 BST	CTD032 at TS [event 55] 56.968724°N, 1.897194°W	15:00 BST - A lot of diving gannet activity by the ship.
17:00 BST	CTD033 at TS [event 56] 56.968363°N, 1.897197°W	
18:30 BST	CTD034 at TS [event 57] 56.968003°N, 1.897503°W	
20:00 BST	CTD035 at TS [event missing from log] Transit to TN	
21:30 BST	CTD036 at TN [event 58] 57.046392°N, 1.816964°W	
23:00 BST	CTD037 at TN [event 59] 57.046483°N, 1.816771°W	
18th August 00:30	CTD038 at TN [event 60] 57.046011°N, 1.816437°W	
02:00 BST	CTD039 at TN [event 61] 57.046538°N, 1.816421°W	
03:30 BST	CTD040 at TN [event 62] 57.046539°N, 1.816415°W	
05:00 BST	CTD041 at TN [event 63] 57.046539°N, 1.816415°W	No wind, glass calm, foggy.
06:30 BST	CTD042 at TN [event 64] 57.046124°N, 1.816726°W	
08:00 BST	CTD043 at TN [event 65] 57.046123°N, 1.816716°W	
09:30 BST	CTD044 at TN [event 66] 57.046124°N, 1.816717°W	
11:00 BST	CTD045 at TN [event 67] 57.046123°N, 1.816718°W	Fog clears gradually.

12:30 BST	CTD046 at TN [event 68] 57.046125°N, 1.816718°W	
14:00 BST	CTD047 at TN [event 69] 57.046124°N, 1.816717°W	
15:30 BST	CTD048 at TN [event 70] 57.046121°N, 1.816721°W	
17:00 BST	CTD049 at TN [event 71] 57.046123°N, 1.816718°W	
18:30 BST	CTD050 at TN [event 71?] 57.046121°N, 1.816724°W	Bridge log glitch – repeated event number
20:00 BST	CTD051 at TN [event 72] 57.046123°N, 1.816722°W	
21:30 BST	CTD052 at TN [event 73] 57.046123°N, 1.816718°W Transit to Z1	
19th August		
00:30 BST	On station Z1 57.071574°N, 1.794438°W	
00:35 BST 00:43 BST 00:55 BST 01:11 BST 01:27 BST	Net 1 to 20m [event 74] Net 2 to 40m Net 3 to 60m Net 4 to 90m Net 5 to 90m [event 78]	
01:52 BST	CTD053 at Z1 [event 79] 57.071543°N, 1.794274°W	Wind 10 – 13 knots northerly Slight sea
03:20 BST	On station Z3 56.983783°N, 1.883531°W	
03:23 BST 03:32 BST 03:42 BST 03:56 BST 04:10 BST	Net 1 to 20m [event 80] Net 2 to 40m Net 3 to 60m Net 4 to 68m Net 5 to 68m [event 84]	
04:37 BST	CTD054 at Z3 [event 85] 56.983777°N, 1.883489°W	
08:25 BST	Scanfish deployment begins box N 57.075469°N, 1.812825°W	Fog patches
09:00 BST	Scanfish survey begins box N	Scanfish altimeter (replaced) still dysfunctional. Using pressure to set the surveys depths again.
15:00 BST	Scanfish snags fishing gear – a creel pot line, possibly drifting or bouncing along the seabed with the tide. Fishing gear released OK and in one piece.	

15:25 BST	Scanfish recovered. Re-termination required.	Wind 15 – 18 knots northerly Slight sea
18:00 BST	Transit to TE for 25 hour station CTD055 at TE [event 88] 56.983382°N, 1.751935°W	
19:30 BST	CTD056 at TE [event 88] 56.983382°N, 1.751936°W	Bridge event log glitch
21:00 BST	CTD057 at TE [event 89] 56.983378°N, 1.751957°W	
22:30 BST	CTD058 at TE [event 89] 56.983354°N, 1.751848°W	Bridge event log glitch
August 20th		
00:00 BST	CTD059 at TE [event 90] 56.983382°N, 1.752127°W	
01:30 BST	CTD060 at TE [event 91] 56.9834°N, 1.75216°W	
03:00 BST	CTD061 at TE [event 92] 56.983398°N, 1.75216°W	
04:30 BST	CTD062 at TE [event 93] 56.983398°N, 1.752159°W	
06:00 BST	CTD063 at TE [event 94] 56.983398°N, 1.752166°W	Wind 14 – 18 knots northerly Slight sea, 1 – 1.5 swell
07:30 BST	CTD064 at TE [event 95] 56.9834°N, 1.752164°W	
09:00 BST	CTD065 at TE [event 96] 56.983387°N, 1.752165°W	
10:30 BST	CTD066 at TE [event 97] 56.9834°N, 1.75216°W	Wind 17 – 20 knots northerly Slight sea, 1 – 1.5m swell
12:00 BST	CTD067 at TE [event 98] 56.983388°N, 1.75213°W	
13:30 BST	CTD068 at TE [event 99] 56.983388°N, 1.752122°W	
15:00 BST	CTD069 at TE [event 100] 56.983388°N, 1.752128°W	
16:30 BST	CTD070 at TE [event 101] 56.983392°N, 1.752127°W	
18:00 BST	CTD071 at TE [event 102] 56.983414°N, 1.752216°W	

	Transit to C9	
19:40 BST	CTD072 at C9 [event 103] 57.04049°N, 1.631822°W	Wind 10 – 15 knots northerly Slight sea, weakening swell
21:15 BST	CTD073 at C7 [event 104] 57.056253°N, 1.69516°W	
22:40 BST	CTD074 at C5 [event 105] 57.073262°N, 1.758491°W	
August 21st		
00:43 BST	CTD075 at C3 [event 106] 57.089926°N, 1.821541°W	
02:03 BST	CTD076 at C1 [event 107] 57.106414°N, 1.884953°W	
03:25 BST	CTD077 at K1 [event 108] 57.055069°N, 1.808542°W	
06:00 BST	CTD078 at K3 [event 109] 56.949249°N, 1.905467°W	Wind 8 – 12 knots north-westerly Slight swell, calm sea
10:00 BST	CTD079 at Z1 [event 111] 57.071889°N, 1.794809°W	
10:46 BST	Net 1 to 100m 9event 112] Net 2 [event 113] Net 3 [event 114] Net 4 [event115] Net 5 [event 116] Net 6 [event 117]	
	Transit to Z3	
13:34 BST	CTD080 at Z3 [event 119] 56.983558°N, 1.883397°W	Wind 8 – 10 knots ENE'ly Slight sea, slight swell
14:21 BST	Net 1 [event 120] Net 2 [event 121] Net 3 [event 122] Net 4 [event 123] Net 5 [event 124]	
16:36 BST	CTD081 at Z1 [event 125] 57.072138°N, 1.795746°W	
18:03 BST	CTD082 at ZN [event 126] 57.047236°N, 1.816899°W	
19:14 BST	CTD083 at Z2 [event 127] 57.030851°N, 1.831446°W	
20:26 BST	CTD084 at Z3 [event 128]	

	56.984103°N, 1.884156°W	
21:22 BST	CTD085 at TS [event 129] 56.967957°N, 1.897621°W	
22:10 BST	CTD086 at Z4 [event 130] 56.942998°N, 1.920569°W	
	Transit to Aberdeen	
August 22nd		
08:30 BST	Dock, Aberdeen South harbour. Swap a few scientists. Pick up BBC Countryfile crew.	
12:00 BST	BBC Countryfile filming until 17:00. CTD087 at Z2 – shallow dip to collect water for Countryfile filming.	
17:10 BST	Countryfile crew dropped off.	
18:34 BST	CTD088 at C1 [event 131] 57.107244°N, 1.884569°W	
20:30 BST	CTD089 at C3 [event 132] 57.090985°N, 1.822066°W	
22:29 BST	CTD090 at C5 [event 133] 57.073765°N, 1.759654°W	
August 23rd		
00:32 BST	CTD091 at C7 [event 134] 57.056637°N, 1.695701°W	
01:34 BST	CTD092 at C9 [event 135] 57.040508°N, 1.633094°W	
03:30 BST	CTD093 at D9 [event 136] 56.891267 °N, 1.771584°W	
05:00 BST	CTD094 at D7 [event 137] 56.908179°N, 1.834359°W	Wind 5 – 6 knots, southerly Very calm, smooth sea.
06:29 BST	CTD095 at D5 [event 138] 56.924957°N, 1.897624°W	Remarkable mixed layer, upper 20 metres, during up-cast.
07:59 BST	CTD096 at D3 [event 139] 56.94211°N, 1.961482°W	
09:32 BST	CTD097 at D1 [event 140] 56.958798°N, 2.025152°W	
12:08 BST	Nets begin [event 141] 5 deployments at Z3 56.982216°N, 1.884777°W	
13:47 BST	CTD098 at Z3 [event 142]	

	56.983095°N, 1.883453°W Transit to Z1	
15:42 BST	Nets begin [event 143] 5 deployments at Z1 57.072699°N, 1.794242°W	Wind 10 – 15 knots southerly Slight swell, slight sea
17:00 BST	CTD099 at Z1 [event 144] 57.072006°N, 1.795535°W Head for the 12-mile limit to discharge food waste.	
21:00 BST	Scanfish deployed for box B survey [event 145] 56.973341°N, 1.839678°W	
August 24th	Scanfish around Box B continues	AM: Wind 9 – 11 knots southerly Calm sea PM: Wind 15 – 18 knots southerly Calm sea
20:10 BST	Scanfish recovery begins	
21:36 BST	CTD100 at TN [event 146] 57.046613°N, 1.816958°W	
23:00 BST	CTD101 at TN [event 147] 57.046609°N, 1.81696°W	
August 25th		
00:33 BST	CTD102 at TN [event 148] 57.045968°N, 1.815635°W	
02:01 BST	CTD103 at TN [event 149] 57.046161°N, 1.816412°W	
03:31 BST	CTD104 at TN [event 150] 57.046164°N, 1.816416°W	
05:00 BST	CTD105 at TN [event 151] 57.046163°N, 1.816416°W	Wind 10 knots southerly Slight swell, calm sea
06:30 BST	CTD106 at TN [event 152] 57.046165°N, 1.816414°W	
08:02 BST	CTD107 at TN [event 153] 57.046163°N, 1.816416°W	
09:34 BST	CTD108 at TN [event 154] 57.046165°N, 1.816414°W	
11:00 BST	CTD109 at TN [event 155]	

	57.046161°N, 1.816416°W	
12:30 BST	CTD110 at TN [event 156] 57.046166°N, 1.816441°W	Wind 10 – 12 knots SE'ly Slight swell, calm sea.
14:06 BST	CTD111 at TN [event 157] 57.046167°N, 1.81644°W	
15:29 BST	CTD112 at TN [event 158] 57.046168°N, 1.816388°W	
17:01 BST	CTD113 at TN [event 159] 57.046153°N, 1.816366°W	Wind 16 – 18 knots SE'ly Slight sea and swell
18:29 BST	CTD114 at TN [event 160] 57.04657°N, 1.815758°W	
20:03 BST	CTD115 at TN [event 161] 57.04657°N, 1.815763°W	
21:30 BST	CTD116 at TN [event 162] 57.046571°N, 1.815762°W Transit to TS	
August 26th		
01:00 BST	CTD117 at TS [event 163] 56.968905°N, 1.896981°W	
02:31 BST	CTD118 at TS [event 164] 56.968906°N, 1.89698°W	
04:01 BST	CTD119 at TS [event 165] 56.968908°N, 1.896985°W	
05:30 BST	CTD120 at TS [event 166] 56.968909°N, 1.896978°W	
06:59 BST	CTD121 at TS [event 167] 56.968911°N, 1.896986°W	Wind 15 knots SSE'ly Slight swell, calm sea.
08:31 BST	CTD122 at TS [event 168] 56.96891°N, 1.896971°W	
10:00 BST	CTD123 at TS [event 169] 56.968908°N, 1.896975°W	
11:31 BST	CTD124 at TS [event 170] 56.968907°N, 1.896979°W	Wind 12 – 14 knots southerly Slight swell, calm sea
12:55 BST	CTD125 at TS [event 171] 56.968904°N, 1.896975°W	
14:30 BST	CTD126 at TS [event 172] 56.968908°N, 1.896979°W	

15:56 BST	CTD127 at TS [event 173] 56.968909°N, 1.89698°W	
17:24 BST	CTD128 at TS [event 174] 56.968903°N, 1.896842°W	
18:56 BST	CTD129 at TS [event 175] 56.968905°N, 1.896842°W	
20:30 BST	CTD130 at TS [event 176] 56.968901°N, 1.896848°W	
21:59 BST	CTD131 at TS [event 177] 56.968899°N, 1.89684°W	
23:08 BST	CTD132 at TS [event 178] 56.968899°N, 1.896845°W	
August 27th		
00:59 BST	CTD133 at TS [event 179] 56.968488°N, 1.896982°W	
	Transit to L1	Wind 7 – 8 knots southerly Slight swell, calm sea
06:00 BST	CTD134 at L1 [event 180] 56.801858°N, 2.029578°W	
07:28 BST	CTD135 at L2 [event 181] 56.860858°N, 1.981945°W	
09:00 BST	CTD136 at L3 [event 182] 56.92134°N, 1.932494°W	
10:30 BST	CTD137 at Z3 [event 183] 56.98361°N, 1.882231°W	
11:59 BST	CTD138 at Z1 [event 184] 57.030466°N, 1.829991 °W	Wind 13 – 16 knots SE'ly Slight swell, slight sea
13:28 BST	CTD139 at L4 [event 185] 57.091581°N, 1.777935°W	
14:57 BST	CTD140 at L5 [event 186] 57.147047°N, 1.725923°W	
16:32 BST	CTD141 at L6 [event 187] 57.209585°N, 1.673871°W	
	Line up ready to deploy Scanfish.	
18:25 BST	Scanfish deployment begins [event 189]	
18:44 BST	Scanfish max wire out. 57.26097°N, 1.695347°W	
August 28th		

00:55 BST 01:19 BST 03:13 BST 03:15 BST 03:27 BST 03:42 BST 04:01 BST 04:26 BST 05:55 BST 10:42 BST	Scanfish recovery begins 56.797216°N, 2.034418°W Scanfish on deck On station Z3 56.983372°N, 1.884694°W Net 1 at Z3 [event 190] Net 2 at Z3 Net 3 at Z3 Net 4 at Z3 [event 193] CTD142 at Z3 [event 194] 56.983307°N, 1.884585°W Transit to Z1 CTD143 at Z1 [event 195] 57.071882°N, 1.796297°W Survey box A for hazards, plus a quick trip to 12-mile limit to discharge food waste. Scanfish deployed box A [event 196] 57.051197°N, 1.881679°W	 Wind 15 – 18 knots SSE'ly Slight sea and swell PM: Wind 20 – 22 knots SSE'ly Slight sea and swell
August 29th 12:38 BST 17:44 BST 19:00 BST 20:30 BST 21:55 BST 23:27 BST	 End of box A. Scanfish recovered. Proceed to replace light batteries on moorings K1 and K3. CTD144 at D1 [event 199] 56.95845°°N, 2.024748°W CTD145 at D3 [event 200] 56.941806°N, 1.962807°W CTD146 at D5 [event 201] 56.925209°N, 1.898296°W CTD147 at D7 [event 202] 56.908517°N, 1.83404°W CTD148 at D9 [event 203] 56.89279°N, 1.771257°W	 Wind 12 – 14 knots SSE'ly Slight swell, calm sea. PM: Wind 10 – 12 knots SSE'ly Slight swell, calm sea.
August 30th 00:53 BST 10:04 BST 01:16 BST 01:30 BST 01:55 BST	 Net1 deployed at Z3 [event 204] 56.983268°N, 1.882861°W Net 2 Net 3 Net 4 [event 207] CTD149 at Z3 [event 208] 56.983308°N, 1.883586°W	

03:11 BST	Net1 deployed at Z1 [event 209] 57.071782°N, 1.796338°W	
03:19 BST	Net 2	
03:31 BST	Net 3	
03:44 BST	Net 4 [event 212]	Wind 6 – 7 knots SSW'ly
	CTD150 at Z1 [event 213] 57.071792°N, 1.79579°W	Calm sea, slight swell.
	Transit to check box B for hazards	
08:30 BST	Scanfish deployed and undulating box B [event 214]	
		PM: wind 14 – 17 knots S'ly
19:51 BST	Scanfish recovered early – wind increasing and difficult to make the turns on the survey without pushing into fishing gear area.	21:00 Wind 28 – 32 knots SE'ly Slight swell, moderate sea but increasing.
August 31st		
04:00 BST	CTD151 at TN [event 215] 57.046567°N, 1.816242°W	
05:29 BST	CTD152 at TN [event 216] 57.046581°N, 1.816248°W	
		Wind 13 – 16 knots S'ly
06:59 BST	CTD153 at TN [event 217] 57.046589°N, 1.816298°W	2m swell, slight sea
08:37 BST	CTD154 at TN [event 218] 57.046593°N, 1.816311°W	
10:02 BST	CTD155 at TN [event 219] 57.046581°N, 1.816459°W	Wind 18 – 22 knots SE'ly 2m swell, moderate sea
11:30 BST	CTD156 at TN [event 220] 57.046586°N, 1.816454°W	
12:58 BST	CTD157 at TN [event 221] 57.046583°N, 1.816469°W	PM: wind 25 – 28 knots SE'ly 2 – 2.5m swell, moderate sea.
14:35 BST	CTD158 at TN [event 222] 57.046815°N, 1.819161°W	
16:00 BST	CTD159 at TN [event 223] 57.046834°N, 1.819148°W	
17:27 BST	CTD160 at TN [event 224] 57.046838°N, 1.819164°W	
19:00 BST	CTD161 at TN [event 225] 57.04672°N, 1.819739°W	
20:28 BST	CTD162 at TN [event 226] 57.046721°N, 1.81971°W	
22:01 BST	CTD163 at TN [event 227]	

	57.0467721°N, 1.819759°W	
23:01 BST	CTD164 at TN [event 228] [278] 57.0467481°N, 1.819731°W	
September 1st		
00:59 BST	CTD165 at TN [event 229] [279] 57.047013°N, 1.817595°W	
02:29 BST	CTD166 at TN [event 230] [280] 57.047031°N, 1.817533°W	
04:00 BST	CTD167 at TN [event 231] [281] 57.047034°N, 1.817492°W	
	Transit to TS	
06:29 BST	CTD168 at TS [event 232] 56.969225°N, 1.897681°W	Wind 25 – 30 knots SE'ly Moderate swell and sea
08:00 BST	CTD169 at TS [event 233] 56.96924°N, 1.897692°W	
09:32 BST	CTD170 at TS [event 234] 56.969225°N, 1.897674°W	
10:59 BST	CTD171 at TS [event 235] 56.969235°N, 1.897671°W	
12:27 BST	CTD172 at TS [event 236] 56.969223°N, 1.897649°W	
13:57 BST	CTD173 at TS [event 237] 56.969242°N, 1.897652°W	Wind 20 – 25 knots SSE'ly Moderate swell and sea.
15:30 BST	CTD174 at TS [event 238] 56.969248°N, 1.897659°W	
17:01 BST	CTD175 at TS [event 239] 56.969281°N, 1.898014°W	
18:29 BST	CTD176 at TS [event 240] 56.969287°N, 1.898042°W	Wind 18 – 22 knots S'ly Slight sea and moderate swell.
19:58 BST	CTD177 at TS [event 241] 56.969293°N, 1.897959°W	
21:30 BST	CTD178 at TS [event 242] 56.969291°N, 1.897941°W	
23:00 BST	CTD179 at TS [event 243] 56.969295°N, 1.897811°W	
September 2nd		
00:37 BST	CTD180 at TS [event 244] 56.968819°N, 1.897421°W	

02:00 BST	CTD181 at TS [event 245] 56.968804°N, 1.897383°W	
03:30 BST	CTD182 at TS [event 246] 56.968798°N, 1.897385°W	
04:57 BST	CTD183 at TS [event 247] 56.96879°N, 1.897359°W	
06:27 BST	CTD184 at TS [event 248] 56.968789°N, 1.89735°W	Wind 18 – 22 knots SSW'ly Slight swell, moderate sea.
	Transit to Z3	
10:02 BST	Nets at Z3 [event 250] 56.982834°N, 1.883526°W	
11:07 BST	Nets complete.	
11:16 BST	CTD185 at Z3 [event 251] 56.98284°N, 1.883526°W	
12:53 BST	Nets at Z1 [event 252] 57.072579°N, 1.795044°W	
14:02 BST	Nets complete.	
14:14 BST	CTD186 at Z1 [event 253] 57.072572°N, 1.795042°W	Wind 16 – 20 knots S'ly Slight swell, moderate sea.
15:27 BST	CTD187 at C1 [event 254] 57.106961°N, 1.88522°W	
16:59 BST	CTD188 at C3 [event 255] 57.091054°N, 1.82183°W	
18:28 BST	CTD189 at C5 [event 256] 57.074755°N, 1.761124°W	
19:56 BST	CTD190 at C7 [event 257] 57.05741°N, 1.695853°W	Wind 15 knots SSE'ly Slight sea and swell
21:00 BST	CTD191 at C9 [event 258] 57.040769°N, 1.632072°W	
23:11 BST	CTD192 at D9 [event 260] event glitch 56.892035°N, 1.771957°W	
September 3rd		
00:59 BST	CTD193 at D7 [event 261] 56.908091°N, 1.83497°W	
02:29 BST	CTD194 at D5 [event 262] 56.92518°N, 1.898049°W	
03:59 BST	CTD195 at D3 [event 263] 56.941866°N, 1.960852°W	

05:04 BST	CTD196 at D1 [event 264] 56.95903°N, 2.024962°W	Wind 12 – 14 knots ESE'ly Calm sea slight swell.
09:08 BST	CTD197 at M3 [event 265] 56.98923°N, 1.884334°W	
10:32 BST	M3 lander recovered [event 266]	Wind 2 – 5 knots ENE'ly Calm sea, slight swell, heavy rain.
11:56 BST	CTD198 at M2 [event 267] 57.0357°N, 1.84831°W	
13:54 BST	M2 lander recovered [event 268]	
14:17 BST	CTD199 at M1 [event 269] 57.02783°N, 1.851308°W	
16:00 BST (approx.)	M1 recovered [no bridge event logged]	
16:57 BST	M4 recovered [event 270]	
17:15 BST	CTD200 at M4 [event 271] 57.018458°N, 1.837342°W	
September 4th 07:52 BST	CTD201 near Slocum glider [event 272] 56.935645°N, 1.924773°W Move to recover glider using FRC.	Wind <5 knots SSW'ly Calm sea, slight swell.
09:32 BST	Slocum glider recovered [event 273] 56.936235°N, 1.92324°W	
11:18 BST	CTD202 near Seaglider [event 275] 57.071069°N, 1.737585°W	
11:58 BST	CTD203 near Seaglider [event 276] 57.061999°N, 1.749874°W	
12:37 BST	Seaglider recovered [event 277] 57.062416°N, 1.750036°W	
13:07 BST	CTD204 near K1 mooring [event 278] 57.057637°N, 1.804857°W	Wind 8 – 10 knots SSE'ly Calm sea, slight swell.
13:42 BST	K1 released [event 279] Recovery begins.	
14:47 BST	K1 mooring recovered.	
16:05 BST	CTD205 near K3 mooring [event 280] 56.954308°N, 1.899937°W	
17:10 BST	K3 mooring recovered [event 281]	
17:46 BST	Slocum glider deployed [event 282]	

19:40 BST	56.938708°N, 1.87732°W CTD206 near glider [event 283] 57.089876°N, 1.695269°W	
September 5th 04:57 BST 08:41 BST 08:57 BST	 CTD207 at TN [event 284] 57.046789°N, 1.816244°W Proceed to check around box B for hazards. Scanfish deployed [event 285]. 56.968612°N, 1.83972°W Scanfish running box B. 56.989324°N, 1.820106°W	 Wind 8 – 10 knots SW'ly Slight swell, calm sea.
September 6th 10:35 BST 13:56 BST 16:05 BST 18:13 BST 20:00 BST (approx.)	 Scanfish recovered 57.015367°N, 1.88781°W Misbehaving Slocum glider recovered using FRC [event 286]. 56.811633°N, 1.957686°W Zooplankton nets at Z1 [event 287] 57.071055°N, 1.795993°W CTD208 at Z1 [event 288] 57.071298°N, 1.795431°W Slocum glider redeployed.	 Wind 16 – 18 knots SE'ly Slight swell, slight sea.
September 7th 08:30 BST	 End of science. Too rough to do nets or CTD. Heave to and pack up.	 Wind 25 – 32 knots SE'ly Moderate swell, rough sea.
September 8th 16:15 BST 18:00 BST	 Pick up pilot. Docked in Dundee.	

CTD Measurements and Calibration

Sophie Durston

Physical and biological variables were measured in 208 casts using a Seabird 9+ CTD. Primary conductivity (C), temperature (T), and dissolved oxygen (DO) sensors were located on the vane and secondary CT sensors were located on the SeaBird 9+. An altimeter, fluorometer, transmissometer, a backscatter sensor, and two photosynthetically active radiation (PAR) sensors (uplooking and downlooking) were also present. Water samples were taken using 24 10 litre Niskin bottles mounted on a stainless-steel rosette frame to measure particulate organic carbon, chlorophyll, dissolved organic carbon, nutrients, and genetics.

After each CTD cast, data was output to the ship's shared science drive by the NMF team, and processing was done with NOC's Mexec software (https://github.com/NOC-OCP/ocp_hydro_matlab), which reproduces most of SeaBird's processing steps and enables manual editing options to remove spikes and bad scan ranges. The main automatic processing steps are as follows:

1. Align oxygen sensor relative to other sensors
2. Correct for the conductivity cell's thermal inertia
3. Average raw 24 Hz data to 1Hz
4. Bin-average into pressure bins
5. Split profile in downcast and upcast

Each CTD profile was processed and screened visually for bad data. Data quality was very high throughout the entire cruise, with spikes being almost always limited to the conductivity sensors. The productive shelf seas were filled with jellyfish and salps and occasionally they blundered into the conductivity and oxygen sensors but were quickly flushed out. Enhanced values from the jellyfish were removed during processing. See Figure 1 for an example CTD profile.

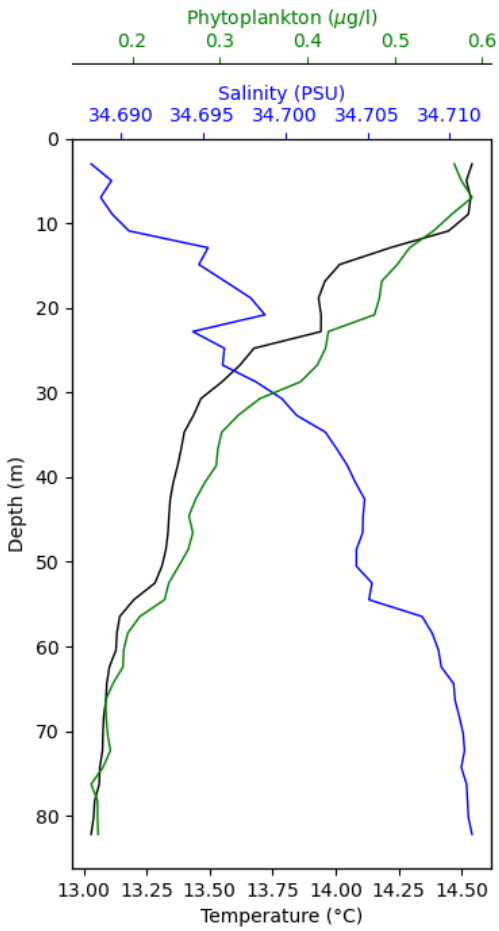


Figure 1. Example CTD profiles of temperature, salinity, and chlorophyll.

The final few casts (CTD190 to 207) were used as calibrations for a fluorometer used on the Scanfish instrument and therefore the outputs have an extra fluorometer variable. The final cast, CTD208, the oxygen SBE43 sensor was replaced with the one used on the Scanfish, also for calibration. The majority of casts featured Fast Repetition Rate Fluorometer, by CTG FastOcean3, which provided additional fluorescence measurements but were recorded separately to the CTD data.

For calibration, water samples were collected using Niskin bottles mounted on the CTD rosette system and subsequently analysed. Dissolved oxygen and chlorophyll fluorescence were measured in the onboard chemical laboratory. Salinity samples were analysed using an Autosal Salinometer on land within the calibration laboratory at NOC. To calibrate sensor data, the corresponding bottle files produced with the mstar code were used to match *in situ* sensor measurements of dissolved oxygen, chlorophyll, and practical salinity with the laboratory-measured values. Regression analyses were then performed to derive calibration curves for each parameter, which were applied to the CTD dataset (Figure 2). For both salinity and DO, a linear regression provided the best fit, with coefficients of determination (R^2) equal to 0.917 and 0.988 respectively. The Root Mean Square Deviation was calculated to be 0.013 PSU. For chlorophyll fluorescence, a cubic regression produced the best fit, with a R^2 value of 0.91. The

Root Mean Square Deviation was calculated to be 0.204 µg/l. See the Dissolved Oxygen section for the oxygen linear regression analysis figure.

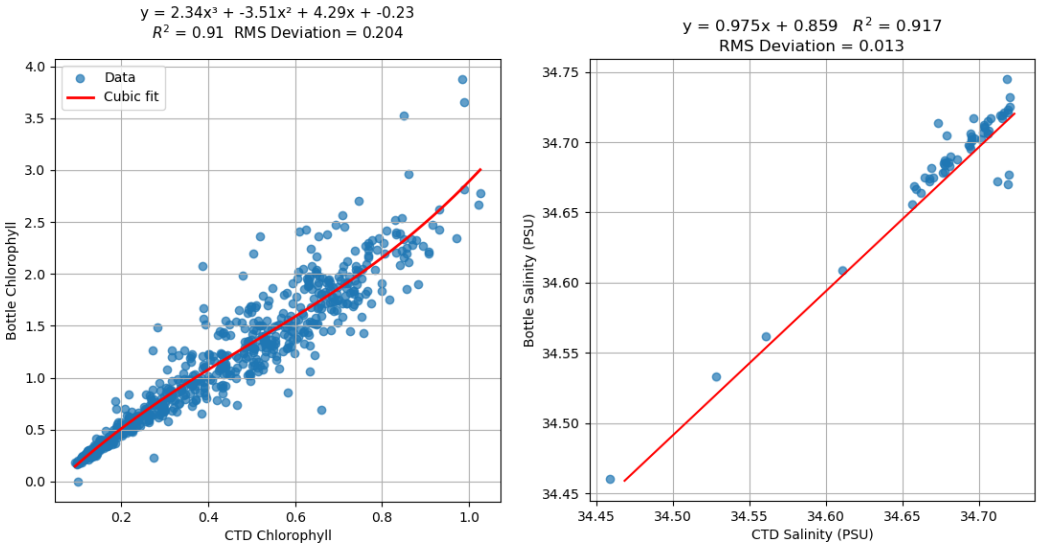


Figure 2. Regression analysis used for calibration for the salinity measurements (left) and the chlorophyll (right).

ScanFish Data and Calibration

Sophie Durston

Physical and biological variables were measured across 7 tows of a ScanFish. Conductivity, temperature, pressure, and dissolved oxygen were measured using a housed Seabird 9+ CTD and chlorophyll was measured using the WET Labs FLNTU fluorometer. Images of the instrument configuration is seen in Figure 1.

Figure 1. Image of the ScanFish during pre-deployment checks (left) and during deployment (right).

During the initial tow, bottom depth was being measured *in situ* by the altimeter sensor, however, this instrument was unreliable. Therefore, during the tow, and the subsequent tows, a manual bottom and top dive depth was set to minimise the risk of collision with any objects on the seafloor. Tows of the ScanFish consisted of loops around the Kincardine windfarm along predetermined boxes for approximately 24 hours (Figure 2). The ScanFish had to be recovered early during Tow 2 (Box N) due to a collision with fishing gear. All other Tows were successful. See Table 1 for a list of all the ScanFish tows and their subsequent start

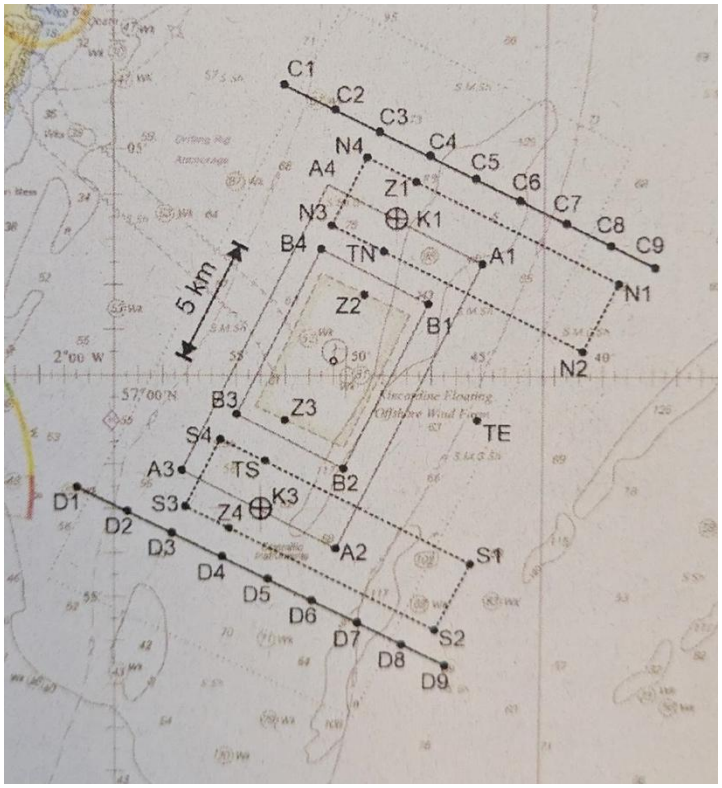


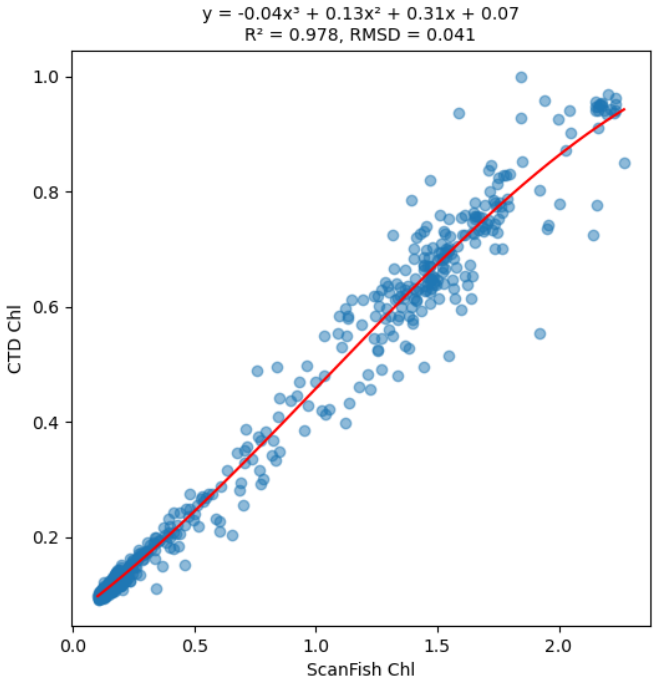
Figure 2. Map of the boxes used for ScanFish surveys and CTD stations.

Table 1. ScanFish survey tows and its affiliated box and times.

Tow	Box	Start	End
1	A	15/8/25 13:50	16/8/25 14:15
2	N	19/8/25 08:00	19/9/25 13:52
3	B	23/8/25 20:30	24/8/25 19:10
4	L	27/8/25 18:20	27/8/25 23:53
5	A	28/8/25 10:00	29/8/25 11:53
6	B	30/8/25 07:30	30/8/25 18:27
7	B	5/9/25 08:00	6/9/25 09:10

To calibrate the salinity measurements, samples from the ship's underway samples were taken during the two periods of slack water within the 24-hour surveys of the boxes. Once the 500m distance between the ship and the ScanFish, the 10 minute lag between surface water reaching the underway taps, and the speed of the ship (6 knots) are taken into account, these samples

were matched up with the surface measurements made by the ScanFish to calibrate the salinity. The fluorometer and the dissolved oxygen sensors were attached to the CTD for the final few casts and calibrated using the calibrated CTD data. For chlorophyll fluorescence, a cubic regression produced the best fit, with a coefficient of determination (R^2) value of 0.978. The Root Mean Square Deviation was calculated to be 0.041 µg/l (Figure 3). Calibrations for dissolved oxygen and salinity will be completed post-cruise, but the calibration coefficients and



error values will be included within the ScanFish metadata.
Figure 3. Regression analysis used for calibration for of the ScanFish chlorophyll measurements.

Data was able to be visualised in real-time on board, but also preliminary results were able to determine differences between upstream and downstream of the Kincardine windfarm from plotting the ScanFish transects for both temperature and chlorophyll (Figure 4).

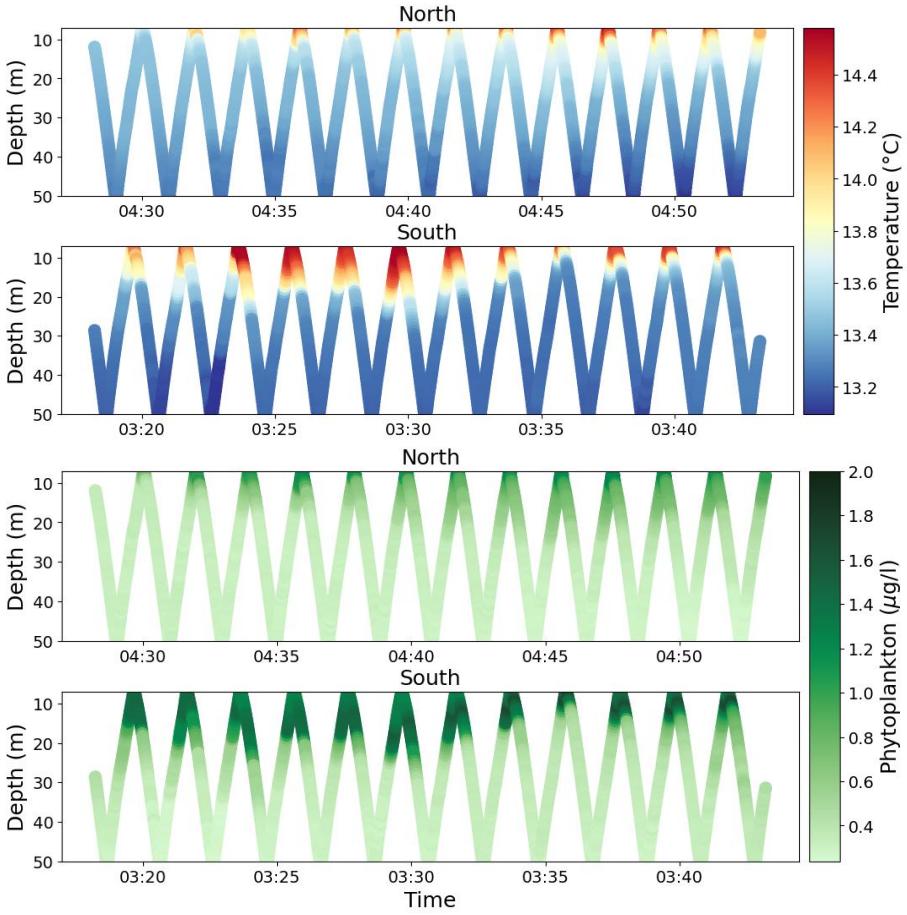


Figure 4. Example temperature and chlorophyll data from a ScanFish transect, north and south of the Kincardine windfarm during a flood (southerly flowing) tide.

Chlorophyll a analysis

Sara Pursey and Mark Moore (University of Southampton), Vanessa Cavucci (University of Southampton/NOC)

Measurements of total chlorophyll-*a* were made onboard cruise DY197 in order to evaluate the distribution of phytoplankton in the water column and responses within experiments. For total chlorophyll-*a* measurements, 100 mL was filtered onto Fisherbrand MF300 glass fibre filters, with filters placed in 20 mL glass vials and chlorophyll-*a* extracted in 6 mL of 90% acetone (HPLC grade) for 18 to 24 hours at 4°C in a dark fridge. Chlorophyll-*a* fluorescence was subsequently measured onboard using a Turner Designs Trilogy fluorometer set up with a non-acidification module (after Welschmeyer, 1994). The fluorometer was calibrated against a pure chlorophyll-a extract prior to the cruise and a solid standard and 90% acetone blank was used at the start of each set of measurements to check for instrument drift.

A total of 1070 samples were collected, consisting of 763 from CTDs, with the remainder being from the a set of nutrient addition experiments (see below), or a limited number of underway samples.

The following samples were collected from the CTD stations:

CTD number	No. of Samples	CTD number	No. of Samples	CTD number	No. of samples
010	1	099	5	195	8
018	8	100	8	196	8
019	8	105	1	207	4
020	8	106	8		
022	8	108	8		
024	8	110	8		
026	8	116	8		
028	8	117	8		
030	8	121	8		
032	8	125	8		
034	8	129	8		
036	8	133	8		
038	8	134	8		
040	8	135	8		
042	8	136	8		
044	8	137	8		
046	7	138	8		
048	8	139	8		
052	8	140	8		
053	5	141	7		
054	5	143	4		
055	8	144	8		
057	8	145	8		
059	7	146	8		

061	8	147	8		
063	7	148	8		
065	8	151	8		
067	8	153	8		
069	8	155	8		
071	8	157	8		
072	8	159	8		
073	8	163	8		
074	8	167	8		
075	8	168	8		
076	7	172	8		
079	8	176	8		
080	8	180	8		
088	7	184	8		
089	8	185	8		
090	8	186	3		
091	8	187	8		
092	8	188	8		
093	8	189	8		
094	8	190	8		
095	8	191	8		
096	8	192	8		
097	8	193	8		
098	5	194	8		

Preliminary data is available on the cruise drive at 'Y:\DY197\science\Chlorophyll' within the spreadsheet 'DY197_Chlorophyll a data'.

Fluorometry

Single Turnover Active Fluorometry of Enclosed Samples (STAFES) and Fast Repetition Rate fluorometry (FRRf)

Sara Pursey and Mark Moore (University of Southampton), Vanessa Cavucci (University of Southampton/NOC)

Active chlorophyll fluorescence analysis, specifically Single Turnover Active Fluorometry (STAF) and Fast Repetition Rate fluorometry (FRRf), can provide a useful non-destructive and rapid index of the physiological status of phytoplankton. STAF / FRRf can be used to measure a suite of parameters pertaining to the photosynthetic physiology of the entire phytoplankton community, most commonly an estimate of the photosystem II photochemical efficiency (Fv/Fm) which can provide a proxy of the overall photosynthetic 'health' of the community, alongside other variables which can be used to derive photosynthetic electron transport rates using a 'Fluorescence Light Curve' (FLC) sampling protocol. The STAFES and FRRf techniques measure in real time and at high sensitivity.

For DY197 measurements were made with both LabSTAF STAFES and Fastocean FRRf instruments

STAFES Instruments summary:

Three LabSTAF instruments were used during DY197.

Serial number	Location on ship	Use
19-0105-004	Chem lab	Continuous FLC
21-1345-003	Chem lab	Discrete FLC
19-0105-001	Chem lab	Discrete FLC

Calibration:

All instruments were calibrated prior to the cruise, calibration files are available on the DY197 shared drive (\DY197\Active Chlorophyll Fluorometry\calibration).

Software:

Instruments were run on RunSTAF v9.1.18. The software version used is available on the DY197 shared drive (\DY197\Active Chlorophyll Fluorometry\RunSTAF v9.1.18).

Continuous FLC measurements:

Instrument 19-0105-004 was used to run continuous fluorescence light curves (FLC) using the same protocol throughout the cruise. The instrument was run in AutoFLC mode, with dynamic FLC and AutoHigh activated which results in the light levels of light steps automatically adjusting during each FLC. The FLC protocol included a low light time of 200s at 20 umol quanta m^{-2} s^{-1} and a dark step of 40s, 10 light levels of 80s each and a final dark step of 60s. The sample exchange / rinse time between samples was 120s. A dual waveband measurement (DWM) was automatically run prior to each FLC. Photochemical excitation profiles (PEP) were also run prior to FLCs. The value of Seq/Saq (number of acquisitions to be averaged) was set to 16. Blanks were run with MQ water and 0.2 um filtrates run on occasion (approximately weeklY0. The instrument was cleaned with MQ water every day and 70% ethanol every two days. Raw data files for the underway data can be found at \DY197\Active Chlorophyll Fluorometry\STAFES\190105_004_UW.

Discrete FLC measurements:

Instruments 21-1345-003 and 19-0105-001 were used to run fluorescence light curves (FLC) on discrete samples from CTD casts (surface and subsurface chlorophyll maximum samples from the 'Optics' CTD). A similar FLC setup to the continuous FLC protocol used on instrument 19-0105-004 was used (10 light steps and 1 dark step, DWM and PEP). Raw files can be found at DY197\Active Chlorophyll Fluorometry\STAFES under separate folders for each instrument (211345_003_Discrete2_Surf and 190105_001_Discrete1_SCM).

Resources (LabSTAF instrument):

More information about the instrument and approach can be found in the instrument handbook, available on the Ocean Best Practice Repository: https://repository.oceanbestpractices.org/handle/11329/1531.4

The latest version of the instrument software, required to open raw files, can be downloaded at https://1drv.ms/u/s!AkUtV8PHZSmVvJ9wFOm-fSR1FbwYGQ?e=

A zenodo repository of continuous FLC data from previous cruises can be accessed on: https://zenodo.org/communities/staf_underway?q=&l=list&p=1&s=10&sort=newest

FastOcean FRRf measurements:

In addition to the STAFES measurements, single turnover active chlorophyll fluorescence measurements were also made using a Chelsea Technologies Group (CTG) FastOceanTM fluorometer on sub-samples from the nutrient addition experiments (see Section on nutrient amendment experiments) and from discrete samples collected in parallel with chlorophyll measurements from all the CTD casts (see table above).

The instrument (SN 15-0093-002) was set up with a saturating sequence of 100 flashlets (at 2µs pitch) and a relaxation sequence of 20 flashlets (at 60 µs pitch), with 110 sequence repeats at a sequence interval of 100ms. Data was downloaded daily and analysed with 'FastPro8' software to derive fluorescence parameters (see above). Raw data and a scan of the completed log book is available on the ships drive at the location 'Z:\DY197\Active Chlorophyll Fluorometry\Discrete FRRf'. Processed data are available on the ships drive within the data files for the nutrient addition experiments at location: '\DY197\Nutrient Addition Experiments' within the spreadsheet 'All_NEx'. Processed data for the discrete CTD samples are available on the cruise drive within the folder '\DY197\science\Active chlorophyll fluorometry\Discrete FRRf' within the file named 'CTD_Discrete_Compiled'

Nutrient addition and mixing experiments

Sara Pursey and Mark Moore (University of Southampton), Vanessa Cavucci (University of Southampton/NOC)

Nutrient addition and sub-surface enrichment incubation experiments were conducted during DY197 to assess the impacts of nutrient availability, including through natural mixing and potential mixing generated by floating wind turbines, on phytoplankton growth, physiology, community structure, and macronutrient drawdown in the sampled shelf sea system.

A total of six experiments were run, collecting water from different stations (Table 1).

Experiment id	Latitude (N)	Longitude (E)	Station	CTD#	Start date	End date
NEx-01	56° 58.980'	1° 45.178'	TE	18	15/08/2025	19/08/2025
NEx-02	56° 59.000'	1° 45.43'	TE	63	20/08/2025	23/08/2025
Nex-03	57° 2.769'	1° 48.985'	TN	106	25/08/2025	27/08/2025
Nex-04	57° 4.3128'	1° 47.777'	Z1	143	28/08/2025	30/08/2025
Nex-05	57° 2.795'	1° 48.97'	TN	153	31/08/2025	02/09/2025

Table 1: Sample location, start and end dates of nutrient addition experiments. Details available in the DY97 cruise folder under '\DY197\science\Nutrient addition experiments' within the file 'DY197 Nutrient expts metadata'.

For each experiment, seawater was collected directly from the sampled Niskin bottles into triplicate acid washed and Millli-Q rinsed 2.5 L polycarbonate bottles for each condition. The bottles were then sealed and placed in deckboard flow-through incubators shaded with Lee Filters 'Misty Blue' optical filters to a level of 20% above surface irradiance, with temperature maintained near in-situ conditions through supply with continuously circulating surface seawater from the ships non-toxic supply. Treatments and duration of the experiments varied depending on the specific experimental design.

Experimental Design

For every experiment, the bottles were enumerated with sequential numbers with three sequential numbers identifying the three replicates for each treatment. The six experimental designs are described in the following tables, using the following abbreviations: S : Surface waters; Sf : Surface waters filtered; D: Below thermocline or deep waters; Df: Below thermocline or deep waters filtered; N : Nitrate spike to have a concentration of 1.25 µM in the treatment; P : Phosphate spike to have a concentration of 0.1 µM in the treatment. Timesteps sampled varied between the experiments, with two samplings following the Tzero measurements, up to a total duration of 2-4 days.

Experiment ID	**NEx01**, CTD 018, Station TE								
Treatment	1			2			3		
	Control (S)			S + N + P			S (90%) + D (10%)		
Bottles	1	2	3	4	5	6	7	8	9
Timesteps (days)	0	0	0	0	0	0	0	0	0
	1	1	1	1	1	1	1	1	1
	3	3	3	3	3	3	3	3	3
	4	4	4	4	4	4	4	4	4

Experiment ID	**NEx02**, CTD 063, Station TE											
Treatment	1			2			3			4		
	Control (S)			S + N + P			S (90%) + D (10%)			S (90%) + D f (10%)		
Bottles	1	2	3	4	5	6	7	8	9	10	11	12
Timesteps (days)	0	0	0	0	0	0	0	0	0	0	0	0
	1	1	1	1	1	1	1	1	1	1	1	1
	2	2	2	2	2	2	2	2	2	2	2	2
	3	3	3	3	3	3	3	3	3	3	3	3

Experiment ID	**NEx03**, CTD106 Station TN														
Treatment	1			2			3			4			5		
	Control (S)			S + N + P			S (90%) + D (10%)			S (90%) + D f (10%)			S (80%) + D (20%)		
Bottles	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Timesteps (days)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2

Experiment ID	**NEx04**, CTD143 Station Z1														
Treatment	1			2			3			4			5		
	Control (S)			S + N + P			S (90%) + D (10%)			S (80%) + D(20%)			S (70%) + D (30%)		
Bottles	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Timesteps (days)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

Experiment ID	**NEx05**, CTD153 Station TN														
Treatment	1			2			3			4			5		
	Control (S)			S + N + P			S (90%) + D (10%)			Sf (80%) + S(20%)			Sf (80%) + S(20%) + N + P		
Bottles	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

Timesteps (days)	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Experiment ID	**NEx06**, CTD194 Station D5														
Treatment	1			2			3			4			5		
	Control (S)			S + N + P			S (90%) + D (10%)			S (80%) + D(20%)			S (60%) + D(40%)		
Bottles	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Timesteps (days)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2

Further details including sampling depths, Niskins sampled and detailed sampling times are all in the associated metadata spreadsheet 'DY197 Nutrient expts metadata' on the drive at '\DY197\science\Nutrient addition experiments'

An initial mixing ratio of deep water (D) to surface water (S) of 1:10 was estimated based on the temperature difference observed between surface waters and waters below the thermocline and data on the temperature drop observed within the wakes sampled by the RV Maddog. A series of treatments with increasing mixing ratios were then added to evaluate the influence of mixing above these levels, noting observations of substantial stratification breakdown at times during the cruise, likely due to both the influence of the spring tides towards the middle of the cruise and some significant wind events towards the end of the cruise. The direct nutrient amendments were similarly targeted at levels representative of the highest surface nutrient concentrations observed throughout the cruise. In the experiment NEx02, treatment 5 with Df was done to remove a portion of chlorophyll-containing particles. This step was necessary because, in this shelf sea, subsurface waters typically exhibit higher chlorophyll concentrations than surface waters; hence it is run to check on its effect on the variables measured. The NEx05 experiment was designed to assess grazing rates. By filtering out a known percentage of surface w ater, grazing rates could be back-calculated relative to the control treatment.

Sub-sampling details

The Tzero subsampling was performed directly from the Niskin bottles. Water for the experimental setup was collected in 2.5 L polycarbonate bottles, placed in incubators, and then sub-sampled at T1, T2 (and on occasion T3). Sub-samples from each bottle were taken for the following analyses:

Chl a: to quantify phytoplankton biomass; FRRf : to assess photosynthetic physiology; Nutrients: to measure concentrations of dissolved inorganic nutrients; Analytical Flow Cytometry (2 ml collected and preserved in 1% final concentration glutaraldehyde): to determine microbial and phytoplankton abundances by flow cytometry; Cytosense flow cytometry (50 ml collected and preserved in 0.25% final concentration glutaraldehyde): to characterize phytoplankton size structure and community composition; High Performance

Liquid Chromatography (HPLC) (1 L filtered, flash frozen in liquid nitrogen then transferred and stored at -80°C): to analyze phytoplankton pigment composition.

Chl a, FRRf and macronutrients were measured for every timepoint directly on board. The remaining sub-samples were preserved for subsequent land-based analyses on return.

Example preliminary data

Examples of data from two experiments (NEx04 and NEx06) are shown below.

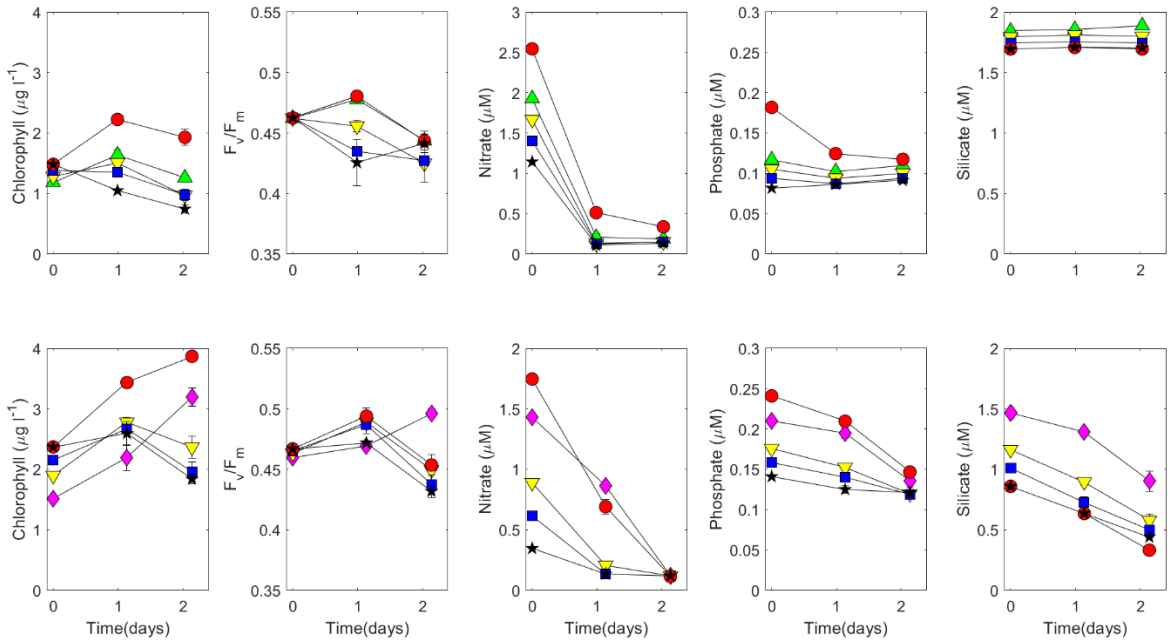


Figure 1: Examples of data from two experiments. Treatments are: Control (black star symbols), +N+P (red circles), and enrichments with 10% (blue squares), 20% (yellow triangles), 30% (green triangles) and 40% (purple diamonds) sub-thermocline water.

A clear response to direct nutrient addition can be observed in both experiments, while addition of sub-thermocline water also results in clear biological responses, which scale with the % of sub-surface water added.

Carbon and nitrate uptake using 13C and 15N

Sara Pursey and Mark Moore (University of Southampton)

Samples were collected for the estimation of carbon fixation via incorporation of 13C and nitrate uptake via incorporation of 15N at a series of the stations sampled (see Table below). Samples were collected from early morning CTD casts, with a series of 1L acid-washed and Milli-Q rinsed bottles filled directly from the sampled Niskin bottles. Incubation bottles were then transferred to the container laboratory and spiked to final concentrations of 100 μM NaH13CO3 and 0.01 μM K15NO3. Samples were then incubated in a XXXX incubator set at 15°C for 24 hrs (with an additional 6 hr timepoint for experiments 6, 7, 10 and 14), with two replicate bottles incubated in the dark and two at 225 μmol photons m-2 s-1 irradiance provided by white light LED panels shaded with a single layer of LEE filters 'Misty Blue' filter. Incubations were terminated by filtration onto pre-combusted Whatman GF/F filters, dried for >24hr at 30°C, then placed in centrifuge tubes for transport back for analysis on return to the laboratory. Blanks and time zero samples were also collected for each experiment.

Table of samples collected for C and N uptake using stable isotopes.

Expt	Date	Jday	Start time	CTD #	Niskin	Depth (m)
PP01	15/08/2025	227	06:57	18	22	2
PP02	17/08/2025	229	06:20	26	22	3
PP03	18/08/2025	230	06:20	42	17	3
PP04	20/08/2025	232	06:21	63	21	3
PP05	23/08/2025	235	05:20	94	24	3
PP06	25/08/2025	237	04:35	105	1	3
PP07	26/08/2025	238	06:43	121	18	3
PP08	27/08/2025	239	05:54	134	19	3
PP09	28/08/2025	240	06:05	143	14	3
PP10	31/08/2025	243	07:10	152	19	3
PP11	01/09/2025	244	06:15	168	17	3
PP12	02/09/2025	245	06:36	184	23	3
PP13	03/09/2025	246	05:00	196	17	3
PP14	05/09/2025	248	04:45	207	15	3

Biogeochemistry (SAMS)

1. Dissolved Inorganic Nutrients
2. Dissolved Oxygen
3. Dissolved Organic Carbon/Nitrogen
4. Particulate Organic Carbon/Nitrogen
5. Nitrate isotopes
6. Silicon isotopes

The temporal and spatial variability in inorganic nutrients (nitrate, nitrite, phosphate, silicate), dissolved oxygen and organic matter (dissolved and particulate carbon/nitrogen) were sampled through a high resolution sampling campaign around the Kincardine wind farm. Spatial samples have been collected from the D,C, L and Z transects. The temporal variability over tidal cycles was sampled at the TS, TN and TE stations over a 25 hour period. TS and TN samples were collected at spring and neap tides, TE at neap tides.

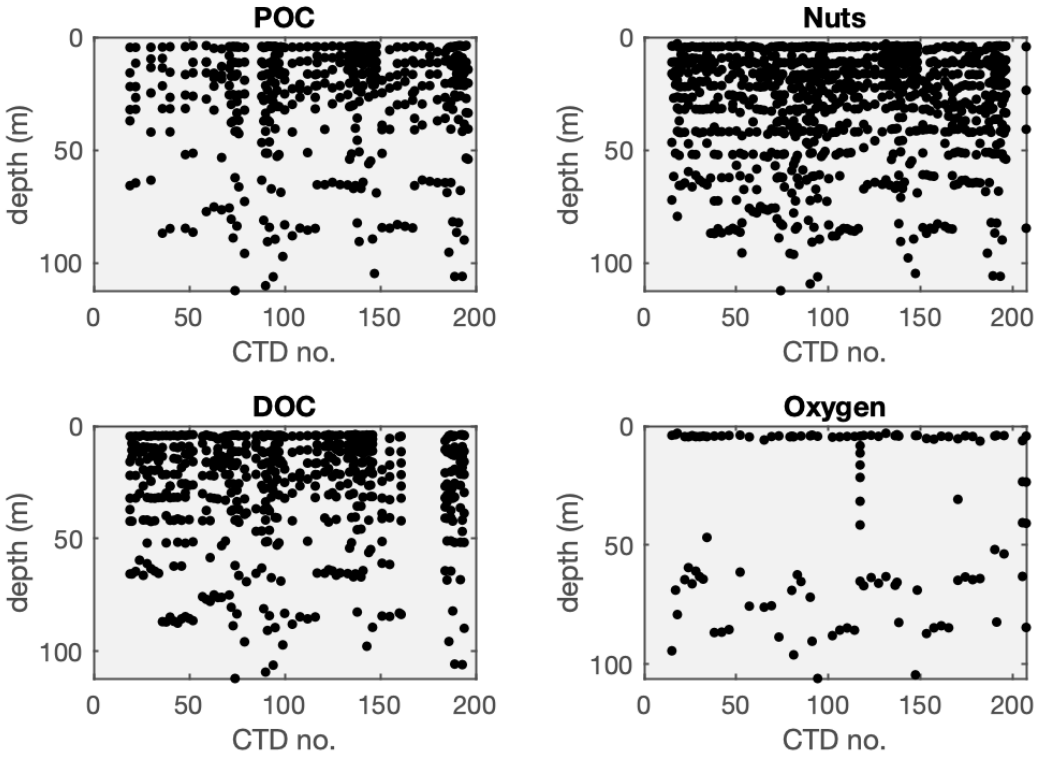


Figure 1. Samples collected for POC, nutrients, DOC and oxygen, plotted against CTD number.

Dissolved Inorganic Nutrients

Contact: Richard Abell or Robyn Tuerena

Onboard Analysis: Richard Abell

The concentrations of dissolved seawater nutrients silicate (silicic acid [$Si(OH)_4$]), phosphate, nitrate and nitrite were determined on board during DY197. 1443 seawater samples were measure from CTD Niskin bottles, the ships underway surface water sampling system and in-situ phytoplankton uptake experiments conducted on board.

Nutrient analysis was achieved using a Seal AA500 continuous bubble segmented flow auto-analyser following well established techniques to accurately determine sub-micromolar nutrient concentrations along hydrographic sections. (e.g., Rees et al., 2019).

Sampling

Sampling of the 24 Niskin 10 litre CTD bottles was done using an AcroPak/Cytiva 0.45um gravity capsule filter to remove particulates and zooplankton. The filter was well flushed prior to collecting the final sample and rinsed with de-ionised water between casts.

Samples were collected into 50ml Falcon tubes. The sampling containers were all pre-cleaned by leaching for a minimum of 24 hours 10% HCl, rinsed three times in de-ionised water and further rinsed three times directly with samples before final collection. Samples were refrigerated at 4 °C in the dark until being brought to room temperature prior to analysis. The analysis was conducted within 12 hours of collection. If this was not possible samples were frozen for up to 24 hours. Frozen samples recovered from the Research Vessel Prince Madog conducting tandem operations were defrosted for 24hrs and measured onboard during DY197.

Onboard Analysis

Silicate was determined using Seal method no. A-006-19 Rev.3 based on the reduction of silico-molybdate in acidic solution to molybdate blue using ascorbic acid measured at 820nm. Oxalic acid was used to minimise interference from phosphates.

Nitrite using Seal method no. A-003-18 Rev.3 whereby nitrite reacts with sulfanilimide under acidic conditions to form a diazo compound. The colouring agent N-1-napthylethylenediamine dihydrochloride is added to form a purple azo dye which is measured at 540nm. On a separate channel, the total oxidised nitrogen (nitrate + nitrite) was determined via the reduction of nitrate to nitrite on a copper-cadmium column buffered with ammonium chloride at pH 8.5 (Armstrong et al., 1967).

Nitrate is determined by subtraction of the nitrite concentration from the total oxidised nitrogen concentration. Cadmium column efficiency was tested prior to every run using recovery of

separate 2uM nitrite and nitrate solutions to ensure efficiency was >98% and the column was reconditioned if this efficiency was noted to have dropped.

Phosphate was measured as orthophosphate by reaction with molybdate and antimony followed by reduction with ascorbic acid at pH < 1 (Murphy and Riley, 1962) with an optimised $[H^+]$: [Mo] ratio (Drummond and Maher, 1995). The reduced blue phosphor-molybdate complex was measured at 880nm.

Pipettes were gravimetrically calibrated prior to the cruise. All glass (and plastic used for silicate reagents/standards) volumetric flasks and calibration solutions were buoyancy-corrected.

Quantification was achieved using two sets of calibration standards. The first prepared inhouse from oven dried high-purity salts (potassium dihydrogen phosphate Merck Supraure 99.999%, potassium nitrate Merck Suprapure 99.995%, potassium nitrite Alfa Aesar 99.999%, Sodium Hexafluorosilicate Alfa Aesar 99+%). The second were commercially available National Institute of Standards and Technology (US department of commerce) traceable standard solutions (Supelco Certipur, Merck, Germany). Cross calibration was performed twice through the cruise when stock solutions were changed. The Supelco Silicon standard is provided in a 0.5 NaOH solution and was diluted with addition of 1N HCl to lower pH. In-house phosphate, nitrate and nitrite calibration solutions were indistinguishable from NIST cross calibration values. In-house Si was consistently 1.1% lower than certified solutions. This is likely due to the lower purity and solubility of the Sodium Hexafluorosilicate salt and so in-house standard concentrations were adjusted to NIST certified values.

Quality assurance and data control was carried out using repeat measurements of certified reference material KANSO LOT-CU (Japan Agency for Marine-Earth Science and Technology (JAMSTEC)). Between run checks were also carried out using repeat samples of intermediate water collected from one bottle sampled at 20m and frozen. Once thawed, this gave a lower concentration sample with which to monitor any analysis inaccuracy. Reproducibility of CRM and Check standards was better than 3% for phosphate, silicate and total oxidised nitrogen in line with GO-SHIPS QA/QC requirements (Becker et al., 2020). No ‘normalisation’ of the raw nutrient data based on the KANSO data were performed. However, variation in the nitrite ratio of OSIL LNSW batch 31 (OSIL certificate value = 0.160 µM) : KANSO CU (certified vale = 0.044 µM) were noted during the cruise. Offsets of up to 0.1 µM nitrite were measured which may suggest between bottle differences in the certificate value of nitrite within OSIL batch 31. Aliquots of LNSW batch 31 from all bottles used were stored and will be cross referenced against an ultra-pure synthetic seawater once returned to the home laboratory. This may slightly improve the overall accuracy of the calibration and accuracy of the data.

References:

Armstrong, F.A.J., Stearns, C.A., and Strickland, J.D.H., “The measurement of upwelling and subsequent biological processes by means of the Technicon Autoanalyzer and associated equipment,” Deep-Sea Research, 14, pp.381-389 (1967)

Becker., S. et al., 2020. GO-SHIP Repeat Hydrography Nutrient Manual: The Precise and Accurate Determination of Dissolved Inorganic Nutrients in Seawater, Using Continuous Flow Analysis Methods. Front. Mar. Scie., 30 October 2020 Sec. Ocean Observations Volume 7 doi :10.3389/fmars.2020.581790.

Drummond and W. Maher, 1995. Re-examination of the optimum conditions for the analysis of phosphate. Analytical Chimica Acta 302: 69-74.

Rees, C., et al. 2019. Methods for reproducible shipboard SFA nutrient measurement using RMNS and automated data processing. *Limnol. Oceanogr.: Methods 17, 2019, 25-41 doi:10:1002/lom3.10294*.

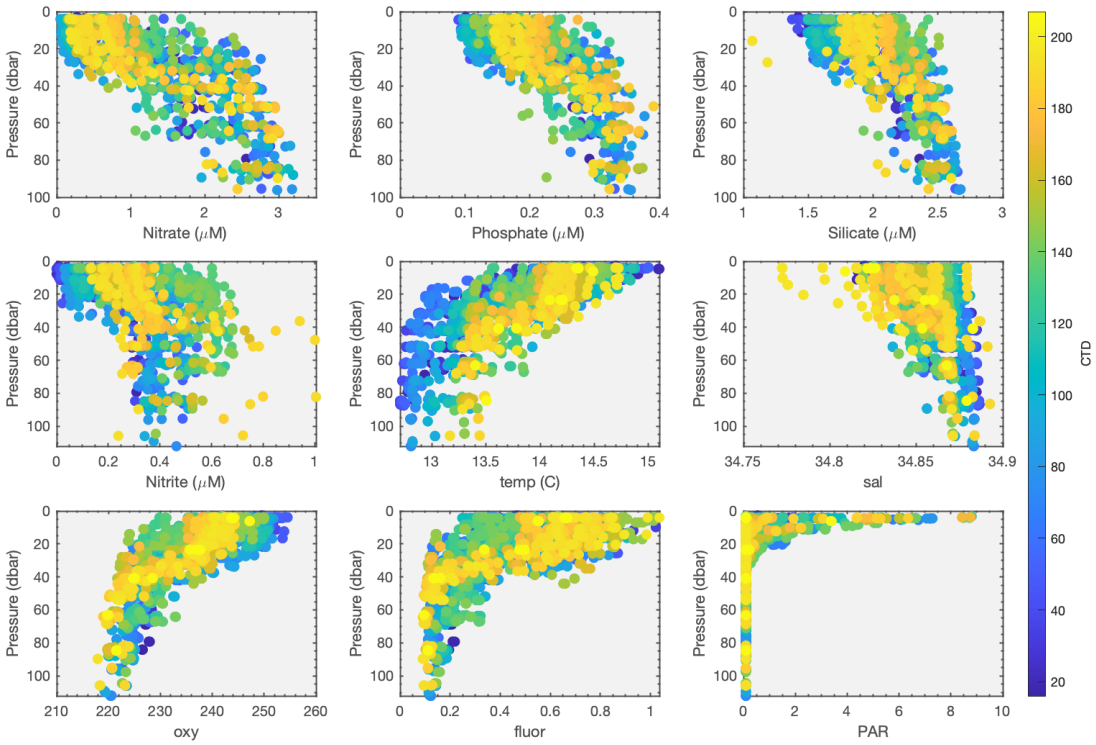


Figure 1. Profile plots of all bottles fired on DY197. (a) nitrate, (b) phosphate, (c) silicate, (d) nitrite, (e) temperature, (f) salinity, (g) oxygen (uncalibrated), (h) fluorescence and (i) PAR). CTD number is shown with colour bar.

Dissolved Oxygen

Contact: Robyn Tuerena or Rich Abell
Onboard Analysis: Sarah Beith (SAMS); Xin Meng (University of Liverpool)

Introduction

422 seawater samples were collected from 57 CTD casts at Hornsea and Kincardine windfarms and analysed via Winkler amperometric auto-titration to determine concentrations of dissolved

oxygen. Sampling was carried out around the clock; analysis was performed during the day. Procedures used are documented in the 'Go-Ships' protocol (Langdon, 2010), based on the standard methodologies of Carpenter (1965) and adapted for large scale hydrographic studies (Culbertson, 1991; Dickson, 1995).

Sampling

Seawater samples were drawn from Niskin bottles via a 30cm length of flexible silicon tubing, ensuring air bubbles did not enter the glass sampling bottles. Each bottle was flushed with ~ 3 times the volume of water using a continuous flow of Niskin water, inverting the bottle during flushing to aid cleaning. The bottle was then carefully filled from the bottom, allowing ~ 2 bottle volumes to smoothly flow over. The flow of water was slowed by gently pinching the tube as it was removed; this helped reduce turbulence, ensuring air bubbles were not introduced into the sample.

Samples were fixed immediately after collection via addition of 1 ml of Winkler A reagent (3M MnCl2. 4H2O) followed by 1 ml of Winkler B reagent (8M NaOH + 4M NaI). Reagents were dispensed just below the surface of the water to ensure no introduction of air bubbles and no reacting species are lost with the displaced seawater. Bottle stoppers were placed in carefully at an angle to ensure any air bubbles were removed along with the overflowing water as the stopper was inserted. The samples were then shaken vigorously by inverting the bottle back and forth for 30 seconds.

Whilst collecting samples, a spare bottle was filled with water from the CTD and allowed to come to ambient temperature; it was then refilled with water from the same Niskin as each set of replicate samples and a calibrated digital temperature probe was used to record the draw temperatures.

Sample pre-treatment and storage

Samples were transferred to a storage tub full of DI water in the lab, with the sample bottles being fully submerged under water to preserve the seal and prevent any oxygen ingress. After 30 minutes, samples were vigorously shaken for a further 30 seconds, placed back into the storage tub and allowed to settle and equilibrate with lab temperature for at least 2 hours prior to analysis.

Quality control

At the beginning of each analytical session the Na2S203 titrant (~0.1 M) was standardised using a commercial KIO3 standard (Titrisol; 0.01665 M) or an in-house KIO3 standard (0.003034 M). In addition, triple standardisations were carried out using the Titrisol and in-house standards alongside a second commercial KIO3 standard (OSIL; 0.001667 M) for each batchnof Na2S203 used. Seawater blanks were analysed twice weekly throughout the cruise or whenever a new batch of Na2S203 or Winkler reagent brought into use. Blank concentrations were subtracted from titration calculations (Carpenter, 1965).

Analysis

To each sample, 1 ml of 75 % H_2SO_4 was added. The sample was immediately mixed on a stirrer plate for approximately 12 seconds to ensure all the precipitate had dissolved, then auto-

titrated to the endpoint. Endpoint titres were recorded in the 'Winkler Calculation Spreadsheet eSWEETS 2025'.

References

Carpenter, J.H. 1965. The Chesapeake Bay Institute technique for the Winkler dissolved oxygen method. *Limnol.and Oceanogr.* 10:141-143.

Culbertson, C.H. 1991. Dissolved Oxygen. WHPO Publication 91-1.

Dickson, A.D. 1995. Determination of dissolved oxygen in sea water by Winkler titration. WOCE Operations Manual, Part 3.1.3 Operations & Methods, WHP Office Report WHPO 91 – 1.

Langdon. C. 2010. Determination of dissolved oxygen in seawater by Winkler titration using the amperometric technique. The GO-SHIP Repeat hydrography manual: A collection of expert reports and guidelines. IOCCP report No.14.

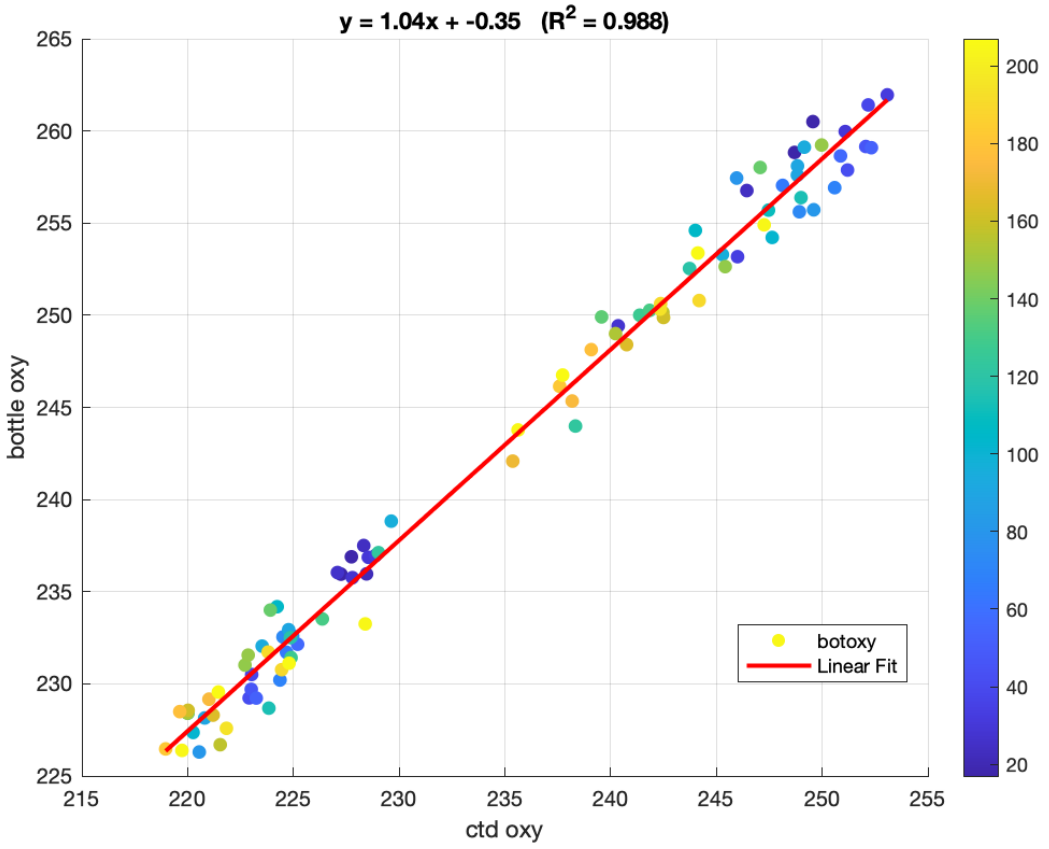


Figure 3. Regression of CTD oxygen and bottle oxygen.

Dissolved Organic Carbon/Nitrogen

Contact: Lisa Friberg or Robyn Tuerena

Sampling and Methodology

Samples were taken from each CTD cast at 6-8 depths. DOC samples were filtered in-line from the CTD through precombusted 47mm GFF filters into a pre-acidified (50 µl 85% phosphoric acid) 20 ml glass vial with a screw cap and septum. Samples were stored upright in the 4°C fridge prior to analysis at SAMS. DOC samples will be analysed on the TOC-V Shimadzu at SAMS, in a method similar to Pan et al., (2014).

References

Pan, X., Achterberg, E. P., Sanders, R., Poulton, A. J., Oliver, K. I. C., & Robinson, C. (2014). Dissolved organic carbon and apparent oxygen utilization in the Atlantic Ocean. *Deep Sea Research Part I: Oceanographic Research Papers*, *85*, 80–87. doi:10.1016/j.dsr.2013.12.003

Particulate Organic Carbon/Nitrogen

Contact: Lisa Friberg or Robyn Tuerena

Sampling and Methodology

Typically six depths were sampled from the Rosette system, to characterise variability over the water column, particularly between the surface, SCM and deep waters (Figure 1). 4-6 litres of water was collected from the Niskin into 10L carboys. In the GC lab, approximately 2L of seawater was filtered through 47 mm 0.7 µm pre-combusted GFFs. Once complete, the volume of water filtered was recorded and filters were folded into quarters, placed into pre-combusted foil packets, labelled and frozen at -20C. Samples will be acid fumed in a desiccator and analysed for POC, PN, d13CPOC and d15N-PN using a Carlo Erbo elemental analyser coupled with IRMS (e.g. Tuerena et al., 2021).

References

Tuerena, R. E., Hopkins, J., Buchanan, P. J., Ganeshram, R. S., Norman, L., von Appen, W.-J., et al. (2021). An Arctic strait of two halves: The changing dynamics of nutrient uptake and limitation across the Fram Strait. *Global Biogeochemical Cycles*, 35, e2021GB006961.

Nitrate isotopes

Contact: Robyn Tuerena

Sampling and Methodology

Samples were collected on the L, C and D lines of the transect in the same way as nutrients, in-line from the CTD through an acropak and frozen at -20C prior to preparation for isotopic analysis at SAMS. Samples were collected from stations C1, C5, C9, D1, D5, D9, L1, L6 and TE to capture a wide spatial area.

Isotopic analysis will be carried out using the Denitrifier Method (Sigman et al., 2001, Casciotti et al., 2002), by the conversion of nitrate to nitrous oxide using bacterial strain *P. aureofaciens* and analysis by isotope ratio mass spectrometry.

References

Casciotti, K. L., D. M. Sigman, M. G. Hastings, J. K. Bohlke, and A. Hilkert (2002), Measurement of the oxygen isotopic composition of nitrate in seawater and freshwater using the Denitrifier method, Analytical Chemistry, 74(19), 4905-4912.

Sigman, D. M., K. L. Casciotti, M. Andreani, C. Barford, M. Galanter, and J. K. Bohlke (2001), A bacterial method for the nitrogen isotopic analysis of nitrate in seawater and freshwater, Analytical Chemistry, 73(17), 4145-4153.

Si isotopes

Contact: Lisa Friberg

Sampling and Methodology

Water for δ^{30}Si samples was filtered directly from the Niskin bottle using an in-line Acropak filter (0.8/0.45 µm) attached using pre-acid cleaned silicone tubing. A 250 ml pre-acid cleaned Nalgene bottles was rinsed three times with filtered seawater, then filled up to the top. Samples were stored at +4 °C. Samples were collected from stations C1, C5, C9, D1, D5, D9, L1, L6 and TE to capture a wide spatial area.

The samples will be pretreated using the MAGIC method following Reynolds et. al. (2006) to remove excess ions and preconcentrate the dissolved silicon, and subsequently purified using column chemistry. Isotopic signatures will then be measured using a multi-collector inductively coupled plasma mass spectrometer (MC-ICP-MS).

References:

Reynolds, B., Frank, M., Halliday, A., (2006), Silicon isotope fractionation during nutrient utilization in the North Pacific. Earth and Planetary Science Letters, 244(1-2): 431-443.

Zooplankton Nets

Louise Gao and Kay Ihle (SAMS)

Zooplankton samples were collected at the Kincardine offshore windfarm site during the day and night using a WP2 vertical plankton net with a 200 µm mesh. After attempting the full Z1-Z4 transect once (Z1-2 upstream from the wind farm, Z3-4 downstream), it was decided to cut down the number of stations due to time constraints. Z1 being further away and upstream was chosen as a control location, and Z3 being closest downstream to the wind farm as an impact location. Sampling was conducted during both day and night to investigate the effects of the wind farm on vertical distribution during these periods. The transects were done in both a North-South and South-North direction to cancel out potential effects of biological rhythms.

For sample collection, the net was deployed to a specified depth bin, opened using a messenger, and vertically hauled to the top of the depth bin at a speed of 12 m/min. Then it was closed with a messenger. Depth bins were placed in increments of 20 m from the surface to 60 m. From depths greater than 60 m, due to depth variability across stations, the deepest depth bin started from 60 m to the deepest depth possible at the station. Net deployment occurred from the P frame on the rear starboard side of the ship, with the net wire supported by the deck crew. Nighttime samples were collected with the search light switched off to minimise impact on zooplankton distribution, but deck lights necessary for the work were kept on.

Samples collected from the cod end were sieved through a 200 µm mesh sieve. The samples were stored in labelled 500 ml plastic containers and preserved with 10% borax-buffered formalin. A total of 56 samples were taken over seven sampling days; 3 days and 4 nights.

Date	Day/Night	Transect direction	Stations
14th – 15th Aug.	Night	N - S	Z1, Z2, Z3
18th – 19th Aug.	Night	N - S	Z1, Z3
21st Aug.	Day	N - S	Z1, Z3
23rd Aug.	Day	S - N	Z1, Z3
27th – 28th Aug.	Night	N - S	Z1, Z3
29th – 30th Aug.	Night	S - N	Z1, Z3
3rd Sept.	Day	S - N	Z1, Z3

DY197 Zooplankton net sampling log

Date	Day/Night	Station	Net	Depth Bin (m)	Seafloor depth (m)	Latitude	Longitude	Time net opened (BST)	Time net closed (BST)	Comments

14/08/2025	Night	Z1	001	60-95	106	57° 04.3	-1° 47.7	22:24	22:29	Drifted slightly
			002	40-60				22:48	22:52	
			003	20-40				23:07	23:09	
			004	0-20				23:21	23:22	
15/08/2025		Z2	005	60-80	91	57° 01.8	-1° 49.8	01:27	01:29	
			006	40-60				01:46	01:48	
			007	20-40				01:58	02:00	
			008	0-20				02:07	02:09	
		Z3	009	60-70	76	56° 59.0	-1° 53.0	04:54	04:57	
			010	40-60				05:08	05:11	Cloudy sunrise
			011	20-40				05:22	05:24	
			012	0-20				05:32	05:33	
19/08/2025	Night	Z1	013	0-20	106	57° 04.3	-1° 47.7	00:36	00:38	
			014	20-40				00:46	00:49	
			015	40-60				01:00	01:02	
			016	60-95				01:16	01:20	
		Z3	017	0-20	76	56° 59.0	-1° 53.0	03:25	03:29	
			018	20-40				03:34	03:37	Wire at an angle
			019	40-60				03:46	03:49	
			020	60-70				04:00	04:03	
21/08/2025	Day	Z1	021	60-98	106	57° 04.3	-1° 47.7	11:13	11:17	
			022	40-60				11:30	11:34	
			023	0-40				11:59	12:02	2x sample pots used for 023 (Net for 20-40 m did not close)
			024	0-20				12:12	12:14	Cloudy conditions
		Z3	025	60-70	76	56° 59.0	-1° 53.0	14:25	14:27	Cloud cover, minimal swell
			026	40-60				14:42	14:44	Cloud cover – tide close to substrate
			027	20-40				14:54	14:58	Wind picked up
			028	0-20				15:05	15:07	

23/08/2025	Day	Z3	029	0-20	76	56° 59.0	-1° 53.0	12:10	12:13	Cloudy skies
			030	20-40				12:22	12:24	
23/08/2025	Day		031	40-60				12:57	12:59	
			032	60-70				13:13	13:15	
		Z1	033	60-95	103	57° 04.3	-1° 47.7	15:50	15:54	
			034	40-60				16:09	16:11	
			035	20-40				16:22	16:25	
			036	0-20				16:33	16:35	
28/08/2025	Night	Z3	037	0-20	76	56° 59.0	-1° 53.0	03:17	03:23	
			038	20-40				03:29	03:32	~40% cloud cover
			039	40-60				03:45	03:48	Angled wire
			040	60-70				04:02	04:06	Delay so no Z1
30/08/2025	Night	Z3	041	0-20	76	56° 59.0	-1° 53.0	00:56	00:58	Hazy
			042	20-40				01:06	01:09	
			043	40-60				01:20	01:23	Clear skies
			044	60-70				01:34	01:36	
		Z1	045	0-20	103	57° 04.3	-1° 47.7	03:12	03:18	Partially cloudy
			046	20-40				03:22	03:24	
			047	40-60				03:34	03:37	
			048	60-95				03:48	03:52	
03/09/2025	Day	Z3	049	60-70	76	56° 59.0	-1° 53.0	10:22	10:25	
			050	40-60				10:36	10:39	
			051	20-40				10:50	10:53	
			052	0-20				11:01	11:03	
		Z1	053	60-95	103	57° 04.3	-1° 47.7	12:59	13:03	
			054	40-60				13:15	13:18	
			055	20-40				13:28	13:31	
			056	0-20				13:38	13:40	

Seaglider Mission (UEA)

Chris Auckland (UEA) and Rob Hall (UEA)

Overview

One Seaglider (SG673) was deployed and recovered from the RRS Discovery during DY197 (Table 1). The glider was deployed from the starboard aft crane. Recovery was via a standard recovery loop, lassoing the glider, before securing to a rope on the p-frame to be lifted aboard. The glider was piloted onboard the vessel running a transect approximately N-S, parallel to the windfarm (Table 2, Figure 1). The glider completed 16 sections over 1065 dives. Due to ship-based ScanFish operations the glider was held in position at different waypoints (NORTH_VM, SOUTH_VM) as a virtual mooring at either end of the section, before continuing once safe to proceed. A series of intermediary waypoints were given to minimise distance from the optimal transect line with an offshore waypoint, away from the windfarm, in case of emergency (Table 2).

Waypoint Name	**Latitude**	**Longitude**	**WP Radius (m)**
NORTH	57° 04.88' N	01° 43.88' W	500
A	57° 02.19' N	01° 46.38' W	500
B	56° 59.50' N	01° 48.88' W	500
C	56° 56.81' N	01° 51.38' W	500
SOUTH	56° 54.13' N	01° 53.88' W	500
NORTH_VM	57° 03.53' N	01° 45.13' W	500
SOUTH_VM	56° 55.47' N	01° 52.63' W	500
OFFSHORE	57° 00.00' N	01° 36.00' W	500

Sensors and Configuration

SG673 comprised of an unpumped CT cell (SN: 0357), an Aanderaa 4831 dissolved oxygen optode (SN: 886), a WETLabs optical sensor (SN: 8544) measuring chlorophyll-a fluorescence and optical scatter, and a QSP PAR sensor (SN: 50286). All sensors recorded every 5 seconds across all depths on both climbs and dives.

eSWEETS^3 Glider Flight and Trimming

Figure 1 shows the gliders track through water once on section. The first 40 dives were from the deployment location to the section and are not shown on the plot. The glider remained on section for 18 days with 90% of dives within 2 km of the section. The glider initially went for 30m dives whilst the pitch and VBD parameters were tuned. After this first pass the target depth was increased to 100m to tune the altimeter and roll parameters. Due to the shallow bathymetry the glider altimeter was conservatively set to turn on at 50m, with an initial turn margin of 30m. Throughout the mission was tuned to a turn margin of 15m which, based on the altimeter ping depth and recorded pressure, turned the glider consistently within 3m of the seabed.

Initially the trimming gave longer pumping periods at depth leading to asymmetric dive and climb profiles. This was corrected with more dives leading to a better fit for the hydrodynamic flight model. The boost engine parameters were also increased giving extra power to the pump, however this had minimal effect on the dive profiles

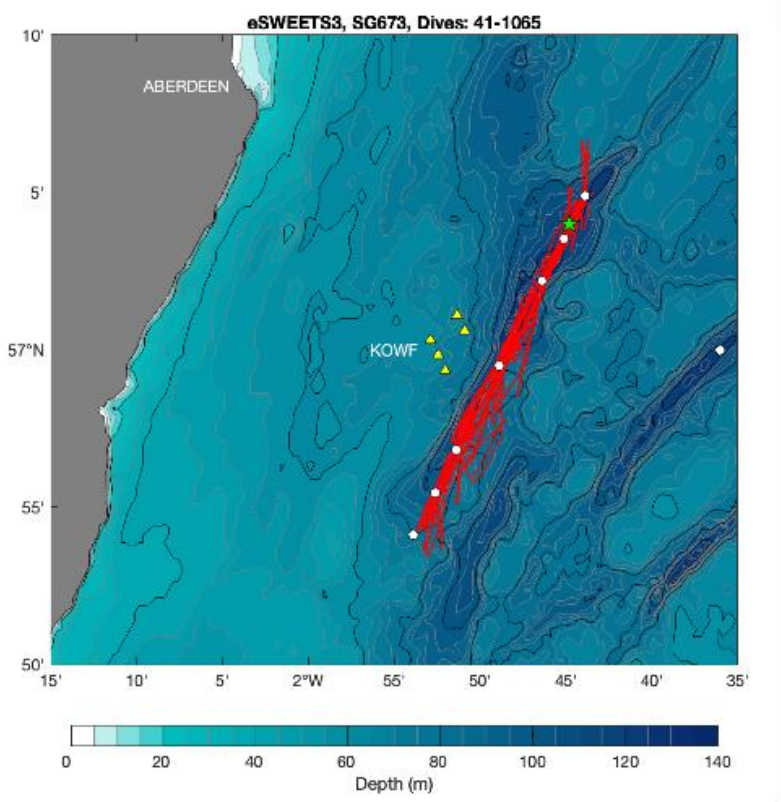


Figure 1 - SG673 track through water. Waypoints are indicated by white dot, the turbines are indicated with yellow triangles and the point of recovery by the green star

Glider Science Timeseries

Figure 2 shows the T-S curve for the entire mission, with measured oxygen shown as plot colour. Figure 3 shows the full timeseries of the uncalibrated temperature, salinity, chlorophyll, turbidity, salinity and temperature corrected oxygen with an arbitrary offset, and PAR. Through the deployment period the degree of stratification decreased with smaller surface bottom temperature differences by the end of the deployment and a more mixed water column. The salinity shows signs of significant lag, with one dive removed due to anomalous data. The chlorophyll profiles show evidence of non-photochemical quenching, with reduced fluorescence in the top 10 metres on a daily cycle. Unfortunately, the PAR sensor failed with non-physical readings through the water column. This was switched off to conserve after dive 121.

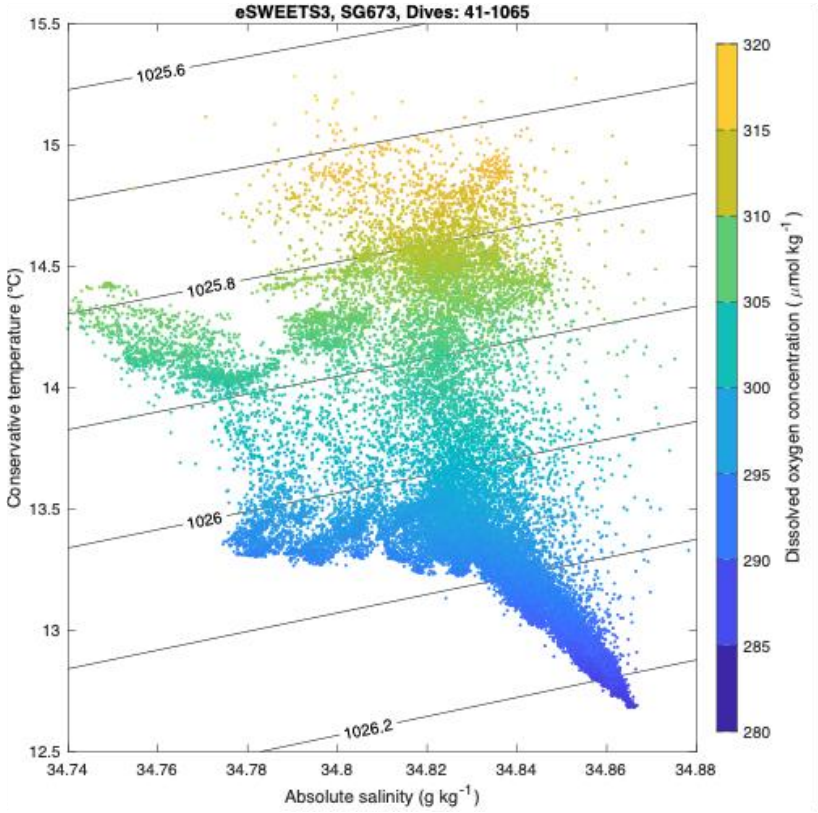


Figure 2 - SG673 T-S plot coloured by dissolved oxygen

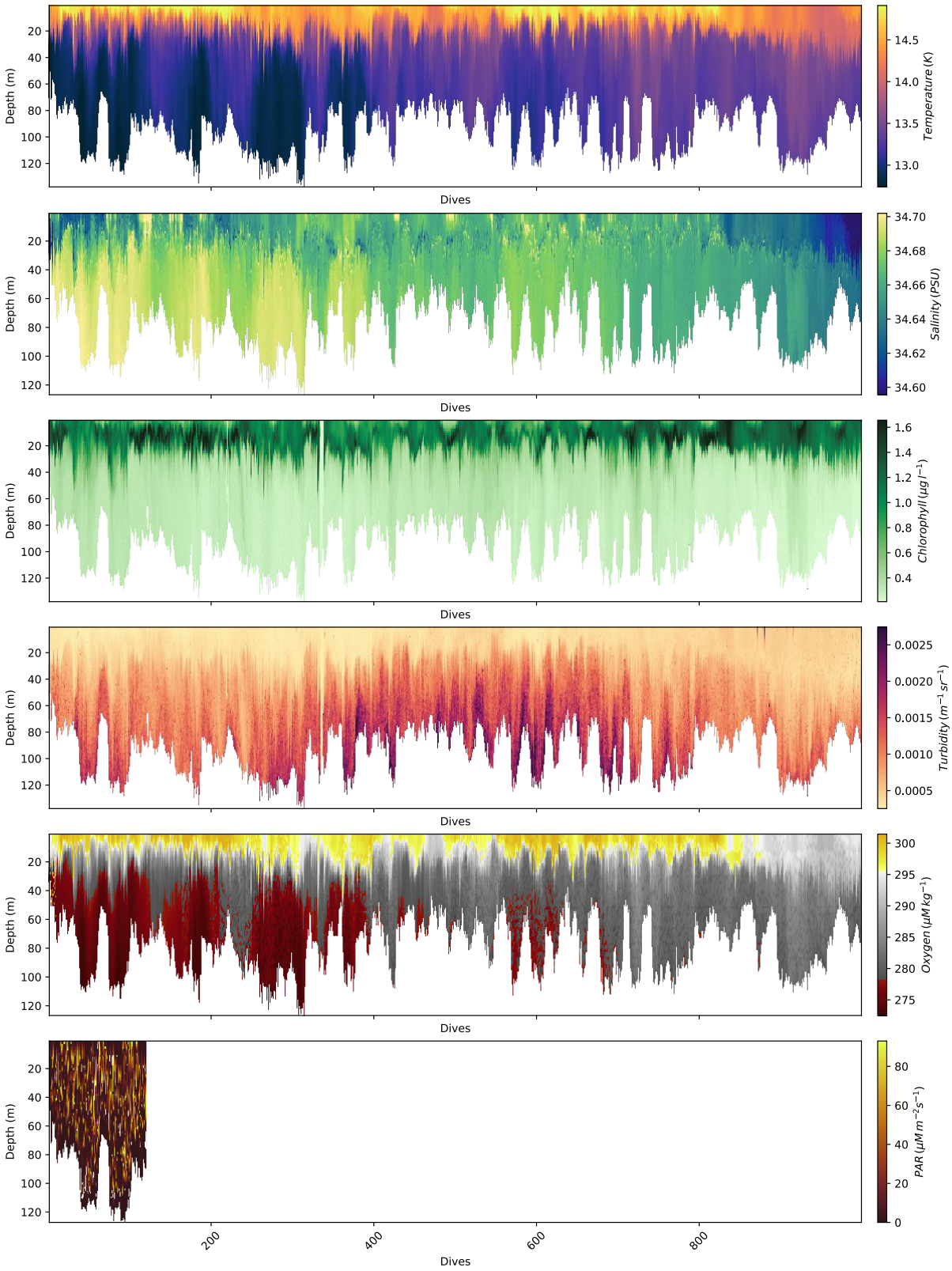


Figure 3 - SG673 uncalibrated scientific sensor timeseries

Hornsea wind farm sampling

Benjamin Whitcombe

Hornsea Dogger Bank, the world's largest offshore wind farm, comprises 339 Turbines, situated 89 km from the Yorkshire coast. Aboard RRS Discovery, stations HS1-HS6 were sampled, with repeat sampling at HS1, 4, 5, and 6 after tidal changes to investigate the impact of offshore monopile infrastructure upon phytoplankton dynamics. Station locations are illustrated in Figure 1 below. Additionally, Table 1 presents the station coordinates, their corresponding sampling dates and times, and the depths from which samples were taken.

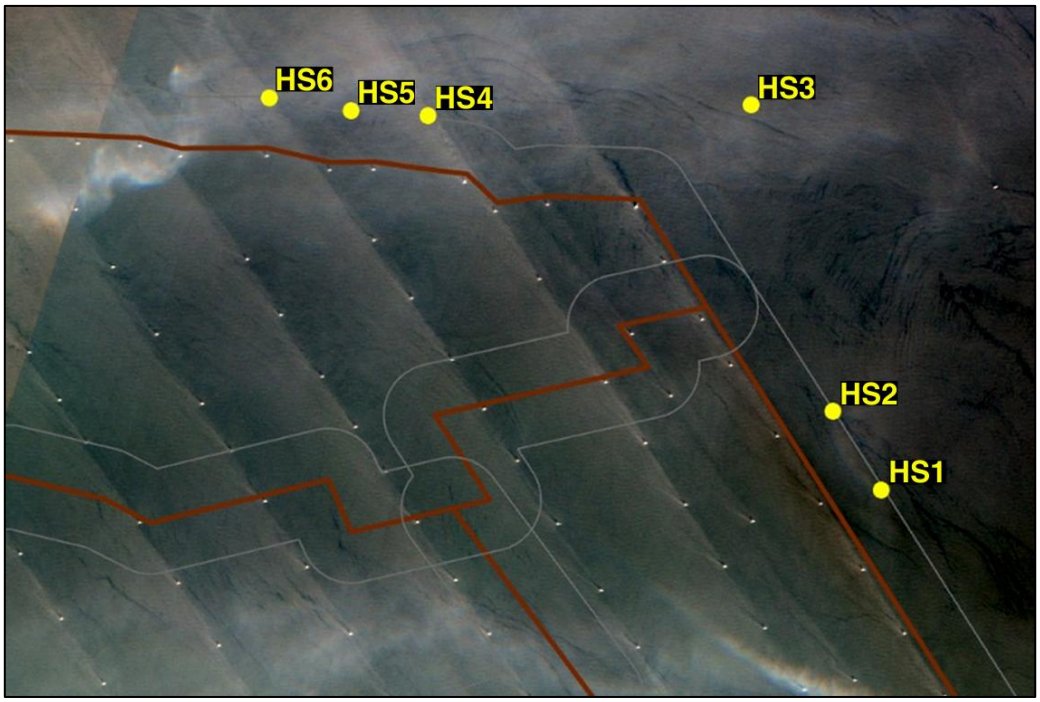


Figure 4: Hornsea Dogger Bank Stations sampled aboard RRS Discovery with wind farm boundaries and 1km buffer lines overlaying a Sentinel-2 image showing turbine sediment wakes.

Table 1: Hornsea Dogger Bank station coordinates, their corresponding sampling dates and times, and the depths from which samples were taken.

Station	Date	Time (UTC)	Latitude	Longitude	Underway System Sample Depth (M)	Fluorescence Maximum Sample Depth (M)	Deep Water Sample Depth (M)
HS1a	12/08/2025	20:04	53°55.490'N	002°09.226'E	5.00	20.00	25.00
HS1b	12/08/2025	22:05	53°55.503'N	002°09.230'E	5.00	21.00	26.00
HS2	12/08/2025	23:04	53°56.300'N	002°08.369'E	5.00	14.00	27.00
HS3	13/08/2025	01:06	53°59.506'N	002°06.879'E	5.00	24.00	54.00
HS4a	13/08/2025	03:00	53°59.425'N	002°01.079'E	5.00	34.00	48.00
HS5a	13/08/2025	04:00	53°59.483'N	001°59.745'E	5.00	27.00	48.00
HS6a	13/08/2025	04:58	53°59.611'N	001°58.308'E	5.00	23.00	49.00
HS6b	13/08/2025	05:30	53°59.611'N	001°58.308'E	5.00	20.00	51.00
HS5b	13/08/2025	06:00	53°59.462'N	001°59.765'E	5.00	14.00	49.00
HS4b	13/08/2025	07:00	53°59.407'N	002°01.138'E	5.00	18.00	50.00

Sampling incorporated Conductivity, Temperature, and Depth sensor profiles, fluorometry, and HPLC pigment analysis to resolve fine-scale vertical and horizontal gradients in chlorophyll, temperature, salinity, nutrients, and pH. The instruments used can be seen in Table 2. CTD casts were undertaken at each station, firing Niskin bottles at the maximum depth and Fluorescence maximum, water from the ship's underway system was taken to analyse surface waters. For each sample, vacuum filtration was used to filter 2 litres of water. Filters were then stored in the -80 °C freezer aboard. Additionally, water from each sample was poured into a separate small container, and the pH sensor was dipped into and swirled in the sample. The value was then recorded. Furthermore, raw sweater and seawater filtered using syringe filter tips were analysed using the FRRFII Fluorometer to measure chlorophyll mg/m^3, Functional absorption cross section of PSII (σ_{PSII}), and the maximum quantum efficiency of photochemistry (F_V/F_M). Filtered water was also measured using the Hanna Instruments Marine Master Multiparameter Photometer for Nitrate and Phosphate values.

Additionally, Sentinel-1 and Sentinel-2 imagery will be analysed, to reveal sediment wakes and tidal variability linked to turbine-induced hydrodynamic changes. Sentinel-3 Ocean colour images will also be analysed to investigate frontal gradients and seasonal changes in primary productivity. Copernicus Ocean Physics Model Data will also be used to analyse hourly ocean current speed and direction around the wind farm. Together, these datasets will help enhance our understanding of phytoplankton dynamics across mixed and stratified waters, improving the detection of subtle shifts in productivity and water clarity, as well as how these are influenced by offshore wind farm infrastructure.

Table 2: Instruments used aboard RRS Discovery for sampling, and the parameters measured

Instrument	Parameter Measured
Seabird CTD	Conductivity (to calculate Salinity), Temperature, Pressure (Depth), Dissolved oxygen, Turbidity, PAR and Chlorophyll Fluorescence.
Chelsea Technologies FRRFII Fast Act Fluorometer	Chlorophyll Fluorescence
Hanna Instruments Marine Master Multiparameter Photometer	Marine Nitrate Marine Phosphate
Hanna Instruments pH sensor	pH

Moorings Technical Report

Sensors and Moorings
National Marine Facilities
Paul Henderson, Jon Short, Dougal Mountifield & Finnegan Sougioultzoglou

Summary

Two NMF provided moorings, K1 and K3, where deployed on DY197. Both moorings where of a similar design with a low-profile anchor with twin releases. Immediately above the releases was a buoy 300kHz up looking ADCP along with a SBE 37 (microCAT), RBRconcerto and Novatch Iridium beacon. Full instrument list and mooring design is found at the end of this document. Between the buoy and the surface billings float thermistors were secured every couple of meters with a small number of SBE37s and RBRduos. The surface billings float had a Novatech strobe beacon to impove visibility of the mooring at night and 15m of recovery line. Full instrument lists and mooring diagrams are found at the end of this document.

RBRsolo, RBRduo and RBRconcero instruments were provided by the science party. All other instruments and hardware was provided by NMF.

K1

Deployed: 2025-08-14 10:46:29 UTC

Latitude: 57° 5.036’ N

Longitude: 001° 48.497’ W

Released: 2025-09-04 12:42:11 UTC

K3

Deployed: 2025-08-14 13:50:02 UTC

Latitude: 56° 56.970’ N

Longitude: 001° 54.007’ W

Released: 2025-09-04 16:10:03 UTC

Issues

Missing Thermistor Loggers – Four thermistor loggers (either RBRsolos or StarODDIs) were missing from the instrumentation supplied. The following sensor locations were removed from the planned moorings: K1 108m &118m, and K3 78m & 88m.

Strobe Beacons – Both Novatech strobe beacons failed two weeks after deployment due to depleted batteries. These beacons were swapped out for new beacon using the ship's fast rescue craft at the earliest opportunity.

SBE37 9382 – A warning sticker was left on SBE37 9382 during deployment. Caution is advised before using the temperature and conductivity data from this instrument. The data should be validated against the RBRconcerto co-located on the same buoy.

Instrument Setup

Instruments (including those supplied by the science party) were setup by embarked NMF technicians. RBEsolo, RBRduo, StarODDI and SBE37s were setup to log once a minute. RBRconcertos were setup to log once every 5 minutes. 300kHz ADCPs were programed with 6 seconds between pings with a 5-minute ensemble (60 pings). All setup config files were saved prior to deployment and an example for each instrument type is appended to the end of this document.

Data was recovered from all instruments on recovery. All data was recovered successfully.

All mooring data and associated documents were saved to the following folder:

current_cruise\Sensors_and_Moorings\MOORINGS

K1 Instrument List and Mooring Diagram

Depth (on diagram)	Component	Instrument	Serial Number
10	Nautilus	N/A	N/A
23	MTD	RBRSolo	76498
26	Billings 3 sphere	N/A	N/A
27	MTD on billings	RBRSolo	76500
27	Light	Novatech	A08-013
30	MTD on chain	RBRSolo	76501
33	MTD	RBRSolo	76516
35	SBE37	SBE37	9396
37	MTD	RBRSolo	76517
40	MTD	RBRSolo	236399
42	MTD	RBRDuo	50749
45	2x glass	N/A	N/A
45	MTD	RBRSolo	236400
47	2x glass	N/A	N/A
47	MTD	RBRSolo	236401
49	2x glass	N/A	N/A
49	MTD	RBRSolo	236402

51	MTD	RBRDuo	50751
54	MTD	RBRSolo	236403
56	MTD	RBRSolo	236404
59	MTD	StarODDI	4196
61	MTD	StarODDI	4197
64	MTD	RBRDuo	50750
66	3x glass	N/A	N/A
69	MTD	StarODDI	4198
74	MTD	StarODDI	4199
77	2x glass	N/A	N/A
78	MTD	RBRDuo	50752
83	MTD	StarODDI	4214
88	MTD	StarODDI	4221
94	MTD	StarODDI	4247
97	2x glass	N/A	N/A
98	SBE37	SBE37	11110
103	MTD	StarODDI	4248
113	MTD	StarODDI	4249
123	MTD	StarODDI	4251
126	SBE37	SBE37	11137
127	33in Buoy	N/A	N/A
127	300kHz ADCP	300kHz	24496
127	RBRConcerto	RBRConcerto	236397
127	Beacon	Novatech	J06863
128	MTD on release	StarODDI	4252
128	Releases	OCEANO 2500	1502
128	Releases	OCEANO 2500	1748
130	Anchor	N/A	N/A

eSweets-K1$_v$2

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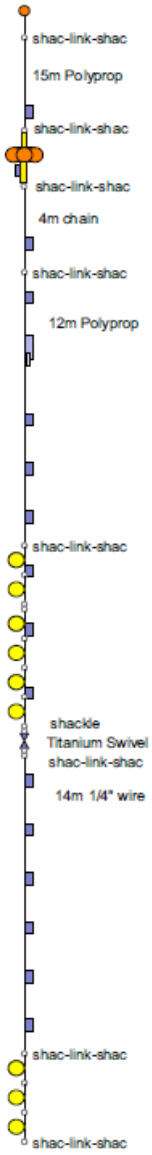
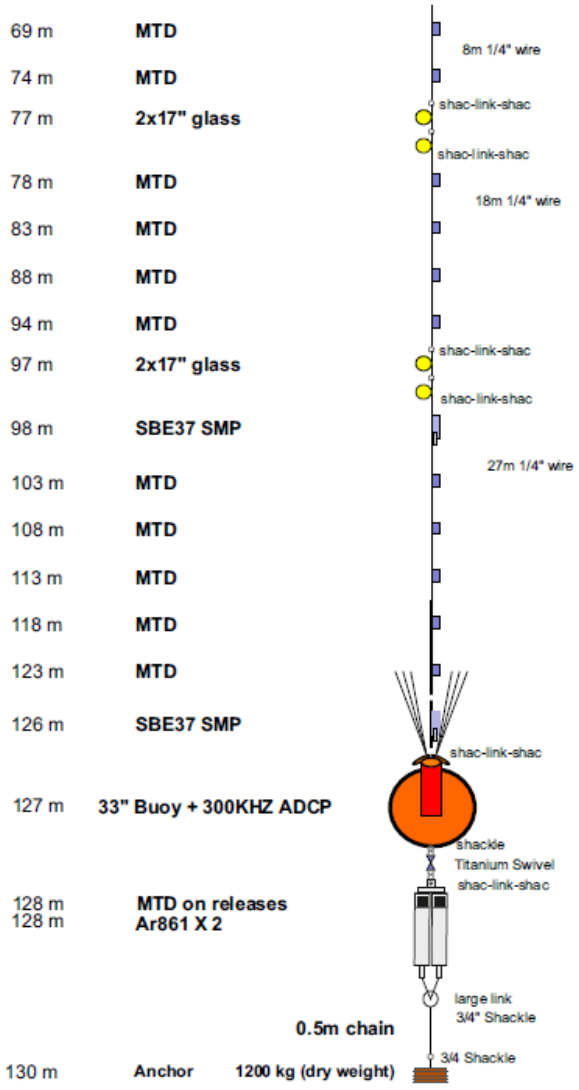
depth (incl. stretch)	component	S/N	rope # & Length	Distance from lower rope end	in/out of water comment
10 m	**Nautilus 13"**				
23 m	**MTD**				
26 m	**Billings 3 sphere**				
27 m	**MTD on billings mast**				
30 m	**MTD on chain**				
33 m	**MTD**				
35 m	**SBE37 SMP**				
37 m	**MTD**				
40 m	**MTD**				
42 m	**MTD**				
45 m	**2x17" glass**				
45 m	**MTD on chain**				
47 m	**2x17" glass**				
47 m	**MTD on chain**				
49 m	**2x17" glass**				
49 m	**MTD on chain**				
51 m	**MTD**				
54 m	**MTD**				
56 m	**MTD**				
59 m	**MTD**				
61 m	**MTD**				
64 m	**MTD**				
66 m	**3x17" glass**				



eSweets-K1$_v$2					09-Jul-2025 9:51 Page # 2 / 4
depth (incl. stretch)	component	S/N	rope # & Length	Distance from lower rope end	in/out of water comment



K3 Instrument List and Mooring Diagram

Depth (on diagram)	Component	Instrument	Serial
12	Nautilus	N/A	N/A
25	MTD	StarODDI	4253
28	Billings 3 sphere	N/A	N/A
28	Light	Novatech	A08-016
29	MTD on billings	StarODDI	4257
31	MTD on chain	StarODDI	4278
34	MTD	StarODDI	4279
36	SBE37	SBE37	3276
39	MTD	StarODDI	4280
41	MTD	StarODDI	4281
44	2x glass	N/A	N/A
44	MTD	StarODDI	4282
46	2x glass	N/A	N/A
46	MTD	StarODDI	4283
48	2x glass	N/A	N/A
48	MTD	StarODDI	4285
50	MTD	RBRDuo	50753
53	MTD	StarODDI	4286
55	MTD	StarODDI	4287
58	MTD	StarODDI	4288
60	MTD	StarODDI	4290
63	MTD	StarODDI	4291
65	MTD	StarODDI	4292
67	1x glass	N/A	N/A
68	SBE37	SBE37	11139
73	MTD	StarODDI	4293
83	MTD	StarODDI	4294
93	MTD	StarODDI	4295
98	SBE37	SBE37	9382
99	33in Buoy	N/A	N/A
99	300kHz ADCP	300kHz	24588
99	RBRConcerto	RBRConcerto	236398
99	Beacon	Novatech	H04-023
100	MTD on release	StarODDI	4303
101	Release	OCEANO 2500	1497
101	Release	OCEANO 2500	2334
103	Anchor	N/A	N/A

eSweets-K3$_v$1

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9:51
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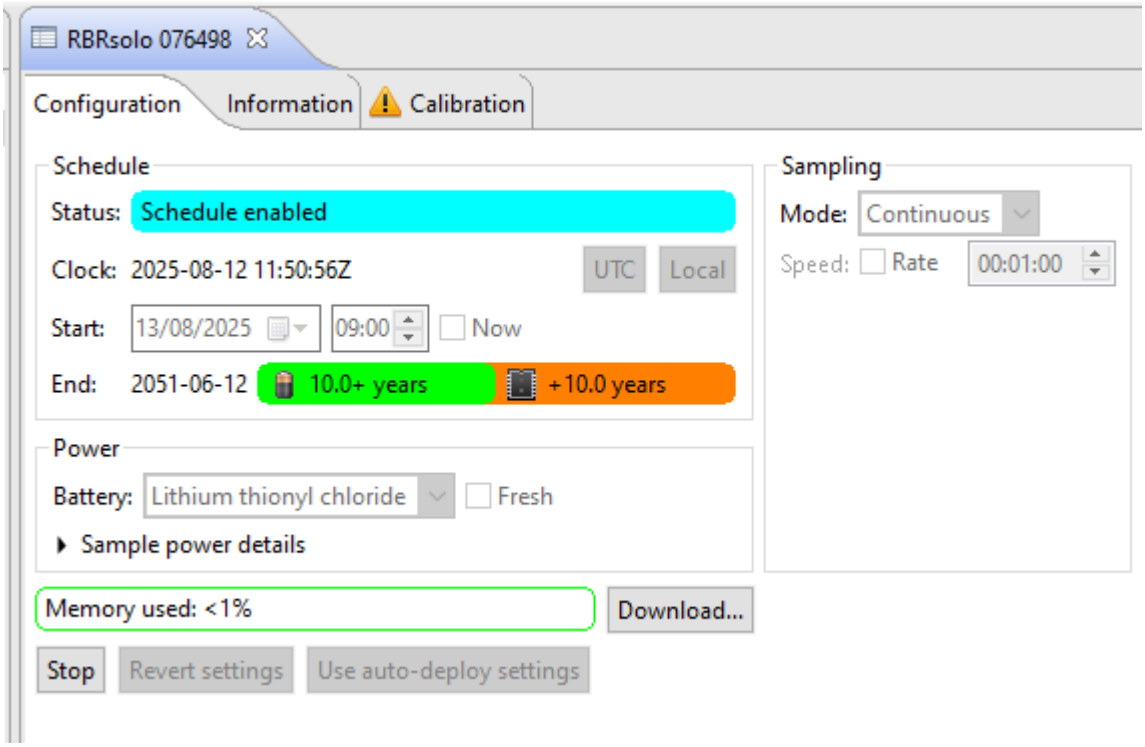
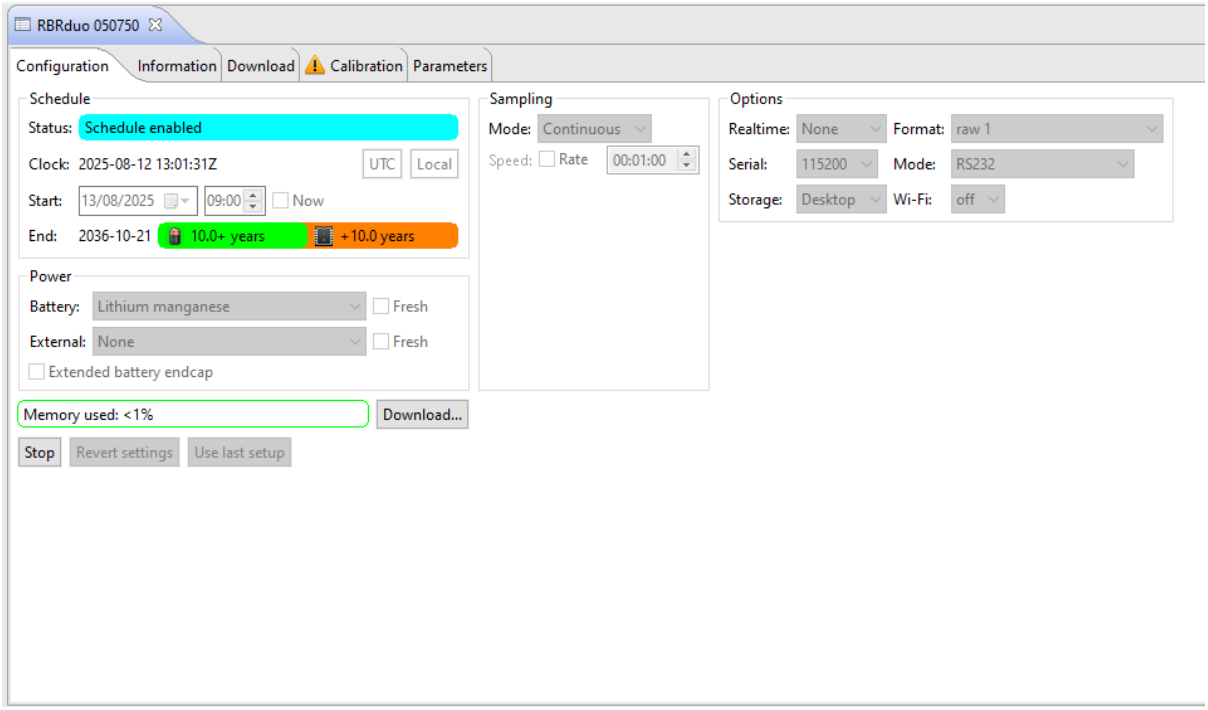
depth (incl. stretch)	component	S/N	rope # & Length	Distance from lower rope end	in/out of water comment
12 m	**Nautilus 13"**				
				shac-link-shac	
				15m Polyprop	
25 m	**MTD**				
				shac-link-shac	
28 m	**Billings 3 sphere**				
29 m	**MTD on billings mast**				
				shac-link-shac	
				4m chain	
31 m	**MTD on chain**				
				shac-link-shac	
34 m	**MTD**				
				9.5m Polyprop	
36 m	**SBE37 SMP**				
39 m	**MTD**				
41 m	**MTD**				
				shac-link-shac	
44 m	**2x17" glass**				
44 m	**MTD on chain**				
46 m	**2x17" glass**				
46 m	**MTD on chain**				
48 m	**2x17" glass**				
48 m	**MTD on chain**				
				shackle	
				Titanium Swivel	
				shac-link-shac	
50 m	**MTD**				
				16.5m 1/4" wire	
53 m	**MTD**				
55 m	**MTD**				
58 m	**MTD**				
60 m	**MTD**				
63 m	**MTD**				
65 m	**MTD**				
67 m	**1x17" glass**			shac-link-shac	
				shac-link-shac	
68 m	**SBE37 SMP**				
				30m 1/4" wire	
73 m	**MTD**				
78 m	**MTD**				
83 m	**MTD**				
88 m	**MTD**				
93 m	**MTD**				
98 m	**SBE37 SMP**				
				shac-link-shac	
				1m CHAIN	
99 m	**33" Buoy + 300KHZ ADCP**				
				shackle	
				Titanium Swivel	
				shac-link-shac	
100 m	**MTD on releases**				
101 m	**Ar861 X 2**				
				large link	
				3/4" Shackle	
			0.5m chain		
				3/4 Shackle	
103 m	**Anchor**	**700 kg (dry weight)**			

Instrument Setup Examples

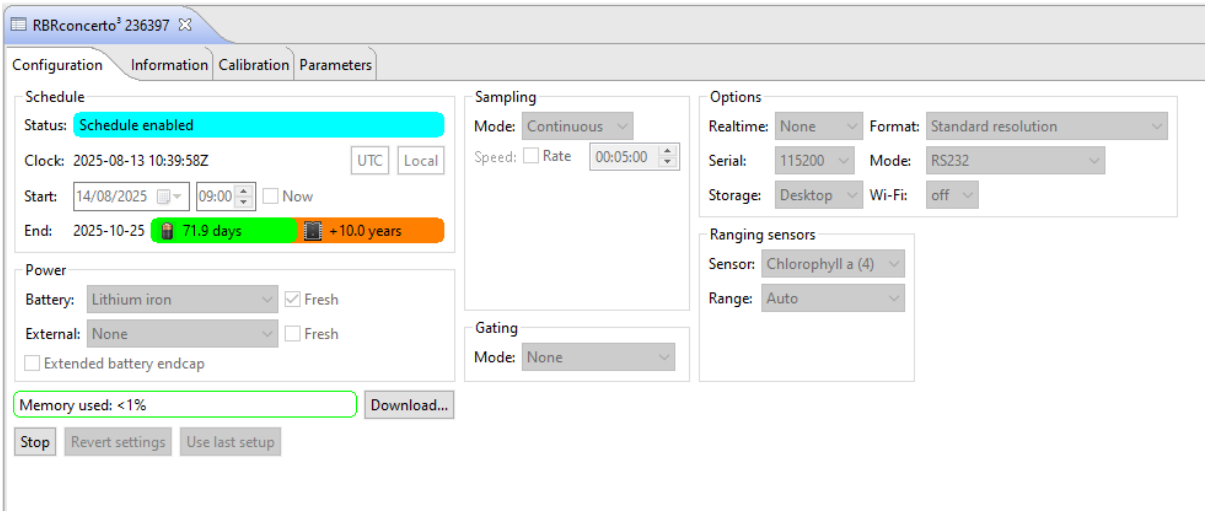
RBRsolo



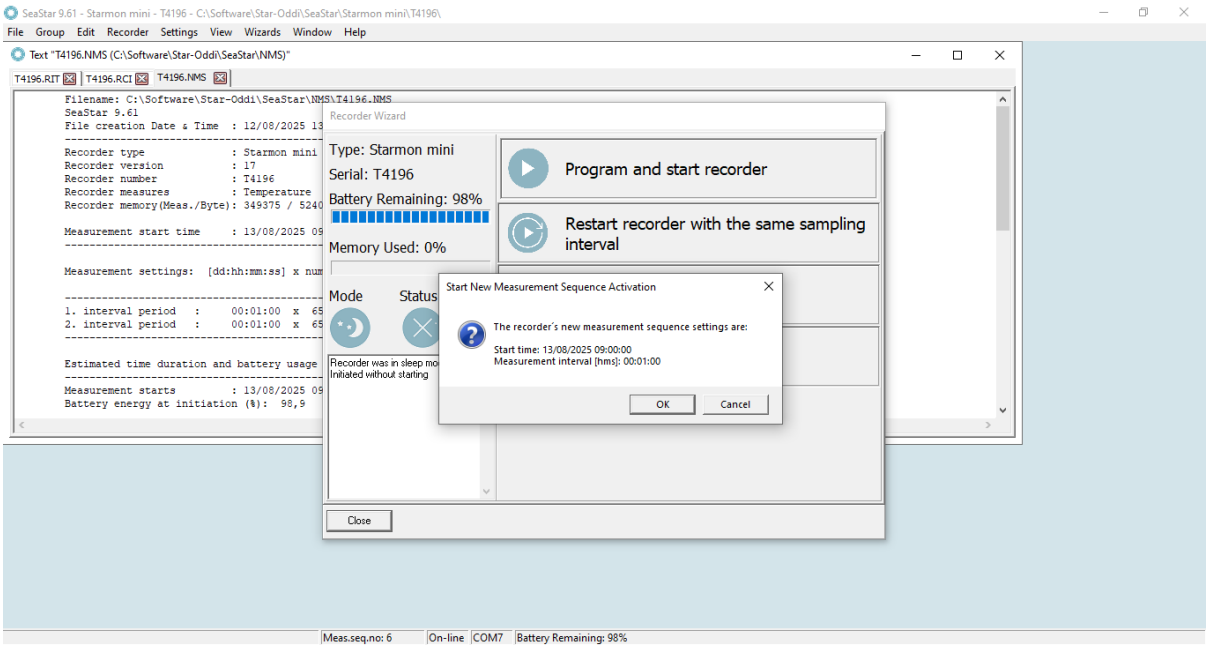
RBRduo



RBRconcerto



StarODDI



SBE37

DS
SBE37SM-RS232 v4.1 SERIAL NO. 11110 12 Aug 2025 09:10:45
vMain = 13.35, vLith = 2.86
samplenumber = 1, free = 559239
not logging, waiting to start at 14 Aug 2025 08:00:00
sample interval = 60 seconds

data format = converted engineering
transmit real-time = no
sync mode = no
pump installed = yes, minimum conductivity frequency = 3149.0
S>DC
SBE37SM-RS232 v4.1 11110
temperature: 06-Apr-25
   TA0 = -1.108004e-04
   TA1 = 3.089122e-04
   TA2 = -4.649455e-06
   TA3 = 2.078230e-07
conductivity: 06-Apr-25
   G = -9.933438e-01
   H = 1.418639e-01
   I = -2.146593e-04
   J = 3.772478e-05
   CPCOR = -9.570000e-08
   CTCOR = 3.250000e-06
   WBOTC = 2.202082e-07
pressure S/N 2143068, range = 10153 psia 01-Apr-25
   PA0 = -3.562526e+00
   PA1 = 3.092216e-02
   PA2 = 1.960156e-09
   PTCA0 = 5.234236e+05
   PTCA1 = -1.041975e+01
   PTCA2 = 2.486637e-01
   PTCB0 = 1.014312e+02
   PTCB1 = -9.036423e-03
   PTCB2 = 0.000000e+00
   PTEMPA0 = -9.606688e+01
   PTEMPA1 = 3.972601e-02
   PTEMPA2 = 1.432521e-06
   POFFSET = 0.000000e+00
S>gethd
<HardwareData DeviceType = 'SBE37SM-RS232' SerialNumber = '03711110'>
  <Manufacturer>Sea-Bird Electronics, Inc.</Manufacturer>
  <FirmwareVersion>4.1</FirmwareVersion>
  <FirmwareDate>Jan 17 2012 15:32:03</FirmwareDate>
  <CommandSetVersion>1.0</CommandSetVersion>
  <PCBAssembly>41720A</PCBAssembly>
  <PCBSerialNum>62343</PCBSerialNum>
  <PCBAssembly>41660B</PCBAssembly>
  <PCBSerialNum>60603</PCBSerialNum>
  <PCBAssembly>41661B</PCBAssembly>
  <PCBSerialNum>62308</PCBSerialNum>
  <MfgDate>01-AUG-2013</MfgDate>
  <FirmwareLoader>SBE 37-232-V3 FirmwareLoader V 1.0</FirmwareLoader>
  <InternalSensors>
    <Sensor id = 'Temperature'>
      <type>temperature-1</type>
      <SerialNumber>03711110</SerialNumber>
    </Sensor>
    <Sensor id = 'Conductivity'>
      <type>conductivity-1</type>
      <SerialNumber>03711110</SerialNumber>
    </Sensor>

```
    <Sensor id = 'Pressure'>
      <type>strain-0</type>
      <SerialNumber>2143068</SerialNumber>
    </Sensor>
  </InternalSensors>
</HardwareData>
S>
```

TRDI 300kHz ADCP

```
; DY197 eSWEETS3 (Sharples)
; WHS300 K1 & K3 Moorings
; 52 x 2m bins
; First depth cell 4.69m
; Last depth cell 106.69m
; 6 seconds per ping, 50 pings per ensemble, 5 minute ensemble interval
; RDI Plan Estimated Standard Deviation = 0.98cm/s
; RDI Plan Estimated Storage Required = 9.84 Mb
; RDI Plan Estimated Power Usage = 174.42 Wh
; RDI Plan Estimated Battery Usage = 0.4 batteries
; Dougal Mountifield (NMF) & Jonathan Sharples 12 August 2025
;
$T                  ; Set ADCP Clock to PC Time
PS0                 ; Display System Configuration
CR1                 ; Restore Factory Defaults
WM1                 ; General Purpose Profiling - Mode 1 (default)
CF11101                     ; Disable Serial Output
EA00000                     ; Zero Beam 3 Misalignment (default)
EB00000                     ; Zero Heading Bias (default)
EC1500        ; Speed of sound 1500 m/s (default)
ED00000                     ; 0m Transducer Depth (default)
ES35                ; Salinity 35PSU (default)
EX11111             ; Earth Coord Tranformations, Use Tilts, Allow 3-beam solutions, Use bin mapping (default)
EZ0011101           ; Use temp, heading and tilt sensors (use EC speed of sound, ED depth, ES salinity)
WA50                ; False Target Fish filter 50 counts (default)
WB0                 ; Wide Bandwidth (default)
WC064               ; 64 count Low Correlation Threshold for 3-beam solution (default)
WD111100000         ; Collect and Process all data (default)
WF225               ; 2.25m Blank (TRDI recommended blank for 6000m rated 300kHz WHS)
WN52                ; 52 Bins
WP50                ; 50 Pings Per Ensemble
WS200               ; 2m Bins
WV175               ; 175cm/s Ambiguity Velocity
TE00:05:00.00       ; 5 Minute Minimum Time Per Ensemble
TP00:06.00          ; 6 Second Minimum Time Between Pings
CK                  ; Save As User Defaults
CS                  ; Start Pinging
```

CTD Technical Report

Sensors and Moorings
National Marine Facilities
Finnegan Sougioultzoglou, Paul Henderson, Jon Short, & Dougal Mountifield

CTD Cast Summary

Total number of casts: 208

Stainless steel frame: 57 CTD profiles and 151 CTD casts with bottle stops

Deepest cast:

Stainless steel frame – 127m CTD202

CTD	Date	Time In Water	Station Number	Max Wire Out	Water Depth (uncorrected)	Comments	FRRF3
1	12/08/2025	20:03:00	HS1	26	34	2x concertos	
2	12/08/2025	22:00:00	HS1	26	34	2x concertos	
3	12/08/2025	23:01:00	HS2	27	34	2x concertos	
4	13/08/2025	01:00:00	HS3	53	62	2x concertos	
5	13/08/2025	03:00:00	HS4	50	57	2x concertos	no (battery)
6	13/08/2025	04:02:00	HS5	48	56	2x concertos	
7	13/08/2025	04:58:00	HS6	50	58	2x concertos	
8	13/08/2025	05:28:00	HS6	51	58	2x concertos	
9	13/08/2025	06:03:00	HS5	49	58	2x concertos, 1x USBL WMT	
10	13/08/2025	07:04:00	HS4	50	60	2x concertos, 1x USBL WMT	
11	14/08/2025	02:17:00	Seagreen	50	58	1x FRRF3, Lander instruments (1x SBE37, 1x RBR Maestro)	
12	14/08/2025	11:10:00	K1	88	97	Profile only	
13	14/08/2025	14:05:00	K3	61	71	Profile only	
14	14/08/2025	18:46:00	M4	81	90	Lander validation, profile only, No LADCP	no (battery)
15	14/08/2025	19:53:00	Z1	93	103	CTD before nets	
16	14/08/2025	23:25:00	Z2	82	91	CTD before nets	
17	15/08/2025	02:35:00	Z3	67	75	CTD before nets	
18	15/08/2025	05:29:00	TE	77	84		

19	16/08/2025	19:02:00	TS	63	73	TS 25 hr station commences	no (battery)
20	16/08/2025	20:33:00	TS	63	73		
21	16/08/2025	22:01:00	TS	63	71	Profile only	
22	17/08/2025	23:32:00	TS	62	71		
23	17/08/2025	01:01:00	TS	61	71	Profile only	
24	17/08/2025	02:30:00	TS	57	72		
25	17/08/2025	04:00:00	TS	63	72	Profile only	
26	17/08/2025	05:30:00	TS	64	73		
27	17/08/2025	07:00:00	TS	64	73		
28	17/08/2025	08:30:00	TS	59	73		
29	17/08/2025	10:00:00	TS	63	72	Profile only	
30	17/08/2025	11:27:00	TS	61	72		
31	17/08/2025	12:58:00	TS	62	71	Profile only	
32	17/08/2025	14:27:00	TS	62	72		
33	17/08/2025	15:56:00	TS	62	72	Profile only	
34	17/08/2025	17:27:00	TS	63	72		
35	17/08/2025	18:58:00	TS	63	73	Profile only	
36	17/08/2025	20:29:00	TN	84	94	TN 25 hr station commences	
37	17/08/2025	21:57:00	TN	84	94		
38	18/08/2025	23:32:00	TN	84	93		
39	18/08/2025	01:01:00	TN	82	93	Profile only	
40	18/08/2025	02:30:00	TN	82	92		
41	18/08/2025	04:00:00	TN	83	93	Profile only	
42	18/08/2025	05:30:00	TN	84	93		
43	18/08/2025	07:02:00	TN	84	93	Profile only	
44	18/08/2025	08:32:00	TN	85	94		
45	18/08/2025	10:00:00	TN	85	94	Profile only	
46	18/08/2025	11:27:00	TN	83	93		
47	18/08/2025	12:58:00	TN	83	92	Profile only	
48	18/08/2025	14:28:00	TN	82	92		
49	18/08/2025	15:58:00	TN	82	92	Profile only	
50	18/08/2025	17:28:00	TN	83	93		
51	18/08/2025	18:58:00	TN	83	93	Profile only	

52	18/08/2025	20:28:00	TN	84	94		
53	19/08/2025	00:52:00	Z1	93	102	Nets before CTD	
54	19/08/2025	03:36:00	Z3	65	72	Nets before CTD	no (battery)
55	19/08/2025	17:01:00	TE	73	82	TE 25 hr station commences	no (battery)
56	19/08/2025	18:28:00	TE	73	82	Profile only	
57	19/08/2025	19:57:00	TE	73	83		
58	19/08/2025	21:27:00	TE	73	84	Profile only	
59	19/08/2025	23:01:00	TE	75	84		
60	20/08/2025	00:33:00	TE		84	Profile only	
61	20/08/2025	02:02:00	TE	75	83		
62	20/08/2025	03:30:00	TE	73	82	Profile only	
63	20/08/2025	05:00:00	TE	72	82		
64	20/08/2025	06:29:00	TE	72	82	Profile only	
65	20/08/2025	07:58:00	TE	73	82		
66	20/08/2025	09:31:00	TE	74	83	Profile only	
67	20/08/2025	10:58:00	TE	76	84		
68	20/08/2025	12:28:00	TE	74	84	Profile only	
69	20/08/2025	13:58:00	TE	73	83		
70	20/08/2025	15:28:00	TE	73	83	Profile only	
71	20/08/2025	16:38:00	TE	73	82		
72	20/08/2025	18:42:00	C9	78	88		
73	20/08/2025	20:13:00	C7	86	95		no (battery)
74	20/08/2025	21:43:00	C5	109	119		
75	21/08/2025	00:00:00	C3	81	90		
76	21/08/2025	01:02:00	C1	64	73		
77	21/08/2025	03:35:00	K1		98		
78	21/08/2025	05:01:00	K3		69		
79	21/08/2025	09:01:00	Z1	92	103		
80	21/08/2025	12:35:00	Z3	67	76		
81	21/08/2025	15:34:00	Z1	93	104		
82	21/08/2025	17:03:00	TN	82	91		
83	21/08/2025	18:14:00	Z2	81	91		
84	21/08/2025	19:25:00	Z3	63	72		
85	21/08/2025	20:19:00	TS	63	72		

86	21/08/2025	21:15:00	Z4	57	66		
87	21/08/2025	13:31:00	BBC	10	93	Fired all bottles at 10m	
88	22/08/2025	17:31:00	C1	61	70		
89	22/08/2025	19:26:00	C3	78	89		
90	22/08/2025	21:28:00	C5	107	116		
91	22/08/2025	23:32:00	C7	88	95		
92	23/08/2025	00:33:00	C9	82	90		
93	23/08/2025	02:30:00	D9	65	75		
94	23/08/2025	04:00:00	D7	103	112		
95	23/08/2025	05:30:00	D5	87	95		
96	23/08/2025	07:01:00	D3	51	59		
97	23/08/2025	08:30:00	D1	50	59	Noisy BBRTD	
98	23/08/2025	12:47:00	Z3	67	76		
99	23/08/2025	16:18:00	Z1	94	103		
100	24/08/2025	21:36:00	TN	80	90	TN 25 hr station commences	no (battery)
101	24/08/2025	22:00:00	TN	81	91	Profile only	
102	24/08/2025	23:30:00	TN	85	94		
103	25/08/2025	01:02:00	TN		95	Profile only	
104	25/08/2025	02:30:00	TN	84	94		
105	25/08/2025	04:00:00	TN	3	94		
106	25/08/2025	05:29:00	TN	83	93	Valeport VA500 disconnected, testing Tritech PA500 via serial uplink, Tritech altimeter data messy	
107	25/08/2025	07:02:00	TN		91	Profile only, Valeport VA500 disconnected, Tritech PA500 connected via serial	
108	25/08/2025	08:32:00	TN	82	91	Tritech PA500 altimeter	
109	25/08/2025	10:00:00	TN		91	Profile only, Tritech PA500 altimeter	
110	25/08/2025	11:31:00	TN	82	92	EK80 fish finder off, scanfish Tritech on frame, LADCP running	
111	25/08/2025	13:06:00	TN	82	94	Profile only, EK80 fish finder off, Scanfish Tritech altimeter on frame on 9P 9600 band uplink (com 9) 19,200, blank at 15-20m	

112	25/08/2025	14:29:00	TN	83	94	Scanfish Tritech altimeter on frame	
113	25/08/2025	16:00:00	TN	84	94	Profile only, Scanfish altimeter removed prior to cast	
114	25/08/2025	17:29:00	TN	83	94		no (battery)
115	25/08/2025	19:00:00	TN	83	93	Profile only	
116	25/08/2025	20:30:00	TN	82	92		
117	26/08/2025	00:00:00	TS	63	73	TS 25 hr station commences	
118	26/08/2025	01:30:00	TS		74	Profile only	
119	26/08/2025	03:00:00	TS	65	74		
120	26/08/2025	04:30:00	TS		74	Profile only	
121	26/08/2025	06:00:00	TS	63	73		
122	26/08/2025	07:30:00	TS		72	Profile only	
123	26/08/2025	09:01:00	TS	62	71		
124	26/08/2025	10:30:00	TS	62	71	Profile only	
125	26/08/2025	11:55:00	TS	62	72		
126	26/08/2025	13:29:00	TS	62	73	Profile only	no (battery)
127	26/08/2025	14:57:00	TS	64	74		
128	26/08/2025	16:25:00	TS	64	74	Profile only	
129	26/08/2025	17:55:00	TS	63	73		
130	26/08/2025	19:29:00	TS	62	72	Profile only	
131	26/08/2025	20:58:00	TS	61	72		
132	26/08/2025	22:08:00	TS	61	72	Profile only	
133	27/08/2025	00:00:00	TS	63	73		
134	27/08/2025	04:59:00	L1	52	61		
135	27/08/2025	06:29:00	L2	50	60		
136	27/08/2025	08:00:00	L3	65	75		
137	27/08/2025	09:30:00	Z3	64	73		
138	27/08/2025	10:59:00	Z2	80	90		
139	27/08/2025	12:27:00	L4	88	98		
140	27/08/2025	13:57:00	L5	65	76		no (battery)
141	27/08/2025	15:29:00	L6	62	72		
142	28/08/2025	03:25:00	Z3		76	Profile only	
143	28/08/2025	04:54:00	Z1	95	105		

144	29/08/2025	16:44:00	D1	54	63		
145	29/08/2025	17:59:00	D3	53	63		
146	29/08/2025	19:28:00	D5	87	97		
147	29/08/2025	20:55:00	D7	102	113		
148	29/08/2025	22:27:00	D9	67	76		
149	30/08/2025	00:54:00	Z3		75	Profile only	
150	30/08/2025	03:09:00	Z1	95	104	Profile only	
151	31/08/2025	03:00:00	TN	82	93	TN 25 hr station commences	
152	31/08/2025	04:30:00	TN		94	Profile only	
153	31/08/2025	05:59:00	TN	84	94		no (battery)
154	31/08/2025	07:30:00	TN		94	Profile only	
155	31/08/2025	09:02:00	TN	82	93		
156	31/08/2025	10:30:00	TN		93	Profile only	
157	31/08/2025	11:57:00	TN	82	92		
158	31/08/2025	13:38:00	TN	80	91	Profile only	
159	31/08/2025	14:58:00	TN	80	91		
160	31/08/2025	16:29:00	TN	80	91		
161	31/08/2025	17:59:00	TN	81	92		
162	31/08/2025	19:27:00	TN	81	92	Profile only	
163	31/08/2025	20:58:00	TN	81	91		
164	31/08/2025	22:00:00	TN	81	91	Profile only	
165	01/09/2025	23:59:00	TN	82	91		
166	01/09/2025	01:29:00	TN		92	Profile only	
167	01/09/2025	03:00:00	TN	82	92		
168	01/09/2025	05:30:00	TS	63	73	TS 25 hr station commences	
169	01/09/2025	06:59:00	TS	63	73		no (battery)
170	01/09/2025	08:30:00	TS	63	73		
171	01/09/2025	09:59:00	TS		73	Profile only	
172	01/09/2025	11:28:00	TS	61	72		
173	01/09/2025	12:57:00	TS	62	69	Profile only	
174	01/09/2025	14:30:00	TS	61	72		
175	01/09/2025	15:59:00	TS	61	72	Profile only	
176	01/09/2025	17:28:00	TS	62	72		

177	01/09/2025	18:58:00	TS	62	73	Profile only	
178	01/09/2025	20:27:00	TS	62	73		
179	01/09/2025	22:00:00	TS	61	73	Profile only	
180	01/09/2025	23:36:00	TS	62	73		
181	02/09/2025	00:59:00	TS		73	Profile only	
182	02/09/2025	02:29:00	TS	62	76		
183	02/09/2025	03:57:00	TS		72	Profile only	
184	02/09/2025	05:27:00	TS	62	73		
185	02/09/2025	10:16:00	Z3	66	76	FLNTU on frame instead of BBRTD	
186	02/09/2025	13:14:00	Z1	92	104	FLNTU on frame instead of BBRTD	
187	02/09/2025	14:26:00	C1	62	73	FLNTU on frame instead of BBRTD	
188	02/09/2025	15:58:00	C3	79	89	FLNTU on frame instead of BBRTD	
189	02/09/2025	17:26:00	C5	103	115	FLNTU on frame instead of BBRTD	
190	02/09/2025	18:56:00	C7	84	94	FLNTU on frame instead of BBRTD	
191	02/09/2025	20:27:00	C9	80	90	FLNTU on frame instead of BBRTD	
192	02/09/2025	22:11:00	D9	66	75	FLNTU on frame instead of BBRTD	no (battery)
193	03/09/2025	00:00:00	D7	103	112	FLNTU on frame instead of BBRTD	
194	03/09/2025	01:29:00	D5	87	96	FLNTU on frame instead of BBRTD	
195	03/09/2025	03:00:00	D3	52	61	FLNTU on frame instead of BBRTD	
196	03/09/2025	04:04:00	D1	52	61	FLNTU on frame instead of BBRTD	
197	03/09/2025	08:08:00	M3		69	FLNTU on frame instead of BBRTD	
198	03/09/2025	10:55:00	M2	66	73	FLNTU on frame instead of BBRTD	
199	03/09/2025	13:17:00	M1	67	77	FLNTU on frame instead of BBRTD	
200	03/09/2025	16:14:00	M4	80	90	FLNTU on frame instead of BBRTD	

201	04/09/2025	06:51:00	Glider Cal		70	FLNTU on frame instead of BBRTD	
202	04/09/2025	10:17:00	Glider Cal	117	127	BBRTD refitted	
203	04/09/2025	10:58:00	Glider Cal	112	122		stayed continuously on for cast 203-204)
204	04/09/2025	12:07:00	K1	92	102	LADCP stayed on	stayed continuously on for cast 203-204)
205	04/09/2025	15:02:00	K3	77	87	oxygen samples	no (battery)
206	04/09/2025	18:40:00	Glider Cal	61	72	Profile	
207	05/09/.2025	03:57:00	TN	82	92		
208	06/09/2025	17:11:00	Z1	92	101	CTD + Nets	

Stainless Steel CTD

Stainless Steel CTD Wire

CTD Wire 2 was used for all casts. The wire was mechanically and electrically terminated on DY197 and load tested to 2 tonnes. Resistance and insulation of the cable were checked periodically. The torque setting on the fasteners of the mechanical termination were checked throughout and no slippage was noted. The wire was greasy throughout most of the casts. The frame was periodically cleaned for grease. The termination was left on at the end of the DY197.

CTD Wire 2 before cast 001 readings:

Resistance 78 Ohms, Insulation >1000 MOhms @500 VDC

CTD Wire 2 readings after cast 208 readings:

Resistance 79 Ohms, >1000 MOhms @500 VDC

Note: The deep tow wire was also mechanically and electrically terminated but *not* load tested. It was prepared in case the SS CTD traction winch misalignment wasn't resolved.

Stainless Steel CTD sensor set-up

CTD frame was setup for DY197 with primary conductivity, temperature, and dissolved oxygen sensor on the vane and secondary conductivity and temperature sensors on the

9plus. Only one oxygen was requested. Other sensors on the frame were altimeter, fluorometer, transmissometer, backscatter, and 2 x PAR.

Full sensors information can be found on the Sensor information sheet – appendix 1.

- On casts CTD 106 – CTD 112 Valeport VA500 was disconnected and dummied in order to test the Tritech PA500 via serial uplink. This was to confirm whether or not the Scanfish Tritech altimeter was working. Tritech altimeter data was messy.
- On casts CTD187 – CTD 201 the BBRTD was swapped with the FLNTURTD from the ScanFish for cross verification (Voltage channel 02).
- On casts CTD208 and CTD209 the Oxygen was swapped with the Oxygen from the Scanfish (SFOxygen).

Stainless Steel Water Samplers

OTE 10L water samples were used on the stainless-steel frame and performed well throughout the cruise with only one water sampler not firing correctly due to unknown reasons. Carousel was cleaned with fresh water to remove dirt possibly preventing latch trigger. Sampler' 21's lanyard and hook were replaced due to the hook being loose.

SeaBird Data Processing CTD

Basic post-processing of the CTD cast data was carried out following guidelines established with BODC (ref. Moncoiffe 7th July 2010).

Both the stainless-steel and titanium CTD casts were processed using SBE Data Processing, V7.26.7. The following modules were used to process the data:

- Data Conversion
- Bottle Summary

CTD2MET processing was carried out for each cast stainless-steel CTD and sent to the Met Office.

Configuration reports for the SeaSave setup can be found in Appendix 2 for all three configurations BBRTD, FLNTURTD, and SFOxygen.

All SeaBird and associated CTD data and documents were saved to the following folder:

N:\DY197\CTD

LADCP on CTD

The CTD frame was fitted with a 300kHz Slave (uploooker) and a 600kHz Master (downlooker). Midway through the cruise the star cable connection with the Slave was not consistent when connecting to the laptop for data download. Attempts were made to clean the pins and adjust the wires but the cable remained temperamental. After cast

CTD201 Jonathan Sharples (Principal Scientist) said we didn't need to log data on the Slave anymore.

Below are the two command files:

WHM300 Slave Command File

```
; DY197 300 kHz LADCP Slave/Upwards
; Dougal Mountifield (NMF) & Rob Hall (UEA)
;
$T                  ; Set LADCP Clock to PC Time
PS0                 ; Display System Configuration
CR1                 ; Restore Factory Defaults
WM15                ; LADCP Water Mode 15
CF11101             ; Disable Serial Output
EA00000             ; Zero Beam 3 Misalignment (default)
EB00000             ; Zero Heading Bias (default)
EC1500      ; Speed of sound 1500 m/s (default)
ED00000             ; Zero Transducer Depth (default)
ES35                ; Salinity 35PSU (default)
EX00100             ; Beam Coordinates, use tilts
EZ0011101           ; Use temp, heading and tilt sensors (use EC speed of sound, ED depth, ES salinity)
TE00:00:01.00       ; 1 Second Minimum Time Per Ensemble (default for WM15)
TP00:01.00          ; 1 Second Minimum Time Between Pings (default for WM15)
LP00001             ; 1 Ping Per Ensemble (default)
LD111100000         ; Collect and Process all data (default)
LF0400              ; LADCP 4m Blank
LN025               ; LADCP 25 Bins
LS0400              ; LADCP 4m Bins (twice the bin size of the 600 kHz Master)
LV250               ; LADCP 250cm/s Ambiguity Velocity (limited to max 330 in LW1 mode)
LJ1                 ; LADCP High Receiver Gain (default)
LW1                 ; LADCP Narrow Bandwidth (default)
LZ30,220; LADCP Default Bottom Detect and Correlation Thresholds
SM2                 ; RDS3 Slave
SA001               ; Wait for Sync Pulse Before Water Ping (default)
SB0                 ; Disable Hardware Break Detection on Channel B
$B                  ; Send a Break
$W">",2             ; Wait up to 2 seconds for prompt before continuing
ST0                 ; Wait Indefinitely For Sync Pulse From Master (default)
RN SLAV_            ; Set filename header to SLAV_
CK                  ; Save As User Defaults
CS                  ; Start Pinging
```

WHS600 Master Command File

```
; DY197 600 kHz LADCP Master/Downwards
; Dougal Mountifield (NMF) & Rob Hall (UEA)
;
$T                  ; Set LADCP Clock to PC Time
PS0                 ; Display System Configuration
CR1                 ; Restore Factory Defaults
WM15                ; LADCP Water Mode 15
```

CF11111 ; Enable Serial Output (sends the ensemble in binary format)
CD001000000 ; Serial Data Out Fields (echo intensity for live serial uplink via CTD SBE9+)
EA00000 ; Zero Beam 3 Misalignment (default)
EB00000 ; Zero Heading Bias (default)
EC1500 ; Speed of sound 1500 m/s (default)
ED00000 ; Zero Transducer Depth (default)
ES35 ; Salinity 35PSU (default)
EX00100 ; Beam Coordinates, use tilts
EZ0011101 ; Use temp, heading and tilt sensors (use EC speed of sound, ED depth, ES salinity)
TE00:00:01.00 ; 1 Second Minimum Time Per Ensemble (default for WM15)
TP00:01.00 ; 1 Second Minimum Time Between Pings (default for WM15)
LP00001 ; 1 Ping Per Ensemble (default)
LD111100000 ; Collect and Process all data (default)
LF0200 ; LADCP 2m Blank
LN025 ; LADCP 25 Bins
LS0200 ; LADCP 2m Bins
LV250 ; LADCP 250cm/s Ambiguity Velocity (limited to max 330 in LW1 mode)
LJ1 ; LADCP High Receiver Gain (default)
LW1 ; LADCP Narrow Bandwidth (default)
LZ30,220; LADCP Default Bottom Detect and Correlation Thresholds
SM1 ; RDS3 Master
SA001 ; Send Sync Pulse Before Water Ping (default)
SB0 ; Disable Hardware Break Detection on Channel B
$B ; Send a Break
$W">",2 ; Wait up to 2 seconds for prompt before continuing
SW05000 ; Ping 500ms after Sending Sync Pulse
RN MAST_ ; Set file name header to MAST_
CK ; Save As User Defaults
CS ; Start Pinging
All associated LADCP data and documents were saved to the following folder:

N:\DY197\LADCP

Autosal

Salts were collected during the cruise and will be sent back to NOC Autosal Calibration Lab for running.

Total crates: 6 crates – 3 CTD and 3 TSG

Appendix 1 – Sensor Information Sheets

Sensor Information Sheet - Setup of Stainless Steel 24-way CTD frame DY197

Instrument / Sensor	Manufacturer/ Model	Serial Number	Channel	Casts Used
Stainless steel 24-way frame	NOCS	SBE CTD 6	N/A	All casts

EM CTD Swivel	Machinery Development Services ST6003-2E2-Ti	1246-2	N/A	All casts
Primary CTD deck unit	SBE 11plus	11P-24680-0588	N/A	All casts
CTD Underwater Unit	SBE 9plus	09P-34173-0758	N/A	All casts
24-way Carousel	SBE 32	32-60380-0805	N/A	All casts
Primary Temperature Sensor	SBE 3P	03P-5785	F0	All casts
Primary Conductivity Sensor	SBE 4C	04C-3272	F1	All casts
Digiquartz Pressure sensor	Paroscientific	90074	F2	All casts
Secondary Temperature Sensor	SBE 3P	03P-5835	F3	All casts
Secondary Conductivity Sensor	SBE 4C	04C-3529	F4	All casts
Primary Pump	SBE 5T	05T-6320	N/A	All casts
Secondary Pump	SBE 5T	05T-3085	N/A	All casts
Primary Dissolved Oxygen Sensor	SBE 43	43-3847	V0	CTD001-207
Primary Dissolved Oxygen (Scanfish)	SBE 43	2819	V0	CTD208
Free	Free	Free	V1	All casts
Altimeter	Valeport VA500	96098	V2	CTD001-105 and CTD112-209
Altimeter	Tritech PA500	403051	V2	CTD106-111
Light Scattering Sensor	WETLabs Light Scattering	BBRTD -758R	V3	CTD001-184 and CTD202-208
Transmissometer	WETLabs C-Star	CST-1837TR	V4	All casts
Fluorometer	CTG Aquatracka MKIII	88-2615-124	V5	All casts
FLNTU	WETLabs	2952	V2	CTD185-201
PAR UWIRR	SBE Satlantic PAR	PARLOGICSW-2348	V6	All casts
PAR DWIRR	SBE Satlantic PAR	PARLOGICSW-2349	V7	All casts
LADCP Down-looking (master)	TRDI WHM 600KHz	01001	N/A	All casts
LADCP Up-looking (slave)	TRDI WHM 300KHz	24609	N/A	CTD001-201
LADCP Battery pack	NOCS	WH008T	N/A	All casts
10L water samplers	Ocean Test Equipment	Set B	N/A	All casts
FRRF	CTG FastOcean3	15-0427-001	N/A	Majority of casts

Stainless Steel CTD Setup w/BBRTD

PSA file: C:\Users\sandm\Documents\Cruises\DY197\Data\Seasave Setup Files\DY197_0758_SS_nmea.psa

Date: 08/10/2025

Instrument configuration file: C:\Users\sandm\Documents\Cruises\DY197\Data\Seasave Setup Files\DY197_0758_SS_nmea.xmlcon

Configuration report for SBE 911plus/917plus CTD

Frequency channels suppressed : 0
Voltage words suppressed : 0
Computer interface : RS-232C
Deck unit : SBE11plus Firmware Version >= 5.0
Scans to average : 1
NMEA position data added : Yes
NMEA depth data added : No
NMEA time added : Yes
NMEA device connected to : PC
Surface PAR voltage added : No
Scan time added : Yes

1) Frequency 0, Temperature

Serial number : 3P-5785
Calibrated on : 14-Dec-24
G : 4.33649690e-003
H : 6.27474509e-004
I : 1.92493533e-005
J : 1.37617577e-006
F0 : 1000.000
Slope : 1.00000000
Offset : 0.0000

2) Frequency 1, Conductivity

Serial number : 4C-3272
Calibrated on : 21-Dec-24
G : -9.78974195e+000
H : 1.27442032e+000
I : -2.66369982e-004
J : 7.40969048e-005
CTcor : 3.2500e-006
CPcor : -9.57000000e-008
Slope : 1.00000000
Offset : 0.00000

3) Frequency 2, Pressure, Digiquartz with TC

Serial number : 90074
Calibrated on : 23-Sep-22
C1 : -6.571123e+004
C2 : 2.050504e-001
C3 : 1.612220e-002
D1 : 2.883800e-002
D2 : 0.000000e+000
T1 : 2.986693e+001
T2 : -2.678465e-004
T3 : 3.986390e-006
T4 : 7.472100e-010
T5 : 0.000000e+000

Slope : 1.00012000
Offset : 0.01710
AD590M : 1.283700e-002
AD590B : -8.642460e+000

4) Frequency 3, Temperature, 2

Serial number : 3P-5835
Calibrated on : 17-Dec-24
G : 4.37865422e-003
H : 6.73100614e-004
I : 2.75414073e-005
J : 2.10068593e-006
F0 : 1000.000
Slope : 1.00000000
Offset : 0.0000

5) Frequency 4, Conductivity, 2

Serial number : 4C-3529
Calibrated on : 03-Jan-25
G : -9.92734862e+000
H : 1.57237764e+000
I : -2.84972044e-003
J : 3.18524198e-004
CTcor : 3.2500e-006
CPcor : -9.57000000e-008
Slope : 1.00000000
Offset : 0.00000

6) A/D voltage 0, Oxygen, SBE 43

Serial number : 43-3847
Calibrated on : 14-June-24
Equation : Sea-Bird
Soc : 3.75100e-001
Offset : -7.21700e-001
A : -3.10060e-003
B : 1.44680e-004
C : -2.34010e-006
E : 3.60000e-002
Tau20 : 1.12000e+000
D1 : 1.92634e-004
D2 : -4.64803e-002
H1 : -3.30000e-002
H2 : 5.00000e+003
H3 : 1.45000e+003

7) A/D voltage 1, Free

8) A/D voltage 2, OBS, WET Labs, ECO-BB

Serial number : BBRTD-758R
Calibrated on : 21/9/2022
ScaleFactor : 0.003461
Dark output : 0.073000

9) A/D voltage 3, Altimeter

Serial number : 96098

Calibrated on : 13/06/2025
Scale factor : 15.000
Offset : 0.000

10) A/D voltage 4, Transmissometer, WET Labs C-Star

Serial number : CST-1837TR
Calibrated on : 17-Oct-2022
M : 21.6525
B : -0.1840
Path length : 0.250

11) A/D voltage 5, Fluorometer, Chelsea Aqua 3

Serial number : 88-2615-124
Calibrated on : 28-Sep-2023
VB : 0.248960
V1 : 2.042400
Vacetone : 0.319730
Scale factor : 1.000000
Slope : 1.000000
Offset : 0.000000

12) A/D voltage 6, PAR/Irradiance, Biospherical/Licor

Serial number : 2348
Calibrated on : February 19, 2024
M : 0.80753400
B : 1.05899300
Calibration constant : 735890000.00000000
Conversion units : umol photons/m^2/sec
Multiplier : 1.00000000
Offset : 0.00000000

13) A/D voltage 7, PAR/Irradiance, Biospherical/Licor, 2

Serial number : 2349
Calibrated on : February 19, 2024
M : 0.80861200
B : 1.05340900
Calibration constant : 735890000.00000000
Conversion units : umol photons/m^2/sec
Multiplier : 1.00000000
Offset : 0.00000000

Scan length : 45

Pump Control
This setting is only applicable to a custom build of the SBE 9plus.
Enable pump on / pump off commands: NO

Data Acquisition:
Archive data: NO
Delay archiving: NO
Data archive: C:\Users\sandm\Documents\Cruises\DY197\Data\CTD Raw Data\DY197_CTD_test.hex
Timeout (seconds) at startup: 60
Timeout (seconds) between scans: 10

Instrument port configuration:
Port = COM1

```
  Baud rate = 19200
  Parity    = N
  Data bits = 8
  Stop bits = 1
-------------------------------------------------
Water Sampler Data:
  Water Sampler Type:   SBE Carousel
  Number of bottles:   36
  Port:            COM5
  Enable remote firing: NO
  Firing sequence:     User input
  Tone for bottle fire confirmation uses PC sound card.
-------------------------------------------------
Header information:
  Header Choice = Prompt for Header Information
    prompt 0 = Ship: RRS Discovery
    prompt 1 = Cruise: DY197
    prompt 2 = Cast:
    prompt 3 = Station:
    prompt 4 = Julian Day:
    prompt 5 = Date:
    prompt 6 = Time [UTC]:
    prompt 7 = Latitude:
    prompt 8 = Longitude:
    prompt 9 = Depth [uncorrected m]
    prompt 10 = Principal Scientist: Jonathan Sharples
    prompt 11 = Operator:
-------------------------------------------------
TCP/IP - port numbers:
  Data acquisition:
    Data port:         49163
    Status port:       49165
    Command port:      49164
  Remote bottle firing:
    Command port:      49167
    Status port:       49168
  Remote data publishing:
    Converted data port:  49161
    Raw data port:     49160
-------------------------------------------------
Miscellaneous data for calculations
  Depth, Average Sound Velocity, and TEOS-10
    Latitude when NMEA is not available:  50.00000000
    Longitude when NMEA is not available: 0.00000000
  Average Sound Velocity
    Minimum pressure [db]:           20.00000000
    Minimum salinity [psu]:          20.00000000
    Pressure window size [db]:       20.00000000
    Time window size [s]:            60.00000000
  Descent and Acceleration
    Window size [s]:                 2.00000000
  Plume Anomaly
    Theta-B:                         0.00000000
    Salinity-B                       0.00000000
    Theta-Z / Salinity-Z             0.00000000
    Reference pressure [db]          0.00000000
  Oxygen
    Window size [s]:                 2.00000000
    Apply hysteresis correction:     1
    Apply Tau correction:            1
```

Potential Temperature Anomaly
A0: 0.00000000
A1: 0.00000000
A1 Multiplier: Salinity

Serial Data Output:
Output data to serial port: NO

Mark Variables:
Variables:
Digits Variable Name [units]
------ ----------
0 Scan Count
4 Depth [salt water, m]
7 Conductivity [S/m]
5 Salinity, Practical [PSU]

Shared File Output:
Output data to shared file: NO

TCP/IP Output:
Raw data:
Output raw data to socket: NO
XML wrapper and settings: NO
Seconds between raw data updates: 0.00000000
Converted data:
Output converted data to socket: NO
XML format: NO

SBE 11plus Deck Unit Alarms
Enable minimum pressure alarm: NO
Enable maximum pressure alarm: NO
Enable altimeter alarm: NO

SBE 14 Remote Display
Enable SBE 14 Remote Display: NO

PC Alarms
Enable minimum pressure alarm: NO
Enable maximum pressure alarm: NO
Enable altimeter alarm: NO
Enable bottom contact alarm: NO
Alarm uses PC sound card.

Options:
Prompt to save program setup changes: YES
Automatically save program setup changes on exit: NO
Confirm instrument configuration change: YES
Confirm display setup changes: YES
Confirm output file overwrite: YES
Check scan length: NO
Compare serial numbers: NO
Maximized plot may cover Seasave: NO

Stainless Steel CTD Setup w/FLNTURTD

PSA file: C:\Users\sandm\Documents\Cruises\DY197\Data\Seasave Setup Files\DY197_0758_SS_nmea_FLNTU.psa

Date: 09/06/2025

Instrument configuration file: C:\Users\sandm\Documents\Cruises\DY197\Data\Seasave Setup Files\DY197_0758_SS_nmea_FLNTU.xmlcon

Configuration report for SBE 911plus/917plus CTD

Frequency channels suppressed : 0
Voltage words suppressed : 0
Computer interface : RS-232C
Deck unit : SBE11plus Firmware Version >= 5.0
Scans to average : 1
NMEA position data added : Yes
NMEA depth data added : No
NMEA time added : Yes
NMEA device connected to : PC
Surface PAR voltage added : No
Scan time added : Yes

1) Frequency 0, Temperature

Serial number : 3P-5785
Calibrated on : 14-Dec-24
G : 4.33649690e-003
H : 6.27474509e-004
I : 1.92493533e-005
J : 1.37617577e-006
F0 : 1000.000
Slope : 1.00000000
Offset : 0.0000

2) Frequency 1, Conductivity

Serial number : 4C-3272
Calibrated on : 21-Dec-24
G : -9.78974195e+000
H : 1.27442032e+000
I : -2.66369982e-004
J : 7.40969048e-005
CTcor : 3.2500e-006
CPcor : -9.57000000e-008
Slope : 1.00000000
Offset : 0.00000

3) Frequency 2, Pressure, Digiquartz with TC

Serial number : 90074
Calibrated on : 23-Sep-22
C1 : -6.571123e+004
C2 : 2.050504e-001
C3 : 1.612220e-002
D1 : 2.883800e-002
D2 : 0.000000e+000
T1 : 2.986693e+001
T2 : -2.678465e-004
T3 : 3.986390e-006
T4 : 7.472100e-010
T5 : 0.000000e+000
Slope : 1.00012000
Offset : 0.01710
AD590M : 1.283700e-002

AD590B : -8.642460e+000

4) Frequency 3, Temperature, 2

Serial number : 3P-5835
Calibrated on : 17-Dec-24
G : 4.37865422e-003
H : 6.73100614e-004
I : 2.75414073e-005
J : 2.10068593e-006
F0 : 1000.000
Slope : 1.00000000
Offset : 0.0000

5) Frequency 4, Conductivity, 2

Serial number : 4C-3529
Calibrated on : 03-Jan-25
G : -9.92734862e+000
H : 1.57237764e+000
I : -2.84972044e-003
J : 3.18524198e-004
CTcor : 3.2500e-006
CPcor : -9.57000000e-008
Slope : 1.00000000
Offset : 0.00000

6) A/D voltage 0, Oxygen, SBE 43

Serial number : 43-3847
Calibrated on : 14-June-24
Equation : Sea-Bird
Soc : 3.75100e-001
Offset : -7.21700e-001
A : -3.10060e-003
B : 1.44680e-004
C : -2.34010e-006
E : 3.60000e-002
Tau20 : 1.12000e+000
D1 : 1.92634e-004
D2 : -4.64803e-002
H1 : -3.30000e-002
H2 : 5.00000e+003
H3 : 1.45000e+003

7) A/D voltage 1, Free

8) A/D voltage 2, Fluorometer, WET Labs ECO-AFL/FL

Serial number : 2952
Calibrated on : 091-Nov-2022
Dark output : 0.0650
Scale factor : 6.00000000e+000

9) A/D voltage 3, Altimeter

Serial number : 96098
Calibrated on : 13/06/2025
Scale factor : 15.000
Offset : 0.000

10) A/D voltage 4, Transmissometer, WET Labs C-Star

Serial number : CST-1837TR
Calibrated on : 17-Oct-2022
M : 21.6525
B : -0.1840
Path length : 0.250

11) A/D voltage 5, Fluorometer, Chelsea Aqua 3

Serial number : 88-2615-124
Calibrated on : 28-Sep-2023
VB : 0.248960
V1 : 2.042400
Vacetone : 0.319730
Scale factor : 1.000000
Slope : 1.000000
Offset : 0.000000

12) A/D voltage 6, PAR/Irradiance, Biospherical/Licor

Serial number : 2348
Calibrated on : February 19, 2024
M : 0.80753400
B : 1.05899300
Calibration constant : 735890000.00000000
Conversion units : umol photons/m^2/sec
Multiplier : 1.00000000
Offset : 0.00000000

13) A/D voltage 7, PAR/Irradiance, Biospherical/Licor, 2

Serial number : 2349
Calibrated on : February 19, 2024
M : 0.80861200
B : 1.05340900
Calibration constant : 735890000.00000000
Conversion units : umol photons/m^2/sec
Multiplier : 1.00000000
Offset : 0.00000000

Scan length : 45

Pump Control
This setting is only applicable to a custom build of the SBE 9plus.
Enable pump on / pump off commands: NO

Data Acquisition:
Archive data: YES
Delay archiving: NO
Data archive: C:\Users\sandm\Documents\Cruises\DY197\Data\CTD Raw Data\DY197_CTD_201.hex
Timeout (seconds) at startup: 60
Timeout (seconds) between scans: 10

Instrument port configuration:
Port = COM1
Baud rate = 19200
Parity = N
Data bits = 8

```
  Stop bits = 1
-------------------------------------------------
Water Sampler Data:
  Water Sampler Type:  SBE Carousel
  Number of bottles:  36
  Port:            COM5
  Enable remote firing: NO
  Firing sequence:    User input
  Tone for bottle fire confirmation uses PC sound card.
-------------------------------------------------
Header information:
  Header Choice = Prompt for Header Information
    prompt 0 = Ship: RRS Discovery
    prompt 1 = Cruise: DY197
    prompt 2 = Cast:
    prompt 3 = Station:
    prompt 4 = Julian Day:
    prompt 5 = Date:
    prompt 6 = Time [UTC]:
    prompt 7 = Latitude:
    prompt 8 = Longitude:
    prompt 9 = Depth [uncorrected m]
    prompt 10 = Principal Scientist: Jonathan Sharples
    prompt 11 = Operator:
-------------------------------------------------
TCP/IP - port numbers:
  Data acquisition:
    Data port:        49163
    Status port:      49165
    Command port:     49164
  Remote bottle firing:
    Command port:     49167
    Status port:      49168
  Remote data publishing:
    Converted data port:  49161
    Raw data port:    49160
-------------------------------------------------
Miscellaneous data for calculations
  Depth, Average Sound Velocity, and TEOS-10
    Latitude when NMEA is not available:  50.00000000
    Longitude when NMEA is not available: 0.00000000
  Average Sound Velocity
    Minimum pressure [db]:          20.00000000
    Minimum salinity [psu]:         20.00000000
    Pressure window size [db]:      20.00000000
    Time window size [s]:           60.00000000
  Descent and Acceleration
    Window size [s]:                2.00000000
  Plume Anomaly
    Theta-B:                        0.00000000
    Salinity-B                      0.00000000
    Theta-Z / Salinity-Z            0.00000000
    Reference pressure [db]         0.00000000
  Oxygen
    Window size [s]:                2.00000000
    Apply hysteresis correction:    1
    Apply Tau correction:           1
  Potential Temperature Anomaly
    A0:                             0.00000000
    A1:                             0.00000000
```

A1 Multiplier: Salinity

Serial Data Output:
Output data to serial port: NO

Mark Variables:
Variables:
Digits Variable Name [units]
------ ----------
0 Scan Count
4 Depth [salt water, m]
7 Conductivity [S/m]
5 Salinity, Practical [PSU]

Shared File Output:
Output data to shared file: NO

TCP/IP Output:
Raw data:
Output raw data to socket: NO
XML wrapper and settings: NO
Seconds between raw data updates: 0.00000000
Converted data:
Output converted data to socket: NO
XML format: NO

SBE 11plus Deck Unit Alarms
Enable minimum pressure alarm: NO
Enable maximum pressure alarm: NO
Enable altimeter alarm: NO

SBE 14 Remote Display
Enable SBE 14 Remote Display: NO

PC Alarms
Enable minimum pressure alarm: NO
Enable maximum pressure alarm: NO
Enable altimeter alarm: NO
Enable bottom contact alarm: NO
Alarm uses PC sound card.

Options:
Prompt to save program setup changes: YES
Automatically save program setup changes on exit: NO
Confirm instrument configuration change: YES
Confirm display setup changes: YES
Confirm output file overwrite: YES
Check scan length: NO
Compare serial numbers: NO
Maximized plot may cover Seasave: NO

Stainless Steel CTD Setup w/SFOxygen

PSA file: C:\Users\sandm\Documents\Cruises\DY197\Data\Seasave Setup Files\DY197_0758_SS_nmea_SFOxygen.psa

Date: 09/06/2025

Instrument configuration file: C:\Users\sandm\Documents\Cruises\DY197\Data\Seasave Setup Files\DY197_0758_SS_nmea_SFOxygen.xmlcon

Configuration report for SBE 911plus/917plus CTD

Frequency channels suppressed : 0
Voltage words suppressed : 0
Computer interface : RS-232C
Deck unit : SBE11plus Firmware Version >= 5.0
Scans to average : 1
NMEA position data added : Yes
NMEA depth data added : No
NMEA time added : Yes
NMEA device connected to : PC
Surface PAR voltage added : No
Scan time added : Yes

1) Frequency 0, Temperature

Serial number : 3P-5785
Calibrated on : 14-Dec-24
G : 4.33649690e-003
H : 6.27474509e-004
I : 1.92493533e-005
J : 1.37617577e-006
F0 : 1000.000
Slope : 1.00000000
Offset : 0.0000

2) Frequency 1, Conductivity

Serial number : 4C-3272
Calibrated on : 21-Dec-24
G : -9.78974195e+000
H : 1.27442032e+000
I : -2.66369982e-004
J : 7.40969048e-005
CTcor : 3.2500e-006
CPcor : -9.57000000e-008
Slope : 1.00000000
Offset : 0.00000

3) Frequency 2, Pressure, Digiquartz with TC

Serial number : 90074
Calibrated on : 23-Sep-22
C1 : -6.571123e+004
C2 : 2.050504e-001
C3 : 1.612220e-002
D1 : 2.883800e-002
D2 : 0.000000e+000
T1 : 2.986693e+001
T2 : -2.678465e-004
T3 : 3.986390e-006
T4 : 7.472100e-010
T5 : 0.000000e+000
Slope : 1.00012000
Offset : 0.01710
AD590M : 1.283700e-002
AD590B : -8.642460e+000

4) Frequency 3, Temperature, 2

Serial number : 3P-5835
Calibrated on : 17-Dec-24
G : 4.37865422e-003
H : 6.73100614e-004
I : 2.75414073e-005
J : 2.10068593e-006
F0 : 1000.000
Slope : 1.00000000
Offset : 0.0000

5) Frequency 4, Conductivity, 2

Serial number : 4C-3529
Calibrated on : 03-Jan-25
G : -9.92734862e+000
H : 1.57237764e+000
I : -2.84972044e-003
J : 3.18524198e-004
CTcor : 3.2500e-006
CPcor : -9.57000000e-008
Slope : 1.00000000
Offset : 0.00000

6) A/D voltage 0, Oxygen, SBE 43

Serial number : 2819
Calibrated on : 10-Dec-24
Equation : Sea-Bird
Soc : 4.06730e-001
Offset : -4.86800e-001
A : -3.28390e-003
B : 1.83020e-004
C : -2.67270e-006
E : 3.60000e-002
Tau20 : 1.10000e+000
D1 : 1.92634e-004
D2 : -4.64803e-002
H1 : -3.30000e-002
H2 : 5.00000e+003
H3 : 1.45000e+003

7) A/D voltage 1, Free

8) A/D voltage 2, OBS, WET Labs, ECO-BB

Serial number : BBRTD-758R
Calibrated on : 21/9/2022
ScaleFactor : 0.003461
Dark output : 0.073000

9) A/D voltage 3, Altimeter

Serial number : 96098
Calibrated on : 13/06/2025
Scale factor : 15.000
Offset : 0.000

10) A/D voltage 4, Transmissometer, WET Labs C-Star

Serial number : CST-1837TR
Calibrated on : 17-Oct-2022
M : 21.6525
B : -0.1840
Path length : 0.250

11) A/D voltage 5, Fluorometer, Chelsea Aqua 3

Serial number : 88-2615-124
Calibrated on : 28-Sep-2023
VB : 0.248960
V1 : 2.042400
Vacetone : 0.319730
Scale factor : 1.000000
Slope : 1.000000
Offset : 0.000000

12) A/D voltage 6, PAR/Irradiance, Biospherical/Licor

Serial number : 2348
Calibrated on : February 19, 2024
M : 0.80753400
B : 1.05899300
Calibration constant : 735890000.00000000
Conversion units : umol photons/m^2/sec
Multiplier : 1.00000000
Offset : 0.00000000

13) A/D voltage 7, PAR/Irradiance, Biospherical/Licor, 2

Serial number : 2349
Calibrated on : February 19, 2024
M : 0.80861200
B : 1.05340900
Calibration constant : 735890000.00000000
Conversion units : umol photons/m^2/sec
Multiplier : 1.00000000
Offset : 0.00000000

Scan length : 45

Pump Control
This setting is only applicable to a custom build of the SBE 9plus.
Enable pump on / pump off commands: NO

Data Acquisition:
Archive data: YES
Delay archiving: NO
Data archive: C:\Users\sandm\Documents\Cruises\DY197\Data\CTD Raw Data\DY197_CTD_207.hex
Timeout (seconds) at startup: 60
Timeout (seconds) between scans: 10

Instrument port configuration:
Port = COM1
Baud rate = 19200
Parity = N
Data bits = 8
Stop bits = 1

Water Sampler Data:

```
  Water Sampler Type:   SBE Carousel
  Number of bottles:    36
  Port:             COM5
  Enable remote firing: NO
  Firing sequence:      User input
  Tone for bottle fire confirmation uses PC sound card.
-------------------------------------------------
Header information:
  Header Choice = Prompt for Header Information
    prompt 0 = Ship: RRS Discovery
    prompt 1 = Cruise: DY197
    prompt 2 = Cast:
    prompt 3 = Station:
    prompt 4 = Julian Day:
    prompt 5 = Date:
    prompt 6 = Time [UTC]:
    prompt 7 = Latitude:
    prompt 8 = Longitude:
    prompt 9 = Depth [uncorrected m]
    prompt 10 = Principal Scientist: Jonathan Sharples
    prompt 11 = Operator:
-------------------------------------------------
TCP/IP - port numbers:
  Data acquisition:
    Data port:          49163
    Status port:        49165
    Command port:       49164
  Remote bottle firing:
    Command port:       49167
    Status port:        49168
  Remote data publishing:
    Converted data port:  49161
    Raw data port:      49160
-------------------------------------------------
Miscellaneous data for calculations
  Depth, Average Sound Velocity, and TEOS-10
    Latitude when NMEA is not available:  50.00000000
    Longitude when NMEA is not available: 0.00000000
  Average Sound Velocity
    Minimum pressure [db]:            20.00000000
    Minimum salinity [psu]:           20.00000000
    Pressure window size [db]:        20.00000000
    Time window size [s]:             60.00000000
  Descent and Acceleration
    Window size [s]:                  2.00000000
  Plume Anomaly
    Theta-B:                      0.00000000
    Salinity-B                    0.00000000
    Theta-Z / Salinity-Z              0.00000000
    Reference pressure [db]           0.00000000
  Oxygen
    Window size [s]:                  2.00000000
    Apply hysteresis correction:      1
    Apply Tau correction:             1
  Potential Temperature Anomaly
    A0:                           0.00000000
    A1:                           0.00000000
    A1 Multiplier:                    Salinity
-------------------------------------------------
Serial Data Output:
```

Output data to serial port: NO

Mark Variables:
Variables:
Digits Variable Name [units]
------ ----------
0 Scan Count
4 Depth [salt water, m]
7 Conductivity [S/m]
5 Salinity, Practical [PSU]

Shared File Output:
Output data to shared file: NO

TCP/IP Output:
Raw data:
Output raw data to socket: NO
XML wrapper and settings: NO
Seconds between raw data updates: 0.00000000
Converted data:
Output converted data to socket: NO
XML format: NO

SBE 11plus Deck Unit Alarms
Enable minimum pressure alarm: NO
Enable maximum pressure alarm: NO
Enable altimeter alarm: NO

SBE 14 Remote Display
Enable SBE 14 Remote Display: NO

PC Alarms
Enable minimum pressure alarm: NO
Enable maximum pressure alarm: NO
Enable altimeter alarm: NO
Enable bottom contact alarm: NO
Alarm uses PC sound card.

Options:
Prompt to save program setup changes: YES
Automatically save program setup changes on exit: NO
Confirm instrument configuration change: YES
Confirm display setup changes: YES
Confirm output file overwrite: YES
Check scan length: NO
Compare serial numbers: NO
Maximized plot may cover Seasave: NO

EIVA ScanFish III Rocio (Technical Report)

Dougal Mountifield

ScanFish Survey Summary

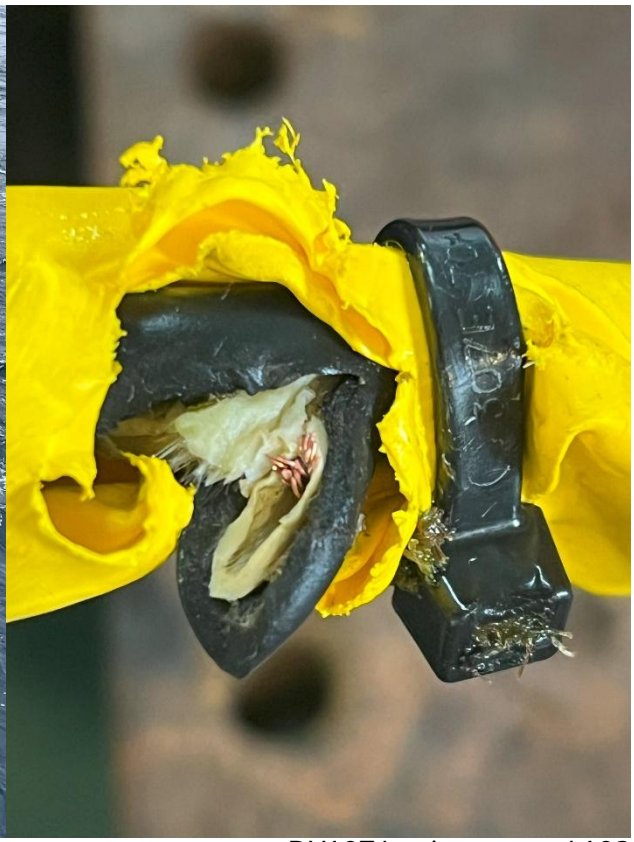
The DY197 ScanFish work consisted of a series of tows in the vicinity of the Kincardine experimental floating wind-farm, offshore from Aberdeen. The work was undertaken as part of the eSWEETS[3] project to assess the physical and biogeochemical effects of the floating wind-turbine structures on the seasonally stratified shelf-sea.

7 tows were completed with an EIVA ScanFish III Rocio ROTV system with over 120 hours on survey, covering over 700 nautical miles. ScanFish completed about 3,600 undulations between 5m and 50m depth. The minimum proximity of ScanFish to the sea-bed was 10m at the shallowest point of each survey. Due to unresolvable issues with the ScanFish altimeter system, these surveys were achieved with the altimeter system disabled.

The first tow (Tow 1) was successfully completed over 24 hours through 15th-16th August. This tow made repeated laps around Kincardine at far-field (Box A).

Tow 2 (Box N) was started on 19th August, however this was aborted about 6 hours after deployment when the tow-wire fouled fishing gear during a turn to starboard on the clockwise box survey. The fishing floats ran down the wire to the ScanFish vehicle where they cut the electrical cable-tail of the sea-cable. This resulted in loss of power and communication with the ScanFish. The ScanFish went into battery fail-safe mode which brings the fish into level flight at 2m depth to allow a controlled recovery. The wire had to be re-terminated due to the damage to the sea-cable tail.

As the sea-cable tail is routed on the starboard side of the ScanFish, all subsequent box surveys were completed counter-clockwise (a great observation and suggestion from Simon Jones – NMF) so that all vessel turns were to port. Due to the heavy presence of fishing gear at the eastern end of Box N, this was not re-surveyed, and its counterpart Box S was likewise not surveyed.



Tow 3 (Box B) was completed over 24 hours through 23rd-24th August on the near-field box around the wind-farm. This was the first of 3 surveys that were undertaken with repeated laps around Box B.

Tow 4 (Line L) was completed over 5 ½ hours on 27th August. Line L was a single line survey extending to the North and South of the wind-farm. This was broken by following a dog-leg of the inshore segments of Box B.

Tow 5 (Box A) was completed over 25 hours through 28th-29th August as a repeat of the box surveyed on Tow 1.

Tow 6 (Box B) was started on 30th August, however this was aborted after 11 hours due to deteriorating weather which was limiting the ability of the vessel to follow the survey track during turns due to wind and sea conditions.

Tow 7 (Box B) was completed over 25 hours through 5th-6th September as a repeat of the aborted Tow 6.

ScanFish Tow Summary

Deployment Times

Tow	Deployment Started	ScanFish in Water	Deployment Finished	Deployment Duration (hh:mm)
1	15-Aug-25 13:16	15-Aug-25 13:19	15-Aug-25 13:48	00:32
2	19-Aug-25 07:23	19-Aug-25 07:26	19-Aug-25 07:41	00:18
3	23-Aug-25 20:03	23-Aug-25 20:06	23-Aug-25 20:36	00:33
4	27-Aug-25 17:21	27-Aug-25 17:24	27-Aug-25 17:44	00:23
5	28-Aug-25 09:40	28-Aug-25 09:43	28-Aug-25 10:00	00:20
6	30-Aug-25 07:17	30-Aug-25 07:20	30-Aug-25 07:32	00:15
7	5-Sep-25 07:38	5-Sep-25 07:41	5-Sep-25 07:56	00:18

Total	**02:39**
Average Deployment Duration	**00:23**

Survey Times, Distances & Undulation Cycles

Tow	Survey Plan	Survey Started	Survey Finished	Survey Duration (hh:mm)	Survey Distance (nm)	Undulation Cycles
1	Box A	15-Aug-25 13:51	16-Aug-25 14:15	24:24	~150	~725
2	Box N	19-Aug-25 08:04	19-Aug-25 13:52	05:48 (fouled	~35 (fouled	~175 (fouled
3	Box B	23-Aug-25 20:36	24-Aug-25 19:08	23:32	~140	~705
4	Line L	27-Aug-25 18:20	27-Aug-25 23:53	05:33	~33	~165
5	Box A	28-Aug-25 10:00	29-Aug-25 11:13	25:13	~150	~750
6	Box B	30-Aug-25 07:33	30-Aug-25 18:27	10:54 (aborted -	~65 (aborted -	~330 (aborted -
7	Box B	5-Sep-25 07:57	6-Sep-25 09:11	25:14	~150	~750
Totals				**120:41**	**~723**	**~3600**

Recovery Times

Tow	Start Recovery	Time on Deck	Recovery Duration (hh:mm)
1	16-Aug-25 14:15	16-Aug-25	00:30
2	19-Aug-25 13:52	19-Aug-25	00:29
3	24-Aug-25 19:08	24-Aug-25	00:24
4	27-Aug-25 23:53	28-Aug-25	00:26
5	29-Aug-25 11:13	29-Aug-25	00:24
6	30-Aug-25 18:27	30-Aug-25	00:21

7	6-Sep-25 09:11	6-Sep-25 09:34	00:23
Total			**02:57**
Average Recovery Duration			**00:25**

ScanFish Vehicle Configuration

Instrument Package

The vehicle was instrumented with a SeaBird Electronics SBE 9plus CTD fitted with a single pair of temperature (SBE-3p) & conductivity (SBE-4c) sensors pumped with an SBE-5T. A single SBE-43 dissolved oxygen sensor was used in-line with the pumped duct.

Following issues with considerable salinity spiking that was experienced on the DY166 ScanFish trials, the temperature and conductivity sensors were relocated from internal mounted to external mounted on the starboard wing-end. This new mounting arrangement was integrated during the preparation for DY195 and proven during that cruise. The oxygen sensor and pump continue to be mounted within the body of the ScanFish vehicle.

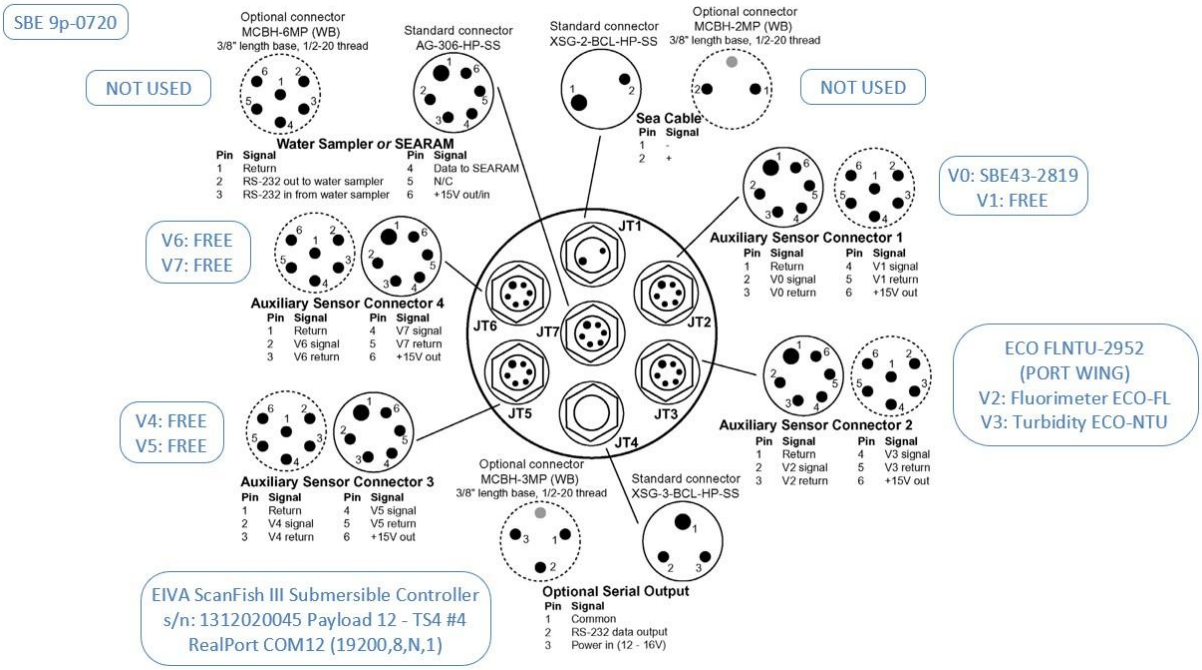
A WET Labs FLNTU combined chlorophyll fluorimeter and turbidity meter was used as an auxiliary analogue instrument.

Component	Type	Serial Number
Tow Body	EIVA ScanFish III Rocio	1312010027
Submersible Control Unit	EIVA ScanFish III Control	1312020045
Motion Reference Unit	XSens	02301486
Pressure Sensor	GE Sensing PDCR-1830	3915063
Port Flap Drive	EIVA ScanFish III	1602030198
Starboard Flap Drive	EIVA ScanFish III	1602030199
Altimeter (Tow 1)	Tritech PA500 RA	403051
Altimeter (Tow 2 – 7)	Tritech PA500 RA	403053
CTD Underwater Unit	Seabird 9P	09P-31240-0720

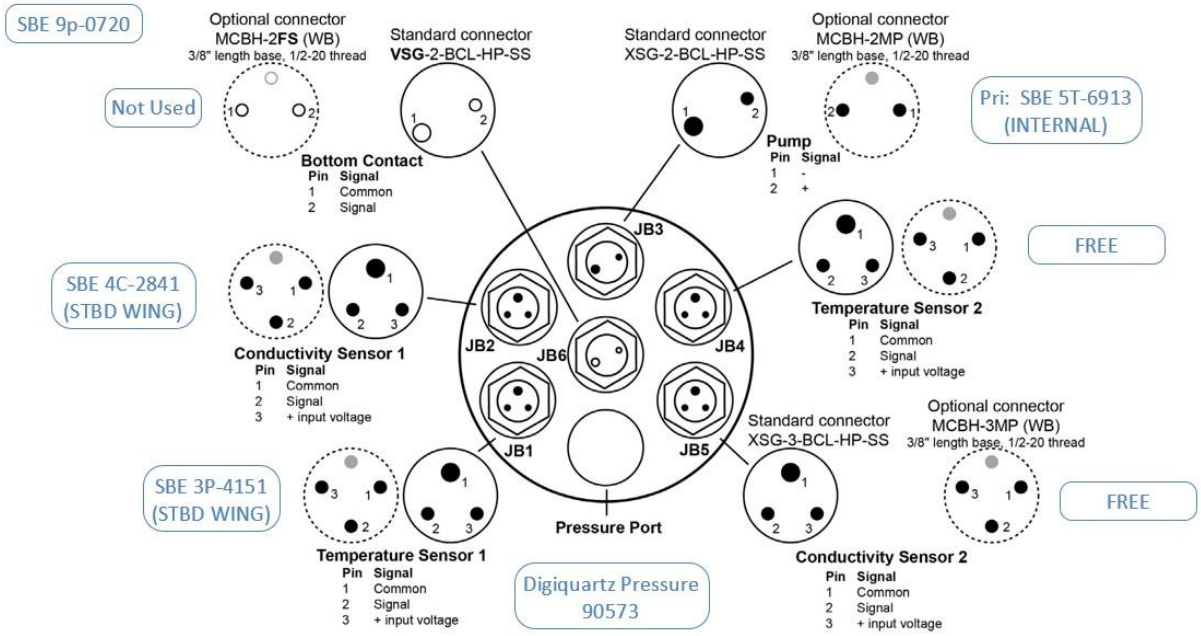
CTD Pressure Sensor	Digiquartz (Installed in 9P)	90573
CTD Temperature Sensor	Seabird SBE3P	03P-4151
CTD Conductivity Sensor	Seabird SBE4C	04C-2841
Dissolved Oxygen Sensor	Seabird SBE43	43-2819
Submersible Pump	Seabird SBE5T	5T-6913
Chlorophyll Fluorimeter	WET Labs ECO FLNTU	2952

All instrument serial numbers and all channels of the 9plus underwater unit checked prior to completing the build sheet 'ScanFish Build Sheets 5 August 2025.docx'

SBE 9plus CTD Top End Cap Configuration



SBE 9plus CTD Bottom End Cap Configuration



ScanFish Sensor Locations

All sensors were mounted using custom NMF designed brackets and mounts to place them in the most optimal location to maximise data quality. All scientific sensors were interfaced with the Sea-Bird 9plus CTD underwater unit. The flight control Druck pressure sensor and altimeter were provided by EIVA and located as supplied by EIVA. The flight control sensors interface with the EIVA ScanFish Rocio Submersible Controller housing.

Sea-Bird SBE 3p Temperature (F0), SBE 4c Conductivity (F1) Sensors

The Sea-Bird SBE 3p & 4c sensors were mounted on the starboard side wing end. The outflow tubing from the conductivity cell quick-disconnect fitting was connected an elbow fitting and entered the vehicle via a cable-gland.

Sea-Bird SBE 3p & 4c Sensor Mounting Location with Forward-facing Exhaust

Sea-Bird SBE 43 Dissolved Oxygen Sensor (V0) and SBE 5T Submersible Pump

Within the vehicle there was a second elbow fitting on the internal side of the cable-gland to which was connected the tubing to the internally mounted SBE 43 Dissolved Oxygen sensor and 5T pump.

Sea-Bird SBE 43 DO sensor & SBE 5T Pump Internal Mounting Location

WET Labs ECO FLNTU rtd Chlorophyll Fluorimeter & Turbidity Meter (V2/V3)

The WET Labs ECO FLNTU Chlorophyll Fluorimeter & Turbidity meter was fitted in a side-looking orientation near the leading edge on the port-side wing end of the ScanFish vehicle. The instrument was positioned with the optical face protruding over-flush to place it in clean flow.

WET Labs ECO FLNTU Chlorophyll Fluorimeter & Turbidity Sensor Mounting Location

Topside Equipment Configuration

The display configuration used on DY197 was as shown below:

Top Far-Left: Grafana ScanFish Scientific Instrument Dashboard

Bottom Far-Left: Grafana ScanFish Operational Dashboard

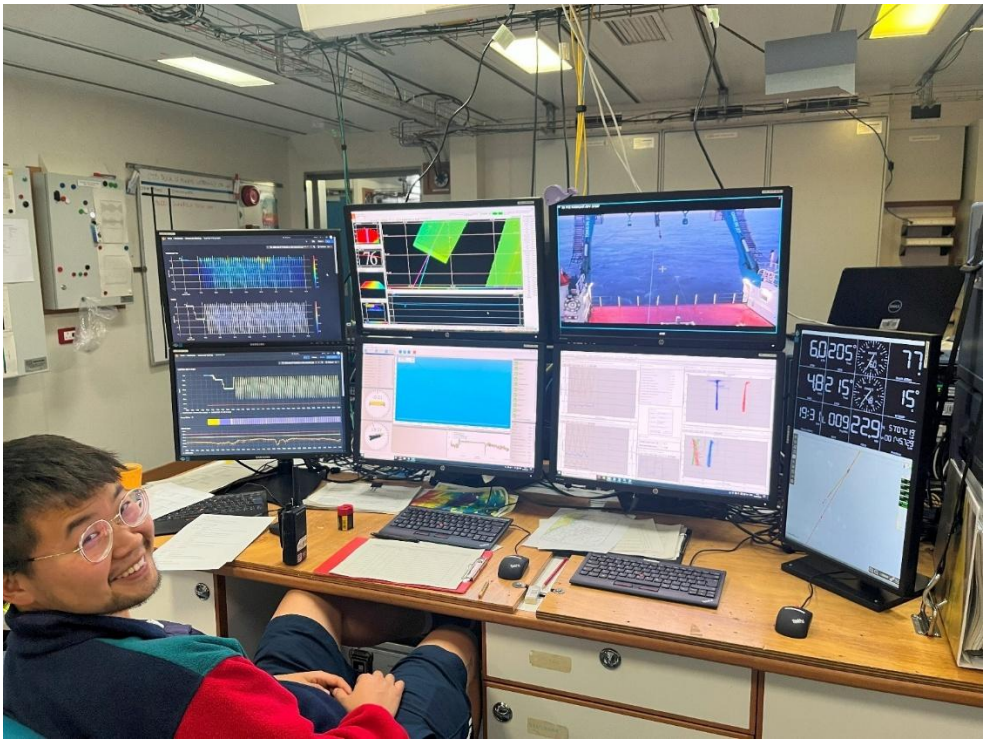
Top Left: EM710 multi-beam echosounder

Bottom Left: EIVA ScanFish Flight

Top Right: CCTV of aft-deck to monitor towing wires and blocks (via Blackbox MFD)

Bottom Right: SeaBird Seasave ScanFish CTD data acquisition showing time-series and stacked profiles

Far Right: Navigation display comprising PolarCOM and OpenCPN.



Seasave Configuration & Instrument Calibrations

The Seasave Instrument Configuration file used for all tows was DY195_ScanFish_27_0720_NMEA.xmlcon

```
PSA file: C:\Users\sandm\Documents\Cruises\DY197\ScanFish CTD\Data\Seasave
Setup Files\DY197_ScanFish_27_0720_NMEA.psa

Date: 08/10/2025

Instrument configuration file:
C:\Users\sandm\Documents\Cruises\DY197\ScanFish CTD\Data\Seasave Setup
Files\DY197_ScanFish_27_0720_NMEA.xmlcon

Configuration report for SBE 911plus/917plus CTD
------------------------------------------------

Frequency channels suppressed : 0
Voltage words suppressed      : 0
Computer interface            : RS-232C
Deck unit                     : None
Scans to average              : 1
NMEA position data added      : Yes
NMEA depth data added         : No
```

```
NMEA time added               : Yes
NMEA device connected to      : PC
Surface PAR voltage added     : No
Scan time added               : Yes

1) Frequency 0, Temperature

   Serial number : 4151
   Calibrated on : 15-Mar-25
   G             : 4.34120851e-003
   H             : 6.28751092e-004
   I             : 2.03043866e-005
   J             : 1.58958085e-006
   F0            : 1000.000
   Slope         : 1.00000000
   Offset        : 0.0000

2) Frequency 1, Conductivity

   Serial number : 2841
   Calibrated on : 04-Mar-25
   G             : -1.03856580e+001
   H             : 1.43161122e+000
   I             : -1.63187093e-004
   J             : 7.84115318e-005
   CTcor         : 3.2500e-006
   CPcor         : -9.57000000e-008
   Slope         : 1.00000000
   Offset        : 0.00000

3) Frequency 2, Pressure, Digiquartz with TC

   Serial number : 90573
   Calibrated on : 21-Mar-24
   C1            : -4.666978e+004
   C2            : -2.615846e-001
   C3            : 1.373870e-002
   D1            : 3.884300e-002
   D2            : 0.000000e+000
   T1            : 3.015158e+001
   T2            : -3.442071e-004
   T3            : 4.048350e-006
   T4            : 2.094500e-009
   T5            : 0.000000e+000
   Slope         : 1.00004000
   Offset        : -0.26590
   AD590M        : 1.280800e-002
   AD590B        : -9.338280e+000

4) Frequency 3, Free

5) Frequency 4, Free
```

```
6) A/D voltage 0, Oxygen, SBE 43

   Serial number : 2819
   Calibrated on : 10-Dec-24
   Equation      : Sea-Bird
   Soc           : 4.06730e-001
   Offset        : -4.86800e-001
   A             : -3.28390e-003
   B             : 1.83020e-004
   C             : -2.67270e-006
   E             : 3.60000e-002
   Tau20         : 1.10000e+000
   D1            : 1.92634e-004
   D2            : -4.64803e-002
   H1            : -3.30000e-002
   H2            : 5.00000e+003
   H3            : 1.45000e+003

7) A/D voltage 1, Free

8) A/D voltage 2, Fluorometer, WET Labs ECO-AFL/FL

   Serial number : 2952
   Calibrated on : 01-Nov-2022
   Dark output   : 0.0650
   Scale factor  : 6.00000000e+000

9) A/D voltage 3, Turbidity Meter, WET Labs, ECO-NTU

   Serial number : 2952
   Calibrated on : 01-Nov-2022
   ScaleFactor   : 2.000000
   Dark output   : 0.066000

10) A/D voltage 4, Free

11) A/D voltage 5, Free

12) A/D voltage 6, Free

13) A/D voltage 7, Free

Scan length                   : 45
-------------------------------------------
Pump Control
   This setting is only applicable to a custom build of the SBE 9plus.
   Enable pump on / pump off commands: NO
-------------------------------------------
Data Acquisition:
   Archive data:                  NO
   Delay archiving:               NO
```

```
   Data archive:
C:\Users\sandm\Documents\Cruises\DY197\ScanFish CTD\Data\Raw Data\test.hex
   Timeout (seconds) at startup:    60
   Timeout (seconds) between scans: 20
-----------------------------------------
Instrument port configuration:
   Port      = COM12
   Baud rate = 19200
   Parity    = N
   Data bits = 8
   Stop bits = 1
-----------------------------------------
Water Sampler Data:
   Water Sampler Type:   None
-----------------------------------------
Header information:
   Header Choice = Prompt for Header Information
      prompt 0 = Ship: RRS Discovery
      prompt 1 = Cruise: DY197
      prompt 2 = Tow:
      prompt 3 = Station:
      prompt 4 = Julian Day:
      prompt 5 = Date:
      prompt 6 = Time [UTC]:
      prompt 7 = Latitude:
      prompt 8 = Longitude:
      prompt 9 = Depth [uncorrected m]:
      prompt 10 = Principal Scientist: Jonathan Sharples
      prompt 11 = Operator:
-----------------------------------------
TCP/IP - port numbers:
   Data acquisition:
      Data port:            49163
      Status port:          49165
      Command port:         49164
   Remote bottle firing:
      Command port:         49167
      Status port:          49168
   Remote data publishing:
      Converted data port:  49161
      Raw data port:        49160
-----------------------------------------
Miscellaneous data for calculations
   Depth, Average Sound Velocity, and TEOS-10
      Latitude when NMEA is not available:  50.000000
      Longitude when NMEA is not available: 0.000000
   Average Sound Velocity
      Minimum pressure [db]:                20.000000
      Minimum salinity [psu]:               20.000000
      Pressure window size [db]:            20.000000
      Time window size [s]:                 60.000000
   Descent and Acceleration
```

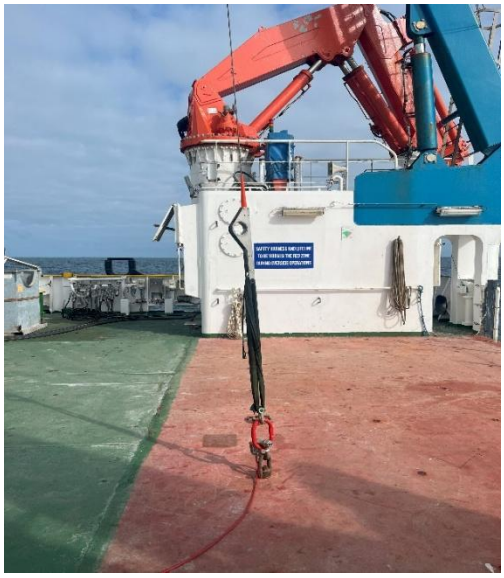
```
      Window size [s]:                        2.000000
   Plume Anomaly
      Theta-B:                                0.000000
      Salinity-B                              0.000000
      Theta-Z / Salinity-Z                    0.000000
      Reference pressure [db]                 0.000000
   Oxygen
      Window size [s]:                        2.000000
      Apply hysteresis correction:            1
      Apply Tau correction:                   1
   Potential Temperature Anomaly
      A0:                                     0.000000
      A1:                                     0.000000
      A1 Multiplier:                          Salinity
-----------------------------------------------
Serial Data Output:
   Output data to serial port: YES
   Seconds between updates:    0.500000
   Port      = COM2
   Baud rate = 9600
   Parity    = N
   Data bits = 8
   Stop bits = 1
   Variables:
   Digits   Variable Name [units]
   ------   ---------------------
   3        Depth [salt water, m]
   3        Temperature [ITS-90, deg C]
   3        Salinity, Practical [PSU]
   3        Oxygen, SBE 43 [umol/kg]
   3        Fluorescence, WET Labs ECO-AFL/FL [mg/m^3]
   3        Turbidity, WET Labs ECO [NTU]
   3        Density [sigma-theta, kg/m^3]
-----------------------------------------------
Mark Variables:
   No variables are selected.
-----------------------------------------------
Shared File Output:
   Output data to shared file: NO
-----------------------------------------------
TCP/IP Output:
   Raw data:
      Output raw data to socket:              NO
      XML wrapper and settings:               NO
      Seconds between raw data updates:       0.000000
   Converted data:
      Output converted data to socket:        NO
      XML format:                             NO
-----------------------------------------------
SBE 11plus Deck Unit Alarms
   Enable minimum pressure alarm:    NO
   Enable maximum pressure alarm:    NO
```

```
   Enable altimeter alarm:           NO
-------------------------------------------
SBE 14 Remote Display
   Enable SBE 14 Remote Display:     NO
-------------------------------------------
PC Alarms
   Enable minimum pressure alarm:    NO
   Enable maximum pressure alarm:    NO
   Enable altimeter alarm:           NO
   Enable bottom contact alarm:      NO
   Alarm uses PC sound card.
-------------------------------------------
Options:
   Prompt to save program setup changes: YES
   Automatically save program setup changes on exit: NO
   Confirm instrument configuration change: YES
   Confirm display setup changes: YES
   Confirm output file overwrite: YES
   Check scan length: YES
   Compare serial numbers: YES
   Maximized plot may cover Seasave: NO
```

ScanFish Operations

ScanFish Deployment Method

ScanFish was towed from the Lebus ScanFish Winch mounted to the aft deck. The ScanFish winch had a Rochester A320327 cable installed. The tow-wire was reeved through a Wireline Technologies (WTI) G2-17” diameter rigging sheave which was configured as a hanging snatch-block. The snatch-block was handled by a 5T GP winch via the stern A-frame main-block.



The vehicle was launched from and recovered to the NMF designed ScanFish Deck Cradle mounted at the forward end the red-zone.

Winches, Wires, Sheave and Load-test:

- Lebus ScanFish Winch SFW-01 s/n: 35F (SWL 2 Te)
- 1700m of 8.18mm Rochester A320327 double-armoured coaxial signal transmission cable (MBL 4.35 Te)

Load-test to 2.0 Te after re-termination rigged using snatch-block

- Lebus 5T Winch No.2 s/n: F752 to handle the towing snatch-block via the main centre-block of the stern 'A'-frame
- Wireline Technologies Inc. (WTI) G2 17" rigging sheave s/n: G217-7428 (SWL 9Te at head)

Survey Operations

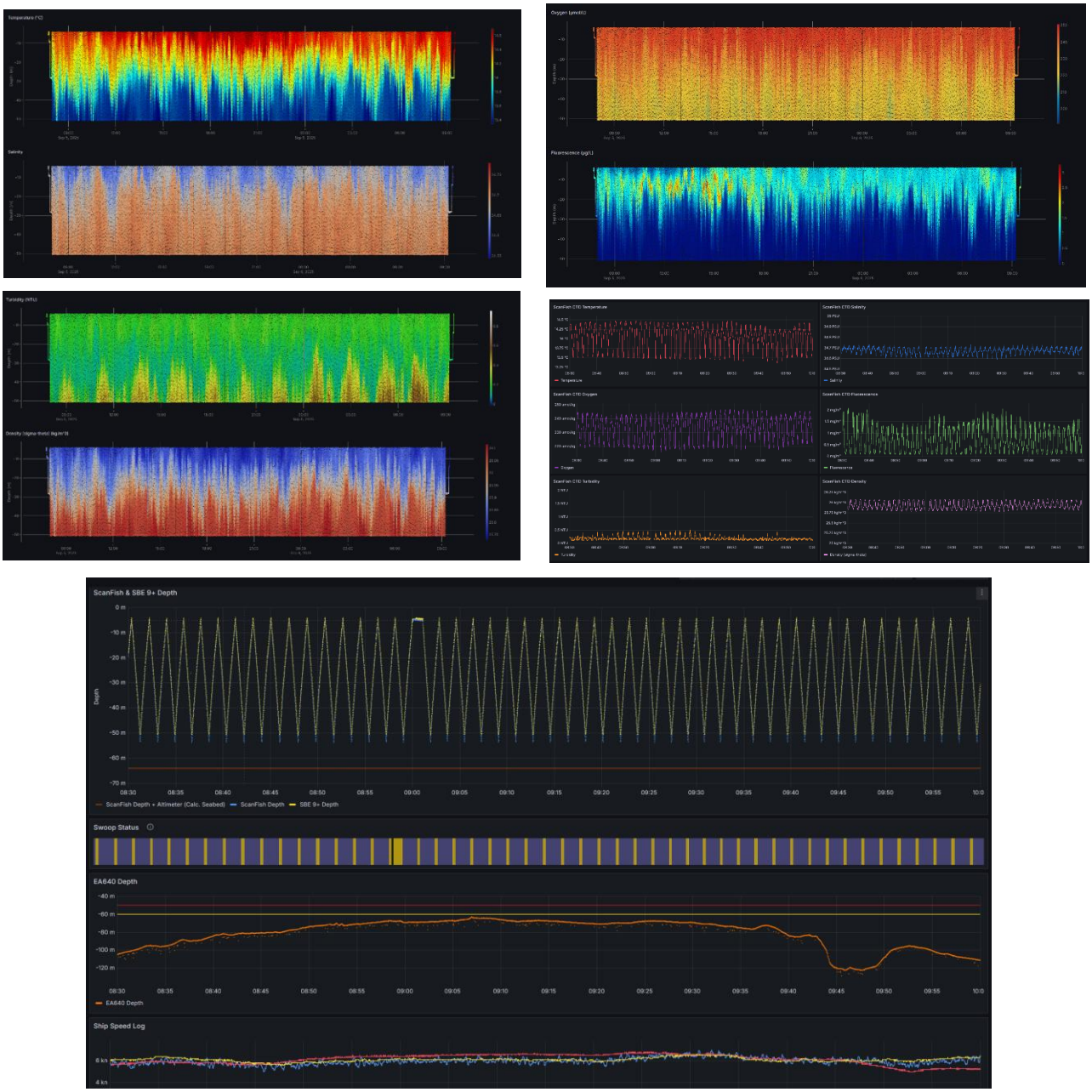
Prior to each ScanFish tow, the vessel did one pass of the survey line to establish the bathymetry (EM710 swath and EA640 single beam) and mark any nearby fishing gear hazards on the bridge ECDIS. This pre-survey established the shallowest water depth that would be encountered during the tow.

The vehicle was towed with a vessel speed of 6 knots through the water with between 500m and 600m of wire deployed, putting ScanFish about 3 minutes astern of the ship. Vessel turn rates were limited to 10°/minute resulting in 90° turns being completed in 9 minutes. Deployment times averaged 23 minutes from pickup from deck to all wire deployed. Recovery times were similar at 25 minutes from start of haul to ScanFish back on deck. Allowing for pre-flight tests before deployment and securing the ScanFish after recovery, results in a 1 hour overhead for each tow.

The altimeter was disabled and the water depth fixed at the shallowest depth observed during the pre-deployment lap of the survey path. The maximum dive depth of ScanFish was set with a 10m margin above the shallowest point on the survey. For most of the survey time, this yielded undulations between 5m and 50m. The dive and climb rates were set at 1 ms^{-1} which yielded undulation periods of approximately 2 minutes, with ScanFish completing about 30 undulations per hour.

Data Visualisation

Grafana dashboards for operational and scientific data visualisation were written by Paul Henderson during DY195 using the Plotly plugin. These provide critical information for ScanFish operations, particularly when operating in shallow water. They also present an intuitive view of all instrument data that allows scientists to undertake real-time



analysis of the developing instrument data-set for the tow.

ScanFish Performance, Technical Issues & Instrument Changes

ScanFish Vehicle Performance

Instrument Performance

There were no major technical issues with the ScanFish suite during the cruise and no scientific instruments required changing for spares. There was no noticeable change in the difference between the ScanFish temperature & conductivity sensors at 6m depth and the underway SBE 45 TSG during the cruise. The ScanFish FLNTU fluorescence channel also tied in well with the SurfMet underway fluorimeter at 6m depth.

ScanFish Altimeter System Technical Issues

DY166 ScanFish Trials (Benthos Altimeters)

During DY166 ScanFish deep water trials, problems were identified with the ScanFish Benthos altimeter system (100m range) preventing the vehicle from diving from the near-surface in deep water. During the trials, the altimeter was disabled to allow the vehicle to undulate.

DY195 Deep Water ScanFish Operations (Benthos Altimeters)

During DY195 which was also in deep water, these problems continued and once again, the altimeter system had to be disabled to enable the ScanFish to undulate. With the shallow surveys of DY197 in mind, EIVA were contacted for advice. EIVA strongly suggested replacing the Benthos altimeters with Tritech PA500 units (50m range). Three Tritech PA500 units, brackets and associated cables were purchased from EIVA along with blanking plates to cover the aperture used by the Benthos units. These were supplied in time for DY197 and integrated and bench-tested by NMF prior to the DY197 mobilisation.

DY197 Shallow Water ScanFish Operations (Tritech PA500 Altimeters)

Similar false echo detections near the surface were experienced during DY197 with the new Tritech altimeters. These false bottom detections created problems with the control system, preventing the ScanFish from diving. Occasionally there would be a gap in the altimeter spiking which would enable the ScanFish to dive from near-surface. However the spiking would almost always return mid-water column, or would happen on the approach to the bottom, both causing the ScanFish to return to the surface. A few times, the altimeter spiking caused a violent oscillating vehicle response which created extreme flap actuator movement and excessive tow-cable loads.

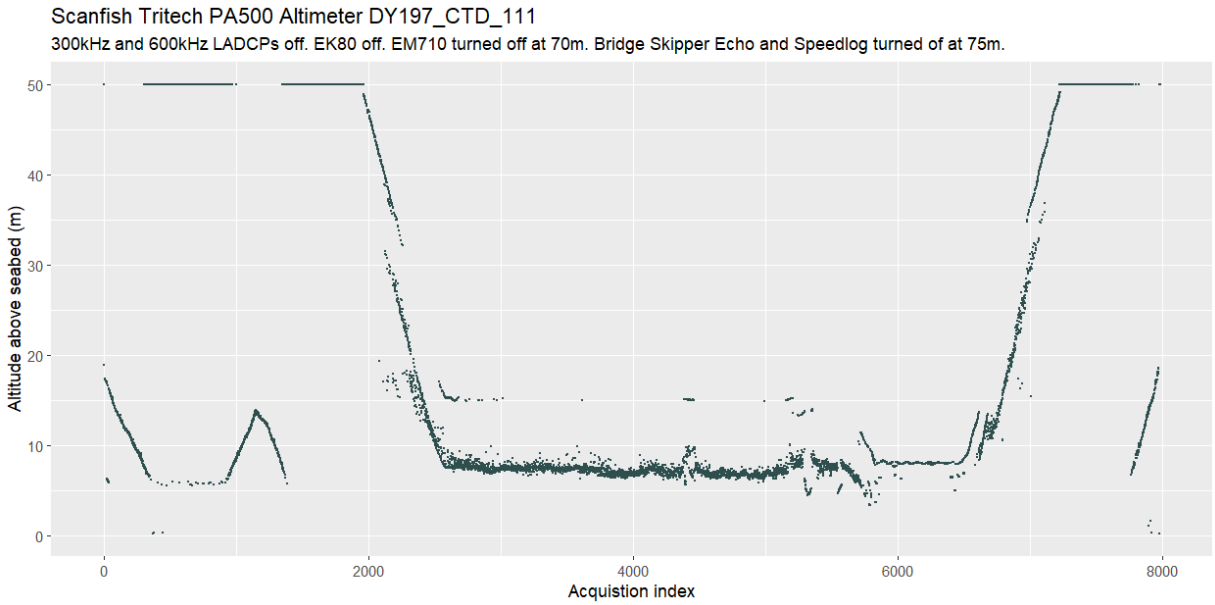
Numerous combinations of altimeter settings within the Flight software, and in the web interface for the ScanFish controller were tried without success.

Prior to Tow 2, the Tritech PA500 altimeter and cable was replaced with the spare unit. Further experimentation with altimeter settings was tried at the beginning of Tow 2, but the same problems were seen, and a workable solution could not be found.

To allow the operation of the ScanFish and to undertake the survey work on DY197, once again the altimeter system was disabled, and a fixed 'dummy' altimeter depth was set based on the minimum observed water depth on the pre-deployment bathymetry survey.

DY197 ScanFish Tritech PA500 Testing on CTD Frame

The ScanFish Tritech PA500 altimeters were integrated into the CTD suite by splicing a new interface cable. A few casts were completed. Tests were done with all normal vessel acoustics running, LADCPs running and not running, and also a completely quiet ship. Results were similar. A lot of spiking near the surface, significant spiking on approach to the bottom, and inconsistent readings throughout. The readings were not stable even when 5m from the sea-bed. The performance of these altimeters is unacceptable, particularly when compared to the consistent, reliable altimtetry that we always obtain from our Valeport 500kHz units on our CTD suite.



ScanFish Spares Availability, Wire Condition and Maintenance

A completely instrumented spare ScanFish tow-fish unit and an additional full suite of spare instruments were available for use. There were no instrumentation issues during the cruise and no instruments were changed during the cruise.

The ScanFish wire showed no signs of polishing that would be expected following contact with a sandy sea-bed. The newer WTI rigging sheave has a narrower gate, which allows the keeper pins to be located closer to the gate. This has almost removed the potential for the wire to rub on the keeper pins during deployment and recovery. Hence there was no polishing of the wire observed through contact with the keeper pins.

Following each deployment, the pumped duct was flushed thoroughly with Milli-Q and the protective caps fitted. The termination was inspected for mechanical security. The access panels were removed and the ScanFish was rinsed thoroughly inside and out with fresh-water. The vehicle was inspected for damage and security of all fixings, cables and connectors.

Data Processing

All Sea-Bird CTD data extraction and processing of the ScanFish raw data was completed using Sea-Bird Data Processing software by NMF S&M Technicians.

The processing order used was:

- *[DY197_ScanFish_DatCnv.psa]*

  Data Conversion (skipover = 0, ox_hysteresis_correction = no):

  # name 0 = scan: Scan Count

  # name 1 = timeS: Time, Elapsed [seconds]

  # name 2 = timeJ: Julian Days

  # name 3 = timeQ: Time, NMEA [seconds]

  # name 4 = latitude: Latitude [deg]

  # name 5 = longitude: Longitude [deg]

  # name 6 = f2: Frequency 2

  # name 7 = prDM: Pressure, Digiquartz [db]

  # name 8 = ptempC: Pressure Temperature [deg C]

  # name 9 = f0: Frequency 0

  # name 10 = t090C: Temperature [ITS-90, deg C]

  # name 11 = f1: Frequency 1

  # name 12 = c0S/m: Conductivity [S/m]

  # name 13 = v0: Voltage 0

  # name 14 = sbeox0V: Oxygen raw, SBE 43 [V]

  # name 15 = v2: Voltage 2

  # name 16 = flECO-AFL: Fluorescence, WET Labs ECO-AFL/FL [mg/m^3]

  # name 17 = v3: Voltage 3

  # name 18 = turbWETntu0: Turbidity, WET Labs ECO [NTU]

  # name 19 = pumps: Pump Status

  # name 20 = modError: Modulo Error Count

- *[DY197_ScanFish_FilterP.psa]*

  Filter 150ms on Pressure (prDM)

- *[DY197_ScanFish_AlignCTD.psa]*

  AlignCTD 5s on oxygen voltage channels only (v0, sbeox0V)

- *[DY197_ScanFish_CellTM.psa]*

CellTM on primary conductivity channel (alpha = 0.03, tau = 7)

- [DY197_ScanFish_27_Derive.psa]

  Derive: (time window doc/dt = 2s, oxy tau correction = yes)

  # name 21 = depSM: Depth [salt water, m], lat = 56.9923

  # name 22 = potemp090C: Potential Temperature [ITS-90, deg C]

  # name 23 = sal00: Salinity, Practical [PSU]

  # name 24 = density00: Density [density, kg/m^3]

  # name 25 = sigma-é00: Density [sigma-theta, kg/m^3]

  # name 26 = sigma-t00: Density [sigma-t, kg/m^3]

  # name 27 = svCM: Sound Velocity [Chen-Millero, m/s]

  # name 28 = svDM: Sound Velocity [Delgrosso, m/s]

  # name 29 = svWM: Sound Velocity [Wilson, m/s]

  # name 30 = sbeox0PS: Oxygen, SBE 43 [% saturation], WS = 2

  # name 31 = sbeox0ML/L: Oxygen, SBE 43 [ml/l], WS = 2

  # name 32 = sbox0Mm/Kg: Oxygen, SBE 43 [umol/kg], WS = 2

  # name 33 = flag: flag

- *[DY197_ScanFish_BinAvg1Hz.psa]*

  Bin Average (bintype = seconds, binsize = 1, include surface bin=no)

- *[DY197_ScanFish_ASCII_Out.psa]*

  ASCII Out of 1Hz binned .cnv file

- *[DY197_ScanFish_SeaPlot_Depth_Time.psa]*

  Seaplot: jpg of ScanFish depth time series for 24Hz and 1Hz data

- *[DY197_ScanFish_SeaPlot_O2_Conc_5s.psa]*

  Seaplot: .jpg of Dissolved Oxygen for 24Hz and 1Hz data to check alignment

The loop-edit and wild-edit modules were not used. Pressure spiking due to 9plus framing errors was noted in a couple of files, and these will require wild-editing by the end-user of the data (see Depth_Time Seaplot .jpg files in the Plots folder).

Software Used

EIVA ScanFIsh Flight v1.6 (ScanFish flight control and status monitoring)

Sea-Bird Seasave 7.26.7.121 (SBE 9/11plus data acquisition on ScanFish CTD Industrial PC)

Sea-Bird SBE Data Processing 7.26.7.129 (SBE 9/11plus data processing on ScanFish CTD Industrial PC)

OpenCPN v5.12.2 (chart plotter for operational survey use)

PolarCOM 1.9 (NMEA navigational instrument display)

Moxa PComm Terminal Emulator 2.10 (Serial port testing and instrument configuration)

Notepad ++ 8.8.3 (Data-file and Header viewing)

Paint.NET v5.1.9 (Image editing for documentation)

Ship Scientific Systems

Ship Scientific Systems (SSS) is responsible for operating and managing the Ship's scientific information technology infrastructure, data acquisition, compilation and delivery, and the suite of ship-fitted instruments and sensors in support of the Marine Facilities Programme (MFP)

The work site was the [***cruise work site***].

The main objectives for SSS in the service of the science party on this cruise were:

1. Acquire underway data and metadata, including sea-surface, meteorological, position and attitude, depth and multibeam swath.
2. Provide services for monitoring data streams and displaying data.
3. Provide services for recording metadata and events.
4. Provide basic IT support.

All times in this report are in UTC.

Summary

A summary of the progress made against objectives is shown below.

[X] Objectives, [X] completed, [X] partially completed, [X] not completed.

Target	Outcomes	Objective met?
Acquire underway data and metadata, including sea-surface, meteorological, position and attitude, depth and multibeam swath.		Yes
Provide services for monitoring data streams and displaying data.		Yes
Provide services for recording metadata and events.		Yes
Provide basic IT support		Yes

Scientific computer systems

Underway data acquisition

Data from the suite of ship-fitted scientific instrumentation was aggregated onto a network drive on the ship's file server. This was available throughout the voyage in read-only mode to permit

scientists to work with the data as it was acquired. A Public network folder was also available for scientists to share files.

A copy of these two drives are written to the end-of-cruise disks that are provided to the Principal Scientist and the designated data centre.

The designated data centre for this cruise is: British Oceanographic Data Centre

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List of logged ship-fitted scientific systems:

/Ship_Systems/*[Keywords]*_Ship_fitted_information_sheet.docx

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The ship Systems portion of the cruise disk is split into three directories; **Data**, **Metadata** and **Documentation**.

Directory	Explanation
Data	Folder: /Ship_Systems/Data/ Purpose: All raw and processed datasets, including structured metadata. Examples; • Raw sensor time series data (.txt) • Structured sensor metadata (.json) • Processed sensor time series data (.nc) Example file formats: .txt, .nc, .csv, .json, .all, .raw, .log
Metadata	Folder: /Ship_Systems/Metadata/ Purpose: All non-structured metadata. This helps to explain some of the datasets. Examples; • Data description documentation (.docx) • Sensor calibration documentation (.pdf). • Ship survey documentation (.pdf). Example file formats: .docx, .pdf
Documentation	Folder: /Ship_Systems/Documentation/ Purpose: All non-metadata documentation. As an example, PDF documentation for sensor operation. Examples; • Instrument manuals (.pdf).

	Example file formats: .docx, .pdf

The data acquisition systems used on this cruise are detailed in the table below. The data and data description documents are filed per system in the *Data* and *Metadata* directories respectively within Ship Systems folder on the cruise data disk.

Table 3: Data acquisition systems used on this cruise.

Data acquisition system	Usage	Data products	Directory system name
Ifremer TechSAS	Continuous.	NetCDF ASCII pseudo-NMEA	/TechSAS/
NMF RVDAS	Continuous.	ASCII Raw NMEA SeaDataNet NetCDF (Testing)	/RVDAS/
Kongsberg SIS (EM122)	Discrete	Kongsberg .all	/Acoustics/EM-122/
Kongsberg SIS (EM710)	Continuous	Kongsberg .all	/Acoustics/EM-710/
Kongsberg SBP	Unused.	None	/Acoustics/SBP-27/
Kongsberg EA640	Continuous	None, redirected to Techsas/RVDAS RAM	/Acoustics/EA-640/
Kongsberg EK80	Continuous		/Acoustics/EK-80/
UHDAS (ADCPs)	Continuous	ASCII raw, RBIN, GBIN, CODAS files	/Acoustics/ADCP/
VMDAS (ADCPs)	Unused.		/Acoustics/ADCP/
Sonardyne Ranger2	Discrete.	None, redirected to Techsas/RVDAS RAM	/Acoustics/USBL/
Rutter WAMOS	Continuous	None, redirected to Techsas/RVDAS RAM	/Wamos/

Data description documents per system:

/Ship_Systems/Metadata/[systemName]/

Data directories per system:

/Ship_Systems/Data/[systemName]/

Significant acquisition events and gaps

On this cruise, the RVDAS event logger was used with CSV records of events saved to the cruise data directory.

Path and pattern to event log CSV files:

/Ship_Systems/Data/RVDAS/Event_logs/[logName]/*.csv

Summary of main events

Date	Time start*	Time end*	Event
2025-08-10	13:40		TechSAS logger started
2025-08-10	13:48		RVDAS logger started
2025-08-11	14:14	19:05	SURFMET Underway DATA TSG, Fluorimeter, Transmissometer logging valid data
2025-08-11	19:05	2025-08-12 01:34	Data acquisition paused upon entering French waters (no permit)
2025-08-12	01:34		Data acquisition resumed after exiting French waters
2025-08-22	05:17		Surfmet Underway DATA TSG, Fluorimeter, Transmissometer logging paused (Aberdeen Ports of Call) Seawater Tap closed
2025-08-22	07:50	11:40	Tied up in Port Aberdeen
2025-08-22	11:50	2025-09-07 13:40	Data acquisition resumed after exiting Aberdeen.
2025-09-07	13:40	-	Data Acquisition Terminated (TechSAS, RVDAS)

Summary of data gaps

Date	Time start	Time end	Event
2025-08-11	11:52:41	14:14:29	RVDAS logger paused (gap length: 2h 21m 48s)

Internet provision

Satellite communications were provided with Starlink, OneWeb, VSat and Iridium Certus.

The ship operated with bandwidth controls to prioritise business use.

Outreach and streaming

None.

Data acquisition systems

NMF operated two central acquisition systems; **TechSAS** and **RVDAS**.

TechSAS

TechSAS (Technical and Scientific Acquisition System) is a central acquisition system developed by the oceanographic institute Ifremer. TechSAS has been used on the RRS James Cook and RRS Discovery since ~2007/2013 and is currently the primary acquisition system.

TechSAS produced two file types; NetCDF and NMEA (ASCII);

File type	Explanation
NetCDF	Data: /Ship_Systems/Data/TechSAS/NetCDF/[SENSOR]/ Filename format: YYYYMMDD-HHMMSS-[SENSOR]-[SENSOR].[SENSOR] Source: Written in real time by system. Data description: /Ship_Systems/Metadata/Techsas/Data_Description Collection: All data at acquisition resolution. Purpose: Standard NetCDF format with global attribute metadata, variable metadata and 1D variable timeseries data.
NMEA	Data: /Ship_Systems/Data/TechSAS/NMEA/[SENSOR]/ Filename format: YYYYMMDD-HHMMSS-[SENSOR].[SENSOR] Source: Written in real time by system. Data description: /Ship_Systems/Metadata/Techsas/Data_Description Collection: All data at acquisition resolution. Purpose: ASCII data format with pseudo-NMEA data sentences in 1D timeseries.

System	Quick reference
Primary GPS	NetCDF: /Ship_Systems/Data/TechSAS/NetCDF/GPS/YYYYMMDD-HHMMSS-[TYPE]-POSMV_GPS.gps NMEA: /Ship_Systems/Data/TechSAS/NMEA/mvpos/YYYYMMDD-HHMMSS-POSMV_GPS.mvpos Data description: /Ship_Systems/Metadata/TechSAS/Data_Description/Posmv Data Description.docx
Biogeochemical, meteorological and solar irradiance sensors	NetCDF: /Ship_Systems/Data/TechSAS/NetCDF/SURFMETV3/YYYYMMDD-HHMMSS-[TYPE]-SURFMET.SURFMETv3 NMEA: /Ship_Systems/Data/TechSAS/NMEA/surfm/YYYYMMDD-HHMMSS-SURFMET.surfm Data description: /Ship_Systems/Metadata/TechSAS/Data_Description/Surfmet Data Description_v5_DY.docx
Thermosalinograph	NetCDF: /Ship_Systems/Data/TechSAS/NetCDF/SURFMETV3/YYYYMMDD-HHMMSS-[TYPE]-SURFMET.SURFMETv3 NMEA: /Ship_Systems/Data/TechSAS/NMEA/surfm/YYYYMMDD-HHMMSS-SURFMET.surfm Data description: /Ship_Systems/Metadata/TechSAS/Data_Description/Surfmet Data Description_v5_DY.docx
Windsonic	NetCDF: /Ship_Systems/Data/TechSAS/NetCDF/SURFMETV3/YYYYMMDD-HHMMSS-WINDSONIC-WINDSONIC.WINDSONIC NMEA: /Ship_Systems/Data/TechSAS/NMEA/winds/YYYYMMDD-HHMMSS-WINDSONIC.winds Data description: /Ship_Systems/Metadata/TechSAS/Data_Description/Windsonic Data Description.docx

Date	Time start	Time end	Event
2025-08-26	19:53:12.160	2025-08-27 12:54:54.594	DY_ships_gyro_GYRO stream crashed gap (6 hours, 58 minutes, and 17.566 seconds)

RVDAS

RVDAS (Research Vessel Data Acquisition System) is a central acquisition system developed by NMF and the British Antarctic Survey. RVDAS has been used since ~2018 and is currently the common data acquisition format across the NERC research ships RRS Discovery, RRS James Cook and RRS Sir David Attenborough.

RVDAS produced one real-time data file (raw ASCII), one real-time PostgreSQL database, one post-cruise PostgreSQL dump, six post-processed data files (NetCDF and CSV), structured metadata files (JSON) and eventlog files (CSV).

File type	Explanation
Raw text	Data: /Ship_Systems/Data/RVDAS/Raw_TXT/ Filename format: [Keywords]_[SENSOR]_YYYY_MM_DD.nmea.txt Source: Written in real time by acquisition module (v2.7.0). Data description: /Ship_Systems/Data/RVDAS/Sensor_metadata/ Collection: All data at acquisition resolution. Purpose: ASCII data format with NMEA-0183 standardised or pseudo-NMEA data sentences in 1D timeseries. Status: Production data product.
PostgreSQL database	Data: Only available onboard ship. Source: Written in real time by database module (v1.0.0). Data description: /Ship_Systems/Data/RVDAS/Sensor_metadata/ Collection: All data at acquisition resolution. Purpose: Advanced querying of timeseries data on ship. Status: Production data product.
PostgreSQL database dump	Data: /Ship_Systems/Data/RVDAS/Database_SQL_dump/ Filename format: Source: Written on demand by NetCDF module (v1.0.0) at cruise stop. Data description: /Ship_Systems/Data/RVDAS/Sensor_metadata/ Collection: All data at acquisition resolution. Purpose: Advanced querying of timeseries data off ship. Status: Production data product.
Sensor metadata	Data: /Ship_Systems/Data/RVDAS/Sensor_metadata/ Filename format: [SENSOR]_[SHIP]_YYYY-MM-DDTHHMMSSZ-YYYY-MM-DDTHHMMSSZ.json Source: Written on demand by metadata module (v1.0.0).

	Collection: Manual entries of structured sensor and acquisition metadata. Status: Production data product.
Event logs	Data: /Ship_Systems/Data/RVDAS/Event_logs/[LOG TYPE]/ Filename format: [LOG TYPE].csv Source: Written in real time by eventlogging module (v1.0.0). Collection: Entries of acquisition and science event history. Status: Production data product.
NetCDF (Raw)	Data: /Ship_Systems/Data/RVDAS/Database_NetCDF/Raw/ Filename format: metocean-[Keywords]-[SENSOR]_[SENTENCE]-raw-YYYMMDD-HHMMSS.nc Source: Written by NetCDF module (v1.0.0) as post-processing from database. Data description: /Ship_Systems/Data/RVDAS/Sensor_metadata/ Collection: All data at acquisition frequency. Status: Work-in-progress data product.
NetCDF (SAMOS)	Data: /Ship_Systems/Data/RVDAS/Database_NetCDF/SAMOS/ Filename format: samos_YYYYMMDD-HHMMSS.nc Source: Written by NetCDF module (v1.0.0) as post-processing from database. Collection: SAMOS data variables at 1 min resolution (bin averaged). Data description: https://samos.coaps.fsu.edu/html/documentation.php Status: Work-in-progress data product.
NetCDF (METOCEAN)	Data: /Ship_Systems/Data/RVDAS/Database_NetCDF/METOCEAN/ Filename format: metocean_YYYYMMDD-HHMMSS.nc Source: Written by NetCDF module (v1.0.0) as post-processing from database. Collection: All data at 5 min resolution (bin averaged). Data description: /Ship_Systems/Data/RVDAS/Sensor_metadata/ Status: Work-in-progress data product.
CSV (Raw)	Data: /Ship_Systems/Data/RVDAS/Database_CSV/Raw/ Filename format: metocean-[Keywords]-[SENSOR]_[SENTENCE]-raw-YYYMMDD-HHMMSS.csv Source: Written by NetCDF module (v1.0.0) as post-processing from database.

	Data description: /Ship_Systems/Data/RVDAS/Sensor_metadata/ Collection: All data at acquisition frequency. Status: Work-in-progress data product.
CSV (SAMOS)	Data: /Ship_Systems/Data/RVDAS/Database_CSV/SAMOS/ Filename format: samos_YYYYMMDD-HHMMSS.csv Source: Written by NetCDF module (v1.0.0) as post-processing from database. Collection: SAMOS data variables at 1 min resolution (bin averaged). Data description: https://samos.coaps.fsu.edu/html/documentation.php Status: Work-in-progress data product.
CSV (METOCEAN)	Data: /Ship_Systems/Data/RVDAS/Database_CSV/METOCEAN/ Filename format: metocean_YYYYMMDD-HHMMSS.csv Source: Written by NetCDF module (v1.0.0) as post-processing from database. Collection: All data at 5 min resolution (bin averaged). Column header format: [VARIABLE]-[SENSOR]_[SENTENCE] Data description: /Ship_Systems/Data/RVDAS/Sensor_metadata/ Status: Work-in-progress data product.

System	Quick reference
Primary GPS	Raw data: /Ship_Systems/Data/RVDAS/Raw_TXT/[Keywords]_POSMV_YYYY_MM_DD.nmea.txt Data description: /Ship_Systems/Data/RVDAS/Sensor_metadata/posmv-[SHIP]-YYYY-MM-DDTHHMMSSZ-YYYY-MM-DDTHHMMSSZ.json
Seawater biogeochemical sensors	Raw data: /Ship_Systems/Data/RVDAS/Raw_TXT/[Keywords]_NUDAMUWY_YYYY_MM_DD.nmea.txt Data description: /Ship_Systems/Data/RVDAS/Sensor_metadata/nudamuwy-[SHIP]-YYYY-MM-DDTHHMMSSZ-YYYY-MM-DDTHHMMSSZ.json
Meteorological sensors	Raw data: /Ship_Systems/Data/RVDAS/Raw_TXT/[Keywords]_NUDAMMET_YYYY_MM_DD.nmea.txt

	Data description: /Ship_Systems/Data/RVDAS/Sensor_metadata/nudammet-[SHIP]-YYYY-MM-DDTHHMMSSZ-YYYY-MM-DDTHHMMSSZ.json
Solar irradiance sensors	Raw data: /Ship_Systems/Data/RVDAS/Raw_TXT/[Keywords]_NUDAMLGT_YYYY_MM_DD.nmea.txt Data description: /Ship_Systems/Data/RVDAS/Sensor_metadata/nudamlgt-[SHIP]-YYYY-MM-DDTHHMMSSZ-YYYY-MM-DDTHHMMSSZ.json
Windsonic	Raw data: /Ship_Systems/Data/RVDAS/Raw_TXT/[Keywords]_WINDSONIC_YYYY_MM_DD.nmea.txt Data description: /Ship_Systems/Data/RVDAS/Sensor_metadata/windsonic-[SHIP]-YYYY-MM-DDTHHMMSSZ-YYYY-MM-DDTHHMMSSZ.json

Instrumentation

Coordinate reference

Path to ship survey files:

/Ship_Systems/Documentation/Vessel_Survey

Origin (RRS Discovery)

All coordinates, unless otherwise specified, use the following convention:
Central reference point (0,0,0) at Frame 44, centreline, main deck with sense (X+ fwd, Y+ stbd, Z+ down). This CRP is at (32.4m, 0m, -7.4m) with respect to the ship's absolute stern, centreline, baseline.

The ship's survey (Parker Maritime, 2013) defines two systems of reference point using two different central reference points (CRPs):

1. (0,0,0) at Frame 0 (aft-most frame, 6m forward from stern), centreline (centre of keel), baseline (ship's bottom-most longitudinal).
2. (0,0,0) at ship's centre of gravity (CG), Frame 44 (26.4m forward from Frame 0 at 0.6m framespacing), centreline (centre of keel), main deck (7.4m up from baseline).

The survey coordinate sense is X is positive forward, Y positive starboard, and Z positive down. The coordinate order in the survey is (Y,X,Z), but unless otherwise noted, all coordinates are given elsewhere as (X,Y,Z).

For all scientific purposes, unless otherwise stated, the coordinate system is referenced using the second system, with the CRP at the CG.

Primary scientific position and attitude system

The translations and rotations provided by this system (Applanix PosMV) have the following convention:

1. Roll positive port up,
2. Pitch positive bow up,
3. Heading true positive to starboard,
4. Heave positive up.

Position, attitude and time

System	Navigation (Position, attitude, time)		
Data product(s)	NMEA (mvpos, mvatt, spatt, sppos, cnpos): /Ship_Systems/Data/TechSAS/NMEA/ NetCDF (GPS): /Ship_Systems/Data/TechSAS/NetCDF/ Raw NMEA (POSMV, SEAPATH, CNAV): /Ship_Systems/Data/RVDAS/Raw_TXT Raw & processed NetCDF (POSMV, SEAPATH, CNAV): /Ship_Systems/Data/RVDAS/Database_NetCDF Raw NMEA (POSMV, SEAPATH, CNAV): /Ship_Systems/Data/RVDAS/Database_CSV		
Data description	/Ship_Systems/Data/RVDAS/Sensor_metadata /Ship_Systems/Metadata/Techsas/Data_Description ~~/Ship_Systems/Metadata/RVDAS/Data_Description~~		
Other documentation	/Ship_Systems/Documentation/GPS_and_Attitude		
Component	Purpose	Outputs	Headline Specifications
Applanix PosMV	Primary GPS and attitude.	Serial NMEA to acquisition systems and multibeam	Positional accuracy within 0.15 m.

Kongsberg Seapath 330 NOT OPERATIONAL	Secondary GPS and attitude.	Serial and UDP NMEA to acquisition systems and multibeam	Positional accuracy within 1 m.
Oceaneering C-NavX1	Correction service for primary and secondary GPS and dynamic positioning.	RTCM to primary and secondary GPS	Positional accuracy within 0.03 m.
Meinberg NTP Clock	Provide network time	NTP protocol over the local network.	

Significant position, attitude or time events or losses

Date	Time start*	Time end*	Event
Length of cruise	-	-	CNAV system is not fully configured, therefore POSMV has an accuracy of 0.20m

Ocean and atmosphere monitoring systems

SURFMET

System	SURFMET (Surface water and atmospheric monitoring)
Data product(s)	NMEA (surfm, sbe38, sbe45, winds): /Ship_Systems/Data/TechSAS/NMEA/ NetCDF (SURFMETV3, SBE38, TSG, WINDSONIC): /Ship_Systems/Data/TechSAS/NetCDF/ Raw NMEA (NUDAM***, SF***, SBE38DK, SBE45, WINDSONIC): /Ship_Systems/Data/RVDAS/Raw_TXT Raw & processed NetCDF (NUDAM***, SF***, SBE38DK, SBE45, WINDSONIC): /Ship_Systems/Data/RVDAS/Database_NetCDF Raw NMEA (NUDAM***, SBE38DK, SBE45, WINDSONIC): /Ship_Systems/Data/RVDAS/Database_CSV
Data description	/Ship_Systems/Data/RVDAS/Sensor_metadata /Ship_Systems/Metadata/Techsas/Data_Description ~~/Ship_Systems/Metadata/RVDAS/Data_Description~~
Other documentation	/Ship_Systems/Documentation/SURFMET

Calibration info	See [Keywords]_Ship_fitted_information_sheet.docx for calibration information for each sensor. Calibration documents: /Ship_Systems/Metadata/SURFMET/Calibration_Files	
Component	Purpose	Outputs
Inlet temperature probe (SBE38)	Measure temperature of water at hull inlet.	Serial to Interface Box.
Drop keel temperature probe (SBE38)	Measure temperature of water flush to hull at the drop keel.	Serial to Interface Box.
Thermosalinograph (SBE45)	Measure temp. and conductivity at sampling board. Salinity is calculated.	Serial to Interface Box.
Interface Box (SBE90402)	Signals management.	Serial to Moxa.
Debubbler	Reduces bubbles through instruments.	None.
Transmissometer (CST)	Measure of transmittance.	Analogue to NUDAM.
Fluorometer (WS3S)	Measure of fluorescence.	Analogue to NUDAM.
Air temperature and humidity probe (HMP45A, HMP155)	Temperature and humidity at met. platform.	Analogue to NUDAM.
Ambient light sensors (PAR, SKE510; TIR, CMP6)	Ambient light at met. platform.	Analogue to NUDAM.
Barometer (PTB110, PTB210)	Atmospheric pressure at met. platform.	Analogue to NUDAM.
Anemometer (Windsonic)	Wind speed and direction at met. platform.	Serial to Moxa.
NUDAM	A/D converter.	Serial NMEA to Moxa.
Moxa	Serial to UDP converter.	UDP NMEA to Surfmet VM.
Surfmet Virtual Machine	Data management.	UDP NMEA to TechSAS, RVDAS.

The calibration functions below refer to both the TechSAS and RVDAS data products.

Component	Calibrated product steps

SBE38: Temperature (°C)	No calibration to apply because the residuals are below uncertainty.
SBE45: Temperature (°C)	No calibration to apply because the residuals are below uncertainty.
SBE45: Conductivity (S m^{-1})	No calibration to apply because the residuals are below uncertainty.
HMP155: Temperature (°C)	
HMP155: Relative humidity (%)	No calibration to apply because the residuals are below uncertainty.
PTB110 / PTB210: Pressure (hPa)	No calibration to apply because the residuals are below uncertainty.
Windsonic: Wind speed (m s^{-1})	No calibration to apply.
Windsonic: Wind direction (m s^{-1})	

The calibration functions below refer to the TechSAS data products only.

Component	Calibrated product steps	
	TechSAS NetCDF	TechSAS NMEA
CST: Transmission (%)	Product $= (\text{Data} - V_{\text{dark}})/(V_{\text{ref}} - V_{\text{dark}})$. Here product has units % and data, V_{dark} and V_{ref} have units V.	
WS3S: Fluorescence (µg L^{-1})	Product $=$ Coefficient $\times$ (Data $-$ Offset). Here product has units µg L^{-1}, coefficient has units µg L^{-1} V^{-1}, and data and offset have units V.	
SKE510: PAR (W m^{-2})	Product $=$ Data $\times \left(\frac{10^6}{\text{Coefficient}}\right)$. Here product has units W m^2, data has units 10^{-5} V, the 10^6 scalar has units µV V^{-1}, and coefficient has units µV m^2 W^{-1}.	Product $=$ Data $\times \left(\frac{10}{\text{Coefficient}}\right)$. Here product has units W m^2, data has units W m^2, the 10 scalar has units µV m^2 W^{-1}, and coefficient has units µV m^2 W^{-1}.
CMP6: TIR (W m^{-2})	Product $=$ Data $\times \left(\frac{10^6}{\text{Coefficient}}\right)$. Here product has units W m^2, data has units 10^{-5} V, the 10^6 scalar has units µV V^{-1}, and coefficient has units µV m^2 W^{-1}.	Product $=$ Data $\times \left(\frac{10}{\text{Coefficient}}\right)$. Here product has units W m^2, data has units W m^2, the 10 scalar has units µV m^2 W^{-1}, and coefficient has units µV m^2 W^{-1}.

The calibration functions below refer to the RVDAS data products only.

Component	Calibrated product steps

	RVDAS raw text	RVDAS NetCDF & CSV
CST: Transmission (%)	Product $= (\text{Data} - V_{\text{dark}})/(V_{\text{ref}} - V_{\text{dark}})$. Here product has units % and data, V_{dark} and V_{ref} have units V.	
WS3S: Fluorescence (µg L^{-1})	Product = Coefficient × (Data − Offset). Here product has units µg L^{-1}, coefficient has units µg L^{-1} V^{-1}, and data and offset have units V.	
SKE510: PAR (W m^{-2})	Product $= \text{Data} \times \left(\frac{1000}{\text{Coefficient}}\right)$. Here product has units W m^2, data has units mV, the 1000 scalar has units µV mV^{-1}, and coefficient has units µV m^2 W^{-1}.	Product $= \text{Data} \times \left(\frac{10}{\text{Coefficient}}\right)$. Here product has units W m^2, data has units W m^2, the 10 scalar has units µV m^2 W^{-1}, and coefficient has units µV m^2 W^{-1}.
CMP6: TIR (W m^{-2})	Product $= \text{Data} \times \left(\frac{1000}{\text{Coefficient}}\right)$. Here product has units W m^2, data has units mV, the 1000 scalar has units µV mV^{-1}, and coefficient has units µV m^2 W^{-1}.	Product $= \text{Data} \times \left(\frac{10}{\text{Coefficient}}\right)$. Here product has units W m^2, data has units W m^2, the 10 scalar has units µV m^2 W^{-1}, and coefficient has units µV m^2 W^{-1}.

The NMF Surfmet system was run throughout the cruise, excepting times for cleaning, entering and leaving port, and whilst alongside. Please see the separate information sheet for details of the sensors used and whether their recorded data have calibrations applied or not.

Surface water sampling board maintenance

Date	Time start*	Time end*	Event	Trans high (V)	Trans low (V)	Fluoro (V)	Salinity (PSU)
			Pre cruise sensor cleaning	4.710V	0.008V	0.746V	-
2025-08-11	14:14:28	19:05	Underway Seawater Data logging valid	3.9520V	-	0.1305V	34.8588
2025-08-11	19:05	2025-08-22 01:34	Underway Data logging paused on French waters	4.1809	-	0.226	34.6941
2025-08-12	01:34	2025-08-22 06:40	Underway data logging reinstated after exitin French waters	2.2556	-	0.1637	34.703

2025-08-22	05:17	13:30	Underway data logging paused Aberdeen Ports of Call	3.430	0.008	0.169	34.700
2025-08-22	06:45	07:10	Underway Transmissometer and fluorometer and TSG cleaned	-	0.008	-	-
2025-08-22	13:30	-	Underway data logging again (valid) after Aberdeen Ports of Call	3.48	-	0.125	34.64
2025-08-25	11:06	11:07	Underway Transmissometer and fluorometer prior cleaning	3.43	-	0.144	34.68
2025-08-25	11:08	11:30	Cleaning in progress CST Air and dark test	4.74 open air	0.01 blanked	-	-
2025-08-25	11:30		Underway data logging valid	4.12	-	0.153	34.67
2025-08-29	11:27	11:27	Underway Transmissometer and fluorometer prior cleaning	3.53	-	0.139	34.68
2025-08-29	11:35	11:50	Cleaning in progress CST Air and dark test	4.66 open air	0.005 blanked	-	-
2025-08-29	11:50	2025-09-02 08:50	Uderway data logging valid	3.44	-	0.192	34.60
2025-09-02	08:54	09:15	Cleaning in progress CST Air and dark test	4.73	0.0056	-	-
2025-09-02	09:15	2025-09-05 09:31	Underway data logging valid	4.04	-	0.186	34.64
2025-05-09	09:31	09:33	Prior cleaning	3.07	-	0.133	34.59

2025-09-05	09:32	10:10	Cleaning in progress CST Air and dark test	4.74 open	0.0056 blanked	-	-
2025-09-05	10:10	2025-09-07 08:08	Underway data logging valid	3.64	-	0.131	34.58
2025-09-07	08:08	08:40	System was cleaned using Decon solution.				

The system was cleaned prior to the cruise.

Wave radar

System	WAMOS Wave Radar	
Data product(s)	NMEA (wamos, rexwr): /Ship_Systems/Data/TechSAS/NMEA/ NetCDF: /Ship_Systems/Data/TechSAS/NetCDF/NC Raw NMEA (WAMOS, REX2): /Ship_Systems/Data/RVDAS/Raw_TXT Raw & processed NetCDF (WAMOS, REX2): /Ship_Systems/Data/RVDAS/Database_NetCDF Raw NMEA (WAMOS, REX2): /Ship_Systems/Data/RVDAS/Database_CSV	
Data description	/Ship_Systems/Metadata/WAMOS /Ship_Systems/Data/RVDAS/Sensor_metadata /Ship_Systems/Metadata/Techsas/Data_Description ~~/Ship_Systems/Metadata/RVDAS/Data_Description~~	
Other documentation	/Ship_Systems/Documentation/WAMOS	
Component	Purpose	Outputs
Rutter OceanWaves WAMOS	Measure wave height, direction, period and spectra.	Summary statistics in NMEA to TechSAS and RVDAS. Spectra files.
RsAqua Rex2 Wave Height Sensor	Measure wave height at bow to provide calibration reference dataset.	Wave height NMEA, UDP to TechSAS, RVDAS.
Furuno Radar	Measures radar reflection on sea surface.	Radar data to WAMOS.

Data is being synced to two external disks, including the large POLAR files.

The wave radar magnetron requires annual replacement. Following replacement, WAMOS needs to collect wave data within 5 km of another wave height sensor over the full range of sea-states in order to derive wave height calibration coefficients for the new magnetron. This reference dataset can be derived by examining the ship's track for wave buoys and downloading their data, or by using the onboard RsAqua Wave Height sensor fitted on the ship's bow.

Summary of data gaps

Date	Time start	Time end	Event
2025-08-11	10:08	19:05	WAMOS logging data
2025-08-11	19:05	2025-08-22 01:34	WAMOS Data logging paused on French waters
2025-08-12	01:34	2025-08-22 06:40	WAMOS data logging reinstated after exiting French waters
2025-08-22	07:55	12:03	WAMOS FURUNO radar switched off during Aberdeen Ports of Call
2025-09-07	07:50		WAMOS data collection terminated

pCO_2 system

System	pCO_2 system	
Data product(s)	Raw: /Ship_Systems/Data/pCO2/Raw Processed: /Ship_Systems/Data/pCO2/Processed	
Data description	/Ship_Systems/Metadata/pCO2/Data_Description /Ship_Systems/Data/RVDAS/Sensor_metadata ~~/Ship_Systems/Metadata/RVDAS/Data_Description~~	
Other documentation	/Ship_Systems/Documentation/pCO2	
Component	Purpose	Outputs
General Oceanics' model 8060 dry enclosure	Brains of pCO_2 system. Controls electronics and merges data streams.	Data product sentence to file and via UDP to central acquisition.
General Oceanics' model 8060 wet enclosure	Controls seawater and atmospheric gas samples to gas analyser.	

General Oceanics' model 8060 deck enclosure	Measure deck pressure.	Deck pressure via serial to dry enclosure.
LI-COR 7815 gas analyser	Measure dry mixing ratio of CO_2 (xCO_2)	xCO_2 via ethernet to dry enclosure.
Aanderaa 4835 oxygen optode	Dissolved O_2 sensor.	Measured O_2 concentration, O_2 saturation and sensor temperature to dry enclosure.
External SURFMET sensors	Send additional valuable data for merge.	Data via UDP to dry enclosure.
NMF data reduction script.	Process raw data product into higher-level data products (i.e. pCO_2/fCO_2).	Additional data products to cruise disk.

Summary of data gaps

Date	Time start	Time end	Event
2025-08-11	14:51	19:33	System started
2025-08-11	19:33	2025-08-22 01:34	Underway Data logging paused on French waters
2025-08-12	01:44	2025-08-22 06:40	Underway data logging reinstated after exitin French waters
2025-08-121	14:41	2025-08-13 04:14	Low flow rate (less than 2.5 l/min) 2.3l/min
2025-08-13	06:41	11:44	Condenser issues
2025-08-22	05:31	13:45	Data logging paused Aberdeen Ports of Call
2025-08-22	13:45	2025-09-07 07:50	Data logging again after Aberdeen Ports of Call
2025-09-07	07:50	-	Data logging terminated

The LI-COR 7815 gas analyser sampled reference gases on an automated ~21 hour cycle.

Path to gas calibration certificates:

/Ship_Systems/Metadata/pCO2/Calibration/

Standard	Known conc. (ppm)	Source	Scale / traceability
STD1	0	BOC	n/a
STD2	249.788±0.012	ICOS (2023-04-27)	WMO-CO2-X2007-EXTENDED
STD3	403.081±0.014	ICOS (2021-01-21)	WMO-CO2-X2007-EXTENDED
STD4	812.918±0.030	ICOS (2023-04-27)	WMO-CO2-X2007-EXTENDED

A post-processor "data reduction script" developed by NMF was used to process the raw instrument data into reduced calibrated datasets. The processor was configured to run automatically daily at 00:10 and the output files were temporarily stored in the directory /Ship_Systems/Data/pCO2/Processed/YYYY-MM-DD/. At the end of the cruise, the SST deleted the temporary products and then ran the script manually to produce the final data products, which were stored in the directory /Ship_Systems/Data/pCO2/Processed/.

For the calculation of pCO_2 and fCO_2, the equations from Pierrot et al. (2009)[1] were used. Seawater pCO_2/fCO_2 calculation used equation 6 with the wet equilibrator pCO_2/fCO_2 values of equations 4 and 1 respectively. Atmospheric pCO_2 and fCO_2 used equation 4 and equation 1, respectively, with sea surface temperature substituted for equilibrator temperature. Below shows the data sources of each variable;

Variable	Data source
$equT$	Primary equilibrator thermometer. Data file variable 'EquTemp'.
x_{CO_2}	Drift-corrected dry mixing ratio. Drift-corrected dry mixing ratio was calculated by cross-linearly interpolating the routine gas standards checks (~21 hr) to the data file variable 'CO2ppm'.
P_{equ}	Sum of the equilibrator differential pressure sensor and the wet box enclosure pressure sensor. Data file variables 'EquPress' and 'DruckLabPress' respectively.
P_{atm}	Deck box enclosure PTB210 pressure sensor. Data file variable 'Deck_Press'.

[1] Pierrot et al. (2009) Recommendations for autonomous underway pCO2 measuring systems and data-reduction routines. https://doi.org/10.1016/j.dsr2.2008.12.005.

	If the deck box enclosure PTB210 pressure sensor data was not unavailable, the mast-mounted PTB210 pressure sensor was used (external data). Data file variable 'air_pressure'.
SSS	Underway SBE45 thermosalinograph (external data). Data file variable 'salinity'.
SST	Hull-mounted SBE38 thermometer (external data). Data file variable 'hull_temperature'. If the hull-mounted SBE38 thermometer data was not unavailable, the inlet-mounted SBE38 thermometer was used (external data). Data file variable 'inlet_temperature'.

The data reduction script produced the following core data products;

File type	Explanation
Calibration data	Filename format: YYYY-MM-DD_YYYY-MM-DD_calibration_data.csv Data description: /Ship_Systems/Metadata/pCO2/Data_Description/ Purpose: Time series of calibration events with regression statistics and residual data. Status: Production data product.
Seawater data	Filename format: YYYY-MM-DD_YYYY-MM-DD_seawater_data.csv Data description: /Ship_Systems/Metadata/pCO2/Data_Description/ Purpose: Time series of equilibrator measurements (seawater) with drift-corrected xCO_2, and calculated pCO_2 and fCO_2. Dataset is reduced to geophysical data only. Status: Production data product.
Atmospheric data	Filename format: YYYY-MM-DD_YYYY-MM-DD_atmospheric_data.csv Data description: /Ship_Systems/Metadata/pCO2/Data_Description/ Purpose: Time series of atmospheric measurements with drift-corrected xCO_2, and calculated pCO_2 and fCO_2. Dataset is reduced to geophysical data only. Status: Production data product.

The data reduction script produced the following optional data products at request of Chief Scientist;

File type	Explanation
Temperature latency data	Filename format: YYYY-MM-DD_YYYY-MM-DD_temperature_latency_data.csv

	~~Data description: /Ship_Systems/Metadata/pCO2/Data_Description/~~ Purpose: Time series of latency between seawater inlet and primary equilibrator. Status: Work-in-progress data product.
System health data	Filename format: YYYY-MM-DD_YYYY-MM-DD_system_health_data.csv Data description: /Ship_Systems/Metadata/pCO2/Data_Description/ Purpose: Time series of all diagnostic measurements and processed flags. Status: Work-in-progress data product.
SOCAT pCO2 data	Filename format: YYYY-MM-DD_YYYY-MM-DD_SOCAT_data.csv ~~Data description: /Ship_Systems/Metadata/pCO2/Data_Description/~~ Purpose: Minimum viable product for SOCAT database submission. Contains a minimal metadata header. Status: Work-in-progress data product.

Hydroacoustic Systems

System	Acoustics	
Data product(s)	Raw (EA-640, EM-122): /Ship_Systems/Data/Acoustics NMEA (eadep, emdep): /Ship_Systems/Data/TechSAS/NMEA NetCDF (EA600, DEPTH): /Ship_Systems/Data/TechSAS/NetCDF Raw NMEA (EA640, EM122): /Ship_Systems/Data/RVDAS/Raw_TXT Raw & processed NetCDF (EA640, EM122): /Ship_Systems/Data/RVDAS/Database_NetCDF Raw NMEA (EA640, EM122): /Ship_Systems/Data/RVDAS/Database_CSV	
Data description	/Ship_Systems/Metadata/Acoustics /Ship_Systems/Data/RVDAS/Sensor_metadata /Ship_Systems/Metadata/Techsas/Data_Description /Ship_Systems/Metadata/RVDAS/Data_Description	
Other documentation	/Ship_Systems/Documentation/Acoustics	
Component	Purpose	Operation and Outputs

10/12 kHz Single beam (Kongsberg EA-640)	Primary depth sounder	Continuous, NMEA over serial, raw files
12 kHz Multibeam (Kongsberg EM-122)	Full-ocean-depth multibeam swath.	Continuous, Discrete Binary swath, centre-beam NMEA, *.all files, optional water column data
70 kHz Multibeam (Kongsberg EM-710)	Coastal/shallow multibeam swath.	Continuous, Binary swath, centre-beam NMEA, *.all files.
Sub-bottom Profiler (Kongsberg SBP-27)	Multi-frequency echogram to provide along-track sub-bottom imagery.	Unused BMP, raw files, optional water column data.
Drop keel sound velocity sensor	Provide sound velocity at transducer depth	Continuous, free running Value over serial to Kongsberg SIS.
Sound velocity profilers (Valeport Midas, Lockheed XBT)	Direct measurement of sound velocity in water column.	Discrete ASCII pressure vs sound velocity files. Manually loaded into Kongsberg SIS or Sonardyne Ranger2.
75 kHz ADCP (Teledyne OS75)	Along-track ocean current profiler	Unused (via UHDAS)
150 kHz ADCP (Teledyne OS150)	Along-track ocean current profiler	Continuous, free running (via UHDAS)
USBL (Sonardyne Ranger2)	Underwater positioning system to track deployed packages or vehicles.	Discrete NMEA over serial
Kongsberg EK80 Wideband Scientific Echo Sounder	Scientific echo sounder system designed for high-precision underwater acoustic measurements.	Continuous Raw Acoustic Data and Processed Acoustic Metrics
CARIS	Post-processing	Discrete CARIS Project file. CARIS Vessel files

MB-System	Post-processing	Unused XYZ, SegY files

Marine Mammal Protection

NMF policy is to follow JNCC guidelines for marine mammal observations before operating any equipment which causes significant acoustic disturbance in the water column. Such equipment includes the deep-water multibeam and sub-bottom profiler. For these systems, an MMO procedure is followed, which, in summary, involves a 60-minute bridge observation with a ramped start 20 minutes into the observation.

Path to Marine Mammal Observations logs:

/Ship_Systems/Metadata/Acoustics/MMOs

A member of the scientific party was responsible for carrying out and recording MMO activities.

Table 4: Marine mammal observation events reported to SSS.

Date	System	Obs. Start Time	Sys. Start Time Full Power	Notes (inc. any observations or actions)
2025-09-03	EM710	16:00	16:40 (shallow ~90m)	No sightings

Sound velocity profiles

Sound velocity profiles were measured directly with a Midas SVP, derived from CTD or calculated from the WOA13 model using Ifremer DORIS.

Path of sound velocity profile data on the cruise datastore:

/Ship_Systems/Data/Acoustics/Sound_Velocity

Details of when sound velocity profiles were taken and applied are shown in the table below:

Table 5: Sound velocity profiles.

Datetime	Method	Location (Lat/Lon)	Filename	Datetime SVP applied

				to SIS / Ranger2
2025-08-12	From CTD12	57 deg 03.50N, 001 deg 48.50E	DY197_CTD_012_SV_2m_bins-extended_thinned.asvp	15:38 added to SIS+Ranger2 survey: em710-dy179-hornsea line:89

Equipment-specific comments

ADCPs

Path of ADCP data on the cruise datastore:

/Ship_Systems/Data/Acoustics/ADCP

Attribute	Value
Acquisition software	UHDAS
Frequencies used	75 kHz, 150 kHz
Running mode	Free-running (untriggered)

EM-122 Configuration and Surveys

Path of Multibeam data on the cruise datastore:

/Ship_Systems/Data/Acoustics/EM-122

Path of EM122 CARIS Vessel Configuration File:

/Ship_Systems/Data/Acoustics/EM-122/CARIS_Processed/VesselConfig

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<table>
<tr><th>Attribute</th><th>Value</th></tr>
<tr><td>Number of surveys</td><td>Not logged.</td></tr>
<tr><td>Date of patch test</td><td>Not undertaken.</td></tr>
<tr><td>Offsets and rotations</td><td>
<table>
<tr><th>Item</th><th>X (m, + Forward)</th><th>Y (m, + Starboard)</th><th>Z (m, + Down)</th></tr>
<tr><td>Tx transducer</td><td>39.910</td><td>0.885</td><td>7.426</td></tr>
<tr><td>Rx transducer</td><td>35.219</td><td>-0.005</td><td>7.438</td></tr>
<tr><td>Attitude</td><td>0.00</td><td>0.00</td><td>0.00</td></tr>
<tr><td>Waterline</td><td></td><td></td><td>1.0</td></tr>
</table>
<table>
<tr><th>Item</th><th>Roll (deg)</th><th>Pitch (deg)</th><th>Yaw (deg)</th></tr>
<tr><td>Tx transducer</td><td>0.07</td><td>0.15</td><td>0.05</td></tr>
<tr><td>Rx transducer</td><td>0.05</td><td>0.37</td><td>-1.15</td></tr>
<tr><td>Attitude</td><td>-0.10</td><td>0.45</td><td>-1.15</td></tr>
</table>
</td></tr>
<tr><td>Post-processing undertaken</td><td>None.</td></tr>
</table>

EM-710 Configuration and Surveys

Path of Multibeam data on the cruise datastore:

/Ship_Systems/Data/Acoustics/EM-710

Path of EM710 CARIS Vessel Configuration File:

/Ship_Systems/Data/Acoustics/EM-710/CARIS_Processed/VesselConfig

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Attribute	Value
Number of surveys	(Run continuously)

<table>
<tr><td>Date of patch test</td><td>Not undertaken. Pitch tested with CARIS no change required on offset.</td></tr>
<tr><td>Offsets and rotations</td><td>
<table>
<tr><th>Item</th><th>X (m, + Forward)</th><th>Y (m, + Starboard)</th><th>Z (m, + Down)</th></tr>
<tr><td>Tx transducer</td><td>37.570</td><td>-1.994</td><td>7.425</td></tr>
<tr><td>Rx transducer</td><td>36.819</td><td>-2.051</td><td>7.427</td></tr>
<tr><td>Attitude</td><td>0.00</td><td>0.00</td><td>0.00</td></tr>
</table>
<table>
<tr><th>Item</th><th>Roll (deg)</th><th>Pitch (deg)</th><th>Yaw (deg)</th></tr>
<tr><td>Tx transducer</td><td>-0.07</td><td>0.33</td><td>0.22</td></tr>
<tr><td>Rx transducer</td><td>0.01</td><td>0.12</td><td>359.7</td></tr>
<tr><td>Attitude</td><td>-0.14</td><td>-0.40</td><td>-1.00</td></tr>
<tr><td>Waterline</td><td></td><td></td><td>1.0</td></tr>
</table>
</td></tr>
<tr><td>Post-processing undertaken</td><td>Yes, but it's not a complete hydrographic processing.</td></tr>
</table>

EK80 Configuration and Surveys

Path of raw and processed metrics data on the cruise datastore:

/Ship_Systems/Data/Acoustics/EK80 *We moved the data to an external disk due to its large volume.*

Path for Configuration File:

/Ship_Systems/Data/Acoustics/EK80

Attribute	Value
Number of surveys	(Run continuously)
Date of last	All transducers, apart from the 333 kHz, were calibrated on 2023-jan-04 in Rosita Harbour, South Georgia. (DY158)

calibration	
Transducers frequency, mode and serial numbers	

Channel	s/n	Pulse Type	Filter Type	Mode	Pulse Duration (ms)	Power (W)	Start Frequency (Hz)	Ramping
ES18	2111	-	-	Active	1.024	1600	-	-
ES38-7-narrow	350	CW	Standard Res.	Active	1.024	2000	38000	Fast
ES70-7C	258	CW	Standard Res.	Active	1.024	750	70000	Fast
ES120-7C	2250	CW	Standard Res.	Active	1.024	250	120000	Fast
ES200-7C	533	CW	Standard Res.	Active	1.024	150	200000	Fast
ES333-7C	135	CW	Standard Res.	Active	1.024	50	-	-

Post-processing undertaken	No.

Summary of data gaps:

Date	Time start	Time end	Event
2025-08-11	19:06:00	2025-08-12 01:37:00	While transiting through French waters, DY197 logging has been paused on the acoustic systems
2025-08-12	12:45:02	13:26:00	EK80 run on passive mode for test
2025-08-25	13:31:00	13:20:00	EK80 temporarily halted pinging during the Scanfish Altimeter test.
2025-08-22	06:40:01	11:50:01	Aberdeen Ports Of Call
2025-09-02	15:24:00	2025-09-03 05:51:00	Discovered in the morning the EK80 internal data disk was full. Connected a new external disk and redirected data logging to it. Previously collected data from the internal disk was also transferred to the external drive.

2025-09-07	07:42		Survey DY197 terminated

USBL Configuration and deployments

Path of Multibeam data on the cruise datastore:

NMEA: /Ship_Systems/Data/TechSaS/NMEA/usblp

NetCDF: /Ship_Systems/Data/TechSaS/NetCDF/USBL

$PSONLLD ASCII: /Ship_Systems/Data/RVDAS/rawdata/*RANGER2USBL*.txt

---

Attribute	Value
Number of deployments	5
Heads used for operations	HPT7000 Starboard
Datetime of last CASIUS	2019-08-15 (HPT5000 and HPT7000)
Port Head 1DRMS (HPT5000)	14.5m 0.3%
Starboard Head 1DRMS (HPT7000)	12.4m 0.26%

Deployment information:

Deployment name	Head used	Beacon(s) used	Datetime Start	Datetime End	SVP Used (Filename)
Test	HPT7000@STBD	WMT2707	2025-08-13 07:05	07:16	SVP from CTD12
M1 lander	HPT7000@STBD	M1 2201 M1 2202	2025-08-14 17:21	17:41	SVP from CTD12
M2 lander	HPT7000@STBD	M2 2101 M2 2102	2025-08-14 18:05	18:16	SVP from CTD12

Lander M1 and M2 CASIUS information can be found in the following folder:

Ship_Systems/Data/Acoustics/USBL

Other systems

Cable Logging and Monitoring

Winch activity is monitored and logged using the CLAM system.

Appendix

METOCEAN CSV headers

The column names have the structure [variable]-[sensor]_[sentence]. To locate the metadata, navigate to /Ship_Systems/Data/RVDAS/Sensor_metadata/ and find the file in the format [SENSOR]_[SHIP]_YYYY-MM-DDTHHMMSSZ-YYYY-MM-DDTHHMMSSZ.json. Inside the file, there is a list of dictionaries “sentences” that have a key-value pair of "name": "[sentence]". Each sentence value has a list of dictionaries “fields” that have a key-value pair of "fieldNumber": "[variable]". This inner dictionary contains the required metadata. Note that this is a work-in-progress dataset.

The SEAPATH system (secondary GPS) was not provided in the table below because this was inoperative during DY197. The FUGRO and PHINS systems (quaternary and quinary GPS systems) were not provided in the table below because the data can be found in the primary and tertiary GPS systems (POSMV and CNAV respectively).

Column name	Explanation
time	Start timestamp of the averaging period.
utctime-cnav_gngga	UTC timestamp from CNAV. Format is HHMMSS.S.
latitude-cnav_gngga	Latitude position from CNAV. Format is DDMM.MMMM.
longitude-cnav_gngga	Longitude position from CNAV. Format is DDMM.MMMM.
ggaqual-cnav_gngga	GPS quality flag from CNAV.
numsat-cnav_gngga	Number of satellites used in GPS fix by CNAV.
hdop-cnav_gngga	Horizontal dilution of precision from CNAV.
altitude-cnav_gngga	Altitude position from CNAV. Unit is m.
geoidaltitude-cnav_gngga	Altitude (geoid) position from CNAV. Unit is m.
diffcage-cnav_gngga	Age of differential correction from CNAV. Unit is s.
dgnssrefid-cnav_gngga	Reference station for differential correction used by CNAV.
rms-cnav_gngst	RMS value of the pseudorange residuals from CNAV.
majoraxis-cnav_gngst	Error ellipse, semi-major axis, 1-sigma error from CNAV. Unit is m.

minoraxis-cnav_gngst	Error ellipse, semi-minor axis, 1-sigma error from CNAV. Unit is m.
orientation-cnav_gngst	Error ellipse orientation (true). Unit is °.
laterr-cnav_gngst	Standard deviation in latitude position from CNAV. Unit is m.
lonerr-cnav_gngst	Standard deviation in longitude position from CNAV. Unit is m.
alterr-cnav_gngst	Standard deviation in altitude position from CNAV. Unit is m.
courseoverground-cnav_gnvtg	Vessel course over ground (true) from CNAV. Unit is °.
magnetictrack-cnav_gnvtg	Vessel course over ground (magnetic) from CNAV. Unit is °.
speedknots-cnav_gnvtg	Vessel speed over ground from CNAV. Unit is kn.
speedkmph-cnav_gnvtg	Vessel speed over ground from CNAV. Unit is kph.
waterdepthfeetfromsurface-ea640_sddbs	Seafloor depth below water surface from EA640. Unit is feet.
waterdepthmetrefromsurface-ea640_sddbs	Seafloor depth below water surface from EA640. Unit is m.
waterdepthfathomfromsurface-ea640_sddbs	Seafloor depth below water surface from EA640. Unit is fathoms.
waterdepthmetretransducer-ea640_sddpt	Seafloor depth below transducer from EA640. Unit is m.
transduceroffset-ea640_sddpt	Transducer – surface offset in EA640. Unit is m.
humidity-envtemp_wimhu	Relative humidity of the controlled environment laboratory. Unit is %.
airtemperature-envtemp_wimta	Temperature of the controlled environment laboratory. Unit is °C.
flow-nudamuwy_sfuwy	Flow rate in seawater sensors. Unit is L min^{-1}.
fluo-nudamuwy_sfuwy	Raw fluorescence sensor signal. Unit is V.
trans-nudamuwy_sfuwy	Raw transmission sensor signal. Unit is V.
ppar-nudamlgt_sflgt	Photosynthetically available radiation sensor (port). Unit is W m^{-2}.
spar-nudamlgt_sflgt	Photosynthetically available radiation sensor (starboard). Unit is W m^{-2}.
ptir-nudamlgt_sflgt	Total irradiance sensor (port). Unit is W m^{-2}.
stir-nudamlgt_sflgt	Total irradiance sensor (starboard). Unit is W m^{-2}.
airtemp-nudammet_sfmet	Atmospheric temperature. Unit is °C.

humidity-nudammet_sfmet	Atmospheric relative humidity. Unit is %.
press-nudammet_sfmet	Atmospheric pressure. Unit is hPa.
windspeed-windsonic_iimwv	Wind speed. Unit is m s^{-1}.
winddirection-windsonic_iimwv	Wind direction. Unit is °.
tension-winch_winch	Tension on winch cable. Unit is t.
cableout-winch_winch	Cable length deployed from winch. Unit is m s^{-1}.
rate-winch_winch	Cable deploy rate. Unit is m s^{-1}. Positive values are cable paying out.
backtension-winch_winch	Back tension on winch cable. Unit is t.
rollangle-winch_winch	Roll angle of cable. Unit is °.
utctime-posmv_gpgga	UTC timestamp from POSMV. Format is HHMMSS.S.
latitude-posmv_gpgga	Latitude position from POSMV. Format is DDMM.MMMM.
longitude-posmv_gpgga	Longitude position from POSMV. Format is DDMM.MMMM.
ggaqual-posmv_gpgga	GPS quality flag from POSMV.
numsat-posmv_gpgga	Number of satellites used in GPS fix by POSMV.
hdop-posmv_gpgga	Horizontal dilution of precision from POSMV.
altitude-posmv_gpgga	Altitude position from POSMV. Unit is m.
diffcage-posmv_gpgga	Age of differential correction from POSMV. Unit is s.
dgnssrefid-posmv_gpgga	Reference station for differential correction used by POSMV.
latitude-posmv_gpgll	Latitude position from POSMV. Format is DDMM.MMMM.
longitude-posmv_gpgll	Longitude position from POSMV. Format is DDMM.MMMM.
semimajor-posmv_gpgst	Error ellipse, semi-major axis, 1-sigma error from POSMV. Unit is m.
semiminor-posmv_gpgst	Error ellipse, semi-minor axis, 1-sigma error from POSMV. Unit is m.
ellipseorient-posmv_gpgst	Error ellipse orientation (true). Unit is °.
standarddeviationoflatitude-posmv_gpgst	Standard deviation in latitude position from POSMV. Unit is m.
standarddeviationoflongitude-posmv_gpgst	Standard deviation in longitude position from POSMV. Unit is m.
standarddeviationofheight-posmv_gpgst	Standard deviation in altitude position from POSMV. Unit is m.
headingtrue-posmv_gphdt	Vessel heading (true) from POSMV. Unit is °.

latitude-posmv_gprmc	Latitude position from POSMV. Format is DDMM.MMM.
longitude-posmv_gprmc	Longitude position from POSMV. Format is DDMM.MMM.
speedknots-posmv_gprmc	Vessel speed over ground from POSMV. Unit is kn.
trackmadegood-posmv_gprmc	Vessel course over ground (true) from POSMV. Unit is °.
coursetrue-posmv_gpvtg	Vessel course over ground (true) from POSMV. Unit is °.
speedknots-posmv_gpvtg	Vessel speed over ground from POSMV. Unit is kn.
speedkmph-posmv_gpvtg	Vessel speed over ground from POSMV. Unit is kph.
day-posmv_gpzda	Calendar day from POSMV. Format is DD.
month-posmv_gpzda	Calendar month from POSMV. Format is MM.
year-posmv_gpzda	Calendar year from POSMV. Format is YYYY.
heading-posmv_pashr	Vessel course over ground (magnetic) from CNAV. Unit is °.
roll-posmv_pashr	Vessel roll from POSMV. Unit is °. Positive is port side up.
pitch-posmv_pashr	Vessel pitch from POSMV. Unit is °. Positive is bow up.
heave-posmv_pashr	Vessel heave from POSMV. Unit is m. Positive is motion up.
rollaccuracy-posmv_pashr	Vessel roll accuracy from POSMV. Unit is °.
pitchaccuracy-posmv_pashr	Vessel pitch accuracy from POSMV. Unit is °.
headingaccuracy-posmv_pashr	Vessel heave accuracy from POSMV. Unit is m.
temph-sbe45_nanan	Housing temperature of thermosalinograph. Unit is °C.
conductivity-sbe45_nanan	Conductivity of seawater from thermosalinograph. Unit is S m^{-1}.
tempr-sbe45_nanan	Remote temperature from thermosalinograph (at seawater inlet). Unit is °C.
salinity-sbe45_nanan	Derived salinity from thermosalinograph. Unit is PSU.
soundvelocity-sbe45_nanan	Derived sound velocity from thermosalinograph. Unit is PSU.
tempdk-sbe38dk_sbe38	Temperature of seawater measured from dropkeel sensor. Unit is °C.
headingtrue-shipsgyro_hehdt	Vessel heading (true) from SHIPSGYRO. Unit is °.
rateofturn-shipsgyro_tirot	Rate of turn from SHIPSGYRO. Unit is ° min^{-1}. Negative values are turns to port.
watertemperatureincelsius-skipperlog_vdmtw	Temperature of SKIPPERLOG transducer. Unit is °C.

longitudinalwaterspeed-skipperlog_vdvbw	Bow–stern vessel speed through water from SKIPPERLOG. Unit is kn. Negative values are astern.
transversewaterspeed-skipperlog_vdvbw	Port–starboard vessel speed through water from SKIPPERLOG. Unit is kn. Negative values are to port.
longitudinalgroundspeed-skipperlog_vdvbw	Bow–stern vessel speed over ground from SKIPPERLOG. Unit is kn. Negative values are astern.
transversegroundspeed-skipperlog_vdvbw	Port–starboard vessel speed over ground from SKIPPERLOG. Unit is kn. Negative values are to port.
hs-wamos_pwam	Significant wave height from WAMOS. Units is m.
tm2-wamos_pwam	Wave period from WAMOS. Units is s.
pdir-wamos_pwam	Wave peak direction from WAMOS. Unit is °.
tp-wamos_pwam	Wave peak period from WAMOS. Unit is s.
lp-wamos_pwam	Wave peak wavelength from WAMOS. Unit is m.
dp1-wamos_pwam	Direction of swell system from WAMOS.
tp1-wamos_pwam	Period of swell system from WAMOS. Unit is s.
lp1-wamos_pwam	Wavelength of swell system from WAMOS. Unit is m.
dp2-wamos_pwam	Direction of wind sea system from WAMOS.
tp2-wamos_pwam	Period of wind sea system from WAMOS. Unit is s.
lp2-wamos_pwam	Wavelength of wind sea system from WAMOS. Unit is m.
currentdir-wamos_pwam	Surface current direction from WAMOS. Unit is °.
currentspeed-wamos_pwam	Surface current speed from WAMOS. Unit is m s^{-1}.

BODC Ship-fitted Systems Information Sheet (Discovery)

Cruise	DY197
Technician	Zoltan Nemeth
Date	2025-08-10 – 2025-09-09

Ship-fitted instruments:

The following table lists the logging status of ship-fitted instrumentation and suites.

Manufacturer	Model	Function/data types	Logged? (Y/N)	Comments
Meinberg	LANTIME M300	GPS network time server (NTP)	N	

Applanix	POS MV	DGPS and attitude	Y	Slightly reduced accuracy. Now 0.20 m
C-Nav	X1	DGPS and DGNSS	Y	Misconfigured
Kongsberg Seatex	Seapath 330+	DGPS and attitude	N	Inoperative
Sonardyne	Ranger2 USBL	USBL	N	
Sperry Marine		Ship gyrocompasses x 2	Y	
Kongsberg Maritime	Simrad EA640	Single beam echo sounder (hull)	Y	
Kongsberg Maritime	Simrad EM122	Multibeam echo sounder (deep)	Y	
Kongsberg Maritime	Simrad EM710	Multibeam echo sounder (shallow)	N	
Kongsberg Maritime	Simrad SBP27	Sub bottom profiler	N	
Kongsberg Maritime	Simrad EK80	Scientific echo sounder (fisheries)	N	
NMF-SSS	CLAM	CLAM system winch log	N	
NMF-SSS	SURFMET	Meteorology suite	Y	
		Skipper log (ship's velocity)	Y	
Rutter OceanWaveS GmbH	WaMoS II Sigma S6	Wave Radar	Y	
RSAqua	Rex2	Wave Height Sensor	Y	
Teledyne RD Instruments	Ocean Observer 75 kHz	UHDAS	N	Inoperative
Teledyne RD Instruments	Ocean Observer 150 kHz	UHDAS	Y	
General Oceanics	8060 pCO2 system	pCO2	N	