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MRV *Scotia*

Survey 1421S

CRUISE REPORT

08 – 20 October 2021

Loading: Aberdeen, 06 October 2021
Unloading: Aberdeen, 20 October 2021

In setting the survey programme and specific objectives, etc. the Scientist-in-Charge needs to be aware of the restrictions on working hours and the need to build in adequate rest days and rest breaks as set out in Marine Scotland's Working Time Policy (Notice 34/03). In addition, the Scientist-in-Charge must formally review the risk assessments for the survey with staff on-board before work is commenced.

In the interest of efficient data management it is now mandatory to return the survey report, to I Gibb and the Survey Summary Report (old ROSCOP form) to M Geldart, within four weeks of a survey ending. In the case of the Survey Summary Report a nil return is required, if appropriate

Personnel

A Gallego	(SIC)
H Smith	(Co-SIC)
B Rabe	
M Geldart	
M Rennie	
C Dempsey	
E Magyar	
M Bargus	
J Scott	

Out-turn days per project: 11 days: ST05B; 2 days COMPASS

Gear

Sea-Bird CTDs (SBE9, SBE25, RBR, SBE37's and SBE56's), mooring frames (AL-200s), ADCPs and current meter instrumentation, water filtering equipment, plankton nets, mooring equipment, chemistry sampling equipment. Mooring components (anchor, chain, etc.).

Objectives

1. Test the SBE911 and CTD carousel (main CTD crane) at Goldeneye location and collect water samples - achieved

2. Perform hydrographic sampling along the JONSIS long term monitoring section in the northern North Sea - achieved

3. Perform hydrographic sampling along the long term monitoring Faroe-Shetland Channel Fair Isle – Munken (FIM) section - achieved

4. Perform hydrographic sampling along the long term monitoring Faroe-Shetland

Channel Nolso – Flugga (NOL) section - achieved

5. Turn around (refurbish) the Loch Ewe metocean buoy mooring and repair or swap over its SBE37 instrument - achieved

6. Carry out the Loch Ewe CTD transect and collect water, phytoplankton and zooplankton samples - achieved

7. Deploy ADCP (Sig250) in trawl resistant AL-200 frame in Linne Crowlin (east Skye, new frame prepared) - achieved

8. Recover ADCP (Sig250) in trawl resistant AL-500 frame in the Little Minch and deploy ADCP (Sig250) in trawl resistant AL-200 frame in the same location (new frame prepared) - achieved

9. Recover ADCP (Sig500) in steel frame in Loch Erisort (east Lewis) and deploy ADCP (AWAC) in steel frame in the same location - achieved

10. Run the thermosalinograph (TSG) throughout the survey. TSG will be cleaned prior to sailing - achieved (TSG cleaned after the survey)

11. Run the VMADCP on all the standard sections - achieved

12. Take water samples for long term storage on Fair Isle – Munken or Nolso – Flugga section stations - achieved

13. Carry out oil degrading bacteria work: water filtration on selected NOL/FIM stations - achieved

14. Test Aberdeen University Holocam in deeper water (on plankton crane, 500-1000 m – depth pending confirmation from UoA) – achieved (shallower water due to a change in the request)

15. If weather/time permits perform Shelf CTD lines - achieved (Shelf 3 and Shelf 4)

16. If weather/time permits, perform CTD line along the AlterECO line and gather additional data near Stonehaven - achieved (plus phytoplankton samples)

17. If weather/time permits repeat the JONSIS line at the end of the cruise and extend to 001° 30' east – no time

18. If weather/time permits, perform VMADCP/CTD survey work in the Moray Firth and/or Aberdeen Bay – no time

Narrative

On sailing from Aberdeen *Scotia* made passage to the Goldeneye oil field to test the CTD and carousel water sampler on the main CTD crane and to collect baseline water samples for any potential future Carbon Capture & Storage (CCS) monitoring. The target sampling position of 58° 0.3' N 0° 21.96' W was sampled.

On completion of these tests and sampling, *Scotia* sailed to the JONSIS section to carry out sampling with the CTD and carousel water sampler. On completion of the JONSIS section, Scotia made way to the Faroe Shetland Channel.

Passage was then made towards the eastern (Shetland) end of the Fair Isle – Munken (FIM) section to collect water samples and take CTD profiles.

After the FIM section, *Scotia* headed north to the western (Faroe) side of the Nolso-Flugga (NOL) section to carry out standard CTD and water sampling along that line. A pre-deployment calibration dip for the CT instruments to be deployed on moorings was carried out at a one of the NOL stations.

West coast CTD and mooring work was carried out next. All mooring deployments and recoveries took place during daylight hours. Passage was first made to Loch Ewe where a line of CTD stations was conducted from the mouth of the loch to the position of the metocean buoy, with additional (phyto- and zoo-) plankton sampling and then an attempt was made at recovering the metocean buoy and mooring. Unfortunately, very windy conditions prevented a successful recovery so we postponed this objective after an unsuccessful attempt and *Scotia* steamed to Linne Crowlin (east of Skye) to deploy an ADCP, and then on to the Little Minch deployment site to recover an AL500 ADCP instrument frame and deploy a new AL200 frame. Unfortunately, the bottom part of the AL500 frame was lost on recovery, although the top part (with all the instruments) was successfully recovered. *Scotia* then sailed back to Loch Ewe to recover the metocean buoy and refurbish it by successfully retrieving it on board, minus the met-station which was damaged on recovery, replacing components and re-deploying it with modified retrieval lines (including replacing the faulty SBE37 instrument on the buoy). Upon completion, *Scotia* sailed across to the Loch Erisort (east Lewis) mooring location to recover and re-deploy an ADCP instrument frame, measuring currents for model validation.

After the mooring work was completed, CTD sampling along the shelf lines Shelf 4 and Shelf 3, off the west coast, was carried out. A post-deployment calibration dip for the CT instruments recovered from the moorings was carried out at two suitable locations on Shelf 3.

On completion of the above, CTD, water and phytoplankton sampling on the AlterEco line in the North Sea was carried out prior to *Scotia*'s return to Aberdeen in the night of 19 Oct. Unloading took place on 20 Oct.

Mooring Positions (Recovery)

MIN	57° 28.804' N 006° 57.600' W	AL-500 trawl resistant frame (Sig250)
LE	58° 06.623' N 006° 21.531' W	Steel frame (Sig500)

Target Mooring Positions (Deployment)

CRO	57° 19.480' N 005° 52.120' W	AL-200 trawl resistant frame (Sig250)
MIN	57° 28.804' N 006° 57.600' W	AL-200 trawl resistant frame (Sig250)
LE	58° 06.623' N 006° 21.531' W	Steel frame (AWAC)

Scientific Procedures

Deployments of hydrographic equipment were carried out with the CTD crane whilst the vessel was on station. The plankton crane was used for the deployment of ADCP moorings from the hangar deck using an acoustic release to release the frames once they are on/close to the seabed. The steel ADCP frame was recovered off the aft using the cod end crane and redeployed off the hangar deck, as the other moorings. The Loch Ewe metocean buoy was recovered and re-deployed using the cod end crane and the bottom net drums.

Zooplankton net samples were taken using a bongo net deployed using the plankton crane

and wire. Phytoplankton samples were taken by sampling/filtering water from the non-toxic supply with a hand net.

Holographic images of zooplankton were taken using a prototype Holocam deployed using the plankton crane and wire.

Two container laboratories were used (one for water filtering and a dry container for communications with sampling equipment). Chlorophyll samples were stored frozen in the freezer in the Fish House. Nutrient samples were stored frozen in an empty and cleaned (fish-free) freezer on the lower container deck.

CTD data were emailed 4 times a day to the Met Office and the global Telecommunications System (GTS), to be used on ocean forecast models. Overall, 97 CTD profiles were submitted.

In total, 97 hydrographic stations were completed, and 127 salinity, 118 dissolved oxygen, 34 TA-DIC, 92 nutrients, 195 chlorophyll, 18 oil-degrading bacteria, 15 phytoplankton and 8 zooplankton samples were collected.

Submitted:

Alejandro Gallego

Date: 25 Oct. 2021

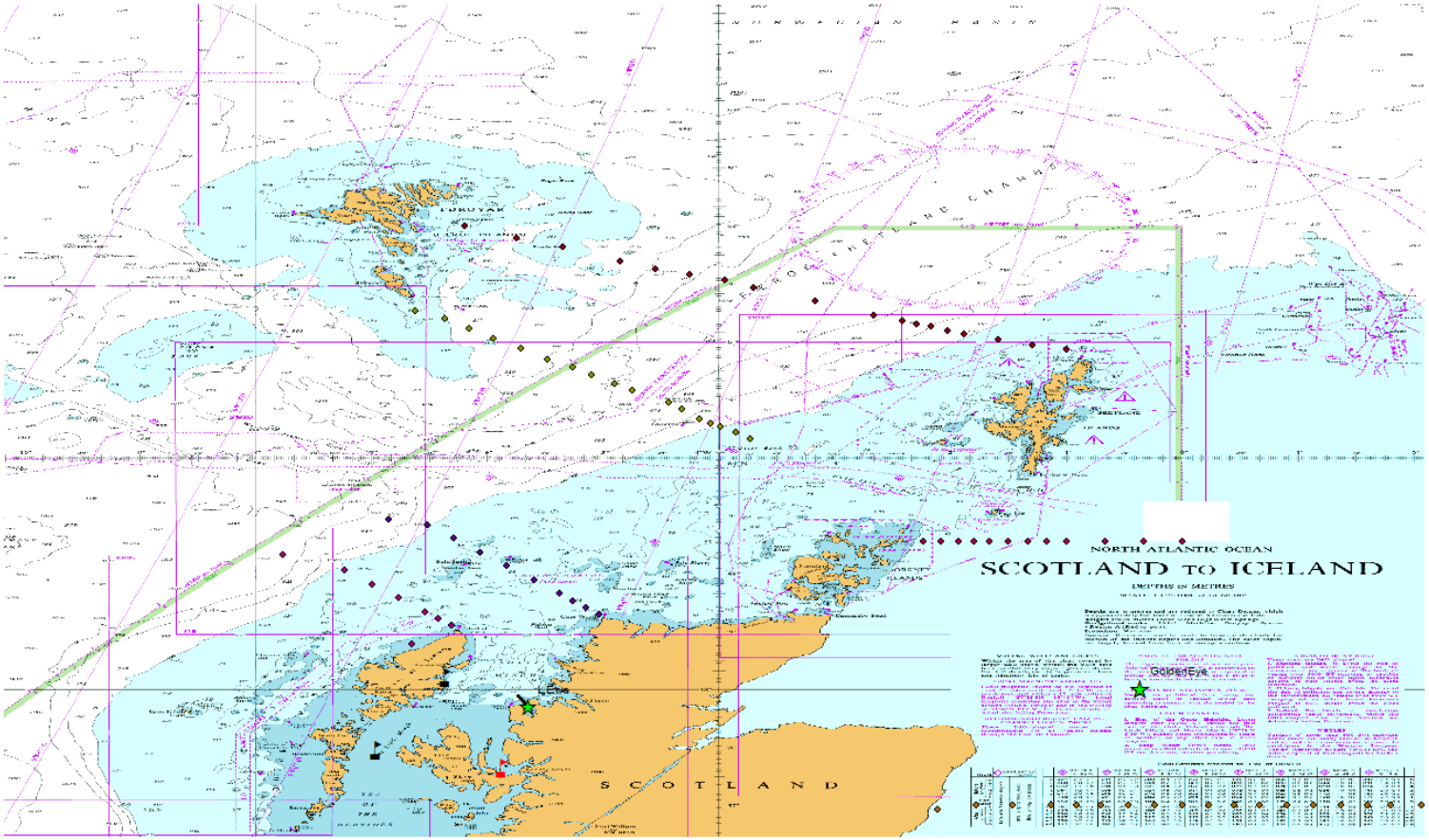

Chart showing key activities on 1421S

JONSIS Line

#	Name	Latitude	Longitude	Depth	Spacing
01	JO 1	59° 17.00' N	02° 14.00' W	75 m	
02	JO 1A	59° 17.00' N	02° 5.00' W	90 m	4.59 nm
03	JO 2	59° 17.00' N	01° 56.00' W	100 m	4.59 nm
04	JO 3	59° 17.00' N	01° 48.00' W	80 m	4.08 nm
05	JO 4	59° 17.00' N	01° 40.00' W	90 m	4.08 nm
06	JO 5	59° 17.00' N	01° 30.00' W	95 m	5.10 nm
07	JO 6	59° 17.00' N	01° 20.00' W	110 m	5.10 nm
08	JO 6A	59° 17.00' N	01° 10.00' W	120 m	5.10 nm
09	JO 7	59° 17.00' N	01° 0.00' W	125 m	5.10 nm
10	JO 8	59° 17.00' N	00° 40.00' W	120 m	10.20 nm
11	JO 9	59° 17.00' N	00° 20.00' W	140 m	10.20 nm
12	JO10	59° 17.00' N	00° 0.00' W	135 m	10.20 nm
			Totals	1180 m	68.36 nm

Nolso-Flugga (NOL)

#	Name	Latitude	Longitude	Depth	Spacing
01	NOL-01	60° 56.00' N	01° 00.00' W	110 m	
02	SEFN1	60° 58.70' N	01° 17.70' W	125 m	9.00 nm
03	SEFN2	61° 01.40' N	01° 35.40' W	155 m	8.99 nm
04	NOL-02	61° 04.00' N	01° 53.00' W	270 m	8.91 nm
05	SEFN3	61° 06.00' N	02° 01.50' W	440 m	4.57 nm
06	NOL-03	61° 08.00' N	02° 10.00' W	550 m	4.57 nm
07	SEFN4	61° 09.30' N	02° 17.50' W	630 m	3.85 nm
08	NOL-3a	61° 11.00' N	02° 25.00' W	730 m	3.98 nm
09	NOL-04	61° 14.00' N	02° 40.00' W	1080 m	7.82 nm
10	NOL-05	61° 21.00' N	03° 10.00' W	1370 m	16.03 nm
11	NOL-06	61° 28.00' N	03° 42.00' W	1235 m	16.84 nm
12	FARN2	61° 32.00' N	03° 57.00' W	1200 m	8.18 nm
13	NOL-07	61° 35.00' N	04° 15.00' W	990 m	9.08 nm
14	FARN1	61° 38.00' N	04° 33.00' W	530 m	9.07 nm
15	NOL-08	61° 42.00' N	04° 51.00' W	235 m	9.44 nm
16	NOL-09	61° 49.00' N	05° 21.00' W	180 m	15.84 nm
17	NOL-10	61° 54.00' N	05° 45.00' W	290 m	12.37 nm
18	NOL-11A	61° 56.50' N	05° 57.00' W	159 m	7.0 nm
			Totals	10245 m	162.60 nm

Fair Isle - Munken (FIM) (Amended for presence of Foinaven oil platform*)

#	Name	Latitude	Longitude	Depth	Spacing
01	FIM-01	60° 10.00' N	03° 44.00' W	150 m	
02	SEFF1	60° 13.00' N	03° 51.50' W	170 m	4.74 nm
03	FIM-02	60° 16.00' N	03° 59.00' W	200 m	4.84 nm
04	SEFF2	60° 18.00' N	04° 04.50' W	330 m	3.36 nm
*05	*FIM-03*	*60° 20.00' N*	*04° 10.00' W*	*390 m*	*3.03 nm*
06	FIM-04	60° 25.00' N	04° 19.00' W	655 m	6.88 nm
07	FIM-05	60° 29.00' N	04° 26.00' W	995 m	5.45 nm
08	FIM-06	60° 35.00' N	04° 45.00' W	1090 m	11.15 nm
09	FIM-6a	60° 38.00' N	04° 54.00' W	1030 m	5.33 nm
10	FIM-07	60° 43.00' N	05° 06.00' W	915 m	7.70 nm
11	FIM-08	60° 47.00' N	05° 16.00' W	830 m	6.34 nm
12	FIM-09	60° 51.00' N	05° 29.00' W	600 m	7.36 nm
13	FARF3	60° 56.70' N	05° 42.80' W	333 m	8.90 nm
14	FIM-10	61° 02.00' N	05° 57.00' W	280 m	8.68 nm
15	FARF2	61° 07.20' N	06° 09.40' W	250 m	7.95 nm
16	FIM-11A	61° 11.30' N	06° 20.00' W	242 m	7.0 nm
			Totals	8,558 m	108.18 nm

AlterEco line

#	Name	Latitude	Longitude	Depth [m]	Spacing
~~01~~	~~AlterEco1~~	~~57° 00.00' N~~	~~02° 04.00' E~~	~~92~~	
~~02~~	~~AlterEco2~~	~~57° 00.00' N~~	~~01° 48.00' E~~	~~94~~	~~8.72 nm~~
03	AlterEco3	57° 00.00' N	01° 36.00' E	99	6.54 nm
04	AlterEco4	57° 00.00' N	01° 22.00' E	104	7.63 nm
05	AlterEco5	57° 00.00' N	01° 08.00' E	85	7.63 nm
06	AlterEco6	57° 00.00' N	00° 54.00' E	102	7.61 nm
07	AlterEco7	57° 00.00' N	00° 40.00' E	92	7.61 nm
08	AlterEco8	57° 00.00' N	00° 27.00' E	89	7.09 nm
09	AlterEco9	57° 00.00' N	00° 14.00' E	84	7.09 nm
10	AlterEco10	57° 00.00' N	00° 00.00' E	83	7.61 nm
11	AlterEco11	57° 00.00' N	00° 14.00' W	79	7.61 nm
12	AlterEco12	57° 00.00' N	00° 28.00' W	82	7.63 nm
13	AlterEco13	57° 00.00' N	00° 42.00' W	68	7.63 nm
14	AlterEco14	57° 00.00' N	00° 55.00' W	75	7.07 nm
15	AlterEco15	57° 00.00' N	01° 08.00' W	67	7.07 nm
16	AlterEco16	57° 00.00' N	01° 28.00' W	68	10.91 nm
17	AlterEco17	57° 00.00' N	01° 47.00' W	98	10.56 nm
18	*AlterEco18*	*56° 57.80' N*	*02° 06.80' W*	*47*	*10.78 nm*
			Totals	1508 m	136.83 nm

Loch Ewe line

stn	lat		lon		
0	57	50.982	5	39.010	W
1	57	52.104	5	39.674	W
2	57	53.061	5	40.245	W
3	57	53.977	5	41.118	W
4	57	54.893	5	41.992	W
5	57	55.810	5	42.865	W
6	57	56.726	5	43.739	W
7	57	57.642	5	44.612	W
8	57	58.559	5	45.486	W