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MRV *Scotia*

Survey 1919S

## REPORT

12-22 December 2019

**Loading:** Aberdeen, 09 December 2019

**Unloading:** Aberdeen, 22 December 2019

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

B Rabe	(SIC)	12:00 – 00:00
H Smith	(co-SIC)	12:00 – 00:00
M Geldart	(Watch Leader)	12:00 – 00:00
A Gallego	(Watch Leader)	00:00 – 12:00
M Gray		00:00 – 12:00
M Hadjal (Vistor, Uni.of Stathclyde)		00:00 – 12:00

**Out-turn days per project:** 11 days: ST05b

## Gear

Sea-Bird CTD/Carousel, water filtering equipment, mooring deployment/recovery equipment, chemistry sampling equipment.

## Objectives

1. Test the SBE911 and CTD carousel (main CTD crane) and the SBE25 and Aquatracka (using plankton crane) in the Buchan Deep. **(tested the SBE911, not the SBE25)**
2. Perform routine hydrographic sampling at stations along the long term monitoring JONSIS section in the northern North Sea (Priority 1). **(achieved)**
3. Perform routine hydrographic sampling at stations along the long term monitoring Faroe-Shetland Channel section: Nolso-Flugga (Priority 1). **(achieved)**
4. Perform routine hydrographic sampling at stations along the long term monitoring Faroe-

Shetland Channel section Fair Isle-Munken (Priority 1). **(achieved)**

5. Take salinity, nutrient, chlorophyll, dissolved oxygen samples along all standard lines. **(achieved)**
6. Run the thermosalinograph throughout the survey. **(achieved)**
7. Run the VMADCP on all the standard sections. **(achieved)**

Extra work listed below will be performed if time allows, the order of priority 2 pieces of work are not listed in order of importance and the sequence will be determined depending on time/location/weather:

8. Opportunistically communicate with lost ADCP mooring on NOL section and Foinaven mooring and potentially recover (Priority 2). **(achieved, tried to communicate but no response)**
9. Deploy one new ADCP (NWEX) on a single string mooring on the NOL section (Priority 2). **(achieved)**
10. If weather/time permits repeat the JONSIS line at the end of the cruise and extend to 001° 30' east (if we have Norwegian clearance) (Priority 2). **(partly achieved)**
11. Perform hydrographic sampling along the Shelf 1 section (NW of Orkney) (Priority 2). **(achieved)**
12. Perform hydrographic sampling along the Shelf 2 section (NW of Orkney) (Priority 2). **(achieved)**
13. Perform hydrographic sampling along the Shelf 3 section (NW of Orkney) (Priority 2). **(not achieved)**
14. Perform hydrographic sampling along the East Coast section (in the Northern North Sea) (Priority 2). **(not achieved)**
15. Perform hydrographic sampling along the Fedje/Shetland section between Shetland and Norway (in the Northern North Sea, if we have Norwegian clearance) (Priority 2). **(not achieved)**
16. Perform hydrographic sampling along the Stonehaven AlterEco section in the northern North Sea (Priority 2). **(not achieved)**
17. If conditions in the Faroe-Shetland Channel don't allow further work in the Faroe-Shetland Channel, conduct VMADCP/CTD work in the Moray Firth (details to be determined) (Priority 3). **(not achieved)**
18. If weather/time permits, perform a CTD/VMADCP survey on part of the Jonsis line (around 59° 17' N, 001° 15' W) (Priority 3). **(not achieved)**
19. If sheltering in a suitable location around Shetland or Orkney due to bad weather conduct VMADCP/CTD surveys (details to be determined). (Priority 3). **(not achieved)**

## **Narrative**

12 Dec: Staff joined the ship on the 11<sup>th</sup> by midnight and Scotia sailed at 04:30 from Aberdeen towards the east end of the Jonsis line. At 12:00 a test dip with the SBE911 was performed; everything worked fine after initial problems with the NMEA input. After that the standard drills were performed before continuing towards Jonsis. The SBE25 was not tested because the plankton crane winch was not available. The Jonsis line was started at 18:40.

13 Dec: We continued working on the Jonsis line from east to west and finished the line without problems at 06:50. Scotia made way to the eastern end of the NOL line along the west side of Shetland. At 09:30 a blocked cold water intake was discovered and the decision was made to head into Scalloway for repairs. We were in Scalloway port from about 13:00 to 16:00 and then continued to the start of NOL line. We arrived around 22:45 but the weather had deteriorated at that point and after evaluation at NOL-01 we decided to call it off and re-evaluate at 08:30 the next morning in day light.

14 Dec: At 8:30 the weather was still unfavourable to start the NOL section and we eventually started at NOL-01 at 12:15. We completed NOL-01 and NOL-02 without problems. At around 14:00 the power in the ship went off and the general alarm sounded. Everyone gathered at their muster station while the crew dealt with the problem in the engine room. The main problem got resolved within an hour but we were down to two engines. We restarted all our systems (VMADCP, TSG, EK60) due to the power outage. Due to the heavy rolling while without power the rosette had moved and was hanging/standing on deck at an angle but no damage was done. We then continued sampling the rest of the day with a few communication issues with the CTD (a restart solved the problem), VMADCP (collecting data but not plotting it correctly) and the Fluorescence (possibly linked to power outages).

15 Dec: We finished a deep station early in the morning and then headed to the mooring deployment location. At 08:00 MG held a toolbox talk on the bridge while AG, HS and BR set up the ADCP. The single-string mooring was successfully deployed at 09:45 and sampling along NOL continued for the rest of the day. At 23:30 we tried pinging the lost mooring on NOL (NWEA) but with no luck. Since the conditions were perfect with no waves, swell and almost no wind and we still didn't get a response we now need to write this mooring off.

16 Dec: We continued on NOL with one slight computer problem but finished the line at 08:00. We then slowly made way to the start of the FIM line while the engineers did some work on the engine. Due to an issue with the Faroese clearance (which we have never had before) we had to stay out of Faroese waters and we headed straight to a slightly more easterly FIM-11 location (skipping the closest inshore station). When starting at FIM-11 at 14:00 the winch was not working properly and the rosette had to be brought back on board for the engineers to work on. At 15:00 we started FIM and continued throughout the night.

17 Dec: In the night there was an issue with the crane but CTDs continued after it got fixed. We finished FIM at 17:30 and steamed to NWES (lost mooring) to ping for it. We tried to communicate with both acoustic releases but no luck. We then made our way to the start of the Shelf 1 line which we started at 20:30.

18 Dec: Shelf 1 was completed at 07:45 and we continued on to Shelf 2 where we did the first station before stopping at 12:30 to work on the wire (which involved taking the rosette off the wire and reattaching it after the work was done). This work was completed at 16:30 and we made our way back the Shelf 2 line where we started sampling (including using the first CTD as a test for the wire/winch) from 18:00 until 22:45. At that point the wind and swell had picked up too much to continue to work and we stopped until the morning.

19 Dec: Conditions had improved in the morning and we restarted the Shelf 2 line at 08:40 to be finished by 17:30. The wire/winch had deteriorated again and we had to swap instrument to the

SBE25 to be deployed off the Hydro 2 winch. We then steamed back to the eastern end of the Jonsis line.

20 Dec: We arrived at the beginning of the Jonsis line (after a bumpy steam) at 04:30 and after initial problems connecting with the SBE25 the line was started. In the morning the decision was made to cut the line short due to a health issue of a crew member and on-going problems with the ship. We agreed to continue until JO-07 but after JO-05 the Hydro 2 winch stopped working. The winch got repaired and we finished the last stations until JO-07 and started our way back to Aberdeen.

21 Dec: We arrived back in Aberdeen at 08:30 and held the post-survey meeting at 09:00.

22 Dec: Unloading started at 07:00 and finished around 08:30.

The TSG was running throughout the trip (except during and right after power outages) with 24 salinity and chlorophyll samples collected for calibration.

#### **Mooring Positions (Pinging/Recovery)**

NWSE          60° 16.29' N    004° 20.76' W          Short single string mooring (lost)

**No communication**

NWEA          61° 38.01' N    004° 32.60' W          (lost)

**No communication**

#### **Mooring Position (Deployment)**

NWEX          61° 11.00' N    002° 25.00' W          Single string mooring

**Deployed**

#### **Scientific Procedures**

Deployments of hydrographic equipment were carried out with the CTD crane whilst the vessel was on station. At the end of the trip the Hydro 2 winch was used when we switched to the SBE25. The single-string ADCP mooring deployment was done from the trawl deck.

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 and nutrient samples in fish-free freezer down below.

(NOTE: The survey will potentially take *Scotia* into the Foinaven Development Area. This is now standard practice, and normal on-site communications will be established with the Foinaven co-ordinating officer).

Normal contacts were maintained with the laboratory.

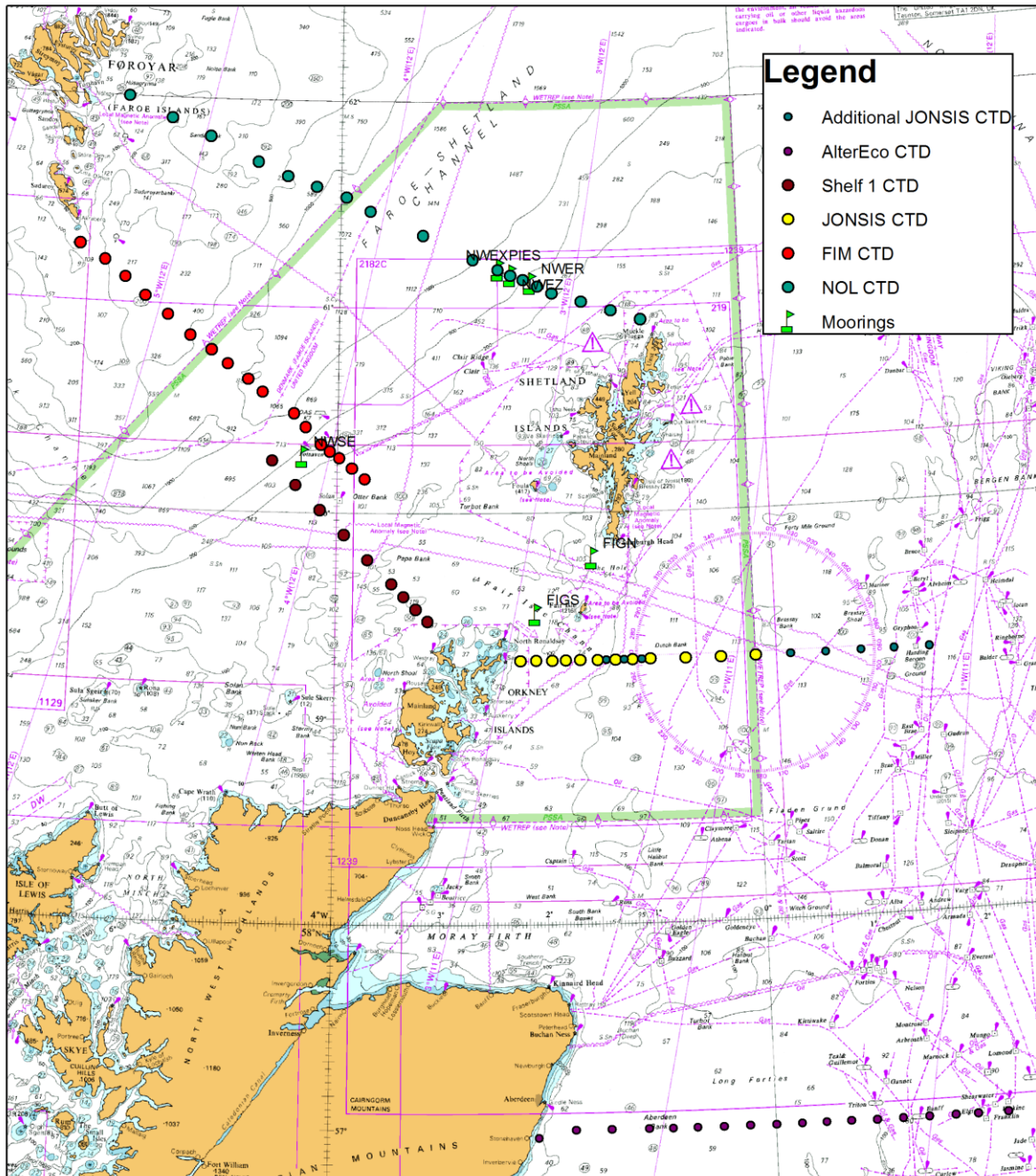
#### **Sampling**

Overall, 77 hydrographic stations were completed. 145 nutrient samples were collected (one at sampled depth), as well as 113 chlorophyll (one at sampled depth) (plus 24 for TSG calibration), 78 oxygens (three at each sampled depth), and 92 salinity calibration samples (two at each sampled depth) (plus 24 for TSG calibration).

Submitted:  
B. Rabe/H. Smith  
22 December 2019

Approved:  
I. Gibb  
15 January 2020

**Figure 1:** Map of main monitoring lines (Jonsis, NOL, FIM) (including some of the extra lines, no indication of their importance)



**Table 1: Jonsis****JONSIS Line**

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

Priority Stations are JO-01, JO-03 and JO-06a, JO-10

**Standard depths of water bottles:**

5, 10, 20, 30, 50, 75, 100 and bottom\*

\*Fire a 'bottom' bottle if seabed is more than 20m below the lowest standard bottle

**Total number of samples:** 32 Salinity, 36 Chlorophyll, 28 Nutrients, 24 Oxygen

**Table 2: NOL line (reduced sampling)****Nolso-Flugga**

(SEFOS naming changed Nov-2014, Updated for 2015 to include additional Faroese Stations)

CODE	#	Name	Latitude	Longitude	Depth	Spacing
N, CH, DS, S	01	NOL-01	60° 56.00' N	01° 00.00' W	110 m	
CH, S	02	SEFN1	60° 58.70' N	01° 17.70' W	125 m	9.00 nm
CH, S	03	SEFN2	61° 01.40' N	01° 35.40' W	155 m	8.99 nm
N, O, CH, S	04	NOL-02	61° 04.00' N	01° 53.00' W	270 m	8.91 nm
CH, DS, S	05	SEFN3	61° 06.00' N	02° 01.50' W	440 m	4.57 nm
N, CH, S	06	NOL-03	61° 08.00' N	02° 10.00' W	550 m	4.57 nm
CH, S	07	SEFN4	61° 09.30' N	02° 17.50' W	630 m	3.85 nm
CH, S	08	NOL-3a	61° 11.00' N	02° 25.00' W	730 m	3.98 nm
N, O, CH, DS, S	09	NOL-04	61° 14.00' N	02° 40.00' W	1080 m	7.82 nm
N*, CH, S	10	NOL-05	61° 21.00' N	03° 10.00' W	1370 m	16.03 nm
N, O, CH, S	11	NOL-06	61° 28.00' N	03° 42.00' W	1235 m	16.84 nm
CTD only	12	FARN2	61° 32.00' N	03° 57.00' W	1200 m	8.18 nm
N*, CH, DS, S	13	NOL-07	61° 35.00' N	04° 15.00' W	990 m	9.08 nm
CTD only	14	FARN1	61° 38.00' N	04° 33.00' W	530 m	9.07 nm
N, O, CH, S	15	NOL-08	61° 42.00' N	04° 51.00' W	235 m	9.44 nm
N, CH, S	16	NOL-09	61° 49.00' N	05° 21.00' W	180 m	15.84 nm
CH, DS, S	17	NOL-10	61° 54.00' N	05° 45.00' W	290 m	12.37 nm
N, O, CH, S	18	NOL-11	62° 00.00' N	06° 12.00' W	125 m	14.04 nm
				Totals	8250 m	162.60 nm

**Standard depths of water bottles:**

5, 50, 100, 200, 300, 400, 500, 600, 700, 800, 900, 1000, 1100, 1200 and bottom

If all 12 bottles used drop 50m, 200m and 400m depths in this order.

Fire a bottom bottle if seabed is more than 50m below the lowest standard bottle

If stations need to be missed they should be dropped in this order

[Priority 4: FARN1, FARN2], [Priority 3: SEFN1, SEFN2, SEFN3, SEFN4]

[Priority 2, NOL-3a, NOL-05, NOL-07, NOL-10]

**Total number of samples:** 58 Salinity, 48 Chlorophyll, 69 Nutrients, 30 Oxygen



**Table 3: FIM (reduced sampling)****Fair Isle - Munken**

(Amended for presence of Foinaven oil platform; SEFOS naming changed Nov-2014, Updated for 2015 to include additional Faroese Stations)

CODE	#	Name	Latitude	Longitude	Depth	Spacing
S, N, CH, DS	01	FIM-01	60° 10.00' N	03° 44.00' W	150 m	
S, CH	02	SEFF1	60° 13.00' N	03° 51.50' W	170 m	4.74 nm
S, N, O, CH	03	FIM-02	60° 16.00' N	03° 59.00' W	200 m	4.84 nm
S, CH	04	SEFF2	60° 18.00' N	04° 04.50' W	330 m	3.36 nm
S, N, CH, DS	* 05	FIM-03	60° 20.00' N	04° 10.00' W	390 m	3.03 nm
S, CH	06	FIM-04	60° 25.00' N	04° 19.00' W	655 m	6.88 nm
S, N*, CH	07	FIM-05	60° 29.00' N	04° 26.00' W	995 m	5.45 nm
S, N, O, CH	08	FIM-06	60° 35.00' N	04° 45.00' W	1090 m	11.15 nm
S, CH, DS	09	FIM-6a	60° 38.00' N	04° 54.00' W	1030 m	5.33 nm
S, CH	10	FIM-07	60° 43.00' N	05° 06.00' W	915 m	7.70 nm
S, N, O, CH	11	FIM-08	60° 47.00' N	05° 16.00' W	830 m	6.34 nm
S, N*, CH, DS	12	FIM-09	60° 51.00' N	05° 29.00' W	600 m	7.36 nm
CTD only	13	FARF3	60° 56.70' N	05° 42.80' W	333 m	8.90 nm
S, N, CH	14	FIM-10	61° 02.00' N	05° 57.00' W	280 m	8.68 nm
CTD only	15	FARF2	61° 07.20' N	06° 09.40' W	250 m	7.95 nm
S, N, O, CH, DS	16	FIM-11	61° 12.00' N	06° 22.00' W	240 m	7.67 nm
CTD only	17	FARF1	61° 16.40' N	06° 37.70' W	400 m	8.80 nm
				Totals	8,558 m	108.18 nm

\* FIM-03 - Use 60 20.25'N 004 09.00'W if above position is occupied.

**Standard depths of water bottles:**

5, 50, 100, 200, 300, 400, 500, 600, 700, 800, 900, 1000 and bottom

If all 12 bottles used drop 50m depth.

Fire a bottom bottle if seabed is more than 50m below the lowest standard bottle

If stations need to be missed they should be dropped in this order

[Priority 4: FARF1, FARF2, FARF3], [Priority 3: SEFF1, SEFF2]

[Priority 2, FIM-04, FIM-06a, FIM-07]

**Total number of samples:** 55 Salinity, 45 Chlorophyll, 61 Nutrients, 24 Oxygen

**Figure 2:** Map of some of the extra hydrographic lines

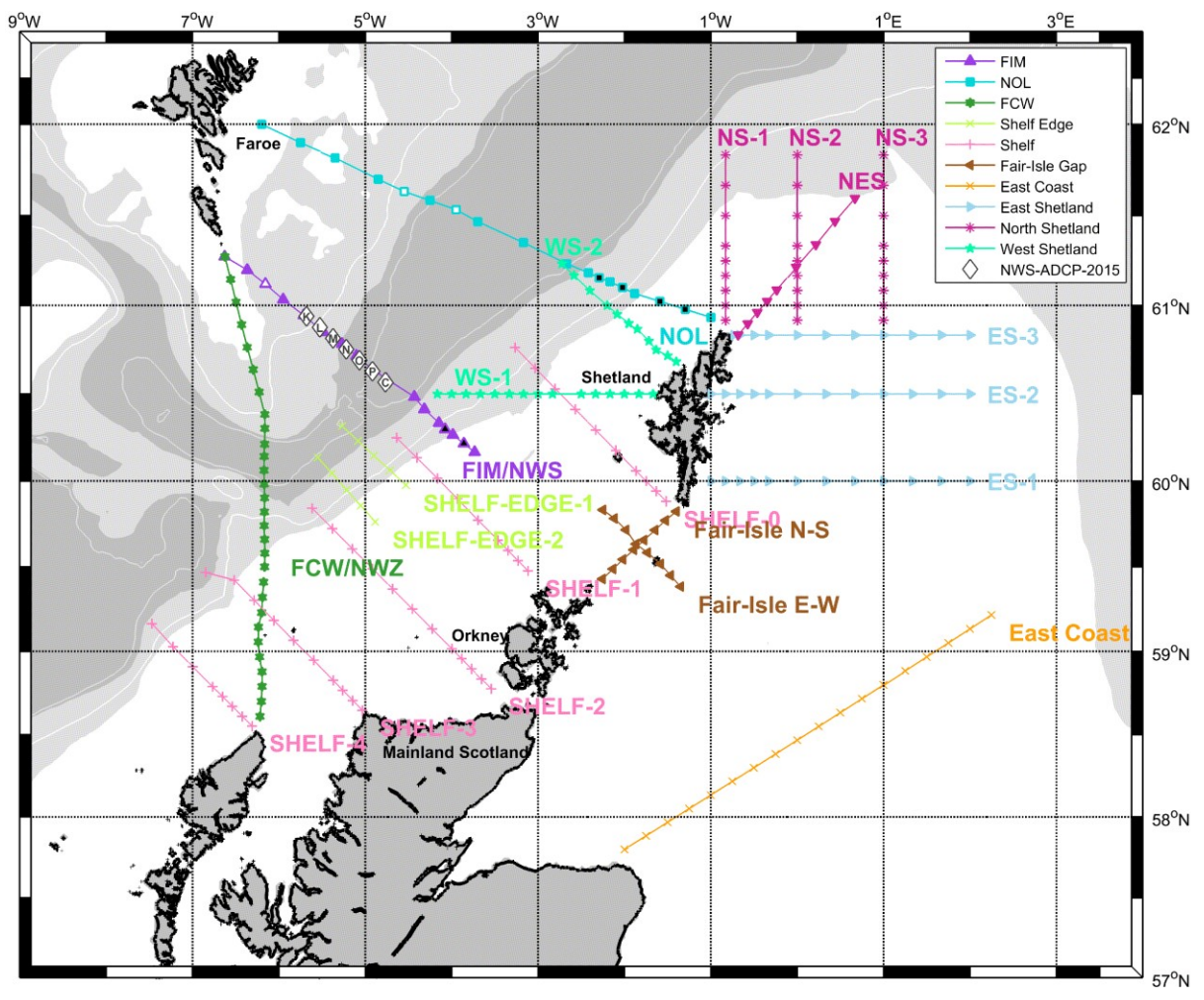


Table 4: Shelf 1

**Principal Name:** Shelf Line 1

**Additional Names:**

	Name	Latitude	Longitude	Depth	Spacing
01	S1_1	59° 28.61' N	03° 07.08' W	74 m	
02	S1_2	59° 32.14' N	03° 14.02' W	77 m	4.99 nm
03	S1_3	59° 35.75' N	03° 20.95' W	73 m	5.03 nm
04	S1_4	59° 39.41' N	03° 27.89' W	152 m	5.06 nm
05	S1_5	59° 46.46' N	03° 41.96' W	116 m	9.99 nm
06	S1_6	59° 53.74' N	03° 55.93' W	160 m	10.10 nm
07	S1_7	60° 00.88' N	04° 09.99' W	155 m	10.01 nm
08	S1_8	60° 08.01' N	04° 24.25' W	195 m	10.06 nm
09	S1_9	60° 14.96' N	04° 38.22' W	630 m	9.81 nm
Totals				m	65.05 nm

**Standard depths of water bottles:**

- No water sampling

Table 5: Shelf 2

**Principal Name:** Shelf Line 2

**Additional Names:**

	Name	Latitude	Longitude	Depth	Spacing
01	S2_1	59° 50.57' N	05° 36.97' W	574 m	
02	S2_2	59° 43.49' N	05° 23.04' W	144 m	9.95 nm
03	S2_3	59° 36.37' N	05° 08.97' W	142 m	10.05 nm
04	S2_4	59° 29.33' N	04° 54.91' W	143 m	10.00 nm
05	S2_5	59° 22.21' N	04° 41.13' W	112 m	9.98 nm
06	S2_6	59° 15.11' N	04° 27.34' W	94 m	9.99 nm
07	S2_7	59° 07.99' N	04° 13.65' W	79 m	9.98 nm
08	S2_8	59° 00.90' N	03° 59.95' W	73 m	9.98 nm
09	S2_9	58° 57.34' N	03° 53.18' W	85 m	4.98 nm
10	S2_10	58° 53.75' N	03° 46.32' W	88 m	5.04 nm
11	S2_11	58° 50.14' N	03° 39.34' W	85 m	5.10 nm
12	S2_12	58° 46.60' N	03° 32.56' W	70 m	5.12 nm
Totals				m	90.16 nm

**Standard depths of water bottles:**

No water sampling