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MRV *Scotia*

Survey 1821S

REPORT

10-20 December 2021

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

B Rabe (SIC/co-SIC)
H Smith (co-SIC/SIC)
A Gallego
M Geldart
M Bargus
E Magyar
R Parpucis
K Mcintosh

Out-turn days per project: 9 days: ST05b, 2 days: COMPASS - 20397

Gear

Sea-Bird CTD/Carousel (SBE9, SBE9 (BAS), SBE25, SBE19+), water filtering equipment, chemistry sampling equipment, zooplankton nets, weeHolocam, glider recovery kit

Objectives

1. Test the CTD crane and carousel, perform both Stonehaven CTD casts (Table 1) at beginning/end of cruise (depending on the Stonehaven sampling schedule). **Achieved**

2. Water sampling at GoldenEye (Table 2). **Achieved**

3. Perform routine hydrographic sampling at stations along the long term monitoring JONSIS section in the northern North Sea (Table 3, Appendix 1, Priority 1). **Achieved**

4. Carry out the Loch Ewe CTD transect and collect water and zooplankton samples (Table 4, Priority 1). **Achieved**

5. Deploy the weeHolocam at all Loch Ewe stations. Mostly **Achieved**

6. 13 hour VMADCP transect at mouth of Loch Ewe. **Achieved**

7. Inner Loch Ewe CTD station grid for better understanding of general oceanographic conditions in the Loch Ewe system (Table 5). **Achieved**

8. Perform routine hydrographic sampling at stations along the long term monitoring Faroe-Shetland Channel section: Nolso-Flugga (Table 6, Appendix 1, Priority 1). **Achieved**

9. Perform routine hydrographic sampling at stations along the long term monitoring Faroe-Shetland Channel section Fair Isle-Munken (Table 7, Appendix 1, Priority 1). **Achieved**

10. Take salinity, nutrient, chlorophyll, dissolved oxygen, TADIC samples along all standard lines, full sampling strategy. **Achieved**

11. Run the thermosalinograph (TSG) throughout the survey. TSG will be cleaned prior to sailing. **Achieved**

12. Run the VMADCP on all the standard sections. **Achieved**

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

14. Provide the Met Office with CTD data similar to 1421S. **Achieved**

15. Recover HECLA Faroes Glider if required and if time allows (potentially at NW corner of Shelf 3 line, Figure 1). **Achieved**

16. Set up SBE19+ with CDOM fluorometer for the chemists for cruise 0122S. **Achieved**

17. Perform hydrographic sampling along the Stonehaven AlterEco section in the northern North Sea (Table 8, Priority 2). Partly **Achieved**

Narrative

10/12/2021

Scotia left Aberdeen at 08:45, the science crew had a muster drill on the lifeboat deck and a scientific briefing on the hangar deck. BR started as SIC, with HS as co-SIC with the plan to swap roles halfway through 1821S.

We then headed to the two Stonehaven sampling sites, with the outer station sampled first. The CTD deck unit cable connection to the CTD wasn't working properly so it required intensive trouble shooting. We found that the connections were not tight enough in the box on the wall opposite the container, that fixed, all data came through fine. The first CTD cast involved full sampling and water sampling demonstrations for new people. We took water samples for oxygen method validation at the inner station. We finished ~ 12:30 and steamed to GoldenEye for ~20:00, did all required sampling there and then headed for the Eastern end of Jonsis.

Initial issues with the chemistry nutrient analyser were sorted by the end of the day, so samples could be analysed on board.

11/12/2021

We started Jonsis at 05:00, sampled throughout the day without any problems and finished at 18:00. The VMADCP was running for the whole transect, although there were a few brief power outages so the data collection had to be restarted, there may therefore be gaps in the data. The weather forecast for the FSC was bad, so we decided to go straight to Loch Ewe from Jonsis.

12/12/2021

INTERREG VA COMPASS work – Loch Ewe standard transect began at 09:30 from the data buoy seawards. The CTD, bongo net and the weeHoloCam were deployed at each station, water samples were taken at every other station. All worked well until station 6, when the weeHoloCam failed to boot up. We tried the troubleshooting sequences provided several time, but no luck and sent an email to ask for further options. Given that the weather forecast was still awful for the FSC, we ran a repeat VMADCP transect at the mouth of Loch Ewe overnight, starting at 19:00 for a 13 hour tidal cycle.

13/12/2021

INTERREG VACOMPASS work - VMADCP transect finished at 08:00, then we steamed into Loch Ewe to do the Inner Loch Ewe Grid CTD stations. This grid was designed to give a better understanding of the Loch Ewe system, relative to the DataBuoy and a starting point for more finer scale work in the Loch. Working until dusk, we achieved 17 stations (all but one in the inner loch and the last five stations north of the DataBuoy). Due to the creel density in the Loch, we had to stop work after dusk.

During the day we were keeping an eye on the weather in the FSC and working out timings/options to fit in a potential glider rescue at the end of our work. Even though the wave forecast still looked on the edge for working, we decided that the only way we could achieve all our work and rescue the glider was to leave for the start of NOL in the late afternoon. Thankfully the weather was behind us and we made good time steaming North to the east end of NOL.

14/12/2021

Steaming to NOL, arrived at 16:00, started sampling with the understanding that the weather could require work stopping at points if the wind/wave combination was too much, particularly in darkness.

We provided the Captain with an approximate time for entry/exit into/from Faroese waters, as requested.

15/12/2021

We continued along the NOL line overnight and arrived in Faeroese waters 4 hours ahead of schedule. Based on the officer's decision to cross the line early we kept sampling, sticking to our adjusted station (NOL-11A) to stay outside of Faroese territorial waters.

16/12/2021

We finished NOL in early hours of the morning, steamed south to the north-west start of FIM, started FIM at 10:30 and steadily worked through FIM the rest of the day without any issues.

HS officially took over SIC duties on the 16th from BR who became co-SIC to provide moral support and guidance.

17/12/2021

We continued along FIM. The CTD crane extender was fickle – sometimes staying stuck out and we had to sample closer to the wave gate. The engineers eventually fixed this.

We started serious time planning for glider pick up – NOC team were keen for us to give it a go, even though forecast ~3 m swell conditions were not ideal, their suggested recovery limit was 2.5 m swell. We started steaming towards the glider location after we finished FIM around 14:30.

18/12/2021

Arrived on glider location (59.204 N, -7.937 W) in the early morning so that the glider could be spotted in the dark, kept eyes on it at ~1/4 nm distance until daylight. We did a pre recovery CTD calibration dip for the glider down to 200 m. We organized a toolbox talk on the bridge to make sure everyone knew what their role was and to go over the planned method of recovery. The conditions were much calmer than forecast and we successfully recovered the glider by 09:30, while in continuous comms with glider people via Whatsapp. Following the instructions provided by NOC we turned the glider off, took wings and thruster off, safely stored it in its provided crate on after deck and strapped it down.

Note - For recovery of any instrumentation in the water, comms with bridge are key, particularly in last few metres when those on the bridge lose sight of the thing in the water. Comms was emphasised at the toolbox talk but it still fell short of the captain's expectations. Having a designated comms person, who doesn't get involved in the physical recovery until the kit is on board is vital.

Given all had gone smoothly with the glider recovery, we had enough time to head back to the East coast to do more science before heading to port, so we pointed for Stonehaven.

19/12/2021

Steaming to Stonehaven, arrived 08:30, repeated two standard Stonehaven sampling including the Bongo net. We tested the SBE19+ with a CDOM sensor at Stonehaven2 to make sure it was working ok for the next cruise, 0122S. We then sampled along the AlterECO line until we had to turn and head for port. Last station was AlterECO 14, where we did a second test of the 19+CDOM set up and run through.

Docked at ~22:00 – some scientists went home for the night.

20/12/2021

Loading for January cruise/unloading started early but took longer than we have been used to due toa lot of jobs and only one MSS driver and then a malfunctioning crane in the afternoon. All gear was safely stored away in the hydro store. The glider was rinsed with freshwater and left to dry in the workshop over the festive period.

The TSG was running throughout the trip with 29 salinity and 33 chlorophyll samples collected for calibration. The fluorometer was replaced before we left Aberdeen, there was some confusion about whether the confile needed updating or not, this will be reviewed on land.

Scientific Procedures

Deployment of hydrographic equipment was carried out with the CTD crane whilst the vessel was on station. Plankton bongo-net samples were taken using the plankton crane and wire. WeeHolocam deployments were using the plankton crane and wire.

Glider recovery took place on the hangar deck using the plankton crane.

Three container laboratories were used (one for the chemists, 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 unanalysed nutrient samples were stored in a **cleaned, fish-free** freezer down below.

(NOTE: The position of the CTD sampling station in the Goldeneye oil field may be adjusted for any exclusion zones and oil infrastructure).

(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).

(NOTE: Hydrographic stations at NOL and FIM have been amended to avoid entering Faroese territorial waters).

Normal contacts were maintained with the laboratory.

Sampling

Overall, 84 hydrographic stations were completed. 344 nutrient samples were collected (one per sampled depth), as well as 147 chlorophyll (one per sampled depth) (plus 33 for TSG calibration), 154 oxygen samples (triplicates per sampled depth, duplicates at Stonehaven and Loch Ewe), 214 TA/DICs (duplicates at each depth) and 88 salinity calibration samples (duplicates at each sampled depth) (plus 29 for TSG calibration). 10 integrated water column bongo net samples for zooplankton were collected.

Submitted:
Berit Rabe and Helen Smith
06/01/2022

Figure 1: Map of main monitoring lines (Jonsis, NOL, FIM, AlterECO and Loch Ewe) and location of GoldenEye and glider recovery

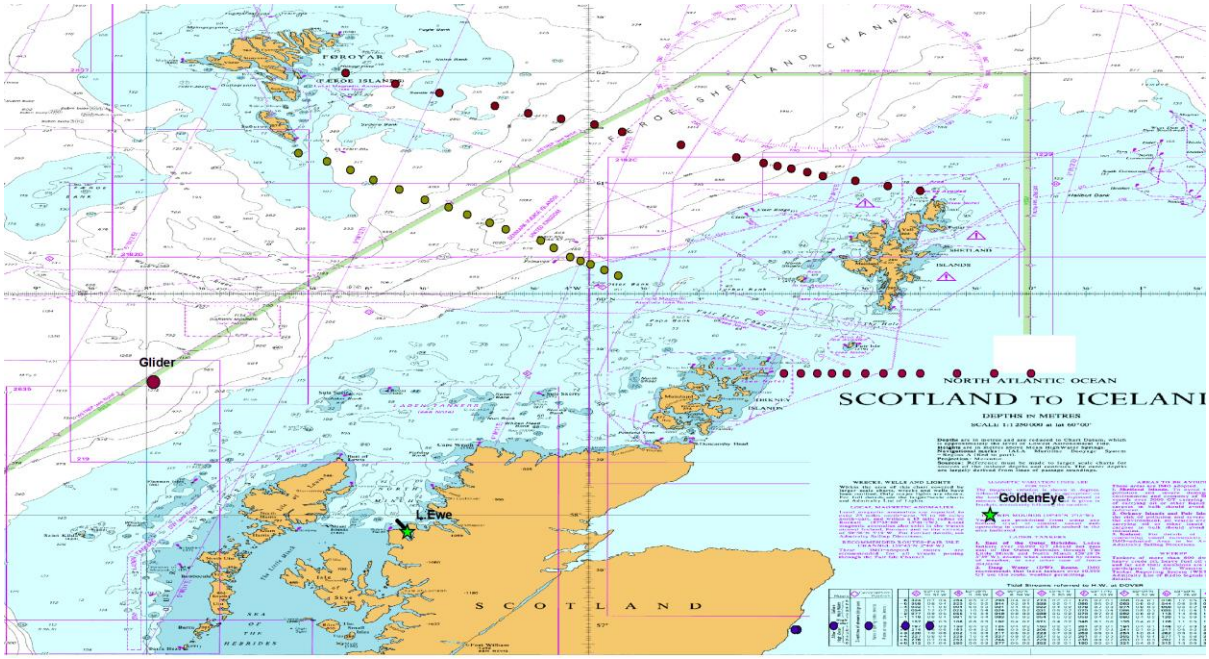


Table 1: Stonehaven sampling

Stonehaven CTD stations

CODE	#	Name	Latitude	Longitude	Depth [m]	Spacing
N, CH, O, DS, TADIC	**1**	**Stonehaven 2**	**56° 57.801' N**	**02° 06.795' W**	47	0.77 nm
CTD only	**2**	**Stonehaven 1**	**56° 57.801' N**	**02° 08.157' W**	47	

Table 2: GOLDENEYE STATION

Name	Latitude	Longitude	Depth [m]
GoldenEye	58° 00.30' N	00° 21.96' W	123

Table 3: Jonsis line

CODES	#	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

Table 4: Loch Ewe Transect

stn	lat		lon			Depth (m)	Distance (nm)
0	57	50.982	5	39.010	W	46	
1	57	52.104	5	39.674	W	32	1
2	57	53.061	5	40.245	W	37	1
3	57	53.977	5	41.118	W	55	1
4	57	54.893	5	41.992	W	62	1
5	57	55.810	5	42.865	W	82	1
6	57	56.726	5	43.739	W	104	1
7	57	57.642	5	44.612	W	95	1
8	57	58.559	5	45.486	W	123	1
						640	**8**

Table 5: Loch Ewe inner CTD grid
New for 1821S

Name	Latitude	Longitude	Depth (m)
LEgrid-01	57 50.68N	005 36.77W	18
LEgrid-02	57 51.00N	005 37.48W	26
LEgrid-03	57 50.87N	005 38.79W	42
LEgrid-04	57 51.05N	005 39.65W	45
LEgrid-05	57 50.71N	005 39.81W	37
LEgrid-06	57 50.43N	005 39.26W	47
LEgrid-07	57 49.76N	005 38.79W	45
LEgrid-08	57 49.13N	005 38.64W	54
LEgrid-09	57 48.56N	005 38.43W	31
LEgrid-10	57 47.78N	005 38.35W	45
LEgrid-11	57 47.38N	005 38.82w	29
LEgrid-12	57 47.75N	005 37.63W	42
LEgrid-13	57 47.98N	005 36.89W	50
LEgrid-14	57 48.14N	005 36.26W	45
LEgrid-15	57 48.60N	005 36.32W	42
LEgrid-16	57 48.53N	005 37.33W	63
LEgrid-17	57 49.09N	005 37.97W	35

Table 6: NOL line
Nolso-Flugga

Updated 2021 to include NOL-11A to stay outside of Faeroes Territorial Waters

#	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-11~~ **(NOL-11A)**	~~62° 00.00' N~~ **(61° 56.50' N)**	~~06° 12.00' W~~ **(05° 57.00' W)**	~~125 m~~ **(159 m)**	~~14.04 nm~~ **(7.0 nm)**
			Totals	10245 m	162.60 nm

Table 7: FIM
Fair Isle - Munken

(Amended for presence of Foinaven oil platform)
Updated 2021 to include FIM-11A to stay outside of Faeroes Territorial Waters, in which case FARF1 will **not** be sampled

#	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-11** (FIM-11A)	**61° 12.00' N (61° 11.30' N)**	**06° 22.00' W (06° 20.00' W)**	**240 m (242 m)**	**7.67 nm (7.0 nm)**
~~17~~	~~FARF1~~	~~61° 16.40' N~~	~~06° 37.70' W~~	~~100 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.

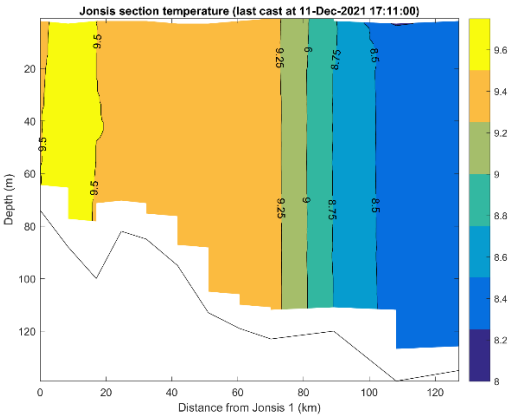
Table 8: AlterEco Transect 1821S – stations sampled

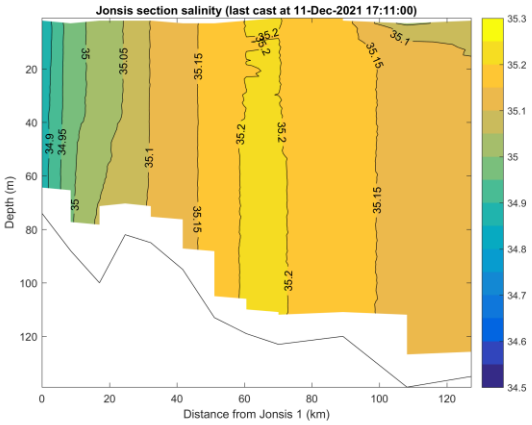
#	Name	Latitude	Longitude	Depth [m]	Spacing
14	AlterEco14	57° 00.00' N	00° 55.00' W	75	7.07 nm
15	**AlterEco15**	**57° 00.00' N**	**01° 08.00' W**	**67**	**7.07 nm**
16	**AlterEco16**	**57° 00.00' N**	**01° 28.00' W**	**68**	**10.91 nm**
17	AlterEco17	57° 00.00' N	01° 47.00' W	98	10.56 nm
18	***AlterEco18***	***56° 57.80' N***	***02° 06.80' W***	***47***	***10.78 nm***
			Totals	1508 m	136.83 nm

Appendix 1: Section plots for long-term monitoring lines

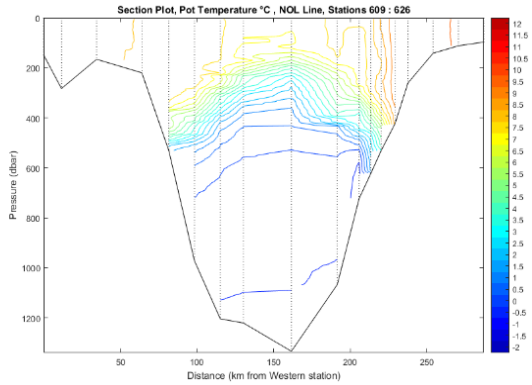
Temperature/Potential temperature (left) and salinity (right) section plots for Jonsis, NOL and FIM

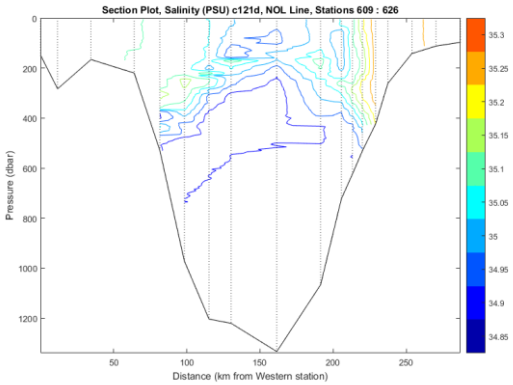
Jonsis:





NOL:





FIM: