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FRV *Scotia*

Cruise 1021S

Report

Dates

28th July – 17th August 2021

Personnel

R. Gillespie-Mules (SIC)
M. Kinghorn
N. McLeod
F. Armstrong
J. Dooley
L. Barnwall
C. McWhirter
Ha. Holah (MIK)

Out-turn days: 21 days – RV2110 / 20665

Fishing Gear: GOV Trawl (BT 137) fitted with groundgear A or B. MIK Net (Round frame with IK depressor)

Objectives

1. To complete an internationally coordinated demersal trawling survey in the North Sea in ICES area IV.

2. To obtain temperature, salinity and dissolved oxygen concentration data from the water column at each trawling station using a RBR CTD.

3. To undertake MIK sampling for pre-metamorphosed clupeoid larvae during the hours of darkness within the trawl survey area.

4. To collect additional biological data in connection with the Data Collection Framework (DCF).

5. To identify and quantify all gelatinous zooplankton caught during trawling.

6. To collect and quantify all marine litter encountered on the survey for MSFD.

7. To identify and quantify the presence of non-indigenous species observed.

8. To collect surface water phytoplankton samples in selected STSQs.

9. To collect low nutrient sea water from 43F0 for the MSS chemistry department.

10. To collect a variety of additional samples.

Narrative

Scotia sailed from Aberdeen at 07:30 UTC on the 28th July in good sea conditions. Pre-sailing, groundgear A was attached to the GOV trawl to allow the completion of the southern half of the survey first. The first trawl station Southeast of Aberdeen in rectangle 43E8 doubled as a familiarisation tow and was completed successfully with the fishing gear, the majority of the SCANMAR and bottom contact sensors performing well and a further two stations were completed with the SCANMAR issues solved. The CTD on the third station was re-run due to sensor issues.

With the final trawl being completed for the day, the MIK net was prepared and deployed following darkness with 4 MIK tows were undertaken. The next morning, following the second trawl, ~23 carboys of low nutrient sea water were collected for analysis by MSS's Marine Environmental chemists. Three further trawls were completed successfully with two MIK tows undertaken overnight.

The morning of the 30th July, during the second trawl, a medical emergency occurred that required the affected crew member to be evacuated by helicopter to Stavanger, Norway. The trawl was recovered immediately and Scotia proceeded to steam towards the evac helicopter. Following evacuation Scotia proceeded back to the trawl station, repeated it successfully and completed 2 further trawls that day with 4 MIK tows and MIK calibrations overnight.

The next two days passed largely without incident, a further 11 trawl stations and 7 MIK tows being completed. The evening of the 02nd Aug, following 5 successful trawl stations, the trawl stuck on the seafloor and tore the belly section. This was promptly repaired before undertaking 2 MIK tows later that evening. 11 trawls were successfully completed on the 03rd and 04th Aug with tow S21_372 requiring a repetition due to not settling properly on the seafloor. 6 MIK trawls were completed successfully.

On the 5th Aug, during towing at the third trawl station of the day, Scotia was hailed by Seagreen Windfarm traffic control and asked to stop trawling despite there being no restrictions in place. Scotia complied and cut the trawl short, carried out a CTD with permission and left the Seagreen Windfarm area to continue the survey north. Please see Annex 1 for the full report.

This marked the successful completion of the southern half of the survey and the groundgear was swapped to groundgear B for the remainder of the survey due to all remaining trawl stations being north of 57° 30N.

The morning of the 6th Aug, the trawl stuck and resulted in an invalid tow. The damage was quickly repaired and the trawl repeated successfully with a further 5 trawls completed. Following MIK sampling overnight, 6 more trawl stations were completed before Scotia made for Kirkwall for the scheduled half landing.

Scotia left Kirkwall at 22:00 on the 8th of Aug, carrying out 1 MIK station before making for the first trawl station of the next day. Surveying over the next 6 days went smoothly with no invalid trawls, minimum gear damage and fine weather. The final core trawl survey station was completed on the 14th Aug, allowing time to cover two stations dropped due to Scotia completing stations for the German survey, cancelled due to vessel issues. A further 4 stations were undertaken to increase survey resolution and enhance overall coverage whilst also finding new trawlable ground in waters around Shetland. Following the last trawl on the 16th Aug, the net was cleaned and stripped and Scotia made for Aberdeen for unloading. Docking later that evening, all scientific equipment and staff were unloaded the next morning.

Results

Trawl Survey

The locations used for the trawl stations were a combination of established trawl locations as well as completely new locations. The SCANMAR system was used to monitor headline height, wing-spread, door-spread, and distance covered during each trawl. The SCANMAR Trawleye was used to monitor bottom type and fish density entering the net. A bottom contact sensor was attached to the groundgear for each trawl to monitor ground contact as well as to validate touchdown and lift-off of the groundgear. Not all trawl stations had associated bottom contact data and this was due to

sensor failures. The EDC system was used to collect all catch data, with data being downloaded and screened for errors following every successful haul. All trawls were undertaken during the daylight period.

Groundgear A was deployed on all stations south of 57'30 N with groundgear B being used on all stations north of that latitude. In all, 42 stations using groundgear A and 54 stations using groundgear B were completed successfully. All stations used the West Coast GOV trawl design with strengthening strips to limit the damage that regularly occurs throughout the survey area with the same trawl being used throughout the survey.

The GOV was deployed on 100 stations, with 96 valid trawls resulting in coverage of 75 statistical rectangles. Of those rectangles where Scotland was the sole surveying nation (25), 18 were sampled twice, with 3 having additional trawls undertaken at the end of the survey (see Figure 1). Four invalid trawls occurred during the survey however all were successfully repeated. 17 trawls were of a non-standard duration of ≥ 15 minutes due to dense fish marks, to prevent gear damage, to avoid static gear and due to Seagreen Windfarm area's request.

A total of 89 species were observed for an overall catch weight of 40,988.1 kg, a marked decrease in catch weight compared to the previous year (2020) but still above the normal average of ~33 tons. Initial observations of the catch data show a significantly lower 0-group Haddock class showing compared to 2019 and 2020 along with a reduced 0-group Pout index in the Scottish area of the IBTS. The total haddock catch was ~ 24% bigger than in 2020 owing to a large 1 and 2 year component. Major components (tonnes) included: Haddock (~13.55), Herring (~6.48), Norway Pout (~5.23), Whiting (~4.35), Mackerel (~2.25), and Common dab (~1.8). The catch per unit effort (CPUE) for major species is detailed in Table 1. A total of 7114 individual fish were sampled for biological data, detailed in Table 2.

The full dataset from this as well as from the other surveys undertaken during the international quarter 3 North Sea survey programme are uploaded to the ICES DATRAS trawl survey database. From this, a set of international abundance indices is calculated for the target commercial species. This international combined survey index is provided to ICES Working Group on the Assessment of Demersal Stocks in the North Sea and Skagerrak (WGNSSK) where it is used as a tuning tool in the stock assessment models for several commercial species.

MIK Survey

A total of 51 MIK hauls targeting sprat (*Sprattus sprattus*) larvae were undertaken over the course of the survey (see Figure 2). In addition to these, two further pairs of tows were carried out for calibration of the flowmeters during each half of the survey. The 51 valid deployments covered 48 of the total 75 ICES rectangles surveyed during Q3, including 3 squares which contained 2 deployments. As darkness hours were limited with often long distances to cover overnight sampling was ad-hoc and prioritised the targeting of as many unique rectangles as possible over the planned route rather than following set transects or attempting to sample every rectangle. MIKeyM nets were not used during Q3 MIK tows as eggs were not being targeted by sampling.

Samples were sorted at sea with all potential clupeoid larvae being extracted and fixed in formalin for species level ID, flatfish larvae were also counted and fixed separately. The remaining samples were stored for further analysis in future. Jellyfish were counted and identified during sampling but were not fixed and stored with the remainder of the samples.

Identification and measurement of the clupeoid and other target larval species were undertaken partly at sea and partly at the Marine Laboratory. Identification is ongoing however clupeoid larvae were recorded in 44 of the 51 deployments. Catches of clupeoids were noticeably higher than those seen in the January MIK survey, with multiple tows recording over 500 clupeoids. In these instances, 500 larvae were removed from the sample and fixed separately, with the rest being extracted from

the stored sample upon returning to land. The highest concentrations of clupeoid larvae were centred around ICES rectangles 37F0 and 38E9, with the highest concentrations of flatfish larvae found in ICES rectangles 50F1 and 50F2.

Hydrography

The CTD (RBR Concerto was deployed at 97 trawling stations in order to obtain a temperature and salinity profile at each station. 102 surface and seafloor water samples were collected for dissolved oxygen and chlorophyll analysis. 40 surface and seafloor water samples were collected for nutrient analysis.

Biological Sampling

Additional biological data were collected from a number of species in support of the EU Data Collection Framework (DCF). A summary of numbers collected by species is displayed in Table 2.

In addition;

- All sampled Herring were checked for the presence of *Icthyophonus* sp. and coded accordingly.
- All Cod (*Gadus morhua*) routinely sampled were examined for the presence and number of Cod liver worms.
- Tissue samples from juvenile Cod (*G. morhua*) (<25cm) were collected for genetic analysis for a stock identification project at MSS.
- Tissue samples from Anglerfish (*Lophius piscatorius*) were collected from NW Shetland for genetic analysis at IMR – Norway.
- Tissue samples from routinely sampled Hake (*Merluccius merluccius*) were collected for genetic analysis at IMR – Norway.
- All shelled molluscs were retained for identification and species distribution mapping.
- All Loliginid squid >39cm were retained for a population study.

Electronic Data Capture

All haul summary data, catch composition, length frequency data and biological data were entered into the FSS system at sea utilising the electronic data capture (EDC) system. This allowed error screening during and post capture, vastly increasing the quality of the data collected. All data was uploaded to the lab servers following final quality checks whilst Scotia was returning to port.

Miscellaneous

Marine litter:

- All litter picked up in the trawl was classified, quantified and recorded then retained for appropriate disposal.

Gelatinous zooplankton:

- All trawl caught gelatinous zooplankton were identified to species (where possible), weighed and quantified.

Seawater sampling:

- 23 carboys of seawater were collected whilst underway in perceived low nutrient areas for routine monitoring.

Non-indigenous Species:

- All catch, fish and benthos, were screened for the presence of 'Non-Indigenous Species' with none encountered.

Phytoplankton Sampling:

- Phytoplankton samples were collected from 20 stations including 20 net samples and 20 natural water samples for training and future research projects.

Inter-vessel Variability:

- Additional deployment and retrieval parameters were recorded to better understand international inter-vessel variability.

Species Collection:

- Haddock were retained for Aberdeen University's MSc practical on fish dissection.
- A variety of species were retained for Aberdeen University's MSc practical on fisheries biological data collection.

My sincere thanks go out to the scientists and crew of MRV Scotia who pulled together to successfully complete a challenging though ultimately rewarding survey despite the operational restrictions in place to mitigate the continuing threat posed by SARS Cov-2.

Ruadhán Gillespie-Mules 28/10/2021

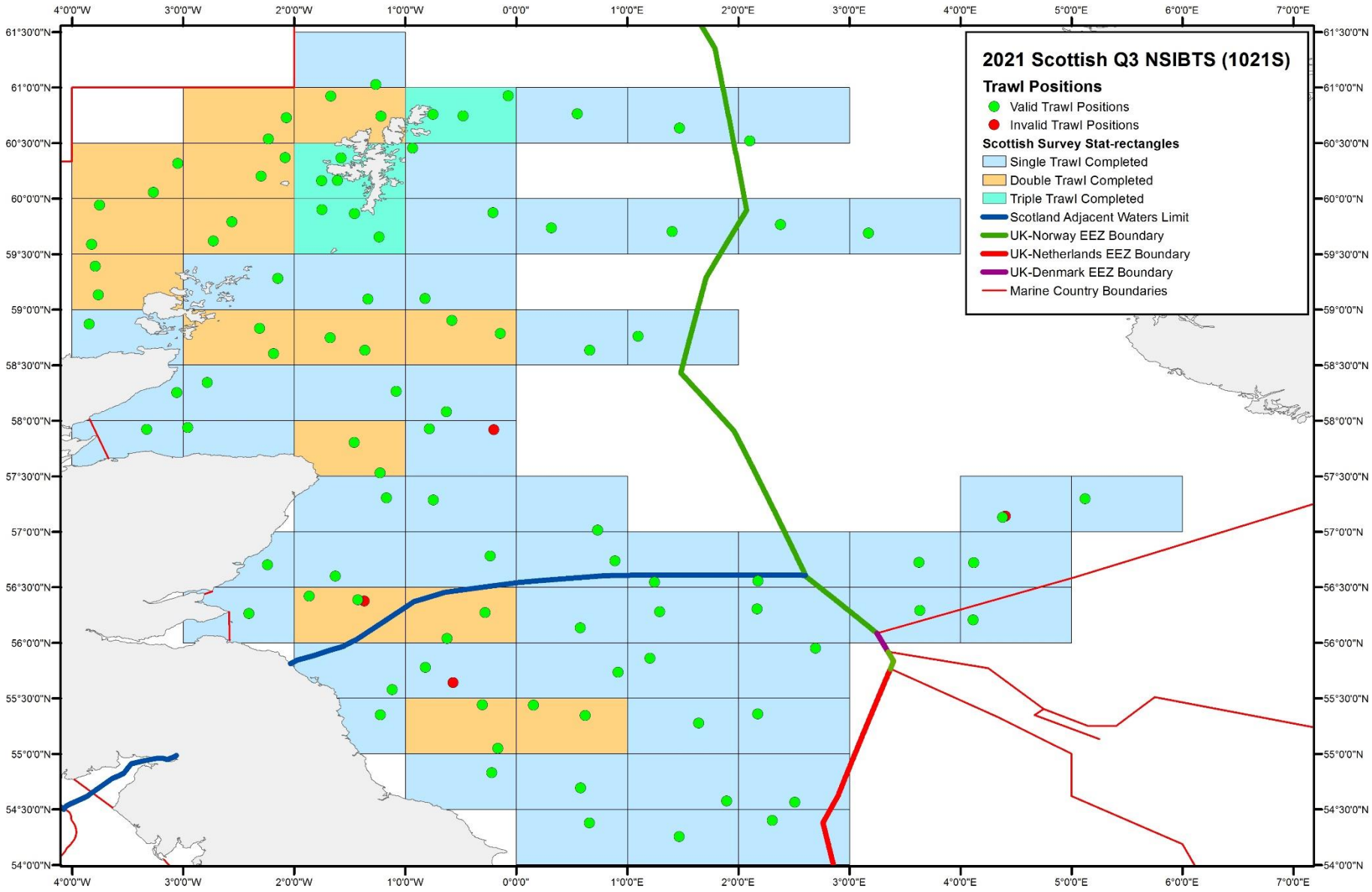

Figure 1: Survey chart illustrating completed rectangles, valid hauls, invalid hauls and marine boundaries for 1021S.

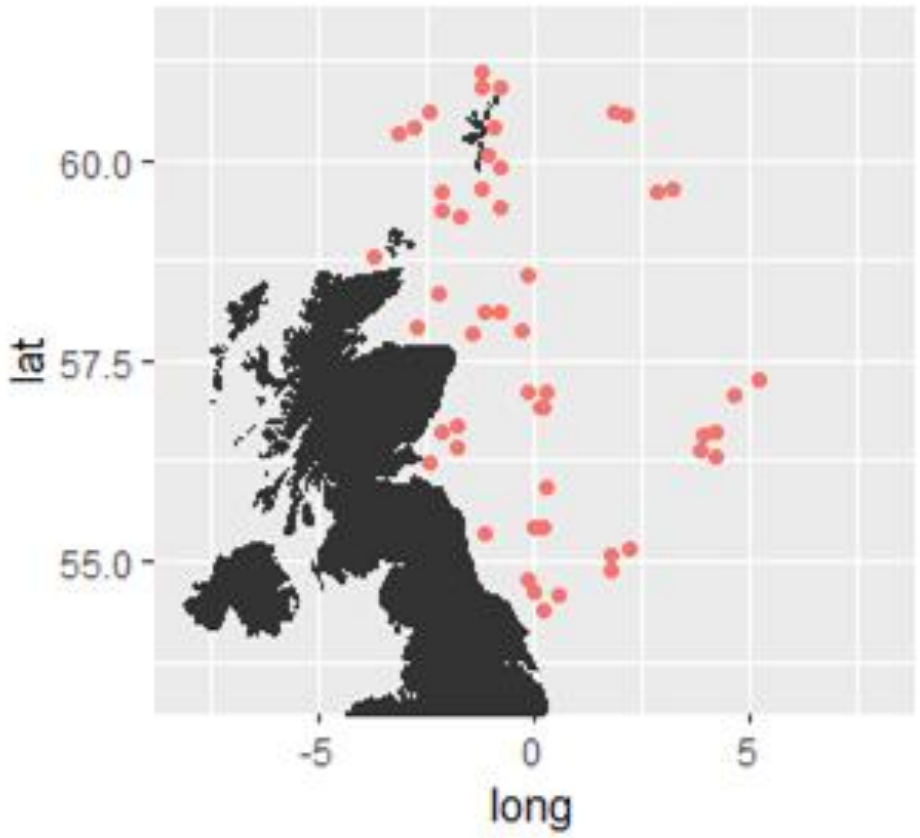

Figure 2: Survey chart illustrating shoot locations of the 1021S Q3 NSIBTS MIK tows.

Table 1: CPUE of major species observed during 1021S.

Species	CPUE nos/h	CPUE kg/h
Haddock (*Melanogrammus aeglefinus*)	1544.9	298.1
Herring (*Clupea harengus*)	755.9	142.4
Norway Pout (*Trisopterus esmarkii*)	14443.3	115
Whiting (*Merlangius merlangus*)	742.5	95.8
Mackerel (*Scomber scombrus*)	191.3	49.5
Common Dab (*Limanda limanda*)	646.3	39.7
Cod (*Gadus morhua*)	19	30
Sprat (*Sprattus sprattus*)	1078.9	17.1
Spurdog (*Squalus acanthias*)	8.5	13.7
Plaice (*Pleuronectes platessa*)	66.2	10.2
Grey Gurnard (*Eutrigla gurnardus*)	99.4	10.1
Lesser Spotted Dogfish (*Scyliorhinus canicula*)	10.2	9
Lemon Sole (*Microstomus kitt*)	66.2	8.1
Horse Mackerel (*Trachurus trachurus*)	22	7.9
Long Rough Dab (*Hippoglossoides platessoides*)	237.3	6.7
Flapper Skate (*Dipturus intermedius*)	0.4	6.5
Blue Whiting (*Micromesistius poutassou*)	227.7	5.1
Ling (*Molva molva*)	2.5	4.1
Saithe (*Pollachius virens*)	2.5	3.8
Hake (*Merluccius merluccius*)	3.2	3.7

Table 2: Numbers of biological observations per species collected during 1021S (length, weight, sex & age, * length, weight, sex, maturity & age, ** length, weight and age, *** length, weight, sex & maturity (males only), **** length, weight, sex plus otoliths retained but not aged, ***** length, weight & sex, ****** length, weight sex & maturity.

Species	No.	Species	No.
Haddock (*Melanogrammus aeglefinus*)	1974	Starry Ray (*Amblyraja radiata*)***	52
Whiting (*Merlangius merlangus*)	1263	Cuckoo Ray (*Leucoraja naevus*)***	58
Herring (*Clupea harengus*)*	826	Spotted Ray (*Raja montagui*)***	18
Mackerel (*Scomber scombrus*)*	507	Flapper Skate (*Dipturus intermedius*)***	19
Norway Pout (*Trisopterus esmarkii*)	508	Turbot (*Psetta maxima*)*****	1
Cod (*Gadus morhua*)	704	Brill (*Scophthalmus rhombus*)*****	1
Plaice (*Pleuronectes platessa*)	443	Halibut (*Hippoglossus hippoglossus*)*****	2
Hake (*Merluccius merluccius*)****	129	Shagreen Ray (*Leucoraja fullonica*)***	1
Sprat (*Sprattus sprattus*)**	140	Angler (*Lophius piscatorius*)******	29
Saithe (*Pollachius virens*)	111	Thornback Ray (*Raja clavata*)***	1
Spurdog (*Squalus acanthias*)***	327		

Annex 1. IBTS Survey 1021S – MRV Scotia Activity in the Seagreen Windfarm Area Report

On the 05/08/2021, having completed 2 trawl stations in the Bell Rock Lighthouse and Montrose area, MRV Scotia headed to the third trawl station of the day approximately 2.5NM South West of the Montrose Bank within the Seagreen Windfarm Area. There was no indication on the charts, both paper and ECDIS, that the area was restricted to trawling and no active Admiralty Weekly Notices to Mariners in force concerning restrictions in the area. Local Notices to Mariners also stated no restrictions were in place for the track chosen for the trawl station. A 'navigate with caution within windfarm construction area' is shown on the ECDIS however this has no restrictions to trawling following interrogation of the ECDIS report for the 'navigate with caution.' Following all checks on the trawl location MRV Scotia made passage to the trawl start position and began to deploy the trawl.

MRV Scotia deployed the trawl in position 56° 37.84'N – 001° 37.86'W at 11:22 BST and towed a course of 168° (T) at an average speed of 3.8 kts.

A vessel 'GLOMAR WORKER' was stationery approx. 1.5NM North of MRV Scotia's trawl deployment location.

Approximately 15 minutes into the tow, MRV Scotia was contacted on VHF CH16 by 'Seagreen Traffic', with a working channel being agreed (VHF CH72). 'Seagreen Traffic' asked what MRV Scotia's intentions were. The Fishing Master explained that the vessel was carrying out an International Bottom Trawl Survey (IBTS) and was towing a bottom trawl at a long-term historical site, previously visited the same year on the 10/02/21 during the Q1 North Sea IBTS. Seagreen Traffic explained that there were three Unexploded Ordinances (UXO) in the relative vicinity and coordinates were passed, the closest being over 2NM away from MRV Scotia's position (see Figure 3).

Seagreen Traffic then asked if MRV Scotia could retrieve the fishing gear ASAP despite MRV Scotia posing no risk to the UXOs and operating out with the UXO restriction boundary. MRV Scotia complied and retrieved the fishing gear off the seafloor at position 56° 36.16'N – 001° 37.63'W at 11:47 BST (Figure 3). The gear was recovered completely at 12:00 BST. On request of the Chief Scientist, the Fishing Master asked Seagreen Traffic if it was possible to carry out a CTD water sample profile at 56° 35.61'N – 001° 38.28'W (Figure 1). This was agreed to be acceptable by Seagreen Traffic and the CTD was deployed @ 12:05 BST and retrieved at 12:11 BST. MRV Scotia then exited the Seagreen Windfarm area at approximately 12:30 BST.

Notable points during the Radio Telephone (RT) conversation with Seagreen Traffic:

- Seagreen Traffic explained that 'Local Notices to Mariners' were issued and in-force and all restrictions and information displayed on 'KINGFISHER' website.
- Seagreen Traffic explained that every 6 hours sécurité messages were broadcast on VHF CH16 with coordinates of suspected UXOs.
- Seagreen Traffic apologised and admitted during the RT conversation to there 'being a break-down in communication from their end' regarding present survey work and suspected UXO finds.
- As explained during the RT conversation with Seagreen Traffic. MRV Scotia is very flexible in their working areas, and is more than happy to stay away from restricted areas. We work regularly in the vicinity of the Seagreen Windfarm site, having visited the area on two other occasions in 2021 with no issues.

Key points to be noted:

- MRV Scotia updates all Admiralty Notices to Mariners weekly as required by maritime law. No Admiralty NTMs were active or in force concerning an on-going Seagreen Windfarm survey and no restrictions were in force.
- MRV Scotia was conducting an International Bottom Trawl Survey alongside other vessels from various nations. Local Notices to Mariners are not sent to vessels and it is not practical for vessels to monitor and check every website. Note this is not saying MRV Scotia was not aware of the Seagreen Windfarm site.
- MRV Scotia had been working in the area for the previous 24 hours and no sécurité messages were received on the MRV Scotia's 2 VHF stations which were (and constantly are) programmed to CH16, nor on the vessels GMDSS DSC. Note these are monitored 24 hours a day. Immediately after the RT conversation was completed with Seagreen Traffic, whilst MRV Scotia was retrieving the trawl gear, a sécurité message was broadcast from 'GLOMAR WORKER' on VHF CH16 with coordinates of the three UXOs and requested a 500-metre exclusion zone from the relative positions. This was the first time the sécurité was received by MRV Scotia.
- No NAVTEX warnings were issued as confirmed by the Commanding Officer of the MRV Scotia having contacted 'GLOMAR WORKER' following the incident. It is industry standard that NAVTEX warnings are issued in the event that UXOs have been located – ensuring warnings are received even if internet communications are not possible.

The Local NTM that Seagreen Windfarm published to the Kingfisher Bulletin website identifies that in the area MRV Scotia undertook the trawl that 'A Potential Unexploded Ordnance (pUXO) identification survey will take place within the Seagreen Offshore Wind Farm site boundary. The survey vessel, Glomar Worker will utilise an ROV mounted magnetometer and video camera to conduct the survey of numerous targets to identify any possible UXO risk. Wind Turbine Generator positions, Inter Array Cable routes and 1 Offshore Sub-station location within the Seagreen site boundary will be surveyed.' It must be noted that nowhere in this local NTM does it state that bottom trawling should not take place in the area.

On the Kingfisher Bulletin website, three confirmed UXO targets are published in the Seagreen Windfarm survey area, the locations that were also provided to MRV Scotia following the VHF RT conversation. The notices state 'The target has a 500 metre exclusion zone in place with immediate effect. The on-site vessel "Glomar Worker" will transmit a sécurité broadcast at 6 hourly intervals giving full details of the hazard to all vessel in the area.' It must be noted that at no point was MRV Scotia within this exclusion zone nor was a sécurité received in the previous 24 hours that MRV Scotia was in the vicinity prior to deploying the trawl (see Figure 3).

To summarise, MRV Scotia undertook an IBTS trawl in an area with no restrictions to prevent trawling in place and at no time entered an exclusion zone.

MRV Scotia Fishing Master and Chief Scientist
12/08/2021

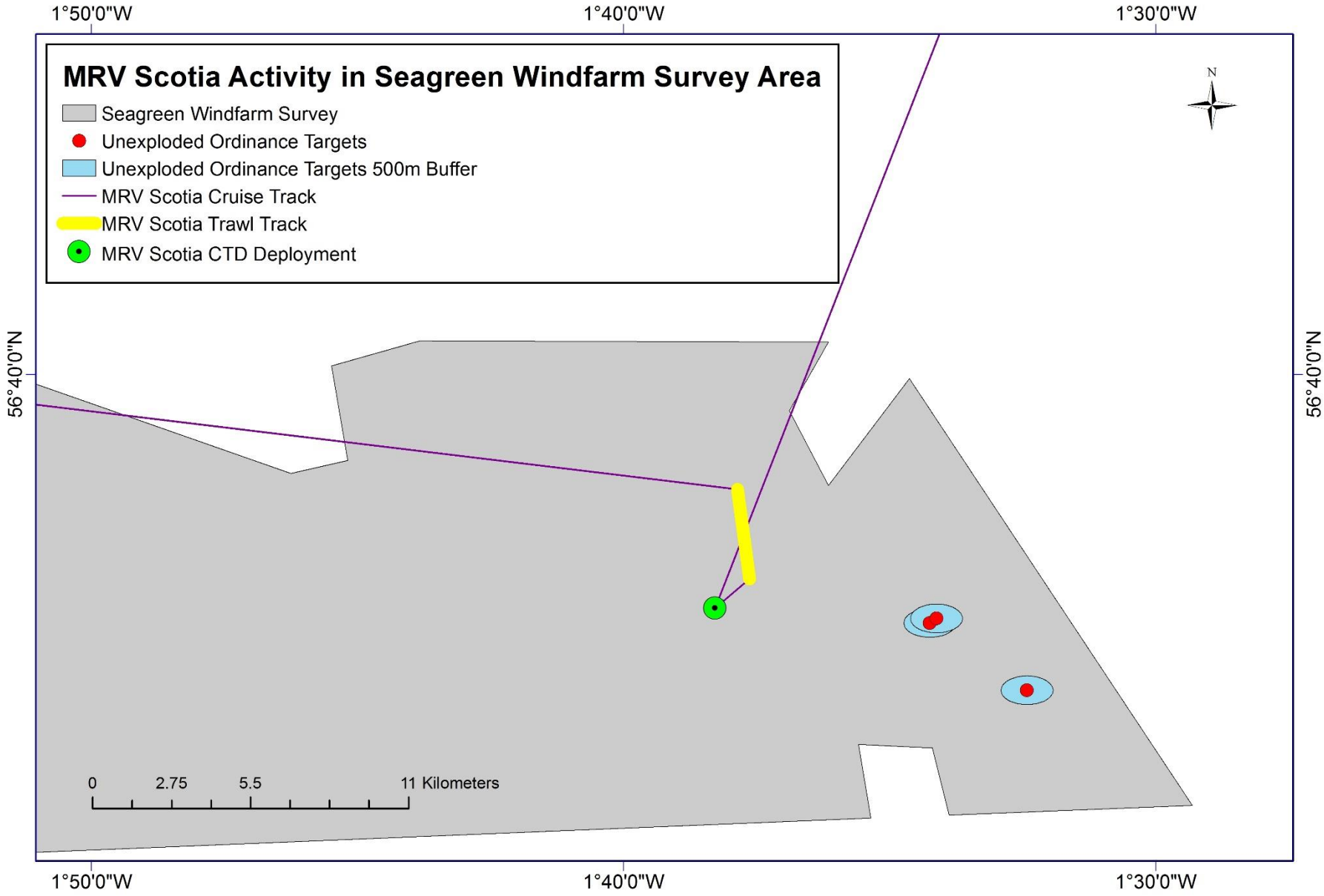

Figure 3. Chart indicating the activity MRV Scotia undertook in the Seagreen Windfarm Area.