Not to be cited without reference to the Marine Laboratory, Aberdeen

MRV *Scotia*

Cruise 1023S

Report

7 – 28 August 2023

Half-landing: Aberdeen, 21 - 22 August (Scotia in for an additional day in order to effect repairs to plankton winch)

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 Directorate, Working Time Policy (Lab 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, Delivery Leads 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.

Out-turn days: 21 days – IBTSNS / 20671, 1 day – RE004 / 20231

Fishing Gear: GOV Trawl (BT 137) with Ground Gear A & B
Hydrographic Gear: RBR Concerto^3 CTD
Plankton Sampling Gear: MIK Net (Round frame with IK depressor)

Objectives

1. Completion of an internationally coordinated demersal trawling survey in the North Sea in ICES Subareas 4a and 4b.

2. Obtain temperature, salinity and dissolved oxygen concentration data from the water column at each trawling station using a RBR CTD.
3. Sample surface and bottom layers for Nutrients, Chlorophyll and dissolved oxygen calibration samples from selected stations (see figure 2).

4. Deploy MIK sampler opportunistically for collection and reporting of pre-metamorphosed clupeoid larvae during the hours of darkness and at locations within the allocated trawl survey area.

5. Collect additional biological data in connection with the Data Collection Framework (DCF) / UK Work Plan.

6. Retrieval and re-deployment of passive acoustic moorings located at discrete sites within the survey area and as part of the Scotland Passive Acoustic Network (SPAN).

7. Collection of low nutrient sea water for chemists from the Marine Directorate (MD).

Narrative

Part 1 (7th – 20th August)
Scotia departed Aberdeen at 0800 on the 7th August and after a muster drill and a brief and also successful shakedown haul within Aberdeen Bay to test fishing trawl and trawl sensors, headed North to the first trawl station located within the Southern Trench and in rectangle 44E8. Pre-sailing, groundgear B was attached to the GOV trawl to allow the surveying of the Northern half (North of 57º 30'N) first. The trawl completed successfully with one further trawl station being completed on 7th August and also within 44E8. This was followed up with 3 night-time deployments of the MIK net in and around the same area. During the 8th August 5 trawl stations were completed around the Bosie's Bank and Buzzard field region with Scotia eventually finishing up North around the Pentland Skerries area. With conditions deteriorating Scotia diverted into the Moray Firth to avoid the worst of the oncoming NW gales ensuring that surveying would be able to continue during the following day. 2 MIK deployments were also completed successfully within the Moray Firth during the evening/early morning of the 8th/9th August. With strong NW winds continuing into 9th August Scotia spent the day in the Moray Firth and completed 5 stations before heading through the Pentland Firth overnight. One MIK deployment was completed at 47E6, however a serious leak in hydraulics feeding the plankton winch detected during the MIK's retrieval called a halt to any further MIK deployments for the remainder of part 1.

Over the next 5 days excellent progress was made first with stations West of Orkney and then those to the West of Shetland also being completed with only moderate Easterly winds and generally calm conditions being encountered. An impromptu stop into Scalloway to put a member of the crew ashore due to a family bereavement resulted in several hours being lost on the 11th August however it also presented welcome opportunity to take on fresh water during the 2 hours that Scotia was alongside. Aside from this, the survey proceeded largely without issue albeit trawl damage was sustained on 2 of the trawl stations at 50E7 and 50E8 respectively. On both occasions repairs to the trawl were effected quickly and the stations successfully repeated with only minimal time lost.

With the calm and settled conditions continuing, the 15th, 16th and 17th August were spent completing the survey transects on the East side of Shetland and Orkney and from there the long overnight passage was taken southeast to the trawl station in 43F4. This passage also signified a move into ICES subarea 4b and with that a changeover to groundgear 'A' which would be used for the remainder of the survey. Over the next 3 days Scotia surveyed West and back towards Aberdeen and was alongside by early evening on the 20th August for the mid cruise break. Repairs were planned to take place on the plankton winch plus there would be a partial changeover of scientific staff. The extended and lengthy duration of the first half of the survey was entirely due to the availability of the shoreside engineers required to repair the plankton winch with the earliest availability being Monday 21st August.

Part 2 (23rd – 28th August)
Scotia departed Aberdeen harbour at 0700 on the 23rd August. This was one day later than expected and was due to another hydraulic leak being encountered whilst repairs were taking place on the plankton winch. With both hydraulic leaks repaired Scotia

was able to successfully complete 4 trawl stations on the 23rd August with the first taking place at Aberdeen Bank located just 15nm East of the harbour. 2 MIK deployments followed within rectangles 42E9 and 41E9. During the following day trawl stations around Marr and Berwick Bank were completed followed by stations located within the Firth of Forth. A small boat transfer was completed on the East side of Bass Rock in order to return ashore of a member of the scientific complement that had joined Scotia at the start of part 2. This was completed without incident and Scotia was able to return to her trawl objectives with only minimal time lost. During the remaining 3 days Scotia was successful in completing all the remaining trawl stations located in and around the Dogger and East Bank Area off the Northumbrian coast as well as completing 9 deployments of the MIK sampler within the same area.
Scotia arrived back into Aberdeen at 0730 on the morning of the 28th August with unloading taking place later the same morning.

Results

Trawl Survey

Trawl Survey

The GOV was deployed on 88 occasions. A total of 86 valid hauls were achieved and with all the 74 statistical rectangles allocated to Scotland being successfully sampled at least once. Of the 16 rectangles where Scotland was the sole surveying nation 12 were sampled twice with 4 of the stations only being trawled once (see figure 1). During the survey there were 2 foul hauls within 50E7 and 50E8. Both of these stations were successfully repeated. 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, 37 stations were completed successfully using groundgear 'A' and 52 stations with groundgear 'B'. Fourteen valid trawls were of a duration that was less than the nominal 30 minutes and the reasons for this are multifarious. Heavy (and often pelagic) fish marks were observed during several deployments (hauls: 176, 215, 237, 241, 246, 248, 255, 257), hauls 257 and 224 experienced net lifting during these deployments for short periods resulting in trawl duration being reduced. In addition the trawl net coming fast on the bottom together with other terrain related issues also resulted in shorter trawl durations for hauls 184, 190, 201, 247 and in order to prevent possible damage to the trawl gear. The locations used for the trawl positions were a combination of established Scottish IBTS trawl locations as well as those undertaken by other countries during previous IBTS surveys. All trawls were undertaken during the daylight period.

The Scanmar receiver unit together with the RADOS system was used to monitor headline height, wing spread, door spread and distance covered during each trawl tow with SS4 distance units being deployed to monitor wing and door spread. An MD built bespoke bottom contact sensor was attached to the trawl's groundgear during each tow to monitor ground contact as well as to validate record of touch-down (TD) and lift-off (LO) of the groundgear. This was downloaded and analysed subsequent to every haul in order to verify and cross-check trawl duration by cross referencing TD and LO times against the RADOS trawl summary output.

A total of 93 species were observed for an overall catch weight of 54,806 kg. This is a slight decrease in overall catch weight compared to the previous year (57,027 kg)

although still greater than the 5 year average of ~43,000 kg. Due to significant differences in the area surveyed by Scotland during 2022 and 2023 CPUE comparisons for key species are not included in this survey report.

Major components (tonnes) included: haddock (20.3), herring (8.9), Norway Pout (3.4), whiting (9.0), mackerel (3.6) and cod (1.2). The catch per unit effort (CPUE) estimates for the major species are detailed in table 1. A total of 7411 individual fish were sampled for biological data and details of these by species can be found in table 2.

The full dataset from this as well as all the other surveys undertaken during the International Quarter 3 2023 North Sea survey programme, are uploaded to the ICES DATRAS trawl survey database. From this, international abundance indices are generated for several 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

Due to mechanical faults with the plankton winch MIK sampling was cut short during the first half of the cruise and was unable to continue until after the mid-cruise break, as such only limited coverage was achieved. A total of 17 MIK hauls were undertaken over the course of the survey, due to issues with the plankton winch speed controls 2 hauls were raised early (9m and 11m from the seabed respectively). An additional 3 deployments were carried out with an open net for calibration of the flowmeters. The aforementioned mechanical faults resulted in deployments being limited to 7 nights, and as such the 17 valid deployments only covered 17 of the possible 74 ICES rectangles, with 1 sample being taken in each rectangle.

Clupeid larvae were found in 16 of the 17 deployments with the highest counts found in ICES rectangles 40F1 and 43E8. A total of 582 sprat larvae were identified, as well as 8 sardine larvae and 2 clupeid larvae which were too damaged to identify to species level. Other clupeiform larvae such as sandeels and Argentines were also extracted during the at-sea picks and treated as ‘target’ species. The total counts of each target species identified and the number of hauls they were present in are summarised below in Table 3.

Table 3. *Number of hauls where species were observed and total count of individuals*

Species	No. Hauls	Total Count
Clupeid sp.	1	2
Sardina pilchardus	1	8
Sprattus sprattus	16	584
Ammodytes sp.	11	338
Hyperoplus lanceolatus	6	41
Hyperoplus immaculatus	3	5
Argentina sphyraena	6	29
Glyptocephalus cynoglossus	2	6
	Total	1013

Separation and fixation of clupeid and other target larval species was undertaken at sea. Species level identification of target larvae was undertaken on-shore following the cruise, identification of non-target larvae is ongoing. Distribution plots of all clupeid and other clupeiform species are presented in figures 2 and 3.

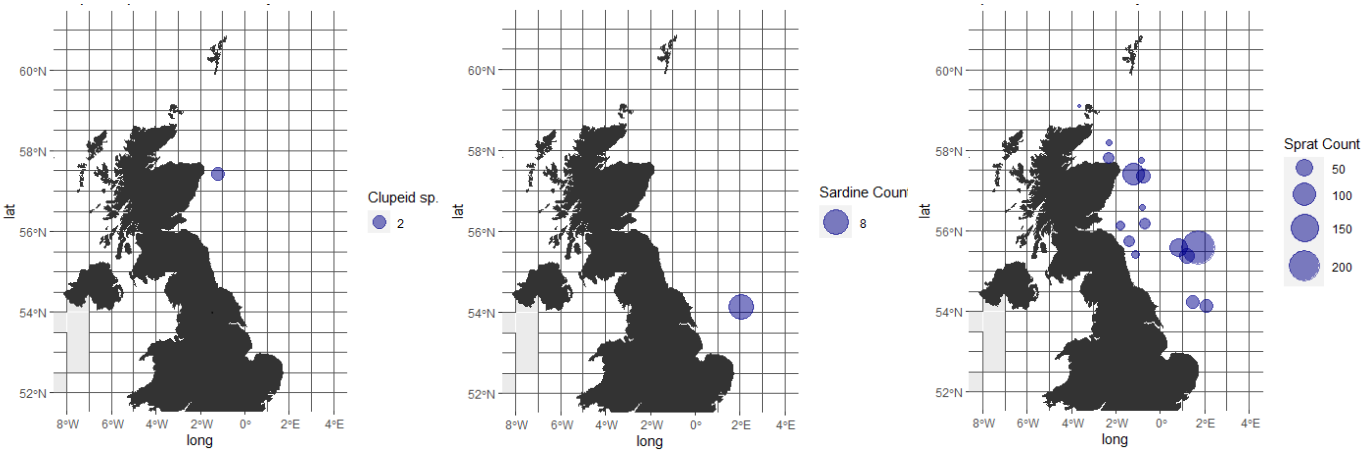

Figure 2: Species distribution plots for clupeid species; Clupeid sp. is used where individual larvae were unable to be identified to species level due to damage.

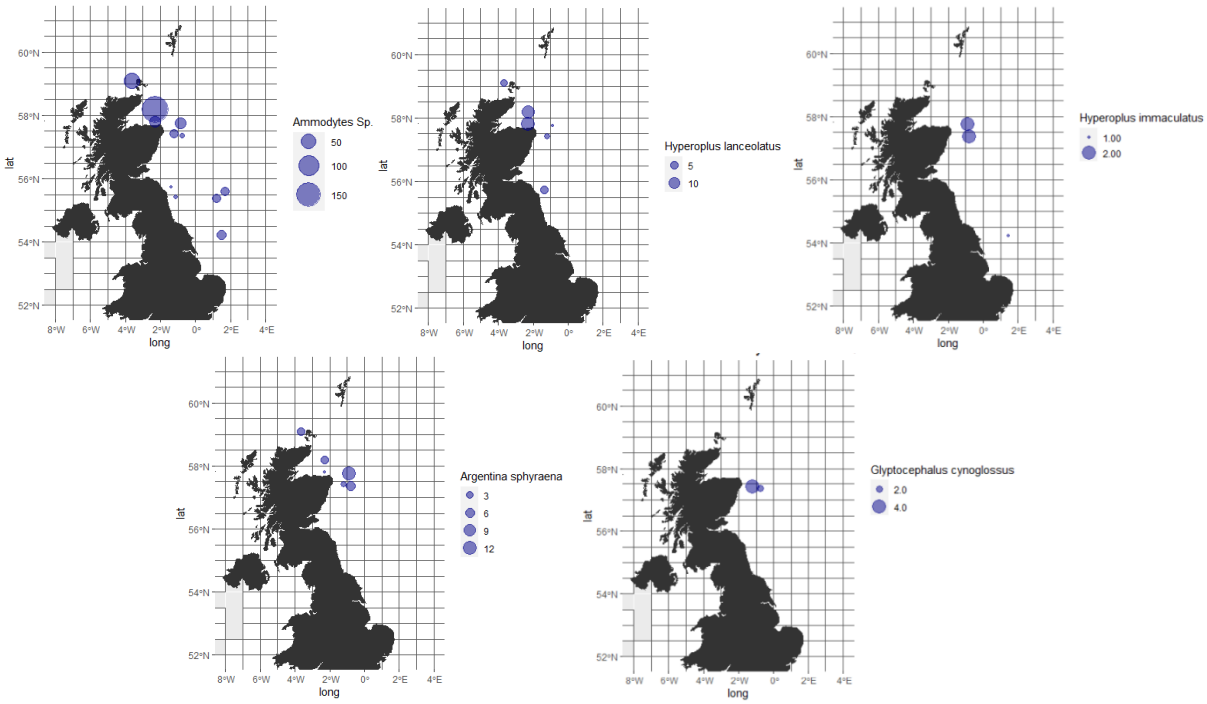

Figure 3: Species distribution plots for other clupeiform species; Ammodytes sp. is used where there is some uncertainty regarding larval identification.

SPAN Acoustic Moorings Deployments/Retrieval

5 moorings were successfully deployed during 1023S and of the 3 scheduled mooring retrievals 2 were recovered successfully. Unfortunately there was no communication with the mooring at Bosie's bank and therefore this could not be retrieved. As a result the deployment location of the new mooring in this area was made some distance away from the original deployment position which was virtually right on top of the existing unsuccessfully retrieved mooring which was within an area known to be trawled regularly. All deployment positions were recorded within the accompanying moorings location folder which returned back with renewables colleagues at the end of the survey. SPAN Mooring locations are plotted in figure 1.

Hydrography

The CTD (RBR Concerto) was deployed at all 86 valid trawling stations (see figure 1) to obtain a temperature and salinity profile at each station with 172 *(surface and seabed)* water samples being collected for salinity calibration.
Additional marine chemistry sampling was performed on 44 selected stations (see figure 4) for both chlorophyll and nutrient analysis *(surface and seabed)* as well as for dissolved oxygen analysis *(duplicates surface and seabed)*.

14 carboys of seawater were collected from square 43F0 in a perceived low nutrient area for routine monitoring by chemists from MD.

Biological Sampling

In total 7411 biological observations on selected species were collected in support of the UK Workplan and also the EU Data Collection Regulation. A summary of numbers collected for all sampled species is displayed in Table 2. All otoliths were aged upon return to the marine laboratory.

Monitoring of Non Indigenous Invasive Species (NIS)

All catches were screened for the presence of selected NIS species with the results being reported back to the project coordinator at CEFAS.

Marine litter

All litter picked up in the trawl was classified, quantified, recorded, photographed and retained for appropriate disposal ashore. The data is uploaded to the MSS database from where it will eventually be uploaded to DATRAS.

Miscellaneous and additional sampling requests – 1023S

- All trawl caught gelatinous zooplankton were identified to species (where possible), weighed and quantified – *Marine Directorate*
- Retained small/juvenile fish samples from a range of species within 16 selected statistical rectangles located around the outer Moray Firth, Tay and Forth areas

and looking at non-breeding season ecology of guillemots and razorbills - *Marine Directorate as partner of SCOTMER project*

- Genetic samples retained from hake and anglerfish encountered looking at population structure of these species within the Northeast Atlantic – *GIFAMAN project*
- Samples retained of selected prey species from trawl stations within the Moray Firth Area to progress ongoing work into feeding ecology of Minke Whales using stable isotope of prey species – *Exeter University*
- Haddock retained for Aberdeen University's MSc fish dissection practical.
- A variety of species were kept for Aberdeen University's MSc practical on fisheries biological data collection.
- Whole mackerel frozen to investigate variations in field metabolic rate proxy using sagittal otoliths. 3 sets of 30 fish collected from geographically distinct areas – *Southampton University*
- All shelled molluscs retained for the Mackay reference collection.

Summary

This survey in 2022 *(1022S)* was delayed by over 2 weeks on account of mechanical issues affecting Scotia's rudder. The knock on impact was that Scotia was then unable to complete any of her rectangles within the Norwegian and Danish EEZ and hence trawl effort was diverted elsewhere within the remaining UK survey area. Fast forward to 2023 and thankfully none such issues were encountered with Scotia able to revert back to her existing survey area which was completed successfully without too many issues. Scotia did lose almost 2 full survey days due to a combination of several issues notably repairs being effected to the hydraulic winch during the midcruise break as well as having to deal with other related hydraulics issues and also the unscheduled port call during part 1. Nevertheless Scotia was successful in getting round the entire survey area completing 86 valid trawls stations with the only impact being 4 rectangles *(out of 16 doubles)* that were trawled only once. Despite only being able to undertake 17 deployments with the MIK net the results that these generated will be extremely valuable with sprat larvae which were the main target species being recorded in 16 of these deployments. All the MIK larval data have been sent to the Q3 MIK survey coordinator at DTU Aqua where they will be incorporated into the international survey dataset and ultimately uploaded to the ICES egg and larval database where the intention is to use these data to develop a sprat larval abundance index similar to that generated for herring larvae during the Q1 North Sea IBTS.

A massive thank you to all the officers, engineers and crew of the Scotia for ensuring the success of what was at times a challenging although ultimately an extremely enjoyable and successful survey.

Finlay Burns
31/10/2023

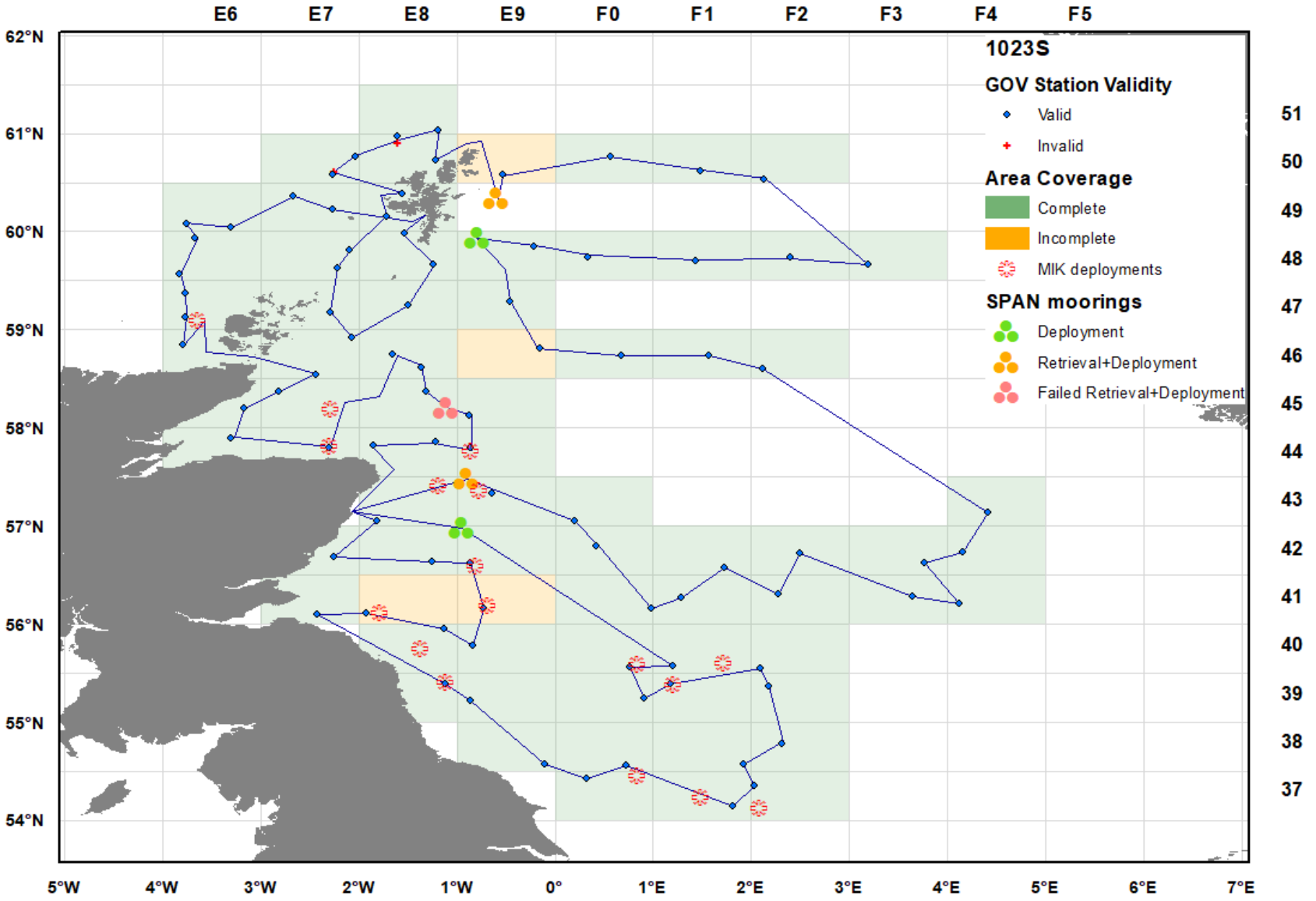

Figure 1: Survey chart illustrating completion status of sampled rectangles, GOV trawl stations and SPAN moorings as well as location of MIK deployments and also Scotia cruise track for 1023S.

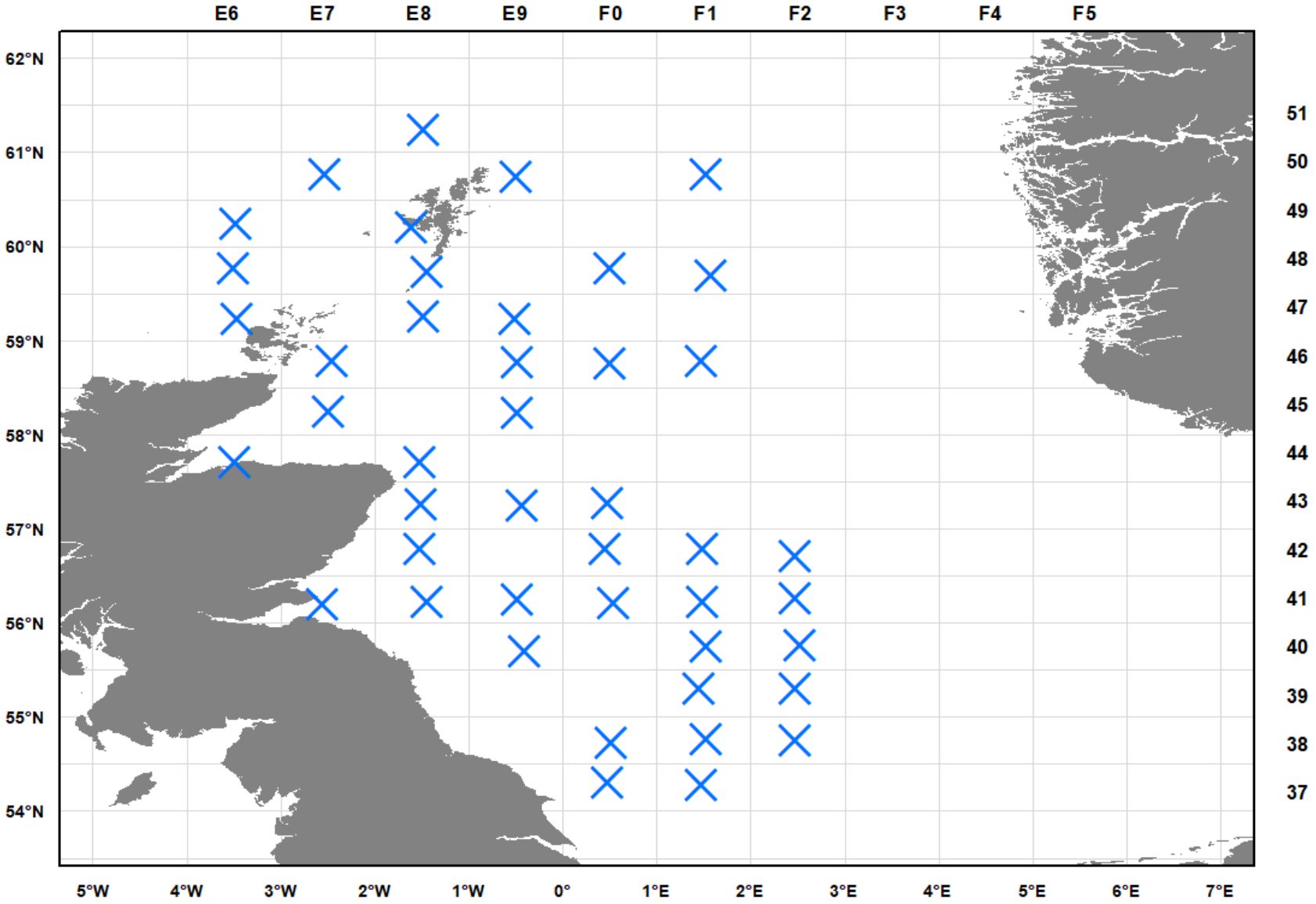

Figure 4: Survey chart highlighting 44 statistical rectangles where additional marine chemistry sampling was completed during survey 1023S and denoted by a blue cross.

Table 1: CPUE of major species observed during 1023S.

Species	CPUE nos/h	CPUE kg/h
Haddock (*Melanogrammus aeglefinus*)	1894	502
Herring (*Clupea harengus*)	2171	220
Mackerel (*Scomber scombrus*)	315	89.3
Norway Pout (*Trisopterus esmarkii*)	14175	83.4
Whiting (*Merlangius merlangus*)	1377	223
Blue Whiting (*Micromesistius poutassou*)	542	10.9
Cod (*Gadus morhua*)	131	4.9
Spurdog (*Squalus acanthias*)	10.7	21.4
Common Dab (*Limanda limanda*)	644.5	37.3
Lesser Spotted Dogfish (*Scyliorhinus canicula*)	17.7	14.3
Grey Gurnard (*Eutrigla gurnardus*)	120	10.2
Plaice (*Pleuronectes platessa*)	80.2	13.8
Poor Cod (*Trisopterus minutus*)	131	4.9
Saithe (*Pollachius virens*)	14.8	17
Sprat (*Sprattus sprattus*)	795	11.6
Horse Mackerel (*Trachurus trachurus*)	88.7	24.2
Long Rough Dab (*Hippoglossoides platessoides*)	179.6	6.6
Long Finned Squid (*Loligo forbesii*)	51.5	3.2
Lemon Sole (*Microstomus kitt*)	61.4	7.5
Flapper Skate (*Dipturus intermedius*)	0.5	3.4

Table 2: Numbers of biological observations per species collected during 1023S (length, weight, sex & age, * length, weight, sex, age & stomach retained, ** 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 & genetics.

Species	No.	Species	No.
Haddock (*Melanogrammus aeglefinus*)	1955	Cuckoo Ray (*Leucoraja naevus*)****	56
Herring (*Clupea harengus*)**	1190	Witch (*Glyptocephalus cynoglossus*)	30
Whiting (*Merlangius merlangus*)*	1345	Starry Ray (*Amblyraja radiata*)****	35
Cod (*Gadus morhua*)	548	Flapper Skate (*Dipturus intermedius*)****	20
Mackerel (*Scomber scombrus*)**	534	Thornback Ray (*Raja clavata*)****	7
Norway Pout (*Trisopterus esmarkii*)	482	Starry Smooth Hound (*Mustelus asterias*) ****	2
Plaice (*Pleuronectes platessa*)	432	Brill (*Scophthalmus rhombus*)******	1
Spurdog (*Squalus acanthias*)****	96	Halibut (*Hippoglossus hippoglossus*)******	2
Saithe (*Pollachius virens*)	286	Black-bellied Angler (*Lophius budegassa*)*******	5
Sprat (*Sprattus sprattus*)***	165	Blonde Ray (*Raja brachyura*)****	2
Angler (*Lophius piscatorius*)*******	56	Shagreen Ray (*Leucoraja fullonica*)****	1
Hake (*Merluccius merluccius*)*******	136	Spotted Ray (*Raja montagui*)****	22