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MRV *Scotia*

Survey 0223S North Sea IBTS Quarter 1

REPORT

22 January – 11 February 2023

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Objectives

1. To complete Scotland's commitments to the North Sea Quarter 1 International Bottom Trawl Survey (Q1 IBTS) 2023 in ICES area IV.

2. To collect additional biological data in line with the UK Work Plan and EU Multi Annual Plan (for some parameters required for international coordination) and by IBTSWG and other request.

3. To sample the water column using a circular-frame plankton (MIK) net for pre-metamorphosed clupeid larvae within the trawl survey area. During selected MIK deployments to deploy additional subsidiary ring nets (MIKey-M) on the MIK frame itself to target eggs and sandeel larvae.

4. To obtain temperature and salinity data from the surface and seabed at each trawling station.

5. To collect samples of surface and near seabed water for nutrient analysis (nitrates, silicates and phosphates).

6. To record marine litter at each trawl station in line with UK Marine Strategy.

7. To deploy new survey trawl BT238 with the Morgère Polyvalent Oval trawl doors to collect net and door geometry data for the combination and to provide catch comparison data with the GOV trawl.

8. To deploy two passive acoustic monitoring moorings for recording of marine mammal and underwater noise on behalf of the marine mammal group within REEA on pre-selected sites to the east of Shetland.

Out-turn days: 21 days, IBTSNS / 20671

Survey Gear

- GOV Trawl (BT137) rigged with 47m sweeps and ground gears A and B.
- New survey trawl (BT238) rigged with 47m sweeps and light hopper ground gear.
- Morgère Polyvalent Oval 1100kg GOV trawl doors
- 2.3m Midwater Ring Net (MIK) with attached subsidiary ring nets (MkM).
- CTD (RBR Concerto^3).
- Scanmar net geometry, door angle and catch sensors
- Bottom contact (BCon) sensors (in-house design)
- Acoustic monitoring moorings

Narrative

Scotia sailed from Aberdeen at 0930 on 22 January with vessel familiarisations, drills, and safety briefings taking place shortly afterwards. The GOV survey trawl incorporating ground gear A was rigged on the lower net drum while new survey trawl BT238 incorporating light hopper gear was rigged on the top drum to allow swift deployment as occasion permitted. Steaming east in a moderate southerly breeze and slight seas *Scotia* was on station at 1100 to undertake a trial trawl deployment (12) in rectangle 43E8. With the trawl successful and no unresolved issues the station and catch was considered valid for survey purposes and *Scotia* continued due east to make best use of a favourable 24-hour forecast for the central north sea, completing one more trawl that day before commencing the clupeid larvae (MIK net) survey after full darkness. Six MIK deployments working east were completed overnight. Some issues with plankton winch control were noted in that maintaining a constant speed of pay-out and retrieval of the MIK was difficult, and that a slightly faster overall deployment speed than preferred was typical. The first of the three trawls of 23 January was undertaken in rectangle 43F1, outside the northern boundary of the Gannet and Montrose MPA, following which *Scotia* worked south west. MIK deployments overnight continued westward allowing trawling around the inshore stations with no issues and good conditions. Some excellent catches of 1-gp haddock were encountered as well as high counts of clupeiforms in the plankton trawls. By late afternoon of 25 January all trawl stations with ground gear A (those south of the 57.5^o line) were completed including double trawl effort in rectangles 42E8 and 43E8. The GOV ground gear was changed to B overnight while *Scotia* completed MIK stations northeast into the central north sea where conditions were again favourable for a few days.

Over 26-28 January the eastern-most block of rectangles were covered along with those to the NE of Fraserburgh in good conditions. With some time available following completion of station 27 on 26 January trawl BT238 was shot (open codend) for the first time on the cruise to collect geometry data while used in conjunction with the new version of the Morgère Polyvalent Oval trawl doors. On 27 January after completion of four GOV trawls another chance arose, this time to undertake the first comparative trawl (31) with BT238 300m to the east of the position of GOV station 30 with the catch fully worked up bar biological data. As forecast the wind picked up strongly from the southwest over the night of 28 January during which seven MIK stations were completed working into the shelter of the inner Moray Firth and trawls in all four Moray Firth rectangles were completed there the next day. Moderate-sized haddock (though few juveniles) were a major component of the catches. The continuation of very strong winds meant the cancellation of overnight MIK work and *Scotia* steamed slowly to the slight lee available in rectangle 47E7 to complete four trawls on 30 January. With slight drop in wind overnight *Scotia* was able to complete three MIK stations in the vicinity before making a move to the relative shelter of northeast of Shetland for further operations.

Scotia continued the survey on 30 Jan with station 40 east of Balta in a 40 kt westerly airflow with moderate seas and completed two more trawl stations before pausing to deploy the first

of the acoustic moorings. Station 46 was undertaken just over the line into rectangle 49E9, this being the only workable option at the time, however, it meant that there was <10 nmi between that and the previous station 45. The acoustic mooring was deployed successfully on the position given some 6 nmi southeast of Out Skerries. With the conditions that evening MIK deployments were only possible in rectangles 49E9 and 50E9, however, *Scotia* made passage east in high seas to 49F0 in hope of a lull, which was, however, not forthcoming and MIK sampling in the square was dropped pending a return in two days en route to half landing in Lerwick. With the wind having swung to a northerly and decreasing for a time *Scotia* was able to complete the northern section of the survey area without issue and on run up to the half landing on 2 February station 54 north of Muckle Flugga was completed as the wind increased markedly, this time strongly from the southeast. MIK work struggled overnight with no opportunity for a second station in F1F0 as *Scotia* worked towards Lerwick and while a single deployment in 50F0 was successful, winds were again too strong in 49F0 and with no return possible this rectangle was left uncovered by Scotland. Plans to undertake MIK calibrations close in to land were shelved and instead the second mooring was successfully deployed on position in poor seas some 16 nmi SE of Bard, following which Scotia steamed for Lerwick and the half landing, being alongside by mid-morning. There was a changeover of one crew and one scientist.

Scotia departed Lerwick mid-morning of 4 February and following drills made for the first trawl station (55) a considerable steam (35 nmi) to the southeast of Lerwick in 48E9. With the forecast ahead for west of Orkney-Shetland looking very poor in general for the remainder of the cruise, but with slightly better conditions to the northwest of the survey area *Scotia* was able to also cover 47E9 before it became necessary to MIK survey back around Sumburgh, then up the eastern coast to the most viable trawl stations. At this point ship's engineers reported some concerns with the starboard engine which necessitated *Scotia* maintain an engine power (100 revs max) limit for the rest of the survey. Following three GOV stations (with respectable catches of cod noted), time permitted a second comparative tow with the BT238 (a close-by repeat of station 59 in the data-poor rectangle 50E7) which was successfully undertaken despite deployment from the top drum being far from ideal in the poor conditions. Accordingly the BT238 was left on the back deck for deployment first thing in the morning in 49E6 as part of a third comparable set of two trawls. With no opportunities for MIK, *Scotia* dodged SW to find still marginal conditions prevailing at dawn with a 5 m swell and 35+ kt winds. The recently introduced engine power limit gave difficulties when trying to shoot into the high seas at the lower speeds possible and concerning difficulties in getting the new doors to spread became evident. Following block up it was found impossible to maintain proper towing speed into the seas with the power limitation and with speed generally ranging over 3.0-3.3 kts the net was however hauled back to avoid damage when this actually dropped to 1.4 kts. While the catch was worked up without biological data being recorded the low speed, however, invalidated the trawl for comparative purposes. The associated paired GOV station in 49E6 was abandoned due to the continuing poor conditions and *Scotia* made the move east to 49E7 where forecast looked slightly better allowing a GOV trawl there to be completed. Though sea conditions here were improved the power limit again meant that the overall speed remained lower than preferred (mean 3.35 kts) but the catch was fully worked up and the low speed flagged. Prior to the next trawl slight adjustments were made to the rigging of the doors to improve their spreading performance at low speeds, these adjustments proved successful. The wind and swell eased slightly briefly overnight allowing three MIK to be completed. With the forecast in rectangles to the west and northwest of Orkney particularly bad, *Scotia* was able to go no further west than rectangle 48E7, however, the first station of the day (64) was invalidated by the net overspreading and lifting off the bottom, and a repeat station close by, though an improvement, was likewise affected, with study of the BCon outputs leading to subsequent invalidation. A re-adjustment of the trawl door rigging back to the original configuration solved these immediate problems but highlighted the importance of some urgent experimental work to find the optimum arrangement. A further two trawls were completed

successfully, again with good numbers of cod apparent. The wind eased off overnight, and while rectangle 49E7 had to be dropped for MIK the slightly more workable conditions slightly south enabled 7 MIK deployments that night.

With the wind picking up at dawn and foul conditions (8 m swell and 50 kt winds) in the un-surveyed rectangles west of Orkney the final programmed trawl (68) of the survey was undertaken in the slight lee available east of Orkney. In an effort to maximise the chance of workable seas the only choice of station was one right in the south-western corner of 47E8 putting it relatively close to trawls in adjacent rectangles. The station was, however, completed successfully despite the marginal conditions. Just after completion the captain brought news of a positive case of Covid-19 on board, this was dealt with according to ship's protocols. With no further survey stations possible *Scotia* steamed closer in to Orkney to undertake some door rigging experiments, these were, however, cut short by the conditions and *Scotia* instead steamed south to undertake MIK calibrations that night in the lee of the Moray Firth.

On morning of 9 February experiments with Morgere doors continued with the GOV in the morning and BT238 in the afternoon. These were successfully concluded by late afternoon with definite results. With there being not enough daylight time remaining to undertake some intended GOV/BT238 comparison tows, *Scotia* steamed north to be in position for continuation of MIK survey overnight. A second positive Covid-19 case was announced shortly after making headway at which point the ship's officers made it clear that a third positive case would prompt a return to port. At 1700 on 9 February a third positive case was indeed announced and *Scotia* turned south for Aberdeen. *Scotia* was tied up in Aberdeen at 1500 on 10 February with all equipment and staff leaving the vessel on 11 February.

Resutls

1. Demersal Trawl Survey

Demersal trawling was undertaken with the GOV trawl incorporating ground gear A on all programmed stations south of 57.5^{o} and ground gear B on all stations north of that. Three non-programmed stations were additionally undertaken with new survey net BT238 for catch comparison purposes, and a further deployment of BT238 was made to collect gear geometry data only (open codend). The Scanmar system was used throughout the survey to monitor headline height, wing spread, door spread and door angle in real time. *Scotia's* own navigation system provided data on vessel speed over the ground and distance covered during each trawl. A self-recording bottom contact sensor was attached to the ground gear with the data being downloaded and checked after each tow to monitor contact with the seabed throughout the duration of the trawl. All trawls were undertaken during the pre-defined hours of daylight.

There were 12 deployments of GOV with ground gear A of which all 12 were considered as valid. There were 42 deployments of GOV with groundgear B, of which 40 were considered valid (Figure 1). Of the 48 rectangles in the Scottish survey area 44 had at least one valid trawl. Of the 11 of these rectangles assigned for double effort eight were covered by two valid trawls, one by a single valid trawl and two of these rectangles were not covered at all. There were two occurrences of invalid GOV trawls (60 and 61). Despite adverse conditions compounded by the power limitations in place on the vessel towards the end of the survey period, meticulous planning the ensured the maximum coverage possible. Rectangles not covered by the trawl or the MIK survey were those west and northwest of Orkney (46E6, 47E6, 48E6 and 49E6). Unfortunately, these are rectangles undertaken by Scotland only and will not be covered by any other nation. Rectangles 49E7 and 49F0 were additionally not covered by MIK survey, and while 49E7 is again a Scotland-only rectangle, 49F0 was covered by Norway as part of their standard survey area.

A total of 19.9 tonnes was caught for 24.4 hours fishing. This compares to 23.9 tonnes from 26.6 hours in 2021, 14.1 tonnes from 26.6 hours in 2020 and 15.3 tonnes from 28 hours in 2019 (the 2022 survey was cut short by vessel breakdown after only 14 valid trawls). A total of 81 different species were observed. Some good haddock recruitment was noted in the south of the survey area while cod recruitment was not prominent, larger cod were found in respectable numbers and moreover were caught in most trawls, especially those to the northwest of the survey area. Catches of pelagic species overall were low and juveniles in particular with only a single catch of juvenile mackerel (602 kg from station 53) standing out. Catches in the four main Moray Firth rectangles a were dominated by 3+ year old haddock. As results from 0223S alone are not expected to be representative of NS IBTSQ1 overall these will not be discussed in detail in this report. However, the combined preliminary 1+ group indices for all countries based on 316 hauls are illustrated in Table 1 where haddock, herring, sprat and mackerel are observed at considerably above long term average values, while cod are low, and whiting and norway pout closer to the average.

Table 1: Preliminary 1+ group indices of selected species for Q1 IBTS 2023 (all countries).

Species	Final 2022	Preliminary 2023	Mean (Av. 1980-2022)
cod	1.5	1.2	7
haddock	129.4	1023	549
whiting	380	401	441
norway pout	1599.3	2559	2960
herring	805.8	5227	1944
sprat	857.7	3745	1363
mackerel	59.1	380	140

The above indices are based on the numbers of fish caught per hour below a pre-defined length selected as a probable delimiter of age 1+ fish correct as of 16 March 2021. The definitive indices will be calculated once all the catch data from all the surveys have been uploaded together with the corresponding age data.

Plots of CPUE and distribution for commercial species age 1 using the provisional data contributed by 0223S alone is shown as scaled plots in Figure 2.

Protected areas

Protected areas both inshore and offshore were intentionally avoided except for northwest Orkney MPA where limited scientific trawling does not impact the conservation objectives set for the area as confirmed following assessment by Joint Nature Conservation Committee (JNCC) in December 2022. Survey of stations within the Southern Trench MPA were assessed as having negligible impact under current management measures following discussions with NatureScot in January 2023 although avoiding the conservation feature (burrowed mud in this case) was put forward as best practice. This assessment may change however as updated management measures are announced and fisheries managers along with IBTSWG will need to be aware of the future potential for difficulties in accessing this important area.

2. Biological data/Age determination/Additional UK Work Plan sampling

In total of 4500 biological samples (Table 2) were collected from GOV trawl deployments as part of the routine biological sampling programme on a broad range of mainly commercial species. Otoliths from cod, haddock, whiting, saithe, norway pout, plaice, witch, herring, mackerel and sprat were collected for immediate ageing back at Marine Lab. Data collection

on cod, haddock, whiting and norway pout during standard sampling was expanded to include a count of the numbers of the ectoparasite *Lernaeocera branchialis* (living and dead recorded separately) observed on each individual that was otolithed. Supplementary biological data was also collected from other species from which stomachs or genetic material were collected (see additional biological sampling below). All otoliths were aged post-survey.

Table 2: Numbers of biological samples collected from GOV deployments. Data format is: [1]length, weight, sex, maturity, age and a count of individuals (living and dead separately) of Lernaeocera branchialis infecting the specimen; [2]length, weight, sex, maturity and age; [3]length, weight, sex and maturity; [4]length, weight, sex and externally observed maturity only.

Species	No.	Species	No.
[1]Melanogrammus aeglefinus	1333	[3]Solea solea	1
[1]Merlangius merlangus	837	[3]Trachurus trachurus	101
[1]Gadus morhua	460	[3]Molva molva	21
[1]Pollachius virens	42	[3]Chelidonichthys lucerna	1
[1]Trisopterus esmarkii	447	[3]Scophthalmus maximus	1
[2]Pleuronectes platessa	207	[3]Scophthalmus rhombus	5
[2]Clupea harengus	420	[4]Dipturus flossada	5
[2]Sprattus sprattus	206	[4]Dipturus intermedia	6
[2]Scomber scombrus	113	[4]Leucoraja naevus	23
[2]Glyptocephalus cynoglossus	23	[4]Mustelus asterias	18
[3]Merluccius merluccius	85	[4]Raja montagui	51
[3]Lophius piscatorius	39	[4]Amblyraja radiata	5
[3]Lophius budegassa	4	[4]Squalus acanthias	36
[3]Limanda limanda	1	[4]Raja brachyura	9

Additional biological sampling

Some additional biological sampling was agreed was agreed following request from IBTS working group and foreign institute (AZTI).

- **Cod liver parasites:** Biodata from all examined cod >24 cm total length (424 individuals) was expanded to include an infection category (from pre-defined protocol) of 'cod liver worm' according to visual inspection along with an individual liver weight in each case.
- **Expanded haddock data collection:** As logistics allowed, collection of haddock biodata during the final trawl of each day was expanded to include the following: mm length, whole weight, sex, maturity, eviscerated weight, count of living *L. branchialis*, count of dead *L. branchialis* and the presence of externally apparent skeletal defects (e.g. dwarfism). The overall numbers of fish examined in each trawl were increased beyond otolith collection protocol and included fish from both extremities of the length frequency. No additional otoliths were collected, however, these having already been covered during standard sampling. This expanded data was collected from a total of 570 individuals covering nine trawls and included individuals both from within standard sampling procedure (i.e. that in Table 3) and additional sampling post trawl work-up.
- **Stomach collection**: Intact cod and horse mackerel stomachs were collected and frozen at a rate of two per 5 cm length class and other species as encountered as per NS IBTS Q1 program. Stomachs collected were as follows: cod (311 individuals),

horse mackerel (101), turbot (1), brill (4), tub gurnard (1), ling (21). Most ling encountered were found to have everted stomachs thus the low number as compared to the much higher total caught. Length, weight, sex and maturity were recorded in each individual case. Stomachs are labelled and frozen at MS Marine Laboratory pending further analysis.

- **Genetic samples on behalf of AZTI Genetic Close Kin Analysis (GECKA):** Muscle tissue samples from hake (84 individuals), anglerfish (39) and black-bellied anglerfish (4) were collected according to the protocols provided and stored in RNA later prior to freezing. Length, weight, sex and maturity were recorded in each case.

***Lernaeocera branchialis* infection.**

Otolithed* individuals of five commercial gadoids were inspected for infection by *L. branchialis* (Table 2). Observations were split into obviously living *Lernaeocera* and dead (typically observed as decalcified partial remains) and a count of each was recorded. Infection severity in haddock ranged from counts of 0 to a count of 6 living plus three dead *Lernaeocera* from one individual in trawl 51 with an overall infection incidence of 12.4% including both living and dead stages. In cod the infection incidence was similar (11.1%) however overall severity of infection was lower with a maximum of three living *Lernaeocera* from one individual (trawl 56). No infection was recorded from hake, saithe or norway pout, though all have been recorded as host species.

*as were with haddock subject to the expanded data collection described above

Skeletal defects

Externally obvious skeletal defects in haddock were recorded in 0.27% of individuals (Table 3). In the cases of other otolithed species, individuals with skeletal defects have only the total length recorded and thus the skeletal defect incidence for the time being is unknown.

Table 3: Observed incidence of infection by *L. branchialis* in haddock, whiting, cod, hake saithe, and Norway pout along with incidence of externally obvious skeletal defects in haddock.

Species	No. examined	No. infected	% infected	No. skeletal defects	% skeletal defects	*L. branchialis* overall counts		
						live	dead	total
Haddock	1851	230	12.4	5	0.27	241	126	367
Whiting	879	26	3.0	na	na	9	26	35
Cod	460	51	11.1	na	na	63	5	68
Hake	85	0	0	na	na	0	0	0
Saithe	42	0	0	na	na	0	0	0
Norway pout	447	0	0	na	na	0	0	0

3. MIK Survey

A total of 78 MIK valid trawls were undertaken over the course of the survey, in addition there were a further two trawls considered invalid either for being of too short a duration overall or when there was contact with the seabed and a spoilt sample. There were some difficulties with control of the plankton winch throughout sometimes leading to shorter durations than expected as well as some problems with power. There were a further four deployments carried out with an open net for calibration of the flowmeters. The 78 valid

deployments covered 42 of the programmed 48 rectangles each with at least one sample, including two rectangles which contained yhree deployments. Both squares containing greater than two MIK deployments (43E8, 47E7) were those where extra Scottish effort was programmed.

Pre-metamorphosed herring larvae were found in 44 of the 80 deployments with the highest counts found in ICES rectangles 41E7 and 41E8. A total of 1255 herring larvae were identified. The total counts of each species identified and the number of trawls they were present in are summarised in Table 4. Catches of herring larvae were largely comparable to catches obtained in 2021 when compared by ices rectangle, and no sprat or sardine larvae were found during the survey. Overall distribution as total counts of larval species by MIK deployment (not yet adjusted to volume filtered) is illustrated in Figure 3.

Table 4: Number of trawls where target species were observed and total count of individuals.

Species	No. Trawls	Total Count
Ammodytes tobianus	8	11
Clupea harengus	44	1255
Clupeidae	2	2
Merluccius merluccius	1	1
Maurolicus muelleri	2	5
	Total	1274

Identification and measurement of the clupeid and other target larval species were undertaken on shore due to damage to the microscope at sea. Non target larvae were preserved for later processing and identification at the Marine Laboratory.
MIK Marine Litter – see below.

MIKey-M

MIKey-M sampling on behalf of WGEGGS2/WGSINS was carried out during 48 of the 80 valid MIK trawls, with at least one MIKey-M sample taken in each of the 42 ICES rectangles sampled. Five rectangles were targeted twice with MIKey-M sampling to examine the samples for early stage sandeel larvae. MIKey-M samples were preserved at sea for analysis at the Marine Laboratory bar eight samples collected in addition and retained frozen for isotope analysis (see additional samples below).

4. Hydrographic Data

The CTD was deployed at 49 out of a possible 52 valid GOV trawl stations in order to obtain vertical dip temperature-salinity data to within approximately 5 m of the seabed. The CTD was dropped from two stations to make time for daylight trawling while poor sea conditions affected a third.

5. Nutrient samples

Surface and near-seabed water samples were collected during all CTD deployments for analysis of nitrate, silicate and phosphate content back in the lab.

6. Marine Litter

Demersal trawl - All marine litter picked up in the trawls were classified, quantified and recorded then retained on board for appropriate disposal ashore**.**
MIK trawl - All marine litter collected from the MIK codends were individually stored and labelled and will be categorised and recorded at the Marine Laboratory.
Litter data on the MS database is subsequently uploaded to DATRAS.

7. BT238

The most useful locations for undertaking catch comparisons were considered to be the squares to the NW of the survey area where only a single GOV is programmed for the overall survey and where available grounds are very limited when using the GOV-B rig. As such the southern and eastern area of the survey area was completed first to allow best chance of using any available time at the end for this purpose. However sea conditions in the second half of the cruise were particularly unfavourable and with all efforts being put into completing the GOV survey only two opportunities (stations 60 and 61) arose in this area to use BT238. While station 60 was successful and fully worked up according to IBTS protocols station 61 undertaken first thing the following day in less favourable conditions was affected both by engine limitations and heavy seas and was cut short early to avoid damage when the speed dropped to 1.4 knots. While scored as invalid the catch was worked up without collection of biological data. Another comparative trawl (31) had already been made earlier on in the cruise in the central north sea. Another was made to collect gear geometry only (open codend). No deployments of BT238 were made at the expense of any GOV trawls. Data from BT238 deployments will not be submitted to DATRAS at this point.

7. Acoustic Moorings

Two acoustic moorings were successfully deployed despite the marginal conditions prevailing at the time:

Deployment 162 Equipment 6495/LS1x-21: 60º, 20.123N 0º, 35.430W in 151m depth ~ 6 nmi SE of Out Skerries, East Shetland on 31 Jan 2023.

Deployment 163 Equipment 6493/LS1x-6: 59º, 55.528N 0º, 40.299W in 125m depth ~ 16 nmi SE of Bard, East Shetland on 3 February 2023.

8. (Additional) Rigging Experiments with Morgère Polyvalent Oval 1100kg trawl doors

A new set of Morgère trawl doors (P19/P20) replaced the old standard set (P15/P16) which are no longer available. The new set differs slightly in design from the older model and is similar to those used by England and Germany during their IBTS cruises. P19/P20 doors have the same overall dimensions and weight as their predecessors, however the box section incorporated into the old design has now been replaced with single steel plate. When operating P19/P20 it was found they had outward heel on shooting and inward heel when fishing. The outward heel was particularly problematic when the vessel was shooting slower than normal (partly due to engine restrictions) into heavy seas which caused the doors to stop spreading with potential for the doors actually locking. Furthermore, once fishing it was noted that the GOV had a tendency to overspread and lift off on two occasions when the towing speed approached four knots and fishing into heavy seas. After all GOV stations had been completed as far as possible the remainder of the daylight cruise was spent in areas out of the swell here trials could be safely undertaken to assess the correct rigging of the new doors when used with both the GOV and BT238 trawls. The trials consisted in sequentially altering the towing point attachment (upper and lower points) and adjusting the top backstrop length (the number of chain links left hanging) while checking for correct geometry and seabed contact using scanmar instrumentation and BCon sensor. It was found

the optimum rigging for these doors when fishing both trawls was warp attachment: top towing point; and top backstrop chain (16 mm mid-link): one link shorter than the standard length of 4.56m. This rule will also apply when the GOV is used with long (97m) sweeps for instance during Q3 Rockall surveys or West Coast IBTS at 80 m or greater trawling depth.

9. Other

Non-indigenous Species

All catch, fish and benthos were screened as far as possible for the presence of non-indigenous species, with none evident. The results will be reported back to the project coordinator at CEFAS.

Additional Samples and Miscellaneous Requests

- Juvenile mackerel: two sets of five juveniles (13-16cm) were frozen whole for a study of the impact of temperature on capacity for mackerel growth (MS/University of Southampton).
- Isotope analysis: Flank sections of whiting (10 sections), herring (15), mackerel (13), sprat (2), smooth sandeel (1) pilchard (7) along with eight additional MIKey-M samples were frozen for stable isotope analysis in connection with the feeding ecology on Minke whales in the Moray Firth (University of Exeter).
- Video footage of flatfish species was collecting on IBTS Q1 for the purposes of training human reviewers and AI/ML technologies to better identify and separate the various flatfish species on recorded footage. This footage will be reviewed by human reviewers initially to determine a baseline of flatfish identification accuracy that will be used subsequently in conjunction with electronic monitoring footage.
- All shelled molluscs were retained frozen for identification and distribution mapping by D. Mackay.

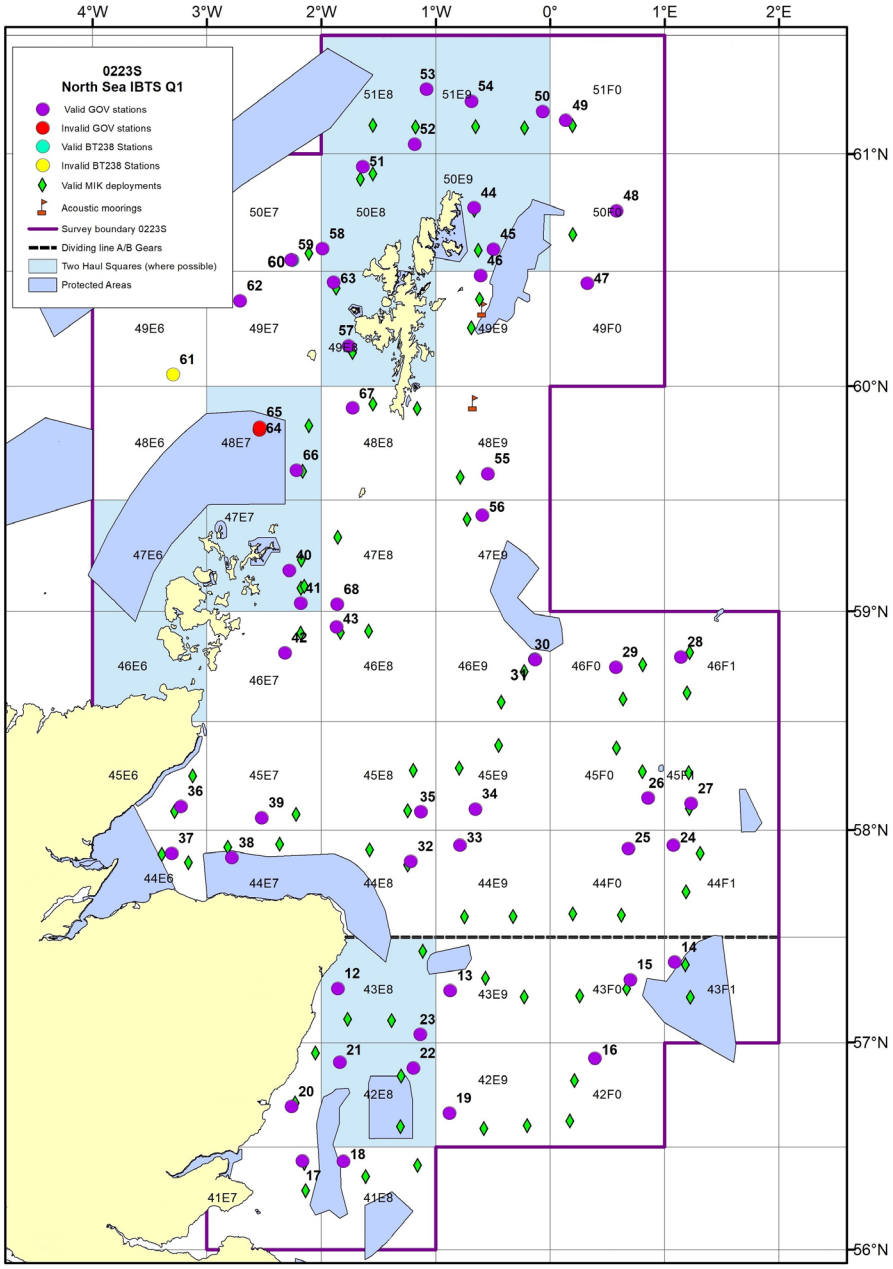

Figure 1: Scottish North Sea Q1 IBTS survey area along with completed trawl stations, station numbers, MIK deployments, and sites of acoustic moorings for 2023. Note station 60 (valid BT238) is obscured by station 59 (valid GOV), station 31 (valid BT238) is obscured by station 30 (valid GOV) and stations 64 and 65 (both invalid GOV, the second a repeat of the first) are almost on top of each other.

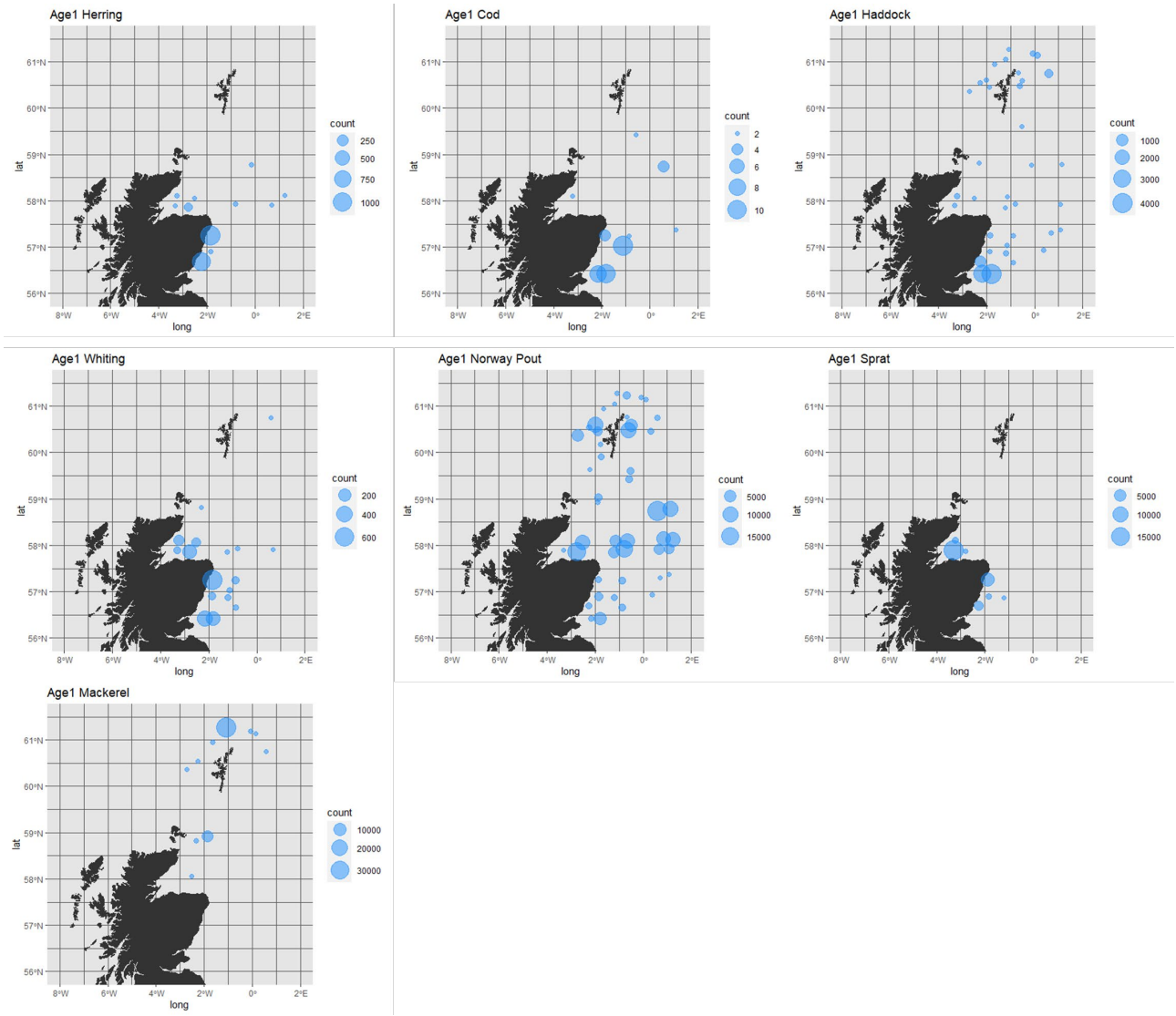

Figure 2: Preliminary distributions and CPUE (no./hr) of age one herring, norway pout, sprat, cod, whiting, mackerel, and haddock during the Scottish North Sea Q1 IBTS 2023. Note: abundance scale varies between plots.

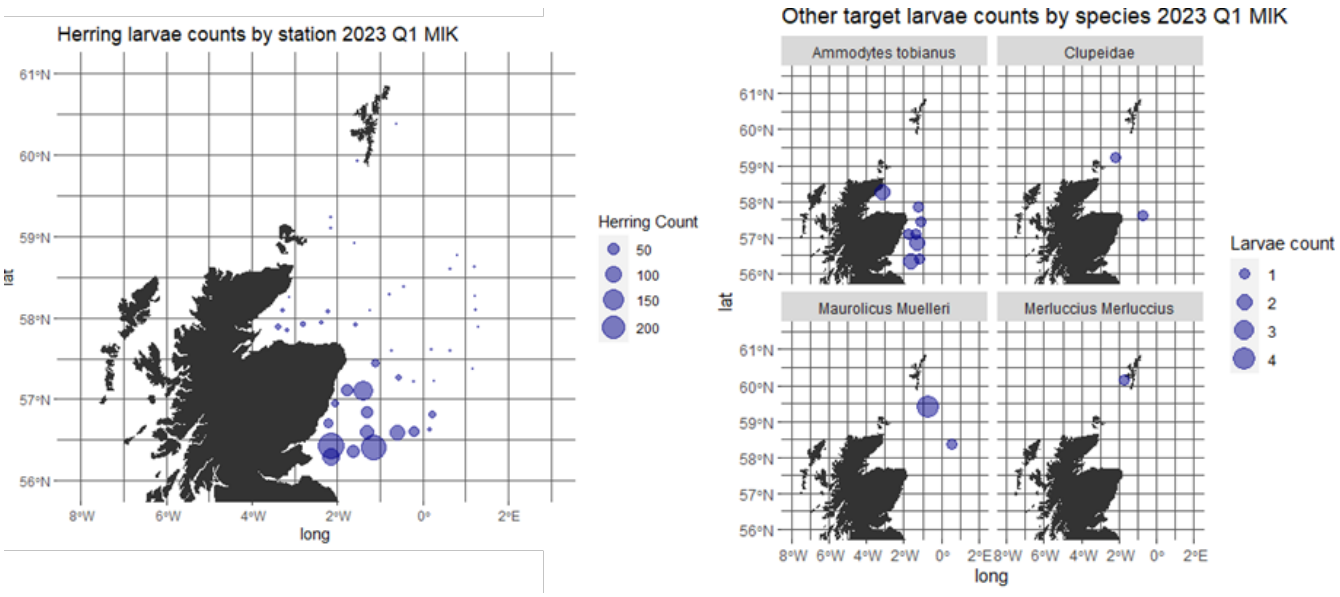

Figure 3: Species distribution plots for target species; Clupeidae is used where individual clupeid larvae were unable to be identified to species level due to damage.

The full dataset* from this survey will be available from DATRAS online database.
*trawl survey will be GOV data only.

Submitted:
J Drewery
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16 March 2023

Many thanks must go to the officers and crew of *Scotia* for their expertise, their assistance with planning, and for safe operation of the fishing gears. Many thanks also to the ships engineers for the great efforts made in seeking the cause of mechanical faults during 0223S.