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MRV Scotia

Survey 0221S

REPORT

23 January – 12 February 2021

Personnel

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Objectives

1. To complete Scotland's commitments to the Quarter 1 International Bottom Trawl Survey (Q1 IBTS) 2021 in the North Sea in ICES area IV.

2. To sample the water column using circular-frame plankton (MIK) net for pre-metamorphosed herring and sprat larvae during the hours of darkness within the trawl survey area. During selected MIK deployments to deploy additional small subsidiary ring nets on the MIK frame itself to target eggs and sandeel larvae.

3. To obtain temperature and salinity data from the surface and seabed at each trawling station using a SEABIRD 19+ CTD.

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

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

6. To record marine litter at each trawl station for MSFD

Out-turn days: 21 days, RV2101 / 20590

Survey Gear:
- GOV Trawl (BT 137) rigged with 47m sweeps and ground gears A and B
- Midwater Ring Net (MIK) with attached subsidiary ring nets (MIKeyM)
- CTD (Seabird 19+)

Narrative

Scotia sailed from Aberdeen at 1100 on 24 January and steamed east to undertake a shakedown haul (station 14) in rectangle 43E8 using ground gear A. With the fishing gear and net monitoring instrumentation working correctly the haul was considered valid for the

survey and was subsequently worked up. As only limited daylight was still available a second haul was undertaken in the same rectangle (a two haul rectangle) before switching to MIK operations after dark. An initial MIK haul was completed for shakedown/training purposes following which a further 4 were completed overnight. With sea conditions good for the foreseeable future the decision was made to take advantage of this, switching to gear B and surveying north and east into the central North Sea then continuing on up to the waters around Shetland. Despite an unexpectedly torn net at station 17 near the beginning of the survey all went well and the most easterly stations were worked over the next few days with typically 3-4 trawls and 7-8 MIK being completed over each 24 hour period. On 28 Jan the most northerly rectangles were covered (with surprisingly poor volume catches) and again enjoying good conditions the survey continued to the west of Shetland. Most hauls were completed without incident however 2 foul hauls with considerable net damage were encountered in this area. An initial set of MIK flowmeter calibrations were undertaken off St Magnus' bay on 29 Jan following which the survey worked down the west of the Orkneys over the next two days. The wind picked up as the survey covered rectangles to the east of Orkney where 2.1 tonnes of small haddock were recorded from a haul off Copinsay. The first of only 2 short weather-induced halts to MIK operations took place on 3 Feb and Scotia steamed to Scrabster, docking at 0700 on 4 Feb for a change to ships complement and to take on water. At this point the replacement MIKeyM nets were also picked up and MIKeyM samples would be collected from at least 1 deployment in each rectangle from this point on. Scotia departed Scrabster at 2300 the same day and with the wind still very strong from the east moved into the lee of mainland Orkney to undertake a second set of MIK calibrations and remained in shelter throughout the morning while some engineering work was completed on the winches. Scotia then proceeded through the Pentland Firth around slack water at midday into an increasing south-easterly gale. Making for the Moray Firth the vessel passed through rectangle 45E6 after dark in poor seas and blizzards without deploying MIK and moved into the lee of Moray to get manageable conditions where three MIK hauls were completed for the night. Both trawling and MIK frequency were slowed down over the next two days by the unfavourable conditions. On 9 Feb the last trawl with ground gear B was completed and the change was made to gear A as the rectangles south of 57.5^{o}N were covered and four hauls were completed over each of 9 and 10 Feb along with 14 valid MIK deployments. On the final fishing day a second haul in 42E8 was successfully completed and the survey finished on a high with 700kg of small haddock caught. The survey was complete as of 0900 and Scotia sailed for Aberdeen docking at 1700 the same day. Staff and equipment left the vessel on 12 Feb.

RESULTS

Demersal Trawl Survey

Demersal trawling was undertaken with the GOV trawl incorporating ground gear B on all stations north of 57^{o}30N (45 valid hauls plus 3 foul) and ground gear A on all stations south of that latitude (12 valid hauls plus 1 foul). The Scanmar system was used throughout the survey to monitor headline height, wing spread and door spread. Scotia's own navigation system provided data on vessel speed over the ground and distance covered during each haul. 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 haul.

A total of 61 hauls were undertaken during 0221S of which 57 were considered valid (Figure 1). Of the 48 rectangles in the Scottish survey area all 48 were surveyed with at least one valid haul. A further of 9 out of the 48 rectangles (42E8, 43E8, 46E6, 47E6, 49E8, 50E8, 51E8, 51E9 and 50E9) contained 2 valid hauls as per the ICES IBTS NS Q1 programme 2021. Rectangles 47E7, 48E7 which were also assigned potential for 2 hauls were limited to 1 haul during this survey for logistical reasons.

There were four occurrences of invalid haul (stations 17, 31, 38 and 65) with significant damage to the trawl. In all four cases however an alternative haul was successfully completed in the same rectangle. It was no surprise to find that the North-western area (rectangles 49E6, 50E7) of the survey again contributed heavily to the damage quota. Here a combination of the very limited grounds available to successfully work even ground gear B plus the more exposed nature of the area means that major damage and lost time has become a regular occurrence.

Catches were found to be an improvement on last year in terms of overall weight with a total catch weight of 23.8 tonnes from 26.6 hours combined valid trawl time. This compares to 14.1 tonnes from 26.6 hours in 2020 and 15.3 tonnes from 28 hours in 2019. A total of 78 different species were observed. The combined preliminary 1+ group indices for all countries (Table 1.) illustrate haddock, mackerel, sprat and norway pout as showing considerably above long term average values, with cod and herring however as low, and whiting as somewhere around the average.

Table 1. *Preliminary* 1+ group indices of selected species for Q1 IBTS 2021 (all countries).

Species	Final 2020	Preliminary 2021	Mean (Av. 1980-2021)
cod	3.7	1.6	7
haddock	2356	1166	492
whiting	519	493	445
norway pout	3901	4014	2900
herring	1021	805	1975
sprat	2908	2058	1369
mackerel	698	1017	107

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-Mar-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.

The distribution and preliminary abundance from the data contributed by 0221S alone is shown as scaled CPUE plots in Figure 2.

MIK Survey

Overall 108 MIK hauls were undertaken of which 3 were repeats due to samples being considered unsuitable. On top of this there were another 6 deployments solely for calibration of the flowmeters. The 105 valid deployments covered all bar 1 of the programmed 48 rectangles each with at least 2 samples, including 8 rectangles which contained 3 deployments and one rectangle which contained 4. Most the rectangles containing greater >2 MIK deployments were those where extra Scottish effort was programmed. No deployments were undertaken in rectangle 45E6 as conditions prevented safe deployment there at the time however successful arrangements were subsequently made with the SIC of Germany's *Walter Herwig* to cover this. Where possible all deployments were at minimum 5 nmiles from the rectangle boundaries and 10nmiles or greater from each other.

During 0221S Scotia sailed without MIKeyM nets while new sets were constructed onshore. MIKeyM samples were therefore collected from a subset only of the total rectangles; however the survey was planned to ensure that all rectangles with highest potential for

presence of sandeel larvae were among those covered. In total these samples were collected from 22 hauls covering 13 rectangles.

Pre-metamorphosed herring larvae were found in 62 of the 105 deployments with the highest concentrations centred on rectangles 41E8, 42E8, and 42E7. A total of 1490 herring larvae were identified. The total counts of each species identified and the number of hauls they were present in are summarised below. Catches of herring larvae were (significantly) higher than in 2020 (1490 vs 358), while catches of European pilchard had decreased from 2020 (9 vs 32). No sprat larvae were found during the survey. The distribution data for herring and sardine larvae as contributed by 0221S alone is shown as scaled plots of total catch in Figure 3.

Table 2. Number of hauls where species were observed and total count of individuals

Species	No. of hauls	Total count
Ammodytes marinus	8	12
Argentina sphyraena	1	1
Chirolophis ascanii	8	14
Ciliata sp.	1	1
Clupea harengus	62	1490
Clupeid sp.	20	24
Lebetus sp.	4	4
Maurolicus muelleri	15	90
Microstomus kitt	1	1
Sardina pilchardus	4	9
Total		1646

Identification and measurement of the clupeid and other target larval species were undertaken partly at sea and partly at the Marine Laboratory. Catches of gobiidae were recorded at sea for later subsampling and identification at the Marine Laboratory.

All marine litter collected from the MIK codends were individually stored and labelled, and will be identified and recorded at the Marine Laboratory.

Biological Sampling / Age determination / Additional DCF sampling

In total of 4377 biological samples (Table 3) were collected as part of the routine biological sampling programme on a broad range of mainly commercial species. Otoliths from cod, haddock, whiting, saithe, norway pout, herring, mackerel and sprat were collected for immediate ageing back at Marine Lab. Hake and plaice otoliths were also retained from the survey, a subset of which will be aged at a later date. Biological data for Lophoius ssp were collected for an-house project (see Additional Samples)

Table 3. Numbers of biological samples collected.

Species	No. Sampled	No. Aged
Angler (*Lophius piscatorius*)	28	tba
Angler (*Lophius budegassa*)	7	tba
Blue Skate (*Dipturus flossada*)	9	0
Cod (*Gadus morhua*)	415	415

Cuckoo Ray (*Leucoraja naevus*)	48	0
Flapper Skate (*Dipturus intermedia*)	10	0
Haddock (*Melanogrammus aeglefinus*)	1221	1221
Hake (*Merluccius merluccius*)	74	tba
Herring (*Clupea harengus*)	504	504
Lemon Sole (*Microstomus kitt*)	83	0
Mackerel (*Scomber scombrus*)	296	296
Norway Pout (*Trisopterus esmarkii*)	395	395
Plaice (*Pleuronectes platessa*)	116	tba
Saithe (*Pollachius virens*)	24	66
Spotted Ray (*Raja montagui*)	74	0
Sprat (*Sprattus sprattus*)	324	324
Starry Smooth Hound (*Mustelus asterias*)	3	0
Thornback Ray (*Raja clavata*)	3	0
Whiting (*Merlangius merlangus*)	743	743
Total	4377	

Hydrographic Data

The CTD and reverser bottle were deployed at 55 out of a possible 59 valid trawl stations in order to obtain temperature-salinity data. Issues with the Seabird unit itself meant however that the files had to be retrieved and processed on return to the laboratory post cruise. Surface and near-seabed water samples were collected from all CTD deployments for analysis of nitrate, silicate and phosphate content back in the lab.

Marine Litter

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

Additional Samples and Miscellaneous Requests

A further 7 requests for additional samples were received for 0221S; these and the projects they contribute to are summarised below.

Tissue samples:
The following sets of tissue samples were collected, contributing to studies on the genetic resolution of population structure with subsequent use in informing management decisions:

- Cod: 127 tissue samples (Marine Scotland Science (MSS)).
- Common skate: (*Dipturus intermedia and D. flossada*): 18 skin swab samples (PhD, MSS/University of Aberdeen).

Further miscellaneous samples:

- Anglerfish (*L. piscatorius)*: 12 sets of complete internal organs were frozen to support an MSc project (MSS/University of Aberdeen) studying parasite load in anglerfish as population markers. A further 10 juvenile *L. piscatorius* and 7 juvenile *L. budegassa* frozen whole will contribute to the same project.
- Mackerel: Two sets of 50 juveniles from geographically distinct hauls were frozen whole for a study of the impact of temperature on capacity for mackerel growth (University of Southampton).
- Tunicates: Tissue samples were collected from 5 unidentified specimens with the remainder of each specimen preserved (MSS).

- Axinellid sponges: Tissue samples from 30 specimens of mainly *Phakellia ventilabrum* and *Axinella infundibuliformis* were collected for phylogenetic study (Natural History Museum).
- All shelled molluscs were retained frozen for the Mackay reference collection.

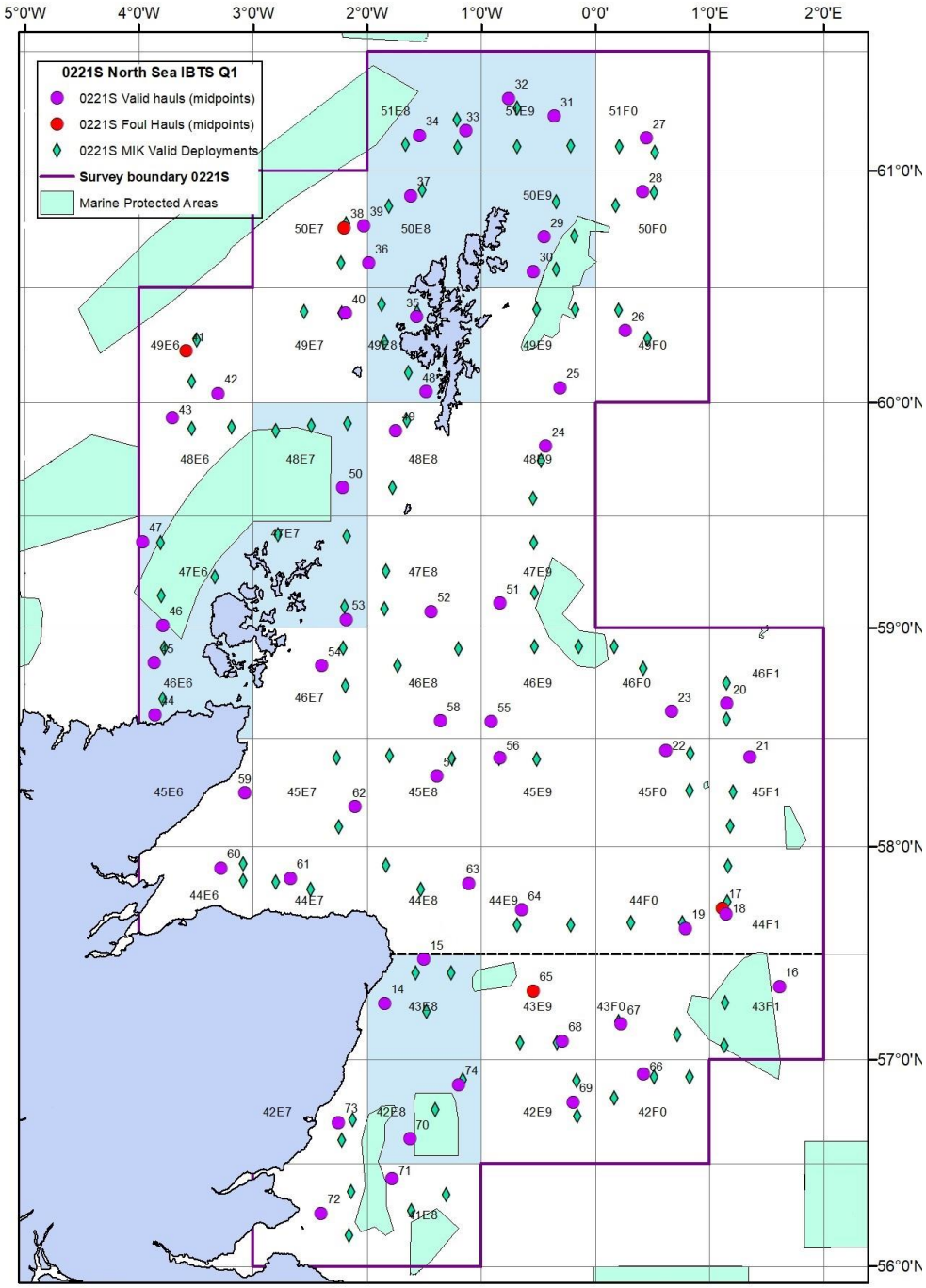
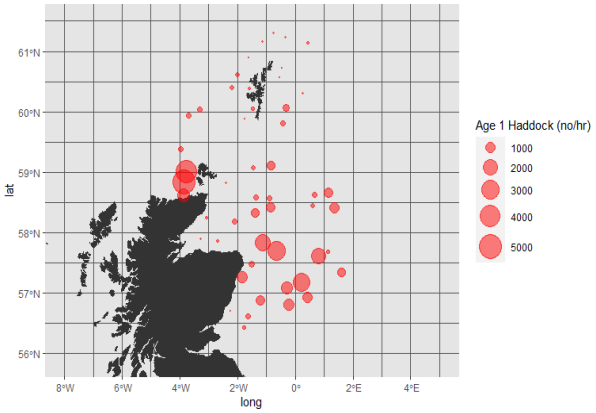


Figure 1. Scottish North Sea Q1 IBTS survey area along with completed trawl stations, station numbers and MIK deployments for 2021. All deployment symbols represent approximate midpoints. Dashed line represents dividing line at 57°30N between ground gears used (A – South of division line, B – North of division line). Rectangles shaded blue represent those planned for extra Scottish effort as logistics and conditions permit.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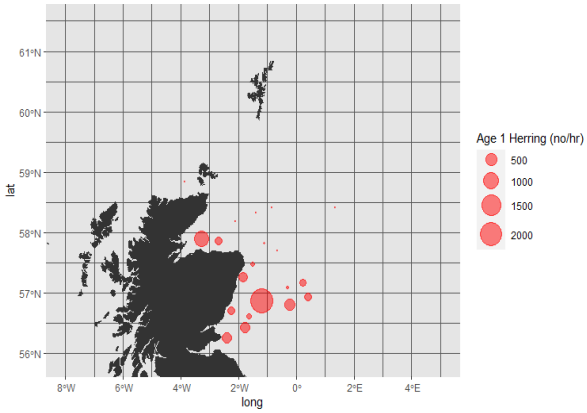
60°N
59°N
58°N
57°N
56°N
lat
8°W
6°W
4°W
2°W
0°
2°E
4°E
long
Age 1 Haddock (no/hr)
1000
2000
3000
4000
5000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4°W
2°W
0°
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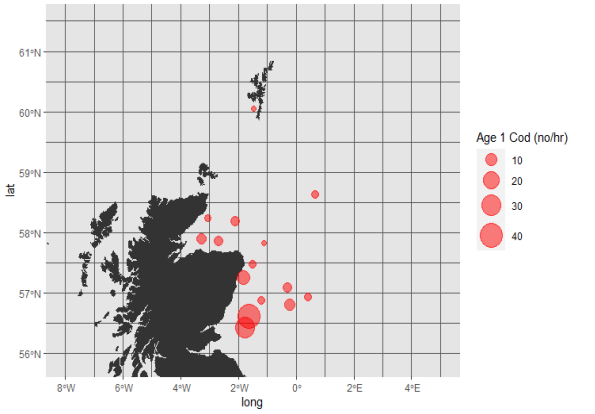
4°E
long
Age 1 Herring (no/hr)
500
1000
1500
2000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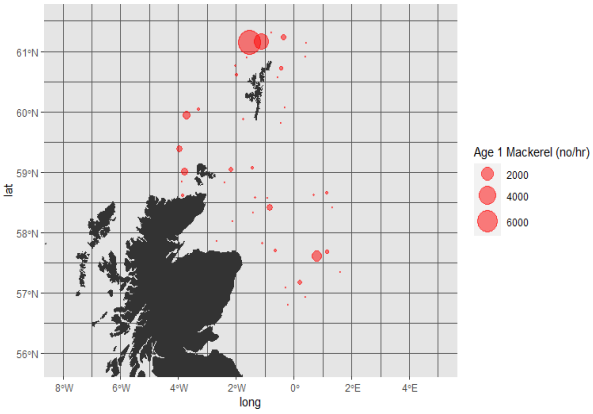
long
Age 1 Cod (no/hr)
10
20
30
40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58°N
57°N
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lat
8°W
6°W
4°W
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0°
2°E
4°E
long
Age 1 Mackerel (no/hr)
2000
4000
6000


61°N
60°N
59°N
58°N
57°N
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lat
8°W
6°W
4°W
2°W
0°
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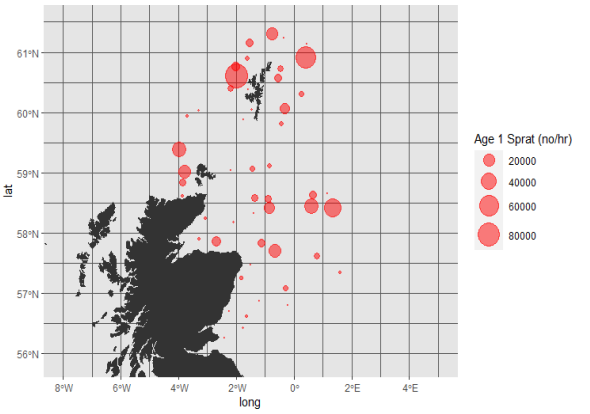
long
Age 1 Norway Pout (no/hr)
20000
40000
60000
80000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4°W
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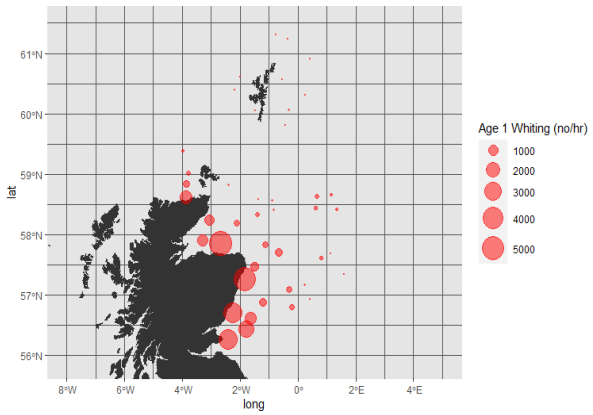
2°E
4°E
long
Age 1 Sprat (no/hr)
20000
40000
60000
80000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57°N
56°N
lat
8°W
6°W
4°W
2°W
0°
2°E
4°E
long
Age 1 Whiting (no/hr)
1000
2000
3000
4000
5000

Figure 2. Preliminary distributions and CPUE (no./hr) of age 1 haddock, herring, cod, mackerel, norway pout, sprat, and whiting during the Scottish North Sea Q1 IBTS. Note: abundance scale varies between plots.

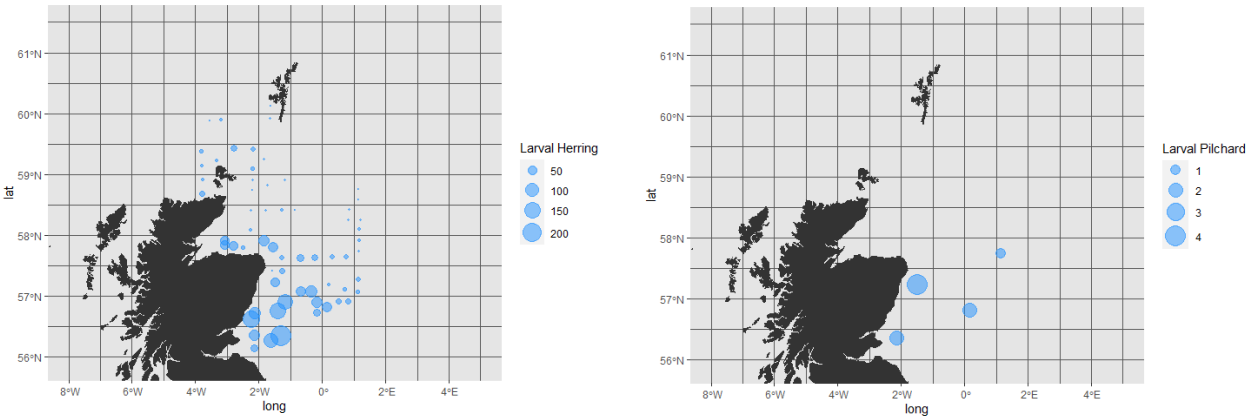

Figure 3. Distributions and catch (total numbers) of larval herring and European pilchard during Scottish North Sea Q1 IBTS. Note: abundance scale varies between plots.

Submitted:
J Drewery
16 March 2021

Thanks to Hannah Holah for distribution and abundance plots.