CENTRE FOR ENVIRONMENT, FISHERIES AND AQUACULTURE SCIENCE
LOWESTOFT LABORATORY, LOWESTOFT, SUFFOLK NR33 0HT

2018 RESEARCH VESSEL PROGRAMME

REPORT: RV CEFAS ENDEAVOUR: 04/18

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DURATION: 11 February – 12 March.

LOCATION: Celtic Seas/western English Channel (ICES Divisions 7.e–j)

RESULTS BY AIM:

Primary Survey Aims

1. *To carry out an otter trawl survey of the demersal fisheries resources in the Celtic Sea and western English Channel to provide more robust data to improve commercial fish stock assessments using a Jackson monkfish trawl, standardised for fisheries monitoring purposes.*

This aim was only partially completed to the mechanical failure of the vessel which reduced the total available sampling time.

A total of 62 stations were completed successfully (Table 1; Figure 6), out of a planned total of 138 for the survey (Figure 1). Figure 7 shows the survey track each day for the Jackson monkfish trawl deployments. The majority of these tows (57) were carried out in the western English Channel strata, with five trawl stations conducted in Stratum C of the Celtic Sea stratum in the approaches to the Bristol Channel.

Mechanical trouble with the RV Cefas Endeavour, and the resulting loss of ~ ten days of fishing time was the main reason for the primary aim not being completed, with weather and unfamiliarity of the new trawl also contributing to a lesser extent. Strata 10 and 11 were also complicated by the priority stations being limited by widespread deployment of commercial static gear and areas of poor ground. This resulted in some significant gear damage, which also impacted on fishing time.

Eighty-eight different fish and shellfish species were measured on the survey (Table 2) in addition to benthic species (Table 3). Forty-four commercial fish species were sampled for biological parameters (Table 4). The abundance and distribution and of the major species across the survey can be seen in Figure 8 and the length distributions of the same species is shown in Figure 9.

Starry smooth-hound was the main species by catch weight, with over 2.5 t caught across the 39 stations they were observed at, and over 1000 individuals sampled for biological information. This was over double the amount of the second highest recorded species weight, lesser-spotted dogfish (1.2 t caught). Tope was another elasmobranch species that was well represented (373 kg), with only mackerel, whiting and haddock caught in greater biomass.

Mackerel (976 kg) was the third highest catch weight seen across the survey, and was seen in far greater quantities than other pelagic species such as herring and sprat (*Sprattus sprattus*). For the smaller-bodied pelagic species, as with many of the smaller-sized species, the 100 mm cod-end mesh may explain their smaller catch weights.

Whiting and haddock were the gadoids caught in the highest quantities, with total weights of 809 kg and 590 kg respectively. As a result, they were also sampled for the most otoliths (1313 between the two species). Red gurnard was one of the most

commonly seen species, occurring on most of the stations sampled (54), with over 350 kg caught.

Other species making up the top ten by weight caught were John dory, conger eel and plaice. While conger eels were seen less regularly through the survey (21 stations compared to 30 for John dory), 215 kg of John dory's total 339 kg caught came from two stations (Stratum 11, Station 10 and Stratum 12, Station 5). Plaice was the only flatfish represented in the top twenty species by catch weight, with over 340 kg caught.

Both species of anglerfish were seen on the survey, with anglerfish (289 kg) much more abundant than the black-bellied anglerfish (*Lophius budegasa*, 32 kg). With the design of the trawl adapted to targeting these species, it is noticeable that anglerfish wasn't in the top ten species caught, although this may have been different if the strata in the Celtic Sea were completed.

Other species of note seen on the survey were specimens of Yarrell's blenny (Stratum 11, Station 10), allis shad (Stratum 5, Station 1), Couch's sea-bream (Stratum 3, Station 3) and marbled electric ray (Stratum 13, Station 2). Several common stingray were also captured.

Table 3 shows the 128 species of epibenthos seen during the survey, with yellow boring sponge (*Cliona celata*) and spiny starfish (*Marthasterias glacialis*) being the most abundant by catch weight (158 kg and 143 kg respectively). Of note were parasitic isopods found at two stations (Stratum 5, Station 5 and Stratum 9, Station 4), with specimens retained for identification. This parasite was associated with black sea-bream.

Figure 10 shows the anthropogenic debris recorded across the 76 total fishing tows. Plastics are the most abundant, with 123 pieces observed making up nearly 78% of total litter seen on the survey. Rubber was the second most abundant, with 11 pieces recorded.

At 28 sampling locations (25 in the western Channel and 3 in the Celtic Sea), a CTD profile using an ESM2 logger and Niskin water sampler were deployed. Salinity samples were collected just above the seabed ('bottom' samples) at each location using the Niskin sampler deployed from the starboard gantry and attached to the hydrographic wire. A further 3 CTD deployments were carried out in the western Channel to produce SVP's for multibeam calibration. Additionally, surface seawater samples were collected for salinity using the feed from the Ferrybox.

2. To collect multibeam data and fisheries acoustic data at three operating frequencies (38, 120 & 200 kHz) and continuously throughout the cruise if this does not result in interference between the two systems. These data will be used to determine the spatial scale of various habitats. All data will be stored as raw files, but also maintained individually in Olex to aid the subsequent beam trawl survey fishing the same stations.

Data were collected during operational survey time and accordingly the aim was fully completed for the 76 Jackson monkfish trawl tows and 19 targeted sampling survey days.

Acoustic data was collected at three operating frequencies (38, 120 & 200 kHz) throughout the survey for further extrapolation and analysis. Multibeam data was also recorded through Olex to aid subsequent surveys in these areas and raw data was logged during fishing activities.

Secondary Survey Aims

3. Test and develop the Plankton Image Analysis (PIA) system, to maximise the data provided from plankton samples.

Testing and some development was carried out during the survey, consequently the aim is partially complete. Further testing and development will be conducted during the Quarter 1 South West Ecosystem Survey (Q1SWECOS).

The PIA (Plankton Image Analysis) system is an instrument used *in situ* to take immediate colour images of zooplankton organisms being pumped through the system. Its design was modified for this survey to work in two modes; continuous sampling of sea water using a pre-existing flow system which collected water at 6 m below the surface and a stand-alone mode to sample a controlled body of water containing zooplankton samples collected from a ring net. During the first half of the survey, ring net samples were taken at every station and run through the system to capture images of the collected zooplankton. Continuous sampling of sea water was also run for half an hour before and half an hour after the deployment of the ring net. The images were then copied to a hard drive and sent back to the Cefas laboratory to compare species identified by the PIA when running at 6 m sea depth to the species collected using the ring net.

During the second half of the survey the number of ring net deployments were dropped to two within a 24-hour period, however the same method was used throughout. Due to the redesign of the PIA system, bubbles within the flow were a constant issue but notes and observations were made regarding why the bubbles may be occurring, and potential solutions such as software to remove the captured bubble images and hardware adjustments are in discussion for future surveys. During the mid-survey staff change over J. Tilbury travelled to Fowey to work on some adjustments to the PIA to increase image capture quality. Unfortunately, in the process of making these adjustments, the PIA's LED light was damaged. The replacement LED, however, increased the image quality during the second half. Image analysis is still to be completed at the time of writing.

4.Deploy 2 m beam trawl at selected stations, to assess consistency with the epibenthic component observed in the main otter trawl, should this be found to capture significant numbers of epibenthic organisms.

The aim was not addressed during the survey and consequently was incomplete.

Due to time constraints for fishing with the main trawl, no 2 m beam trawl tows were possible during the survey.

5.All dead shad (allis and twaite) and all dead lampreys are to be frozen and returned to the lab for analyses, marking samples with the survey, station and date.

The aim was fully completed for all survey days conducted.

Two allis shad and three twaite shad were caught during the survey. All specimens were dead when brought onboard and were frozen biological studies at Cefas.

6. Tag and release specimens of various elasmobranchs (including undulate, cuckoo, and blonde ray, common skate, tope and starry smooth-hound).

The aim was fully completed for all survey days conducted.

Over the course of the survey a total of 242 elasmobranchs were tagged with Petersen discs and released (Table 5). Positions of capture and release were recorded, as well as individual biological information.

7. To continuously log sub-surface (3m) salinity, temperature, fluorometry and other environmental data using the 'Ferrybox'. Run the flow-cytometer (phytoplankton) in conjunction with the 'Ferrybox' and undertake water filtrations to obtain chlorophyll concentrations (from 1st March onwards).

The aim was fully completed for all survey days conducted.

The flow cytometer was switched at 21:00 hrs on the 7th March and analysed the water from the ferry box every hour. Two staff members (C. Reeve and S. Lozach) were responsible for the daily calibration which consisted of running a solution of seawater and micro-beads through the machine at 11:30 every day. This ran continuously until the machine was switched off at 09:30 hrs on the 12th March aside from a period on 10th March where the ferrybox stopped working. During this time there was a risk that lots of bubbles had accumulated in the machine so isotonic water was used to clean the machine at approximately 09:00 hrs on the 11th March.

Seawater filtrations and plankton samples were also collected daily between 11:00 and 12:00. For the seawater filtration, seawater samples were taken from the ferry box outlet and then filtered on the filtration bench to obtain two samples per station on micro-filters that were preserved in the -80°C freezer. For the plankton, water was collected from the ferry box outlet and then preserved using Lugols solution. The total number of samples taken can be seen in Table 6.

8. Collect dead specimens of selected species for ID purposes as well as length-weight measurements where required.

The aim was fully completed for all survey days conducted.

All squid were retained for species verification and potential training in maturity staging. A Couch's seabream (*Pagrus pagrus*) was also retained to confirm identification. Additional length-weight information was recorded for garfish (*Belone belone)*, spiny lobster, shad, Yarrells's blenny and topknot (*Zeugopterus punctatus*).

9. To collect other samples in support of active Cefas projects.

The aim was fully completed for all survey days conducted.

Various samples were collected in support of other Cefas projects during the survey, these include:

a) Squid sample collection. A total of 28 squid samples were retained for subsequent maturity analysis (V. Laptikhovsky – Cefas, Lowestoft).
b) Whelk sample collection. Ten whelk (*Buccinum undatum*) samples were retained as part of on-going shellfish projects (V. Laptikhovsky – Cefas, Lowestoft).
c) Elasmobranch collection. A total of 19 specimens of elasmobranchs found to be dead upon hauling were retained for on-going elasmobranch biological studies. These comprised 16 blonde ray (*Raja brachyura*) and three tope (*Galeorhinus galeus*). Vertebrae were extracted and retained for age determination from 15 of the blonde ray and all the tope. (J. Ellis / S. McCully Phillips – Cefas, Lowestoft).
d) Mackerel sample collection. At total of 50 whole mackerel from a size range between 30–35 cm captured in the western Channel were retained for laser ablation studies to analyse historical collections as part of an MSc thesis. (E. Hunter / R. Vieira – Cefas, Lowestoft).
e) Anchovy and sprat sample collection. Sprat and anchovy not required for biological sampling were retained for subsequent analysis (J. Van Der Kooij – Cefas, Lowestoft).
f) Additional Zooplankton sample collection. A zooplankton sample was collected at the West Gabbard SmartBuoy within the first 24 hours of departing Lowestoft, this was preserved in 4% formaldehyde for later analysis at Cefas. The sample was collected to contribute to the Lifeform project (Defra) as part of the UK monitoring network for zooplankton (S. Pitois – Cefas, Lowestoft).

10. To collect genetic samples from anglerfish (Lophius piscatorious) in support of the GECKA project

The aim was fully completed for the western Channel and incomplete for the Celtic Sea. The Q1SWECOS will collect samples within the Celtic Sea survey area.

During the first half of the survey genetic samples were obtained from 50 white anglerfish within ICES area VIIe and preserved in RNAlater®. The main objective of the GCEKA project (Genetic close-kin analysis on white anglerfish for abundance estimates in support of deep sea fisheries management under the common fisheries policy) is to establish the genetic population structure of the white anglerfish across the Atlantic FAO fishing area 27 and to provide a solid baseline for a close-kin abundance estimate. Samples were collected from the Northern stock in project defined sample area C.

OPPORTUNISTIC AIMS:

11. Developing the protocol for monitoring and recording floating litter, test the feasibility of using the CALPS system to collect microplastic samples from the Ferrybox water supply and test the marine litter app to assist with recording marine litter captured in the trawl.

The aim was incomplete for all survey days conducted.

With a reduced second half of the survey, time limitations prevented the development of additional marine litter surveying techniques.

12. Collect and transport samples of marine invertebrates captured in the trawl back to the Cefas Laboratory in Lowestoft for aquarium studies.

The aim was incomplete for all survey days conducted.

No live marine invertebrates were retained for further work at Cefas due to transport issues from de-mobbing in Swansea.

SURVEY SAMPLING PROTOCOL:

A survey sampling location was characterised by one set of deployments. Operations consisted of plankton sampling and a Jackson monkfish trawl deployment. Additionally, ESM2/Niskin sampling was carried out once per 12-hour period.

The fishing gear used on this survey was a BT195 Jackson 575 Monkfish Survey Trawl, with 16" rockhopper discs, Morgere Ovalfoil doors and a 100 mm cod-end without a liner[1]. All fish and selected commercial shellfish were identified to species, weighed and measured, with large catches of individual species sub-sampled. A SAIV micro CTD unit was attached to the headline in order to record the temperature and salinity depth profile at each station fished and a Marport net-sonde headline echosounder sensor was attached further back from the centre of the headline to determine

[1]See Reid, D.G., Allen, V.J., Bova, D.J., Jones, E.G., Kynoch, R.J., Peach, K.J., Fernandes, P.G., and Turrell, W.R. (2007). Anglerfish catchability for swept-area abundance estimates in a new survey trawl. *ICES Journal of Marine Science*, 64: 1503–1511; and Annex 4 of ICES (2009) Report of the Workshop on Anglerfish and Megrim (WKAGME), 23–27 February 2009, Aberdeen, UK. ICES CM 2009/ACOM:28. 112 pp.

headline height above the seabed and to inform on footrope ground contact. A Scanmar headline sensor was fixed just behind the net headline. Scanmar wing end sensors were fitted on the port and starboard net wing tips adjacent to the second grouping of floats and Scanmar door sensors were attached to both the Morgere Ovalfoil doors (Figure 5). The Scanmar sensors were used to determine net geometry and ensure the gear was fishing properly.

Figure 5: Trawl showing (left) Scanmar wing end sensor and (right) starboard door with Scanmar door sensor in door pocket

The WP2 plankton ring net fitted with a 200 µmicron x 0.5 m net and KC-Denmark A/S digital flowmeter was deployed from the starboard gantry to obtain plankton samples which were processed using the PIA system. In addition, twice per 24 hours, a surface salinity sample was taken simultaneously with a Niskin bottom water sample and an ESM2 logger profile. Additionally, a SAIV Micro CTD unit was used to obtain a sound velocity profile (SVP) for calibration of the multibeam.

All catch details and sample data were entered directly into the Fisheries Electronic Data Capture (FEDC) system and uploaded directly into the Fishing Survey System (FSS). Station details were manually entered into the FSS using information collected from the Transas bridge logging system and bridge logbook. Benthic catches were sorted by species and weighed and counted as appropriate. Subsampling was employed where required.

Litter bycatch was recorded separately for all fishing stations. Each piece of litter bycatch was categorised by type of material and size, then weighed and photographed, with details of any attached organisms recorded.

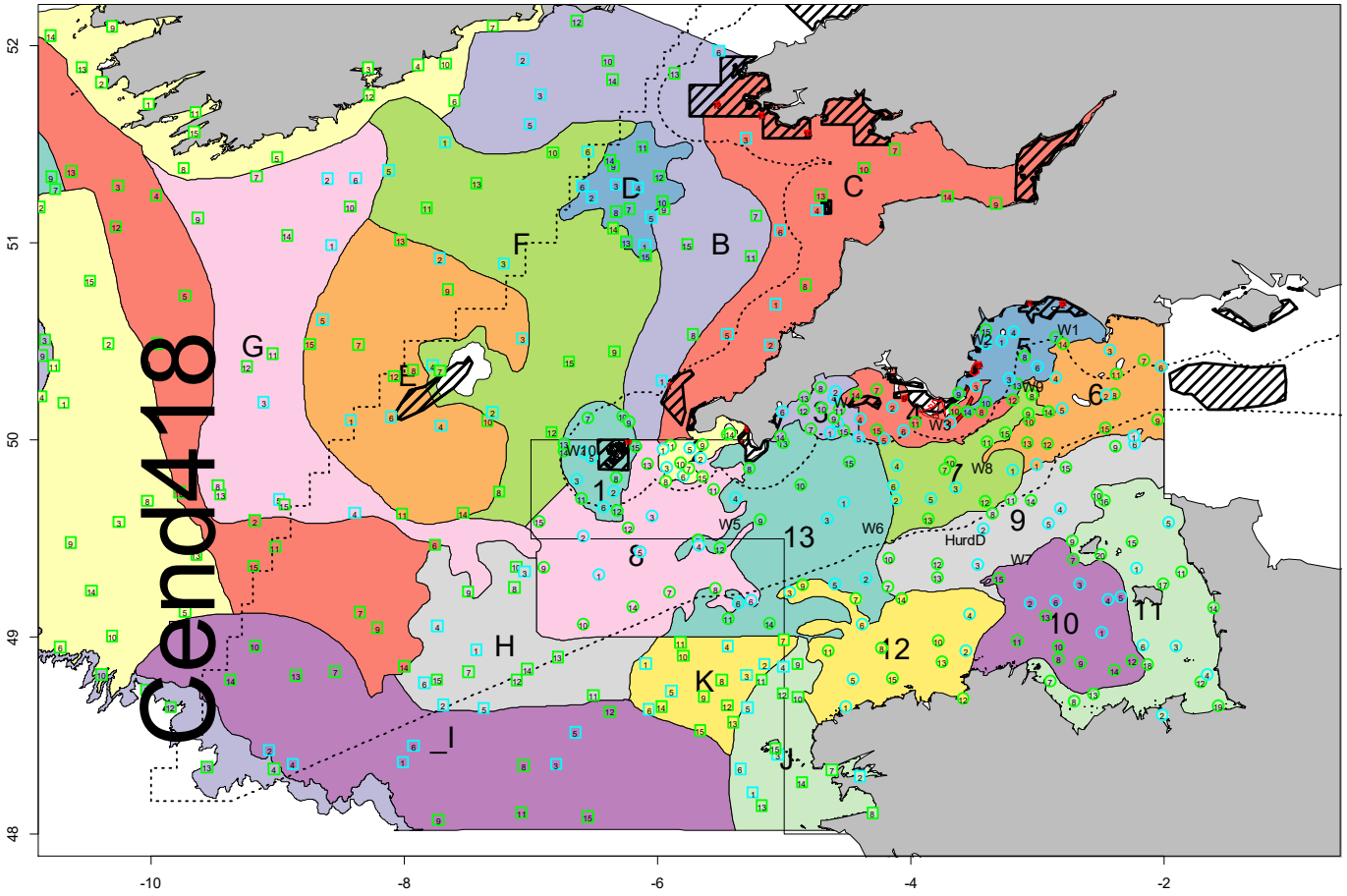

Figure 1: Chart of survey area showing strata and the randomly selected stations for survey 5/18

NARRATIVE (all times G.M.T.)

Part 1: February 11th to February 26th 2018

RV Cefas Endeavour sailed from Lowestoft on February 11th 2018 at 05:30 hrs. On board were 16 Cefas scientific staff, B. Hernon (a senior gear technician with P&O Maritime) and J. Tilbury (University of Plymouth). Upon departure, the ship travelled 14 nm south, to a known clear area of sea bed off Sizewell and commenced the first of six shakedown tows with the fishing gear. The trawl was a BT195 Jackson 575 monkfish trawl, with 16" rockhopper ground gear, Morgere Ovalfoil doors and a 100 mm cod-end (with no liner).

After successfully deploying and retrieving the trawl, to familiarise the crew with deployment and retrieval of the gear, a 15 minute tow was completed successfully in deeper water to the south east, which resulted in a small catch of blonde ray (*Raja brachyura*), thornback ray (*Raja clavata*) and lesser-spotted dogfish (*Scyliorhinus canicula*), as well as one specimen of greater weever (*Trachinus draco*). A shakedown cast was then completed with the ring net, again for familiarisation, but also to provide a sample for testing the Plankton Image Analyser (PIA). A further shakedown tow with the monkfish trawl was completed at 19:00 hrs, this time with all net geometry sensors attached. Another 15-minute tow resulted in a small catch, comprised mostly of elasmobranchs.

Overnight, the ship moved further south to the outer Gabbard area of the Outer Thames and collected a plankton sample around 00:00 hrs before heading back to the site of the first net deployment tests. At 08:00 hrs another shakedown tow was attempted, but had to be abandoned due to loss of sensor data. Unfortunately, it was discovered upon retrieval that the starboard Scanmar wingend sensor had been lost. A further tow on this ground was attempted, this time with the 19 mm tickler chain attached, but this tow was cut short due to the gear twisting and becoming caught fast on something on the sea floor. The net was recovered successfully by 12:00 hrs and passage made back to Lowestoft. Here, B. Hernon and J. Tilbury departed by small boat transfer after their input to monkfish trawl and PIA system, respectively. C. Reeve was then brought aboard to join the rest of the scientific staff for the remainder of the first part of the survey. With a full complement on board, RV Cefas Endeavour began the 280 nm steam to the western English Channel to commence the survey in Stratum 7 (Station 1).

A standard station comprised a deployment of a WP2 plankton ring net (200 µm mesh size) with CTD sensor, which would then be filtered into the PIA system. Plankton samples from the ring net were processed using the PIA system, as well as surface samples taken before and after each station. This would then be followed by a tow (up to 3 nm) with the monkfish trawl, once the ground had been checked using the multibeam where needed. The catch from the monkfish trawl would be separated by species and weighed and/or counted/measured. Biological data (length, weight, sex, maturity and, where appropriate, otoliths) were collected for commercial fish species. Twice per 24 hrs the ESM2 profiler would be deployed and surface and bottom water

samples taken for salinity. Acoustic data from the EK60 sounder was recorded at 38 Khz, 120 Khz and 200 Khz throughout the survey and multibeam data were recorded during the fishing activities.

Due to bad weather in the English Channel, passage to the first station was delayed until late on February 13th. An ESM2 profiler and plankton net deployments were completed successfully, although the subsequent fishing resulted in an invalid tow due to the loss of wing end sensor data and the net again coming fast after contact on the sea floor. Upon retrieval it was found that another wing end sensor had been lost (this time the port sensor), though the net was undamaged. The weather subsequently worsened, which delayed fishing activities. The ship slowly moved south west to Stratum 9, Station 13, where another day of shakedown tows took place to assess some of the issues with the previous attempts. Three tows were completed, with the agreed consensus that a slightly higher speed (3.2–3.3 knots) was required over the ground. These "additional" stations had small catches comprised mostly of starry smooth-hound (*Mustelus asterias*) and some tope (*Galeorhinus galeus*), including a large male (156 cm, 16.2 kg).

RV Cefas Endeavour moved to Stratum 9, Station 3 and in the early hours of February 15th completed the first successful tow with the trawl, yielding a catch of mainly female starry smooth-hound (~40 kg). This was followed up by another successful station at Stratum 9, Station 2, which saw a similar catch of tope (96 kg) and starry smooth-hound (75 kg), along with some John dory (*Zeus faber*, 38 kg). By the end of the day, the ship had returned to Stratum 7, Station 1, this time completing a valid haul of mainly whiting (*Merlangius merlangus*). Of note here was a large, gravid, female anglerfish (*Lophius piscatorius*, 102 cm, ~20 kg), whose gonads measured up to 11.5 m and weighed 8.5 kg (Figure 2).

Figure 2: Gravid female *Lophius piscatorius* caught at Stratum 7, Station 1

The survey then moved west and successfully completed Stations 2–6 in Stratum 7 over the next 14 hrs. Mackerel (*Scomber scombrus*) and whiting were dominant at most stations, with both red (*Chelidonichthys cuculus*) and grey (*Eutrigla gurnardus*) gurnard also present. Catches were mostly <150 kg, with the highest catch weight (158.79 kg) recorded at Station 4. By the evening of February 16th, Stratum 13, Stations 1 and 3 were sampled for plankton and ESM2/Niskin, but fishing was delayed due to mechanical problems with the single net drum. During repairs, the grounds were surveyed with multibeam and sampled for plankton at a further six stations (Stratum 8, Station 4; Stratum 12, Station 3; Stratum 13, Stations 1–2, 3 and 5).

By 12:00 hrs the next day, the single net drum had been repaired, and RV Cefas Endeavour had moved north west to Stratum 8, Station 3. Fishing was completed successfully with a catch dominated by haddock (*Melanogrammus aegelfinus*, 225 kg) and common (grey) skate (*Dipturus batis*, 34 kg, 28–107 cm). To the west, at Stratum 8, Station 2, a similar species composition was sampled, although with more common skate this time (67 kg) compared to haddock (23 kg). Further to the south on February 18th, Stratum 8, Station 1 had to be repeated due to the tickler chain parting on the first attempt. The second was successful, again with elasmobranch species making up a large proportion of the catch. 66 kg of starry smooth-hound (including a 116 cm female weighing 8.87 kg) and 19 kg of common skate were sampled here. Starry smooth-hound were also caught at Stratum 8, Station 5 to the east (27 kg), along with lesser-spotted dogfish (22 kg), haddock (14 kg) and black-bellied anglerfish (*Lophius budegassa*, 14 kg).

The survey then moved north into Stratum 2 and by midday had completed Station 3, again with another catch largely made up of starry smooth-hound, lesser-spotted dogfish, with cuckoo ray (*Leucoraja naevus*) and spotted ray (*Raja montagui*) also caught. Station 1 saw over 150 kg of haddock caught, as well as ~65 kg of whiting. Of note here was two female spiny lobster (*Palinurus elephas*, 102–112 mm, 1.15 kg, Figure 3) and a male ballan wrasse (*Labrus bergylta*, 35 cm, 0.74 kg). More cuckoo ray (31 kg) were sampled at Station 2 to the east. With Stations 4 and 5 deemed unfishable, Stations 6 and 7 were both completed successfully. Station 6 was a small catch (36 kg) of haddock, lesser-spotted dogfish and poor cod (*Trisopterus minutus*), whilst Station 7 was slightly larger (~47 kg) and comprised of cuckoo ray and anglerfish. Considering that these stations were less than 3 nm apart, it was noted that species composition was slightly different, even though catch size was similar.

Figure 3: *Palinurus elephas* caught at Stratum 2, Station 1

On February 19th, with Stratum 2 completed, Station 4 in Stratum 13 was sampled successfully, yielding a small catch of haddock and lesser-spotted dogfish (21 and ~18

kg, respectively). The ship then headed north to Mevagissey, where a small boat transfer saw S. Phillips and M. Whybrow depart at approximately 09:00 hrs, and I. Holmes and R. Kynoch (Marine Scotland Science) joined the survey. By 12:00 hrs work had begun in Stratum 3, with Station 2 completed successfully with a catch of ~100 kg, the composition of which was mainly mackerel (mostly individuals <30 cm). The close-by Station 4 had a greater quantity of mackerel (>300 kg), and over 100 kg of lesser-spotted dogfish. The survey then moved south and further offshore to Stratum 4, Station 4 and completed another tow, with more mackerel (70 kg) brought aboard. Stratum 3, Station 3 was completed next, with small amounts of grey gurnard, plaice (*Pleuronectes platessa*) and anglerfish (all less than 10 kg each).

By the start of February 20th, the survey had moved into Stratum 4 and in approximately 14 hours managed to fish Stations 1–3, 5 and 6, completing the stratum. Catches were found to be abundant in gadoids to the west of the stratum (120 kg of whiting at Station 5, then 33 kg along with 15 kg of bib (*Trisopterus luscus*) at station 6), but as stations further to the east were completed, more mackerel (70 kg at Station 2, 21 kg at Station 1) were seen. However, by Station 3 to the north-east of the stratum, starry smooth-hound and thornback ray were the more abundant components of the catch, making up two thirds of the ~140 kg catch weight.

Due to the waning daylight, work then moved further offshore as potential static gear on the inshore stations could no longer be spotted and avoided. At Stratum 5, Station 3, ~40 kg of lesser-spotted dogfish were caught, with half that again of starry smooth-hound. Stratum 6, Station 5 also yielded a small amount of lesser-spotted dogfish (10 kg), with a similar amount of plaice and 24 kg of mackerel. Of note here was a large female undulate ray (95 cm, 6.34 kg). Another large female undulate ray was caught at the next station (Stratum 6, Station 4; 91 cm, 5.85 kg), along with a larger catch of other elasmobranchs (133 kg of lesser-spotted dogfish and 81 kg of starry smooth-hound). This catch, however, was dwarfed by that seen at Stratum 5, Station 6, where the largest catch of the survey so far saw 870 kg of starry smooth-hound sampled. Also, of note here was another two, large female undulate rays and a common stingray (*Dasyatis pastinaca;* 52 cm, 0.8 kg), which was tagged and released.

On the morning of February 21st, the survey had moved further north and back into Lyme Bay. Stratum 5, Station 5 was completed successfully, despite a shallow water depth of 25 m, with almost 100 kg of thornback ray caught. Of note here was an isopod parasite (possibly from the family Cymothoidae), which was preserved for further study after the survey. This was followed up by a more modest catch (>30 kg) at the nearby Station 1 that contained flounder (*Platichthys flesus*), plaice, whiting and herring (*Clupea harengus*). Of note here were two allis shad (*Alosa alosa*). A similar catch was seen slightly further to the east, at Station 4, with more flounder, plaice and some European squid (*Loligo vulgaris*). By the evening, stations further offshore were targeted. Stratum 6, Station 1, to the south, yielded a catch of mackerel (19 kg), whiting (18 kg) and common cuttlefish (*Sepia officinalis*, 8 kg), which had been seen in small numbers in these offshore areas during the survey up to this point.

Further south, at Stratum 9, Station 5, another catch abundant with elasmobranchs was sampled. 112 kg of undulate ray and 38 kg of lesser-spotted dogfish were caught here, as well as a large number of queen scallop (*Aequipecten opercularis;* 66 kg). The close-by Station 4 also saw a similar catch of lesser-spotted dogfish, along with nearly 800 black sea-bream (*Spondyliosoma cantharus;* 14–36 cm, 129 kg). Also, of note here was a large male tope (136 cm, 10.96 kg) and another common stingray (52 cm, 1.21 kg).

By midday on February 22nd, the survey had moved north and inshore again, completing Stratum 6, Station 2, which provided a catch of ~70 kg, consisting mainly of lesser-spotted dogfish with some undulate rays and anglerfish. Further north, just off Portland, Station 3 was sampled, yielding a catch of starry smooth-hound (~70 kg). The areas of harder ground also meant more sedentary taxa were caught, such as yellow boring sponge (*Cliona celata*) and other sponges (e.g. *Polymastia*). With Stratum 6 completed, the survey then headed south towards the Channel Islands.

En route, Stratum 9, Station 1 was completed, although it took nearly two hours to find a clear tow position amongst static gear. This site was then fished successfully, with the catch dominated by starry smooth-hound (67 kg) and epibenthic fauna (>25 kg).

Work began in Stratum 11 in the early hours of February 23rd. Station 10 was attempted however, the was invalid due to the trawl being hauled early due to erratic door spread sensor readings. Station 16, ca. 3 nm to the south east, was completed after this, with another catch abundant in elasmobranchs (208 kg of starry smooth-hound; 30 kg of tope). Also caught here were three conger eels (*Conger conger*, 121–183 cm, 28 kg). A further two attempts were then made at Station 10. On the first, the tickler chain parted and was declared invalid. The third overall attempt was successful and yielded over 200 kg of tope and starry smooth-hound, along with ~75 kg of John dory, including large individuals up to 63 cm long, and also of note was a Yarrell's blenny (*Chirolophis ascanii*). Moving further south to Station 15 saw another invalid tow here, again where the tickler had parted on the very rough ground in this area.

It was at this point, with reluctance, that the decision to leave Stratum 11 incomplete and move on with the rest of the survey was made. With lost time from the invalid tows, coupled with the critical need for daylight to see potential static gear and with many of the stations in the stratum below the established minimum water depth, the survey moved westwards to maximise efforts in making sure other strata would be sampled.

Overnight, RV Cefas Endeavour moved west into Stratum 10 and successfully completed Station 2 where there was a small catch (>40 kg) of starry smooth-hound, red gurnard and anglerfish. Station 6, to the east, was then attempted but before the net had settled it came fast on a raised piece of ground. To free the gear, retrieve it and check for damage took over eight hours and lost much of the daylight required for checking for static gear that day. Station 1, to the south east was completed that

afternoon, with a small catch of elasmobranchs (thornback ray, starry smooth-hound and lesser-spotted dogfish), as well as a number of small rocks, an indication of the rough ground in this area.

After communicating with local fishermen, Guernsey Government and the Jersey Fishermen's Association it was determined that Stations 3, 5, 7 and 8 in Stratum 10 were all untrawlable, due to static gear. Station 4 was completed, with a larger catch of mackerel (194 kg), undulate ray (28 kg) and many spiny starfish (*Marthasterias glacialis;* 30 kg). However, with many of the alternative stations in very shallow water, or on ground very similar to where the issues with Station 6 occurred, and the loss of daylight, it was decided to move the survey away from Stratum 10. Whilst only managing three stations here, these were all completed in order following the survey protocols.

By February 25th, work had moved further offshore to the previously visited Stratum 13, Station 2. Unfortunately, 45 minutes into the tow the net came fast and the belly was torn whilst trying to retrieve it. The mend took over six hours to complete. By the time this was done, however, easterly winds had picked up and, with the direction of the swell, fishing activities were determined too dangerous. The ship then waited on Station 5 (Stratum 12) for a few hours to see if the weather would moderate sufficiently for work to recommence. However, by 18:00 hrs, the conditions had only worsened and the decision was made to move north back to Stratum 3 to see if Stations 1 or 3 could be completed before the mid-survey staff change in Fowey.

Unfortunately, a mechanical fault developed during passage and the potential work in Stratum 3 had to be abandoned for immediate docking in Fowey as the tide allowed. This mechanical issue kept RV Cefas Endeavour in port until March 7th until it was repaired, allowing sailing from Fowey at 18:00 hrs. Due to the lost time, the survey scope was reduced, with the main focus shifted towards trying to complete the strata in the western English Channel and the number of plankton dips was reduced to only one every 12 hours, in an effort to increase available time for fishing operations.

Part 2: March 7th to March 12th

The survey resumed at 21:00 hrs, March 7th, at the near-by Stratum 3, Station 3. A full station was completed here, with a small catch of bib (*Trisopterus luscus*; 40 kg), lesser-spotted dogfish and whiting (~16 kg each). By the next day, Station 1, c.a. 3 nm to the south west, yielded another small catch (>65 kg), which contained mainly whiting and a conger eel (137 cm, ~11 kg). Further south, at Stratum 13, Station 1 an even larger conger eel (213 cm) was caught, weighing 39 kg. It was in a larger catch of whiting (122 kg), with some bib (30 kg) and anglerfish (29 kg) too.

To the south west, Stratum 13, Station 3 was fished successfully, with a large variety of species brought aboard. The near 150 kg catch contained hake (*Merluccius merluccius*, 27 kg), poor cod (16 kg), cuttlefish (14 kg), bib (12 kg) and mackerel (11 kg). As the ship moved into the French sector, Stratum 13, Station 5 was attempted in the afternoon of March 8th. With warnings of static gear and hard rough ground

detected on the sea bed from the multibeam, only a 1.5 nm tow could be completed here, with starry smooth-hound (>100 kg) and conger eel (ca. 30 kg) constituting the main part of the catch.

The survey moved a short way east to make a second attempt at Stratum 13, Station 2, where significant gear damage had occurred previously. A 3 nm tow was completed to the north of the previous sampling attempt, with starry smooth-hound (<100 kg) and red gurnard (<50 kg) caught, as well as a large boulder. Of note here was a juvenile marbled electric ray (*Torpedo marmorata;* 27 cm, 0.5 kg; Figure 4). With Stratum 13 complete, the survey moved into Stratum 12. At Station 4, to the east-south-east, a smaller catch of more starry smooth-hound (30 kg), lesser-spotted dogfish (18 kg), black sea-bream (34 kg) and Dover sole (*Solea solea;* 14 kg) was sampled. By daylight on March 9th the ship had moved closer inshore to Station 2, to make sure the area was free of static gear. A small catch was brought aboard (< 100 kg), of which starry smooth-hound constituted the majority of the catch weight and also were the most abundant (~50 kg).

Figure 4: *Torpedo marmorata* caught on Stratum 13, Station 2

36 nm to the west, Station 5 yielded a larger catch. Starry smooth-hound were present here also (134 kg), along with a large number of John dory (140 kg, 28–55 cm). An attempt was made at Station 6, to the north, but local commercial fishermen warned of static gear they had deployed and the net had to be retrieved after only 0.7 nm. Upon retrieval, however, it was discovered that the belly of the net had a large tear. The subsequent mending took over seven hours to complete. With such extensive gear damage, and the knowledge of static gear across Station 6, the decision was made to not attempt it again and instead, following the survey protocols, move to Station 7 instead.

The vessel transited north-north west to Station 7, which was completed successfully at the start of March 10th. Again, starry smooth-hound were the main part of a comparatively large catch, with 213 kg caught. Boarfish (*Capros aper*) were also present, with over 50 kg sampled here. Approximately 20 nm to the west, Station 3 was the final station of Stratum 12 to be completed. With weather becoming more inclement, and hard rough ground seen on the multibeam, only a 1 nm tow could be achieved. This was abundant in elasmobranchs (lesser-spotted dogfish, 24 kg; tope, 15 kg, starry smooth-hound, 12 kg), with smaller amounts of anglerfish, hake and red gurnard (~10 kg each) also caught.

RV Cefas Endeavour then moved out of French waters and headed north-west to Stratum 8, Station 4. With some hard ground only a 2.5 nm tow could be completed here, with 176 kg of boarfish (10–15 cm) caught.

With the weather worsening and southerly gale force winds forecast, the decision was made to abandon Stratum 1 around the Scilly Isles. With a low expectation to be able to complete enough stations to satisfy the survey aims, the hope was to use the time saved to possibly complete Stratum C instead.

Work began in Stratum C at the start of March 11th, with Stations 1–5 completed over the course of the next ten hours. Species composition changed from station to station. Station 5 was abundant in flatfish, with <200 kg of plaice and 90 kg of dab (*Limanda limanda*) caught. 50 kg of spurdog (*Squalus acanthias*) were also sampled, with the liveliest tagged and released. Plaice were also seen at Station 1, to the north east, albeit with a much smaller catch weight (34 kg), alongside nearly 100 kg of blonde ray and some lesser-spotted dogfish (40 kg). Further inshore, at Station 2, only 1 nm could be fished due to static gear and rough ground. This had some blonde ray (~15 kg) but had a significant epibenthic component, including yellow boring sponge.

By the afternoon the survey had moved close to Lundy, where Station 4 was successfully completed. This station yielded a catch abundant in elasmobranchs; over 100 kg in starry smooth-hound and ~110 kg in lesser-spotted dogfish. Also of note was the presence of barrel jellyfish (*Rhizostoma pulmo*, 40 kg) and large specimens of male and female small-eyed ray (*Raja microocellata*; 72 cm and 85 cm, respectively). Approximately 30 nm to the north west, the final station of the survey, Stratum C, Station 3, was completed at 21:15 hrs. This was, again, abundant in elasmobranchs; lesser-spotted dogfish (60 kg), thornback ray (20 kg) and spotted ray (15 kg) made up a majority of the catch weight.

With the survey time at an end, RV Cefas Endeavour sailed to Swansea, where docking was completed at approximately 13:00 hrs, March 12th 2018.

Table 1: Number of gear deployments during the survey, by validity (see Appendix for station details).

Gear	Valid	Additional	Invalid
Jackson monkfish trawl	62	4[4]	10[1]
ESM2 Profiler and Niskin	28	0	0
200µ WP2 plankton ring net	61[2]	2	1[3]
CTD only	3	0	0

[1] causes due to gear damage, 19 mm tickler chain parting or sensor data loss
[2] includes deployment as per secondary aim
[3] cause due to PIA computer inoperative at time of net deployment
[4] shakedown tows; 2 in the southern North Sea and 2 in western Channel (1 with ticker and 1 without)

Table 2: Measured species caught in valid tows, by total catch weight

Common name	Scientific name	Cefas node	Total catch weight (kg)
Starry smooth-hound	*Mustelus asterias*	SDS	2576.453
Lesser-spotted dogfish	*Scyliorhinus canicula*	LSD	1200.001
Mackerel	*Scomber scombrus*	MAC	976.260
Whiting	*Merlangius merlangus*	WHG	809.153
Haddock	*Melanogrammus aegelfinus*	HAD	590.820
Tope	*Galeorhinus galeus*	GAG	373.032
Red gurnard	*Chelidonichthys cuculus*	GUR	352.959
Plaice	*Pleuronectes platessa*	PLE	340.551
John dory	*Zeus faber*	JOD	339.161
Conger eel	*Conger conger*	COE	337.700
Undulate ray	*Raja undulata*	UNR	289.522
Anglerfish (monkfish)	*Lophius piscatorius*	MON	289.027
Bib	*Trisopterus luscus*	BIB	257.690
Boarfish	*Capros aper*	BOF	254.970
Spurdog	*Squalus acanthias*	DGS	215.905
Black sea-bream	*Spondyliosoma cantharus*	BKS	212.853
Thornback ray	*Raja clavata*	THR	197.953
Blonde ray	*Raja brachyura*	BLR	163.953
Grey gurnard	*Eutrigula gurnardus*	GUG	163.319
Poor cod	*Trisopterus minutus*	POD	151.894
Common (grey) skate	*Dipturus batis*	SKG	143.038
Cuckoo ray	*Leucoraja naevus*	CUR	138.342
Spotted ray	*Raja montagui*	SDR	133.179
Dab	*Limanda limanda*	DAB	112.791
Hake	*Merluccius merluccius*	HKE	107.466
Greater-spotted dogfish	*Scyliorhinus stellaris*	DGN	105.502
Common cuttlefish	*Sepia officinalis*	CTC	102.635
Lemon sole	*Microstomus kitt*	LEM	82.757
Dover sole	*Solea solea*	SOL	64.884
European sea bass	*Dicentarus labrax*	ESB	60.565
Pollack	*Pollachius pollachius*	POL	60.55

Common name	Scientific name	Cefas node	Total catch weight (kg)
Horse mackerel	*Trachurus trachurus*	HOM	52.843
Common ling	*Molva molva*	LIN	51.600
Tub gurnard	*Chelidonichthys lucerna*	TUB	41.711
Greater spider crab	*Hyas araneus*	SCR	34.769
Red mullet	*Mullus surmuletus*	MUR	34.126
Black-bellied anglerfish	*Lophius budegassa*	WAF	32.379
European squid	*Loligo vulgaris*	LLV	32.016
Common dragonet	*Callionymus lyra*	CDT	31.379
Small-eyed ray	*Raja microcellata*	PTR	29.630
Flounder	*Platichthys flesus*	FLE	26.710
Megrim	*Lepidorhombus whiffiagonis*	MEG	18.815
Common stingray	*Dasyatis pastinaca*	SGR	17.354
Herring	*Clupea harengus*	HER	17.202
Great scallop	*Pecten maximus*	SCE	15.137
Turbot	*Scophthalmus maximus*	TUR	14.970
Shagreen ray	*Leucoraja fullonica*	SHR	8.990
Brill	*Scophthalmus rhombus*	BLL	6.625
Ballan wrasse	*Labrus bergylta*	BNW	6.416
Common spiny lobster	*Palinurus elephas*	SLO	6.049
Edible crab	*Cancer pagurus*	CRE	5.860
European lobster	*Homarus gammarus*	LBE	5.604
Northern squid	*Loligo forbesi*	NSQ	4.816
Witch	*Glyptocephalus cynoglossus*	WIT	4.629
Sprat	*Sprattus sprattus*	SPR	4.049
Pilchard	*Sardina pilchardus*	PIL	3.971
Streaked gurnard	*Trigloporus lastoviza*	GUS	3.285
Blue whiting	*Micromesistius poutassou*	WHB	3.097
Twaite shad	*Alosa fallax*	TAS	2.980
Norway pout	*Trisopterus esmarki*	NOP	2.813
Cod	*Gadus morhua*	COD	2.225
Cuckoo wrasse	*Labrus mixtus*	CUW	1.895
European anchovy	*Engraulis encrasicolus*	ANE	1.759
Velvet swimming crab	*Necora puber*	MLP	1.555
Greater weever fish	*Trachinus draco*	WEG	1.154
Common squids	*Loligo* spp.	SQC	1.137
Imperial scaldfish	*Arnoglossus imperialis*	ISF	0.828
Topknot	*Zeugopterus punctatus*	TKT	0.711
Long-finned gurnard	*Chelidonichthys obscurus*	GUL	0.542
Couch's sea-bream	*Pagrus pagrus*	SBC	0.525
Marbled electric ray	*Torpedo marmorata*	MER	0.524
Pink cuttlefish	*Sepia orbingnyana*	SEO	0.468
Allis shad	*Alosa alosa*	AAS	0.390
Three-bearded rockling	*Gaidropsarus vulgaris*	TBR	0.380

Common name	Scientific name	Cefas node	Total catch weight (kg)
Lesser weever fish	*Echiichthys vipera*	WEL	0.350
Thick-back sole	*Microchirus variegates*	TBS	0.260
Scaldfish	*Arnoglossus laterna*	SDF	0.192
Argentine	*Argentinidae*	ARG	0.135
Lesser flying squid	*Todaropsis eblanae*	OME	0.103
Elegant cuttlefish	*Sepia elegans*	SEE	0.074
Goldsinny wrasse	*Ctenolabrus rupestris*	GDY	0.038
Alloteuthis subulata		ATS	0.030
Ekstrom's topknot	*Zeugopterus regius*	EKT	0.028
Northern short-fin squid	*Illex illecebrosus*	SQI	0.021
Yarrell's blenny	*Chirolophis ascanii*	YBY	0.017
Pogge (armed bullhead)	*Agonus cataphractus*	POG	0.005
Clingfish	Gobiesocidae	CFX	0.001
Reticulated dragonet	*Callionymus reticulatus*	RDT	0.001

Table 3: Non-measured species sampled from valid tows, by total weight (kg) and including total counts

Common name	Scientific name	Cefas code	Total weight (kg)	Count
Assorted rocks	-	ROK	280.379	-
Yellow boring sponge	*Cliona celata*	CLI	158.581	-
Spiny starfish	*Marthasterias glacialis*	MAG	142.999	534
Queen Scallop	*Aequipecten opercularis*	QSC	74.219	3027
Edible sea urchin	*Echinus esculentus*	URS	68.198	348
Sponges	*Porifera*	PFZ	63.720	-
-	*Diazona violacea*	DIV	41.322	-
Whelk eggs	-	WES	32.782	-
Curled octopus	*Eledone cirrhosa*	EDC	23.331	74
Common starfish	*Asterias rubens*	STH	22.190	372
Broken shell	-	BSL	17.036	-
Common whelk	*Buccinum undatum*	WHE	14.759	263
-	*Echinus acutus*	URA	10.796	68
American slipper limpet	*Crepidula fornicata*	ASL	9.060	-
Hermit in whelk	*Eupagurus/pagurus in buccinum*	HIW	7.937	183
Dead-men's fingers	*Alcyonium digitatum*	DMF	6.977	-
-	*Pachymatisma johnstonia*	PMJ	5.157	-
Sea mouse	*Aphrodite aculeata*	AAC	4.359	138
Kelp	*Laminaria* spp.	LMX	4.262	-
-	*Luidia ciliaris*	LDC	4.258	35
Plumose anemone	*Metridium senile*	PMA	3.493	112
Common sunstar	*Crossaster papposus*	CTP	3.475	106
Dog cockle	*Glycymeris glycymeris*	GLG	2.891	30
Star ascidian	*Botryllus schlosseri*	BIS	2.790	-
Ross coral	*Pentapora foliacea*	PET	2.655	-

Common name	Scientific name	Cefas code	Total weight (kg)	Count
Swimming crab	*Liocarcinus depurator*	LMD	2.060	227
-	*Axinella infundibuliformis*	AXI	1.513	-
Sea squirts	Ascidiacea	SSX	1.388	17
Sand star	*Astropecten irregularis*	API	1.279	75
Purple heart urchin	*Spatangus purpureus*	SPG	0.988	17
Hornwrack	*Flustra foliacea*	FAF	0.906	-
Dahlia anemone	*Urticina felina*	DHA	0.901	25
Sea slugs	Nudibranchia	NBX	0.838	27
Parchment worm tubes	*Chaetopterus* tubes	CVT	0.726	-
-	*Dysidea fragilis*	DYS	0.705	-
Hermit in Adamsia	*Pagurus prideaux/Adamsia*	HIA	0.704	45
-	*Luidia sarsi*	LUS	0.511	14
Hydroids	Hydroids	HYD	0.475	-
-	*Echinocardium* spp.	ECV	0.433	23
-	Molgulidea	MGX	0.413	-
Gibb's sea spider	*Pisa armata*	PAA	0.389	35
-	Ascididae	ASY	0.364	-
-	*Tethya aurantia*	TAA	0.333	5
Swimming crab	*Macropipus tuberculatus*	MPT	0.293	18
-	*Archidoris pseudoargus*	ADP	0.291	33
-	Polymastiidae	PMX	0.286	-
-	*Psammechinus miliaris*	PMM	0.279	42
-	*Acanthochitona* spp.	ACC	0.269	-
-	*Tritonia hombergi*	TNH	0.266	12
Red cushion star	*Porania pulvillus*	PPV	0.265	4
Norway cockle	*Laevicardium crassum*	LCC	0.264	5
Common swimming crab	*Polybius (Liocarcinus) holsatus*	LMH	0.250	61
-	*Serpula vermicularis*	SAV	0.239	-
Barnacles	*Cirrepedia* spp.	CIZ	0.226	-
Anemones	Actiniaria (order)	AMU	0.226	8
-	*Henricia oculata*	HEO	0.209	26
Seaweeds	*Fucus* spp.	FUX	0.208	-
Sponge crab	*Dromia personata*	DRP	0.185	2
-	*Ascidia mentula*	ASM	0.183	-
Curly weed	*Alcyondium diaphanum*	ALG	0.154	-
Goose-foot star	*Anseropoda placenta*	PLM	0.154	13
-	*Scaphander lignarius*	SDL	0.152	7
-	*Calliactis parasitica*	CAR	0.150	7
Sponge	*Haliclona oculata*	HAO	0.141	-
Masked crab	*Corystes cassivelaunus*	CCV	0.115	10
Slender-leg spider crab	*Inachus leptochirus*	INL	0.111	31
Sea cucumbers	Holothuroidea	HTZ	0.105	8
Bryozoan	Cellariidae	CEL	0.097	-

Common name	Scientific name	Cefas code	Total weight (kg)	Count
-	*Colus gracilis*	CSG	0.096	4
Common brittle star	*Ophiothrix fragilis*	OPF	0.090	82
Hermit (naked)	*Pagurus bernhardus*	PEB	0.068	2
Variegated scallop	*Chlamys varia*	CHV	0.068	13
-	*Filograna implexa*	FII	0.066	-
Kelps	Laminariaceae	LMY	0.066	-
Squat lobsters	*Galathea* spp.	GLX	0.061	2
Stalk ascidian	*Styela clava*	SAA	0.061	5
-	*Ophiura ophiura*	OHT	0.058	14
Scorpion spider crab	*Inachus dorsettensis*	IND	0.050	15
-	*Nemertesia antennina*	NEA	0.048	-
-	*Ophiocomina nigra*	OPN	0.048	20
Brown seaweeds	*P*haeophyceae	SWB	0.043	-
Prickly cockle	*Acanthocardia echinata*	CPY	0.040	1
-	*Pleurobranchus membranaceous.*	PBM	0.037	7
Sickle hydroid	*Hydrallmania falcata*	HYH	0.034	-
-	*Chaetopterus variopedatus*	CPV	0.033	5
-	*Diphasia nigra*	DIN	0.029	-
Toothed wrack	*Fucus serratus*	WRS	0.028	-
Squat lobster	*Munida rugosa*	MNR	0.027	1
-	*Sagartia* spp.	SAG	0.025	2
Unidentified algae	*Laminaria* spp.	ALU	0.024	-
Hairy crab	*Pilumnus hirtellus*	PNH	0.024	7
Contracted crab	*Hyas coarctatus*	HYC	0.022	5
Circular crab	*Atelycyclus rotundatus*	ALR	0.013	1
Squid eggs	-	SQS	0.013	-
-	*Crangon allmanni*	CGA	0.012	5
Common (brown) shrimp	*Crangon crangon*	CSH	0.011	9
-	*Pagurus prideaux*	PEX	0.011	2
Slender spider crab	*Macropodia tenuirostris*	MCT	0.009	6
Sea mats	Bryozoa	EPZ	0.009	-
Dogfish egg case	-	DEG	0.008	1
-	*Inachus* spp.	INX	0.008	4
-	*Nemertesia ramosa*	NER	0.008	-
Risso's crab	*Xantho pilipes*	XAP	0.008	2
-	*Alcyonidium parasiticum*	ALA	0.006	-
Isopod parasite	*Cymothoidae*	CYM	0.006	4
Feather star	*Antedon bifida*	ADB	0.004	1
-	Crinoidea	CNZ	0.004	5
Little cuttlefish	*Sepiola atlantica*	SPA	0.004	1
-	*Bathynectes longipes*	BAL	0.003	2
-	*Eurydice* spp.	EDX	0.003	1
Hydroid	*Nemertesia* spp.	NEM	0.003	-

Common name	Scientific name	Cefas code	Total weight (kg)	Count
Hermit crabs	Paguridae	PAY	0.003	1
Long-clawed porcelain crab	*Pisidia longicornis*	PIS	0.003	5
-	*Upogebia* spp.	UPX	0.003	1
Pheasant tail hydoid	*Lytocarpia myriophyllum*	HYL	0.002	-
-	*Limaria hians*	LIM	0.002	1
-	*Macropodia linaresi*	MCL	0.002	1
-	Ophiurida (order)	OPH	0.002	1
Atlantic mud shrimp	*Solenocera membranacea*	SOA	0.002	1
Sea orange	*Suberites* spp.	SUD	0.002	-
Broad-clawed burrowing shrimp	*Alpheus macrocheles*	ALM	0.001	1
Goose barnacles	Lepadidae	GOZ	0.001	1
Scale worm	*Hermione histrix*	HMH	0.001	1
Marbled swimming crab	*Liocarcinus marmoreus*	LMM	0.001	1
-	Processidae	PCY	0.001	1
-	*Simnia patula*	SIM	0.001	1
Red seaweeds	Rhodophyceae	SWR	0.001	-
Artic cowrie	*Trivia artica*	TRA	0.001	1
Barrel jellyfish	*Rhizostoma pulmo*	BAR	73.215	-

Table 4: Species sampled for biological information, by number of samples and sex.

	Common name	Scientific name	Cefas code	M	F	U	Total
Species sampled for length, weight, sex, maturity and collection of otoliths	Whiting	*Merlangius merlangus*	WHG	397	516	4	917
	Haddock	*Melanogrammus aegelfinus*	HAD	155	237	4	396
	Plaice	*Pleuronectes platessa*	PLE	148	198	0	346
	Black sea-bream	*Spondyliosoma cantharus*	BKS	111	166	2	279
	Bib	*Trisopterus luscus*	BIB	103	113	0	216
	Anglerfish (monkfish)	*Lophius piscatorius*	MON	75	93	8	176
	Red mullet	*Mullus surmuletus*	MUR	56	94	3	153
	Dab	*Limanda limanda*	DAB	52	91	1	144
	Lemon sole	*Microstomus kitt*	LEM	49	86	0	135
	Herring	*Clupea harengus*	HER	74	49	0	123
	Mackerel	*Scomber scombrus*	MAC	50	54	2	106
	Dover sole	*Solea solea*	SOL	26	75	0	101
	Tub gurnard	*Chelidonichthys lucerna*	TUB	29	56	0	85
	Hake	*Merluccius merluccius*	HKE	22	45	10	77
	Sprat[1]	*Sprattus sprattus*	SPR	0	0	65	65
	European sea bass	*Dicentarus labrax*	ESB	41	13	0	54
	Megrim	*Lepidorhombus whiffiagonis*	MEG	3	48	0	51
	Black-bellied anglerfish	*Lophius budegassa*	WAF	7	24	2	33
	European anchovy[1]	*Engraulis encrasicolus*	ANE	0	0	25	25
	Norway pout	*Trisopterus esmarki*	NOP	7	14	0	21
	Pollack	*Pollachius pollachius*	POL	12	8	0	20
	Streaked gurnard	*Trigloporus lastoviza*	GUS	9	9	0	18
	Pilchard	*Sardina pilchardus*	PIL	7	6	5	18
	Witch	*Glyptocephalus cynoglossus*	WIT	5	9	0	14
	Common ling	*Molva molva*	LIN	5	5	0	10
	Turbot	*Scophthalmus maximus*	TUR	2	5	0	7
	Brill	*Scophthalmus rhombus*	BLL	2	4	0	6
	Long-finned gurnard	*Chelidonichthys obscurus*	GUL	2	2	0	4
	Cod	*Gadus morhua*	COD	2	1	0	3
Species sampled for length, weight sex and maturity only	Starry smooth-hound	*Mustelus asterias*	SDS	525	557	0	1082
	John dory	*Zeus faber*	JOD	122	154	0	276
	Spotted ray	*Raja montagui*	SDR	91	88	0	179
	Cuckoo ray	*Leucoraja naevus*	CUR	84	87	0	171
	Blonde ray	*Raja brachyura*	BLR	42	59	0	101
	Thornback ray	*Raja clavata*	THR	35	42	0	77
	Spurdog	*Squalus acanthias*	DGS	14	60	0	74
	Undulate ray	*Raja undulata*	UNR	28	42	0	70
	Common skate	*Dipturus batis*	SKG	25	41	0	66
	Tope	*Galeorhinus galeus*	GAG	39	20	0	59
	Conger eel[2]	*Conger conger*	COE	0	0	40	40
	Greater-spotted dogfish	*Scyliorhinus stellaris*	DGN	15	17	0	32
	Small-eyed ray	*Raja microocellata*	PTR	4	10	0	14
	Common stingray	*Dasyatis pastinaca*	SGR	5	5	0	10
	Shagreen ray	*Leucoraja fullonica*	SHR	2	2	0	4

[1] Collected as whole fish for subsequent analysis after the survey

[2] Conger eels generally sampled for individual length and weight, before release

Table 5: Total number of elasmobranchs tagged during the survey, including minimum and maximum length

Common Name	Scientific Name	Cefas Code	Length range (cm)	No. tagged
Starry smooth-hound	*Mustelus asterias*	SDS	62–121	73
Spurdog	*Squalus acanthias*	DGS	68–114	50
Tope	*Galeorhinus galeus*	GAG	92–156	49
Undulate ray	*Raja undulata*	UNR	53–100	25
Common skate	*Dipturus batis*	SKG	60–114	22
Blonde ray	*Raja brachyura*	BLR	41–113	9
Greater-spotted dogfish	*Scyliorhinus stellaris*	DGN	69–101	6
Spotted ray	*Raja montagui*	SDR	61–71	3
Common stingray	*Dasyatis pastinaca*	SGR	52–84	2
Shagreen ray	*Leucoraja fullonica*	SHR	78–103	2
Small-eyed ray	*Raja microocellata*	PTR	81–81	1

Table 6: Samples taken during flow cytometry work during the second half of the survey

Date	Number of Samples Collected		
	Flow Cytometer	Filtration	Plankton
07/03/18	3	0	0
08/03/18	24	2	1
09/03/18	24	2	1
10/03/18	24	2	1
11/03/18	23	2	1
12/08/18	9	0	0

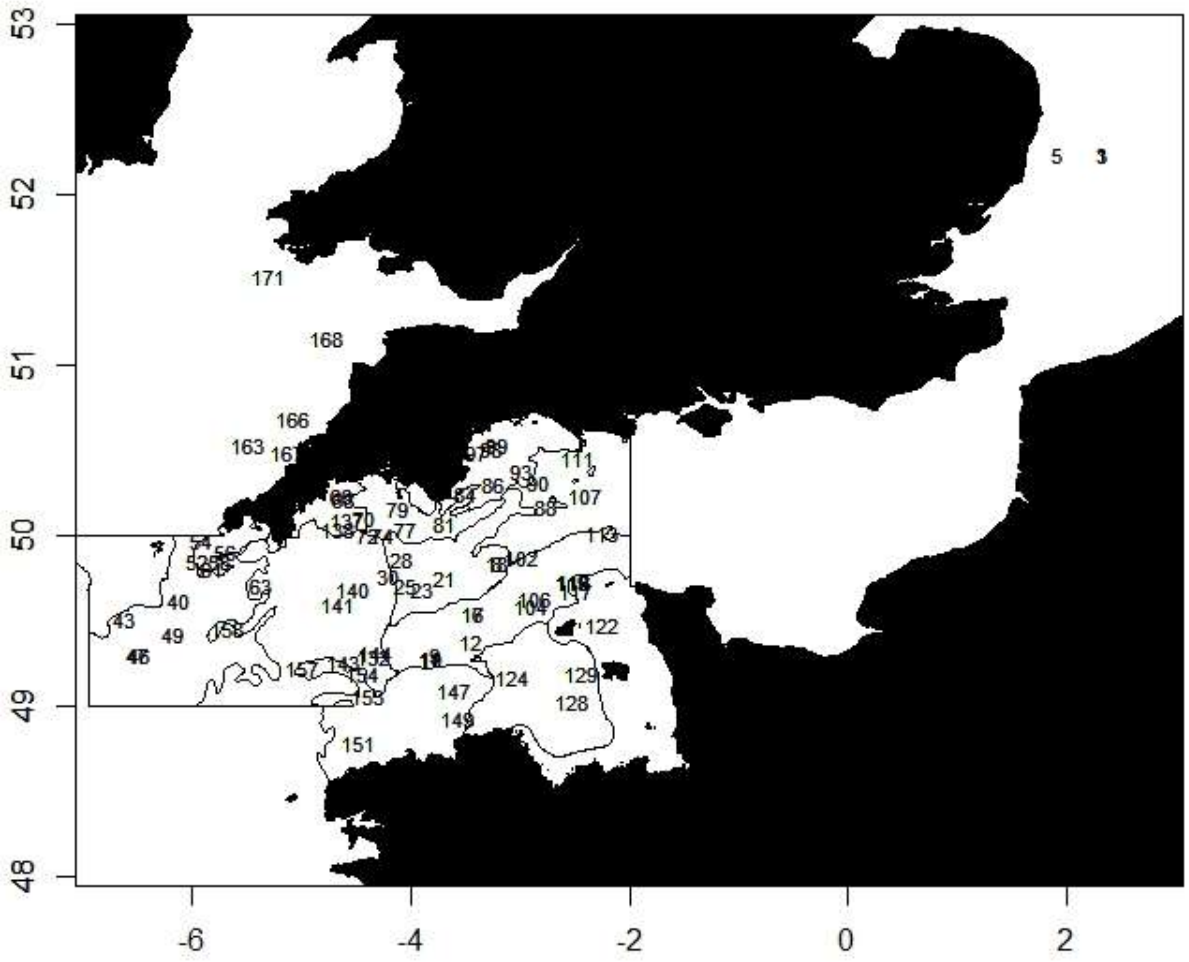

Figure 6: Chart of survey station numbers for CEND 5/18 (Jackson monkfish trawl only)

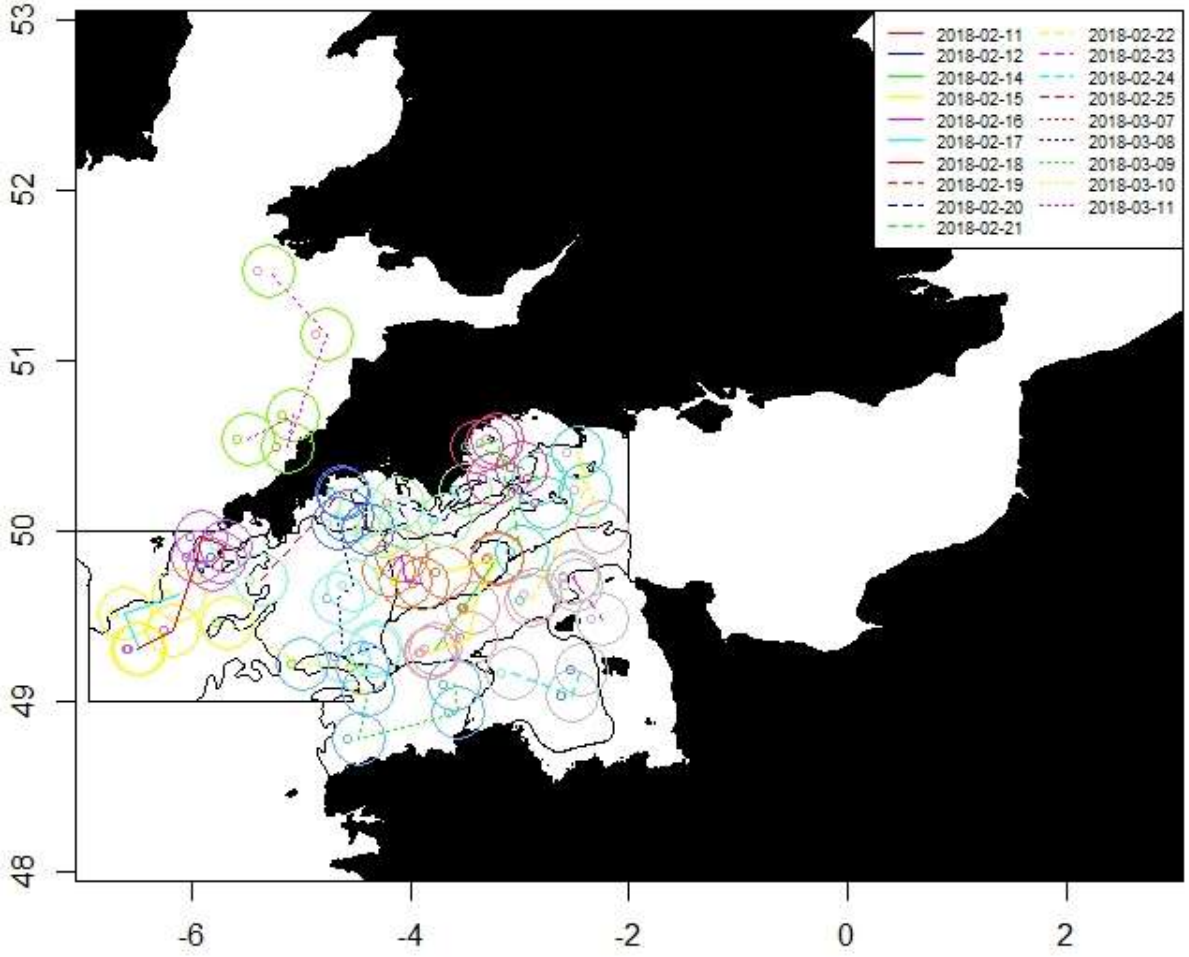

Figure 7: Survey track showing trawl stations deployment by day

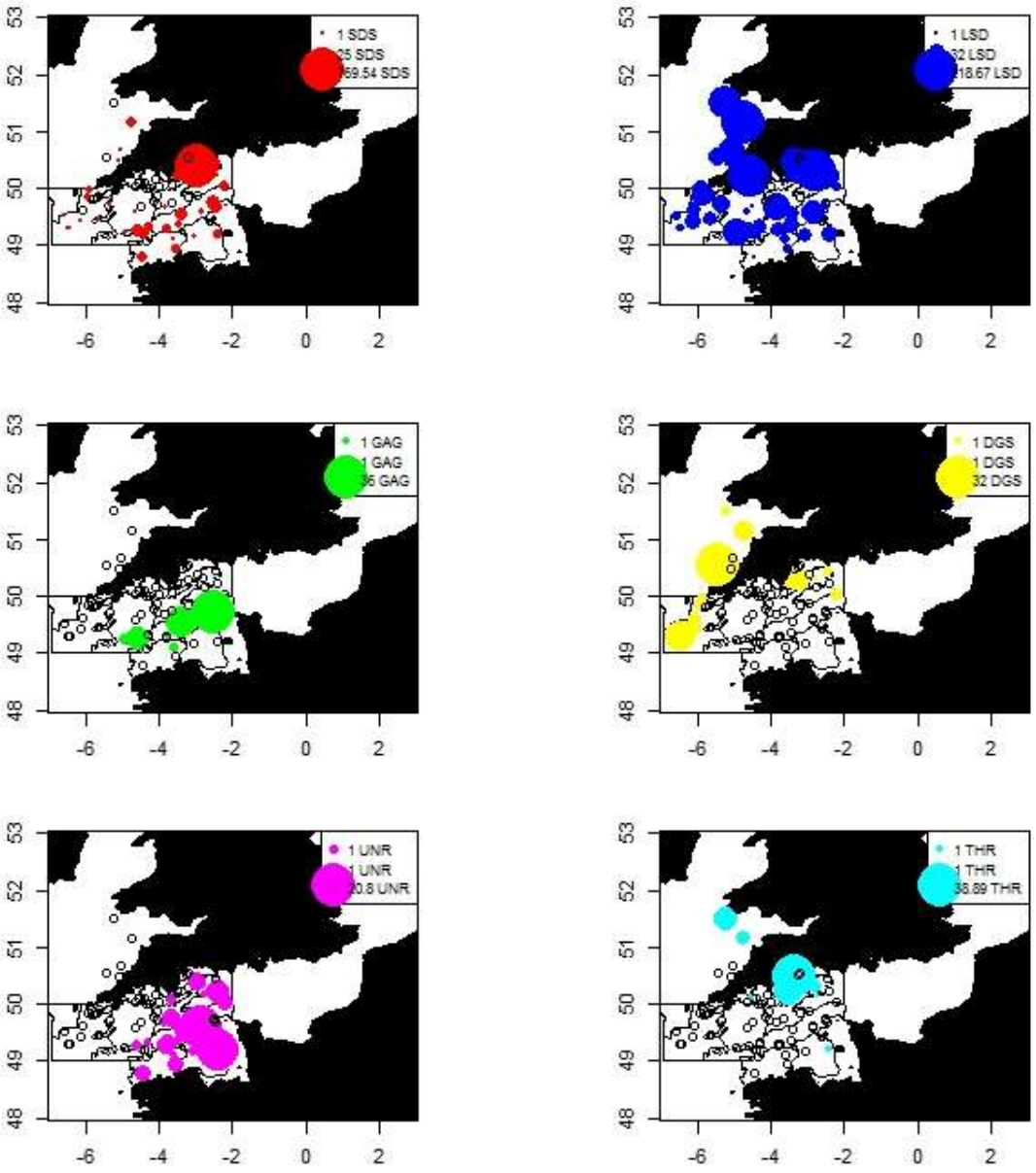

Figure 8: Distribution and relative abundance of the main fish species captured by station (SDS = starry smooth-hound; LSD = lesser-spotted dogfish; GAG = tope; DGS = spurdog; UNR = undulate ray and THR = thornback ray).

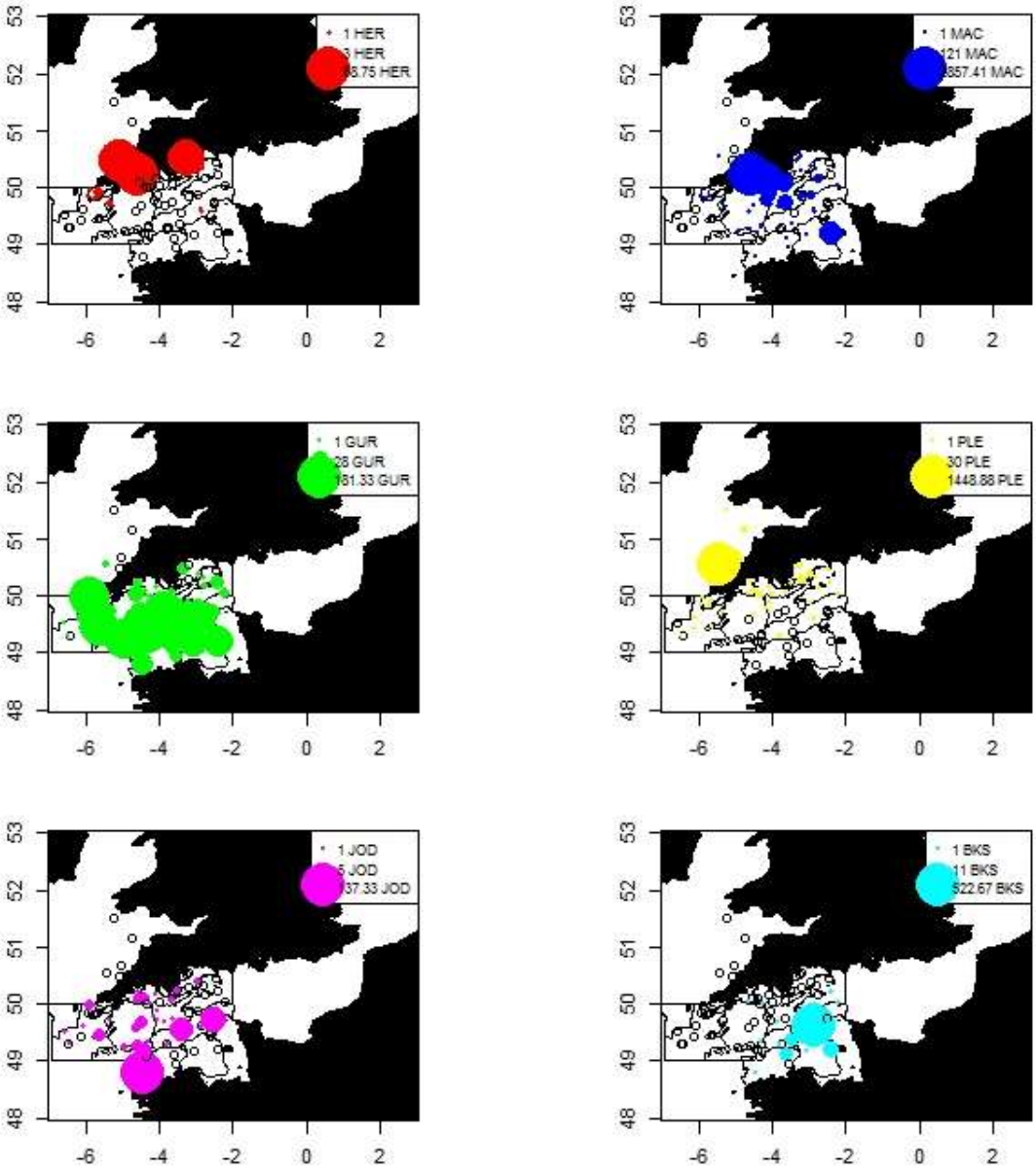

Figure 8 (continued): Distribution and relative abundance of the main fish species captured by station (HER = herring; MAC = mackerel; GUR = red gurnard; PLE = plaice; JOD = John dory and BKS = black sea-bream).

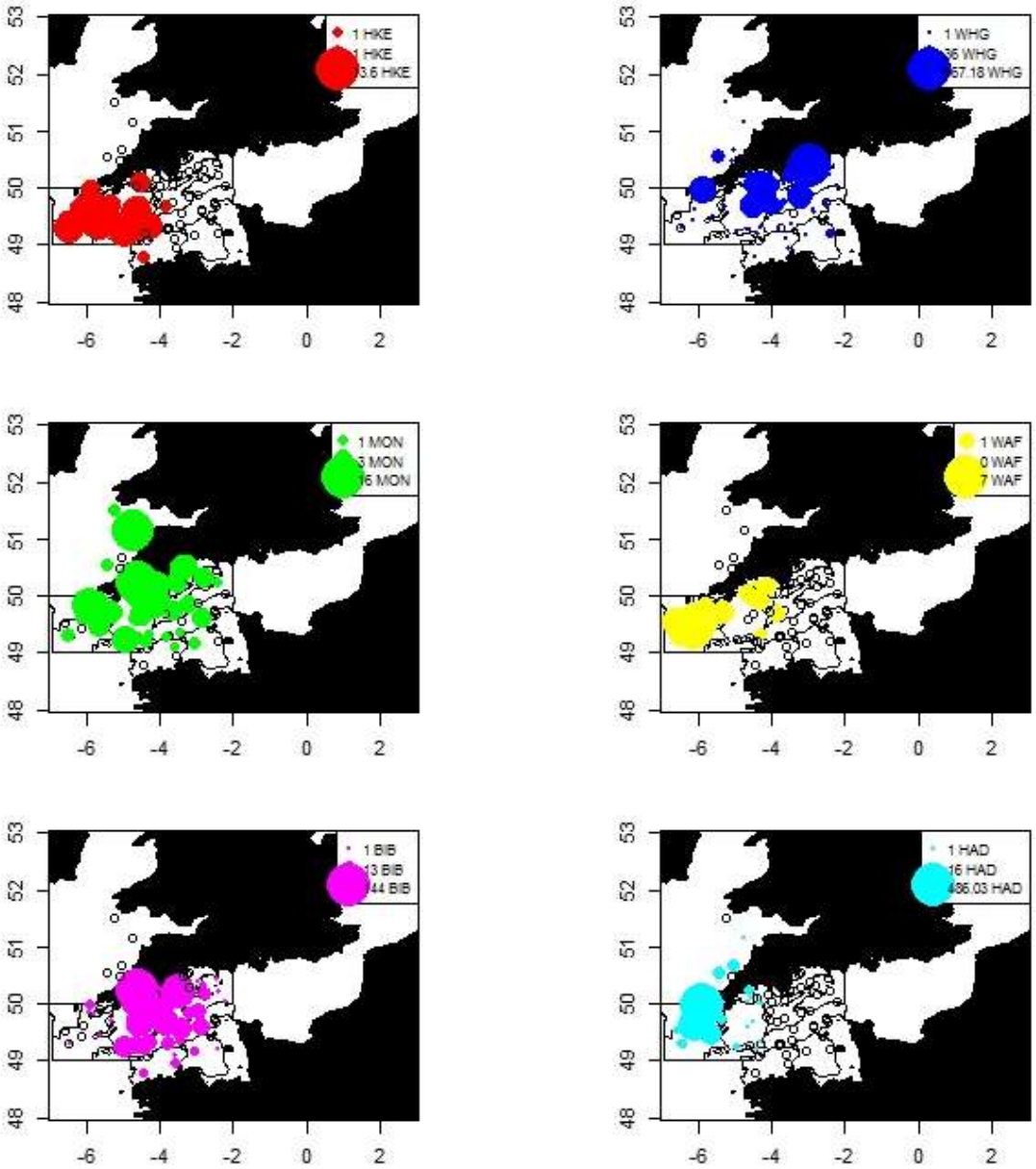

Figure 8 (continued): Distribution and relative abundance of the main fish species captured by station (HKE = hake; WHG = whiting; MON = anglerfish; WAF = black-bellied anglerfish; BIB = bib and HAD = haddock).

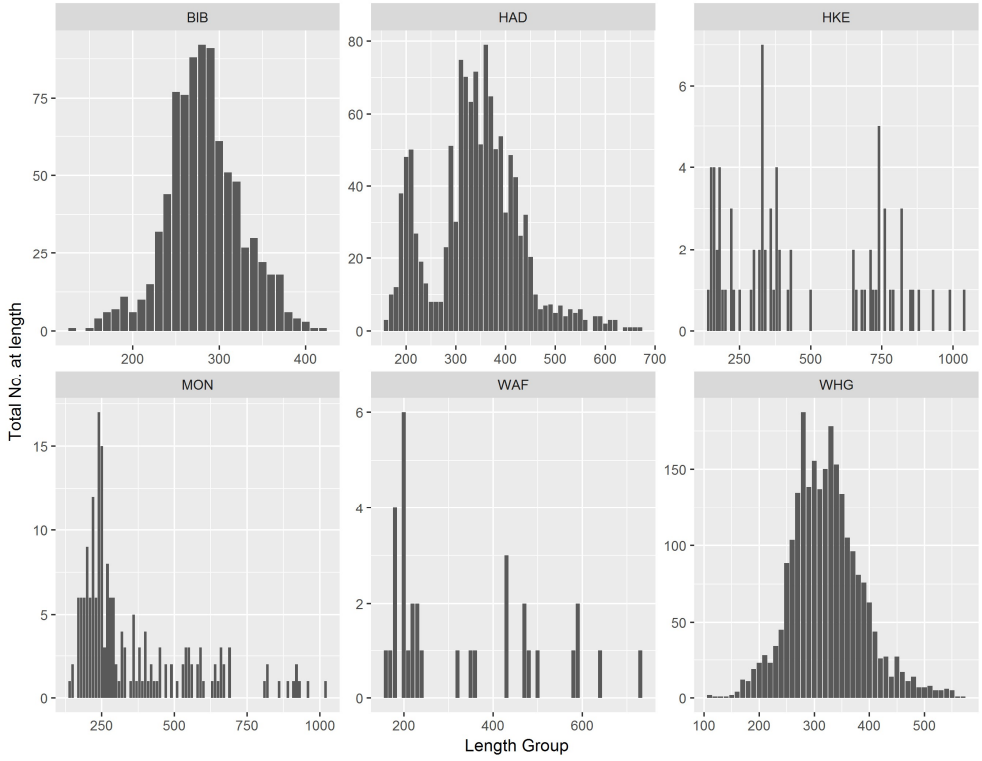

Figure 9: Length distributions (mm) of the main fish species captured (BIB = bib; HAD = haddock; HKE = hake; MON = anglerfish; WAF = black-bellied anglerfish and WHG = whiting).

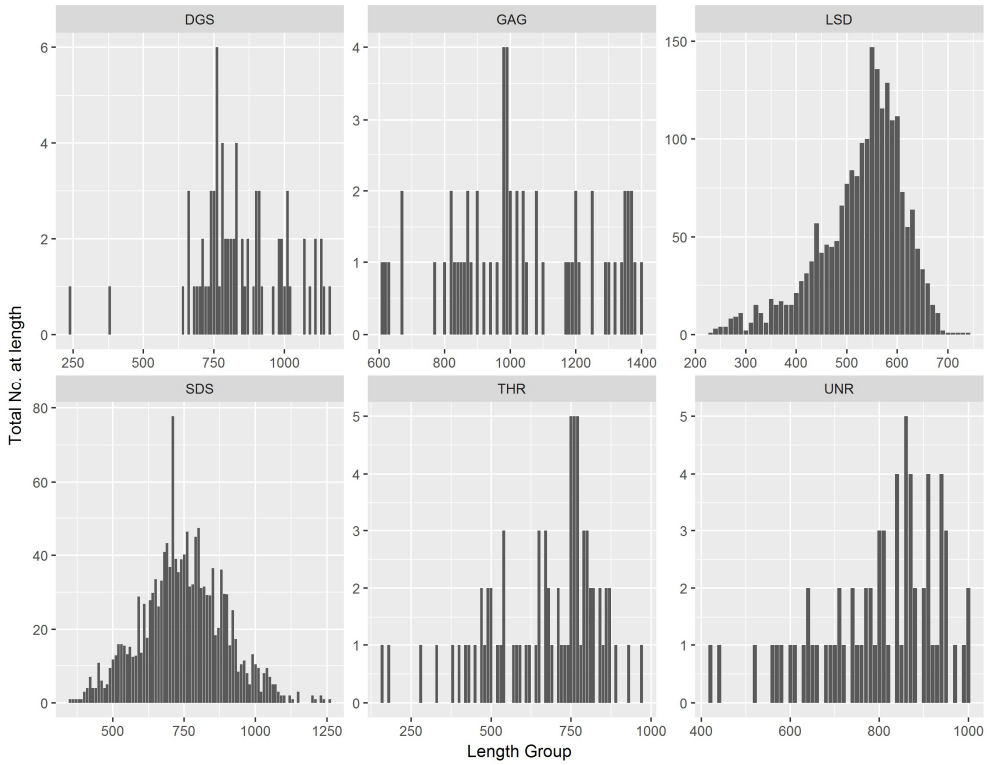

Figure 9 (continued): Length distributions (mm) of the main fish species captured (DGS = spurdog; GAG = tope; LSD = lesser-spotted dogfish; SDS = starry smooth-hound; THR = thornback ray and UNR = undulate ray).

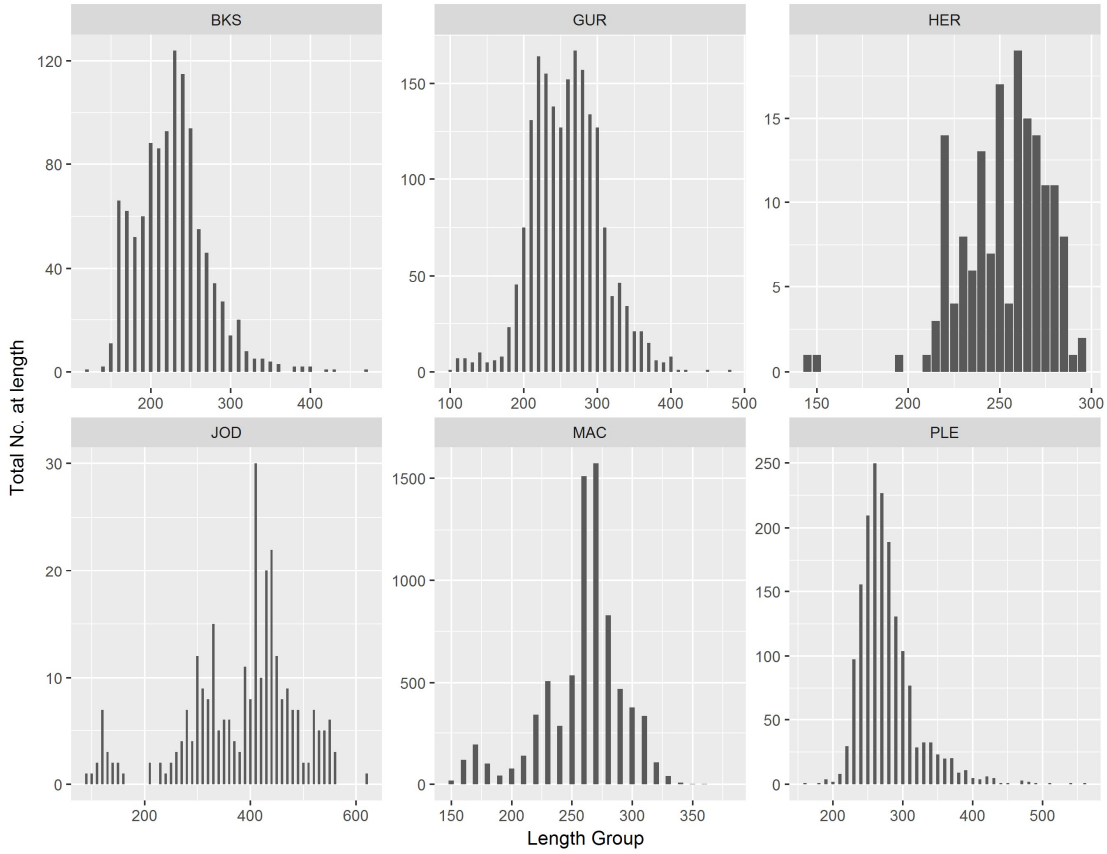

Figure 9 (continued): Length distributions (mm) of the main fish species captured (BKS = black sea-bream; GUR = red gurnard; HER = herring; JOD = John dory; MAC = mackerel and PLE = plaice).

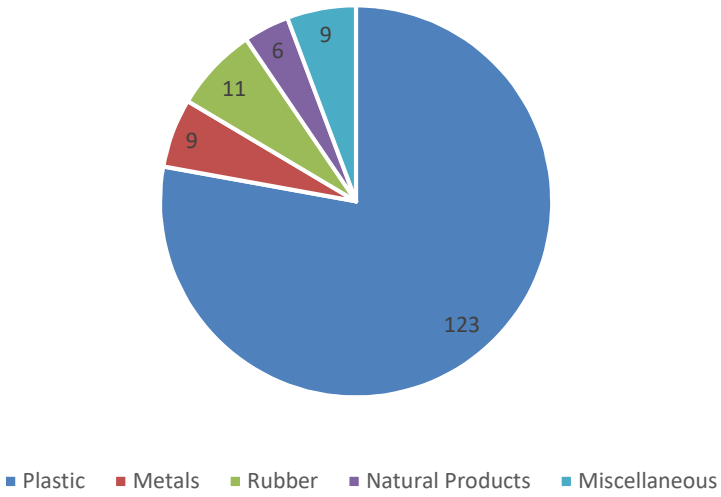

Figure 10: Marine litter caught in the monkfish trawl during the survey n = 158

Ben Hatton & Louise Straker Cox
10th April 2018

INITALLED:
SEEN IN DRAFT:

APPENDIX: Station log information

Stn.	Date_time shot	Shot Lat.		Shot Long.		Haul Lat.		Haul Long.		E/W	Dist. (nm)	Log (nm)		Depth (m)		Tide		Wind		Sea ht. (m)	Swell		Barom.	Gear	Val.
		Deg.	Min.	Deg.	Min.	Deg.	Min.	Deg.	Min.			Shot	Haul	Shot	Haul	Dir.	Spd.	Dir.	Spd.		Dir.	Ht. (m)			
1	11/02/18_14:13:53	52	13.84	2	19.63	52	14.26	2	18.56	E	0.7	53.8	54.5	56	56	9	0.4	270	24	1.5	180	1.5	993	Jackson monkfish trawl	A
2	11/02/18_16:18:53	52	14.33	2	18.96	52	14.33	2	18.96	E		60.2	60.2	57	57	195	0.7	270	24	1.5	180	1	994	200um plankton net	A
3	11/02/18_19:26:53	52	13.98	2	19.19	52	14.52	2	18.2	E	0.8	71.4	72.2	58	56	201	0.9	270	26	1.5	200	1.5	995	Jackson monkfish trawl	A
4	12/02/18_00:02:53	51	57.7	2	8.54	51	57.7	2	8.54	E		96	96	41	41			300	27	1.5	200	1.5	1001	Outer Gabbard ring net	V
5	12/02/18_08:42:53	52	14.16	1	55.24	52	14.14	1	54.63	E	0.4	124.2	124.6	37	35			270	24	1.5	200	1	1005	Jackson monkfish trawl	I
6	13/02/18_21:56:53	49	50.78	3	11.71	49	50.78	3	11.71	W		455.7	455.7	70	70	258	0.5	310	10	0.7	300	2	1002	ESM2 profiler/Niskin	V
7	13/02/18_22:22:53	49	50.76	3	11.61	49	50.76	3	11.61	W		455.8	455.8	69	69	248	0.7	310	10	0.7	300	2	1002	200um plankton net	V
8	14/02/18_07:33:53	49	50.61	3	12.1	49	50.63	3	12.27	W	0.1	504.8	504.9	74		39	0.7	180	30	2	220	2	996	Jackson monkfish trawl	I
9	14/02/18_18:30:53	49	18.28	3	46.61	49	17.29	3	48.54	W	1.7	558	559.7	89	91	71	0.6	230	18	1	220	1.7	994	Jackson monkfish trawl	A
10	14/02/18_20:41:53	49	17.12	3	48.94	49	18.09	3	46.99	W	1	565	566	89	87	246	0.7	230	20	1	220	1.5	994	Jackson monkfish trawl	I
11	15/02/18_01:32:53	49	16.92	3	49.58	49	17.8	3	47.27	W	1.8	585.4	587.2	89	87	281	0.2	230	20	1			997	Jackson monkfish trawl	A
12	15/02/18_04:50:53	49	22.54	3	27.17	49	20.92	3	31.05	W	3	604.5	607.5	83	85	74	0.7	250	20	1.5	220	1	1000	Jackson monkfish trawl	V
13	15/02/18_07:06:53	49	22.09	3	28.21	49	22.09	3	28.21	W		613.2	613.2	86	86	49	1.2	250	18	1.5	220	1	1002	ESM2 profiler/Niskin	V
14	15/02/18_07:21:53	49	22.13	3	27.69	49	22.13	3	27.69	W		613.6	613.6	85	85	47	1.1	250	18	1.5	220	1	1002	200um plankton net	V
15	15/02/18_09:25:53	49	33.28	3	24.7	49	33.28	3	24.7	W		630.9	630.9	113	113	339	0.4	270	20	1.5	220	1	1005	200um plankton net	V
16	15/02/18_10:51:53	49	33	3	25.45	49	32.82	3	26.09	W	0.3	637.8	638.1	112	110			280	16	1	220	1	1008	Jackson monkfish trawl	I
17	15/02/18_13:22:53	49	32.94	3	25.56	49	33.5	3	23.28	W	1.6	648.2	649.8	108	111	227	1	280	16	0.7	270	1.2	1008	Jackson monkfish trawl	V
18	15/02/18_18:50:53	49	50.38	3	12.62	49	49.98	3	14.75	W	1.4	682.7	684.1	74	76	55	1.3	290	20	1.5	280	2.5	1011	Jackson monkfish trawl	V
19	15/02/18_22:04:53	49	45.62	3	38.48	49	45.62	3	38.48	W		701	701	76	76	254	0.4	290	22	1.2	280	1.7	1005	200um plankton net	V
20	15/02/18_22:24:53	49	45.79	3	38.37	49	45.79	3	38.37	W		701.2	701.2	75	75	257	0.6	290	22	1.2	280	1.7	1005	ESM2 profiler/Niskin	V
21	15/02/18_23:24:53	49	45.33	3	40.79	49	45.55	3	39.09	W	1.1	706.1	707.2	72	74	258	0.3	280	22	1.2	280	1.7	1005	Jackson monkfish trawl	V
22	16/02/18_01:27:53	49	42	3	50.8	49	42	3	50.8	W		717.5	717.5	79	79	256	0.7	280	18	1.5	280	2	1016	200um plankton net	V
23	16/02/18_02:17:53	49	41.44	3	53.08	49	41.97	3	50.92	W	1.5	721.9	723.4	79	79	254	0.4	280	15	1.5	280	2	1017	Jackson monkfish trawl	V
24	16/02/18_04:40:53	49	42.28	4	5.45	49	42.28	4	5.45	W		735.5	735.5	84	84	77	0.8	280	10	15	280	2	1017.5	200um plankton net	V
25	16/02/18_05:29:53	49	42.57	4	3.16	49	41.99	4	7.69	W	3	739.4	742.4	82	84	78	1	280	8	1	280	2	1017.5	Jackson monkfish trawl	V
26	16/02/18_08:14:53	49	52.18	4	6.37	49	52.18	4	6.37	W		754.9	754.9	78	78	56	0.3			0.5	280	2	1017.5	200um plankton net	V
27	16/02/18_08:25:53	49	52.2	4	6.07	49	52.2	4	6.07	W		755.1	755.1	77	77	56	0.2			0.5	280	2	1017.5	ESM2 profiler/Niskin	V
28	16/02/18_09:20:53	49	51.67	4	5.18	49	52.39	4	9.68	W	3.7	759.2	762.9	77	77	244	0.1				270	1.5	1018	Jackson monkfish trawl	V
29	16/02/18_11:45:53	49	46.29	4	8.66	49	46.29	4	8.66	W		772.8	772.8	77	77	258	0.9	200	10	0.5	270	1	1018	200um plankton net	V
30	16/02/18_12:33:53	49	46	4	11.61	49	46.8	4	6.79	W	3.2	776.9	780.1	76	78	258	0.9	200	11	1	270	1	1018	Jackson monkfish trawl	V
31	16/02/18_16:34:53	49	41.11	4	31.38	49	41.11	4	31.38	W		800.4	800.4	84	84	75	0.9	200	8	1	270	1	1015	200um plankton net	V
32	16/02/18_18:48:53	49	36.05	4	39.17	49	36.05	4	39.17	W		810.2	810.2	91	91	92	0.8	180	20	1	270	1.5	1014	ESM2 profiler/Niskin	V
33	16/02/18_19:43:53	49	36.61	4	37.43	49	36.61	4	37.43	W		811.5	811.5	90	90	115	0.4	180	18	1	270	1.5	1013	200um plankton net	V
34	17/02/18_00:13:53	49	17.91	4	21.72	49	17.91	4	21.72	W		844.5	844.5	90	90	251	14	160	15	1	280	1.5	1003	200um plankton net	V
35	17/02/18_02:36:53	49	16.28	4	36.29	49	16.28	4	36.29	W		861.4	861.4	97	97	351	0.3			1	280	1.5	1012	200um plankton net	V
36	17/02/18_04:44:53	49	13.59	4	57.52	49	13.59	4	57.52	W		876.5	876.5	107	107	61	1.7			1	280	1.5	1012	200um plankton net	V
37	17/02/18_09:14:53	49	27.74	5	40.5	49	27.74	5	40.5	W		910.7	910.7	108	105	219	0.7	300	14	1	280	1.5	1015	200um plankton net	A
38	17/02/18_11:19:53	49	36.8	6	2.6	49	36.8	6	2.6	W		928.1	928.1	102	102	247	1.2	280	10	1	280	1	1016	200um plankton net	V
39	17/02/18_11:31:53	49	36.72	6	2.97	49	36.72	6	2.97	W		928.3	928.3	102	102	251	1.2	280	10	1	280	1	1016	ESM2 profiler/Niskin	V
40	17/02/18_13:16:53	49	37.37	6	6.95	49	37.19	6	1.78	W	3.3	935.2	938.5	102	103	296	0.7	280	12	0.7	280	1	1016	Jackson monkfish trawl	V
41	17/02/18_17:38:53	49	30.73	6	35.27	49	30.73	6	35.27	W		965.4	965.4	113	113	52	0.7	220	19	1.2	280	1.7	1013	ESM2 profiler/Niskin	V
42	17/02/18_17:57:53	49	31.13	6	34.39	49	31.13	6	34.39	W		966.1	966.1	113	113	59	0.7	220	19	1.2	280	1.7	1013	200um plankton net	I
43	17/02/18_18:37:53	49	31	6	36.69	49	29.15	6	40.84	W	3.3	968.4	971.7	114	114	83	0.6	200	20	1.2	280	2	1012	Jackson monkfish trawl	V
44	17/02/18_21:20:53	49	30.18	6	36.05	49	30.18	6	36.05	W		980.3	980.3	112	112	199	0.6	270	18	1.5	280	2	1013	200um plankton net	V
45	17/02/18_22:44:53	49	19.26	6	28.6	49	19.26	6	28.6	W		992.3	992.3	117	117	232	1	270	20	1.5	280	2	1013	200um plankton net	V
46	17/02/18_23:31:53	49	18.53	6	29.1	49	19.61	6	26.06	W	2.3	995.9	998.2	118	116	243	1	270	20	1.5	280	2	1013	Jackson monkfish trawl	I
47	18/02/18_02:12:53	49	18.48	6	30.12	49	18.8	6	27.09	W	2.1	1007.8	1009.9	119	119	341	0.5	270	15	1.5	280	2	1013	Jackson monkfish trawl	V
48	18/02/18_04:54:53	49	26.21	6	7.18	49	26.21	6	7.18	W		1027.3	1027.3	116	116	210	1.2	270	18	1.5	280	2	1012	200um plankton net	V

Stn.	Date_time shot	Shot Lat.		Shot Long.		Haul Lat.		Haul Long.		E/W	Dist. (nm)	Log (nm)		Depth (m)		Tide		Wind		Sea ht. (m)	Swell		Barom.	Gear	Val.
		Deg.	Min.	Deg.	Min.	Deg.	Min.	Deg.	Min.			Shot	Haul	Shot	Haul	Dir.	Spd.	Dir.	Spd.		Dir.	Ht. (m)			
49	18/02/18_06:03:53	49	25.34	6	9.79	49	24.08	6	12.19	W	2	1029.9	1031.9	116	115	73	1.3	270	18	1.5	280	2	1012	Jackson monkfish trawl	V
50	18/02/18_10:15:53	49	51.74	5	55.77	49	51.74	5	55.77	W		270	270	82	82	216	0.9	270	20	1	280	2.5	1012	200um plankton net	V
51	18/02/18_10:26:53	49	51.52	5	55.67	49	51.52	5	55.67	W		1066.3	1066.3	82	82	216	0.9	270	20	1	280	2.5	1012	ESM2 profiler/Niskin	V
52	18/02/18_11:17:53	49	51.13	5	56.92	49	53.3	5	53.71	W	3	1069.8	1072.8	83	76	237	0.9	270	10	1	280	2	1013	Jackson monkfish trawl	V
53	18/02/18_14:35:53	49	57.2	5	57.29	49	57.2	5	57.29	W		1084.3	1084.3	70	70	334	0.9	270	15	1	280	2	1013	200um plankton net	V
54	18/02/18_15:17:53	49	58.21	5	55.36	49	57.17	5	57.02	W	1.5	1088	1089.5	69	73	339	1.2	270	15	1	280	2	1013	Jackson monkfish trawl	V
55	18/02/18_17:49:53	49	54.65	5	39.2	49	54.65	5	39.2	W		1103.8	1103.8	79	79	117	0.1			0.7	300	2	1013	200um plankton net	V
56	18/02/18_18:19:53	49	54.5	5	41.34	49	54.94	5	43.52	W	1.5	1105.4	1106.9	78	79	73	0.4			0.7	300	1.5	1013	Jackson monkfish trawl	V
57	18/02/18_20:06:53	49	51.27	5	44.97	49	51.27	5	44.97	W		1113.2	1113.2	87	87	141	0.9			0.5	300	1.5	1013	200um plankton net	V
58	18/02/18_20:49:53	49	50.84	5	44.07	49	51.61	5	46.09	W	1.6	1116.3	1117.9	87	86	157	0.9	303	10	0.5	300	1.5	1013	Jackson monkfish trawl	V
59	18/02/18_22:34:53	49	48.86	5	48.15	49	48.86	5	48.15	W		1122.5	1122.5	86	86	211	0.8	270	10	0.5	300	1.5	1114	200um plankton net	V
60	18/02/18_22:49:53	49	48.69	5	48.07	49	48.69	5	48.07	W		1122.6	1122.6	87	87	216	0.7	270	10	0.5	300	1.5	1114	ESM2 profiler/Niskin	V
61	18/02/18_23:37:53	49	48.36	5	48.86	49	49.46	5	47.2	W	1.6	1125.7	1127.3	87	86	238	0.7	270	10	0.5	300	1.5	1114	Jackson monkfish trawl	V
62	19/02/18_02:35:53	49	42.34	5	22.98	49	42.34	5	22.98	W		1148.8	1148.8	90	90	308	1	270	10	1	280	1	1014	200um plankton net	V
63	19/02/18_03:37:53	49	42.61	5	22.24	49	41.15	5	18.54	W	2.8	1153.8	1156.6	91	94	337	0.9	270	18	1	280	1	1013	Jackson monkfish trawl	V
64	19/02/18_11:54:53	50	14.74	4	35.95	50	14.74	4	35.95	W		1209.8	1209.8	54	54	243	0.3	330	10	0.5	0	0	1013	200um plankton net	V
65	19/02/18_12:07:53	50	14.58	4	35.94	50	14.58	4	35.94	W		1210	1210	55	55	247	0.3	300	14	0.5	0	0	1013	ESM2 profiler/Niskin	V
66	19/02/18_13:38:53	50	14.13	4	37.93	50	14.76	4	35.79	W	1.6	1219.4	1221	51	50	251	0.4	300	14	0.5			1013	Jackson monkfish trawl	V
67	19/02/18_15:18:53	50	12.86	4	36.49	50	12.86	4	36.49	W		1227.3	1227.3	56	56	260	1.6	320	14	0.7			1013	200um plankton net	V
68	19/02/18_16:00:53	50	12.93	4	36.51	50	13.03	4	34.18	W	1.5	1229.8	1231.3	56	57	261	0.1	320	12	1			1013	Jackson monkfish trawl	V
69	19/02/18_18:21:53	50	6.52	4	22.94	50	6.52	4	22.94	W		1242.6		71		82	0.3	320	12	0.7			1010	200um plankton net	V
70	19/02/18_19:03:53	50	6.43	4	25.4	50	6.73	4	27.66	W	1.5	1244.4	1245.9	70	71	78	0.4			0.7			1012	Jackson monkfish trawl	V
71	19/02/18_21:41:53	50	0.83	4	24.07	50	0.83	4	24.07	W		1255.8	1255.8	74	74	67	0.2	330	16	0.7			1014	200um plankton net	V
72	19/02/18_23:38:53	50	0.51	4	23.61	50	0.97	4	25.78	W	1.5	1268	1269.5	72	72	247	0.2			0.7			1014	Jackson monkfish trawl	V
73	20/02/18_01:58:53	50	0.26	4	12.97	50	0.26	4	12.97	W		1284.4	1284.4	69	69	265	0.9	310	12	1	0	0	1015	200um plankton net	V
74	20/02/18_02:41:53	50	0.2	4	15.53	50	0.21	4	13.06	W	1.6	1288.1	1289.7	71	69	269	0.8	310	12	1	0	0	1015	Jackson monkfish trawl	V
75	20/02/18_04:38:53	50	2.58	4	4.17	50	2.58	4	4.17	W		1299.7	1299.7	71	71	286	0.9	310	12	0.7			1015	200um plankton net	V
76	20/02/18_04:46:53	50	2.51	4	4.27	50	2.51	4	4.27	W		1299.8	1299.8	71	71	286	0.8	310	12	0.7			1015	ESM2 profiler/Niskin	V
77	20/02/18_05:34:53	50	2.47	4	2.81	50	2.22	4	0.5	W	1.5	1302.3	1303.8	71	71	304	0.1	310	14	1			1014	Jackson monkfish trawl	V
78	20/02/18_08:29:53	50	10.08	4	8.72	50	10.08	4	8.72	W		1321.8	1321.8	64	64	262	0.9	330	24	1.2			1016	200um plankton net	V
79	20/02/18_09:17:53	50	9.78	4	7.15	50	10.09	4	9.49	W	1.5	1325.5	1327	65	63	108	0.8	310	26	1.2			1017	Jackson monkfish trawl	V
80	20/02/18_11:56:53	50	4.69	3	41.88	50	4.69	3	41.88	W		1348	1348	67	67	71	0.5	310	18	0.7			1018	200um plankton net	V
81	20/02/18_12:38:53	50	4.23	3	40.93	50	4.42	3	43.24	W	1.5	1351.3	1352.8	67	67	155	0.1	10	15	1.2			1018	Jackson monkfish trawl	V
82	20/02/18_15:34:53	50	16.2	3	29.46	50	16.2	3	29.46	W		1372	1372	53	53	209	0.7	10	16	1			1017	200um plankton net	V
83	20/02/18_15:47:53	50	15.79	3	29.72	50	15.79	3	29.72	W		1372.5	1372.5	53	53	209	0.9	10	18	1			1017	ESM2 profiler/Niskin	V
84	20/02/18_16:29:53	50	14.62	3	30.43	50	16.04	3	29.54	W	1.5	1375.7	1377.2	52	54	203	1	10	18	1			1017	Jackson monkfish trawl	V
85	20/02/18_18:54:53	50	18.43	3	12.58	50	18.43	3	12.58	W		1388.9		66		333	0.1	10	16	1			1012	200um plankton net	V
86	20/02/18_19:17:53	50	18.41	3	14.33	50	18.18	3	16.65	W	1.6	1390.2	1391.8	56	55	35	0.6	10	20	1			1012	Jackson monkfish trawl	V
87	20/02/18_22:24:53	50	9.39	2	47.64	50	9.39	2	47.64	W		1415.2		61		78	1.9	0	26	1			1017	200um plankton net	V
88	20/02/18_23:08:53	50	9.96	2	45.69	50	9.01	2	50.11	W	2.9	1419	1421.9	61	61	79	1.9	0	26	1	0	0	1017	Jackson monkfish trawl	V
89	21/02/18_02:00:53	50	18.94	2	51.34	50	18.94	2	51.34	W		1436.5	1436.5	53	53	131	0.2	20	22	0.7			1017	200um plankton net	V
90	21/02/18_02:39:53	50	18.59	2	50.29	50	19.9	2	52.67	W	3	1440	1443	53	53	235	0.5	20	22	0.7	0	0	1017	Jackson monkfish trawl	V
91	21/02/18_04:49:53	50	22.37	3	1.01	50	22.37	3	1.01	W		1450.5	1450.5	53	53	268	1.1	20	18	0.7			1018	200um plankton net	V
92	21/02/18_04:57:53	50	22.25	3	1.43	50	22.25	3	1.43	W		1450.8	1450.8	53	53	269	1.1	20	18	0.7			1018	ESM2 profiler/Niskin	V
93	21/02/18_05:44:53	50	22.62	2	59.35	50	23.08	2	57.12	W	1.5	1452.9	1454.4	53	53	276	0.9	20	18	0.7			1018	Jackson monkfish trawl	V
94	21/02/18_08:07:53	50	30.49	3	16.83	50	30.49	3	16.83	W		1471.8	1471.8	32	32	13	0.4	60	14	0.5			1019	200um plankton net	V
95	21/02/18_08:52:53	50	33.18	3	10.96	50	33.18	3	10.96	W		1476.8	1476.8	31	31	60	0.5	60	14	0.7			1019	200um plankton net	V
96	21/02/18_10:37:53	50	29.3	3	24.36	50	29.3	3	24.36	W		1491.2		25		42	0.6	150	10	0.7			1020	200um plankton net	V
97	21/02/18_11:27:53	50	29.59	3	23.53	50	29.9	3	21.24	W	1.8	1493.1	1494.9	25	25	57	0.5	80	10	0.7			1020	Jackson monkfish trawl	V
98	21/02/18_13:10:53	50	30.78	3	15.48	50	30.15	3	17.62	W	1.5	1500.8	1502.3	30	30	103	0.1	80	10	0.7			1020	Jackson monkfish trawl	V
99	21/02/18_15:06:53	50	32.05	3	12.44	50	32.88	3	10.54	W	1.5	1509.2	1510.7	29	28	223	0.4	90	6	0.7			1019	Jackson monkfish trawl	V

Stn.	Date_time shot	Shot Lat.		Shot Long.		Haul Lat.		Haul Long.		E/W	Dist. (nm)	Log (nm)		Depth (m)		Tide		Wind		Sea ht. (m)	Swell		Barom.	Gear	Val.
		Deg.	Min.	Deg.	Min.	Deg.	Min.	Deg.	Min.			Shot	Haul	Shot	Haul	Dir.	Spd.	Dir.	Spd.		Dir.	Ht. (m)			
100	21/02/18_19:31:53	49	52.2	3	1.35	49	52.2	3	1.35	W				72	72	196	0.3			0.5			1018	200um plankton net	V
101	21/02/18_19:52:53	49	52.06	3	1.55	49	52.06	3	1.55	W				71	71	197	0.3			0.5			1018	ESM2 profiler/Niskin	V
102	21/02/18_21:00:53	49	52.63	2	59.11	49	51.47	3	3.23	W	2.9	1558.9	1561.8	73	74	62	1	70	12	0.7			1017	Jackson monkfish trawl	V
103	22/02/18_00:22:53	49	35.08	2	54.59	49	35.08	2	54.59	W		1581.7	1581.7	75	75			90	22	1			1016	200um plankton net	V
104	22/02/18_01:37:53	49	35.66	2	53.94	49	33.36	2	55.45	W	2.5	1589	1591.5	73	72	334	0.8	90	18	1			1015	Jackson monkfish trawl	V
105	22/02/18_04:16:53	49	39.63	2	48.83	49	39.63	2	48.83	W		1602	1602	71	71	232	2.3	80	20	1.5			1015	200um plankton net	V
106	22/02/18_05:03:53	49	37.73	2	51.84	49	39.72	2	48.39	W	3	1606.8	1609.8	72	72	219	2.6	80	20	1.5			1015	Jackson monkfish trawl	V
107	22/02/18_12:24:53	50	14.3	2	24.51	50	14.32	2	27.1	W	1.7	1664.5	1666.2	62	61	85	2	80	20	0.7	60	2	1015	Jackson monkfish trawl	V
108	22/02/18_13:50:53	50	13.72	2	26.55	50	13.72	2	26.55	W		1667.9	1667.9	60	60	91	1.1	80	20	1.2	70	1.5	1015	200um plankton net	V
109	22/02/18_14:02:53	50	13.57	2	26.44	50	13.57	2	26.44	W		1668.1	1668.1	61	61	92	1	80	20	1.2	70	1.5	1015	ESM2 profiler/Niskin	V
110	22/02/18_15:57:53	50	27.61	2	26.35	50	27.61	2	26.35	W		1685.1	1685.1	46	46	256	2.5	80	12	1.2			1014	200um plankton net	V
111	22/02/18_16:55:53	50	27.39	2	28.56	50	27.47	2	26.21	W	1.6	1688.9	1690.5	46	45	253	3.1	80	10	1.2			1014	Jackson monkfish trawl	V
112	22/02/18_21:05:53	50	1.16	2	14.87	50	1.16	2	14.87	W		1720.9	1720.9	65	65	20	0	80	18	1			1013	200um plankton net	V
113	22/02/18_22:26:53	50	1.19	2	14.4	50	0.07	2	15.96	W	1.5	1726.5	1728	65	67	70	1	80	30	2	90	1.2	1014	Jackson monkfish trawl	V
114	23/02/18_01:45:53	49	43.64	2	31.45	49	43.64	2	31.45	W		4752	4752	71	71	35	1.5	80	20	1.5	90	1.5	1012	200um plankton net	V
115	23/02/18_01:53:53	49	43.72	2	31.49	49	43.72	2	31.49	W		1752.2	1752.2	72	72	35	1.5	80	20	1.5	90	1.5	1012	ESM2 profiler/Niskin	V
116	23/02/18_02:35:53	49	44.13	2	30.61	49	43.86	2	31.17	W	0.5	1754.8	1755.3	71	71	31	1	90	18	1.5	90	1.5	1012	Jackson monkfish trawl	I
117	23/02/18_07:24:53	49	40.66	2	29.05	49	42.53	2	28.22	W	2	1776.6	1778.6	67	70	220	2	90	20	1.5	90	1.5	1012	Jackson monkfish trawl	V
118	23/02/18_10:28:53	49	43.98	2	30.38	49	42.76	2	32.86	W	2	1793	1795	72	70	64	1	90	22	1.5	90	1.5	1010	Jackson monkfish trawl	I
119	23/02/18_12:19:53	49	43.58	2	30.86	49	42.69	2	32.73	W	1.5	1800.4	1801.9	71	70	225	23	90	24	1.2	90	1.2	1010	Jackson monkfish trawl	V
120	23/02/18_16:07:53	49	28.64	2	15.76	49	28.64	2	15.76	W		1822.4	1822.4	50	50	258	0.7	90	22	2	90	1.2	1009	200um plankton net	V
121	23/02/18_16:17:53	49	28.61	2	15.82	49	28.61	2	15.82	W		1822.5	1822.5	50	50	262	0.7	90	22	2	90	1.2	1009	ESM2 profiler/Niskin	V
122	23/02/18_16:56:53	49	28.79	2	15.21	49	29.39	2	13.24	W		1826.3		47	48	229	1	90	24	2	90	1.2	1009	Jackson monkfish trawl	I
123	23/02/18_22:56:53	49	10.36	3	3.49	49	10.36	3	3.49	W		1881	1881	73	73	112	1.4	90	26	1.7	90	1.2	1007	200um plankton net	V
124	24/02/18_00:02:53	49	10.29	3	4.31	49	10.43	3	6.58	W	1.6	1846.8	1848.4	73	74	84	0.7	90	26	1.7	90	1.2	1007	Jackson monkfish trawl	V
125	24/02/18_02:28:53	49	11.08	2	51.31	49	11.08	2	51.31	W		1861		64		304	1.1	100	16	1.5	90	1.5	1008	200um plankton net	V
126	24/02/18_02:33:53	49	11.14	2	51.5	49	11.14	2	51.5	W		1861.1		66		304	1.1	100	16	1.5	90	1.5	1008	ESM2 profiler/Niskin	V
127	24/02/18_12:49:53	49	1.53	2	30.4	49	1.53	2	30.4	W		1900.6	1900.6	52	52	69	0.3	90	20	1	90	1	1009	200um plankton net	V
128	24/02/18_14:03:53	49	2.06	2	31.01	49	1	2	29.53	W				52	50	350	0.5	90	18	1	90	1	1008	Jackson monkfish trawl	V
129	24/02/18_16:57:53	49	11.58	2	26.6	49	10.92	2	24.56	W	1.5	1925.8	1927.3	52	50	300	1	70	20	1.2	90	1	1008	Jackson monkfish trawl	V
130	24/02/18_18:55:53	49	11.24	2	26.9	49	11.24	2	26.9	W		1933.9	1933.9	51	51	251	0.3	70	22	1.5	90	1	1010	200um plankton net	V
131	25/02/18_01:43:53	49	18.18	4	20.94	49	18.18	4	20.94	W				93	93	96	0.2	90	24	2	90	2	1011	CTD dip	V
132	25/02/18_02:27:53	49	17.78	4	20.18	49	16.25	4	23.71	W	2.7	2013.6	2016.3	93	94	226	0.2	90	24	2	90	2	1011	Jackson monkfish trawl	I
133	25/02/18_11:22:53	48	47.24	4	27.22	48	47.24	4	27.22	W		2060.7	2060.7	98	98	76	1.4	80	30	2	90	2	1014	200um plankton net	V
134	25/02/18_11:39:53	48	47.27	4	27.06	48	47.27	4	27.06	W		2061.1	2061.1	97	97	76	1.4	80	30	2	90	2	1014	ESM2 profiler/Niskin	V
135	07/03/18_21:24:53	50	5.81	4	34.26	50	5.81	4	34.26	W		8.6	8.6	73	73	73	0.3	270	30	1	250	1	988	200um plankton net	V
136	07/03/18_21:49:53	50	6.28	4	33.57	50	6.28	4	33.57	W		9.2	9.2	74	74	72	0.3	270	30	1	250	1	988	ESM2 profiler/Niskin	V
137	07/03/18_23:04:53	50	5.45	4	34.28	50	5.35	4	36.63	W	1.5	16.8	18.3	75	74	62	0.1	270	30	1	250	1	986	Jackson monkfish trawl	V
138	08/03/18_01:42:53	50	2.59	4	39.87	50	2.28	4	37.58	W	1.5	26.7	28.2	75	74	221	0.4	270	28	1.5	250	1.5	987	Jackson monkfish trawl	V
139	08/03/18_05:03:53	49	41.02	4	31.47	49	41.02	4	31.47	W		52.1	52.1	83	83	266	0.2	270	28	2	250	2	987	CTD dip	V
140	08/03/18_05:51:53	49	41.09	4	31.27	49	40.86	4	35.5	W	2.7	54.7	57.4	85	86	275	0	270	28	2	250	2	988	Jackson monkfish trawl	V
141	08/03/18_09:33:53	49	36.17	4	40.07	49	35.98	4	44.67	W	3	72.6	75.6	91	91	71	1.1	270	24	2	250	2.2	991	Jackson monkfish trawl	V
142	08/03/18_13:35:53	49	15.77	4	36.17	49	15.77	4	36.17	W		102.1	102.1	95	95	241	1	270	16	1.5	290	2	994	ESM2 profiler/Niskin	V
143	08/03/18_16:34:53	49	15.71	4	36.23	49	16.34	4	34.17	W	1.5	117.6	119.1	95	96	274	0.3	270	12	1.5	290	1.7	994	Jackson monkfish trawl	V
144	08/03/18_18:59:53	49	19.17	4	19.46	49	17.59	4	23.42	W	3.1	132.4	135.5	91	94	64	0.4			0.7	290	1.2	996	Jackson monkfish trawl	V
145	08/03/18_00:02:53	49	6.76	3	31.98	49	6.76	3	31.98	W		173.1	173.1	81	81	309	0.1	140	8	1	290	1	996	200um plankton net	V
146	09/03/18_00:09:53	49	6.78	3	31.94	49	6.78	3	31.94	W		173.2	173.2	80	80	286	0.3	140	8	1	290	1	996	ESM2 profiler/Niskin	V
147	09/03/18_02:04:53	49	5.71	3	36.38	49	6.72	3	32.07	W	3	185.2	188.2	79	79	261	0.9	140	14	0.7	290	1	996	Jackson monkfish trawl	V
148	09/03/18_05:58:53	48	56.06	3	33.08	48	56.06	3	33.08	W		204.6	204.6	73	73	180	0	140	14	0.7	290	1	994	CTD dip	V
149	09/03/18_07:02:53	48	55.95	3	33.59	48	55.95	3	35.86	W	1.5	210.3	211.8	74	75	69	0.5	140	12	0.7	290	0.7	993	Jackson monkfish trawl	V
150	09/03/18_11:09:53	48	47.29	4	27.09	48	47.29	4	27.09	W		246.9	246.9	97	97	100	0.1	14	16	0.7	270	0.7	990	ESM2 profiler/Niskin	V

Stn.	Date_time shot	Shot Lat.		Shot Long.		Haul Lat.		Haul Long.		E/W	Dist. (nm)	Log (nm)		Depth (m)		Tide		Wind		Sea ht. (m)	Swell		Barom.	Gear	Val.
		Deg.	Min.	Deg.	Min.	Deg.	Min.	Deg.	Min.			Shot	Haul	Shot	Haul	Dir.	Spd.	Dir.	Spd.		Dir.	Ht. (m)			
151	09/03/18_12:09:53	48	47.07	4	28.54	48	47.41	4	26.29	W	1.5	251.5	253	97	96	249	0.5	140	16	0.7	270	0.7	989	Jackson monkfish trawl	V
152	09/03/18_15:12:53	49	3.89	4	23.08	49	3.89	4	23.08	W		274.6	274.6	96	96	266	0.8	200	26	1.5	200	1	988	200um plankton net	V
153	09/03/18_16:02:53	49	3.86	4	23.46	49	4.09	4	22.44	W	0.7	277.6	278.3	96	95	267	0.7	200	26	1.5	200	1	988	Jackson monkfish trawl	I
154	10/03/18_00:52:53	49	11.68	4	26.17	49	12.63	4	21.81	W	3.1	318	321.1	95	94	185	0	180	18	1.2	200	1	985	Jackson monkfish trawl	V
155	10/03/18_05:32:53	49	13.91	4	56.49	49	13.91	4	56.49	W		348.2	348.2	103	103	258	0.4	160	25	1.5	170	1.5	982	200um plankton net	V
156	10/03/18_05:40:53	49	14.1	4	56.63	49	14.1	4	56.63	W		348.4	348.4	103	103	259	0.3	160	25	1.5	170	1.5	982	ESM2 profiler/Niskin	V
157	10/03/18_09:13:53	49	13.58	4	59.08	49	12.81	5	0.02	W	1	366.7	367.7	105	106	60	0.6	180	33	2	170	2	982	Jackson monkfish trawl	V
158	10/03/18_15:21:53	49	27.63	5	40.72	49	29.21	5	37.75	W	2.5	415.9	418.4	108	106	247	0.5	230	22	1.7	225	3	985	Jackson monkfish trawl	V
159	10/03/18_17:38:53	49	27.85	5	40.59	49	27.85	5	40.59	W		423.9	423.9	107	107	279	0.2	180	16	1.7	225	3	986	200um plankton net	V
160	10/03/18_17:53:53	49	27.82	5	40.68	49	27.82	5	40.68	W		424	424	107	107	277	0.2	180	16	1.7	225	3	986	ESM2 profiler/Niskin	V
161	11/03/18_00:14:53	50	32.41	5	26.82	50	32.41	5	26.82	W		499.7	499.7	66	66	74	0	140	18	1.5	225	1	984	200um plankton net	V
162	11/03/18_00:20:53	50	32.47	5	26.71	50	32.47	5	26.71	W		499.8	499.8	66	66	82	0.1	140	18	1.5	225	1	984	ESM2 profiler/Niskin	V
163	11/03/18_00:56:53	50	32.27	5	29.01	50	31.45	5	30.98	W	1.5	501.7	503.2	68	68	150	0.1	160	10	1	225	1.2	984	Jackson monkfish trawl	V
164	11/03/18_04:34:53	50	41.5	5	4.13	50	41.5	5	4.13	W		529	529	60	60	285	0.1	140	10	1	225	1.2	982	200um plankton net	V
165	11/03/18_04:39:53	50	41.54	5	4.15	50	41.54	5	4.15	W		529	529	59	59	295	0.1	140	10	1	225	1.2	982	ESM2 profiler/Niskin	V
166	11/03/18_05:15:53	50	41.18	5	4.39	50	40.23	5	6.22	W	1.5	531.3	532.8	59	60	351	0.1	140	12	1	225	1.2	982	Jackson monkfish trawl	V
167	11/03/18_09:59:53	50	29.51	5	7.39	50	28.55	5	7.85	W	1	557.5	558.5	43	41	54	0.3	80	30	1	240	1.2	977	Jackson monkfish trawl	V
168	11/03/18_15:43:53	51	9.24	4	46.02	51	9.73	4	43.78	W	1.5	611.6	613.1	44	49	241	0.6	120	14	1	240	1.2	976	Jackson monkfish trawl	V
169	11/03/18_19:34:53	51	31.97	5	19.43	51	31.97	5	19.43	W		647.4	647.4	60	60	146	0.3	120	16	1	240	1.7	977	200um plankton net	V
170	11/03/18_19:46:53	51	32.03	5	19.61	51	32.03	5	19.61	W		647.5	647.5	59	59	146	0.3	120	16	1	240	1.7	977	ESM2 profiler/Niskin	V
171	11/03/18_20:45:53	51	31.33	5	17.71	51	31.95	5	19.95	W	1.5	653.2	654.7	60	69	138	0.7	120	18	1	240	2	977	Jackson monkfish trawl	V