

RESEARCH VESSEL SURVEY REPORT

RV CEFAS ENDEAVOUR
Survey: CEND 4/23.

STAFF:

Part 1 (21 March – 1 April)		Part 2 (1 -16 April)	
Name	Role	Name	Role
Ian Holmes	SIC	<i>Day shift (midday-midnight)</i>	
Georgina Eastley	2IC/Deckmaster	Ian Holmes	SIC
Matt Eade	2IC/Deckmaster	Linford Mann	Deckmaster
Bryan Goodsir Thompson	Marine Ops	Mary Brown	Benthic sampler
Georgia Robson	Sampler	Joanna Ford	Sampler
Tom Woods	Sampler	Axa Molina-Ramirez	Marine Ops
Hayden Close	Benthic sampler	Richard Buck	Sampler
Molly Meadows	Sampler	Kathrin Vossen	Genetics
Kathrin Vossen	Genetics		
		<i>Night shift (midnight to mid-day)</i>	
Ben Hatton (Joined 26/3)	SIC	Ben Hatton	SIC
Joanna Ford (Joined 26/3)	Sampler	Georgina Eastley	Deckmaster
		Gary Burt	Benthic sampler
		Charlotte Reeve	Sampler
		Lisa Readdy	Sampler
		Rose Finneran	Sampler
		Thomas Power (Irish Observer)	Observer

DURATION: 21 March – 16 April 2023 (27 days, 23 days at sea)

LOCATION: Western Channel and Celtic Sea (ICES areas 27.7.e-j)

AIMS:

PRIMARY:

- 1) To carry out a beam trawl survey of the Celtic Sea, south-western Approaches and Western Channel, deploying standardised 4m beam trawls (x2) and water column profiler. Station selection will be based on a fully random stratified approach with gears deployed at each station where appropriate.

Catches from the trawls will be processed to obtain information on:

- Distribution, size composition and relative abundance of fish, cephalopods, and benthic invertebrates.
- Biological parameters of selected species.
- Distribution and classification of anthropogenic debris.

The data obtained from processing the trawl catches is collected in support of the UK fisheries data collection (previously the EU DCF) and will be submitted to ICES working groups and will also support other Cefas biological studies.

- 2) Genomic sampling of selected fish species to study population genomics as part of the Defra project C8503 to improve the methodology to assess finfish, pelagic, data-limited, and non-quota stocks. (D Murray – Cefas, Lowestoft).
- 3) Collect additional data from dead skates and rays (males: testes weight and outer clasper length; females: ovary weight and shell gland width) and collect a section of vertebral column comprising ca. 6-8 vertebrae from that part overlying the body cavity; samples to be kept frozen - as part of Defra project C8503 to improve the methodology to assess finfish, pelagic, data-limited, and non-quota stocks . (J Ellis – Cefas, Lowestoft).

SECONDARY:

- 4) Collect multibeam data throughout the survey.
- 5) To collect full depth, conductivity, temperature, and depth profiles at each trawl station alongside surface and near-bottom water samples.
- 6) To continuously log sub-surface (3m) salinity, temperature, fluorometry and other environmental data using the 'Ferrybox'. Collect, retain and filter surface water samples from Ferrybox underway water supply every 12 hours (or once a day) for subsequent chlorophyll sampling in support of SLA25 (Naomi Greenwood).
- 7) To record details of surface sightings of any marine mammals, sea turtles and large pelagic fish, and record observations on jellyfish aggregations (Sea Watch Foundation).

- 8) Collect water samples for caesium & tritium analysis under SLA22 (T Bailey – Cefas, Lowestoft).
- 9) To collect biological samples and information for greater weever *Trachinus draco* as part of a Cefas study on species growth and biology. (S Barnett – Cefas, Lowestoft).
- 10) To collect King Scallop *Pecten maximus* shell height/weight information along with the collection of shell (flat side) for subsequent ageing and growth studies (J Harvey – Cefas, Lowestoft).
- 11) Collect queen scallops (queenies) *Aequipecten opercularis* to allow for experimental work on ageing, for L/W relationship analysis, development of length to height parameters and, to provide specimens to Bangor University for further work which will be made available to ICES WGScallop (J Harvey - Cefas, Lowestoft).
- 12) To collect samples of whelk *Buccinum undatum* where caught in reasonable quantities (5 kg sample size). Bag and freeze samples for subsequent analysis at Cefas. (J Harvey - Cefas, Lowestoft).
- 13) To collect specimens of pink cuttlefish *Sepia orbignyana* and elegant cuttlefish *Sepia elegans* to further Cefas studies. Collect specimens of European common squid *Alloteuthis subulata* over the survey area – 10 samples of 5 squid each. Additionally, collect *Loligo* egg masses where found in reasonable quantities, and take photos of any common octopus *Octopus vulgaris* where encountered. (V Laptikhovsky – Cefas, Lowestoft).
- 14) To recover the lost Cefas beam trawl (from 2021) located off the French Coast north of Brest.

OPPORTUNISTIC:

- 15) Tag and release specimens of starry smooth-hound *Mustelus asterias*, spurdog *Squalus acanthias*, tope *Galeorhinus galeus*, common skate complex, blonde ray *Raja brachyura* and cuckoo ray *Leucoraja naevus*, in support of the ICES Working Group for Elasmobranch Fishes work to inform on stock units for demersal elasmobranchs. (J Ellis – Cefas, Lowestoft)
- 16) To retain any dead specimens of tope and common skate complex for biological studies. (J Ellis – Cefas, Lowestoft).
- 17) Collect specimens of rare or unusual species (where dead) for ID verification purposes in the laboratory including specimens of eelpout (*Zoarces*, *Lycodes* and *Lycenchelys*), as well as collection of length-weight measurements where still required or the rare species (J Ellis - Cefas – Lowestoft).

- 18) All diadromous species (including allis shad *Alosa alosa*, twaite shad *Alosa fallax* and lampreys (*Petromyzontidae*)) found dead on capture are to be frozen and returned to the lab for analyses, marking samples with the survey, station, and date to support DiadES project. (T Basic – Cefas, Lowestoft)
- 19) Collect a vertical ring net sample at the west Gabbard smartbuoy, contributing to the Lifeform project (Defra) as part of the UK monitoring network for zooplankton.
- 20) Collect isopod parasites from specimens of black seabream *Spondyliosoma cantharus*, European seabass *Dicentrarchus labrax* etc. when seen, photograph in situ and freeze the isopod. (P Barry – Cefas, Lowestoft)

NARRATIVE: (All times are GMT)

Note : A number of randomly selected stations were fished in each stratum. For this report for example, site 5(2) would represent Station 2 in Stratum 5.

An advance party of Cefas scientists arrived at 1500hr, 19 March with the remaining staff arriving the following day. All scientists and crew undertook a COVID-19 lateral flow tests (LTF) producing negative results prior to travel. Prior to sailing, safety inductions and emergency drills took place. Toolbox talks for gear deployment and catch sorting and sampling took place prior to sailing.

RV “Cefas Endeavour” (henceforth referred to as CEND 4/23) sailed at 1548hr 21 March and headed to the nearest sampling location to carry out a shakedown tow and ESM2 deployment. west Gabbard smart-buoy location at site 4(C). Beam trawl deployment at this location began at 0833hr and was successful with small quantities caught in both gears. A successful ESM2 deployment was carried out at 2153hr and following this, CEND 4/23 began the journey south to the western Channel to a position just off Falmouth where sea conditions looked to be the most workable. Progress over night was slow and with an ETA at the planned location expected to be late afternoon, and with less severe sea conditions being encountered in the approach to Mounts Bay, an alternative starting location there was selected.

Work on 22 March began at location 5(2) with an ESM2 deployment and was followed by four successful beam trawl deployments in stratum 2 and 8 all yielding small catches with sole *Solea solea* being the primary species caught. Work started in earnest the following morning with scientific staff adopting a split-shift work pattern and work commencing at 0548hr in stratum 13 south of Falmouth where two sampling locations were completed yielding small catches once again. At the third station of the day off Falmouth, the tow was hauled at 1.73nm following concern that the gear had sustained damage, but upon hauling no damage was observed. Survey operations were suspended at 1210hr following discovery of a problem with the starboard towing block, and CEND 4/23 headed into Falmouth, docking at 1450hr that day to undergo the necessary repairs. Whilst in port, two extra scientific staff were enlisted and a 24/7 working pattern adopted in an attempt to catch up for the lost time.

Following completion of these repairs, CEND 4/23 sailed again at 1100hr 27 March and headed directly to the nearest unfished sampling location within stratum 3. At the first location at 3(6), no tow was possible due the presence of commercial static gear and nearby fish farms. At 1506h, the tow at location 3(3) was successfully fished yielding small catches and a further 4 successful tows were completed before midnight all in stratum 3 and 4.

On 28 March, work began offshore in stratum 7 before heading inshore to complete stations in stratum 4 during daylight hours. A total of 10 stations were successfully completed through the day, with catches generally small and clean comprising mainly sole, plaice *Pleuronectes platessa*, whiting *Merlangius merlangus* and common cuttlefish *Sepia officinalis*. The following day work began offshore in stratum 7 before heading closer inshore again for first light before heading back offshore to begin the journey south into the French EEZ. A total of 10 successful tows were again completed on this day in stratum 7, 4 and ending in stratum 6 with our first tow in French water taking place at 1634hr at sampling location 9(6). Catch remained light yield ~1 box per gear at most stations apart from sampling location 7(1) which yielded ~7 boxes of sand and shell.

At first light on 30 March, work commenced in stratum 11 to the east of Guernsey, yielding several boxes of broken shell, spider crabs *Maja brachydactyla* and lesser spotted dogfish *Scyliorhinus canicula*. This proved to be the largest catch of spider crab encountered on the survey with ~200 kg caught in the starboard gear and another 100 kg+ in the port gear. The following tow at 11(2) was shortened to 1.19nm due to the presence of static gear, and the third tow was shortened to 1.26nm due to rough ground. The last tow of the day was at 10(3) which was checked for static gear before daylight was lost and shot in darkness. This yielded our first large catch of common brittlestars *Ophiothrix fragilis* with over 12 boxes caught between the two gears.

With poor weather arriving from the west, CEND 4/23 took shelter at the southern end of stratum 11 close to the French coast. With the strong likelihood of encountering static gear, work did not commence until first light 31 March with two tows successfully being completed but both had a reduced tow length due to the poor ground encountered. A third tow was attempted at sampling location 11(1) but no suitable ground could be located and was abandoned. Further work was not possible due to poor sea conditions, so the decision was taken to suspend work and head to Portland for the mid-survey break. CEND 4/23 docked in Portland at 0648hr, 1 April and fresh food supplies were taken aboard, and a change of scientific staff took place.

CEND 4/23 sailed from Portland at 1848hr the same day and headed to the eastern end of Lyme Bay. At sampling location 11(3) a short snouted seahorse *Hippocampus hippocampus* was caught, one of only 2 on the entire survey (Figure 1). Both specimens caught were weighed and released back into the sea immediately.



Figure 1: A short-snouted seahorse *Hippocampus hippocampus* caught at sampling location 11(3).

On 2 April, work recommenced at 0541hr at sampling location 5(4) west of Portland, where the tow was hauled at 1.7nm due to a peak observed on the sounder. The remainder of the daylight hours were spent completing a further six stations in the inshore waters of Lyme Bay where the catches were generally small (~1-2 boxes from each gear) but contained good quantities of both sole and plaice. Sampling location 5(7) was fished for a reduced tow length of 1.1nm due to the presence of commercial static gear. The remainder of the day was spent offshore fishing one further sampling location at 5(5) before heading south overnight to a position east of Alderney.

At first light 3 April, two tows were successfully fished to the east of Alderney working in strong tides and on rough ground and as a result, the second tow at 11(8) was fished for just 1.55nm. Following completion, CEND 4/23 headed west to a position west of Guernsey where one tow was fished yielding ~2 boxes from each gear comprised mainly of common starfish *Asterias rubens*. The next two tows were located around the Hurd Deep and these yielded anglerfish *Lophius piscatorius*, scallops and common starfish. A small detour was undertaken over the deepest part of the Hurd Deep in order to collect a water sample for the analysis of caesium and tritium by Cefas colleagues. The final three stations of the day were located within stratum 10 to the south of the Hurd Deep. These yielded large quantities of queen scallop and brittlestars.

On 4 April, work began at first light close to the French coast at sampling location 10(6), where a tow of 1.01nm was completed due to sets of static gear being shot whilst we were towing. At this tow, a 22 cm (180 g) couch's seabream *Pagrus pagrus* was found in the starboard catch, a rare record on Cefas surveys (Figure 2). The main component of the catch at this location was hornwrack *Flustra foliacea*. The following two tows within the same stratum yielded large catches of brittlestars with the catch at sampling location 10(7) being ~43 baskets between the two gears and led to the catch being sorted on the deck. Following these tows, CEND 4/23 headed west along the French coast into stratum 12 where at sampling location 12(3) a short

tow (1.02nm) was fished with the gear hauled early due to poor ground. This tow yielded large quantities of sponge *Porifera*, football ascidian *Diazona violacea* and rock along with a large common octopus weighing 2.26 kg (Figure 3). At the following sampling location at 12(5) no tow was possible, and the location was abandoned.



Figure 2: A couches seabream *Pagrus pagrus*, caught at sampling location 10(6).



Figure 3: A common octopus *Octopus vulgaris* caught at sampling location 12(3).

CEND 4/23 headed offshore to work south of the Hurd Deep with two successful tows completed in stratum 9 where large quantities of spiny starfish *Marthasterias glacialis* were observed. Following this, two further tows in stratum 13 were completed but it was subsequently found that at the second of these tows at location 13(4), a tear along the selvedge of the starboard gear rendered this tow invalid.

At 1130hr 5 April, survey operations were paused at the location where a beam trawl was lost during the 2021 survey (CEND 5/21) off the coast of France north of Brest. Work to locate the beam began with some multi-beam passes over the original tow. With no obvious signals on the multi-beam, attention switched to using a high-definition drop camera (Figure 4) and after several parallel tracks along the original tow, the beam was spotted on the seabed at ~1530hr. The location was logged but the actual location of the beam was uncertain as the deployed drop camera was being taken aft due to the tide. Several further attempts to locate the beam using the drop camera were made once the tide conditions had eased but these failed to find it again. One attempt to recover the beam was made by towing a grapple over the anticipated location but to no avail. At 2030hr 5 April, attempts to locate and recover the lost beam trawl were abandoned and CEND 4/23 steamed offshore to resume survey operations.

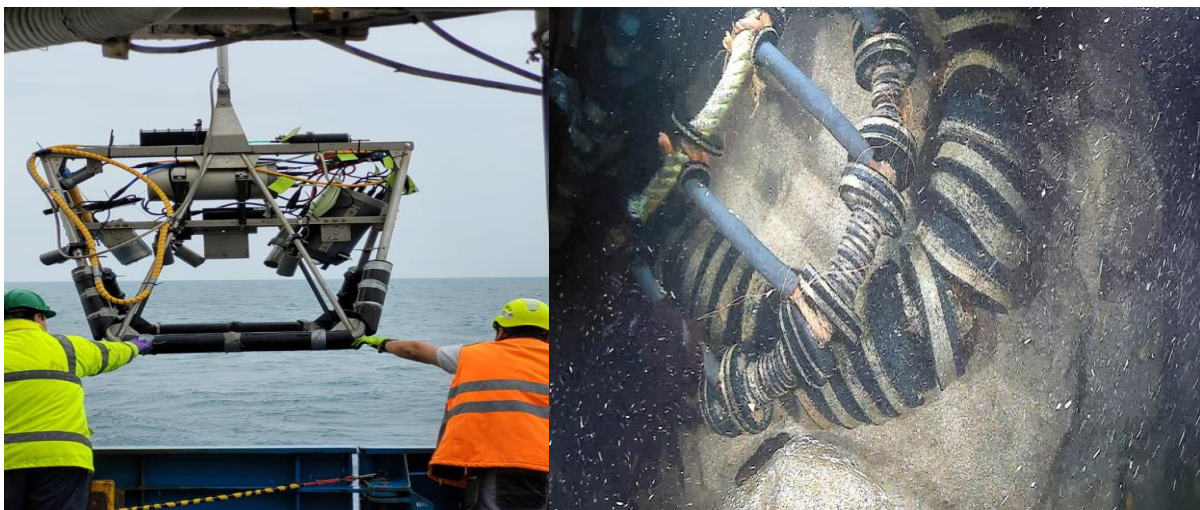


Figure 4: Deployment of the high-definition drop camera with an image of the lost beam observed on the seabed.

Fishing resumed at 2358hr at sampling location 12(4) and two further offshore locations were successfully sampled yielding sponge, edible sea-urchins *Echinus esculentus* and weed along with monkfish and conger eel *Conger conger*. By sunrise, CEND 4/23 was back inshore off the French coast working at sampling location 12(2) where a shortened tow of 1.8nm was completed due to concern over the tension on the warps. Following completion, CEND 4/23 headed into stratum J where sampling location J(3) was completed. A long steam through the inshore traffic zone north-east of Brest to location J(5) resulted in no tow as the ground was deemed inappropriate to tow over. A successful tow was completed further south at J(1) before heading briefly into stratum N to fish one station. This tow yielded in excess of 11 boxes (combined catch) mainly consisting of sand, meaning a long sorting time was required. This meant that the next station at J(7) was dropped as a timed arrival at the following location of K2 was required as it was positioned close to the TSS and between cables so had to be fished with a particular tide direction.

On 7 April, the day was spent working in stratum K around the TSS to the west of Brest with a total of 6 tows successfully completed. At sampling location K(1), a small hole was found in the port gear codend rendering that catch as invalid, but the starboard catch was valid, and the catch was fully processed with observations from the port gear taken only. The location was not re-fished and sampling location K(5) was added to the stations to be fished. On the following day, the final sampling location in the French EEZ were completed at 0642hrs at H(1).

Following this, the decision was taken to head back into the western Channel to complete the remaining priority sampling locations ahead of period of expected poor weather and sea conditions that would be upon us in the coming days.

Work began the following day offshore in stratum 8 at sampling location 8(4) with a successful tow and this was followed by a further 5 successful tows all offshore within stratum H, 8 and 13. At first light 9 April, work in Mounts Bay recommenced at sampling location 2(4) and was followed by a successful tow at sampling location 2(1) to the west of Wolf Rock. Following this, CEND 4/23 moved to a position to the north of the Isles of Scilly where three successful tows were completed before the hours of darkness. Catches at these stations were ~2-3 boxes in each gear and consisted mainly of edible sea-urchins, dead-man's fingers *Alcyonium digitatum*, with sole and lemon sole *Microstomus kitt* being the major fish species caught.

Overnight, two nearby offshore stations in the Celtic Sea were fished in stratum E and F, before heading to a position to the south of the Isles of Scilly for first light to ensure the tide was in the correct direction to fish a station located in the east to west flow of the TSS. This was completed at 0715hr before moving to the final two sampling locations to be fished in the western Channel in stratum 1. Following the successful completion of these at 1059hrs, the beams were brought aboard and CEND 4/23 headed to an anchorage position in the sheltered area in Falmouth Bay to await the passing of the expected poor weather, anchoring at 1720hr, 10 April.

With the worst of the poor weather having passed and sea conditions expecting to have calmed, the vessel left its anchorage position at 0600hr, 13 April and made passage to a sampling location in stratum C off the north Cornish coast. Work commenced here at 1315hrs the same day with a successful tow yielding ~3 boxes of catch in each gear with the major component being spiny starfish. A long steam followed to a position off the south Wales coast at sampling location C(2) arriving at 1927hrs and after a successful tow, a 5 further sampling locations in stratum B, D and F were successfully fished without incident, with small catches (~1 box in each gear) caught at each location.

At 1241hr, 14 April, survey operations ceased and CEND 4/23 began the long journey back to Lowestoft. During the journey, scientists completed the clean down, gear dismantling and packing and data checks. On route, a small detour was made in order to collect a plankton sample at the West Gabbard smart buoy location, and this was collected at 2123hr, 15 April. The Cefas Endeavour docked in Lowestoft at 0604hr, 16 April and unloading took place later that day and on the following day.

RESULTS BY AIM:

This western Channel part of the survey routinely takes place in March each year and since 2013, the survey has been extended into the Celtic Sea. Each survey sampling location was sampled with 2 x 4 m beam trawls. Twice a day, an ESM2 and Niskin water sampler was deployed, and this was generally carried out at the beginning and end of each working day. The survey initially operated long days with two cross-over teams in the western Channel before switching to 24/7 operations after the extended port visit and when working in the Celtic Sea to cater for the loss of survey days and then the longer steams between stations. Inshore stations were scheduled to be worked in daylight hours so that commercial static gear could be seen and avoided.

The fishing gear used on this survey were the (survey) standard 4 m-beam trawls (number 5) with chain mat, flip-up ropes and the net was fitted with a 40 mm cod-end liner and 3m cod-end extension (starboard side), and the same gear (number 1) but without the 40 mm cod-end liner on the port side. Beam number 2 was taken as a spare.

All fish, cephalopod and selected commercial shellfish were identified to species, weighed, and measured with large catches of an individual species being sub-sampled. A SAIV mini CTD unit was attached to the headline on the starboard 4m-beam trawl to record the temperature and salinity depth profile at each station fished. At two locations each day, a surface salinity sample was taken simultaneously with a Niskin bottom water sample and an ESM2 logger profile. Additionally, a SAIV mini CTD unit was used to obtain a sound velocity profile (SVP) for calibration of the multibeam when required.

All catch details and sample data were entered directly into the fisheries Electronic Data Capture (EDC) system and uploaded directly into the Fishing Survey System (FSS). Station details were manually entered into the FSS using information collected from the Electronic Chart Display Information System (ECDIS) bridge logging system and bridge logbook.

PRIMARY AIMS:

- 1) To carry out a beam trawl survey of the Celtic Sea, south-western Approaches and Western Channel, deploying standardised 4m beam trawls (x2) and water column profiler. Station selection will be based on a fully random stratified approach with gears deployed at each station where appropriate.*

A Total of 77 out of 81 planned tows in the western Channel survey area were successfully fished along with 22 out of a planned 50 tows in the Celtic Sea. The reduced days working on the survey (4 days in port and ~days due to poor weather) led to the loss of 4 tows in the western Channel and 28 tows in the Celtic Sea. However, following survey protocol of completing stations in numerical order reduces the number of valid tows in the Celtic Sea to 18 valid tows, with the remaining 4 tows to be considered as 'additional'. The locations not worked in the western Channel were in stratum 5, 10, 12 and 13, with one station missed from each. The loss of survey working days meant that CEND 4/23 was unable to work in the western areas of the Celtic Sea and work was concentrated in the French EEZ and in the Bristol

Channel sea areas. Table 1 shows the total number of beam trawl deployments by validity and area. Table 2 shows the survey sampling achievement by stratum along with the initial targets for the survey.

Table 1: 4m Beam trawl deployments by validity and area (V = Valid; I = Invalid; A = Additional)

Area	Gear	Validity	Number of Deployments
Western Channel	4m Beam Trawl with blinder	V	77
Western Channel	4m Beam Trawl with blinder	A	1
Celtic Sea	4m Beam Trawl with blinder	V	22
Western Channel	4m Beam Trawl without blinder	V	77
Western Channel	4m Beam Trawl without blinder	A	1
Celtic Sea	4m Beam Trawl without blinder	V	21
Celtic Sea	4m Beam Trawl without blinder	I	1

Table 2: Target achievement by survey stratum.

Stratum	Area	Target	Achievement	Comments
1	Western Channel	5	5	All valid
2	Western Channel	5	5	All valid
3	Western Channel	5	5	All valid
4	Western Channel	10	10	All valid
5	Western Channel	8	7	All valid – but 1 station missed
6	Western Channel	5	5	All valid
7	Western Channel	6	6	All valid
8	Western Channel	5	5	All Valid
9	Western Channel	5	5	All valid
10	Western Channel	9	8	All valid – but 1 station missed
11	Western Channel	7	7	All valid
12	Western Channel	5	4	All valid – but 1 station missed
13	Western Channel	6	5	All valid – but 1 station missed
B	Celtic Sea	5	1	0 valid, 1 additional (out of sequence) – 4 missed
C	Celtic Sea	5	3	3 valid – 2 missed
D	Celtic Sea	5	3	3 valid – 2 missed
E	Celtic Sea	5	1	0 valid, 1 additional (out of sequence) – 4 missed
F	Celtic Sea	5	2	0 valid, 2 additional (out of sequence) - 3 missed
G	Celtic Sea	5	0	No successful tows
H	Celtic Sea	5	3	3 valid – 2 missed
J	Celtic Sea	5	3	3 valid – 2 missed
K	Celtic Sea	5	5	All valid
N	Celtic Sea	5	1	1 valid – 4 missed
	Total	131	99	95 valid, 4 additional (out of sequence), 32 missed

The total sampled and non-sampled catches of each species caught on the survey using the 4m beam trawls are shown in Tables 3 and 4. The numbers of biological sample collections are shown in Table 5. A total of 112 species were observed and measured on the survey, compared to 108 observed in 2022 and the 120 species observed in 2021, based on 99, 66 and 110 successful tows in each year respectively.

Table 3: Total catch of sampled species, ordered by size of total catch.

Common Name	Scientific Name	CEFAS code	Sampled weight (kg)	Catch weight (kg)
Great spider crab	<i>Maja brachydactyla</i>	SCR	798.354	798.354
Lesser spotted dogfish	<i>Scyliorhinus canicula</i>	LSD	439.844	439.844
Anglerfish (monk)	<i>Lophius piscatorius</i>	MON	334.655	334.892
Queen scallop	<i>Aequipecten opercularis</i>	QSC	52.790	315.979
Common cuttlefish	<i>Sepia officinalis</i>	CTC	272.633	274.257
Poor cod	<i>Trisopterus minutus</i>	POD	191.877	198.454
European plaice	<i>Pleuronectes platessa</i>	PLE	147.569	147.569
Sole (dover sole)	<i>Solea solea</i>	SOL	146.939	146.939
European conger eel	<i>Conger conger</i>	COE	140.195	140.195
Whiting	<i>Merlangius merlangus</i>	WHG	139.930	139.930
Whiting-pout (bib)	<i>Trisopterus luscus</i>	BIB	134.723	138.839
Great scallop	<i>Pecten maximus</i>	SCE	113.045	113.371
Starry smooth hound	<i>Mustelus asterias</i>	SDS	94.128	94.128
Red gurnard	<i>Aspitrigla (chelidonichthys) cuculus</i>	GUR	93.077	93.503
Megrim	<i>Lepidorhombus whiffiagonis</i>	MEG	79.754	79.754
Common dragonet	<i>Callionymus lyra</i>	CDT	72.628	72.991
Boar fish	<i>Capros aper</i>	BOF	52.431	72.820
Black-bellied anglerfish	<i>Lophius budegassa</i>	WAF	72.327	72.327
Haddock	<i>Melanogrammus aeglefinus</i>	HAD	69.587	69.587
Lemon sole	<i>Microstomus kitt</i>	LEM	65.009	65.009
Cuckoo ray	<i>Leucoraja naevus</i>	CUR	61.497	61.497
Blue whiting	<i>Micromesistius poutassou</i>	WHB	56.999	59.538
Thickback sole	<i>Microchirus variegatus</i>	TBS	45.079	50.772
European hake	<i>Merluccius merluccius</i>	HKE	44.986	44.986
Blonde ray	<i>Raja brachyura</i>	BLR	43.790	43.790
Black seabream	<i>Spondyliosoma cantharus</i>	BKS	43.790	43.790
Tub gurnard	<i>Trigla (chelidonichthys) lucerna</i>	TUB	39.423	39.423
Spotted ray	<i>Raja montagui</i>	SDR	36.895	36.895
Edible crab unsexed	<i>Cancer pagurus</i>	CRE	32.805	32.805
Imperial scaldfish	<i>Arnoglossus imperialis</i>	ISF	31.210	31.478
Thornback ray (roker)	<i>Raja clavata</i>	THR	26.204	26.204
Grey gurnard	<i>Eutrigla (chelidonichthys) gurnardus</i>	GUG	23.059	23.059
Red mullet	<i>Mullus surmuletus</i>	MUR	21.434	21.434
Marbled electric ray	<i>Torpedo marmorata</i>	MER	20.748	20.748
Smalleyed (painted) ray	<i>Raja microcellata</i>	PTR	20.359	20.359
Streaked gurnard	<i>Trigloporus (chelidonichthys) lastoviza</i>	GUS	18.366	18.366
Nurse hound	<i>Scyliorhinus stellaris</i>	DGN	17.036	17.036
Dab	<i>Limanda limanda</i>	DAB	15.641	15.641
Brill	<i>Scophthalmus rhombus</i>	BLL	15.155	15.155
Turbot	<i>Scophthalmus maximus (psetta maxima)</i>	TUR	12.310	12.310
European seabass	<i>Dicentrarchus labrax</i>	ESB	12.097	12.097
John dory	<i>Zeus faber</i>	JOD	11.997	11.997
Undulate ray	<i>Raja undulata</i>	UNR	10.210	10.210
Ballan wrasse	<i>Labrus bergylta</i>	BNW	9.784	9.784
Sand sole	<i>Pegusa (solea) lascaris</i>	SOS	9.477	9.477
(European) mackerel	<i>Scomber scombrus</i>	MAC	8.241	8.241
Tope shark	<i>Galeorhinus galeus</i>	GAG	8.140	8.140
Common spiny lobster	<i>Palinurus elephas</i>	SLO	8.029	8.029



Common Name	Scientific Name	CEFAS code	Sampled weight (kg)	Catch weight (kg)
Atlantic cod	<i>Gadus morhua</i>	COD	7.930	7.930
European lobster	<i>Homarus gammarus</i>	LBE	7.288	7.288
Comber	<i>Serranus cabrilla</i>	CMR	7.048	7.048
Scald fish	<i>Arnoglossus laterna</i>	SDF	6.751	6.751
Three-bearded rockling	<i>Gaidropsarus vulgaris</i>	TBR	6.490	6.490
Solenette	<i>Buglossidium luteum</i>	SOT	4.231	6.241
Cuckoo wrasse	<i>Labrus mixtus (l. bimaculatus)</i>	CUW	5.773	5.773
Witch	<i>Glyptocephalus cynoglossus</i>	WIT	5.753	5.753
Horse-mackerel (scad)	<i>Trachurus trachurus</i>	HOM	4.635	4.635
Blue skate (Grey skate)	<i>Dipturus batis</i>	SKG	4.597	4.597
Greater forkbeard	<i>Phycis blennoides</i>	GFB	3.931	3.931
Norway pout	<i>Trisopterus esmarki</i>	NOP	3.298	3.298
Velvet swimming crab	<i>Necora puber</i>	MLP	2.903	2.903
Sprat	<i>Sprattus sprattus</i>	SPR	2.778	2.778
Spurdog	<i>Squalus acanthias</i>	DGS	2.470	2.470
Goldsinny	<i>Ctenolabrus rupestris</i>	GDY	2.202	2.202
Topknot	<i>Zeugopterus punctatus</i>	TKT	2.009	2.009
Long-finned gurnard	<i>Aspitrigla (chelidonichthys) obscura</i>	GUL	1.837	1.837
Squid	<i>Loligo vulgaris</i>	LLV	1.316	1.316
Butterfly blenny	<i>Blennius ocellaris</i>	BBY	1.127	1.127
Pollack	<i>Pollachius pollachius</i>	POL	1.115	1.115
American plaice (long-rough dab)	<i>Hippoglossoides platessoides</i>	PLA	1.084	1.084
Cuttlefish	<i>Sepia elegans</i>	SEE	0.925	0.925
Norwegian topknot	<i>Zeugopterus (phrynorhombus) norvegicus</i>	NKT	0.782	0.782
Lesser weever fish	<i>Echiichthys (trachinus) vipera</i>	WEL	0.767	0.767
Baillons wrasse	<i>Symphodus (crenilabrus) balloni</i>	BLW	0.757	0.757
Norway lobster	<i>Nephrops norvegicus</i>	NEP	0.670	0.670
Pogge (armed bullhead)	<i>Agonus cataphractus</i>	POG	0.535	0.535
Great sandeel	<i>Hyperoplus lanceolatus</i>	GSE	0.368	0.368
Pink cuttlefish	<i>Sepia orbignyana</i>	SEO	0.352	0.352
Spotted dragonet	<i>Callionymus maculatus</i>	SDT	0.350	0.350
Greater weever fish	<i>Trachinus draco</i>	WEG	0.295	0.295
European common squid	<i>Loligo (alloteuthis) subulata</i>	ATS	0.277	0.277
Lesser flying squid	<i>Todaropsis eblanae</i>	OME	0.271	0.271
Immaculate sandeel	<i>Hyperoplus immaculatus</i>	ISE	0.269	0.269
Pilchard	<i>Sardina pilchardus</i>	PIL	0.268	0.268
Northern shortfin squid	<i>Illex illecebrosus</i>	SQI	0.267	0.267
Argentines	<i>Argentinidae</i>	ARG	0.239	0.239
Steven's goby	<i>Gobius gasteveni</i>	GSV	0.214	0.214
Couch's seabream	<i>Pagrus pagrus</i>	SBC	0.179	0.179
Red bandfish	<i>Cepola rubescens (c. macrophthalma)</i>	RPF	0.170	0.170
Sea scorpion	<i>Taurulus bubalis</i>	SSN	0.162	0.162
Great pipefish	<i>Syngnathus acus</i>	GPF	0.137	0.137
Ekstroms topknot	<i>Zeugopterus (phrynorhombus) regius</i>	EKT	0.084	0.084
Common skate	<i>Dipturus (raja) batis</i>	SKT	0.078	0.078
Tompot blenny	<i>Parablennius gattorugine</i>	TBY	0.071	0.071
European anchovy	<i>Engraulis encrasicolus</i>	ANE	0.060	0.060
Black goby	<i>Gobius niger</i>	BLG	0.060	0.060
Sandeel	<i>Ammodytes tobianus</i>	TSE	0.057	0.057
Small-mouthed wrasse	<i>Centrolabrus exoletus</i>	SMW	0.049	0.049



Common Name	Scientific Name	CEFAS code	Sampled weight (kg)	Catch weight (kg)
Gobies	<i>Pomatoschistus spp</i>	POM	0.040	0.040
Lesser forkbeard	<i>Raniceps raninus</i>	LFB	0.039	0.039
Red seabream	<i>Pagellus bogaraveo</i>	SBR	0.027	0.027
Sandeels	<i>Ammodytidae</i>	SAX	0.026	0.026
Four-bearded rockling	<i>Enchelyopus cimbrius</i>	FRR	0.021	0.021
Rock goby	<i>Gobius paganellus</i>	RKG	0.008	0.008
*Sea horse (short snouted)	<i>Hippocampus hippocampus</i>	SNH	0.000	0.007
Northern rockling	<i>Ciliata septentrionalis</i>	NNR	0.004	0.004
Two spotted clingfish	<i>Diplecogaster bimaculata</i>	TSC	0.003	0.003
Yarrel's blenny	<i>Chirolophis ascanii</i>	YBY	0.003	0.003
Jeffrey's goby	<i>Buenia jeffreysii</i>	JYG	0.002	0.002
Shore clingfish	<i>Lepadogaster lepadogaster</i>	SCF	0.001	0.001
Bullheads and sculpins	<i>Cottidae</i>	CDY	0.001	0.001
Crystal goby	<i>Crystallogobius linearis</i>	CLG	0.001	0.001

*Species was not measured

Table 4: Total catches of non-sampled species, ordered by size of total catch.

Common Name	Scientific Name	Cefas code	Catch weight (kg)
Rocks	<i>Assorted rocks</i>	ROK	4014.474
Epibenthic mix unidentified	<i>Epibenthic mixture</i>	BEN	2363.676
Shell	<i>Broken shell</i>	BSL	1657.791
Common brittle star	<i>Ophiothrix fragilis</i>	OPF	1104.224
Spiny starfish	<i>Marthasterias glacialis</i>	MAG	695.266
Edible sea urchin	<i>Echinus esculentus</i>	URS	527.442
Dead-man's fingers	<i>Alcyonium digitatum</i>	DMF	249.742
Sponges	<i>Porifera</i>	PFZ	217.260
Yellow boring sponge	<i>Cliona celata</i>	CLI	156.380
Common starfish	<i>Asterias rubens</i>	STH	134.651
Football ascidia	<i>Diazona violacea</i>	DIV	101.921
Curled octopus	<i>Eledone cirrhosa</i>	EDC	69.403
Purple heart urchin	<i>Spatangus purpureus</i>	SPG	61.744
Hornwrack	<i>Flustra foliacea</i>	FAF	57.838
Hydroids	<i>Hydroida (order)</i>	HYD	55.242
Sponge	<i>Polymastiidae</i>	PMX	54.754
Sea squirts	<i>Ascidacea</i>	SSX	53.445
Seven-armed starfish	<i>Luidia ciliaris</i>	LDC	51.184
Parchment worm tubes	<i>Chaetopterus tubes</i>	CVT	50.006
Starfish	<i>Luidia sarsi</i>	LUS	49.391
Sea mouse	<i>Aphrodite aculeata</i>	AAC	49.016
Bryozoan	<i>Pentapora foliacea</i>	PET	48.641
Hermit in adamsia	<i>Eupagurus / pagurus in adamsia</i>	HIA	40.366
Bryozoan	<i>Cellariidae</i>	CEL	39.367
Antenna hydroid	<i>Nemertesia antennina</i>	NEA	38.725
Bivalves	<i>Mollusca-bivalvia</i>	BIV	36.123
Sponge	<i>Raspailia spp</i>	RAS	28.069
Sponge	<i>Haliclona oculata</i>	HAO	28.007
Ascidian	<i>Molgulidae</i>	MGX	27.116
Sand star	<i>Astropecten irregularis</i>	API	26.287
Star ascidian	<i>Botrylloides leachi</i>	BOT	25.986
Kelp	<i>Laminaria spp</i>	LMX	23.311
Red cushion star	<i>Porania pulvillus</i>	PPV	23.260
Green sea urchin	<i>Psammechinus miliaris</i>	PMM	20.207
Auger shell	<i>Turritella communis</i>	TUC	18.578
Bloody Henry starfish	<i>Henricia oculata</i>	HEO	17.819
Elephant ear sponge	<i>Pachymatisma johnstonia</i>	PMJ	15.795
Great spider crab	<i>Hyas araneus</i>	HYA	15.654
Sickle hydroid	<i>Hydrallmania falcata</i>	HYH	14.432
Black hydroid	<i>Diphasia nigra</i>	DIN	14.368
Common sunstar	<i>Crossaster papposus</i>	CTP	13.948
North Atlantic cup sponge	<i>Axinella infundibuliformis</i>	AXI	13.066
Circular crab	<i>Atelycyclus rotundatus</i>	ALR	11.816
Hydroid	<i>Nemertesia ramosa</i>	NER	11.022
Sea urchin	<i>Echinus acutus</i>	URA	9.860
Whelk eggs	<i>Whelk eggs</i>	WES	9.317
Serpent star	<i>Ophiura ophiura</i>	OHT	8.908
Brown seaweeds (nei)	<i>Phaeophyceae</i>	SWB	8.573
Plumose anemone	<i>Metridium senile</i>	PMA	8.460
Opisthobranch	<i>Scaphander lignarius</i>	SDL	8.220
Black brittlestar	<i>Ophiocoma nigra</i>	OPN	7.899
Scorpion spider crab	<i>Inachus dorsettensis</i>	IND	7.307
Common octopus	<i>Octopus vulgaris</i>	OCV	6.555
Slender-leg spider crab	<i>Inachus leptochirus</i>	INL	6.459



Common Name	Scientific Name	Cefas code	Catch weight (kg)
Gibbs sea spider	<i>Pisa armata</i>	PAA	6.166
Swimming crab	<i>Liocarcinus depurator</i>	LMD	6.075
American slipper limpet	<i>Crepidula fornicata</i>	ASL	5.845
Sea lemon	<i>Archidoris pseudoargus</i>	ADP	5.503
Common whelk	<i>Buccinum undatum</i>	WHE	5.143
Hermit in whelk	<i>Eupagurus / pagurus in buccinum</i>	HIW	5.065
Cotton spinner	<i>Holothuria forskali</i>	COT	4.553
Curly weed	<i>Alcyonidium diaphanum</i>	ALG	4.529
Wracks	<i>Fucus spp</i>	FUX	4.461
Goose-foot star	<i>Anseropoda placenta</i>	PLM	4.219
Sea slug	<i>Pleurobranchus membranaceus</i>	PBM	3.925
Sponge	<i>Suberites spp</i>	SUB	3.711
Feather star	<i>Antedon bifida</i>	ADB	3.286
Gaping fireclam	<i>Limaria hians</i>	LIM	3.012
Dahlia anemone	<i>Urticina (tealia) felina</i>	DHA	2.578
Rosy starfish	<i>Stichastrella rosea</i>	SLR	2.323
Red seaweeds (nei)	<i>Rhodophyceae</i>	SWR	2.118
Sea urchins	<i>Echinoidea</i>	EEZ	2.040
Herrings	<i>Clupeidae</i>	CLU	1.914
Squid eggs	<i>Squid eggs</i>	SQS	1.859
Slender spider crab	<i>Macropodia tenuirostris</i>	MCT	1.854
Star ascidian	<i>Botryllus schlosseri</i>	BIS	1.807
Sponge crab	<i>Dromia personata</i>	DRP	1.756
Red starfish	<i>Echinaster sepositus</i>	ECS	1.584
Scaleworm	<i>Laetmonice (hermione) hystrix</i>	HMH	1.562
Dog cockle	<i>Glycymeris glycymeris</i>	GLG	1.507
Hermit in suberites	<i>Eupagurus / pagurus in suberites</i>	HIS	1.459
Common swimming crab	<i>Polybius (liocarcinus) holsatus</i>	LMH	1.401
Sea potato	<i>Echinocardium spp</i>	ECV	1.374
Golfball sponge	<i>Tethya aurantia</i>	TAA	1.233
Hermit anemone	<i>Calliactis parasitica</i>	CAR	1.178
Stout bobtail squid	<i>Rossia macrosoma</i>	ROM	1.137
Contracted crab	<i>Hyas coarctatus</i>	HYC	1.091
Stalk ascidian	<i>Styela clava</i>	SAA	1.055
Anemone	<i>Actinauge richardi</i>	ACR	1.003
Squat lobster	<i>Munida rugosa</i>	MNR	0.932
Tube worm	<i>Hyalinoecia tubicola</i>	HYT	0.913
Dogfish egg case	<i>Dogfish egg cases</i>	DEG	0.869
Masked crab	<i>Corystes cassivelaunus</i>	CCV	0.806
Pheasant tail hydroid	<i>Lytocarpia myriophyllum</i>	HYL	0.797
Leachs spider crab	<i>Inachus phalangium</i>	INP	0.791
Bladder wrack	<i>Fucus vesiculosus</i>	WRB	0.683
Devonshire cup-coral	<i>Caryophyllia smithii</i>	DCC	0.663
Parchment tube-worm	<i>Chaetopterus variopedatus</i>	CPV	0.629
Common goose barnacle	<i>Lepas anatifera</i>	GEB	0.572
Sea slugs	<i>Nudibranchia</i>	NBX	0.560
Goosebump sponge	<i>Dysidea fragilis</i>	DYS	0.510
Pink seafan	<i>Eunicella verrucosa</i>	EUV	0.510
Hairy sea-squirt	<i>Asciidiella scabra</i>	ASS	0.491
Sea cucumber	<i>Cucumariidae</i>	CMX	0.489
Hermit crab	<i>Pagurus bernhardus</i>	PEB	0.485
Sea cucumbers	<i>Holothuroidea</i>	HTZ	0.477
Corrugated swimming crab	<i>Liocarcinus corrugatus</i>	LIC	0.476
Anemone unidentified	<i>Anemone unidentified</i>	AMU	0.474
Hermit crab	<i>Pagurus variabilis</i>	PEV	0.460
Xanthidae	<i>Xanthid crab</i>	XAN	0.441



Common Name	Scientific Name	Cefas code	Catch weight (kg)
Processa shrimp	<i>Processidae</i>	PCY	0.396
Spider crab	<i>Macropodia linaresi</i>	MCL	0.373
Deeplet sea anemone	<i>Bolocera tuediae</i>	BCT	0.368
Sea slug	<i>Tritonia hombergi</i>	TNH	0.289
Common pelican's foot	<i>Aporrhais pespelicani</i>	APP	0.280
Hermit crabs	<i>Paguridae</i>	PAY	0.277
Angular crab	<i>Goneplax rhomboides</i>	GOR	0.253
Swimming crab	<i>Macropipus tuberculatus</i>	MPT	0.235
Ascidian	<i>Ascidia virginea</i>	ASV	0.220
Atlantic mud shrimp	<i>Solenocera membranacea</i>	SOA	0.209
Brown shrimp	<i>Crangon allmanni</i>	CGA	0.209
Marbled swimming crab	<i>Liocarcinus marmoreus</i>	LMM	0.188
Squat lobsters	<i>Galathea spp</i>	GLX	0.181
Flat wrack	<i>Fucus spiralis</i>	WRE	0.180
Long-leg spider crab	<i>Macropodia rostrata</i>	MCR	0.174
Slender/graceful colus	<i>Colus gracilis</i>	CSG	0.169
Lacy tubeworm	<i>Filograna implexa</i>	FII	0.155
Toothed wrack	<i>Fucus serratus</i>	WRS	0.140
Norway cockle	<i>Laevicardium crassum</i>	LCC	0.134
Sea mats	<i>Bryozoa</i>	EPZ	0.132
Pennant's nut-crab	<i>Ebalia tuberosa</i>	EBT	0.131
Bloody Henry starfish	<i>Henricia sanguinolenta</i>	HNS	0.123
Variegated scallop	<i>Chlamys varia</i>	CHV	0.115
Necklace shell	<i>Euspira (polinices) catena</i>	PNC	0.113
Tiger scallop	<i>Palliolium tigerinum</i>	CYT	0.101
Serpents table brittle star	<i>Ophiura albida</i>	OHA	0.099
Anemone	<i>Sagartia spp</i>	SAG	0.097
Granulated topshell	<i>Calliostoma granulatum (=c. papillosum)</i>	PTQ	0.092
Mantis shrimp	<i>Rissoides (meiosquilla) desmaresti</i>	MED	0.092
Ragworms	<i>Nereis spp</i>	NEX	0.090
Dwarf-swimming crab	<i>Liocarcinus pusillus</i>	LPU	0.084
Morlog	<i>Morlog</i>	MOG	0.084
Long clawed porcelain crab	<i>Pisidia longicornis</i>	PIS	0.081
Rough crab	<i>Eurynome aspersa</i>	EUA	0.077
Whip shrimp	<i>Dichelopandalus bonnieri</i>	PDB	0.068
Venus shells	<i>Veneridae</i>	CLV	0.067
Goose barnacles	<i>Lepadidae</i>	GOZ	0.067
Hairy crab	<i>Pilumnus hirtellus</i>	PNH	0.065
European sting wrinkle (drill)	<i>Ocenebra erinacea</i>	OCE	0.064
Sand mason	<i>Lanice conchilega</i>	LCE	0.062
Isopod	<i>Idoteidae</i>	IOZ	0.062
Polinices eggs	<i>Euspira (polinices) eggs</i>	NAE	0.062
Anemone	<i>Paraphellia expansa</i>	PAE	0.058
Open simnia	<i>Simnia patula</i>	SIM	0.057
Isopod	<i>Cirolana cranchii</i>	CIB	0.056
Bobtail squid	<i>Sepiolidae</i>	SPY	0.052
False cowrie	<i>Erato voluta</i>	ERA	0.050
Common nut shell	<i>Nucula nucleus</i>	NNU	0.050
Bryozoan	<i>Bugula spp</i>	BUG	0.050
Venus casina (Clam)	<i>Circomphalus casina</i>	CIA	0.041
Bristle worms	<i>Polychaeta</i>	BWX	0.035
Hydroid	<i>Diphasia spp</i>	DIP	0.032
Nudibranch	<i>Doris sticta</i>	DOR	0.030
Swimming crabs indet	<i>Portunidae</i>	PUZ	0.029
Burrowing heart	<i>Spatangidae</i>	STY	0.029
Opisthobranch	<i>Pleurobranchaea</i>	PBR	0.028



Common Name	Scientific Name	Cefas code	Catch weight (kg)
Sulcate astarte	<i>Astarte sulcata</i>	AES	0.027
Common prawn	<i>Palaemon serratus</i>	CPR	0.027
Common razor shell	<i>Ensis ensis</i>	ESE	0.026
Sea lettuce	<i>Ulva lactuca</i>	ULL	0.026
Pink shrimp	<i>Pandalus montagui</i>	PRM	0.024
Spiny shrimp	<i>Pontophilus spinosus</i>	PPS	0.023
Hermit crab in epizoanthus	<i>Anapagurus in epizoanthus</i>	HIE	0.023
Pink shrimp	<i>Pandalus propinquus</i>	PDP	0.022
Netted dogwhelk	<i>Hinia (nassarius) reticulatua</i>	NSR	0.020
Fan mussel	<i>Atrina fragilis</i>	AFR	0.020
Squat lobster	<i>Galathea strigosa</i>	GLT	0.020
Red snapping shrimp	<i>Alpheus glaber</i>	ALP	0.018
Barnacles	<i>Balanidae</i>	BEY	0.017
Thorny rough crab	<i>Eurynome spinosa</i>	EUS	0.016
Opishobranch	<i>Philine aperta</i>	PHP	0.015
Hydroid	<i>Tubularia spp</i>	TUI	0.014
Red dead man's finger	<i>Alcyonium glomeratum</i>	AYG	0.014
Sulcate nutclam	<i>Nucula sulcata</i>	NUS	0.014
Squids (nei)	<i>Loliginidae</i>	SQZ	0.013
Green seaweeds	<i>Chlorophyceae</i>	CHZ	0.013
Ghost shrimp	<i>Pasiphaea spp</i>	PAS	0.012
Small serpent star	<i>Ophiura affinis</i>	OHF	0.011
Epizoanthid	<i>Epizoanthus encrustans</i>	EZI	0.010
Ross worm (colonies)	<i>Sabellaria spinulosa</i>	RCL	0.009
Top shells	<i>Trochidae</i>	TSX	0.009
Hermit crab	<i>Anapagurus laevis</i>	APL	0.009
Priapulid worm	<i>Priapulus caudatus</i>	PPC	0.009
Humphrey's whelk	<i>Buccinum humphreysianum</i>	WHH	0.006
Surf clams and trough	<i>Spisula spp</i>	SPS	0.006
Slit limpet	<i>Emarginula fissura</i>	EMA	0.005
Necklace shell	<i>Euspira fusca</i>	EFU	0.005
Oval venus	<i>Timoclea ovata</i>	VEO	0.005
Broad clawed burrowing shrimp	<i>Alpheus macrocheles</i>	ALM	0.005
Cirolana crabs	<i>Cirolana spp</i>	CIR	0.005
Granulated nut crab	<i>Ebalia granulosa</i>	EBG	0.005
Xanthid crab	<i>Monodaeus couchi</i>	EPM	0.005
Horn tusk worm	<i>Ditrupea arientina</i>	DTA	0.004
Mud shrimp	<i>Upogebia spp</i>	UPX	0.004
Sipunculid worm indet	<i>Sipuncula</i>	SIZ	0.004
Bryozoan	<i>Flustridae</i>	FAX	0.004
Mantis shrimp indet	<i>Squillae</i>	SQY	0.004
Sea pen (slender pinnate)	<i>Pennatula phosphorea</i>	PNP	0.001
Furrow shells indet	<i>Abra spp</i>	ABR	0.001
Cranch's nut-crab	<i>Ebalia cranchii</i>	EBC	0.001
Opisthobranch indet	<i>Opisthobranchia</i>	OPI	0.001



Table 5: Biological information and samples collected by sex (order alphabetically by scientific name)

Common Name	Scientific Name	Sex	Western Channel	Celtic Sea
Queen scallop	<i>Auquiptecten opercularis</i>	U	714	5
Red gurnard	<i>Aspitrigla (Chelidonichthys) cuculus</i>	F	211	75
Red gurnard	<i>Aspitrigla (Chelidonichthys) cuculus</i>	M	150	62
Red gurnard	<i>Aspitrigla (Chelidonichthys) cuculus</i>	U	15	2
Long-finned Gurnard	<i>Aspitrigla (Chelidonichthys) obscura</i>	F	8	0
Long-finned Gurnard	<i>Aspitrigla (Chelidonichthys) obscura</i>	M	1	0
Small-mouthed wrasse	<i>Centrolabrus exoletus</i>	F	2	0
Conger eel	<i>Conger conger</i>	F	6	0
Conger eel	<i>Conger conger</i>	M	2	0
Conger eel	<i>Conger conger</i>	U	58	17
Goldsinny	<i>Ctenolabrus rupestris</i>	F	24	0
Goldsinny	<i>Ctenolabrus rupestris</i>	M	5	0
Goldsinny	<i>Ctenolabrus rupestris</i>	U	2	1
European seabass	<i>Dicentrarchus labrax</i>	F	5	0
European seabass	<i>Dicentrarchus labrax</i>	M	10	0
Blue skate (Grey skate)	<i>Dipturus batis</i>	M	1	0
Grey Gurnard	<i>Eutrigla gurnardus</i>	F	102	40
Grey Gurnard	<i>Eutrigla gurnardus</i>	M	57	20
Grey Gurnard	<i>Eutrigla gurnardus</i>	U	17	8
Cod	<i>Gadus morhua</i>	F	0	4
Cod	<i>Gadus morhua</i>	M	0	1
Tope shark	<i>Galeorhinus galeus</i>	F	0	1
Witch	<i>Glyptocephalus cynoglossus</i>	F	0	34
Witch	<i>Glyptocephalus cynoglossus</i>	M	1	8
Ballan wrasse	<i>Labrus bergylta</i>	F	18	0
Cuckoo wrasse	<i>Labrus mixtus (l. bimaculatus)</i>	F	28	0
Cuckoo wrasse	<i>Labrus mixtus (l. bimaculatus)</i>	M	6	0
Cuckoo wrasse	<i>Labrus mixtus (l. bimaculatus)</i>	U	1	0
Megrim	<i>Lepidorhombus whiffiagonis</i>	F	134	179
Megrim	<i>Lepidorhombus whiffiagonis</i>	M	44	74
Cuckoo Ray	<i>Leucoraja naevus</i>	F	34	14
Cuckoo Ray	<i>Leucoraja naevus</i>	M	41	18
Black bellied Anglerfish	<i>Lophius budegassa</i>	F	18	17
Black bellied Anglerfish	<i>Lophius budegassa</i>	M	18	13
Black bellied Anglerfish	<i>Lophius budegassa</i>	U	2	2
Anglerfish	<i>Lophius piscatorius</i>	F	113	28
Anglerfish	<i>Lophius piscatorius</i>	M	112	25
Anglerfish	<i>Lophius piscatorius</i>	U	3	0
Haddock	<i>Melanogrammus aeglefinus</i>	F	13	42
Haddock	<i>Melanogrammus aeglefinus</i>	M	6	48
Haddock	<i>Melanogrammus aeglefinus</i>	U	0	1
Whiting	<i>Merlangius merlangus</i>	F	162	25
Whiting	<i>Merlangius merlangus</i>	M	108	22
Whiting	<i>Merlangius merlangus</i>	U	2	0
Hake	<i>Merluccius merluccius</i>	F	12	15
Hake	<i>Merluccius merluccius</i>	M	14	7
Hake	<i>Merluccius merluccius</i>	U	2	2
Lemon Sole	<i>Microstomus kitt</i>	F	97	61
Lemon Sole	<i>Microstomus kitt</i>	M	71	33
Lemon Sole	<i>Microstomus kitt</i>	U	1	1
Red Mullet	<i>Mullus surmuletus</i>	F	57	12
Red Mullet	<i>Mullus surmuletus</i>	M	25	5
Red Mullet	<i>Mullus surmuletus</i>	U	1	0
Starry Smooth-hound	<i>Mustelus asterias</i>	F	35	4
Starry Smooth-hound	<i>Mustelus asterias</i>	M	37	5
Greater scallop	<i>Pecten maximus</i>	U	744	17
Sand sole	<i>Pegusa (solea) lascaris</i>	F	27	6
Sand sole	<i>Pegusa (solea) lascaris</i>	M	9	1
Plaice	<i>Pleuronectes platessa</i>	F	210	34
Plaice	<i>Pleuronectes platessa</i>	M	136	25
Blonde Ray	<i>Raja brachyura</i>	F	10	3
Blonde Ray	<i>Raja brachyura</i>	M	10	5
Thornback Ray	<i>Raja clavata</i>	F	14	4
Thornback Ray	<i>Raja clavata</i>	M	3	6
Small-eyed Ray	<i>Raja microocellata</i>	F	8	1
Small-eyed Ray	<i>Raja microocellata</i>	M	2	1
Spotted Ray	<i>Raja montagui</i>	F	27	11
Spotted Ray	<i>Raja montagui</i>	M	23	18
Undulate Ray	<i>Raja undulata</i>	F	2	0
Undulate Ray	<i>Raja undulata</i>	M	4	0
Turbot	<i>Scophthalmus maximus (psetta maxima)</i>	F	3	0

Common Name	Scientific Name	Sex	Western Channel	Celtic Sea
Turbot	<i>Scophthalmus maximus (psetta maxima)</i>	M	1	2
Brill	<i>Scophthalmus rhombus</i>	F	5	2
Brill	<i>Scophthalmus rhombus</i>	M	7	2
Nursehound	<i>Scyliorhinus stellaris</i>	F	2	2
Nursehound	<i>Scyliorhinus stellaris</i>	M	2	2
Common cuttlefish	<i>Sepia officinalis</i>	F	56	32
Common cuttlefish	<i>Sepia officinalis</i>	M	73	49
Common cuttlefish	<i>Sepia officinalis</i>	U	24	136
Sole	<i>Solea solea</i>	F	220	51
Sole	<i>Solea solea</i>	M	194	56
Black Seabream	<i>Spondyliosoma cantharus</i>	F	99	1
Black Seabream	<i>Spondyliosoma cantharus</i>	M	27	0
Black Seabream	<i>Spondyliosoma cantharus</i>	U	7	0
Spurdog	<i>Squalus acanthias</i>	M	3	0
Baillons wrasse	<i>Symphodus (crenilabrus) balloni</i>	F	4	0
Baillons wrasse	<i>Symphodus (crenilabrus) balloni</i>	M	4	0
Baillons wrasse	<i>Symphodus (crenilabrus) balloni</i>	U	1	0
Marbled Electric Ray	<i>Torpedo marmorata</i>	F	7	3
Marbled Electric Ray	<i>Torpedo marmorata</i>	M	15	4
Tub Gurnard	<i>Trigla (Chelidonichthys) lucerna</i>	F	56	9
Tub Gurnard	<i>Trigla (Chelidonichthys) lucerna</i>	M	29	7
Tub Gurnard	<i>Trigla (Chelidonichthys) lucerna</i>	U	1	0
Streaked Gurnard	<i>Trigloporus (Chelidonichthys) lastoviza</i>	F	53	0
Streaked Gurnard	<i>Trigloporus (Chelidonichthys) lastoviza</i>	M	40	0
Streaked Gurnard	<i>Trigloporus (Chelidonichthys) lastoviza</i>	U	1	0
John dory	<i>Zeus faber</i>	M	3	0

Figure 7 shows the positions of all 4m beam trawl fishing stations, with Figure 8 showing the survey track each day with the relevant tow validities of these 4m beam trawl deployments. Species composition pie charts for the entire survey are shown on Figure 9. The distribution of six major commercial species for the survey are shown in Figure 10 along with the length distributions of the same species, along with total catch numbers for the two different gears shown in Figure 11.

Appendix 1 gives the station details of each survey station including date/time, shooting, and hauling coordinates and various weather/sea-state observational data. Appendix 2 shows the planned priority sampling locations not fished with the reasons why this was not possible, along with the alternative sampling locations fished where appropriate.

Note

Observations on the catches are given below. It should be noted that the changes are from the 2022 and 2021 surveys but should be viewed in the context that the number of successful sampling locations fished is different in each survey year making data comparisons difficult. The number of successful tows completed in the three years are 99 (2023), 66 (2022) and 110 (2021) and the spatial coverage was also different in each of the three years.

Target species observations

Sole:

In the western Channel, the largest catches of sole were observed south-west of Lands-End, around the Isles of Scilly, in Mounts Bay, south-east of Start Point and in Lyme Bay. In addition, smaller catches were observed to the east of the Channel Islands and in mid-Channel areas around the Hurd Deep. Smaller numbers of sole were caught around the Eddystone lighthouse and off the northern French coast. In the Celtic Sea, the largest catches were observed off the north Cornwall coast and north of the Isles of Scilly. Smaller catches were also observed off the west coast of France and at one location south of Milford Haven.

In the western Channel, sole catch numbers (414) were 40% higher than those observed in 2022 (297) and 10% higher than in 2021 (376) when a similar survey coverage in the western Channel was achieved. Both 2023 and 2022 had an L_{MEAN} value (mean length of the fish caught) of ~29/30 cm. The catch weight of sole in the western Channel was 120.97 kg which was 6% higher than observed in 2021 (113.75 kg) and 28% higher than in 2022 (94.49 kg). Most sole were caught within stratum 2 (Mounts Bay) and stratum 4 (Plymouth to Start Point) as in previous years.

In the Celtic Sea, sole catch numbers (110) were 212% higher than observed in 2022 (52) and 250% higher than in 2021 (44) when a similar survey coverage in the Celtic Sea was achieved. In 2023, an L_{MEAN} of ~28 cm was observed, whereas in 2022 this was just 24 cm. The catch weight of sole in 2023 was 26.42 kg compared to just 9.91 kg in 2022 and 14.10 kg in 2021.

Plaice:

In the western Channel, plaice were caught predominantly in Lyme Bay and around Start Point. As observed in previous years, few plaice were caught in French waters. In the Celtic Sea, the largest catches were observed at single location south of Milford Haven with small numbers caught off the north Cornwall Coast.

In the western Channel, a total of 796 plaice were caught, this being around 28% lower than observed in 2022 and around 39% lower than observed in 2021. The L_{MEAN} value for 2023 was observed as being 25 cm which was similar to that seen in 2022 (24 cm). Catch weights of plaice in the western Channel were 135.3 kg and were 29% less than observed in 2022 (191.9 kg) and 32% lower than observed in the 2021 (199.5 kg).

In the Celtic Sea only 22 out of 50 locations were completed in 2023, but the major areas where plaice are routinely caught were not fished. A total of 62 fish were caught in 2023 compared to 65 fish in 2021 and 340 in 2021. The L_{MEAN} this year was 27 cm compared to 25 cm in 2022 and 22 cm in 2021. Plaice catches in the Celtic Sea in 2023 (12.3 kg) were 15% greater than that observed in 2022 (10.6 kg) but were 70% less than in 2021 (40.2 kg).

Monk: (*Lophius piscatorius*)

Lophius piscatorius were observed in greatest abundance in the western English Channel between Mounts Bay and Lyme Bay, mid Channel to the east of the Hurd Deep and off the French coast south and south-west of the Channel Islands. In the Celtic Sea, the greatest abundance was observed north of the Isles of Scilly and at the Celtic Deep.

In the western Channel, a total of 308 were caught, this being 110% greater than observed in 2022 (147) and 39% greater than in 2021 (222). Many of the specimens caught in 2023 were small with an L_{MEAN} of just 26 cm compared to L_{MEAN} values in 2022 and 2021 of 30 cm. The catch weight in the western Channel was 245.6 kg and was observed to be 60% greater than that seen in 2022 (153.2 kg) and 22% greater in 2021 (201.5 kg). The largest catch in the western Channel was seen in stratum 9 (Hurd Deep).

In the Celtic Sea, a total of 58 fish were caught in 2023 compared to 38 fish in 2022 and 57 in 2021. The additional catches in 2023 (compared to 2022) were in stratum H,J,K & N which were not visited in 2022 with the catch in stratum being the largest in the Celtic Sea. Catches in the Celtic Sea in 2023 (89.5 kg) were 150% greater than that observed in 2022 (35.8 kg) and were 32% greater than in 2021 (67.7 kg).

Anglerfish: (*Lophius budegassa*)

Lophius budegassa were observed in greatest abundance in the western English Channel, south of the Isles of Scilly and in Falmouth Bay. In the Celtic Sea, the greatest abundance was observed to the north-west of the Isles of Scilly and west of Brest.

In the western Channel, a total of 38 specimens were caught, this being 30% less than observed in 2022 (54 fish) and 56% less than in 2021 (87 fish). The largest differences were observed in the smallest fish 11-23 cm where in 2023 much fewer were caught having an L_{MEAN} of 32 cm compared to L_{MEAN} values in 2022 of 22 cm and in 2021 of 17 cm. The catch weight in the western Channel was 34.9 kg and was observed to be 14% greater than that seen 2022 (30.6 kg) and around 3% greater than seen in 2021 (34.0 kg). In 2023, stratum 8 (mid Channel south of the Isles of Scilly) was the most productive survey area. However, in 2022, the most productive area was found to be stratum 1 (Isles of Scilly).

In the Celtic Sea, a total of 32 fish were caught compared to 43 fish in 2022 and 158 fish in 2021 equating to decreases of 25% and 80% respectively. As with the western Channel, a much lower L_{MEAN} was observed in 2023 (40 cm) compared to 2022 (31 cm) and 2021 (21 cm). The catch weight in the Celtic Sea in 2023 (37.4 kg) was 15% greater than that observed in 2022 (32.6 kg) but was 64% lower than seen in 2021 (102.9 kg). The most productive stratum in 2023 was stratum K (west of Brest). In 2021, the most productive survey area was stratum G (south of Ireland), but this stratum was not visited in either 2023 or 2022.

Lemon sole:

Lemon sole was caught predominantly off the Cornish and south Devon coast and around the Isles of Scilly, with smaller catches observed in the mid-Channel areas and in the French stratum. In the Celtic Sea, catches were mostly observed north of the Isles of Scilly and Cornish coast with smaller catches seen to the west of the French coast.

Catch numbers in the western Channel were 198 in 2023 compared to 293 in 2022 and 170 in 2021, equating to a decrease from 2022 of 33% and an increase from 2021 of 16%. In all three years, the L_{MEAN} was $\sim 24/25$ cm. In the Celtic Sea, catch numbers amounted to 98 compared to 594 observed in 2022 and 83 in 2021. This constituted increases of 66% and 18% in comparison to 2022 and 2021 respectively. Catch weights of lemon sole in the western Channel decreased in 2023 (44.7 kg) compared to 2022 (68.9 kg) but were greater than that observed in 2022 (37.5 kg) equating to a 33% decrease and a 19% increase respectively.

Common cuttlefish:

Common cuttlefish were caught throughout the western Channel but predominantly in UK waters in Falmouth Bay and Lyme Bay with lower numbers observed in the French survey areas. Few specimens were caught around the Isles of Scilly. In the Celtic Sea, catches were mostly limited to an area north-west of Brest, France in stratum H, J and K with minimal numbers caught in areas fished north of the Cornish coast.

Catch numbers in the western Channel were 860 in 2023 compared to 393 in 2022 and 517 in 2021, equating to an increase of 119% from 2022 and 66% from 2021. The L_{MEAN} in each of these three survey years was around 9 cm. In the Celtic Sea, catch numbers in 2023 were 304 compared to 184 in 2021, an increase of 65%. No catches were observed in 2022. Catch weights of common cuttlefish in the western Channel increased in 2023 (211.9.6 kg) compared 118 kg (2022) and 165.6 kg (2021) equating to increases of 80% and 28% respectively. The most productive survey area was stratum 7 (Start Point offshore) as has been the case in previous years. The catch weight observed in the Celtic Sea was 62.3 kg which was 180% larger than seen in 2021.

Other species observations

Skates and rays:

Cuckoo ray, blonde ray, marbled electric ray *Torpedo marmorata*, small-eyed ray, *Raja microocellata* and undulate ray *Raja undulata* all had increased catches compared to the 2022 survey. The largest ray catch was Cuckoo ray (61.5 kg) which had an increase in catch weight compared to the 2022 survey (32.0 kg) of 92% but was 12% lower than observed in 2021 (69.2 kg). Just 32 specimens were caught this year compared to 43 in 2022 and 49 in 2021, but fewer small fish were caught having an L_{MEAN} of 50 cm whereas in 2022 this value was 34 cm (32 cm in 2021). The total catch weight of blonde ray (45.3 kg) was 60% higher than observed in 2022 (28.5 kg) and 248% higher than in 2021 (13.0 kg). A total of 34 specimens were caught in 2023, which was more than double those caught in 2022 (16 fish). Catches of marbled electric ray,

small-eyed ray and undulate ray all increased in 2023 compared to the 2022 survey with increases of 1027%, 151% and 31% respectively.

Catches of spotted ray *Raja montagui* (37.1 kg), thornback ray *Raja clavata* (26.2 kg) and blue skate *Dipturus batis* (4.6 kg) in 2023 were all lower compared to the 2022 survey with falls of 43%, 45% and 76% respectively. Thornback ray catches fell for the second year in succession from a catch of 106.3 kg in 2021 when the species was the most abundant ray species caught on the survey. A single blue skate was caught on the 2023 survey.

Shark species:

Most shark species catches increased in 2023, with the increases in weight caught of starry smooth-hound of 28%, lesser-spotted dogfish of 4% compared with the 2022 survey. In 2023, there were also catches recorded of tope and spurdog where no catches were observed in 2022.

Lesser spotted dogfish remained the most prevalent species caught on the 2023 survey in terms of catch weight with 446.2 kg and 1149 individuals caught in total. This was a similar result to that observed in 2022 where 429.6 kg and 1142 individuals were caught. Starry smooth-hound catches amounted to a total of 94.4 kg and 83 individuals caught, compared to the 73.5 kg and 92 individuals caught in 2022. In 2023, the L_{MEAN} was found to be 67 cm which was much larger than seen in 2022 (52 cm).

Three spurdog were caught on the survey, all in the western Channel and in addition, one tope was caught at a location in stratum F in the Celtic Sea. This specimen was a female of length 121 cm weighing 8.1 kg.

Flatfish:

Brill *Scophthalmus rhombus* catches in 2023 (15.2 kg) were 30% higher than observed in 2022 but 33% lower than seen in 2021. A total of 18 specimens were caught in 2023, more than observed in both 2022 (13 fish) and 2021 (16 fish). Turbot, *Scophthalmus maximus* catches in 2023 (12.3 kg) were 63% greater than observed in 2022 (7.5 kg) and 93% greater than in 2021 (6.2 kg). Five specimens were caught in each of these three survey years.

Megrim *Lepidorhombus whiffiagonis* catches in 2023 (79.8 kg) were 29% up on the 2022 survey (61.7 kg) but substantially lower than observed in 2021 (170.7 kg). Witch *Glyptocephalus cynoglossus* catches in 2023 (5.8 kg) were 66% smaller than observed in 2022 (17.0 kg) with all specimens caught in the Celtic Sea.

Roundfish:

Whiting-pout (Bib) *Trisopterus luscus* were the most prevalent roundfish species caught on the 2023 survey with 138.8 kg and 656 specimens caught, a 13% fall in catch weight and a 3% increase in catch numbers compared to the 2022 survey (160.1 kg and 637 fish).

Haddock *Melanogrammus aeglefinus* catches (69.6 kg) were 16% down on the 2022 survey with catch numbers (275 fish) down by 14%. The L_{MEAN} in 2023 was around 25 cm compared to an L_{MEAN} of around 30 cm in 2022. The catch weight of hake *Merluccius merluccius* (45.0 kg) increased by 100% with catch numbers (52 fish) also increasing by 58% compared to the 2022 survey (22.0 kg and 33 fish respectively) but both measures of abundance remain well below those observed in 2021 (112.4 kg and 169 fish). Catches of cod *Gadus morhua* were small with just 7.9 kg and 5 fish caught in 2023 equating to reductions of 59% and 58% respectively with all specimens caught in the Celtic Sea in stratum D and F. Whiting catch weight in 2023 was 140.9 kg and catch numbers were 747 fish, an 84% and 40% increase in these measures compared to 2022.

Blue whiting *Micromesistius poutassou* catch weight and number in 2023 were 59.5 kg and 735 fish respectively. These were both up compared to the 2022 survey where 26.6 kg and 439 fish were caught. A total of 15 European seabass were caught in 2023 compared to just 5 on 2022 and 2021, with all specimens caught in the western Channel.

Gurnards:

The most prevalent gurnard species caught on the survey was red gurnard *Aspitrigla (chelidonichthys) cuculus* with a total catch of 93.9 kg and 707 individuals caught. This was an increase from the 2022 survey in catch weight of 56% (60.1 kg) and catch numbers of 88% (377 fish). Most of the catch (80%) was taken in the western Channel, with the most productive stratum being stratum 10 of the coast of northern France.

Grey Gurnard *Eutrigla (chelidonichthys) gurnardus* catches also increased from the 2022 survey with 23.5 kg and 593 fish caught, equating to decreases of 31% and 44% respectively. Streaked gurnard *Trigloporus (chelidonichthys) lastoviza* catches were also up compared to the 2022 survey with increases of 208% in weight and 283% in catch numbers. Tub gurnard *Trigla (chelidonichthys) lucerna* catch weight (39.6 kg) increased from the 2022 survey (22.7 kg) by 74% with catch numbers (108 fish) increasing by 21%. A total of 9 specimens of long-finned gurnard *Chelidonichthys obscura* were caught on the 2023 survey weighing 1.8 kg.

Shellfish:

Greater spider crab was the most abundant shellfish species caught on the survey with 800.4 kg and 1774 individuals observed. Catch weight increased by 458% in terms of weight (143.4 kg) and 419% in terms of numbers caught (342 individuals). At sampling location 11(6) north of Jersey, a total of 308.2 kg (616 individuals) were caught, this being the largest single catch of this species for many years.

Queen scallop catches on this survey amounted to 3126.0 kg, much higher than observed in 2022 (102.9 kg) or 2021 (133.3 kg). A total of ~24000 individuals were caught in 2023 compared to ~6300 individuals in 2022 and ~8700 individuals in 2021. Almost all queen scallops (99.9%) were caught in the western Channel in 2023. Catches of scallop were 113.4 kg compared to just 80.6 kg in 2022 and 78.2 kg in 2021. Catch numbers were 775 individuals

in 2023 compared to 536 in 2022 and 541 in 2021 with over 97% being caught in the western Channel.

Edible crab *Cancer pagurus* (32.8 kg) and European lobster *Homarus gammarus* (7.3 kg) catches were both greater than that observed in 2022 with 25.3 kg and 5.8 kg respectively. Catches of velvet swimming crab (2.9 kg) were consistent with those observed in 2022 (2.8 kg) but catches of Norwegian lobster *Nephrops norvegicus* (0.7 kg) and common spiny lobster *Palinurus elephas* (8.2 kg) were both lower than seen in 2022 where catches weights of 7.5 kg and 16.3 kg respectively were observed.

Other species of note:

Black sea-bream catch weight and numbers on this survey were 43.8 kg and 416 fish in total and were up by 277% and 357% compared to the 2022 survey. These increases are almost entirely due to a large increase observed in stratum 10 off the northern French coast. Red mullet *Mullus surmuletus* catch weight and numbers on this survey were 21.4 kg, up from 9.1 kg in 2022 and 18.0 kg in 2021. Boarfish *Capros aper* catches were 72.85 kg this year compared to 5.2 kg in 2022 and 46.5 kg in 2021. Comber *Serranus cabrilla* catches appears to be increasing year-on-year with 7.0 kg (72 individuals) caught in 2023 compared to 1.5 kg (32 individuals) in 2022 and 0.1 kg (2 individuals) in 2021. No specimens of this species had been observed on this survey prior to 2020. All specimens were caught in the southern areas of the western Channel off the French coast.

A total of 112 species were caught on the survey in 2023, 4 more than observed in 2022. Species of note included one couch's seabream, only the twelfth specimen encountered on this survey series.

Benthic catches:

At every haul, the benthic catches were sorted by species and weighed and counted as appropriate. Any benthic species seen in the port gear catch not already seen in the starboard gear catch were added to the starboard catch as observations only to enable these to be identified as being port catch. The exception to this, were the rare sentinel benthic species, which when observed in the port gear, were recorded as such. In total, 211 benthic species were caught on the survey compared to 181 in 2022. On this survey, rock was the largest benthic component with a total of 4.014 tonnes caught compared to 1.400 tonnes in 2022. The most abundant benthic lifeform on this survey were common brittle star with a total catch of 1.104 tonnes caught compared to just 0.032 tonnes in 2022.

Marine litter by-catch:

Details of marine litter by-catch caught at all fishing stations were recorded separately by gear using a bespoke application on a tablet. Litter by-catch was categorized by 'type', weighed, photographed, and categorized by size at every fishing station with, details of any attached organisms being recorded. A total of 666 individual items of marine litter weighing 24.48 kg were caught and analysed on the survey. Most litter items caught were classified as plastic (74%, 496 items) with rubber items making up just over 11%. Of the plastic litter items, these were mostly made up of fishing line, both monofilament and entangled (45%), plastic sheet/bags (20%) and synthetic rope (15%). One unusual item of litter was retained for the marine litter team for use in displays and presentations and this item was part of an old protective hard hat.

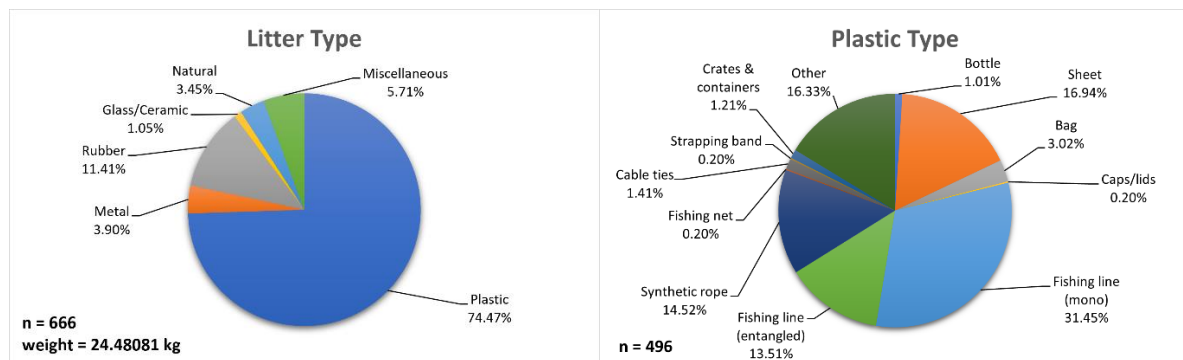


Figure 5: Marine litter classified by type with plastics analysed further by type of plastic.

- 2) *Genomic sampling of selected fish species to study population genomics as part of Defra project C8503 to improve the methodology to assess finfish, pelagic, data-limited, and non-quota stocks. (D Murray – Cefas, Lowestoft).*

Under C8503, an extra staff member joined the full survey to carry out the genetic sampling. Target species for this survey were flat fish. A total of 86 flatfish samples were successfully collected during the survey. Three samples for pelagic species were also collected.

Additional opportunistic aim as part of C8503: To collect tissue samples and carcasses (to be kept as intact as possible after sampling) in support of the Darwin Tree of Life project (DToL)

Work conducted under C8503 was also in support of the Darwin Tree of Life (DToL) initiative. This initiative aims to provide fully assembled and annotated genomes for every eukaryotic organism in the UK. The original target list for the DToL sampling to be conducted during CEND 4/23 consisted of various skates and rays. Only deceased elasmobranchs and opportunistic sampling of finfish were collected for DToL. One specimen of each of three-bearded rockling *Gaidropsarus vulgaris*, starry smooth-hound *Mustelus asterias*, Whiting-pout (bib) *Trisopterus luscus* and lemon sole *Microstomus kitt* were successfully dissected and sampled.

- 3) *Collect additional data from dead skates and rays (males: testes weight and outer clasper length; females: ovary weight and shell gland width) and collect a section of vertebral column comprising ca. 6-8 vertebrae from that part overlying the body cavity; samples to be kept frozen - as part of Defra project C8503 to improve the methodology to assess finfish, pelagic, data-limited, and non-quota stocks. (J Ellis – Cefas, Lowestoft).*

All live elasmobranchs were released as soon as possible but any moribund or deceased specimens of selected elasmobranch species were retained and dissected to obtain the following additional biological information: wing width, gonad weight, outer clasper length (for males only) and width of the shell glad (for females only). Furthermore, a section of the vertebral column as well as a fin clip from deceased specimens were collected and frozen for further analysis. The target species for this survey were: blonde ray, cuckoo ray, small-eyed ray, undulate ray, thornback ray and spotted ray.

As most specimens of these selected skates and rays were returned to the sea alive, only one spotted ray and two blonde rays were able to be retained and dissected to obtain the additional data as part of this survey aim.

SECONDARY AIMS

- 4) *Collect multibeam data throughout the survey.*

Multibeam data was collected continuously throughout the survey.

- 5) *To collect full depth, conductivity, temperature, and depth profiles at each trawl station alongside surface and near-bottom water samples.*

The port-side 4 m beam was deployed with a SAIV mini CTD unit attached to the headline to collect a full salinity, temperature, and depth profile at each tow. This was successful at most tows and the salinity and temperatures at the surface and bottom were added to the FSS station logs. At 20 sampling locations in the western Channel and 9 locations in the Celtic Sea, a CTD profile using an ESM2 logger along with a Niskin water sampler were deployed using the starboard gantry with the 'hydrographic' wire. Salinity samples from the 'bottom' were collected at each location from the Niskin along with a surface sea-water sample collected using the 'feed' from the Ferrybox.

- 6) *To continuously log sub-surface (3m) salinity, temperature, fluorometry and other environmental data using the 'Ferrybox'. Collect, retain and filter surface water samples from Ferrybox underway water supply every 12 hours (or once a day) for subsequent chlorophyll sampling in support of SLA25 (Naomi Greenwood).*

The Ferrybox was running throughout the survey sending live data remotely back to Cefas. A total of 6 chlorophyll samples were collected and were frozen in the -80°C freezer for analysis in Lowestoft. All samples were taken between the hours of 11am and 1pm.

- 7) *To record details of surface sightings of any marine mammals, sea turtles and large pelagic fish, and record observations on jellyfish aggregations (Sea Watch Foundation).*

Some observations were made but no recording of details taken due to the distance to the animals or for operational reasons as we did not have a dedicated sea mammal observer on board.

- 8) *Collect water samples for caesium & tritium analysis under SLA22 (T Bailey – Cefas, Lowestoft).*

All eleven samples targeted were successfully collected at the nearest survey sampling location to the water collection site. At each location, 3 x 25 litre carboys and a 1 litre bottle were filled with surface seawater.

- 9) *To collect biological samples and information for greater weever *Trachinus draco* as part of a Cefas study on species growth and biology. (S Barnett – Cefas, Lowestoft).*

Two samples were collected on this survey.

- 10) *To collect King Scallop *Pecten maximus* shell height/weight information along with the collection of shell (flat side) for subsequent ageing and growth studies (J Harvey – Cefas, Lowestoft).*

A total of 761 records of individual shell height/weight were collected on the survey with most coming from the western Channel (744) with a much smaller number of records collected in the Celtic Sea (17). In addition, 32 samples (multiple specimens) of the flat side of the shell were retained for many of the recorded specimens for subsequent ageing and growth studies.

- 11) *Collect queen scallops (queenies) to allow for experimental work on ageing, for L/W relationship analysis, development of length to height parameters and, to provide specimens to Bangor University for further work which will be made available to ICES WGScallop (J Harvey - Cefas, Lowestoft).*

Six bags of whole queen scallops were collected for J Harvey to aid experimental ageing work being conducted at Cefas Lowestoft.

- 12) To collect samples of whelk *Buccinum undatum* where caught in reasonable quantities (5 kg sample size). Bag and freeze samples for subsequent analysis at Cefas. (J Harvey - Cefas, Lowestoft).

No samples were collected on this survey due to the small catch weights encountered, with a total of ~5 kg caught on the entire survey.

- 13) To collect specimens of pink cuttlefish *Sepia orbignyana* and Elegant cuttlefish *Sepia elegans* to further Cefas studies. Collect specimens of European common squid *Alloteuthis subulata* over the survey area – 10 samples of 5 squid each. Additionally, collect *Loligo* egg masses where found in reasonable quantities, and take photos of any common octopus *Octopus vulgaris* where encountered. (V Laptikhovsky – Cefas, Lowestoft).

A total of 32 specimens of elegant cuttlefish were collected for these studies. In addition, a total of 18 specimens of European common squid were collected along with 3 samples of squid egg masses. Several photographs of common octopus were also taken of these animals when encountered. Finally, several samples of squid and cuttlefish caught of the survey were collected for validation of species identification.

- 14) To recover the lost Cefas beam trawl (from 2021) located off the French Coast north of Brest.

Despite dedicating several hours to this task and actually observing the beam trawl on the seabed with the drop camera, recovery of this gear was not possible in 2023. Further attempts to recover this gear will be considered for the 2024 survey.

OPPORTUNISTIC AIMS:

- 15) Tag and release specimens of starry smooth-hound *Mustelus asterias*, spurdog *Squalus acanthias*, tope *Galeorhinus galeus*, common skate complex, blonde ray *Raja brachyura* and cuckoo ray *Leucoraja naevus*, in support of the ICES Working Group for Elasmobranch Fishes work to inform on stock units for demersal elasmobranchs. (J Ellis – Cefas, Lowestoft)

A total of 6 individual fish were deemed to be lively and of an appropriate size to tag with Peterson discs and release back into the sea. These individuals were:

Common Name	Scientific name	Number tagged/released
Nursehound	<i>Scyliorhinus stellaris</i>	5
Blue skate (Grey skate)	<i>Dipturus batis</i>	1
	Total	6

16) To retain any dead specimens of tope and common skate complex for biological studies.
(J Ellis – Cefas, Lowestoft).

One sample of ‘dead’ blue skate (grey skate) was collected for biological studies. In addition, one dead specimen of starry smooth hound was also retained for this purpose.

17) Collect specimens of rare or unusual species (where dead) for ID verification purposes in the laboratory including specimens of eelpout (*Zoarces*, *Lycodes* and *Lycenchelys*), as well as collection of length-weight measurements where still required for the rare species (J Ellis, Cefas – Lowestoft).

Eleven length-weight measurements were collected on the survey, and these comprised:

Common name	Scientific name	Number of samples
Greater forkbeard	<i>Phycis blennoides</i>	3
Imperial scaldfish	<i>Arnoglossus imperialis</i>	2
Conger eel	<i>Conger conger</i>	1
Red gurnard	<i>Aspitrigla (chelidonichthys) cuculus</i>	1
Yarrel's blenny	<i>Chirolophis ascanii</i>	1
Red mullet	<i>Mullus surmuletus</i>	1
Black sea bream	<i>Spondyliosoma cantharus</i>	1
Three-bearded rockling	<i>Gaidropsarus vulgaris</i>	1
	Total	11

In addition, a total of 29 samples of fish and benthic specimens were kept for subsequent identification confirmation back at Cefas Lowestoft and these comprised:

Common name	Scientific name	Number of samples
Unidentified benthic specimens	<i>Unidentified benthic specimens</i>	4
Bivalve indet	<i>Mollusca bivalvia</i>	3
Northern rockling	<i>Ciliata septentrionalis</i>	2
Sandeels	<i>Ammodyidae</i>	2
Thorny rough crab	<i>Eurynome spinosa</i>	1
Common nut shell	<i>Nucula nucleus</i>	1
Two spotted clingfish	<i>Diplecogaster bimaculata</i>	1
Necklace shell	<i>Euspira fusca</i>	1
Shore clingfish	<i>Lepadogaster lepadogaster</i>	1
Whip shrimp	<i>Dichelopandalus bonnieri</i>	1
Blue skate (grey skate)	<i>Dipturus batis</i>	1
Couch's seabream	<i>Pagrus pagrus</i>	1
Sulcate astarte	<i>Astarte sulcata</i>	1
Granulated nut crab	<i>Ebalia granulosa</i>	1
Comber	<i>Serranus cabrilla</i>	1
European sting wrinkle	<i>Ocenebra erinaceus</i>	1
Sand goby	<i>Pomatoschistus spp.</i>	1
Oval venus	<i>Timoclea ovata</i>	1

Dog cockle	<i>Glycymeris glycymeris</i>	1
Bullhead or sculpin	<i>Cottidae</i>	1
Colus whelk	<i>Colus spp.</i>	1
Red seabream	<i>Pagellus bogaraveo</i>	1
	Total	29

18) All diadromous species (including allis shad *Alosa alosa*, twaite shad *Alosa fallax* and lampreys (*Petromyzontidae*)) found dead on capture are to be frozen and returned to the lab for analyses, marking samples with the survey, station, and date to support DiadES project. (T Basic – Cefas, Lowestoft)

No samples were collected on this survey.

19) Collect a vertical ring net sample at the west Gabbard smartbuoy, contributing to the Lifeform project (Defra) as part of the UK monitoring network for zooplankton.

This sample was successfully collected on 15 April.

20) Collect isopod parasites from specimens of black seabream, bass etc. when seen, photograph in situ and freeze the isopod. (P Barry – Cefas, Lowestoft)

Three samples (5 specimens) of isopod parasite were collected on the survey. All were found attached to specimens of black sea bream *Spondyliosoma cantharus*.

Acknowledgements

My thanks go to all the officers and crew of RV Cefas Endeavour for their invaluable help, support and advice given during this survey. I also thank my scientific team for their hard work, patience and dedication, without which the survey would not have been as successful as it was. Finally, my thanks go to the shore based AWSM staff who ensured that all the survey gear and equipment needed for the survey arrived in survey-ready condition. The successes of this survey are a direct result of the 'whole team' effort of all on-board. To successfully achieve a 75% survey tow completion rate given the loss of survey days to engineering issues and weather was a remarkable outcome.

Ian Holmes
Scientist in Charge
4 June 2023

DISTRIBUTION:

Survey personnel +	Crown Estate
P Falconer (PL)	States of Jersey
D Pettengell (PM)	Bailiwick of Guernsey
Cefas Fisheries/MPA Survey SICs/2ICs	FCO (for France and Republic of Ireland)
G Burt (Data Steward)	Marine Management Organisation (MMO)
T Bailey/R Hillier, E Garnacho/D Murray, J Ellis, N Greenwood, P Barry, J Harvey, S Barnett, Vladimir Laptikhovsky	AW Ship Management
Southern IFCA	Master/First Officer (Cefas Endeavour)
Devon and Severn IFCA	BODC
Isles of Scilly IFCA	
Cornwall IFCA	

2 x 4m Beam Trawls

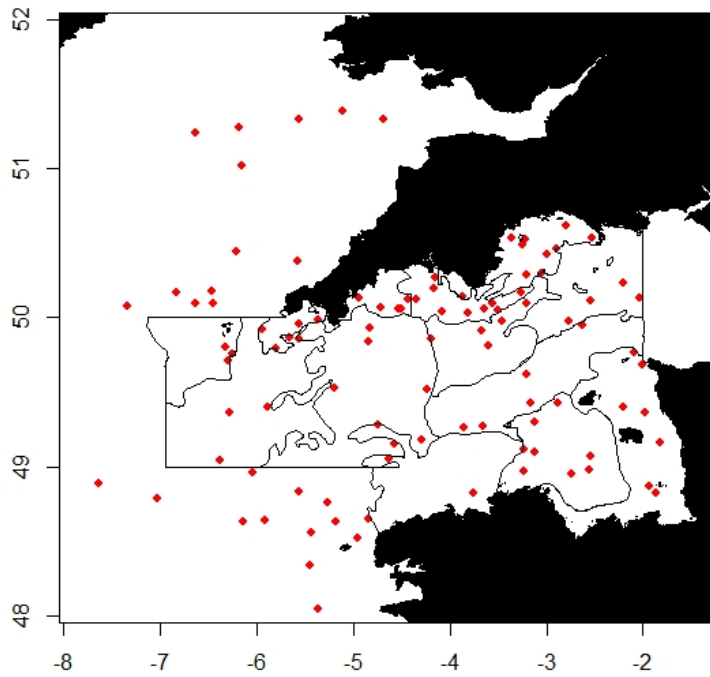


Figure 6: chart of survey stations numbers for CEND 4/23 (4m beam trawl stations only)

ESM2 and Niskin samples

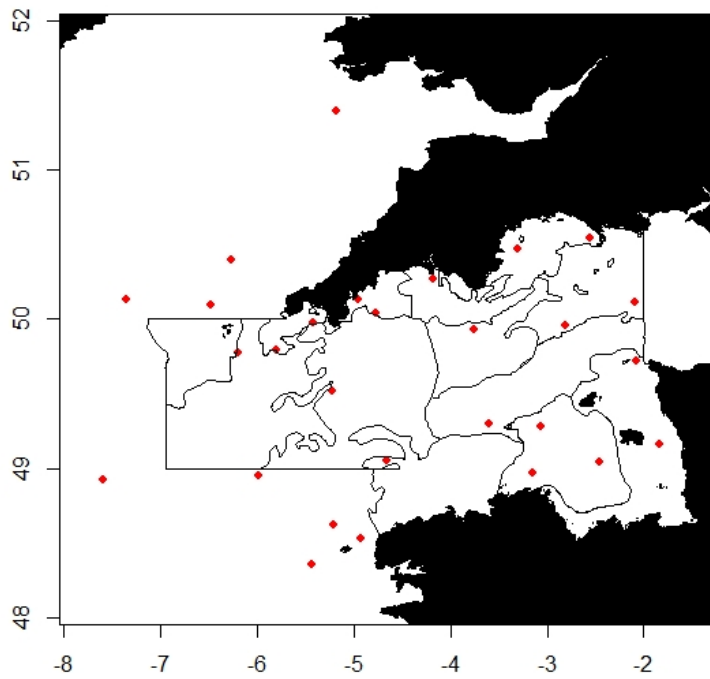


Figure 7: chart of survey stations numbers for CEND 4/23 (ESM2 profiler and Niskin sampler only)

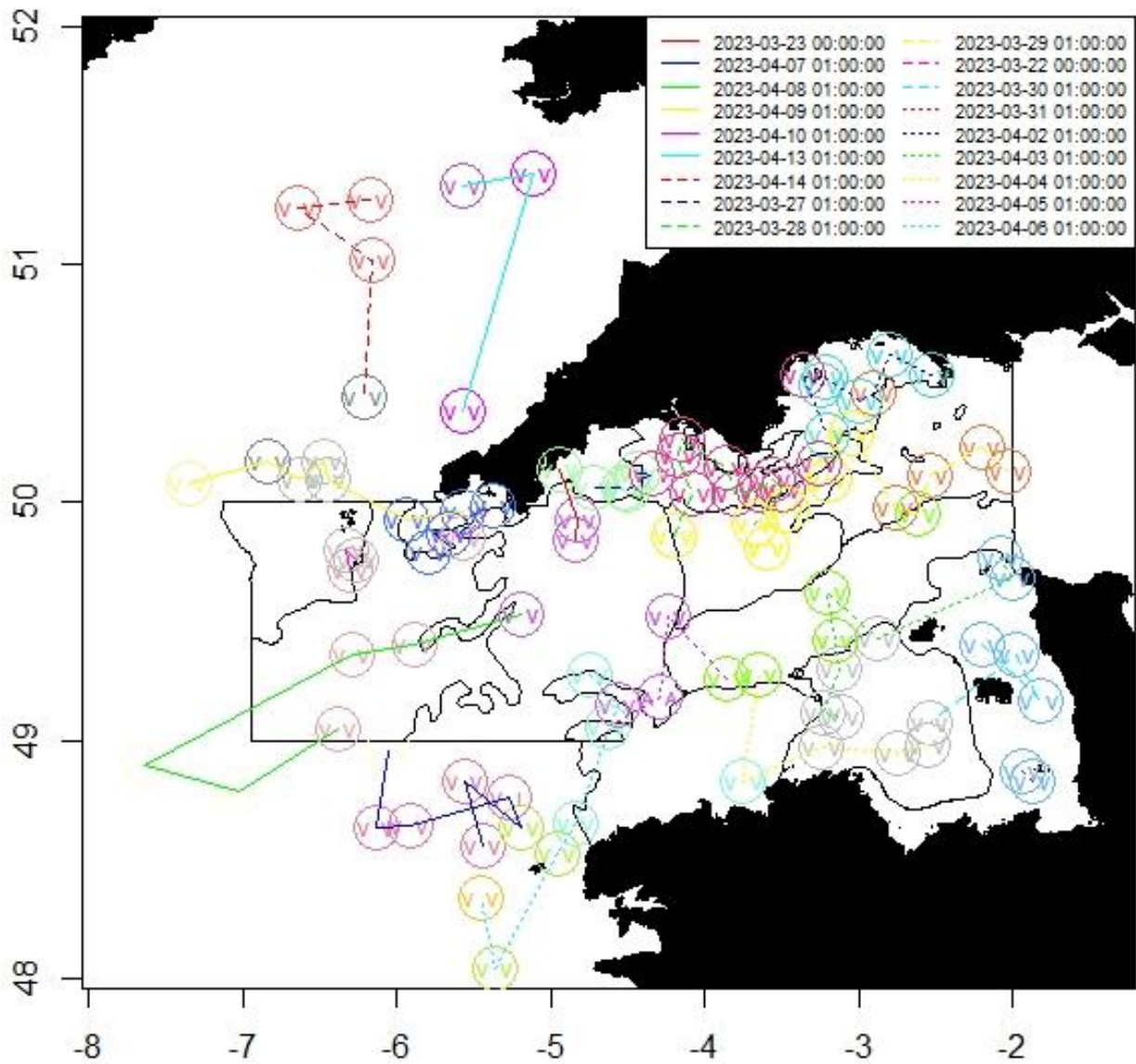


Figure 8: Survey track showing 4m beam trawl stations and deployment validity codes (V = Valid; I = Invalid; A = Additional) by day.

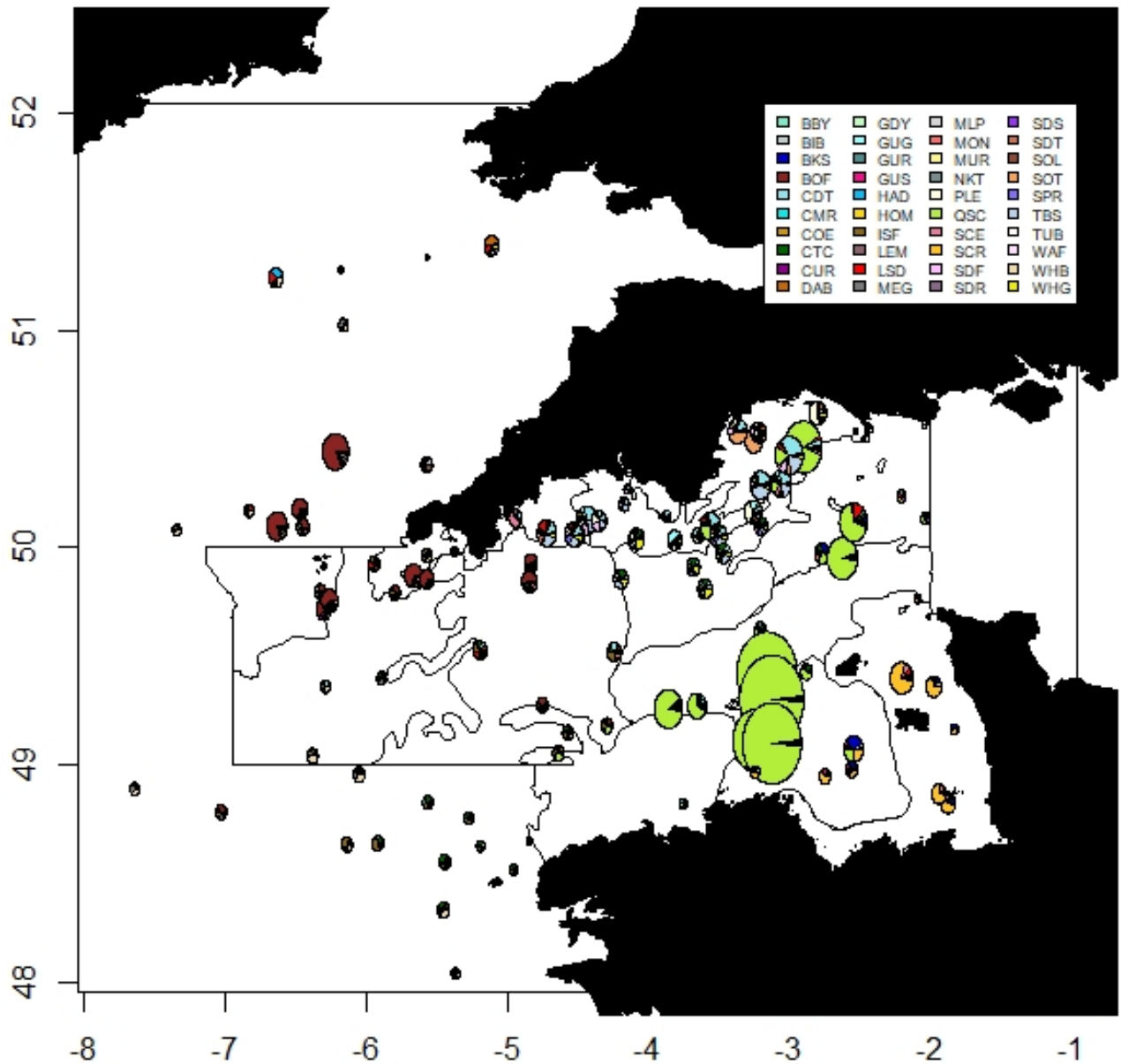


Figure 9: Species composition pie plots for CEND 4/23. Size of circles represents the size of the overall catch in numbers of the 40 most abundant species at a station with the size of the slice representing the relative proportion of each species encountered. For Cefas species codes, see Table 2.

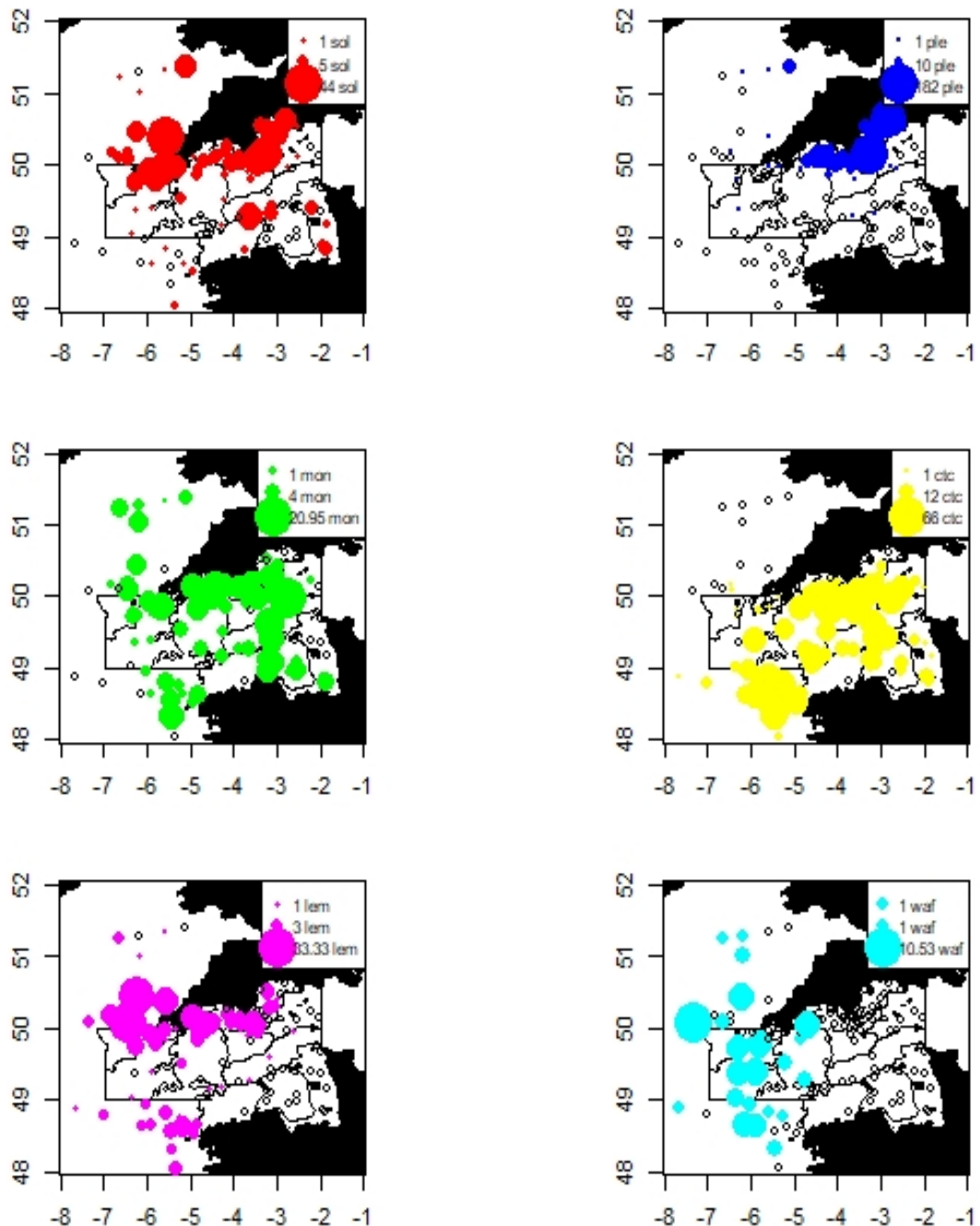


Figure 10: Distribution and total numbers of major commercial species by station (see Table 2, for species codes).

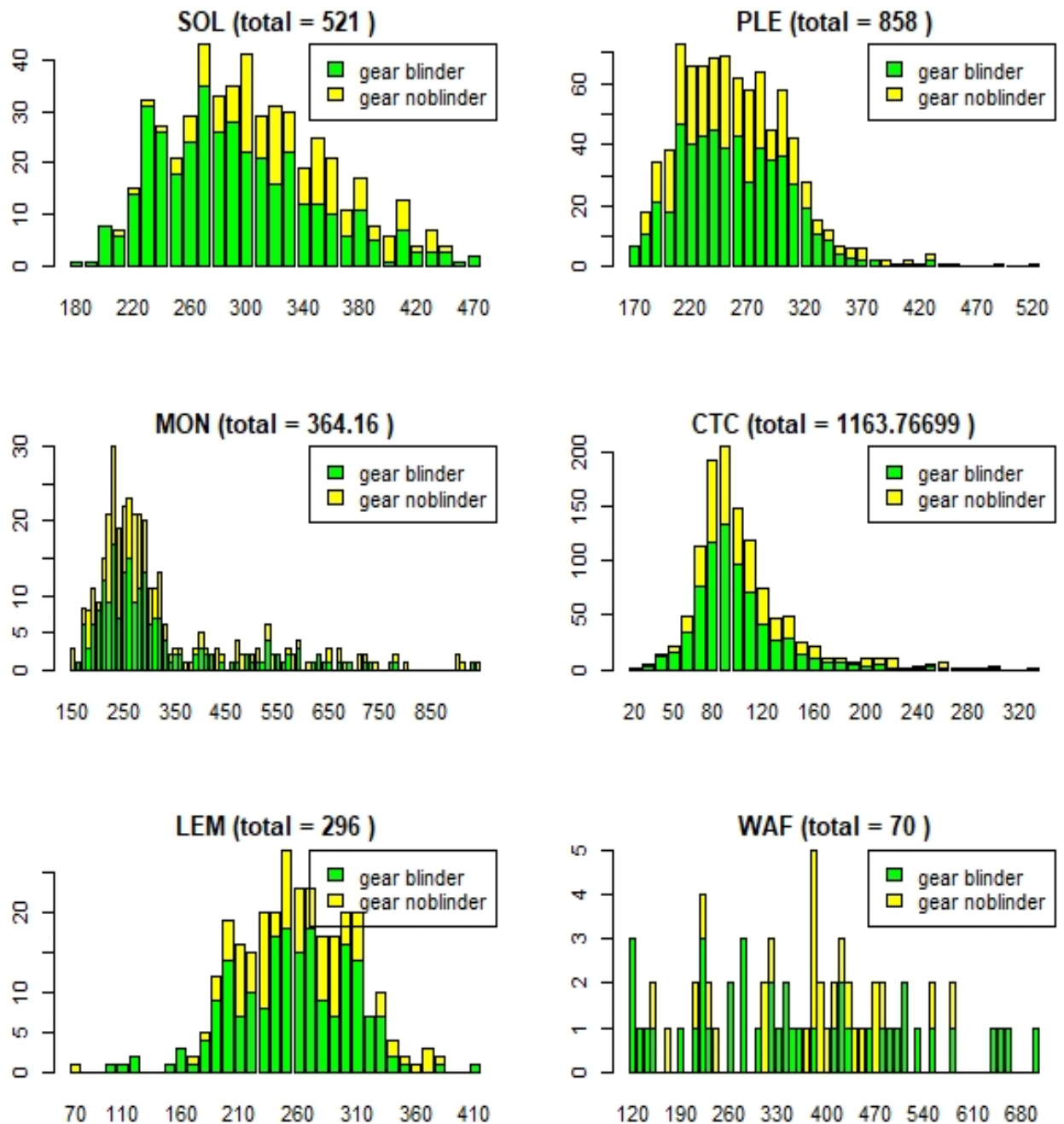


Figure 11: Length distributions (mm) for the major commercial species with total catch numbers by the two different gear types.

Appendix 1: Station Log information

Station	Date/Time	Lat Shot	Long Shot	Lat Haul	Long Haul	Distance	Depth Shot	Depth Haul	Tide dir.	Tide speed	Wind dir.	Wind speed	Sea Height	Swell dir.	Swell hgt.	Barom	Gear
1	21/03/2023 20:33	51.33017	-4.692	51.343	-4.64267	2	55	54	262	0.6	190	28	2	220	1.5	1005	4m Beam
2	21/03/2023 21:53	51.31567	-4.65267	51.31567	-4.65267	0	55	55	262	0.6	190	28	2	220	1.5	1005	ESM2 and Niskin
3	22/03/2023 12:22	49.79233	-5.80483	49.79233	-5.80483	0	86	86	281	0.9	230	23	1.5	250	2.5	1004	ESM2 and Niskin
4	22/03/2023 13:19	49.793	-5.797	49.78833	-5.74583	2	83	84	321	1.1	230	23	1.5	250	2.5	1004	4m Beam
5	22/03/2023 15:01	49.8715	-5.66517	49.838	-5.66333	2	78	81	5	1	210	27	1.5	220	2	1002	4m Beam
6	22/03/2023 16:35	49.856	-5.56883	49.839	-5.61283	2	79	83	338	0.3	220	31	1.5	200	2.5	1000	4m Beam
7	22/03/2023 18:57	49.98383	-5.37133	49.98183	-5.42283	2	50	58	96	0.8	230	37	2	210	2.2	1000	4m Beam
8	22/03/2023 19:51	49.97333	-5.42783	49.97333	-5.42783	0	58	58	96	0.8	230	34	2	210	2.2	1000	ESM2 and Niskin
9	23/03/2023 05:48	49.8435	-4.8425	49.83	-4.88967	2	88	89	63	1.4	220	35	2	220	2.2	1001	4m Beam
10	23/03/2023 07:54	49.93083	-4.83167	49.91983	-4.8805	2	85	86	60	0.7	230	26	2	230	2	1002	4m Beam
11	23/03/2023 10:20	50.13067	-4.96083	50.13067	-4.96083	0	45	45	203	0.6	210	18	1.5	230	1.5	1001	ESM2 and Niskin
12	23/03/2023 11:09	50.13633	-4.94083	50.1515	-4.9025	1.8	42	44	203	0.7	230	23	1.5	230	1.5	1001	4m Beam
13	27/03/2023 15:06	50.12667	-4.437	50.1485	-4.3975	2	69	67	254	0.2	170	12	0.2			1030	4m Beam
13	27/03/2023 15:06	50.12667	-4.437	50.1485	-4.3975	2	69	67	254	0.2	170	12	0.2			1030	Caesium and Tritium
14	27/03/2023 16:41	50.12283	-4.348	50.106	-4.393	2	69	71	264	0.2	170	13	0.2			1029	4m Beam
15	27/03/2023 18:11	50.05783	-4.50733	50.047	-4.458	2.1	74	75	325	0	160	8	0.2	230	0.5	1028	4m Beam
16	27/03/2023 20:13	50.06133	-4.529	50.04533	-4.57483	2	75	76	81	0.2	150	8	0.2	230	0.5	1028	4m Beam
17	27/03/2023 22:08	50.067	-4.71867	50.05083	-4.7645	2	75	75	54	0.4	170	13	0.5	230	0.5	1027	4m Beam
18	27/03/2023 23:21	50.039	-4.77533	50.039	-4.77533	0	75	75	107	0.1	170	20	0.5	250	0.5	1027	ESM2 and Niskin
19	28/03/2023 03:14	49.857	-4.19417	49.86667	-4.14517	2	75	75	258	0.7	180	18	0.5	250	0.5	1024	4m Beam
20	28/03/2023 05:24	50.04	-4.082	50.05267	-4.03417	2	72	73	284	0.6	160	20	0.5	250	0.5	1022	4m Beam
21	28/03/2023 08:54	50.2	-4.171	50.20367	-4.22267	2	61	60	71	0.2	180	21	1	210	1	1021	4m Beam
22	28/03/2023 10:53	50.26817	-4.15033	50.27083	-4.2025	2	52	52	111	0.4	180	26	1	180	2	1019	4m Beam
23	28/03/2023 12:00	50.26817	-4.17933	50.26817	-4.17933	0	52	52	111	0.4	190	31	1.5	180	2.2	1018	ESM2 and Niskin
24	28/03/2023 14:19	50.14467	-3.86633	50.11533	-3.895	2.1	61	68	271	0.4	210	35	1.5	180	2.2	1018	4m Beam
25	28/03/2023 15:49	50.03517	-3.81183	50.05733	-3.77317	1.9	72	72	276	0.6	230	20	1.5	170	2	1018	4m Beam
25	28/03/2023 15:49	50.03517	-3.81183	50.05733	-3.77317	1.9	72	72	276	0.6	230	20	1.5	170	2	1018	Caesium and Tritium
26	28/03/2023 17:08	50.05583	-3.64733	50.07833	-3.6085	2	70	68	242	1	230	14	1.5	220	2	1018	4m Beam
27	28/03/2023 18:08	50.09767	-3.557	50.12	-3.51833	2	67	67	240	1	230	9	1.5	220	1.5	1017	4m Beam
28	28/03/2023 20:06	50.05383	-3.50083	50.03083	-3.53833	2	69	71	224	0.2	240	11	1	220	1.5	1017	4m Beam
29	28/03/2023 22:31	49.91267	-3.679	49.9185	-3.72883	2	74	75	82	0.7	250	14	1	220	2	1018	4m Beam
30	28/03/2023 23:37	49.92733	-3.75767	49.92733	-3.75767	0	75	75	88	0.4	250	16	1	220	1.5	1018	ESM2 and Niskin
31	29/03/2023 01:10	49.81067	-3.59633	49.77983	-3.61617	2	75	75	278	0.1	210	14	1	220	1.5	1019	4m Beam
31	29/03/2023 01:10	49.81067	-3.59633	49.77983	-3.61617	2	75	75	278	0.1	210	14	1	220	1.5	1019	Caesium and Tritium
32	29/03/2023 03:56	49.9745	-3.4645	49.99883	-3.42933	2	70	70	222	0.1	190	17	0.2	220	1	1018	4m Beam
33	29/03/2023 05:56	50.10017	-3.19967	50.126	-3.16717	2.1	66	65	223	0.7	190	19	1	220	1	1016	4m Beam
34	29/03/2023 07:38	50.16467	-3.25583	50.18733	-3.21783	2	64	62	224	0.7	190	22	1	220	1	1014	4m Beam

Station	Date/Time	Lat Shot	Long Shot	Lat Haul	Long Haul	Distance	Depth Shot	Depth Haul	Tide dir.	Tide speed	Wind dir.	Wind speed	Sea Height	Swell dir.	Swell hgt.	Barom	Gear
35	29/03/2023 09:35	50.29417	-3.05633	50.26933	-3.091	2	58	60	28	0.1	190	22	1	210	1.5	1012	4m Beam
35	29/03/2023 09:35	50.29417	-3.05633	50.26933	-3.091	2	58	60	28	0.1	190	22	1	210	1.5	1012	Caesium and Tritium
36	29/03/2023 14:27	49.97483	-2.76483	49.965	-2.8155	2.1	67	68	65	0.6	210	27	1	210	1.5	1011	4m Beam
37	29/03/2023 15:26	49.955	-2.817	49.955	-2.817	0	68	68	59	0.4	200	26	1	210	1.5	1011	ESM2 and Niskin
38	29/03/2023 16:34	49.95083	-2.62183	49.95933	-2.57167	2	68	68	263	0.2	200	25	1	230	1.2	1010	4m Beam
39	29/03/2023 18:55	50.11683	-2.54467	50.12883	-2.49617	2.1	64	63	250	0.9	200	27	1	230	1.2	1009	4m Beam
40	29/03/2023 21:37	50.236	-2.20417	50.23967	-2.1525	2	58	58	272	0.6	210	30	1	230	1.2	1010	4m Beam
41	29/03/2023 23:39	50.1345	-2.03417	50.11967	-2.08083	1.9	60	60	74	0.3	220	28	1	210	2	1010	4m Beam
42	30/03/2023 00:47	50.11	-2.09483	50.11	-2.09483	0	61	61	81	0.7	240	25	1	210	2	1010	ESM2 and Niskin
43	30/03/2023 06:16	49.4015	-2.201	49.42533	-2.16533	2	52	48	235	0.3	200	10	1	230	1.2	1013	4m Beam
44	30/03/2023 11:14	49.16717	-1.82783	49.175	-1.85583	1.3	25	21	64	0.2	230	19	0.5	180	0.5	1015	4m Beam
45	30/03/2023 11:57	49.168	-1.83117	49.168	-1.83117	0	22	22	62	0.3	245	18	0.5	180	0.5	1015	ESM2 and Niskin
46	30/03/2023 14:43	49.3615	-1.97433	49.34517	-1.95417	1.2	27	24	329	0.3	182	10	0.5	270	1	1013	4m Beam
47	30/03/2023 18:49	49.07583	-2.54317	49.0635	-2.49583	2	52	50	281	0.3	190	25	1.2	260	1.5	1007	4m Beam
48	30/03/2023 19:51	49.04745	-2.4635	49.04745	-2.4635	0	47	47	264	0.1	190	25	1.2	260	1.5	1007	ESM2 and Niskin
49	31/03/2023 06:28	48.82683	-1.87167	48.81067	-1.9025	1.6	28	30	272	0.3	270	29	2	240	2	1001	4m Beam
50	31/03/2023 08:32	48.87	-1.9355	48.865	-1.9855	2	25	28	88	0.1	260	32	1.5	240	1.5	1003	4m Beam
51	02/04/2023 05:41	50.54533	-2.55967	50.54533	-2.55967	0	33	33	129	0.7	0	15	0.5	260	0.5	1026	ESM2 and Niskin
52	02/04/2023 07:01	50.53617	-2.52533	50.55233	-2.56083	1.7	30	25	145	0.7	0	13	0.5	260	0.5	1028	4m Beam
53	02/04/2023 09:28	50.618	-2.79733	50.59967	-2.79933	1.1	27	27	266	0.1	20	13	0.5	260	0.5	1030	4m Beam
53	02/04/2023 09:28	50.618	-2.79733	50.59967	-2.79933	1.1	27	27	266	0.1	20	13	0.5	260	0.5	1030	Caesium and Tritium
54	02/04/2023 11:18	50.4615	-2.90067	50.45633	-2.84917	2.1	45	46	266	0.5	0	15	0.5	260	0.5	1031	4m Beam
55	02/04/2023 12:55	50.42417	-2.999	50.42517	-2.94667	2	49	49	283	0.4	30	12	0.5	260	0.5	1031	4m Beam
56	02/04/2023 15:06	50.52667	-3.21767	50.50967	-3.263	2	34	34	18	0.2	60	10	0.5	260	0.5	1031	4m Beam
57	02/04/2023 16:32	50.491	-3.25133	50.47667	-3.29867	2	38	38	32	0.3	60	4	0.5			1032	4m Beam
58	02/04/2023 17:19	50.4675	-3.30383	50.4675	-3.30383	0	39	39	38	0.3	60	4	0.5			1032	ESM2 and Niskin
59	02/04/2023 18:14	50.535	-3.36533	50.508	-3.39633	2	25	25	44	0.3	90	11	0.5			1032	4m Beam
59	02/04/2023 18:14	50.535	-3.36533	50.508	-3.39633	2	25	25	44	0.3	90	11	0.5			1032	Caesium and Tritium
60	02/04/2023 21:05	50.28733	-3.20283	50.31183	-3.16717	2	59	57	203	0.1	20	8	0.5			1034	4m Beam
61	03/04/2023 07:01	49.76617	-2.08667	49.73917	-2.11683	2.1	60	45	27	4.1	90	17	0.5			1032	4m Beam
62	03/04/2023 08:15	49.721	-2.08283	49.721	-2.08283	0	43	43	30	1.1	90	21	0.5			1032	ESM2 and Niskin
63	03/04/2023 08:55	49.6815	-2.0075	49.65567	-2.0095	1.6	38	35	351	1.3	90	21	0.5			1032	4m Beam
64	03/04/2023 13:21	49.43017	-2.87583	49.4635	-2.87317	2.1	68	69	190	1.5	70	22	0.5			1031	4m Beam
65	03/04/2023 15:35	49.62167	-3.20183	49.61867	-3.253	2	84	78	75	0.9	80	18	1	70	1	1029	4m Beam
66	03/04/2023 16:41	49.58117	-3.30783	49.58117	-3.30783	0	111	111	75	0.9	1	18	1	70	1	1029	Caesium and Tritium
67	03/04/2023 17:58	49.42433	-3.1575	49.405	-3.19933	2	77	77	46	1	80	24	1	70	1	1029	4m Beam
67	03/04/2023 17:58	49.42433	-3.1575	49.405	-3.19933	2	77	77	46	1	80	24	1	70	1	1029	Caesium and Tritium
68	03/04/2023 19:25	49.304	-3.12317	49.2795	-3.08833	2	70	69	335	0.8	90	17	1	70	1	1029	4m Beam
69	03/04/2023 20:23	49.27833	-3.0715	49.27833	-3.0715	0	69	69	304	1	90	17	1	70	1	1029	ESM2 and Niskin
70	03/04/2023 22:12	49.1145	-3.23617	49.11183	-3.1825	2.1	71	70	270	1.8	90	22	1	70	1	1029	4m Beam

Station	Date/Time	Lat Shot	Long Shot	Lat Haul	Long Haul	Distance	Depth Shot	Depth Haul	Tide dir.	Tide speed	Wind dir.	Wind speed	Sea Height	Swell dir.	Swell hgt.	Barom	Gear
71	03/04/2023 23:21	49.10167	-3.1215	49.09933	-3.07067	2	68	67	267	1.1	90	18	1	70	1	1029	4m Beam
72	04/04/2023 05:46	48.98217	-2.55433	48.97633	-2.5785	1.1	52	51	83	0.5	90	9	0.5			1029	4m Beam
73	04/04/2023 08:05	48.94983	-2.7455	48.922	-2.7175	2	49	46	305	1.3	70	6	0.5			1030	4m Beam
74	04/04/2023 11:27	48.97133	-3.24083	48.974	-3.19	2	66	66	262	1.6	90	8	0.5			1030	4m Beam
75	04/04/2023 12:31	48.97433	-3.14783	48.97433	-3.14783	0	64	64	262	1.6			0.2	260	0.5	1031	ESM2 and Niskin
76	04/04/2023 16:59	48.8255	-3.751	48.8325	-3.7745	1	69	72	73	1	30	6	0.2	260	0.5	1029	4m Beam
77	04/04/2023 22:38	49.27367	-3.65333	49.293	-3.61217	2	80	80	245	1.3			0.5	270	1	1029	4m Beam
78	04/04/2023 23:41	49.30417	-3.60333	49.30417	-3.60333	0	81	81	250	1.2			0.5	270	1	1029	ESM2 and Niskin
79	05/04/2023 01:00	49.26017	-3.85567	49.26033	-3.90667	2	87	88	266	1.1			0.2	270	1	1028	4m Beam
80	05/04/2023 04:28	49.52117	-4.2405	49.515	-4.291	2	88	90	76	1.4	210	10	0.2	260	1	1026	4m Beam
80	05/04/2023 04:28	49.52117	-4.2405	49.515	-4.291	2	88	90	76	1.4	210	10	0.2	260	1	1026	Caesium and Tritium
81	05/04/2023 07:17	49.18317	-4.2925	49.16833	-4.338	2	94	93	257	0.1	220	12	0.5	260	1	1026	4m Beam
82	05/04/2023 11:11	48.655	-4.6765	48.655	-4.6765	2.7	78	78			230	15	0.5	260	0.5	1024	M/Beam+ Grapple
82	05/04/2023 11:11	48.655	-4.6765	48.655	-4.6765	2.7	78	78			230	15	0.5	260	0.5	1024	Drop camera
83	05/04/2023 23:25	49.0525	-4.66417	49.0525	-4.66417	0	93	93	253	1.3	238	15	0.5	260	0.5	1023	ESM2 and Niskin
84	05/04/2023 23:58	49.0565	-4.63733	49.06317	-4.5875	2	93	92	261	1.1	250	12	0.5	260	0.5	1023	4m Beam
85	06/04/2023 02:30	49.27817	-4.75033	49.262	-4.79483	2	100	101	41	0.6	290	16	0.5	260	1.2	1022	4m Beam
86	06/04/2023 05:07	49.15067	-4.5705	49.136	-4.61617	2	101	99	67	1.7	280	16	0.5	260	1	1021	4m Beam
87	06/04/2023 09:03	48.65333	-4.8425	48.66817	-4.80283	1.9	97	97	239	2.3	290	10	0.5	260	1	1023	4m Beam
88	06/04/2023 11:11	48.5295	-4.929	48.5295	-4.929	0	78	78	218	0.4	300	15	0.5	260	1	1024	ESM2 and Niskin
89	06/04/2023 11:51	48.523	-4.95667	48.52333	-4.9065	2	92	73	23	0.2	300	10	0.5	260	1	1024	4m Beam
90	06/04/2023 19:52	48.04433	-5.367	48.0775	-5.36083	2	115	115	202	1.6	350	10	0.5	280	1	1025	4m Beam
91	06/04/2023 22:32	48.33667	-5.4535	48.37017	-5.448	2	113	113	196	1.8	0	7	0.5	270	1	1026	4m Beam
92	06/04/2023 23:59	48.358	-5.4395	48.358	-5.4395	0	113	113	218	0.3	20	5	0.2	270	1	1026	ESM2 and Niskin
93	07/04/2023 02:43	48.55867	-5.44333	48.52783	-5.46183	2	115	115	24	1.3			0.2	270	1	1025	4m Beam
94	07/04/2023 07:42	48.83133	-5.56267	48.84933	-5.52017	1.9	115	114	170	0.5	115	9	0.5	280	1	1024	4m Beam
95	07/04/2023 11:19	48.62567	-5.205	48.62567	-5.205	0	108	108	253	2.4	90	8	0.5	280	1	1024	ESM2 and Niskin
96	07/04/2023 11:45	48.63083	-5.1895	48.6475	-5.1455	2	108	108	259	1.9	130	11	0.5	280	1	1024	4m Beam
97	07/04/2023 13:50	48.7585	-5.27283	48.72517	-5.275	2	109	110	341	0.6	100	7	0.5	280	1	1024	4m Beam
98	07/04/2023 19:38	48.64367	-5.918	48.65067	-5.96333	1.8	120	120	153	0.8	100	10	0.5	290	1	1023	4m Beam
99	07/04/2023 21:05	48.63667	-6.136	48.6695	-6.1255	2	122	122	203	1.2	80	11	0.5	290	1	1025	4m Beam
100	07/04/2023 23:50	48.95917	-6.05083	48.95717	-6.01133	1.6	120	118	281	0.7	100	12	0.5	290	1	1024	4m Beam
101	08/04/2023 00:46	48.95767	-5.991	48.95767	-5.991	0	118	118	301	0.7	130	9	0.5	290	1	1024	ESM2 and Niskin
102	08/04/2023 02:31	49.04417	-6.38217	49.01083	-6.38783	1.9	123	125	65	1.1	130	20	0.5	290	1	1024	4m Beam
103	08/04/2023 06:12	48.7865	-7.02867	48.78983	-7.07883	2	120	127	105	0.9	130	17	0.5	290	1	1023	4m Beam
104	08/04/2023 09:18	48.89317	-7.64267	48.91717	-7.60717	2	154	148	228	0.6	130	12	1	290	1.2	1024	4m Beam
105	08/04/2023 10:23	48.922	-7.59083	48.922	-7.59083	0	137	137	231	0.7	145	20	1	290	1.2	1024	ESM2 and Niskin
106	08/04/2023 16:16	49.36317	-6.28917	49.339	-6.32417	2	116	117	44	1.2	150	23	1	270	1.2	1024	4m Beam
107	08/04/2023 18:43	49.40117	-5.89117	49.3935	-5.94117	2	111	111	86	1.1	110	16	1	260	1	1024	4m Beam
108	08/04/2023 23:18	49.524	-5.2195	49.524	-5.2195	0	96	96	251	1.3	140	20	1	260	1	1025	ESM2 and Niskin

Station	Date/Time	Lat Shot	Long Shot	Lat Haul	Long Haul	Distance	Depth Shot	Depth Haul	Tide dir.	Tide speed	Wind dir.	Wind speed	Sea Height	Swell dir.	Swell hgt.	Barom	Gear
109	08/04/2023 23:52	49.52933	-5.19183	49.5365	-5.14167	2	95	94	257	1.3	140	21	0.5	260	1	1025	4m Beam
109	08/04/2023 23:52	49.52933	-5.19183	49.5365	-5.14167	2	95	94	257	1.3	140	21	0.5	260	1	1025	Caesium and Tritium
110	09/04/2023 05:58	49.96267	-5.5695	49.9335	-5.54417	2	69	72	29	0.2	140	17	1	260	0.5	1021	4m Beam
111	09/04/2023 09:13	49.92667	-5.944	49.95883	-5.9575	2	72	70	172	1	170	20	1	190	0.5	1021	4m Beam
112	09/04/2023 13:39	50.0945	-6.4765	50.0945	-6.4765	0	89	89	244	1.2	190	16	1	190	1	1020	ESM2 and Niskin
113	09/04/2023 14:06	50.094	-6.45017	50.09967	-6.41217	1.5	87	87	262	0.7	190	16	1	190	1	1020	4m Beam
114	09/04/2023 15:46	50.177	-6.46983	50.15083	-6.50167	1.9	92	95	22	0.7	200	20	1	190	1	1018	4m Beam
115	09/04/2023 17:18	50.0995	-6.633	50.0675	-6.64833	2	100	102	57	1.6	190	27	1	190	1	1017	4m Beam
115	09/04/2023 17:18	50.0995	-6.633	50.0675	-6.64833	2	100	102	57	1.6	190	27	1	190	1	1017	Caesium and Tritium
116	09/04/2023 19:10	50.1705	-6.8335	50.1495	-6.874	2	107	108	49	0.6	190	23	1	240	1	1017	4m Beam
117	09/04/2023 22:08	50.08117	-7.34467	50.11417	-7.33667	1.9	115	114	193	1	210	20	1.5	240	1.7	1016	4m Beam
118	09/04/2023 23:13	50.12933	-7.35467	50.12933	-7.35467	0	113	113	226	1.1	180	15	1.5	340	1.5	1015	ESM2 and Niskin
119	10/04/2023 07:15	49.71583	-6.30167	49.715	-6.35317	2.1	103	101	81	1.3	230	21	1.5	250	2.5	1015	4m Beam
120	10/04/2023 08:52	49.7995	-6.32683	49.8105	-6.3755	2.1	95	93	124	0.9	260	22	1.5	250	2	1015	4m Beam
121	10/04/2023 10:28	49.75667	-6.25933	49.77467	-6.216	2	97	95	194	0.8	270	20	1.5	250	2	1017	4m Beam
122	10/04/2023 12:06	49.77817	-6.2025	49.77817	-6.2025	0	93	93	246	1.3	260	26	1.5	250	2	1017	ESM2 and Niskin
123	13/04/2023 13:15	50.38083	-5.57133	50.41333	-5.55883	2	53	56	225	0.5	260	8	1	270	1.5	1011	4m Beam
124	13/04/2023 19:27	51.38667	-5.11133	51.38983	-5.1645	2	67	69	101	1	220	14	1	250	1	1008	4m Beam
125	13/04/2023 20:22	51.391	-5.18383	51.391	-5.18383		70		100	1.1	220	14	1	250	1	1008	ESM2 and Niskin
126	13/04/2023 22:07	51.333	-5.56933	51.32233	-5.61983	102	78	80	60	0.2	240	13	1	250	1	1007	4m Beam
127	14/04/2023 01:11	51.277	-6.17967	51.26817	-6.1285	2	105	104	329	0.2	210	9	1	210	1	1005	4m Beam
128	14/04/2023 04:09	51.24017	-6.64067	51.2535	-6.59217	2	90	95	223	0.2	160	11	1	240	1	1004	4m Beam
129	14/04/2023 07:19	51.02283	-6.16133	51.056	-6.16417	2	98	99	145	0.2	40	20	1	270	1	1001	4m Beam
130	14/04/2023 11:42	50.44117	-6.21783	50.4165	-6.25333	1.9	93	94	53	0.3	10	23	1	30	1	1006	4m Beam
131	14/04/2023 12:41	50.399166	-6.27367	50.399166	-6.27367		94		90	0.2	10	23	1	30	1	1006	ESM2 and Niskin

Appendix 2: Survey priority stations not worked on CEND 4/23

Stratum	Priority number	P Reference number	Reason for not working	Alternative priority station worked
1	3	P16013	In Isles of Scilly no trawl area	Str 1; Stn 6
1	5	P16065	In Isles of Scilly no trawl area	Str 2; Stn 7
1	7	P15993	In Isles of Scilly no trawl area	Str 1; Stn 8
3	1	P20977	In Cornwall IFCA no trawl area	Str 3; Stn 6
3	6	P24429	Static gear present	Str 3; Stn 7
5	6	P27083	In East of Start Point MCZ	Str 5; Stn 9
5	9	P27239	No time to complete	-
10	4	P25552	Too Shallow	Str 10; Stn 10
10	10	P25766	No time to complete	-
11	1	P27824	Poor ground	Str 11; Stn 8
11	4	P30108	Too Shallow	Str 11; Stn 9
11	9	P29974	Too Shallow	Str 11; Stn 10
12	5	P23080	Poor ground	Str 12; Stn 6
12	6	P25433	No time to complete	-
13	4	P20075	Gear damaged	Str 13; Stn 7
13	7	P19973	No time to complete	-
B	1	P18193	No time to complete	-
B	3	P18032	No time to complete	-
B	4	P14140	No time to complete	-
B	5	P21787	No time to complete	-
C	1	P29773	Too shallow	Str C; Stn 6
C	5	P20820	No time to complete	-
C	6	P24642	No time to complete	-
D	4	P17339	No time to complete	-
D	5	P17454	No time to complete	-
E	1	P9661	No time to complete	-
E	2	P12731	No time to complete	-
E	4	P12952	No time to complete	-
E	5	P13574	No time to complete	-
F	1	P10046	No time to complete	-
F	3	P16660	No time to complete	-
F	5	P12581	No time to complete	-
G	1	P6009	No time to complete	-
G	2	P5743	No time to complete	-
G	3	P9279	No time to complete	-
G	4	P11732	No time to complete	-
G	5	P10376	No time to complete	-
H	4	P11183	No time to complete	-
H	5	P14971	No time to complete	-
J	2	P22603	Poor ground	Str J; Stn 6
J	4	P18893	In a munitions site	Str J; Stn 7
J	5	P18801	Poor Ground	Str J; Stn 8
J	7	P18754	No time to complete	-
J	8	P18922	No time to complete	-
K	1	P19443	Gear damaged	Str K; Stn 6
K	6	P19205	No time to complete	-
N	2	P8005	No time to complete	-
N	3	P7735	No time to complete	-
N	4	P4684	No time to complete	-
N	5	P18866	No time to complete	-