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

2013 RESEARCH VESSEL PROGRAMME

REPORT: Cefas Endeavour: Survey 2/13

STAFF:

Part 1	**Part 2**
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S Stones	M Vedor
	S Kupschus

DURATION: Part 1 15th February – 1st March
Part 2 1st March – 14th March

LOCATION: Celtic Sea, South Western Approaches, Western English Channel (ICES Divisions VIIe to VIIh)

AIMS:

PRIMARY AIMS:

1. To carry out a survey of the Celtic Sea and South Western Approaches with a modified GOV trawl fitted with rockhopper ground gear and a single standardised 4m beam trawl. Survey positions will be selected using a stratified random approach for both gear types.

2. To carry out a beam trawl survey of the Western Channel with standardised twin 4m beam trawls using a stratified random approach.

3. To collect fisheries acoustic data at three operating frequencies (38, 120 & 200 kHz) and multibeam data continuously throughout the cruise.

Trawl catch will be processed to obtain information on;

a) Distribution, size composition and relative abundance of fish, cephalopods, and benthic invertebrates.
b) Age-length distribution of selected fish species.
c) Biological parameters of selected species.

The data obtained from processing the trawl catches was collected in support of the EU Data Collection Framework (DCF) and will be submitted to ICES working groups and other biological studies.

SECONDARY AIMS

4. Collect information on;
    a) Distribution of macrobenthos
    b) Distribution and classification of anthropogenic debris.
    c) Distribution of fish in relation to their environment.

5. To continuously log sub-surface (3m) salinity, temperature, fluorometry and other environmental data using the Ferrybox.

6. To collect full depth conductivity, temperature and depth profiles at each trawl station alongside surface and near-bottom water samples using an ESM2 logger and Niskin bottles.

7. To collect water samples for Dissolved Inorganic Carbon (DIC) and Total Alkalinity (TA) analysis

8. To collect data using the onboard PCO2 system.

9. To record details of surface sightings of any marine mammals, sea turtles and large pelagic fish, and record observations on jellyfish aggregations

10. To collect water samples for caesium and tritium analysis under SLA22.

11. To deploy the Manta micro litter trawl.

OPPORTUNISTIC AIMS; these will be undertaken if survey progress and weather allow.

12. Conduct a preliminary survey of sediment status in the Celtic Sea region. Key parameters from Sediment Profile Imagery and grabs will be PSA (sediment type), total organic carbon, pigments and redox depth (aRPD).

13. To tag and release specimens of spurdog (*Squalus acanthias*), smooth-hound (*Mustelus spp*)., tope (*Galeorhinus galeus*), greater-spotted dogfish (*Scyliorhinus stellaris*) and various skates (*Rajidae*).

14. To deploy a Baited Remote Underwater Video System (BRUVS), where possible, to provide an alternative, non-lethal method for sampling larger piscivorous fish which are often under represented in trawl surveys due to the nature of the trawl catchability. The BRUVS system will be used to acquire data on the presence and abundance of piscivorous fish and benthic fauna, their behaviour and size. In additional to determining the habitat and stratum type and associated species composition, across a variety of habitats, including those that cannot be sampled effectively with trawls such as rocky reefs.

15. Collect muscle tissue samples from clupeid species, and preserve them in ethanol, for further development of TagMan Assay.

16. Collect frozen specimens of Sepiolidae.

17. Collect whole sprats across the size range caught for subsequent otolith morphology studies.

18. Collect berried lobster and edible crab for return to Lowestoft as brood stock.

19. Collect samples of fish (by species) for radiological analysis.

20. Collect samples of fish for FSA dioxin analysis.

NARRATIVE:

Staff travelled from Lowestoft to Swansea on the 14th of February, boarding Cefas Endeavour at 16:00 . The day of the 15th was spent setting up the fish lab and preparing gear for sampling. Cefas Endeavour sailed later that day, leaving Swansea at 18:30.

The initial operational plan for the survey was to work the stations in the Celtic Sea using the GOV during the day, changing gears to fish the beam trawl at night.
During the day additional survey operations would be carried out including: ESM2 logger with a Niskin, TA/DIC sample collection and a Manta micro litter trawl. During the night, the additional survey operations were: Day-grabs, ESM2 logger with a Niskin and a SPI camera.

Sampling commenced at 00:27 on the 16th of February in stratum C in the Celtic Sea, with two tows fished using both the beam trawl and GOV. The vessel steamed to stratum D (see annex 1 for stratum map) where one additional beam trawl and GOV station was fished. The GOV station was invalid due to a tear in the belly, the tow was subsequently successfully repeated.

Fishing moved across to stratum B where one station was fished with the GOV. Despite damage to the wing the tow was deemed valid as the Scanmar log indicated that the damage had occurred 23 minutes into the tow. A successful beam trawl station completed fishing for the day. On the 18th of February work continued in stratum B, sampling two beam trawl and two GOV stations.

The initial plan was reviewed on the 19th as it became apparent that it would become unworkable over the longer term. Back-tracking across the grid to re-fish tows on a daily basis was using inordinate amounts of vessel time, and lifting trawl doors and beam trawls in anything more than a calm sea would be putting people at unnecessary risk. It was decided to fish round the grid using the beam trawl, fitting in the additional sampling equipment (Grabs, SPI etc.) on a dynamic basis. Once the grid was completed with the beam trawls we would then revisit the sites with the GOV and any missing sampling gears. This would involve removing the daylight/darkness restrictions on the fishing gears, but as this would in effect be randomised by the vessel position it would not add significant bias to the sampling design.

Following this decision four beam trawl stations were sampled in stratum A.

The vessel headed south completing 8 beam trawl stations in stratum E, G and H before work was forced to stop due to winds gusting up to 47 knots. The unfavourable weather conditions were forecast to last for at least 48 hours so the decision was taken to steam to the channel section of the grid where we could continue in the more sheltered conditions.

Fishing commenced with the twin beams on the 22nd of February working around the grid in stratum 10 and 11. Some tows were reduced to less than 2NM due to concerns over the hard ground in the central area. Two stations had to be abandoned due to unsuitable fishing grounds being found after one hour searching.

On the 24th of February the vessel headed to stratum 9 where two beam trawl stations were fished. One of the stations was close to a marked explosive dumping ground (Hurd Deep), the deck crew and scientific staffs were briefed on appropriate actions should anything suspicious be found in the catch.

The 25th of February followed much the same pattern as previous days with six beam trawl stations completed along with ESM2 water profiler casts and salinity samples. On attempting to undertake the Day-grab and SPI camera element at station H2 the coring winch failed when attempting to deploy the equipment; further work using the winch was suspended pending repair by engineering staff.

Over the next three days Endeavour continued to work Strata H, K and 12 without incident (11 beam trawl and ESM2 stations), the coring winch was repaired and successfully load tested in 100m of water.

Endeavour docked in Falmouth at 10:30 on 28th February to enable scientific crew changeover, re-provisioning and fuel bunkering.

Endeavour sailed again at 05:30 on 2nd March and headed to Stratum 2 to commence operations. On arrival at station 2-2 a quantity of static gear was noted in the area. After liaison via VHF with two local vessels (Silvery Sea and Providence) we obtained a position for the tow that was known to be clear of other gear.

Work continued round the grid working stations in Strata 1, 2, 8, E, G and F until 18:30 on 4th March. During the Beam trawl tow on prime station F3 the EK60 sounder failed. Towing continued using the multibeam and Olex system to provide depth and bottom contour information. Once the tow was complete the day grab was deployed to provide substrate samples before attempting to deploy the SPI camera. Whilst swapping gear out to deploy the SPI camera the coring winch failed to operate, as did the net drum. Engineers traced and rectified the fault allowing the deck crew to swap the Beam for the GOV. Further work with the coring winch was suspended pending work by the engineers. Over the following 12 hours the EK60 sounder was rebuilt and the coring winch repaired. Due to the nature of the faults the survey continued and only around one hour of survey time was lost.

20:30 on the 5th of March saw the end of the major multi-disciplinary section of the survey. The GOV, Day-grab and SPI camera were dismantled and packed away

whilst Endeavour resumed the twin beam element of the survey in Stratum 1, completing three beam trawl stations before steaming to the French sector in the English Channel to pick up the outer stations of Strata 13, 10, 9 and 6.

Work continued in exceedingly good weather for the time of year through to 15:30 on 10th March by which time a further 40 beam trawl stations had been completed. During the course of the morning of the 10th with five stations left to work the weather worsened considerably, with a North Easterly Gale 8 forecast to reach force 9 to 10 over the following 24 to 48 hours. Survey work was halted and Endeavour headed to shelter in Lyme Bay, reaching anchorage at 23:30.

Whilst at anchor, the BRUVS camera was deployed and five x 2hour deployments were undertaken during the night and the following day.

The weather forecast was reviewed on a regular basis with a view to completing the final five core stations of the channel grid. The weather eventually broke and it was deemed safe to work at 17:30 on 13th March. Endeavour left anchorage at 18:30 and proceeded to complete the remainder of the grid. Once the grid was complete a series of five parallel tows were undertaken in Lyme Bay to provide data on inter-tow variability. Endeavour docked in Portland at 09:30 on 14th March. After cleaning down and unloading equipment the scientific staff left the vessel at 10:00.

I would like to thank the Officers, Crew and Scientific staff; without their expertise, professionalism, enthusiasm and flexibility we could not have completed the quantity and variety of work that we did.

RESULTS:

Table 1. Number of deployments by gear type.

Gear type	**Number of deployments**
GOV trawl	20
Single beam trawl	34
Twin beam trawl	88
ESM2 logger (with Niskin)*	117
Day-Grab	24
SPI camera	16
BRUVS camera	5
Manta micro litter Trawl	33

*Near bottom and surface salinity samples were also collected for later processing

Figure 1. Position of twin beam trawl tows in western channel.

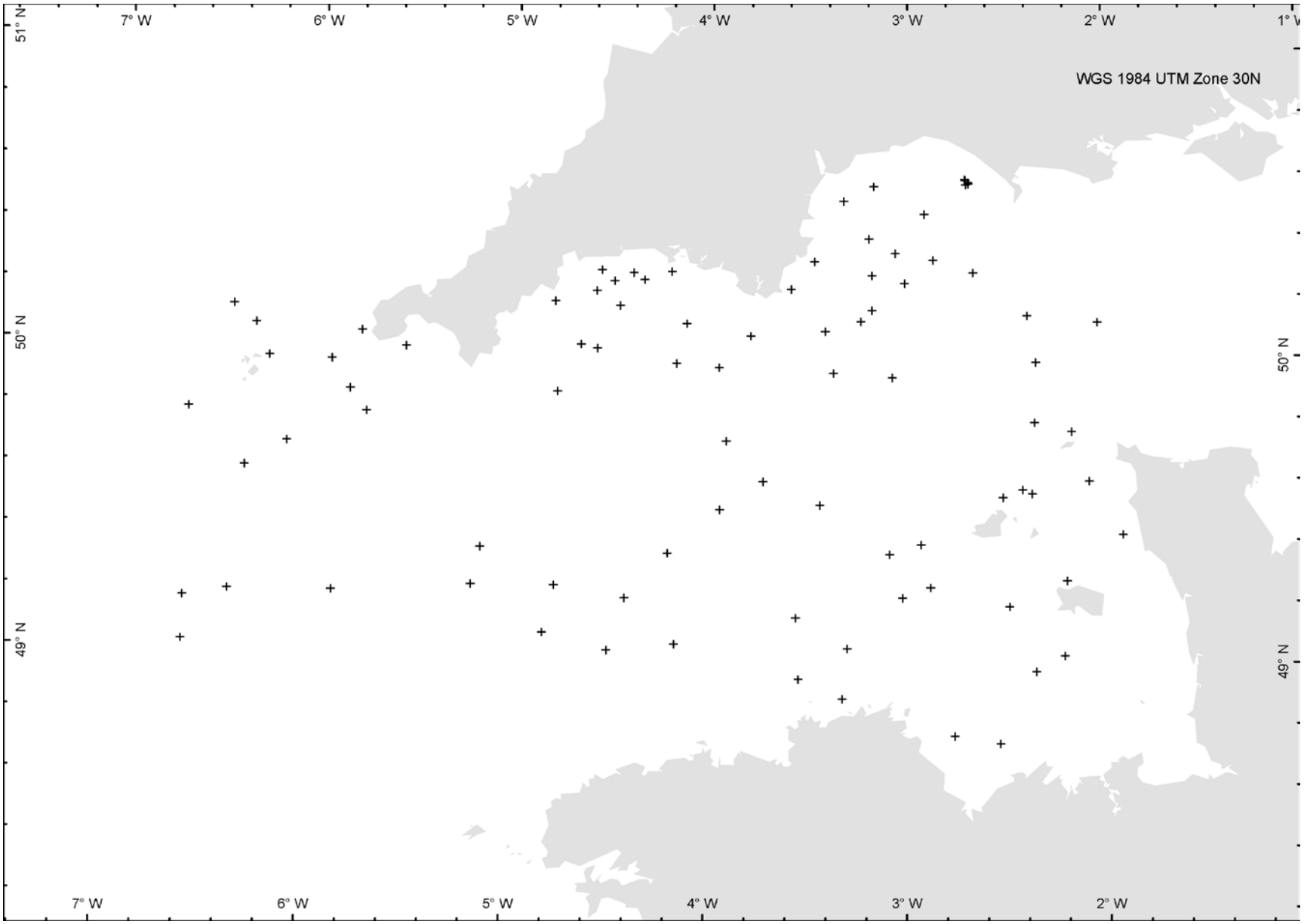


Figure 2. Position of high speed manta tows, entire survey

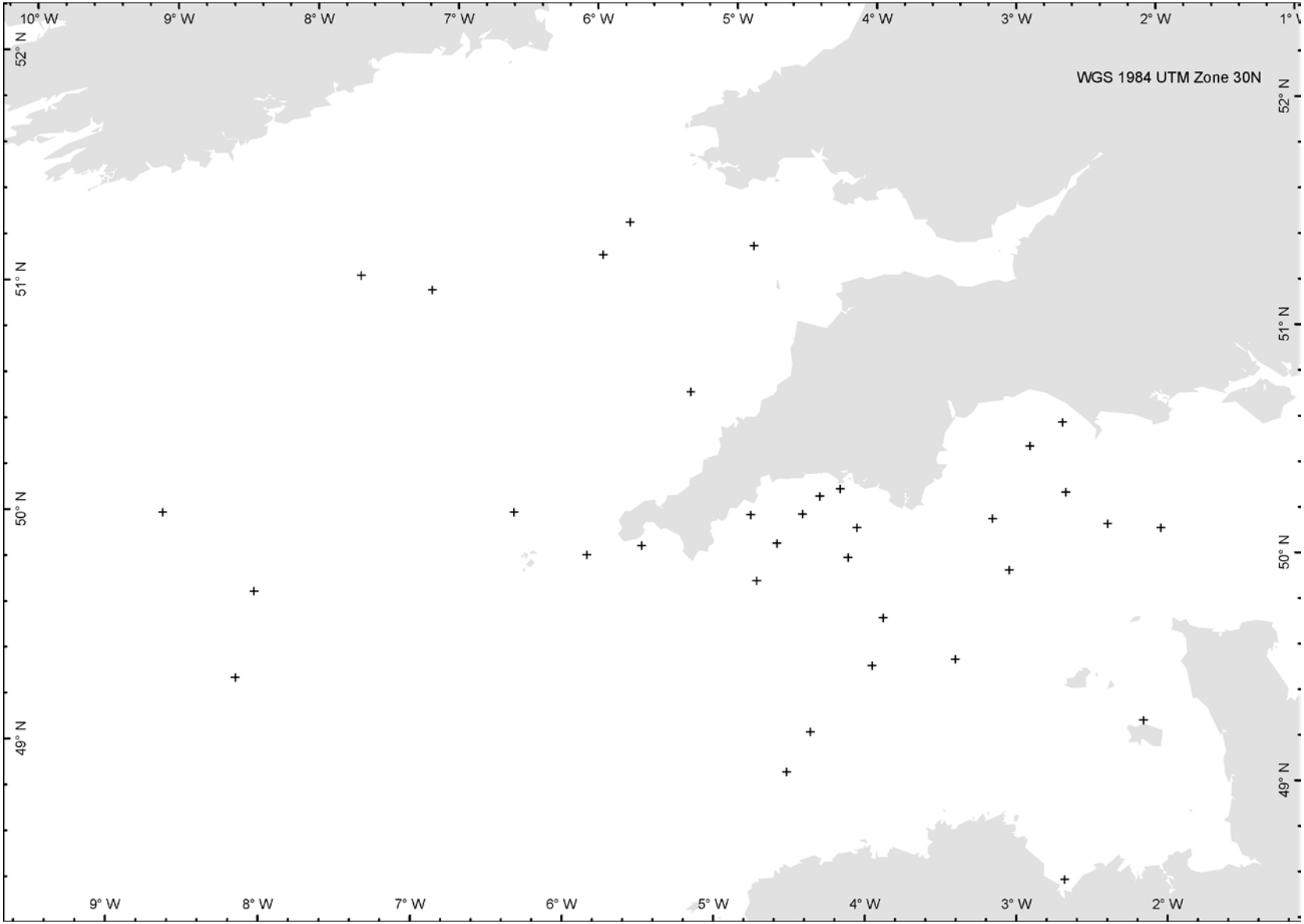


Figure 3, Deployment of the various gears in the multidisciplinary element of the survey.

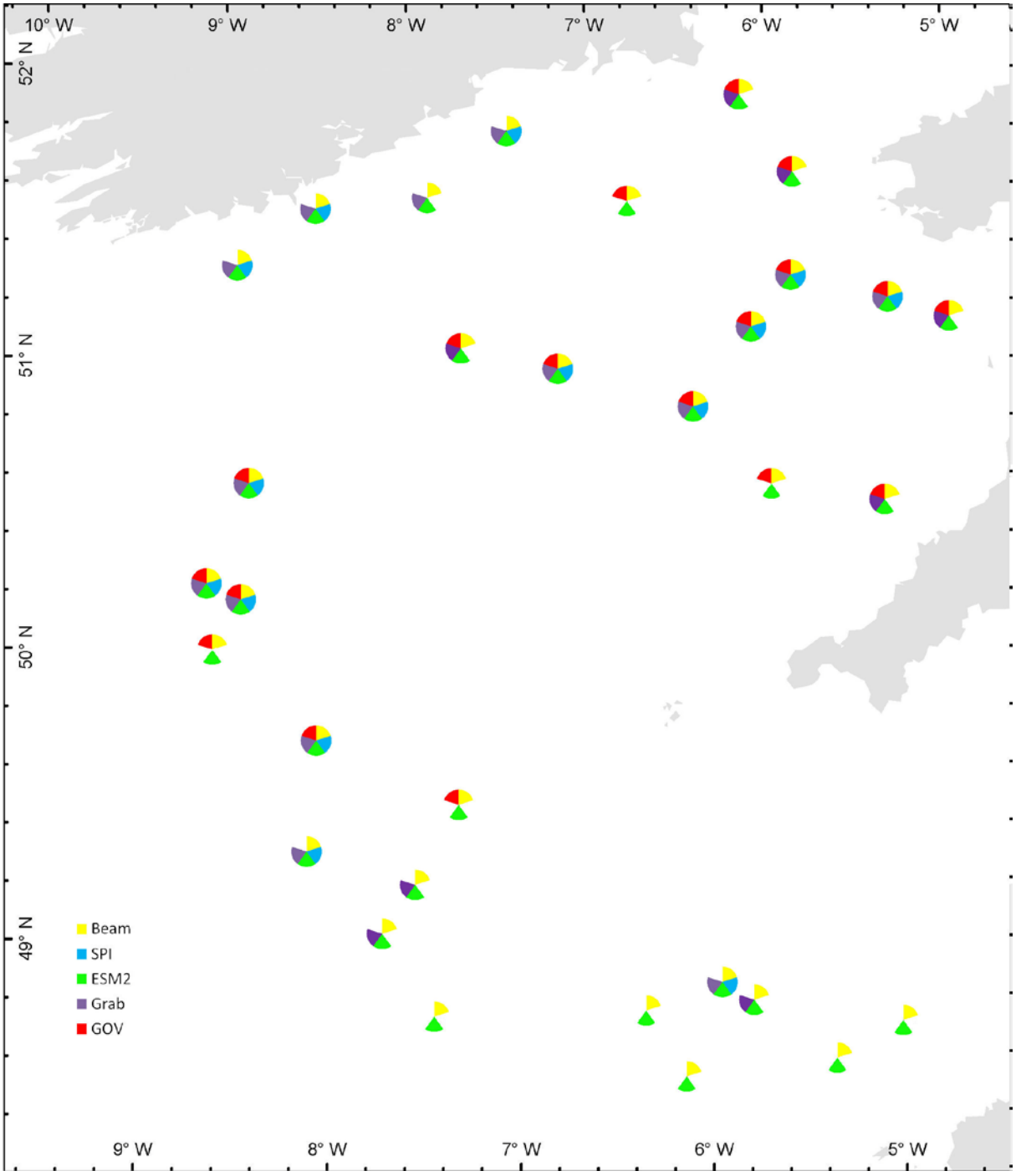


Table 1. List of species caught and the number of stations they were caught at, all fishing gears combined.

Species	Number	Species	Number
Acanthocardia aculeata	*1*	*Actinauge richardi*	7
Actinia spp	*1*	*Aequipecten opercularis*	90
Agonus cataphractus	*32*	*Alcyonidium diaphanum*	40
Alcyonidium parasiticum	*1*	*Alcyonium digitatum*	71
Alcyonium glomeratum	*1*	*Alpheus glaber*	3
Alpheus macrocheles	*3*	*Anapagurus in epizoanthus*	2
Anapagurus laevis	*2*	*Anemone unidentified*	14
Anseropoda placenta	*47*	*Antedon bifida*	11
Aphrodite aculeata	*61*	*Archidoris pseudoargus*	41
Arctica islandica	*2*	*Argentinidae*	31
Armina loveni	*1*	*Arnoglossus imperialis*	71
Arnoglossus laterna	*61*	*Ascidia conchilega*	1
Ascidia mentula	*3*	*Ascidiacea*	35
Ascidiella scabra	*1*	*Aspitrigla (chelidonichthys) cuculus*	122
Assorted rocks	*102*	*Asterias rubens*	60
Astropecten irregularis	*56*	*Atelycyclus rotundatus*	25
Atrina fragilis	*4*	*Axinella infundibuliformis*	5
Barnea candida	*2*	*Bathynectes longipes*	1
Belone belone	*1*	*Blennius ocellaris*	14
Bolocera tuediae	*3*	*Botryllus schlosseri*	11
Branchiostoma (amphioxus) lanceolatum	*1*	*Bryozoa*	2
Buccinum humphreysianum	*1*	*Buccinum undatum*	39
Buenia jeffreysii	*6*	*Buglossidium luteum*	26
Calliactis parasitica	*9*	*Callionymus lyra*	167
Callionymus maculatus	*42*	*Callionymus reticulatus*	4
Calliostoma granulatum (c. Papillosum)	*1*	*Calliostoma zizyphinum*	1
Cancer pagurus	*87*	*Capros aper*	58
Caryophyllia smithii	*7*	*Cellariidae*	14
Cepola rubescens (c. Macrophthalma)	*6*	*Chaetopterus tubes*	41
Chirolophis ascanii	*5*	*Chlamys varia*	3
Chlorophyceae	*1*	*Ciliata mustela*	1
Ciliata septentrionalis	*21*	*Circomphalus casina*	1
Cirolana cranchii	*7*	*Clausinella fasciata*	2
Cliona celata	*11*	*Clupea harengus*	14
Conger conger	*22*	*Corystes cassivelaunus*	8
Crangon allmanni	*39*	*Crangonidae*	4

Crepidula fornicata	*6*	*Crossaster papposus*	41
Crystallogobius linearis	*1*	*Ctenolabrus rupestris*	29
Cuttle eggs	*1*	*Dasyatis pastinaca*	1
Dendronotus frondosus	*3*	*Dicentrarchus labrax*	3
Dichelopandalus bonnieri	*9*	*Diphasia nigra*	5
Diplecogaster bimaculata	*2*	*Dipturus (raja) batis*	6
Dogfish egg cases	*32*	*Dosinia spp*	2
Dromia personata	*5*	*Dysidea fragilis*	3
Ebalia cranchii	*1*	*Ebalia tuberosa*	3
Ebalia tumefacta	*1*	*Echiichthys (trachinus) vipera*	14
Echinocardium cordatum	*6*	*Echinus acutus*	35
Echinus esculentus	*36*	*Eledone cirrhosa*	93
Enchelyopus cimbrius	*1*	*Engraulis encrasicolus*	5
Epibenthic mixture	*201*	*Eunicella verrucosa*	8
Eupagurus / pagurus in adamsia	*68*	*Eupagurus / pagurus in buccinum*	20
Eupagurus / pagurus in suberites	*23*	*Eurydice spp*	9
Eurynome aspersa	*5*	*Euspira (polinices) eggs*	9
Euspira fusca	*1*	*Eutrigla (chelidonicthys) gurnardus*	70
Filograna implexa	*3*	*Flustra foliacea*	34
Fucus vesiculosus	*23*	*Gadus morhua*	23
Gaidropsarus vulgaris	*15*	*Galathea dispersa*	1
Galathea spp	*4*	*Galathea strigosa*	1
Galeorhinus galeus	*1*	*Glycymeris glycymeris*	5
Glyptocephalus cynoglossus	*22*	*Gobiesocidae*	1
Gobius gasteveni	*21*	*Gobius niger*	5
Goneplax rhomboides	*5*	*Haliclona oculata*	5
Henricia oculata	*31*	*Hinia (nassarius) reticulatua*	1
Hippocampus hippocampus	*3*	*Hippoglossoides platessoides*	27
Holothuria forskali	*1*	*Holothuroidea*	16
Homarus gammarus	*6*	*Hyalinoecia tubicola*	28
Hyas araneus	*1*	*Hyas coarctatus*	21
Hydrallmania falcata	*8*	*Hydroida (order)*	90
Hyperoplus immaculatus	*6*	*Hyperoplus lanceolatus*	2
Illex illecebrosus	*1*	*Inachus dorsettensis*	52
Inachus leptochirus	*25*	*Labrus bergylta*	3
Labrus mixtus (l. Bimaculatus)	*18*	*Laetmonice (hermione) histrix*	10
Laevicardium crassum	*5*	*Laminaria spp*	8
Lepidorhombus boscii	*3*	*Lepidorhombus whiffiagonis*	103
Leucoraja fullonica	*6*	*Leucoraja naevus*	38
Limanda limanda	*53*	*Limaria hians*	13
Liocarcinus depurator	*55*	*Liocarcinus marmoreus*	8
Liocarcinus pusillus	*4*	*Loligo (alloteuthis) subulata*	27

Loligo forbesi	*18*	*Loligo spp*	3
Loligo vulgaris	*2*	*Lophius budegassa*	17
Lophius piscatorius	*97*	*Luidia ciliaris*	63
Luidia sarsi	*40*	*Lytocarpia myriophyllum*	2
Macropipus tuberculatus	*5*	*Macropodia linaresi*	2
Macropodia rostrata	*3*	*Macropodia tenuirostris*	49
Maja squinado	*147*	*Marthasterias glacialis*	66
Maurolicus muelleri	*13*	*Melanogrammus aeglefinus*	45
Merlangius merlangus	*61*	*Merluccius merluccius*	57
Metridium senile	*12*	*Micrenophrys (taurulus) lilljeborgi*	3
Microchirus variegatus	*113*	*Micromesistius poutassou*	17
Microstomus kitt	*111*	*Molva molva*	7
Mullus surmuletus	*27*	*Munida rugosa*	30
Mustelus asterias	*77*	*Necora puber*	74
Nemertea	*1*	*Nemertesia antennina*	13
Nemertesia ramosa	*2*	*Nemertesia spp*	18
Nephrops norvegicus	*34*	*Neptunea eggs*	1
Nudibranchia	*9*	*Ophiocomina nigra*	15
Ophiothrix fragilis	*26*	*Ophiura ophiura*	43
Ophiuroidea	*3*	*Paguridae*	14
Pagurus variabilis	*1*	*Palaemon serratus*	6
Palinurus elephas	*1*	*Palliolum tigerinum*	1
Pandalus montagui	*24*	*Pandalus propinquus*	1
Pandalus spp	*2*	*Parablennius gattorugine*	2
Pasiphaea spp	*9*	*Pecten maximus*	88
Pegusa (solea) lascaris	*18*	*Pentapora foliacea*	62
Phaeophyceae	*19*	*Phallusia mammillata*	2
Phaxus pellucidus	*1*	*Philine aperta*	2
Pholis gunnellus	*2*	*Phycis blennoides*	12
Pilumnus hirtellus	*2*	*Pisa armata*	10
Pisidia longgicornis	*13*	*Platichthys flesus*	8
Pleurobrachia pileus	*1*	*Pleurobranchus membranaceus*	14
Pleuronectes platessa	*172*	*Pollachius pollachius*	10
Polybius (liocarcinus) holsatus	*62*	*Polychaeta*	3
Pomatoschistus spp	*35*	*Pontophilus spinosus*	9
Porania pulvillus	*32*	*Poraniomorpha hispida*	1
Porella compressa	*1*	*Porifera*	46
Processa canaliculata	*19*	*Psammechinus miliaris*	29
Psilaster andromida	*1*	*Raja brachyura*	4
Raja clavata	*13*	*Raja egg cases*	1
Raja microocellata	*2*	*Raja montagui*	42
Raja undulata	*12*	*Raniceps raninus*	1

Rhodophyceae	*6*	*Rossia macrosoma*	13
Sabellaria spinulosa	*1*	*Sardina pilchardus*	8
Scalpellum scalpellum	*6*	*Scaphander lignarius*	37
Scaphopoda	*1*	*Scomber scombrus*	27
Scophthalmus maximus (psetta maxima)	*12*	*Scophthalmus rhombus*	12
Scyliorhinus canicula	*240*	*Scyliorhinus stellaris*	9
Securiflustra securifrons	*1*	*Sepia elegans*	64
Sepia officinalis	*75*	*Sepia orbignyana*	33
Sepiola atlantica	*22*	*Simnia patula*	2
Sipunculidae	*1*	*Solea solea*	150
Solenocera membranacea	*11*	*Spatangus purpureus*	21
Spinulosida (order)	*1*	*Spondyliosoma cantharus*	25
Sprattus sprattus	*53*	*Squalus acanthias*	5
Squid eggs	*31*	*Stichastrella rosea*	24
Styela clava	*3*	*Suberites spp*	13
Symphodus (crenilabrus) balloni	*5*	*Syngnathus acus*	23
Taurulus bubalis	*2*	*Tethya aurantia*	7
Todaropsis eblanae	*14*	*Torpedo marmorata*	3
Torpedo nobiliana	*1*	*Trachurus trachurus*	29
Trigla (chelidonichthys) lucerna	*41*	*Trigloporus (chelidonichthys) lastoviza*	37
Trisopterus esmarki	*30*	*Trisopterus luscus*	101
Trisopterus minutus	*199*	*Tritonia hombergi*	12
Trivia arctica	*1*	*Tubeworms*	3
Turritella communis	*7*	*Upogebia deltaura*	1
Urosalpinx cinerea	*2*	*Urticina (tealia) felina*	38
Whelk eggs	*46*	*Xanthid crab*	5
Xantho pilipes	*9*	*Zeugopterus (phrynorhombus) norvegius*	56
Zeugopterus (phrynorhombus) regius	*19*	*Zeugopterus punctatus*	34
Zeus faber	*50*		

Table 2. Number of biological samples collected by species, all gears combined.

Code	Common name	Scientific name	Number of Biological Samples
WAF	Black-bellied anglerfish	*Lophius budegassa*	39
GUG	Grey gurnard	*Eutrigla (chelidonicthys) gurnardus*	317
JOD	John dory	*Zeus faber*	93
HAD	Haddock	*Melanogrammus aeglefinus*	388
HKE	European hake	*Merluccius merluccius*	398
THR	Thornback ray (roker)	*Raja clavata*	14
MON	Anglerfish (monk)	*Lophius piscatorius*	284
ESB	European seabass	*Dicentrarchus labrax*	5
SKT	Common skate	*Dipturus (raja) batis*	6
DGN	Nurse hound	*Scyliorhinus stellaris*	28
PTR	Smalleyed (painted) ray	*Raja microocellata*	2
SHR	Shagreen ray	*Leucoraja fullonica*	6
TUR	Turbot	*Scophthalmus maximus (psetta maxima)*	12
BLL	Brill	*Scophthalmus rhombus*	12
COD	Atlantic cod	*Gadus morhua*	63
GUS	Streaked gurnard	*Trigloporus (chelidonichthys) lastoviza*	140
UNR	Undulate ray	*Raja undulata*	14
CUR	Cuckoo ray	*Leucoraja naevus*	99
MUR	Red mullet	*Mullus surmuletus*	38
SPR	Sprat	*Sprattus sprattus*	299
SDR	Spotted ray	*Raja montagui*	74
SDS	Starry smooth hound	*Mustelus asterias*	174
SOL	Sole (dover sole)	*Solea solea*	363
LEM	Lemon sole	*Microstomus kitt*	417
MEG	Megrim	*Lepidorhombus whiffiagonis*	559
PLE	European plaice	*Pleuronectes platessa*	686
TUB	Tub gurnard	*Trigla (chelidonichthys) lucerna*	164
COE	European conger eel	*Conger conger*	22
DGS	Spurdog	*Squalus acanthias*	4
GUR	Red gurnard	*Aspitrigla (chelidonichthys) cuculus*	519
HER	Herring	*Clupea harengus*	325
WHG	Whiting	*Merlangius merlangus*	438
BLR	Blonde ray	*Raja brachyura*	5
MAC	(European) mackerel	*Scomber scombrus*	112

Notes to table 2;

Sprat – Whole fish frozen, may not result in all fish successfully otolithed when processed later.

Rajidae – Individual weight for all fish, maturity stage for majority.

Anglerfish – Ilicia and otoliths collected

In addition, 316 individuals of a variety of species were sampled for length/weight analysis.

Table 3. Number of individuals measured by species, all fishing gears combined.

Code	Common name	Scientific name	Number of individuals measured
POD	Poor cod	*Trisopterus minutus*	9043
SPR	Sprat	*Sprattus sprattus*	2200
CDT	Common dragonet	*Callionymus lyra*	2192
NOP	Norway pout	*Trisopterus esmarki*	1846
LSD	Lesser spotted dogfish	*Scyliorhinus canicula*	1765
TBS	Thickback sole	*Microchirus variegatus*	1597
HKE	European hake	*Merluccius merluccius*	1477
PLE	European plaice	*Pleuronectes platessa*	1462
WHG	Whiting	*Merlangius merlangus*	957
BOF	Boar fish	*Capros aper*	933
NEP	Norway lobster	*Nephrops norvegicus*	899
GUR	Red gurnard	*Aspitrigla (chelidonichthys) cuculus*	861
SOT	Solenette	*Buglossidium luteum*	852
BIB	Whiting-pout (bib)	*Trisopterus luscus*	742
HAD	Haddock	*Melanogrammus aeglefinus*	737
MAC	(European) mackerel	*Scomber scombrus*	636
MEG	Megrim	*Lepidorhombus whiffiagonis*	585
DAB	Dab	*Limanda limanda*	564
HER	Herring	*Clupea harengus*	559
LEM	Lemon sole	*Microstomus kitt*	548
ATS		*Loligo (alloteuthis) subulata*	540
SDF	Scald fish	*Arnoglossus laterna*	517
PLA	American plaice (lr dab)	*Hippoglossoides platessoides*	490
ISF	Imperial scaldfish	*Arnoglossus imperialis*	474
GUG	Grey gurnard	*Eutrigla (chelidonicthys) gurnardus*	453
SOL	Sole (dover sole)	*Solea solea*	415
SCE	Great scallop	*Pecten maximus*	395

SCR	Spiny spider crab	*Maja squinado*	388
CTC	Common cuttlefish	*Sepia officinalis*	334
MON	Anglerfish (monk)	*Lophius piscatorius*	295
SDT	Spotted dragonet	*Callionymus maculatus*	276
TUB	Tub gurnard	*Trigla (chelidonichthys) lucerna*	180
SDS	Starry smooth hound	*Mustelus asterias*	176
HOM	Horse-mackerel (scad)	*Trachurus trachurus*	172
NKT	Norwegian topknot	*Zeugopterus (phrynorhombus) norvegius*	155
SEE	Cuttle-fish	*Sepia elegans*	154
GUS	Streaked gurnard	*Trigloporus (chelidonichthys) lastoviza*	153
POG	Pogge (armed bullhead)	*Agonus cataphractus*	147
SEO	Null	*Sepia orbignyana*	146
POM	Gobies	*Pomatoschistus spp*	140
PLS	Pearlside	*Maurolicus muelleri*	138
MLP	Velvet swimming crab	*Necora puber*	129
CRE	Edible crab unsexed	*Cancer pagurus*	125
ARG	Argentines	*Argentinidae*	121
JOD	John dory	*Zeus faber*	101
CUR	Cuckoo ray	*Leucoraja naevus*	99
SDR	Spotted ray	*Raja montagui*	98
BKS	Black seabream	*Spondyliosoma cantharus*	96
WIT	Witch	*Glyptocephalus cynoglossus*	88
GDY	Goldsinny	*Ctenolabrus rupestris*	80
TKT	Topknot	*Zeugopterus punctatus*	79
ISE	Immaculate sandeel	*Hyperoplus immaculatus*	75
PIL	Pilchard	*Sardina pilchardus*	72
COD	Atlantic cod	*Gadus morhua*	66
SOS	Sand sole	*Pegusa (solea) lascaris*	65
WHB	Blue whiting	*Micromesistius poutassou*	63
GSV	Steven's goby	*Gobius gasteveni*	50
GPF	Great pipefish	*Syngnathus acus*	41
WAF	Black-bellied anglerfish	*Lophius budegassa*	39
JYG	Jeffrey's goby	*Buenia jeffreysii*	39
MUR	Red mullet	*Mullus surmuletus*	39
NNR	Northern rockling	*Ciliata septentrionalis*	36
BBY	Butterfly blenny	*Blennius ocellaris*	32
COE	European conger eel	*Conger conger*	31
NSQ	Northern squid	*Loligo forbesi*	30
DGN	Nurse hound	*Scyliorhinus stellaris*	30
EKT	Ekstroms topknot	*Zeugopterus (phrynorhombus) regius*	29
CUW	Cuckoo wrasse	*Labrus mixtus (l. Bimaculatus)*	26
THR	Thornback ray (roker)	*Raja clavata*	22

TBR	Three-bearded rockling	*Gaidropsarus vulgaris*	21
WEL	Lesser weever fish	*Echiichthys (trachinus) vipera*	21
POL	Pollack	*Pollachius pollachius*	21
OME		*Todaropsis eblanae*	20
GFB	Greater forkbeard	*Phycis blennoides*	18
FLE	Flounder (european)	*Platichthys flesus*	17
BLW	Baillons wrasse	*Symphodus (crenilabrus) balloni*	14
UNR	Undulate ray	*Raja undulata*	14
BLL	Brill	*Scophthalmus rhombus*	13
TUR	Turbot	*Scophthalmus maximus (psetta maxima)*	12
BLG	Black goby	*Gobius niger*	10
LBE	European lobster	*Homarus gammarus*	9
RPF	Red bandfish	*Cepola rubescens (c. Macrophthalma)*	9
LIN	Common ling	*Molva molva*	8
BLR	Blonde ray	*Raja brachyura*	6
GSE	Great sandeel	*Hyperoplus lanceolatus*	6
ANE	European anchovy	*Engraulis encrasicolus*	6
YBY	Yarrel's blenny	*Chirolophis ascanii*	6
SHR	Shagreen ray	*Leucoraja fullonica*	6
RDT	Reticulate dragonet	*Callionymus reticulatus*	6
SKT	Common skate	*Dipturus (raja) batis*	6
BNW	Ballan wrasse	*Labrus bergylta*	5
DGS	Spurdog	*Squalus acanthias*	5
ESB	European seabass	*Dicentrarchus labrax*	5
NVB	Norway bullhead	*Micrenophrys (taurulus) lilljeborgi*	3
MER	Marbled electric ray	*Torpedo marmorata*	3
LLV	Squid	*Loligo vulgaris*	3
LBI	Four spot megrim	*Lepidorhombus boscii*	3
PTR	Smalleyed (painted) ray	*Raja microocellata*	3
TBY	Tompot blenny	*Parablennius gattorugine*	3
GAG	Tope shark	*Galeorhinus galeus*	2
TSC	Twp spotted clingfish	*Diplecogaster bimaculata*	2
BTF	Butter fish	*Pholis gunnellus*	2
SSN	Sea scorpion	*Taurulus bubalis*	2
SGR	Sting ray	*Dasyatis pastinaca*	2
GAR	Garfish	*Belone belone*	1
CWG	Corkwing	*Symphodus (crenilabrus) melops*	1
FRR	Four-bearded rockling	*Enchelyopus cimbrius*	1
FVR	Five-bearded rockling	*Ciliata mustela*	1
CFX	Clingfishes	*Gobiesocidae*	1
ECR	Common electric ray	*Torpedo nobiliana*	1
SQI	Northern shortfin squid	*Illex illecebrosus*	1

LFB	Lesser forkbeard	*Raniceps raninus*	1
CLG	Crystal goby	*Crystallogobius linearis*	1
SLO	Common spiny lobster	*Palinurus elephas*	1

Figure 4. Species composition, Celtic sea region, Beam trawl.

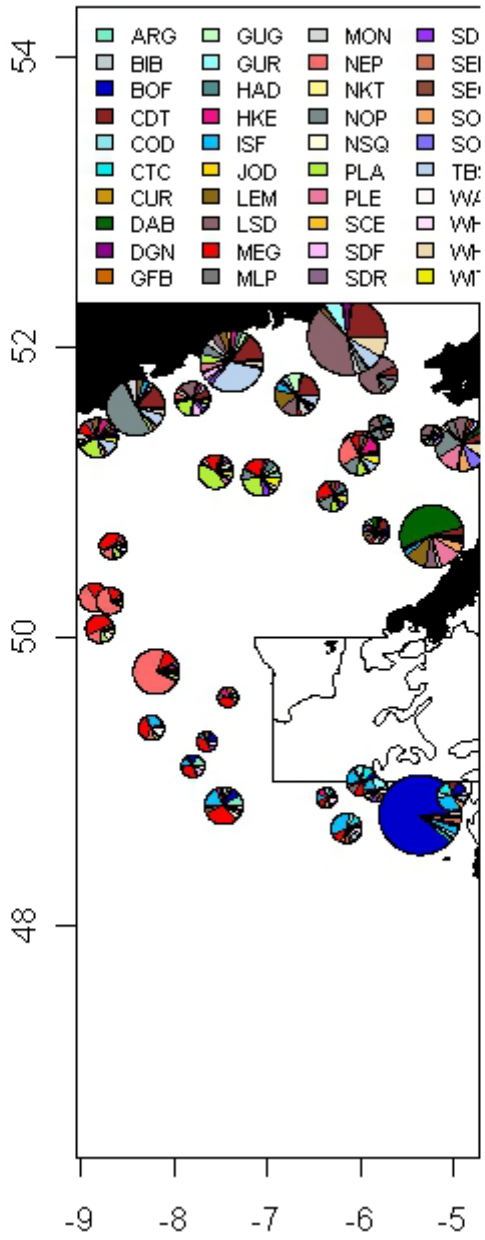


Figure 5. Species composition, Celtic sea region, GOV trawl.

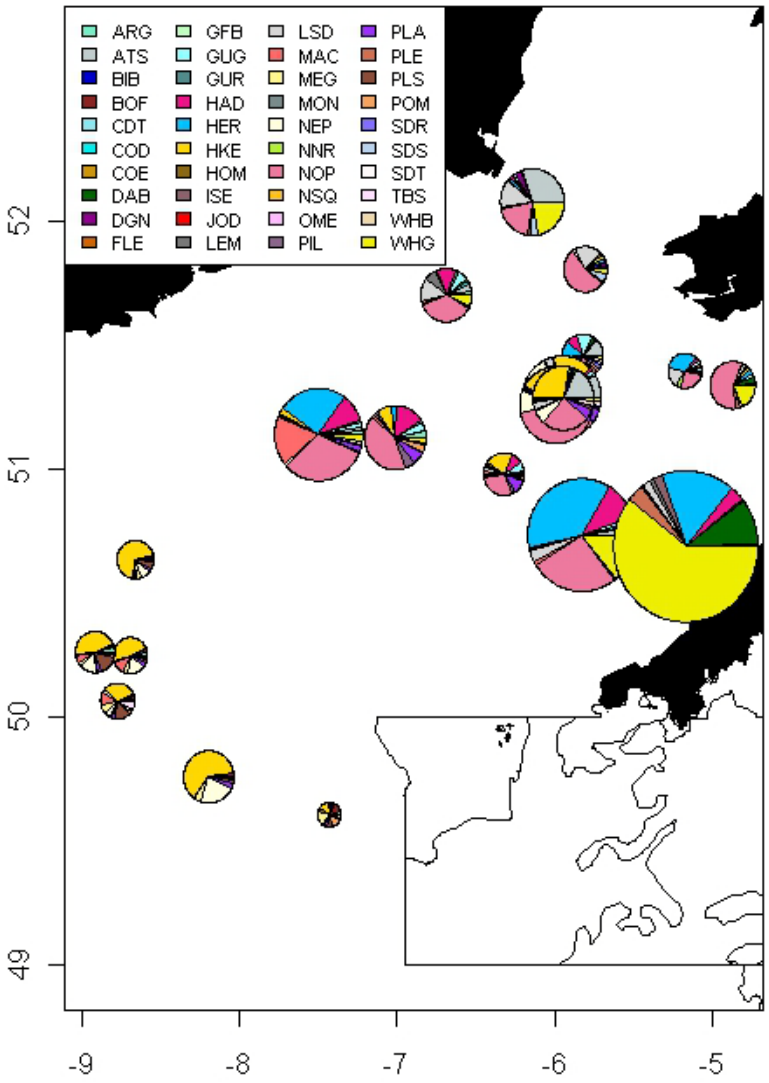


Figure 6. Species composition,wWestern channel region, Twin beam trawl.

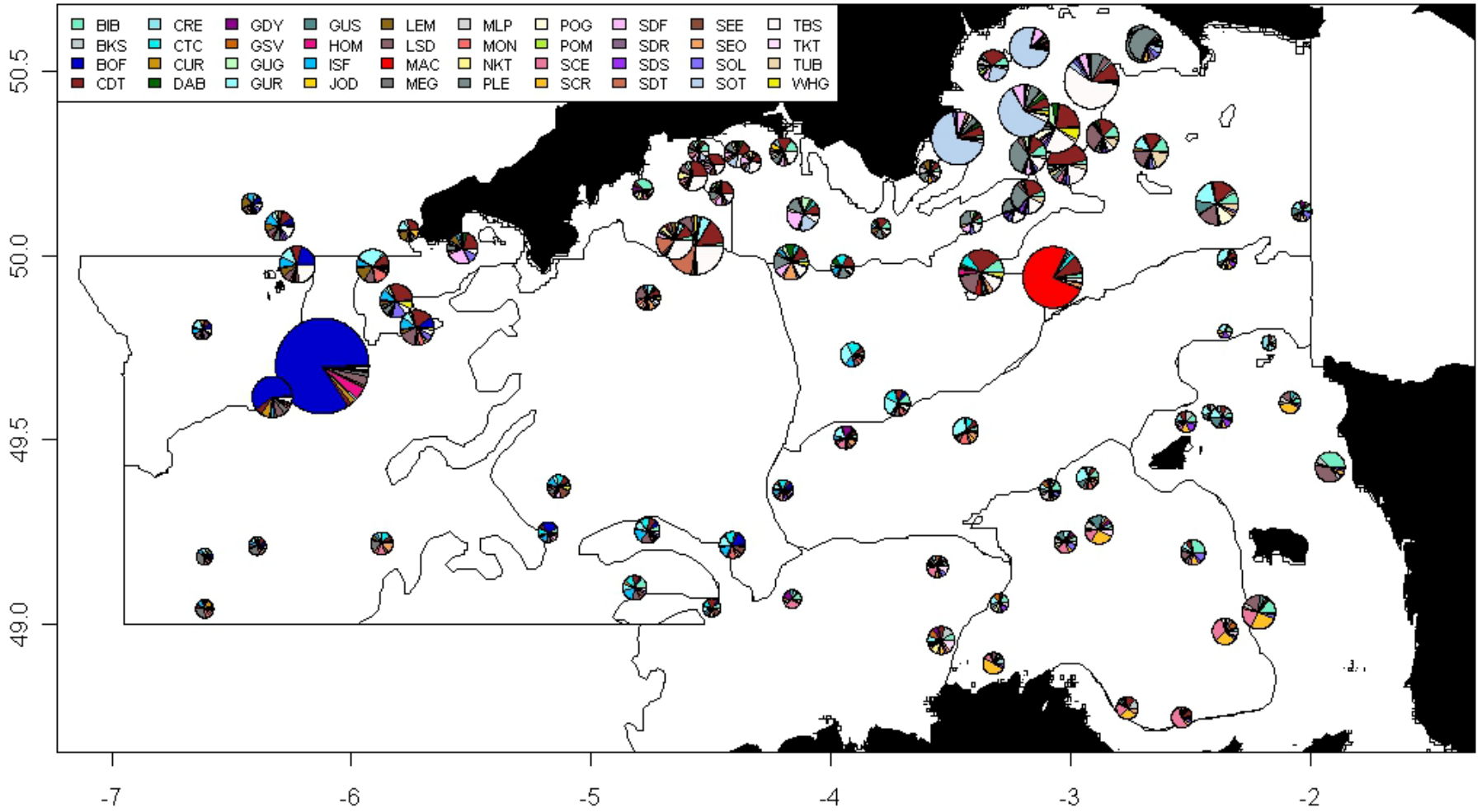
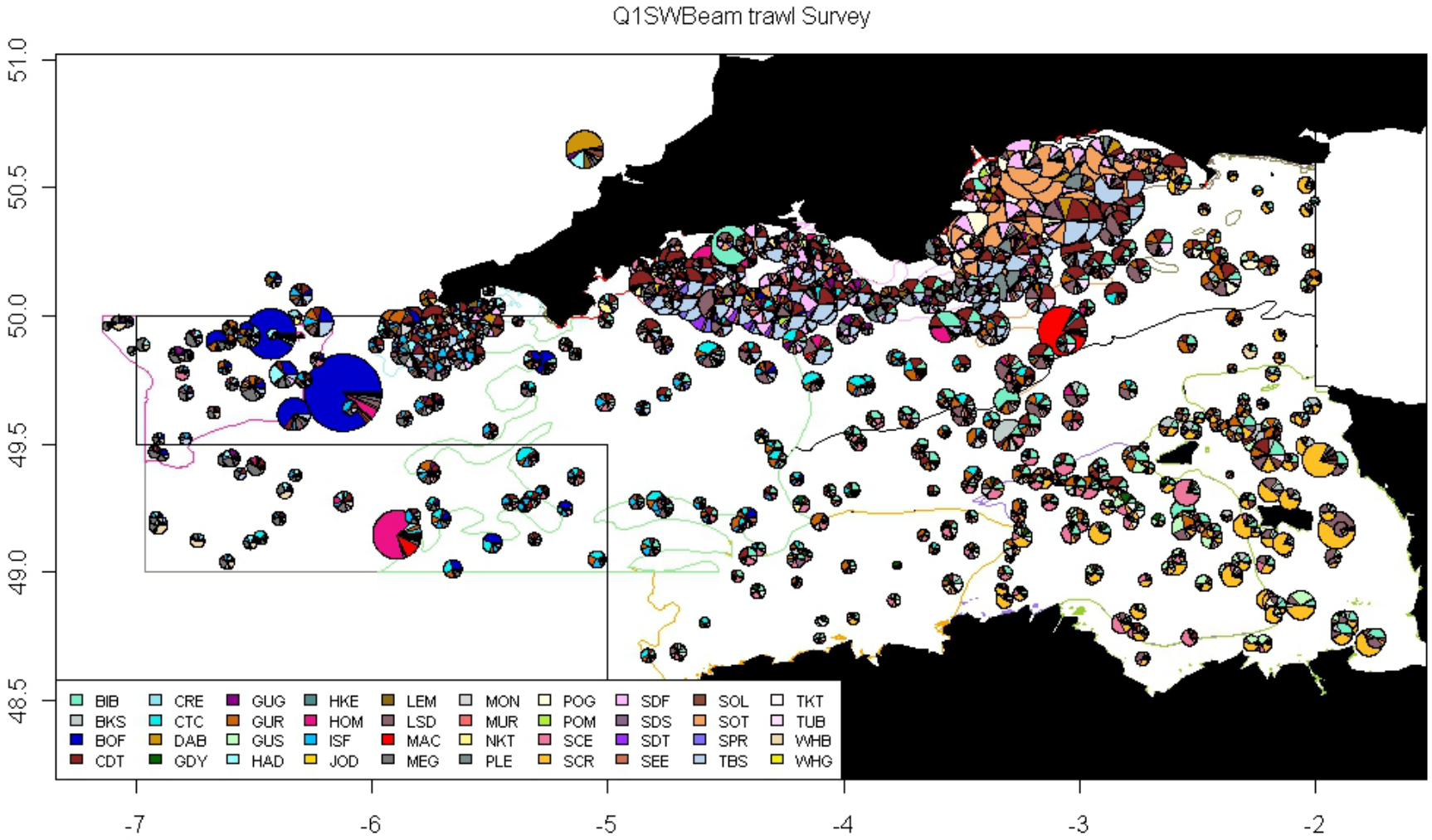


Figure 7. Species composition, western channel region, all surveys within time series.



Preliminary Analysis of replicate tows

The survey tow with twin beam trawls undertaken on 12th March (stn 326) was repeated five times the following day. The replicate tows were completed on parallel courses approximately 200 to 250m apart. Towing direction remained constant as did the warp out to water depth ratio. Bottom contour information showed that all the tows were conducted on a flat sandy substrate, replicate 5 however, did show small sand ripples which were not apparent on the other tows.

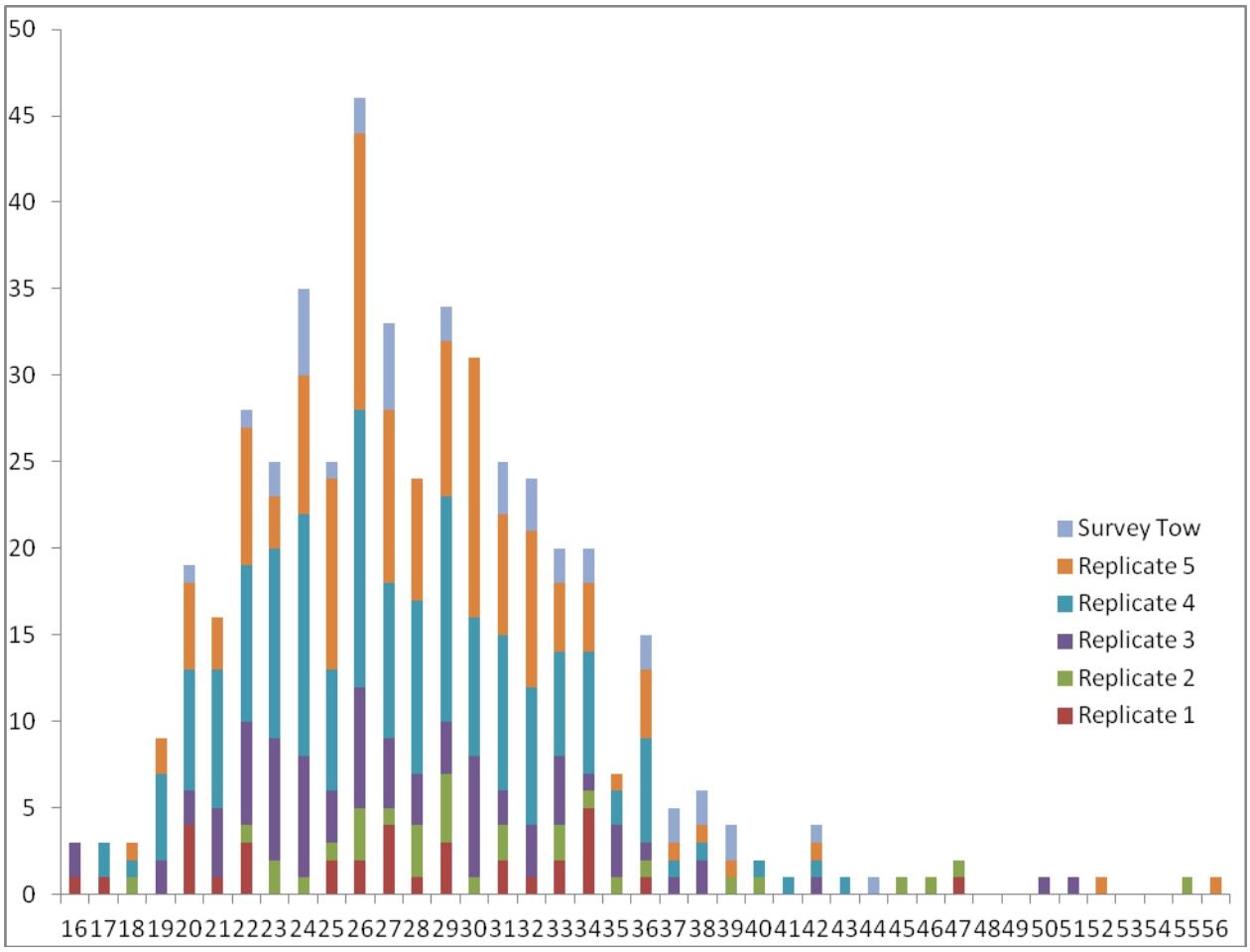
Table 4. Number of Cod-end catches each species was present in (maximum possible = 12).

Species	Count	Species	Count
European anchovy	1	Gobies	4
Butterfly blenny	2	Smalleyed (painted) ray	1
Epibenthic mix unidentified	12	Queen scallop	1
Whiting-pout (bib)	4	Rocks	2
Black goby	1	Red bandfish	1
Brill	1	Spiny spider crab	9
Blonde ray	1	Scald fish	9
Common dragonet	7	Spotted ray	11
Edible crab unsexed	2	Starry smooth hound	4
Corkwing	1	Sole (dover sole)	11
Dab	4	Solenette	12
Lemon sole	6	Little cuttlefish	3
Lesser spotted dogfish	11	Sprat	7
Velvet swimming crab	4	Thickback sole	6
European plaice	12	Thornback ray (roker)	6
Poor cod	5	Common whelk	8
Pogge (armed bullhead)	6	Whiting	2

Table 5. Catch weight (Kg) by species for survey and replicate tows.

Species	Survey Tow	Replicate 1	Replicate 2	Replicate 3	Replicate 4	Replicate 5
European anchovy	0.005					
Butterfly blenny					0.008	0.007
Epibenthic mix	16.51	14.82	13.74	18.86	13.7	20.12
Whiting-pout (bib)		0.145		0.115		0.86
Black goby						0.007
Brill		0.52				
Blonde ray			0.035			
Common dragonet	0.049	0.105		0.115	0.028	0.008
Edible crab		0.6				0.5
Corkwing						0.01
Dab	0.054		0.049	0.015		0.155
Lemon sole	0.405	0.94	0.595		0.375	0.59
Lesser spotted dogfish	3.89	10.04	2.61	5.735	3.37	3.82
Velvet swimming crab		0.012	0.016	0.025		0.15
European plaice	11.52	7.775	10.17	16.96	34.395	30.92
Poor cod	0.035	0.027	0.04	0.005		0.03
Pogge (armed bullhead)		0.016	0.007	0.02	0.016	0.02
Gobies	0.002	0.002	0.002			0.001
Smalleyed (painted) ray		1.48				
Queen scallop	0.057					
Rocks		2.835			0.45	
Red bandfish						0.03
Spiny spider crab	0.737	0.325	1.445	0.435	0.63	3.235
Scald fish	0.128	0.157	0.07	0.11	0.077	0.077
Spotted ray	1.726	0.675	0.355	0.471	0.345	1.66
Starry smooth hound	1.5	1.47	2.829			
Sole (dover sole)	2.99	3.13	0.495	4.975	2.28	3.79
Solenette	0.284	0.677	0.439	0.275	0.56	0.254
Little cuttlefish			0.002	0.003	0.001	
Sprat	0.044	0.03	0.032			0.015
Thickback sole	0.11	0.405	0.229		0.042	0.06
Thornback ray (roker)		0.051			0.039	1.815
Common whelk	1.204			0.595	0.348	1.9
Whiting		0.075		0.045		
Number of species caught (excluding Rocks)	19	23	19	17	16	25

Figure 3. Length distribution of Plaice *(P. platessa)* from survey and replicate tows.



Aims 11 and 4.b - Marine litter.

Data on marine benthic litter was collected at all fisheries stations and categorised using international standards. Preliminary results show that 73% of the 607 items collected were plastic (Figure 4).
In addition to macroplastics from the seabed, microplastics were also collected from the surface at 33 specifically chosen sites using a manta micro litter trawl with a mesh size of 333µm. The sites were chosen to form transects across the English Channel and Celtic Sea, to compare inshore and offshore data. Furthermore, the manta trawl was towed from the side gantry at the same time as the beam or GOV otter trawl, to allow comparison between floating and benthic litter.

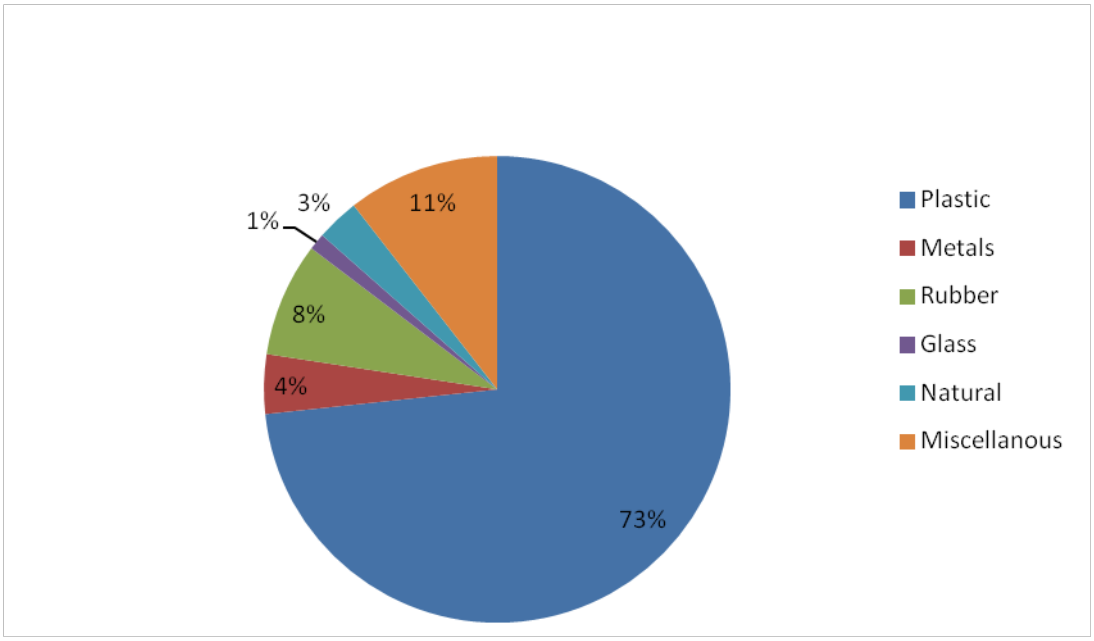


Figure. 4. Marine benthic litter collected during CEND 2_13 (N=607)

Aim 3 – Fisheries acoustic data

The EK60 sounder had a major system failure on 4th March requiring a full rebuild of the system, the data recorded prior to this was irrecoverable. Once rebuilt, the system failed on two further occasions. Tthe failures occurred when data logging was underway and as a result of this, logging was halted for the remainder of the trip.

Aims 5 and 8 – Ferrybox and PCO2 systems.

The Ferrybox and PCO2 systems ran continuously for the entire trip, issues with the satellite link meant that, at times, data delivery was inconsistent. The PCO2 system stopped delivering data on 23rd Feb. No obvious solution could be found onboard and as the system appeared to be logging data locally(retrieved at the end of the trip), no further action was taken.

Aim 8 – TA/DIC samples.

Over the survey, 82 sets of samples were collected for Nutrient, Total Alkalinity and Dissolved Inorganic Carbon analysis.

Aim 9 – Marine mammal and turtle observations.

Observations were recorded regarding marine mammals and were forwarded to the SeaWatch Foundation.

Aim 10 – SLA22 (Caesium and Tritium samples).

50 litre and 1 litre samples were collected for further processing from nine sites in the western channel.

Aim 12 - Preliminary survey of sediment status in the Celtic Sea.

The Day-grab was deployed at 24 sites, samples frozen and returned to Lowestoft for further analysis. The SPI camera was deployed at 16 sites, the resultant images will be examined over the coming months.

Aim 13 – Tagging of Dogfish and Rays.

Species	**Number of individuals tagged and released**
Nursehound	27
Spurdog	2
Tope	2
Starry Smooth-hound	41
Painted Ray	2
Common Skate	2
Undulate Ray	7

Aim 14 – BRUVS system.

The baited underwater camera system (BRUVS) was deployed on five occasions (10th -12th March) whilst at anchor sheltering from bad weather in Lyme Bay. Deployments were made both during the night and day, resulting in 12 hours and 20 minutes of video footage. Species including lesser spotted dogfish and bib were identified, being drawn in by the mackerel bait.

Aim 15 – TagMan assay.

10 Herring, 10 Sprat, 3 Anchovy and 10 Pilchards were sampled as part of the TagMan Assay project.

Aim 16 – Sepiolidae.

Samples of various Sepiolid species were frozen.

Aim 17 – Frozen Sprats.

Samples of frozen Sprats were collected at six stations (299 individuals) in the Celtic Sea.

Aim 18 – Berried Lobster and Crab.

One berried Lobster and one berried crab were caught and returned alive to Lowestoft.

Aim 19 – Frozen fish for radiological analysis

Samples of Haddock and Whiting were collected in the Celtic Sea for further analysis.

Aim 20 – Samples of fish for dioxin analysis

Specimens of Monkfish, Megrim, Turbot, Haddock, Herring and Witch were collected as part of Cefas' agreement with FSA.

Richard Ayers
Scientist In Charge
14th March 2013

SEEN IN DRAFT:
Master: T Byrne.
Senior Fishing Mate: G Hughes.

INITIALLED:

DISTRIBUTION:

Annex 1 : Stratum Map