

# LOWESTOFT LABORATORY, LOWESTOFT, SUFFOLK, NR33 OHT

## 2013 RESEARCH VESSEL PROGRAMME

### REPORT: RV CEFAS ENDEAVOUR: SURVEY 18/13

#### STAFF:

##### Part One

I Holmes (SIC)  
R Bush (2IC)  
S Walmsley  
T Gooding  
S Shaw  
M Etherton  
K Vanstaen  
T Hull (10-12 Sept)  
D White (NOC Southampton) 10-12 Sept.  
L Suberg (NOC Southampton) 10-12 Sept.

##### Part Two

I Holmes (SIC)  
S Shaw (2IC)  
S Walmsley  
T Gooding  
P Dolder  
S Stones  
G Thomas  
S Murphy (Irish Observer)

DURATION: 12 September – 3 October 2013

LOCATION: Irish Sea (VIIa); Bristol Channel & Celtic Sea (VIIf&g)

#### AIMS:

1. To carry out a 4m beam-trawl survey of groundfish to i) obtain fisheries independent data on the distribution and abundance of commercial flatfish species, and ii) derive age compositions of sole, plaice, cod and whiting for use in stock assessments.
2. To collect biological data including maturity and weight at age of sole, plaice, lemon sole and other commercially important finfish species as part of CEFAS' requirements under the EU Data Collection Framework.
3. To determine the distribution and relative abundance of juvenile and adult sole and plaice.
4. To collect surface & bottom temperature/salinity data using CTD and Niskin Bottle.
5. To quantify epibenthos using 4m beam trawl by-catch.
6. Collect length/weight & maturity information using individual fish measurements, in support of the EU Data Collection Framework.
7. To collect surface sea-water samples for processing on return to Lowestoft for the analysis of tritium (AE001) (K Leonard - Cefas).
8. To collect fish samples in support of other Cefas projects and training courses.
9. To collect water alkalinity and dissolved inorganic carbon (DIC) samples – (N Greenwood - Cefas)
10. To deploy and carry out sea trials of Slocum sea-glider for National Oceanography Centre (Southampton)

**NARRATIVE: (All times GMT)**

Cefas scientists joined the vessel at 1000h 12 September in readiness for sailing. Endeavour sailed at 1106h and headed south ahead of a strong north-westerly breeze. Once sailed, Cefas and visiting scientists participated in vessel safety induction training and an emergency safety drill. In addition, 'toolbox' talks were held with the ship's officers/crew and scientists to discuss survey operations for both the beam trawl operations and the deployment of the Slocum sea-gliders.

On 11 September, a shakedown beam trawl tow was conducted near the Isle of Wight to fully test the fishing gear deployment and the on-board fishing sampling systems. A trial 'dip' of the ESM2 logger with niskin water sampler was also successfully carried out at this position.

After an uneventful passage through the Channel, Endeavour reached the designated area for the deployment of the Slocum sea-gliders to the south-west of the Scilly Isles. The proposed route of the sea-glider was run-over to check for any static gear deployments and none were located. A total of 7 ESM2 profiles were also taken along the designated track to check for temperature fronts. At 0941h on 12 September, the first sea-glider was successfully deployed and this was followed by a period of calibration checks and test dives before control of the glider was handed over to the National Oceanographic Centre (NOC) in Southampton. The second sea-glider was successfully deployed at 1143h. Once again a series of calibration checks and test dives were performed before control was handed over to the NOC. Once these operations were completed, Endeavour streamed to a position off St. Ives where the three staff deploying the gliders disembarked for their return journey home.

Overnight, Endeavour steamed the short distance to the first survey fishing station. The fishing survey commenced in the Bristol Channel Outer (BCO) sector at prime station 508 at 0532h on 13 September with an ESM2/Niskin sample followed by the first beam trawl station of the survey. A further 7 stations were successfully fished during that day with another 8 the following day. On 15 September, fishing was suspended at 1015h due to strong south-westerly gales and heavy swell. The decision was taken to utilise this fishing down-time by completing the series of tritium water sample collections in the Avon Estuary. The series of water sampling begun at 1423 off the north Devon coast and continued through the night until 0530h off south Wales. This enforced down-time allowed us the complete almost the entire grid of positions with just four locations not sampled this year.

The fishing survey resumed at first light on the following day at prime station 117 (16 September) at 0553h and continued throughout the day completing a total of 10 Bristol Channel Inner (BCI) sector stations. The following day, plans to fish the remaining BCI survey stations were thwarted by the weather and only six of the remaining nine stations were completed. Prime station 112 was attempted but the tow was curtailed by a 5-6m steep pinnacle encountered during the early stages of the tow. This feature of the tow had never been observed before in >25 years of fishing the tow. With three stations left in the sector, and with an improvement in the weather forecast for the following day, the decision was made to set anchor near Caldey Island and complete the sector the following day before leaving the area.

On 18 September, the 3 remaining BCI stations were successfully fished without incident. Following the long steam from this sector to the Cardigan Bay, two St George's Channel (SGC) fishing stations were completed before heading north to begin the Irish Sea South (ISS) priority survey grid of fishing stations. Fishing began in this sector early on 19 September, and over the course of the next 5 full fishing days, this survey sector and the Irish Sea North (ISN) sector were completed. At ISN prime station 12, it was discovered that a new wind-farm under construction (West of Duddon Sands) covered the existing tow. A new tow location was located within the same depth contour 1.9nm south of the previous tow. At prime station 53 (ISS), a large catch of broken shell was landed and had to be sorted on the deck, with the weight of the benthic by-catch having to be estimated.

Once the ISS/ISN survey grids had been completed, survey operations were suspended and Endeavour headed into Douglas IOM for a mid survey staff change. En-route to Douglas, a 'man-over-board' drill was conducted, with the 'casualty' being recovered and back on-board within 7 minutes. Endeavour docked at 1500h 23 September. On 24 September there was a changeover of both scientific and ship's personnel and whilst in port the vessel took on fresh water and catering supplies.

Cefas Endeavour left Douglas IOM on 25 September at 0450h and headed directly to the nearest fishing station in the Irish Sea West (ISW) sector arriving at 0535hrs at prime station 424. Upon completion of this first tow, a brief 'toolbox' talk was held for the newly arrived officers and scientists. During this day, six ISW stations were successfully fished including prime 425 which had a history of large by-catches of broken shell. This year, plans to fish the full 30 minute tow were thwarted when after 17 minutes, there were indications that the net was filling up. Upon hauling, just seven baskets of mainly broken shell were landed.

Over the following two days, the remaining ISW stations and five northerly SGC stations were fished without incident. On 28 September, another six stations around Anglesey and at the northern end of Cardigan were successfully fished. Prime station 313 was fished for the an extended 20 minutes tow duration in order to avoid catching large quantities of weed but in hope of catching an angel shark (*Squatina squatina*). Upon hauling we had failed to catch such a specimen, but also failed to catch large quantities of weed. Overnight, Endeavour steamed to a position off Arklow (Republic of Ireland) to complete the remaining three SGC stations down the Irish coast. The final SGC station (prime 438) was completed at 1220h 29 September. With several hours of daylight left that day, two additional South-East Ireland (SEI) stations were fished.

With a favourable weather forecast for the following two days, the decision was taken to fish some additional SEI tows the following day before heading south to complete the BCO survey grid. That evening, the survey beam (no. 3) was replaced with the spare beam (no 2) in order to give that gear some 'fishing time'. This was a request from the P&O nets & gear team as the spare beam had not been used in over 2 years. Given that all the priority stations had been successfully been fished, this was a request we could help out with.

Five more SEI stations were fish on 30 September, some of which had not been fished since 1996. Therefore at each of these stations, a full benthic sort was either carried out on board or a sample frozen for analysis back in the laboratory. The final fishing day of the survey saw the completion of the remaining 5 stations in the BCO survey sector.

Given the long distances to travel in the completion of these stations, prime station 533 was fished before sunrise. Given the depth of water at this station (>90m), fishing this in semi-darkness was considered an acceptable compromise. The final survey fishing station was hauled at 1632h 1 October. At prime station, the gear was hauled at 20 minutes due to indications that the cod-end had filled up and upon hauling, over 50 baskets of dead shell was landed. The catches at this particular prime station are unpredictable and it is recommended that in future, a carefully monitored 15 minute tow only is conducted at this station to try and avoid this heavy by-catch of shell.

With the full survey fishing grid now complete, Cefas Endeavour headed back to Lowestoft, and during this period, scientists began the process of cleaning up and packing away all scientific equipment in readiness for docking.

Cefas Endeavour docked in Lowestoft at 0745h 3 October.

## RESULTS:

### Aims 1, 2 & 3

The survey gear was the standard 4m-beam trawl (number 3) with chain mat, flip-up ropes and the net was fitted with a 40mm cod-end liner. All fish and selected commercial shellfish were identified to species, weighed and measured with large catches of an individual species were sub-sampled beforehand.

A SAIV Micro CTD unit was attached to the headline on the 4m-beam trawl in order to record the temperature and salinity depth profile at each station fished. In addition, surface water was taken at each station and at the first and last fishing station on each working day a surface sample was taken simultaneously with a Niskin bottom water sample and an ESM2 logger profile.

All catch details and sample data were entered directly into the 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 Transas bridge logging system and bridge logbook. The total number of survey otoliths/scales taken in each ICES Division are shown in Table 1.

Table 2 shows the top 10 species by both weight (kg) and number of individuals caught in core survey tows. Table 3 shows a list of measured species caught during the survey and number of stations at which they were recorded. The trawl survey covering the Irish Sea and Bristol Channel is divided up into six sectors consisting of 108 beam trawl tows, of which all were successfully fished (Figure 2), including all 65 out of the 65 ISN, ISS and BCI stations used for tuning data for the Working Group of the Celtic Seas Eco-region. In addition there are a number of additional stations in a survey sector South-East Ireland (SEI) but these are rarely fished and are not considered to be part of the routine annual survey. Table 4 shows the number of gear deployments undertaken on the survey.

A total of 9 prime stations – numbers 27 (off Blackpool), 53 and 54 outer Liverpool Bay), 313 (Tremadoc Bay), 214 (Skerries), 203 (Dundrum Bay), 220 (north of Dublin), 233 (south of Wicklow) and 501 (southwest of Milford Haven) were reduced from the standard 30-minute to either a 20 or 15-minute tow. In addition, a total of 9 prime stations were hauled early - numbers 133 (south of Lundy), 136 (Caldey Is), 2 (Luce Bay), 3 (Wigtown Bay), 425 (midway Anglesey/IOM), 112 (Stackpole Head), 302 (south of Holyhead), 523 (Waterford), 512 (off Padstow). All tow reductions were due to expected large catches of weed, broken shell or small flatfish, fading light, static gear over the tow or fishing a new tow location. A few stations were moved short distances to avoid snagging undersea cables (an increasing problem in this busy sea area) or to move the tow outside of a planned wind farm.

**Table 1: Numbers of fish otolithed by ICES division**

	VIIa	VIIb	VIIg	Total
Anglerfish ( <i>Lophius piscatorius</i> )	19	11	26	56
Anglerfish ( <i>Lophius budegassa</i> )	0	0	1	1
Brill	14	13	1	28
Cod	131	38	48	217
Dab	136	135	13	284
Bass	0	13	0	13
Grey Gurnard	55	172	79	306
Red Gurnard	175	50	6	231
Streaked Gurnard	3	1	0	4
Tub Gurnard	92	125	0	217
Haddock	28	11	37	76
Hake	5	12	45	62
John Dory	13	45	6	64
Lemon Sole	69	76	45	190
Megrim	0	14	66	80
Plaice	1375	435	161	1971
Red Mullet	1	10	0	11
Sole	284	361	63	708
Turbot	6	11	2	19
Whiting	132	20	50	202
<b>Total</b>	<b>2172</b>	<b>1553</b>	<b>649</b>	<b>3731</b>

**Table 2: Summary of the main species caught over the entire survey\***

	Weight caught (kg)				Number caught		
	2013*	2012	2011*		2013*	2012	2011*
Lesser spotted dogfish	1057	965	1083	Dab	16969	19517	11502
Plaice	1029	918	830	Plaice	10040	9899	8759
Dab	629	887	621	Solenette	8257	6653	5184
Thornback ray	259	179	164	Poor cod	6645	5509	4180
Sole	209	184	197	Whiting	4702	1951	2522
Common dragonet	171	123	103	Common dragonet	4083	2989	2552
Poor cod	105	93	78	Lesser spotted dogfish	2361	2158	2353
Solenette	104	90	82	Scaldfish	1971	1503	1636
Edible crab	82	84	90	Sole	1545	1384	1425
Whiting	149	82	82	Grey gurnard	1567	920	884
<b>TOTAL (All species)</b>	<b>4680</b>	<b>4319</b>	<b>4239</b>	<b>TOTAL (All species)</b>	<b>67471</b>	<b>57947</b>	<b>48099</b>

\*Excludes SEI stations

**Table 3:** List of measured species caught during the survey and number of stations at which they were recorded.

Species	Stations	Species	Stations
<i>Agonus cataphractus</i>	67	<i>Merluccius merluccius</i>	19
<i>Ammodytidae</i>	10	<i>Microchirus variegatus</i>	56
<i>Ammodytes marinus</i>	2	<i>Micromesistius poutassou</i>	1
<i>Ammodytes tobianus</i>	3	<i>Microstomus kitt</i>	32
<i>Argentina sphyraena</i>	5	<i>Molva molva</i>	2
<i>Arnoglossus imperialis</i>	1	<i>Mullus surmuletus</i>	7
<i>Arnoglossus laterna</i>	69	<i>Mustelus asterias</i>	33
<i>Aspitrigla cuculus</i>	40	<i>Myoxocephalus scorpius</i>	6
<i>Blennius ocellaris</i>	12	<i>Nephrops norvegicus</i>	17
<i>Buenia jeffreysii</i>	4	<i>Pecten maximus</i>	25
<i>Buglossidium luteum</i>	63	<i>Pegusa (Solea) lascaris</i>	17
<i>Callionymus lyra</i>	93	<i>Pholis gunnellus</i>	4
<i>Callionymus maculatus</i>	10	<i>Phrynorhombus norvegicus</i>	6
<i>Callionymus reticulatus</i>	16	<i>Platichthys flesus</i>	9
<i>Cancer pagurus</i>	55	<i>Pleuronectes platessa</i>	92
<i>Capros aper</i>	1	<i>Pollachius pollachius</i>	1
<i>Centrolabrus exoletus</i>	1	<i>Pomatoschistus minutus</i>	47
<i>Cepola rubescens</i>	1	<i>Raja brachyura</i>	18
<i>Ciliata mustela</i>	4	<i>Raja clavata</i>	62
<i>Clupea harengus</i>	1	<i>Raja microocellata</i>	8
<i>Conger conger</i>	5	<i>Raja montagui</i>	55
<i>Crystallogobius</i>	1	<i>Scomber scombrus</i>	2
<i>Ctenolabrus rupestris</i>	4	<i>Scophthalmus maximus</i>	17
<i>Dicentrarchus (Morone) labrax</i>	10	<i>Scophthalmus rhombus</i>	21
<i>Diplecogaster bimaculata</i>	2	<i>Scyliorhinus canicula</i>	103
<i>Eutrigla gurnardus</i>	90	<i>Scyliorhinus stellaris</i>	15
<i>Gadus morhua</i>	48	<i>Solea solea (s.vulgaris)</i>	78
<i>Gaidropsarus vulgaris</i>	5	<i>Spondylisoma cantharus</i>	1
<i>Glyptocephalus cynoglossus</i>	11	<i>Sprattus (Clupea) sprattus</i>	5
<i>Gobius niger</i>	1	<i>Symphodus bailloni</i>	1
<i>Hippoglossoides platessoides</i>	7	<i>Syngnathus acus</i>	13
<i>Homarus gammarus</i>	6	<i>Taurulus bubalis</i>	3
<i>Hyperoplus lanceolatus</i>	4	<i>Trachinus (echiichthys) vipera</i>	23
<i>Labrus bergylta</i>	1	<i>Trachinus draco</i>	3
<i>Leucoraja naevus</i>	14	<i>Trachurus trachurus</i>	8
<i>Lepidorhombus whiffiagonis</i>	6	<i>Trigla lucerna</i>	61
<i>Lesueurigobius friesii</i>	1	<i>Trigloporus lastoviza</i>	3
<i>Limanda limanda</i>	87	<i>Trisopterus esmarki</i>	13
<i>Liparis liparis</i>	1	<i>Trisopterus luscus</i>	13
<i>Lophius budegassa</i>	1	<i>Trisopterus minutus</i>	68
<i>Lophius piscatorius</i>	22	<i>Zeugopterus punctatus</i>	6
<i>Melanogrammus aeglefinus</i>	37	<i>Zeus faber</i>	22
<i>Merlangius merlangus</i>	92		

**Table 4: Summary of gear deployments and sample collections**

Gear	Valid	Additional	Invalid	Total
Standard 4m Beam trawl with cod end liner	107	9	2	118
Water sample: Tritium (1 litre)	47	0	0	47
Water sample: Caesium (50 litre)	23	0	0	23
Surface salinity samples	118	13	0	131
ESM2 profile+Niskin sea-bed water samples	34	12	0	46
Dissolved inorganic carbon/ Nutrient and alkalinity samples	29	1	0	30
Slocum glider deployments.	2	0	0	2

Abundances of pre-recruit and recruited plaice and sole in the Irish Sea and Bristol Channel are shown in Figures 3 and 4. As with previous surveys, pre-recruit plaice were most abundant off the east coast of Ireland and in inshore waters off North Wales and northwest England. Pre-recruit sole were most abundant in the Bristol Channel, particularly Carmarthen Bay and in inshore waters off north Wales and Liverpool Bay. Abundances of pre-recruit and recruited dab and lemon sole are shown in Figure 5 and Figure 6.

### **Plaice**

Abundance by catch number was up in all survey sectors except ISN and ISW compared to last year's survey and the abundance by catch weight was up in all sectors except BCI and ISW.

In BCI, both the numbers and weight caught remained at the high levels observed in 2012 with only small changes observed this year. In BCO the numbers of fish caught fell by 23% from 2012 but the weight of fish caught continued to increase with a 16% increase this year and is now at the highest level over the period 2001-13. Catch numbers of juvenile plaice (<22cm) in BCI/BCO increased in 2013 by approx. 150% compared to the previous year with around 250 being caught this year (100 in 2012). This is around 65% above the average number of juveniles caught over the period 2001-13.

In the Irish Sea, ISN plaice abundance fell in terms of numbers caught (14%) but increased in terms of weight caught (14%). However, both catch number and weight caught are above the survey average (2001-13). In ISS, plaice catch weights and numbers were higher than those observed in 2012 with increases of 12% and 14% respectively. These two survey sectors continue to be the most productive for plaice. Both catch numbers and weights in ISW fell this year but are close to the series low



(2001-12) whereas catches in SGC increased from those observed in 2012 with catch numbers up 55% and weights up 56%. Trends in survey catch rates over recent surveys are shown in Figure 7. Catch numbers of juvenile plaice (<22cm) in these four Irish Sea survey sectors remained close to the high levels observed in the previous three surveys with most of these juvenile fish being caught in the ISN/ISW survey sectors.

## Sole

Abundance by catch number increased in all survey sectors compared to 2012 and the abundance by catch weight increased in all survey sectors except ISN where a small fall was observed. The BCI survey sector continues to be the most productive but historically this sector was 'matched' by similar catch rates in the ISS survey sector but this has ceased to be the case over the past nine years.

In BCI, both catch numbers and weights increased compared to the 2012 survey with increases of 5% and 16% respectively and these are currently above the series average over period 2001-13. In BCO catch numbers and catch weights increased compared to the 2012 survey by 49% and 34% respectively. Catch numbers of juvenile sole in BCI/BCO (<22cm) were around 60% lower in 2013 (391 fish) than those seen in 2012 (667 fish) and are currently at around 60% of the average numbers observed over the period 2001-13. Numbers of recruited sole (>21cm) caught were at the highest level (~800 fish) since 2001 increasing by 75% compared to the 2012 survey.

In the Irish Sea, ISN, catch numbers increased by around 36% and catch weights fell by 2% compared to 2012 and both remain close to the series low (2011-13). In the ISS survey sector, catch numbers and catch weights both increased by 39% and 17% respectively but remain close to the series low over the period 2001-13. In SGC, both catch numbers and weights were similar to those observed in 2012 and again remain close to the series low. ISW saw increases in both catch numbers (88%) and catch weights (33%) but once again these are still close to the series low. The numbers of juvenile sole (<22cm) in the Irish Sea (ISS/ISN/ICW/SGC) increased by over 115% (126) from those observed in 2012 (59). The numbers of recruited sole (>21cm) increased by 15% compared to those seen in 2012, but numbers of both juvenile and recruited sole in 2013 remain below the average observed over the period 2001-13. Trends in survey catch rates over recent surveys are shown in Figure 8.

## Dab

Abundance of dab by catch number and catch weight increased in all survey sectors this year except for ISS where a fall was observed, but in terms of catch weight, increases were observed in all survey sectors except ISS and BCI. The most productive survey sectors are consistently ISS/ISW and the survey sectors of BCI/BCO generally see the smallest catches of dab

In BCI catch numbers increased for the fourth year in succession with a 17% increase and is now at a series high (2001-13) but this year catch weights fell by 27%. In 2013, catch numbers were three times those observed during the survey years 2001 to 2009. In BCO, abundance by number caught and weight caught both increased compared to 2012 but remain at relatively low levels. Numbers of juvenile dab in BCI/BCO (<17cm)

have increased by >100% since 2012 and this follows a similar increase the previous year. The number of juveniles caught in 2013 totalled 2089 fish and this is three times the average number caught over the period 2001-13 (659 fish). Numbers of recruited dab (>16cm) fell in 2013 by 60% but remain above the average over the same time period.

In the Irish Sea, ISS catch numbers and catch weights fell by 55% and 63% respectively and the abundance is now at a series low after being at a series high in 2012. The survey sectors of ISN, ISW and SGC all showed moderate increases in both catch numbers and weights and all three sectors currently have abundance at above average levels. The number of juvenile (<17cm) dab in the four survey sectors fell by 10% in 2013 compared to the previous survey but remain 10% above for the same period. Numbers of recruited dab (>16cm) fell by 30% in 2013 and are now observed as being below average. Trends in survey catch rates over recent surveys are shown in Figure 9.

### **Lemon sole**

Catch rates of lemon sole remain low in all survey sectors despite seeing increases in both catch numbers and catch weights in four of the six sectors. The most productive sector in the survey is BCO but this sector saw falls in both catch numbers (10%) and catch weights (28%).

In the Irish Sea, juvenile numbers (<20cm) increased 3-fold from 16 in 2012 to 43 in 2013 and are now at average levels (2001-13). Numbers of recruited lemon sole (>19cm) in 2013 (48 fish) were observed in similar number to 2012 and remain below the series average (70 fish).

In the Bristol Channel, juvenile numbers also increased almost 3-fold and are currently 30% above the series average (2001-13). However, recruited lemon sole fell by 20% in 2013 and are currently observed as being 20% below average levels. Trends in survey catch rates over recent surveys are shown in Figure 10.

### **Other species**

Cod – total catch numbers in 2013 (394) was up compared to 2012 (46) of which 93% were juvenile (<21cm). In the Irish Sea survey sectors, the numbers of juvenile cod caught in 2013 (182) were the highest since 1990 and were almost four times the average observed over the period 2001-13 (51). Similarly, juvenile cod catches in the Bristol Channel survey sectors in 2013 (184) were the highest observed in the survey series and were almost seven times the average caught over the period 2001-13 (28).

Haddock - total catch numbers in 2013 (888) was up compared to 2012 (52) and 97% were juvenile (<21cm). In the Irish Sea survey sectors, the numbers of juvenile haddock caught in 2013 (237) were the highest since 2006 and was over double the average observed over the period 2001-13 (104). Similarly, juvenile haddock catches in the Bristol Channel survey sectors were the highest observed in the survey series and the numbers caught in 2013 (620) were almost five times the average caught over the period 2001-13 (130).

Whiting - total catch numbers in 2013 (4701) were up compared to 2012 (1951) and 93% were juvenile (<21cm). In the Irish Sea survey sectors, the numbers of juvenile whiting caught in 2013 (2627) were the highest since 2004 and were almost double the average observed over the period 2001-13 (1494). Similarly, juvenile whiting catches in the Bristol Channel survey sectors were the highest observed since 2008 and the numbers caught in 2013 (1741) were 70% higher than the average caught over the period 2001-13 (1001).

Thornback ray - total catch numbers in 2013 (591) was up compared to 2012 (406) and 49% were juvenile (<27cm). In the Irish Sea survey sectors, the numbers of juvenile thornback ray caught in 2013 (253) were the highest in the survey series and were three times the average observed over the period 2001-13 (83). Similarly, juvenile thornback ray catches in the Bristol Channel survey sectors were the highest in the survey series and the numbers caught in 2013 (34) were double the average caught over the period 2001-13 (15).

Monk (*Lophius piscatorius*) - total catch numbers in 2013 (45) were down by 55% compared to 2012 (101) and the numbers of smaller juvenile fish (<21cm) were down by 78%. In the Irish Sea survey sectors, only one juvenile was caught in 2013 with the average being four over the period 2001-13. Juvenile catch numbers in the Bristol Channel survey sectors amounted to 8 fish which was also below the average caught over the period 2001-13 (15).

Lesser spotted dogfish - total catch numbers in 2013 (2358) was up compared to 2012 (2165) with just 7% being juvenile (<35cm). In the Irish Sea survey sectors, the numbers of juvenile LSD caught in 2013 (106) was close to the average observed over the period 2001-13 (64). Juvenile LSD catches in the Bristol Channel survey sectors were below the average caught over the period 2001-13 (80).

Total catch numbers of grey gurnard in 2013 (1567) was up compared to 2012 (919) with most of these (66%) being smaller juvenile fish (<16cm) and this is almost double the average for the period 2001-13. Red gurnard total catch numbers in 2013 (456) was up compared to 2012 (369) but compared with grey gurnard, only a small percentage (4%) of these were juveniles (<16cm). The numbers of juveniles caught in 2013 are around the average for the period 2001-13

The total number of starry smooth-hound caught in 2013 (174) was up compared to the 2012 survey (148) and the number of juvenile individuals (<36cm) was also up to 90 in 2013 from just 63 in 2012. Poor cod numbers in 2013 (4359) were up compared with the 2012 survey (3692) but the proportion of smaller juvenile individuals (<12cm) remained the same at 80%. Common dragonet numbers in 2013 (4079) were up 35% compared with the 2012 survey (3005) and are currently at the highest level over the period 2001-13.

*Note – Irish sea survey sectors are ISS/ISN/ISW/SGC and the Bristol Channel survey sectors are BCI/BCO with stations fished in SEI sector being excluded from these results as these stations are not normally fished.*

#### Aim 4 - Surface and bottom water sampling

At each fishing station, a surface water salinity sample was taken using on-board sea-water supply taken from a depth of 5m. The starboard gantry with the 'hydrographic' wire was used in the collection of bottom water samples using a niskin sampler and an ESM2 logger (S/N UWQ 7788). The sample was routinely taken at around 2-3m off the seabed. A total of 131 surface and 46 bottom salinity samples were collected.

#### Aim 5 - Epibenthos

At 25 selected fishing stations, samples of the epi-benthic by-catches were sorted and 32 'core species' identified and quantified. A standard operating procedure (SOP) for the processing of this by-catch was provided. Some non-SOP benthic species were identified where on-board expertise allowed.

At all SEI stations, a full benthic sort was carried out unless there was not enough time. Two samples of benthic by-catch was frozen for analysis at Lowestoft. Many of these stations had not been fished with a beam-trawl for many years so analysis of the epi-benthic catches was seen as important.

At all fishing stations on the survey, catches of 9 sentinel taxa of benthic invertebrates were recorded. The total weight of the remaining by-catch of epi-benthic invertebrates was recorded at all stations with the exception of prime stations 512 (BCO) and 53 (ISS) where the by-catch was estimated. In addition, benthic observations were recorded from the catches at non-benthic stations.

#### Aim 6 - Length weight & maturity information

A total of 24 length/weight measurements were collected on the survey in addition to the length weight information routinely collected with survey otoliths. Species were targeted this year to supplement those measurements taken on the 2009 - 2012 surveys. The species sampled in 2013 are shown in Table 5.

**Table 5:** Species sampled for length/weight

<b>Species</b>	<b>No of length/weight measurements.</b>
Butterfish ( <i>Pholis gunnellus</i> )	14
Two-spotted clingfish ( <i>Diplecogaster bimaculata</i> )	2
Butterfly blenny ( <i>Blennius ocellaris</i> )	1
Sea snail ( <i>Liparis liparis</i> )	4
Five-bearded rockling ( <i>Ciliata mustela</i> )	3

## Aim 7 – Tritium and Caesium water sampling

1 litre surface seawater samples were collected from 37 stations in the Bristol Channel & Severn Estuary for tritium H-3 analysis and a further 39 stations in the Irish Sea. In addition, 50 litre samples for caesium analysis were also collected from 39 stations in the Irish Sea. All samples were all taken from the on-board sea-water supply. T Bailey (Cefas, Lowestoft).

## Aim 8 - Additional sample collections

Additional samples were taken in support of other Cefas projects:

A) Monk (*Lophius piscatorius*) illicia were collected supplement the otoliths. S Songer (Cefas, Lowestoft).

B) No rare or unusual species were caught on this survey.

C) A total of 13 Nursehound (*Scyliorhinus stellaris*), 5 Blonde ray (*Raja brachyura*), 12 Starry smooth-hound (*Mustelus asterias*) and 2 Small-eyed ray (*Raja microocellata*), were tagged and released. J Ellis (Cefas, Lowestoft).

D) A total of 11 sightings of Cetaceans were recorded during the survey. Details of location, date/time and identification were noted on each occasion. Ten of the sightings were of common dolphin (*Delphinus delphis*) with the remainder being a minke whale (*Balaenoptera acutorostrata*). Sea Watch Foundation.

E) No specimens of sea trout or any other diadromus species were caught and retained as part of the EU Interreg – Celtic Sea Trout Project (Ted Potter)

F) Samples of dab, lesser spotted dogfish, spotted ray, (*Raja montagui*), thornback ray (*Raja clavata*), Edible crab, squid (*Loligo vulgaris*) and octopus (*Eledone cirrhosa*) were collected for the radiological monitoring programme from the northern part of the Irish Sea. P Rumney (Cefas, Lowestoft).

G) Three samples (1 x small crab, 1 x shellfish and 1 x fish) were frozen for subsequent identification in the laboratory by J Ellis and K Vanstaen – Cefas.

H) A total of 384 measurements of jellyfish caught were taken. Each individual was identified to species, measured across the 'umbrella' disc and weighed. D Righton (Cefas Lowestoft).

I) No collection of Shad (Allis or Twaite) or Lamprey was possible on the survey. A Walker (Cefas Lowestoft)

J) A total of 1 Starry Smooth-hound (*Scyliorhinus stellaris*) was frozen to aid work on forth-coming Cefas contracts. J Ellis (Cefas Lowestoft)

K) A total of 7 specimens were collected for the Foods Standards Agency and these comprised, 1 LSD, 5 Brill and 1 Turbot. R Law (Cefas Lowestoft)

L) Throughout the entire survey, levels of  $pCO_2$  were collected for the ocean acidification project. N Greenwood (Cefas Lowestoft).

M) At two fishing stations, large samples of whelk (*Buccinum undatum*) were collected for analysis as part of on-going Cefas shellfish projects. A Lawler (Cefas Lowestoft)

N) A selection of small benthic invertebrates (starfish, urchins and small crabs) caught at the end of the survey were retained 'live' on board for the Great Yarmouth Sea Life Centre stocks.

#### Aim 9 - Water alkalinity, dissolved inorganic carbon (DIC) and nutrient sample collection

At every ESM2 profile station, samples were taken for dissolved inorganic carbon, nutrients and alkalinity analysis. Samples were collected using the standard operating procedures and training provided earlier prior to the survey. A total of 30 sample collections were taken, with surface and bottom water samples taken at each of these stations. Surface water samples were taken from the surface (5m) sea-water supply and the bottom water samples were taken from the niskin water sampler.

#### Aim 10 - To deploy and carry out sea trials of Slocum sea-glider for National Oceanography Centre (Southampton)

In a cooperation between researchers from the National Oceanography Centre (NOCS), Cefas, the British Antarctic Survey (BAS) and the University of St. Andrews, two shallow water (200m) Slocum gliders were deployed from the Cefas Endeavour on 12 September 2013 around the western Scilly Isles to conduct repeated transects over a tidal mixing front until late October 2013. A tidal mixing front is a transition zone between different water masses (in this case, mixed coastal versus stratified shelf water), which may be associated with elevated abundance of marine life. Therefore, these hydrodynamic features are often thought of as biodiversity hotspots and considered in marine conservation management. Due to the EC Habitat Directive, the UK is committed to the establishment of a network of Marine Protected Areas (MPAs). In this context, high resolution data and information on potential aggregation sites of marine life, such as fronts, are highly desirable, but at the same time subject to cost and time intense survey methodologies.

Considering the above situation, the objectives of this DEFRA funded project are

1. The characterization of a front and its effect on the surrounding ecosystem.
2. A proof of concept to use gliders as a cost effective alternative to vessel surveys in monitoring marine habitats.

Gliders are members of a group of so called Autonomous Underwater Vehicles (AUVs), which independently travel the oceans and collect data using survey specific sensors.

The gliders use small changes in their buoyancy to move through the water column, consuming only very low energy. When at the surface, the glider can communicate with the scientists via Iridium and even send collected data. This allows for adjustment of e.g. the transect location or sampling regime in real time if necessary.

Both gliders were equipped with CTDs to capture data on the physical properties of the water column. Since we are interested in the effect of fronts on marine biota, additional bio-sensors are being utilized. A 120 kHz echo-sounder was integrated into Unit\_194 to collect data on zooplankton and fish. The second Slocum, Zephyr, was equipped with a hydrophone recording underwater noise, but we were specifically targeting cetacean sounds. Furthermore, colleagues from the Norwegian Institute for Water Research (NIVA) attached specific hydrocarbon filters, to collect contaminants dissolved in the water. In a final step, a simultaneous (approximately 24hrs) survey between the gliders and the Cefas Endeavour will be conducted to validate the data collected by the AUVs. All together, the gliders may provide high resolution data over multiple trophic levels, which allow a greater insight into ecosystem functioning and a better understanding of the interaction of its components.

For further information on glider technology and other projects involving AUVs around the UK, please refer the NOCS AUV webpage. This site, which is updated multiple times a day, also provides a map of gliders currently deployed and visual displays of the data they have collected along the way:

<http://www.noc.soton.ac.uk/omf/projects/glider/index.php>

### Micro CTD

The SAIV Micro CTD unit number 533 was attached to the 4m-beam trawl in order to record the temperature, salinity and depth profile at each station fished and this was successful in recording data on all fishing days and a total of 115 successful CTD data collections were made.

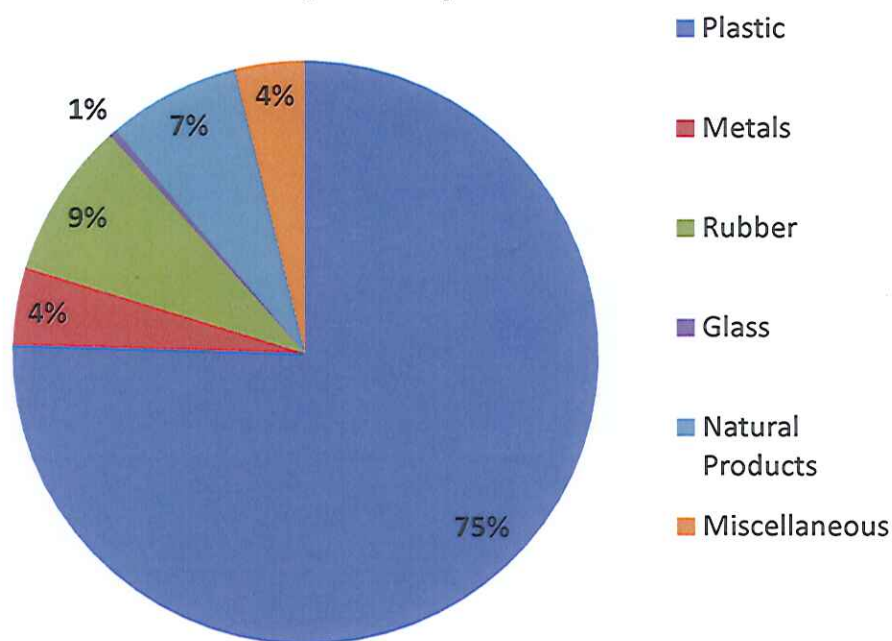
### Litter by-catch information

Details of the by-catch of litter caught at all fishing stations were recorded. In total, litter by-catch was categorized by 'type', weighed, photographed and categorized by size at a total of 83 fishing stations with a total of 232 individual items. In addition details of any attached organisms were recorded. Photographs of all litter items were taken.

Early analysis of the information collected suggests that around 75% of items caught in the beam were classified as plastics. The remainder was a mixture of natural items, glass, rubber and metals. Figure 1 below shows the breakdown of litter items caught by type.

Figure 1 – Breakdown of litter by-catch by type.

### Benthic Litter collected during Cend 18/13 (N=232)



Once again, our thanks go to the officers and crew of RV Cefas Endeavour for their help, support and advice given during this survey and it is largely due to their skill and co-operation that all survey aims were achieved. Finally, I would also like to thank all personnel on-board for their generosity and support of the Cefas MacMillan coffee 'morning' held on board on 27 September with special mention to the catering staff for providing the refreshments to ensure the event was a success. The event and various social activities raised an on-board total of £370 for this worthy cause, and our vessel operators (P & O Maritime Services) very kindly added an extra £250 to that sum.

I D Holmes  
17 October 2013

INITIALLED: B Harley

SEEN IN DRAFT: Master: Capt. T Bryne / Capt. P Kersey  
First Officer: R Reynolds / M Polson

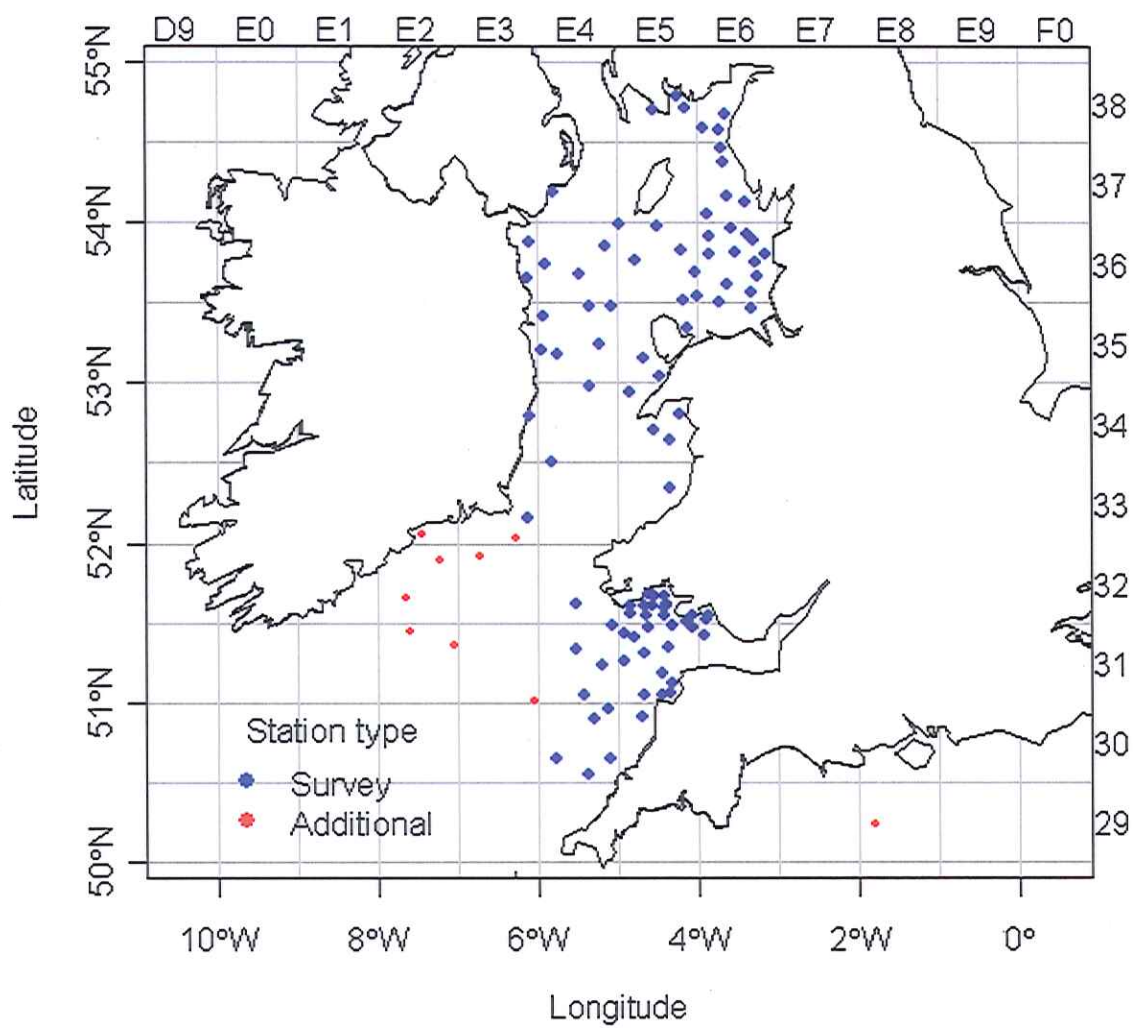


DISTRIBUTION:

I Holmes  
R Bush  
S Shaw  
S Walmsley  
T Gooding  
M Etherton  
K Vanstaen  
P Dolder  
G Thomas  
S Stones  
S Murphy (MI Ireland)  
T Hull  
D White (NOC)  
L Suberg (NOC)

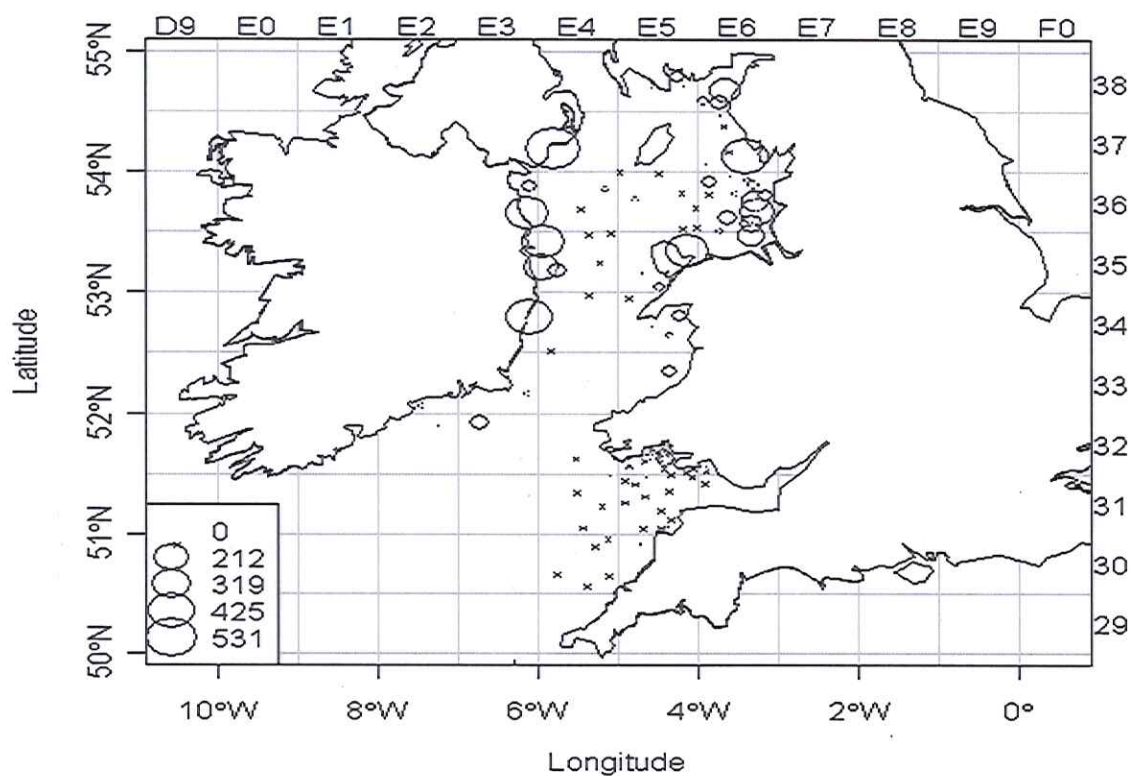
T Owen (P&O)  
Master (Cefas Endeavour)  
B Harley  
S Kupschus  
Cefas Intranet  
P-J Schon (AFBI NI, Belfast)  
P Connolly (DOM, Dublin)  
FCO (for Republic of Ireland)  
Marine Management Organisation  
Welsh Government (WG)  
Devon & Severn IFCA  
Cornwall IFCA  
Isles of Scilly IFCA  
North Western IFCA  
Crown Estate

Figure 2 – Beam trawl station positions for CEND 18/13.

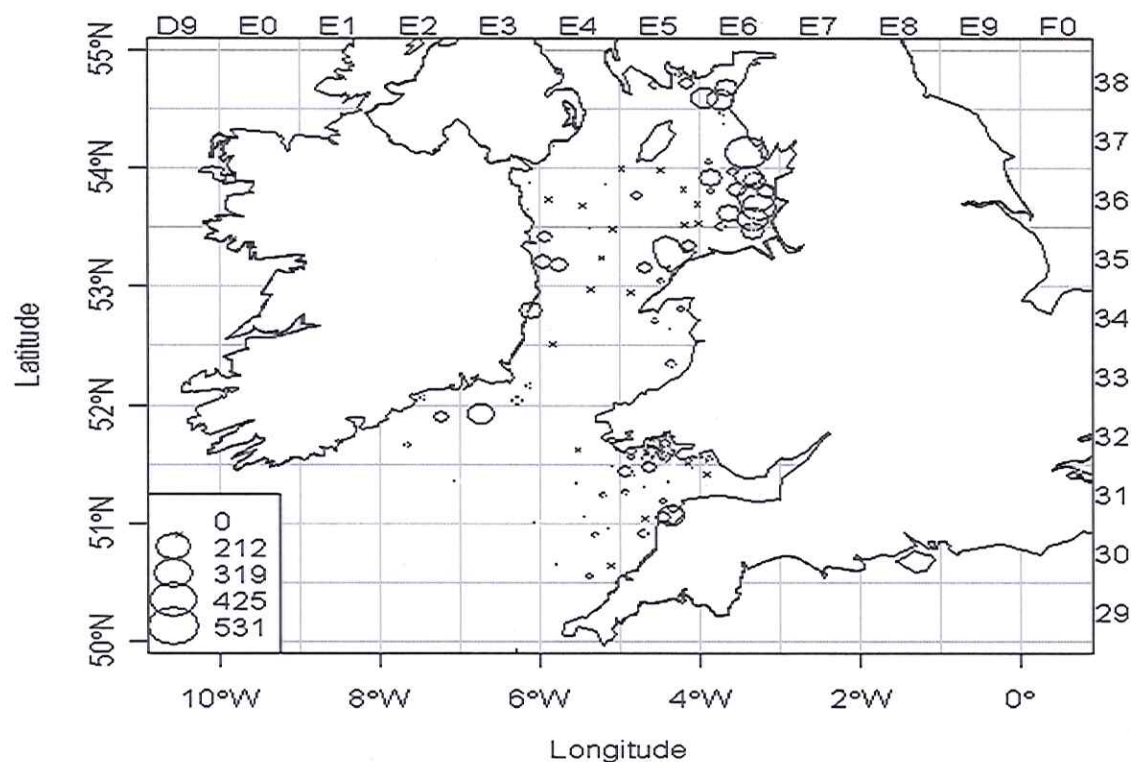


**Figure 3** - Abundance (number caught per 30 minute tow) of pre-recruit (a) (<21 cm TL) and recruited (b) ( $\geq 21$  cm TL) - plaice.

a)

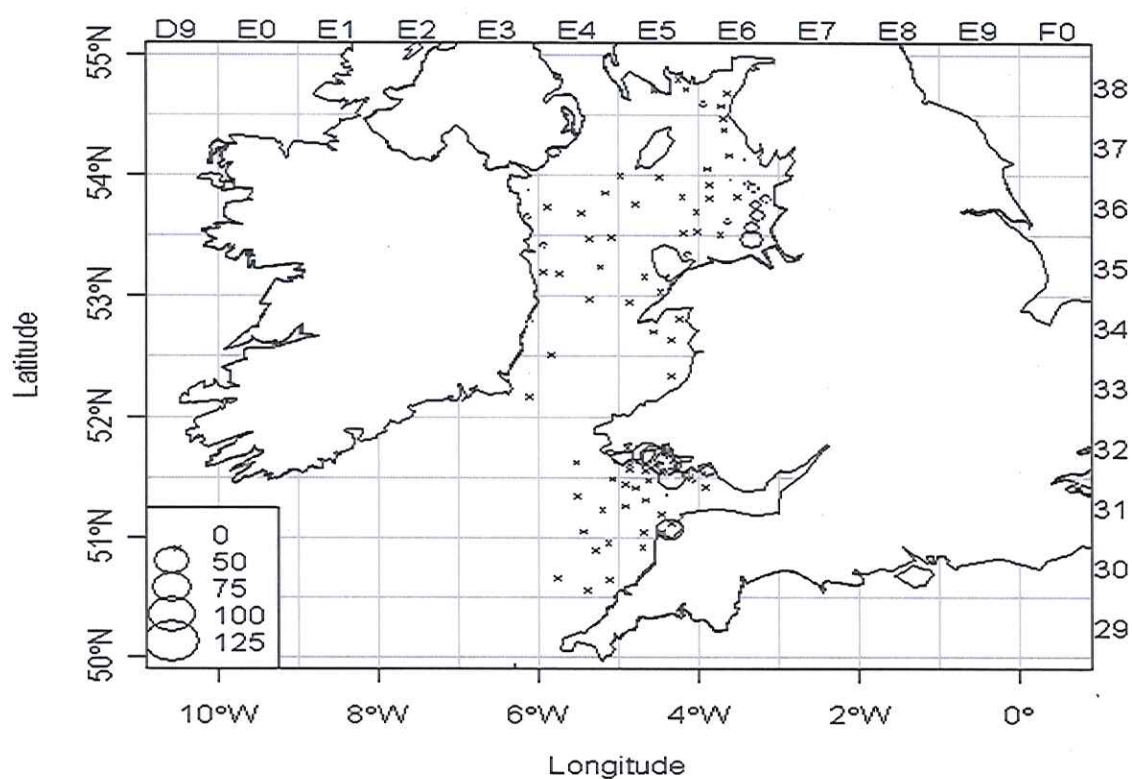


b)

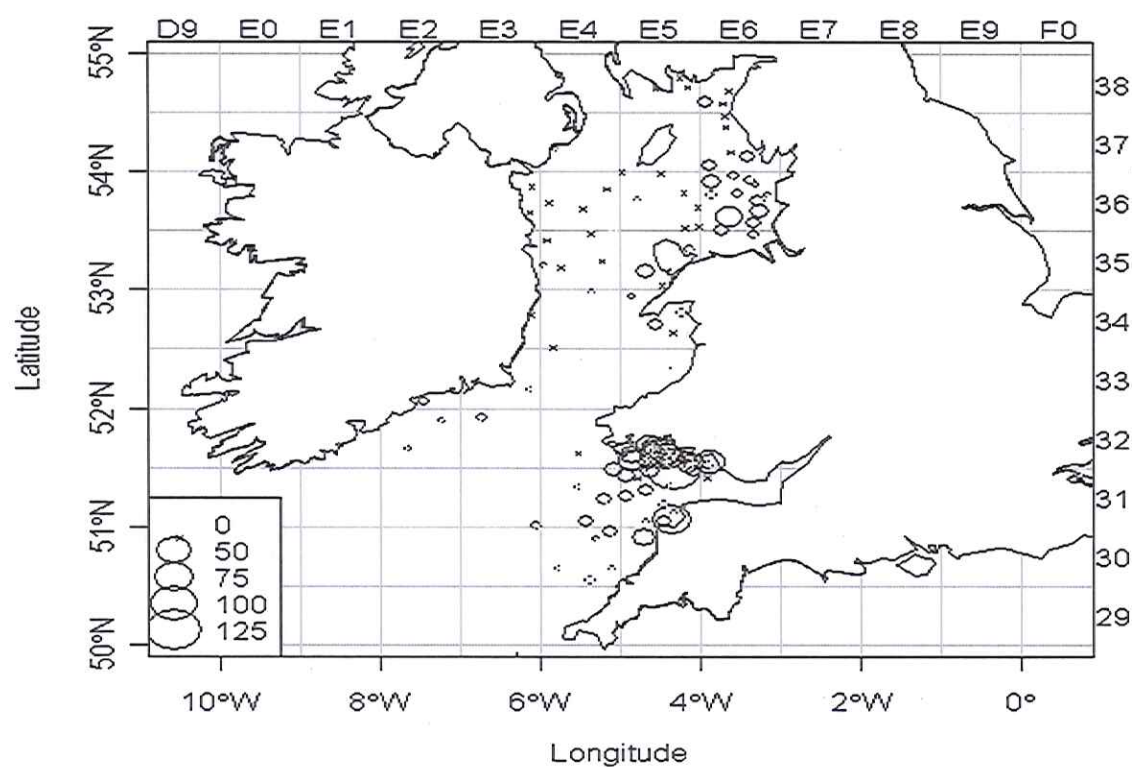


**Figure 4** - Abundance (number caught per 30 minute tow) of pre-recruit (a) (<21 cm TL) and recruited (b) ( $\geq 21$  cm TL) - sole.

a)

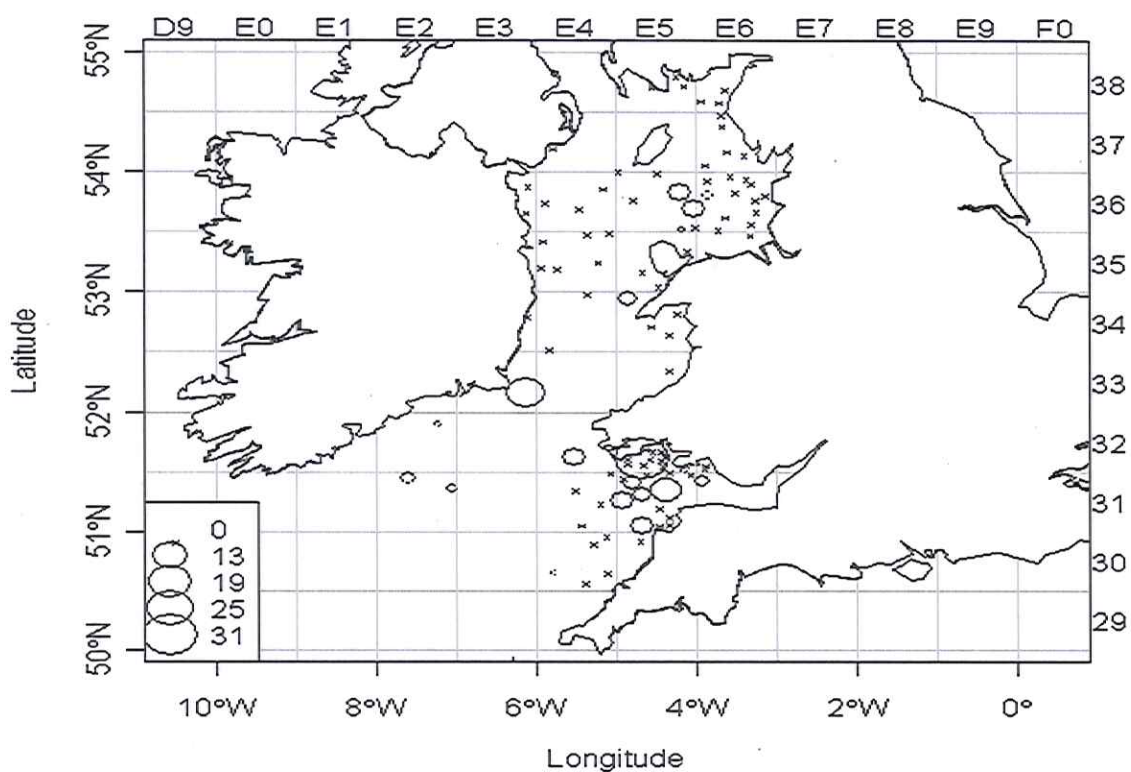


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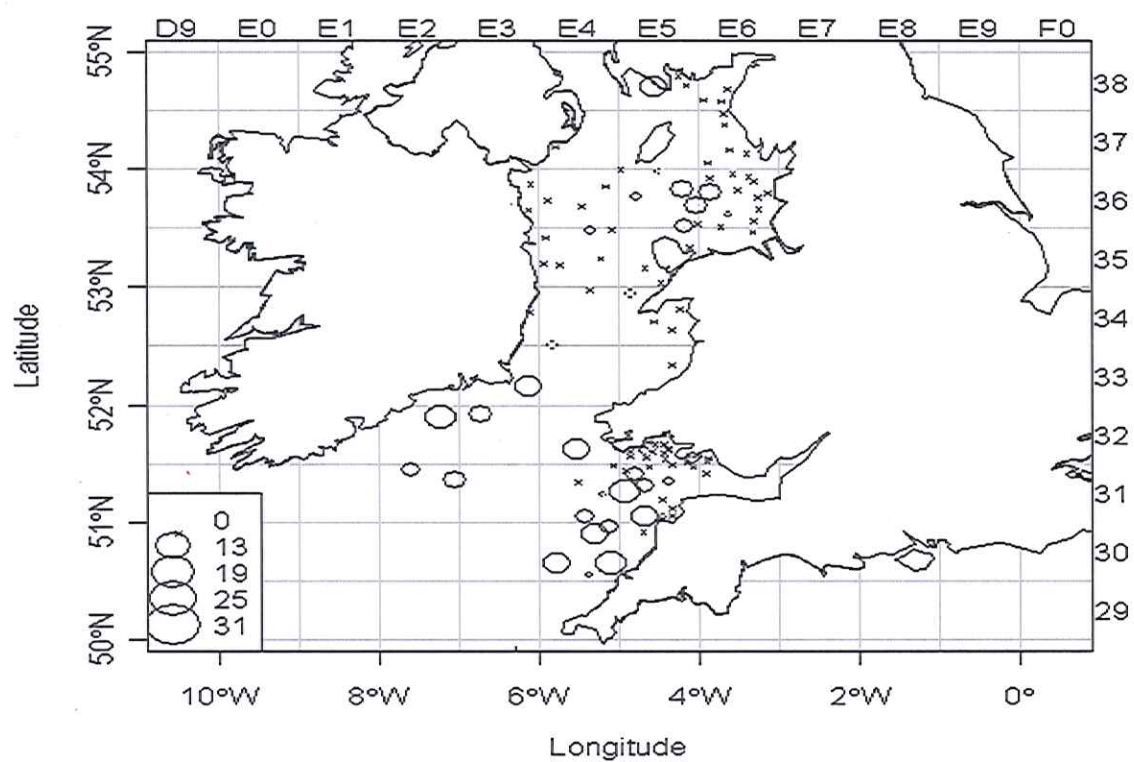


**Figure 5** - Abundance (number caught per 30 minute tow) of pre-recruit (a) (<16 cm TL) and recruited (b) ( $\geq 16$  cm TL) - dab.

a)

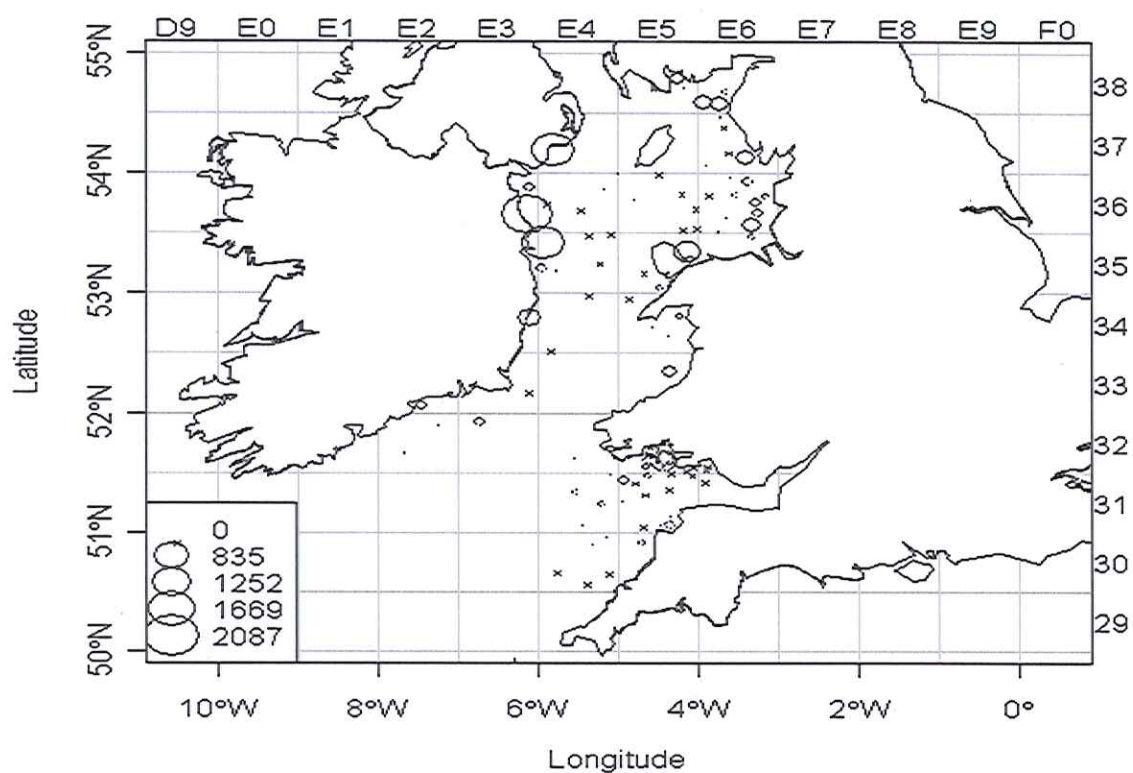


b)

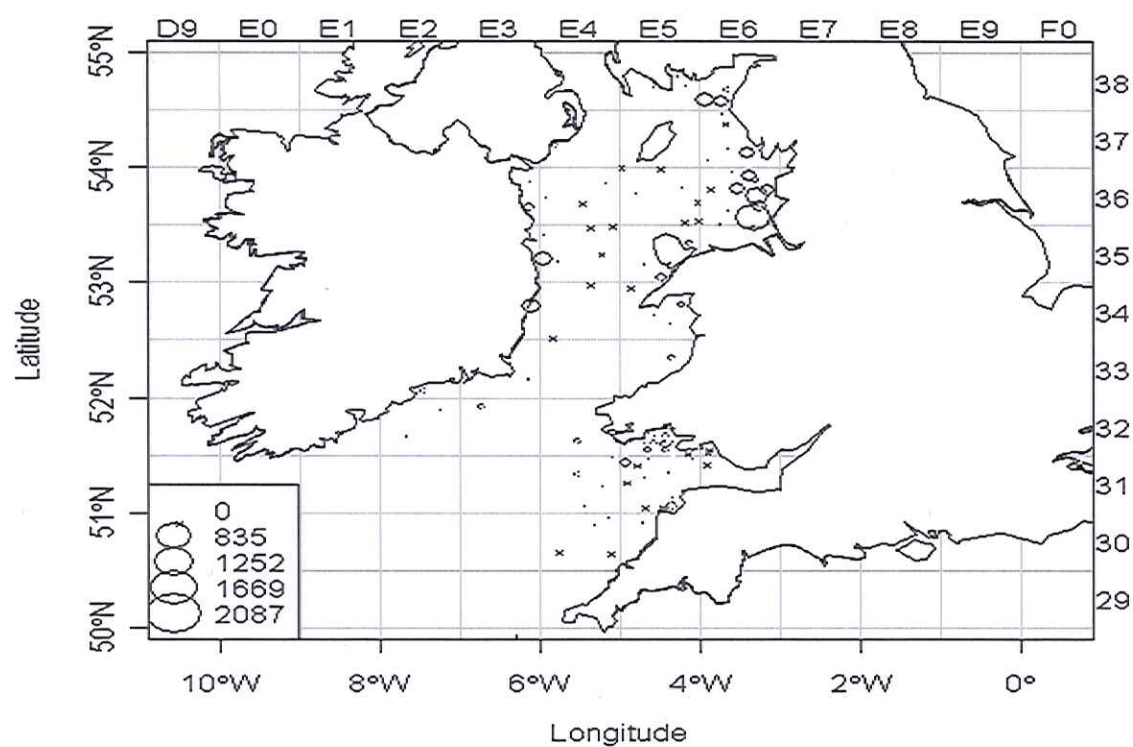


**Figure 6** - Abundance (number caught per 30 minute tow) of pre-recruit (a) <19 cm TL and recruited (b) ( $\geq 19$  cm TL) - lemon sole.

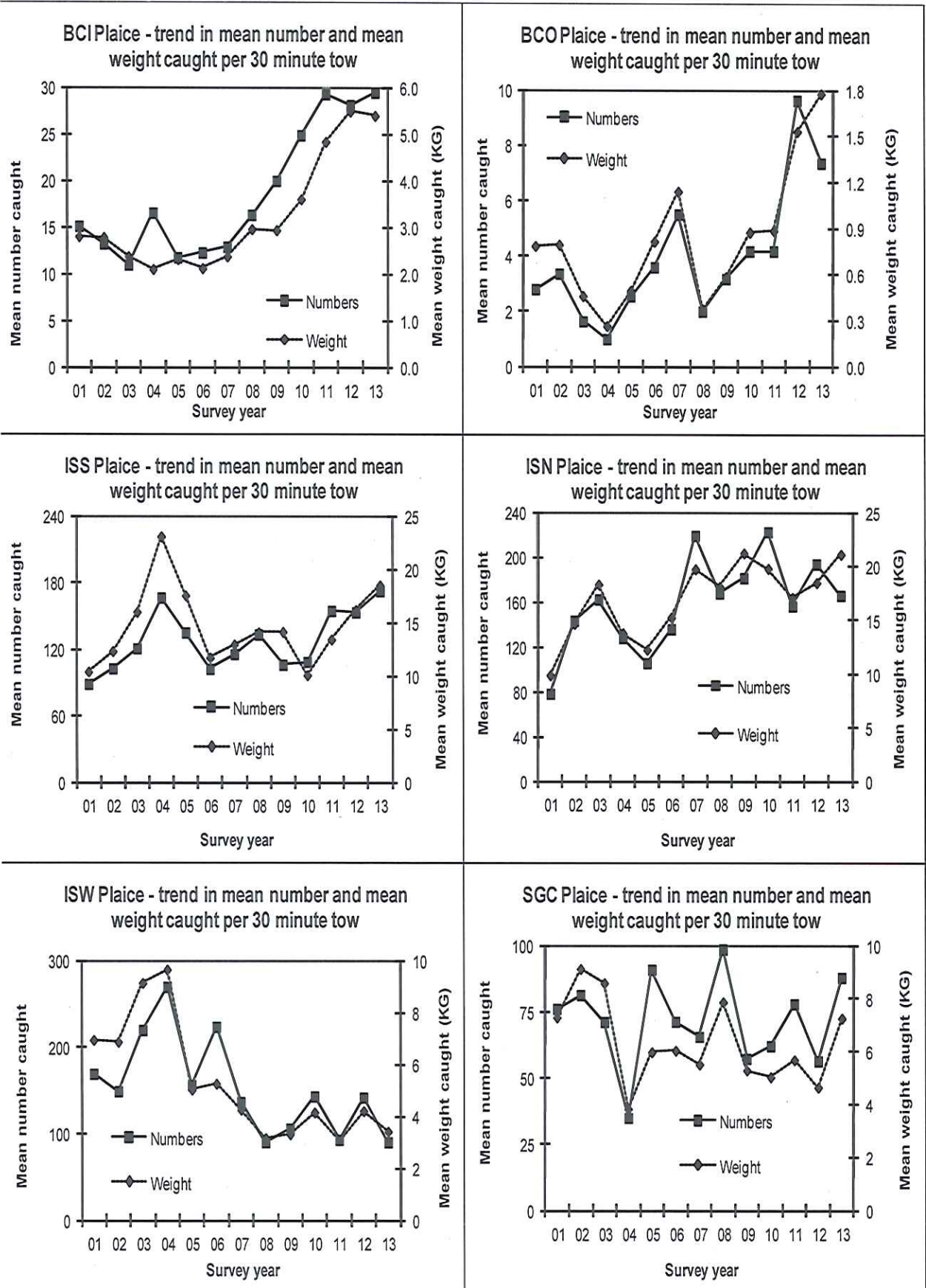
a)



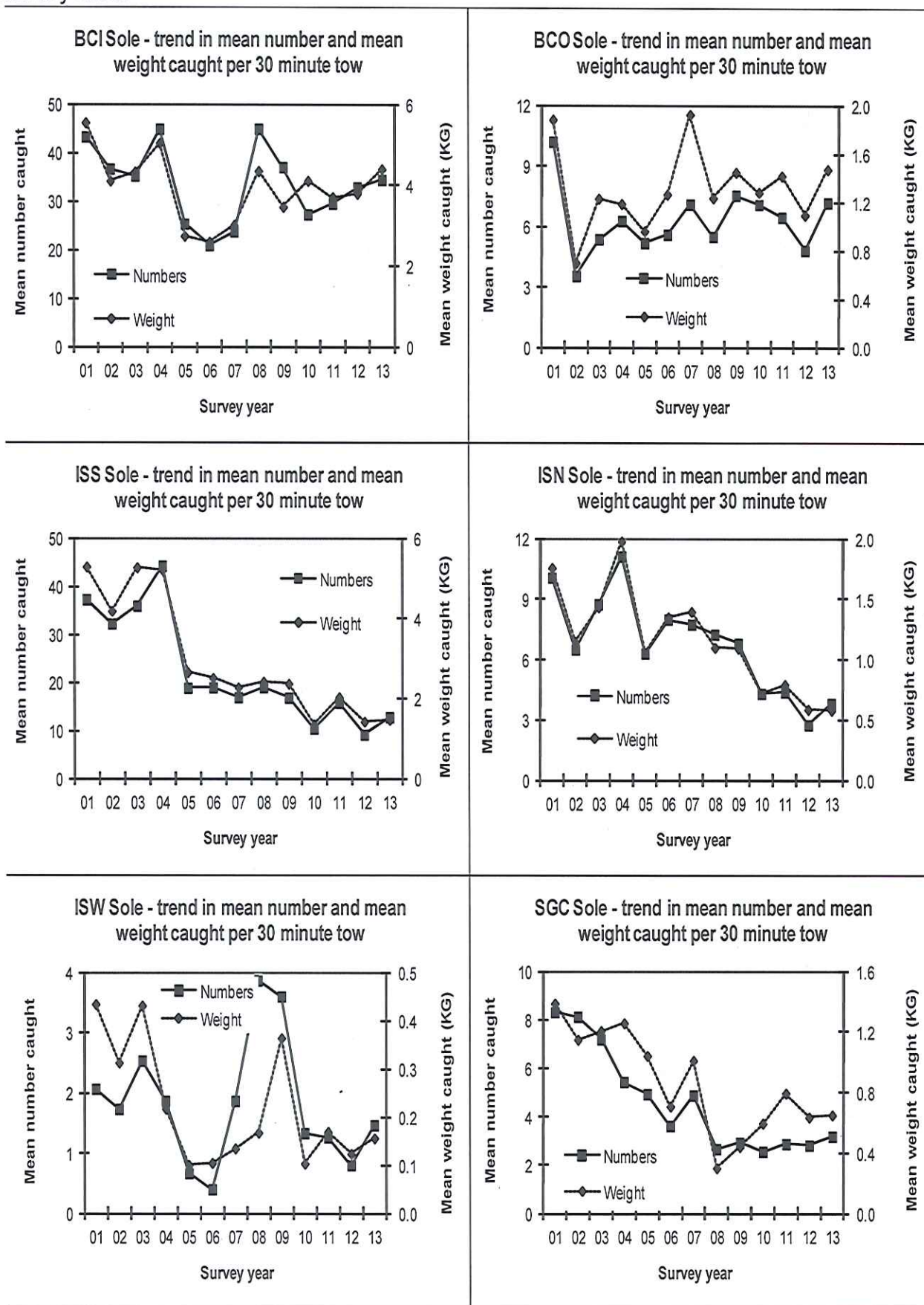
b)



**Figure 7 – Mean number and weight of plaice (*Pleuronectes platessa*) caught per 30-minute tow - by survey area**

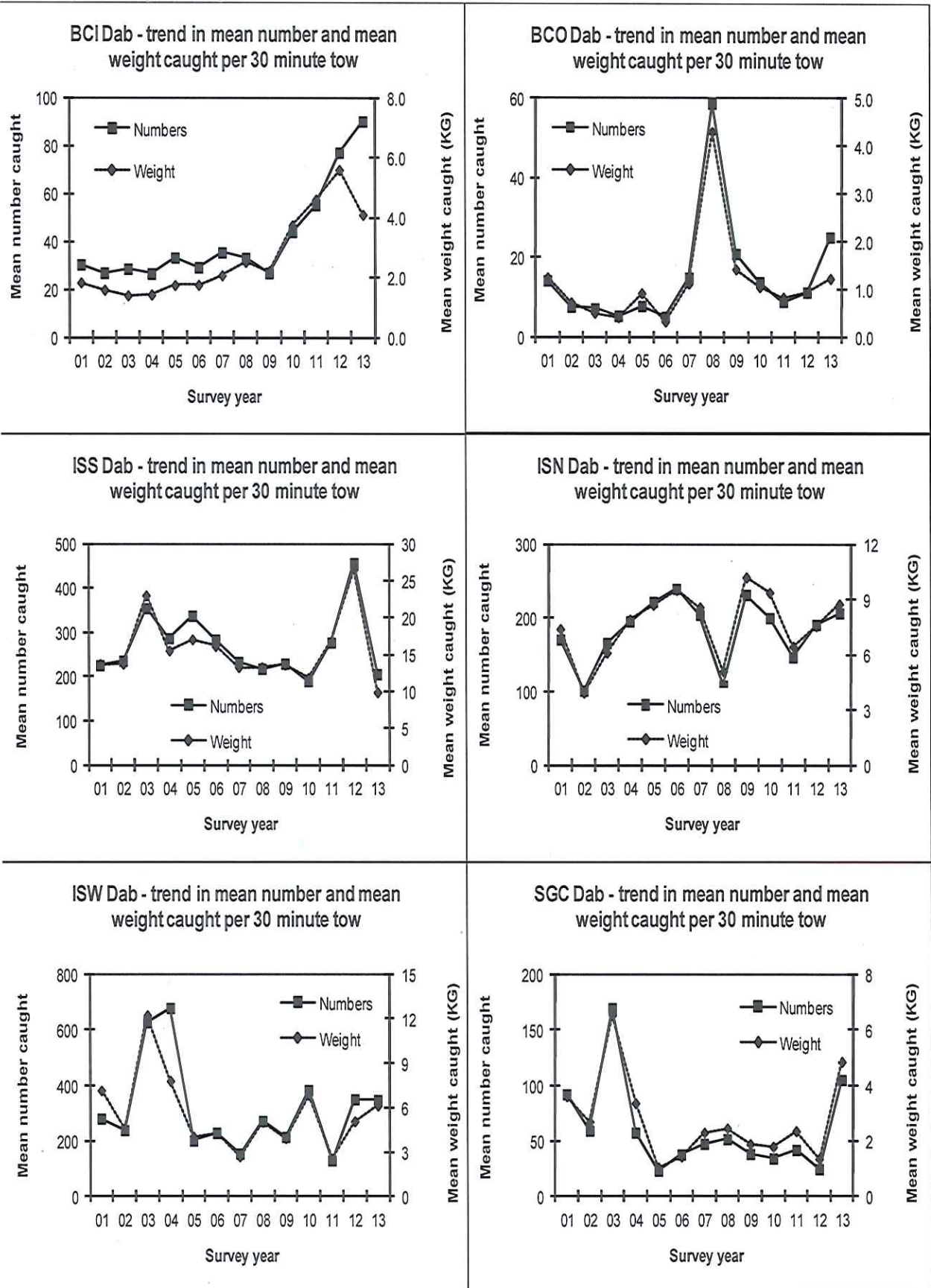


**Figure 8 - Mean number and weight of sole (*Solea solea*) caught per 30-minute tow - by survey area.**





**Figure 9** - Mean number and weight of dab (*Limanda limanda*) caught per 30-minute tow - by survey area per 30-minute tow.



**Figure 10** - Mean number and weight of lemon sole (*Microstoma kitt*) caught per 30-minute tow - by survey area per 30-minute tow.

