

# LOWESTOFT LABORATORY, LOWESTOFT, SUFFOLK, NR33 OHT

## 2012 RESEARCH VESSEL PROGRAMME

### REPORT: RV CEFAS ENDEAVOUR: SURVEY 15/12

#### STAFF:

##### Part One

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DURATION: 13 September – 4 October 2012

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

#### AIMS:

1. To carry out a 4m beam-trawl survey of groundfish (Figure 1) 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 the assessments of stock size.
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)

NARRATIVE: (All times GMT)

Cefas scientists joined the vessel at 1400h 13 September to participate in vessel safety induction training and setting up of sampling equipment with Endeavour sailing at 1800h that evening. Shortly after sailing, 'toolbox' talks were held with the ship's officers/crew and scientists.

At a known 'clear' fishing tow off Benacre, the fishing gear was deployed, towed for 16 minutes and successfully retrieved to ensure that all was in good working order. The catch was also fully sorted and processed in order to adequately test the EDC system and FSS upload functions. Early on the 14 September a 'toolbox' talk was held with the ship's officers/crew and scientists.

After an uneventful passage through the Channel, the survey commenced in the Bristol Channel Outer (BCO) sector at prime station 508 at 0943h 15 September with an ESM2/Niskin sample followed by the first beam trawl station of the survey. A further 6 stations were successfully fished during that day, 5 of which were within the priority survey grid Bristol Channel Inner (BCI). Overnight, Cefas Endeavour headed into Carmarthen Bay in order to complete the inshore stations within the MOD range areas during the in-active weekend period. Five stations were successfully fished without incident. Upon hauling the sixth station (prime 137 – BCI), it was found that a large proportion of the net had been lost. The beam trawl net had picked up a very heavy weight, parting the headline and tearing the lower wings and belly away from the fishing line, parting the dog rope at the towing chain end. The cause of this damage remains a mystery as there was no history of damage on this tow and nothing untoward was observed on the sounder or the Olex.

With only 3 planned stations left un-fished for the day, the decision was taken to head into the shelter of the shallow waters around Caldey Island in order to allow the crew to fit the spare net and cod-end to the beam. This onerous task was completed with great skill and dedication during that evening ensuing that fishing could recommence at first light the following morning.

On 17 September, a total of 8 BCI prime stations were successfully fished including a replacement tow for prime 137 where the net had suffered damage on the previous day. At this tow, the vessel steamed over the original tow fished the previous day and the sea-bed profile was recorded and observed using the multi-beam and Olex systems. Given that no obvious snagging point was found, an alternative tow was located within the same depth contour 800m along a parallel track to the original tow. This tow was 'run' with the multi-beam before fishing a 20-minute tow without incident. At the end of this day, Cefas Endeavour embarked on a 'reduced grid' of Tritium water samples. A total of 18 samples were collected in the Bristol Channel between 1849h and 2352 that evening.

At first light the following morning, the BCI fishing survey grid recommenced at BCI prime station 117 (0537h 16 September). After fishing prime station 122, survey operations were temporarily suspended whilst a search was conducted for some beam trawl netting seen earlier, however the search proved fruitless and survey operation were resumed. Work in this survey grid continued without incident until completion at 1552h 19 September.

On 20 September, the day was spent fishing the 6 Cardigan Bay stations in the St George's Channel sector (SGC) en-route to begin the Irish Sea South (ISS) priority survey grid. These stations were successfully fished without any problems encountered. Overnight, Cefas Endeavour steamed north around Anglesey to begin the Irish Sea South (ISS) survey grid the following day.

On 21 September a total of eight fishing stations were successfully fished including seven in the priority ISS sector. Prime station 49 in outer Liverpool Bay was fished for a precautionary 20 minute tow with warp load tested every five minutes. In recent years this station had yielded large by-catches of broken shell and gravel and was extremely difficult to safely get aboard. This year's tow yielded just 4 baskets. Consideration should be given to fish this tow for the full 30 minutes duration in future surveys. During the day, catches of plaice and dab were both down on the previous year.

The following day a 'string' of inshore ISS stations were fished heading north from prime station 32 in Liverpool Bay. These stations yielded very large numbers of dab and plaice with >2300 dab caught at a single station (prime 31). At prime station 28, given the major net damage suffered in 2011, a precautionary 20 minute tow was fished checking the warp tension at regular intervals. On hauling, <5 baskets of fish and benthic by-catch was landed. In 2011, prime station 54 no valid tow was fished as over 3 tonnes of broken shell was caught. This year, an alternative tow was located on a level sea-bed and this was steamed over and the tow mapped using the multi-beam and Olex on-board systems. Given the findings of this, a 15 minute tow along this track was successfully fished yielding just 3 baskets with very little broken shell.

At prime station 49, the gear was hauled after 20 minutes given the heavy catches of broken shell and sand caught in recent years. This year, approximately 3½ baskets of shell were caught. Again at prime station 54, a known problem fishing station, the gear was hauled after 15 minutes. The following day (23 September), at prime station 53 (ISS), a new tow of 15 minutes duration using the same 5 minute tow fished in 2011 but extending this south-east to avoid the broken shell. This new tow caught a manageable 10 baskets of fish and broken shell and should be fished in future surveys. Overnight Cefas Endeavour steamed north to begin the Irish Sea North (ISN) grid of stations and work began at prime station 2 (Luce Bay). A total of 7 stations were fished on this day in deteriorating weather conditions. On 25 September, the final five ISN stations were fished without incident before heading into Douglas IOM for a mid survey break docking at 1500h. On 26 September there was a changeover of both scientific and ship's personnel and whilst in port the vessel took on fresh catering supplies.

Cefas Endeavour left Douglas IOM on 27 September at 0400h and headed directly to the nearest fishing station in the Irish Sea West (ISW) sector arriving at 0548hrs at prime station 424. 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. Given the favourable catches with a 15 minute tow in 2011, this was repeated again this year with a similar outcome of <1/2 basket and only minimal amounts of shell.

On 28 September, prime station 214 was fished for the full 30 minutes tow duration as in recent surveys but this year the tow yielded large numbers of small dab (*Limanda limanda*) and plaice (*Pleuronectes platessa*) with 2700 and 600 respectively. Consideration should be given to reducing the tow duration to 15 minutes again in 2013.

The survey continued over the period 28-30 September completing the majority of ISW and SGC fishing stations. At prime station 441 in SGC, a large metal anchor was caught in the chain mat but this caused no damage to the gear and did not invalidate the tow. The anchor was retained on board and returned to Lowestoft. The final SGC station (prime 418) was fished early in 1 October and this was followed by a lengthy steam into the BCO sector to begin fishing the final survey stations. Given the long distances to travel in the completion of the final five stations, prime station 504 was fished before sunrise. Given the depth of water at this station (>80m), fishing this mostly in darkness was considered an acceptable compromise. The final survey fishing station was hauled at 1609h 2 October.

With the full survey fishing grid now complete, Cefas Endeavour headed towards a position in Weymouth Bay in order to recover a Smart-Buoy due for recovery in early October. This was successfully retrieved at 0851h 3 October. Following the smart-buoy recovery, 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 1043h 4 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.

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.

A total of 9 prime stations – numbers 27 (off Blackpool), 53 and 54 (outer Liverpool Bay), 313 (Tremadoc Bay), 425 (SW of Isle of Man), 203 (Dundrum Bay), 220 (north of Dublin), 233 (south of Wicklow) and 501 (southwest of Milford Haven) and were reduced from the standard 30-minute to 15-minute tows. In addition, a total of 4 prime stations were fished for 20 minutes - numbers 28 (off Blackpool), 49 (outer Liverpool Bay), 137 (Rhosili Bay) and 512 (off Padstow). All tow reductions were due to expected large catches of weed, broken shell or small flatfish or fishing a new tow location.

In addition, 2 stations were hauled a few minutes early due to either cables or static gear at the end of the tow. A few other stations were moved short distances to avoid snagging undersea cables (an increasing problem in this busy sea area) or to avoid static gear.

Table 4 shows the number of gear deployments undertaken on the survey.

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

	VIIa	VIIb	VIIg	Total
Anglerfish ( <i>Lophius piscatorius</i> )	25	32	27	84
Anglerfish ( <i>Lophius budegassa</i> )	0	0	0	0
Brill	14	13	2	29
Cod	33	1	1	35
Dab	234	322	12	568
Bass	0	9	1	10
Haddock	18	5	19	42
Hake	4	2	16	22
John Dory	2	18	3	23
Lemon Sole	51	86	18	155
Megrim	0	18	19	37
Plaice	1382	444	22	1848
Red Mullet	1	1	0	2
Sole	234	370	27	631
Turbot	9	9	0	18
Whiting	165	34	28	227
<b>Total</b>	<b>2172</b>	<b>1364</b>	<b>195</b>	<b>3731</b>

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

	Weight caught (kg)				Number caught		
	2012	2011	2010		2012	2011	2010
Lesser spotted dogfish	965	1083	664	Dab	19517	11502	11228
Plaice	918	830	703	Plaice	9899	8759	7948
Dab	887	621	557	Solenette	6653	5184	4776
Sole	184	197	185	Poor cod	5509	4180	2227
Thornback ray	179	164	174	Common dragonet	2989	2552	2399
Common dragonet	123	103	100	Lesser spotted dogfish	2158	2353	1522
Poor cod	93	78	69	Whiting	1951	2522	1778
Solenette	90	82	61	Scaldfish	1503	1636	1351
Edible crab	84	90	78	Sole	1384	1425	1214
Whiting	82	82	45	Grey gurnard	920	884	726
<b>TOTAL (All species)</b>	<b>4319</b>	<b>4239</b>	<b>3246</b>	<b>TOTAL (All species)</b>	<b>57947</b>	<b>48099</b>	<b>39956</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>	69	<i>Merluccius merluccius</i>	10
<i>Anguilla anguilla</i>	1	<i>Microchirus variegatus</i>	56
<i>Ammodytidae</i>	1	<i>Micromesistius poutassou</i>	1
<i>Ammodytes tobianus</i>	7	<i>Microstomus kitt</i>	34
<i>Argentina sphyraena</i>	5	<i>Molva molva</i>	1
<i>Arnoglossus imperialis</i>	2	<i>Mullus surmuletus</i>	2
<i>Arnoglossus loterna</i>	66	<i>Mustelus asterias</i>	31
<i>Aspitrigla cuculus</i>	39	<i>Myoxocephalus scorpius</i>	8
<i>Blennius ocellaris</i>	10	<i>Nephrops norvegicus</i>	16
<i>Buenia jeffreysii</i>	9	<i>Pegusa (Solea) lascaris</i>	19
<i>Buglossidium luteum</i>	64	<i>Pholis gunnellus</i>	2
<i>Callionymus lyra</i>	89	<i>Phrynorhombus norvegicus</i>	11
<i>Callionymus maculatus</i>	3	<i>Platichthys flesus</i>	6
<i>Callionymus reticulatus</i>	6	<i>Pleuronectes platessa</i>	95
<i>Cancer pagurus</i>	55	<i>Pomatoschistus minutus</i>	30
<i>Cepola rubescens</i>	1	<i>Raja brachyura</i>	17
<i>Ciliata mustela</i>	6	<i>Raja clavata</i>	62
<i>Clupea harengus</i>	1	<i>Raja microocellata</i>	13
<i>Conger conger</i>	6	<i>Raja montagui</i>	50
<i>Ctenolabrus rupestris</i>	4	<i>Raniceps raninus</i>	1
<i>Dicentrarchus (Morone) labrax</i>	6	<i>Scophthalmus maximus</i>	16
<i>Diplecogaster bimaculata</i>	2	<i>Scophthalmus rhombus</i>	20
<i>Enchelyopus cimbrius</i>	1	<i>Scyliorhinus canicula</i>	96
<i>Eutrigla gurnardus</i>	79	<i>Scyliorhinus stellaris</i>	21
<i>Gadus morhua</i>	8	<i>Solea solea (s.vulgaris)</i>	84
<i>Gaidropsarus vulgaris</i>	2	<i>Spinachia spinachia</i>	1
<i>Glyptocephalus cynoglossus</i>	6	<i>Sprattus (Clupea) sprattus</i>	8
<i>Gobius niger</i>	1	<i>Syngnathus acus</i>	11
<i>Hippoglossoides platessoides</i>	3	<i>Taurulus bubalis</i>	4
<i>Homarus gammarus</i>	5	<i>Thorogobius ephippiatus</i>	1
<i>Hyperoplus lanceeolatus</i>	3	<i>Trachinus (echiichthys) vipera</i>	21
<i>Labrus bergylta</i>	1	<i>Trachinus draco</i>	5
<i>Leucoraja naevus</i>	10	<i>Trachurus trachurus</i>	1
<i>Lepidorhombus whiffiagonis</i>	9	<i>Trigla lucerna</i>	56
<i>Limanda limanda</i>	93	<i>Trisopterus esmarki</i>	8
<i>Liparis liparis</i>	1	<i>Trisopterus luscus</i>	24
<i>Lophius piscatorius</i>	32	<i>Trisopterus minutus</i>	68
<i>Melanogrammus aeglefinus</i>	13	<i>Zeugopterus punctatus</i>	2
<i>Merlangius merlangus</i>	74	<i>Zeus faber</i>	17

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

Gear	Valid	Additional	Invalid	Total
Standard 4m Beam trawl with cod end liner	107	2	1	110
Water sample: Tritium (1 litre)	27	0	0	27
Surface salinity samples	116	0	0	116
ESM2 profile+Niskin sea-bed water samples	33	0	0	33
Dissolved inorganic carbon/ Nutrient and alkalinity samples	33	0	0	33

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 number and weight was up in all survey sectors except SGC compared to last year's survey. In BCI, the weight of plaice caught increased for the seventh year running whereas the catch numbers fell slightly. Abundance by weight caught in this year's survey is at the survey series high over the period 2001-12 with an increase of 14% observed. Catch numbers remain at a high level over the same time period but fell slightly by 4% compared to 2011. Catch numbers of juvenile plaice (<21cm) in BCI fell in 2012 by around 50% with just 58 caught this year compared to 113 in 2010 and this follows a similar fall in 2011. In BCO, there were large increases in both catch numbers and weight compared to the survey in 2011, with numbers up 129% and weight up 72% but this sector remains much less productive than BCI.

In the Irish Sea, ISN plaice abundance increased in terms of both numbers caught (24%) and weight caught (8%). Both numbers and weights caught are above the survey average (2001-12). In ISS, plaice catch weights were higher than those observed in 2011 with an increase of 21% observed. However the numbers caught in this sector remained static with a small 1% fall compared to 2011. Catch numbers of juvenile plaice (<21cm) in ISS/ISN remained close to the high levels observed in 2011 with most of these juvenile fish coming from the ISN sector. Catches numbers and weights in ISW increased this year but are still close to the series low (2001-12) whereas catches in SGC decreased from those observed in 2011 with catch numbers down 28% and weights down 18%. Trends in survey catch rates over recent surveys are shown in Figure 7.

**Sole:** Abundance by numbers and weights have fallen in all survey sectors except BCI compared to the 2011 survey with the largest decreases observed in ISS and ISN. Both catch numbers and catch weights are either at or close to the series low (2001-12) in these sectors. In BCI, both catch numbers and weights were both up on the 2011



survey by 11% and 2% respectively, but are still around the series average over the same time period. In ISS and ISN, catch numbers fell by around 40% and catch weights by around 30% compared to 2011 and both are now close to the series low. Catch numbers of juvenile sole in BCI (<21cm) were around 30% higher in 2012 (606 fish) than those seen in 2011 (458 fish) and this follows a large increase in 2011. Numbers of recruited sole caught have remained level compared to 2011. Numbers of juvenile sole in ISS/ISN (<21cm) decreased by around 70% (33) from those observed in 2011 (103). The numbers of recruited sole (>=21cm) remained at similar levels to those seen in 2011. Trends in survey catch rates over recent surveys are shown in Figure 8.

Dab: Dab catches saw large increases in all survey sectors except for SGC. In BCI both catch numbers and weights increased for the third year in succession with a 40% increase in catch numbers and a 22% rise in catch weights. In 2012, both catch numbers and weights are at a series high (2001-12) and current levels are twice that seen during the surveys years 2001 to 2009. Numbers of juvenile dab in BCI (<16cm) have increased by 80% since 2011 with 1042 caught in 2012 compared to just 568 in 2011. In BCO, abundance increased slightly on the previous year but remain at low levels. In ISS, catch numbers and catch weights increased 65% and 58% respectively and the abundance is currently at a series high of the period 2001-12 having been at a series low only two years previous. Both ISN and ISW both showed moderate increases in both catch numbers and weights but both sectors currently have abundance at average levels over the same time period. The number of juvenile dab in ISS/ISN (<16cm) has increased by 35% since 2011 and a similar increase in the recruited population was also observed. 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 and fell again in 2012 in all sectors except ISS which showed a slight improvement in both catch numbers and weights caught. Trends in survey catch rates over recent surveys are shown in Figure 10.

Other noteworthy changes to the catch rates of other main species are a decrease in the weight of cod over the entire survey with a fall from 32kg to just 12kg in 2012 with the same numbers caught. However, most cod caught in 2012 were 0-group juveniles. Total numbers of haddock caught fell from 214 (43kg) in 2011 to just 52 (14kg) this year. Catches of thornback ray were generally up over the survey with the largest increase seen in SGC and are now at the highest levels observed in this sector over the period 2001-12. Catches of lesser-spotted dogfish fell in all nearly all survey sectors with the largest decreases observed in the ISN and SGC sectors.

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

At each fishing station, a surface water salinity sample was taken using on-board seawater 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 PR007). The sample was routinely taken at around 3-4m off the seabed and a total of 33 bottom water 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 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 409 (ISW) and 36 (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 146 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 - 2011 surveys. The main species sampled in 2012 are shown in Table 5.

**Table 5:** Main species sample for length/weight

Species	No of length/weight measurements.
Bullrout ( <i>Myoxocephalus scorpius</i> )	41
Butterfish ( <i>Pholis gunnellus</i> )	12
Jeffrey's Goby ( <i>Buenaia jeffreysii</i> )	12
Two-spotted clingfish ( <i>Diplecogaster bimaculata</i> )	11
Butterfly blenny ( <i>Blennius ocellaris</i> )	10
Sand Goby ( <i>Pomatoschistus minutus</i> )	10
Sea scorpion ( <i>Taurulus bubalis</i> )	9
Four-bearded rockling ( <i>Rhinonemus cimbrius</i> )	8
Goldsinny ( <i>Ctenolabrus rupestris</i> )	8
Reticulated dragonet ( <i>Callionymus reticulatus</i> )	7

#### Aim 7 – Tritium water sampling

1 litre surface seawater samples were collected from 27 stations in the Bristol Channel & Severn Estuary for Tritium H-3 analysis for Trevor Bailey. (Cefas, Lowestoft).

## Aim 8 - Additional sample collection

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 22 Nursehound (*Scyliorhinus stellaris*) and 1 Blonde ray (*Raja brachyura*) were tagged and released. J Ellis (Cefas, Lowestoft).

D) A total of 7 sightings of Cetaceans were recorded during the survey. Details of location, date/time and identification were noted on each occasion. All 7 sightings were of common dolphin (*Delphinus delphis*). Sea Watch Foundation.

E) Details of the by-catch of litter caught at all fishing stations were recorded. In total, litter by-catch was categorized by 'type', weighed and categorized by size at a total of 84 fishing stations. In addition details of any attached organisms were recorded. Photographs of all litter items were also taken.

F) 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)

G) Samples of dab, lesser spotted dogfish, spotted ray, (*Raja montagui*), Edible crab and octopus (*Eledone cirrhosa*) were collected for the radiological monitoring programme from the northern part of the Irish Sea. No specimens of cuttlefish (*Sepia officinalis*) were caught in the required sea areas. P Rumney (Cefas, Lowestoft).

H) Three fish samples were frozen for post-survey identification.

I) A total of 135 measurements of jellyfish caught were taken. These were identified to species and measured across the 'umbrella' disc. D Righton (Cefas Lowestoft).

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

K) Specimens of a dab, plaice and whiting were collected for otolith extraction training at Cefas. S Shaw (Cefas Lowestoft).

L) A total of 7 Starry Smooth-hound (*Scyliorhinus stellaris*) were frozen to aid work on forth-coming Cefas contracts. J Ellis (Cefas Lowestoft)

M) A total of 24 cod samples were collected for analysis of teeth wear patterns. Prof. Paul Hart – (University of Leicester)

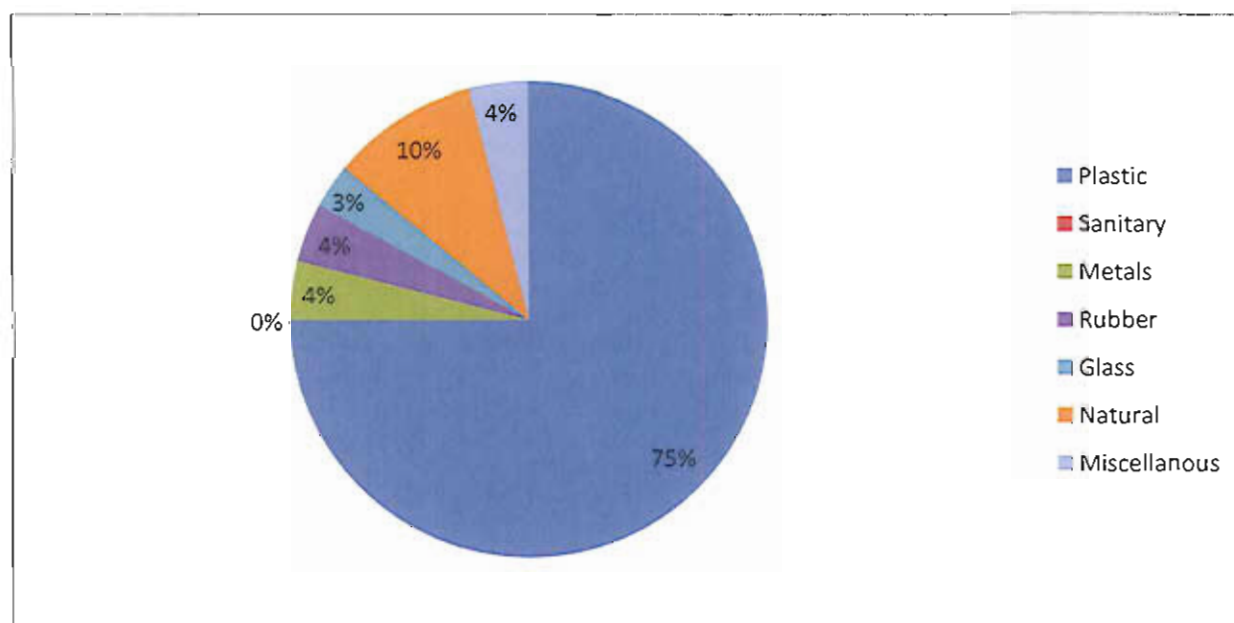
## Aim 9 - Water alkalinity, dissolved inorganic carbon (DIC) and nutrient sample collection

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 33 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 running through the 'ferrybox' system and the bottom water samples were taken from the niskin water sampler.

### 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 and categorized by size at a total of 84 fishing stations with a total of 248 individual items. In addition details of any attached organisms were recorded and 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.



### Micro CTD

The SAIV Micro CTD unit number 717 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 109 successful CTD data collections were made.

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 28 September with special mention to the catering staff for providing the refreshments to ensure the event was a success. The event raised a total of £145 for this worthy cause.

I D Holmes  
4th October 2012

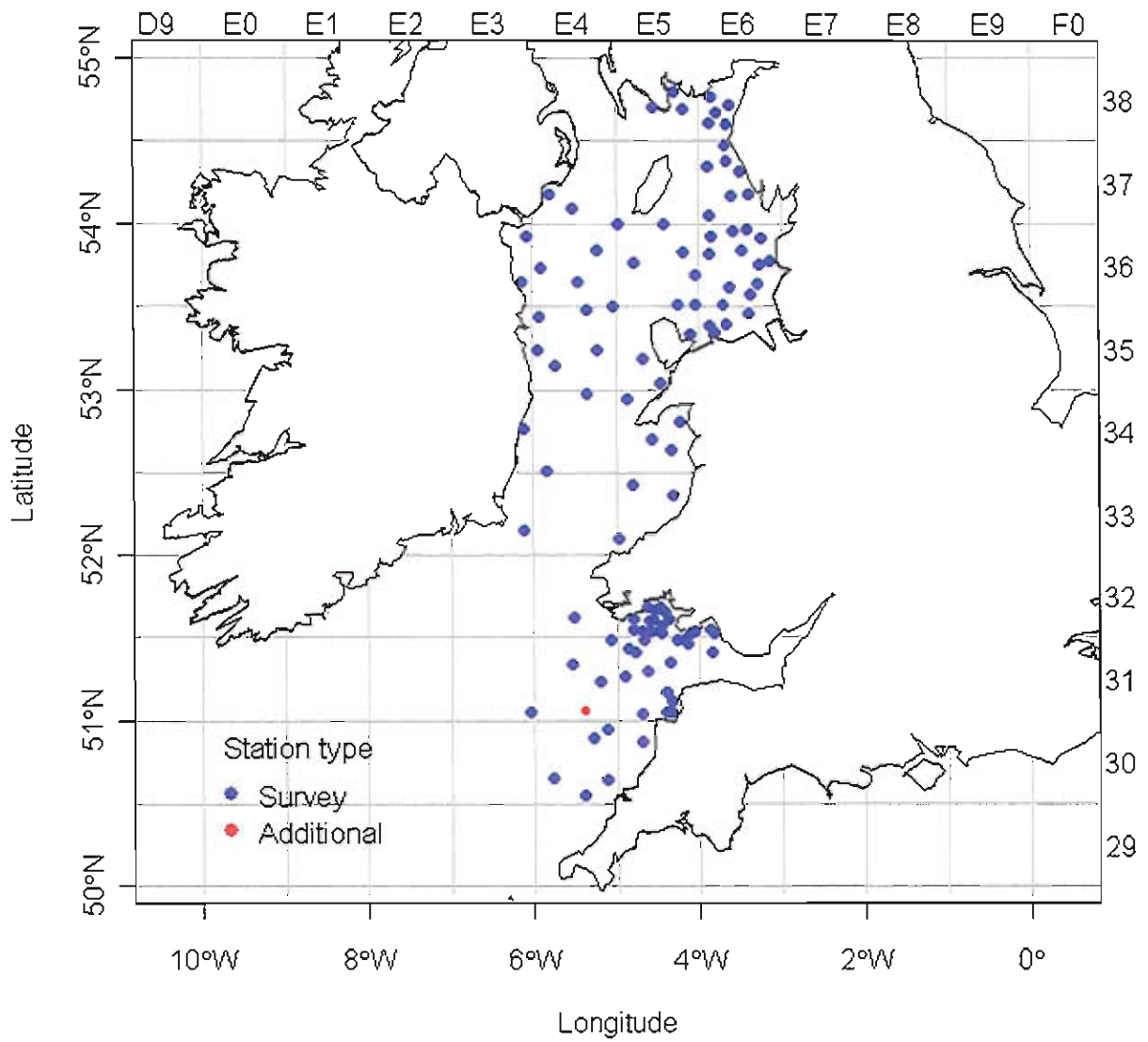
INITIALLED: B Harley

SEEN IN DRAFT: Master: Capt. M Ingham  
First Officer: R Reynolds

DISTRIBUTION:

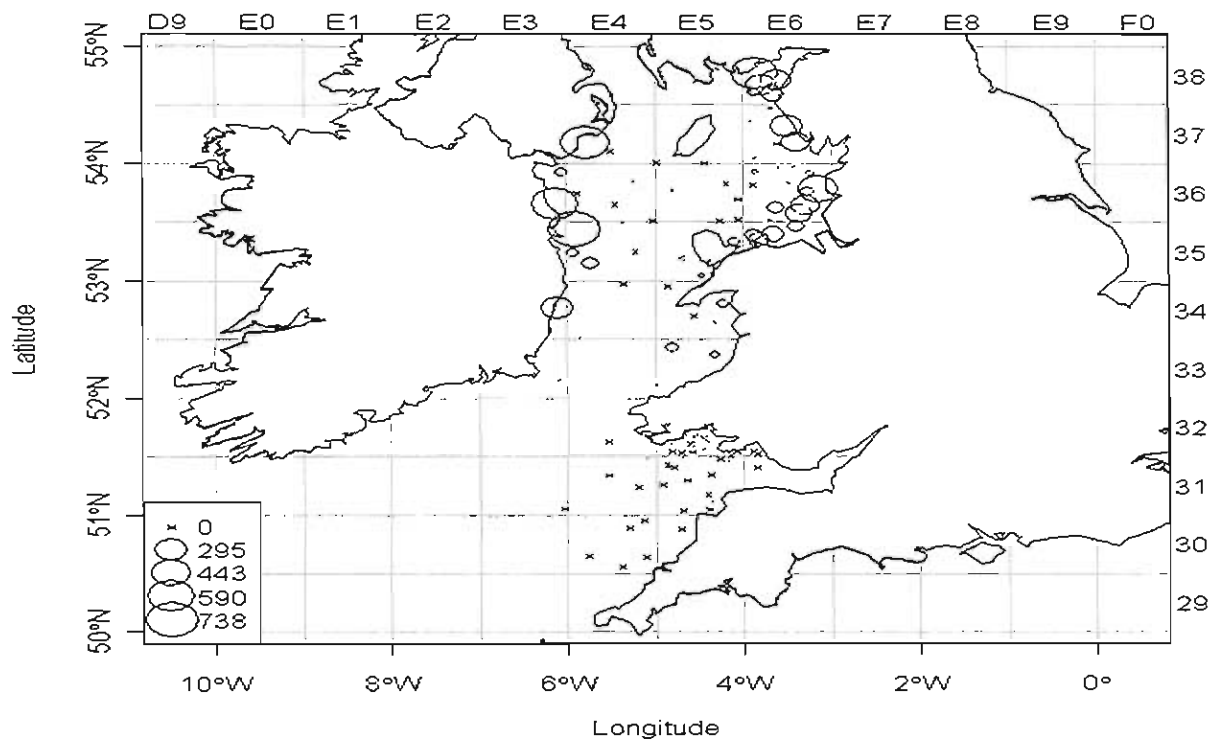
I Holmes	T Owen (P&O)
S Walmsley	Master (Cefas Endeavour)
M Etherton	B Harley
T Gooding	S Kupschus
R Bush	Cefas Intranet
J Silva	P-J Schon (AFBI NI, Belfast)
O Williams	P Connolly (DOM, Dublin)
J Pettigrew	FCO (for Republic of Ireland)
R Masefield	Marine Management Organisation
S Davis	Welsh Government (WG)
K Bentley (MI Ireland)	Devon & Severn IFCA
	Cornwall IFCA
	Isles of Scilly IFCA
	North Western IFCA
	Crown Estate

Figure 2 - Station Positions for CEND 15/12.

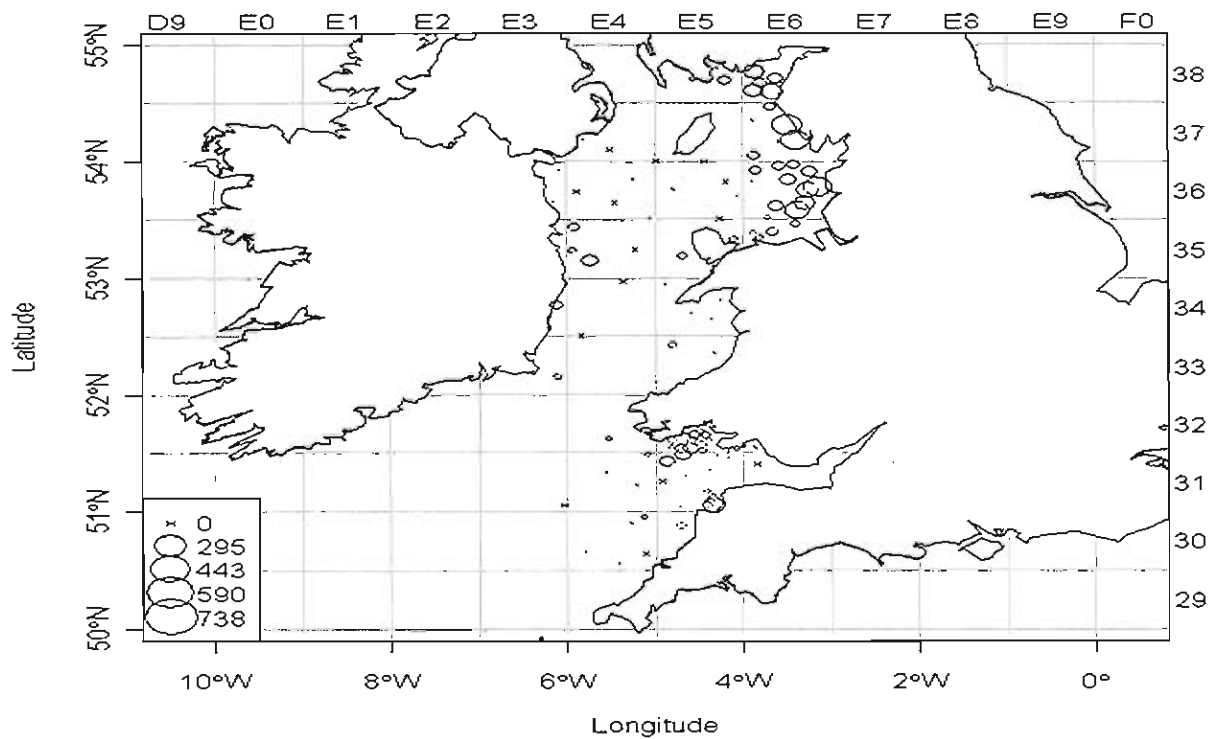


**Figure 3** - Abundance (number caught per 30 minute tow) of pre-recruit (a) (<21 cm TL) and recruited (b) ( $\geq 21$  cm TL) - plaice.

a)

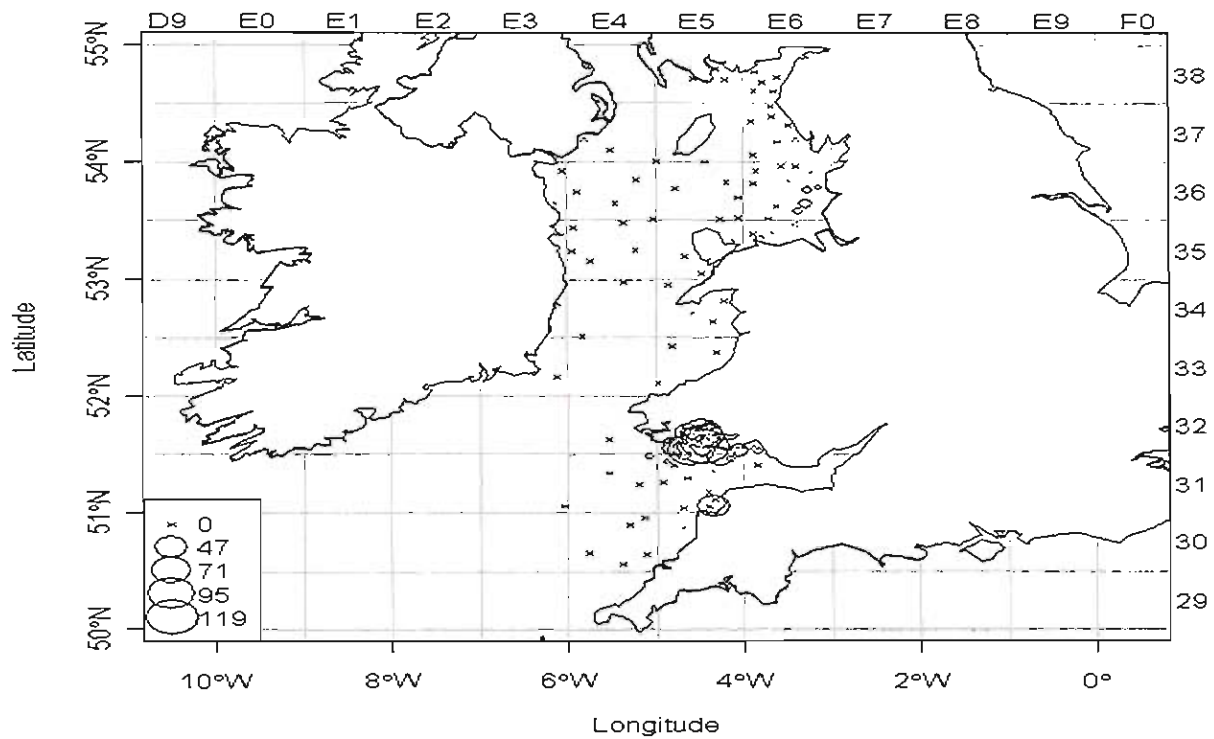


b)

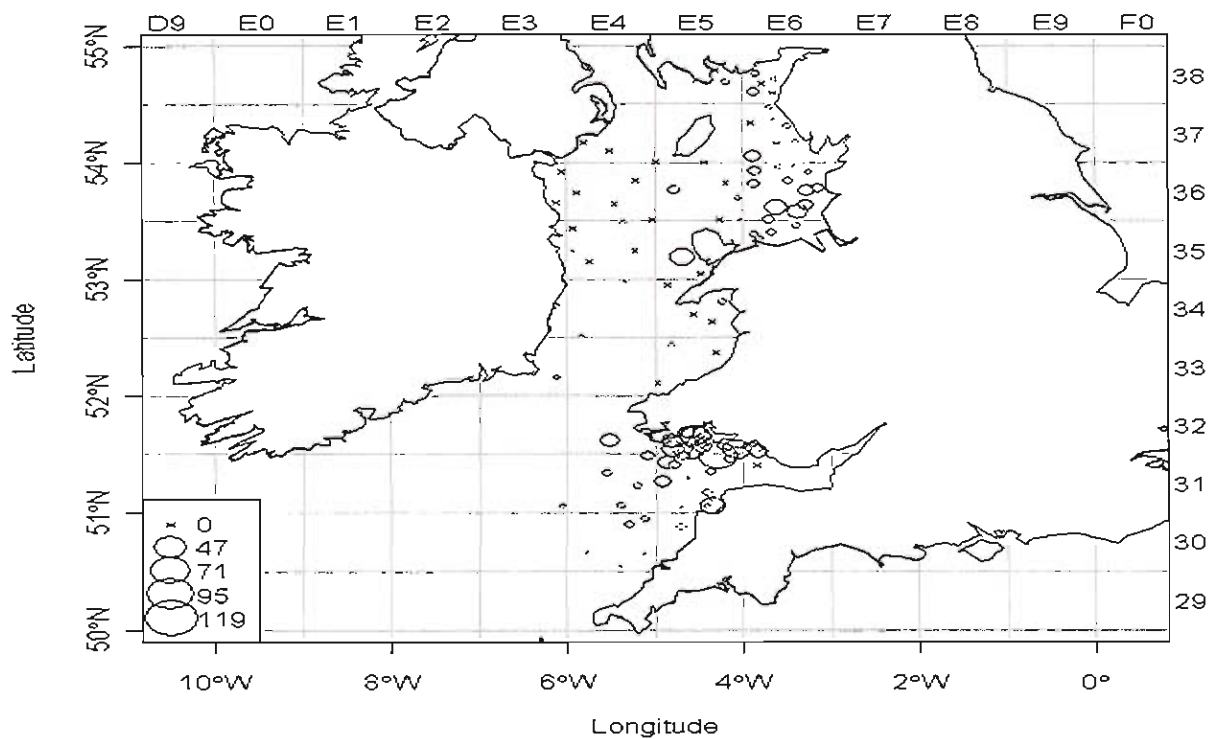


**Figure 4** - Abundance (number caught per 30 minute tow) of pre-recruit (a) (<21 cm TL) and recruited (b) ( $\geq 21$  cm TL) - sole.

a)



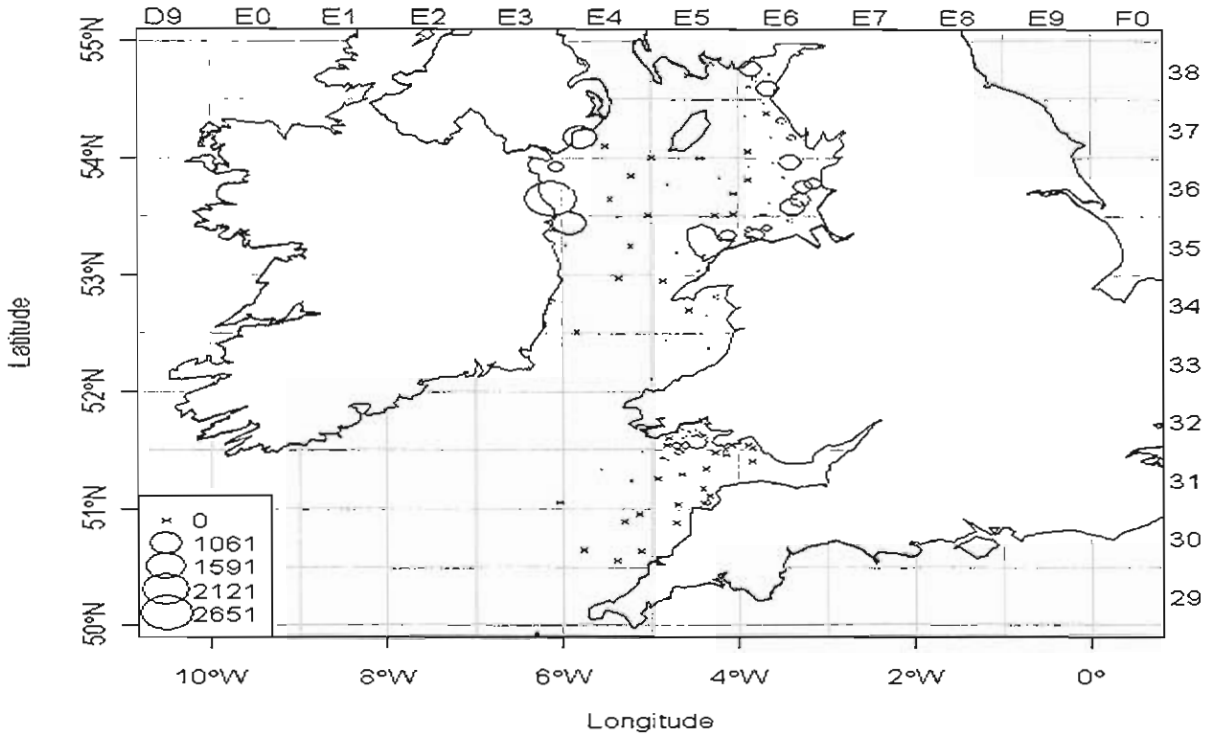
b)



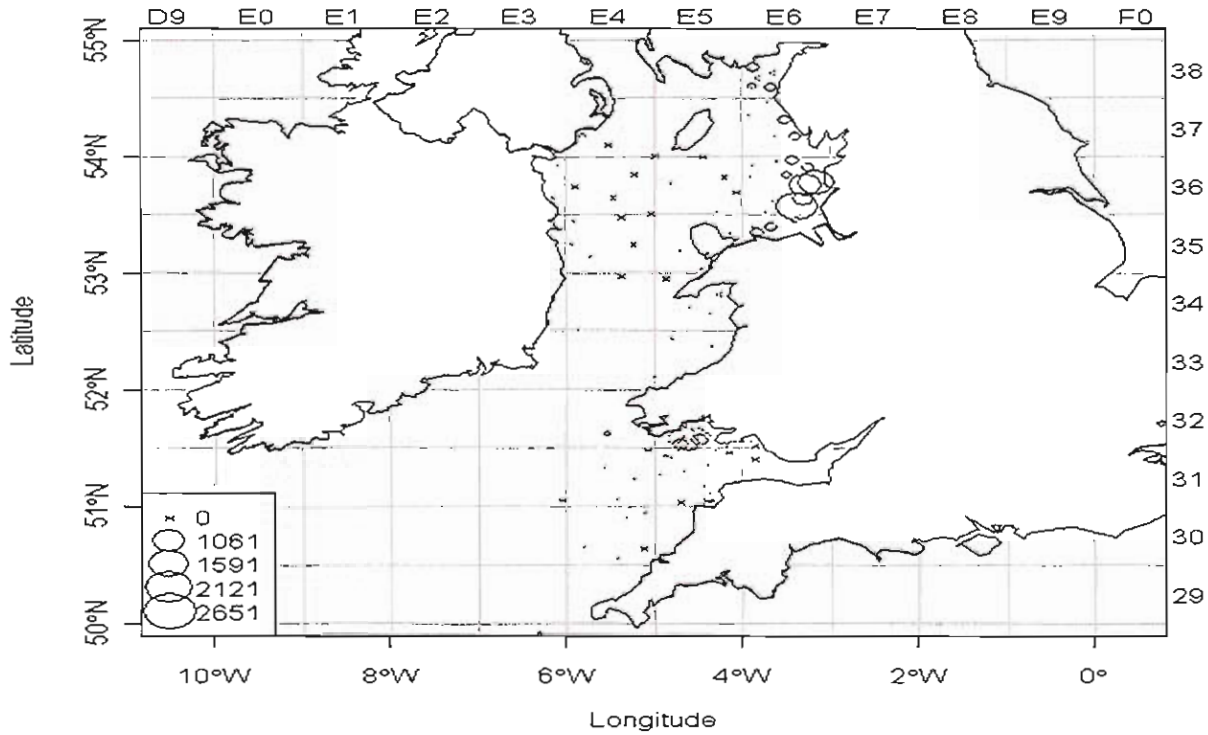


**Figure 5** - Abundance (number caught per 30 minute tow) of pre-recruit (a) (<16 cm TL) and recruited (b) ( $\geq 16$  cm TL) - dab.

a)

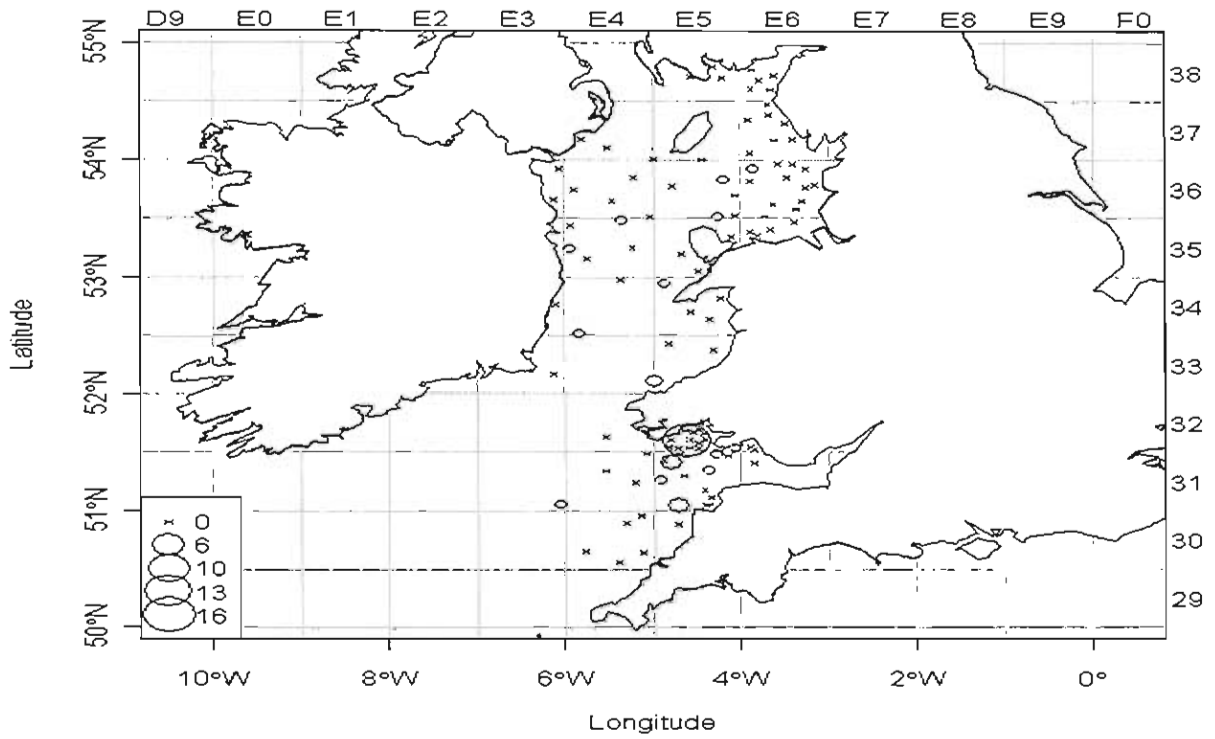


b)

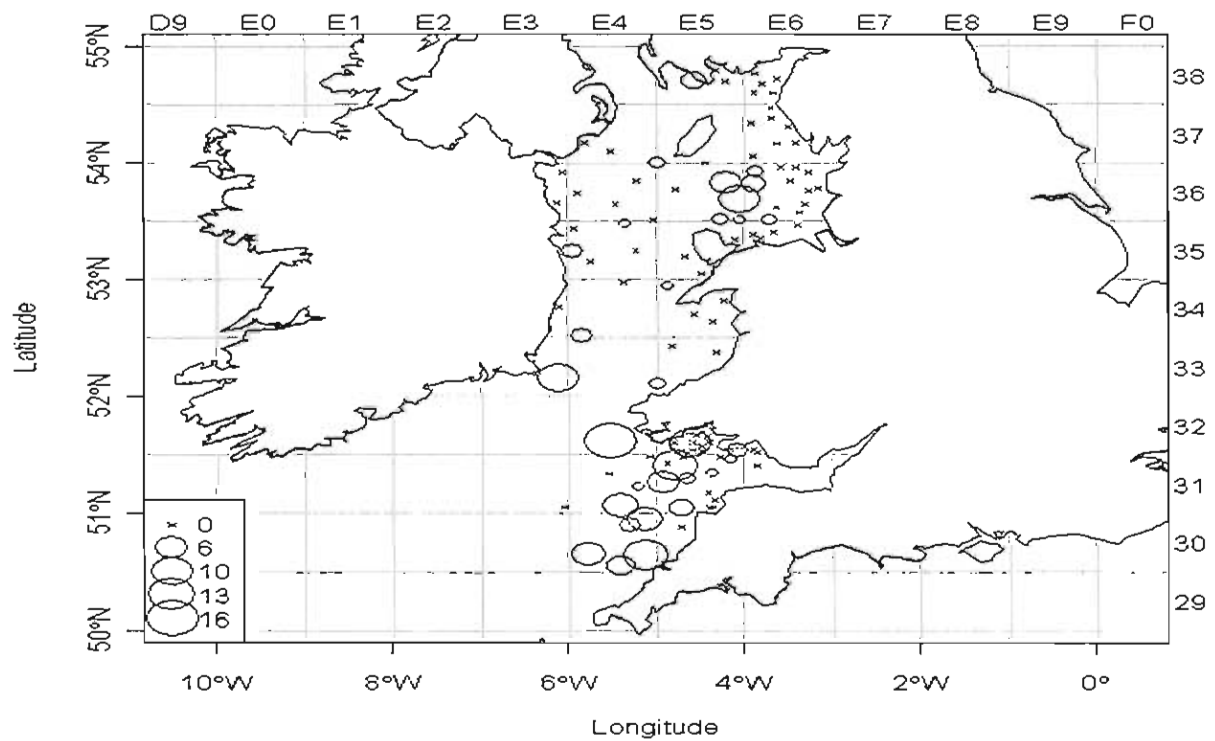


**Figure 6** - Abundance (number caught per 30 minute tow) of pre-recruit (a) <19 cm TL and recruited (b) ( $\geq 19$  cm TL) - lemon sole.

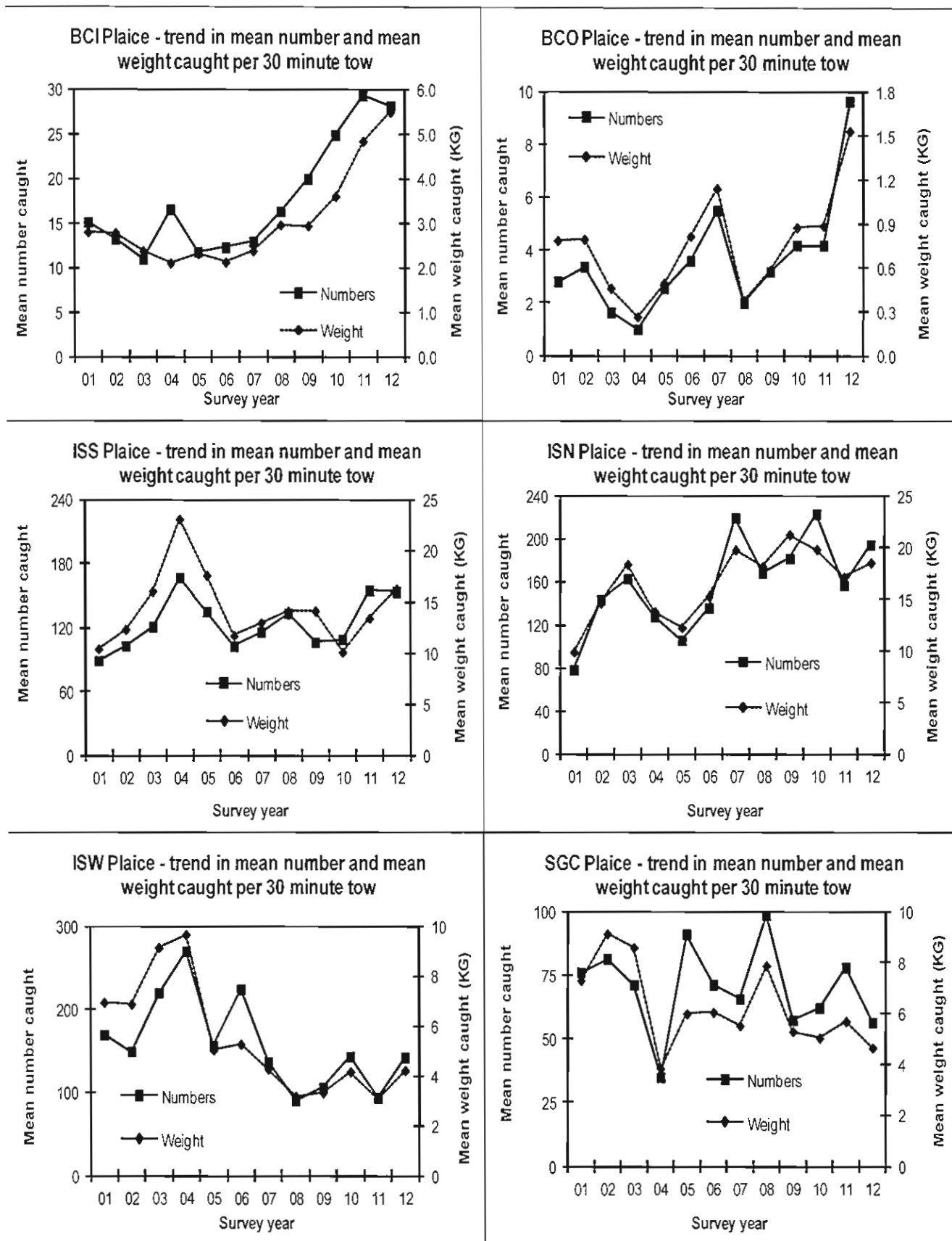
a)



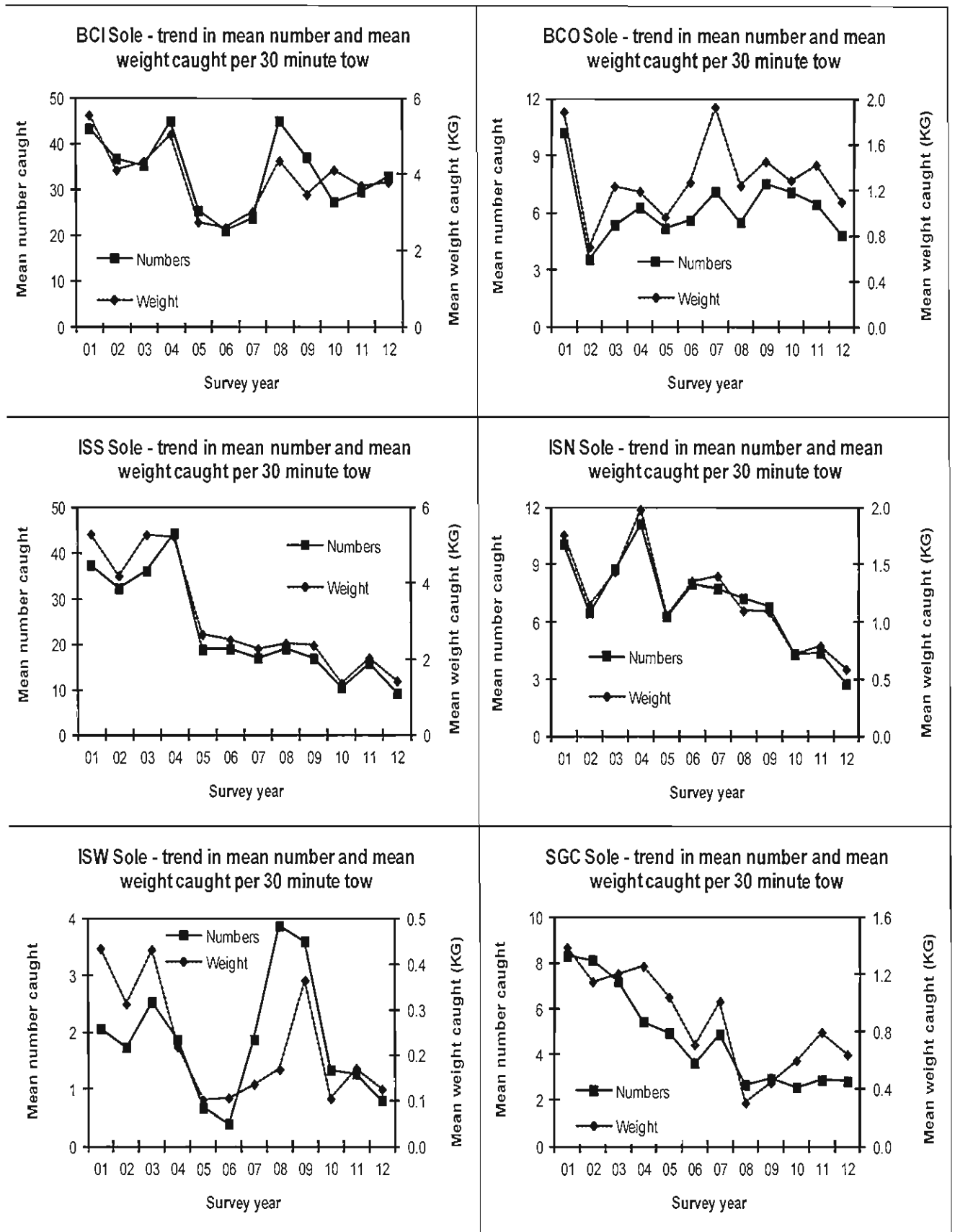
b)



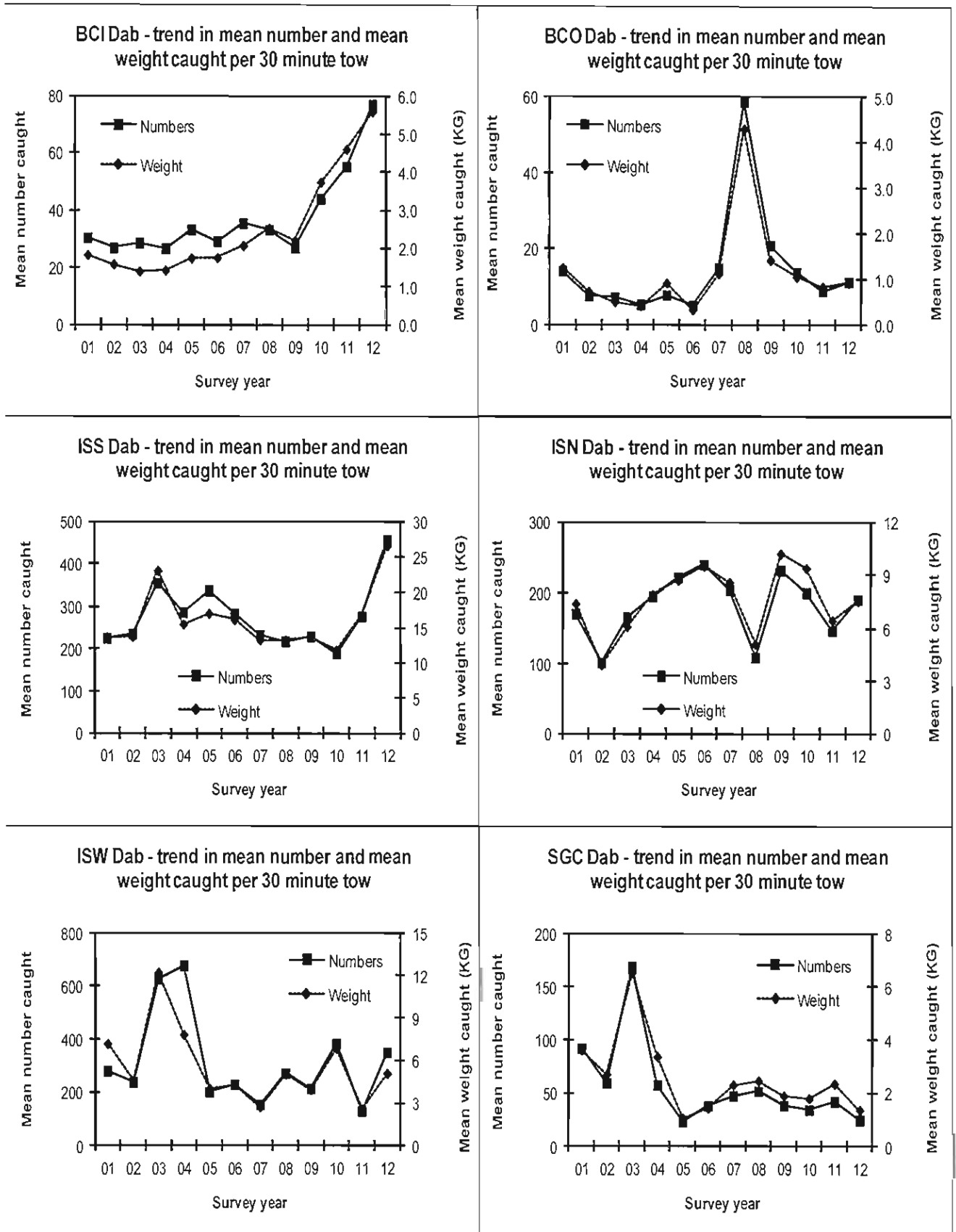
**Figure 7** – Mean number and weight of plaice (*Pleuronectes platessa*) caught per 30-minute tow - by survey area



**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.

