LOWESTOFT LABORATORY, LOWESTOFT, SUFFOLK, NR33 OHT

2009 RESEARCH VESSEL PROGRAMME

REPORT: RV CEFAS ENDEAVOUR: SURVEY 13/09

STAFF:

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DURATION:

9 September – 1 October 2009

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 and bottom temperature and salinity data using CTD rosette and Niskin Bottle.
5. To quantify epibenthos using 4m beam trawl by-catch.
6. To collect Length weight & maturity information using individual fish measurements, in support of the EU Data Collection Framework.
7. To collect surface seawater samples for processing on return to Lowestoft for the analysis of tritium (AE001) (C Smedley).
8. To collect fish samples in support of other Cefas projects and training courses.
9. To collect photographic images of sole, plaice and dab gonads for the Workshop on Maturity Staging of Sole, Plaice, Dab and Flounder'.
10. To collect jellyfish distribution and associated individual measurements.

NARRATIVE: (All times GMT)

Cefas scientists joined the vessel at 0830h 9 September in order to undertake safety inductions and 'toolbox' talks with the ship's officers/crew. Sailing was delayed by two hours due to extended repair and testing of the aft deck crane. Cefas Endeavour sailed at 1400h 9 September.

At a known 'clean' fishing tow off Benacre, the fishing gear was deployed, towed for 15 minutes and successfully retrieved to ensure that all was in good working order. The catch was also sorted and processed in order to adequately test the EDC system and FSS upload functions. This showed that a minor database design fault existed and following consultation with staff ashore, was subsequently fixed and tested. Following a smooth passage though the channel, Cefas Endeavour was 'met' by a port vessel at a position near Falmouth, where a replacement deckhand joined the vessel at 1725h 10 September. At this time, a trial Niskin sample was collected to test both equipment and software.

Fishing commenced in the Bristol Channel Outer (BCO) sector at prime station 513 at 0554h 11 September. A further three valid tows were successfully fished within this sector prior to beginning the Bristol Channel Inner (BCI) priority survey grid. Fine weather ensured that between 11–15 September, a total of 37 stations were fished, comprising all 32 stations of the BCI sector and 5 stations of the BCO sector. Cefas Endeavour then headed northwards to complete the stations in Cardigan Bay in St George's Channel (SGC) on 16 September en-route to begin the Irish Sea South (ISS) priority survey grid. Work in the ISS sector began at 0616h 17 September.

At prime station 54 (ISS), the net suffered major damage. The net had ripped apart due to the cod-end filling up with sand causing the trawl to part and the beam to 'flip' over. The cod end was recovered as it was still attached to the 'lazy deckie'. It was decided to use the 'spare' beam (no. 5) for the next few tows whilst the net on beam no. 4 was repaired overnight. The opportunity to re-fish the nearby prime station 47 that had been fished incorrectly earlier in the day was taken and a new towing position for prime station 54 was located and fished for 15 minutes.

The following morning, plans to fish prime station 53 (ISS) were thwarted by the presence of static gear across the tow. Therefore an alternative track was selected and this was fished for two precautionary 5-minute (darkness) tows over the track. On the previous year's survey, RV Corystes had been unable to successfully fish this station despite two attempts, due to exceptionally large catches of queen scallops (*Chlamys opercularis*). These exploratory tows were carried out in order to determine the extent of the queen scallop population in the area this year. The resultant 'small' catches led to the station being fished for a precautionary 20 minutes. The ISS survey grid was completed at 1032h 20 September. With the weather forecast to deteriorate in the northern Irish Sea late on 21 September, the decision to complete the northern-most stations in the ISN sector was taken. Over the course of 21-22 September, the remainder of the ISN stations were successfully fished. With the three priority survey sectors now completed, Cefas Endeavour headed west to fish the prime stations of the Irish Sea West (ISW) and St Georges Channel (SGC).

Fishing in ISW began at 0615h 23 September at prime station 424. Between 23-25 September, the remaining 13 ISW stations were fished as well as 2 SGC stations. Two prime stations in ISW were fished for 30 minutes where previously only fished for 15 minutes. These were 203 (Dundrum Bay) and 220 (North of Dublin). In addition, having made excellent progress on the survey, two prime stations already fished for the 'normal' 15 minutes were fished again but this time for the full 30 minutes. In recent years, the quantities of both the fish and benthic catches at these stations had fallen from the high levels encountered previously that had led to the reduction in the fishing time. These were prime station 40 (Red Wharf Bay) and 313 (Tremadoc Bay). At prime station 313 there was a heavy catch of weed presumably caught at the north end of the tow, as this was not present on the earlier 15-minute tow. It is recommended that if a 30-minute tow is required in future, the tow should be moved south-west to avoid this weed.

At prime station 313, an angel shark (*Squatina squatina*) was caught. This was the first capture of this species by any Cefas survey for over 10 years and only the third specimen caught by Cefas surveys in around 23 years. This rare fish was measured, photographed and released unharmed.

Between 26-28 September, all remaining stations in SGC and BCO were successfully fished. In addition, the opportunity was taken to locate and fish an additional 3 tows in ICES rectangles where we have no beam trawl fishing stations. At each of these positions, Cefas Endeavour steamed over the tow in advance of shooting to determine the ground profile. No net CTD data was collected and the beam was towed for 15 minutes only on two of these stations. A full benthic sort was carried out at each of these stations. One of these new tows was fished at a position used by the Q4 SWGFS (prime station E9).

With the full survey grid now complete and with a 'spare' fishing day left, Cefas Endeavour embarked on a series of experimental fishing tows for juvenile ray in an area to the north of the Lundy Marine Protected Area. This work was a survey aim in 2008 but bad weather and static gear limited the amount of work that was possible. Work began at 0718h 29 September and a total of 8 experimental tows were completed amounting to a total of 3h 20 minutes fishing time. The catch at each of these tows was sorted and measured as normal but no otolith samples were taken. Any ray egg cases caught were retained for Identification at Lowestoft. No CTD profiles, salinity samples or Niskin profiles were collected at these stations.

On 30 September, the final trawl station was fished. This was prime 117 (BCI) being fished for a second time as it had been incorrectly fished the first time. With all fishing activity completed, Cefas Endeavour then embarked on a 'grid' of tritium water sampling. This began at 0802h 30 September and was completed at 1943h that evening, with 30 water stations completed. Samples were not collected from two Cardiff Bay stations (W23 & W31) because port fees were required to reach these positions. During this period, CEFAS scientists began the process of cleaning up and packing away all scientific equipment in readiness for docking.

Cefas Endeavour docked in Swansea at 1430h 1 October and unloading took place later that day. Cefas scientists departed the vessel in the morning of 2 October.

RESULTS:

Aims 1, 2 & 3

The survey gear was the standard 4m-beam trawl (number 4) 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 (large catches of an individual species were sub-sampled beforehand).

A SAIV Micro CTD unit was attached to the 4m-beam trawl in order to record the temperature and salinity depth profile at each fishing station fished. In addition, surface water was taken at each station and at the first, middle and last fishing station on each working day a surface sample was taken simultaneously with a Niskin bottom water sample and a CTD 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 is shown in Table 1. In addition to the survey otoliths, an additional 412 pairs of otolith were collected for other survey aims. Table 2 shows the top 10 species by both weight (kg) and number of individuals caught in core survey tows (New exploratory tows, 'Additional' tows, and Lundy tows are excluded).

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 108 were successfully fished (Figure 1), including all 65 ISN, ISS and BCI stations used for tuning data for the Working Group of the Celtic Seas Eco-region (formerly the Northern and Southern Shelf Working Groups). A total of 6 Prime stations – numbers 27 (Morecambe Bay), 40 (Red Wharf Bay), 313 (Tremadoc Bay), 214 (north of Dublin), 233 (south of Wicklow), 501 (southwest of Milford Haven) were reduced from the standard 30-minute to 15-minute tows because of expected large catches of weed, shell/small flatfish. Two of these (prime 40 & 313) were re-fished for 30 minutes later in the survey. In addition, 4 prime stations were reduced to 15 or 20-minute tows as a precautionary measure following invalid tows due to damaged gear, new tow positions or exceptionally large catches seen on previous surveys. 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	VIIf	VIIg	Total
Anglerfish (*Lophius piscatorius*)	11	18	17	46
Brill	28	9	0	37
Cod	61	110	2	173
Dab	243	238	2	483
Bass	0	3	0	3
Haddock	20	20	21	61
Hake	6	12	14	32
Lemon Sole	75	62	13	150
Megrim	0	7	57	64
Plaice	1425	384	10	1819
Red Mullet	5	6	0	11
Sole	403	384	39	826
Turbot	5	19	1	25
Whiting	148	69	10	227
Total	**2430**	**1341**	**186**	**3942**

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

Weight caught (kg)				**Number caught**			
	2009	2008	2007		2009	2008	2007
Plaice	773	662	704	Dab	11787	8792	9782
Lesser spotted dogfish	729	650	630	Plaice	7239	6296	7549
Dab	561	432	471	Solenette	6217	5926	7179
Sole	192	207	187	Poor cod	3470	6436	6679
Thornback ray	178	140	129	Common dragonet	2241	2647	3014
Common dragonet	102	117	130	Scaldfish	1958	2044	1866
Solenette	83	81	86	Whiting	1778	4666	1854
Poor cod	82	116	138	Sole	1736	1913	1321
Edible Crab	74	44	60	Lesser spotted dogfish	1712	1448	1481
Whiting	71	107	68	Grey gurnard	1045	1520	1956
TOTAL (All species)	**3443**	**3075**	**3316**	**TOTAL (All species)**	**45751**	**47107**	**50823**

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

Scientific Name	Stations	Scientific Name	Stations
AGONUS CATAPHRACTUS	74	*MICROCHIRUS VARIEGATUS*	68
AMMODYTES TOBIANUS	8	*MICROMESISTIUS POUTASSOU*	4
ARGENTINIDAE	1	*MICROSTOMUS KITT*	47
ARNOGLOSSUS IMPERIALIS	4	*MOLVA MOLVA*	3
ARNOGLOSSUS LATERNA	75	*MULLUS SURMULETUS*	7
ASPITRIGLA CUCULUS	48	*MUSTELUS ASTERIAS*	20
BLENNIUS OCELLARIS	19	*MUSTELUS MUSTELUS*	1
BUENIA JEFFREYSII	3	*MYOXOCEPHALUS SCORPIUS*	7
BUGLOSSIDIUM LUTEUM	72	*NEPHROPS NORVEGICUS*	13
CALLIONYMUS LYRA	108	*PAGELLUS BOGARAVEO*	1
CALLIONYMUS MACULATUS	4	*PEGUSA (SOLEA) LASCARIS*	21
CALLIONYMUS RETICULATUS	13	*PHOLIS GUNNELLUS*	3
CANCER PAGURUS	61	*PHRYNORHOMBUS NORVEGIUS*	15
CAPROS APER	1	*PHRYNORHOMBUS REGIUS*	3
CEPOLA RUBESCENS	1	*PLATICHTHYS FLESUS*	6
CILIATA MUSTELA	5	*PLEURONECTES PLATESSA*	97
CLUPEA HARENGUS	1	*RAJA BRACHYURA*	21
CONGER CONGER	3	*RAJA CLAVATA*	60
CTENOLABRUS RUPESTRIS	6	*RAJA MICROOCELLATA*	20
DICENTRARCHUS (MORONE) LABRAX	3	*RAJA MONTAGUI*	52
DIPLECOGASTER BIMACULATA	3	*RAJA NAEVUS*	16
ENCHELYOPUS CIMBRIUS	5	*SCOPHTHALMUS MAXIMUS*	18
ENTELURUS AEQUOREUS	1	*SCOPHTHALMUS RHOMBUS*	26
EUTRIGLA GURNARDUS	89	*SCYLIORHINUS CANICULA*	103
GADICULUS ARGENTEUS	1	*SCYLIORHINUS STELLARIS*	8
GADUS MORHUA	38	*SOLEA SOLEA (S.VULGARIS)*	92
GAIDROPSARUS SPP	1	*SPRATTUS (CLUPEA) SPRATTUS*	7
GLYPTOCEPHALUS CYNOGLOSSUS	7	*SQUATINA SQUATINA*	1
GOBIUS NIGER	3	*SYNGNATHUS ACUS*	8
HIPPOGLOSSOIDES PLATESSOIDES	10	*TAURULUS BUBALIS*	3
HOMARUS GAMMARUS	9	*TRACHINUS (ECHIICHTHYS) VIPERA*	27
HYPEROPLUS LANCEEOLATUS	8	*TRACHINUS DRACO*	4
LEPIDORHOMBUS WHIFFIAGONIS	7	*TRACHURUS TRACHURUS*	2
LESUEURIGOBIUS FRIESII	3	*TRIGLA LUCERNA*	68
LIMANDA LIMANDA	103	*TRIGLOPORUS LASTOVIZA*	2
LIPARIS MONTAGUI	2	*TRISOPTERUS ESMARKI*	11
LOPHIUS PISCATORIUS	29	*TRISOPTERUS LUSCUS*	23
MELANOGRAMMUS AEGLEFINUS	36	*TRISOPTERUS MINUTUS*	70
MERLANGIUS MERLANGUS	78	*ZEUS FABER*	19
MERLUCCIUS MERLUCCIUS	14		

Table 4: Summary of gear deployments

Gear	Valid	Additional	Replicate	Invalid	Total
Standard 4m Beam trawl with cod end liner	108	17	N/A	2	127
Water sample for Tritium analysis	39	N/A	N/A	N/A	39
Surface salinity samples	110	1	N/A	N/A	111
Niskin sea-bed water samples	51	1	N/A	N/A	52

Abundances of pre-recruit and recruited plaice and sole in the Irish Sea and Bristol Channel are shown in Figures 2 and 3. As with last year's survey, 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 Figures 4 and 5.

Plaice: Plaice abundance, by number and weight were generally up in comparison to last year's survey. In BCI, plaice abundance increased for the fourth year running. Abundance by number in this year's survey is at the survey series high (2001-09), whereas the weight caught remained static at the high level seen in 2008. Catch numbers of juvenile plaice (<21cm) in BCI has increased dramatically over the last two years rising from 86 in 2007 to 286 this year. In BCO, there was an increase in the number and weights of 60% and 48% respectively. In the Irish Sea, ISN plaice abundance was up 8% and 17% by number and weight, respectively and these levels are close to the survey high (2001-09). Catch numbers of juvenile plaice (<21cm) in ISS/ISN have fallen dramatically over the last two years from 3755 in 2007 to 2434 this year. Catches in both ISS and SGC were down on those in 2008. Catches in ISW remained at 2008 levels.

Sole: Numbers of sole were down in BCI, with abundance down by 18% and 20% by number and weight on last year, respectively but were still above the average 0f 2001-09. Catch numbers of juvenile sole (<21cm) in BCI has fallen by 44% from 2008. In the ISS and ISN sectors, catches have remained at a similar level for the last 4 years. Numbers of juvenile sole in ISS/ISN (<21cm) have also remained static. In BCO, abundance is at 2007 levels when the survey grid was last successfully completed. In ISW however, catches increased, particularly in terms of the weight caught which was 112% higher than in 2008. Sole in SGC continues to remain at the lowest levels (2001-09).

Dab: Dab in BCI fell from the levels seen in 2008 and are now at average levels (2001-09). Numbers of juvenile dab in BCI (<21cm) have fallen by 50% in the last 2 years (691 in 2007; 344 in 2009). In BCO, abundance returned to 2007 levels when the grid was last completed. Catches in ISS and ISW remain relatively stable whereas in ISN, an increase in catch numbers and weights was observed (114% & 100% respectively).

This maybe a return to stable levels after the poor catches seen in 2008 The Numbers of juvenile dab in ISS/ISN (<21cm) have increased by 50% since 2008.

Lemon sole: Catch rates of lemon sole remain low in all survey sectors (Figure 9).

Noteworthy changes to the catch rates of other main species were increases in the abundance of 0-grp cod in BCI (<21cm) from 4 in 2008 to 112 in 2009. Catches of cod in ISS/ISN remained static. Catches of 0-grp (<21cm) Haddock increased from the low levels caught in 2008 and whiting was down in all survey sectors except ISN and ISW. Catches of all ray species were up on the previous two years with thornback ray showing the largest increase. Catches of lesser-spotted dogfish fell in all survey sectors except ISN and ISW.

Aim 4 - Surface and bottom water sampling

At every fishing station, a surface water salinity sample was taken using on-board sea-water supply. The starboard gantry with the 'hydrographic' wire was used in the collection of bottom water samples with a SAIV Micro CTD unit (S/N 533) and a niskin sampler. The sample was routinely taken at around 3m off the seabed. A total of 51 bottom water samples and associated CTD data 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. In addition, a full SOP benthic sort was carried out at each of the three new experimental stations.

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 on all except 2 stations where the by-catch was very heavy and had to be estimated. The weight of rocks caught in the trawl was also recorded at each station. In addition, benthic observations were recorded from the catches at non-benthic stations.

Aim 6 - Length weight & maturity information

A total of 10826 length/weight measurements were collected on the survey in addition to the length weight information routinely collected with survey otoliths. The main species sampled are shown in Table 5.

Table 5: Main species sample for length/weight

Species	**No of length/weight measurements.**
Lesser spotted dogfish (*Scyliorhinus canicula*)	1488
Common dragonet (*Callionymus lyra*)	1257
Poor cod (*Trisopterus minutus*)	1216
Grey gurnard (*Eutrigla gurnardus*)	856
Thick back sole (*Microchirus variegatus)*	764
Scaldfish (*Arnoglossus laterna)*	709
Pogge (*Agonus cataphractus*)	691
Solenette (*Buglossidium luteum*)	538
Red gurnard (*Aspitrigla cuculus*)	386
Norway pout (*Trisopterus esmarkii*)	323

Aim 7 – Tritium water sampling

1 litre surface seawater samples were collected from 39 stations in the Bristol Channel & Severn Estuary for Tritium H-3 analysis for Carol Smedley. (Cefas, Lowestoft).

Aim 8 - Additional sample collection

Additional samples were taken in support of other CEFAS projects:

A) All monkfish *(Lophius piscatorius)* had illicia taken to supplement the otoliths collected. S Songer (CEFAS, Lowestoft).

B) Details of the angel shark (*Squatina squatina*) caught at prime station were recorded and made available to the National Marine Aquarium, Plymouth.

C) A total of 9 Bullhuss (*Scyliorhinus stellaris*) were tagged and released. J Ellis (Cefas, Lowestoft).

D) A total of 8 sightings of Cetaceans were recorded during the survey. Details of location, date/time and identification were noted on each occasion. Seven sightings were of common dolphin (*Delphinus delphis*) and one was of fin whale (*Balaenoptera physalus*). Details were collected for the Sea Watch Foundation.

E) A total of 173 cod (*Gadus Morhua*) had otoliths removed using non-metallic forceps with 61 being collected from the Irish Sea. The 'spare' otolith will potentially be supplied for a trace metal project (C Fox)

F) A total of 412 pairs of otolith from 58 different fish species were collected to supplement the Cefas reference otolith collection set. M Etherton (Cefas, Lowestoft).

G) A total of 56 selected fish species were photographed for inclusion in the new photo ID key being developed at Cefas. J Ellis & D Brown (Cefas, Lowestoft)

H) A total of 200 fin-clips were collected. This comprised 100 thornback ray (*Raja clavata*); 7 spotted ray (*Raja montagui*); 44 blonde ray (*Raja brachyura*); 23 cuckoo ray (*Raja naevus*); 26 small-eyed ray (*Raja microcellata*). J Ellis (Cefas, Lowestoft)

I) No specimens of shore rockling (*Gaidropsarus mediterraneus*), 3-spined stickleback (*Gasterosteus aculeatus*), long-finned gurnard (*Aspitrigla obscura*), montague's blenny (*Coryphoblennius galerita*), tompot blenny (*Blennius pholis*) were caught and frozen for ID - J Ellis (Cefas, Lowestoft)

J) No specimens of corkwing wrasse (*Crenilabrus melops*) were caught and frozen. J Ellis (Cefas, Lowestoft) – for Norwegian colleague.

K) A total of 15 Lesser spotted dogfish (*Scyliorhinus canicula*) were measured at capture and at various times after capture to determine post mortality length and measurement changes. J Ellis (Cefas, Lowestoft).

L) A total of 37 Brill (*Scophthalmus rhombus*) and 15 turbot (*Scophthalmus maximus*) fin-clips were taken in support of a study into the comparative population genetic structure. S Vandamme (IVLO, Belgium).

M) Samples of dab (*Limanda limanda*), lesser spotted dogfish (*Scyliorhinus canicula*), spider crabs (*Maia squinado)*, thornback ray (*Raja clavata*), velvet swimming crab (*Liocarcinus puber*) 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).

N) One sample of benthic material was preserved in formaldehyde for post-survey identification. In addition 1 smoothhound (*Mustelus mustelus*), several norwegian topknot (*Phrynorhombus norvegicus*), several benthic elements and a wrasse were frozen for identification confirmation.

Aim 9 - Maturity photographic collection

A total of 98 ovary photograph sets from individual specimens were taken. For each individual, 4-6 images were captured. This comprised plaice (*Pleuronectes platessa*) – 40; sole (*Solea Solea*) – 41; dab (*Limanda limanda*) – 17. B Harley & I Holmes (Cefas, Lowestoft).

Aim 10 – Jellyfish measurement collection.

A total of 32 measurements of jellyfish caught were taken. These were identified to species and measured across the 'umbrella' disc. D Righton (Cefas Lowestoft)

Micro CTD

The SAIV Micro CTD unit number 426 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 114 successful CTD data collections were made. The CTD unit was removed from the net for the three new tows and each of the Lundy exploratory tows.

Fish ID quality control tests

During the survey, two fish identification tests were carried out. For each test, 15 species were randomly selected from the catch and all scientists on-board were asked to identify them (common name, Latin name and FSS code). Any wrongly identified species were discussed detailing specific identification aspects.

Finally, our thanks go to all the officers and crew of RV Cefas Endeavour for their help, support and advice given during this survey. As a result of their skill and co-operation, all survey aims were achieved and in addition, some valuable additional sampling was possible.

I D Holmes
1st October 2009

INITIALLED: B Harley

SEEN IN DRAFT: Master: Capt A Reading
First Officer: B Salter

DISTRIBUTION:
Basic List +

I Holmes
M Etherton
S Walmsley
L Readdy
R Bush
J Ashworth
J Pettigrew
C Kerrigan

S Kupschus
B Harley
Cefas Intranet
R Briggs (AFBI NI, Belfast)
P Connolly (DOM, Dublin)
FCO (for Republic of Ireland)
Sea Fisheries Committees:
Cumbria
North Western and North Wales
South Wales
Devon
Cornwall

Figure 1 - Station Positions for CEND 13/09. Closed circles represent stations in the core survey grid, crosses represent experimental tows to the north of Lundy and closed triangles indicate additional tows made in the SGC/BCO sectors.

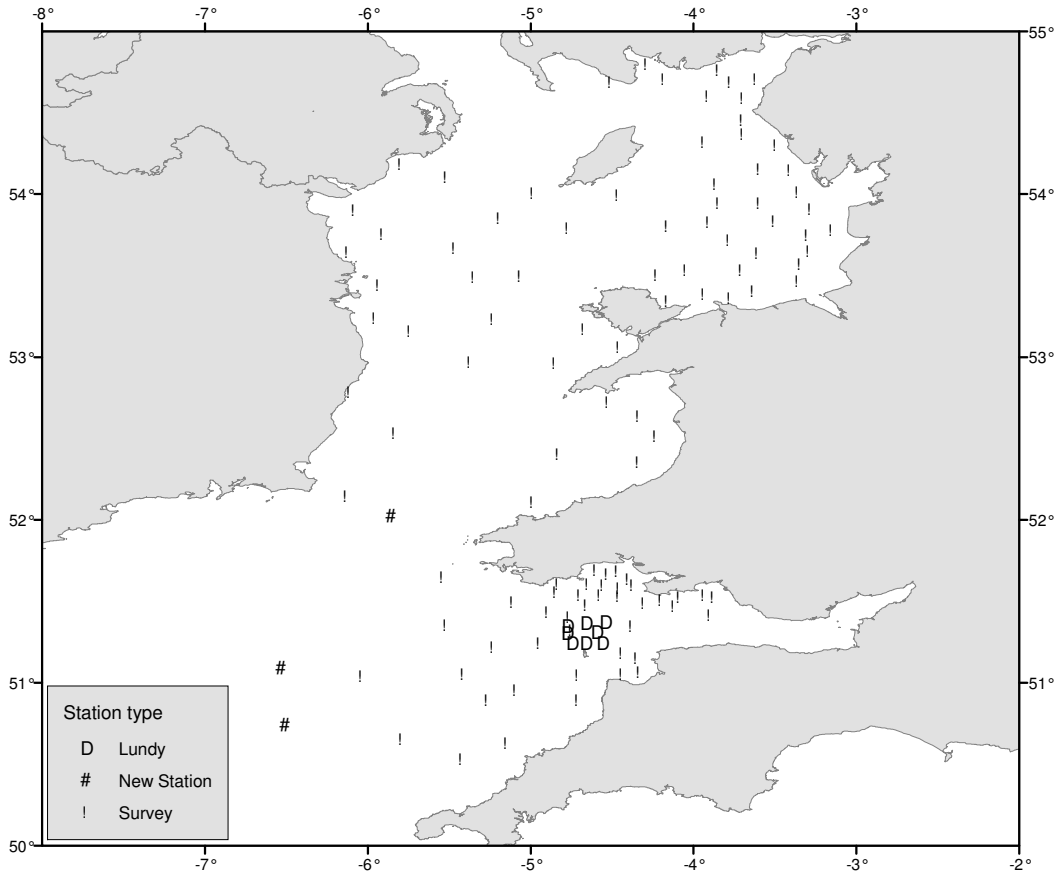
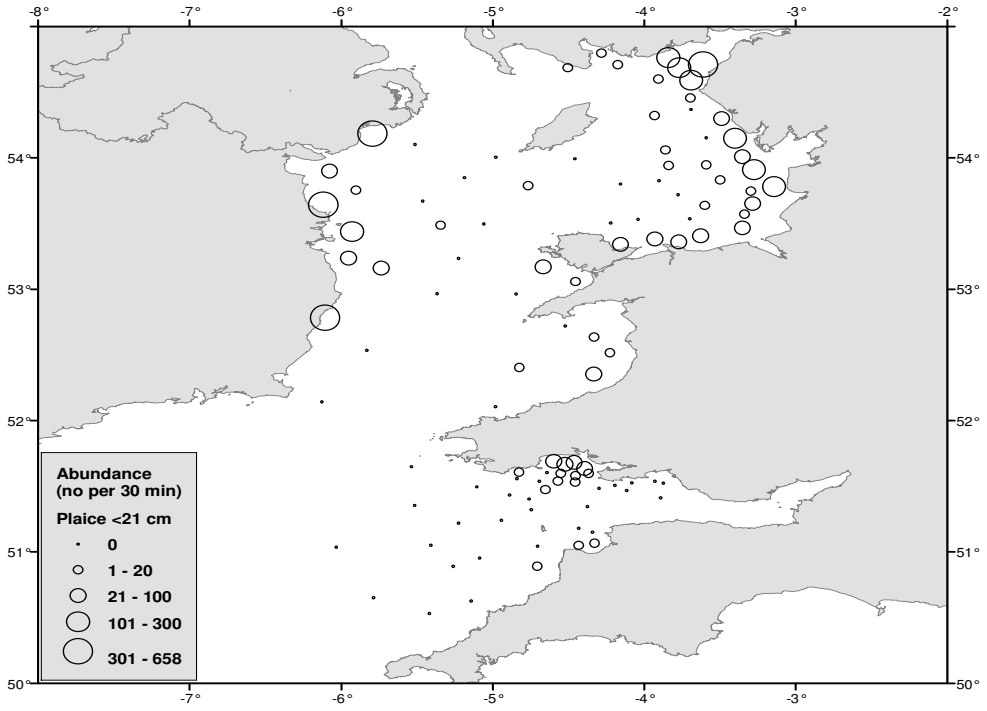


Figure 2 - Abundance (number caught per 30 minute tow) of pre-recruit (a) (<21 cm TL) and recruited (b) (≥21 cm TL) plaice.

a)



b)

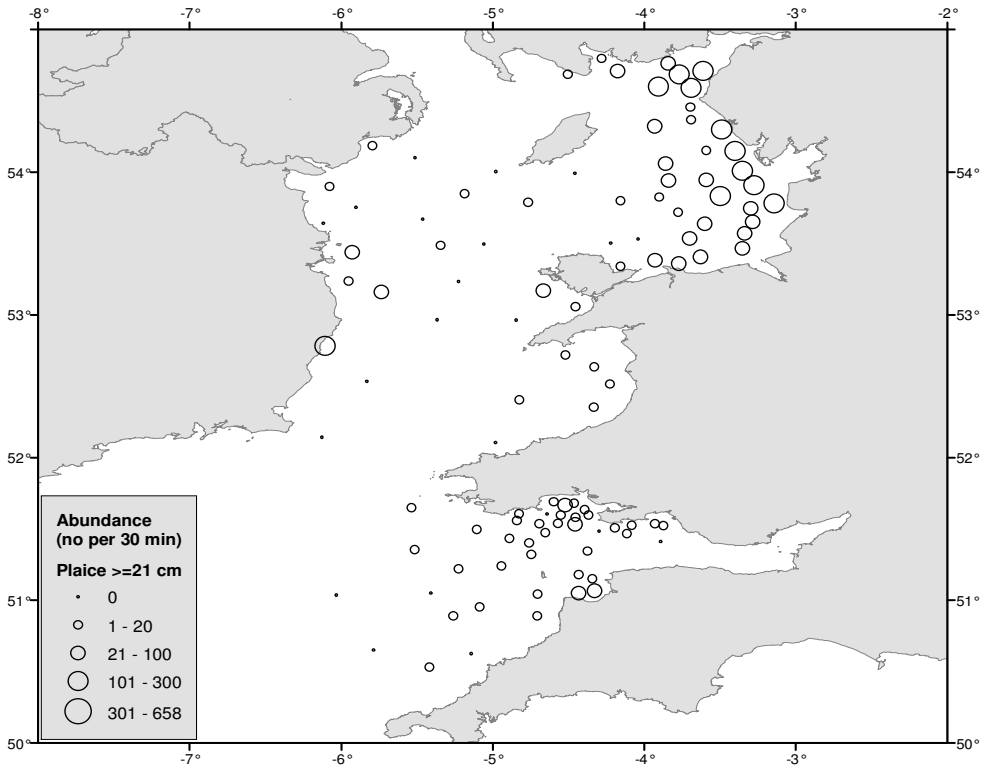
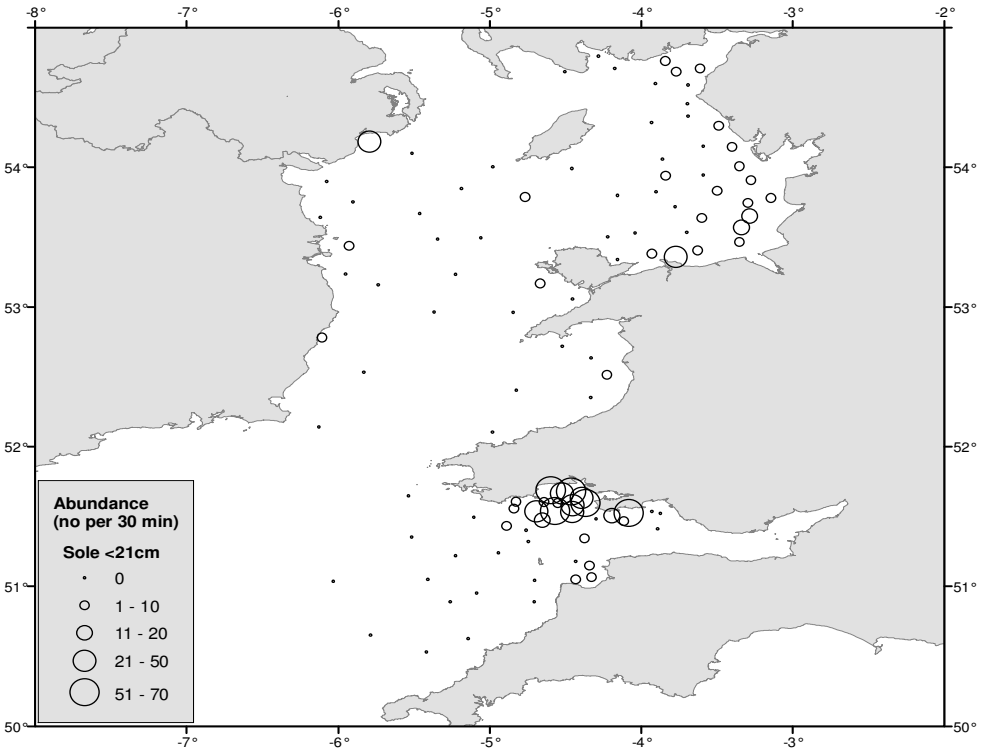


Figure 3 - Abundance (number caught per 30 minute tow) of pre-recruit (a) (<21 cm TL) and recruited (b) (≥21 cm TL) sole.

a)



b)

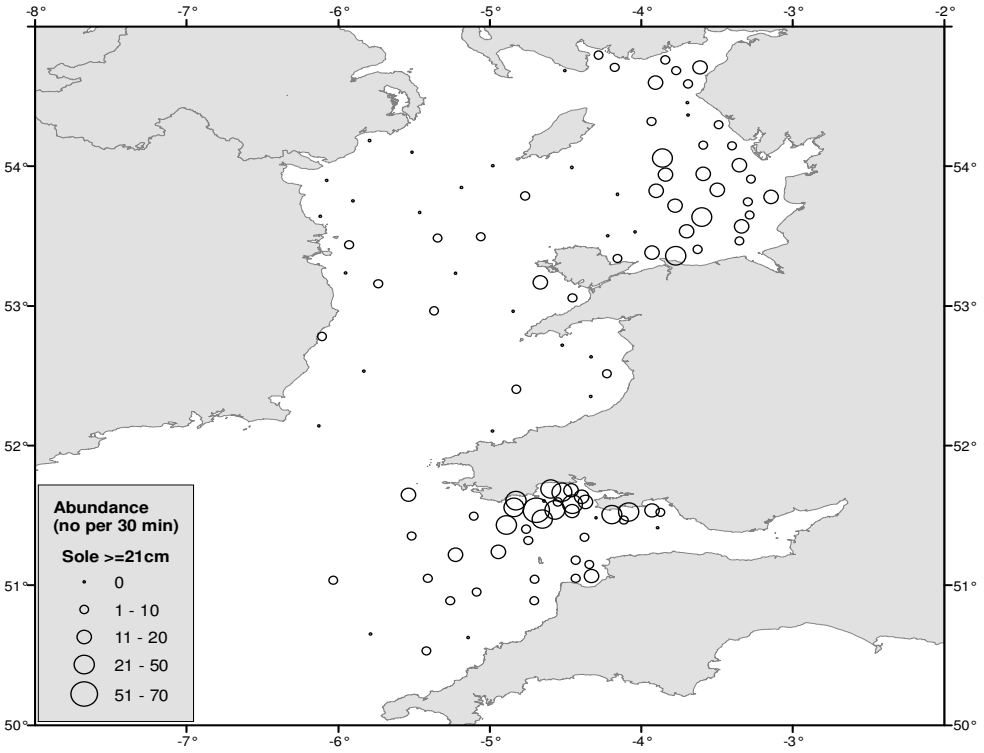
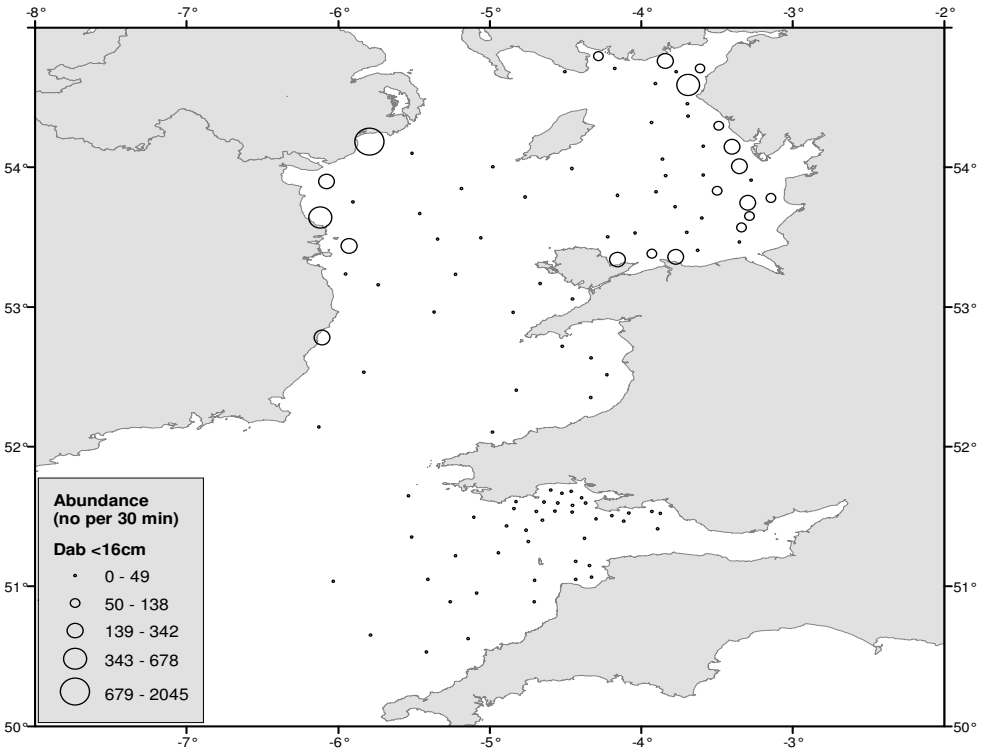


Figure 4 - Abundance (number caught per 30 minute tow) of pre-recruit (a) (<16 cm TL) and recruited (b)(≥16 cm TL) dab.

a)



b)

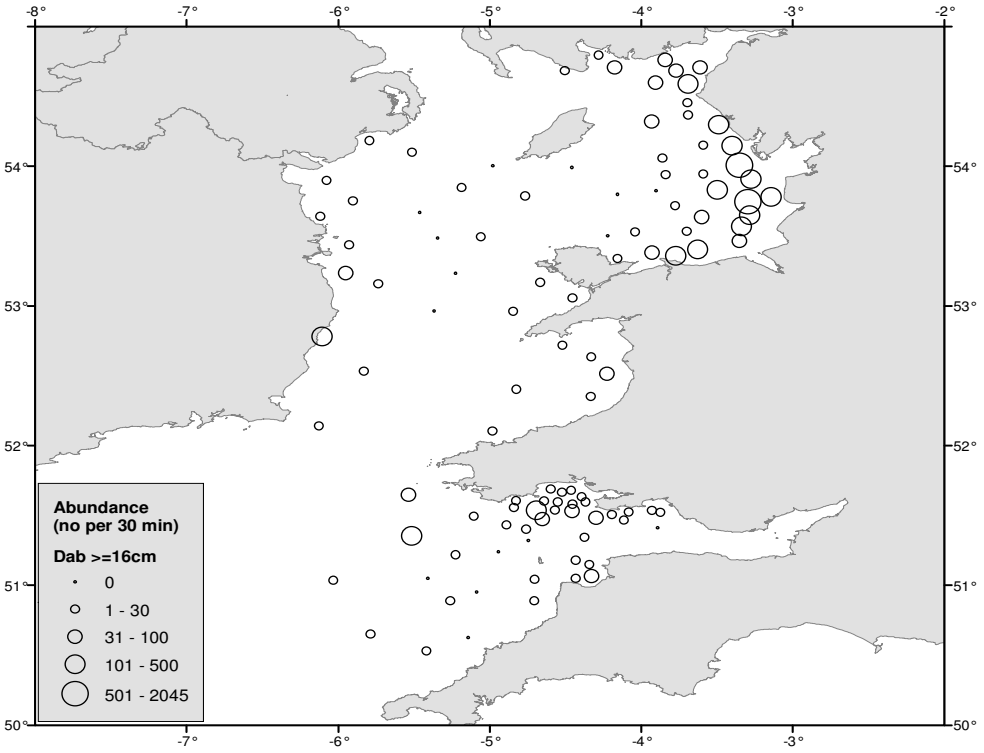
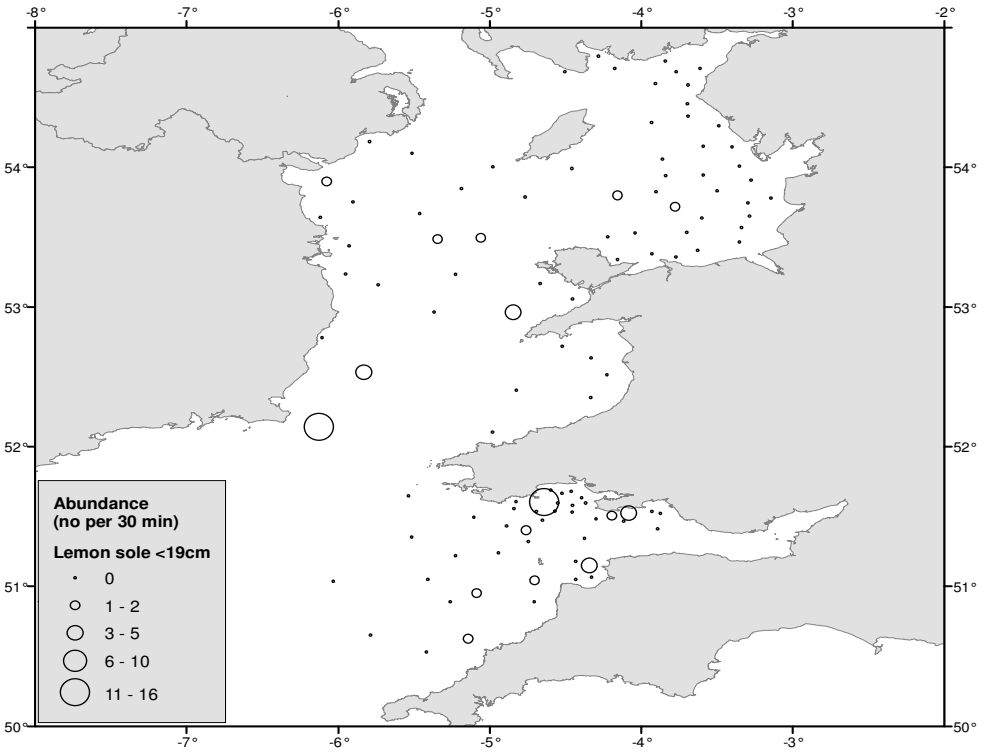


Figure 5 - Abundance (number caught per 30 minute tow) of pre-recruit (a) <19 cm TL) and recruited (b)(≥19 cm TL) lemon sole.

a)



b)

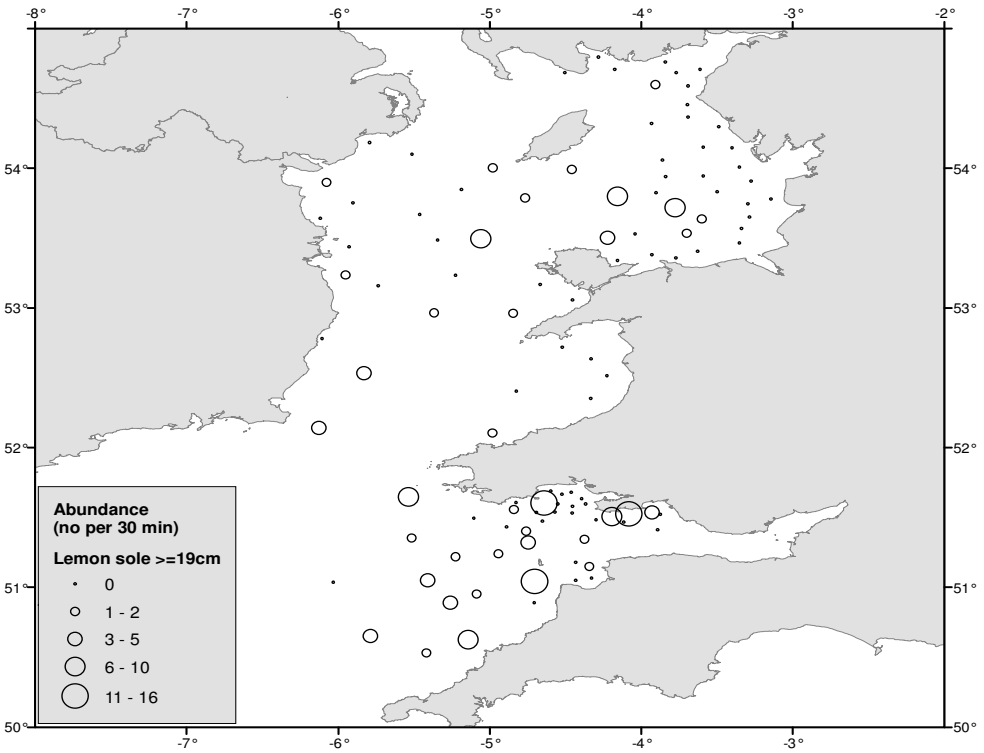


Figure 6 – Mean number and weight of plaice (*Pleuronectes platessa*) caught per 30-minute tow - by survey area

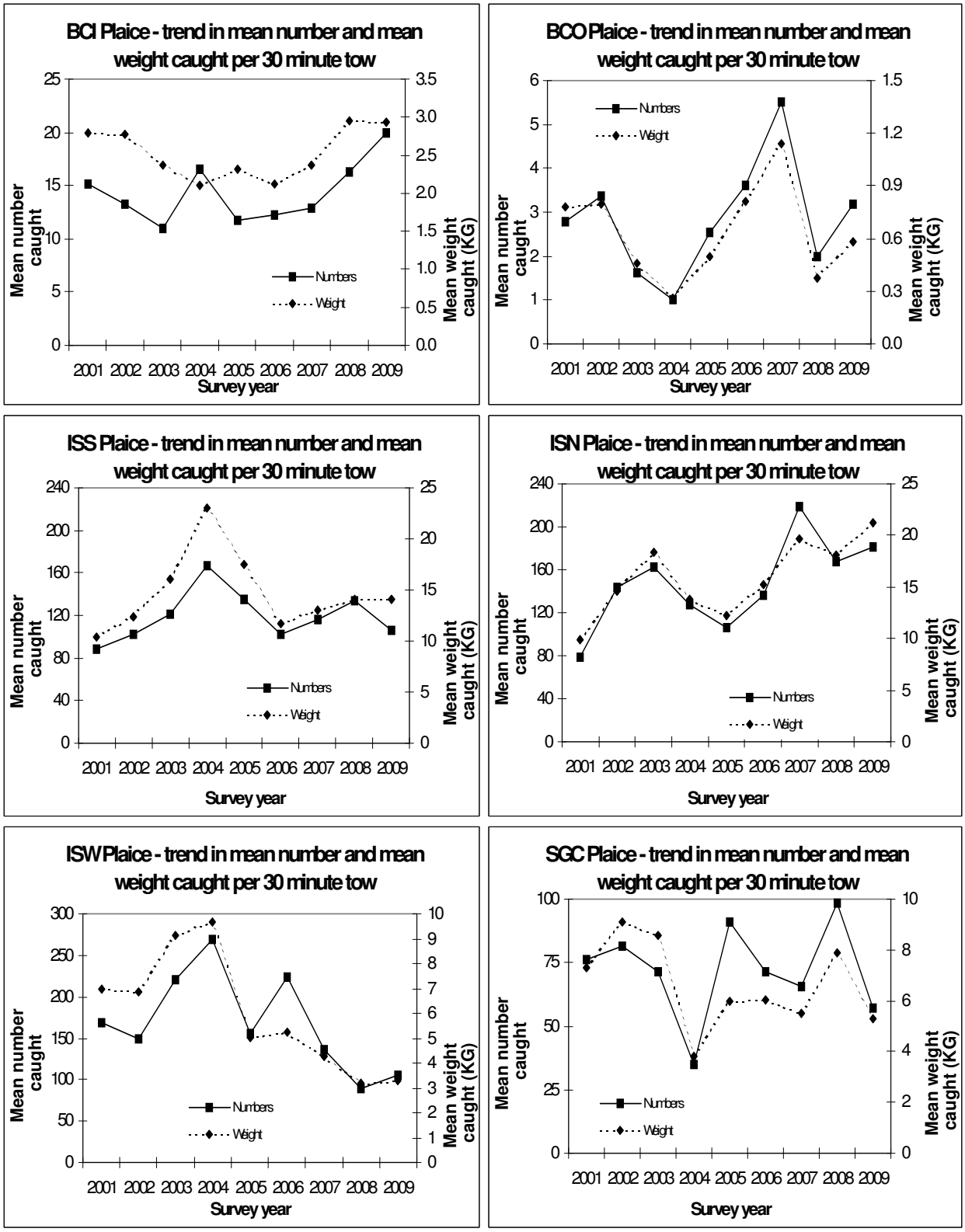


Figure 7 - Mean number and weight of sole (*Solea solea*) caught per 30-minute tow - by survey area.

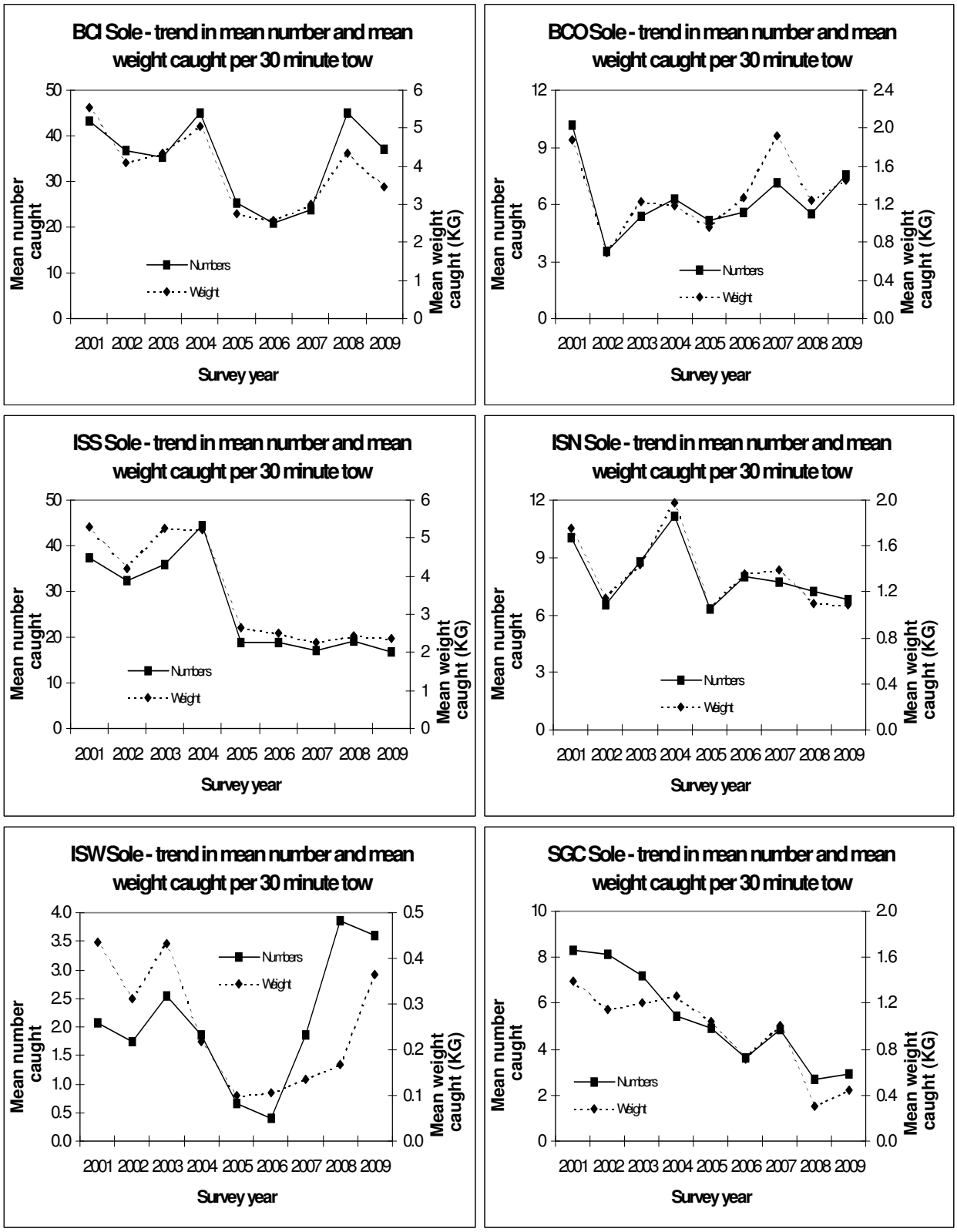


Figure 8 - Mean number and weight of dab (*Limanda limanda*) caught per 30-minute tow - by survey area per 30-minute tow.

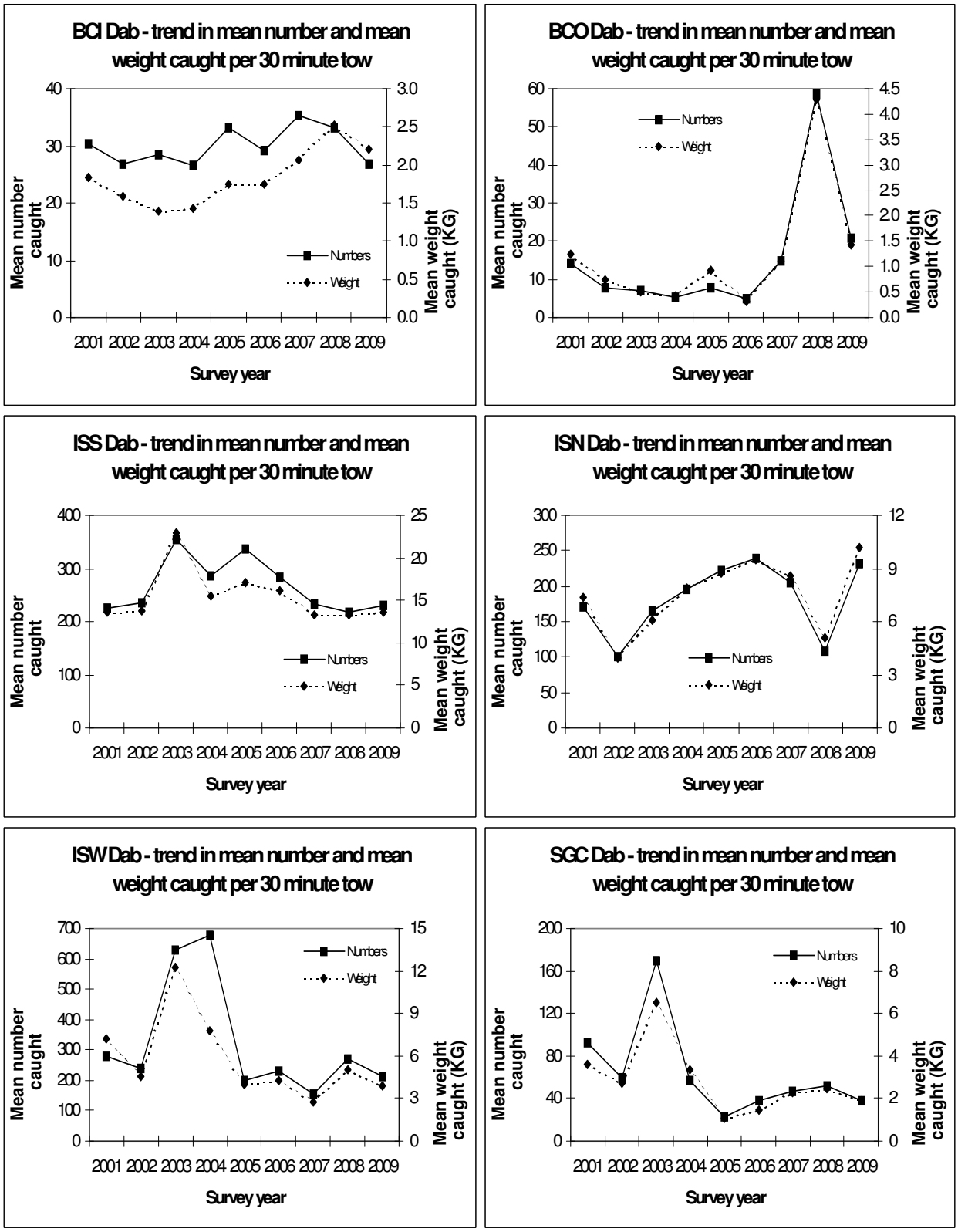


Figure 9 - Mean number and weight of lemon sole (*Microstoma kitt*) caught per 30-minute tow - by survey area per 30-minute tow.