

RESEARCH VESSEL SURVEY REPORT

RV CEFAS ENDEAVOUR

Survey: CEND 14/19.

STAFF:

Part 1

Part 2

Name	Role	Name	Role
S Shaw	SIC	S Shaw	SIC
S Walmsley	2IC	S Walmsley	2IC
F Mynott	Sampler	F Mynott	Sampler
G Eastley	Deckmaster	G Eastley	Deckmaster
J Ford	Sampler	J Ford	Sampler
G Thomas	Sampler	G Thomas	Sampler
S Roslyn	Sampler	C Reeve	Sampler
M Kinneen	Irish Observer	M Kinneen	Irish Observer
		D Montgomery	Exeter Uni
		C Dolan	AFBINI

DURATION: 8th to 27th September 2019 (20 Days)

LOCATION: Irish Sea (VIIa), Bristol Channel & Celtic Sea (VIIIfg)

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 stock assessments.
2. To collect biological data including maturity and weight at age of sole *Solea solea*, plaice *Pleuronectes platessa*, lemon sole *Microstomus kitt* 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 and 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 and caesium (AE001) (K Leonard – Cefas, Lowestoft).
8. To collect fish samples in support of Cefas and non-Cefas projects and training courses.
9. Retain any dead specimens of diadromous fish for the DiadES Interreg project (T Basic - Cefas, Lowestoft)
10. Collect chlorophyll samples to test for nutrients from the surface water for the ASMIAC project. (N Greenwood – Cefas, Lowestoft)
11. Collect plankton sample at the Gabbard smart buoy site. (S Pitois – Cefas, Lowestoft)
12. Complete vitality assessments on smooth hounds (J Silva – Cefas, Lowestoft)
13. Collect sediment and plankton sample from two sites for naturally occurring radioactive material measurements (F Dal-Molin – Cefas, Lowestoft)

NARRATIVE: (All times **GMT**)

Cefas scientists joined Cefas Endeavour at 2000h, 7 September for sailing, departing from Lowestoft at 0400h, 8 September. At 0756h, a ring net and water sample collection was carried out at the West Gabbard smart buoy location for the Pelagic sciences team at Cefas. Survey briefing tool-box talks were held with the vessel officers and crew to discuss the survey operations followed by a general emergency muster drill.

At 1326h, a shakedown Seabird CTD Rosette sampler cast was successfully carried out at a position East of Goodwin sands (7DBTS prime station 79) collecting salinity, Chlorophyll and oxygen samples. This was followed by successful shake-down beam trawl tow (beam number 2) at the same position to fully test the beam trawl deployment and the on-board fish sampling systems. The vessel recommenced the steam to the first survey stations in the Bristol Channel.

On 9 September off Penzance, a rosette sample was successfully carried out as no fishing stations were in range of the vessel during daylight hours. Strong northerly winds led to the decision to start 10 September in the BCI (Bristol Channel Inner) sector along the South Wales coast. No rosette sample was taken due to time restraints. The first tow in BCI, prime station 101 was invalid due to static gear encountered soon after deployment, however the second attempt was successful. In total, eleven valid fishing stations were completed during the day followed by a rosette deployment. On 11 September, seven fishing stations were completed, working from the east to end the day off Port Talbot. Prime station 114 was hauled after 23 minutes due to shoaling of the seabed. At 1630h, a ring net followed by a mini Hamon grab were deployed to collect samples to measure the naturally occurring radioactive material.

On 12 September, nine stations in BCI sector were completed making the most of the calm weather. The first tow (prime station 112) on 13 September had to be moved slightly to the east due to a sand bar being formed over the original tow and the modified tow was fished successfully. A further four BCI stations were completed followed by two in the BCO (Bristol

Channel Outer) sector giving a total of seven prime stations completed during the day. No firing range activity was scheduled in Cardigan Bay on 14 September allowing the six stations in this area within SGC (St Georges Channel) sector to be completed in the day. Overnight, the vessel transited to the ISS (Irish Sea South) sector where fishing commenced at first light on 15 September at prime station 55. Ten stations were completed with four being altered, with prime station 37 reduced in time due to static gear, prime station 36 reduced in time due to cables and static gear, prime station 32 towed due East to avoid an anchored vessel and prime station 31 heading altered to avoid a ‘fouled’ anchorage.

On 16 September seven stations in ISS were completed. At the fourth station of the day, (prime station 53) a deck sort was necessary due to a by-catch of approximately 2.5 tonnes of sand and shell. The fishing gear was checked before the next station and found to be undamaged. Overnight the vessel steamed to the most northern stations of the survey in the ISN (Irish Sea North) sector. Seven stations were completed with prime station 2 having to be moved to an alternative tow due to static gear in the area. After fishing operations, the vessel had a short steam to complete a ring net and Hamon grab station off Sellafield. On 18 September, four stations were completed before the vessel docked into Douglas Isle of Man at 1430h to take on supplies and have a crew changeover.

Cefas Endeavour departed from Douglas at 2348h, 19 September. The following day saw the completion of the final prime station in both the ISS and ISN sectors and ending the day with one location completed in ISW (Irish Sea West) sector. At prime station 423, a Yarrell’s Blenny *Chirolophis ascanii* was caught with this being the first observed on this survey since 1998, Figure 1. On 21 September, six stations were completed south of the Isle of Man. At prime station 408, multiple fishing vessels were observed operating in the area.



Figure 1 – Yarrell’s Blenny(*Chirolophis ascanii*) caught at prime station 423.

On 22 September, the survey continued to work towards Ireland. At prime station 206, a second attempt at a tow was necessary due to static gear over the station. Seven stations were completed on this day finishing off the ISW sector. At the final tow (prime station 220), the fishing line was found to be parted. This was deemed to be because of wear and tear and had not affected catch and overnight, the ship's crew changed over to the spare gear, beam 3. On 23 September, six stations were completed and the following day the final four stations in the SGC sector were completed before steaming to the final sector of the survey, BCO. Due to poor weather, survey work was delayed until 0953h on 25 September and only four stations were possible due to the poor sea state.

On 26 September, the final five stations in BCO sector were completed and this finished all 108 fishing stations on the survey. Once fishing operations finished, Cefas Endeavour steamed to the Bristol channel to complete the final water sample stations overnight. During this period, scientists began the process of cleaning up and packing away all scientific equipment in readiness for docking.

Cefas Endeavour docked in Swansea at 1554h, 27 September and the survey de-mobbed the following day.

RESULTS BY AIM:

Aims 1, 2 & 3

The survey gear was the standard 4m-beam trawl (Beam number 2 was used for most stations and beam number 3 was used for the last three days) 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 being sub-sampled.

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, at the first and last fishing station most days, a surface and bottom water sample was taken with a Niskin and rosette 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 on the survey in the past three years. Table 3 shows a list of measured species caught during the survey and number of stations at which they were caught. The trawl survey covering the Irish Sea and Bristol Channel is divided up into six sectors consisting of 108 beam trawl tows, all were successfully fished (Figure 2), including all ISN, ISS, ISW, SGC and BCI stations used for tuning data for the Working Group of the Celtic Seas Eco-region.

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

A total of 14 prime stations – primes 27 and 28 (off Blackpool), 40 (Red Wharf Bay), 47, 53 and 54 (outer Liverpool Bay), 313 (Tremadoc Bay), 214 (Skerries), 203 (Dundrum Bay), 220 (north of Dublin), 233 (south of Wicklow), 425 (midway Anglesey/IOM), 120 (Pembroke coast) and 501 (southwest of Milford Haven) were reduced from the standard 30-minute tow to either a 20 or 15-minute tow.

In addition, a total of 5 prime stations were hauled early – prime station 114 (Mumbles Head), 36 (Off Rhyll), 409 (Irish Sea west deep), 4 (Solway Firth) and 37 (Off Llandudno). All tow reductions were due to expected large catches of weed, broken shell or small flatfish, static gear over the tow, fading light or fishing a new tow location. A few stations were moved short distances to avoid undersea cables (an increasing problem in this busy sea area).

Table 1: Numbers of otolith/scale samples taken by ICES division

	VIIa	VIIb	VIIg	Total
Anglerfish (<i>Lophius piscatorius</i>)	19	25	15	59
Anglerfish (<i>Lophius budegassa</i>)	0	1	0	1
Brill	30	1	2	33
Cod	17	7	2	26
Dab	142	82	32	256
Bass	0	11	0	11
Grey Gurnard	70	46	3	119
Red Gurnard	50	18	0	68
Tub Gurnard	62	19	0	81
Haddock	28	22	29	79
Hake	0	0	7	7
John Dory	7	12	3	22
Lemon Sole	52	49	7	108
Megrim	5	12	32	49
Plaice	1411	363	42	1816
Red Mullet	20	19	0	39
Sole	632	418	58	1108
Streaked Gurnard	1	0	0	1
Turbot	5	7	1	13
Whiting	131	26	23	180
Total	2682	1138	256	4085

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

Weight caught (kg)				Number caught			
	2019	2018	2017		2019	2018	2017
Plaice	872	932	959	Dab	15342	10116	10108
Dab	677	516	463	Plaice	7848	7051	7848
Lesser spotted dogfish	667	1055	808	Sole	3530	3392	2556
Thornback ray	494	484	401	Solenette	3459	2559	1805
Sole	387	419	266	Common dragonet	2171	1848	1333
Spiny spider crab	113	171	361	Grey gurnard	1973	2121	856
Spotted ray	109	90	110	Scaldfish	1741	1377	1022
Common dragonet	94	75	60	Lesser spotted dogfish	1479	2263	1601
Blond ray	70	44	39	Whiting	1444	2487	1865
Whiting	67	98	84	Poor cod	1371	2176	1209
TOTAL (All species)	5084	4546	4196	TOTAL (All species)	60345	40905	35548

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

Species	Stations	Species	Stations
<i>Aequipecten opercularis</i>	37	<i>Melanogrammus aeglefinus</i>	22
<i>Aequorea spp</i>	2	<i>Merlangius merlangus</i>	78
<i>Agonus cataphractus</i>	32	<i>Merluccius merluccius</i>	5
<i>Ammodytes tobianus</i>	5	<i>Microchirus variegatus</i>	44
Argentinidae	1	<i>Microstomus kitt</i>	31
<i>Arnoglossus imperialis</i>	4	<i>Mullus surmuletus</i>	16
<i>Arnoglossus laterna</i>	62	<i>Mustelus asterias</i>	23
<i>Aspitrigla (chelidonichthys) cuculus</i>	27	<i>Myoxocephalus scorpius</i>	3
<i>Belone belone</i>	1	<i>Necora puber</i>	29
<i>Blennius ocellaris</i>	7	<i>Nephrops norvegicus</i>	10
<i>Buenia jeffreysii</i>	2	<i>Pecten maximus</i>	8
<i>Buglossidium luteum</i>	55	<i>Pegusa (solea) lascaris</i>	19
<i>Callionymus lyra</i>	90	<i>Pelagia noctiluca</i>	1
<i>Callionymus maculatus</i>	5	<i>Pholis gunnellus</i>	3
<i>Callionymus reticulatus</i>	4	<i>Pleuronectes platessa</i>	90
<i>Cancer pagurus</i>	23	<i>Pomatoschistus spp</i>	37
<i>Capros aper</i>	5	<i>Raja brachyura</i>	20
<i>Centrolabrus exoletus</i>	1	<i>Raja clavata</i>	73
<i>Chirolophis ascanii</i>	1	<i>Raja microocellata</i>	10
<i>Chrysaora hysoscella</i>	4	<i>Raja montagui</i>	57
<i>Conger conger</i>	8	<i>Rhizostoma octopus</i>	19
<i>Ctenolabrus rupestris</i>	3	<i>Scophthalmus maximus (psetta maxima)</i>	11
<i>Cyanea capillata</i>	47	<i>Scophthalmus rhombus</i>	19
<i>Dicentrarchus labrax</i>	8	<i>Scyliorhinus canicula</i>	97
<i>Echiichthys (trachinus) vipera</i>	21	<i>Scyliorhinus stellaris</i>	18
<i>Enchelyopus cimbrius</i>	1	<i>Sepia elegans</i>	3
<i>Eutrigla (chelidonichthys) gurnardus</i>	92	<i>Sepia officinalis</i>	9
<i>Gadus morhua</i>	10	<i>Solea solea</i>	94
<i>Gaidropsarus vulgaris</i>	3	<i>Sprattus sprattus</i>	2
<i>Glyptocephalus cynoglossus</i>	10	<i>Squalus acanthias</i>	1
<i>Gobius niger</i>	1	<i>Symphodus (crenilabrus) melops</i>	1
<i>Hippoglossoides platessoides</i>	3	<i>Syngnathus acus</i>	6
<i>Homarus gammarus</i>	4	<i>Syngnathus rostellatus</i>	2
<i>Hyperoplus lanceolatus</i>	3	<i>Taurulus bubalis</i>	2
<i>Lepidorhombus whiffiagonis</i>	7	<i>Trachinus draco</i>	7
<i>Leucoraja naevus</i>	16	<i>Trachurus trachurus</i>	10
<i>Limanda limanda</i>	85	<i>Trigla (chelidonichthys) lucerna</i>	52
<i>Liparis liparis</i>	1	<i>Trigloporus (chelidonichthys) lastoviza</i>	1
<i>Loligo (alloteuthis) subulata</i>	30	<i>Trisopterus esmarki</i>	8
<i>Loligo forbesi</i>	2	<i>Trisopterus luscus</i>	19
<i>Loligo vulgaris</i>	29	<i>Trisopterus minutus</i>	48
<i>Lophius budegassa</i>	1	<i>Zeugopterus (phrynorhombus) norvegicus</i>	5
<i>Lophius piscatorius</i>	26	<i>Zeugopterus punctatus</i>	1
<i>Maja squinado</i>	49	<i>Zeus faber</i>	14

Table 4: Summary of gear deployments and sample collections

Gear	Valid	Additional	Invalid	Total
Standard 4m Beam trawl with cod end liner	108	1	2	111
Rosette sampling with CTD and Niskin (surface and bottom)	28	0	0	28
Ring net sample	3	0	0	3
Mini Hamon grab	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 Bideford 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 both catch numbers and catch weight in 2019 decreased for the third year from the high levels observed in 2013-2016 with the largest falls observed in the ISN, BCI and SGC sectors.

In BCI, both the catch numbers and weight caught decreased by 7% and 12% respectively, decreasing for the fourth year from the high levels observed in 2015. In BCO the numbers of fish caught increased by 4% from 2018 and the weight of fish caught fell by 7%. Plaice catches are below the survey high (2015) in both Bristol Channel survey sectors. Catch numbers of juvenile plaice (<22cm) in BCI/BCO in 2019 (124) were similar to 2018 (125) and this is near the survey average (141) over the period 2001-19. Catch numbers of recruited plaice (>22cm) remain below the survey average (564) for the second year at 459 fish.

In the Irish Sea, ISN plaice abundance decreased in terms of numbers caught (10%) and by weight caught (21%). Catch numbers remain below the survey average whilst weight caught decreased to below average (2001-19). In ISS, plaice catch numbers increased for the first time in five years by 23%, whilst catch weight increased by 6%. Both measures of abundance remain above the survey average (2001-19). In ISW, both catch numbers and weights increased for the first time in four years with increases of 77% and 26% respectively. These three survey sectors continue to be the most productive for plaice. Catch numbers in SGC fell by 4% from those observed in 2018 whilst catch weight also decreased by 11%.

Catch numbers of juvenile plaice (<22cm) in these four Irish Sea survey sectors increased (4370 fish) for the first time since 2014 but remain below the survey average of 5742 fish (2001-19). Trends in survey catch rates over recent surveys are shown in Figure 7.

Sole

Abundance by catch number and weight increased in the ISN, ISS and ISW survey sectors compared to 2018. The BCI survey sector continues to be productive, but this sector has been surpassed by the increased catch rates in the ISS survey sector. This is the first time in fourteen years of survey history.

In BCI, catch numbers and weight decreased by 28% and 27% respectively compared to the survey high observed in 2018 and remain above the series average over period 2001-19. In BCO catch weight and number decreased by 44% and by 42% compared to the 2018 survey. Catch numbers of juvenile sole in BCI/BCO (<22cm) were around 10% lower in 2019 (827 fish) than those seen in 2018 (914 fish) and are still above average levels observed over the period 2001-19. Numbers of recruited sole (>21cm) caught decreased by 39% from 2018 (1360 fish) to around 832 fish but are still higher than the survey average of 624 fish (2001-2019).

In the Irish Sea, ISN catch numbers and catch weights both increased by 23% and 20% respectively compared to 2018 with both measures remaining above the series average and at the survey high (2001-19). In the ISS survey sector, an increase was observed in both catch weight and numbers of 53% and 113% respectively compared to 2018 and are now at a survey high (2001-19). ISW saw increases in both catch numbers (17%) and catch weights (69%) and catches remain low compared to the ISS/ISN survey sectors. In SGC, catch numbers (46%) and weight (36%) decreased from those observed in 2018 and remain near the series average (2001-19). Recruited (>21cm) sole numbers (634) increased above the survey average (414) while juvenile (<21cm) sole numbers (1237) increase significantly above the survey average (338) observed over the period 2001-19. Trends in survey catch rates over recent surveys are shown in Figure 8.

Dab *Limanda limanda*

Abundance of dab by catch number increased in all survey sectors. The abundance by catch weight also increased in the all sectors except BCO (0%) and BCI (15%). The most productive survey sectors remain ISS/ISN/ISW and the survey sectors of BCI/BCO generally see the smallest catches of dab.

In BCI catch numbers increased by 35% and catch weight decreased by 15% in 2018 and remain at average levels (2001-19). In BCO, abundance by number caught increased by 7% and weight remained the same. Numbers of juvenile dab in BCI/BCO (<17cm) increased in 2019 (1108) compared to 2018 (237) and increase above the survey average over the period 2001-19 (609). However, the numbers of recruited dab (>16cm) decreased by 23% in 2019 (960) compared to 2018 (1253) and fall below average.

In the Irish Sea, ISS catch numbers and catch weights both increased compared to the 2018 survey and are now above the abundance averages (2001-19). The survey sectors of ISN showed an increase in both catch numbers and weight (32% and 40% respectively) to those seen in 2018 and are now above the sector average. ISW showed increases in both catch weight and number. ISW sector currently have abundance at below average level. In the SGC survey sector, catch numbers and weight increased by 7% and 4% respectively and both measures remain below the survey average (2001-19).

The number of juvenile (<17cm) dab in the Irish Sea survey sectors increased by 43% in 2019 compared to the previous survey and are at 73% of the average over the period 2001-19. Numbers of recruited dab (>16cm) increased by 29% in 2019 and are observed as being above the survey 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 increases in both catch numbers and catch weights in BCO, BCI, ISS, ISN and SGC survey sectors. In all survey sectors, except ISS, both catch numbers and catch weights are either at or close to the series low over the period 2001-19.

In the Irish Sea, juvenile numbers (<20cm) decreased from 43 in 2018 to 33 in 2019 and are now below average levels (2001-19). Numbers of recruited lemon sole (>19cm) in 2019 (39 fish) increased from 2018 (33) and but also remain below the series average (60 fish).

In the Bristol Channel, juvenile numbers increased in 2019 (41) from 2018 (12) and are currently below the series average (2001-19). Recruited lemon sole increased by around 51% in 2019 (36) and are also observed as being below average levels. Trends in survey catch rates over recent surveys are shown in Figure 10.

Other species

Cod *Gadhus morhua* total catch numbers in 2019 (29) were down compared to 2018 (150) of which 45% were juvenile (<21cm). In total, 18 Cod caught in 2019 were caught in the Irish Sea.

Bass *Dicentrarchus labrax* total catch numbers in 2019 (12) were down compared to 2018 (74) and are around the survey average (10).

Haddock *Melanogrammus aeglefinus* total catch numbers in 2019 (343) were down compared to 2018 (430). Juvenile catch numbers (<21cm) in both the Irish Sea and the Bristol Channel were lower than observed in 2018, they are now slightly below the survey average (2001-19).

Whiting *Merlangius merlangus* total catch numbers in 2019 (1444) were 42% down on those caught in 2018 (2487) with the similar decreases observed in the Irish Sea and the Bristol Channel. Juvenile catch numbers (<21cm) decreased by 56% from 2018 and remain below average (2001-19) in both the Bristol Channel and Irish Sea.

Thornback ray *Raja clavata* total catch numbers in 2019 (773) were down compared to 2018 (835). Monk (*Lophius piscatorius*) total catch numbers in 2019 (75) decreased from the survey high in 2015 (109). Lesser spotted dogfish *Scyliorhinus canicula* total catch numbers in 2019 (1479) decreased compared to 2018 (2263) with under 6% being juvenile (<35cm). The numbers of juvenile LSD caught in the Bristol Channel in 2019 (29) was just 48% of the average observed over the period 2001-19 (60). Juvenile LSD catches in the Irish Sea survey sectors (57) were also below the average caught over the period 2001-19 (77).

Total catch numbers of grey gurnard *Eutrigla gurnardus* in 2019 (1973) decreased compared to 2018 (2121) and the weight caught in 2019 (61kg) remained the same as 2018. Red

gurnard *Aspitrigla cuculus* total catch numbers in 2018 (174) decreased in 2019 (161) with a similar drop in catch weight observed.

Poor-cod *Trisopterus minutus* catch numbers in 2019 (1371) were down compared to 2018 (2176) and the proportion of smaller juvenile individuals (<12cm) decreased compared to 2018. Pogge *Agonus cataphractus* catch numbers decreased in 2019 by 25% with a fall in the weight caught also observed. Red mullet *Mullus surmuletus* catch numbers in 2019 (48) were low compared with the 2018 survey when 182 were caught, while total catch weight increased by 97% due to adult fish. Solenette *Buglossidium luteum* catch numbers in 2019 (3459) increased compared with the 2018 survey (2559). Starry Smoothhound *Mustelus asterias* catches decreased from 155 in 2018 to 147 in 2019.

Note – Irish sea survey sectors are ISS/ISN/ISW/SGC and the Bristol Channel survey sectors are BCI/BCO.

Aim 4 - Surface and bottom water sampling

At the start and end of most survey days, a surface and bottom water salinity sample was taken using the rosette, the starboard gantry with the 'CTD' wire was used. The sample was routinely taken at around 5m off the surface and seabed. A total of 28 surface and 28 bottom salinity samples were collected.

Aim 5 – Epi-benthos

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

At all fishing stations on the survey, catches of 14 sentinel taxa of benthic invertebrates were recorded. The total weight of the remaining by-catch of epi-benthic invertebrates was recorded at all stations, benthic observations were recorded from the catches at non-benthic stations.

Aim 6 - Length weight & maturity information

Length weight and maturity information were collected for all fish that were biologically sampled.

Aim 7 – Collection of water samples for analysis of tritium and caesium levels

A total of 47 one-litre water samples were collected at fishing stations and a further 25 in the Bristol channel collected at non-fishing locations for the analysis of tritium levels. In addition, a further 111 20-litre water samples were collected at 37 fishing stations for analysis of caesium levels.

Aim 8 - Additional sample collections

Additional samples were taken in support of other projects:

- A) No rare or unusual species were caught on this survey.
- B) A total of 18 Nurse-hound *Scyliorhinus stellaris* and 3 Blonde Ray *Raja brachyura* were tagged and released. J Ellis (Cefas, Lowestoft).
- C) In total 2 sightings of marine mammals were recorded; all observations were pods of Common Dolphins *Delphinus delphis*.
- D) Seven samples of Greater Weaver *Trachinus draco* were collected for further analysis. S Barnett (Cefas, Lowestoft).
- E) A total of 12 samples of fish and benthic species were frozen for subsequent species identification confirmation in the laboratory. J Ellis (Cefas, Lowestoft).
- F) A total of 82 Plaice, 78 Sole, seven Brill and one cod were collected and frozen for analysis of macro and micro-litter. B De Witte (ILVO, Belgium).
- G) No collection of Shad (Allis or Twaite) or Lamprey was possible on the survey. A Walker (Cefas, Lowestoft)
- H) At two fishing stations, samples of whelk *Buccinum undatum* were collected for analysis as part of an on-going Cefas project. V Laptikhovsky (Cefas, Lowestoft)
- I) Squid samples were collected at 25 fishing stations for species identification confirmation and further biological sampling in the laboratory. V Laptikhovsky (Cefas, Lowestoft)
- J) Five samples of Brown Crabs *Cancer pagurus* were collected to trial a camera system being developed to identify crabs and lobsters on shellfish vessels. D Clark (Cefas, Lowestoft)
- K) A total of 1034 stomach samples were collected and frozen from various species, for FishKOSM (Fisheries knowledge for optimal sustainable management). C Dolan (AFBINI).
- L) Six samples of fish species were frozen for the outreach projects. S Roslyn (Cefas, Lowestoft).

Aim 9 - Retain any dead specimens of diadromous fish

No diadromous species were caught during the trip.

Aim 10 - Collect chlorophyll samples

Samples were collected during the morning deployment of the rosette. Some days were missed due to poor weather and time restraints. In total 16 samples were collected during the trip.

Aim 11 - Collect plankton sample at the Gabbard smart buoy site

This aim was successfully completed on the first day of the survey at 0756h.

Aim 12 - Complete vitality assessments on smooth hounds

In total vitality assessment was completed for 57 smooth hounds, sampling was not possible at every station due to operational pressures.

Aim 13 - Collect sediment and plankton sample from two sites

Both Port Talbot and Sellafield sample areas were completed during the first half of the survey. Both grab samples were successful on first deployment and they followed a ring net sample.

Litter by-catch information

Details of the by-catch of marine litter caught at all fishing stations were recorded. Litter by-catch was categorized by 'type', weighed, photographed and categorized by size at a total of 109 fishing stations with a total of 368 individual items being observed. In addition, details of any attached organisms were recorded. Photographs of all litter items were taken.

Micro CTD

The SAIV Micro CTD unit was attached to the 4m-beam trawl to record the temperature, salinity and depth profile at each station fished and this was successful in recording data for all fishing stations. A total of 110 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 this year.

Our thanks go to the ship's crew and scientists for donating prizes for the Macmillan coffee morning, held on 25 September raising £226 for charity and the generous offer from P&O to match the money raised.

S Shaw (Scientist-in-charge)
11/10/2019

INITIALLED: IDH

DISTRIBUTION:

Survey participants +
I Holmes (PI)
C Leech (Portfolio lead)
D Pettengell (PM)
Cefas Fisheries Survey's SICs/2ICs
Gary Burt (for Cefas Trim)
T Bailey
S Kupschus
J Maitland (P&O)
B Salter (P&O)
Master (Cefas Endeavour)
FCO (for France & Republic of Ireland)
Marine Management Organisation (MMO)
Welsh Government (WG)
Devon & Severn IFCA
Cornwall IFCA
North Western IFCA

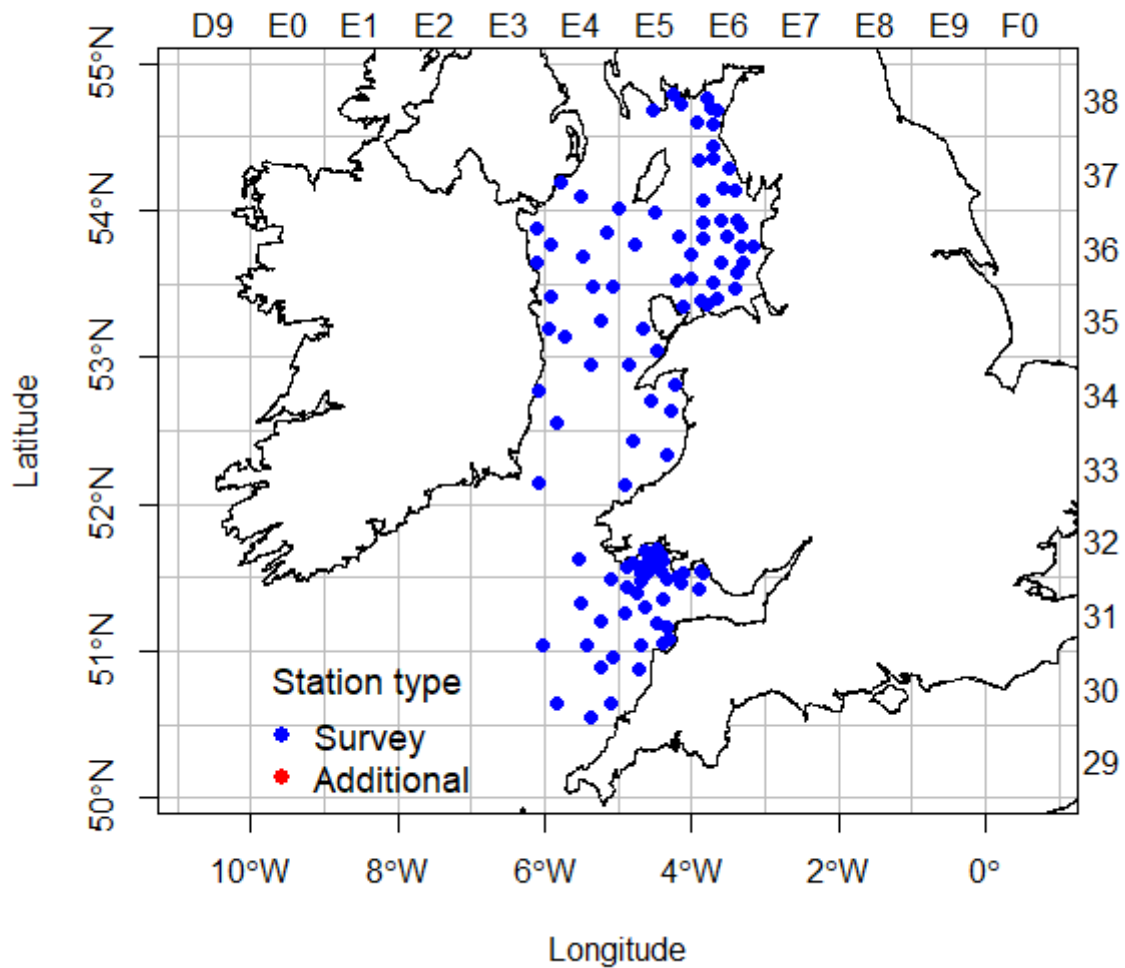
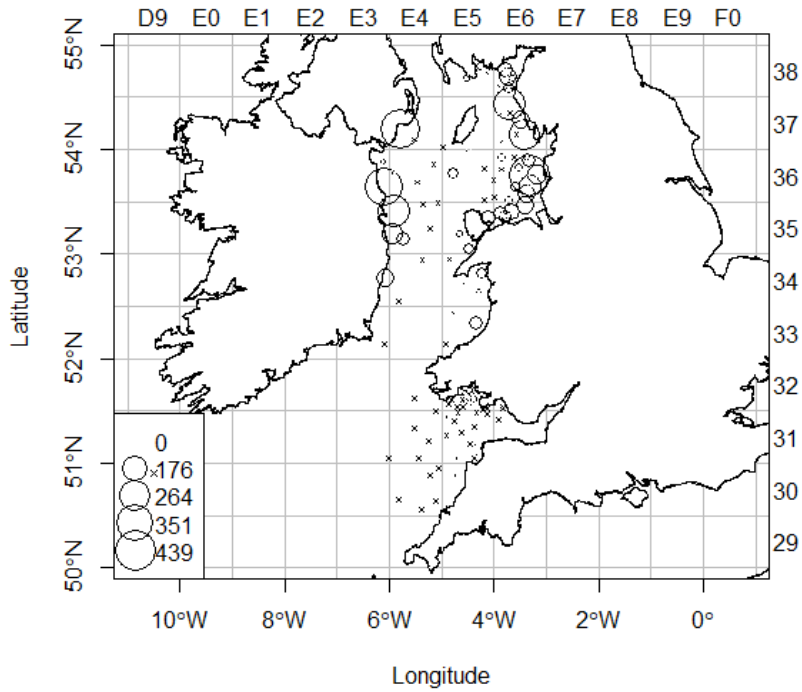


Figure 2: Beam trawl station positions for CEND 14/19.

a)



b)

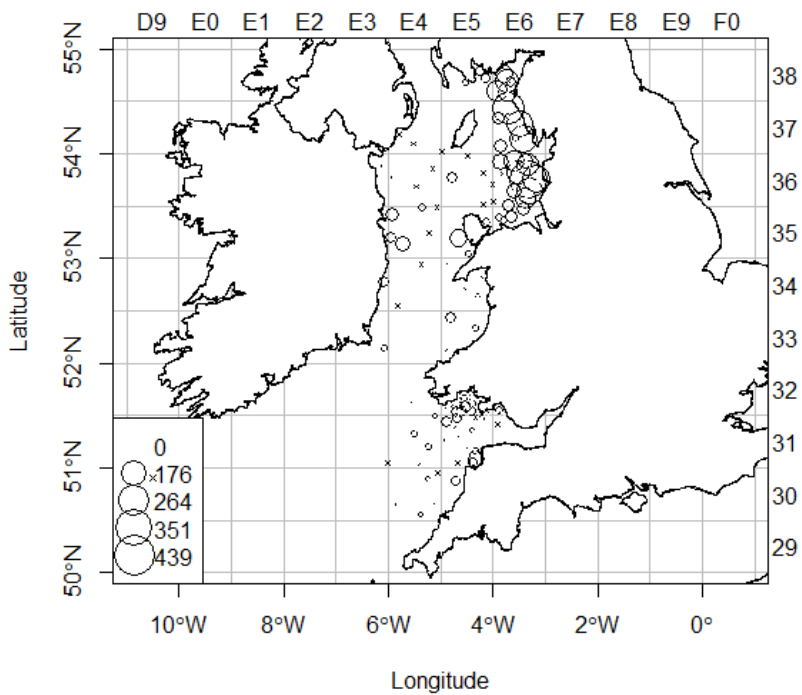
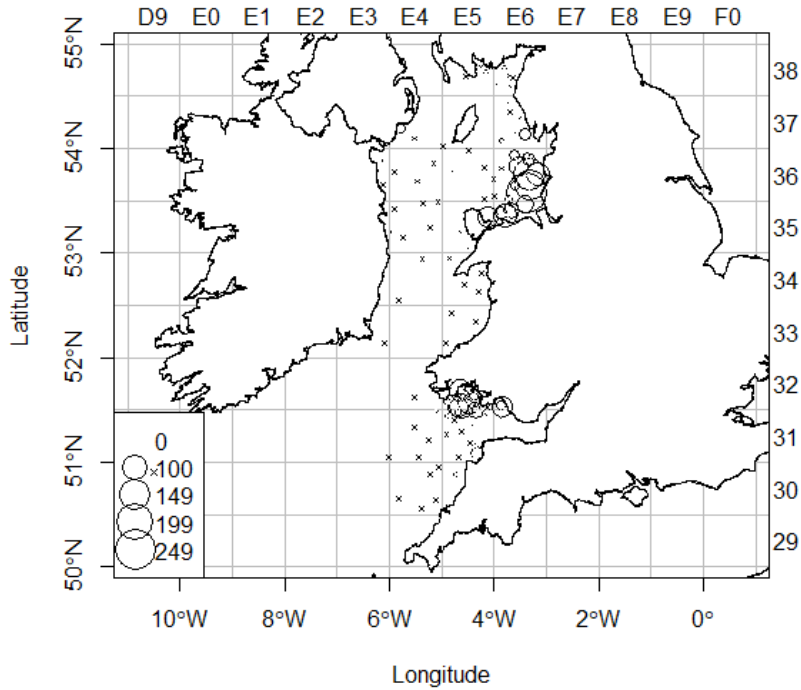


Figure 3: Abundance (number caught per 30-minute tow) of pre-recruit (a) (<21 cm TL) and recruited (b) (≥ 21 cm TL) - plaice.

a)



b)

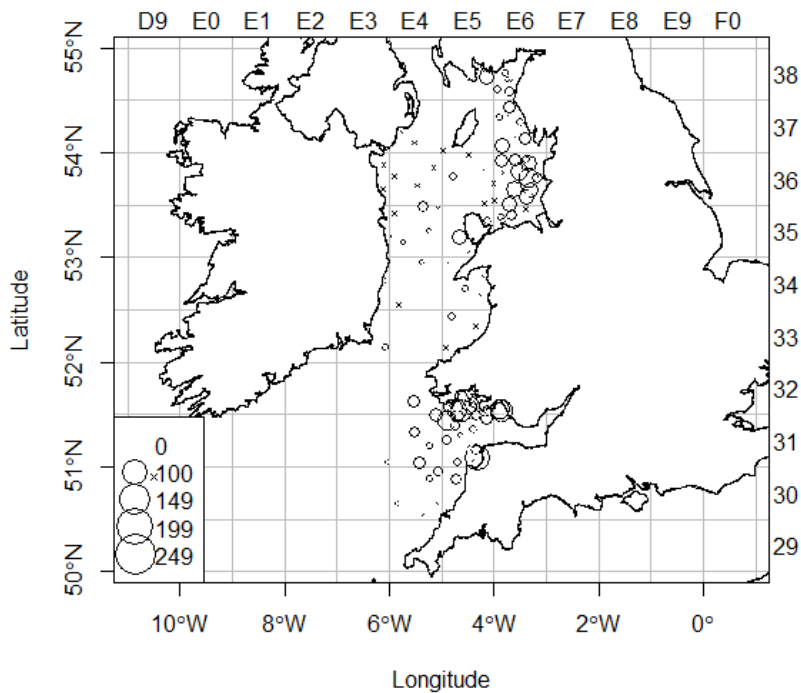
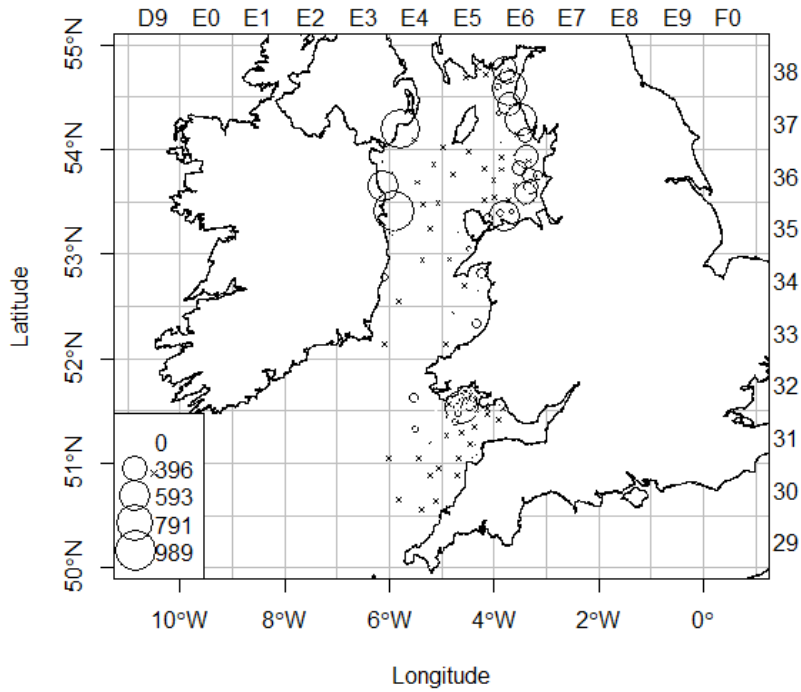


Figure 4: Abundance (number caught per 30-minute tow) of pre-recruit (a) (<21 cm TL) and recruited (b) (≥ 21 cm TL) - sole.

a)



b)

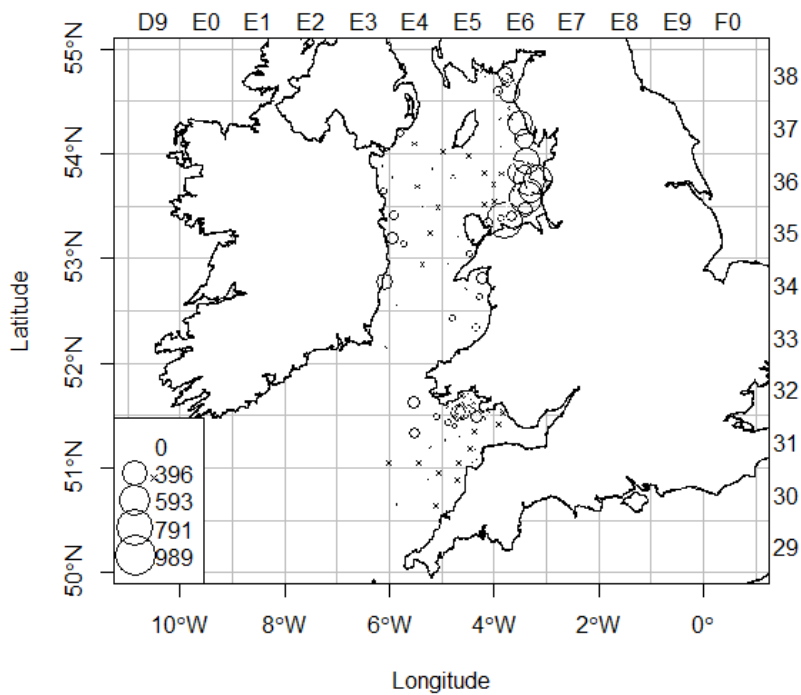
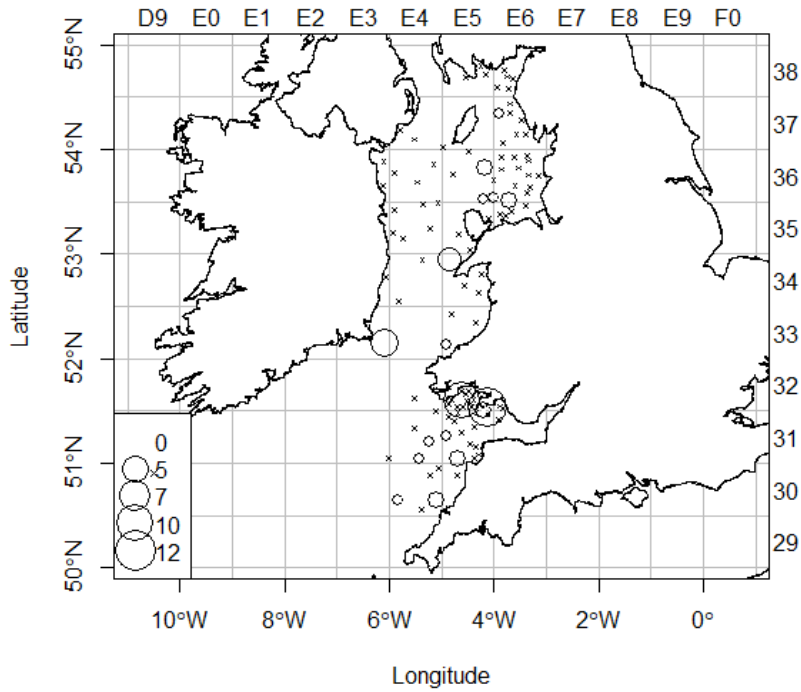


Figure 5: Abundance (number caught per 30-minute tow) of pre-recruit (a) (<16 cm TL) and recruited (b) (≥ 16 cm TL) - dab.

a)



b)

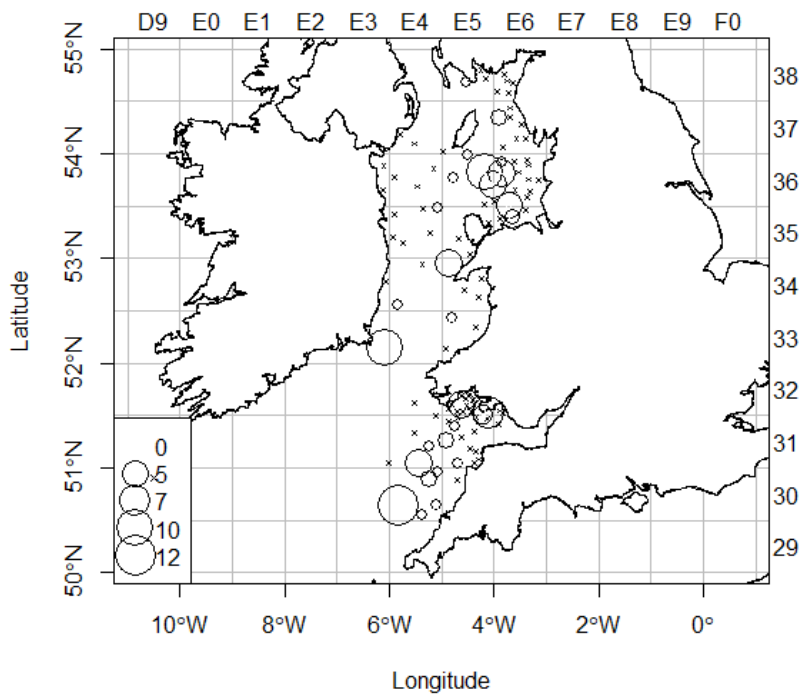


Figure 6: Abundance (number caught per 30-minute tow) of pre-recruit (a) <19 cm TL) and recruited (b) (≥19 cm TL) - lemon sole.

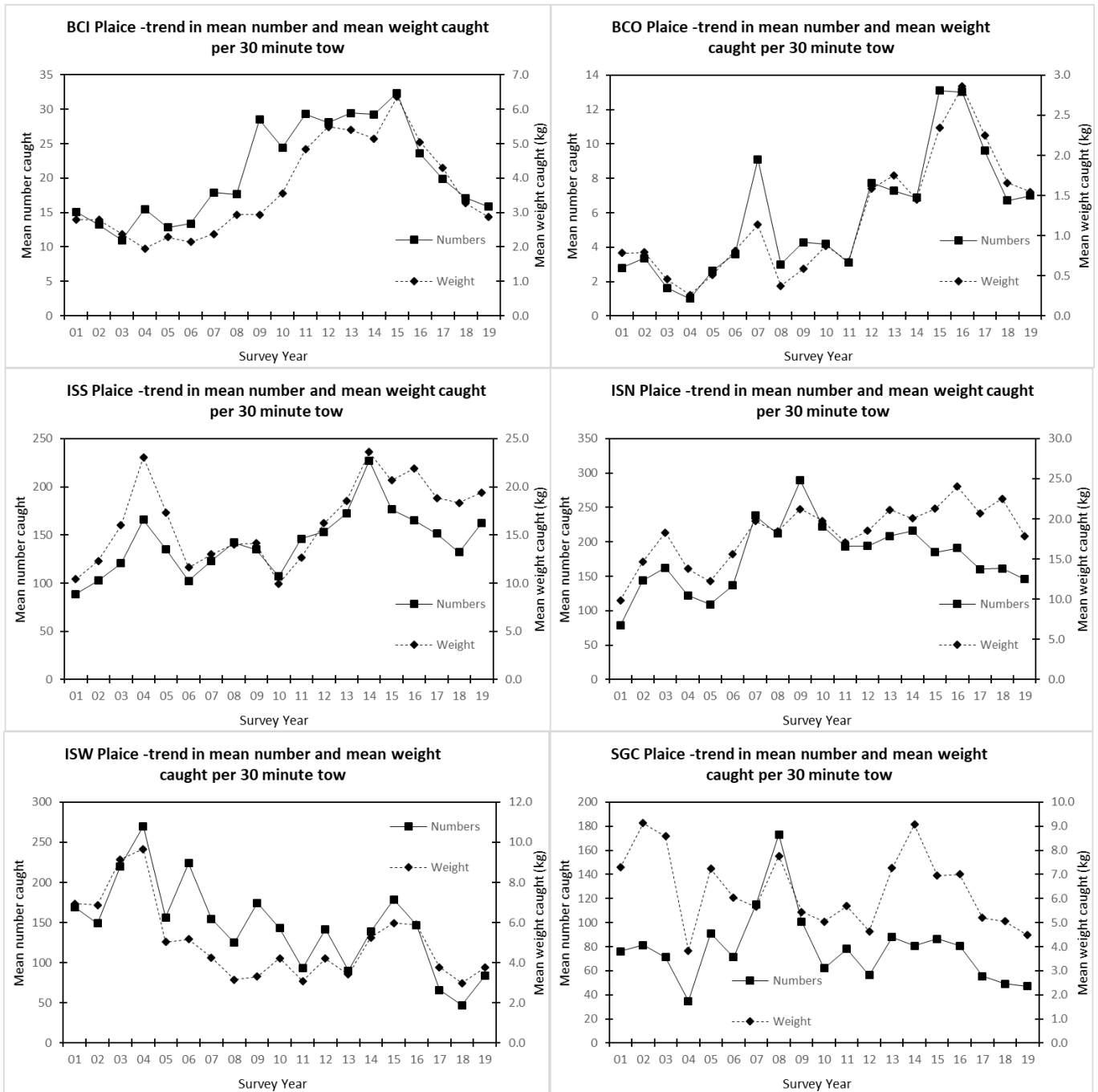


Figure 7: Mean number and weight of plaice caught per 30-minute tow - by survey area

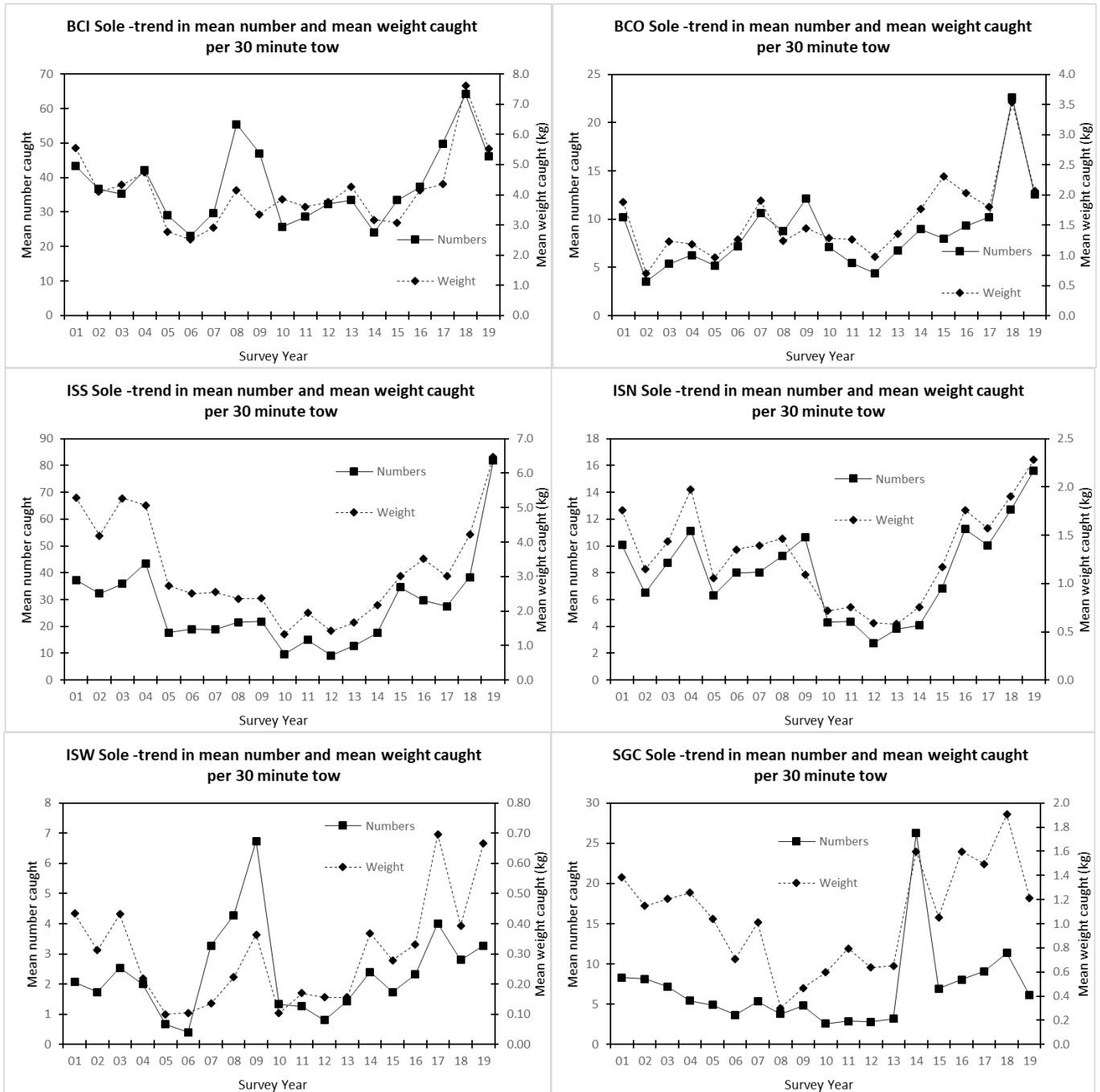


Figure 8: Mean number and weight of sole caught per 30-minute tow - by survey area.

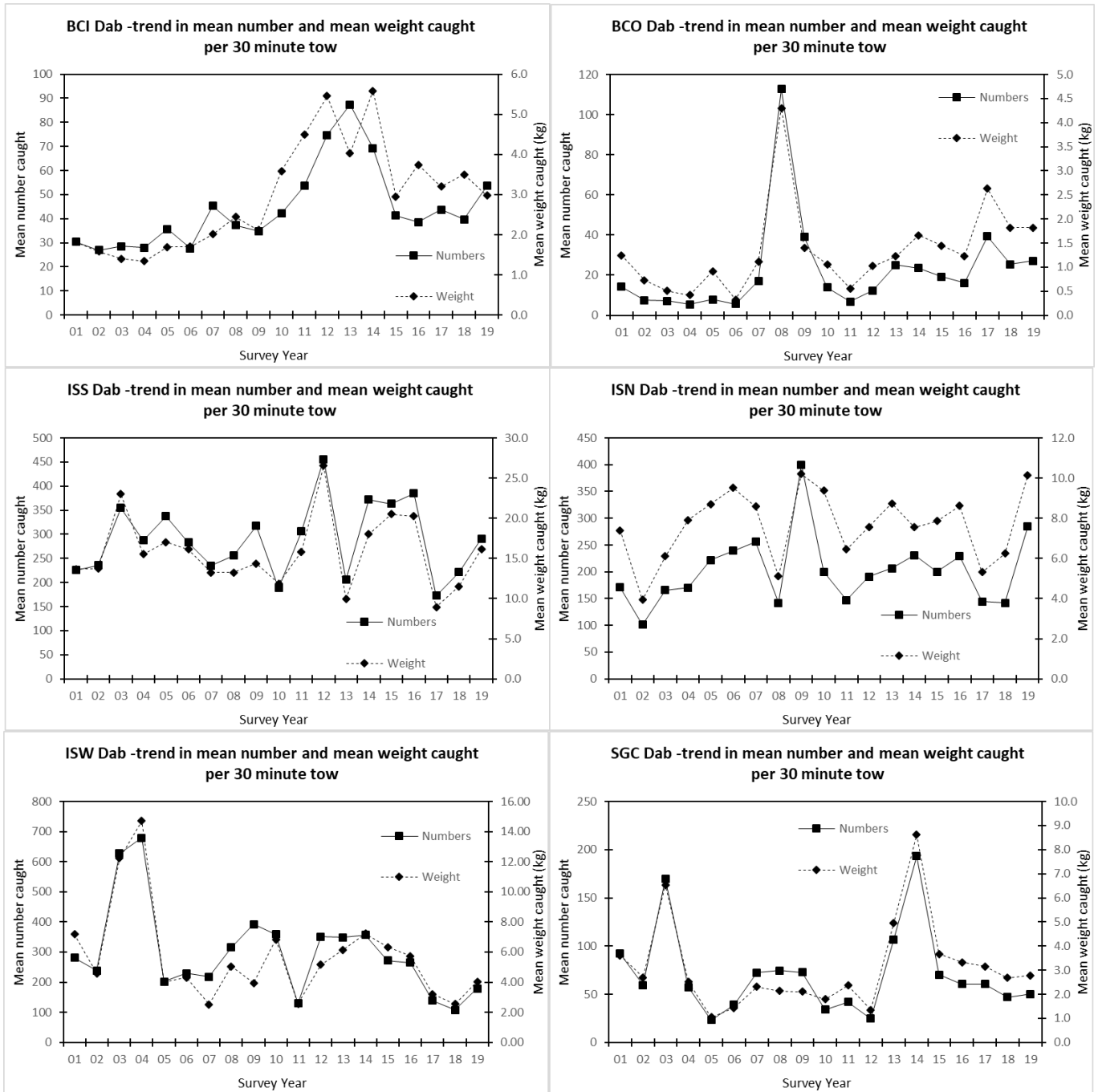


Figure 9: Mean number and weight of dab caught per 30-minute tow - by survey area per 30-minute tow.

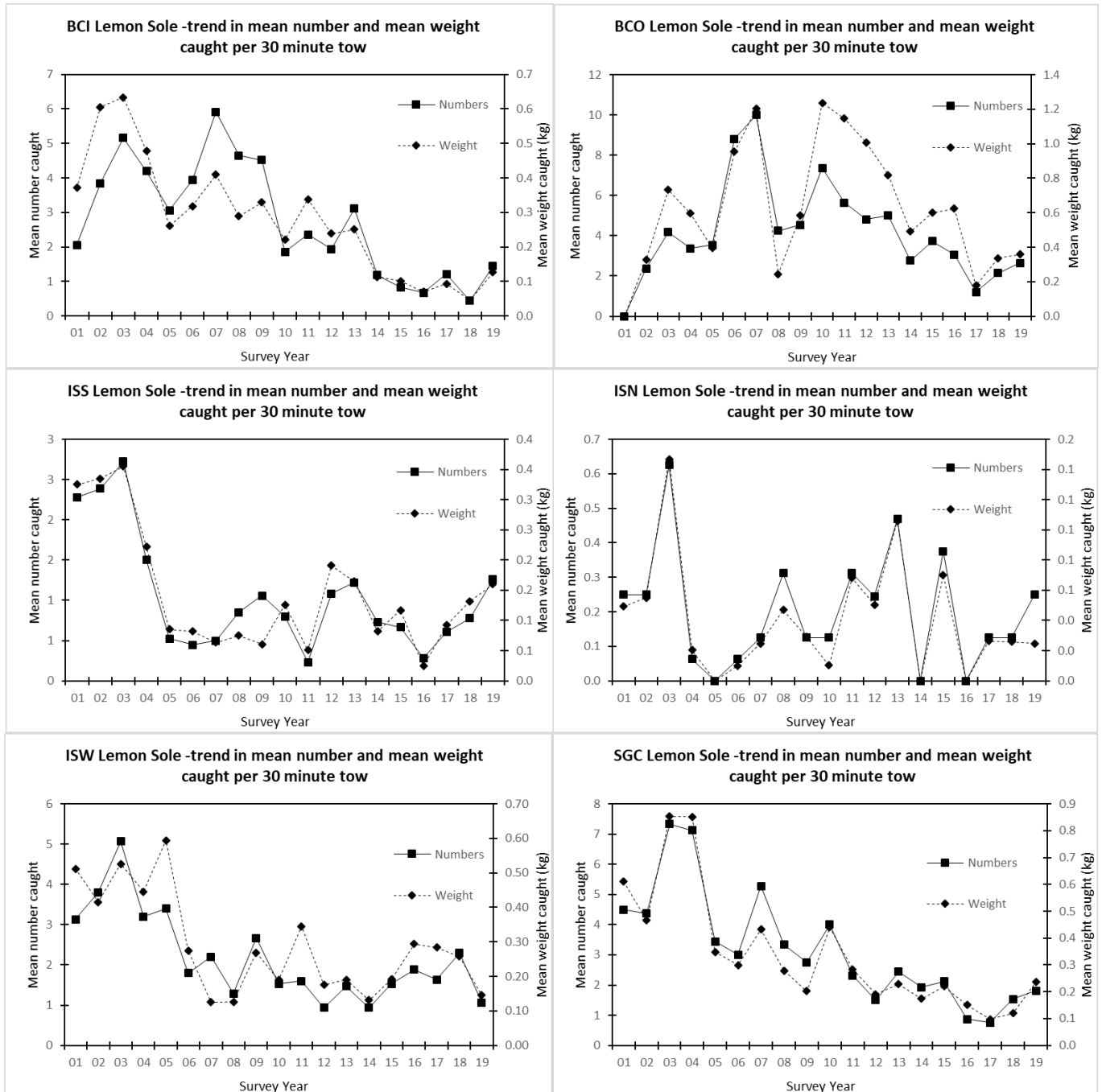


Figure 10: Mean number and weight of lemon sole caught per 30-minute tow - by survey area per 30-minute tow.