THE CENTRE FOR ENVIRONMENT, FISHERIES & AQUACULTURE SCIENCE, LOWESTOFT LABORATORY, LOWESTOFT, SUFFOLK, NR33 0HT.

2016 RESEARCH VESSEL PROGRAMME
REPORT: RV ENDEAVOUR: SURVEY 16/16

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DURATION:
17th July – 30th July 2016

LOCATION:
Eastern English Channel (VIId), Southern North Sea (IVc)

PRIMARY AIMS:

1. To undertake a beam trawl survey in the southern North Sea and eastern Channel as part of an ICES co-ordinated research programme.

2. To obtain fisheries independent data on the distribution and abundance of commercial flatfish species.

3. To collect biological data, including maturity and weight at age of commercial species, to satisfy the requirements of the EU data regulations.

4. To identify the epi-benthos by catch taken in the 4-metre beam trawl and to quantify 12 species as agreed at the Beam Trawl Working Group.

SECONDARY AIMS:

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

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

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

8. To sample litter caught in the beam trawl on every station

OPPORTUNISTIC AIMS:

9. Carry out additional tows to tag and release sole (*Solea solea*) as part of an Ifremer and Agrocampus Ouest project (SMAC). http://wwz.ifremer.fr/smac_eng/The-SMAC-program

10. To tag and release specimens of various commercially exploited skates (*Rajidae*) and other select elasmobranches.

11. Collect specimens of selected species for otolith training of new Cefas market sampling staff

12. To collect length and weight measurements of jellyfish caught and in addition, collect jellyfish 'flesh' samples to allow baseline isotopic signature to be determined in order to compare these with the isotopic signatures of higher trophic level species (K St John Glew – Southampton University)

13. To collect hermits in whelks and freeze (Vladimir Laptikhovsky, Cefas Lowestoft)

14. To collect and freeze Lesser Weevers (*Trachinus vipera*) for a PhD student investigating their biology (Lucy Gorman, Newcastle University)

15. To freeze a variety of fish for a PhD student looking at feeding relationships between fish and jellyfish (Phil Lamb, University of East Anglia)

16. To freeze squid for future work on statolith preparation/ageing (Vladimir Laptikhovsky/Mark Smith/Jo Smith, Cefas Lowestoft)

17. Collection of one water sample per day and one sample 500m from the West Gabbard Smart buoy for chlorophyll analysis (Elisa Cappuzo, Cefas Lowestoft)

18. Carry out additional tows to compare catch rate between 15 and 30 minute tows, using the 4m beam trawl.

NARRATIVE: (ALL TIMES ARE GMT)

The SIC (Joanne Smith), 2IC (Steve Shaw) and Mary Brown travelled from Lowestoft to Portland, joining the Cefas Endeavour (CEND) on the afternoon of 15 July. The following day was spent setting up the EDC kit, testing the new software and unpacking the gear to check that everything was present. The rest of the scientific crew joined the vessel at 1600hrs on 16 July. Vessel safety inductions were given for those needing them at 1800hrs that day.

The vessel sailed from Portland at 0600h on the morning of the 17 July, heading to the first survey station (Prime 44). En-route to this position, the toolbox talk, scientist safety briefing and an emergency muster and lifeboat drill took place.

The survey commenced with a shakedown beam trawl tow (beam number 4) at prime station 44, in the English sector of VIId, east of Portland to fully test the gear deployment and the on-board fish sampling systems. This was followed by the deployment of the ESM2 logger with Niskin bottle. All equipment was working well so the survey continued with the days fishing completing prime stations 43, 45, 47 and 42.

Once the day's fishing was complete CEND steamed east overnight, to begin operations the following morning at prime station 75 and successfully completing eight stations (Primes 75, 80, 74, 73, 64, 63, 65, 66) and one sole tagging tow (Prime 66). The following day seven stations (Primes 60, 62, 61, 94, 67, 58, 59) and two sole tagging tows (Prime 59) were completed. The additional tows were a success with seventy soles tagged within the three tows.

Between the 20 - 21 July, twelve stations were fished for the full 30 minutes, one station (Prime 26) was fished for 20 minutes due to a history of large catches of brittle stars and another (Prime 49) was hauled after 28 minutes to avoid a wreck. Prime 49 was also fished 1.8 NM south of the tow due to static gear.

Fishing continued on the morning of 22 July on prime station 25, completing the English sector of the Channel. Work then began in the French sector, near Barfleur at prime station 10, followed by Primes 8, 9, 12, 6, and 7. Prime 9 was fished for 21 minutes due to static gear on the tow. Prime 7 had a good abundance of sea horses (10), with the birth of young being observed whilst sorting the catch (Figure 2).

Five valid (Prime 4, 1, 11, 21 & 20) and one invalid (Prime 21) fishing stations were successfully fished on 23 July. Prime 21 was invalid due to a large catch of sand, however it was re-fished successfully for 20 minutes. Fishing continued east along the French coast with seven fishing stations (Prime 19, 18, 17, 16, 39, 40 & 38) and one sole tagging tow (Prime 39) completed on the 24 July. Prime station 40 was hauled after 24 minutes because the gear caught on the ground causing a sudden decrease in speed. Once on board the catch was a little larger than normal and contained gravel but the gear was undamaged and the tow was valid.

Fifteen fishing stations were successfully fished between the 25-26 July (Prime 37, 29, 36, 35, 76, 72, 71, 77, 70, 69, 68 & 95), completing the French sector and all core stations in the Channel. Prime stations 37, 29 and 35 were repeated for 15 minutes to make comparison to the standard 30-minute tow, sole caught at these stations were tagged and released by Ifremer staff (Table 7).

Following completion of the stations in the channel CEND steamed overnight to prime station 113, just off the coast of Belgium. Five stations were completed in these waters (113,114,115,116 & 118) before steaming back to prime station 78 in the North Sea. Catch rates of flat fish was up slightly for most species, with plaice showing an increase in numbers at all stations except prime 116. The steam back was used to carry out a working in enclosed space drill.

Work began in the North Sea the following morning (28 July) with completion of seven fishing and one sole tagging station (Primes 78, 79, 119, 96, 97, 82 & 83). Prime station 79 was fished for 20 minutes as it had a history of large catches of rocks. The tow contained a large catch of weed but no rocks and it will be fished for 30 minutes next year. Collection of a water sample near the West Gabbard SMART buoy (Additional aim 17) was carried out in the early hours of 29 July. This was followed by seven fishing and one sole tagging station (Primes 98, 99, 100, 102, 103, 104 & 105), completing the North Sea part of the grid and the entire survey. Prime station 100 was hauled after 28 minutes to avoid a cable at the end of the tow. Fishing was completed by 1400h, whereupon staff took the afternoon/evening to clean up and demob. A pilot boarded at 1645h and CEND docked at 1718h into Lowestoft. All scientific staff stayed aboard overnight, enabling unloading to take place early the following morning.

RESULTS:

Primary aims.

Aim 1.

The survey gear was the standard 4m-beam trawl number 4, with chain mat, flip-up ropes and a 40mm cod-end liner. Beam trawl number 1 was on-board as a spare but not needed during the survey.

A SAIV Micro CTD was attached to the headline on the trawl in order to allow us to record temperature and salinity at each station. In addition, surface and bottom water samples and an ESM2 logger profile was taken twice daily

A typical station consisted of deployment of the 4m beam trawl with mini CTD from the starboard winch. The beam was towed for 30 minutes at a warp ratio of 3.5:1 unless the ground was known to yield an unmanageable by-catch, in which case the warp and tow time were shortened to 3:1 and 20 minutes respectively, or if a strong tide was running in which case the warp ratio was increased to 4:1 to ensure that the gear was settled on the seabed.
All fish and selected commercial shellfish were identified to species, weighed and measured with large catches of an individual species being sub-sampled. 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.

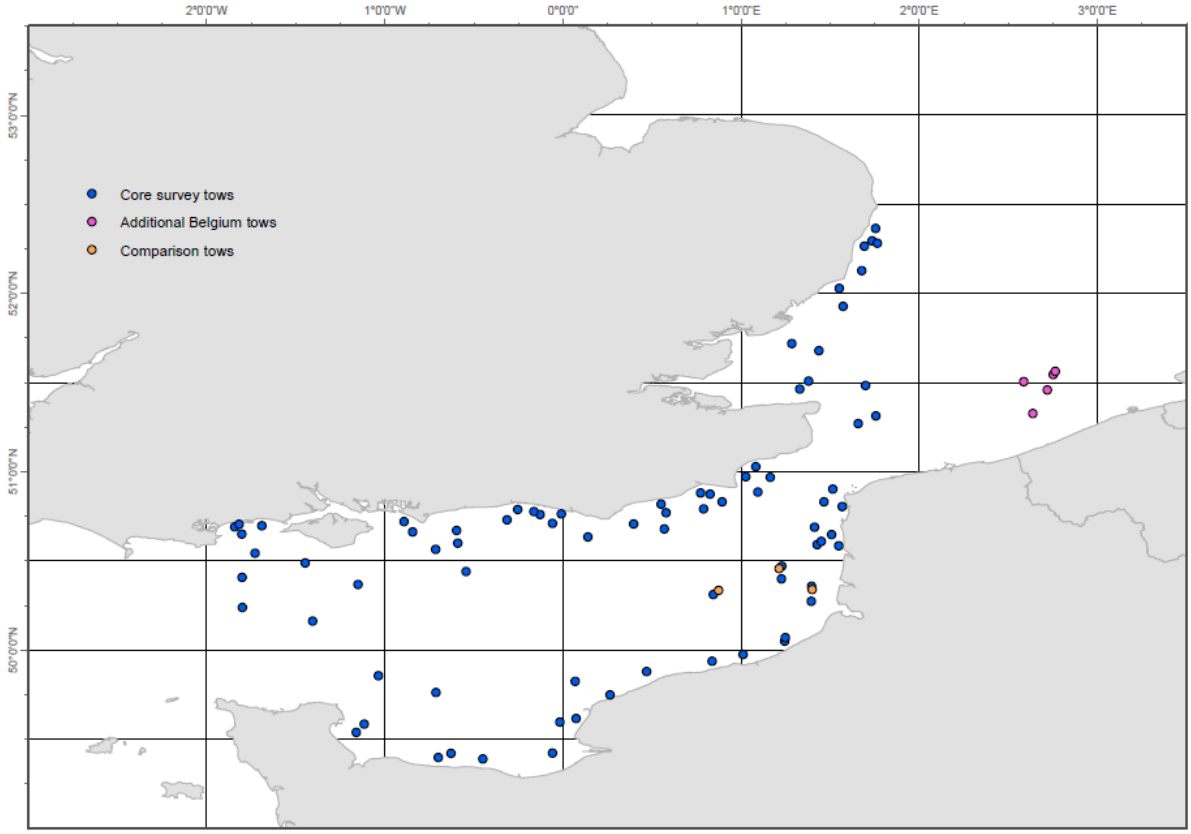
A total number of 4 stations were reduced to 20-24 minute tows due to history of large by-catches or bad ground, 1 tow was reduced to 21 minutes due to static gear and 2 were reduced to 28 minutes due to a cable (Prime 100) and wreck (Prime 49) at the end of the tow.

Figure 1 shows the beam trawl station positions on the survey and Table 1 shows the number of gear deployments undertaken on the survey.

Table 1 The number of valid and invalid tows fished during the survey.

Region	Valid 30 minutes	Valid Tows under 30 minutes	Invalid	Abandoned due to static gear	Total Valid tows
VIId (English)	34	1	0	0	35
VIId (French)	27	3	1	0	29
IVc	12	2	0	0	14
Total	73	6	1	0	79

Figure 1 Core & additional stations fished during 2016 survey



Aims 2 & 3.

All otolithed fish were measured to the whole cm below, weighed individually, sexed and given a sexual maturity code. Table 2 shows the numbers of otoliths collected for the main commercial fish species. All non-commercial finfish by-catch caught were identified to species level, weighed and measured. In addition, the following shellfish and cephalopods were also weighed and measured whenever they were present in the catch, cuttlefish (*Sepia officinalis*), *Alloteuthis spp, Loligo spp,* edible crab (*Cancer pagurus*), lobster (*Homarus gammarus*), scallops (*Pecten maximus*), oysters (*Ostrea edulis*), velvet swimming crab (*Necora puber*), crawfish (*Palinurus elephas)* and spider crab (*Maia squinado*). Queen scallops (*Aequipecten opercularis*) and Octopus (*Octopodidae)* were weighed and counted.

The numbers of individual fish measured this year for the main commercial species can be seen in Table 3 and the total catch weight of the main commercial species can be seen in Table 4. In total, 213 different species were recorded. Table 6 shows the number of stations each species was observed.

Table 2 Otoliths collected from the main commercial species by strata.

Region	Brill	Cod	Dab	Flounder	Lemon sole	Plaice	Sole	Whiting	Turbot
VIId English	4	0	36	13	24	967	155	31	7
VIId French	12	0	48	53	34	837	152	43	11
North Sea (IVc)	4	0	47	26	19	72	181	11	6
Total	20	0	131	92	77	1876	488	85	24

Table 3 Number of fish measured from the main commercial species by strata.

Region	Brill	Cod	Dab	Flounder	Lemon sole	Plaice	Sole	Whiting	Turbot
VIId English	4	0	120	14	28	2014	575	34	7
VIId French	12	0	594	63	49	2897	483	118	14
North Sea (IVc)	4	0	214	48	30	83	656	65	6
Total	20	0	928	125	107	4994	1714	217	27

Table 4 Comparison of catch weight (kg) for the main commercial species over the last 13 surveys (2004-2016).

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Brill	14	9	6	22	13	9	14	26	3	16	10	14	10
Cod	26	1	10	28	43	28	0	4	13	2	16	13	0
Cuttlefish	247	140	198	165	103	94	132	66	109	57	48	35	101
Dab	107	39	60	75	88	139	86	111	61	107	87	73	70
Bass	2	3	7	3	10	11	3	13	3	3	9	2	7
Flounder	32	47	62	31	44	100	27	47	34	35	72	17	29
Lemon	45	39	27	16	56	39	18	66	49	38	38	24	18
Plaice	418	317	358	531	500	612	662	882	679	790	1238	1042	975
Sole	248	160	228	213	192	341	188	172	144	169	235	171	183
Turbot	12	13	6	12	9	6	18	24	16	10	9	15	17
Whiting	69	13	8	13	56	37	28	30	17	20	30	89	24

Table 5 Comparison of catch numbers for the main commercial species over the last 13 surveys (2004-2016).

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Brill	26	10	20	51	26	19	32	41	8	25	31	32	20
Cod	28	5	236	43	77	17	2	11	10	7	43	8	0
Cuttlefish	1150	704	1025	635	528	509	769	401	623	404	214	91	526
Dab	2005	600	2032	1081	1379	2636	1359	1929	897	1484	1684	1183	954
Bass	2	2	10	4	12	15	6	9	4	4	9	2	3
Flounder	171	143	178	90	118	276	103	166	119	118	262	72	127
Lemon	278	187	139	147	299	162	166	379	262	222	258	171	119
Plaice	2139	1232	1475	2040	2210	2726	3043	4723	3054	3778	7197	5635	5137
Sole	2305	1910	2555	1734	1678	2842	1755	1828	1347	1522	2084	2229	1770
Turbot	15	19	15	17	12	15	18	43	16	20	18	23	27
Whiting	1371	287	320	294	831	355	576	425	195	600	388	1201	239

Table 6: List of species caught during the survey and number of stations at which they were recorded.

Species	***No of stations caught***	*Species*	***No of stations caught***
ABRA ALBA	*1*	*ACANTHOCARDIA ECHINATA*	*4*
ACANTHOCHITONA CRINATUS	*2*	*AEQUIPECTEN OPERCULARIS*	*30*
AGONUS CATAPHRACTUS	*31*	*ALCYONIDIUM DIAPHANUM*	*65*
ALCYONIUM DIGITATUM	*46*	*ALCYONIUM GLOMERATUM*	*1*
AMMODYTES TOBIANUS	*1*	*AMMODYTIDAE*	*2*
ANEMONE UNIDENTIFIED	*34*	*ANSEROPODA PLACENTA*	*11*
ANTEDON BIFIDA	*1*	*APHRODITE ACULEATA*	*29*
ARCHIDORIS PSEUDOARGUS	*17*	*ARNOGLOSSUS LATERNA*	*29*
ASCIDIA CONCHILEGA	*1*	*ASCIDIACEA*	*34*
ASPITRIGLA (CHELIDONICHTHYS) CUCULUS	*27*	*ASSORTED ROCKS*	*52*
ASTERIAS RUBENS	*72*	*ASTROPECTEN IRREGULARIS*	*2*
ATELYCYCLUS ROTUNDATUS	*5*	*BLENNIUS OCELLARIS*	*6*
BOTRYLLOIDES LEACHI	*1*	*BOTRYLLUS SCHLOSSERI*	*13*
BRISSOPSIS LYRIFERA	*1*	*BROKEN SHELL*	*11*
BUCCINUM UNDATUM	*28*	*BUENIA JEFFREYSII*	*6*
BUGLOSSIDIUM LUTEUM	*35*	*CALLIONYMUS LYRA*	*52*
CALLIONYMUS MACULATUS	*1*	*CALLIONYMUS RETICULATUS*	*2*
CALLIOSTOMA ZIZYPHINUM	*1*	*CANCER PAGURUS*	*43*
CARCINUS MAENAS	*1*	*CELLARIIDAE*	*3*
CHAETOPTERUS TUBES	*25*	*CHAETOPTERUS VARIOPEDATUS*	*1*
CHLAMYS VARIA	*7*	*CHLOROPHYCEAE*	*2*
CIROLANA CRANCHII	*1*	*CLIONA CELATA*	*5*
CLUPEA HARENGUS	*1*	*CLUPEIDAE*	*3*
CRANGON ALLMANNI	*1*	*CRANGON CRANGON*	*7*
CRANGONIDAE	*4*	*CREPIDULA FORNICATA*	*11*
CROSSASTER PAPPOSUS	*17*	*CTENOLABRUS RUPESTRIS*	*3*
CUTTLE EGGS	*31*	*DICENTRARCHUS LABRAX*	*3*
DIPLECOGASTER BIMACULATA	*2*	*DOGFISH EGG CASES*	*15*
DROMIA PERSONATA	*9*	*EBALIA SPP*	*2*
EBALIA TUBEROSA	*1*	*ECHIICHTHYS (TRACHINUS) VIPERA*	*22*
ECHINOCARDIUM SPP	*8*	*ECHINUS ELEGANS*	*1*
ELEDONE CIRRHOSA	*2*	*EPIBENTHIC MIXTURE*	*63*
EUPAGURUS / PAGURUS IN ADAMSIA	*11*	*EUPAGURUS / PAGURUS IN BUCCINUM*	*32*
EUPAGURUS / PAGURUS IN SUBERITES	*6*	*EURYNOME ASPERSA*	*2*
EUSPIRA PULCHELLA	*1*	*EUTRIGLA (CHELIDONICTHYS) GURNARDUS*	*14*
FILOGRANA IMPLEXA	*5*	*FLUSTRA FOLIACEA*	*41*
FUCUS SPP	*25*	*GAIDROPSARUS SPP*	*2*
GAIDROPSARUS VULGARIS	*2*	*GALATHEA SPP*	*5*
GALEORHINUS GALEUS	*1*	*GARI FERVENSIS*	*1*
GASTROPOD EGGS	*9*	*GLYCYMERIS GLYCYMERIS*	*5*
GOBIUS GASTEVENI	*3*	*GOBIUS NIGER*	*7*
GOBIUS PAGANELLUS	*3*	*GONEPLAX RHOMBOIDES*	*1*
GRAVEL	*1*	*HALICHONDRIA PANICEA*	*1*
HENRICIA OCULATA	*7*	*HINIA (NASSARIUS) RETICULATUA*	*4*
HIPPOCAMPUS HIPPOCAMPUS	*6*	*HIPPOCAMPUS RAMULOSUS (H. GUTTULATUS)*	*2*
HOLOTHUROIDEA	*9*	*HOMARUS GAMMARUS*	*10*
HYALINOECIA TUBICOLA	*1*	*HYAS COARCTATUS*	*8*
HYDRALLMANIA FALCATA	*11*	*HYDROIDA (order)*	*40*
HYPEROPLUS LANCEOLATUS	*3*	*INACHUS DORSETTENSIS*	*9*
Inachus spp	*19*	*LABRUS BERGYLTA*	*2*
LABRUS MIXTUS (L. BIMACULATUS)	*1*	*LAETMONICE (HERMIONE) HISTRIX*	*1*
LAMINARIA SPP	*11*	*LEPADIDAE*	*2*
LIMANDA LIMANDA	*51*	*LIOCARCINUS DEPURATOR*	*18*
LIOCARCINUS MARMOREUS	*1*	*LIOCARCINUS PUSILLUS*	*2*
LOLIGINIDAE	*1*	*LOLIGO (ALLOTEUTHIS) SUBULATA*	*34*
LOPHIUS PISCATORIUS	*4*	*LUTRARIA LUTRARIA*	*2*
Macropodia spp	*13*	*MACROPODIA TENUIROSTRIS*	*19*
Maja squinado	*62*	*MAJIDAE*	*1*
MERLANGIUS MERLANGUS	*24*	*METRIDIUM SENILE*	*9*
MICROCHIRUS VARIEGATUS	*9*	*MICROSTOMUS KITT*	*22*
MOLGULIDAE	*4*	*MOLLUSCA-BIVALVIA*	*7*
MUSTELUS ASTERIAS	*15*	*MYOXOCEPHALUS SCORPIUS*	*3*
MYTILUS EDULIS	*4*	*MYTYLIDAE (MOLLUSCA)*	*2*
NECORA PUBER	*45*	*NEMERTESIA ANTENNINA*	*29*

NEMERTESIA RAMOSA	*6*	*NEMERTESIA SPP*	*1*
NUDIBRANCHIA	*1O*	*PHIOTHRIX FRAGILIS 1*	*9*
OPHIURA ALBIDA	*16*	*OPHIURA OPHIURA*	*32*
OSTREA EDULIS	*6*	*PACHYMATISMA JOHNSTONIA*	*10*
PAGURIDAE	*5*	*PAGURUS BERNHARDUS*	*3*
PALAEMON SERRATUS	*1*	*PANDALUS MONTAGUI*	*8*
PECTEN MAXIMUS	*14*	*PEGUSA (SOLEA) LASCARIS*	*19*
PENTAPORA FOLIACEA	*9*	*PHAEOPHYCEAE*	*34*
PHILINE APERTA	*3*	*PHOLIS GUNNELLUS*	*2*
PILUMNUS HIRTELLUS	*10*	*PISA ARMATA*	*13*
PISA TETRAODON	*1*	*PISIDIA LONGGICORNIS*	*14*
PLATICHTHYS FLESUS	*18*	*PLEURONECTES PLATESSA*	*72*
POLYBIUS (LIOCARCINUS) HOLSATUS	*42*	*POLYCHAETA*	*4*
POLYCLINIDAE	*1*	*POLYMASTIIDAE*	*5*
POMATOSCHISTUS MINUTUS	*1*	*POMATOSCHISTUS SPP*	*13*
PORANIOMORPHA HISPIDA	*2*	*PORIFERA*	*30*
PRIAPULUS CAUDATUS	*1*	*PSAMMECHINUS MILIARIS*	*40*
RAJA BRACHYURA	*7*	*RAJA CLAVATA*	*57*
RAJA MICROOCELLATA	*3*	*RAJA MONTAGUI*	*18*
RAJA UNDULATA	*7*	*RHODOPHYCEAE*	*10*
RISSOIDES (MEIOSQUILLA) DESMARESTI	*2*	*ROSSIA MACROSOMA*	*1*
SABELLARIA SPINULOSA	*3*	*SCAPHANDER LIGNARIUS*	*1*
SCOMBER SCOMBRUS	*1*	*SCOPHTHALMUS MAXIMUS (PSETTA MAXIMA)*	*17*
SCOPHTHALMUS RHOMBUS	*10*	*SCYLIORHINUS CANICULA*	*42*
SECURIFLUSTRA SECURIFRONS	*1*	*SEPIA OFFICINALIS*	*44*
SEPIA ORBIGNYANA	*14*	*SEPIOLA ATLANTICA*	*8*
SERPULA VERMICULARIS	*1*	*SIPUNCULIDAE*	*2*
SOLEA SOLEA	*62*	*SPATANGUS PURPUREUS*	*3*
SPONDYLIOSOMA CANTHARUS	*10*	*SQUID EGGS*	*2*
STICHASTRELLA ROSEA	*1*	*STYELA CLAVA*	*14*
SUBERITES SPP	*8*	*SYMPHODUS (CRENILABRUS) BALLONI*	*2*
SYNGNATHUS ACUS	*3*	*TAURULUS BUBALIS*	*1*
TETHYA AURANTIA	*17*	*TRACHINUS DRACO*	*5*
TRACHURUS TRACHURUS	*7*	*TRIGLA (CHELIDONICHTHYS) LUCERNA*	*30*
LASTOVIZA	*11*	*TRISOPTERUS LUSCUS*	*37*
TRISOPTERUS MINUTUS	*25*	*TRITONIA HOMBERGI*	*6*
TUBULARIA SPP	*6*	*ULVA LACTUCA*	*20*
UPOGEBIA SPP	*3*	*URTICINA (TEALIA) FELINA*	*10*
WHELK EGGS	*9*	*XANTHID CRAB*	*2*
XANTHO PILIPES	*2*	*ZEUGOPTERUS (PHRYNORHOMBUS) REGIUS*	*6*
ZEUGOPTERUS PUNCTATUS	*2*	*ZEUS FABER*	*6*

Plaice

Overall catch numbers (975) and weight (5137 kg) of plaice were slightly lower than in 2015 (1042 & 5635 kg) (Table 4 & 5), with catch weights lower in the English VIId (15%) sector but higher in both the French VIId sector (5%) and the Southern North Sea (42%) (Figure 11). However, both catch numbers and weight were higher than the average (692 & 3415 kg) for the past 13 years catch. Recruited plaice were most abundant off Hastings, Brighton (VIId English sector) & Dieppe, Boulogne (VIId French sector) (Figure 5). Pre-recruit plaice (<21cm) were most abundant off Dieppe and Boulogne (VIId French sector) (Figure 7). Recruited plaice (≥21cm) were most abundant off Brighton, Hasting (VIId English sector) and off Boulogne and Le Havre (VIId French sector) (Figure 7).

Sole

Catch numbers of sole were 7 % higher this year (183) compared to 2015 (171) (Table 4), however, catch weight was 21 % lower (1770 kg) compared to 2015 (2229 kg) (Table 5).Both catch weight and numbers in 2016 were slightly lower than the average historic catch rate (203 & 1966 kg). There was a decrease in sole catch numbers (17%) and weights (44%) in the North

Sea compared to the previous year. Recruited sole (≥21cm) were most abundant off Boulogne (VIId French sector) and Harwich (Southern North Sea) (Figure 6). Pre - recruited sole (<21cm) were most abundant off Boulogne (VIId French sector), with unusually large catches between Folkestone to Brighton (VIId English sector) (Figure 8).

Other species

Catches of whiting, cod, dab, brill, lemon sole were low this year, however there was an increase in the number of flounder (71%) and turbot (13%) caught compared to 2015 (Table 4 & 5). Both lemon sole and dab were mainly seen east of the channel and into the southern North sea. Lemon sole distribution was highest along the Calais/Bolougne coast (Figure 10), however the distribution of dab was higher off Folkstone (Figure 9). Cod catches were particularly poor this year with no recordings in any of the three areas. There were noticeably higher numbers of seahorses caught this year (28) compared to 2015 (5) and a rare sighting of a live seahorse birth (*Hippocampus hippocampus*) (Figure 2). Distribution of this species seemed to be spread along the French coast rather than the usual location around prime station 71.

Figure 2 Image of seahorse birth (*Hippocampus hippocampus*)

Aim 4:

On certain specified stations a full benthic sort was carried out to identify the numbers and weights of species encountered. In addition, on all other stations benthos observed was recorded by species or other taxonomic grouping. There were 9 sentinel species that if encountered at any time on any tow, were removed and quantified with Ross Coral (*Pentapora foliacea*); *Sabelleria spinulosa*; sponge crab (*Dromia personate)* and mantis shrimps (*Meiosquilla desmaresti*) being encountered. All 12 full benthic stations in VIId and 3 in IVc were sampled successfully.

Secondary aims

Aim 5

Depth, conductivity and temperature profiles were successfully taken at 98 trawl stations. In addition, surface and near-bottom water samples taken using a Niskin with ESM2 logger at 26 locations.

Aim 6

Salinity, temperature, fluorometry and other environmental data was continuously logged using the 'Ferrybox'.

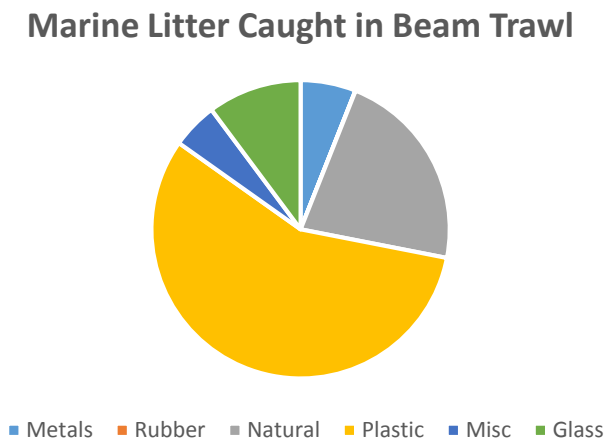
Aim 7

An observer (SEAWATCH) was on board to record details of surface sightings of any marine mammals, sea turtles and large pelagic fish. A small pod (3) of porpoises were spotted around the Thanet Offshore Wind Farm.

Aim 8

Litter was collected and recorded in line with the protocol provided at every valid beam trawl station. The pie chart below (Figure 3) shows the relative commonality of the main types of litter encountered.

Figure 3 Percentage of marine litter collected in the beam trawl



Aim 9

Additional tows with the 4m beam trawl were carried out in order to tag and release sole (*Solea solea*) as part of an Ifremer and Agrocampus Ouest project (SMAC). Two colleagues from Ifremer joined the survey and were able to tag and release a total of 328 sole (Table 7)

Figure 4 Map of position of tagged sole by Ifremer

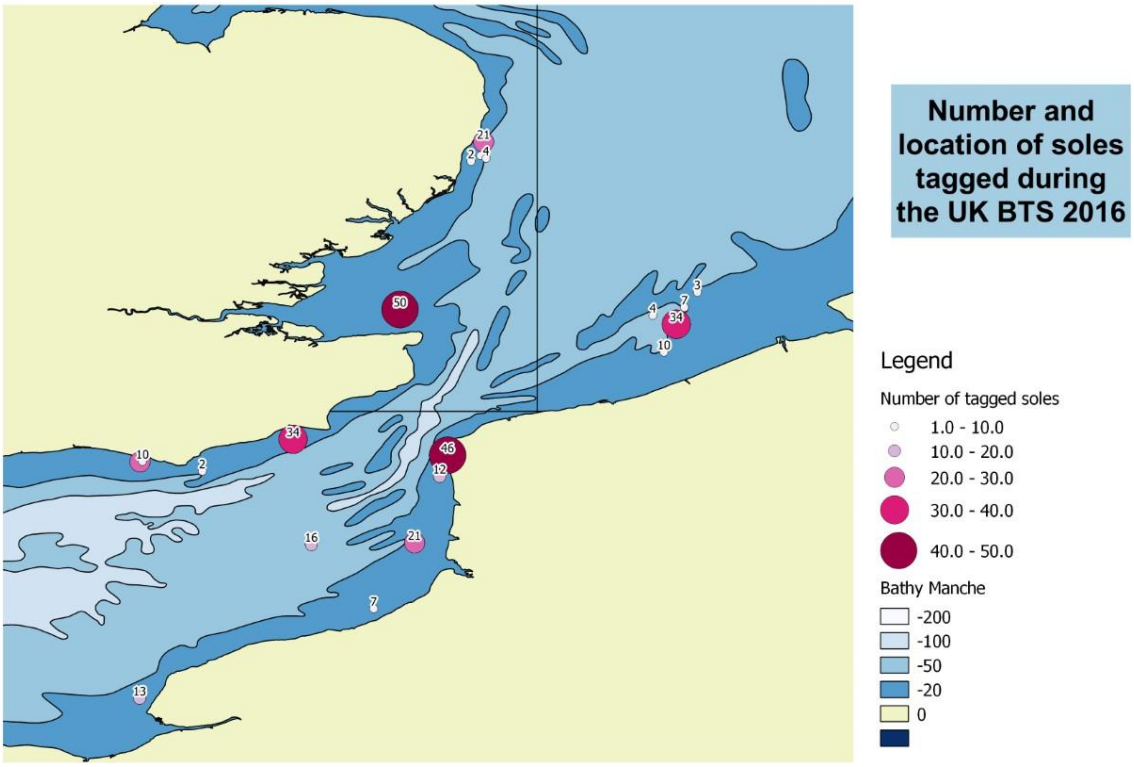


Table 7 Summary of sole tagging work, showing numbers tagged/released by fishing station.

Date	Station	lat_catch	long_catch	lat_release	long_release	number
18/07/2016	18	50.863	0.795	50.744	0.630	34
19/07/2016	24	50.705	0.346	50.650	0.230	2
19/07/2016	29	50.752	0.038	50.758	-0.042	24
19/07/2016	30	50.754	0.051	50.758	-0.042	10
23/07/2016	66	49.585	0.037	49.611	0.067	13
24/07/2016	78	50.027	1.193	50.094	1.322	7
25/07/2016	84	50.352	1.395	50.336	0.874	21
25/07/2016	86	50.343	0.885	50.396	1.207	16
26/07/2016	96	50.679	1.519	50.645	1.475	12
26/07/2016	104	50.784	1.558	50.870	1.546	46
27/07/2016	107	51.293	2.627	51.430	2.688	10
27/07/2016	108	51.430	2.688	51.472	2.596	34
27/07/2016	109	51.474	2.572	51.506	2.676	4
27/07/2016	110	51.513	2.728	51.559	2.761	7
27/07/2016	111	51.588	2.792	51.559	2.761	3
28/07/2016	118	51.453	1.280	51.503	1.328	1
28/07/2016	121	51.503	1.323	51.637	1.371	50
29/07/2016	130	52.234	1.674	52.302	1.736	2
29/07/2016	131	52.262	1.721	52.249	1.748	7
29/07/2016	132	52.249	1.748	52.320	1.762	4
29/07/2016	134	52.330	1.736	52.335	1.791	21

Aim 10

Three Undulate rays (*Raja Undulata*) and six Starry smooth hounds (*Mustelus Asterias*) were tagged and released.

Aim 11

A variety of fish were frozen for otolith extraction technique training of new market sampling staff.

Aim 12

A PhD student from Southampton University joined the survey to collect length and weight measurements of jellyfish caught and in addition, collect jellyfish 'flesh' samples to allow baseline isotopic signature to be determined in order to compare these with the isotopic signatures of higher trophic level species (Table 8)

Table 8 Summary of jellyfish and fish sampled by PhD student Katie St John Glew.

Species	Muscle	Section	Whole specimen	Total
Barrel jellyfish		1		1
Blue Jellyfish			28	28
Compass jellyfish			64	64
Crystal jellyfish			22	22
Cyanea Sp. Jellyfish			3	3
Lion's Mane jellyfish			13	13
Moon jellyfish			12	12
Dab	20			20
Plaice	40			40
Whiting	15			15
Grand Total	**75**	**1**	**142**	**218**

Aim 13

Hermits in whelks were collected and frozen (Vladimir Laptikhovsky, Cefas Lowestoft)

Aim 14

Weevers (*Trachinus vipera*) were frozen for a PHD student investigating their biology (Lucy Gorman, Newcastle University)

Aim 15

A variety of fish were frozen for a PHD student looking at feeding relationships between fish and jellyfish (Phil Lamb, UEA) http://tinyurl.com/enveastpdl

Aim 16

All squid were frozen for future work on statolith preparation/ageing (Vladimir Laptikhovsky/Mark Smith/Jo Smith, Cefas Lowestoft)

Aim 17

One water sample was collected per day and one 500m from the West Gabbard Smart buoy for chlorophyll analysis (Elisa Cappuzo, Cefas Lowestoft)

Aim 18

Additional tows were carried out on three prime stations (Prime 37, 29 & 35) to compare catch rate between 15 and 30 minute tows.

Acknowledgements

As SIC of this survey I would like to offer my sincere thanks to the officers and crew of the Cefas Endeavour for their support and expertise throughout the course of the survey, without which it would not have been possible to achieve the survey aims. I would also like to thank everyone on board for creating a welcoming and happy atmosphere aboard the vessel and always being prepared to go the extra mile.

J Smith (SIC)
20/8/2016

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Figure 5 Abundance (number caught per 30 minute tow) of recruited (≥21 cm TL) plaice

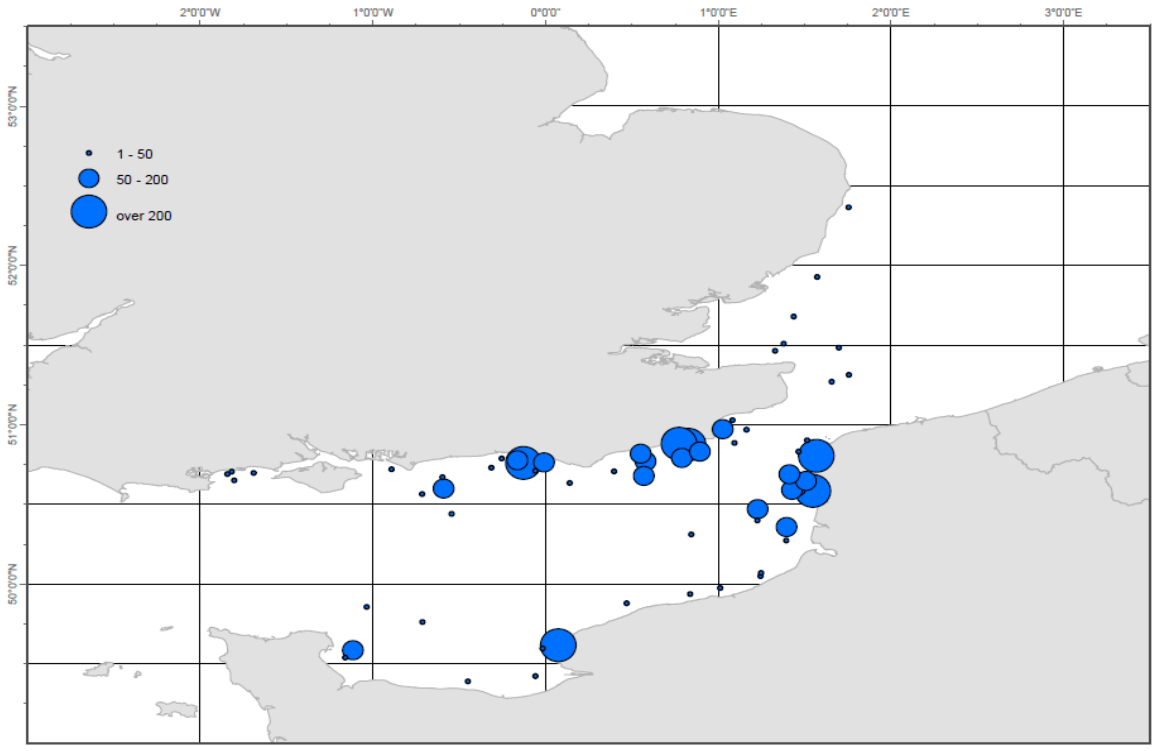


Figure 6 Abundance (number caught per 30 minute tow) of recruited (≥21 cm TL) sole

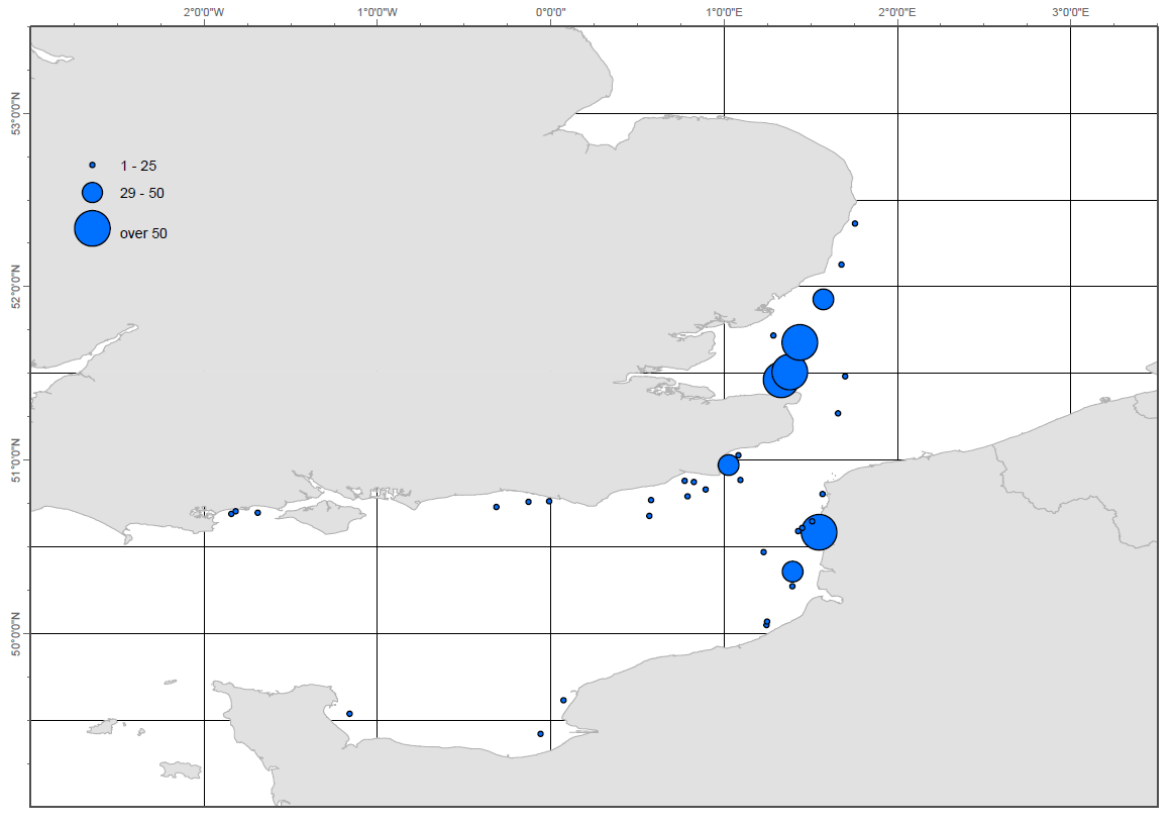


Figure 7 Abundance (number caught per 30 minute tow) of pre-recruit (<21 cm TL) plaice

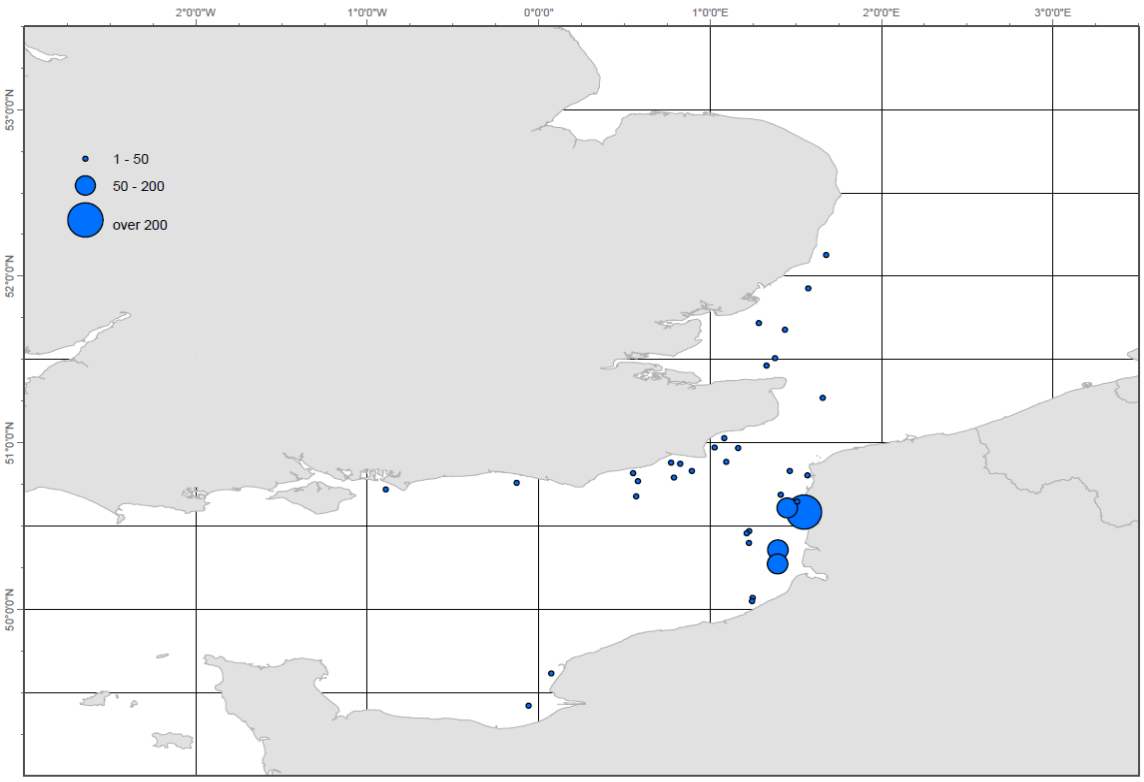


Figure 8 Abundance (number caught per 30 minute tow) of pre-recruit (<21 cm TL) sole

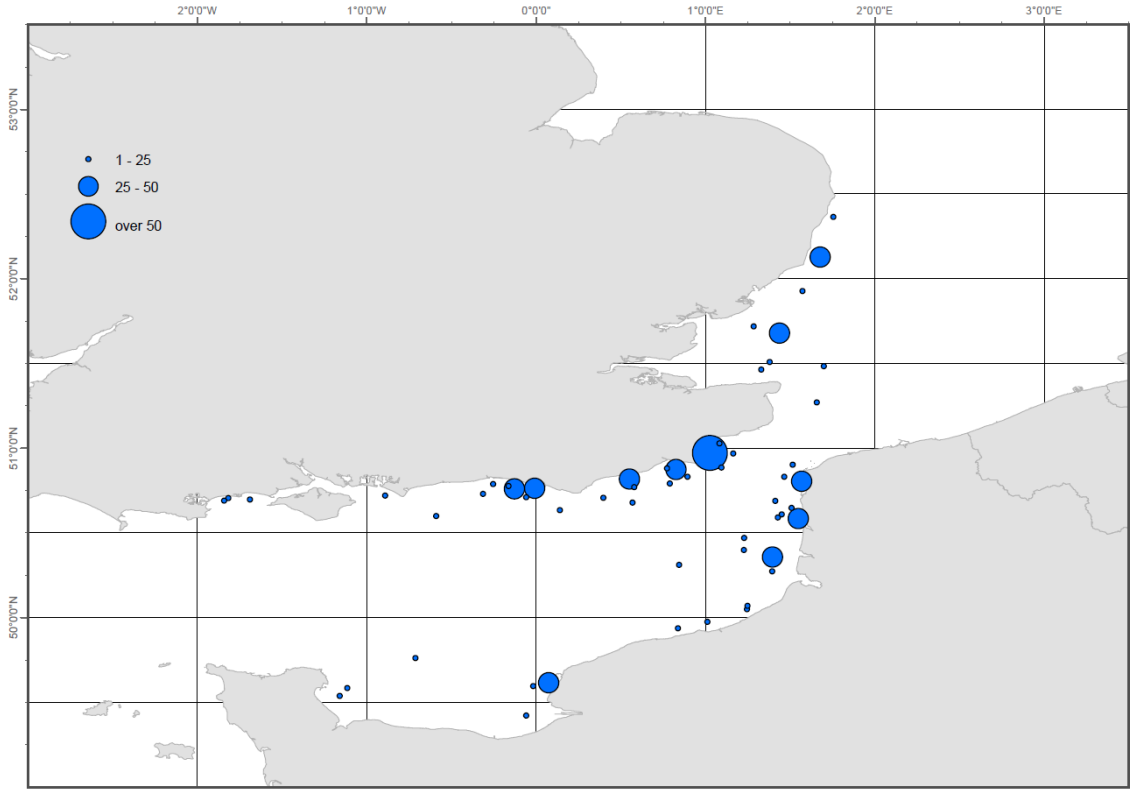


Figure 9 Abundance (number caught per 30 minute tow) of Dab

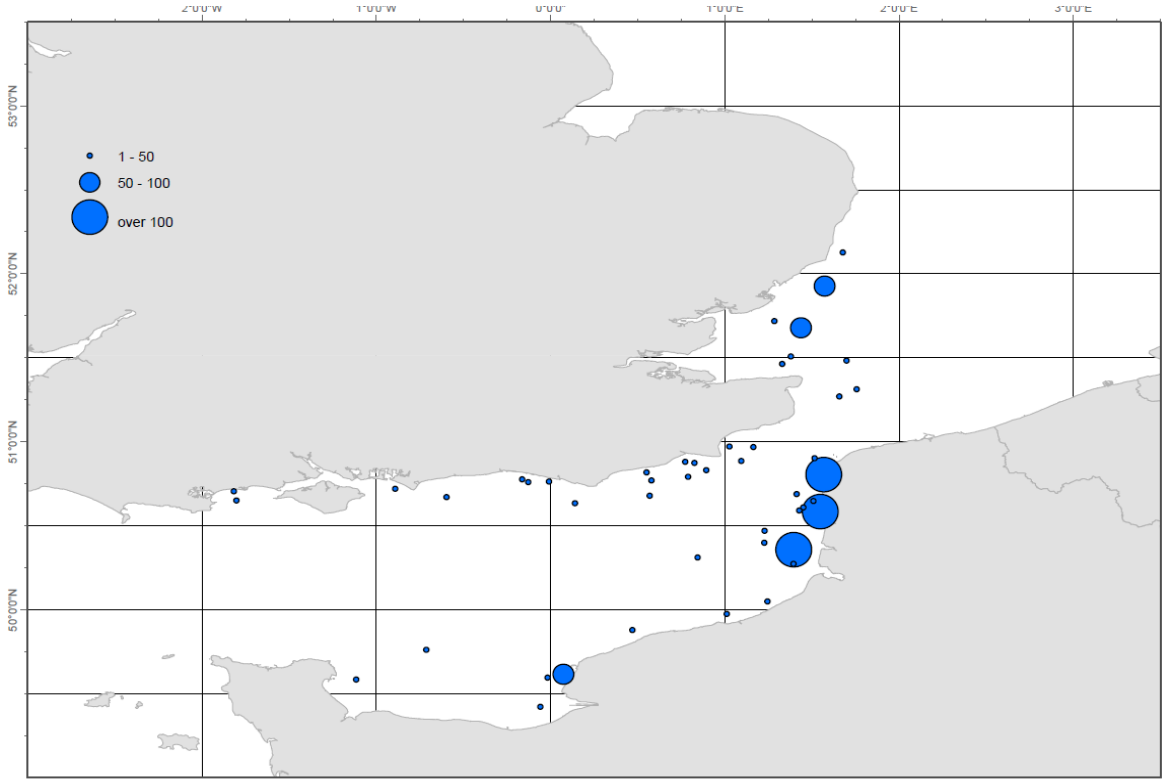


Figure 10 Abundance (number caught per 30 minute tow) of Lemon sole

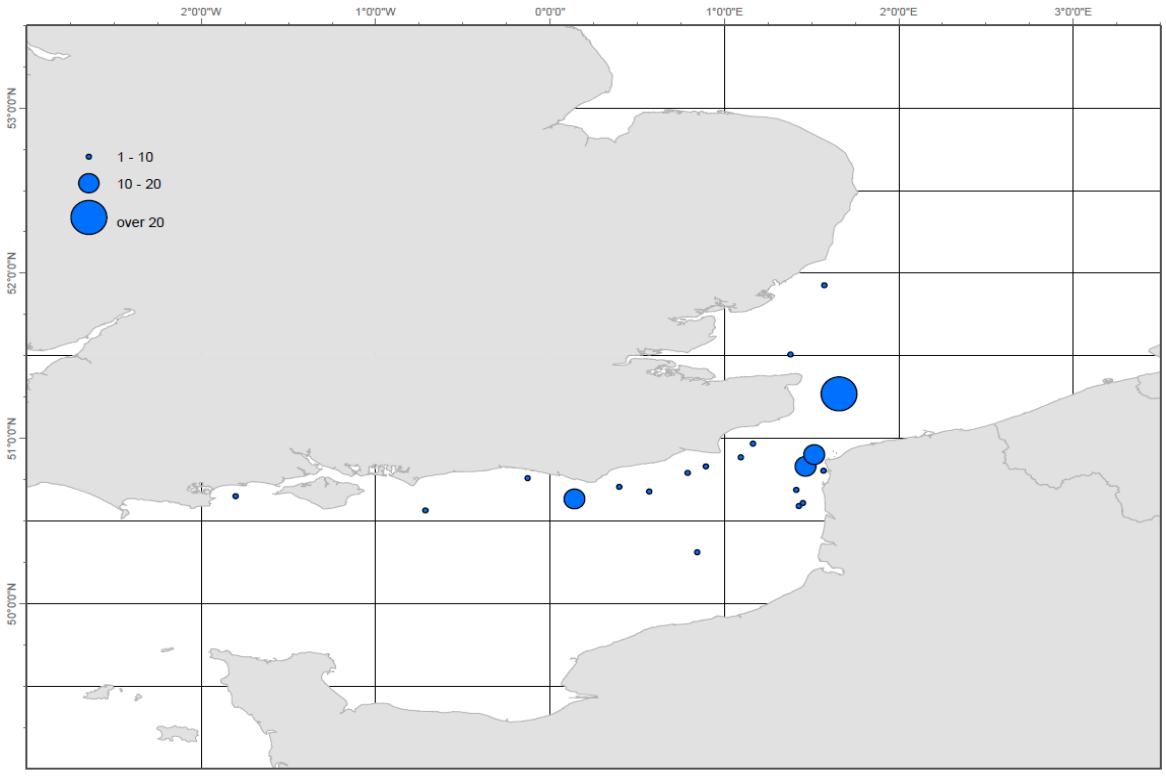
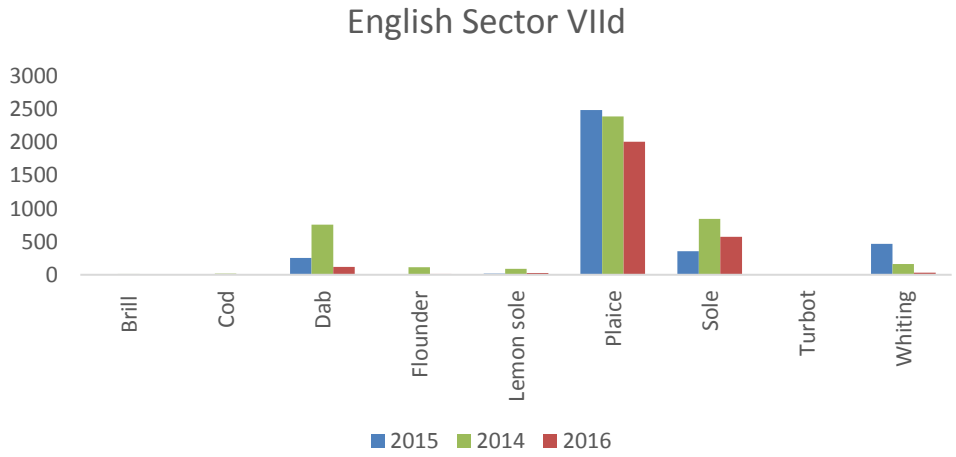
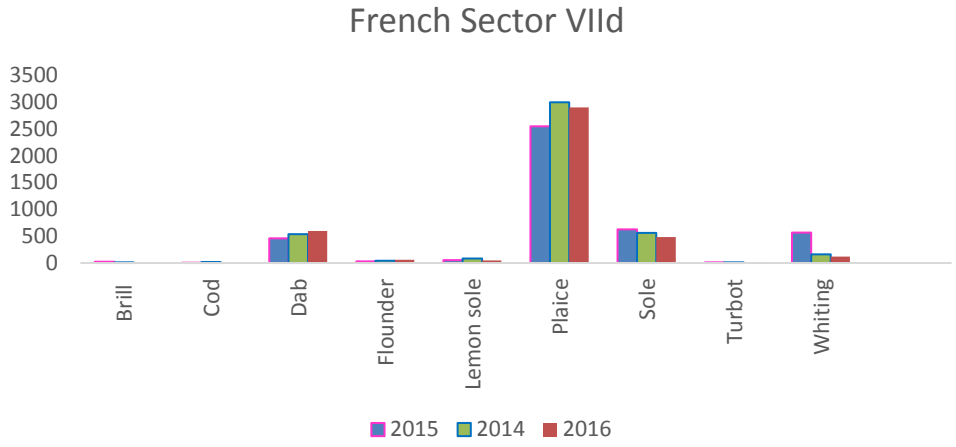


Figure 11 Catch weight of selected commercial fish caught in English and French sectors of the Eastern channel (VIId) and southern North Sea (IVc) during 2014-16 surveys.





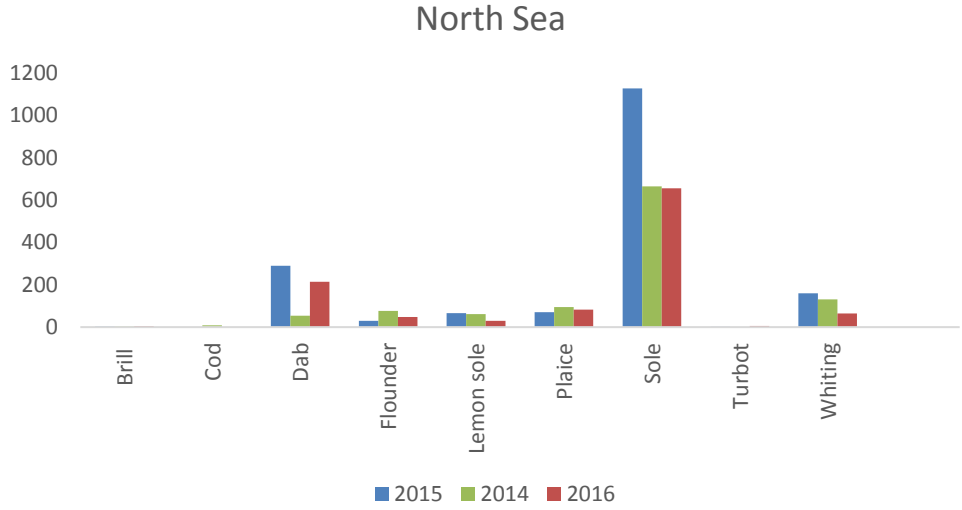


Figure 12 Comparison of total weight of commercial species caught between 2009 - 2016

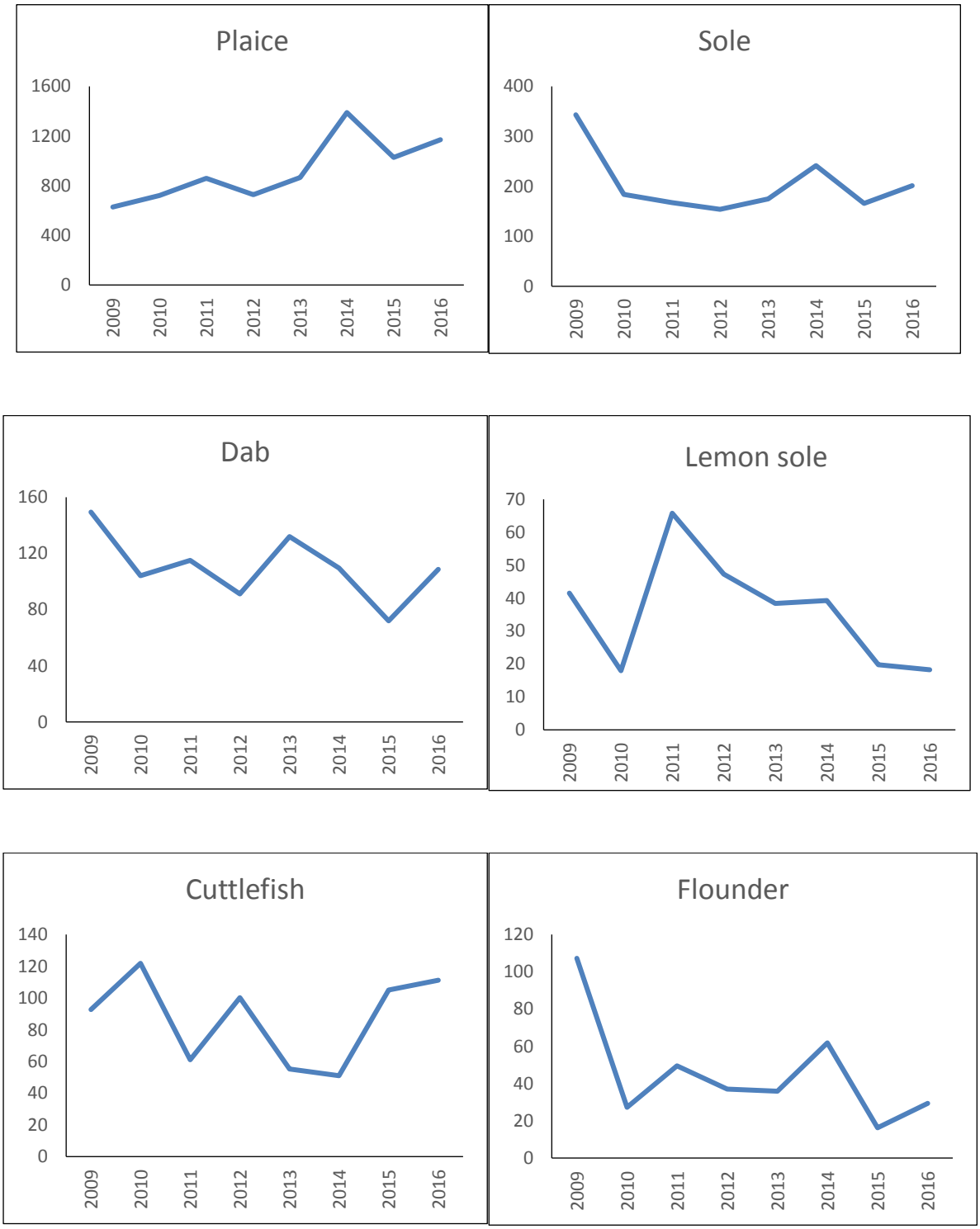


Figure 12 continued Comparison of total weight of commercial species caught between 2009 – 2016