RESEARCH VESSEL SURVEY REPORT

RV CEFAS ENDEAVOUR
Survey: CEND 09/2023

STAFF:

Name	Role
Linford Mann	SIC
Ben Hatton	2IC
Mary Brown	Deckmaster
Matt Eade	Biological sampler
Chris Popham	Biological sampler
Peter Randall	Biological sampler
Johnathan Ball	Biological sampler
Chyanna Allison	Genetics/biological sampler
Maisie Evans (Postgraduate researcher)	Student/Biological sampler

DURATION: 01/07/2023 – 14/07/2023 (14 days)

LOCATION: Southern North Sea (27.4.c) and eastern channel (27.7.d)

PRIMARY AIMS:

1. To complete all 79-prime stations, via the 4-m beam trawl, throughout the southern North Sea and eastern Channel (England and France) as defined by the ICES co-ordinated research programme;

2. To collect fisheries independent data on the distribution and abundance of main commercial demersal species;

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

4. To collect epibenthos by-catch data, via 4-metre beam trawl fishing activities, as agreed at the Beam Trawl Working Group;

5. To collect additional data on skates and rays *Rajiformes*, including gonad weight (to 0.1 g resolution for any deceased specimens), shell gland width (to 0.1 mm resolution for any deceased females) and outer clasper length (to 0.1 mm resolution for all males). For deceased specimens, the section of vertebral column (6-10 vertebrae) from that part overlaying the body cavity should be removed and frozen (with corresponding biological and station details) (J. Ellis - Cefas, Lowestoft);

6. To collect and preserve tissue samples (and corresponding otoliths) for horse mackerel *Trachurus trachurus*, sprat *Sprattus sprattus*, herring *Clupea harengus*, sardine *Sardina pilchardus* and anchovy *Engraulis encrasicolus* caught (all specimens to a maximum of n = 50) to support ongoing studies on population genetics (D. Murray - Cefas, Lowestoft);

7. To collect and preserve tissue samples from deceased specimens of small-eyed ray *Raja microocellata* and undulate ray *Raja undulata* to support ongoing studies on population genetics (D. Murray and J. Ellis - Cefas, Lowestoft);

8. To collect and freeze tissue samples and the carcass of selected fish species in support of the Darwin Tree of Life (DToL) project (D. Murray - Cefas, Lowestoft);

9. To collect litter by-catch data at every prime station via 4-metre beam trawl fishing activities (B. Silburn - Cefas, Lowestoft).

SECONDARY AIMS:

10. To collect conductivity, depth and temperature (CDT) data at each fishing station via the Micro-CTD attached to the 4-m beam trawl;

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

12. To collect water samples (surface and near bottom) at scientific sunrise and after the last fishing station each day using a Niskin sampler and ESM2 data logger (P. Nelson – Cefas, Lowestoft);

13. To collect and process chlorophyll samples (near bottom) at scientific sunrise (N. Greenwood - Cefas, Lowestoft);

14. To collect a zooplankton sample from the West Gabbard Smart Buoy site via a vertical ring net (S. Pitois – Cefas, Lowestoft).

OPPORTUNISTIC AIMS:

15. To complete 5-additional prime stations, via the 4-m beam trawl, in the Belgium EEZ as defined by the ICES co-ordinated research programme;

16. To tag and release specimens of various commercially exploited skates *Rajidae* and other selected elasmobranchs (J. Ellis – Cefas, Lowestoft);

17. Collect specimens of selected species for ID purposes as well as length-weight measurements where still required (J. Ellis and G. Burt – Cefas, Lowestoft);

18. To carry out full biological sampling on common cuttlefish *Sepia officinalis* (V. Laptikhovsky – Cefas, Lowestoft);

19. To collect specimens of *Alloteuthis sp.,* with associated photography, for identification studies to assess potential increase of *A. media* in UK waters. (P. White – Cefas, Lowestoft);

20. To retain and freeze a selection of non-otolithed round fish and flat fish for biological sampling training of new Cefas fisheries staff (C. Hobbs – Cefas, Lowestoft);

21. To dispatch, retain and freeze 20 lesser-spotted dogfish *Scyliorhinus canicula* for the 2023 Cefas Masterclass (R. Mann – Cefas, Lowestoft).

NARRATIVE:
The SIC, 2IC and Deckmaster joined the vessel in Lowestoft on 30 June to mobilise survey gear and set up the fishing survey Electronic Data Capture (EDC) system. Remaining survey staff joined the vessel on the evening of 30 June.

The vessel sailed from Lowestoft at 0900hr on 1 July. During the transit to the first fishing station, a full-crew survey briefing, ship emergency drill, and survey gear toolbox talk were conducted. The vessel transited to the first fishing station (Prime 105) off Southwold, Suffolk and conducted an ESM2 and Niskin deployment for salinity and chlorophyl samples. This deployment was successful and was repeated at the beginning and end of every working day. This was followed by a shakedown tow (using 4-m beam trawl number 1) to fully test fishing gear and on-board systems. The shakedown tow was successful and provided the first valid fishing station. Operations continued throughout the day, completing a further 2 fishing stations (Primes 104 and 103) off Southwold. During the evening gear inspection, it was observed that the beam trawl's fishing line had parted. The damaged fishing line was repaired overnight ready for operations the next day.

On 2 July, the first successful fishing station was completed (Prime 102), and a gear inspection performed to review net repair work from the previous day. Operations continued south along the UK coastline, between Dunwich and the entrance of the Thames Estuary, completing a further 5 fishing stations (Primes 100, 99, 98, 83 and 82). The last fishing station (Prime 82) yielded 15 fish baskets of sand, broken shell, and coal. The daily/evening gear inspection revealed that the fishing line had again parted. As a result, the entire ground gear was replaced overnight ready for operations the next day. This repair work continued on 3 July between 0500hr to 0900hr. Following repair work, a successful fishing station was completed (Prime 97). Operations continued south along the UK coastline, between the entrance of the Thames Estuary and Dover, completing a further 4 fishing stations (Primes 96, 119, 79 and 78).

On 4 July, a successful fishing station was completed (Prime 75) at first light. Operations continued south-west along the UK coastline between Dover and Dungeness, completing a further 6 fishing stations (Primes 80, 74, 73, 64, 66 and 65). The following day a successful fishing station was completed (Prime 63) and operations continued west along the UK coastline, between Dungeness and Newhaven, completing a further 7 fishing stations (Primes

62, 61, 60, 94, 67, 59 and 58). At Prime 62, a 20-minute tow was conducted due to the presence of static gear off Hastings. Similarly, at Prime 59, a 15-minute tow was conducted due to the presence of static gear off Newhaven.

On 6 July, a successful fishing station was completed (Prime 57). Operations continued west along the UK coastline, between Dungeness and Selsey, completing a further 7 fishing stations (Primes 56, 55, 54, 27, 52, 53 and 51). At Prime 56, a 22-minute tow was conducted due to the presence of an electricity cable at the end of the tow line. At Prime 59, a 20-minute tow was conducted due to the presence of an electricity cable at the end of the tow line as well as the tow having a history of large common brittle star *Ophiothrix fragilis* catches.

On 7 July, a successful fishing station was completed (Prime 50). Operations continued west along the UK coastline, between Selsey and Bournemouth, completing a further 4 fishing stations (Primes 49, 26, 22 and 47). At Prime 26, a 20-minute tow was conducted due to a history of large common brittle star catches and a catch of 760kg was caught resulting in a deck sort. At Prime 22, some 'Abandoned, Lost or otherwise Discarded Fishing Gear' (ALDFG) was caught. The same type of ALDFG was also caught in 2021 and was deemed at the time to be discarded cuttlefish traps. Due to daily plan changes, the evening ESM2 and Niskin deployment was not completed. On 8 July, a successful fishing station was completed (Prime 45). Operations continued off Bournemouth, working south across the Channel and into the French Exclusive Economic Zone (EEZ), completing a further 7 fishing stations (Primes 43, 44, 42, 23, 24, 25 and 10). At Primes 45, 43 and 44, static gear was prevalent off Bournemouth, however full 30-minute tows were achieved.

On 9 July, a successful fishing station was completed (Prime 8). Operations continued east along the French coastline, between Barfleur and Le Havre, completing a further 5 fishing stations (Primes 9, 12, 7, 6 and 4). At Prime 9, >800kg epibenthos (predominantly common brittle stars) was caught, causing the dog rope to part during haul. A review meeting and toolbox talk was completed, and the trawl recovered using tugger winches and stern gantry. The damaged dog rope section was removed and the liner re-laced (24 meshes adrift). At Prime 7, a 20-minute tow was conducted due to a history of large mud catches. At Prime 6, a repeat tow was conducted as the first fishing attempt yielded near zero catch (the correct warp ratio was used for environment and weather conditions). The tow line was moved 200m north and repeated. At Prime 4, a 20-minute tow was conducted due to a history of large weed catches.

On 10 July, a successful fishing station was completed (Prime 1). Operations continued east along the French coastline, between Le Havre and Dieppe, completing a further 5 fishing stations (Primes 11, 21, 20, 19 and 18). At Primes 1, 11 and 21, 20-minute tows were conducted due to histories of large mud catches. At Prime 20, the beam trawl was hauled early (8-minutes) due to the presence of static gear across the tow line. The tow line was moved 200m northeast and repeated, achieving a successful 20-minute tow. On 11 July, a successful fishing station was completed (Prime 29). Operations continued north-east along the French coastline, between Dieppe and Berck, completing a further 5 fishing stations (Primes 16, 39, 17, 40 and 38). At Prime 38, ~800kg epibenthos was caught despite a history of small clean catches.

On 12 July, a successful fishing station was completed (Prime 37). Operations continued north along the French coastline, between Berck and Boulogne-sur-Mer, completing a further 6 fishing stations (Primes 36, 35, 72, 71, 76 and 77). At Prime 37, a 20-minute tow was conducted due to a history of substantial sea potato *Echinocardium cordatum* catches. At Primes 71 and 76, 20-minute tows were conducted due to rough, hard ground and histories of gear damage. On 13 July, a successful fishing station was completed (Prime 70). Operations continued north along the French coastline, between Boulogne-sur-Mer and Calais, completing a further 3 fishing stations (Primes 69, 68 and 95). At Prime 68, a 29-minute tow was conducted due to the presence of a 20m pinnacle at the end of the tow line. At Prime 95, a 20-minute tow was conducted due to a history of heavy hornwrack *Flustra foliacea* and common brittle star catches. With all fishing stations complete, transit to Portland Port for demobilisation commenced.

During transit, the wet lab was cleaned and the EDC system part-dismantled for the following survey. On 14 July, the vessel continued to transit at economic speed throughout the morning to Portland Port for demobilisation. Portland Port pilot was booked for 0900 with docking taking place shortly after.

RESULTS
PRIMARY AIMS

Aim 1.
The standard 4-m beam trawl number 1, with chain mat, flip-up ropes and a 40mm cod-end liner was used for all fishing stations. Following gear damage sustained on 1 July, a new fishing line was fitted on the beam trawl. Beam trawl number 4 was on-board as a spare and was not used. A SAIV Micro CTD was attached to the headline on the trawl to allow the recording of temperature and salinity at each station.

A typical fishing station consisted of the 4-m beam trawl, with Micro-CTD attached to the headline, being deployed from the starboard winch. The beam trawl was routinely towed for 30-minutes at a warp/depth ratio of 3.5:1. If the ground had a history of heavy epibenthos or sediment by-catch the warp and tow duration were shortened to 3:1 and 20-minutes respectively. If a strong tide was running, the warp/depth ratio was increased to 4:1 to ensure that the gear was trawling along the seabed.

Fishing station gear deployment details, vessel navigation and weather information were collected from the ECDIS logging system and bridge logbook and manually entered into the Fishing Survey System (FSS). Catch was removed from the beam trawl net (Figure 1), sorted and identified to species. Large catches of individual species were size categorised and/or sub-sampled when required. Catch data (species ID and bulk weight) from all fish and selected commercial shellfish was entered directly into the Electronic Data Capture (EDC) system, measured, and weighed individually. Target species were biologically sampled (measured, weighed, otolith extracted, sex and maturity staged). Catch data and corresponding biological data was uploaded directly to FSS after the completion of each fishing station.

A total of 79 tows (excluding invalid or abandoned tows) were completed during the 2023 survey (Table 1 and Figure 2). All prime fishing stations were completed as required. A total of 18 fishing stations had reduced tow durations; 8 fishing stations had reduced tows due to history of large sediment and/or epibenthos catch, 3 fishing stations were reduced tows due to static gear, 3 fishing stations had reduced tows due to electricity cables on the tow line, 3 fishing stations had reduced tows due to rough ground and, 1 fishing station had a reduced tow due to the wind direction and wind speed affecting the vessel tow speed (Table 2).

Table 1. Valid, additional and invalid tows completed during the 2023 survey

Region	Valid 30-minute	Valid <30-minutes	Additional	Invalid but repeated	Abandoned	Total (exc. invalid and abandoned)
7d (English)	29	5	0	0	0	34
7d (French)	19	11	0	1	0	30
4c (North Sea)	13	2	0	0	0	15
Total	**61**	**18**	**0**	**1**	**0**	**79**

Table 2. Prime stations with reduced tow duration

Prime station number	Region	Tow duration (minutes)	Reason for reduced tow duration
1	7d (French)	20	History of large sediment catch
4	7d (French)	20	History of large epibenthos catch
7	7d (French)	20	History of large sediment catch
11	7d (French)	20	History of large sediment catch
20	7d (French)	20	Static gear on tow
21	7d (French)	20	History of large sediment catch
26	7d (English)	20	History of large epibenthos catch
27	7d (English)	20	Electricity cables on tow and history of large epibenthos catch
37	7d (English)	20	History of large epibenthos catch
56	7d (French)	22	Electricity cables on tow
59	7d (English)	20	Static gear on tow
62	7d (English)	20	Static gear on tow
68	7d (French)	29	Rough ground
71	7d (French)	20	Rough ground
76	7d (French)	20	Rough ground
78	4c (North Sea)	15	Wind direction and wind speed affecting the vessel tow speed
95	7d (French)	20	History of large epibenthos catch
100	4c (North Sea)	20	Electricity cables on tow

Figure 1. Example of unsorted 4-m beam trawl catch from the 2023 survey

Figure 2. Prime stations completed during the 2023 survey
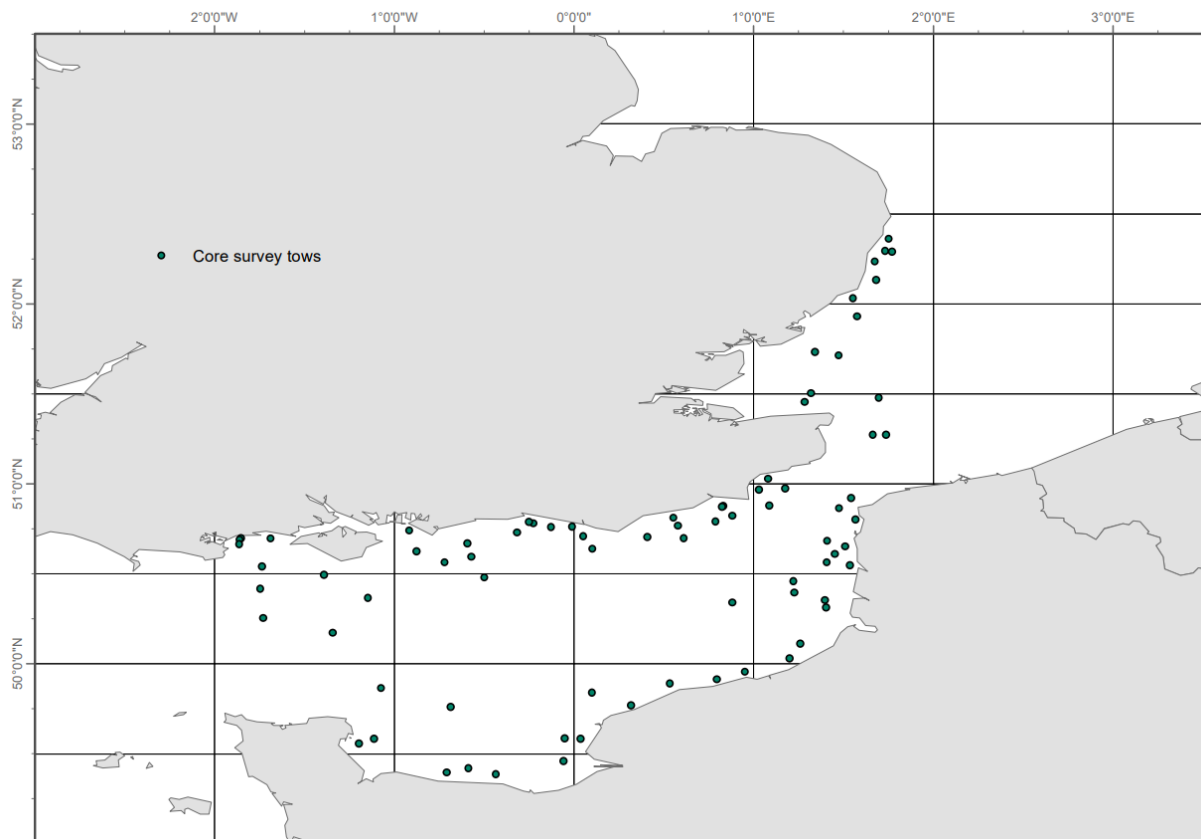
Aims 2 & 3.

All biologically sampled fish were measured to the whole cm below, weighed individually, sexed and allocated a maturity stage. Full biological data was collected for main commercial fish species (Table 3 and 4, and Appendix A. Figure 18). All non-commercial finfish by-catch were identified to species level, and individually weighed and measured. The following shellfish were weighed and measured (to whole mm below) whenever present in the catch; edible crab *Cancer pagurus*, King scallop (*Pecten maximus*), European lobster *Homarus gammarus*, velvet swimming crab *Necora puber*, Atlantic spider crab *Maja brachydactyla*, European flat oyster *Ostrea eduli*s and Queen scallop *Aequipecten opercularis*. The following cephalopod species were weighed and counted; cuttlefish without bone *Sepiolidae*, and stout bobtail *Rossia macrosoma*. All squid and jellyfish species where caught were measured (whole cm below). Where practicable, the following shellfish and cephalopods were weighed, measured, sexed, and allocated a maturity stage; King scallop, Queen scallop and common cuttlefish.

To compare the total catch weight and number of main commercial species to previous years (2014-2023), catch data was raised to standard 30-minute tows (Table 5 and 6, and Appendix A. Figure 19). In total, 216 species were recorded throughout the 2023 survey (Table 7). As the eastern Channel beam trawl survey was not delivered in 2022, comparative catch weight and number data is Not Available (NA).

Table 3. Otoliths collected from main commercial species by region

Region	Brill	Cod	Dab	Flounder	Lemon sole	Plaice	Sole	Whiting	Turbot
7d (English)	6	0	14	4	24	756	159	27	2
7d (French)	4	0	31	15	11	377	145	16	4
4c (North Sea)	4	0	52	16	22	166	189	44	2
Total	**14**	**0**	**97**	**35**	**57**	**1299**	**493**	**87**	**8**

Table 4. Number of main commercial species measured by region

Region	Brill	Cod	Dab	Flounder	Lemon sole	Plaice	Sole	Whiting	Turbot
7d (English)	8	0	252	4	36	4752	468	189	3
7d (French)	5	0	222	21	12	1506	472	1352	4
4c (North Sea)	4	0	186	18	24	366	822	95	2
Total	**17**	**0**	**660**	**43**	**72**	**6624**	**1762**	**1636**	**9**

Table 5. Comparison of catch weight (kg) for main commercial species over the past 9 surveys (2014-2023) (raised to 30-minute tows)

Species	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Plaice	1238	1042	975	836	846	721	541	619	NA	436
Sole	235	171	183	214	231	234	200	187	NA	137
Dab	87	73	70	47	41	42	29	58	NA	29
Lemon sole	38	24	18	14	11	14	13	7	NA	9
Cuttlefish	48	35	101	103	60	111	95	79	NA	156
Flounder	72	17	29	19	27	28	18	16	NA	10
Whiting	30	89	24	52	27	44	51	112	NA	21
Brill	10	14	10	11	13	10	8	5	NA	5
Turbot	9	15	17	15	13	10	18	9	NA	4
Seabass	9	2	7	15	8	5	11	4	NA	24
Cod	16	13	0	1	1	0	0	0	NA	0

Table 6. Comparison of catch numbers for main commercial species over the last 9 surveys (2014-2023) (raised to 30-minute tows)

Species	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Plaice	7197	5635	5137	5364	5904	5546	4586	5379	NA	6623
Sole	2084	2229	1770	2805	2398	3342	2636	2430	NA	1762
Dab	1684	1183	954	917	720	989	641	1209	NA	660
Lemon sole	258	171	119	162	124	170	113	72	NA	73
Cuttlefish	214	91	526	500	279	495	475	527	NA	813
Flounder	262	72	127	95	119	131	71	112	NA	43
Whiting	388	1201	239	927	400	431	542	1042	NA	1636
Brill	31	32	20	24	24	21	24	13	NA	17
Turbot	18	23	27	31	25	23	35	18	NA	9
Seabass	9	2	3	23	6	14	9	4	NA	37
Cod	43	8	0	2	2	3	0	0	NA	0

Table 7. List of species caught during the survey and number of stations at which they were recorded

Species	No. of STNs	Species	No. of STNs
Abra spp	3	*Acanthocardia spp*	4
Aequipecten opercularis	34	*Aequorea spp*	22
Agonus cataphractus	37	*Alcyonidium diaphanum*	45
Alcyonium digitatum	41	*Alloteuthis subulata*	62
Alpheus glaber	1	*Ammodytes tobianus*	11
Anemone indet	6	*Anseropoda placenta*	13
Antedon bifida	1	*Aphrodite aculeata*	29
Arenicola marina	1	*Arnoglossus laterna*	37
Ascidia virginea	1	*Ascidiacea*	42
Astacilla longicornis	1	*Asterias rubens*	48
Atelecyclus rotundatus	5	*Aurelia aurita*	33
Axinella infundibuliformis	2	*Balanomorpha*	11
Barnea candida	1	*Blennius ocellaris*	8
Botryllus schlosseri	6	*Buccinum undatum*	34
Bryozoa	2	*Buglossidium luteum*	32
Buenia jeffreysii	1	*Callionymus maculatus*	1
Callionymus lyra	71	*Calliostoma zizyphinum*	1
Callionymus reticulatus	1	*Carcinus maenas*	2
Cancer pagurus	31	*Cellaria spp (cellariidae)*	4
Catshark (dogfish) eggcase	23	*Chelidonichthys (aspitrigla) cuculus*	33
Chaetopterus variopedatus	2	*Chlamys varia*	17
Chelidonichthys (trigla) lucerna	26	*Chrysaora hysoscella*	37
Chlorophyceae	2	*Cliona celata*	3
Ciliata septentrionalis	2	*Conger conger*	15
Clupea harengus	3	*Crangon crangon*	11
Corystes cassivelaunus	1	*Crossaster papposus*	12
Crepidula fornicata	12	*Cucumariidae indet*	4
Ctenolabrus rupestris	2	*Cyanea capillata*	3
Cuttlefish eggs	35	*Diazona violacea*	2
Cyanea lamarckii	44	*Diodora graeca*	2
Dicentrarchus labrax	13	*Doris pseudoargus*	16
Diphasia nigra	11	*Dysidea fragilis*	1
Dromia personata	11	*Echiichthys (trachinus) vipera*	27
Ebalia tuberosa	2	*Echinocardium spp*	3
Echinocardium cordatum	2	*Echinus esculentus*	1
Echinoida	3	*Epibenthic mix unidentified*	66
Echiura	1	*Eupagurus / pagurus in suberites*	8
Eupagurus / pagurus in buccinum	22	*Euspira pulchella*	1
Eurynome aspera	2	*Filograna implexa*	8
Eutrigla gurnardus	10	*Fucus spp*	28
Flustra foliacea	32	*Gaidropsarus mediterraneus*	4
Fucus vesiculosus	3	*Galathea spp*	1
Gaidropsarus vulgaris	1	*Gibbula spp (monodonta spp)*	1
Gastropod egg mass	21	*Gobius gasteveni*	5
Glycymeris glycymeris	5	*Gobius paganellus*	5
Gobius niger	6	*Hinia (nassarius) reticulatua*	15
Henricia oculata	4	*Holothuroidea*	1
Hippocampus hippocampus	14	*Hyas coarctatus*	11
Homarus gammarus	6	*Hydroida (order)*	24

Hydrallmania falcata	27	*Inachus dorsettensis*	24
Hyperoplus lanceolatus	7	*Inachus phalangium*	1
Inachus leptochirus	18	*Labrus mixtus (l. bimaculatus)*	1
Labrus bergylta	2	*Laevicardium crassum*	2
Laetmonice (hermione) hystrix	3	*Lepadogaster purpurea*	1
Laminarian algae (phaeophyceae)	7	*Limanda limanda*	47
Lesueurigobius friesii	1	*Loliginidae*	1
Liocarcinus depurator	18	*Lophius piscatorius*	1
Loligo vulgaris	2	*Macropodia linaresi*	2
Lutraria lutraria	1	*Macropodia tenuirostris*	24
Macropodia rostrata	18	*Merlangius merlangus*	32
Maja brachydactyla	143	*Microchirus variegatus*	5
Metridium senile	24	*Molgulidae (molgula spp)*	7
Microstomus kitt	17	*Mullus surmuletus*	13
Munida rugosa	1	*Mustelus asterias*	33
Myoxocephalus scorpius	1	*Mytilus edulis*	12
Necklace shell egg mass	5	*Necora puber*	63
Nemertesia antennina	28	*Nemertesia ramosa*	15
Nereis spp / nereidae	1	*Nuculidae (nucula spp)*	1
Nudibranchia	2	*Ophiocomina nigra*	1
Ophiothrix fragilis	17	*Ophiura ophiura*	38
Ostrea edulis	6	*Paguridae*	6
Pagurus prideaux in adamsia	20	*Palaemon serratus*	3
Pandalus montagui	4	*Parablennius gattorugine*	3
Pecten maximus	16	*Pegusa (solea) lascaris*	13
Pentapora foliacea	13	*Phaeophyceae*	21
Philine aperta	8	*Pholis gunnellus*	1
Phrynorhombus (zeugopterus) norvegicus	1	*Pisa armata*	15
Pisidia longicornis	16	*Platichthys flesus*	11
Pleurobrachia pileus	2	*Pleurobranchus membranaceus*	1
Pleuronectes platessa	114	*Polybius (liocarcinus) holsatus*	47
Polychaeta	5	*Polymastiidae*	1
Pomatoschistus spp	22	*Porifera*	18
Processa spp. /processidae	3	*Psammechinus miliaris*	38
Raja brachyura	2	*Raja clavata*	89
Raja microocellata	1	*Raja montagui*	12
Raja undulata	11	*Raspailia spp*	23
Rhodophyceae	18	*Rissoides (meiosquilla) desmaresti*	6
Sabellaria spinulosa	13	*Rossia macrosoma*	1
Scomber scombrus	1	*Scaphander lignarius*	2
Scophthalmus maximus (psetta maxima)	7	*Scomberesox saurus*	2
Scyliorhinus canicula	83	*Scophthalmus rhombus*	12
Scyphozoa	17	*Scyliorhinus stellaris*	2
Sepiolidae	12	*Sepia officinalis*	64
Skate eggcase	1	*Sertularia cupressina*	4
Spatangus purpureus	4	*Solea solea*	64
Spondyliosoma cantharus	12	*Spisula spp*	2
Squid eggs	2	*Sprattus sprattus*	2
Suberites spp	15	*Styela clava*	25
Syngnathus acus	3	*Symphodus (crenilabrus) balloni*	10
Trachinus draco	3	*Tethya aurantium*	13
Trigloporus lastoviza	13	*Trachurus trachurus*	6
Trisopterus minutus	32	*Trisopterus luscus*	51

Tubes of parchment worm (chaetopterus)	22	Tritonia hombergi	3
Ulva lactuca	17	Tubularia spp	2
Upogebia spp	1	Unidentified species	3
Whelk (buccinum) eggs	11	Urticina (tealia) felina	23
Zeugopterus (phrynorhombus) regius	7	Xanthidae	18
Zeus faber	1	Zeugopterus punctatus	2

European plaice *Pleuronectes platessa*

Total catch weight of plaice across all regions (7d English, French and 4c North Sea) were lower this year (436kg) compared to 2021 (619kg) (Appendix A. Figure 19). However, the total catch number (6623 fish) were higher compared to 2021 (5379 fish) (Tables 4 and 5. Appendix A. Figure 18). In the North Sea 4c mean catch weight and number were lower (-11%, -67%) compared to 2021. In the English 7d sector mean catch weight were lower (-23%) compared to 2021, however mean catch number were higher (48%). In the French 7d sector mean catch weight and number were lower than in 2021 (-44%, -22%) (Appendix A. Figure 20). Recruited plaice (≥21cm) distribution was similar to 2021, with high abundance off Brighton and Newhaven (7d England). There was a reduction in abundance off Barfleur and Dieppe (7d France) compared to 2021, however there was a slight increase off Boulogne-sur-Mer (Figure 3). Pre-recruit plaice (<21cm) distribution and abundance were similar to 2021, with highest abundance off Newhaven and Hastings (7d England), and Dieppe and Boulogne (7d France) (Figure 4).

Dover sole *Solea solea*

Total catch weight and number of sole across regions were lower this year (137kg, 1762 fish) compared to 2021 (187kg, 2430 fish) (Tables 4 and 5. Appendix A. Figure 18 and 12). In the North Sea 4c mean catch weight and number were lower (-49%, -25%) compared to 2021. In the English 7d sector mean catch weight and number were lower (-8%, 14%) compared to 2021. In the French 7d sector mean catch weight and number were lower than in 2021 (-27%, -46%) (Appendix A. Figure 21). Recruited sole (≥21cm) distribution was similar to 2021, with high abundance off Hastings, Dungeness and Bournemouth (7d England). There was an increase in abundance between Colleville-sur-Mer and Courseulles-sur-Mer (7d France) compared to 2021 (Figure 5). Pre-recruit sole (<21cm) distribution and abundance were similar to 2021, with highest abundance in the North Sea (4c), off Dungeness (England 7d), and between Berck and Le Touquet and (7d France). There was a decrease in abundance off Le Havre (France 7d) (Figure 6).

Other species

Catch distribution and abundance of dab *Limanda limanda* were similar to 2021. There was a decrease in abundance between Boulogne-sur-Mer and Le Touquet (7d France), however there was an increase in abundance between Hastings and Dungeness (England 7d) as well as Le Havre (7d France) (Figure 7). Overall, total catch weight of dab across all regions was significantly lower than in 2021 (Appendix A. Figure 19).

Catch distribution and abundance of lemon sole *Microstomus kitt* were similar to 2021. There was a large abundance of lemon sole off Ramsgate in the North Sea (4c), and an increase in abundance off Dungeness (England 7d) (Figure 8). Catch weight of lemon sole was slightly higher than in 2021 (Figure 19).

There was a significant decrease in total catch weight of flounder *Platichthys flesus* and turbot *Scophthalmus maximus* compared to 2021, however there was a significant increase in total catch weight of whiting *Merlangius merlangus*, common cuttlefish *Sepia officinalis*, and brill *Scophthalmus rhombus*. Consistent with 2020 and 2021, no Atlantic cod *Gadus morhua* were caught (Figure 19).

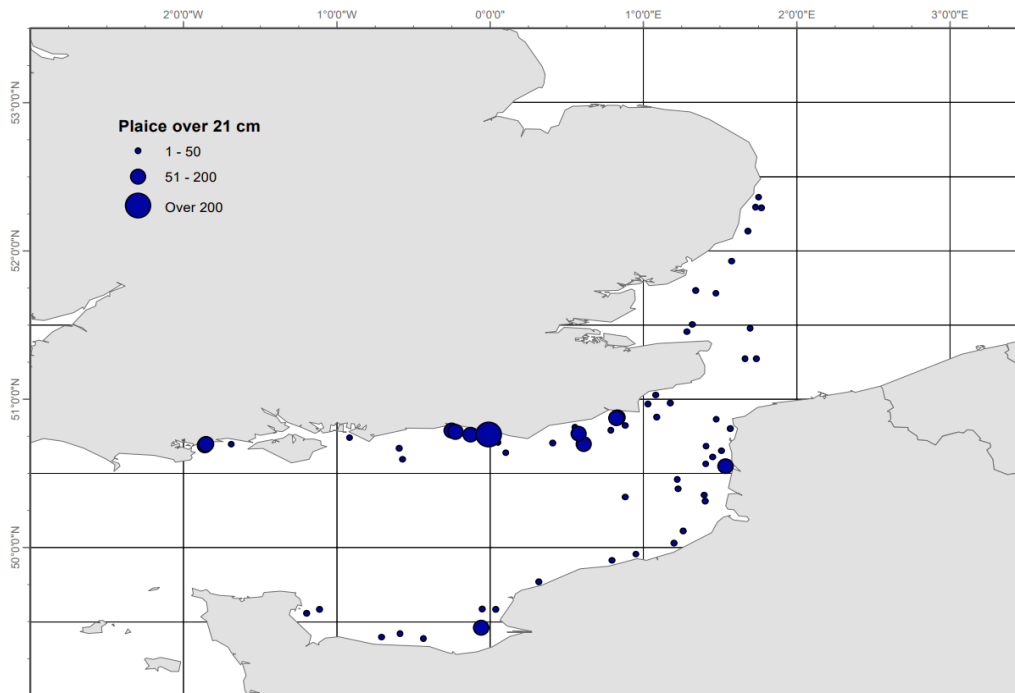Figure 3. Abundance (numbers caught per 30-minute tow) of recruited (≥21 cm TL) plaice

Figure 4. Abundance (numbers caught per 30-minute tow) of pre-recruited (<21 cm TL) plaice
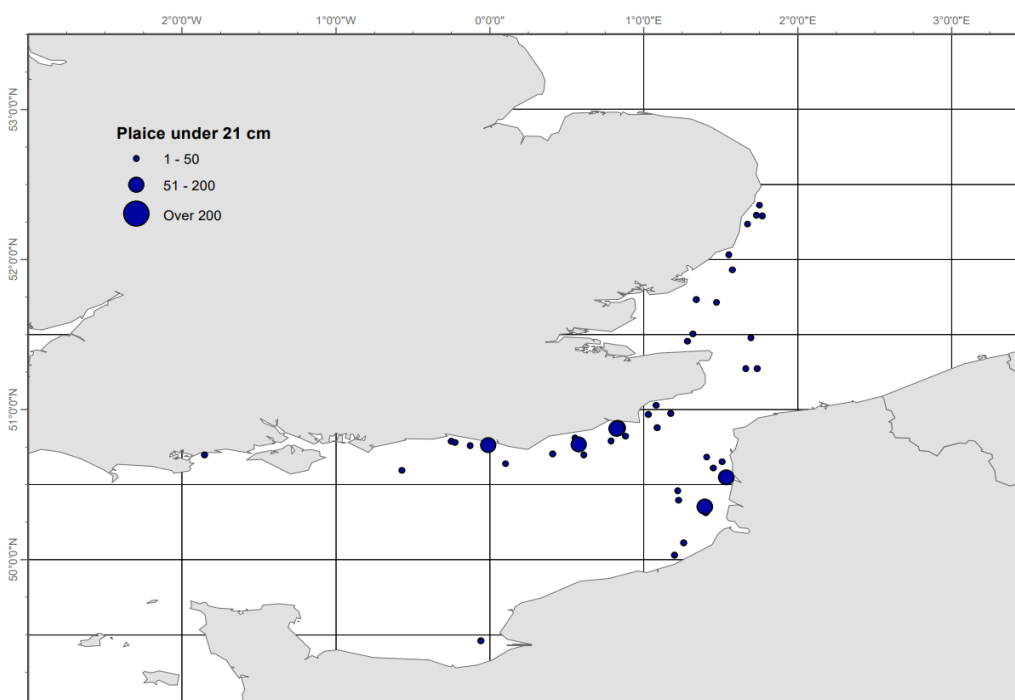
Figure 5. Abundance (numbers caught per 30-minute tow) of recruited (≥21 cm TL) sole
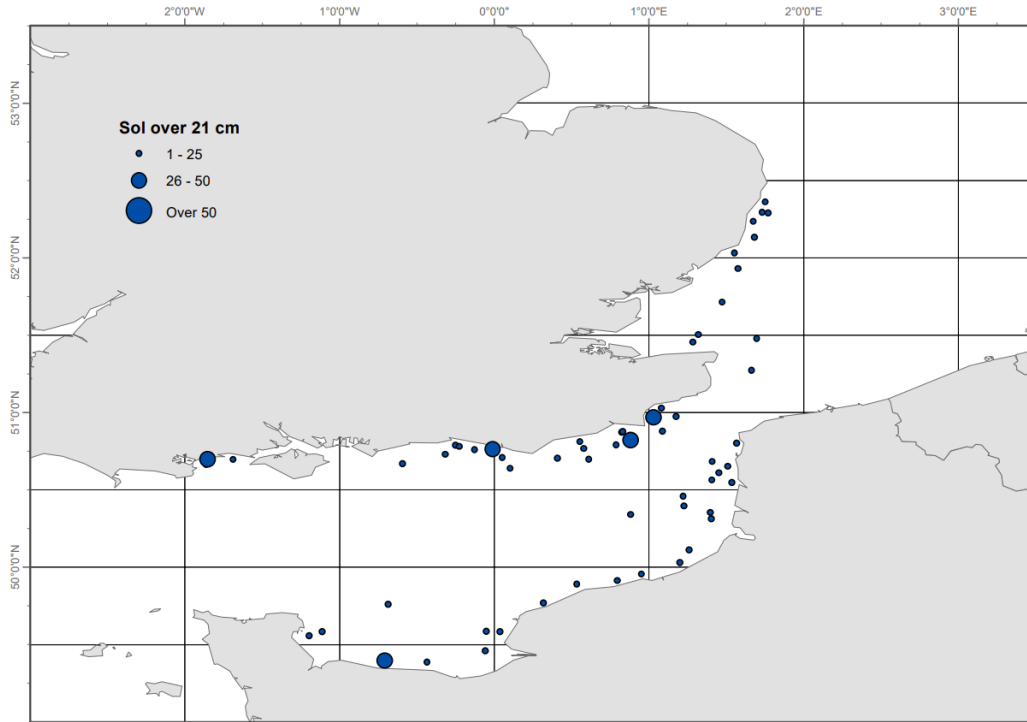
Figure 6. Abundance (numbers caught per 30-minute tow) of pre-recruited (<21 cm TL) sole
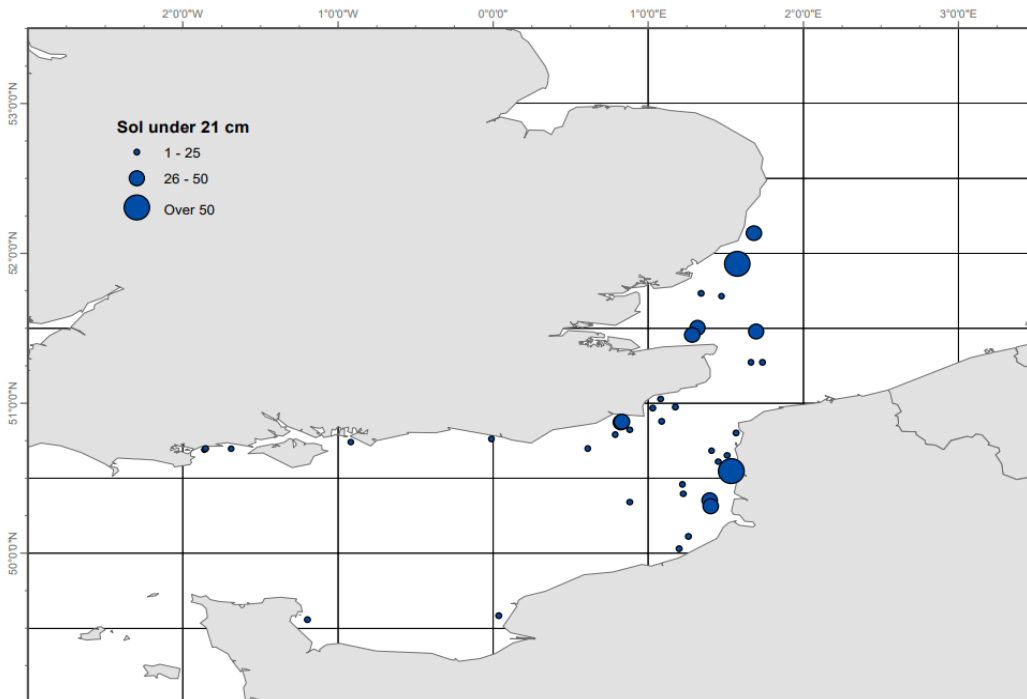
Figure 7. Abundance (numbers caught per 30-minute tow) of dab
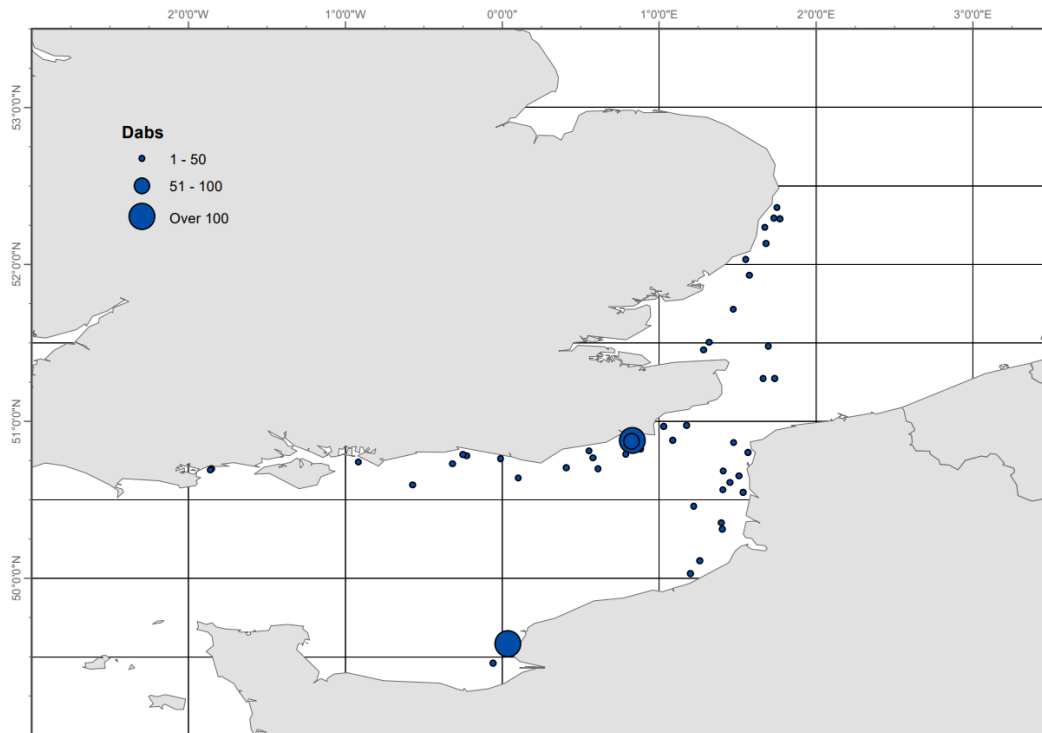
Figure 8. Abundance (numbers caught per 30-minute tow) of lemon sole
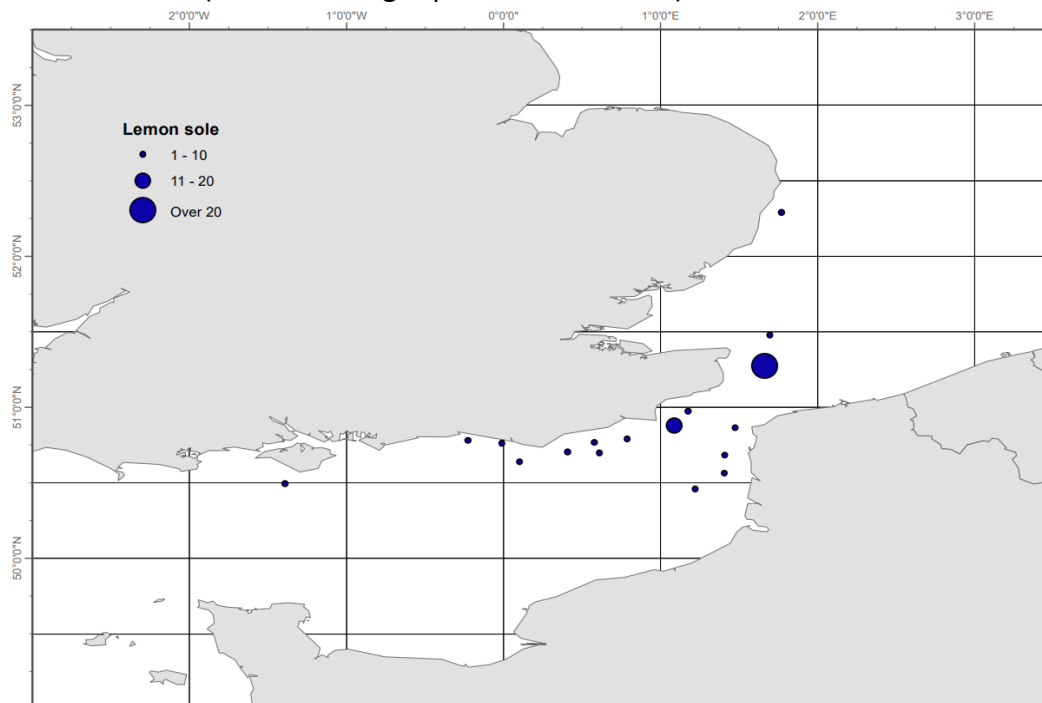
Aim 4.

At specified prime stations (Table 8, Figure 9) full epibenthic sorts were completed to collect species count and weight data. At all other prime stations, epibenthos observations were recorded to an appropriate taxonomic level. Sentinel species were removed and quantified at

every prime station. Throughout the survey, the following sentinel species were encountered; ross coral *Pentapora foliacea*, ross worm *Sabellaria spinulosa*; sponge crab *Dromia personate* (Figure 10), mantis shrimp *Meiosquilla desmaresti*, leathery sea squirt *Styela clava* and slipper limpet *Crepidula fornicate*.

Table 8. Epibenthos prime stations

Prime number	Region
7	7d (French)
10	7d (French)
12	7d (French)
18	7d (French)
24	7d (English)
27	7d (English)
29	7d (French)
37	7d (French)
47	7d (English)
53	7d (English)
62	7d (English)
74	7d (English)
78	4c (North Sea)
82	4c (North Sea)
100	4c (North Sea)

Figure 9. Epibenthos prime station positions
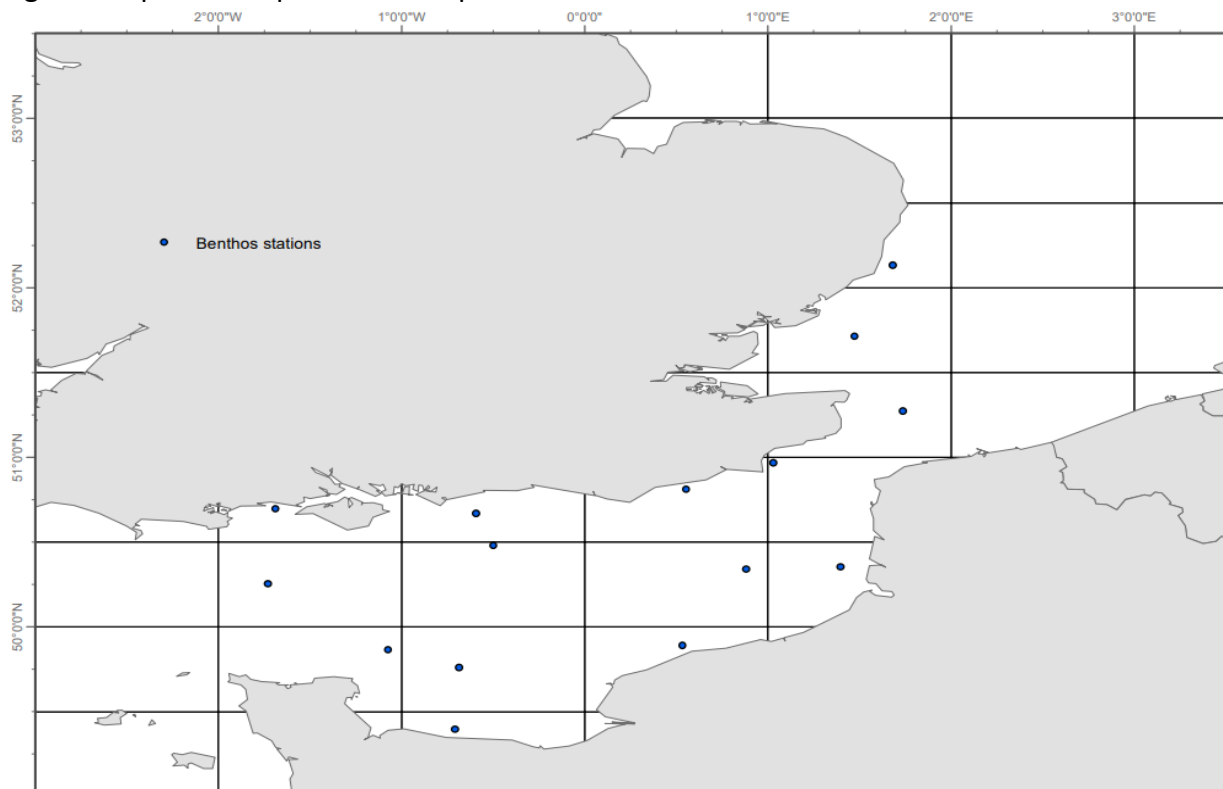
Figure 10. Example of sentinel species encountered during the 2023 survey. Left: juvenile sponge crab. Right: Adult sponge crab

Aims 5, 6, 7 & 8.

A total of 22 genomic and otolith samples from pelagic specimens were collected. Otoliths of selected fish species were also collected to study populations and improve the assessment methodology of finfish, pelagic, data-limited, and non-quota stocks.

A total of 69 samples from deceased skates and rays (vertebrae and additional biological data - males: testes weight and outer clasper length; females: ovary weight and shell gland width) were collected. A section of the vertebral column, comprising of 6-8 vertebrae from the section overlying the body cavity, was also sampled to improve assessment methodology of data-limited and non-quota stocks.

A total of 5 tissue samples and carcasses of selected demersal species were collected to improve assessment methodology of finfish, pelagic, data-limited, and non-quota stocks for the Defra Darwin Tree of Life (DToL) project. The project aims to provide fully assembled and annotated genomes for every eukaryotic organism in the UK.

Aim 9.

There were 450 litter items logged (Figure 11), totalling 21.22kg in weight. There were 277 plastic items recorded (61.56% of all litter). Plastic litter primarily consisted of sheet plastic (34.66%) and monofilament fishing line (28.52%) (Figure 12). There were 139 natural items recorded (30.89% of the total litter), which primarily consisted of fragmented processed wood from one fishing station. Out of the 79 fishing stations, 15 stations had no litter. As a result, litter was found at 81% of all fishing stations (mean of 7 items of litter per fishing station across the survey area).

Figure 11. Types of litter recorded during the 2023 survey

Litter Type

Miscellaneous 1.78%
Natural 30.89%
Rubber 3.56%
Plastic 61.56%
Metal 2.22%
Glass/Ceramic 0.00%

**n = 450
trawls = 79
no litter trawls = 15**
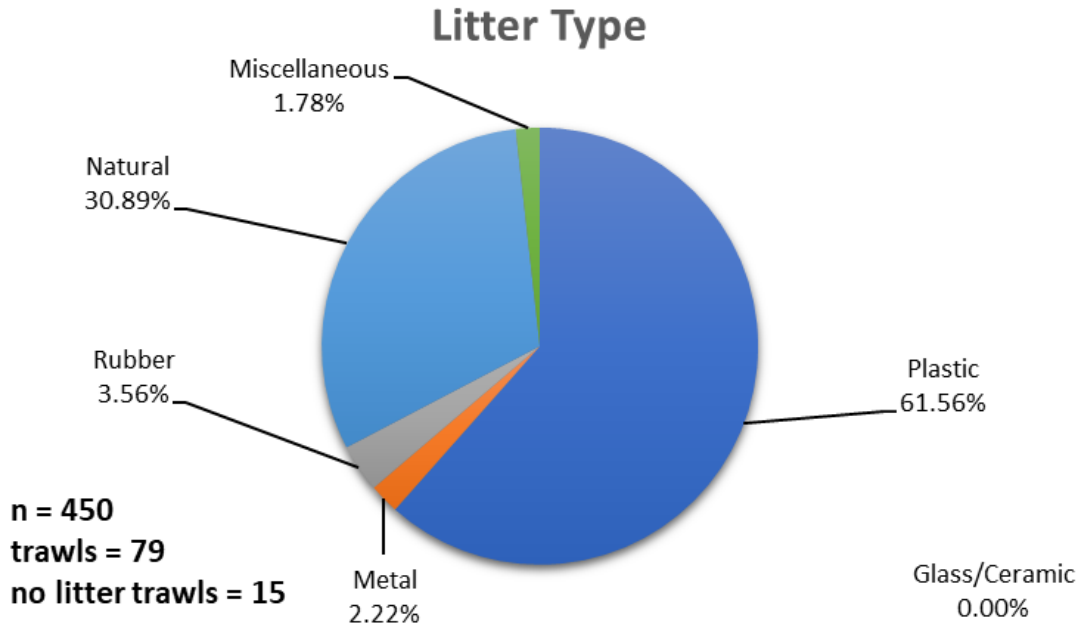
Figure 12. Types of plastic litter recorded during the 2023 survey

Plastic Type

Crates & containers 1.08%
Sanitary items 0.36%
Other 9.39%
Bottle 1.44%
Strapping band 1.44%
Sheet 34.66%
Cable ties 1.08%
Fishing net 4.69%
Synthetic rope 3.61%
Fishing line (entangled) 9.03%
Fishing line (mono) 28.52%
Caps/lids 2.53%
Bag 2.17%

n = 277
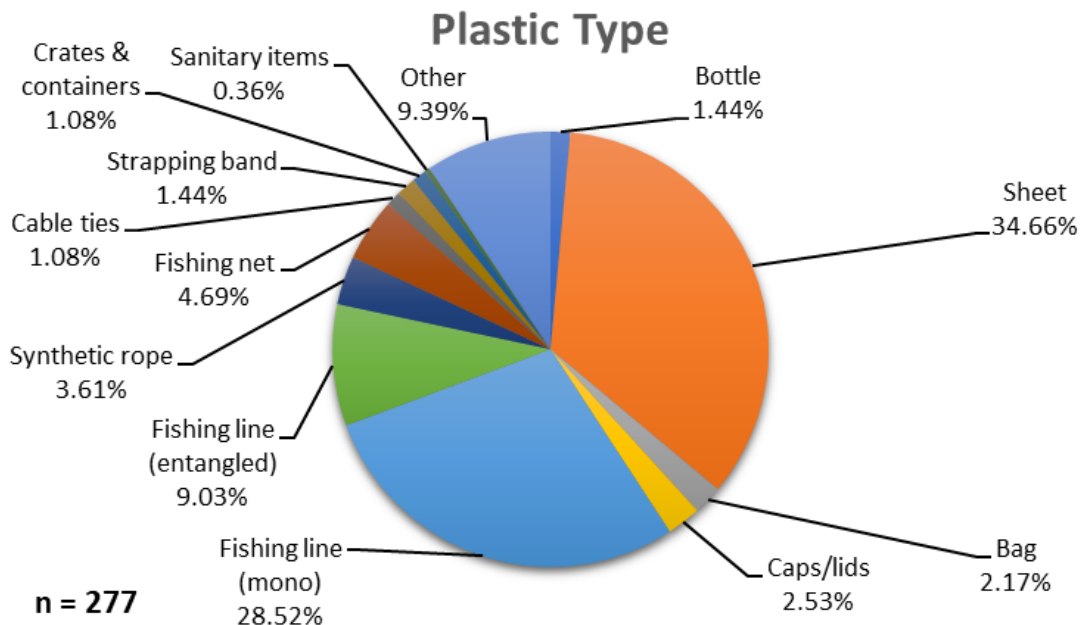
**SECONDARY AIMS
Aim 10.**

A SAIV Micro-CTD unit was attached to the 4-m beam trawl to record temperature and salinity data for 70 of the 79 tows. The unit was unavailable for 9 fishing stations (Primes 45, 43, 44,

42, 23, 24 and 25 and 10) due to technical error. Across the survey area, surface seawater temperature ranged from 15.3-19.5°C, and bottom seawater temperature ranged from 15.2-19.3°C (Figure 13). Surface seawater salinity ranged from 33.78-36.28PPT (Parts Per Thousand), and bottom seawater salinity ranged from 34.51-36.26PPT (Figure 14). Temperature and salinity data for unsampled geographic locations (non-sampled fishing stations, transit area and middle Channel) were predicted using a Kriging prediction and standard error model fitted with a variogram model.

Figure 13. Surface and bottom seawater temperature during the 2023 survey
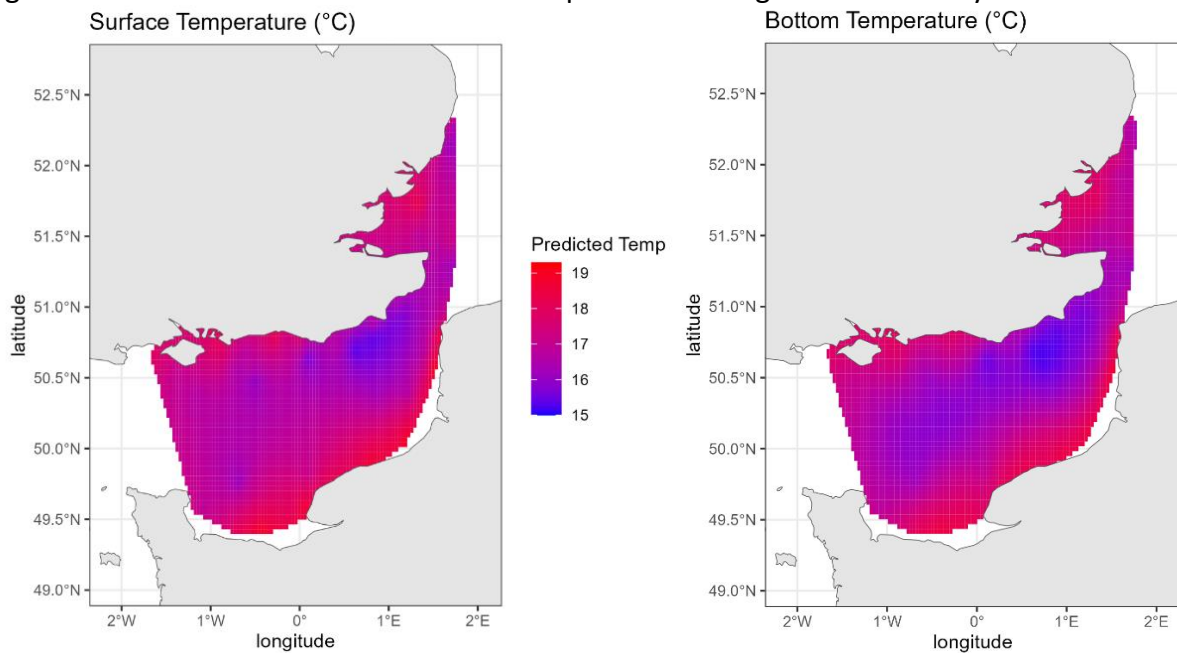
Figure 14. Surface and bottom seawater salinity during the 2023 survey
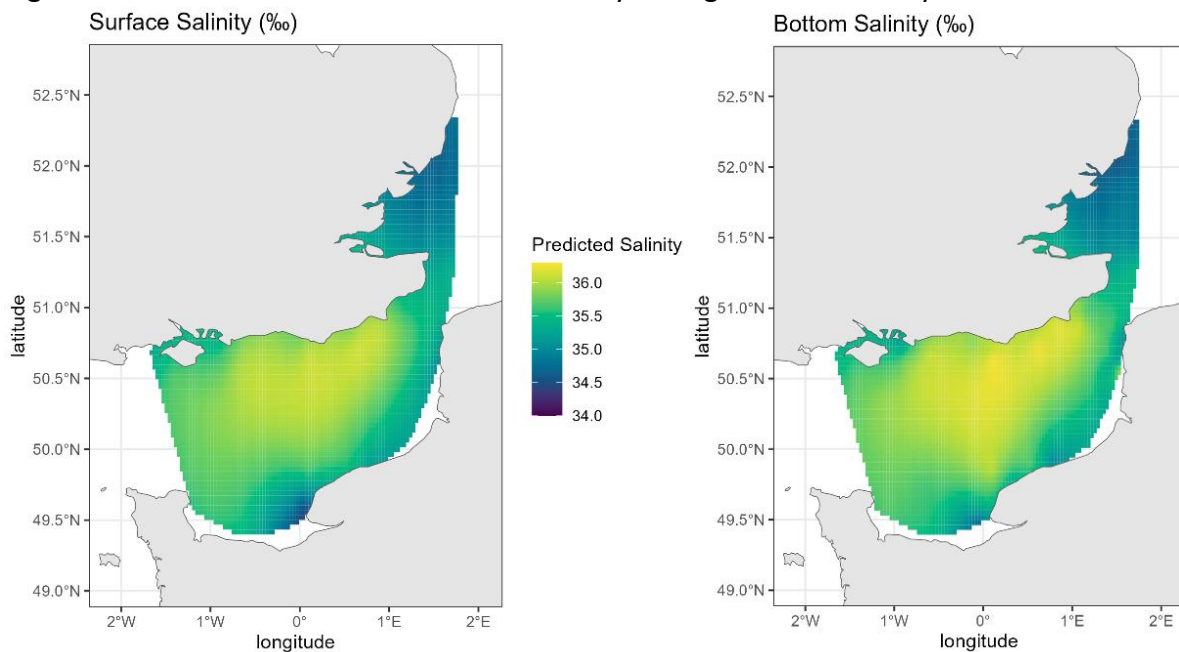
Aim 11.

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

Aim 12.

Seawater samples were collected from the surface and near bottom (4m off seabed), where practical, twice per day at scientific sunrise (15-minutes before first light) and after the last fishing station using a Niskin sampler. During operations, an ESM2 data logger was also deployed to obtain water column environmental data (temperature, salinity, dissolved oxygen, chlorophyll fluorescence and turbidity).

Aim 13.

Chlorophyll samples were collected from the near bottom, where practical, once per day at scientific sunrise. Seawater was collected from the Niskin sampler (500ml) and filtered as required. Chlorophyll samples were collected from a total of 10 fishing stations (Primes 102, 75, 63, 57, 50, 45, 8, 29, 37 and 70).

Aim 14.

A zooplankton sample was not collected from the West Gabbard Smart Buoy site due to lack of time availability (70Nm round trip from primary aim fishing stations, as well as scheduled end of survey passage plan to Portland Port).

OPPORTUNISTIC AIMS:

Aim 15.

Belgium comparative tow fishing stations (Primes 113, 114, 115, 116 and 118) were not completed due to a lack of time availability (170Nm transit from the last fishing station (Prime 95) to Portland Port, sailing head to wind).

Aim 16.

Elasmobranch specimens of significant size and in good health were tagged with Peterson tags and released. During the survey, 1 starry smoothhound *Mustelus asterias* was tagged at Prime 25 (tag number: E677808), and 2 nursehound *Scyliorhinus stellaris* were tagged at Prime 100 (E677809) and Prime 10 (E677810) (Figure 15).

Figure 15. Nursehound tagged with Peterson tag before release

Aim 17.
Selected specimens were frozen and retained for identification purpose back at the laboratory.

Aim 18.
Full biological sampling was carried out, where practical, on common cuttlefish (Figure 16).

Figure 16. Example common cuttlefish sex and maturity staging (female - immature)

Aim 19.
Alloteuthis sp. were collected, photographed (Figure 17), frozen and retained for identification studies back at the laboratory.

Figure 17. Example *Alloteuthis sp.* sample
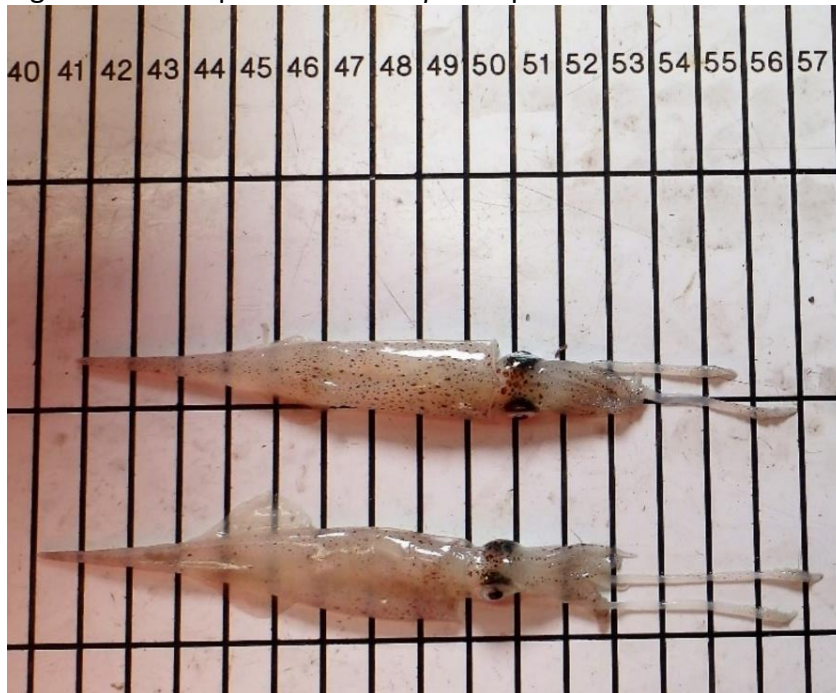
Aim 20.
A selection of non-otolithed round fish and flat fish species from various fishing stations were frozen and retained for biological sampling training of new Cefas fisheries staff back at the laboratory.

Aim 21.
20 lesser-spotted dogfish were frozen and retained for the 2023 Cefas Masterclass

ACKNOWLEDGEMENTS:
Many thanks to the officers and crew of the Cefas Endeavour for their support and expertise throughout the survey, without which it would not have been possible to achieve survey aims. I would also like to thank Mary Brown for producing survey maps and abundance plots, and Chyanna Allison for producing temperature and salinity maps as well as delivering genetic sampling aims. Special thanks to Maisie Evans (Postgraduate researcher) for guest participation on the survey.

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Date: 04/09/2023

INITIALLED: I D Holmes

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B Hatton (Deputy Fishing Survey Manager)
J Smith (Historic Eastern Channel Beam Trawl Survey SIC)
Survey participants
Cefas fisheries survey SICs/2ICs
G Burt (for CDR)
D Evans/B Salter (AWSM)
Master/Fishing Skipper (Cefas Endeavour)
Marine Management Organisation (MMO)
Marine Management Organisation Licencing (MMO)
Marine Management Organisation Conservation (MMO)
FCDO (for Belgium and France)
Els Torreele, Belgium
Carolina Giraldo , France
Kent and Essex, Sussex, Southern and Eastern IFCAs
BODC

APPENDIX A

Total weight and numbers of selected commercial fish by region and year (catch data raised to standard 30-minute tows) during 2014-23 surveys. ESB – European seabass, BLL – brill, COD – cod, DAB – dab, FLE – flounder, LEM – lemon sole, PLE – European plaice, SOL – Dover sole, TUR – turbot, WHG – whiting, and CTC – common cuttlefish.

Figure 18. Total catch by region of selected commercial fish over the past 10 years (2014-2023)

VIId English - weight by species/year
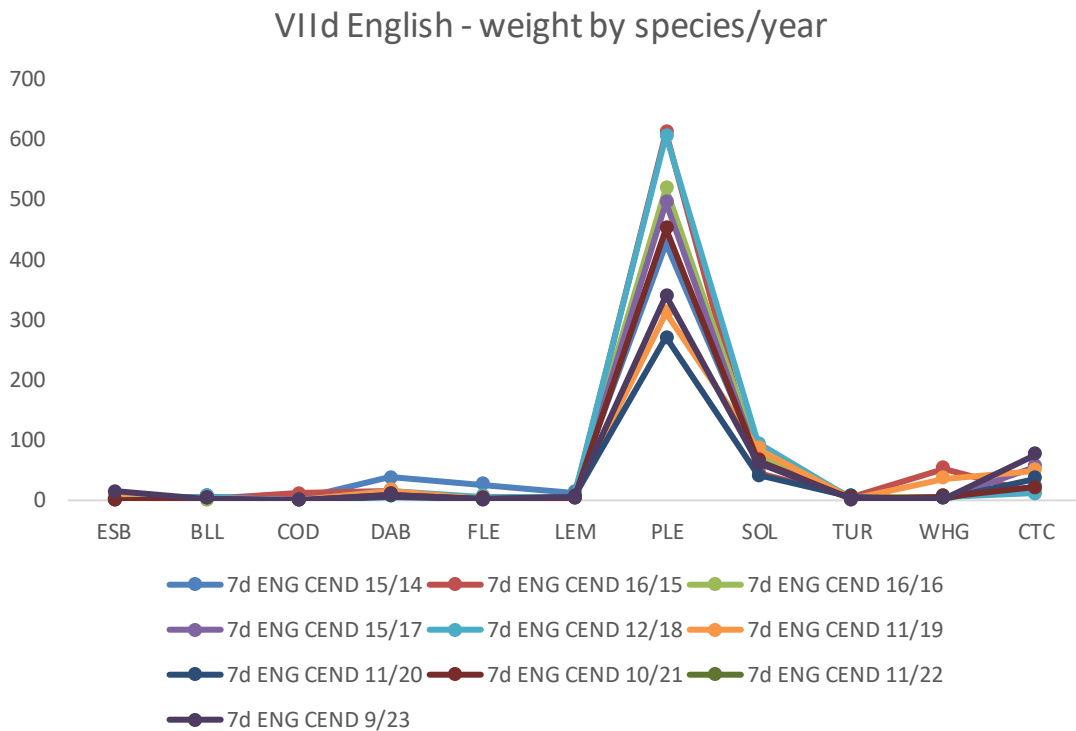
VIId French - weight by species/year
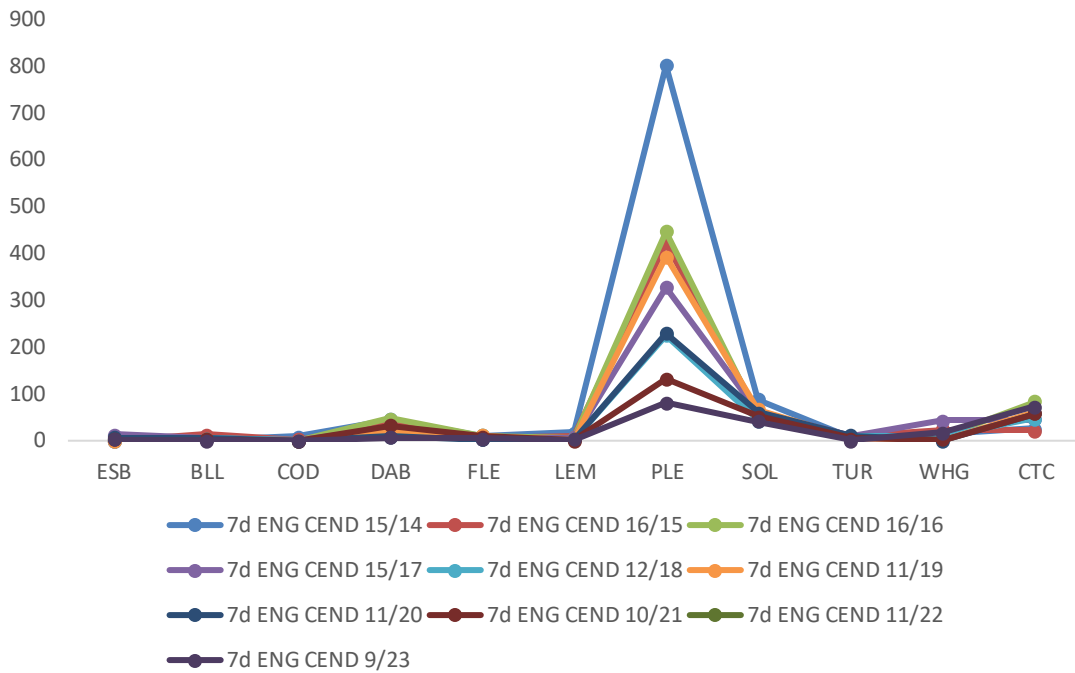
IVc - weight by species/year
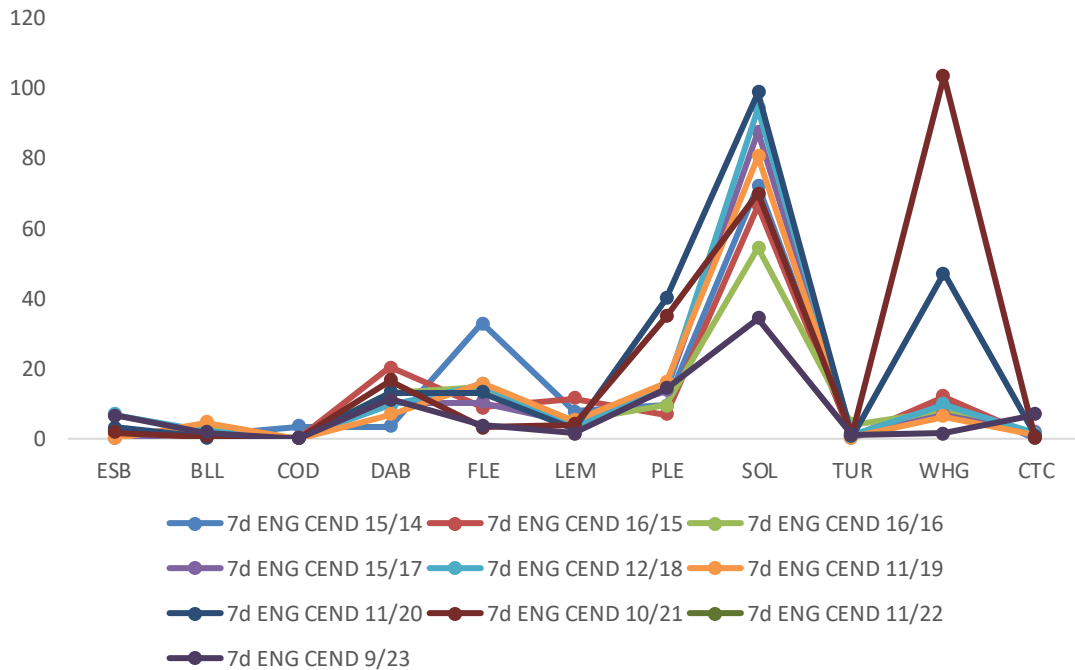
VIId English - numbers by species/year

Legend:
- 7d ENG CEND 15/14
- 7d ENG CEND 16/15
- 7d ENG CEND 16/16
- 7d ENG CEND 15/17
- 7d ENG CEND 12/18
- 7d ENG CEND 11/19
- 7d ENG CEND 11/20
- 7d ENG CEND 10/21
- 7d ENG CEND 11/22
- 7d ENG CEND 9/23
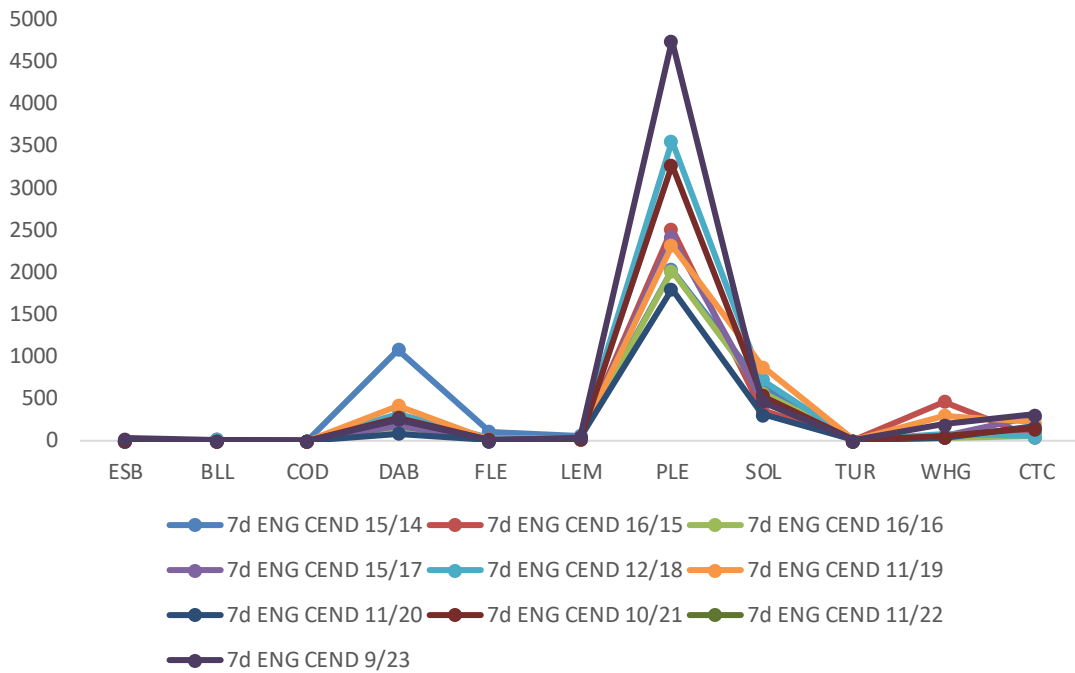
VIId French - numbers by species/year

Legend:
- 7d ENG CEND 15/14
- 7d ENG CEND 16/15
- 7d ENG CEND 16/16
- 7d ENG CEND 15/17
- 7d ENG CEND 12/18
- 7d ENG CEND 11/19
- 7d ENG CEND 11/20
- 7d ENG CEND 10/21
- 7d ENG CEND 11/22
- 7d ENG CEND 9/23

IVc - numbers by species/year

Legend:
- 7d ENG CEND 15/14
- 7d ENG CEND 16/15
- 7d ENG CEND 16/16
- 7d ENG CEND 15/17
- 7d ENG CEND 12/18
- 7d ENG CEND 11/19
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- 7d ENG CEND 10/21
- 7d ENG CEND 11/22
- 7d ENG CEND 9/23
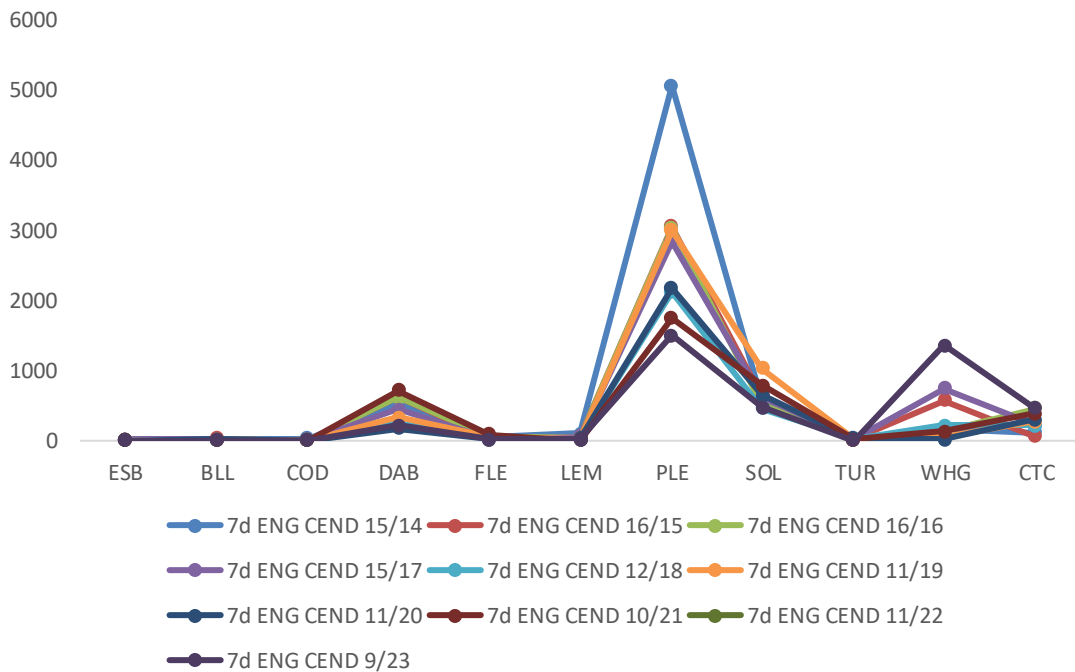
Figure 19. Comparison of total catch weight of selected commercial fish by survey over the past 10 years (2014-2023)
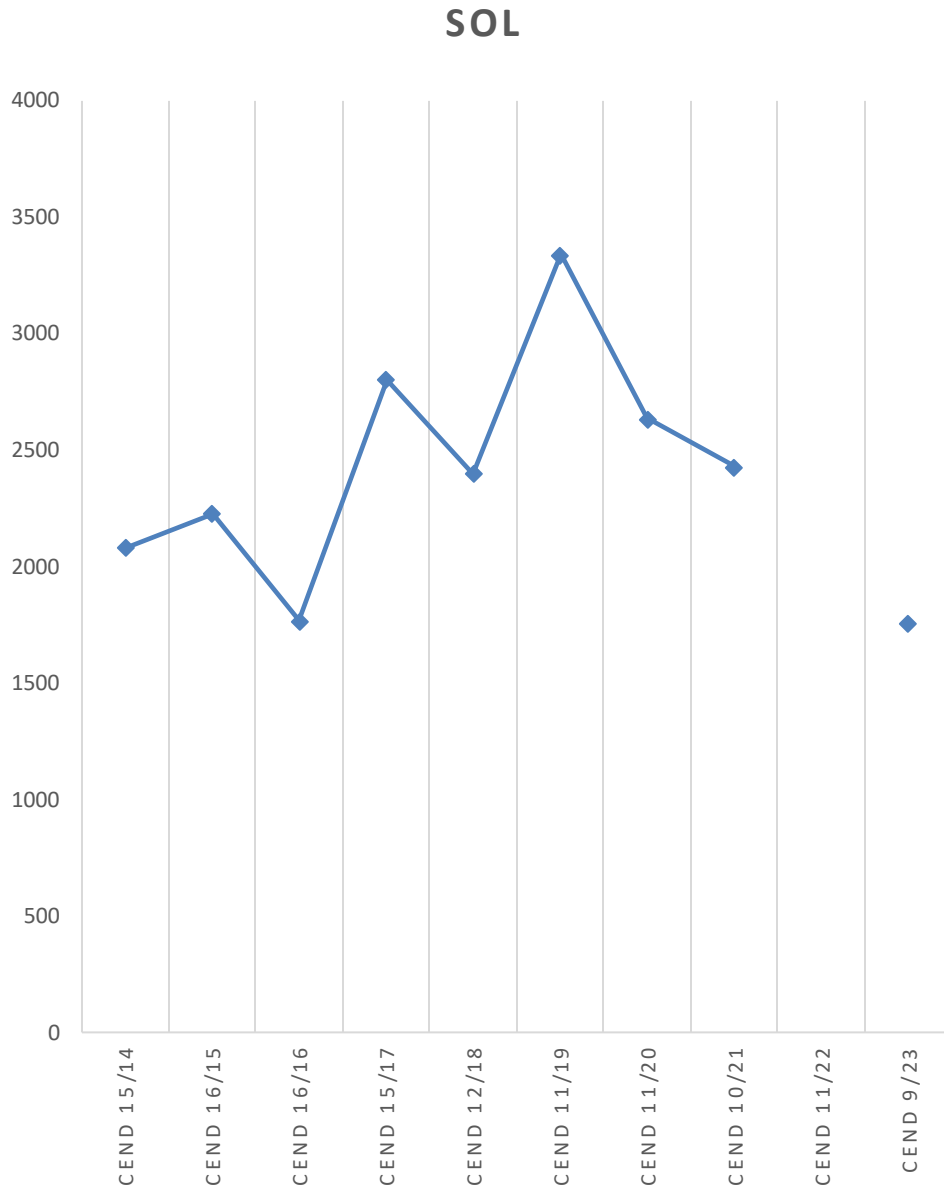
PLE
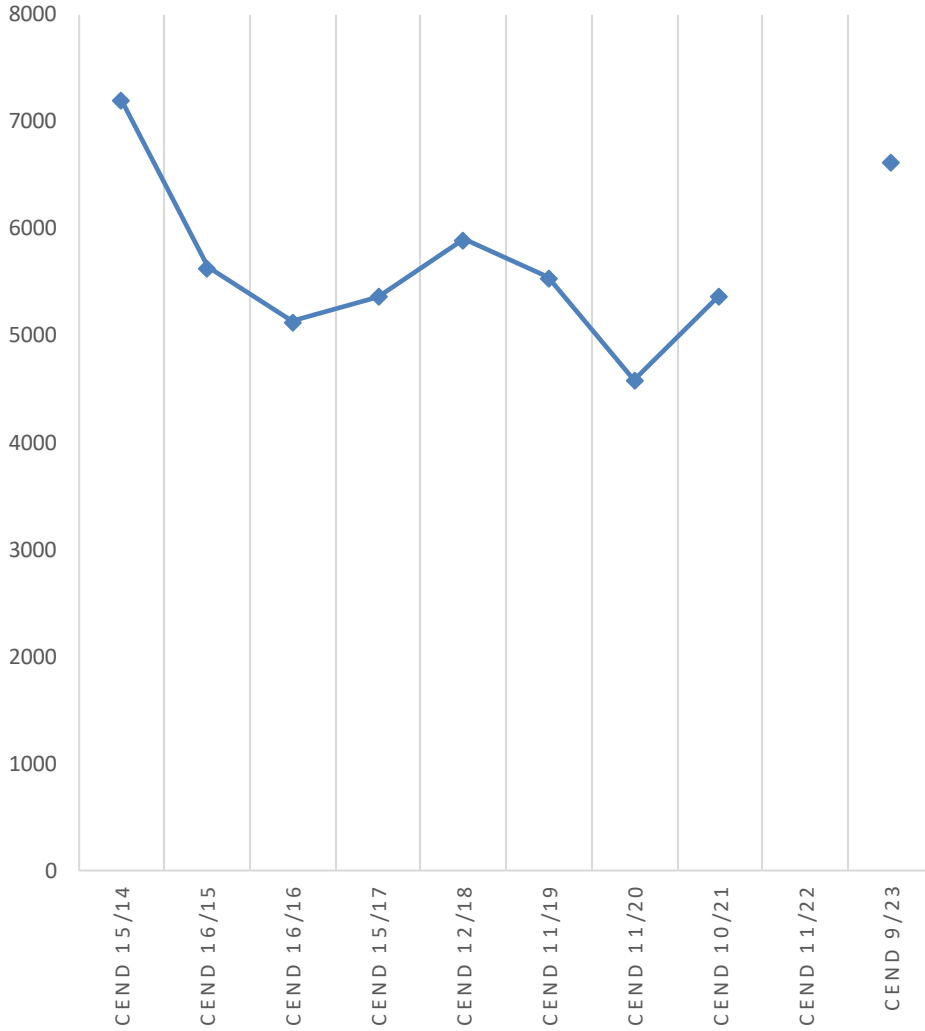
DAB
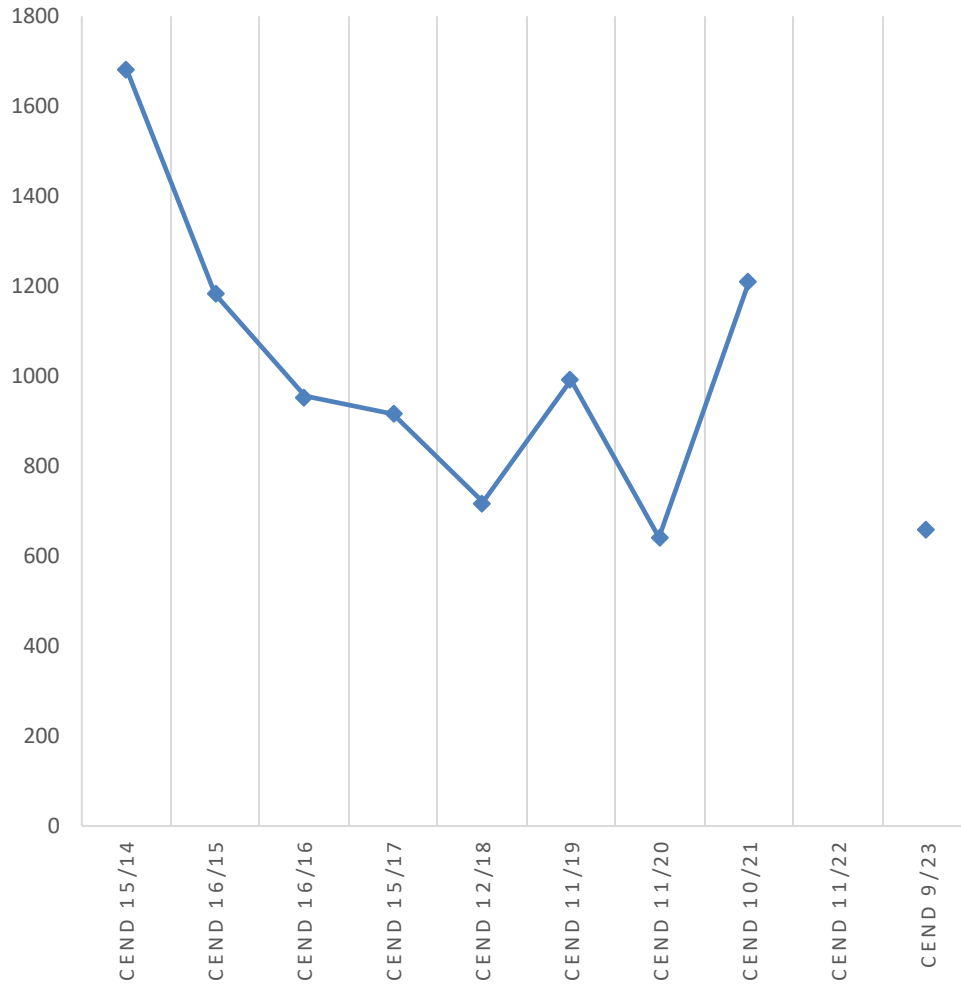
LEM
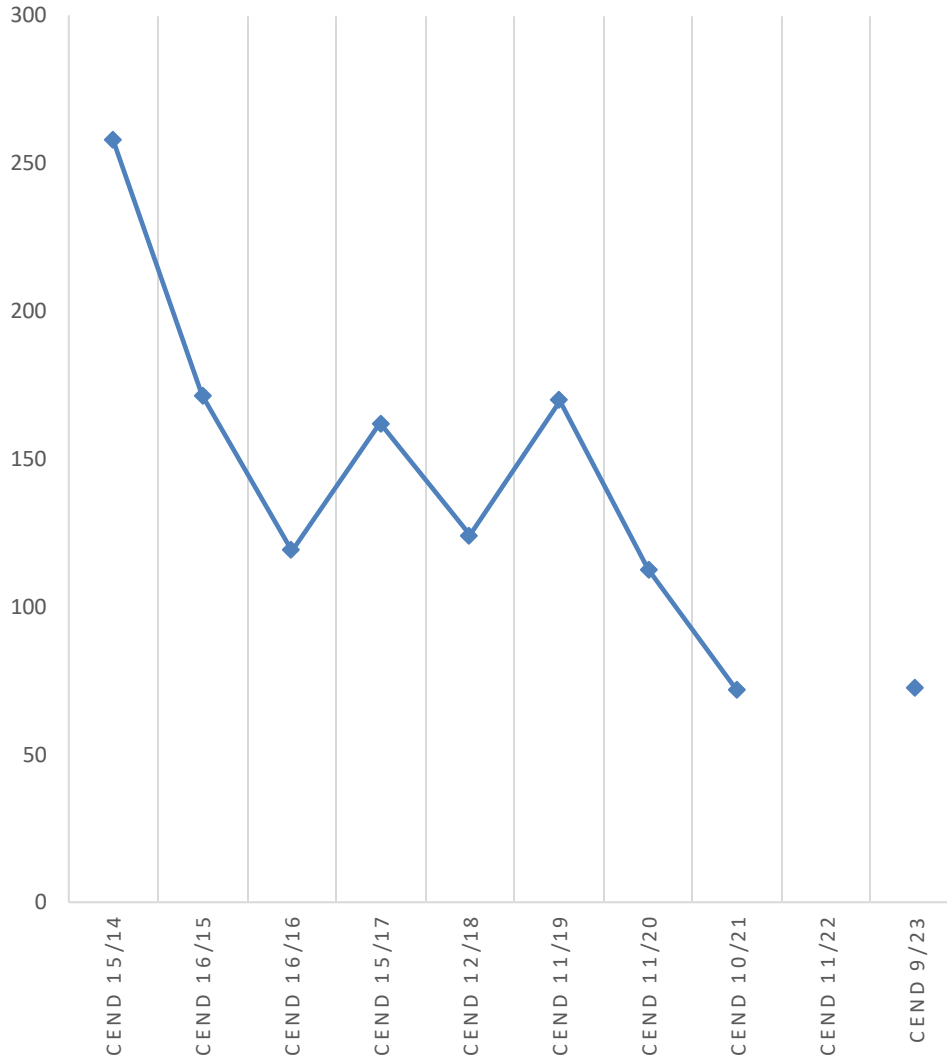
COD
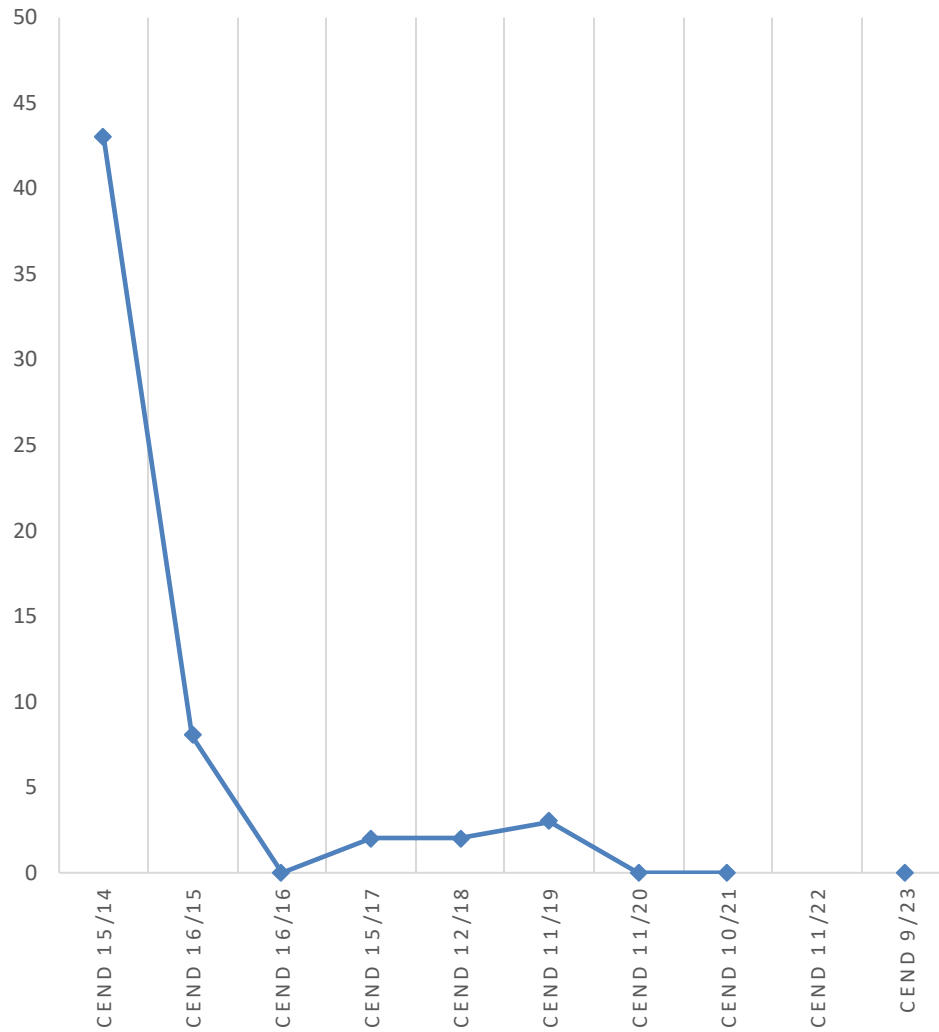
WHG
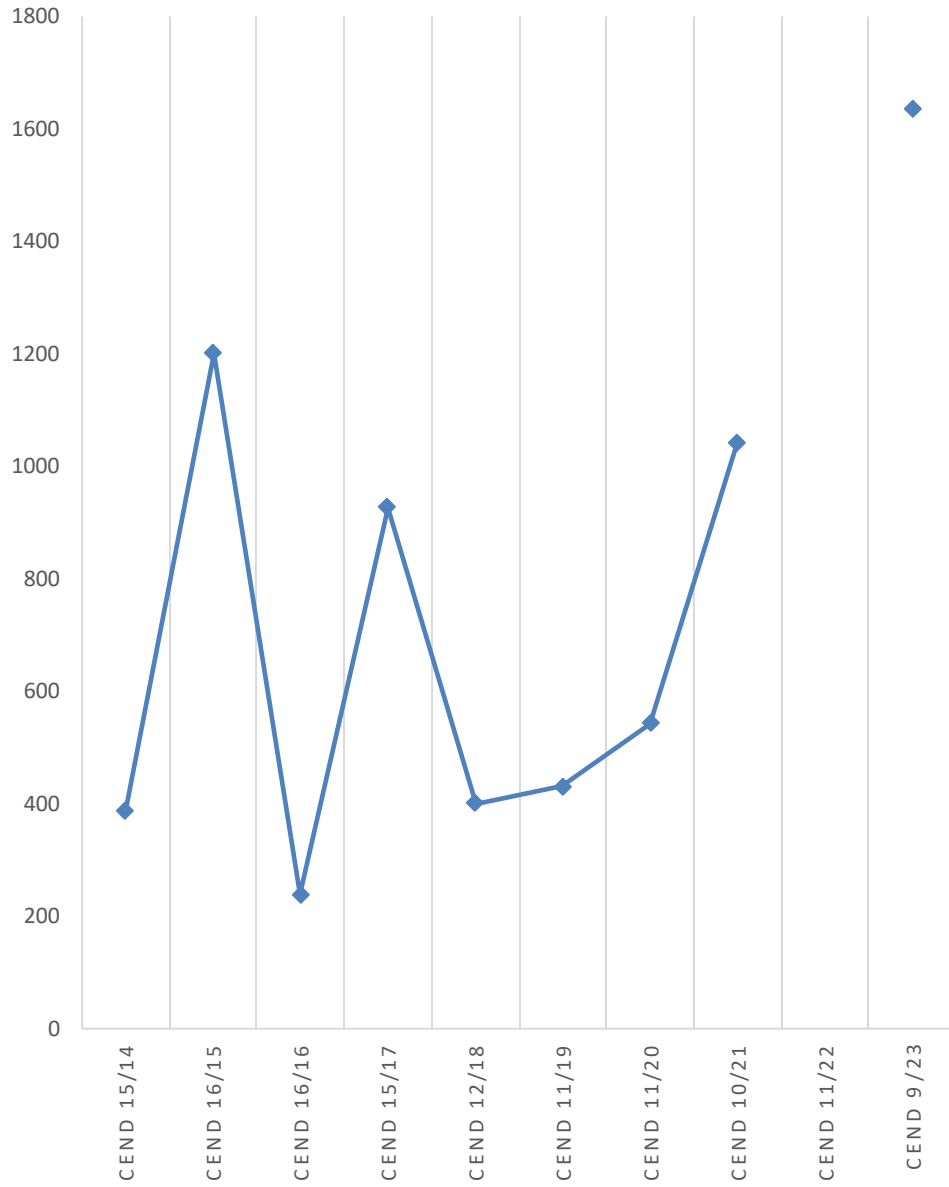
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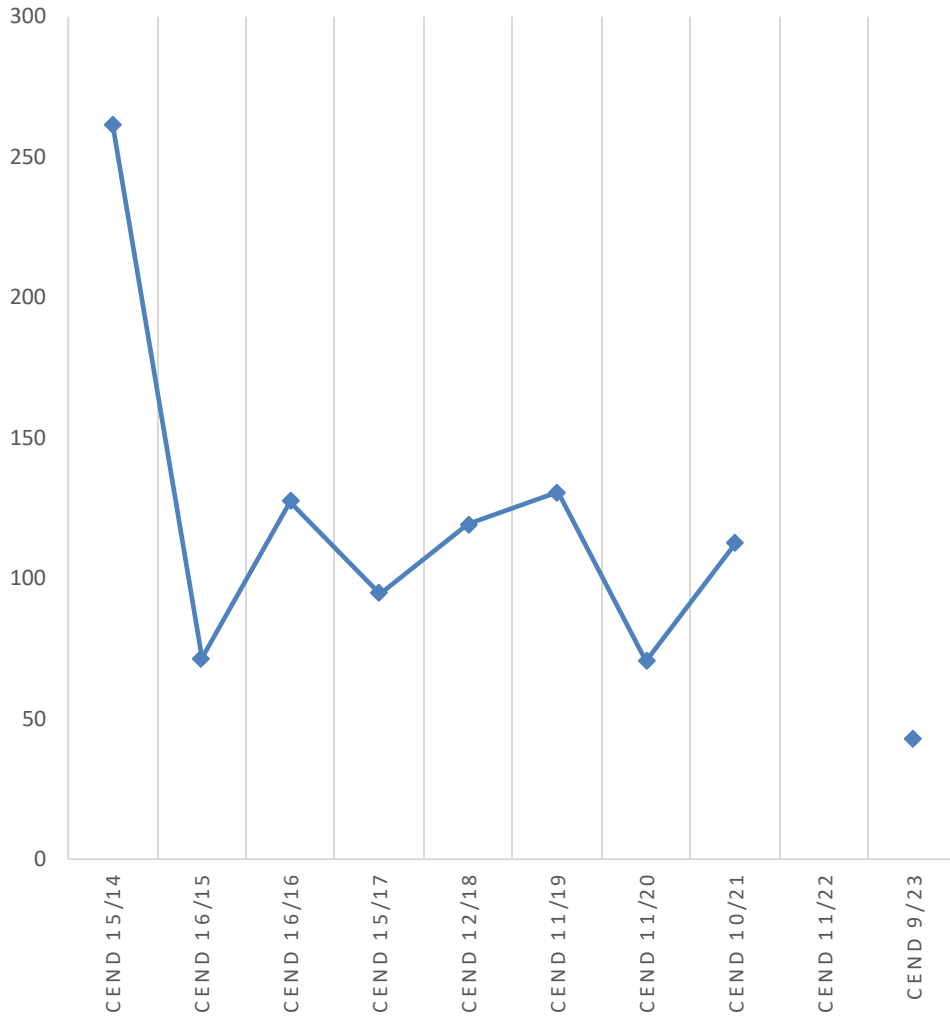
CTC
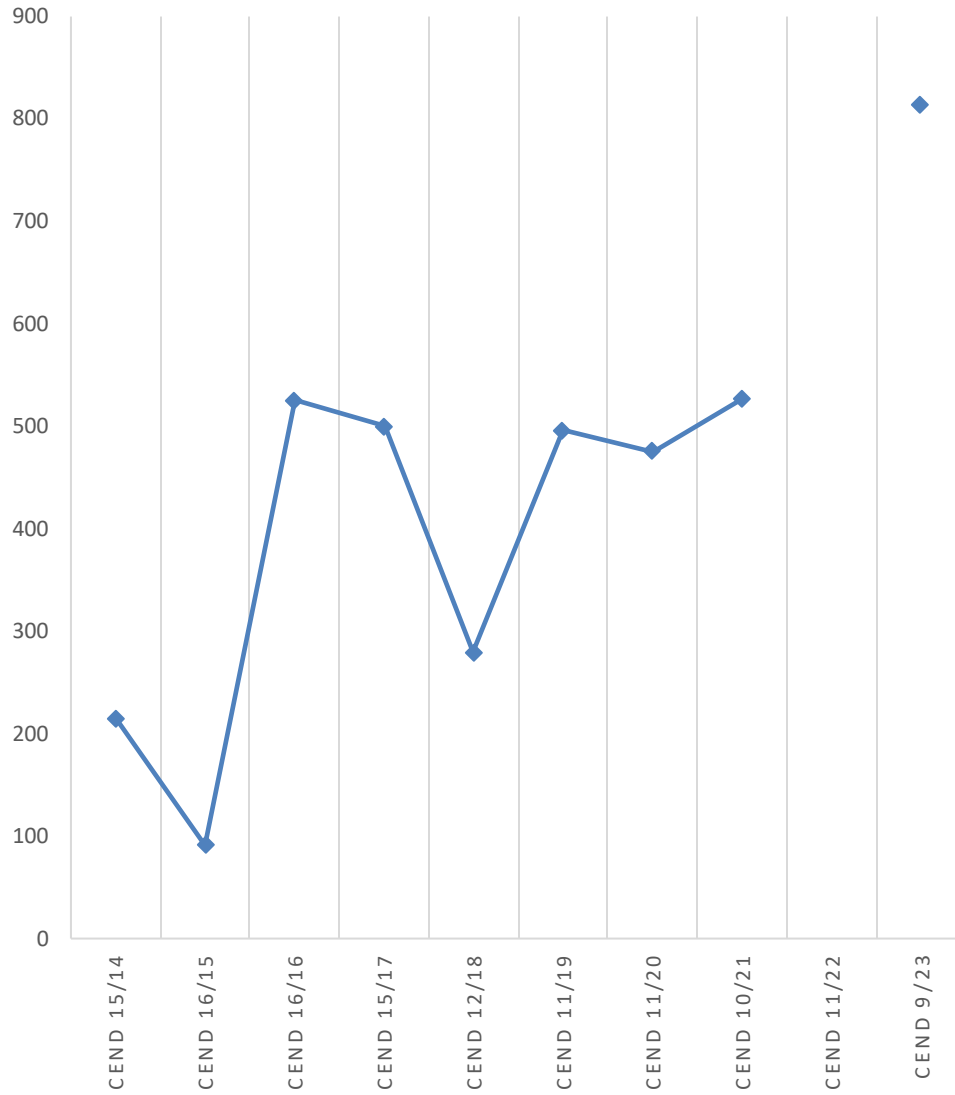
BLL
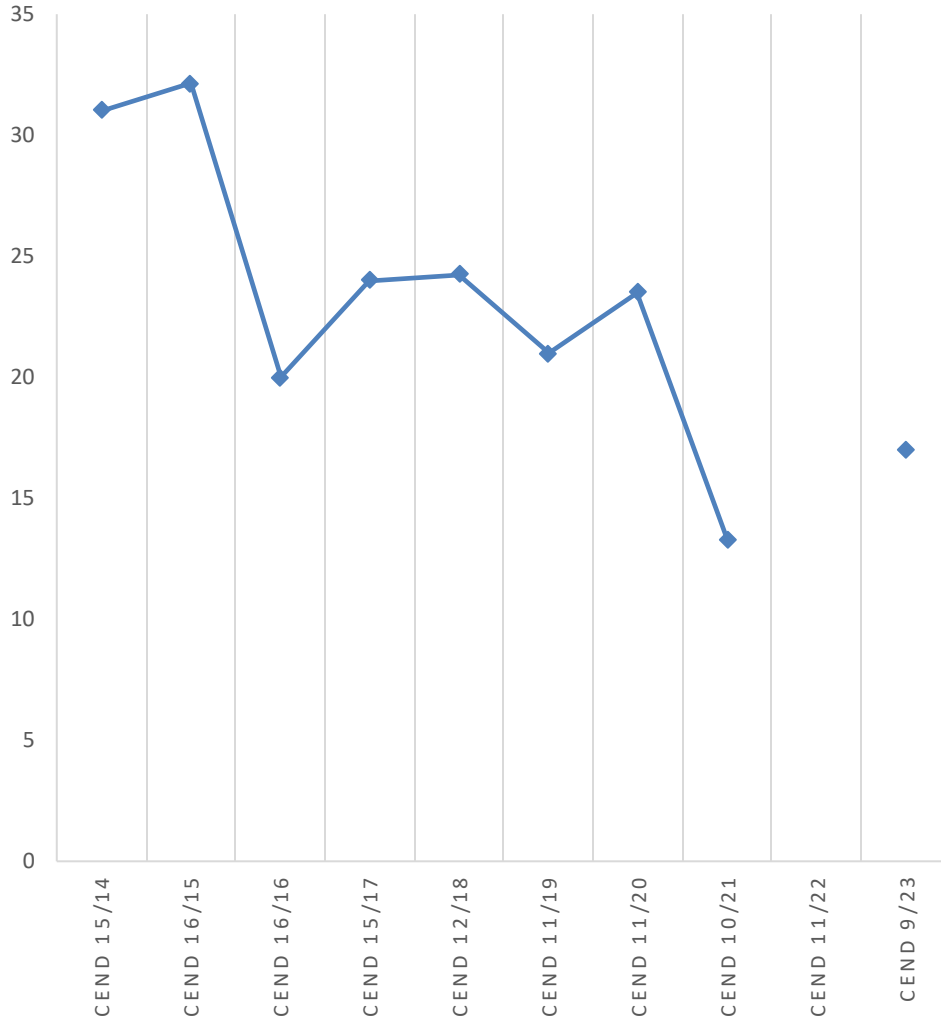
TUR
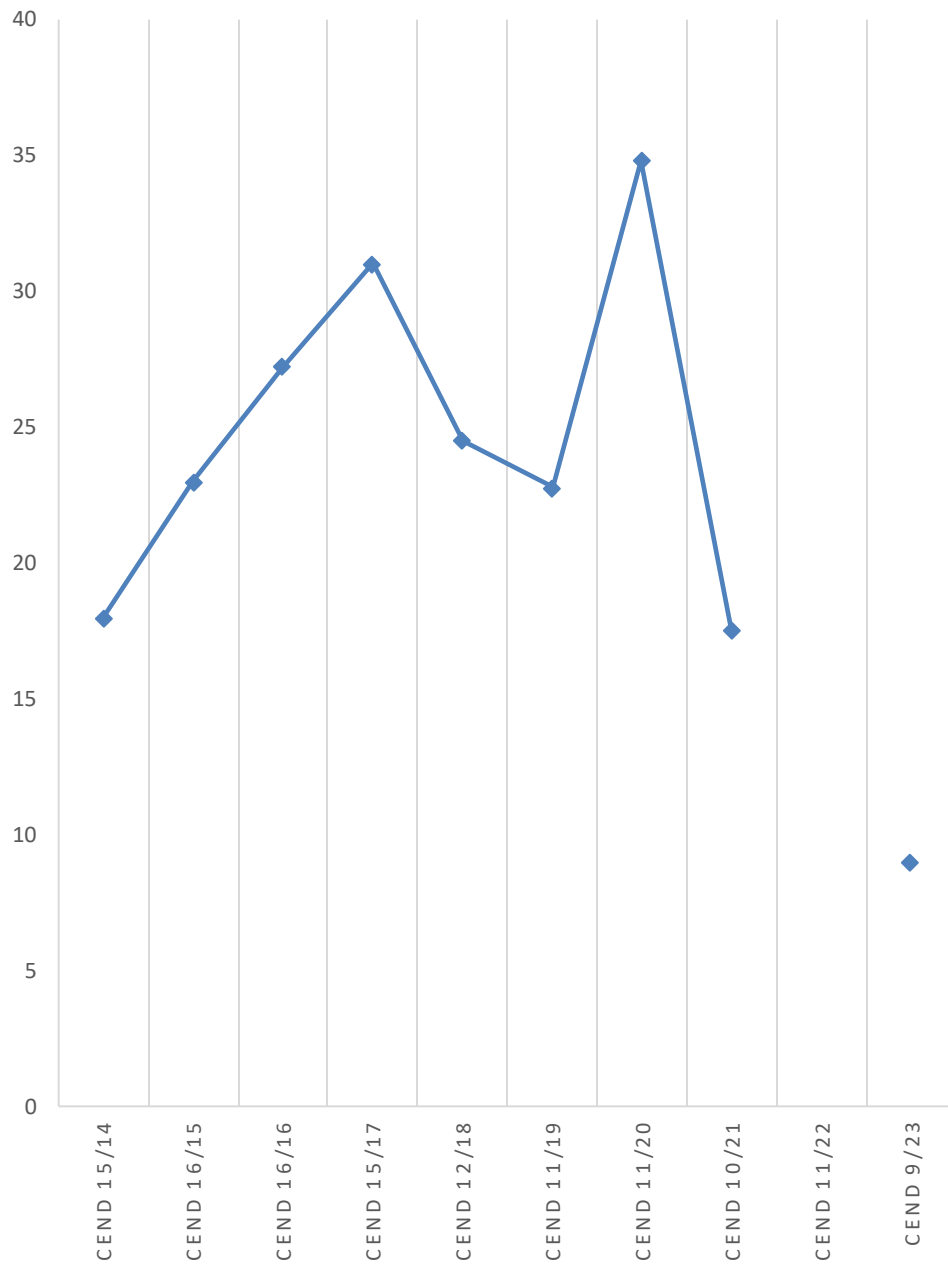
Figure 20. Mean total number and weight of European plaice over the past 10 years (2014-2023)

7d English Plaice - trend in mean number and mean weight caught per 30 minute tow
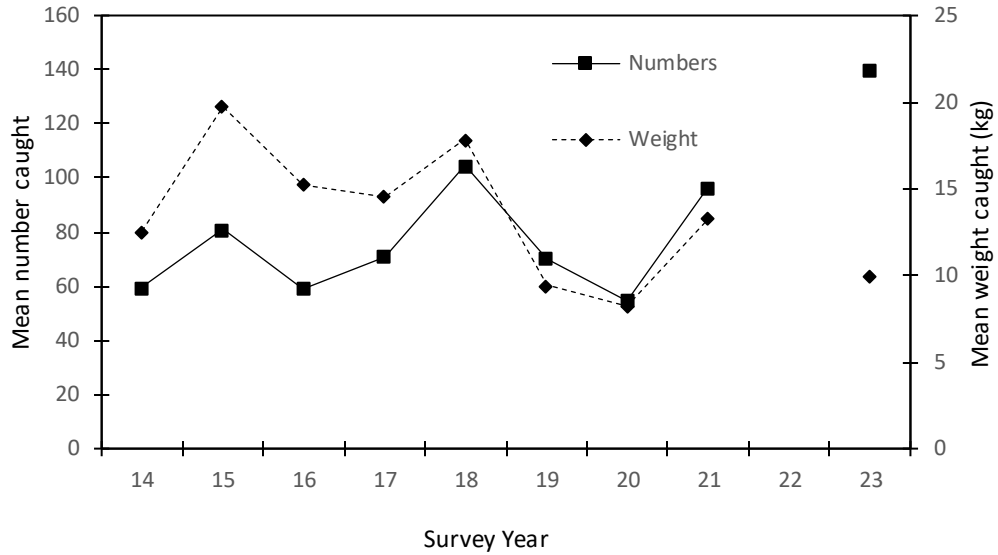
7d French Plaice - trend in mean number and mean weight caught per 30 minute tow
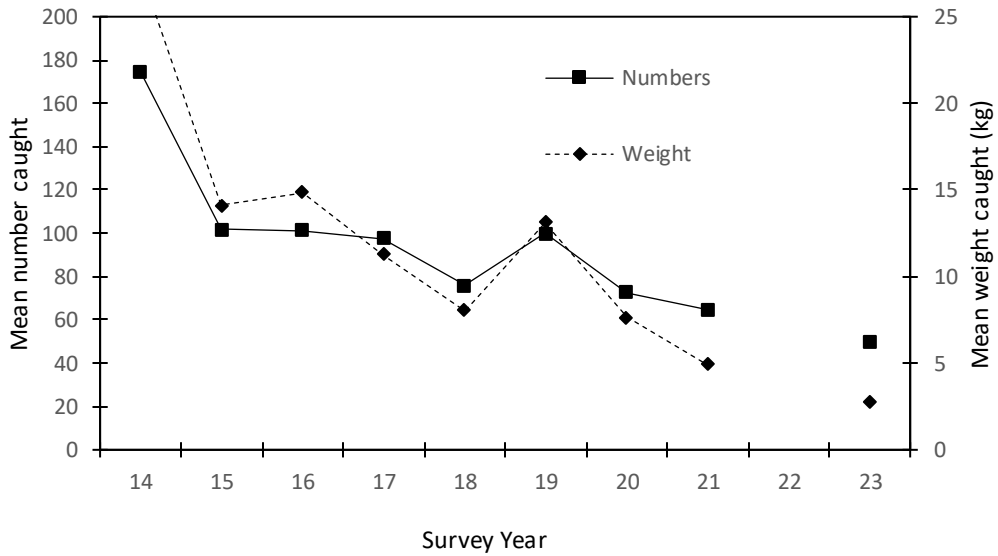
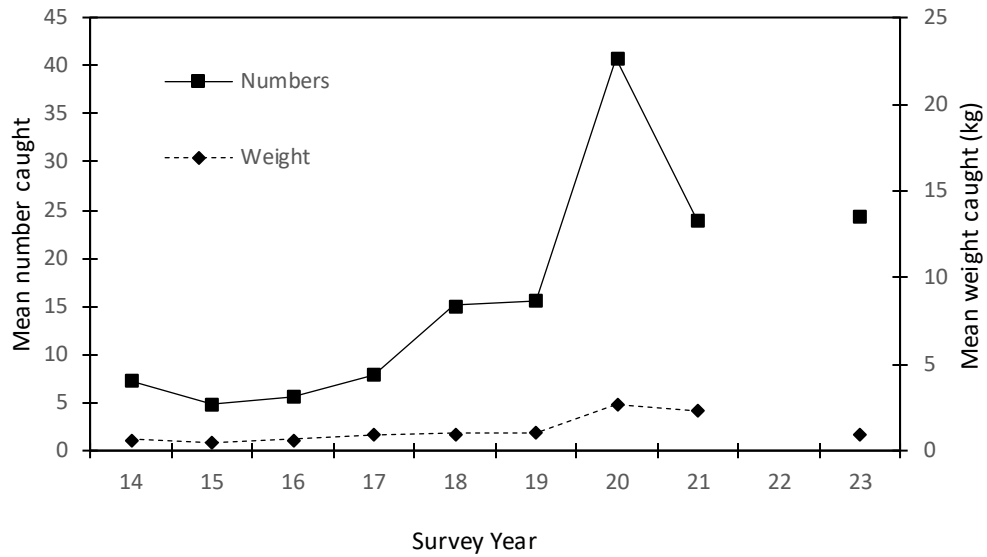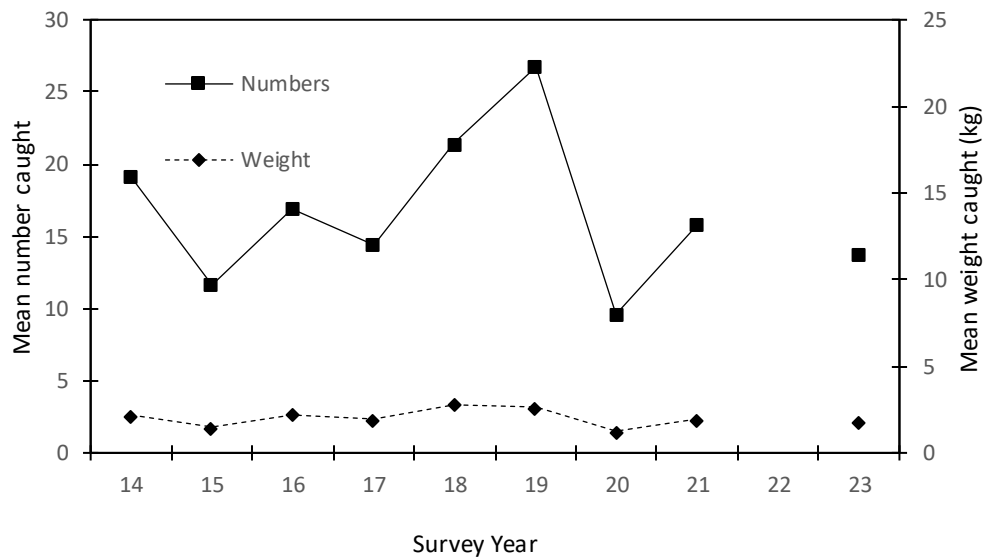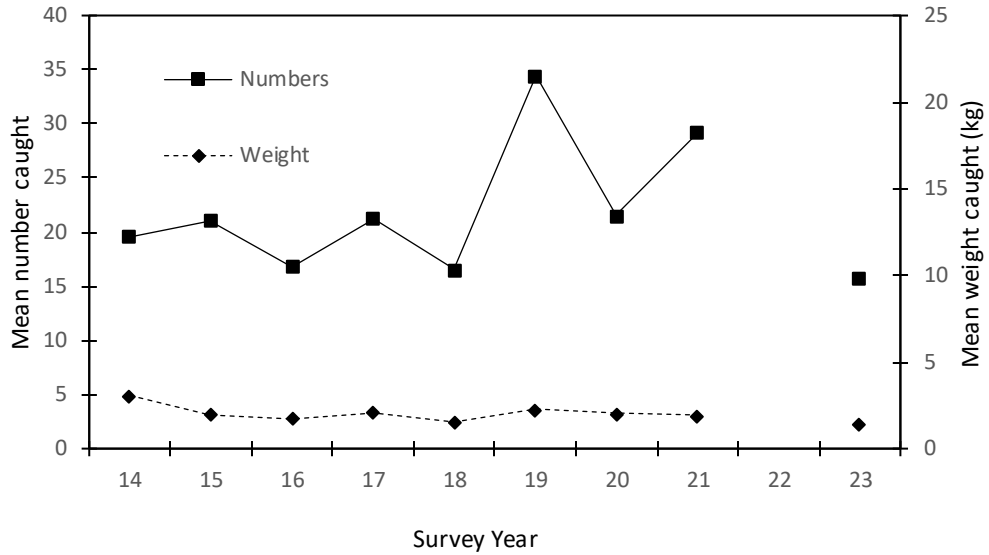**4c Plaice - trend in mean number and mean weight caught per 30 minute tow**

Figure 21. Mean total number and weight of Dover sole over the past 10 years (2014-2023)

7d French Sole - trend in mean number and mean weight caught per 30 minute tow

7d French Sole - trend in mean number and mean weight caught per 30 minute tow

4c Sole - trend in mean number and mean weight caught per 30 minute tow