Centre for Environment Fisheries & Aquaculture Science

Cefas

RESEARCH VESSEL SURVEY REPORT

RV CEFAS ENDEAVOUR
Survey: C END 15 - 2019.

STAFF:

Name	Role	Name	Role
Part 1		**Part 2**	
Jeroen van der Kooij	SIC/acoustics	**Joana Silva**	SIC/fish
Joana Silva	2IC/fish	**Fabio Campanella**	2IC/acoustics
Oliver Twigge	Hydro	**Oliver Twigge**	Hydro
Marc Whybrow	Tech	**Marc Whybrow**	Tech
Richard Humphreys	Fish Lead	**Richard Humphreys**	Fish Lead
Matt Eade	Fish	**Sam Barnett**	Fish
Sam Barnett	Fish	**Allen Searle**	Fish
Fabio Campanella	Acoustics	**Sílvia Rodriguez-Clíment**	Acoustics
James Pettigrew	Plankton	**Hayden Close**	Plankton
Nevena Almeida	Plankton	**Hannah Lloyd-Hartley**	Plankton
James Scott	PhD (UEA)	**James Scott**	PhD (UEA)
Chris Brodie	PhD (Uni Salford)	**Chris Brodie**	PhD (Uni Salford)
Roweena Patel	PhD (Uni Reading)	**Roweena Patel**	PhD (Uni Reading)
Nuala Campbell	ML observer	**Nuala Campbell**	ML observer
Camille Burton	ML observer	**Camille Burton**	ML observer

DURATION: 1st – 28th October (28 days)

LOCATION: Western Channel and Celtic Sea (ICES Divisions 7.d, e, f, g, Fig 1)

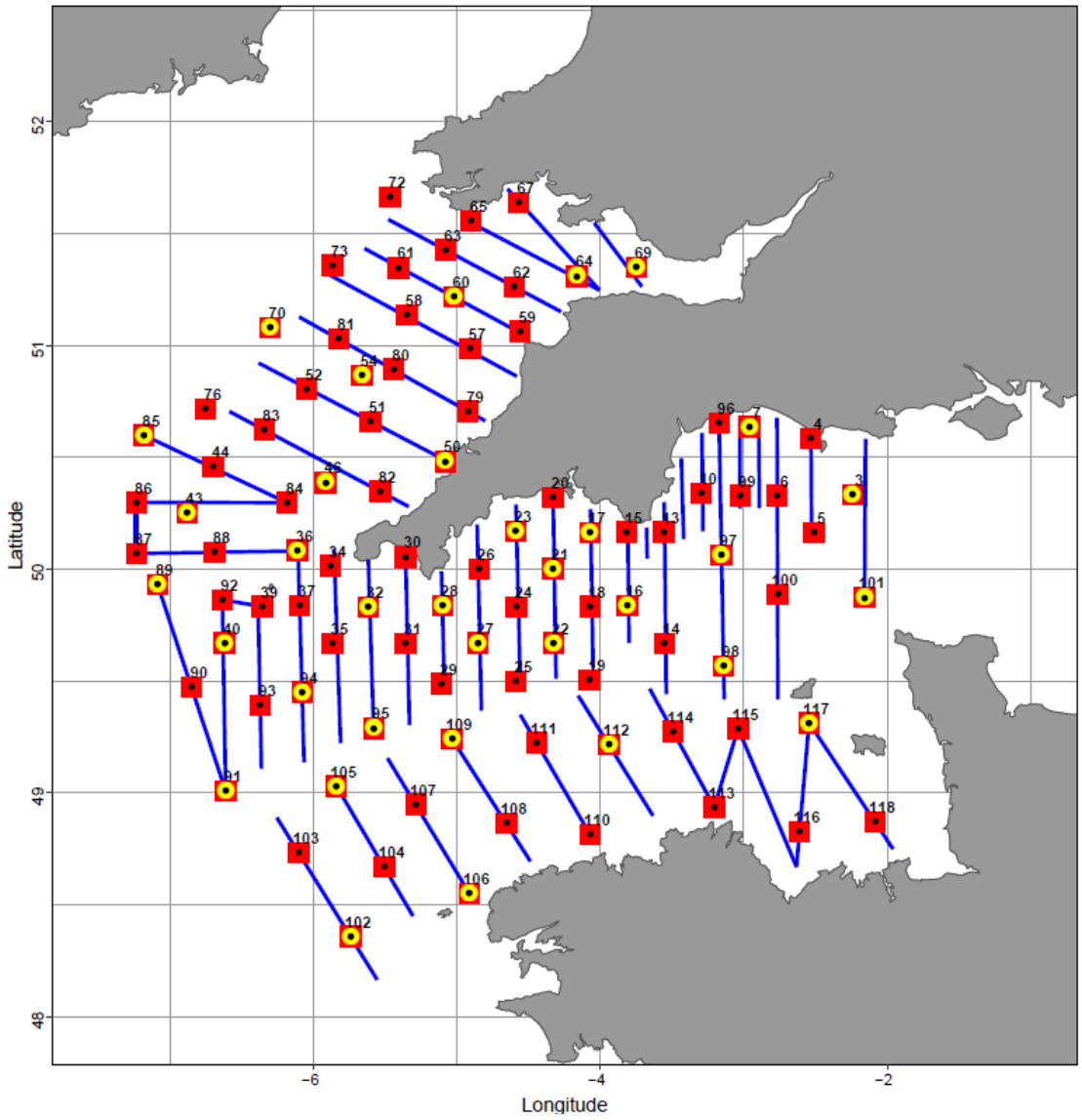

Figure 1. Overview of the planned survey area, with the acoustic transect (blue lines), plankton stations (red squares) and hydrographic stations (yellow circles).

AIMS:

1. To carry out the eighth annual multidisciplinary pelagic survey of the western Channel and Celtic Sea to estimate the biomass of-, and gain insight into the population of the small pelagic fish community including sprat (*Sprattus sprattus)*, sardine (*Sardina pilchardus*), mackerel (*Scomber scombrus*) , anchovy (*Engraulis encrasicolus*), horse mackerel (*Trachurus trachurus*), boarfish (*Capros aper*) and blue whiting (*Micromesistius poutassou*).

   a. To carry out a fisheries acoustic survey during daylight hours only, using four operating frequencies (38, 120, 200 and 333 kHz) to map and quantify the small pelagic species community.
   b. To trawl for small pelagic species using a 20x40m herring (mid-water) trawl in order to obtain information on:
      - Species and size composition of acoustic marks
      - Age-composition and distribution, for small pelagic species
      - Length weight and maturity information of pelagic species
      - Stomach contents of selected species

2. To collect biological data (size, weight, age and maturity) on a range of data-limited fish species, including European seabass (*Dicentrarchus labrax*), black seabream (*Spondyliosoma cantharus*), striped red mullet (*Mullus surmuletus*), garfish (*Belone belone* and *B. svetovidovi*), saury pike (*Scomberesox saurus*).

3. To collect plankton samples using two ring-nets with 80 µm, and 270 µm mesh sizes at fixed stations. Carried out at night by vertical haul and samples will be processed onboard:
   a. Ichthyoplankton (eggs and larvae, 270 µm) of pelagic species will be identified, counted and (in case of clupeids) staged and measured onboard to identify spawning areas.
   b. Zooplankton (80 µm) will be stored for further analysis back in the lab.

4. Water column sampling. At fixed stations along the acoustic transect, a CTD (either an ESM2 profiler or a Seabird mounted on a Rosette sampler) will be deployed to obtain measurements of environmental properties within the water column. Water column profile and water samples will provide information on chlorophyll concentration, dissolved oxygen, salinity, temperature, turbidity, and dissolved inorganic nutrients concentration as well as the relevant QA/QC samples for calibration of the equipment. Water samples will be collected and fixed on board for analysis post-survey. Samples for analysis of the phytoplankton and microzooplankton communities will also be collected at the subsurface at fixed sampling stations.

5. Seabirds and Marine Mammals. Locations, species, numbers and activities observed will be recorded continuously during daylight hours by Marinelife observers located on the bridge.

6. Ferrybox Continuous CTD/Thermo-salinograph. Continuously collect oceanographic data at 4 m depth during steaming, including chlorophyll concentration (from calibrated fluorescence).

7. To carry out hourly measurements of the phytoplankton functional groups using an online flow-cytometer, connected to the Ferrybox; in collaboration with project JERICHO NEXT.

8. To further trial the continuous Plankton Image Analyser (PIA, James Scott, PhD).

9. To collect and process samples of environmental DNA and assess method as monitoring tool for pelagic fish, cetaceans and diversity (Chris Brodie, PhD).

10. To collect stomach contents of small pelagic fish (e.g. anchovy and sardine) for onboard and post-survey analysis (Roweena Patel, PhD).

11. To collect small pelagic fish stomachs for a study on proliferation of microplastics through food webs. Not completed and replaced with #10

12. To collect a zooplankton sample using the 200 µm mesh ring-net at the West Gabbard2 SmartBuoy, for the Lifeform project (Defra) as part of the UK monitoring network of zooplankton. Not completed due to time constraints.

13. To collect and freeze sardine specimens at three different locations: eastern English Channel, Western English Channel and Bristol Channel for genetic and otolith morphometric study (Ana Verissimo, CIBIO, Portugal)

14. To collect 15 tissue samples of sardine for each ICES rectangle for a Portuguese study to integrate genetic analysis into fisheries biology and assessment (Ana Rita Vieira, MARE, University of Lisbon, Portugal)

NARRATIVE:

All staff joined the RV Cefas Endeavour in Swansea docks by 16:00 on the 30th of September. Inductions were held at 16:00 followed by the presurvey debrief at 18:00. Given the incremental weather conditions forecasted, the captain suggested conducting the echosounder calibration in port the following morning (1st of October) before sailing: while the available water depth was shallow at 12 m, the relatively sheltered position and lack of tide led us to consider it. As planned, staff involved with the calibration were ready at 5:30 to make final preparations but a range of circumstances delayed the actual calibration attempt until 9:00 BST. With the pilot due at 10:00, the calibration had to be aborted. The RV sailed out of Swansea at 10:00 and commenced the inner most transect of the Bristol Channel, after which shakedown tows for the plankton nets and rosette/CTD were conducted, both preceded by relevant toolbox talks. At 16:00, after the toolbox talk, the trawl was deployed for a shakedown tow. Overnight, a series of plankton and rosette stations were conducted. At approximately 7:00 BST on Wednesday 2nd of October favourable conditions meant that a second calibration of the echosounders was attempted. A sheltered location at northern end of transect 10, along the western tip of the Pembrokeshire coast was used, which had sufficient water depth, but strong tides. The calibration, conducted on the drift was completed at 9:45 (38, 120 and 200 kHz at 0.512 and the 38 at 0.256) by which point the RV needed to leave the area for planned fire practise, which affected the acoustic sampling of the northern parts of transects 10 and 9. The survey had commenced properly which, as per protocol, involved running acoustic transects during the day at 10 knots, while simultaneously collecting continuous sub-surface oceanographic data with the Ferrybox. Two Marinelife observers recorded qualitative and quantitative information on the top predators on transect. At night, a series plankton and rosette stations was sampled. Late afternoon on Thursday the 3rd of October, the RV sought shelter (daylight required) on the east side of Lundy from Storm Lorenzo which was due to arrive at night. No night time surveying was conducted. Approximately 24 hours later, in the afternoon of Friday the 4th of October, the RV sailed to explore conditions and resumed survey work. For the next few days, the survey progressed westwards under fresh but workable conditions. On the 7th of October, the pelagic trawl was damaged during a fishing operation on transect 15. While the true extent of the damage was not known until later, as a precautionary measure it was decided to rig the spare trawl. Although trawling operations could resume later in the afternoon, few fish schools appeared on the echosounder and therefore no further tows were conducted. Acoustic monitoring was continued as were the overnight primary stations sampling for zooplankton and CTDs. Several plankton stations had to be repeated over the first few weeks due to incidental damage to either the plankton nets (ringnet) or their codend. The next few days, the RV moved away from the Bristol Channel to sample the transects around the Isle of Scilly with weather conditions remaining fresh (25 knots of wind). Transect #18 had to be surveyed straight into the swell (east to west) leading to relatively poor acoustic data quality and reduced vessel speed. However, as very few fish schools were observed and no uplift of weather was expected work was continued. By the 11th of October, the Isles of Scilly transect had been completed and surveying of the Cornish waters in the western Channel commenced. Calmer weather on the 12th October (fair winds of 6 knots) led us to pick the exposed western most transects on the French side of the western Channel and associated prime stations overnight. At the (inshore) start of Transect 47 a series of surface schools were observed on the echosounder which comprised of post-larval anchovy (3.5-7 cm in length). These same schools were later observed inshore of the adjacent transects to the east.

Overnight, the RV steamed to Falmouth for a scheduled crew change on Monday the 14th of October, which was completed by 18:00 BST. Overnight, the vessel steamed from Falmouth to Lyme Bay to use the continued calm conditions to survey this important area for sprat. Most of the Lyme Bay transects were completed by the afternoon of the 17th under very good conditions (5-8 knots of wind, calm seas). While on occasion the wind picked up in the afternoon, daytime conditions remained very favourable and swell remained negligible, ensuring excellent data quality. After scientific staff change in the afternoon of the 17th of October by small boat transfer in Weymouth, the RV steamed back to French waters to survey the eastern-most transects. Due to adverse weather conditions, no trawling operations could be conducted on the 18th of October, but few fish schools were seen on the echograms so this was no major issue. Vastly improved conditions led the RV to commence transect 41, at the southern end, working its way back to Lyme Bay to complete the outstanding transects during the next couple of days. After completion, for the remainder of the survey, the RV resumed some of the western transects in the western Channel, working eastwards including transects in French waters. During this period, it became apparent

that the inflow into the ferrybox (surface oceanographic sampler) was reduced which was likely caused by biofouling. The final two weeks of the survey was conducted without the autopilot working which meant that manual steering was required during the remainder of the survey. This did not adversely affect the quality of the data collected. Fair conditions changed to increasing south-westerly winds towards the end of the survey which reduced night time sampling opportunities of primary stations and several oceanographic and meso-zooplankton stations were not completed. The survey was interrupted due to weather in the early afternoon on the 26th of October, when the vessel steamed into Lyme Bay to shelter. The next morning the survey was resumed and final transects and stations in the Eddystone Bay were completed. On the 28th of October five scientific staff disembarked via small boat transfer in Weymouth after which the RV commenced its transit back to Lowestoft where, after collection of a sample at Dungeness, she docked at 20:00 BST on the 29th of October.

RESULTS:

NOTE: In December 2019, Simrad released the latest EK80 software (v 1.12.4). In the associated release note (https://www.simrad.online/ek80/swrn/ek80_swrn_current_en_a4.pdf), details were provided of a bug discovered in the calibration software of previous versions. The bug affected the Sa correction and as a consequence the biomass estimates originally calculated during the 2019 PELTIC survey and those in 2018 were affected. In this version of the survey report, corrected biomass values are provided.

Pelagic Ichthyofauna

After removing the off-transect data a total of 1800 nautical miles of acoustic sampling units were collected for further analysis (Figure 2). These included several transects in the eastern Channel, which was sampled for the first time this year. A total of 38 valid trawls were made with the mid-water trawl, providing a suitable source of species and length data to partition the acoustic data. The trawl was changed over early on in the survey due to gear damage; although the same make and model as the original trawl, the lighter material used caused some temporary issues with the headline sensor deployment. However, these were fixed by adding a firmer floatation line on the headline. General patters of fish distribution were similar to those observed for the time series and included, for the third year running, the French waters of the western English Channel.

Sprat (*Sprattus sprattus*) was widespread in most of the survey area with the typical presence of two core areas, one in the Bristol Channel, including the coastal waters in the west, and the other in English waters of the western Channel (Lyme bay, Figure 3). Medium sized fish (mode of 8-9 cm) dominated all main areas. As in previous years, the smallest fish were found in the Bristol Channel and the largest (mode of 11.5 cm) in Lyme Bay, although high numbers of age-0 sprat in Lyme Bay suggested a decent recruitment. Preliminary biomass estimate of the sprat population in English waters of western Channel Bay was 36,789 t, a 69% increase from 21,772 t in 2018. Sprat was also found in French waters although further east than in previous years (Figure 3). Sprat biomass for the total area was 111,073 t and comparable to 106,431 in 2018.

Sardine (*Sardina pilchardus*) distribution was comparable to previous years with the bulk of biomass found in the English Channel (Figure 4). The apparent trend of increasing numbers of sardine north of the Cornish Peninsula continued. Northern waters of the English Channel again host the largest size-range of sardines with the largest fish also extending to the waters around the Isles of Scilly. In French waters, most sardines were smaller than 14 cm. Area 7 sardine is the most abundant small pelagic fish in the area with a total biomass for 2019 estimated of the consistently sampled area to be 374,617 t, which was more than double compared to last year's estimate of 145,514 t.

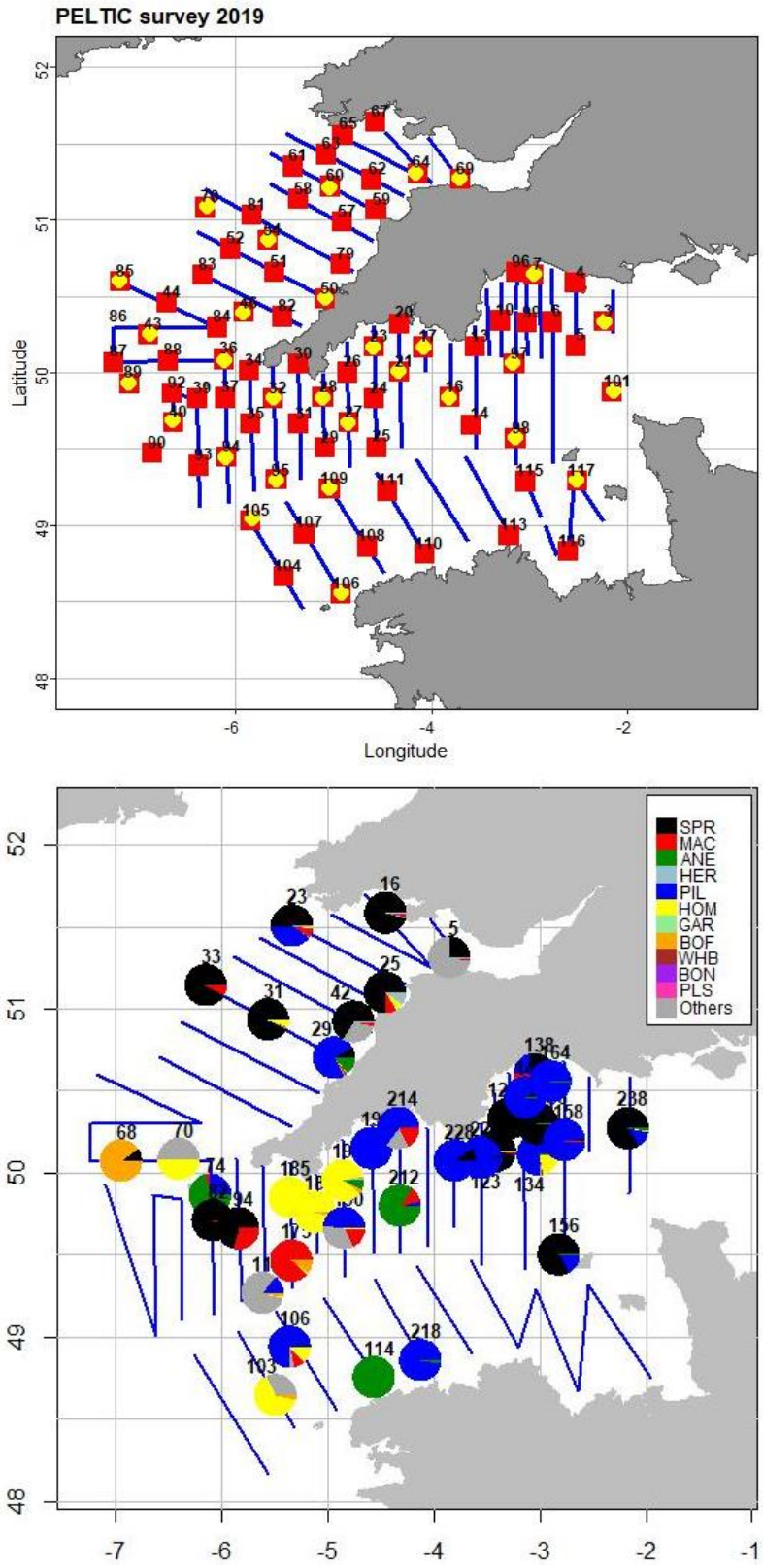

Figure 2. Overview map and detail of the PELTIC19 survey area. Top: Acoustic transects (blue lines) and prime stations completed. Bottom: Trawl stations (pies) with relative catch composition by key species. Three letter codes: SPR=sprat, MAC=mackerel, ANE=anchovy, HER=herring, PIL=sardine, HOM= horse mackerel, GAR=garfish, BOF=Boarfish, WHB=Blue whiting, BON=Atlantic bonito, PLS=pearlside.

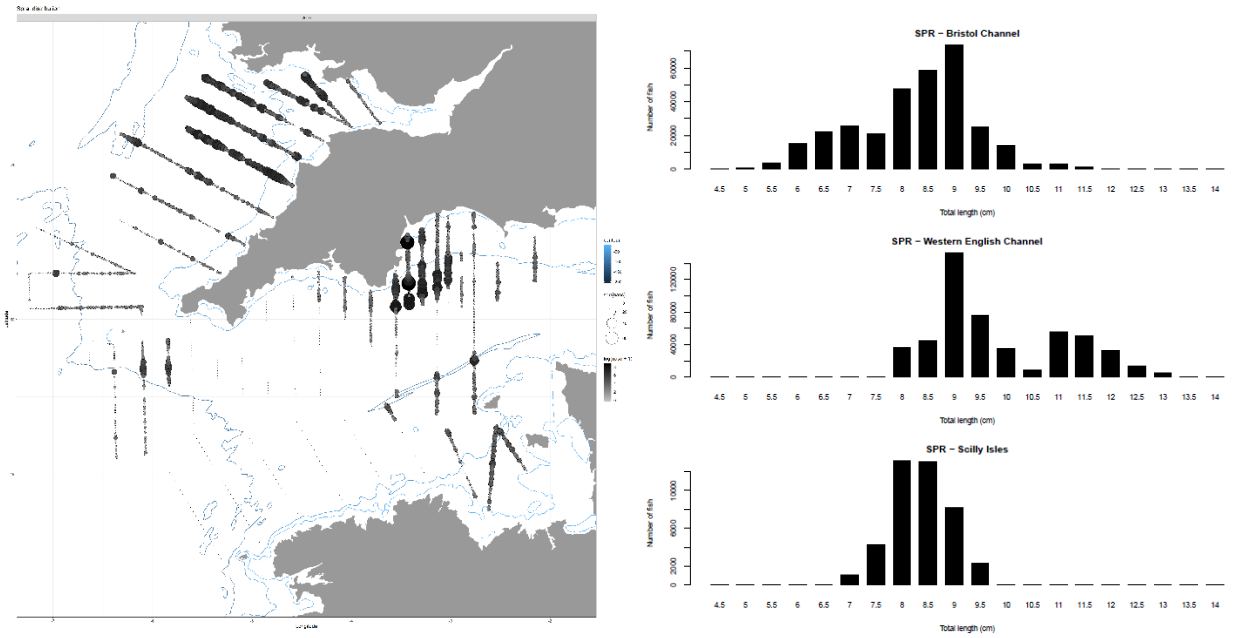

Figure 3. Relative acoustic sprat density distribution (NASC, left) and trawl-based length frequency histogram for sprat in some of the subareas of the Peltic survey (right).

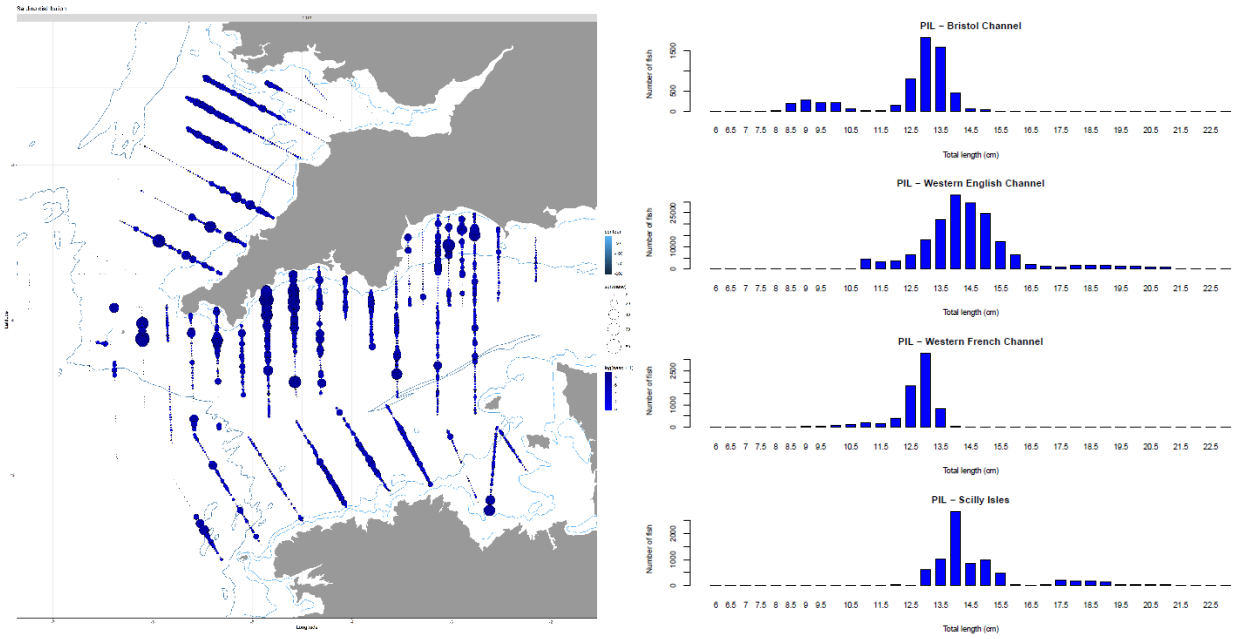

Figure 4. Relative acoustic sardine density distribution (NASC, left) and trawl-based length frequency histogram for sardine in each of the subareas of the Peltic survey. Please note that bubble size has not been standardised between species.

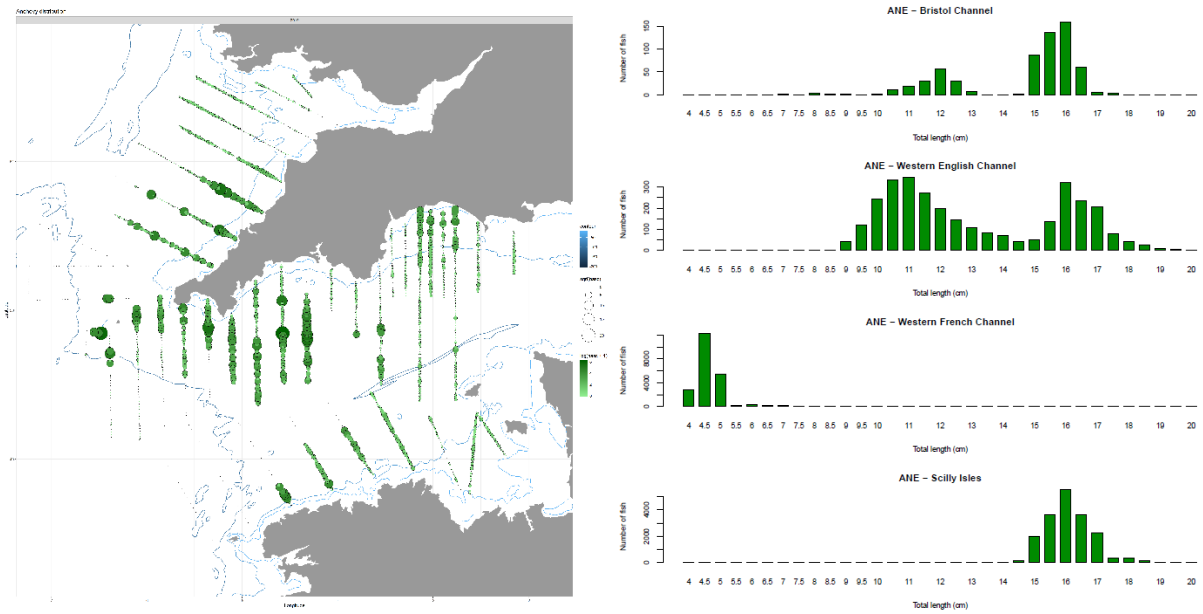

Figure 5. Relative acoustic anchovy density distribution (NASC, left) and trawl-based length frequency histogram for anchovy in each of the subareas of the Peltic survey. Please note that bubble size has not been standardised between species.

Anchovy (*Engraulis encrasicolus*) distribution in 2019 confirmed the expected trend of northwards expansion with increased anchovy biomass in the Bristol Channel, an area not inhabited by anchovy in the first years of the survey series. Similar length frequency modes on both sides of the Cornish Peninsula (11-12 and 16 cm, Fig. 5) suggested that the majority of these fish are from the same population. Particularly notable was the presence of juvenile anchovy in small surface schools on the French side (Fig. 6). This has not been observed in previous years. Genetic samples will confirm which stock they belong to but it is speculated that these are fish originating in the Bay of Biscay. Total anchovy biomass in the survey area was estimated at 14,874 t, which was up from 2018 (10,096 t for the same area).

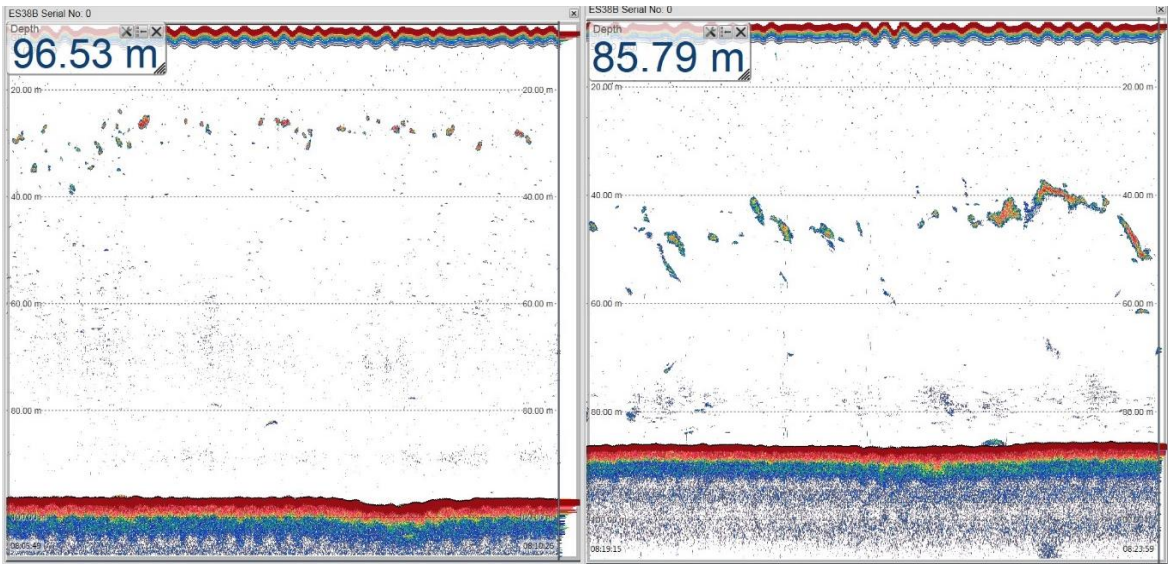

Figure 6. Two example daytime echograms (38 kHz, -70dB gain) of layer of surface schools in near-shore French waters, comprised of juvenile (4-6 cm) anchovy.

Following last year's large apparent recruitment pulse of juvenile **herring (*Clupea harengus*)**, combined acoustic and trawl information suggested that 2019 was more in line with the usual observations. Horse

mackerel and mackerel were again distributed throughout the survey area, largely consisting of young-of-the-year specimens (Horse mackerel: modes between 6-8 cm, mackerel 15-19 cm). Larger horse mackerel (mode at 22 cm) were caught in French waters and larger mackerel (mode at 28 cm) in English waters of the western Channel.

Zooplankton

Samples of mesozooplankton and ichthyoplankton communities were collected at 79 stations using 80 and 270 micron ringnets, respectively. This was fewer than planned and was due to weather conditions. Several stations in the central English Channel and on the French side were missed due to adverse weather conditions. Preliminary results on the distribution of sardine eggs suggested a similar distribution as found in previous years with spawning areas on both side of the Cornish Peninsula but highest densities in the western Channel (Figure 7). Plankton samples were again collected in the southern half of the English Channel. Information on size and taxonomic group of zooplankton samples collected at the same stations, will be obtained by Zooscan processing back in the lab.

For the duration of the survey, the Plankton Image Analyser (PIA) was run to collect images of zooplankton organisms, which will be processed and analysed at PML.

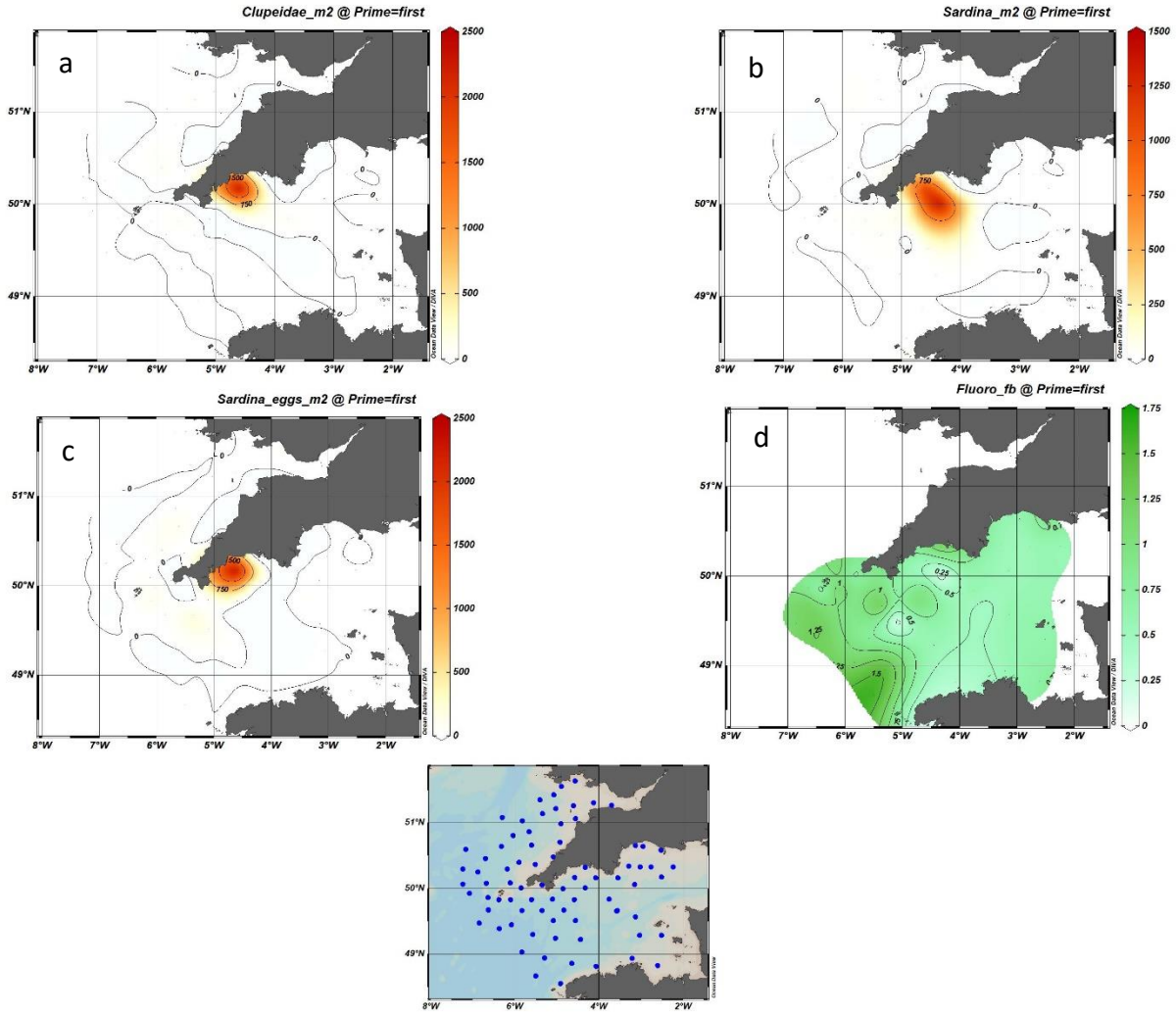

Figure 7. Distribution of fish larvae (total Clupeidae and Sardine; a, b) and eggs at the sampling stations (c), determined from samples collected with the 270 µm ring net and analysed on board; subsurface fluorescence concentration recorded by the Ferrybox (d). Note that the larvae are separated by those confirmed to be sardine (Sardina) and those that could not be further distinguished to species (Clupeidae), the vast majority was considered to also be sardine.

Physical Oceanography

Temperature and salinity of the water column at the 79 zooplankton sampling stations was measured with a SAIV MiniCTD profiler, and, at 33 of these (water stations), a SeaBird CTD, mounted on the Rosette sampler, was also deployed. Total number of stations sampled was lower than planned which was due to adverse weather conditions. The SeaBird CTD was equipped with PAR, oxygen, turbidity and fluorescence sensors and allowed for live measurements of environmental variables along the water column. At 30 of these water stations, water samples were collected for analysis of phytoplankton and microzooplankton communities, dissolved oxygen, salinity, phytoplankton pigments (including chlorophyll-a) and dissolved inorganic nutrients (nitrate, nitrite, ammonium, phosphate, silicate). To collect the water samples, 12 Niskin bottles attached to the Rosette, were used, except during 6 sampling events when sea state was too rough, and samples were collected from the flow-through of the FerryBox.

Water samples were collected at water stations and during trawls, then filtered for determination and quantification of eDNA in the water.

Water at the subsurface (4 m) was continuously monitored by the FerryBox, which recorded different environmental variables, including temperature, salinity, fluorescence, turbidity, and oxygen. Furthermore, a flow cytometer, connected to the FerryBox, carried out measurements of abundance and size of the phytoplankton community every hour, while the PIA (Plankton Image Analyzer) provided continuous monitoring of the mesozooplankton population. Due to issues with the water inflow, neither Ferrybox nor Flowcytometer managed to provide continuous coverage.

Table 1. Number of samples collected during Cend15_19 and number of profiles carried out.

	Total
Salinity	30
Dissolved oxygen (triplicates)	16
Chlorophyll/Pigments analysis (HPLC - duplicates)	31
Inorganic nutrients	30
Phytoplankton	30
Microzooplankton	30
Mesozooplankton (80 µm)	79
Mesozooplankton (270 µm)	79
eDNA samples	?
CTD profiles with Rosette	33
CTD profiles with ESM2	6
CTD profiles with RBR	8
CTD profiles with SAIV MiniCTD	83

As per previous years, sea surface temperature was highest in the Bristol Channel and then just off the Western French Channel near St Brieuc. Maximum temperature from this survey was 17.2°C, this is warmer by more than 0.5 °C compared to previous two years and more closely resembles the maximum of the 2016 survey. As is a common observation during the PELTIC survey series, the lowest surface temperatures were recorded at the mouth of the western English Channel (Fig. 8, 9). Although the lowest surface temperature recorded this year was, at 13.5°C, warmer than that in 2018 and comparable to years before then. Lowest bottom temperatures were taken at the most westly stations advancing into the Celtic Sea.

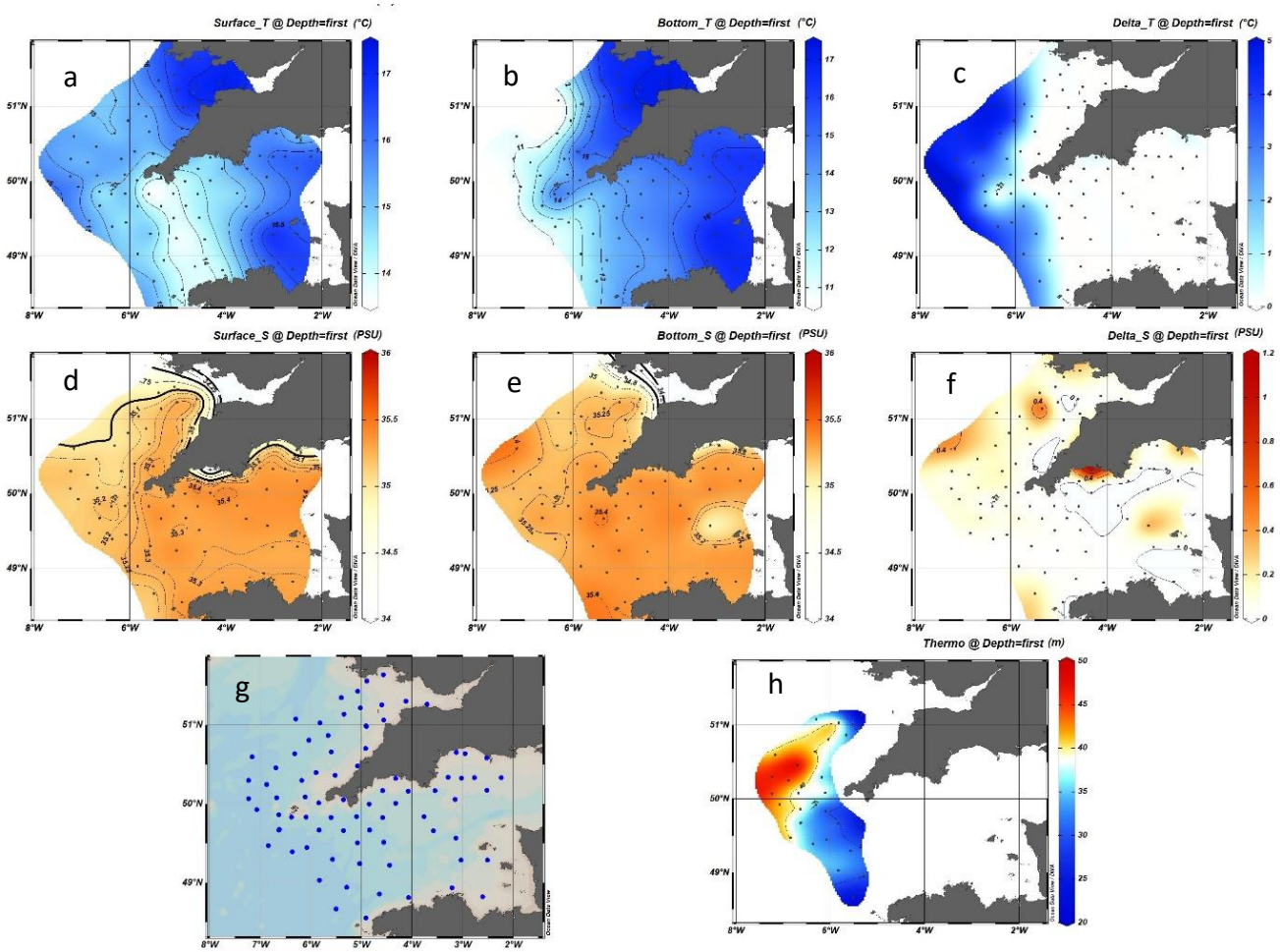

Figure 8. Temperature (a-c, T, °C) and salinity (d-f S) distribution at the surface (a, d) and bottom (b, e) as recorded by the SAIV MiniCTD at the 79 sampling stations (g). The difference in temperature (c, Delta_T) and salinity (f, Delta_S) between surface and bottom is also given, together with depth of the thermocline (h, Thermo), at the stratified stations (Delta_T > 0.5 °C).

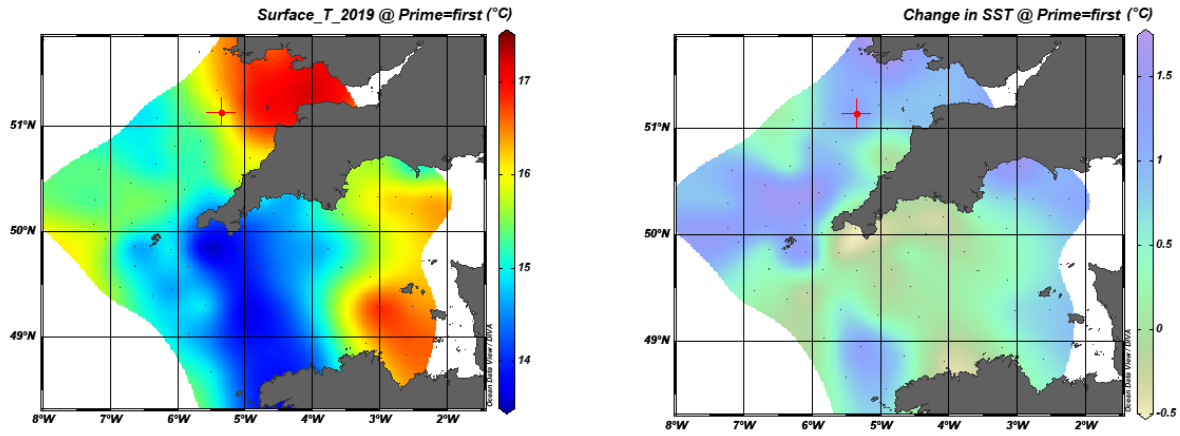

Figure 9. Sea surface temperatures recorded this survey (left) and difference in sea surface temperatures recorded from last year 2018 (right).

Table 2. Summary statistics (minimum, maximum, mean, standard deviation, and number of observations) of temperature and salinity measurements, recorded by the SAIV MiniCTD at the sampling stations. Column titles are the same as in Figure 2.

	Surface_T	Bottom_T	Surface_S	Bottom_S	Delta_T	Delta_S	Thermo
Min	13.51	10.55	31.81	31.85	0	0	21
Max	17.23	17.23	35.39	35.44	4.74	1.16	48
Mean	15.29	14.28	35.12	35.19	1.04	0.09	36.3
StDev	0.93	1.88	0.46	0.43	1.54	0.16	6.6
Number	79	79	79	79	79	79	28

Offshore stations in the Bristol Channel and in the Western approaches, west of Lizard Point, were seasonally thermally stratified (Delta_T > 0.5 °C; Figure 8). While a series of storms with strong wave activity throughout October was thought to have accelerated the mixing, the picture is similar to previous years. Coastal stations in the English and French side of the Channel were vertically mixed (Figure 8). The difference between surface and bottom temperatures was highest at offshore stations in the Celtic Sea and up to 4.74 °C (Table 2). Thermoclines with the deepest initial start of the stratification, >30m, were found at offshore stations (off the Bristol Channel). Those with shallower stratification were more coastal and typically associated with the cooler sea surface temperatures off Western France (minimum of 11m, Table 2 and Figure 8). The strength of stratification was similar to that of previous years between 4.9°C and 4.3°C. Unusually low salinity values were recorded (31.89; Table 2 and Figure 8) in the Bristol Channel and were thought to be due to increased rainfall towards the end of September. This result was confirmed by the value recorded by the Ferrybox (31.70), but this will be validated after calibration of sensors. Salinity remained low throughout Bristol Channel, and was also lower in Lyme Bay and the Bay of Sein, France. Highest salinity values were recorded offshore of Lizard Point (35.39; Table 2 and Figure 8) and south west corners of the Celtic Sea. Surface distribution of chlorophyll concentration was estimated by fluorometers on the Ferrybox and on the SeaBird profiler mounted on the Rosette sampler. Remote sensed images of ocean colour from MODIS (algorithm OC3) from Neodaas.co.uk (PML) were consulted to obtain a synoptic view of the study area, but were of limited use due to cloud cover throughout the survey.

Observer data: Birds, marine mammals and large pelagic fish

For the whole survey, two volunteer MARINElife surveyors, stationed on the bridge in a central position, employed an effort-based 300m box methodology for recording birds (an adapted version of ESAS methodology) with an additional 180° scan area surveyed along each transect line, as used on the majority of MARINElife's year-round surveys. During survey transects, all species of birds (both seabirds and terrestrial migrants) were recorded, along with all sightings of marine mammals and large pelagic fish. . Approximately 3,025km of transect line was sampled during the full course of the survey. This year, very little (incidental) data were collected during the deployment of the fishing net, during the net-retrieval phase or during transits between transects.

The diversity of birds was far fewer than in 2018, which almost certainly reflected the team being less experienced- and competent bird observers than previous years, although other factors may have been at play too. A total of 2,679 sightings of 14,151 birds (44% of the 2018 total), from 21 species (51% of the 2018 total) were recorded throughout the duration of the survey. As in all previous surveys, the Gannet was the highest recorded species. It was a very poor year for shearwater sightings, with no Balearics shearwaters recorded. It should, be noted that there were only five sightings in UK waters in 2018, with none in Lyme Bay and only a further nine sightings in French waters.

Table 3. Cetacean species recorded by MARINElife surveyors on effort during Peltic survey 2018:

Species	Scientific Name	# sightings	# animals
Minke Whale	*Balaenoptera acutorostrata*	2	3
Common Bottlenose Dolphin	*Tursiops truncatus*	3	51
Short-beaked Common Dolphin	*Delphinus delphis*	236	967
White-beaked Dolphin	*Lagenorhynchus albirostris*	1	3
Harbour Porpoise	*Phocoena phocoena*	2	3
	Total:	244	1,026

The MARINElife observers recorded a total of 244 cetacean encounters, totalling approximately 1,026 animals from 5 species. Compared with 2018 there were more sightings (44%), but of fewer individuals (-66%) and species (three less). Encouragingly, White-beaked Dolphins were seen in Lyme Bay. For only the second time in the time series, no Fin Whales were seen although this is likely due to poor visibility (heavy fog) while surveying the hotspot for this species (Celtic Deep). Very few Harbour Porpoises were seen despite the reasonably good viewing conditions. Short-beaked common dolphin *Delphinus delphis* was again by far the most frequently recorded species, with 236 sightings; 86 more than in 2018) of nearly 1,000 animals (2000 less than 2018) (Table 3). These inter annual differences may indicate that there were fewer bigger groups. Common Dolphins were widely distributed (Figure 4) although there were no sightings within the 12 nautical mile limit off west Cornwall and the most easterly transects off the north coast of France. One group of 3 White-beaked Dolphin *Lagenorhynchus albirostris* were seen this year, in Lyme Bay. Of the three Common Bottlenose Dolphin *Tursiops truncatus* sightings, two were north and west of Land's End, Cornwall whilst the third was north west of Ushant.

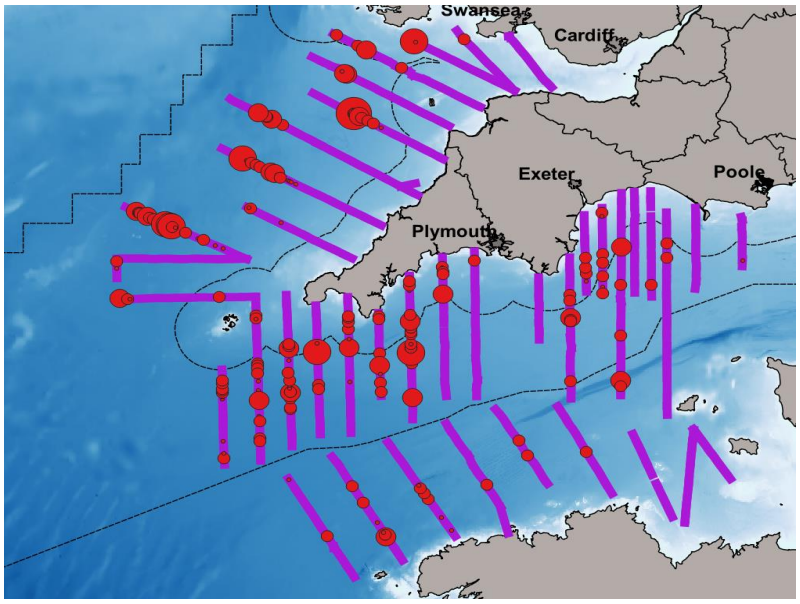

Figure 4: Distribution of all Common dolphin sightings (red circles) in 2019, scaled to abundance. Abundance categories (small to large circles): 1, 2-5, 6-10, 11-20, 20-25. Purple lines show survey effort

In addition to birds and cetaceans, there were three sightings of Atlantic Grey Seal *Halichoerus grypus* and four other unidentified seals. Sightings of tuna were down on those in 2018 at 11 different sightings across the survey area.

Weather was particularly difficult for surveying and there were a few days within the survey, particularly part 1, where the team were faced with storms.

Summary
Peltic19 constituted the 8th autumn survey on small pelagic fish and their ecosystem in the waters of the western English Channel and eastern Celtic Sea. The survey commenced on the 1st of October and ran for 28 effective survey days, starting in the Bristol Channel working into the English Channel. This year, for the third year running, the survey was extended beyond the area covered between 2012 and 2016, which had focussed solely on the Mackerel Box. The extended survey coverage included the French waters of western Channel (ICES 7e). Despite the persistent westerly weather conditions, and resulting down time, the pelagic fish objectives of the survey were successfully completed. In total just under 1800 nautical miles of acoustic sampling units were collected and supplemented with 38 valid trawls which provided details on species composition and biological information. The weather conditions did impact the number of zooplankton and oceanographic stations sampled at night with some stations in the central English Channel missing. The (preliminary) results indicated that sprat was found to be more widespread than in recent years although biomass for survey area was comparable to 2018. The biomass in Lyme Bay, which is relevant to the stock assessment of sprat in 7de, was up from 2018, to 36,789[1] t. As observed in recent years, sardine was widespread in the survey area, including north of the Cornish Peninsula. Sardine egg distribution reflected that of the adults, including the presence of the highest densities, by some margin, in the Eddystone Bay. Sardine biomass for the whole was estimated at 374,619 t, significantly up from 2018. The recent trend in anchovy expansion in the survey area continued. Biomass, at 14,974 t was up from last year. For the first time, large numbers of juvenile anchovy (4-7 cm) were found in a surface layer along the French coast. Details on biomass and distribution of herring, blue whiting, horse mackerel, mackerel and boarfish were also calculated. As in recent years, Atlantic bluefin tuna were observed across the survey area although the number of sightings was down significantly from 2018. Oceanographic conditions in October were back to more usual values of the time series after last year's hot conditions.

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Scientists In Charge
21/02/2019

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[1] Biomass values presented are those recalculated and corrected following the announcement of a software bug in the fisheries acoustic calibration software: https://www.simrad.online/ek80/swrn/ek80_swrn_current_en_a4.pdf