

## 12 Sprat in the English Channel (divisions.de)

The stock structure of sprat populations in this region is not clear, despite evidence from acoustic surveys suggesting the stock is mainly confined to the UK side of 7.e. Further investigations and work is required to resolve this uncertainty.

### 12.1 The Fishery

#### 12.1.1 ICES advice applicable for 2018 and 2019

The TAC for the English Channel (7.d and e) was set equal to 3296 and 2637 tonnes for 2018 and 2019, respectively.

#### 12.1.2 Landings

The total sprat landings by country are provided in Table 12.1.1. Total landings from the international sprat fishery are available since 1950 (Figure 12.1.1.). Sprat landings prior to 1985 in 7.de were extracted from official catch statistics dataset (STATLANT27, Historical Nominal Catches 1950–2010, Official Nominal Catches 2006–2013), from 1985 onwards they come from WG estimates. Since 1985 sprat catch has been taken mainly by UK, England and Wales. According to official catch statistics large catches were taken by Danish trawlers in the English Channel between the late 1970s and 1980s. The identity of these catches was not confirmed by the Danish data managers, raising the question of whether those reported catches were the result of species misreporting (i.e. herring misreported as sprat). Therefore, ICES cannot verify the quality of catch data prior to 1988.

The fishery starts in August and runs into the following year into February and sometimes March. Most of the catch is taken in 7.e, in particular in the Lyme Bay area. In the last decade catch from UK covered about 99% of landed sprat, however in 2015 and 2016 this percentage diminished, with Netherlands, Denmark, and for the first time in the whole times series, Germany, contributing to about 11% of the reported landings. In 2018, 21% of the catches were reported from Denmark with the rest being reported by UK (England, Wales and Northern Ireland). UK has a history of taking the majority of the total landings.

Sprat is found by sonar search and sometimes the shoals are found too far offshore for sensible economic exploitation. This offshore/near shore shift may be related to environmental changes such as temperature and/or salinity.

#### 12.1.3 Fleets

In the English Channel the primary gear used for sprat is midwater trawl. Within that gear type three vessels under 15 m have actively target sprat and have been responsible for the majority of landings (since 2003 they took on average 96% of the total landings). Sprat is also caught by driftnet, fixed nets, lines and pots and most of the landings are sold for human consumption.

#### 12.1.4 Regulations and their effects

There is a TAC for sprat in ICES divisions 7.de, English Channel. Up until the recent period the TAC was not limiting for the sprat landing in the area (Figure 12.1.2).

### 12.1.5 Changes in fishing technology and fishing patterns

There is insufficient information available.

## 12.2 Biological Composition of the Catch

### 12.2.1 Catches in number and weight-at-age

In 2017/2018 fishing season a pilot self-sampling programme started in the South West of UK, involving sprat fisherman from Lyme bay. The skippers have been collecting length frequency distribution of the catches and they have been recording information on fishing trips. The main processors for the fishery have been engaged as well and asked to provide length-weight data from catch subsamples. The length in the fisherman samples ranged from 11 to 15 cm (Figure 12.2.1). The length structure in the processors sample are slightly smaller: few very small individuals have been measured, and the bulk of the catches start from 8 cm up to 15 (Figure 12.2.2).

Four length samples (2 in January and 2 in December) were also collected by the UK within the Data Collection Framework: The length distribution echoes those provided by the skippers within the self-sampling programme (Figure 12.2.3).

Last year was the first year that length frequency distribution for sprat in the English Channel were presented at HAWG. The sampling programme is intended to continue in the future. The data shown are raw numbers-at-length in the samples, and not yet raised to the total catches.

## 12.3 Fishery-independent information

### PELTIC Acoustic Survey

A pelagic survey was undertaken in autumn in the English Channel and Eastern Celtic Sea to acoustically assess the biomass of the small pelagic fish community within this area (divisions 7.d–g). This survey, conducted from the RV Cefas Endeavour, is divided into three geographically separated regions: the western English Channel, the Isles of Scilly and the Bristol Channel (Figure 12.3.1). In 2017, the survey was expanded to cover the southern area of division 7.e and in 2018 was further extended in to division 7.d

Calibrated acoustic data were collected during daylight hours only over three frequencies (38, 120, 200 kHz) from transducers mounted on a lowered drop keel at 8.2 m below the surface. Pulse duration was set to 0.516 m/s for all three frequencies and the ping rate was set to 0.6 s<sup>-1</sup> as the depth did not exceed 100 m. Data from 38 kHz was used to determine target species abundance for all swim bladder fish. To distinguish between organisms with different acoustic properties (echotypes) a multifrequency algorithm was developed, principally based on a threshold applied to the summed backscatter of the three frequencies, eventually resulting in separate echograms for each of the echotypes.

The acoustic data were then processed using the echoR software. The global area has been split into several strata. For each strata, energies were converted into biomass by applying catch ratio and then weighted by abundance of fish in the haul surrounded area.

#### *Biological data*

Biological information from trawl catches carried out during the PELTIC acoustic survey, identified 4 age classes from 0 to 3 contributing on average to 25%, 33%, 36%, and 6% respectively in the samples collected. The age structured observed in 2018 is shown in Figure 12.3.2. Sex ratio is on average skewed towards female, which contributed to 72% of the sampled fish.

### FSP Acoustic Survey off the western English Channel

In October 2011 and 2012, two Fisheries Science Partnership (FSP) surveys were conducted covering the Lyme bay area, where the main sprat population is thought to be concentrated during the onset of the fishing season (September–October).

The estimated sprat biomasses were similar in both years. In 2012, both estimates (2011, and 2012) were re-computed using a new more robust Target Strength (TS) published for herring (Saunders *et al.*, 2012), which has brought down the estimates but still shows a healthy population. The revised 2011 sprat biomass estimate is 33 861 tonnes and the estimate for 2012 is 27 971 tonnes.

#### *Biological data*

Biological information from trawl catches carried out during the FSP acoustic survey where sampling information was available, suggested that most (73.1% by number) of the sprat were mature (spent), with 26.9% immature, and that the sex ratio slightly favored females (59:41). Four age classes were identified: 0, 1, 2 and 3, contributing 1.5%, 8.9%, 70.1% and 19.4% to the population by number, respectively. Low numbers of the 0 and 1 age groups may be the result of gear selectivity. The observed low numbers of sprat age 4 and older could be the result of exploitation as the fishery targets the larger fish for human consumption. However, just three of the trawl hauls contained good samples of sprat, so it is equally possible that the age 4+ sprat were under-sampled because of their different geographic distribution or behavior.

### IBTS Q1 in the Eastern English Channel

Starting in 2006, the French in quarter 1 started to carry out additional tows in the Eastern English Channel as part of the standard IBTS survey. This proved successful and starting in 2007 the RV ‘Thalassa’ carried out 8 GOV trawls and 20 MIK stations.

During the IBTSWG in 2009, Roundfish Area 10 was created to cover these new stations fished by France and the Netherlands.

Data are stored in DATRAS database and available for the period 2007 to 2012.

## **12.4 Mean weight-at-age and maturity at age**

No data on mean weight-at-age or maturity-at-age in the catch are available.

## **12.5 Recruitment**

The acoustic surveys may provide an index of sprat recruitment in divisions 7.d–e. However further work is required.

## **12.6 Stock Assessment**

An attempt for an analytical assessment was carried out for sprat in the English Channel (WKSPRAT, 2013) but was considered preliminary and still not suitable to be used as a basis for advice. A Landing per Unit Effort index (LPUE) based on hours at sea of between 2 and 4 vessels in the Lyme Bay area was used as basis for the assessment until 2015; in 2016 the LPUE was replaced by the PELTIC acoustic survey index, which is currently used as a basis for advice of the sprat stock in divisions 7.d–e.

The advice is based on the ICES framework for category 3 stocks using the ratio between average of the two latest values from the PELTIC acoustic survey and the average of the three preceding values multiplied by the recent ICES advised catch.

The recent workshop on management strategy evaluations (WKSpratMSE, 2018) concluded that for short lived species the “2 over 3” rule was not dynamic enough and a “1 over 2” rule was tested and found to be not precautionary. Further work is due to be carried out in the autumn of 2019 to develop a more appropriate method for providing advice for sprat and other short-lived species.

### 12.6.1 Data exploration

#### *Biomass Index*

A 6-years time-series of biomass estimates from the PELTIC survey is shown in Table 12.6.1: despite being a short time series, the acoustic survey covers a much wider area compared to the original survey carried out in partnership with the fishery. The stock identity for sprat in the Channel is still unclear. However, the extension of the survey into ICES division 7.d and the southern part of 7.e suggests that the stock is mainly located in the more Northerly part of division 7.e during October. The survey conducted in 2018 showed very low numbers of sprat, mainly 0 year old's, in the southern area of 7.e. The transects located in the very eastern part of division 7.e seems to confirm that the sprat stock in the western English Channel do not extend in to the Eastern English Channel (Figure 12.6.1).

Sprat was in general the dominant small pelagic species in the trawl samples, with highest densities in the eastern parts of the western Channel and the Bristol Channel. As in previous years, large schools in the Bristol Channel appeared to consist mainly of juvenile sprat, whereas those in the English Channel also included larger size classes. For more details on the survey design please refer to ICES 2015/SSGIEOM:05.

The age distribution of sprat in the survey area shows a marked distinction between the young fish (0 and 1) found in the Bristol Channel and the older age classes that occupy the Western English Channel. Whether the two clusters belong to the same stock has yet to be proved: the circulation pattern of the area would allow sprat eggs/larvae to travel northward, from division 7.e to 7.g; however, the formation of a front in late spring/early summer seems to suggest the hypothesis of two different stocks.

In 2018 the biomass index from the PELTIC acoustic survey was used to provide advice on sprat in Division 7.d–e applying the “2 over 3” rule (ratio between average biomass of the last 2 years and average biomass of the previous 3 years). The index was also used to provide an indication of the current harvest rate.

The biomass, as estimated by the survey for the English Channel strata only, is stable at high levels in 2013–2014. This trend is followed by a 23% decrease in 2015 and an 85% drop in 2016 to its lowest level of the series. The estimates for 2017 resulted in an upward rescaling (by 3 times) of the biomass compared to 2016, but still remained at about half the values observed at the beginning of the time series (Table 12.6.1, Figure 12.6.2). A slight decline in biomass was observed in 2018.

#### *Landings per Unit of Effort*

A data exploration for English Channel sprat was carried out in 2013 at the benchmark workshop WKSPRAT. An LPUE time-series for English Channel sprat based on mid-water trawler data was constructed and used as the basis for advice until 2015. In 2016 the LPUE index was replaced as basis for advice by the PELTIC acoustic survey, which is deemed to provide a more accurate representation of the stock status. The index is shown here as it provides an indication of the

stock development over time due to the long time series, but it is no longer used for the assessment.

The LPUE was based on data from ~three <15 m vessels that target sprat in the area: the time series was revised in 2017 to account for changes in the database and has been recalculated using days instead of hours, as this information is no longer available (Table 12.6.2 and Figure 12.6.3). Vessels considered for LPUE calculations have been making use of standard sonar technology to locate the fish throughout the period of analysis and no other major technical advances need to be factored out. Also, these vessels account for on average 95% of total landings for the area. The LPUE was computed seasonally from 1 August to 31 March. If there were no landings in August or March, the effort in those months were excluded from the computation.

The index shows an increasing trend over the time series with the highest values observed between 2010 and 2014. A slight drop is observed in 2015 stabilizing around 9000 kg/day (Figure 12.6.3), two to three times higher than that observed at the beginning of the time series.

## 12.7 State of the Stock

The acoustic estimates for 2017 show a three-time increase compared to the all-time low value in 2016, even though the biomass is still half of the high levels recorded in the period 2013–2015. The estimate in 2018 shows a slight decline on the 2017 value but is still twice that of the lowest level of the time series. The harvest rate index (Figure 12.7.1) has dropped from the value of 34% recorded in 2016 to less than 15% which is higher than that observed in 2013–2015.

### CATCH ADVICE

Catch advice for 2019 is based on the 5 years (2014–2018) acoustic estimates. Discards occur but are believed to be negligible, therefore the advice is for catch. The advice is based on category 3.2 (WKLIFE, 2012) according to the data and analyses available and uses the “2 over 3” rule for the calculation of a catch multiplier to be applied to last year catch advice. The ratio resulting from the “2 over 3” rule is 0.47; a 20% uncertainty cap is applied, which means that a reduction of maximum 20% of last year advised catch (1883 tonnes) is recommended; hence, ICES advise that catch in 2020 should not exceed 1506 tonnes.

## 12.8 Short term projections

No projections are presented for this stock.

## 12.9 Reference Points

No precautionary reference points are defined for sprat populations in this region due to uncertainty in stock definition.

An attempt was made to estimate reference points for this stock following ICES guidelines and using the SPiCT model: convergence was achieved using only the last 5 years of the time series and, despite converging, the confidence intervals around the estimated variables were huge, indicating that the data are not informative and the results not reliable. One year of length frequency distribution is available for this stock: however, length-based reference points are not considered suitable for such short lived species. An upcoming benchmark in 2018 will discuss the issues and propose some solutions.

## 12.10 Quality of the Assessment

The coverage of the PELTIC acoustic survey was extended in 2017 towards the southern part of Division 7.e: this extension confirmed that the bulk of the sprat distribution in 7.e is located in Lyme Bay and surrounding areas, and very little extend outside. In fact, the transects carried out off the French coast found very little sprat, mostly of ages 0 and 1.

The extent to which the population migrate into Division 7.d was investigated during the 2018 survey. The survey showed that very little sprat was found on the eastern border of division 7.e suggesting no movements of sprat between the two areas and very little was found in 7.d.

Concerns have been raised about the connection between the Western English Channel stock and the Bristol Channel, where large numbers of juveniles are found. The most plausible hypothesis is that the pool of young fish in the Bristol Channel contribute mainly to the Irish Sea population. Investigations are continuing to resolve this uncertainty.

## 12.11 Management Considerations

Sprat is a short-lived species with large inter-annual fluctuations in stock biomass. The natural inter-annual variability in stock abundance, mainly driven by recruitment variability, is high and does not appear to be strongly influenced by the observed levels of fishing effort.

Sprat annual landings from 7.d–e over the past 20 years have been 2990 tonnes on average. The harvest rate, estimated as the ratio between catches and the acoustic index, is low (around 10%) throughout the 5-year time series available, with the exception of 2016 value (34%). In general, however, it seems that Lyme Bay, where most of the fishery occurs, consistently hosts quite substantial level of the sprat stock: this is confirmed by the fact that even in 2016, when the estimated biomass is overall very low, Lyme Bay still contributed to 50% of the total sprat population in the Western English Channel. This is also supported by the high LPUE values observed in the last few years.

The strong biomass fluctuations observed in the acoustic index and the relatively strong increase in biomass observed in 2017, suggests that the low level of catch is not impairing the recovery of the stock and that the decline in sprat biomass is not to be ascribed to fishing mortality, but it is most likely caused by environmental factors.

## 12.12 Ecosystem Considerations

Multispecies investigations have demonstrated that sprat is one of the important prey species in the North Sea ecosystem, for both fish and seabirds. At present, there are no analysis available on the total amount of sprat, and in general of other pelagic species, taken by seabirds, marine mammals and large predators in the Celtic Seas Ecoregion. However, a wide spectrum of data that covers the whole trophic chains have been collected during the PELTIC acoustic survey: these data in the future will be able to provide a substantial contribution to knowledge available in the area.

Table 12.1.1 Sprat in 7.d-e. Landings of sprat, 1985–2018.

Country	Denmark	France	Netherlands	UK Eng+Wales+N.Irl.	UK Scotland	Other	Total
1985	0	14	0	3 771	0	0	3 785
1986	15	0	0	1 163	0	0	1 178
1987	250	23	0	2 441	0	0	2 714
1988	2 529	2	1	2 944	0	0	5 476
1989	2 092	10	0	1 520	0	0	3 622
1990	608	79	0	1 562	0	0	2 249
1991	0	0	0	2 567	0	0	2 567
1992	5 389	35	0	1 791	0	0	7 215
1993	0	3	0	1 798	0	0	1 801
1994	3 572	1	0	3 176	40	0	6 789
1995	2 084	0	0	1 516	0	0	3 600
1996	0	2	0	1 789	0	0	1 791
1997	1 245	1	0	1 621	0	0	2 867
1998	3 741	0	0	1 973	0	0	5 714
1999	3 064	0	1	3 558	0	0	6 623
2000	0	1	1	1 693	0	0	1 695
2001	0	0	0	1 349	0	0	1 349
2002	0	0	0	1 196	0	0	1 196
2003	0	2	72	1 368	0	0	1 442
2004	0	6	0	836	0	0	842
2005	0	0	0	1 635	0	0	1 635
2006	0	7	0	1 969	0	0	1 976
2007	0	0	0	2 706	0	0	2 706
2008	0	0	0	3 367	0	0	3 367
2009	0	2	0	2 773	0	0	2 775
2010	0	2	0	4 408	0	0	4 410
2011	0	1	37	3 138	0	0	3 176

Country	Denmark	France	Netherlands	UK Eng+Wales+N.Irl.	UK Scotland	Other	Total
2012	6	2	8	4 458	0	0	4 474
2013	0	0	0	3 793	0	0	3 793
2014	45	0	275	3 338	0	0	3 658
2015	0	1	352	2 659	0	0	3 012
2016	185	7	231	2 867	0	49	3 339
2017	0	0	235	2 498	0	0	2 733
2018	474	1	0	1 776	0	0	2 252

**Table 12.6.1. Sprat in 7.d–e. Annual sprat biomass in ICES Subdivision 7.e (Source: Cefas annual pelagic acoustic survey).**

Survey	Area	Season	2011	2012	2013	2014	2015	2016	2017	2018
Partial	Lyme Bay	Oct	33 861	24 246	62 040	67 538	12 212	6 181	29 996	15 310
FSP	Lyme Bay*	Oct	33 861	27 971						
PELTIC	W Eng Ch	May	85 358							
PELTIC	W Eng Ch	Oct			70 680	85 184	65 219	9 826	32 751	17 091

\* ICES rectangles 29E6, 30E6

**Table 12.6.2. Sprat in 7.d–e. Landings per unit effort (LPUE) for 3 vessels that target sprat. The years refer to the start of the season 1 August year (y) to 31 March in year (y+1). Please note that LPUE for 2018 and 2019 is estimated as kg/day, as number of hours were not available.**

Year	HAWG 2015	HAWG 2016	HAWG 2017	HAWG 2018	HAWG 2019*
1988	283	283	624	3 815	3 815
1989	668	682	395	4 432	4 432
1990	429	429	569	3 684	3 684
1991	528	528	481	4 147	4 147
1992	422	422	560	3 887	3 784
1993	630	630	850	4 779	4 737
1994	742	747	612	7 809	7 809
1995	599	599	899	5 831	5 831
1996	803	803	927	6 768	6 768
1997	868	868	601	6 845	6 808



Year	HAWG 2015	HAWG 2016	HAWG 2017	HAWG 2018	HAWG 2019*
1998	736	736	971	6 794	6 794
1999	970	970	844	8 919	8 919
2000	631	683	732	8 369	8 369
2001	508	521	944	5 976	5 976
2002	598	644	622	5 992	5 992
2003	352	375	841	4 215	4 190
2004	588	588	1 108	5 938	5 841
2005	1 050	1 050	1 388	8 820	8 820
2006	992	992	1 059	8 035	8 035
2007	1 050	1 050	945	8 241	8 241
2008	1 029	1 029	890	8 085	8 085
2009	773	773	1 388	7 474	7 474
2010	1 527	1 527	1 288	13 260	13 260
2011	1 042	1 042	1 709	9 801	9 801
2012	1 904	1 904	1 870	13 475	13 475
2013	1 933	1 933	2 225	11 398	11 398
2014	2 413	2 405	1 683	11 977	11 977
2015		2 221	1 765	8 763	8 763
2016			624	9 459	9 459
2017				9 515	9 457
2018					8 373

\*provisional

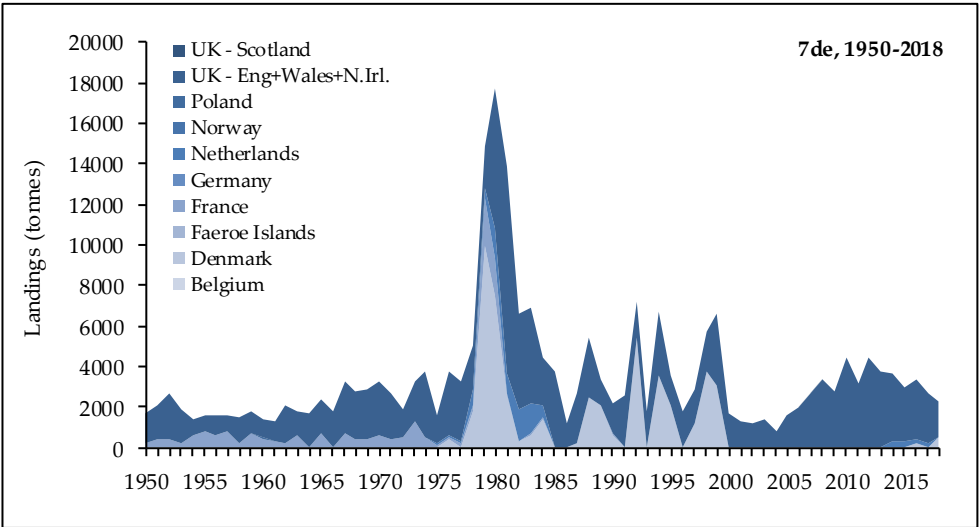


Figure 12.1.1. Sprat in 7.d-e. Landings of sprat 1950–2018.

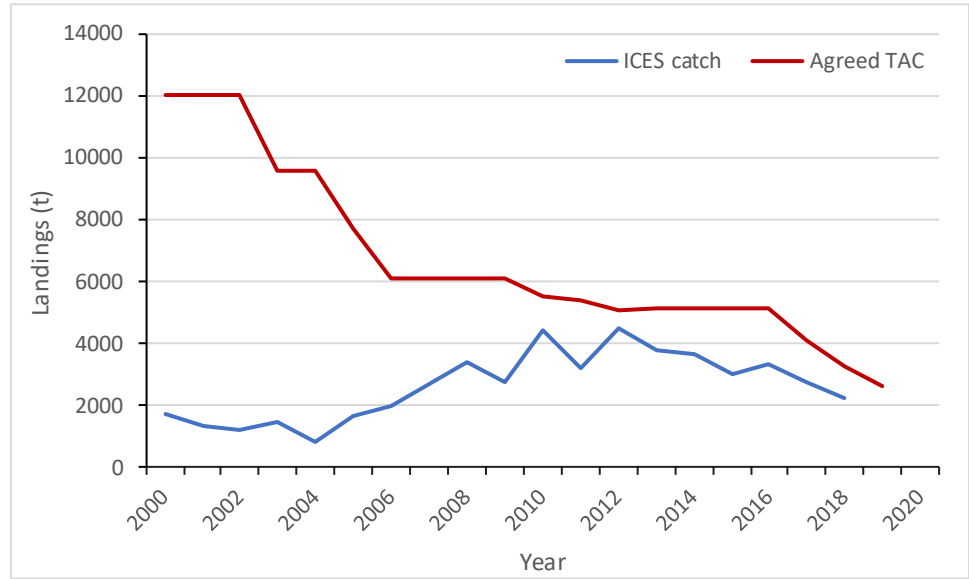


Figure 12.1.2. Sprat in 7.d-e. ICES catch (blue line) and agreed TAC (red line) from 2000 to 2019.

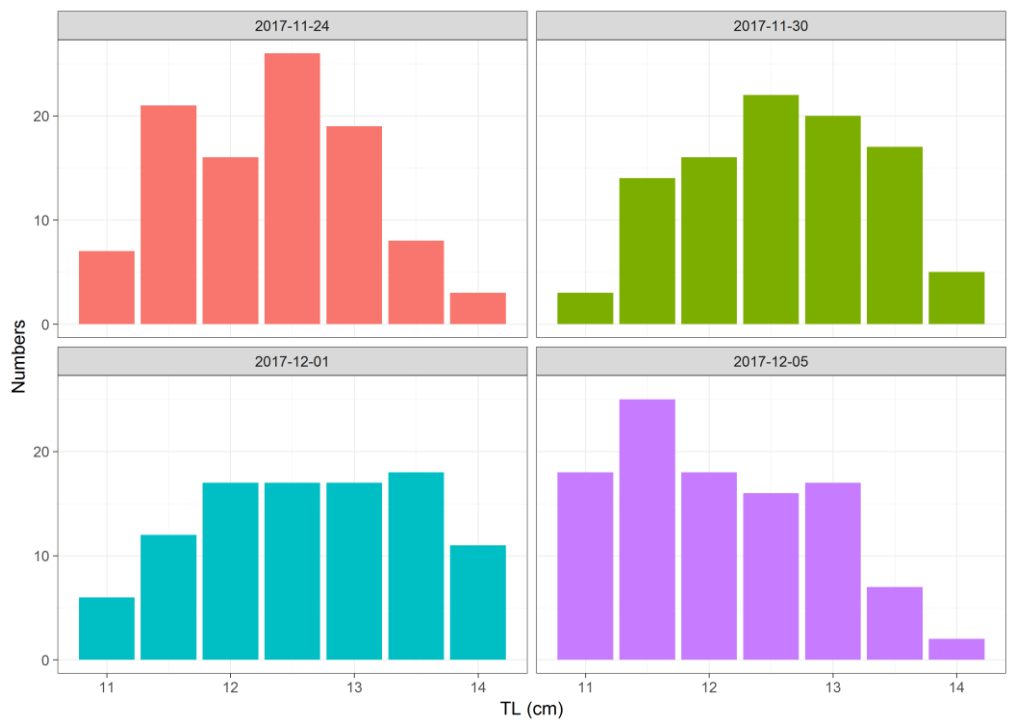


Figure 12.2.1. Sprat in 7.d-e. Length frequency distribution of sprat for 4 samples collected by one vessel from the Lyme bay area within a self-sampling programme.

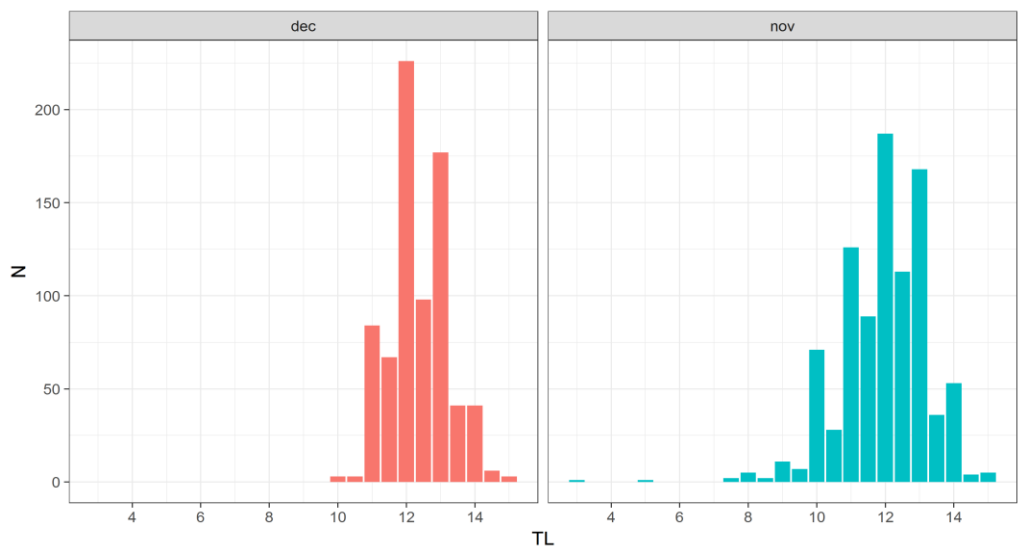


Figure 12.2.2. Sprat in 7.d-e. Length frequency distribution of sprat from samples in November (right) and December (left) collected by one processor in the Lyme Bay area within a self-sampling programme.

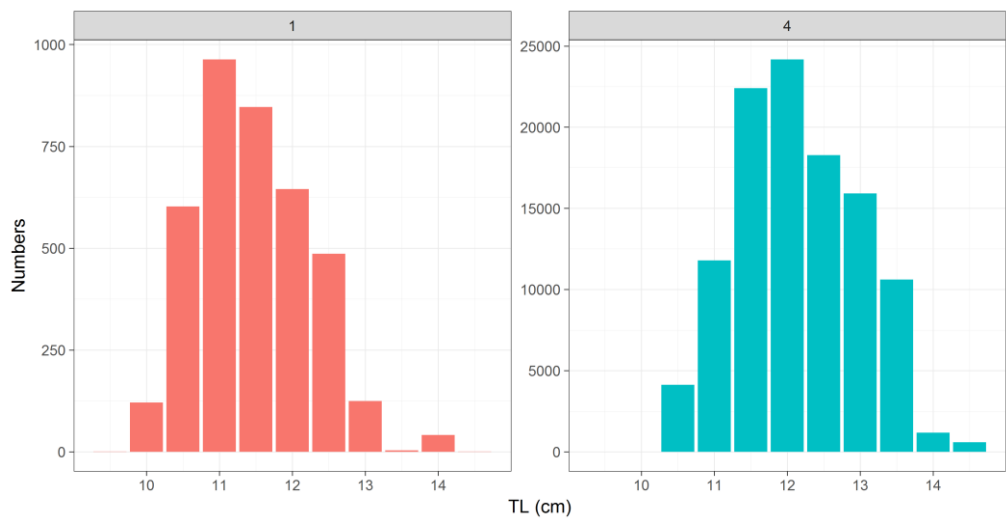


Figure 12.2.3. Sprat in 7.d-e. Length frequency distribution of sprat from samples in Quarter 1 (left) and quarter 4 (right) provided by UK within the Data Collection Framework.

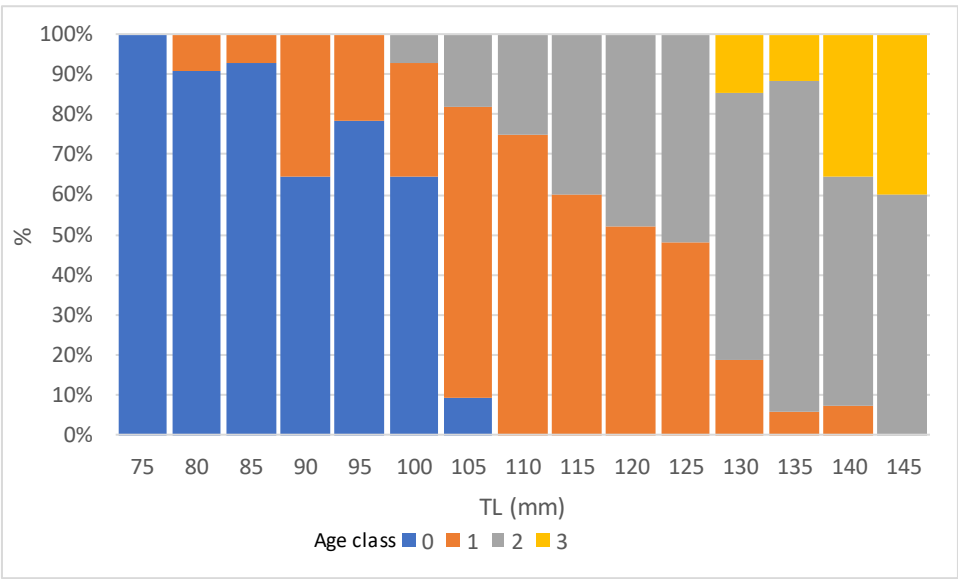


Figure 12.3.2. Sprat in 7.d-e. Proportion of numbers-at-age in the biological sample collected during the 2018 PELTIC acoustic survey

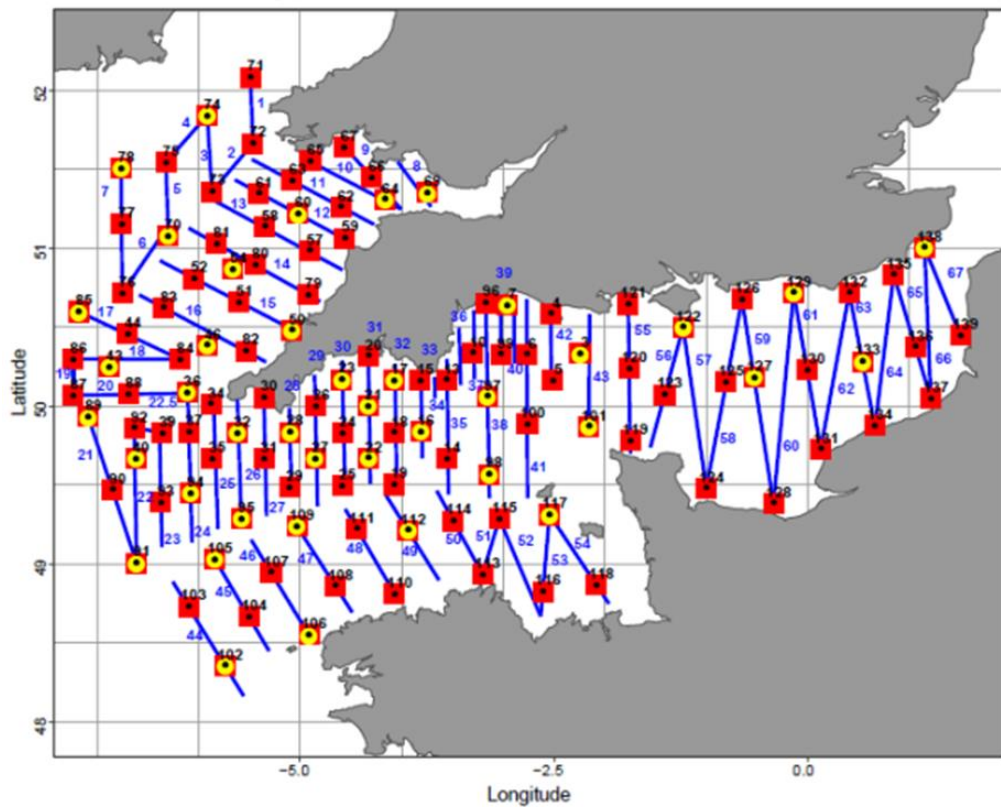


Figure 12.3.1. Sprat in 7.d-e. Survey design with acoustic transects (blue lines), zooplankton stations (red squares) and oceanographic stations (yellow circles).

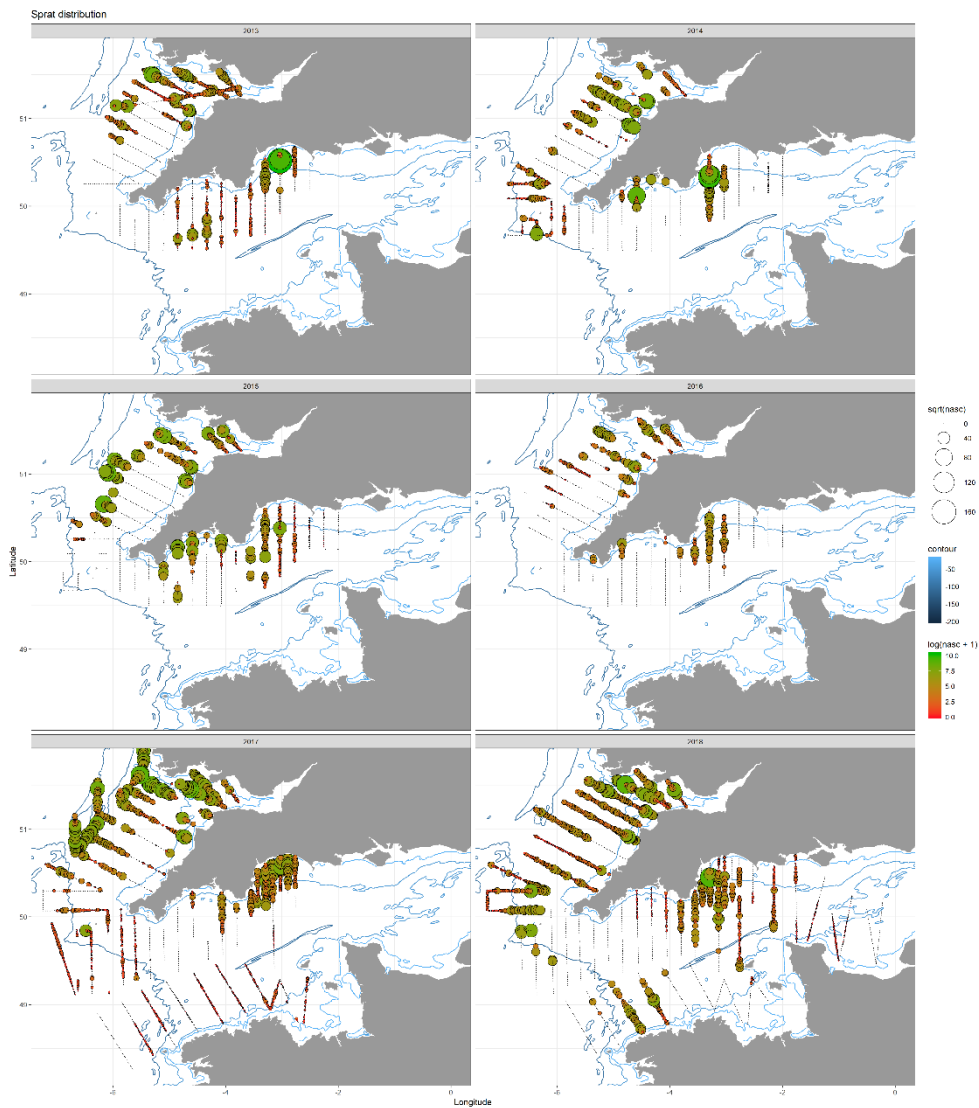


Figure 12.6.1. Sprat in 7.d–e. Acoustic backscatter attributed to sprat per 1 nmi equidistant sampling unit (EDSU) during October.

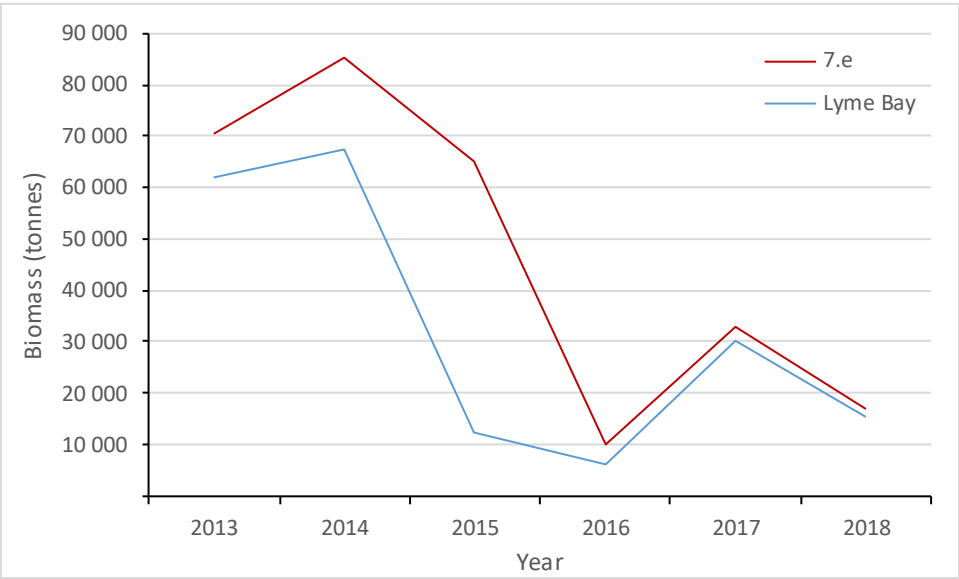


Figure 12.6.2. Sprat in 7.d-e. Biomass of sprat estimated from the PELTIC acoustic survey from 2013 to 2018 for Division 7.e (red line) and the Lyme Bay area (blue line).

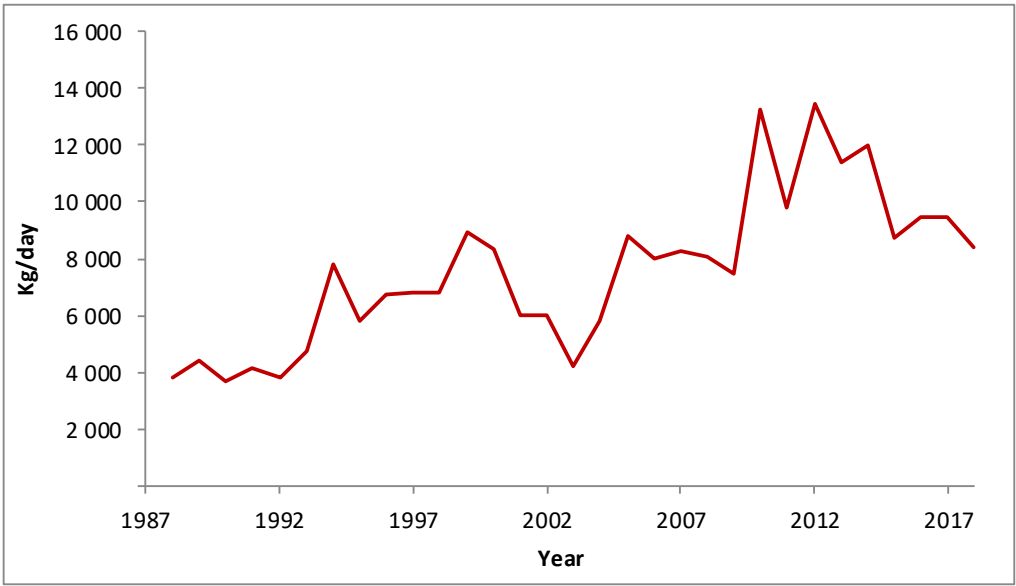


Figure 12.6.3. Sprat in 7.d-e. LPUE (kg/day). LPUE time series from 1989 to 2018.

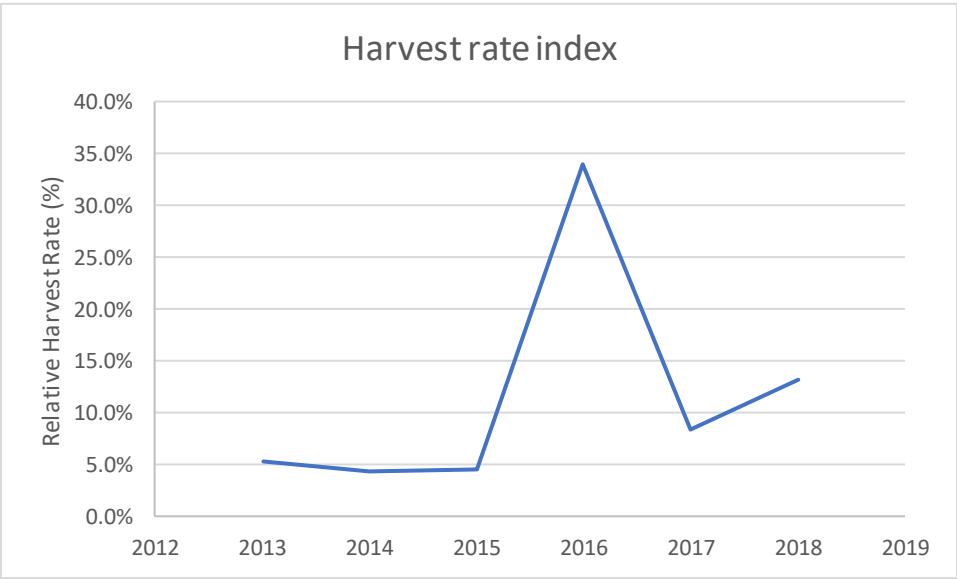


Figure 12.7.1. Sprat in 7.d-e. Harvest rate index (ratio between landings and PELTIC acoustic survey biomass estimate).