

## Stock Annex: Sprat (*Sprattus sprattus*) in Subarea 6 and divisions 7.a–c and 7.f–k (West of Scotland, southern Celtic Seas)

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Stock specific documentation of standard assessment procedures used by ICES.

<b>Stock:</b>	Sprat
<b>Working Group:</b>	Herring Assessment Working Group for the Area South of 62°N (HAWG)
<b>Created:</b>	February 2013
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<b>Last updated:</b>	2013
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### A. General

#### A.1. Stock definition

Most sprat fisheries in the Celtic Seas area are sporadic and occur in different places at different times. Separate fisheries have taken place in the Minch, and the Firth of Clyde (6.aN); in Donegal Bay (6.aS); Galway Bay and in the Shannon Estuary (7.b); in various bays in 7.j; in 7.aS and in the Irish Sea (7.aN):



The stock structure of sprat populations in this ecoregion is not clear. There is insufficient information to conclude that Subareas 6 and 7 constitute a management unit for sprat, and further work is required to solve this. For the time being, ICES will give advice covering the whole area.

## A.2. Fishery

Most sprat in the Celtic Seas ecoregions are caught by small pelagic vessels that also target herring, mainly Irish, English and Scottish vessels. In Ireland, many polyvalent vessels target sprat on an opportunistic basis. At other times these boats target demersals and tuna, as well as pelagics. Targeted fishing takes place when there are known sprat abundances. However the availability of herring quota is a confounding factor in the timing of a sprat targeted fishery around Ireland. In Ireland, larger sprats are sold for human consumption whilst smaller ones for fish meal. Other countries mainly land catches for industrial purposes.

Sprat may also be caught in mixed shoals with herring. The level of discarding is unknown.

No TACs or quotas for sprat exist in this ecoregion. Most sprat catches are taken in small-mesh fisheries for either human consumption or reduction to fishmeal and oil. It is not clear whether bycatches of herring in sprat fisheries in Irish and Scottish waters are subtracted from quota.

### A.3. Ecosystem aspects

It is difficult to assess predation impacts on sprats in this area. This is particularly true of Area 6.a where sprats tend to be aggregated in sealochs where predator populations are likely to differ from those in open sea areas of 6.a.

Information on seabird diets is available for part of the area. The very limited data on seabird diets from Irish Sea colonies (for kittiwakes, auks and terns) suggests that sprats are more important in seabird diets in this area than is generally the case elsewhere.

Chivers *et al.* (2012) showed that kittiwakes breeding at colonies in the Irish Sea fed predominantly on sprats, at least in the two years of their study. Their data also suggested a link between diet composition and breeding success, with kittiwake breeding success in their Irish Sea study colonies being higher when sprats formed a higher proportion of the kittiwake diet. Royal Society for the Protection of Birds (RSPB) observers carried out surveys of kittiwake numbers during sprat acoustic surveys in the Irish Sea in 1995 and 1996 and found no evidence of a correlation between sprat densities and kittiwake densities at sea (P-J. Schön, pers. comm.).

## B. Data

### B.1. Commercial catch

Landings are considered representative of catches; there are no indications of discarding or misreporting. There is no information on catches in number /length, or weight in the catch for sprat in this ecoregion. No data on mean length, weight-at-age or maturity-at-age in the catch are available.

#### Division 6.a (west of Scotland and northwest of Ireland)

Landings have been dominated by UK-Scotland and Ireland. The Scottish fisheries have taken place in both the Minch and in the Firth of Clyde. The Irish fishery has always been in Donegal Bay. Despite the wide separation of these areas, the trends in landings between the two countries are similar, though the UK data have always been higher. Irish data may be underestimated, due to difficulties in quantifying the landings from vessels of less than 10 m length.

Scottish landings were consistently above 4000 t in the 1970s, declining to about 1000 t in 1979. They fluctuated between 500 t and 4000 t until 1994 and then increased markedly to over 8000 t in 1999, after which they have declined substantially.

#### Division 7.a (Irish Sea)

The main historic fishery was by Irish boats, in the 1970s, in the western Irish Sea. This was an industrial fishery and landings were high throughout the 1970s, peaking at over 8000 t in 1978. The fishery came to an end in 1979, due to the closure of the fishmeal factory in the area. It is not known what proportion of the catch was made up of juvenile herring, though the fishing grounds were in the known herring nursery areas. In the late 1990s and early 2000s, UK vessels landed up to 500 t per year. In recent years a trial fishery for sprat was carried out by the vessels that fish herring in the area. This was carried out to investigate the feasibility of a clean commercially viable sprat fishery. The results of the trials were inconclusive and plans to conduct further experiments are under discussion. Irish Landings from 1950–1994 may be from 7.aN or 7.aS. Recent Irish landings are mainly from 7.aS, mainly Waterford Harbour.

### Divisions 7.b,c (west of Ireland)

Sporadic fisheries have taken place, mainly in Galway Bay and the Mouth of the Shannon. The highest recorded landing was in 1980 and 1981 during the winter of 1980/1981, when over 5000 t were landed by Irish boats. This fishery took place in Galway Bay in the winter of 1980/1981 (Department of Fisheries and Forestry (1982). Since the early 1990s landings fluctuated from very low levels to no more than 700 t per year. Irish data may be underestimated, due to difficulties in quantifying the landings from vessels of less than 10 m length.

### Divisions 7.g–k (Celtic Sea)

Sprat landings in the Celtic Sea from 1985 onwards are ICES estimates. In the Celtic Sea, Ireland has dominated landings. Patterns of Irish landings in Divisions 7.g and 7.j are similar, though the 7.j landings have been higher. Landings for 7.g and 7.j were aggregated in this report. Landings have increased from low levels in the early 1990s, with catches fluctuating between 0 t in 1993 and just under 4200 t in 2005. Irish data may be underestimated, due to difficulties in quantifying the landings from vessels of less than 10 m length.

## B.2. Biological

Sampling results of landings (in number length, mean length, weight-at-age or maturity, or weight in the landings) are not available for sprat in this ecoregion.

## B.3. Surveys

There are many surveys taking place in this area. Only the ones that are considered relevant to describe trends in (part of the) sprat population in the area are described here.

	SURVEY ACRONYM	FULL NAME	TYPE OF SURVEY / GEAR	COMMENTS	YEARS	QUARTER
2	SWIBTS	South West International Bottom Trawl Survey	GOV	Survey has been terminated; Index should be split between 7.a and Celtic (North)	2003–2011	Q4
6	ACVIaLochs	Scottish Sea lochs surveys	acoustic/ mid-water trawl	Survey targeted for sprat in six lochs inside the Isle of Skye. No fisheries in this area, doesn't cover the stock.	2001–2005	Q1Q4
7	SWCGFS6a	Scottish Western Coast VIa Groundfish Survey - Quarter 1	GOV	Age-length information may be of value in absence of fishery data.	1981–2012	Q1

8	SWCGFS6a	Scottish Western Coast VIa Groundfish Survey - Quarter 4	GOV	Age-length information may be of value in absence of fishery data.	1990–2012	Q4
10	ACclydeQ3	Clyde acoustic survey for herring and sprat	acoustic/midwater trawl	Survey-series discontinued but may be informative in combination with new survey (11).	1985–1989	Q3
11	ACclydeQ4	Clyde acoustic survey for herring and sprat	acoustic/midwater trawl	Survey is informative for sprat, to be continued; no fisheries in the area	2012–	Q4
12	AC(VIIaN)	Irish Sea Acoustic Survey	acoustic/midwater trawl	Survey designed for herring but surveys sprat all right; no fisheries in the area	1998–2012	Q3

#### **Survey 2) International Bottom Trawl Survey (2003–2011)**

In order to derive an index of sprat abundance from this survey the total number of sprat per haul was first standardized to numbers per hour. An average for each rectangle was then calculated on a spatial basis as a basis for an annual index constructed as mean sprat catch per hour trawling. A final index can then be calculated as the mean of the mean number per hour from rectangles fished for at least 75% of the time-series.

*Examination of results from the IBTS survey (Figures 6.6.3 and 6.6.4) suggest that the stock has fluctuated during the period of the survey with no indication of stock decline. Regrettably, the IBTS series has now been terminated.*

#### **Survey 6) Scottish Sea lochs surveys**

Between 2001 and 2005 a series of detailed surveys were carried out in selected mainland Scottish sea lochs, to the east of the Isle of Skye. This survey targeted sprat, but does not cover the stock. There are no fisheries in this area.

*This type of survey could inform the assessment in this region but the time-series is not relevant to the current state of the stock.*

#### **Survey 7–8) Scottish Western Coast 6.a Groundfish Survey; Quarter 1 and Scottish Western Coast 6.a Groundfish Survey; Quarter 4**

Sprat caught throughout the survey area, even though the survey does not target sprat. Due to gear used and survey design unlikely to produce reliable abundance of sprat.

*Age-length information is available and can be used to indicate stock structure. Survey estimates need verification before they are used as indicators of biomass because they are based on a bottom-trawl gear.*

#### **Survey 10–11) Clyde Acoustic surveys for herring and sprat**

A Clyde herring and sprat acoustic survey was carried out in June/July 1985–1990 and then discontinued. Biomass estimates from all years as well as lengths and ages from some years are available from this survey. In 2012 this survey was reinstated as an

October/November survey and results from the first survey are being processed at the moment.

*Age and length distribution from this survey are available and can be used to indicate stock structure. The survey will need more datapoints to be able to give stock trend information.*

#### **Survey 12) Irish Sea Acoustic Survey**

This survey uses a stratified design with systematic transects, during the first two weeks of September. Time-series of sprat biomass are available and the associated CVs are generally low which suggests a more continuous distribution than is the case for herring (M. Armstrong, pers comm.).

The vessel currently used for the surveys is the R.V. Corystes (UK(NI)) replacing the R.V. Lough Foyle (UK(NI)). Starting positions are randomized each year. The survey is most intense around the Isle of Man (2 to 4 nautical mile transect spacing) where highest densities of adult herring are expected based on previous surveys and fishery data. Transect spacing of 6 to 10 NM are used elsewhere. A sphere-calibrated EK-500 38kHz sounder is employed, and data are archived and analysed using Echoview (SonarData, Tasmania). Targets are identified by midwater trawling. Acoustic records are manually partitioned to species by scrutinising the echograms and using trawl compositions where appropriate. ICES recommended target strengths are used for herring, sprat, mackerel, horse mackerel and gadoids. The survey design and implementation follows, where possible, the guidelines for ICES herring acoustic surveys in the North Sea and west of Scotland. The survey data are analysed in 15 minute elementary distance sampling units (approximately 2.5 NM). An estimate of density by age class, and spawning-stock biomass, is obtained for each EDSU and a distance-weighted average calculated for each stratum. These are raised by stratum area to give population numbers and SSB by stratum.

*Examination of the time-series of biomass based on this survey suggest that since 2005 the stock has fluctuated at a lower level than in previous years. There are no fisheries for sprat in this area.*

#### **B.4. Commercial cpue**

Commercial landings per unit of effort were not calculated, because lpue is not considered an indicator relevant to describe the stock. This has to do with the sprat biology (schooling behaviour), the fact that the stock structure is not clear, and indications from the industry that factors unrelated to stock availability determine the landings.

### **C. Assessment: data and method**

No analytic assessment is put forward for this area. The main indicators for sprat in parts of the area are survey indices that are considered representative for stock trends:

- a) South West International Bottom Trawl Survey (SWIBTS);
- b) Scottish Sea lochs surveys (ACVlaLochs);
- c) Scottish Western Coast VIa Groundfish Survey - Q 1 and Q4 (SWCGFS6a: age-length information);
- d) Clyde acoustic survey for herring and sprat (ACclydeQ3);
- e) Clyde acoustic survey for herring and sprat (ACclydeQ4);
- f) Irish Sea Acoustic Survey (AC(VIIaNI)).

**D. Short-term projection**

No short-term projections are put forward.

**E. Medium-term projections**

No medium-term projections are put forward.

**F. Long-term projections**

No long-term projections are put forward.

**G. Biological reference points**

No precautionary reference points are defined for sprat populations in this region.

Molloy and Bhatnagar (1977) estimated  $F_{0.1}$  separately for Irish Sea and Celtic Sea sprat populations. They concluded that the Celtic Sea population could withstand a higher  $F$ . The estimates of  $F_{0.1}$  were  $F = 0.5$  and  $F = 0.8$  for Irish Sea and Celtic Sea respectively.

**H. Other issues****H.1. Historical overview of previous assessment methods**

Sprat in this area was first assessed by ICES in 2011. No analytic assessment has been put forward so far.

**I. References**

- Chivers, L.S., Lundy, M.G., Colhoun, K., Newton, S.F. and Reid, N. 2012. Diet of black-legged kittiwakes (*Rissa tridactyla*) feeding chicks at two Irish colonies highlights the importance of clupeids. *Bird Study* 59: 363–367.
- ICES. WKSPRAT. 2013. Benchmark Workshop on Sprat Stocks. 11–15 February 2013, ICES HQ, Copenhagen. ICES CM 2013/48.
- Molloy, J. and Bhatnagar, K. 1977. "Preliminary Investigations of the Sprat stocks off the South coast of Ireland", Irish Fisheries Leaflet, Department of Agriculture and Fisheries (Fisheries Division) 1977.