

Tol. V/H

This paper not to be cited without prior reference to the author

International Council for
the Exploration of the Sea

C.M. 1985/H:56
Pelagic Fish Committee

FECUNDITY OF SPRAT FROM THE NORWEGIAN COAST

by

Else Torstensen
Flødevigen Biological Station
N-4800 Arendal, Norway

ABSTRACT

Fecundity-length and fecundity-weight relationships are estimated from sprat in a Norwegian fjord area. The data are mainly from ovaries sampled at the end of January and February, prior to the peak spawning season. Power curves were fitted to the data:

$$F = 2313 \times W^{0.9126} \quad (r = 0.90)$$

$$F = 19.96 \times L^{2.8399} \quad (r = 0.87)$$

The relationships indicate higher fecundity than previously estimated from the west coast of Scotland and the NW North Sea.

INTRODUCTION

In Torstensen (1984) spawning stock estimations were made from abundance of sprat eggs in Norwegian fjords, based on fecundity data from sprat in the NW North Sea (Bailey and Pipe, 1977).

Previous investigations of fecundity of sprat in the NE Atlantic, (De Silva, 1973; Bailey and Pipe, 1977) gave various results. To get data on fecundity in Norwegian areas, fecundity studies were started in the spring 1985. Fecundity is defined as the number of eggs produced during the spawning season by a female. Sprat is a serial spawner with a protracted spawning season, and thus the sprat ovaries contain oocytes in different developing stages.

The present report is preliminary, based on fecundity data from the very beginning of the spawning season.

MATERIALS AND METHODS

Sprat for fecundity studies were collected in a fjord area on the south eastern coast of Norway (Fig. 1). Earlier investigations have shown that sprat spawn in this area (Ellingsen, 1979). The spawning season is from February to July, with peak spawning in the period April-June. Catches were taken by pelagic trawl (Engel, 8 x 8 fathoms) every 4th week from the end of January to the beginning of May.

Ichthyoplankton was sampled simultaneously, the number of sprat eggs without embryo (EU) was used as a relative measure for the spawning progress. This is shown in Fig. 2, which also gives the occurrences of females in maturing stage 4 (ripening) and stage 5 (spawning) in the catches. With reference to Fig. 2 the fecundity studies so far have mainly been based on stage 4 ovaries sampled in January and February (Table 1).

Ovaries were collected from sprat with a wide size range. The methods used for preservation and fecundity study are described

Table 1

Sampling data and number of ovaries for fecundity studies

Date	Number
Jan. 29	9
Febr. 28	17
March 28	4
April 16	3
May 6	1

in Iversen and Adoff (1983). Three subsamples were taken from the ovaries, in the anterior, middle and posterior region.

From published histological work (Bailey and Pipe, 1977) and relative transparency of the oocytes (Iversen and Adoff, 1983), oocytes larger than 150 μm are defined as developing oocytes. The developing oocytes are categorized in 6 size groups.

RESULTS AND DISCUSSION

There were ripening sprats (stage 4) in lengths from 7.5 to 15.0 cm, and weights from 3.3 to 24.8 gram. The fish were from 1 to 5 years old. The fecundity varied from 4.000 to 44.000 with a great variation within each size group.

There was a variance of about 10% between the fecundity estimated from the three subsamples, indicating an even distribution of the oocytes in the ovary. The distribution of the different size groups, however, indicates a decreasing number of the smallest developing oocytes from the anterior to the posterior region of the ovary:

	Egg diameter (µm)					
	150-299	300-449	450-599	600-749	750-899	>900
Anterior	66.7	26.4	5.3	1.3	0.3	-
Middle	65.6	27.1	5.6	1.4	0.3	-
Posterior	64.5	28.6	5.0	1.6	0.4	+

About 40% of the oocytes in the ovaries were maturing oocytes. The stage distribution of these oocytes gave an increasing part of oocytes larger than 450 µm during the season (Table 2).

Table 2

Size distribution (%) of developing oocytes in the sprat ovaries

Date	N	Egg diameter (µm)					
		150-299	300-449	450-599	600-749	750-899	>900
29.1	9	79.0	20.3	0.7	-	-	-
28.2	17	64.5	32.2	2.7	0.6	+	-
28.3	4	81.0	15.5	2.9	0.5	+	+
16.4	4	62.6	27.0	6.8	3.6	+	+

Low number of the largest oocytes is also shown by Bailey and Pipe (1977). This might indicate a rapid development of oocytes into maturing batches in a short time prior to spawning.

A power curve was fitted to the fecundity length data:

$$F = 19.96 \cdot L^{2.8399} \quad (\text{length in cm}) \quad r=0.87$$

This relationship indicates higher fecundity for the Norwegian sprat than for sprat in the Scottish waters (De Silva, 1973) and NW North Sea (Bailey and Pipe, 1977) (Fig. 3). These publications are based on a lower size for defining developing oocytes, 122 μm and 144 μm respectively. In my data, however, less than 2% of the developing oocytes were smaller than 150 μm .

The fecundity for the NW North Sea is probably underestimated. The ovaries were sampled in May-June and the low values of fecundity seem to be a result of earlier spawning.

The fecundity-weight relationship was estimated and fitted to the power curve

$$F = 2312 \cdot W^{0.9126} \quad (\text{weight in gms}) \quad r=0.90$$

This gives a nearly linear description of the fecundity-weight relationship.

The relationships, fecundity-length and fecundity-weight, indicate higher fecundity for the Norwegian sprat compared to the Scottish. Whether these differences are real or depend on different methods or variation from one year to another, is not known.

REFERENCES

- BAILEY, R.S. and PIPE, R.K. 1977. Preliminary observations on the maturation cycle and fecundity of sprats in the north-western North Sea. ICES CM 1977/H:32 (Mimeo.)
- DE SILVA, S.S. 1973. Aspects of the reproductive biology of the sprat, *Sprattus sprattus* (L) in inshore waters of the west coast of Scotland. J. Fish. Biol., 5: 689-705.
- ELLINGSEN, E. 1979. The abundance of sprat eggs and larvae in the Langesund and Oslofjord areas, south eastern Norway, 1974-1978. ICES CM 1979/H:60 (Mimeo.)
- IVERSEN, S.A. and ADOFF, G.R. 1982. Fecundity observations on mackerel from the Norwegian coast. ICES CM 1983/H:45.
- TORSTENSEN, E. 1984. Sprat spawning in two fjord areas of western Norway in 1982 and 1983. ICES CM 1984/H:41 (Mimeo.)

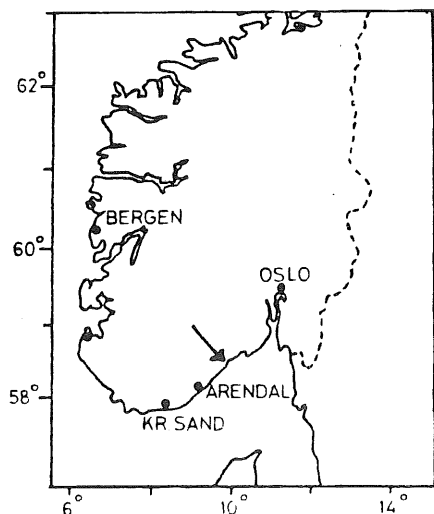


Fig. 1. Location of the sampled area on the south eastern coast of Norway.

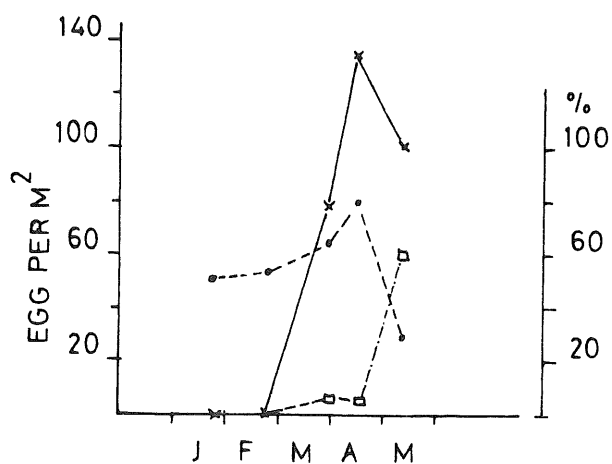


Fig. 2. The number of sprat eggs (EU) per m² related to the occurrences (%) of maturing stages 4 (ripening, •-----•) and 5 (spawning, □-----□) in the sprat catches.

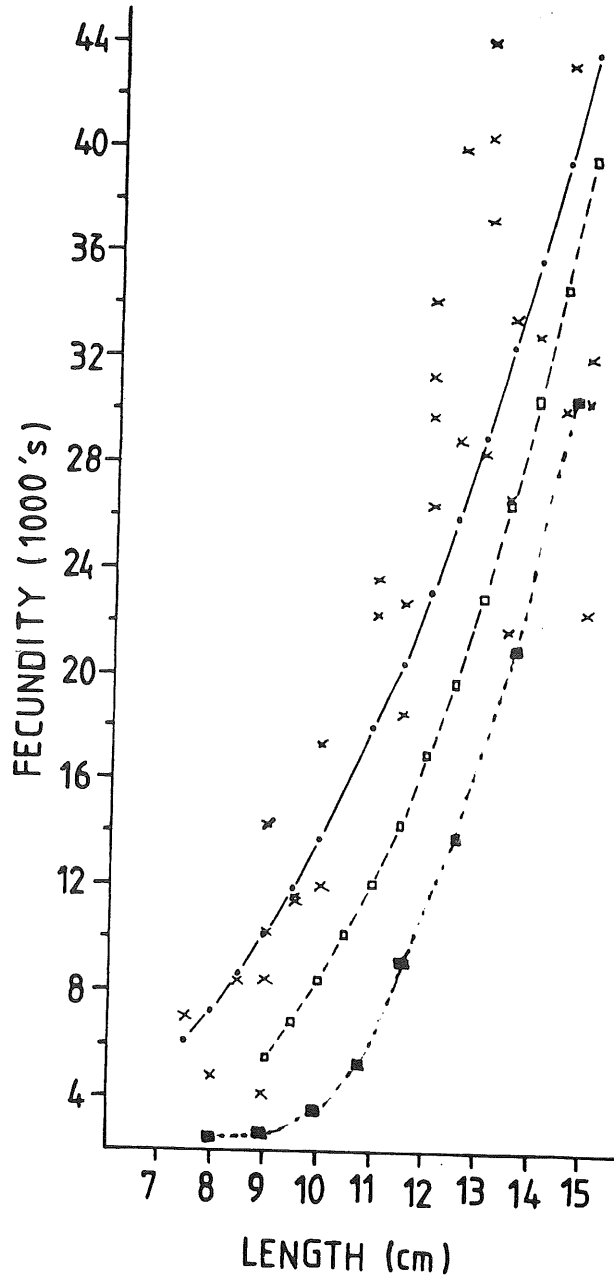


Fig. 3. The relationship between fecundity and length, with the fitted curves for Norwegian sprat (•—•), the inshore waters of the west coast of Scotland (De Silva, 1973) (□---□) and NW North Sea (Bailey and Pipe, 1977) (■---■).

