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PRELIMINARY RESULTS OF A HISTOLOGICAL STUDY THE GONADS OF THE SOUTHERN HORSE MACKEREL (TRACHURUS TRACHURUS L.) STOCK

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The problem of deciding which method to use to determine the Spawning Stock Biomass of the horse mackerel depends on whether we consider it to be a total or a multiple spawner. The reason for presenting these preliminary results of a study of the histology of the gonads, as a working document, is that they may have some value in the discussion of the reproductive behavior of the species.

The reproductive biology of this species is being studied from several angles: 1) The spawning cycle, from monthly samples of eggs and larvae in three different regions of the Spanish Atlantic coast. 2) The spawning areas, from special cruises to determine them, and 3) The fecundity and spawning frequency with a histological study of the ovaries.

The collections were made in the waters of Galicia and the northwest Cantabrian sea (area VIIIc of ICES, Fig. 1) on board commercial trawlers, between February and June 1989 which is the spawning season, (Sola et al, 1989).

A total of 18 hauls was made with a trawl net, between 02 00 and 18 00 (GMT), at depth less than 200 m.

A number of 723 individuals were sampled ranging in size between 18 and 41 cm. (Fig. 2). For the histological study, 153 individuals randomly selected from each of the samples were used. The ovaries which were extracted immediately after each haul were preserved following the method of Hunter, 1984 (Table 1).

RESULTS AN DISCUSSION

The sex ratio of all individuals sampled was usually about 1:1, but was lower (47%) during the months of maximum spawning intensity which may indicate differential reproductive behavior.

Of the 153 individuals which were studied histologically, it was found that 8 were immature, i.e. the oocytes were without yolk, about 5% of the sample. In addition, 3 ovaries were already in postspawning condition, according to the terminology of Hunter and Macewicz (1984), which is only 2% of the samples. Of the individuals sampled, 93% had oocytes with yolk (Table 2). These results show that the sampling coincided with the spawning period as previously defined by Sola et al (1989) during ichthyoplankton studies.

The histological study of mature individuals (145), showed that during February, despite the fact that all the ovaries had oocytes with yolk, there were no signs that spawning had occurred since ovaries with degenerating follicles were not observed.

A progressive increase in the percentage of ovaries with follicles in different stages of regression was observed in subsequent months, and reached a maximum in April when 23% of the ovaries contained follicles, and the spawning fraction were between 0.10 and 0.13, depend on the ages of the follicles with which the calculation are made. Although these results are very preliminary, they reveal a period of 8 to 10 days in this month between two partial spawnings for the horse mackerel.

One feature which is very clear in Table 2 is the low frequency of ovaries in spawning or near-spawning conditions: this could be due to a bias in the original sample caused by the availability of the species to the gear, or by the depth in which the commercial fleet operates.

No ovaries were found in which the oocytes were hydrated, and there were no indications of spawning, so that, it is not possible to estimate batch fecundity.

If the spawning stages of the ovaries sampled are examined with respect to the time of fishing, it can be seen that ovaries in which the nuclei of the oocytes have migrated to one pole were fished between 06 00 and 10 00 hours GMT, and those oocytes in which fusion of the yolk had begun were only found in fish captured between 10 00 and 18 00 hours. If in addition we consider that all of ovaries which had at the same time hydrated oocytes and postovulatory follicles, or only postovulatory follicle without signs of degeneration, came from individuals caught in the early morning, we can probably conclude that spawning takes place at night (before 02 00 hours), since at this time ovaries are found with hydrated oocytes and postovulatory follicles.

Ovaries with atretic oocytes are common in this species and have been mentioned before by other authors (Macer 1974). In this study a large proportion of ovaries were found with oocites in alpha atresia, the earliest stage of atresia (Hunter and Macewicz, 1984).

Of the total number of ovaries with yolk oocytes in this period, 40% had alpha atresia, but if we take into account the percentage of ovaries with alpha atresia during different months, the percentage varies; 64% in February declining to 32% in April and increasing slightly to 36% in june (Table 3). This variation in the percentage in which atresia appears seems to show that the incidence of atresia varies as the spawning season advances. The lowest incidence of atresia is found at peak spawning when the spawning fraction is highest.

If we calculate separately the incidence of atresia in ovaries with and without signs of partial spawning, the values obtained are very different. The proportion of ovaries with atresia is higher in those without postovulatory follicles (43%) and much lower (29%) in those with follicles. The month with the

lowest proportion of ovaries with atretic oocytes and follicles present is April (13%), coinciding with the highest fraction of spawning females. These results might be influenced by the absence of oocytes with yolk immediately after a partial spawning, but it was found that all ovaries with postovulatory follicles, in whatever stage of regression, contained oocytes with yolk

Of all the ovaries seen, four were found with hydrated atresic oocytes, which represents 2.7% of the total. This finding is of great importance for the calculation of the batch fecundity of this species.

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Collection number	Date	Time of day (h)	Total length		Number of fish samples	Number of histological samples
			Mean	Range		
1	14-2-89	10 00	27	26-28	47	9
2	14-2-89	14 00	29	28-30	58	5
3	20-3-89	15 00	36	31-41	62	8
4	31-3-89	06 00	28	27-30	51	15
5	31-3-89	10 00	33	29-39	50	18
6	31-3-89	02 00	31	25-39	48	10
7	31-3-89	18 00	29	27-30	28	9
8	18-4-89	06 00	28	25-31	50	8
9	18-4-89	11 00	30	26-37	52	8
10	18-4-89	16 00	30	26-40	24	7
11	26-4-89	09 00	26	21-30	42	4
12	26-4-89	13 00	25	22-34	45	8
13	01-6-89	05 00	26	24-33	50	15
14	01-6-89	09 00	26	23-29	50	7
15	01-6-89	13 00	25	24-27	50	6
16	15-6-89	-	-	-	3	3
17	15-6-89	-	-	-	5	5
18	15-6-89	-	-	-	8	8
Total					723	153

Table 1. Characteristics of 18 collections of female horse mackerel from the Iberian waters in 1989.

State	February	March	April	June	
0	14	47	23	33	
1	0	3	1	2	
2	0	6	7	9	
Total	14	56	31	44	145

Table 2. Number of different gonad states by month.
0= no postovulatory follicles
1= hydrated+postovulatory follicles
2= postovulatory follicles

Month	Atretic State	Non-spawning follicles	Postovulatory follicles	Total
2	0	5	0	5
	1	8	0	8
	2	1	0	1
	3	0	0	0
Total		14	0	14
3	0	26	5	31
	1	17	3	20
	2	2	1	3
	3	2	0	2
Total		47	9	56
4	0	13	7	20
	1	7	1	8
	2	2	0	2
	3	1	0	1
Total		23	8	31
6	0	20	8	28
	1	12	1	13
	2	1	2	3
	3	0	0	0
Total		33	11	44
2-6	0	64	20	84
	1	44	5	49
	2	6	3	9
	3	3	0	3
Total		117	28	145

Table 3. Numbers of female horse mackerels in different spawning and atretic states.
0=no alpha atresia of yolked oocytes.
1=alpha atresia of yolked oocytes (50%) affected.
2=alpha atresia of yolked oocytes (50%) affected.
3=no yolked oocytes, but beta atresia present.

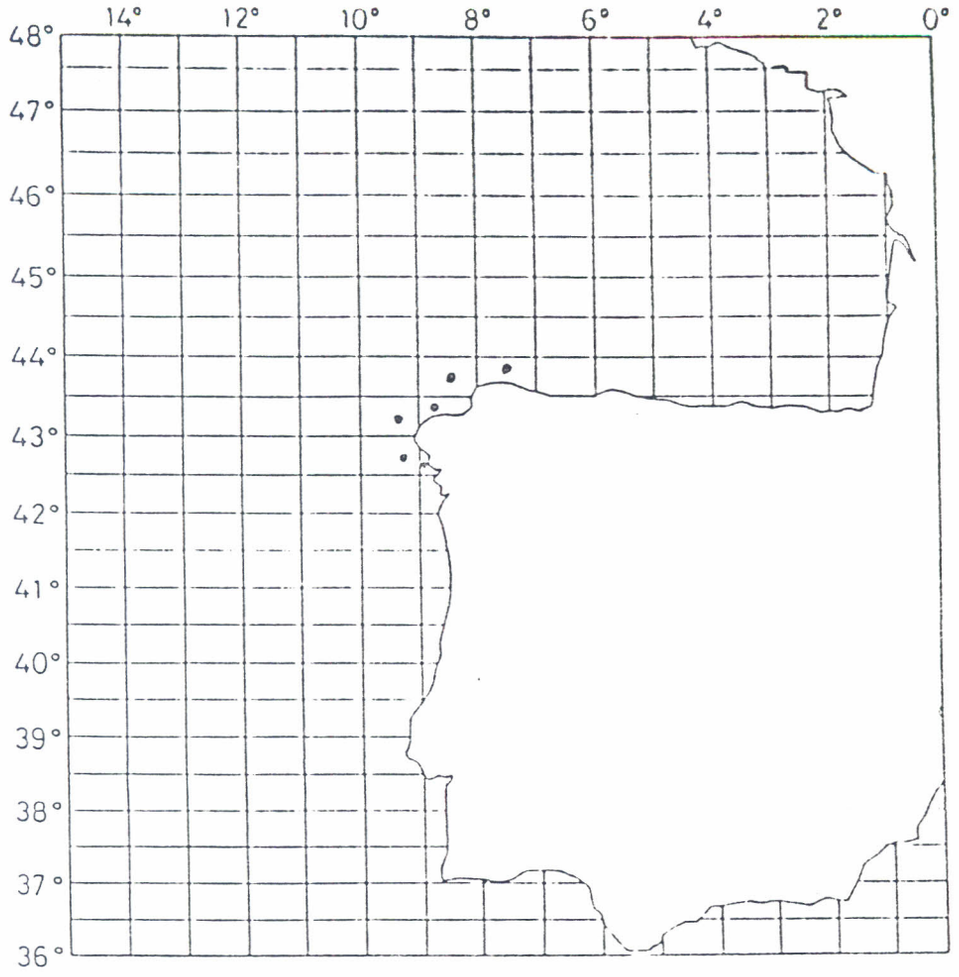

Fig. 1- The stations sampled in 1989.

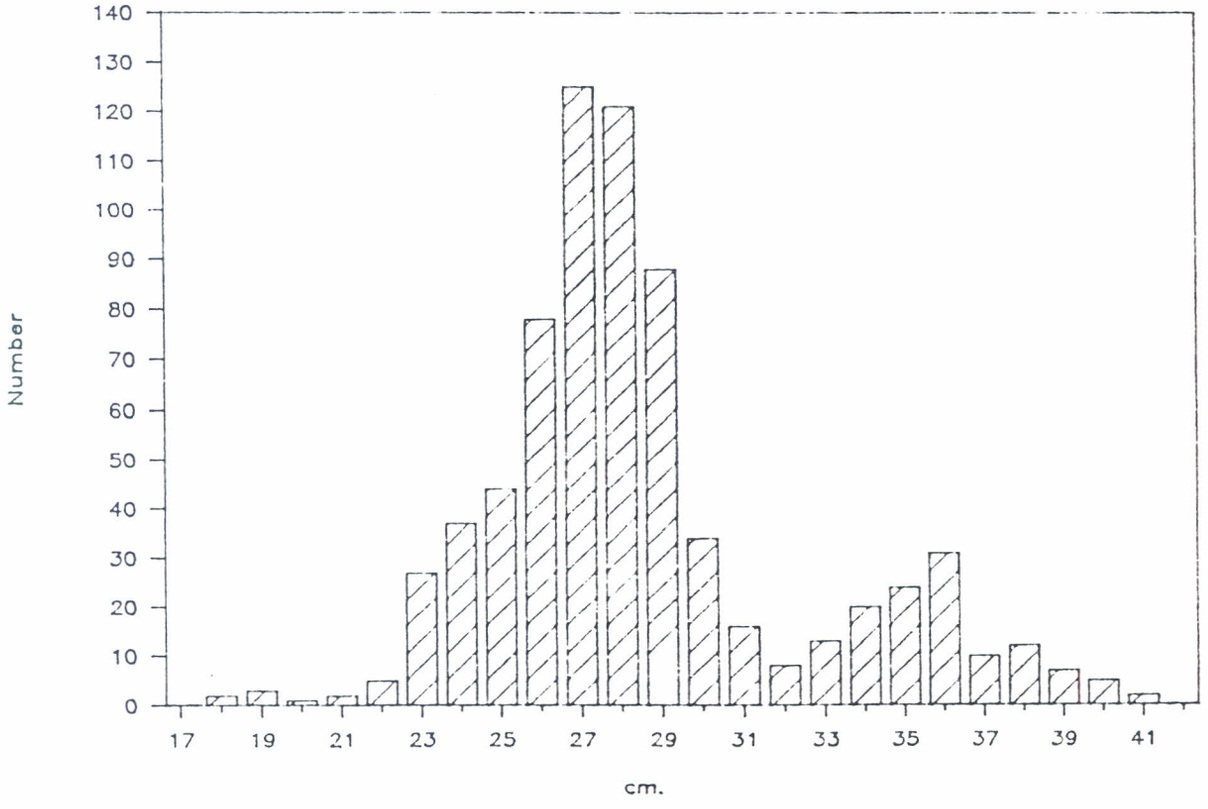

Fig. 2- Length distribution of Horse Mackerel

PROPORTION ALPHA ATRESIA
SOUTHERN HORSE MACKEREL