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Length and Age of First Maturation of Flemish Cap Cod in 1993 with an Histologic Study

by

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ABSTRACT

221 ovaries of cod caught on Flemish Cap in July 1993 were analyzed histologically . Sampled cod range from 31 to 88 cm in lengths. and the age ranged from 2 to 8 years old. To study the percentage of spawning females by size and age classes, the percentage of females ripening for the first time was also studied.

The maduration ogive using cortical alveoli (like an indicative of the next spawners) was calculated as 50% maduration length and age at 50 cm and 4 years old and the maduration ogive using postovulatorie follicles (like indicative of those females which spawned at least one time) was calculated as 50% next maduration lenght and age at 64 cm and 5 years.

INTRODUCTION

The study of sexual maturity by length or by age is improved if the maturity stages are classified histologically. The maturity stage is very easy to identify in females during most of the annual reproductive cycle using the macroscopic features of the ovary (Pitt 1966; Morrison 1990), but is very difficult as ripening begins .

It is difficult to identify future mature females by macroscopic analysis with ovaries sampled outside the ripening season. This is the problem with cod ovaries sampled in the July survey on Flemish Cap. There are histological methods to classify maturity stages. Kjesbu (1991) used oocytes size, and Morrison (1989) and Zamarro et al. (1993) used the presence of different kinds of oocytes in histological preparations. Oocytes in the circumnuclear ring, cortical alveoli and vitellogenesis stages, and the postovulatory follicles were used for the identification of females at the beginning of ripening in an earlier paper (Zamarro et al 1993.).

Previous results indicate that less than two months elapses between the end of spawning and the beginning of the development of cortical alveoli wich indicatior renewed ripening. Also, there is a period of more than three months between the end of spawning and the vitellogenesis stage.

Postovulatory follicles last a long time in the ovary, and their identification is possible seven months after spawning. Thus we can make a maturation ogive three months after spawning.

This work follows the method used by Zamarro et al (1993). Identifications were made using three kinds of oocytes, and postovulatory follicles.

The Gonosomatic Index was not used because it does not allow the correct identification of mature stages in all females (Zamarro et al. 1993).

MATERIAL AND METHODS

221 cod ovaries were sampled during the Flemish Cap summer surveys in 1993 on the R/V Comide de Saavedra .

Ovaries were fixed in 10% buffered formaldehyde (Hunter, 1985), the size and weight of each fish was recorded, and the otoliths were removed. Gonads were weighed in the laboratory. Pieces 0.5 cm thick were embedded in paraffin and 5 microns sections stained with Harri´s Hematoxyline and eosine floxina B.

The Kjesbu and Krivi (1989) and Morrison (1990) criterion was used to differentiate maturity stages . The stages founded were:

- Circumnuclear oocytes : This stage characterizes immature females, if there is not later stages present.
- Cortical alveoli oocytes: This stage is present in females which will spawn the following year.
- Vitellogenesis: This is an intermediate stage, between cortical alveoli and postovulatory follicles.
- Postovulatory follicles: These follicles are present only in females which spawned the previous year.

RESULTS

All ovaries examined had oocytes in the circumnuclear ring stage. These oocytes mature in the next or some later spawning season .

The presence of oocytes in the cortical alveoli stage indicates that such females were to spawn in the next spawning season. The presence of postovulatory follicles, indicates that such females had already spawned at least once before the time of capture.

Tables 1 and 2 show the numbers and the percentage of ovaries with cortical alveoli (CORT), vitellogenesis (VIT) and postovulatory follicles (POF) in different size classes.

Tables 3 and 4 show the numbers and the percentage of ovaries with cortical alveoli (CORT), vitellogenesis (VIT) and postovulatory follicles (POF) in different age classes.

Ovaries without cortical alveoli, vitellogenesis and postovulatory follicles indicate that they came from immature females. Ovaries with cortical alveoli but without postovulatories follicles indicate that they belong to fish which would have spawned during the next season (none were found in this study). So, the reliable maturation ogive had to be constructed using the percentage of ovaries with postovulatory follicles.

Tables 1 and 2 show that females develop cortical alveoli between June and July, indicating that these females will spawn the next year. Similar results were obtained by Zamarro et al. (1993) with 1992 samples. It is also observed that the youngest mature females did not begin vitellogenesis in July (less than 50%). The percentage of females with vitellogenesis stages increases with size. In July, this indicates that in the larger females, the period between the end of spawning and the beginning of vitellogenesis is of shorter duration than in the smaller females.

Figure 1 shows two maturation ogives by length. Using mature females those with postovulatories follicles and the other corresponding to the spawners in 1994 where the cortical alveoli was used as a criterion. The 50% maturation length was at 64cm . The 50% next maturation at 50 cm.

Figure 2 indicates two maturation ogives using age. The first ogive is based on females which spawned in July (with postovulatory follicles) and the second ogive is based the females which were maturiting for the first time (with cortical alveoli). The age of 50% maturity was 5 years in the first case, and 4 in the second .

DISCUSSION

The maturation ogives based on the cortical alveoli stage and postovulatory follicles show that length of 50% maturation is 64 cm, whereas by age at 5 years old, these ogives were using postovulatories follicles as an indicative of spawners females that spawn at least one time. The other ogives, using cortical alveoli stage as an indication of future spawners, show that the lenght of 50% maturation is 50 cm and by age was at 4 years old.

Zamarro et al, (1993) show a difference of 1.8 years between the ages of 50% maturation. A one year difference is due to the one year delay between the cortical alveoli stage and the postovulatory follicles, the rest of the difference, 0.8 years, may be related to differences between cohorts in the age of 50% maturation or to the existence of non-reproductive females.

Other authors give the that lenght of 50% maturation in zones near Flemish Cap (3M) such as 2J+3KL in 1990, as 50 cm. The decrease in this value in recent years is due either to overfishing or to enviromental factors (e.g. water temperature, density etc) (Xucai Xu et al ,1991). In this zone , the 50% maduration by age and lenght show a North-South cline with averages of 5 years and 50 cm respectively (Bard et al, 1986).

In our study, the difference between cortical alveoli and postovulatorie follicles was 1 year, it was possible that we had not more difference because we had not differences between cohorts in age of 50% maduration or the existence of non-reproductive females.

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Table 1.- Sampling by size of July 1993. Number of ovaries, ovaries with oocytes in cortical alveoli stage (CORT.), vitellogénesis (VITEL.),and postovulatorie follicles (POF.)

SIZE	NUMBER	CORT.	VITEL.	POF.
28-34	3	0	0	0
34-40	17	5	0	1
40-46	62	25	1	2
46-52	55	24	4	8
52-58	10	7	1	1
58-64	27	25	9	18
64-70	27	25	9	22
70-76	10	9	4	5
76-82	6	6	2	6
82-88	3	3	2	3
+ 88	1	1	0	1

Table.2- Sampling by size of July 1993. Number of ovaries, percentaje of ovaries with oocytes in cortical alveoli (% CORT), vitellogenesis (% VIT) and postovulatorie follicles (% POF).

SIZE	NUMBER	% CORT	% VIT	% POF
28-34	3	0	0	0
34-40	17	29.41	0	5.88
40-46	62	40.32	1.61	3.23
46-52	55	43.64	7.27	14.55
52-58	10	70	10	10
58-64	27	92.59	33.33	66.67
64-70	27	92.59	33.33	81.48
70-76	10	90	40	50
76-82	6	100	33.33	100
82-88	3	100	66.67	100
+ 88	1	100	0	100

Table 3 .- Sampling by age of July 1993.Number of ovaries, ovaries with oocytes in cortical alveoli stage (CORT.), vitellogénesis (VITEL),and postovulatorie follicles (POF.)

AGE	NUMBER	CORT	VIT	POF
0	26	6	2	4
2	3	0	0	0
3	121	47	3	5
4	15	6	3	3
5	45	43	15	29
6	7	5	1	6
7	20	19	8	15
8	4	4	4	3

Table 4.- Sampling by age of July 1993. Number of ovaries, percentage of ovaries with oocytes in cortical alveoli (% CORT), vitellogenesis (% VIT) and postovulatorie follicles (% POF).

AGE	NUMBER	% CORT	% VIT	% POF
0	26	23.07	25	15.38
2	3	0	0	0
3	121	38.84	2.5	4.13
4	15	40	20	20
5	45	95.55	32.61	64.44
6	7	71.43	14.28	85.71
7	20	95	40	75
8	4	100	100	75

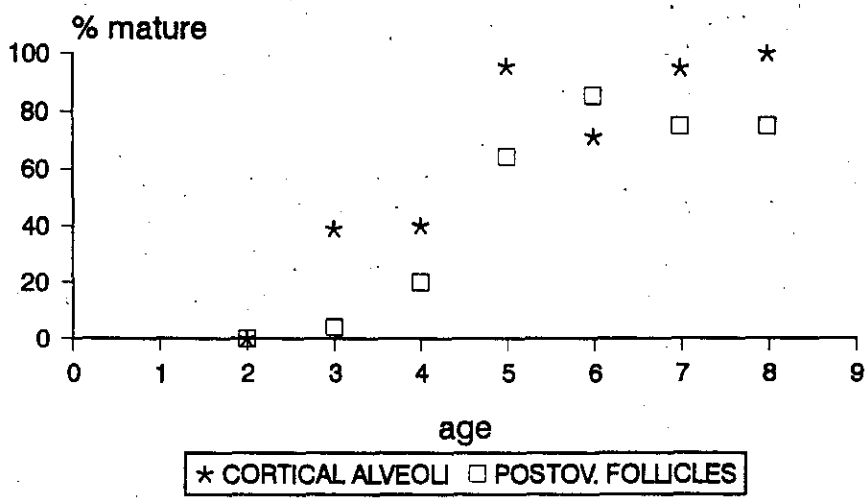

Figure 1.- Percentage by age of mature females (ovaries with oocytes in cortical alveoli stage) Flemish Cap Cod in July 1993.

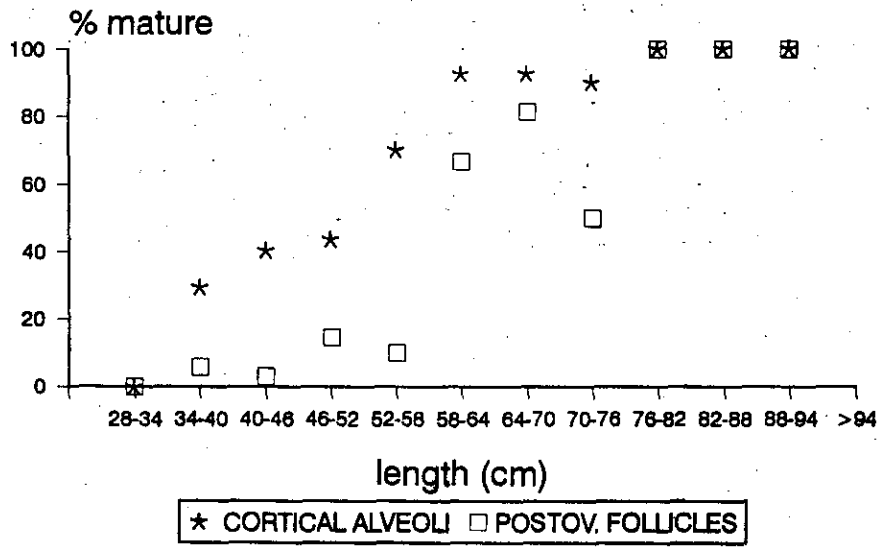

Figure 2.- Percentage by length of mature females (ovaries with oocytes in cortical alveoli stage) Flemish Cap Cod in July 1993.