Northwest Atlantic Fisheries Organization

Serial No. N1566 NAFO SCR Doc. 89/02

Fishery and Biological Aspects of Silver Hake (*Merluccius bilinearis*) in Div. 4W, 1986-87

by

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Abstract

The results of the biological samplings of silver hake in 1986 and 1987 are offered in this work where the equation for the relationship of length-weight by sex and the combination of both were calculated.

The von Bertalanffy equation was used to describe growth each year, analyzing the structure of catches at age in weight and number.

Introduction

Silver hake (*Merluccius bilinearis*) is one of the most important commercial species on the Scotian Shelf. Since 1958, when this fishery began, catche volumes have become increasingly higher until a maximum of 299,000 in 1979. In the last five years, the catches have fluctuated between 36,000 and 83,000 tons. The fishery is carried out mainly by the USSR and Cuba.

Taking into consideration the increasing participation of Cuba in the utilization of this resource, it is necessary to carry out biological samplings and the determination of biological characteristics, that will contribute to its knowledge and conservation.

Materials and Methods

A sampling plan was carried out on board Cuban commercial vessels

between May and July of 1986 and 1987. The samplings included catch composition by sex and length (14,604 measurements in 1986 and 15,008 in 1987), as well as data to calculate the length-weight relationship (stratified sample with 359 measurements in 1987). The calculation of the equations for males, females and both sexes combined were made by the method of least squares for 1987. A co-variance analysis was applied to find the differences between equations for females and males at a significance level of 95%. The relationship for 1986 calculated by the author (Tizol, MS 1987), was considered in the analysis of the catches.

For age studies, 233 pairs of otoliths were analyzed in 1986 and 153 pairs in 1987. The otoliths were conserved according to the conventional treatment given by Hunt (1979). The methodology described by this author in 1978 and 1980 was used for the readings. The von Bertalanffy equation was used to describe growth for each sex and both combined. In order to obtain a better estimation of growth parameters, the readings of 1986 and 1987 were combined and a single age-length key was employed for calculations. At the same time, the computer program ELEFAN (Brey and Pauly, 1986; Pauly *et al.*, 1986) was carried out to estimate growth parameters from 1985-1987 length compositions (Dominguez and Varea, 1986; Tizol *et al.*, 1988).

Results and Discussion

The rate per sex of each year (Fig. 1), showed a tendency for the percentage of males in the catches to decrease through the period 1985-1987, even though in the years 1985 and 1986 they prevailed over the females (62.5 and 54.4% respectively). As in 1987, the amount of males is less than those of females with 45.9% in 1988 according to preliminary data. These relationships were practically the same with 50.8% for females and 49.2% for males.

Coefficients of determination (R^2) of high values were obtained in the calculation of the length-weight relationship, in all cases. Co-variance analysis did not show significant difference between equations of females and males (F theoretical = 3.00; F calculated = 0.072), so the relationship for both sexes combined can be used to describe this relationship. Similar results were obtained by Tizol (MS 1986) both equations are shown in Table 1, while the corresponding graphs are in Figure 2. The mean weight at age, and the mean for 1986 and 1987 are presented in Table 2.

Growth parameters for each sex and for both combined are shown in Table 3A (from otoliths) and 3B (from length compositions). In samplings, individuals with higher values of length than the asymptotic length obtained in our calculations were observed. Even though it is possible to find males with sizes bigger than 45 cm and females with total length more than 61 cm, it is not significant regarding the proportion of individuals of more than 40 cm in commercial fishery (1986, 0.38%; 1987, 0.87%). The same occurs in reference to the proportions in catches of individuals with lengths higher than asymptotic (males 0.06%; females 0.09%).

In general growth parameters presented in this work coincide with the ones obtained by Hunt (1980) and Rikhter (1988), but inferior compared with the ones offered by Mari (1980) and Mari and Valdes (1981), especially with reference to females, where the authors gave values of $L\infty$ higher than 86 cm and bigger than 91 cm for the combination of both sexes.

Age composition of catches in weight and number are given in Table 4 and 5. In 1986 the bulk of the catches corresponded to individuals of 2 years (annual class 1984), in weight as well as in number (41.3% of the catch in weight and 44.67% in number)(Fig. 3 and 4). These results do not coincide with the ones obtained by Waldron *et al.* (1988) and Noskov (1988), which attribute the bulk of the catch in 1986 to the 1983 year class (3 year old

individuals), nevertheless in our results this year class represents the 32.1% in weight and constitutes the second group by its importance. In 1987 the bulk of the catch was reached from the annual classes of 1985 (2-year-old individuals 39.91%) and 1984 (3-years olds, 28.83%).

When the catch in number is analyzed, a strong participation of the 1985 year class is observed in the 1986 and 1987 fisheries, occupying the second place in importance (25.61%) in 1986 and the first in 1987 with 43.6% from the total of individuals captured. In length composition samples from 1986 a great number of individuals belonging to the 1985 year class were found in the catch, which is corroborated in our results (Fig. 5). The annual class corresponding to 1986 (one year) had a high number in 1987, even though they are considered of a medium size, according to the results of Soviet (Noskov, 1988) and Canadian (Waldron *et al*, 1988) samples, the same as the 1987 year class which is in a lower level than the 1985 year class.

The catches in 1988 and 1989 will be represented by individuals of the strong 1985 year class and the medium size year classes of 1984, 1986 and 1987. Taking into account that all year classes which will constitute the bulk of the catch in this period, are in a good level, the general abundance of the population is considered high.

Conclusions

1. In the period 1985-1987, a decrease tendency of male in catch was observed, but not in 1988, where the proportion was very similar.
2. There are no differences between length-weight relationship equations for males and females, in the years 1986 and 1987, so it is possible the use of the equation combined to describe this relation within each year.
3. The most important year classes in 1986 fisheries were corresponding to 1983 and 1984, while in 1987 they were the 1984 and 1985 year classes.

4. The bulk of the catches in 1988-1989 will be formed mainly by the 1985 (strong) and 1984, 1986 and 1987 (medium) year classes..

5. Taking into account the status of the different year classes in the fishery, the general abundance of the population is considered high.

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TABLE 1.- LENGTH-WEIGHT RELATION SHIP FOR 1986 AND 1987 ($P = a\ L^b$).

YEAR	a	b	r^2
1986	0,0022927	3,3235	0,97
1987	0,00178774	3,3784	0,95

TABLE 2.- MEAN WEIGHT AT AGE (gr) FOR 1986 AND 1987.

AGE	1986	1987	P
1	65,36	60,37	62,86
2	153,23	143,55	148,39
3	240,23	226,73	233,48
4	347,31	329,79	338,55
5	429,90	409,66	419,78
6	452,52	431,57	442,04
7	555,74	531,82	543,79
8	668,32	641,50	654,91

TABLE 3.- GROWTH PARAMETERS FROM OTOLITHS (A) AND FROM LENGTH COMPOSITIONS.

A/ 1986-1987	1(MALES)	2 (FEMALES)	1 + 2
K	0,4989	0,3473	0,3183
to	- 0,30314	- 0,50198	- 0,56147
Loo	38,59	44,41	44,87
B/ 1985-1987			
K	0,935	0,351	0,415
to	0,31403	- 0,04775	- 0,30275
Loo	45,75	51,50	61,00

TABLE 4.- AGE COMPOSITION OF THE CATCHES IN WENGHT.

AGE	1986(%)	1987(%)	1986(TON)	1987 (TON)
1	10,1	10,44	8 351,6	6 441,9
2	41,3	39,91	34 150,6	24 626,1
3	32,1	28,83	26 543,2	17 789,3
4	13,31	15,19	11 005,9	9 372,8
5	2,74	4,41	2 265,6	2 721,1
6	0,36	1,03	297,7	635,6
7	0,07	0,13	57,9	80,2
8	0,02	0,06	16,5	37,0
TOTAL	-	-	82 689,0	61 704,0

TABLE 5.- AGE COMPOSITION OF THE CATCHES IN NUMBER

AGE	1986 (%)	1987 (%)	1986 ($\times 10^3$)	1987 ($\times 10^3$)
1	25,61	27,12	127 778	106 706
2	44,67	43,60	222 871	171 551
3	22,15	19,94	110 491	78 460
4	6,35	7,22	31 689	28 421
5	1,06	1,69	5 270	6 642
6	0,13	0,37	658	1 473
7	0,02	0,04	104	151
8	0,01	0,02	25	58
TOTAL	-	-	498 886	393 462

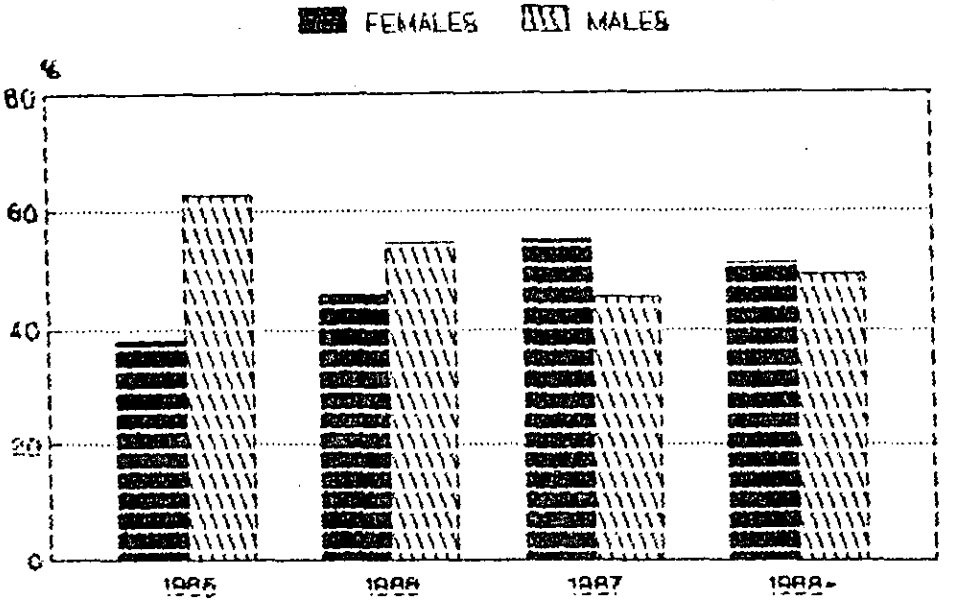


FIG 1.CATCH COMPOSITION PER SEX (1985-1987).

* PRELIMINARY DATA

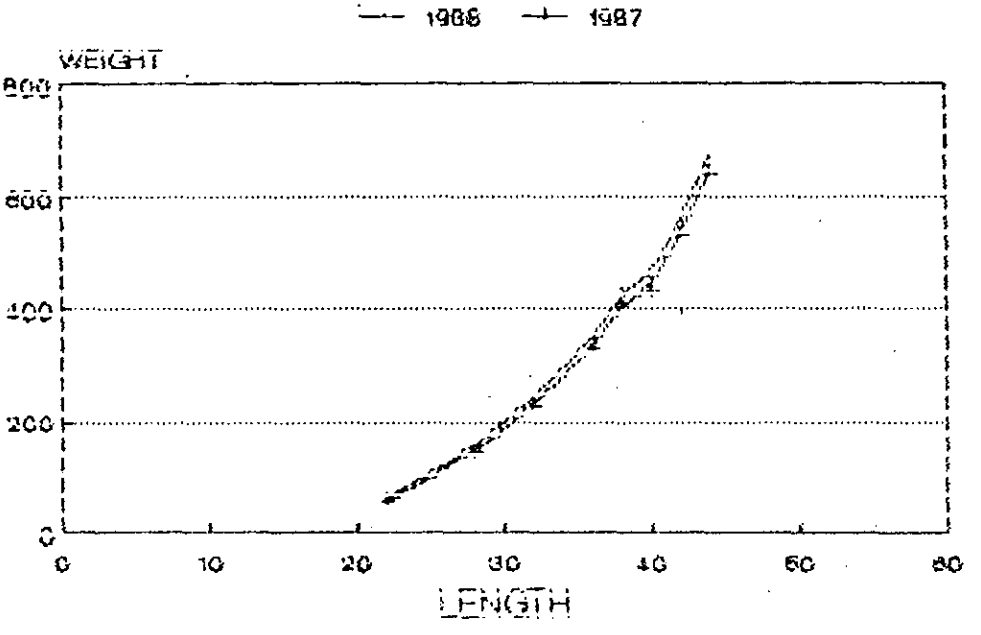


FIG 2.LENGTH-WEIGHT RELATIONSHIP CURVES (1986 & 1987)

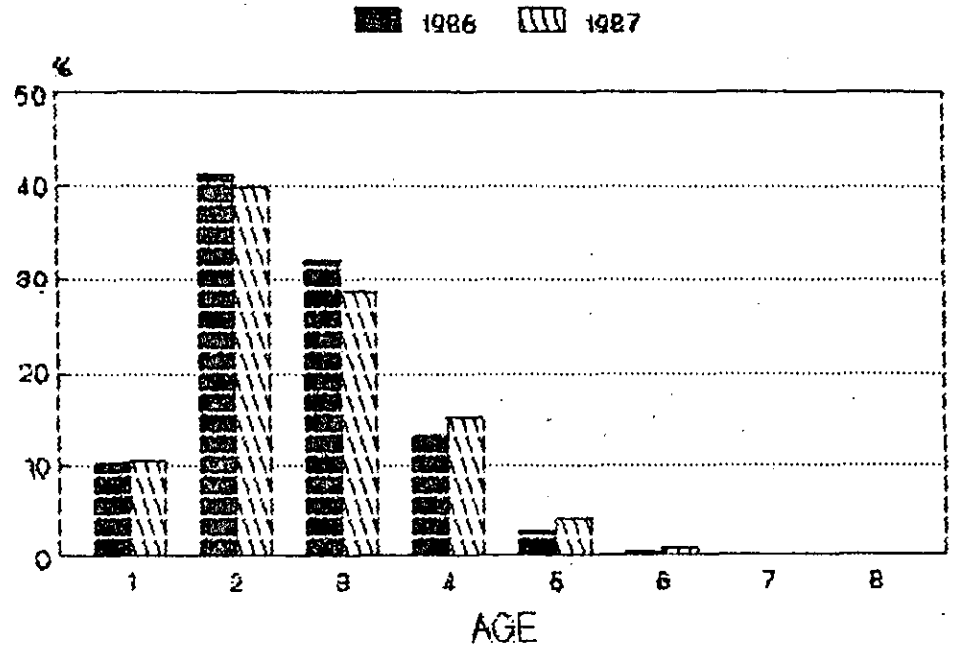


FIG 3. AGE COMPOSITION OF THE CATCHES IN WEIGHT (1986-1987).

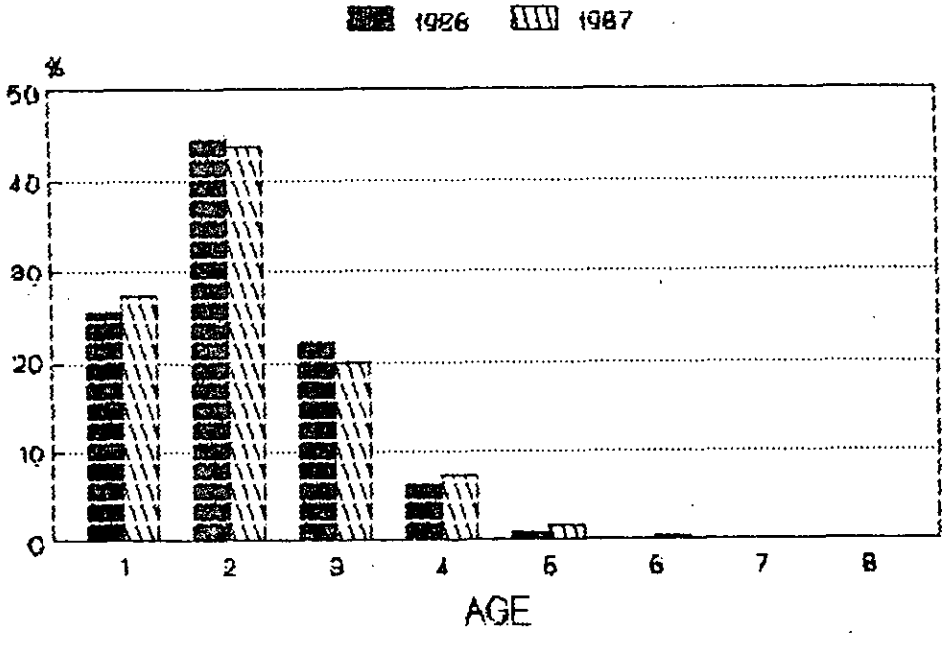
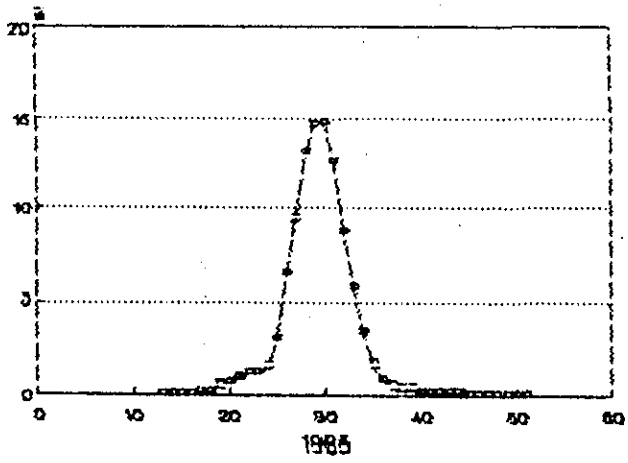
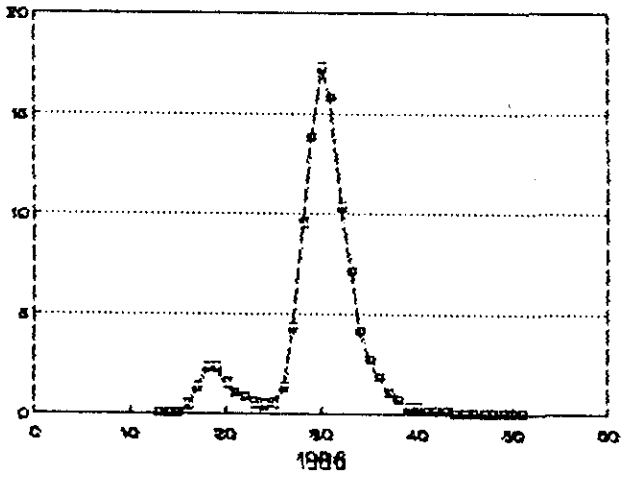


FIG 4. AGE COMPOSITION OF THE CATCHES IN NUMBERS (1986-1987)





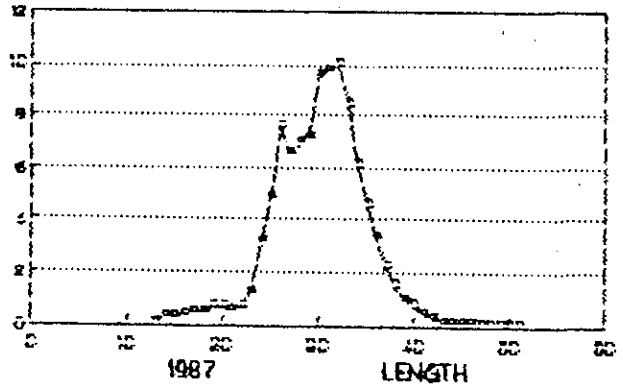


FIG. 6.LENGTH COMPOSITION IN CATCHES, 1985-1987