SOME ASPECTS OF GROWTH AND RECRUITMENT OF HAKE IN THE NORTHERN TYRRHENIAN SEA

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Growth performance of hake in the Mediterranean Sea has been studied with results not always in agreement by several authors. Age reading of otholits of *Merluccius* is difficult, mainly for older individuals. Length frequency analyses are frequently used to estimate the Von Bertalanffy parameters assuming that the modes represent year classes. In this paper, the recent methodology for growth parameter estimation MULTIFAN (OTTER RESEARCH, 1992) has been utilized for the Northern Tyrrhenian Sea hake. It is an integrated data analysis system for simultaneously analyzing sets of length-frequency samples. It utilizes a robust maximum likelihood method to estimate the proportions of fish at age in each sample and the Von Bertalanffy growth model parameters. Extra restrictions can be introduced and superior estimates of the parameters could be obtained. The program tests some hypotheses of the occurrence of certain processes in the population sampled namely : sampling bias for the first cohort, age-dependent standard deviation in length-at-age, seasonally oscillating growth. ORSI RÉLINi *et al.* (1992), SARANO, (1986), ZUPANOVIC (1968) have found for hake multiple spawning and recruitment periods. It is quite difficult to trace a single reliable growth curve through the jumble of modes generated by "multiple" spawning strategies. Uncritical use of modal progression analysis algorithms leads to a possible underestimate of growth constant. K. MULTIFAN has no special routines for fitting growth curves when two or more cohorts are present each year but it has been demonstrated that it gives reliable estimates of growth parameters even for situations like the described above. Length distributions of 9 trawl-surveys performed from 1992 to 1994 with a stratified random design were analyzed separately by sex. Because macroscopic sex identification for individuals smaller than 9 cm was difficult, it was considered valid here to arbitrarily assign half part of them to each sex, considering negligible at this age sexual differences in size according to ALDEBERT *et al.* (1988). The incorporation of constrictions for the first length bias correction improved significantly the fit. The traditional mediterranean bottom trawl nets utilized as sampler during the trawl-surveys is not suitable for the catch of large individuals (ALDEBERT *et al.*, 1993). However, it has been considered that the scarce number of individuals of large size did not alter the precision of the estimates proposed here. In the table are reported the estimates of V.B. growth parameters :

	MALES			**FEMALES**		
	ESTIMATE	C.V.	CONF.LIMITS	ESTIMATE	C.V.	CONF.LIMITS
Loo	53.40	.39	± 0.16	79.10	.24	± 0.142
K	.27	.48	± 0.0009	.19	.24	± 0.003

The hypothesis of seasonal growth has been tested but without producing any improvement of the estimates. Other estimates of L∞ of 77.4 for males and 95.7 for females were obtained with the Powell-Wetherall method (SPARRE *et al.*, 1987). It has been studied the gear selectivity utilizing a cover at the net codend. Selection for the former year classes has been modelized with a logistic function. The partial recruitment was calculated by means of analyses of the left side of the "length converted catch curve". Recruitment patterns were obtained using the appropriate routine of ELEFAN II program (Figs.1 and 2). Two peaks have been detected in December and March for females and in November/December and February for males. In both cases the late Autumn peak was bigger. These indications are in agreement with the results given in ORSI RELINI *et al.* (1992), specially for females. These authors stated that recruitment occurs approximately 6 months after spawning. Figures 3a and 3b show the length frequency distributions for females and males during each trawl-survey. The length distributions have been corrected (in white) for gear selectivity. It is shown how well the estimated growth curves with departure from the two main recruitment moments fit the peaks of the length distributions ordered along the time.

Fig.1 ♀

Fig.2 ♂

Fig.3a ♀

Fig.3b ♂

% Recruitment

Months

Length (cm)
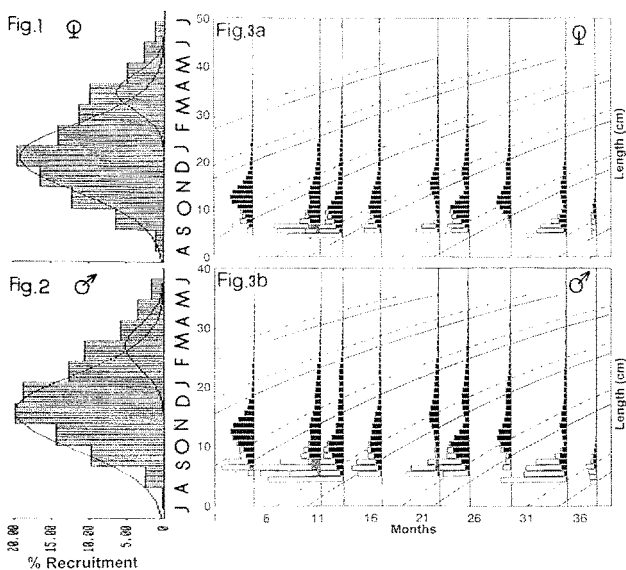
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