AN ASSESSMENT OF GEARS INTERACTION IN HAKE FISHERIES IN THE WESTERN MEDITERRANEAN AND THE STRAIT OF GIBRALTAR

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Abstract
A study on gear interaction in hake fisheries was carried out in the Moroccan Mediterranean and the Gibraltar Strait regions. The trawl landings in both regions were composed mainly of immature specimens while longliners were targeting only mature individuals.
Keywords : Demersal, Stock Assessment, Analytical Methods, Western Mediterranean, Strait Of Gibraltar.

Introduction
The European hake, *Merluccius merluccius*, L. 1758 constitutes a species of high commercial value for the Moroccan demersal fishery. This work focused on the study in both regions of gear interactions in hake fisheries using an analytical model.

Material and Methods
The data used in this study were samples, collected by length category, using a stratified random sampling of hake captures. The sampling was carried out in the 2004 and 2006 surveys in the Mediterranean region, and in 2004 and 2005, from monthly commercial landings of trawlers and longliners in the Gibraltar Strait region.
The samples were weighted and all individuals were measured to the nearest centimeter for total length (TL). A subsample was then chosen, and each fish was measured to the nearest cm and then weighted with a precision of 0.1 g. Otoliths were removed, washed and sectioned for age determination. The von Bertalanffy growth parameters were calculated (sexes combined), using the Fishparm program [1]. The length-weight relationship parameters (a and b), were obtained by linear regression. The natural mortality (M) was estimated based on [2].
The length distributions of the samples were raised to the catches of the vessels and that of the month, and then extrapolated to the species annual catches made in each region.
The annual length distribution by region was then used to estimate the fishing mortality parameters (F) for each region using the linearized catch curve method [3]. The parameters obtained by region are given in Table 1.

Tab. 1. Biological parameters of hake with value (Val.), and standard error (SE): L∞ (cm), K (per year), t_0 (year), are von Bertalanffy growth parameters. Length-weight relation parameters: a and b (slope); M and F are natural and fishing mortality; n is the sample size.

Region	n	L∞		K		t_0		a		b		M	F
		val.	SE	val.	SE	val.	SE	val.	val.	SE	val.	val.	val.
Medit.	484	81.1	23.47	0.12	0.01	0.19	0.04	0.0053	3.04	0.003	0.19	0.43
Strait of Gibralta	482	93.1	46.11	0.09	0.09	-0.37	1.10	0.0041	3.20	0.011	0.31	0.39

A yield par recruit analysis by region was then applied to the average pseudocohort 2004-2006, using VIT [4]. An analysis of sensitivities to the errors related individually to all parameters of the model was also performed.

Results and Discussion
For both regions, the analysis of annual length-frequency distributions showed that the landings of the trawlers were mainly composed of specimens of sizes ranging between 14 and 36 cm, while the landings of longliners were essentially composed of individuals with length from 25 to 58 cm (Fig.1). The fishing mortality (F) in both regions, was higher for juveniles (14-24 cm), exploited exclusively by trawlers (Fig. 1). Longliners targeted only mature individuals of sizes higher than 40 cm (maximum for the size of 52 cm). Similar studies on hake [5] show that the high level of trawling effort causes growth overfishing.
From a study of sensitivity to the errors related individually to all parameters of the model, it appeared that the estimates of yield per recruit and the biomass are very sensitive to the variation of the slope of the length-weight relationship (b). With a simultaneous variation of parameters of the equa-

tion of von Bertalanffy while holding the other parameters constant, the variation of the yield per recruit is particularly important with a reduction of asymptotic length (L∞)., and K of 20 %. The simultaneous variation of M and F generated an almost negligible variation of the estimate of yield per recruit.
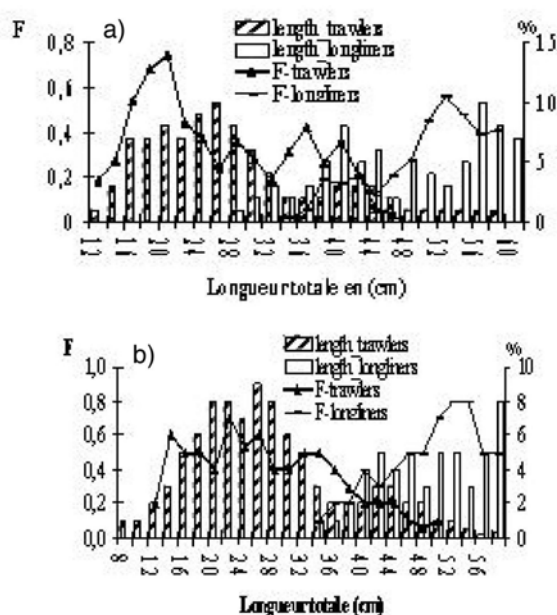

Fig. 1. Length frequency distribution (%) and fishing mortality (F) with length for hake fishery in the Mediterranean (a) and Gibraltar Strait region (b).

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