BIOECONOMIC SIMULATION ANALYSIS OF HAKE FISHERY IN THE GULF OF SARONIKOS (GREECE)

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Abstract

European hake (*Merluccius merluccius*) is one of the most important species in Greek fisheries due to its high commercial interest. It has been reported to be overexploited and in need of management to preserve its exploitation. The MEFISTO bioeconomic simulation model is proposed in order to test the effect of effort reduction in the bioeconomic indicators of the trawl hake fishery. Two alternative policy scenarios are analyzed compared to the *status quo* scenario. The trends of the biological and economic indicator variables through time are displayed for each scenario.

Keywords : Aegean Sea, Demersal, Fisheries, Models, Population Dynamics.

Introduction

European hake, *Merluccius merluccius* is one of the most important resources for the bottom trawl fleets in the Greek territories, both in terms of catch and economic value. The stock has been reported as overexploited [1]. The Saronikos Gulf's trawling fleet is composed of eighteen vessels that operate from October to the end of May, a total of eight months per year. The landings of hake represent 4.5% of the total catches in Saronikos Gulf and 45.5% of the total Greek hake landings and the 5% of the total revenues [2].

Material and Methods

The objective of the MEFISTO simulation model is to reproduce the bioeconomic fishing conditions of the Mediterranean [3]. The model includes the age-structured dynamics of the target species and a relationship between landings of target and secondary species. This particular instance has been run with constant recruitment and catchability. The prices of target and secondary species are assumed to be constant. The simulations are performed through a vessel level analysis. Vessels are characterized through their technical characteristics including catchability and costs. The fishermen will choose a fishing strategy based in yearly profits obtained after discounted an appropriate cost structure to their revenues [3, 4]. The simulation carries out projections starting from the current situation forwards into the future at a yearly scale with the purpose of analyzing the trends of different indicators of the fishery under different scenarios that represent alternative management actions. The simulations presented here are run deterministically through a fifteen year horizon.

The data source: Biological parameters such as the growth parameters [5], the length-weight relationship parameters [1], the fraction of mature individuals at age [1], the natural mortality [1] assumed as constant and initial populations' data [1] as derived by VPA run assuming steady state [6] are shown in Table 1. Economic data were collected by Karlou-Riga (unpublished data).

The scenarios: *Scenario 0.* The control or *status quo* scenario, represents the outcome of the fisheries biological and economic indicators projecting the situation of 2004 (year t=0 for the simulation).

Tab. 1. Biological parameters (a, b, L_{inf}, k, t_0, Mat, M) and initial population data (N, F) at age for hake (a, b: parameters from the length-weight relationship; L_{inf}, k, t_0: growth parameters as derived from the von Bertalanffy equation; Mat: maturity fraction at age; M: natural mortality; N: initial number of individuals at age; F: fishing mortality at age).

a=	0.006	L_{inf} =	73.12 cm
b=	3.13	k=	0.2725
M=	0.43	t_0=	-0.15 yrs

Age	N	Mat	F
0	5908005	0.019	0.298
1	2854163	0.167	1.828
2	298545	0.511	1.463
3	44988	0.905	0.842
4	12614	1	0.085
5	7533	1	0.016
6	4825	1	0.101
7	2837	1	0.5

Scenario 1. The effect of an effort reduction in trawlers activity is tested reducing their legal period of fishing by 12% (1 month) at year t=5 of the simulation.

Scenario 2. The effect of an effort reduction in trawlers activity is tested through a reduction of their legal period of fishing by 24% (two months) at year t=5 of the simulation.

Results

The two scenarios tested bring positive results both for conservation (increase in biomass, fig. 1) and economic objectives (increase in profits, fig.1) after two years of the management action. A short-term (one year) crisis after the implementation of the management measure is noted for hake biomass, which however recovers getting values higher than before the management action. The current overexploitation level of this species suggests that a decrease in its fishing mortality would bring positive results for the fishery. However, it should be noted that even with 24% reduction in fishing time (scenario 2), the stock remains overexploited (i.e. it is still beyond the Y_{max}) and needs more drastic management measures (i.e. improvement of selectivity).

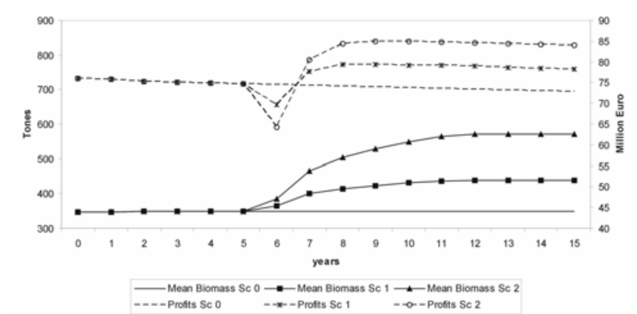

Fig. 1. Bioeconomic indicators for two effort control scenarios against the base or *status quo*.

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