

FISHERY ECOSYSTEM INDICATORS AND DYNAMICS IN THE MEDITERRANEAN FOR 1970-2005

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Abstract

Though concerns about sustainability has been raised globally and ecosystem-based approaches have been proposed to manage fisheries, concepts such as “ecosystem health” and “ecosystem sustainability” are difficult to translate into operational objectives. The Large Marine Ecosystem approach can bring some light to this purpose, with the development of new ecosystem indicators to facilitate the understanding of the dynamics of the ecosystem. The “Mean Trophic Level” (MTL), the “Fishing Is Balanced” index (FIB), Pelagic/Demersal ratio (P/D) and the multispecies index of variability (SSD) are some of such indicators. These indices were utilised to examine the dynamics of the entire Mediterranean fishery ecosystem by analyzing the FAO database of fisheries landings from 1970 to 2005.

Keywords: Fisheries, Food Webs

Introduction and Methods

The present study aims to implement a LME approach in the Mediterranean Sea, that is one of the 64 Large Marine Ecosystems already identified [1]. The objective is to examine the Mediterranean fishery ecosystem in its whole in order to obtain an integrated insight of environmental and fishery issues. A priority to develop these new management strategies is to analyze the dynamics and the changes occurring in the food chain over the time in the ecosystem. Therefore, there is a need for predictive indicators [2], which can be easily parameterised using easily accessible statistics [3] while communicating with a single number a variety of complex processes occurring within an ecosystem [4], such as those derived from the trophic level [5]. The study of MTL series of landings can describe the stages of exploitation of resources and analyze the state of the ecosystem relative to past periods for which there is no other data available except the amount of landings from fish markets [6]. In particular, according with others authors [7], in marine ecosystems, it would be possible to use the MTL of landings as an index of sustainability of the level of exploitation of fish resources and to analysis the phenomenon of the “Fishing Down the marine Food Webs” (FDFW) [6]. This is a gradual transition in landings from piscivorous, long-lived and high trophic level species to short-lived and low trophic level species as planktivorous pelagic fish and crustaceans and occurs because the species most susceptible to collapse are those of greater size with long life cycles, once these stocks will deplete, exploitation shall be directed toward smaller size species with a faster growth rate, and thus the mean trophic level of landings decreased [8]. We aim to examine the hypothesis of “FDFW” and changes in the Mediterranean ecosystem, analyzing FAO fisheries catches by 251 species from 1970 to 2005. The only analysis of the catch may not be sufficient to show the changes of the fishery ecosystem, but was accompanied by indicators such as: the Mean Trophic Level of landings (MTL), used to assess the effects of fishing activities at a ecosystem level, the “Fishing is Balanced” index (FIB), which allows to assess the stages of expansion or contraction of fishing pressure and bearing capacity exploited ecosystem [9], the ratio between pelagic and demersal organisms landed (P/D) which should provide information on the increase of nutrients in the basin and the multispecies index of variability (SSD) that show changes in the multispecies landings.

Results and Discussion

Mediterranean landings have increased from 300.000 in 1970 to 700.000 tonnes in 2005 with associated decrease of the MTL. In quantity terms, the proportion of the total marine fish landings which is accounted for by pelagic fish has risen from about 50% in 1970 to over 60% in 2005. The progression is remarkably sustained, possibly reflecting a shift in the fishery ecosystem. FIB index shows a negative trend in areas where landings and MTL decreases together, and a positive trends where there is increased fishing effort. The SSD index highlights that the abrupt increase in landings is accompanied with major shifts in exploitation of target species. The P/D index shows a positive trend for all the years and in all divisions of the Mediterranean suggesting a clear predominance of pelagic on demersal fishes. Our analysis has revealed numerous ecosystem-level effects of fishing in marine ecosystems. We conclude that it is possible to conduct an innovative ecosystem assessment based on fishing resources in a system such as the Mediterranean Sea, characterized by high complexity and rather often low availability of information.

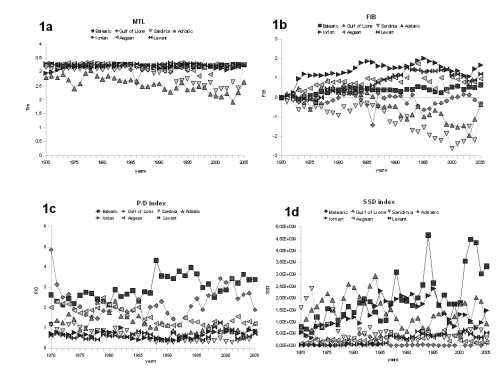


Fig. 1. Ecosystem indicators of Mediterranean GFCM divisions (1970-2005)



Fig. 2. Mediterranean Large Marine Ecosystem with GFCM divisions

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