Estimating fishing pressure from coastal fisheries using Multi-criteria Decision Analysis methodology

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Introduction

The aim of this work is to provide a tool for mapping the distribution and intensity of fishing pressure of the coastal fishing fleet. The Greek coastal fishery is characterized by a high number of professional fishing vessels operating in the coastal zone, most of them are not equipped with a geographical positioning control system. For the implementation of the model, the fishing areas of Patraikos Gulf and the outer part of Ionian Sea were selected. This marine region characterized by an intense fishing footprint and continuous conflicts among numerous coastal and open-sea fisheries.

Materials and methods

Our aspiration is to estimate a fishing pressure index from coastal fisheries (FPc) by applying a Multi-criteria Decision Analysis methodology on currently available geospatial data. The estimated coastal fishery suitability index (Sc) and the coastal vessels activity index (Ac), for the registered vessels by fishing port, were used as an input to estimate FPc based on a Fuzzy Product overlay process (Fig 1).

❑The estimation of Sc, based on certain evaluation criteria and a simulation process which minimizing the pairwise comparison's consistency ratio, that is used as a measurement method in the Analytic Hierarchy Process (AHP) (Saaty, 1980). The quantitative sources of uncertainty in the AHP, assessed by a sensitivity analysis which applied on the weights of the decision criteria and the performance values of the alternatives (Triantaphyllou & Sánchez,1997).

❑An additional fishing capacity indicator based on the length and internal volume (GT) of the vessels, was incorporated in the model (Kavadas et al., 2013). The estimation of the Ac based on spatial interpolation techniques and a Fuzzy Membership function (FM). The optimal interpolation result was defined by a cross validation process and four different scenarios were investigated in order to select the most suitable formulation for the FM function.

❑Finally, visualization was obtained by mapping the estimated fishing pressure index and geographic variation patterns were derived by a spatial clustering process.

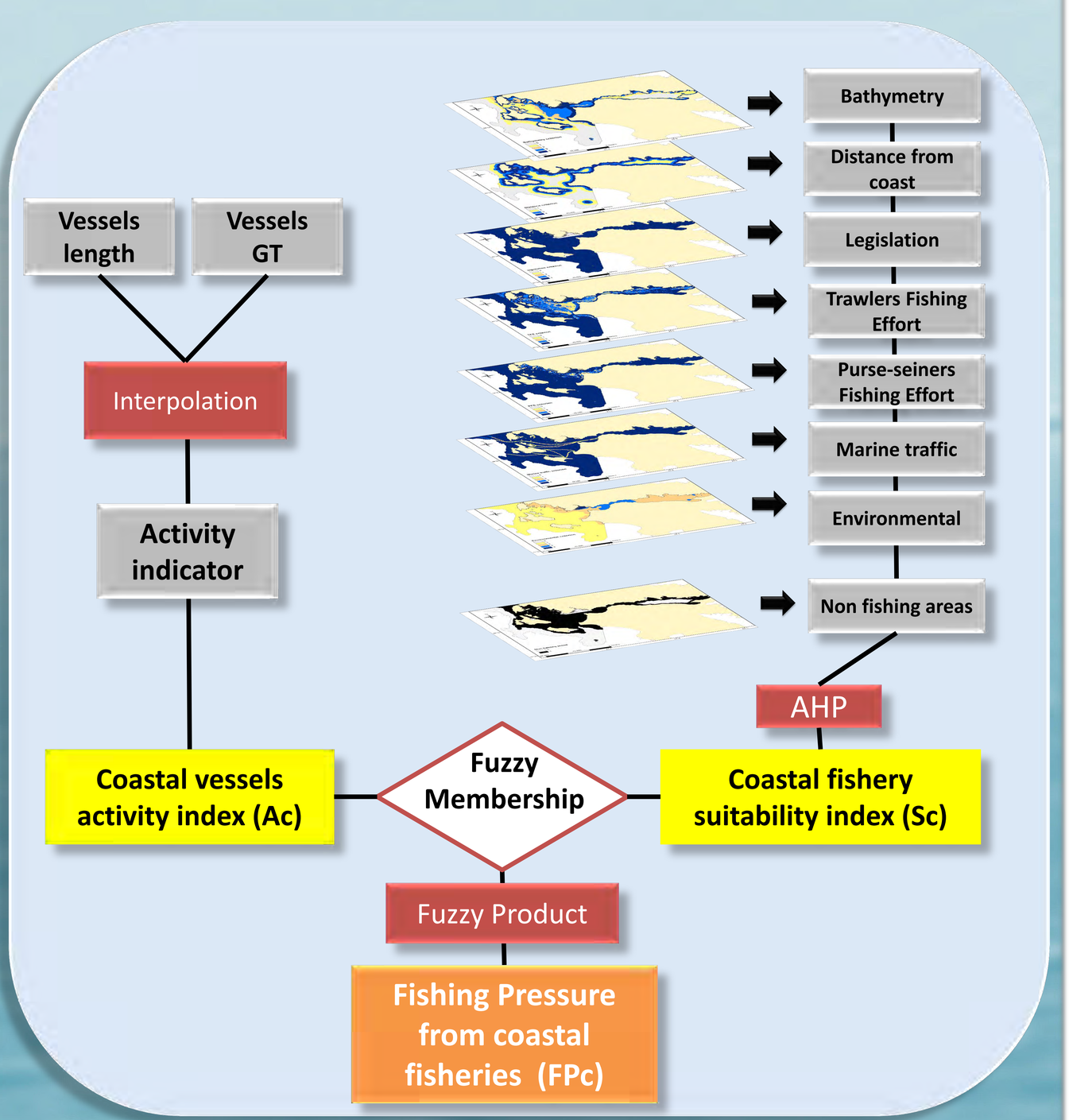

Fig. 1: Methodology of FPc estimation

Fig. 2: The distribution of Fishing Pressure from coastal fisheries

Fig. 3: Areas of high fishing pressure from coastal fisheries

Results

❑ The FPc possibility values shows the intensity of fishing pressure of the coastal fishing fleet in the study area, that is higher in values closer to 1 (Fig. 2).

❑ The local Moran test is used in order to detect local spatial autocorrelation and it can be used to identify local clusters or spatial outliers as well as to reveal the areas of high fishing pressure from coastal fisheries (Anselin, 1995) (Fig. 3).

Conclusions and discussion

This methodology combines MCDA methods and the analytical tools of GIS. In case that primary data of temporal coastal vessels locations do not exist, it is one of the most suitable methods of mapping the distribution of fishing pressure from coastal fisheries. Also this methodology can be improved by using positioning data from pilot programs conducted the last years in Mediterranean countries or by taking into account other parameters (meteorological data etc.) .

References

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