Spatial Fishing Effort Modelling Network

A program supported by the FAO project COPEMED

http://www.faocopemed.org

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Introduction

One of the COPEMED programs deals with the utilization of Geographical Information Systems (GIS) as a decision support tool for fishery management. Within this framework, a network of experts has been set up with the aim to create a model of the spatial distribution of fishing effort.

Based on two models among other studies focussing on the analysis of the spatial components of the fishing effort distribution, the network has conducted a study to design a global approach which has been formalised in order to develop a computerized simulation tool.
The objective of the model is to localise the nominal fishing effort exerted by a homogeneous fleet segment. The fleet segment is composed of a set of boats with similar characteristics which serve as the discriminating factors in determining the spatial distribution of their fishing activity (base port, license, target species, autonomy, strategy, etc...).

Figure 1 explains the causal relationships between the fishing fleet and the geo-referenced components which determine the spatial distribution of the fishing effort: abundance zone, accessible zone and authorized zone.
The modelling process starts with the selection of variables for which the spatial distribution is available and considered as factors contributing to determine the area actually exploited by fishing fleet.

Then the expert assigns a distribution function of the fishing effort for each of the above selected geo-referenced variables. The function may be simply defined by attribution of a score of activity to the different values or value ranges of the variable.

<table>
<thead>
<tr>
<th>Label</th>
<th>Code</th>
<th>Score</th>
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<tbody>
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<tr>
<td>0 - 50 m</td>
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<td>5%</td>
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<tr>
<td>50 - 100m</td>
<td>2</td>
<td>10%</td>
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<tr>
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<td>3</td>
<td>30%</td>
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<td>40%</td>
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<tr>
<td>400-600m</td>
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<tr>
<td>&gt; 1000m</td>
<td>8</td>
<td>0%</td>
</tr>
</tbody>
</table>

Figure 2 is an example of fishing activity scoring for the bathymetry, grouped in 8 classes.
For quantitative variables, score is attributed by range and a linear interpolation is used to smooth the scoring function (Fig.3).

Fig 3: scores of fishing effort as a function of distance from the port

For the variable "distance from the port", an alternative parametric model is applicable. The intensity of fishing effort exerted at a distance $x$ from the port is calculated by a "friction of Distance" equation.
The scored geo-referenced layers, named constraints layers, are then overlaid using a weighted additive or multiplicative linear model, to produce the global fishing effort constraints layer.

The final step is the distribution of the fleet nominal effort on each spatial unit (cell) of the standardized global constraints layer (Fig. 4). The result of the simulation is a map of the fishing effort, presented in raster format.

Fig. 4: the spatial distribution of the nominal fishing effort
The software

The first prototype of the application, called FAST (Fishing Activity Simulation Tool) is now available. It has been developed as an extension for the ESRI ArcView GIS Software (v.3.1) in combination with the Spatial Analyst v. 1.0 extension.

Graphic user interfaces are used to manage the simulations and set the parameters (Fig. 5).

![Fig. 5: FAST software - user interface for a simulation](image)
Prospects

Fishery scientists of the western Mediterranean have been invited to collaborate with us on this project. The collaborators will join the network in an effort to test the model using their respective data sets. For this purpose, a workshop will be organized in September 2002.

The resulting shared work on such real case studies will allow us to evaluate the model, make recommendations to improve it and possibly establish new requirements for the FAST software.

One possible application of the model would be to contribute to the characterization and the identification of the operational units that are currently under development by the General Fishery Commission of the Mediterranean (GFCM).
Contacts

Coordination

Alexis Bensch,
FAO COPEMED - Roma (Italy)
E-mail: alexis.bensch@fao.org

Fabio Carocci,
FAO - Rome (Italy)
E-mail: fabio.carocci@fao.org

Fabio Corsi,
IEA - Rome (Italy)
E-mail: f.corsi@pan.bio.uniroma1.it

Collaborators

Laurent Drapeau,
IRD - Cape Town (South Africa)
E-mail: ldrapeau@mcm.wcape.gov.za

Gildas Le Corre,
IFREMER - Sète (France)
E-mail: Gildas.Le.Corre@ifremer.fr

Jesus Morales,
CICEM - Huelva (Spain)
E-mail: Moralesj@uhu.es

Software development

Cornelius Mende,
GEODIMENSIONS Sarl (France)
E-mail: mende@geodimensions.fr

Web page

visit our WEB page at

Other scientists from different Mediterranean research institutions will join the network for the testing phase.