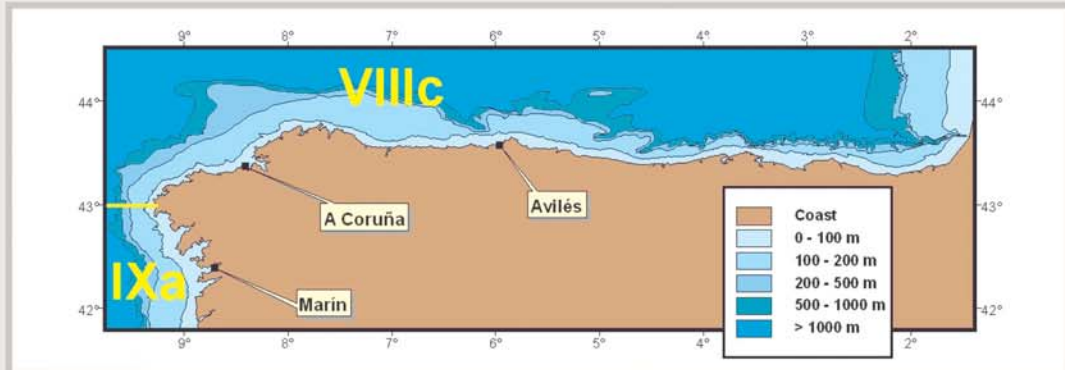


Plausible Shifts on the Spatial Distribution of Fishing Effort by Fishing Management Measures Taken After the Prestige Oil Spill

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MATERIAL AND METHODS

Otter-trawl fleet was chosen as representative fleet because of its importance, both socio-economically and biologically. Also, the harbour selection was Avilés, A Coruña y Marín due to its high fishing effort in each ICES subdivision (División VIIIcE, VIIIcW and IXaN). February 2003 was chosen as representative month of fishing closure time. Also it was the month where the fishing closure area was largest. February 2003 was compared to February 2002 as pre-spill situation and in some cases to February 2004 to observe post-spill situation in a year time.

The distribution of fishing effort is obtained by FAST (Fishing Activity Simulation Tool) v. 1.1, a computerized simulation tool based on two models focussing on the analysis of the spatial components. One of these models was developed by Caddy and Carocci (1999) and is based in two methods, the "friction of distance" approach and the Gaussian Effort Allocation Model approach. The other is based on deductive modelling of use of space (Corsi, 2000). This application is an extension of Arcview GIS software (v. 3.2). The distribution is based on the assigned score to each value of the variables in each location. So, each space unit of the affected area will have assigned a proportion of the effort based on the combined score.

The basic information geo-referenced layers are land-sea, location of the ports and the area of interest for the fleet segment. The used information to determine the fishing effort distribution was bathymetry (fleets bathymetry segregation), seabed substrate (fishable areas), regular fishing regulation and specific oil spill regulation (fishing closure areas). These constraint layers modify the fishing effort density distribution with different scoring. The effort unit was number of trips for each fleet and port in the studied months.

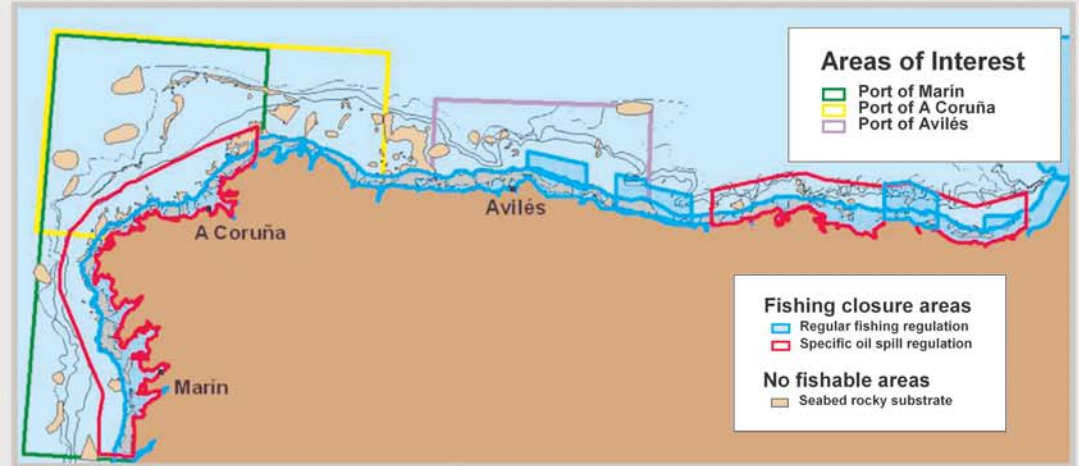
INTRODUCTION

We aim to identify the plausible effects of the fishing management measures taken by the Spanish government after the Prestige oil spill in November 2002 on the spatial distribution of the effort. Among others these contemplated temporary fishing closures and limitation of access to certain gears or segments of fleet.

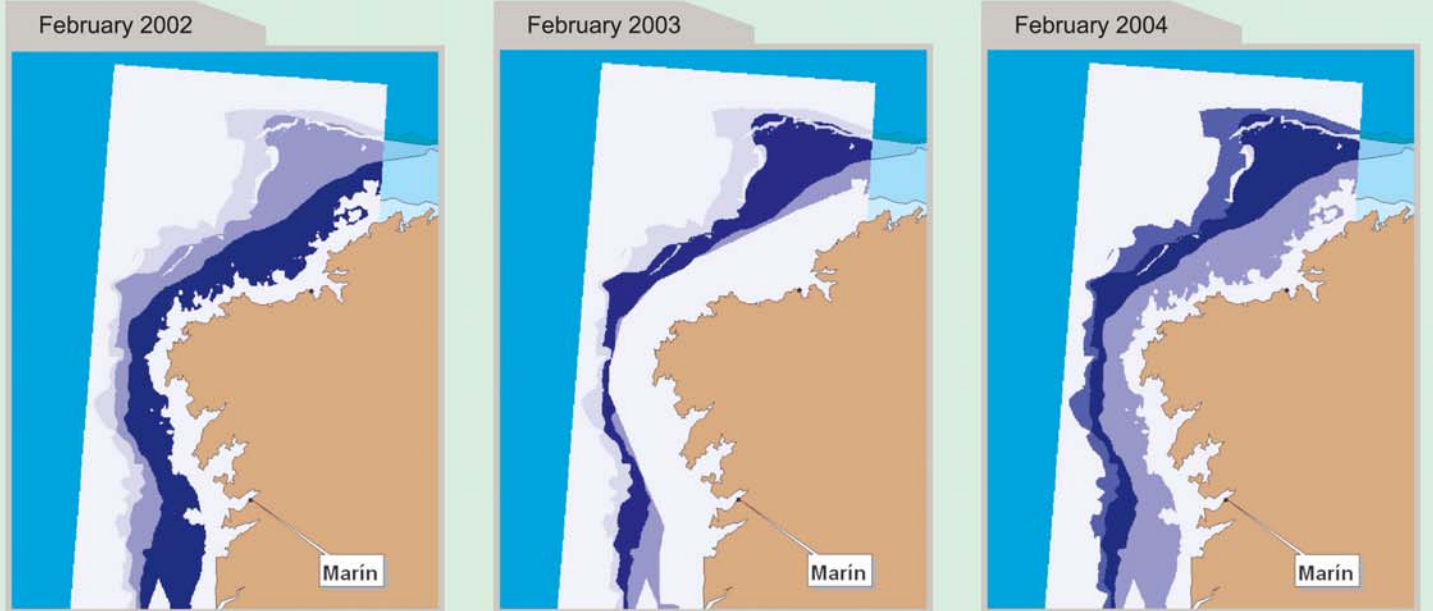
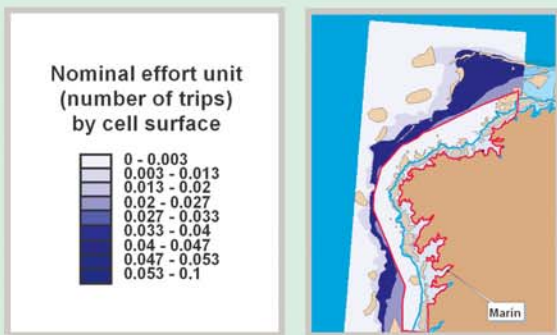
In spite of the importance of the study of spatial distribution of the fishing effort in fisheries and resources management, previous information in the affected area is nonexistent.

The limitations due to the imposed measures have an effect like the produced by the Marine Protected Areas, affecting the effort distribution. This effect influences several important aspects as changes in fishing effort focused to traditional fishing grounds, transfers to other fishing grounds and changes in the exploitation pattern (Pastoors et al., 2000 and Rijnsdorp et al., 2001).

Opposite to other oil spills where artisanal fisheries were pretty much affected, Prestige oil spill affected largely to industrial fisheries operating in the Galicia-Cantabrian area.

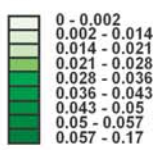


Spatial distribution of the nominal effort over the activity zone

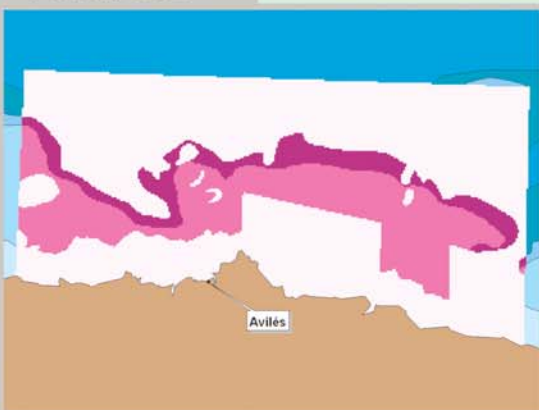


Spatial distribution of the nominal effort over the activity zone

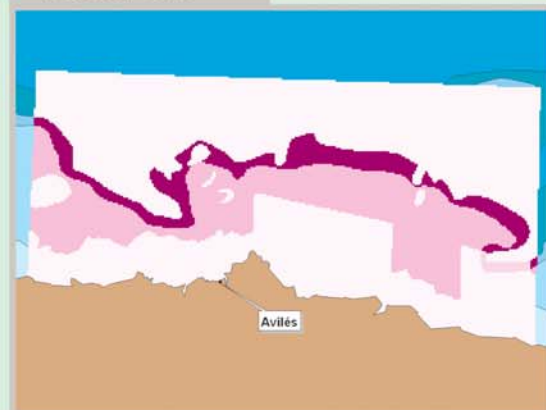
Nominal effort unit (number of trips) by cell surface



February 2002

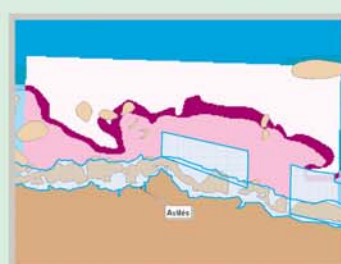
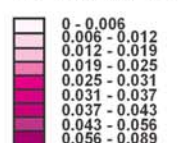


February 2003



Spatial distribution of the nominal effort over the activity zone

Nominal effort unit (number of trips) by cell surface



RESULTS AND DISCUSSION

In Marín, the Prestige fishing closure affected to the area of greater pre-spill effort density. An effort movement toward deeper waters is present, with a possible change in catch composition and total catch. Just to check if this effort movement was persistent after banning, a simulation was done with February 2004 data.

Fishing effort distribution at the Coruña area is also affected by the Prestige fishing closure, with an effort movement toward deeper water. In 2004 (Post-spill) the effort spatial distribution is similar to 2002 (Pre-spill).

Regarding Avilés fleet, it is also present an effort movement toward deeper waters. No new fishing grounds are apparent. As none Prestige fishing closure affected this area, shifts could be explained by an increase in the importance of the fishing trips targeting deeper waters species.

Regarding Marín, it is obvious that the movement to deeper waters was the only option available to the fleet, since the fishing closure occupied almost all the exploited surface with highest effort density in previous years. This movement is persistent after banning, i.e. in 2004 (Post-spill period). Further analysis is needed to check if there has been a change in target species or it is an effect of the fishing closure. In Coruña, other factors should be also analysed, which seem to have influences in effort distribution, directing effort to deeper waters instead of increasing in other areas not affected by banning. A detailed georeferenced information on catches and effort will be needed for further analysis.

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