

# Using GIS as a key tool for the management of Marine Protected Areas (MPAs)

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Fig 1. "Os Miñarzos" Marine Protected Area (W Galicia, NW Spain)

The development of the "Os Miñarzos" MPA started in October 2003 and its designation as an MPA took place in April 2007. This MPA has an extension of 1300 ha, with two No-Take Zones (NTZ) of 37 ha and 12 ha respectively, where the most important habitats present in the zone are represented. These NTZs constitute a refuge for the growth and reproduction of biological communities without fishing pressure.

The "Os Miñarzos" MPA is an initiative that was born from the fishermen who are responsible of its implementation.

## DESIGN

With the aim of defining the boundaries of the MPA, several works were performed to integrate information on biodiversity, fishing activities, habitat distribution and nursery areas.

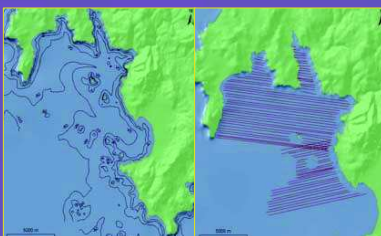


Fig 2. Bathymetric lines in the Seno de Corcubión (left) and detail of the transect performed during the acoustic survey (right).



Fig 3. Example of benthic habitats mapping in "Os Miñarzos" MPA (left) and a detail of benthic habitats in the north (right) of the MPA and in the south (right down), outside of the MPA.

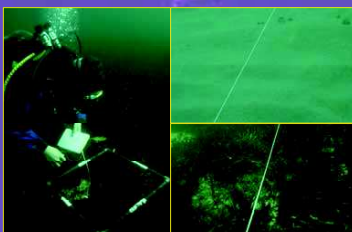


Fig 4. Detail of sampling method to measure biodiversity in sandy (up) and rocky (down) substrates

## INTRODUCTION:

Pollution, overfishing and, in general, human pressure over the coast have aroused the concern among the scientific community about the situation of marine ecosystem. In this context MPAs set up a realistic, viable and easy tool to implement. Protection of all economic, social and environmental stakeholders at the same time, without any additional benefits for any of them.

MPAs are defined as any coastal or open ocean areas in which certain uses are regulated to protect marine values, either ecological, (resources, biodiversity,..), commercial or referred to human livelihoods.

This work is based on the "Os Miñarzos" MPA created in Lira, Carnota (W Galician coast, NW Spain), developed and implemented by the traditional fishing communities as a sustainable management tool to control overfishing.



One of the secrets of success of these protected figures lies in their holistic characteristics, joining efforts from both the scientific and the fishing communities, with a high degree of multidisciplinary required (biologists, anthropologists, geographers, economists, etc.). But it also constitutes one of the main difficulties in the implementation of MAPs.

The GIS allows us an easy integration of the information from different sources, becoming a key tool for the management of the new MPA created in Lira.

## MONITORING

The monitoring of the MAP development is a key to its success, allowing us to assess the effect of the different decisions and to add modifications in the management system. GIS tools allow us the superposition of this information in real time, facilitating the decision making.

### Calculation of Bathymetry

In order to obtain an accurate bathymetry which helps to correctly define fishing areas and fauna distribution, an acoustic survey was performed and raw data were processed in a GIS.

### Definition of benthic habitats

Using the traditional fishermen's knowledge, benthic habitats were classified.

GIS tools allowed us the superimposition of the data from each respondent to detect coincidences and differences, in order to accurately map benthic habitats.

### Study of the biodiversity

For the assessment of the biodiversity present in this area, visual censuses were performed by SCUBA divers. Moreover, sediment samples and submarine photography were used to assess the potential effects of the MPA on biological communities.

### Historical research of fishing activities

In order to characterize fishing activities in this area (in terms of main target species, spatial and temporal productivity patterns, etc), an analysis of the time series of first sale data was performed.

### Fishing activities monitoring

Fishing activities are being monitored through the daily recording of the location and characteristics of the catches of each boat by the fishermen.

Moreover, several boats have been provided with portable GPS devices to track their daily fishing itineraries.

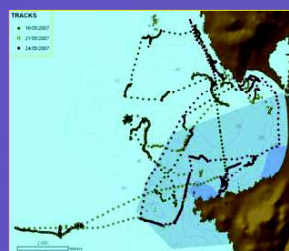


Fig 6. Tracks corresponding to a fishing day on boat number 4

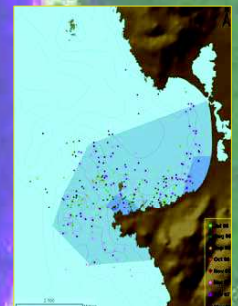


Fig 5. Monthly fishing location during 2006 and 2007 of the boat number 2

### Monitoring of benthic communities

In order to monitor the development of the habitats in this area and the effect of the MAP on the biological communities, fixed transects were established inside the NTZs, the buffer zone and outside the "Os Miñarzos" MPA.

Transects are performed by SCUBA divers each season, recording several data about benthic communities, as well as submarine videos and photographs.

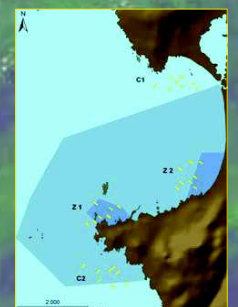


Fig 7. Diving transect in the MPA



Fig 8. Detail of the diving transects in the MPA and in the control zones (outside MPA)

