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Fertilization and connectivity in the Garrucha Canyon (SE-Spain) implications for Marine Spatial Planning



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ABSTRACT

Marine Spatial Planning is usually based on benthic georeferenced information or GPS tracked human activities, whereas the pelagic ecosystem is often ignored because of scarce and limited surface information. However, the 3-D pelagic ecosystem plays a key role connecting all the other ecosystems by physical (currents) and biological (migration) processes. According to remote sensing the Garrucha Canyon is oligotrophic, but 3-D sampling reveals subsurface upwelling, and converts it into the richest area around the Cape of Gata. Vertical connectivity by means of zooplankton migration, measured at two sampling stations, is 40 and 220 times faster than microphytoplankton settling and vertical water velocities respectively. Thus coupled physical-biological connectivity models are necessary to estimate the ecosystem connection and the fate of carbon, but also other substances (e.g. radioactivity), that might accumulate throughout the food-web. This is especially important in the Garrucha Canyon and the Coastal Areas Management Programme Levante de Almería where natural heritage and extractive fishery are important for the local economy.

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1. Introduction

Integrated coastal management is focused mainly on coastal development and impacts, on marine ecosystems close to the shore as well as on the continental shelf (European Commission, 2010). However, in the framework of the blue industry (European Commission, 2012a), the Marine Strategy Framework Directive (MSFD, 2008), Maritime Strategy Planning Directive (MSPD, 2014), Marine Spatial Planning (MSP) include coastal, shelf and open sea waters extending to the Exclusive Economic Zone (EEZ). MSP focuses on spatial distribution in order to locate different activities in space and time, with the aim to make them compatible with a good environmental status of the sea. For this, MSP should consider all interactions, connections and habitats that compose the marine

ecosystem. Moreover, MSP requires spatial information about marine resources, biodiversity, habitat, ecosystem and human activities, which are meant to be acquired in the framework of the Marine Knowledge 2020 programme (European Commission, 2010, 2012b). The information is compiled and distributed by the European Marine Observation and Data Network.

Although huge efforts have been carried out with marine cartography information, most of the studies are concentrated on benthic geographically referenciable properties, excluding the pelagic ecosystem. One of the reasons is that pelagic ecosystems are continuously moving and it is difficult to consider them in spatial approaches. The pelagic ecosystem connects all the other marine ecosystems at different space and time scales. Surface geostrophic current fields can help to detect main connections and ecological corridors which should be considered in MSP (Muñoz et al., 2015) and Marine Protected Area (MPA) network design (Schill et al., 2015). Furthermore the pelagic ecosystem is tridimensional and

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