

THE ROLE OF THE FISHERIES SECTOR IN THE PROCESS OF SEA PROTECTION AND MARITIME PLANNING

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ABSTRACT

The Marine Strategy Framework Directive (MSFD) is the environmental pillar of European maritime policy designed to create a framework for sustainable use of the continent's marine waters. The MSFD aims to achieve Good Environmental Status (GES) of the EU's marine waters by 2020. In order to achieve GES by 2020, each Member State is required to develop a strategy for its marine waters (or Marine Strategy). In addition, and in line with MSFD, Contracting Parties to the Barcelona Convention adopted the Integrated Monitoring and Assessment Programme (IMAP), committing to achieve GES of the Mediterranean Sea. In order to assess the state and pressure of marine diversity at the open part of Montenegrin coast, data from the field of marine fisheries for the period 2014-2016 were processed. The analyses were performed in accordance with the IMAP common indicators (CIs), and the results of the conducted analyses can significantly contribute to the provision of guidelines for maritime spatial planning in Montenegro. Detailed analysis was performed for spatial distribution (CI3) and population

size (CI4) for the most economically important species of fish and crustaceans, - anchovies (*Engraulis encrasicolus*), sardines (*Sardina pilchardus*) and other pelagic species (OPS), red mullet (*Mullus barbatus*), European hake (*Merluccius merluccius*) and deep-water pink shrimp (*Parapenaeus longirostris*). All data were collected during international projects MEDIAS (Mediterranean International Acoustic Survey), MEDITS (Mediterranean Trawl Survey) and FAO AdriMed (Scientific Cooperation to Support Responsible Fisheries in the Adriatic Sea), while assessment of state and pressure of fishery resources in Montenegro was carried out as part of the project "Implementation of ecosystem approach in the Adriatic Sea through marine spatial planning" (*GEF Adriatic*).

Keywords: maritime spatial planning, marine fisheries, ecosystem approach, MSFD, IMAP

1. INTRODUCTION

Marine spatial planning (MSP) is a place-based, multi-sectoral decision-making approach that is being widely promoted for reducing the conflicts and impacts commonly encountered in conventional sector-by-sector planning (Lester *et al.*, 2018). This is especially important in countries that have developed tourism or for which tourism is a priority activity, as is the case with Montenegro. The coastal area is under increasing pressure from different sources - pollution, intensive and/or illegal construction, and other anthropogenic activities leading to conflicts between different sectors competing for the same area. Given that the coastal area is limited and finite in physical and spatial terms, long-term planning is extremely important both for the development of the sector and for the conservation of resources (Mandić *et al.*, 2020).

This paper presents the MSP as part of the case study in Montenegro which was undertaken in the frame of the project "Implementation of ecosystem approach in the Adriatic Sea through marine spatial planning" (*GEF Adriatic*). The data presented in this paper were processed in accordance with the requirements of Marine Strategy Framework Directive (MSFD) and Integrated Monitoring and Assessment Programme of the Barcelona Convention in the framework of the Ecosystem Approach (EcAp). EcAp is a strategy for comprehensive and integrated management of activities that affect marine and coastal ecosystems with the ultimate goal of achieving good ecological status of the Mediterranean Sea and coast.

2. MATERIALS AND METHODS

The data here used have been provided by the international projects such as MEDIAS (Mediterranean International Acoustic Survey), MEDITS (Mediterranean Trawl Survey) and FAO AdriaMed (Scientific Cooperation to Support Responsible Fisheries in the Adriatic Sea) for the period 2014-2016. Analyses of data were done in accordance with IMAP ecological objectives, operational objectives and indicators for the Mediterranean area (IG 20/4). In particular, data for ecological objective 3 (EO3) were processed, which stipulates that “populations of selected fish, crustaceans and molluscs used for commercial purposes are within safe biological limits, and the distribution of population by age and size shows that the fund is healthy.” Detailed analysis was performed for spatial distribution (Common Indicator 3 - CI3) and population size (CI4) for the most economically important species of fish and crustaceans, - anchovies (*Engraulis encrasicolus*), sardines (*Sardina pilchardus*) and other pelagic species (OPS), red mullet (*Mullus barbatus*), European hake (*Merluccius merluccius*) and deep-water pink shrimp (*Parapenaeus longirostris*). Data were processed using GIS application in order to define spatial distribution of species and spawning zones of anchovies. By interpolating the data in GIS, spatial zones ranging from low biomass intensity to very high biomass intensity were obtained.

The data are summarized and presented as a spatial distribution of pelagic and demersal fish species, in order to define the areas that are most valuable in terms of resource richness, which can significantly contribute to the MSP process in Montenegro.

3. RESULTS AND DISCUSSIONS

Spawning of anchovies indicates two main spawning areas of this species - the bay of Kotor and bay of Tivat - in which the spawning intensity was extremely high throughout the study period. Significant spawning was also found in the area of Risan bay. The period when spawning will be most intense, as well as the locality where the number of eggs will be the highest, are generally related to zones with high productivity, especially when the conditions for feeding the adult population are favourable (Somarakis *et al.*, 2004; Martin *et al.*, 2008).

A detailed analysis of the spatial distribution of the early developmental stages of anchovies indicates the existence of two spawning zones in the open waters of the Montenegrin coast. The first, smaller zone extends from Bigova bay to Budva bay, while the second, larger and most important zone stretches from Crni rt to the border with Albania. In both zones, the distribution of the early stages of anchovies is observed from relatively small depths (almost

from the shoreline) to the iso bath of about 100 meters, i.e., the area of the continental shelf (Figure 1).

Analysis of the adult anchovy population indicated the highest density in the area in front of Platamuni and in the area in front of Ulcinj. The highest density of sardines was recorded in the area in front of the Platamuni (near the coast), while a high concentration was also found in the area in front of Budva and in front of Ulcinj (Figure 1).

Analyses of the total biomass of the adult population of anchovies and sardines, as well as all pressures (fishing mortality, fishing, CPUE, etc.), indicate that the biomass of sardines and anchovies in the entire Adriatic is overexploited and overfished (Angelini *et al.*, 2017). However, the measures adopted at the GFCM level on the protection of pelagic resources in the Adriatic do not apply to Montenegro due to the extremely small share in the total fishery in the Adriatic Sea (GFCM/42/2018/8).

In addition to the targeted species (sardines and anchovies) in the catches of pelagic hauls, the following species were also found: *Trachurus trachurus*, *Trachurus mediterraneus*, *Spicara smaris*, *Spicara flexuosa* and *Spicara maena*, *Boop boops*. All species were caught sporadically in individual specimens, and making spatial distribution maps for them is impossible. As none of these species is a target species in fishing and a by-catch, their populations are not under great pressure from fishing and for them there is no biomass assessment at the Adriatic level. Data on pelagic species (adult anchovies and sardines and early life stages of anchovies) were collected during MEDIAS and FAO AdriaMed projects.

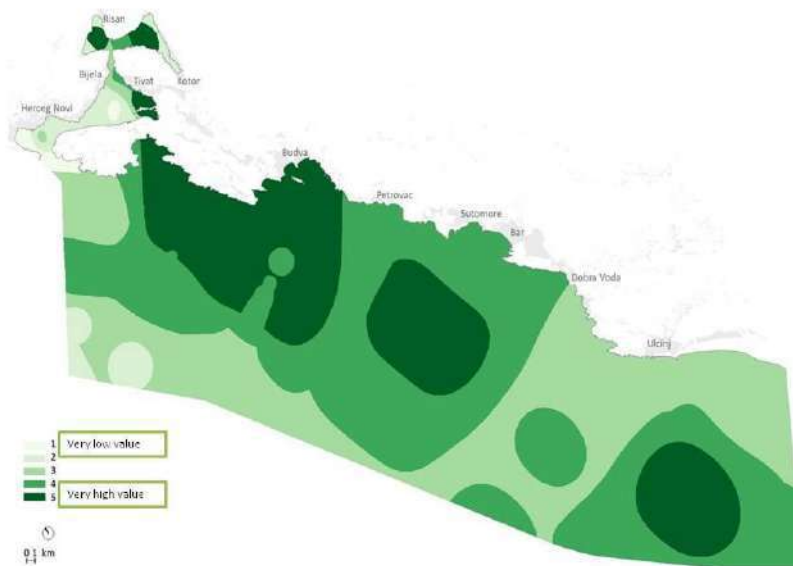


Fig.1: Overall assessment of the value of the area in relation to the spatial distribution of pelagic resources.

When it comes to demersal resources, a high density of *M. barbatus* biomass is present in the area between Platamuni and Volujica at a depth range of 40-110 meters (Figure 2). There are two centers of high biomass of hake on the Montenegrin coast - above the entrance to the Boka Kotorska Bay at depths range between 160-300 meters. The area of the Montenegrin coast with highest hake biomass is the southern Adriatic continental slope, which in Montenegro includes only a small part of the unique slope. In this area and going north towards the Jabučka valley, the largest hake biomass in the Adriatic was recorded through previous hake research surveys through the MEDITS program (Piccinetti *et al.* 2012), so our findings fully agree with these data and they point to the importance hake as a shared resource in the Adriatic Sea. There are two centers of high *P. longirostris* biomass in the area of the Montenegrin coast, above the entrance to the Boka Kotorska Bay at depths range between 100-250 meters. Data on demersal resources were collected during the MEDITS surveys.

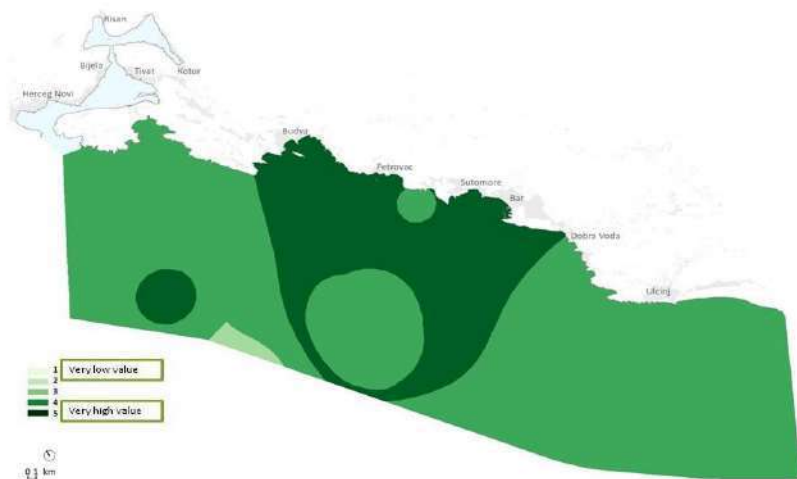


Fig. 2: Overall assessment of the value of the area in relation to the spatial distribution of demersal resources.

The Adriatic Sea is an area with marked pressure on fishery resources, especially pelagic. Data report that anchovies and sardines are overfished across the Adriatic Sea. Nevertheless, Montenegro participates in total fishing below 1% and measures to limit catches of small pelagic fishes do not apply to Montenegro (GFCM/42/2018/8;GFCM/43/2019/5).

National measures in Montenegro are in place to ensure sustainable exploitation of resources, and relate to the protection of fish stock during the reproduction period by a total ban on fishing, bans for large purse seiners within the area of Boka Kotorska Bay and within 3 NM or 50 m isobath on the open sea area.

The most important demersal species in Montenegro is the red mullet. The value of mullet biomass is significantly higher than the estimated biomass for the central and southern Adriatic Sea (Stock Assessment Form Demersal species *Mullus barbatus* in GSA 17 & 18 Reference year: 2016). Although the intensity of catches at the level of Montenegro does not represent significant pressures for the biomass on Adriatic level, it is important to note that there are national measures which ensure sustainable exploitation of resources, bans for trawlers within the area of Boka Kotorska Bay and within 3 NM or 50 m isobath on the open sea area.

The measures currently in force, in line with European directives and guidelines, international conventions and regulations, should be respected in order to protect the fish stock, and especially in order to protect economically important fish species during the reproduction period (Pešić *et al.*, 2011, Ikica

et al., 2013). As part of the MSP process in Montenegro presented results and findings will be taken into considerations, together with other environmental data, to identify the most sensitive marine areas where careful planning of sea uses should be applied in order to reach good environmental status and ensure conservation of the area's natural resources and social wellbeing. This is mostly important for the area of Boka Kotorska ay, which is partly under UNESCO protection and where fishery sector has a centuries-old tradition.

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