

STATE OF BENTHIC (DEMERSAL) RESOURCES IN THE EASTERN COAST OF THE ADRIATIC SEA

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STANJE PRIDNENIH (DEMERZALNIH) RESURSA ISTOČNE OBALE JADRANSKOG MORA

Apstrakt

Pridneni (demerzalni) resursi predstavljaju jednu od najvažnijih komponenti morskog ribarstva u Jadranskom moru, kako u smislu količine ulova, tako i u njegovoj komercijalnoj vrijednosti. Trenutan ukupan ulov kočarskih organizama u Jadranu kreće se oko četrdesetak tisuća tona, od čega najveći dio ulovi talijanska kočarska flota (preko 85%). Prvim ribarstveno-biološkim istraživanjima u Jadranu smatra se ekspedicija „Hvar“ 1948/49. (Šoljan, 1997) koja je pokrila teritorijalna mora ex-Jugoslavije i Albanije, te najveći dio međunarodnih voda otvorenog Jadrana. Vrijednost ove ekspedicije leži u činjenici kako je ona provedena u vrijeme dok je kočarski ribolov bio u začetcima, ali i zaustavljen zbog ratnih aktivnosti 7-8 godina, te su resursi za vrijeme „Hvar“ ekspedicije bili u nultom stanju („virgin state“) i mogu služiti kao referentna točka za opisivanje kasnijih promjena koje su nastale kao posljedica intenzivne eksploatacije. U novije vrijeme intenziviraju se međunarodna istraživanja pridnenih resursa Jadrana. Istraživanja koja su tema ovog rada obavljena su u okviru međunarodne ekspedicije EU MEDITS u razdoblju od 2005. do 2010. godine u cijelom Jadranskom moru (osim najdubljih dijelova Južnojadranske kotline). Opisano je stanje pridnenih resursa kroz GIS prikaze indeksa biomase (ulov kg/km²) u cijelom Jadranu i to za: ukupan ulov tijekom ekspedicije MEDITS (ribe, rakovi i glavonošci), te za MEDITS ciljane vrste (59 najzastupljenijih vrsta kočarskog ribolova), hrskavičnjače, kao i za gospodarski najvažnije vrste: oslić, trlja blatarica, arbun, kovač, mačka bjelica, škamp i kozica.

Ključne riječi: Jadransko more, pridneni resursi, ribolov, ekspedicija MEDITS
Keywords: Adriatic sea, natural resources, fishing, research expedition MEDITS

INTRODUCTION

Demersal resources represent one of the most important components of marine fisheries in the Adriatic Sea, both in terms of amount of catch, as well as its commercial value. The total catch of demersal organisms in the Adriatic Sea in recent years is approximately 40 000 tons per year, most of which (over 85%) is caught by Italian fleet. Large differences in the intensity of fishing and fishing effort in various parts of the Adriatic resulted in large differences in the state of demersal resources (Piccinetti *et al.*, 2012). Investigations and assessment of demersal resources in the Adriatic Sea have a long tradition (Vrgoč *et al.*, 2004), and the "Hvar" expedition in 1948/49 is considered the first systematic fishery-biological research in the Adriatic (Šoljan, 1997). "Hvar" expedition covered the territorial waters of the ex-Yugoslavia and Albania, and most of the international open waters of the Adriatic. The value of this expedition, apart from the quantity and quality of data collected, lies in the fact that it was conducted at a time when trawl fishing was in its infancy. World War II also stopped all trawling activities for 7 or 8 years, and the resources were therefore in the unexploited state ("virgin state") at the time of "Hvar" expedition. The results of the "Hvar" expedition can therefore be used as a reference point to describe the subsequent changes that have occurred as a result of intensive exploitation. After this expedition, numerous studies were organized in the Adriatic, but they were spatially and temporally limited. The most important studies of demersal resources along the eastern coast were conducted by Kirinčić and Lepetić (1954), Crnković (1959), Županović (1961), Županović and Jardas (1989), Vrgoč (2000), Jukic *et al.* (2001), Piccinetti *et al.* (2012) and others. In recent years, international research of demersal resources of the Adriatic was intensified, with the aim to describe qualitative and quantitative composition and the changes that occur as a result of exploitation. The most important research expeditions are EU MEDITS, FAO AdriaMed Trawl Survey, SoleMon project, UWTV survey of shrimps in the open sea and DeepSeaSurvey (Piccinetti *et al.*, 2012).

MATERIAL AND METHODS

Studies presented in this paper were carried out within the framework of an international expedition EU MEDITS, in a period from 2005. to 2010. in the entire Adriatic (except the deepest areas of the South Adriatic Pit). Sampling was conducted using the scientific research net GOC 73 and according to the protocol of MEDITS expedition (Bernard *et al.*, 2002). Research was performed yearly, in the spring-summer period at 260 stations; the duration of the hauls was 30 min at the stations with depths less than 200 meters and 60 min at stations with depths above 200 meters. Qualitative and quantitative analysis of catch and by-catch composition was done on board, while length and weight measurements and determination of sex and maturity stages of economically important species was done in the laboratory. All data were stored in a common database using the ATRIS computer program (Gramolini, 2005), which was used to calculate the biomass index (kg/km²) of species. GIS distribution maps were made using ArcView GIS tools v. 3.2.

RESULTS AND DISCUSSION

A description of demersal resources is given as the GIS biomass index (kg/km^2) for the entire Adriatic for total catch during the MEDITS expedition (fish (including small pelagic), crustaceans and cephalopods) and for MEDITS target species (59 most abundant species in trawl fisheries), cartilaginous, and most important commercial species: hake, red mullet, common pandora, John Dory, small-spotted catshark, shrimp and deep water pink shrimp.

The biomass index for all species caught during MEDITS expedition in the study area (Fig. 1) shows that the highest population density is in the channel areas of the central Adriatic, and in the open waters of northern Adriatic (around the mouth of the River Po). This distribution pattern is primarily due to large catches of small pelagic fish, but also due to the fact that these are the areas of highest primary production (Buljan, 1964).

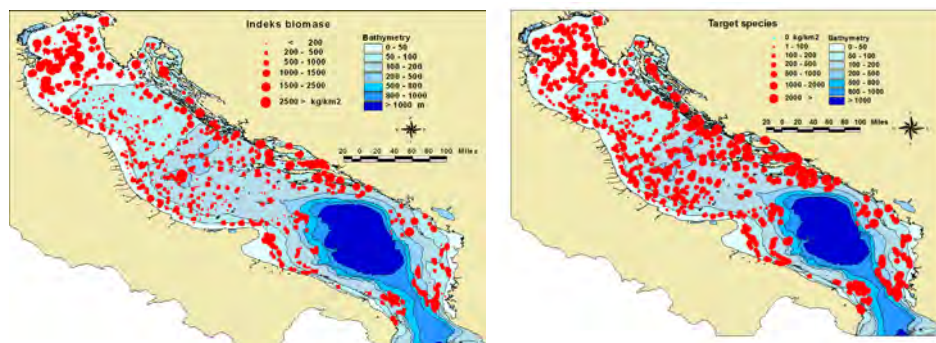


Figure 1. Biomass index for all species caught during the MEDITS expedition (left) and Biomass index of target species during MEDITS expeditions (right)

A much better view of the state of benthic communities is obtained if distribution of MEDITS target species is observed (Fig. 1, right). The highest density is found along the eastern Adriatic coast, mainly in the canal areas, and the lowest density in the open sea. Cartilaginous fishes are accepted as indicators of state of marine communities because they are extremely vulnerable due to their biological characteristics (slow growth, low reproductive potential) and they are the first species to be threatened by intensive fishing. Figure 2 shows that outside of territorial waters of the eastern Adriatic cartilaginous fishes are barely present in catches, which can be explained by intensive exploitation (Vrgoč, 2000; Jukic *et al.*, 2001).

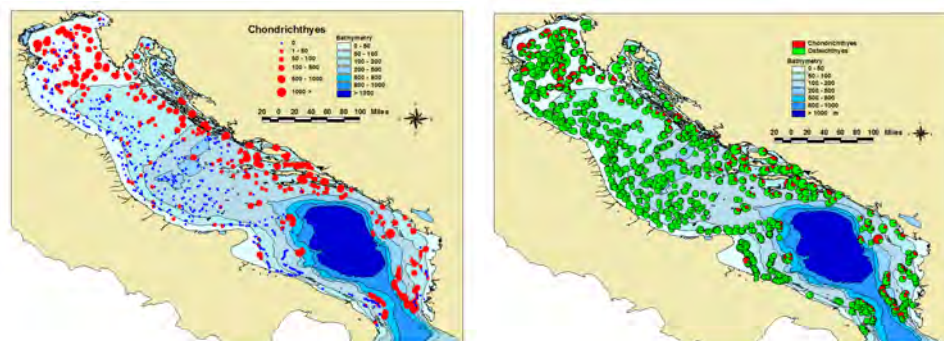


Figure 2. Biomass indexes of cartilaginous during MEDITS expeditions (left) and the ratio of biomass of cartilaginous and teleost during MEDITS expeditions (right)

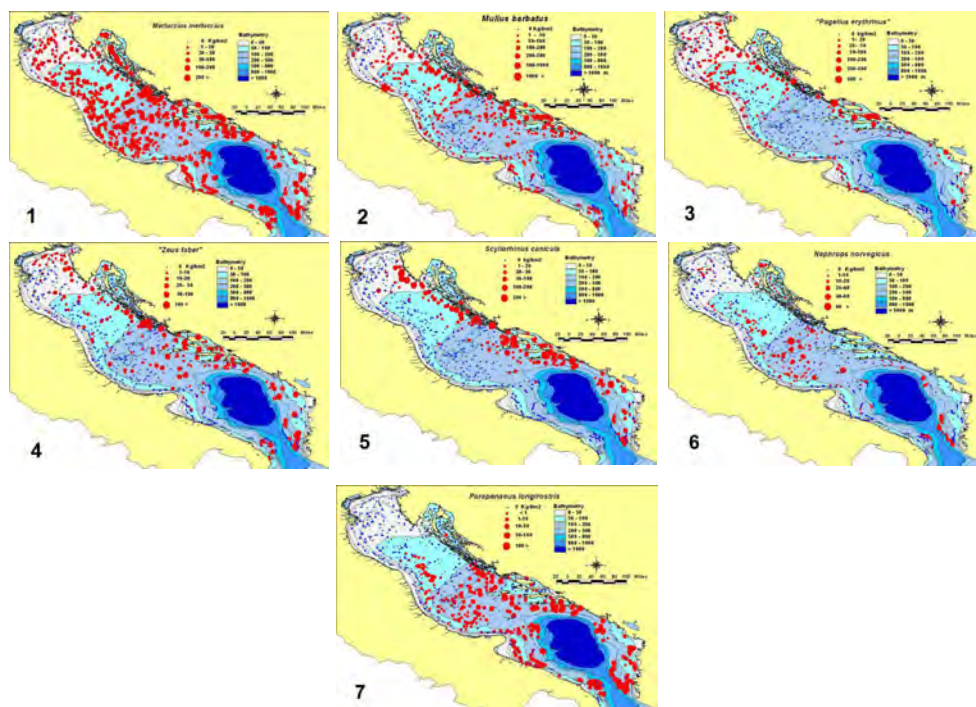


Figure 3. Biomass indexes of economically important species during the MEDITS expedition; 1 – *Merluccius merluccius*, 2 – *Mullus barbatus*, 3 – *Pagellus erythrinus*, 4 – *Zeus faber*, 5 – *Scyliorhinus canicula*, 6 – *Nephrops norvegicus*, 7 – *Parapenaeus longirostris*

Biomass index of economically important species (Fig. 3) shows that the population density is significantly higher along the eastern coast of Adriatic than in the open sea or along the western Adriatic coast. The highest population densities of hake can be found along the eastern coast of the Adriatic Sea and in Jabuka Pit, which is consistent with the fact that Jabuka Pit serves as a nursery and spawning area of this species (Županović

and Jardas, 1989). Red mullet dominated in open waters along the eastern coast of the Adriatic, and in canal areas. This distribution is partly a result of periodic migrations of this species from the east to the west coast (where juveniles are located) of the Adriatic. Common pandora is a typical circalittoral species (Rijavec and Županović, 1965) which can be found on rocky bottom and at depths down to 100 m, which are common along the eastern coast of the Adriatic. The situation is similar with John Dory and small-spotted catshark, which are very scarce outside the territorial waters of countries on the eastern coast of the Adriatic. This is primarily due to intensive exploitation of those extremely vulnerable species along the western coast and in the open waters of the Adriatic, which is consistent with a significant drop in the biomass indexes recorded in the period between "Hvar" and MEDITS's expeditions (Vrgoč, 2000; Jukic *et al.*, 2001). Distribution of shrimp in the Adriatic is related to the distribution of muddy types of sediment, and the densest settlements are located in the Jabika Pit, Velebit channel and part of southeastern Adriatic. Deep-water pink shrimp is a dominant species in deep south Adriatic and part of the central Adriatic, and population density is generally uniform throughout this area.

CONCLUSIONS

The recent state of benthic communities in the Adriatic Sea, described based on the data collected during the MEDITS expeditions shows uneven population densities between eastern and western Adriatic coast and in the open sea. Biomass indexes of the most important commercial species are often several times higher in territorial waters of eastern Adriatic countries. This situation can be explained by the uneven and over-intensive exploitation of demersal resources, primarily by the Italian fleet along the west coast and in the open sea, whose technical characteristics and fishing effort are greater than those along the eastern Adriatic coast. This should be taken into account in any future assessment of demersal fisheries resources and protection management measures in future regional management plans that are prepared within the GFCM.

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