

## **STATE OF POSIDONIA MEADOWS AND FISH ASSAMBLAGES IN THE FUTURE MPA „KATIČ“ (MONTENEGRO)**

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### **ABSTRACT**

A survey on state of *Posidonia* meadows and fish assemblages was carried out as a part of pilot study for the establishment of first Montenegrin Marine Protected Area “Katič”. From the survey results *Posidonia* meadows condition are summarized as „in equilibrium“ and the information of fish assemblages, especially considering the species of commercial and touristic interest, are indicating high fishing pressure. Having in mind information on different, important marine habitats and marine protected species, as well as all information of this area, we consider it as worth to be preserved and protected.

Key words: MPA, habitat, *Posidonia*, fish, Adriatic Sea

## INTRODUCTION

Global decline of marine resources has triggered a worldwide demand for changing the way ocean resources are managed. Ecosystem-based management approaches have emerged using marine protected areas (MPA) as the main tool (Angulo-Valdes & Bruce, 2009; Badalamenti et al. 2000). Beyond the main purpose of the MPAs to safeguard protected species, threatened ecosystems and nature in general, they can also provide economically valuable activities.

Although, Montenegrin parliament set out its relationship with nature by proclaiming Montenegro as an Ecological State in September 1991, so far, there is no marine protected area (MPA). Because of increasing anthropogenic pressures on the coastal zone, especially in recent years and threats to valuable and fragile ecosystems (Macic et al. 2010), there is urgent need for marine protection and balanced environmental development. Because of that, project „Development of the management plan for „Katič“ pilot MPA in Montenegro“ was done thanks to cooperation of Italian Ministry of environment, land and sea and Montenegrin Ministry of sustainable development and tourism.

Following consultation of Ministry of sustainable development and tourism with relevant stakeholders, the study area of the Pilot MPA was selected in April 2009. The area selected for the assessment of MPA establishment is the territory included in Sectors 48, 49, 50 and 51 of the Spatial Plan of coastal area from 2007. The pilot area is covering a coastal stretch of approximately 10km between Budva and Bar and comprises the city of Petrovac that is located in front of Katič and St. Nedelja islands.

As the MPA management plan should ensure that the objectives of nature conservation will match those of sustainable socio-economic development different baseline assessments and field surveys were done. First

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marine survey objectives were to collect data of the main hydrological parameters and provide information on the marine habitat typology. Aim of this marine survey was to evaluate state of *Posidonia* meadows and fish assemblages.

## MATERIAL AND METHODS

Field work was done in June 2010. Two survey teams carried out a visual census on fish populations and a qualitative/quantitative assessment of the seagrass beds (*Posidonia oceanica*) in 11 dive sites along selected transects and two dive points in Donkova seka and Perazića školj (Figure 1).

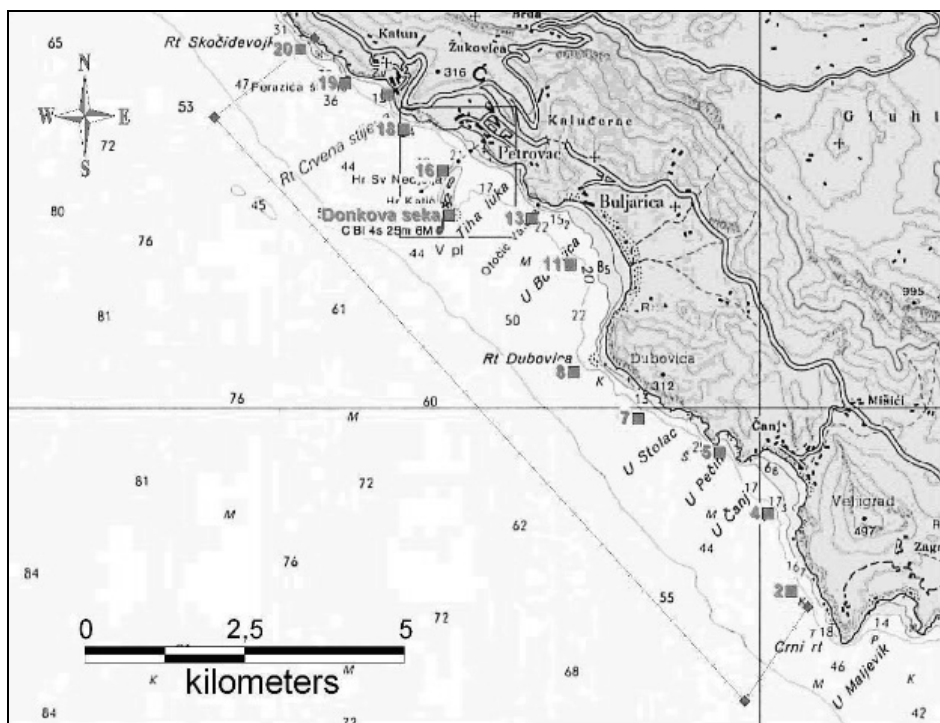


Figure 1 - Scuba diving stations (2. Crni rt, 3. Čanj, 5. Pećin, 7. Dubovica (South), 8. Dubovica (North), 11. Buljarica, 13. Seka Vatulja, 16. Petrovac, Donkova Seka, 18. Rt Crvena Stijena, „As“ hotel, 19. Perazića do and 20. Skočidjevojka)

Analysis of the *Posidonia oceanica* meadow density and limit typology was performed on the 14 transects. According to many authors, typology of the lower limit is depending on variations in environmental conditions, such as transparency of the water, sedimentation, nutrients concentration and others (Pergent *et al.* 1995; Pergent-Martini *et al.* 2005). It is also technically simple and easy to monitor, so it is one of the most frequently used physiographic describers for *Posidonia* meadows. For the evaluation of the lower limit of the *P. oceanica* meadow the recently classifications proposed by Montefalcone (2009) have been used. Density of the meadows was measured *in situ* by counting the leaf shoots inside a frame 40 cm x 40 cm in 3 replicates for each station and in 3 different depths along the transect (lower limit, intermediate depth and upper limit). According to Buia *et al.*, (2004) for each station the status of *P. oceanica* meadow has been defined and classified as: beds in equilibrium, disturbed beds and very disturbed beds.

The visual census technique (Harmelin-Vivien *et al.* 1985) is a standardised method, not destructive, that allows collecting data on fish richness, size structure and density data of fish assemblage. These data could be useful for future comparative studies, after the institution of the MPA. Information on fish assemblages were collected by two methods. The Random Swim Technique (RST) mostly used to get information on species richness and the Stationary Visual Counts (SVC) for collecting data inside an established habitat (rocky bottom, sandy bottom, *Posidonia* meadows).

## RESULTS AND DISCUSSION

In the study area the lower limit of *Posidonia* meadows is on average at about 22 m with maximum found on 26 m depth in Rt Skočidjevojka and minimum of 16.6 m in Buljarica. Different types of lower limits were observed. There is one typology of natural “healthy” limit, such as natural shaded limit,

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in correspondence of Crni rt, Čanj, Donkova Seka, Rt Crvena Stijena and Perazića Do. This kind of limit is characterised by a gradual decrease of *P. oceanica* covering and absence of dead matte (Figure 2).

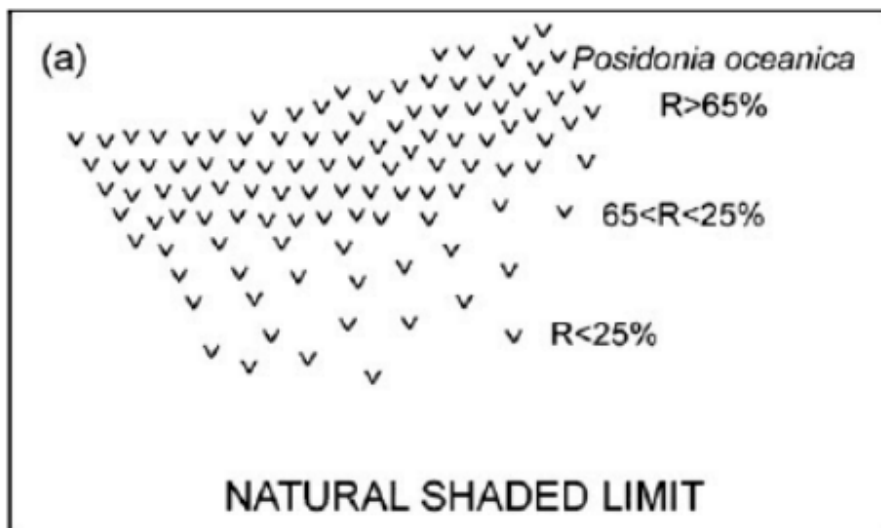


Figure 2. Typology of natural “healthy” limit (from Montefalcone 2009) found in correspondence of Crni rt, Čanj, Donkova Seka, Rt Crvena Stijena and Perazića Do.

Other lower limits are characterised by dead matte so they were defined as regressive limits. In Pećin and Perazića Do there are regressive shaded limits (Figure 3). In Dubovica (South), Dubovica (North) and Seka Vatulja there are regressive limit with patches with steep of matte. In Buljarica Bay and Petrovac (South) there are regressive erosive limits. This trend is very common in the entire Mediterranean basin where the human activities are the main responsible for the regression of the *P. oceanica* meadows (Boudouresque et al. 2006).

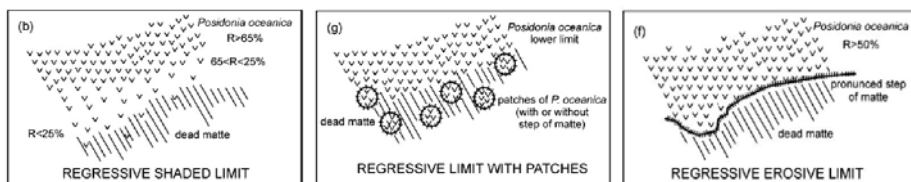


Figure 3 –Regressive shaded limit found in Pećin and Perazića Do; regressive limit with patches with step of matte found in Dubovica (South), Dubovica (North) and Seka Vatulja and regressive erosive limit found in Buljarica Bay and Petrovac (South).

Overall, the meadow condition is summarized as „in equilibrium“, but the density ranges between 129 to 503 shoots/m<sup>2</sup>. The very disturbed beds are observed in Petrovac and in Perazića Do („As“ hotel construction site) and that are probably due to the anthropic impacts such as wastewater discharges and dumping. In Buljarica the low shoot density is likely due to the submarine freshwater springs (data from CTD reveals the salinity about 29 ‰) whereas disturbed beds in some other sites are caused by some other factors.

During field work 72 fish species were observed. *Blennidae*, *Labridae*, *Sparidae*, *Gobidae* and *Serranidae* are the fish family that represent the larger part of the recorded species (respectively with 12, 12, 11, 9 and 5 species). The lower number of species was recorded in transects composed by one habitat Čanj (*Cymodocea nodosa* beds) and transect Buljarica (*Posidonia oceanica* meadow). The higher number of species was recorded in the transect composed by all the considered habitats: sandy bottom, rocky bottom and *Posidonia* meadows (Dubovica and Petrovac transects). This aspect is very common in all the Mediterranean basin where the specific richness of a fish assemblage is positively influenced by habitat heterogeneity (La Mesa *et al.* 2010).

The fish assemblages observed in this study shows a general richness in number of species, but size structure put in evidence the high fishing pressure on fish population. On the most of the sites there are no observed large specimens and when they were observed it was in very low percentage (<

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20%). High fishing pressure is even more evident when we take into account the size composition considering only the species of interest, both for professional fisheries and for recreational scuba diving activities (*Conger conger*, *Diplodus puntazzo*, *D. sargus*, *D. vulgaris*, *Labrus viridis*, *Muraena helena*) (Figure 4).

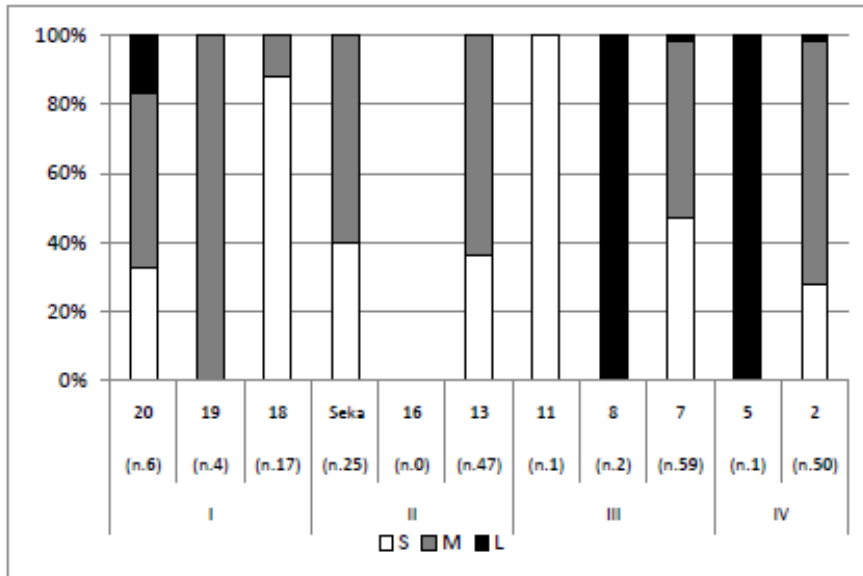


Figure 4. Size composition of the fish species of commercial and touristic interests in each transect (S-small; M-medium; L-large; in brackets is the number of specimens)

## CONCLUSIONS

From the survey results *Posidonia oceanica* meadows condition are summarized as „in equilibrium“ and the information of fish assemblages, especially considering the species of commercial and touristic interest, are indicating high fishing pressure. But having in mind information on different, important marine habitats and marine protected species, as well as all information of this area, we consider it as worth to be preserved and protected.

Presented data for *Posidonia oceanica* meadows with details on meadow density and type of lower limits are the first one of such a kind, for investigated area. Also, information on fish assemblages were scarce, so this study provided information that will be used as „zero state“ for further monitoring process, for appropriate organization of zoning and management in the future MPA „Katič“, but also could be used for Natura 2000 national database and monitoring of protected species and habitats.



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### REFERENCES

- Angulo-Valdes, J., Bruce, G. (2009): A new typology of benefits derived from marine protected areas. *Marine Pollution Bulletin*, Vol. 58, Issue 4, pp. 515-519.
- Badalamenti, F., Ramos, A., Voultziadou, E., Sanchez Lizaso, J.L., D'Anna, G., Pipitone, C., Mas, J., Ruiz Fernandez, J.A., Whitmarsh, D. and S. Riggio (2000): Cultural and socio-economic impacts of Mediterranean marine protected areas. *Environmental Conservation* 27 (2): 110-125.
- Buia M.C., Gambi M.C., Dappiano M. 2004. Seagrass systems. *Biologia Marina Mediterranea*, 11 (suppl. 1): 133-183.
- Pergent-Martini, C., V. Leoni, V. Pasqualini, G.D. Ardizzone, E. Balestri, R. Bedini, A. Belluscio, T. Belsher, J. Borg, C.F. Boudouresque, S. Boumaza, J.M. Bouquegneau, M.C. Buia, S. Calvo, J. Cebrian, E. Charbonnel, F. Cinelli, A. Cossu, G. Di Maida, B. Dural, P. Francour, S. Gobert, G. Lepoint, A. Meinesz, H. Molenaar, H.M. Mansour, P. Panayotidis, A. Peirano, G. Pergent, L. Piazzzi, M. Pirrotta, G. Relini, J. Romero, J.L. Sanchez-Lizaso, R. Semroud, P. Shembri, A. Shili, A. Tomasello and B. Velimirov (2005): Descriptors of *Posidonia oceanica* meadows: Use and application. *Ecological Indicators* Vol. 5, Issue 3, pp. 213-230
- Harmelin J.G. 1976. L'herbier de Posidonies de Port-Cros régresse-t-il? Mise en place de jalons témoins. *Travaux scientifiques Parc national Port-Cros*, 2: 189-190.
- La Mesa G., Molinari A., Gambaccini S., Tunesi L. (2010) – Spatial pattern of coastal fish assemblages in different habitats in North-Western Mediterranean. *Marine Ecology*, 1-11.

- Macic, V., T. Thibaut, B. Antolic and Z. Svircev (2010): Distribution of the most common *Cystoseira* species on the coast of Montenegro (South-East Adriatic Sea). *Fresenius Environmental Bulletin* (ISSN 1018-4619), Vol.19, No.6, pp. 1191-1198
- Montefalcone M. 2009. Ecosystem health assessment using the Mediterranean seagrass *Posidonia oceanica*: A review. *Ecological Indicators*, 9: 595-604.
- Pergent G., Pergent-Martini C., Boudouresque C.F. 1995. Utilisation de l'herbier à *Posidonia oceanica* comme indicateur biologique de la qualité du milieu littoral en Méditerranée: état des connaissances. *Mésogée*, 54: 3-27.