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# Marine biodiversity of Datça-Bozburun specially protected area (Southeastern Aegean Sea, Turkey)

# Datça-Bozburun özel çevre koruma bölgesi'nin biyolojik çeşitliliği (Güneydoğu Ege Denizi, Türkiye)

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## Abstract

Oceanographic and diving surveys were conducted at the largest SPA of Mediterranean basin, Datca Bozburun Specially Protected Area, in 2002-2004 periods by the Institute of Marine Sciences and Management of Istanbul University in order to determine marine biodiversity, distribution and condition of endangared or protected species and to make suggestions on management of coastal areas. Studies revealed in detection of 536 species of fauna and flora.

Some problems were detected in some areas particularly around settlements. Despite of the wide coverage of *Posidonia oceanica* beds at the region, the invasion and distribution of *Caulerpa* species point out severity of problems.

**Key words:** Biodiversity, specially protected area, Datça, *Posidonia oceanica*, *Caulerpa racemosa*

## Introduction

Within the framework of the contract signed between the Authority for the Protection of Special Areas and the Institute of Marine Sciences and Management of Istanbul University in May 2002 for the "Marine Biological Diversity Assessment of Datça-Bozburun Specially Protected Area",

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determination of priorities for the marine environment regarding biological structure, determination of the status and level of the present biological diversity, specification of the facieses and identification of species under threat and danger was aimed. The gathered data will be entered in the standard data entry format developed in accordance with the "Establishing Special Protection Areas in the Mediterranean" protocol of Barcelona Convention.

Being one of thirteen specially protected areas in Turkey, the Datça-Bozburun Specially Protected Area has been accepted and announced with the Governmental Decree no. 90/1117 in 22.10.1990 (Legal Gazette, 1990). The size of the area is 1474 $km^2$, containing two peninsulas; the Datça (Reşadiye) Peninsula extends in a East-to-West direction located between the Gökova Gulf in the north and the Hisarönü Gulf in the south, while the Bozburun Peninsula lies in the south of the Datça Peninsula and extends towards the Rhodes Island in the south (Figure 1).

The marine biodiversity assessment study performed at Datça-Bozburun SPA from 2002 to 2004 intended to detect the marine species of the area, problems threatening the marine ecosystem and biodiversity and to collect scientific data set required for best solutions for the existing and future problems.

## Material and Methods

831 SCUBA and 382 skin dives have been performed in 148 days in 7 cruises to determine the marine biodiversity at the Datça-Bozburun SPA (Figure 1). The daily diving program included 4 groups, each consisting of two or three divers, diving twice a day, one in the morning and one in the afternoon, and most of the time 8 dives were achieved daily. The starting and ending coordinates of each group were determined by GPS. One of the groups carried an underwater video system to document characteristics of the region studies and to record the components of biodiversity while another group carried a professional digital underwater photography system. Aim of video recordings and photographs taken is to document different species, the state of bottom structure, the distribution and condition of the facieses, the biodiversity, and the effect of mankind. In order to obtain a detailed distribution of the biodiversity and communities, groups moved in a zigzag manner and different depths were surveyed during the study. Synchronously with dives, skin divers performed studies at coastal region, where the algae diversity is highest (0-2 m). Data gathered (the species

name, distribution area or strategy, density etc.) have been noted on slides and in cases where sampling became necessary; sampling was performed regarding minimum damage to the organism. Unidentified species were studied aboard and presented to the knowledge and experience of the whole team. If the identification is certain the specimen is returned to its habitat. Macrozoobentic organisms, which could not be identified during the field studies and plankton samples were fixed with borax neutralized formaldehyde solution to 4-5% final concentration and brought to the laboratory. In the laboratory, all organisms were identified to the lowest possible taxonomic level (usually species) using a stereomicroscope and a compound microscope.

For the identification of species the following references are used: for Porifera Bowerbank (1864-1882), Vacelet and Boury-Esnault (1987), Katağan *et al.,* (1991), Hayward *et al.,* (1996), Boury-Esnault and Rützler (1997), Topaloğlu (1999) and Hooper *et al*. (2000); for Cnidaria Manuel (1987) and Hayward and Ryland (1996); for Polychaeta Fauvel (1923, 1927); for Arthropoda Zariquiey Alvarez (1968), Riedl (1983), Holthuis (1987), Kırkım (1998) and Galil *et al*. (2002); for Mollusca Tebble (1966), Parenzan (1970, 1974, 1976), Nordsieck (1972), Gaillard (1987), Poutiers (1987), Poppe and Goto (1993) and Zenetos *et al*. (2003); for Echinodermata Koehler (1921) and Tortonese (1965) and for Tunicata Uysal (1975). The ERMS - European Register of Marine Species (2001) and the ITIS - Integrated Taxonomic Information System (2004) databases have been used for the classification and nomenclature of the defined species.

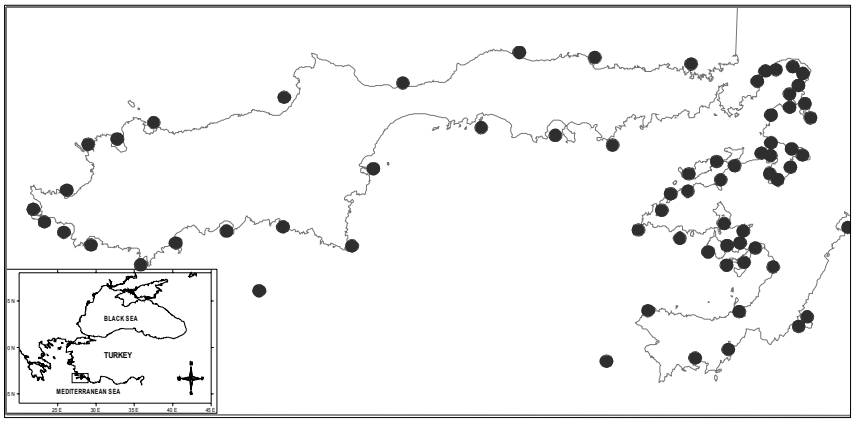


**Figure 1.** Map of the studied area.

In addition, the distributions of fecal coliform and fecal streptococci were studied as indicators of bacteriological pollution at the surface water of 73 oceanography stations in Datça-Bozburun Peninsula SPA.

Oceanographic measurements including physical, chemical and biological parameters were performed in the first or last day of each study period, at 73 total points representing the whole biodiversity study area.

## Results and Discussion

A total of 807 species belonging to 19 groups have been found in 6 cruises performed at the Datça Bozburun SPA. The most diverse phylums are Mollusca with 187 species, fishes with 184 species, and algae with 139 species. If these values are converted into percentages, it can be seen that Mollusca occupied 23.2%; Pisces 22.8% and Thallophyta 17.2%. If algae are compared with each other during all of the 6 studies, *Padina pavonica* of the brown algae comes first with a frequency of 58%, followed by *Codium bursa* of the green algae with a frequency of 51.4%. The most frequent species observed in the phylum of Magnoliophyta, which is represented with 4 species (*Posidonia oceanica*, *Cymodosea nodosa*, *Zostera marina* and *Halophila stipulacea*) was *Posidonia oceanica* with a frequency of 78.9%. 38 species have been observed from Porifera (sponges). The most frequent sponge species is *Ircinia muscarum* with a frequency of 76.7%. Among the 48 species of Cnidaria, Cerianthus membranacea is the most frequent species with a frequency of 37%. *Pinna nobilis*, which is under conservation, was the most frequent species in the phylum of Mollusca (57.8%). In the Polychaeta class with 26 observed species, *Hermodice carunculata* is the most frequent species with a frequency of 70.9%. The sea urchin *Arbacia lixula* is the most frequently observed echinoderm (59%), represented by 42 species. 22 species have been observed in Tunicata class and the most frequent species are *Halocynthia papillosa* (42.3%) and *Microcosmus sabatieri* (33.5%). The most frequent species observed among Pisces are *Chromis chromis* (priest fish) with a frequency of 86.9%, followed by *Coris julis* (sunfish) with a frequency of 80.5%, *Serranus scriba* (78.7%) and *Diplodus vulgaris* (70.8%). From the phylum Reptilia, *Caretta caretta*, which is under conservation, was observed 3 times during the study and was also seen during copulating. From the phylum Mammalia, *Delphinus delphis* (common dolphin) which is also under conservation, was seen in the region as well. Fishermen reports stated that the Mediterranean Monk Seal

*Monachus monachus* inhabits the region and is seen frequently in some areas.

In addition to the determination of the distribution areas, one of the most important scope of the project is the detection of the threat elements for the endangered species in the SPA. These species are faced with extinction in the Mediterranean, and were taken under conservation by the Bern and Barcelona conventions, that Turkey was a side, and by national regulations such as the "Fisheries Law/Circular no 1380" and the "Coastal Law". After three years of study, it has been detected that Datça-Bozburun SPA contains a total of 35 species which are under conservation such as *Posidonia oceanica*, *Cymodocea nodosa*, *Mesophyllum lichenoides, Cystoseira amentacea*, *Scyllarides latus*, *Palinurus elephas*, *Epinephelus marginatus*, *Charonia tritonis variegata*, *Lithophaga lithophaga*, *Pinna nobilis*, *Tonna galea*, *Centrostephanus longispinus*, *Paracentrotus lividus*, *Sciaena umbra*, *Umbrina cirrosa* and *Caretta caretta*.

The *Posidonia oceanica* meadows are one of the most important oxygen sources of the Mediterranean, where the primary production sources are limited despite of the species richness. The meadows do not only provide oxidation of the seawater, but they are also the habitat for many invertebrates and fish species and especially larvae. Since the meadows prefer sandy environments, they help these spots to become more stable and become a habitat for many living organisms. If these habitats are destroyed, not only their contributions to the marine ecosystem will end, but they will also have a direct or indirect effect on the whole ecosystem.

The entire *Posidonia oceanica* meadows cover a total area of 41.16 $km^2$. Among the macrophytes observed, *Posidonia oceanica* covers the largest area in the Datça-Bozburun SPA with 763 $km^2$ marine area. Bearing in mind that the general distribution limits of the species is 2-40 m, it can be seen that the determined area is relatively big and considering that the bottom limit distribution of the species is 40 m, it covers approximately 50% of the marine area. This clearly shows that the marine environment has a relatively healthy structure. Considering that the *Caulerpa racemosa* is distributed down to 58 m approximately 75 m of depth, 20% of all this area (0-75 m) is covered by *Posidonia oceanica*. Most of the regions, there is no distribution of any facieses below 40 m depth, thus these values seems relative high as well.

Although *P. oceanica*, which is very sensitive to damage and pollution, is healthily distributed on large areas at the north of the Datça Peninsula, the meadows are interrupted and sometimes sparse, unhealthy meadows, which were subject to damage by humans, have been seen in the South of Datça and at the Bozburun Peninsula. Particularly in bays with settlements such as Datça, Selimiye, Orhaniye, and Bozburun, or bays such as the Serçe, Bozukkale or the Körmen Harbors, important in terms of tourism. Damages have been observed along the whole coastal line mainly caused by uncontrolled anchoring, whose recovery is very difficult. In addition, it has been observed that uncontrolled establishment of fish farms in the Yesilova Gulf, completely eradicated the *Posidonia* meadows except a very narrow line at the coast, and also reduced the macrobenthic species diversity to a critical degree.

Detailed studies pointed out that, there is an important invasion threat by *C. racemosa* and that this threat is increasing in time. In regions where *P. oceanica* is damaged the advantage is shifted to *C. racemosa*. *P. oceanica* is very sensitive to any kind of alterations in the ecosystem and particularly to physical destruction. Another important finding in the field is that under normal conditions, the *C. racemosa* is distributed below the bottom limits of *P. oceanica* (>40m). Dense distribution of *C. racemosa* has been detected in 40 m to 75 m depths. From 40 m to shallower depths, any negative effect on *P. oceanica* meadow may result in formation of gaps within the community and these areas are immediately filled by the *C. racemosa* (Figure 2).

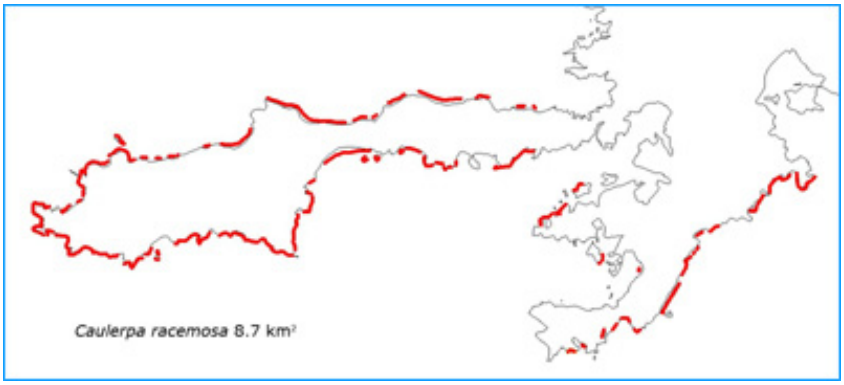


**Figure 2.** Distribution of *Caulerpa racemosa* in Datça Bozburun SPA.

*C. racemosa* becomes more numerous in the areas heavily utilized by men and therefore it is necessary to stop the destruction of *P. oceanica* meadows urgently. The most important point is not to prevent *C. racemosa* distribution or to introduce it as an invasive or terrorist species to show it as the main source of the problems, but to keep negative effects of human destruction on *P. oceanica* at minimum. Accordingly, it is necessary to prevent destruction originated from anchoring activities and by pollution at the first stage.

In addition to *C. racemosa* another *Caulerpa* species, *C. prolifera*, was also distributed in the SPA. This is a native species of the Mediterranean and does not affect other species adversely as *C. racemosa*. Total size of *C. prolifera* is calculated as 0.5 km² (Figure 3).

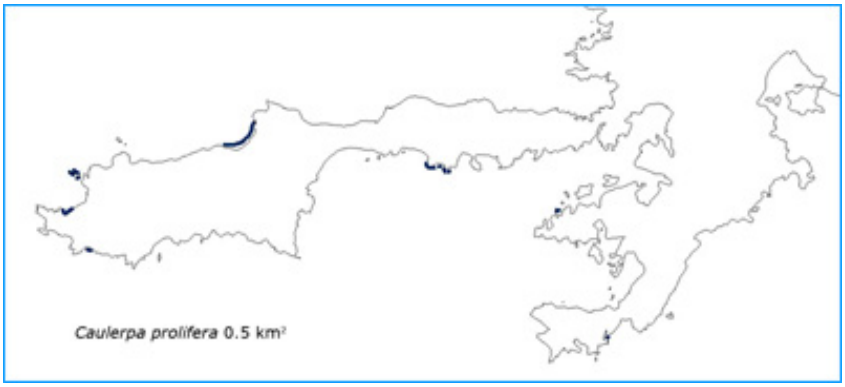


**Figure 3.** Distribution of *Caulerpa prolifera* in Datça-Bozburun SPA.

Results of biodiversity assessment surveys clearly depicted that despite of some problems in the region, it has been observed that the Datça-Bozburun SPA is a heritage for the next generations and that this richness should be considered as a common heritage of the whole country and even the whole world and should be protected. The biological diversity studies, supported by physical and chemical findings, have shown that the Datça-Bozburun SPA is one of the cleanest areas of the Mediterranean, and in addition to its rich biodiversity, its archeological richness makes it one of the most important conservation areas within the borders of Turkey.

Yacht turism and anchoring, foreign species pressure, over fishing, recreational use of the coasts, and pollution effect of aquaculture, coastal fillings and rubble dumping are the main problems of the area investigated.

Some recommendations to sustain ecosystem health in Datça-Bozburun SPA are as follows:

- The fish farms in Datça-Bozburun SPA should be removed, since the SPA status of the region contradicts with the presence of fish farms.
- Anchoring activities should be regulated and studies should be started instantly to establish the infrastructure needed to meet anchoring requirement.
- Alterations in populations of species such as *Caulerpa racemosa*, *Siganus luridus* and *S. rivulatus* that have negative effects on biodiversity of the region should be monitored with scientific studies.
- Increasing in tourism activities causes remarkable increase in anthropogenic stress on marine environment. Urgent measures should be taken in whole area to decrease these effects.
- The hotels and marine vessels should take measures to minimize the solid waste pollution.
- Discharge of oils, paints, fuel oil and other wastes to the sea from marinas slipways and shipyards should be prevented.
- Measures should be taken to prevent fishing and sales of protected species in the region.
- Ecotourism shall be considered as an alternative way to reduce the adverse effects of tourism.

**Özet**

Akdeniz havzasının en büyük özel çevre koruma alanı olan Datça Bozburun özel çevre koruma alanında 2002-2004 tarihleri arasında denizel biyolojik çeşitliliğin araştırılması ve koruma altındaki veya nesli tükenme tehlikesiyle karşı karşıya olan türlerin dağılım ve mevcut durumlarının tespit edilmesi amacıyla oşinografik çalışmalar ve dalış sörveyleri gerçekleştirilmiştir. Çalışmalar sonucunda bölgede fauna ve floraya ait 536 tür tanımlanmıştır.

Özellikle yerleşim bölgeleri civarında bazı problemler tespit edilmiştir. Bölgede *Posidonia oceanica* yataklarının geniş kaplayıcılığına rağmen *Caulerpa racemosa* türünün yayılımı problemin ciddiyetini işaret etmektedir.

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