Pengamatan terakhir Bulu Babi eksotik berduri panjang (Diadema setosum) di Teluk Antalya

The last observation of the long-spined exotic Sea Urchin (Diadema setosum) in the Gulf of Antalya

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1. Introduction

The Mediterranean Sea is connected to the Atlantic Ocean in the west naturally, and to the Red Sea through the man-made Suez Canal in the east. After the opening of the Suez Canal, many tropical organisms originating from the Red Sea migrated and settled in the Mediterranean. One of these migrating organisms is the long-spined sea urchin Diadema setosum. The first record of this echinoderm species in the Mediterranean was made by Yokeş and Galil (2006) along the coast of the Kas Peninsula. Approximately a year after this record, Gökoğlu et al. (2007) reported a second record of D. setosum from Antalya, Konyaalti Beach at a depth of 5-6 meters. Later, in 2009, it was
observed in the coastal waters of Monsef town along the Lebanese coast (Nader & El Indary 2011), and in 2010, it was observed in the Gulf of Iskenderun, Yayladağı, on the southeastern coast of Turkey (Turan et al. 2011). After these reports, *D. setosum* rapidly proliferated in the Mediterranean and expanded its distribution along the coasts of Turkey, Greece, Lebanon, Israel, Egypt, and Libya (Zirler et al., 2023). *D. setosum*, which can be observed up to a depth of 2-3 meters in rocky and stony areas with wave action, has also started to pose a risk for local people.

*D. setosum* is a species of sea urchin belonging to the Diadematidae family. Its long spines are hollow and contain a mild venom. *D. setosum* differs from other Diadema species by having five characteristic white spots on its body. Additionally, a distinctive feature of this species is the presence of a bright orange anal sac around the periproctal cone of the sea urchin (Yokş and Galil, 2006).

*D. setosum*, a species of sea urchin, is distributed in the Indian-Pacific regions from Australia and Africa to Japan and the Red Sea. The spines of this sea urchin can cause painful stings when stepped on, as they are poisonous. Although the toxin is not a deadly threat to humans, it mostly causes swelling and pain. Its long spines are easily broken and enable it to move very quickly (Nour et al. 2022). Mass mortality in sea urchins is a common occurrence. The best example of this can be demonstrated by the collapse of the Diadema antillarum population in the Caribbean and Western Atlantic. In the Caribbean, the sea urchin *D. antillarum*, which almost disappeared the early 1980s due to an unknown reason, experienced a similar mass mortality event again in 2022 (Hewson et al., 2023). These mass mortalities are reported to be caused by a pathogen (*Philaster apodigitiformis*). Similarly, mass mortality events were observed in Diadema africanaum populations in the Eastern Atlantic in 2009 (Zirler et al., 2023). It is reported that *Vibrio alginolyticus*, which increases due to abnormally rising water temperatures, is responsible for these mortalities (Clemente et al., 2020).

During the summer months (in 2022), while scuba diving in the Gulf of Antalya, we encountered some deceased individuals of *D. setosum* and found shells and spines belonging to them. Initially, it was thought that the shells and spines belonged to sea urchins that had been consumed by fish or other organisms. However, after the winter season, mass deaths were observed among *D. setosum* individuals in the Gulf of Antalya. This study aims to determine the current status of *D. setosum* in the Gulf of Antalya.

2. Materials and Methods

This research was conducted between September 2022 and June 2023 in five different areas of the Gulf of Antalya with rocky and stony seabed structures (Cliffs, Konyaalti Beach, Şişan Island surroundings, Çaltıcak region, and Kemer Ağva Cape) (Figure 1). The research was carried out through 50 scuba dives between depths of 2-30 m, and we used scuba tanks filled with 15 liters of air at 200 bars in our studies. A 50-litre canister and long tongs were used to collect sea urchin samples. For underwater photography, we used a Canon G12 camera and a housing. Dives in the research areas were conducted with 2, 4, and 6 individuals, following zigzag patterns. While some dives were from the shore, some boats were used for dives around Şişan Island (9m fishing boat) and in the Kemer region (diving boat belonging to Octopus Diving Centre).

3. Results and Discussion

*D. setosum*, a Red Sea migrant, has rapidly expanded its distribution along the Mediterranean and Aegean coasts of Turkey since its first record in 2006. One of the most densely populated areas of this species in the Mediterranean is the rocky shores of the Gulf of Antalya (Çağlıtay et al. 2022).

The diving courses of Akdeniz University students is generally conducted in Antalya Cliffs, Konyaalti Beach, Şişan Island, Çaltıcak Region, and Kemer Ağva Cape areas. Due to the excessive proliferation of *D. setosum* and the toxicity of its spines, sea urchins are observed and contact with them is avoided during these dives conducted throughout the year. During diving activities carried out in the summer months of 2022, it was observed that some individuals of *D. setosum* died. Initially, it was thought that these deaths were caused by fish or other organisms that consume sea urchins as food. Meanwhile, monthly samplings were conducted for a TUBITAK project related to *D. setosum*. It was observed during scuba dives conducted for these purposes that there was an increase in *D. setosum* mortality in the autumn months. These deaths continued to increase during the winter season, and meanwhile, a strong storm occurred in the Gulf of Antalya on January 27 - 28, 2023. Following this storm, during our scuba dives conducted in February and March, it was determined that 98-99% of the *D. setosum* population at diving and sampling stations had died. In all the areas where we dived, it was observed that the surviving sea urchins either shed their spines or had a decrease in their ability to move.

![Figure 1. Areas (highlighted in red) where the presence of *D. setosum* is being investigated in the Gulf of Antalya.](image1)

![Figure 2. Density of *D. setosum* on the rocky and pebbly surface of Konyaalti Beach (summer season of 2022).](image2)
In our diving in April-May, which are still ongoing in 2023, no live individuals of *D. setosum* could be found, but the spines and shells of dead individuals were encountered (Figure 4-5).

Mass mortality incidents can occur on sea urchins. The best example of this is the collapse of the *Diadema antillarum* population in the Caribbean and Western Atlantic, as found in our literature research (Hewson et al. 2023; Zirler et al. 2023). It has been reported that this species experienced recurring mass mortalities in the 1980s and 2022. Similarly, a similar situation was observed in a related species, *Diadema africanum*, in the Eastern Atlantic in 2009, where 65% of the population was lost, and in the Canary Islands in 2018, where 93% of the population was lost (Hernandez et al. 2020. Sangil and Hernandez 2022). The cause of death was identified as *Vibrio alginolyticus* in the study. A similar mass mortality event also occurred on the Pacific coast of Mexico, affecting *Diadema mexicanum*, which is one of the endemic species of this region (Benítez-Villalobos et al. 2009).

A similar mass death incident is also occurring with *D. setosum*, a Red Sea migrant. In the different regions of the Gulf of Antalya (Cliffs, Konyaalti Beach, Sican island regions, Calticak region, and Kemer Agya Cape), mass mortalities have been observed in the stations we determined, and no living *D. setosum* individuals have been encountered. In discussions with diving tourism centers in the region, it has been reported that these mortalities are also observed in Ucadalar, Beldibi, and Goynuk regions. Although these mass deaths in a foreign and invasive species may seem positive in a way, the pathogens causing them can also be a threat to native sea urchin species in the Mediterranean.

**Conclusion**

In conclusion, this study provides information about the current status of *D. setosum* in the Gulf of Antalya. This is highly important in terms of whether the species will be able to regenerate its population in the future.

**Bibliography**


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