

Effects of a Sea Tide on The Biodiversity along Dikili Coastline, İzmir, Turkey

Dikili (İzmir, Türkiye) Sahillerinde Gözlenen Deniz Çekilmesinin Biyoçeşitlilik Üzerine Etkileri

Research Article

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ABSTRACT

This paper presents the effects of a sea tide on the marine biodiversity of Dikili coastline. A sea tide in winter season of 2012 was observed during sampling for a national project along Dikili coastline. In the sea tide area, many marine organisms were about to be decomposed or already decomposed indicating the sea tide was not an instant event. Since some of the affected species, such as *Holothuria* sp., has economic importance, collection of these species before their decomposition can contribute much to the local economy.

Key Words

Caulerpa racemosa var. *cylindracea*, *Holothuria* sp., sea tide, *Zostera noltii*

ÖZET

Bu çalışmada, bir deniz gel-gitinin Dikili sahilindeki denizel biyoçeşitlilik üzerine etkileri sunulmaktadır. 2012 yılı kış mevsiminde ulusal bir proje için örneklem sırasında Dikili sahili boyunca bir gel-git gözlenmiştir. Gel-gitin yaşandığı alanda, gel-git olayının anlık bir olay olmadığını gösterir biçimde pek çok deniz organizmasının çürümekte olduğu veya önceden çürüdüğü gözlenmiştir. Etkilenen türlerin bazıları, *Holothuria* sp. gibi, ekonomik öneme sahip olduklarından, bu türlerin bozunmadan toplanması yerel ekonomiye büyük katkı sağlayabilir.

Anahtar Kelimeler

Caulerpa racemosa var. *cylindracea*, gel-git, *Holothuria* sp., *Zostera noltii*

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INTRODUCTION

Sea tides are observed seasonally along Turkish coastlines depended on climatical and meteorological forces or other reasons [1]. When sea levels reach to minimum in winter season, the coastal sea ecosystem is adversely affected from sea tides [2]. This kind of sea tide was witnessed during sampling for a national research project of our research group supported by The Scientific and Technological Research Council of Turkey (TÜBİTAK; Grant Number: 111T166). The sea tide was observed over 1 km along the Dikili coastline with a distance of about 75 m from the coast. The aim of this study was to report affected and decomposed species within the tide area and to review their economical values based on published reports for a possible collection before sea tides.

MATERIALS

Geographical coordinates of the area where tide event was observed are 39° 07' 10.50" N and 26° 51' 12.61" E. The area was located in Dikili Bay, İzmir, Turkey. A detailed map of the region was given in Figure 1. The species affected from sea tide were photographed in winter 2012.

RESULTS AND DISCUSSION

A list depicting the taxonomies of the species affected from sea tide was given in Table 1. Detailed images belong to the tide area and decomposing species were given in Figures 2-9.

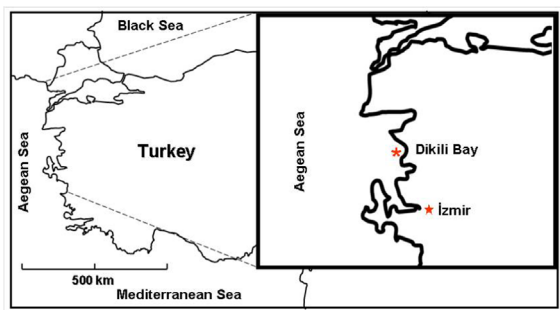


Figure 1. Detailed map showing the sea tide area in Dikili Bay, İzmir, Turkey.

Among the species which were adversely affected from sea tide, *Holothuria* sp., *Zostera noltii* and *Caulerpa racemosa* var. *cylindracea* are known to have high commercial value. *Holothuria* sp., known as sea cucumber, are consumed as food and used in cosmetics and medicine. Most common



Figure 2. Low tide area with a distance of about 75 m from the coast. a) A view of tide area from the coast. b) A view of tide area from the sea. In both Figures, decomposing *Z. noltii* beds can be seen clearly.



Figure 3. Invasive *C. racemosa* var. *cylindracea* within *Z. noltii* and *C. nodosa* leaves.

Table 1. Taxonomy of the species affected from the tide event in Dikili Bay.

Species	Kingdom	Phylum	Class	Family	Genus
<i>Anemonia sulcata</i> var. <i>smaragdina</i>	Animalia	Cnidaria	Anthozoa	Actiniidae	Anemonia
<i>Holothuria</i> sp.	Animalia	Echinodermata	Holothuroidea	Holothuriidae	Holothuria
<i>Paracentrotus lividus</i>	Animalia	Echinodermata	Echinoidea	Parechinidae	Paracentrotus
<i>Marthasterias glacialis</i>	Animalia	Echinodermata	Asteroidea	Asteriidae	Marthasterias
<i>Cerithium vulgatum</i>	Animalia	Mollusca	Gastropoda	Cerithiidae	Cerithium
<i>Ocenebrina</i> sp.	Animalia	Mollusca	Gastropoda	Muricidae	Ocenebrina
<i>Zostera noltii</i>	Plantae	Tracheophyta	Liliopsida	Najadales	Zosteraceae
<i>Caulerpa racemosa</i> var. <i>cylindracea</i>	Plantae	Chlorophyta	Bryopsidophyceae	Caulerpacaeae	Caulerpa
<i>Posidonia oceanica</i>	Plantae	Spermatophyta	Monocotyledonea	Posidoniaceae	Posidonia
<i>Cymodocea nodosa</i>	Plantae	Tracheophyta	Monocots	Cymodoceaceae	Cymodocea

**Figure 4.** *Anemonia sulcata* var. *smaragdina* that was stucked into small area.**Figure 5.** *Anemonia sulcata* var. *smaragdina* on *Z. noltii* leaves.



Figure 6. a) A highly decomposed sample of *Holothuria* sp., b) A decomposing sample of *Holothuria* sp.



Figure 7. *C. vulgatum*.



Figure 8. A decomposed sample of *P. lividus*.



Figure 9. *M. glacialis* sample which was under sea tide threat.

species of *Holothuria* in Turkish coastlines are *H. tubulosa*, *H. sanctori*, *H. polii*, and *H. mammata* [3]. Fishery of *Holothuria* sp. is widespread in Turkey and they are exported to Asian countries in dried or fresh forms. Triterpene glycosides are one of the most commonly known active metabolites of *Holothuria* sp. [4-14].

Metabolites of sea cucumbers have medicinally important bioactivities like anti-metastatic [15], anti-tumor [16], anti-coagulant [17], anti-thrombotic [17], anti-inflammatory [18], cytotoxic [11], and hypolipidemic activities [19]. *Zostera* genus is one of the widespread and also well-studied groups of seagrasses [20]. *Zostera* sp. are generally found in lagoons that are affected from sea tides. *Zostera* sp. are important species for marine ecosystem since they form a critical habitat for other organisms by providing feeding ground, enhancing the local productivity, filtering the water and functioning in nutrient cycle [20-28]. *Zostera* sp. are known to have an important natural antifouling compound called zosteric acid. Seasonal change of this commercially important compound in *Z. marina* and *Z. noltii* was first investigated by Achamlale *et al.* [29]. According to the scientific studies, zosteric acid is not harmful to marine organisms and it prevents settlement of biofouling organisms by inhibiting their adhesion [30-35]. Because of its antifouling properties, zosteric acid was proposed as an eco-friendly biocide in different types of antifouling paints [36-38]. Since the decomposition of *Z. noltii* meadows causes bad odor, bad view and loss of valuable biomass in the tide area, a national research project of our research group supported by TÜBİTAK (Grant No: 111T166) was begun in November 2011 on the evaluation of *Z. noltii* detritus as a zosteric acid source for its incorporation into antifouling paints. In the project, zosteric acid levels are determined seasonally in *Z. noltii* from Turkish coastlines and antifouling performance of zosteric acid is investigated by its incorporation into rosin based antifouling paints as eco-friendly biocide. *Caulerpa racemosa* var. *cylindracea* is one of the famous and alien species belong to *Caulerpa* genus. This species has invaded to 13 Mediterranean countries (Albania, Algeria, Croatia, Cyprus, France, Greece, Italy, Libya, Malta, Monaco (M. Verlaque, pers. commun.), Spain, Tunisia and Turkey [39,40].

Invasion success of *Caulerpa* species is associated with their joint secondary metabolite called caulerpenyne (CYN) [39,41-44]. CYN has sesquiterpene structure and shows anticancer [45], antiproliferative [42,46], antifouling [47,48], phospholipase A₂ inhibition [49], and lipase inhibition properties [50]. In addition to its medicinal importance, there are scientific studies that examines the industrial importance of *C. racemosa* var. *cylindracea* biomass by the removal of methylene blue [51], malachite green [52] and boron [53] as well as its use as an immobilization agent for proteins [54] and biostimulator of plant growth [55]. *C. nodosa* is found at shallow waters and it can form mixed populations with other seagrasses. *C. nodosa* has cytotoxic agents like cymodiene and cymodienol [56]. *Posidonia oceanica* is an endemic Mediterranean sea grass and it has vital roles for marine ecosystem [57,58]. *Anemonia sulcata* var. *smaragdina* is a Cnidarian species with symbiotic facultative life form [59]. It has green fluorescent proteins that are widely used in gene expression and biosensor development studies [59,60]. *Paracentrotus lividus* is one of the abundant sea urchin species in the Mediterranean Sea [61,62]. It can control the diversity of the marine ecosystem by consuming the algae [61,62]. In conclusion, seasonally observed sea tide affects the coastal biodiversity along Dikili beach. Some of the observed species within the sea tide area can be economically evaluated and commercialization of natural bioactive agents from these species can support the local Mediterranean economy. Therefore, further studies on bioactive metabolites within decomposing biomass in sea tide area are not only for Dikili coastline but also FOR other Mediterranean coastlines ARE strongly warranted. The possible collection studies or researches have to be based on the national and international legislations and permissions.

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