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Investigation of marine flora in Ilıca Bay (Çeşme, Izmir, Aegean Sea/Turkey)

Z. Derya YILDIRIM [*1], Atakan SUKATAR [1]

[1] Ege University Science Faculty, Biology Department Hydrobiology Section 35100 Bornova Izmir, Turkey

Abstract

In this study, we performed surveys on marine algae at 10 different locations selected according to coastal variable parameters (human preassure, hot spring entity, pollution etc.). The variable parameters measured, algae samples collected and then taxonomical classifications completed within these field works. As a result, 12 *Cyanophyta*, 32 *Rhodophyta*, 13 *Phaeophyta*, 9 *Chlorophyta* and 2 *Magnoliophyta* members, totally 68 taxon assigned.

Key words: Marine Flora, Algal Taxonomy, Çeşme, Izmir, Aegean Sea

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Ilıca Koyu (Çeşme, İzmir, Ege Denizi, Türkiye) denizsel florasının güncel durumu üzerine inceleme

Özet

Bu çalışmada kıyısal değişkenlere (insan baskısı, sıcak su kaynaklarının varlığı, kirlilik vb.) göre belirlenen 10 istasyonda, belirli periyotlarla denizel algler üzerine arazi çalışmaları yapılmıştır. Bu çalışmalar kapsamında, alandaki değişkenlerin ölçümleri alınmış, alg örnekleri toplanmış ve taksonomik sınıflandırmaları yapılmıştır. Çalışma sonucunda, alanda 12 *Cyanophyta*, 32 *Rhodophyta*, 13 *Phaeophyta*, 9 *Chlorophyta* ve 2 *Magnoliophyta* üyesi, toplamda ise 68 takson saptanmıştır.

Anahtar kelimeler: Denizsel Flora, Alg Taksonomisi, Çeşme, İzmir, Ege Denizi

1. Introduction

In this project, we aimed to investigate marine flora and continuing alterations on biodiversity in Ilıca Bay where tourism, pollution and climate change, seriously stress the enviroment. Previous papers about Aegean Sea Flora from 1966 to 2007 (Aysel et al., 1977a; Aysel and Güner, 1977b; Aysel and Güner, 1978; Aysel and Güner, 1979a; Aysel, 1979b; Aysel and Güner, 1980; Aysel, 1983; Aysel et al., 1983; Aysel, 1984a, Aysel et al., 1984b; Aysel and Güner, 1985; Aysel et al., 1986a; Aysel and Güner, 1986b; Aysel et al., 1994; Aysel et al., 2002; Cirik and Akçalı, 2002; Dural, 1990; Dural, 1995; Ertan et al., 1998; Güner, 1970; Güner, 1976; Güner and Aysel, 1977a; Güner and Aysel, 1977b; Güner and Aysel, 1978a; Güner and Aysel, 1978b; Güner and Aysel, 1979a; Güner, 1979b; Güner et al., 1983; Güner and Aysel, 1984; Güner et al., 1985; Güner et al., 1994; Öztürk and Güner, 1985; Parlakay et al., 2005; Sukatar, 1983; Sukatar et al., 1985a; Sukatar et al., 1992; Sukatar et al., 1994a; Sukatar, 1994b; Zeybek et al., 1983; Zeybek, 1966; Zeybek and Güner, 1973a; Zeybek, 1973b) were overviewed and compared with last data to find out entity or absence of species and the differenciations of the small scale areas flora with whole Aegean Sea within the Project.

* *Corresponding author* / Haberleşmeden sorumlu yazar: zderya.yildirim@gmail.com

1.1. Geographical properties of the Ilıca Bay

Ilıca Bay is located in the north of the Çeşme Peninsula in İzmir. It is vey famous with its beach and hot springs. It is an important holiday destination. The coastline is about 12 km (Figure 1). Two peninsulas shelter Ilıca Bay from fierce weather conditions. Coastal resources like hot springs, sheltered places and substrate varieties made Ilıca Bay is an important place for floral biodiversity.

1.2 Threats on the bay

Tourism has serious adverse impacts on marine biodiversity in Ilıca Bay. Famous with white sandy beach, touristic operations located on the coast rip seagrasses and other algae off at the beginning of the holiday season. The other threat is a harbour located on the west of the bay. The discharched and accidental bilge waters from boats pollute the bay.

Figure 1. Map of Ilıca Bay. *1: ODTÜ Houses, 2: North of Venus Houses, 3: South of Venus Houses, 4: North of TANAY Camping, 5: TANAY Camping, 6: Sheraton Hotel, 7: Breakwater (inside), 8: Breakwater (outside), 9: Yıldız Cape, 10: Altın Yunus Hotel*

2. Materials and methods

In the workspace, 10 locations were choosen. Locations were visited periodically from June 2007 to June 2008. Physical and chemical coastal parameters (temperature and pH) measured with WTW Oxi 315 and samples were collected at the fololowing dates; 06-08-2007, 02-10-2007, 12-10-2007, 19-10-2007, 01-02-2008, 06-04-2008. Also the dissolved oxygen measurements done but because of the calibration problems they eliminated.

Samples were collected by means of SCUBA diving and along the shallow costline. Important parameters that has role on algae growth, were measured (Table 1). The collected samples conserved in 40% formaldehyde and sea water solution. Some of the samples were taxonomically classified when they were fresh and some of them were preserved to designate later. Determination of the species carried out according to macroscobic and microscobic characteristics and compared with previous studies. The physically eligible samples added to the herbarium in dry or wet condition. The samples were photographed with photomicroscopi techniques and archived.

4. Results

As a result, 12 *Cyanophyta*, 32 *Rhodophyta*, 13 *Phaeophyta*, 9 *Chlorophyta* and 2 *Magnoliophyta* members, totally 68 taxon were investigated. Distribution of the species according to the location is given at Table 2. The coastal measurements and the substrate properties of the survey locations are given at Table 1. Comparison of the recorded algae with past studies given at Table 3.

On February 1st, 2008 the tide were observed at about 45- 50 cm which is unusual for the area.
We overviewed the previous studies from 1966 to 2005, between Cape Teke and Çandarlı Bay. There were ***225*** *Rhodophyta, 89 Phaeophyta, 82 Chlorophyta, 5 Magnoliophyta* members found in past studies(Aysel et al., 1977a; Aysel and Güner, 1977b; Aysel and Güner, 1978; Aysel and Güner, 1979a; Aysel, 1979b; Aysel and Güner, 1980; Aysel, 1983; Aysel et al., 1983; Aysel, 1984a, Aysel et al., 1984b; Aysel and Güner, 1985; Aysel et al., 1986a; Aysel and Güner, 1986b; Aysel et al., 1994; Aysel et al., 2002; Cirik and Akçalı, 2002; Dural, 1990; Dural, 1995; Ertan et al., 1998; Güner, 1970; Güner, 1976; Güner and Aysel, 1977a; Güner and Aysel, 1977b; Güner and Aysel, 1978a; Güner and Aysel, 1978b; Güner and Aysel, 1979a; Güner, 1979b; Güner et al., 1983; Güner and Aysel, 1984; Güner et al., 1985; Güner et al., 1994; Öztürk and Güner, 1985; Parlakay et al., 2005; Sukatar, 1983; Sukatar et al., 1985a; Sukatar et al., 1992; Sukatar et al., 1994a; Sukatar, 1994b; Zeybek et al., 1983; Zeybek, 1966; Zeybek and Güner, 1973a; Zeybek, 1973b). First observation of ***Cyanophyta*** members (indicators of the pollution) in Aegean Sea was done by Güner, H., Aysel, V., Sukatar, A., Öztürk, M. in 1985. According to the past literatures, it seems that number of observed Cyanophyta species have been increasing year by year. This increasing on the species can be explain in two way. Either the biological dispersing increasing year by year or maybe due to the incerasing researchers and studies on marine algae, the Cyanophyta species seems that increasing year by year. In our field, we observed Cyanophyta members with low variety but with big batches that were covered all the macroalgae and seagrass beds during the study(Figure 2).

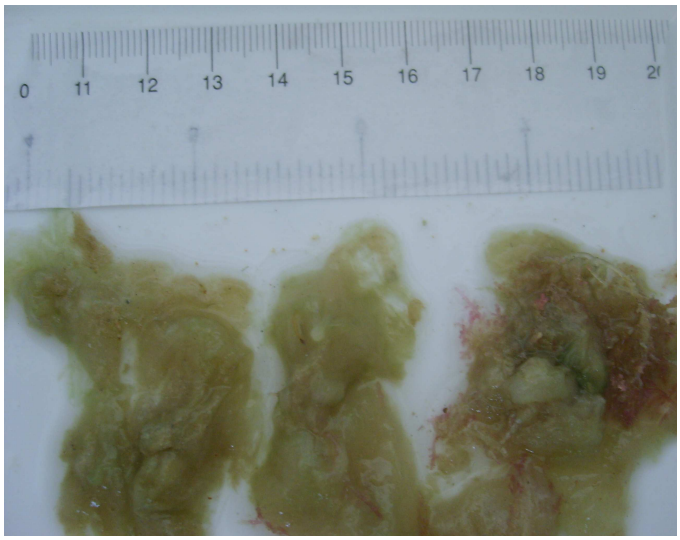

Figure 2. Blue-green algae batches, covering the Posidonia sp. beds and the other macroalgae. Photographer Z. Derya YILDIRIM.

4. Conclusions

This study reveals the differenciation of the algal growth in small scale places depending to the shoreline conditions. Also the study gives rise to thought about human pressure effects at the shorelines. The most persiasive evidence of human pressure effects by pollution is the blue-green algae batches, covering the *Posidonia sp.* beds and the other macroalgae (Figure1).

The comparison of the results of this study and the previous ones shows that there is a considerably difference in algal biodiversity. There are 333 species couldn't observed which constitute %84 of the whole flora in the Aegean Sea according to the past literatures (Aysel et al., 1983-1984., Güner et al., 1983-1984).
Maximum diversity was observed at tenth, fourth and first locations. These three locations have some common properties that supports algal growth. Substrates of these places have more rocky areas then the other locations. There is a five star hotel at the tenth location. It means more nutrients that emits to the sea. Fourth place is rich with nutrients because of the residential buildings. As well the first location is open to the streams whereat the nutrients that can come from Gediz River and Gulf of İzmir.

Table 1. Measurement results and substrate properties of stations. *1: ODTÜ Houses, 2: North of Venus Houses, 3: South of Venus Houses, 4: North of TANAY Camping, 5: TANAY Camping, 6: Sheraton Hotel, 7: Breakwater (inside), 8: Breakwater (outside), 9: Yıldız Cape, 10: Altın Yunus Hotel*

Stations	Substrate	Species	Coordinates		Temperature			pH		
					1/2/2008	6/4/2008	31/5/2008	1/2/2008	6/4/2008	31/5/2008
					°C					
1	Rocky coast, sandy substrate.	28 Taxon	38° 20' 59.60" N	26° 23' 06.63"E	14	15.7	16.4	8.06	7.95	7.5
2	Sandy shore, rocky subsrate at southest of location.	21 Taxon	38° 19' 49.43" N	26° 23' 16.68"E	15.1	16.1	17.2	8.03	7.71	7.8
3	Rocky.	11 Taxon	38° 19' 49.31" N	26° 23' 16.71"E	14.4	15.7	16	8	8.03	7.9
4	Rocky coast, sandy substrate.	31 Taxon	38° 18' 43.10" N	26° 22' 52.77"E	15	16.2	17.5	7.9	7.77	8.1
5	There aren't any rocks except reclaimed areas. Patchy natural rocks, followed sand and sandstone substrate.	6 Taxon	38° 18' 39.24" N	26° 22' 54.37"E	14.4	15.9	17.4	7.95	7.7	7.75
6	Concrete waterfront. Mixture of sandy and rocky substrate at littoral zone.	17 Taxon	38° 18' 32.49" N	26° 21' 40.29"E	15.9	15.5	16	7.91	7.2	7.83
7	Breakwater, sandy bottom.	3 Taxon	38° 18' 48.60" N	26° 21' 36.55"E	36	30	37	6.54	6.91	6.5
8	Breakwater, sandy bottom.	22 Taxon	38° 18' 49.74" N	26° 21' 33.66"E	16	16.8	17.8	7.89	7.45	7.8
9	Naturally sand and articial rocks.	27 Taxon	38° 18' 50.99" N	26° 21' 16.88"E	15.5	16.2	17	7.98	7.23	7.85
10	Mixture of sandy and rocky substrate at littoral zone	37 Taxon	38° 19' 29.50" N	26° 20' 41.28"E	14.5	16.2	16.9	7.5	7.73	7.3

Table 2. Distribution of the species according to the location

	1	2	3	4	5	6	7	8	9	10
ALGAE										
CYANOBACTERIA										
Calothrix aeruginea	√	**x**	**x**	**x**	**x**	**x**	**x**	**x**	**x**	**x**
Chroococcus macrococcus	**x**	**x**	**x**	**x**	**x**	**x**	**x**	**x**	√	**x**
Lyngbya majuscula	**x**	**x**	√	√	**x**	**x**	**x**	**x**	**x**	**x**
Lyngbya sp. 1	√	√	√	√	**x**	√	√	√	√	√
Lyngbya sp. 2	√	√	**x**	√	**x**	√	**x**	√	√	**x**
Merismopedia glauca	**x**	**x**	**x**	**x**	**x**	**x**	**x**	**x**	**x**	√
Microcoleus codii	**x**	**x**	**x**	**x**	**x**	**x**	**x**	**x**	**x**	√
Oscillatoria sp. 1	√	√	**x**	√	**x**	√	√	√	√	√
Oscillatoria sp. 2	√	√	**x**	√	**x**	**x**	**x**	**x**	√	√
Rivularia atra	√	**x**	**x**	**x**	**x**	**x**	**x**	**x**	**x**	√

Table 2. (Continue)

Rivularia sp.	x	√	x	√	x	x	√	x	x	√
Schizothrix sp.	x	x	x	x	x	x	x	√	x	x
CHLOROPHYTA										
Anadyomene stellata	√	x	√	√	x	x	x	x	√	√
Caulerpa racemosa	√	x	x	x	x	x	x	x	x	x
Cladophora sp.	√	x	√	√	x	x	x	√	√	√
Dasycladus vermicularis	x	x	√	x	x	x	x	x	√	√
Halimeda tuna	√	√	√	√	√	√	x	√	√	√
Pedobesia lamourouxii	x	x	x	x	x	x	x	√	x	x
Sphaeroplea brauni	x	x	x	x	x	x	x	√	x	x
Ulothrix sp.	x	x	x	√	x	x	x	x	x	√
Valonia utricularis	x	√	x	√	√	x	x	√	x	√
PHAEOPHYTA										
Cystoseira crinita	x	√	x	√	√	x	x	√	√	√
Cystoseira discors	x	x	x	x	x	x	x	x	√	√
Cystoseira elegans	x	x	x	√	x	x	x	x	x	x
Cystoseira fimbriata	√	x	√	√	x	√	x	√	√	x
Cystoseira mediterranea	√	x	√	√	x	x	x	√	x	√
Dictyota dichotoma	√	x	x	√	x	x	x	x	√	√
Dictyota dichotoma var. implexa	√	x	x	x	x	x	x	x	x	x
Dilophus fasciola	√	x	x	√	x	x	x	x	x	√
Dilophus spiralis	√	x	x	x	x	x	x	x	x	x
Halopteris filicina	x	x	x	x	x	√	x	x	x	x
Padina pavonia	√	√	√	√	√	√	x	√	√	√
Sargassum vulgare	√	x	x	x	x	x	x	x	x	x
Sphacelaria cirrosa	√	x	√	√	x	√	x	√	√	√
RHODOPHYTA										
Achrahoetium virgatilum	x	x	√	x	x	x	x	x	x	x
Amphiroa rigida	√	x	x	x	x	x	x	x	x	√
Anotrichium tenue	x	x	x	√	x	x	x	x	x	x
Audouinella membranacea	x	x	x	√	x	√	x	x	√	√
Bangia sp.	x	x	x	x	x	x	x	√	x	x
Botryocladia botryoides	x	x	x	√	x	x	x	x	x	x
Centroceras clavulatum	√	x	√	x	x	x	x	x	x	x
Ceramium circinatum	x	x	x	x	x	x	x	√	√	x
Ceramium diaphnum	x	x	x	x	x	x	x	x	√	√
Ceramium flaccidium	x	x	x	√	x	x	x	x	x	x
Ceramium sp	√	x	√	√	x	x	x	√	x	√
Chlocladia verticillata	x	x	√	x	x	x	x	x	x	x
Chondria dasyphylla	x	x	√	x	x	x	x	x	x	x
Chondria sp.	x	x	x	x	x	x	x	x	x	√
Corallina granifera	x	x	x	x	x	x	x	x	x	√
Corallina officinalis	x	x	x	x	x	x	x	x	x	√
Corallina sp.	√	x	x	x	x	x	x	x	x	x
Dasya corymbifera	x	x	x	x	x	x	x	x	x	√
Erythrotrichia carnea	x	x	√	√	x	√	x	√	√	√
Herposiphonia tenella	x	x	√	x	x	x	x	x	x	x
Hydrolithon farinosum	x	x	x	√	x	x	x	x	x	x
Jania rubens	√	√	√	√	√	√	x	√	√	√

Table 2. (Continue)

Laurencia obtusa	√	**x**	√	√	**x**	√	**x**	√	√	√
Laurencia paniculata	**x**	**x**	**x**	√	**x**	**x**	**x**	**x**	**x**	**x**
Laurencia papillosa	**x**	**x**	√	**x**	**x**	√	**x**	√	√	**x**
Lithothamnion lenormandi	**x**	**x**	**x**	**x**	**x**	**x**	**x**	**x**	**x**	√
Melobesia membranacea	**x**	**x**	**x**	**x**	**x**	**x**	**x**	**x**	**x**	√
Melobesia sp.	√	**x**	**x**	**x**	**x**	√	**x**	√	√	√
Polysiphonia atra	**x**	**x**	√	√	**x**	**x**	**x**	**x**	**x**	**x**
Polysiphonia sp.	√	**x**	**x**	√	**x**	**x**	**x**	√	√	√
Spyridia flamentosa	**x**	**x**	**x**	**x**	**x**	√	**x**	**x**	**x**	√
Spyridia sp.	**x**	**x**	**x**	**x**	**x**	√	**x**	**x**	√	**x**
MAGNOLIOPHYTA										
Posidonia oceanica	√	√	**x**	**x**	√	**x**	**x**	**x**	√	**x**
Zostera marina	**x**	**x**	**x**	**x**	**x**	**x**	**x**	**x**	**x**	√

Minimum diversity was observed at seventh and fifth locations. There is a clear explanation of the extreme lacking of the algae at this place. There are lots of hot springs inside of the breakwater. Because of this hot conditions it is imposible to be alive for algae beds. Only the thermophilic *Cyanobacteria* species was observed at this location. The other poor location in terms of algae is fifth one. This place was generally covered by sandy substrates. This condition is not eligible for algae to hold on to the substrate, so this explains the lacking of algae.

Lots of variables like temperature, pH, salinity, light intensity, suspended particles, nutrients, streams etc. effect on algal growth, distribution and diversity. These variables are constituted by local coastal and geographical parameters(Geldiay and Kocataş 2001). In this study because of the insufficiency of field measurement equipments, lots of important variable couldn't measured. That's why it is a necessity to work on a wide scale area with high-tech equipments to collect more precise data to observe local algal habitat conditions to monitor decreasing or increasing of the species. Ilıca Bay was a pilot project area and first spark for the follow-up projects.

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Table 3. Comparison of the recorded algae with past studies. √: Existing, x: Absent, √-NR: New Recorderd, ?: Incomparable (Unknown Species). (Aysel et al., 1977a; Aysel and Güner, 1977b; Aysel and Güner, 1978; Aysel and Güner, 1979a; Aysel, 1979b; Aysel and Güner, 1980; Aysel, 1983; Aysel et al., 1983; Aysel, 1984a, Aysel et al., 1984b; Aysel and Güner, 1985; Aysel et al., 1986a; Aysel and Güner, 1986b; Aysel et al., 1994; Aysel et al., 2002; Cirik and Akçalı, 2002; Dural, 1990; Dural, 1995; Ertan et al., 1998; Güner, 1970; Güner, 1976; Güner and Aysel, 1977a; Güner and Aysel, 1977b; Güner and Aysel, 1978a; Güner and Aysel, 1978b; Güner and Aysel, 1979a; Güner, 1979b; Güner et al., 1983; Güner and Aysel, 1984; Güner et al., 1985; Güner et al., 1994; Öztürk and Güner, 1985; Parlakay et al., 2005; Sukatar, 1983; Sukatar et al., 1985a; Sukatar et al., 1992; Sukatar et al., 1994a; Sukatar, 1994b; Zeybek et al., 1983; Zeybek, 1966; Zeybek and Güner, 1973a; Zeybek, 1973b).

	YEARS OF THE PRESSED LITERATURES																						
	1966	**1970-1975**	**1976**	**1977**	**1978**	**1979**	**1980**	**1981**	**1982**	**1983**	**1984**	**1985**	**1986**	**1987-1989**	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996-2004**	**2005**	**2006**	**2007**	**2008**
ALGAE																									
CYANOBACTERIA																									
Calothrix aeruginea	X	NO STUDY	X	X	X	X	X	NO STUDY	X	X	X	√	X	NO STUDY	X	NO STUDY	X	NO STUDY	X	√	NO STUDY	√	X	X	√
Chroococcus macrococcus	X		X	X	X	X	X		X	X	X	X	X		X		X		X	X		√	X	X	√
Lyngbya majuscula	X		X	X	X	X	X		X	X	X	X	X		X		X		√	√		√	X	X	√
Lyngbya sp. 1	?		?	?	?	?	?		?	?	?	?	?		?		?		?	?		?	?	?	√
Lyngbya sp. 2	?		?	?	?	?	?		?	?	?	?	?		?		?		?	?		?	?	?	√
Merismopedia glauca	X		X	X	X	X	X		X	X	X	X	X		X		X		X	X		√	X	X	√
Microcoleus codii	X		X	X	X	X	X		X	X	X	√-NR	X		X		X		X	√		X	X	X	√
Oscillatoria sp. 1	?		?	?	?	?	?		?	?	?	?	?		?		?		?	?		?	?	?	√
Oscillatoria sp. 2	?		?	?	?	?	?		?	?	?	?	?		?		?		?	?		?	?	?	√
Rivularia atra	X		X	X	X	X	X		X	X	X	√	X		X		X		X	√		√	X	√	√
Rivularia sp.	?		?	?	?	?	?		?	?	?	?	?		?		?		?	?		?	?	?	√
Schizothrix sp.	X		X	X	X	X	X		X	X	X	X	X		X		X		X	X		X	X	X	√
CHLOROPHYTA																									
Anadyomene stellata	X	NO STUDY	√	X	X	X	X	NO STUDY	X	√	√	√	X	NO STUDY	X	NO STUDY	X	NO STUDY	√	X	NO STUDY	√	X	√	√
Caulerpa racemosa	X		X	X	X	X	X		X	X	X	X	X		X		X		X	X		√	X	X	√
Cladophora sp.	?		?	?	?	?	?		?	?	?	?	?		?		?		?	?		?	?	?	√
Dasycladus vermicularis	X		X	X	X	X	X		X	√	√	√	X		X		√		√	X		√	X	√	√
Halimeda tuna	√		X	X	X	√	√		X	√	√	√	X		X		X		X	X		√	X	√	√
Pedobesia lamourouxii	X		X	X	X	X	X		X	√	√	√	X		X		X		X	X		X	X	X	√
Sphaeroplea brauni	X		X	X	X	X	X		X	√	√	X	X		X		X		X	X		X	X	X	√
Ulothrix sp.	?		?	?	?	?	?		?	?	?	?	?		?		?		?	?		?	?	?	√
Valonia utricularis	X		√	X	X	X	X		X	√	√	X	X		X		X		√	X		√	X	X	√

Table 3. (Continue)

PHAEOPHYTA																								
Cystoseira crinita	X	NO STUDY	X	X	X	√	X	NO STUDY	X	√	√	√	X	NO STUDY	X	NO STUDY	√	NO STUDY	√	X	NO STUDY	√	X	X	√
Cystoseira discors	X		X	X	√	X	X		X	√	√	X	X		X		X		X	X		X	X	X	√
Cystoseira elegans	X		X	X	X	X	X		X	X	X	√	X		X		X		√	X		√	X	√	√
Cystoseira fimbriata	X		X	X	√	√	√		X	√	√	√	X		X		X		X	X		√	X	√	√
Cystoseira mediterranea	X		X	X	X	X	X		X	X	X	X	X		X		X		X	X		√	X	X	√
Dictyota dichotoma	√		√	X	√	√	√		X	√	√	√	X		X		√		√	X		√	X	√	√
Dictyota dichotoma var. implexa	?		?	?	?	?	?		?	?	?	?	?		?		?		?	?		?	?	?	√
Dilophus fasciola	X		X	X	X	X	√		X	√	√	√	X		X		X		√	X		X	X	X	√
Dilophus spiralis	X		X	X	X	X	X		X	√	√	X	X		X		X		X	X		X	X	X	√
Halopteris filicina	X		X	X	X	X	X		X	√	√	√	X		X		X		√	X		√	X	X	√
Padina pavonia	√		√	√	√	√	√		X	√	√	√	√		X		√		√	X		√	X	√	√
Sargassum vulgare	X		X	X	X	√	X		X	√	√	√	X		X		X		√	X		√	X	X	√
Sphacelaria cirrosa	X		X	X	X	√	X		X	√	√	√	X		X		X		√	X		√	X	X	√
RHODOPHYTA																									
Achrahoetium virgatilum	X	NO STUDY	X	X	X	X	X	NO STUDY	X	√	√	X	X	NO STUDY	X	NO STUDY	X	NO STUDY	X	X	NO STUDY	X	X	X	√
Amphiroa rigida	X		X	√	X	√	X		X	√	√	X	X		X		X		√	X		√	X	√	√
Anotrichium tenue	X		X	X	X	X	X		X	X	X	X	X		X		X		X	X		√	X	X	√
Audouinella membranacea	X		X	X	X	X	X		X	√	√	X	X		X		X		X	X		X	X	X	√
Bangia sp.	?		?	?	?	?	?		?	?	?	?	?		?		?		?	?		?	?	?	√
Botryocladia botryoides	X		X	X	X	X	X		X	√	√	X	X		X		X		√	X		√	X	X	√
Centroceras clavulatum	X		X	X	X	X	X		X	X	X	X	X		X		X		√	X		X	X	X	√
Ceramium circinatum	X		X	X	X	√	X		X	√	√	X	X		X		X		X	X		√	X	X	√
Ceramium diaphnum	X		X	√	√	√	√		X	√	√	X	X		X		X		X	X		√	X	X	√
Ceramium flaccidium	X		X	X	X	X	X		X	X	X	X	X		X		X		X	X		√	X	X	√
Ceramium sp	?		?	?	?	?	?		?	?	?	?	?		?		?		?	?		?	?	?	√
Chlocladia verticillata	X		X	X	X	X	X		X	√	√	X	X		X		X		X	X		X	X	X	√
Chondria dasyphylla	X		X	X	X	X	X		√	√	√	X	X		X		X		√	X		√	X	√	√
Chondria sp.	?		?	?	?	?	?		?	?	?	?	?		?		?		?	?		?	?	?	√
Corallina granifera	X		X	X	√	√	X		X	√	√	X	X		X		X		X	X		X	X	X	√
Corallina officinalis	X		X	√	X	X	√		X	X	√	√	X		X		X		X	X		√	X	X	√
Corallina sp.	?		?	?	?	?	?		?	?	?	?	?		?		?		?	?		?	?	?	√

Table 3. (Continue)

Dasya corymbifera	X		X	X	X	√	X		X	X	√	√	X		X		X		√	X		X	X	X	√
Erythrotrichia carnea	X		X	X	X	X	X		X	X	√	√	X		X		X		X	X		√	X	X	√
Herposiphonia tenella	X		X	X	X	X	X		X	X	√	√	X		X		X		X	X		X	X	X	√
Hydrolithon farinosum	?		?	?	?	?	?		?	?	?	?	?		?		?		?	?		?	?	?	√
Jania rubens	X		X	X	√	√	√		X	√	√	X	X		X		√		√	X		√	X	√	√
Laurencia obtusa	X		√	√	X	√	X		X	√	√	X	X		X		X		√	X		√	X	√	√
Laurencia paniculata	X		X	X	X	X	X		X	√	√	X	X		X		X		X	X		X	X	X	√
Laurencia papillosa	X		X	√	√	X	X		X	√	√	X	X		X		X		√	X		X	X	X	√
Lithothamnion lenormandi	X		X	X	X	√	X		X	X	X	X	X		X		X		X	X		X	X	X	√
Melobesia membranacea	X		X	X	X	X	X		X	√	√	X	X		X		X		√	X		√	X	X	√
Melobesia sp.	?		?	?	?	?	?		?	?	?	?	?		?		?		?	?		?	?	?	√
Polysiphonia atra	X		X	X	X	X	X		X	√-NR	√	X	X		X		X		X	X		√	X	X	√
Polysiphonia sp.	?		?	?	?	?	?		?	?	?	?	?		?		?		?	?		?	?	?	√
Spyridia flamentosa	X		X	√	X	√	X		X	√	√	X	X		X		X		√	X		X	X	X	√
Spyridia sp.	?		?	?	?	?	?		?	?	?	?	?		?		?		?	?		?	?	?	√
MAGNOLIOPHYTA																												
Posidonia oceanica	X		√	X	X	√	X	NO STUDY	X	X	X	√	X	NO STUDY	X	NO STUDY	X	NO STUDY	X	X	NO STUDY	√	X	√	√
Zostera marina	X		√	X	X	√	X		X	X	X	√	X		X		X		X	X		√	X	X	√

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