

Benthic marine flora of Kornati National Park (Kornati Archipelago, Middle Adriatic, Croatia)

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A check list of the marine benthic flora of Kornati National Park (Kornati Archipelago, Middle Adriatic) was compiled on the basis of long-term personal collections and sparse bibliographical data. The list includes 352 specific and infraspecific taxa of algae (225 Rhodophyta, 75 Phaeophyta, 52 Chlorophyta) and 3 species of seagrasses, of which 255 are reported from the archipelago for the first time. The R/P ratio of 3 indicates a sub-tropical flora. The flora is analyzed in terms of its phytogeographical components.

INTRODUCTION

The benthic marine algae and seagrasses of the Kornati Archipelago have been studied sporadically and therefore have remained almost unknown. VOUK (1930) collected algae along parts of the coast of some islets (Obručan Mali, Obručan Veli and Borovnik) and of the island Kornat during his biological research of the mid-Dalmatian islands in May 1925. He collected from deeper bottoms, between the islets Gustac and Klobučar, and along the coast of Lavernaka by dredge.

Since the samplings were sporadic, as stated by VOUK himself, only 47 specific and infraspecific taxa were collected (13 *Chlorophyceae*, 9 *Phaeophyceae* and 25 *Rhodophyceae*). Reports of some algal species from the Kornati Archipelago may be found but rarely in papers by ERCEGOVIĆ (1949, 1952, 1955 a, 1955 b, 1956, 1963). ANTOLIĆ (1985) identified 59 epiphytic algae on the leaves of *Posidonia oceanica* from the Kornati Archipelago during spring and summer. No

complete floristic study of the archipelago has been made previous to the present investigation.

In 1979, we started a program of sampling the benthic algae and seagrasses of the rocky shores of Kornat Island, the cliffs of smaller outer islands and the bottoms around them as part of a study of the marine flora and fauna of Kornati National Park. The vertical and horizontal distribution of the benthic flora was preliminarily described by ŠPAN and ANTOLIĆ (1990). A check list of all benthic marine algae and seagrasses known from the park is presented here.

MATERIAL AND METHODS

This investigation was carried out between 1979 and 1989. The benthic flora was sampled mainly by SCUBA diving at shallow depths and by dredging at greater depths (50.-100 m).

Algal material was collected from a large number of stations along the transects from the supralittoral to the circalittoral zone (disting-

tion made by PÉRÈS and PICARD, 1958). A number of transects were located along the coasts of outer islands and reefs (Purara, Volić, Ravni Žakan, Kameni Žakan, Lunga, Lavsa, Panitula Mala, Piškera, Rašip Veli, Rašip Mali, Mana, Pleščina, Obručan Veli, Obručan Mali) and the coves Prisluga, Stinjiva, Zala Draga and Vrulja on Kornat Island and in Lojena cove on Lavernaka Island. Collections were carried out also at submarine cliffs, submarine sills, reefs and deeper mobile bottoms and well developed coralligenous bottoms near the above mentioned outer islands (Fig. 1). In compiling the inventory of benthic flora, sparse bibliographical were used too.

For categorization and identification of higher taxonomic categories (classes and orders) the classification by PARKE and DIXON (1976), BOUDOURESQUE *et al.* (1984), BOUDOURESQUE and PERRET-BOUDOURESQUE (1987), Hoek *et al.* (1988), PERRET-BOUDOURESQUE and SERIDI (1989) and RIBERA *et al.* (1992) was used. For determination of collected algal material the following references

was consulted: HAUCK (1885), ERCEGOVIĆ (1948, 1949, 1952, 1955 a, 1955 b, 1956, 1957, 1963), FELDMANN (1942), FELDMANN-MAZOYER (1940), FUNK (1927, 1955), HAMEL (1931-1939), HAMEL and LEMOINE (1952), KYLIN (1956), BLIDING (1960, 1963, 1968), HOEK (1963), GIACCONE (1972-1973, 1978), GIACCONE and BRUNI (1973), GIACCONE and BRYCE-DERNI (1972), BRESSAN (1974), CODOMIER (1971), BOUDOURESQUE and DENIZOT (1975), KORNMANN and SAHLING (1977), COPPEJANS (1983), ZINOVA (1967).

We modified slightly the schema proposed by GIACCONE *et al.* (1985) for delineating phytogeographic regions of benthic algae and seagrasses, as follows: M (Mediterranean), A (Atlantic including Ab - Atlantic-boreal, At - Atlantic-tropical and Abt - Atlantic-boreal-tropical taxa), C (cosmopolitan), SC (subcosmopolitan), AP (Atlantic-Pacific including APo - holo Atlantic-Pacific, APt - Atlantic-Pacific-tropical and APtc - Atlantic-Pacific-tropical-cold), IA (Indo-Atlantic including IAo - holo Indo-Atlantic, IAAt - Indo-Atlantic-tropical and IAAtc -

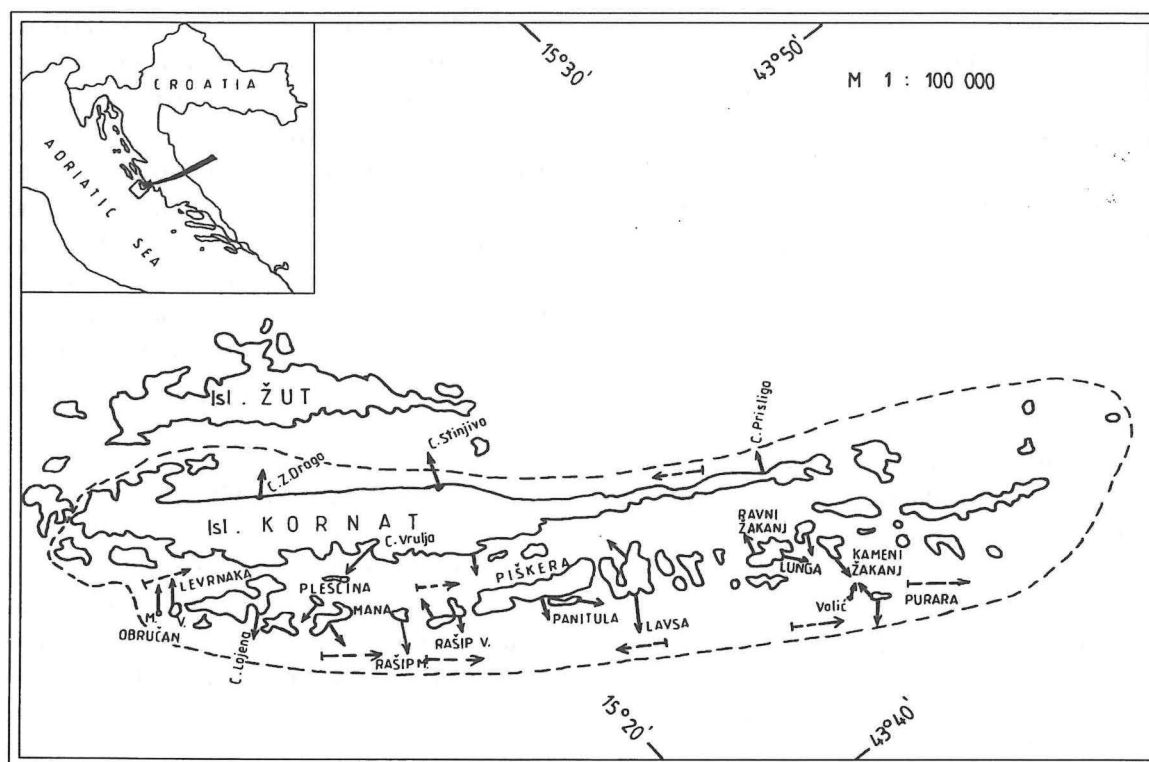


Fig. 1. Map of investigations in the Kornati National Park

----- border of Kornati National Park ———> transects - - - - -> dredging

Indo-Atlantic-tropical-cold taxa), IP (Indo-Pacific), CB (circumboreal), CT (circumtropical) and EAD (endemic-Adriatic).

RESULTS AND DISCUSSIONS

The benthic flora consists of 352 specific and infraspecific taxa of macroalgae and 3 species of seagrasses. Algae were separated in four classes: Bangiophyceae, Florideophyceae, Fucophyceae and Chlorophyceae with a total of 28 orders and 177 genera (see ANEX).

The benthic flora is dominated by representatives of the division Rhodophyta (Bangiophyceae and Florideophyceae) with a 186 species, 32 varieties, 5 forms and 2 stages or 63.9%. Phaeophyta (Fucophyceae) represented by a smaller number of taxa (55 species, 2 subspecies, 11 varieties, 5 forms and 2 stages) with a lower percentage (21.3%), while Chlorophyta (Chlorophyceae) are represented by 47 species, 2 varieties, 2 forms and 1 stage of 14.8%. This inventory is not complete since some genera, such as *Audouinella*, *Lithophyllum*, *Lithohamnion*, *Polysiphonia* (Rhodophyta), *Ectocarpus* (Phaeophyta) and *Cladophora* (Chlorophyta) have not yet been completely worked out. A comparison of the benthic flora of Kornati Archipelago with the flora of islands Vis and Biševo (ŠPAN, 1980) and islet Jabuka (ERCEGOVIĆ, 1957) in the open middle Adriatic showed that the flora of Kornati is poorer than that of Vis and Biševo, and slightly richer than that of the islet of Jabuka (Table 1). To be noted that while the number of Chlorophyta in the three floras is quite similar, some differences do exist in the number of Phaeophyta: greater between the flora of Kornati and that of Vis-Biševo, much lower between Kornati and Jabuka floras; on the contrary, a great difference in the number of Rhodophyta does exist between the flora of Kornati and that of Jabuka (considerably lower between Kornati and Vis-Biševo floras).

The comparison based on per cent values (Table 1), shows increasing values of Rhodophyta from Jabuka (55.2 %) to Vis-Biševo (58.8 %), with the highest in Kornati Islands

(63.9 %); increasing values of Phaeophyta from Kornati (21.3%) to Vis-Biševo (26.6 %), with the highest in Jabuka (28.7 %); while values of Chlorophyta are rather similar in the three areas, with a slightly higher values (16.4 %) in Jabuka.

Table 1. Numbers (N) and percentages (%) of Rhodophyta, Phaeophyta and Chlorophyta members and R/P ratios calculated for floras of Kornati, Vis-Biševo and Jabuka.

Area Division	Kornati		Vis-Biševo		Jabuka	
	N	%	N	%	N	%
RHODOPHYTA	225	63.9	237	58.8	148	55.0
PHAEOPHYTA	75	21.3	107	26.6	77	28.6
CHLOROPHYTA	52	14.8	59	14.6	44	16.4
T O T A L	352		403		269	
R/P	3.0		2.2		1.9	

The differences in the R/P ratio (Table 1) and in the chorological spectra (Table 2) point out different phytogeographic characters of three benthic floras. The R/P ratio (3.0) in the Kornati benthic flora is rather high, and in any case higher than those of Vis-Biševo (2.2) and Jabuka (1.9). The ratio obtained for benthic flora of Kornati Archipelago is that of a subtropical flora. On the contrary, low ratio values obtained for Vis-Biševo and particularly for Jabuka benthic flora, suggest almost boreal character.

Benthic flora of Kornati Islands, like that of the Adriatic Sea, is not unique, but composed of floristic elements from different phytogeographic regions (Table 2). The best represented floristic elements are the Atlantic (A) with 123 taxa or 34.6 %, followed by the Mediterranean (M) with 96 taxa or 27.0 % and the cosmopolitan (C) and sub-cosmopolitan (SC) with a total of 60 taxa or 16.9 %.

A comparison of chorological spectra of the three benthic floras was also made (Table 2). To be noted that the endemic-Adriatic element shows the lowest percentage value (3.4 %) in the Kornati area (9.9 % and 12.2 % in Vis-Biševo and Jabuka respectively). The Atlantic and Mediterranean floristic elements dominate all three surveyed areas.

Table 2. Numbers (N) and percentages (%) of members of different phytogeographic elements in the benthic floras of Kornati, Vis-Biševo and Jabuka.

Division		RHODOPH.		PHEOPH.		CHLOROPH.		ANGIOS.		T O T A L	
Phyt. elem.	Area	N	%	N	%	N	%	N	%	N	%
M	Kornati	59	16.6	28	7.9	7	2.0	1	0.3	96	27.0
	Vis-Biševo	58	14.3	31	7.7	10	2.5	1	0.2	100	24.7
	Jabuka	40	14.8	28	10.4	8	3.0	1	0.4	77	28.5
A	Kornati	81	22.8	15	4.7	25	7.0	2	0.6	123	34.6
	Vis-Biševo	97	24.0	19	4.7	23	5.7	1	0.2	140	34.6
	Jabuka	58	21.5	17	6.3	17	6.3	-	-	92	34.1
AP	Kornati	14	3.9	7	2.0	7	2.0	-	-	28	7.9
	Vis-Biševo	10	2.5	8	2.0	8	2.0	-	-	26	6.4
	Jabuka	7	2.6	6	2.2	4	1.5	-	-	17	6.3
IA	Kornati	13	3.7	4	1.1	1	0.3	-	-	18	5.1
	Vis-Biševo	11	2.7	3	0.7	2	0.5	-	-	16	4.0
	Jabuka	8	3.0	3	1.1	2	0.7	-	-	13	4.8
IP	Kornati	1	0.3	-	-	1	0.3	-	-	2	0.6
	Vis-Biševo	-	-	-	-	1	0.2	-	-	1	0.2
	Jabuka	-	-	-	-	-	-	-	-	-	-
C	Kornati	16	4.5	9	2.5	6	1.7	-	-	31	8.7
	Vis-Biševo	15	3.7	9	2.2	7	1.7	-	-	31	7.7
	Jabuka	8	3.0	4	1.5	1	0.4	-	-	13	4.8
SC	Kornati	24	6.8	5	1.4	-	-	-	-	29	8.2
	Vis-Biševo	25	6.2	7	1.7	1	0.2	-	-	33	8.1
	Jabuka	8	3.0	6	2.2	-	-	-	-	14	5.2
CT	Kornati	7	2.0	3	0.9	4	1.1	-	-	14	3.9
	Vis-Biševo	6	1.5	4	1.0	5	1.2	-	-	15	3.7
	Jabuka	2	0.7	3	1.1	3	1.1	-	-	8	3.0
CB	Kornati	2	0.6	-	-	-	-	-	-	2	0.6
	Vis-Biševo	2	0.5	1	0.2	-	-	-	-	3	0.7
	Jabuka	2	0.7	1	0.4	-	-	-	-	3	1.1
EAD	Kornati	8	2.2	4	1.1	-	-	-	-	12	3.4
	Vis-Biševo	13	3.2	25	6.2	2	0.5	-	-	40	9.9
	Jabuka	15	5.6	9	3.3	9	3.3	-	-	33	12.2
TOTAL											
Kornati		225	63.4	75	21.1	52	14.6	3	0.9	355	
Vis-Biševo		237	58.5	107	26.4	59	14.6	2	0.5	405	
Jabuka		148	54.8	77	28.5	44	16.3	1	0.4	270	

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Bentoska morska flora Nacionalnog parka "Kornati" (Kornatsko otočje, srednji Jadran, Hrvatska)

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KRATKI SADRŽAJ

U ovom se radu iznosi popis svojti bentoskih alga i morskih cvjetnica koje su do sada određene na području Nacionalnog parka "Kornati". Najveći dio svojti u ovom popisu su rezultat naših istraživanja bentoske flore tog područja, koja su obavljena između 1979. i 1989. godine.

Sabiranje fitobentoskog materijala je obavljeno s pomoću samostalnih ronilaca i drežde na brojnim postajama raspoređenih uzduž transekata položenih na čvrstim i pomičnim dnima od supralitoralne do cirkalitoralne (100 m). Transekti su bili položeni na obalama 18 vanjskih otoka i na nekoliko hridi, te u 4 uvale na otoku Kornat i u uvali Lojena na otoku Lavernaka. Sabiranja su obavljena i na podmorskim djelovima klifova, podmorskim pragovima, brakovima te na dubljim pomičnim i koraligenskim dnima oko otoka (Slika 1).

Ukupno je do sada određeno 352 svojti bentoskih alga i 3 vrste morskih cvjetnica (ANEX). Brojem i postotkom prevladavaju svojte iz odjeljka Rhodophyta (Bangiophyceae i Floridophyceae) s 225 svojti (186 vrsta, 32 odlike, 5 oblika i 2 stadija) ili 63.9%, a slijede ih svojte iz odjeljka Phaeophyta (Fucophyceae) s 75 svojti (55 vrsta, 2 podvrste, 11 odlika, 5 oblika i 2 stadija) ili 21.3% i odjeljka Chlorophyta (Chlorophyceae) s 52 svojte (47 vrsta, 2 odlike, 2 oblika i 1 stadij) ili 14.8% (Tablica 1).

Količnik R/P za bentosku floru Kornatskog otočja iznosi 3.0 i daje joj umjereno subtropski značaj. Vrijednosti tog količnika za uspoređivanje bentoske flore vanjskih otoka Visa i Biševa (2.2), i osobito Jabuke (1.9), daju tim florama gotovo borealan značaj (Tablica 1).

Od flornih su elemenata u istraživanoj bentoskoj flori najbolje zastupljeni atlantski elementi (A) s 123 svojte ili 34.6%, slijede ih mediteranski (M) s 96 svojti ili 27.0%, te kozmopolitski (C) i subkozmpolitski (SC) elementi s ukupno 60 svojti ili 16.9% (Tablica 2).

ANNEX - Check list of benthic algae and seagrasses of Kornati National Park (Croatia) with signs of their phytogeographic elements.

Taxa	Phyt. elem.
RHODOPHYTA	
BANGIOPHYCEAE	
Bangiales	
<i>Porphyra leucosticta</i> Thuret	SC
Erythropeltidales	
* <i>Erythrocladia irregularis</i> Rosevinge	C
* <i>Erythrotrichia carnea</i> (Dillwyn) J. Agardh	C
Porphyridiales	
* <i>Chroodactylon ornatum</i> (C. Agardh) Basson	C
* <i>Stylonema alsidii</i> (Zanardini) Drew	C
<i>Stylonema cornu-cervi</i> Reinsch	APo
FLORIDEOPHYCEAE	
Acrochaetiales	
* <i>Audouinella daviesii</i> (Dillwyn) Woelkerling	APo
<i>Audouinella subpinnata</i> (Hamel) Garbary	Ab
<i>Audouinella virgatula</i> (Harvey) Dixon	Ab
Bonnemaisoniales	
<i>Falkenbergia rufolanosa</i> (Harvey) Schmitz - stadium	Abt
<i>Hymenoclonium serpens</i> (Crouan et Crouan) Batters - stadium	Abt
Ceramiales	
* <i>Aglaothamnion hookeri</i> (Dillwyn) J. Feldmann	Abt
<i>Aglaothamnion caudatum</i> (J. Agardh) Feldmann-Mazoyer	M
* <i>Aglaothamnion byssoides</i> (Arnott ex Harvey in Hooker) Boudouresque et Perret-Boudouresque	Ab
<i>Aglaothamnion cordatum</i> (Börjesen) Feldmann-Mazoyer	M
* <i>Aglaothamnion tenuissimum</i> (Bonnemaison) Feldmann-Mazoyer	M
<i>Aglaothamnion tripinnatum</i> (C. Agardh) Feldmann-Mazoyer	Ab
<i>Antithamnion cruciatum</i> (C. Agardh) Nägeli	
var. <i>cruciatum</i>	Abt
* var. <i>profundum</i> Feldmann-Mazoyer	Abt
<i>Antithamnion heterocladum</i> Funk	M
* <i>Antithamnion tenuissimum</i> (Hauck) Schiffner	Ab
<i>Balliella cladoderma</i> (Zanardini) Athanasiadis	M
<i>Callithamniella tingitana</i> (Schousboe ex Bornet) Feldmann-Mazoyer	At
* <i>Callithamnion corymbosum</i> (Smith) Lyngbye	Abt
<i>Callithamnion granulatum</i> (Dulcuzeau) C. Agardh	Ab
* <i>Ceramium bertholdii</i> Funk	M
<i>Ceramium ciliatum</i> (Ellis) Ducluzeau	
* var. <i>ciliatum</i>	Ab
var. <i>robustum</i> (J. Agardh) Mazoyer	M

ANNEX. Continued

	Taxa	Phyt. elem.
	<i>Ceramium circinatum</i> (Kützinger) J. Agardh	Atc
*	<i>Ceramium codii</i> (Richards) G. Mazoyer	IAo
	<i>Ceramium comptum</i> Börgesen	Abt
	<i>Ceramium diaphanum</i> (Lightfoot) Roth	
	var. <i>diaphanum</i>	SC
	var. <i>lophophorum</i> Feldmann-Mazoyer	At
	var. <i>strictum</i> (Kützinger) Feldmann-Mazoyer	Ab
	<i>Ceramium flaccidum</i> (Harvey ex Kützinger) Ardissonne	C
*	<i>Ceramium nodosum</i> (Kützinger) Harvey	SC
*	<i>Ceramium ordinatum</i> Kützinger	M
	<i>Ceramium rubrum</i> (Hudson) C. Agardh	
	var. <i>barbatum</i> (Kützinger) Ardissonne	Ab
	<i>Ceramium tenerimum</i> (Martens) Okamura	SC
	<i>Compsothamnion thuyoides</i> (Smith) Schmitz	Abt
	<i>Crouania attenuata</i> (C. Agardh) J. Agardh	
*	var. <i>attenuata</i>	SC
	var. <i>maior</i> Ercegović	EAD
	<i>Griffithsia barbata</i> (Smith) C. Agardh	Abt
	<i>Griffithsia opuntoides</i> J. Agardh	Ab
	<i>Griffithsia phyllamphora</i> J. Agardh	M
*	<i>Griffithsia schousboei</i> Montagne	Abt
*	<i>Gulsonia nodulosa</i> (Ercegović) J. Feldmann et G. Feldmann	M
	<i>Gymnothamnion elegans</i> (Schousboe ex C. Agardh) J. Agardh	APo
*	<i>Lejolisia mediterranea</i> Bornet	CT
	<i>Monosporus pedicellatus</i> (Smith) Solier	
*	var. <i>pedicellatus</i>	APo
	var. <i>tenuis</i> (Feldmann-Mazoyer) Huisman et Kraft	M
	<i>Pleonosporium borreri</i> (Smith) Nägeli ex Hauck	Abt
	<i>Pterothamnion crispum</i> (Ducluzeau) Nägeli	SC
	<i>Pterothamnion plumula</i> (Ellis) Nägeli	
	var. <i>plumula</i>	SC
	var. <i>bebii</i> (Reinsch) Boudouresque et Perret-Boudouresque	SC
	<i>Ptilothamnion pluma</i> (Dillwyn) Thuret	Ab
	<i>Seirospora apiculata</i> (Meneghini) Feldmann-Mazoyer	M
	<i>Seirospora giraudyi</i> (Kützinger) De Toni	M
*	<i>Seirospora interrupta</i> (Smith) Schmitz	Ab
	<i>Seirospora sphaerospora</i> J. Feldmann	M
*	<i>Spermothamnion flabellatum</i> Bornet	M
*	<i>Spermothamnion johannis</i> Feldmann-Mazoyer	M
	<i>Spermothamnion repens</i> (Dillwyn) Rosevinge	
*	var. <i>repens</i>	Ab
	var. <i>flagelliferum</i> (De Notaris) Feldmann-Mazoyer	Ab
	var. <i>turneri</i> (Mertens) Miranda	Ab
	<i>Sphondilothamnion multifidum</i> (Hudson) Nägeli	Ab
*	<i>Spyridia filamentosa</i> (Wulfen) Harvey	C
*	<i>Wrangelia penicillata</i> (C. Agardh) C. Agardh	APt
*	<i>Dasya baillouviana</i> (S. G. Gmelin) Montagne	IAo
	<i>Dasya corymbifera</i> J. Agardh	Abt
*	<i>Dasya hutchinsiae</i> Harvey	Ab
*	<i>Dasya ocellata</i> (Grateloup) Harvey	Abt
	<i>Dasya punicea</i> (Zanardini) Meneghini	Ab
	<i>Dasya rigidula</i> (Kützinger) Ardissonne	Abt
	<i>Eupogodon planus</i> (C. Agardh) Kützinger	Ab
	<i>Eupogodon spinellus</i> (C. Agardh) Kützinger	Ab

ANNEX. Continued

Taxa	Phyt. elem.
<i>Halodictyon mirabile</i> Zanardini	M
* <i>Heterosiphonia crispella</i> (C. Agardh) Wynne	SC
<i>Acrosorium venulosum</i> (Zanardini) Kylin	M
* <i>Apoglossum ruscifolium</i> (Turner) J. Agardh	Atc
<i>Arachnophyllum confervaceum</i> (Meneghini) Zanardini	M
<i>Erythroglossum balearicum</i> J. Agardh ex Kylin	M
<i>Erythroglossum sandrianum</i> (Kützing) Kylin	Ab
<i>Hypoglossum hypoglossoides</i> (Stackhouse) Collins et Hervey	
var. <i>hypoglossoides</i>	Ab
f. <i>profundum</i> (Ercegović) Špan et Antolić comb. nov.	EAD
<i>Nitophyllum punctatum</i> (Stackhouse) Greville	IA
<i>Nitophyllum tristromaticum</i> Rodriguez ex Mazza	M
<i>Radicilingua thysanorhizans</i> (Holmes) Papenfuss	Ab
<i>Taenioma nanum</i> (Kützing) Papenfuss	Ab
<i>Brongniartella byssoides</i> (Goodenough et Woodward) Schmitz	Ab
<i>Chondria dasyphylla</i> (Woodward) C. Agardh	SC
* <i>Chondria tenuissima</i> (Withering) C. Agardh	IA
* <i>Dipterosiphonia rigens</i> (Schousboe ex C. Agardh) Falkenberg	At
* <i>Erithrocystis montagnei</i> (Derbès et Solier) Silva	M
<i>Halopitys incurva</i> (Hudson) Batters	Abt
<i>Herposiphonia secunda</i> (C. Agardh) Ambronn	
* f. <i>secunda</i>	CT
f. <i>tenella</i> (C. Agardh) Wynne	CT
<i>Janczewskia verruciformis</i> Solms-Laubach	At
* <i>Laurencia obtusa</i> (Hudson) Lamouroux	C
<i>Laurencia paniculata</i> (C. Agardh) J. Agardh	SC
* <i>Laurencia papillosa</i> (C. Agardh) Greville	CT
* <i>Laurencia pinnatifida</i> (Hudson) Lamouroux	SC
<i>Lophosiphonia cristata</i> Falkenberg	CT
<i>Lophosiphonia obscura</i> (C. Agardh) Falkenberg	SC
<i>Polysiphonia elongata</i> (Hudson) Sprengel	Abt
* <i>Polysiphonia fruticulosa</i> (Wulfen) Sprengel	Ab
<i>Polysiphonia opaca</i> (C. Agardh) Moris et De Notaris	Ab
<i>Polysiphonia sanguinea</i> (C. Agardh) Zanardini	Ab
<i>Polysiphonia scopulorum</i> Harvey	IP
* <i>Polysiphonia sertularioides</i> (Grateloup) J. Agardh	IAtc
* <i>Polysiphonia subulifera</i> (C. Agardh) Harvey	Ab
<i>Polysiphonia violacea</i> (Roth) Sprengel	EAD
<i>Pterosiphonia pennata</i> (C. Agardh) Sauvageau	SC
<i>Rodriguezella pinnata</i> (Kützing) Schmitz ex Falkenberg	M
<i>Rodriguezella strafforellii</i> Schmitz	
var. <i>strafforellii</i>	M
* var. <i>crassicaulis</i> Ercegović	EAD
* <i>Rytiphloaea tinctoria</i> (Clemente) C. Agardh	IAt
* <i>Vidalia volubilis</i> (Linnaeus) J. Agardh	At
Corallinales	
<i>Amphiroa beauvoisii</i> Lamouroux	IAt
<i>Amphiroa cryptarthrodia</i> Zanardini	APt
* <i>Amphiroa rigida</i> Lamouroux	SC
* <i>Corralina granifera</i> Ellis et Solander	IAtc
* <i>Corralina officinalis</i> Linnaeus	APo
* <i>Fosliella cruciata</i> Bressan	SC

ANNEX. Continued

Taxa	Phyt. elem.
<i>Fosliella farinosa</i> (Lamouroux) Howe	
* var. <i>farinosa</i>	C
* f. <i>callithamnoides</i> (Foslie) Chamberlain	C
<i>Goniolithon papillosum</i> (Zanardini ex Hauck) Foslie	M
* <i>Jania rubens</i> (Linnaeus) Lamouroux	C
<i>Lithophyllum incrustans</i> Philippi	Ab
* <i>Lithophyllum lichenoides</i> Philippi	At
<i>Lithophyllum racemus</i> (Lamarck) Foslie	M
<i>Lithohamnion corallioides</i> (Crouan et Crouan) Crouan et Crouan	Ab
<i>Melobesia membranacea</i> (Esper) Lamouroux	IAo
<i>Neogoniolithon mamillosum</i> (Hauck) Setchell et Mason	At
<i>Phymatolithon calcareum</i> (Pallas) Adey et Mc Kibbin	Ab
<i>Phymatolithon lenormandii</i> (Areschoug) Adey	Ab
* <i>Pneophyllum fragile</i> Kützinger	C
* <i>Pseudolithophyllum expansum</i> (Philippi) Lemoine	At
<i>Spongites fruticulosus</i> Kützinger	Ab
<i>Spongites notarisii</i> (Dufour) Athanasiadis	Ab
<i>Titanoderma byssoides</i> (Lamarck) Chamberlain et Woelkerling	M
<i>Titanoderma cystoseirae</i> (Hauck) Woelkerling et al.	Ab
<i>Titanoderma pustulatum</i> (Lamouroux) Nägeli	
var. <i>pustulatum</i>	C
var. <i>confine</i> (Crouan et Crouan) Chamberlain	Ab
f. <i>simile</i> (Foslie) Boudouresque et Perret-Boudouresque	M
Gelidiales	
<i>Gelidiella lubrica</i> (Kützinger) Feldmann et Hamel	M
<i>Gelidiella nigrescens</i> (J. Feldmann) Feldmann et Hamel	M
<i>Gelidiella pannosa</i> (J. Feldmann) Feldmann et Hamel	SC
<i>Gelidium crinale</i> (Turner) Gaillon	APo
<i>Gelidium latifolium</i> Bornet ex Hauck	
var. <i>latifolium</i>	SC
var. <i>hystrix</i> (J. Agardh) Hauck	M
var. <i>luxurians</i> (Crouan et Crouan) J. Feldmann et Hamel	M
<i>Gelidium melanoideum</i> Schousboe ex Bornet	
var. <i>melanoideum</i>	M
var. <i>filamentosum</i> Schousboe ex Bornet	Abt
<i>Gelidium pectinatum</i> Montagne	Ab
<i>Gelidium pusillum</i> (Stackhouse) Le Jolis	
var. <i>pusillum</i>	C
var. <i>minusculum</i> Weber van Bosse	C
<i>Gelidium spathulatum</i> (Kützinger) Bornet	Ab
Gigartinales	
<i>Acrodiscus vidovichii</i> (Meneghini) Zanardini	M
<i>Acrosymphyton purpuriferum</i> (J. Agardh) Sjöstedt	M
<i>Aeodes marginata</i> (Roussel ex Montagne) Schmitz	M
* <i>Catanella caespitosa</i> (Withering) L. Irvine	SC
<i>Caulacanthus ustulatus</i> (Turner) Kützinger	SC
<i>Chondrymenia lobata</i> (Meneghini) Zanardini	Ab
<i>Contarinia peyssonneliaeformis</i> Zanardini	M
<i>Contarinia squamariae</i> (Meneghini) Denizot	M
<i>Cryptonemia lomation</i> (Bertoloni) J. Agardh	M

ANNEX. Continued

Taxa	Phyt. elem.
<i>Cryptonemia tunaeformis</i> (Bertoloni) Zanardini	M
* <i>Dudresnaya verticillata</i> (Vellay) Le Jolis	Ab
<i>Gigartina acicularis</i> (Roth) Lamouroux	C
<i>Gracilaria bursa-pastoris</i> (S. G. Gmelin) Silva	SC
<i>Gracilaria corallicola</i> Zanardini	M
<i>Gracilaria dura</i> (C. Agardh) J. Agardh	IAo
<i>Halymenia floresia</i> (Clemente) C. Agardh	
var. <i>floresia</i>	SC
var. <i>ulvoidea</i> (Zanardini) Codomier	M
** <i>Halymenia hvarii</i> Ercegović	EAD
<i>Halymenia pluriloba</i> Ercegović	EAD
<i>Hypnea musciformis</i> (Wulfen) Lamouroux	CT
<i>Kallymenia reniformis</i> (Turner) J. Agardh	CB
<i>Meredithia microphylla</i> (J. Agardh) J. Agardh	Ab
* <i>Nemastoma constrictum</i> Ercegović	EAD
<i>Nemastoma dichotomum</i> J. Agardh	M
<i>Neurocaulon foliosum</i> Zanardini	M
<i>Peyssonnelia armorica</i> (Crouan et Crouan) Børgesen	Ab
<i>Peyssonnelia dubyi</i> Crouan et Crouan	Ab
<i>Peyssonnelia harveyana</i> Crouan et Crouan ex J. Agardh	Ab
<i>Peyssonnelia polymorpha</i> (Zanardini) Schmitz	SC
<i>Peyssonnelia rosa-marina</i> Boudouresque et Denizot	M
* <i>Peyssonnelia rubra</i> (Greville) J. Agardh	Abt
* <i>Peyssonnelia squamaria</i> (S. G. Gmelin) Decaisne	M
<i>Phyllophora fimbriata</i> Ercegović	EAD
<i>Phyllophora herediae</i> (Clemente) J. Agardh	Ab
<i>Phyllophora crispa</i> (Hudson) Dixon	M
<i>Platoma cyclocolpa</i> (Montagne) Schmitz	Ab
<i>Plocamium cartilagineum</i> (Linnaeus) Dixon	SC
<i>Predaea ollivieri</i> J. Feldmann	CB
<i>Rhodophyllis divaricata</i> (Stackhouse) Papenfuss	Ab
<i>Schottera nicaeensis</i> (Lamouroux ex Duby) Guiry et Hollenberg	Ab
<i>Sebdenia dichotoma</i> Berthold	M
<i>Sebdenia monardiana</i> (Montagne) Berthold	M
<i>Sphaerococcus coronopifolius</i> Stackhouse	Ab
<i>Wurdeimannia miniata</i> (Sprengel) Feldmann et Hamel	CT
Hildenbrandiales	
<i>Hildenbrandia rubra</i> (Sommerfelt) Meneghini	APo
Nemaliales	
<i>Tricleocarpa oblongata</i> (Ellis et Solander) Huisman et Borowitzka	IAt
<i>Liagora viscida</i> (Forsskål) C. Agardh	IAo
* <i>Nemalion helminthoides</i> (Vellay) Batters	SC
<i>Scinalia forcillata</i> Bivona	APo
** <i>Helminthora divaricata</i> (C. Agardh) J. Agardh	Ab
Rhodymeniales	
* <i>Botryocladia botryoides</i> (Wulfen) J. Feldmann	Abt
<i>Botryocladia chiajeana</i> (Meneghini) Kylin	Abt
<i>Botryocladia microphysa</i> (Hamel) Kylin	M

ANNEX. Continued

Taxa	Phyt. elem.
<i>Champia parvula</i> (C. Agardh) Harvey	C
* <i>Chrysimenia ventricosa</i> (Lamouroux) J. Agardh	At
* <i>Chylocladia verticillata</i> (Lightfoot) Bliding	IAtc
<i>Faucea repens</i> (C. Agardh) Montagne <i>et</i> Bory	Ab
<i>Gastroclonium clavatum</i> (Roth) Ardissonne	M
<i>Gastroclonium reflexum</i> (Chauvin) Kützing	M
<i>Gloiocladia furcata</i> (C. Agardh) J. Agardh	M
* <i>Lomentaria chylocladiella</i> Funk	M
<i>Lomentaria clavellosa</i> (Turner) Gaillon	IAtc
* <i>Lomentaria linearis</i> (Zanardini) Zanardini	M
<i>Lomentaria subdichotoma</i> Ercegović	EAD
<i>Lomentaria verticillata</i> Funk	M
<i>Rhodymenia ardissonnei</i> J. Feldmann	Ab
<i>Rhodymenia ligulata</i> Zanardini	M

PHAEOPHYTA

FUCOPHYCEAE

Chordariales

* <i>Cladosiphon mediterraneus</i> Kützing	M
<i>Elachista intermedia</i> Crouan <i>et</i> Crouan	Ab
<i>Leathesia mucosa</i> J. Feldmann	M
<i>Myriactula elongata</i> (Sauvageau) Hamel	M
<i>Myriactula rivularie</i> (Suhr) J. Feldmann	Ab
<i>Myriactula stellulata</i> (Harvey) Levring	Ab
* <i>Myrionema orbiculare</i> J. Agardh	APo
* <i>Myrionema strangulans</i> Greville	APo
<i>Nemacystus flexuosus</i> (C. Agardh) Kylin	M
<i>Spermatocchnus paradoxus</i> (Roth) Kützing	SC
* <i>Stilophora rhizodes</i> (Turner) J. Agardh	SC

Cutleriales

<i>Aglaozonia chilosa</i> Falkenberg - stadium	M
<i>Aglaozonia parvula</i> (Greville) Zanardini - stadium	Ab
* <i>Cutleria multifida</i> (Smith) Greville	SC
<i>Zanardinia prototypus</i> (Nardo) Nardo	APo

Desmarestiales

<i>Desmarestia adriatica</i> Ercegović	EAD
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Dictyosiphonales

<i>Arthrocladia villosa</i> (Hudson) Duby	Ab
<i>Asperococcus bullosus</i> Lamouroux	C
<i>Asperococcus compressus</i> Griffiths <i>ex</i> Hooker	AB
* <i>Giraudia sphacelarioides</i> Derbés <i>et</i> Solier	IAtc
<i>Myriotrichia adriatica</i> Hauck	M
<i>Myriotrichia clavaeformis</i> Harvey	At
<i>Stictyosiphon adriaticus</i> Kützing	M

ANNEX. Continued

Taxa	Phyt. elem.
Dictyotales	
* <i>Dictyopteris polypodioides</i> (De Candolle) Lamouroux	C
<i>Dictyota dichotoma</i> (Hudson) Lamouroux	
* var. <i>dichotoma</i>	C
var. <i>intricata</i> (C. Agardh) Greville	SC
* <i>Dictyota linearis</i> (C. Agardh) Greville	CT
<i>Dilophus fasciola</i> (Roth) Howe	IAo
<i>Dilophus spiralis</i> (Montagne) Hamel	Abt
<i>Padina pavonica</i> (Linnaeus) Thivy	CT
<i>Taonia atomaria</i> (Woodward) J. Agardh	Abt
Ectocarpales	
<i>Acinetospora crinita</i> (Carmichael ex Harvey) Sauvageau	M
<i>Ectocarpus siliculosus</i> (Dillwyn) Lyngbye	
* var. <i>siliculosus</i>	C
var. <i>adriaticus</i> (Ercegović) Cormaci et Furnari	M
<i>Feldmannia battersiides</i> (Ercegović) Cormaci et Furnari	M
<i>Feldmannia caespitula</i> (J. Agardh) Knoepffler - Péguy	
var. <i>caespitula</i>	IAtc
var. <i>lebelii</i> (Areschoug ex Crouan et Crouan) Knoepffler - Péguy	Ab
<i>Feldmannia irregularis</i> (Kützinger) Hamel	
var. <i>irregularis</i>	C
var. <i>lebeliides</i> (Ercegović) Špan et Antolić	EAD
<i>Hinckia dalmatica</i> (Ercegović) Cormaci et Furnari	M
** <i>Kuckuckia spinosa</i> (Kützinger) Kuckuck	Ab
<i>Pseudolithoderma adriaticum</i> (Hauck) Verlaque	Ab
<i>Ralfsia verrucosa</i> (Areschoug) J. Agardh	APtc
Fucales	
<i>Cystoseira adriatica</i> Sauvageau	
var. <i>adriatica</i>	M
var. <i>compressa</i> (Ercegović) Giaccone	M
<i>Cystoseira amentacea</i> Bory	
* var. <i>spicata</i> (Ercegović) Giaccone	M
* <i>Cystoseira barbata</i> C. Agardh	M
<i>Cystoseira compressa</i> (Esper) Gerloff et Nizamuddin	
f. <i>compressa</i>	Ab
f. <i>rosetta</i> (Ercegović) Cormaci et al.	EAD
<i>Cystoseira corniculata</i> (Wulfen) Zanardini	
* ssp. <i>corniculata</i>	M
ssp. <i>laxior</i> Ercegović	M
<i>Cystoseira crinita</i> (Desfontaines) Bory	M
<i>Cystoseira dubia</i> Valiante	M
<i>Cystoseira platyramosa</i> Ercegović	M
<i>Cystoseira schiffneri</i> Hamel	
f. <i>schiffneri</i>	M
f. <i>latiramosa</i> (Ercegović) Giaccone	M
f. <i>tenuiramosa</i> (Ercegović) Giaccone	M
<i>Cystoseira zosterooides</i> (Turner) C. Agardh	M
* <i>Fucus virsoides</i> J. Agardh	EAD
* <i>Sargassum hornschurchii</i> C. Agardh	M

ANNEX. Continued

Taxa	Phyt. elem.
<i>Sargassum salicifolium</i> J. Agardh	M
<i>Sargassum vulgare</i> C. Agardh	CT
Scytosiphonales	
<i>Colpomenia sinuosa</i> (Mertens ex Roth) Derbés et Solier	C
<i>Scytosiphon simplicissimus</i> (Clemente) Cremades	C
Sphacelariales	
** <i>Choristocarpus tenellus</i> (Kützinger) Zanardini	M
<i>Halopteris filicina</i> (Grateloup) Kützinger	APtc
<i>Halopteris scoparia</i> (Linnaeus) Sauvageau	SC
* <i>Sphacelaria cirrosa</i> (Roth) C. Agardh	SC
* <i>Sphacelaria fusca</i> (Hudson) S. F. Gray	SC
<i>Sphacelaria plumula</i> Zanardini	Ab
<i>Sphacelaria rigidula</i> Kützinger	C
<i>Sphacelaria tribuloides</i> Meneghini	C
Sporochnales	
<i>Carpomitra costata</i> (Stackhouse) Batters	APtc
<i>Nereia filiformis</i> (J. Agardh) Zanardini	At
<i>Sporochnus pedunculatus</i> (Hudson) C. Agardh	APo
CHLOROPHYTA	
CHLOROPHYCEAE	
Bryopsidales	
<i>Bryopsis corymbosa</i> J. Agardh	M
<i>Bryopsis feldamanii</i> Gallardo et Furnari	M
<i>Bryopsis duplex</i> De Notaris	Ab
<i>Bryopsis hypnoides</i> Lamouroux	C
<i>Bryopsis muscosa</i> Lamouroux	M
<i>Bryopsis plumosa</i> (Hudson) C. Agardh	APo
<i>Codium bursa</i> (Linnaeus) C. Agardh	Abt
<i>Codium effusum</i> (Rafinesque) Delle Chiaje	IAo
<i>Codium vermilara</i> (Olivi) Delle Chiaje	Atc
<i>Derbesia tenuissima</i> (De Notaris) Crouan et Crouan - stadium	Ab
<i>Halicystis parvula</i> Schmitz	Ab
<i>Pedobesia lamourouxii</i> (J. Agardh) J. Feldmann, Loreau, Codomier et Couté	At
<i>Halimeda tuna</i> (Ellis et Solander) Lamouroux	
* f. <i>tuna</i>	CT
f. <i>platydisca</i> (Decaisne) Barton	At
<i>Pseudochlorodesmis furcellata</i> (Zanardini) Börgesen	APo
* <i>Flabellia petiolata</i> (Turra) Nizamuddin	At
Cladiophorales	
* <i>Anadyomene stellata</i> (Wulfen) C. Agardh	CT
<i>Blastophysa polymorpha</i> Kjellman	Abt

ANNEX. Continued

Taxa	Phyt. elem.
<i>Chaetomorpha aerea</i> (Goodenough ex Dillwyn) Kützing	C
<i>Chaetomorpha mediterranea</i> (Kützing) Kützing	
var. <i>mediterranea</i>	Abt
var. <i>crispa</i> J. Feldmann	M
<i>Chaetomorpha linum</i> (Müller) Kützing	C
<i>Cladophora coelothrix</i> Kützing	IA
<i>Cladophora dalmatica</i> Kützing	Abt
<i>Cladophora echinus</i> (Biasoletto) Kützing	IP
<i>Cladophora glomerata</i> (Linnaeus) Kützing	APtc
<i>Cladophora lehmanniana</i> (Lindenberg) Kützing	Ab
<i>Cladophora pellucida</i> (Hudson) Kützing	Ab
<i>Cladophora prolifera</i> (Roth) Kützing	Abt
<i>Cladophora retroflexa</i> (Bonnemaison ex Crouan et Crouan) Hamel	Atc
<i>Cladophora vagabunda</i> (Linnaeus) Hoek	Abt
* <i>Rhizoclonium tortuosum</i> (Dillwyn) Kützing	Abt
<i>Siphonocladus pusillus</i> (Kützing) Hauck	M
* <i>Valonia macrophysa</i> Kützing	CT
<i>Valonia utricularis</i> (Roth) C. Agardh	CT
Dasycladales	
<i>Acetabularia acetabulum</i> (Linnaeus) Silva	Atc
<i>Dasycladus vermicularis</i> (Scopoli) Krasser	At
Ulotrichales	
* <i>Bolbocoleon piliferum</i> N. Pringsheim	APtc
<i>Entocladia endolithica</i> (Ercegović) R. Nielsen	M
<i>Entocladia leptochaete</i> (Huber) Burrows	M
* <i>Entocladia viridis</i> Reinke	C
<i>Epicladia flustrae</i> Reinke	Ab
* <i>Phaeophila dendroides</i> (Crouan et Crouan) Batters	Abt
* <i>Pringsheimiella scutata</i> (Reinke) Marchewianka	Abt
* <i>Ulvella lens</i> Crouan et Crouan	Abt
<i>Ulothrix flacca</i> (Dillwyn) Thuret	APtc
* <i>Ulothrix subflaccida</i> Wille	APo
Ulvales	
<i>Enteromorpha flexuosa</i> (Wulfen ex Roth) J. Agardh	C
<i>Enteromorpha multiramosa</i> Bliding	M
<i>Ulva olivascens</i> Dangeard	Ab
<i>Ulva rigida</i> C. Agardh	C
Volvocales	
<i>Palmophyllum crassum</i> (Naccari) Rabenhorst	At

ANNEX. Continued

	Taxa	Phyt. elem.
ANGIOSPERMAE		
MONOCOTYLEDONEAE		
Potamogetonales		
	<i>Cymodocea nodosa</i> (Ucria) Ascherson	Ab
*	<i>Posidonia oceanica</i> (Linnaeus) Delile	M
	<i>Zostera noltii</i> Hornemann	Ab
*	taxa reported by VOUK (1930), ERCEGOVIĆ (1949, 1955 a, 1955 b, 1956, 1963) and ANTOLIĆ (1985) which we found;	
**	taxa reported by VOUK (1930) and ERCEGOVIĆ (1955 b) which we didn't find.	