

Supplementary materials:

Figure S1. Algal communities in Luhuitou reef in rainy season 2016: (A–J) Transect 1, heavily polluted area; (K–M) Transect 2, moderately polluted area. (A) The upper intertidal monodominant community with the dominance of the brown crust alga *Neoralfsia expansa*; insert: the dominant alga *N. expansa*. (B) The upper intertidal monodominant community of algal turf, the red alga *Polysiphonia howei*; insert: the dominant alga *P. howei*. (C) The upper intertidal monodominant community of algal turf, the green alga *Ulva prolifera*; insert: the dominant alga *U. prolifera*. (D) The upper intertidal monodominant algal turf community of the green alga *Ulva clathrata*; insert: the dominant alga *U. clathrata*. (E) The upper intertidal bidominant community of the red alga *P. howei* and the green alga *Cladophoropsis sundanensis*; insert: the dominant alga *C. sundanensis*. (F) The middle intertidal monodominant community of the red crust alga *Hildenbrandia rubra*. (G) The middle intertidal monodominant community of the brown crust alga *Ralfsia verrucosa*. (H) The middle intertidal monodominant algal turf community with the dominance of the red fine filamentous alga *Centroceras clavulatum*. (I) The lower intertidal bidominant community of the turf-forming red algae *C. clavulatum* and *Jania adhaerens*; insert: the dominant alga *J. adhaerens*. (J) Monodominant community of the red alga *Grateloupia filicina* densely overgrown with the epiphyte *Ceramium cimbrium* in the middle part of concrete chute of outlet from fish farm, and bidominant community of the green algae *Trichosolen mucronatus* and *U. flexuosa* at marginal parts of the chute; inserts: (a) the dominant *U. flexuosa*; (b) *T. mucronatus*; (c) *Grateloupia filicina*. (K) The middle intertidal polydominant community with the dominance *Chondrophycus articulatus*, *Gelidium pusillum* var. *cylindricum*, *Jania adhaerens*, *Millerella pannosa* (Rh); *Cladophora vagabunda* and *U. clathrata* (Ch); inserts: (a) the dominant alga *M. pannosa*; (b) *G. pusillum* var. *cylindricum*; (c) *C. vagabunda*. (L) The lower intertidal polydominant community composed of the turf-forming algae *Amphiroa fragilissima*, *C. clavulatum*, *Jania adhaerens*, *J. unguolata* f. *brevior*, *Spyridia filamentosa* (Rh); *Lobophora variegata* (Ph) and *Caulerpa racemosa* (Ch); inserts: (a) the dominant alga *J. unguolata* f. *brevior*; (b) *J. adhaerens*. (M) The upper subtidal polydominant community; insert: one of the dominant species *A. foliacea*.

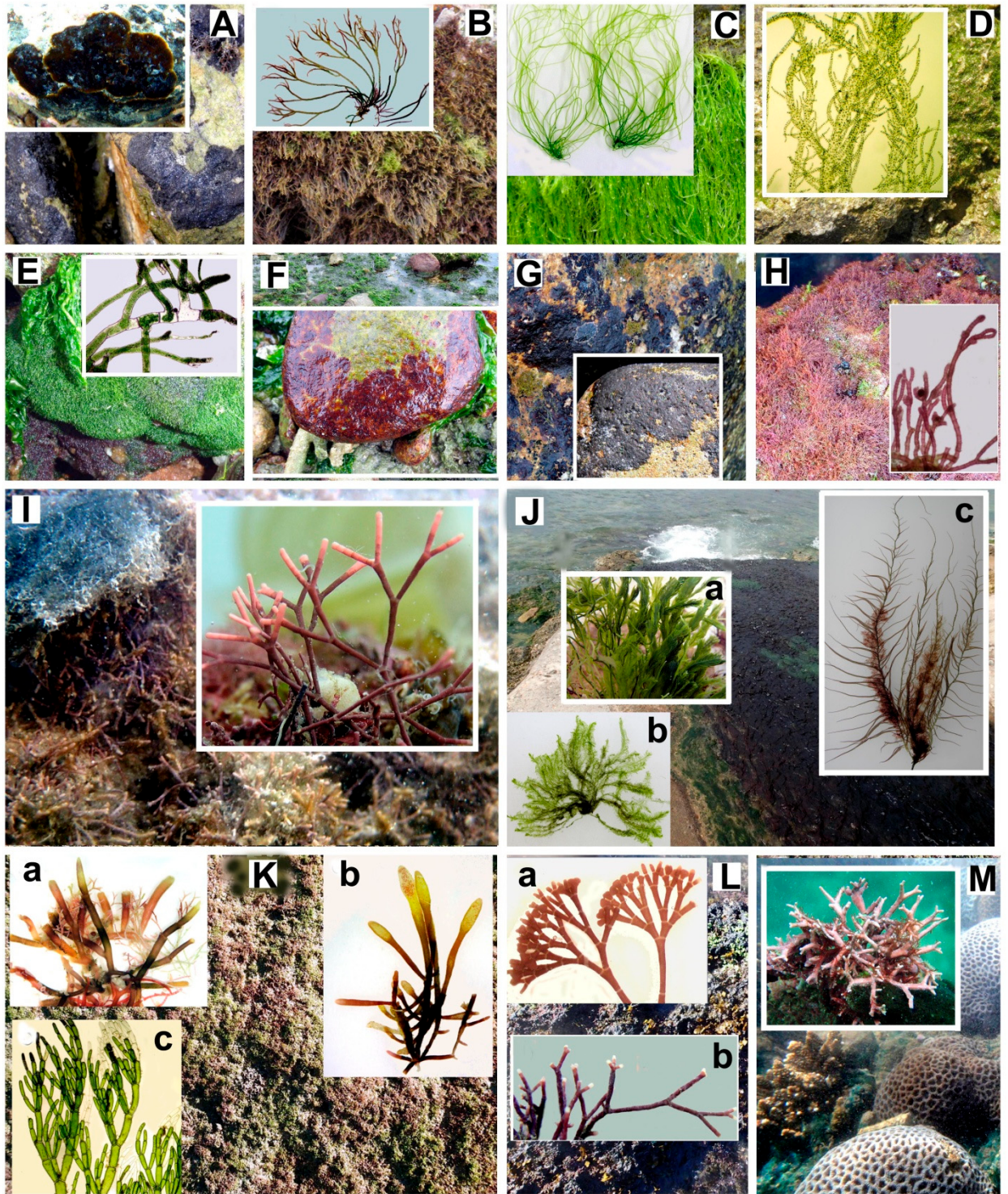
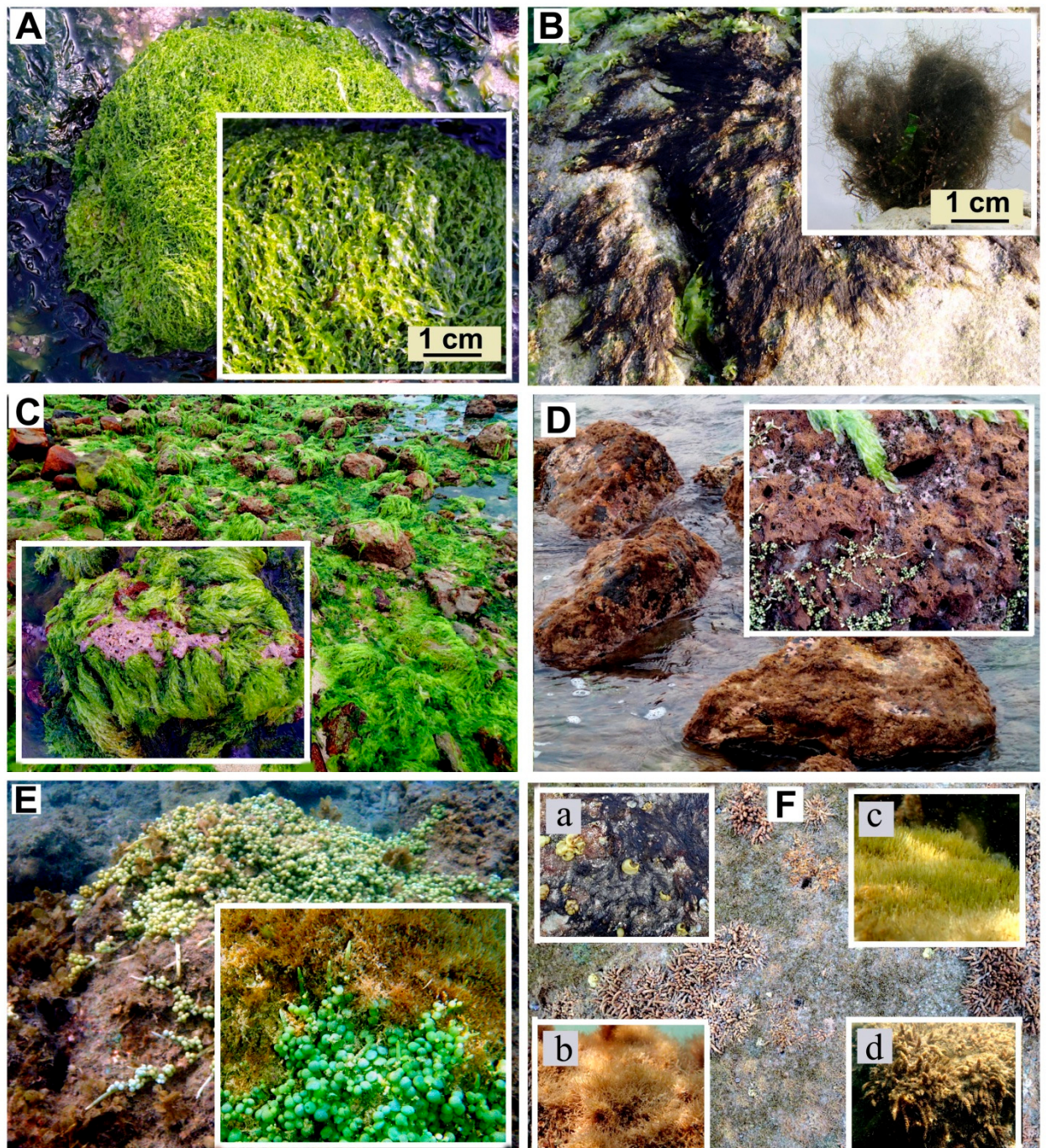


Figure S2. Algal communities at Luhuitou reef in the dry season 2017. (A–E) Transect 1, heavily polluted area. (F–J) Transect 2, moderately polluted area. (A) The middle intertidal monodominant communities of the green alga *Ulva flexuosa*; insert: the dominant alga *U. flexuosa*. (B) The middle intertidal monodominant community of the blue-green alga *Lyngbya majuscula*; insert: the dominant alga *L. majuscula*. (C) the middle intertidal monodominant community of the green alga *Ulva lactuca*; insert: the dominant alga *U. lactuca*. (D) The low intertidal monodominant community of the turf-forming red alga *Centroceras clavulatum*. (E) Monodominant community of the green alga *Caulerpa racemosa* overgrowing community with the dominance of *C. clavulatum*. (F) The middle intertidal polydominant mosaic community with the dominance *Centroceras clavulatum*, *Gelidiella bornetii*, *Palisada papillosa* (Rh) and the blue-green alga *Lyngbya majuscula*; inserts: (a) the dominant alga *L. majuscula*; (b) *C. clavulatum*; (c) *Gelidiella bornetii*; (d) *Palisada papillosa*. (G) The lower intertidal polydominant community of the turf-forming algae: *Acanthophora spicifera*, *Amphiroa fragilissima*, *C. clavulatum*, *Spyridia filamentosa*, *Hypnea valentiae*, *Jania adhaerens* (Rh); *Padina minor* (Ph); *Dictyosphaeria cavernosa*; inserts: (a) the dominant alga *P. minor*, (b) *J. adhaerens*. (H) The coral reef in the upper subtidal zone. (G) The Sargassaceae bed (*Sargassum ilicifolium*, *S. polycystum*, *S. sanyaense* and *Turbinaria ornata*) in the upper subtidal zone; insert: the dominant alga *S. sanyaense*.



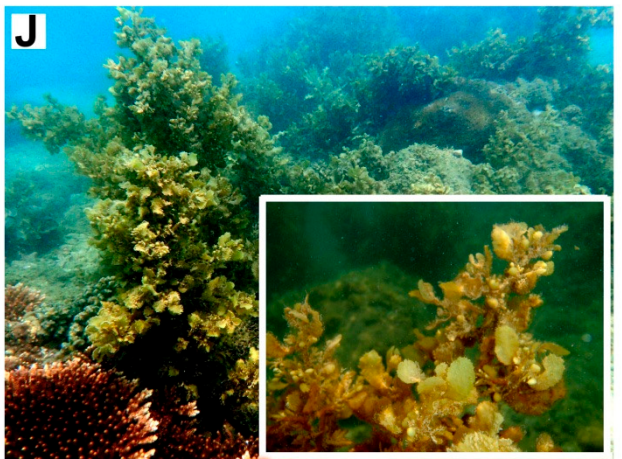
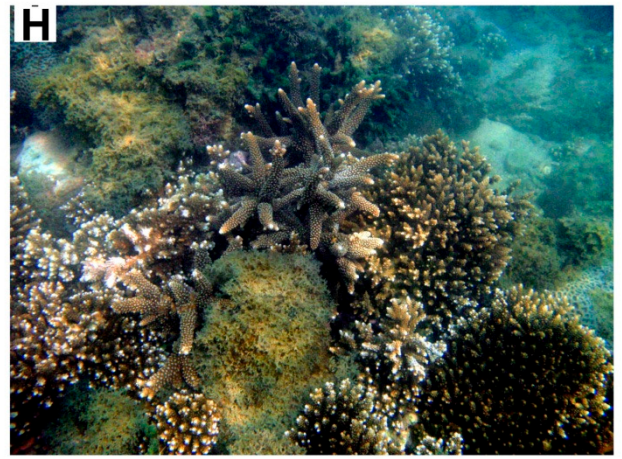
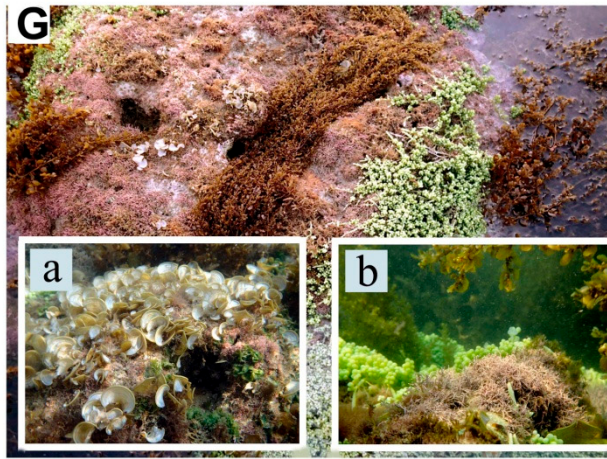


Table S1. List of the seaweeds of Luhuitou, sampled in November 2016 and in March-April 2017 (heavy pollution, Transect 1; moderate pollution, Transect 2). Column “Species, varieties and forms”: ♠, algae found in Hainan Island for the first time in the 1930s–1970s; ♣, new records for Hainan Island in 1990, 1992; ♦, new records in 2008–2015; ♥, new records in 2016–2017. Column “Life forms”: Ep, epiphyte; En, endophyte; HS, algae growing on hard substrata (epilithic). The abundance of taxa: *, exceedingly rare and found only once or twice; +, rare sightings; ++, common; +++, abundant.

Species, varieties and forms	Life form	November 2016		March-April 2017	
		Transects			
		№1	№2	№1	№2
DIVISION RHODOPHYTA					
CLASS STYLANEMATOPHYCEAE					
ORDER STYLONEMATALES					
Family Stylonemataceae					
<i>Stylonema alsidii</i> (Zanardini) K.M. Drew ♣	Ep	++	++	++	++
CLASS COMSPOPOGONOPHYCEAE					
ORDER ERYTHROPELTIDALES					
Family ERYTHROTRICHIACEAE					
<i>Erythrotrichia carnea</i> (Dillwyn) J. Agardh ♣	Ep	++	++	++	++
<i>Sahlingia subintegra</i> (Rosenvinge) Kornmann ♣ ✱	Ep				✱
CLASS FLORIDEOPHYCEAE					
ORDER HILDENBRANDIALES					
Family Hildenbrandiaceae					
<i>Hildenbrandia rubra</i> (Sommerfelt) Meneghini ♦	HS	+++	+++	+++	+++
ORDER ACROCHAETIALES					
Family Acrochaetiaceae					
<i>Acrochaetium microscopicum</i> (Nägeli ex Kützinger) Nägeli ♠	Ep	++	++	++	++
ORDER CORALLINALES					

Family Corallinaceae					
<i>Amphiroa foliacea</i> J.V. Lamouroux ♣	HS		++	++	++
<i>Amphiroa fragilissima</i> (Linnaeus) J.V. Lamouroux ♠	HS	+++	+++	+	+
<i>Amphiroa fragilissima</i> f. <i>cyathifera</i> (J.V. Lamouroux) Weber-van Bosse ♠	HS			++	++
<i>Hydrolithon farinosum</i> (J.V. Lamouroux) D. Penrose & Y.M. Chamberlain ♣	Ep	++	++	++	++
<i>Jania adhaerens</i> J.V. Lamouroux ♠	HS	+++	+++	++	+++
<i>Jania capillacea</i> Harvey ♣	HS			++	++
<i>Jania unguolata</i> f. <i>brevior</i> (Yendo) Yendo ♣	HS	++	++	++	++
<i>Pneophyllum fragile</i> Kützinger ♣	Ep	++	+		
ORDER BONNEMAISONIALES					
Family Bonnemaisoniaceae					
<i>Asparagopsis taxiformis</i> (Delile) Trevisan de Saint-Léon [= <i>Falkenbergia hillebrandii</i> , Sporophytic stage of <i>Asparagopsis taxiformis</i>] ♠	HS	+	+		
ORDER CERAMIALES					
Family Ceramiaceae					
<i>Centroceras clavulatum</i> (C. Agardh) Montagne ♠	HS	+++	++	+++	+++
<i>Ceramium aduncum</i> Nakamura ♣	Ep	+	+		
<i>Ceramium cimbricum</i> H.E. Petersen ♣	Ep	++	++	+++	++
<i>Ceramium cingulatum</i> Weber-van Bosse ♣	Ep	++	++	++	++
<i>Ceramium vagans</i> P.C. Silva ♣	Ep		+++		
<i>Corallophila kleiwegii</i> Weber-van Bosse ♣	Ep	++	++	++	+++
<i>Gayliella mazoyeræ</i> T.O. Cho, Fredericq & Hommersand ♣	Ep	+++	+++	++	+++
Family Rhodomelaceae					
<i>Acanthophora muscoides</i> (Linnaeus) Bory de Saint-Vincent ♠	HS			++	++
<i>Chondria repens</i> Børgesen ♣	Ep				++
<i>Herposiphonia secunda</i> (C. Agardh) Ambronn ♣	Ep	++	++	+	+

<i>Herposiphonia secunda</i> f. <i>tenella</i> (C. Agardh) M.J. Wynne ♣	Ep	++	+++	++	++
<i>Leveillea jungermannioides</i> (K. Hering & G. Martens) Harvey ♠	Ep				++
<i>Lophosiphonia reptabunda</i> (Suhr) Kylin ♣	Ep	+	+		
<i>Palisada papillosa</i> (C. Agardh) K.W. Nam ♠	HS			++	+++
<i>Polysiphonia ferulacea</i> Suhr ex J. Agardh ♠	Ep	++	++	++	+++
<i>Polysiphonia howei</i> Hollenberg ♠	HS	+++	+++	+++	+++
<i>Polysiphonia japonica</i> var. <i>savatieri</i> (Hariot) Yoon ♦	Ep			++	+++
<i>Polysiphonia subtilissima</i> Montagne ♣	Ep			++	++
<i>Polysiphonia scopulorum</i> var. <i>villum</i> (J. Agardh) Hollenberg ♣	Ep	+	++	++	++
<i>Tolypocladia glomerulata</i> (C. Agardh) F. Schmitz ♠	HS			++	++
Family Spyridiaceae					
<i>Spyridia filamentosa</i> (Wulfen) Harvey ♠	HS	+	++	++	+++
Family Wrangeliaceae					
<i>Wrangelia argus</i> (Montagne) Montagne ♣	HS	+	++		
ORDER GELIDIALES					
Family Gelidiaceae					
<i>Gelidium pusillum</i> (Stackhouse) Le Jolis ♠	HS	++	++	++	+++
<i>Gelidium pusillum</i> var. <i>cylindricum</i> W.R. Taylor ♠	HS	+++	++	++	++
Family Gelidiellaceae					
<i>Gelidiella bornetii</i> (Weber-van Bosse) Feldmann & C. Hamel (Hainan) ♠	HS				+++
<i>Millerella pannosa</i> (Feldmann) G.H. Boo & L. Le Gall [= <i>Parviphycus pannosus</i> (Feldmann) G. Furnari] ♣	HS	++	++		
<i>Parviphycus adnatus</i> (E.Y. Dawson) B. Santelices ♣	HS			++	++
Family Pterocladiaceae					
<i>Pterocladia caerulescens</i> (Kützinger) Santelices & Hommersand ♠	HS	+	++		
ORDER GIGARTINALES					
Family Cystocloniaceae					

<i>Hypnea esperi</i> Bory de Saint-Vincent ♦	HS			++	++
<i>Hypnea pannosa</i> J. Agardh ♠	HS		++	+++	+++
<i>Hypnea spinella</i> (C. Agardh) Kützinger ♠	HS	++	++		
<i>Hypnea valentiae</i> (Turner) Montagne ♦	HS			+++	+++
ORDER PEYSSONNELIALES					
Family Peyssonneliaceae					
<i>Peyssonnelia orientalis</i> (Weber-van Bosse) Cormaci & G. Furnari ♠ *	HS				*
<i>Peyssonnelia rubra</i> (Greville) J. Agardh ♣	HS	++	++	++	++
ORDER HALYMENIALES					
Family Halymeniaceae					
<i>Grateloupia carnosa</i> Yamada & Segawa ♦ *	HS			*	
<i>Grateloupia filicina</i> (J.V. Lamouroux) C. Agardh ♦	HS	+++		+++	
ORDER RHODYMENIALES					
Family Lomentariaceae					
<i>Ceratodictyon spongiosum</i> Zanardini ♠	HS	++	++	+	++
<i>Lomentaria corallicola</i> Børgesen ♣	HS		++		
PHYLUM OCHROPHYTA					
CLASS PHAEOPHYCEAE					
ORDER ECTOCARPALES					
Family Acinetosporaceae					
<i>Feldmannia irregularis</i> (Kützinger) G. Hamel ♣	Ep		++		
<i>Feldmannia mitchelliae</i> (Harvey) H.-S. Kim ♠	Ep			++	++
Family Chordariaceae					
<i>Kuetzingiella elachistaeformis</i> (Heydrich) M. Balakrishnan & Kinkar ♠	HS				++
Family Scytosiphonaceae					
<i>Pseudochnoospora implexa</i> (J. Agardh) Santiañez, G.Y. Cho & Kogame [= <i>Chnoospora implexa</i> J. Agardh] ♠	HS				++

<i>Colpomenia sinuosa</i> (Mertens ex Roth) Derbès & Solier ♠	HS				++
ORDER RALFSIALES					
Family Neoralfsiaceae					
<i>Neoralfsia expansa</i> (J. Agardh) P.-E. Lim & H. Kawai ex Cormaci & G. Furnari ♦	HS	++	++	+++	+++
Family Ralfsiaceae					
<i>Ralfsia verrucosa</i> (Areschoug) Areschoug ♦	HS	++	++	+++	+++
ORDER SPHACELARIALES					
Family Sphacelariaceae					
<i>Sphacelaria novae-hollandiae</i> Sonder ♣	Ep	++	++	++	++
<i>Sphacelaria rigidula</i> Kützing ♣	Ep	++	++		
<i>Sphacelaria tribuloides</i> Meneghini ♠	Ep	++	++	+	++
ORDER DICTYOTALES					
Family Dictyotaceae					
<i>Canistrocarpus cervicornis</i> (Kützing) De Paula & De Clerck ♠	HS			+	++
<i>Dictyota implexa</i> (Desfontaines) J.V. Lamouroux ♠	HS		++		
<i>Dictyota friabilis</i> Setchell ♠	HS			++	++
<i>Lobophora variegata</i> (J.V. Lamouroux) Womersley ex Oliveira ♠	HS	++	++	++	+++
<i>Padina boryana</i> Thivy ♠	HS				++
<i>Padina australis</i> Hauck ♠	HS	+	+		++
<i>Padina minor</i> Yamada ♠	HS	+	++	+	+++
ORDER FUCALES					
Family Sargassaceae					
<i>Sargassum aquifolium</i> (Turner) C. Agardh ♠	HS	++	++		++
<i>Sargassum ilicifolium</i> (Turner) C. Agardh ♠	HS				++
<i>Sargassum polycystum</i> (C. Agardh) ♠	HS	+	++	++	+++
<i>Sargassum sanyaense</i> Tseng & Lu ♠	HS		++		+++
<i>Turbinaria ornata</i> (Turner) J. Agardh ♠	HS	++	++	++	++

DIVISION CHLOROPHYTA					
CLASS ULVOPHYCEAE					
ORDER ULVALES					
Family Ulvellaceae					
<i>Acrochaete geniculata</i> (N.L. Gardner) O'Kelly ♣	En			++	++
Family Ulvaceae					
<i>Ulva clathrata</i> (Roth) C. Agardh ♠	HS	++	++	+++	+++
<i>Ulva conglobata</i> Kjellman ♠	HS			+	+
<i>Ulva flexuosa</i> Wulfen ♠	HS	+++		+++	++
<i>Ulva intestinalis</i> Linnaeus ♣	HS			++	++
<i>Ulva lactuca</i> Linnaeus ♠	HS			+++	++
<i>Ulva prolifera</i> O.F. Müller ♠	HS	+++	++	+++	+++
<i>Ulva ralfsii</i> (Harvey) Le Jolis ♣ *	HS	*			
<i>Ulva rigida</i> C. Agardh ♦	HS	++		+	++
ORDER CLADOPHORALES					
Family Anadyomenaceae					
<i>Anadyomene wrightii</i> Harvey ex J.E. Gray ♠	HS			++	++
Family Boodleaceae					
<i>Boodlea coacta</i> (Dickie) G.Murray & De Toni ♥	HS				+
<i>Boodlea composita</i> (Harvey) F. Brand ♠	HS		++		
<i>Cladophoropsis sundanensis</i> Reinbold ♠	HS	+++	++	+++	++
Family Cladophoraceae					
<i>Chaetomorpha javanica</i> Kützinger ♣	HS				+
<i>Chaetomorpha linum</i> (O.F. Müller) Kützinger ♠	HS	+	+	+	+
<i>Cladophora laetevirens</i> (Dillwyn) Kützinger ♣	HS	++	+	++	++
<i>Cladophora vagabunda</i> (Linnaeus) Hoek ♣	HS		++	++	++
<i>Rhizoclonium grande</i> Børgesen ♠	HS	++	+		++
<i>Rhizoclonium riparium</i> (Roth) Harvey ♣	HS	+++	+	++	++
Family Siphonocladaceae					

<i>Dictyosphaeria cavernosa</i> (Forsskål) Børgesen ♠	HS	++	++	++	+++
<i>Dictyosphaeria versluysii</i> Weber-van Bosse ♠	HS				++
<i>Siphonocladus rigidus</i> M.A. Howe ♦	HS			++	+
ORDER BRYOPSIDALES					
Family Bryopsidaceae					
<i>Bryopsis pennata</i> J.V. Lamouroux ♣	HS		++	++	++
<i>Bryopsis plumosa</i> (Hudson) C. Agardh ♦ *	HS		*		
<i>Trichosolen mucronatus</i> (Børgesen) W.R. Taylor ♥	HS	+++		++	
Family Caulerpaceae					
<i>Caulerpa chemnitzia</i> (Esper) J.V. Lamouroux ♠	HS				+
<i>Caulerpa racemosa</i> (Forsskål) J. Agardh ♠	HS	+++	++	+++	+++
<i>Caulerpa sertularioides</i> (S.G. Gmelin) M. Howe ♥	HS	++		++	++
<i>Caulerpa sertularioides</i> f. <i>longiseta</i> (Bory) Svedelius ♠	HS	+++		+++	
<i>Caulerpa serrulata</i> (Forsskål) J. Agardh ♠	HS		+	++	++
Family Udoteaceae					
<i>Rhipidosiphon javensis</i> Montagne ♠	HS				++
<i>Siphonogramen abbreviatum</i> (W.J. Gilbert) I.A. Abbott & Huisman ♥	Ep			+++	++
ORDER DASYCLADALES					
Family Dasycladaceae					
<i>Neomeris annulata</i> Dickie ♠	HS		++		
Family Polyphysaceae					
<i>Parvocaulis exiguus</i> (Solms-Laubach) S. Berger, Fettweiss, Gleissberg, Liddle, U. Richter, Sawitzky & Zuccarello ♠	HS			+	++
<i>Parvocaulis parvulus</i> (Solms-Laubach) S. Berger, Fettweiss, Gleissberg, Liddle, U. Richter, Sawitzky & Zuccarello ♠	HS	++	++	++	++

