



**MSFD Guiding  
Improvements in the Black  
Sea  
Integrated Monitoring  
System**



# **List of NON-NATIVE PHYTOBENTHOS Species from the Black Sea**

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### Abbreviations used:

Black Sea countries	
BG	BULGARIA
GE	GEORGIA
RO	ROMANIA
RU	RUSSIAN FEDERATION
TR	TURKEY
UA	UKRAINE

### Acknowledgements:

Special thanks are given to each of the author, for their participation in establishing the list of non-native phyto-benthic species for the Black Sea.

### Origin of exotic species:

NA - North America  
NE - North Europe  
AO - Atlantic Ocean,  
MS - Mediterranean Sea  
PO - Pacific Ocean  
IO - Indian Ocean  
EW - European water bodies

Co – Cosmopolitan  
SE - South-Eastern Asia  
Au – Australia  
Af - African water bodies  
CS - Caspian Sea  
BS - Black Sea  
MS - Mediterranean Sea

### Establishment success:

C – Casual;            E – Established;        Q – Questionable

### Attitude of species toward salinity of water:

F – Freshwater;        B – Brackish water;    F+B – Fresh and brackish water

### For each species, the following informations are provided:

- full scientific name according to World Registered of Marine Species site – WORMS (<http://www.marinespecies.org>).
- year of the first occurrence in national waters
- place of the first occurrence in national waters
- native range (the origin of species)
- establishment success

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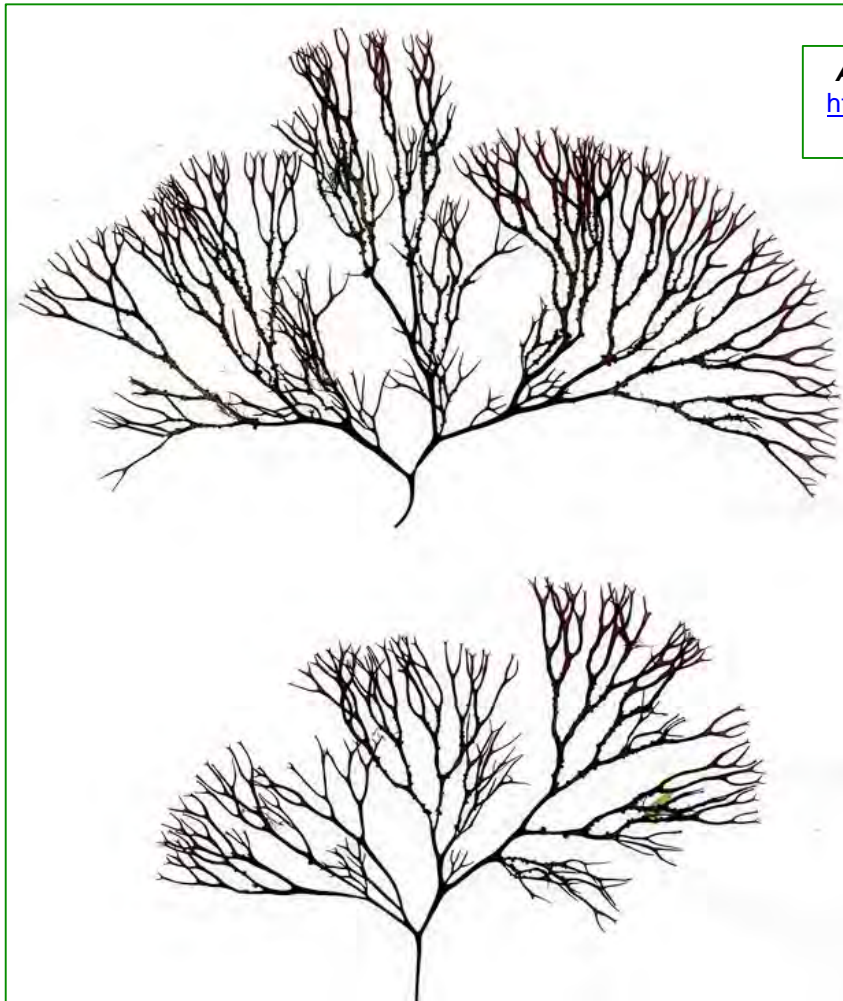
# Black Sea non-native phytobenthic species list

Species	Year of the First Occurrence in National Waters						Place of the first occurrence in national waters						Source	Native range (origin)	Establishment (success)
	BG	GE	RO	RU	TR	UA	BG	GE	RO	RU	TR	UA			
<i>Acrochaetium crassipes</i> (Børgesen) Børgesen, 1915 = <i>Audouinella crassipes</i> (Børgesen) Børgesen					2000s						BS coastal zone		Milchakova et al., 2006	MS, AO, IO, PO	Q
<i>Acrochaetium kylinii</i> G. Hamel, 1927 = <i>Audouinella kylinii</i> G. Hamel, Rhodochorton <i>endophyticum</i> Kylin					2000s						BS coastal zone		Milchakova et al., 2006	NE	Q
<i>Acrochaetium leptanema</i> (Rosenvinge) Børgesen, 1915 = <i>Audouinella leptanema</i> (Rosenvinge) Garbary	2000s				2000s		BS coastal zone				BS coastal zone		Black Sea, 1998; Milchakova et al., 2006	AO	E
<i>Acrochaetium mahumetanum</i> G. Hamel, 1927 = <i>Audouinella mahumetanum</i> (G. Hamel) Garbary			1935		2000s					BS coastal zone	BS coastal zone		Cărăuș I. 2003; Celan M., 1935; Milchakova et al., 2006	MS	Q
<i>Acrochaetium mediterraneum</i> (Levring) Boudouresque, 1970 = <i>Audouinella mediterranea</i> (Levring) Woelkerling					2000s						Coastal zone of Samsun		Milchakova et al., 2006 ; Aysel et al., 2008	MS	Q
<i>Acrochaetium moniliforme</i> (Rosenvinge) Børgesen, 1915 = <i>Audouinella moniliformis</i> (Rosenvinge) Garbary					2000s						BS coastal zone		Milchakova et al., 2006	MS	Q
<i>Acrochaetium rosulatum</i> (Rosenvinge) Papenfuss, 1945 = <i>Audouinella rosulata</i> (Rosenvinge) P.S. Dixon	1990s				2000s		BS coastal zone				BS coastal zone		Black Sea..., 1998; Milchakova et al., 2006	NA, NE	E
<i>Acrochaetium subpinnatum</i> Bornet ex G.Hamel, 1927 = <i>Audouinella subpinnata</i> (Bornet ex G.Hamel) Garbary					2000s						BS coastal zone		Milchakova et al., 2006	MS	Q
<i>Ahnfeltiopsis furcellata</i> (C. Agardh) P.C. Silva et DeCew, 1992					1990s						BS coastal zone		Milchakova, 2007	AO, IO	Q
<i>Amphiroa rigida</i> J.V. Lamouroux, 1816					1990s						BS coastal zone		Milchakova, 2007	AO	Q
<i>Asparagopsis armata</i> Harvey, 1855					1973						BS coastal zone		Çinar , 2005; TDA, 2007	AO	E
<i>Bonnemaisonia asparagoides</i> (Woodward) C. Agardh, 1822					1990s						BS coastal zone		Milchakova, 2007	AO	Q
<i>Chondrophycus papillosus</i> (C. Agardh) Garbary & Harper, 1998 = <i>Palisada perforata</i> (Bory de Saint-Vincent) K.W. Nam, 2007					1973						BS coastal zone		Çinar et al., 2005; TDA, 2007	RS	E
<i>Chrysmenia ventricosa</i> (J.V. Lamouroux) J. Agardh, 1842 = <i>Dumontia ventricosa</i> J.V. Lamouroux					1990s						BS coastal zone: Sinop area		Aysel et al., 2004; Milchakova, 2007	AO	Q
<i>Cladophora flexuosa</i> (O.F. Muller) Kutzing, 1843					1990s						BS coastal zone		Milchakova, 2002	IO, AO	Q
<i>Cladophora hutchinsiae</i> (Dillwyn) Kutzing, 1845	1938				?	?	Coastal area near Balchik				BS coastal zone	?	Celan, 1938; 8. Bavaru A., et. al, 1991	MS, NA, NE	E
<i>Codium fragile subsp. fragile</i> (Suringar) Hariot, 1889					1998						Giresun coast		Aysel et al., 2005	AO, PO	Q
<i>Colaconema codicola</i> (Borgesien) H. Stegenga, J.J. Bolton et R.J. Anderson, 1997 = <i>Acrochaetium cordicolum</i> Borgesien, <i>Audouinella cordicola</i> (Borgesien) Garbary					1994						BS coastal zone		Milchakova, 2007; Çinar , 2005; TDA, 2007	AO	Q
<i>Cymodocea nodosa</i> (Ucria) Ascherson, 1870					2000s						BS coastal zone		Milchakova, 2007	IO, PO	Q

Species	Year of the First Occurrence in National Waters						Place of the first occurrence in national waters						Source	Native range (origin)	Establishment (success)
	BG	GE	RO	RU	TR	UA	BG	GE	RO	RU	TR	UA			
<i>Cystoseira corniculata</i> (Turner) Zanardini, 1841 = <i>Fucus ericoides</i> var. <i>corniculatus</i> Turner).					?							Coastal zone of Samsun	Aysel, Erdugan, 1995; Aysel et al., 2008	IO, PO	Q
<i>Desmarestia viridis</i> (Müll). (Lamouroux, 1813) = <i>Fucus viridis</i> Müller, 1782	?		2004			1992	Coastal area		Vama Veche			Odessa Bay	http://www.blacksea-commission.org/_publ-SOE2009-CH7.asp; Aleksandrov et. al., 2007; TDA, 2007; Milchakova, 2007	AO, NA	E
<i>Ectocarpus caspicus</i> Henckel, 1909			1967			1980			Brackish water lake near Mangalia			Crimea: coastal zone	Celan, Bavaru, 1967; Aleksandrov et. al., 2007	CS	Q
<i>Ectocarpus siliculosus</i> (Dillwyn) (Lyngbye, 1819)			1940		1973				BS coastal zone		BS coastal zone		Çinar , 2005; TDA, 2007; Apaydin et al., 2010; Celan M., 1958	AO	E
<i>Ulva kylinii</i> (Bliding) Hayden, Blomster, Maggs, P.C.Silva, M.J.Stanhope & J.R.Waaland, 2003 = <i>Enteromorpha kylinii</i> Bliding = <i>E. lingulata</i>			1907		?	?					BS coastal zone	?	Bavaru et al., 1991	IO, AO	Q
<i>Erythrocladia irregularis</i> Rosenvinge, 1909	1990s						Coastal area						Black Sea..., 1998	AO, IO, PO, NE	C
<i>Ganonema farinosum</i> (Lamouroux) Fan & Wang, 1974 (Cryptogenic species)					1992						Turkish Black Sea		Çinar et al., 2011	MS, NA, NE (Cryptogenic)	E
<i>Gelidiella nigrescens</i> (J. Feldmann) J. Feldmann et G. Hamel, 1934					2000s						BS coastal zone		Milchakova et al., 2006	MS	Q
<i>Gelidiella pannosa</i> (J. Feldmann) J. Feldmann et G. Hamel, 1934					2000s						BS coastal zone		Milchakova et al., 2006	MS, AO, IO, PO	Q
<i>Gelidiella ramellosa</i> (Kützing) J. Feldmann et G. Hamel, 1934					2000s						BS coastal zone		Milchakova et al., 2006	MS, AO, IO, PO, Au	Q
<i>Gelidiocolax christiana</i> J. Feldman et G. Feldman					2000s						BS coastal zone		Milchakova et al., 2006	MS, NE	Q
<i>Gelidium corneum</i> (Hudson) J.V. Lamouroux, 1813					2000s						BS coastal zone		Milchakova et al., 2006	MS, AO, IO, PO	Q
<i>Gelidium pulchellum</i> (Turner) Kützing, 1868					2000s						BS coastal zone		Milchakova et al., 2006	MS, AO, PO	Q
<i>Gelidium pusillum</i> (Stackhouse) Le Jolis, 1863					1990s						Coastal zone of Samsun		Petran A., 1997 ; Aysel et al., 2008	AO	E
<i>Gelidium spathulatum</i> (Kützing) Bornet, 1892					2000s						BS coastal zone		Milchakova et al., 2006	MS, NE	Q
<i>Gracilaria armata</i> (C. Agardh) Greville, 1830					2000s						BS coastal zone		Milchakova et al., 2006	MS	Q
<i>Halothrix lumbricalis</i> (Kützing) (Reinke, 1888)					1998						BS coastal zone		Çinar , 2005; TDA, 2007	AO	Q
<i>Hildenbrandia canariensis</i> Børgese = <i>Hildenbrandia crouaniorum</i> J. Agardh, 1851	2000s						Coastal area						Black Sea, 1998	?	Q
<i>Jania longifurca</i> Zanardini, 1841					2000s						BS coastal zone		Milchakova et al., 2006	MS, AO, NE, IO	Q

Species	Year of the First Occurrence in National Waters						Place of the first occurrence in national waters						Source	Native range (origin)	Establishment (success)
	BG	GE	RO	RU	TR	UA	BG	GE	RO	RU	TR	UA			
<i>Laurencia caspica</i> Zinova et Zaberzhinskaya, 1967 B			1972		?	←			Brackish water - littoral lakes		BS coastal zone		Celan, Bavaru, 1972	CS	E
<i>Laurencia intermedia</i> (Yamada, 1931)					1986						BS coastal zone		Çinar , 2005; TDA, 2007	IO	E
<i>Liagora viscida</i> (Forsskål) C. Agardh, 1822					2000s						BS coastal zone		Milchakova et al., 2006	MS, AO, NE, IO	Q
<i>Lithophyllum orbiculatum</i> (Foslie) Foslie, 1900 = <i>Pseudolithothamnion orbiculatum</i> (Foslie) Lemoine					2000s						BS coastal zone		Milchakova et al., 2006	MS, NA, NE	Q
<i>Peyssonnelia rosa-marina</i> Boudouresque et Denizot (1973)					2000s						BS coastal zone		Milchakova et al., 2006	MS, NE	Q
<i>Pilayella littoralis</i> (Linnaeus), (Kjellman, 1872)			1969		1998				Coastal area - Mangalia		BS coastal zone		Çinar , 2005; TDA, 2007; Skolka H., 1969	AO	Q
<i>Polysiphonia fucoides</i> (Hudson) Greville, 1824 (syn. <i>Polysiphonia violacea</i> (Roth) Sprengel, 1827)	1936				1973			Coastal area near Balchik			BS coastal zone		Celan, 1936; Çinar , 2005; TDA, 2007	AO	E
<i>Polysiphonia paniculata</i> (Montagne, 1842)					1972						BS coastal zone		Çinar , 2005; TDA, 2007	AO	E
<i>Porphyra minor</i> Zanardini, 1847					2000s						BS coastal zone		Milchakova et al., 2006	MS, NA, NE	Q
<i>Porphyra umbilicalis</i> Kützinger, 1843					2000s						BS coastal zone		Milchakova et al., 2006	MS, NA, NE	Q
<i>Pterocladia melanoidea</i> (Schousboe ex Bornet) Santelices et Hommersand, 1997 - var. <i>melanoidea</i> = <i>Gelidium melanoideum</i> Schousboe ex Bornet var. <i>melanoideum</i>					1990s						BS coastal zone		Milchakova, 2007	AO	Q
<i>Punctaria tenuissima</i> (C.Agardh) Greville, 1830			1976		1993						Zonguldak coast		Aysel et al., 1996, Celan M., Bavaru A., 1976	AO	Q
<i>Pylaiella littoralis</i> (Linnaeus) Kjellman, 1872 ( <b>Cryptogenic species</b> )			1969		1984				Romanian coast - Mangalia		Kırklareli coast		Aysel et al., 1998	MS, AO, NA, NE, Au (cryptogenic)	E
<i>Sargassum hornschurchii</i> C.Agardh, 1820					1990s						BS coastal zone		Milchakova, 2002	MS	Q
<i>Stylonema cornu-cervi</i> (Reinsch) Hauck, 1875 = <i>Goniotrichum cornu-cervi</i> (Reinsch) Hauck					2000s						BS coastal zone		Milchakova et al., 2006	MS, AO, NE	Q
<i>Ulva lactuca</i> Linnaeus, 1753 = <i>Ulva fasciata</i> (Delile, 1813)					1988						BS coastal zone		Çinar , 2005; TDA, 2007; Apaydin et al., 2010	MS, AO, IO, PO	E
<i>Vaucheria dichotoma</i> f. <i>marina</i> Hauck, 1884	2012		1957					Coastal area, Rezovo, Paraskeva Bay		BS coastal zone			Dencheva (unpublished data); Celan M, 1962	Co	C

# Pictures of Black Sea non-native phytobenthic species



*Ahnfeltiopsis furcellata* (C. Agardh) P.C. Silva et DeCew, 1992  
[http://naturalhistory.main.jp/Tree\\_of\\_life/Eukaryote/Plantae/Rhodophyta/Ahnfeltiopsis\\_furcellata/Ahnfeltiopsis\\_furcellata.html](http://naturalhistory.main.jp/Tree_of_life/Eukaryote/Plantae/Rhodophyta/Ahnfeltiopsis_furcellata/Ahnfeltiopsis_furcellata.html)



*Amphiroa rigida* J.V. Lamouroux, 1816  
<http://www.alessandrofalleni.com/home/amphiroa-rigida>



***Asparagopsis armata* Harvey, 1855**  
[http://www.horta.uac.pt/species/algae/Asparagopsis\\_armata/Asparagopsis\\_armata.html](http://www.horta.uac.pt/species/algae/Asparagopsis_armata/Asparagopsis_armata.html)



***Bonnemaisonia asparagoides* (Woodward) C. Agardth, 1822**  
<http://seaweeds.uib.no/?art=707>





*Palisada perforata* (Bory de Saint-Vincent) K.W. Nam, 2007  
<http://botany.natur.cuni.cz/algo/images/Piran2011/macro/chondrophycuspapillosus.html>



*Chrysymenia ventricosa* (J.V. Lamouroux) J. Agardh, 1842  
<http://www.alessandrofalleni.com/home/alghe/chrysymenia-ventricosa>



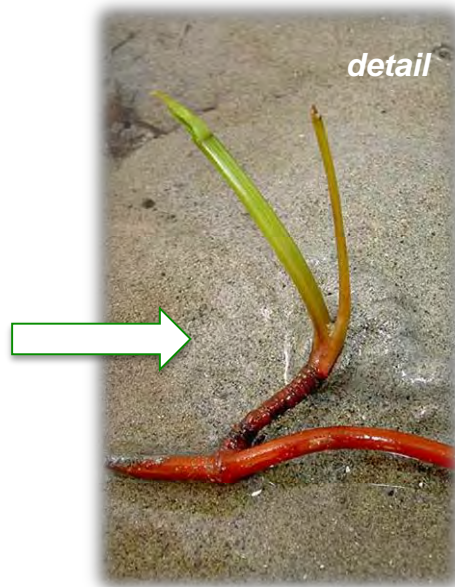
***Cladophora flexuosa* (O.F. Muller) Kutzing, 1843**  
<http://www.nrm.se/faktaomnaturenochrymden/vaxter/kryptogamer/manadenskrypotogam/alger/cladophoraettalgbatteri/cladophoraflexuosa.11151.html>



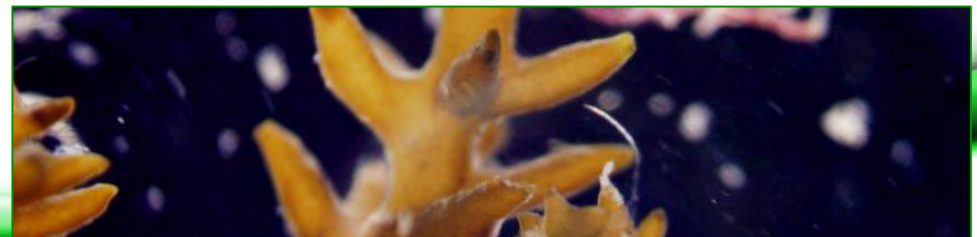
***Cladophora hutchinsiae* (Dillwyn) Kutzing, 1845**  
<http://organismes-marins.univ-lille1.fr/cladophora-hutchinsiae/>



***Codium fragile* subsp. *fragile* (Suringar) Hariot, 1889**  
[http://www.algaebase.org/search/species/detail/?species\\_id=133062](http://www.algaebase.org/search/species/detail/?species_id=133062)



***Cymodocea nodosa* (Ucria) Ascherson, 1870**  
<http://www.biowin.at/all/Pflanzen/bilder/Najadales/Cymodoceaceae/Cymodocea%20nodosa/Cymodocea%20nodosa.htm>  
<http://flora.nhm-wien.ac.at/Seiten-Arten/Cymodocea-nodosa.html>





***Desmarestia viridis* (Müll.) (Lamouroux, 1813)**

<http://faculty.jsd.claremont.edu/dguthrie/aleutian%20algae/Desmarestia%20viridis.htm>



***Ectocarpus siliculosus* (Dillwyn) (Lyngbye, 1819)**

[http://fr.wikipedia.org/wiki/Ectocarpus\\_siliculosus#mediaviewer/Fichier:Ectocarpus\\_siliculosus\\_sur\\_Ulva.jpg](http://fr.wikipedia.org/wiki/Ectocarpus_siliculosus#mediaviewer/Fichier:Ectocarpus_siliculosus_sur_Ulva.jpg)



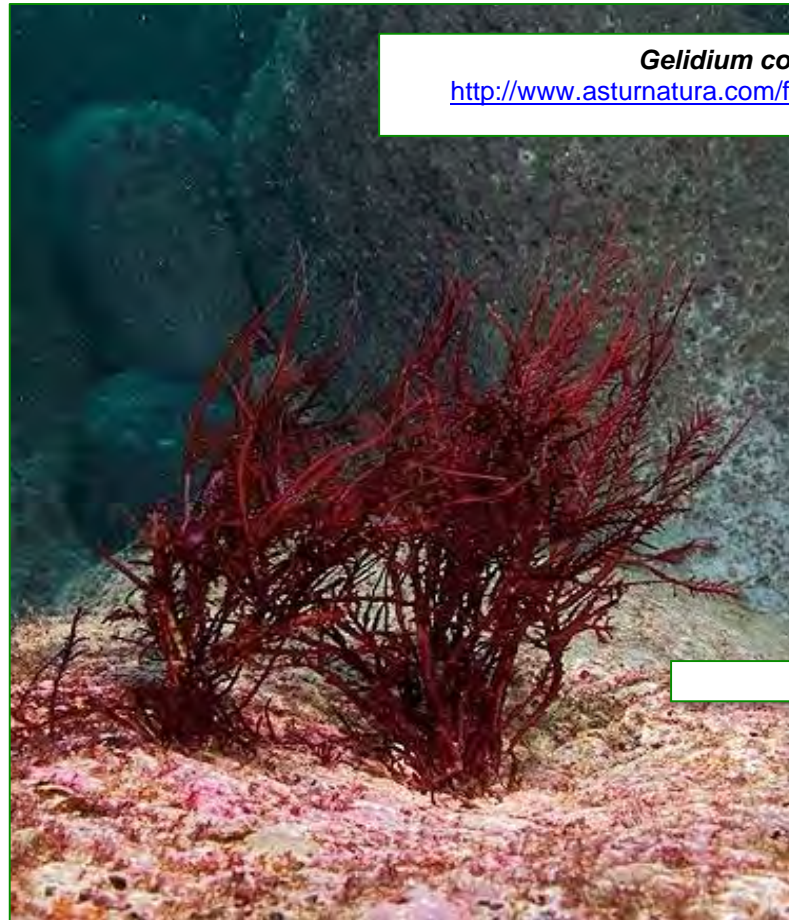
***Ulva kylinii* (Bliding) Hayden, Blomster, Maggs, P.C.Silva, M.J.Stanhope & J.R.Waaland, 2003**  
[http://www.seaweedafrica.org/search/images/view/?img\\_id=39437](http://www.seaweedafrica.org/search/images/view/?img_id=39437)



***Ganonema farinosum* (Lamouroux) Fan & Wang, 1974**  
<http://enunaislaatlantica.blogspot.ro/2014/04/alga-roja-ii-ganonema.html>



***Gelidiella ramellosa* (Kützing) J. Feldmann et G. Hamel, 1934**  
<http://euralga.com/Red%20algae/GelidiellaRam.html>



***Gelidium corneum* (Hudson) J.V. Lamouroux, 1813**  
<http://www.asturnatura.com/fotografia/submarina-fotosub/gelidium-corneum/1440.html>





*Gelidium pulchellum* (Turner) Kützing, 1868  
<http://macoi.ci.uc.pt/galeria.php?page=229>

*Gelidium pusillum* (Stackhouse) Le Jolis, 1863

[http://www.niobioinformatics.in/seaweed/images/gelidium\\_pusillum.jpg](http://www.niobioinformatics.in/seaweed/images/gelidium_pusillum.jpg)



*Gelidium pusillum*



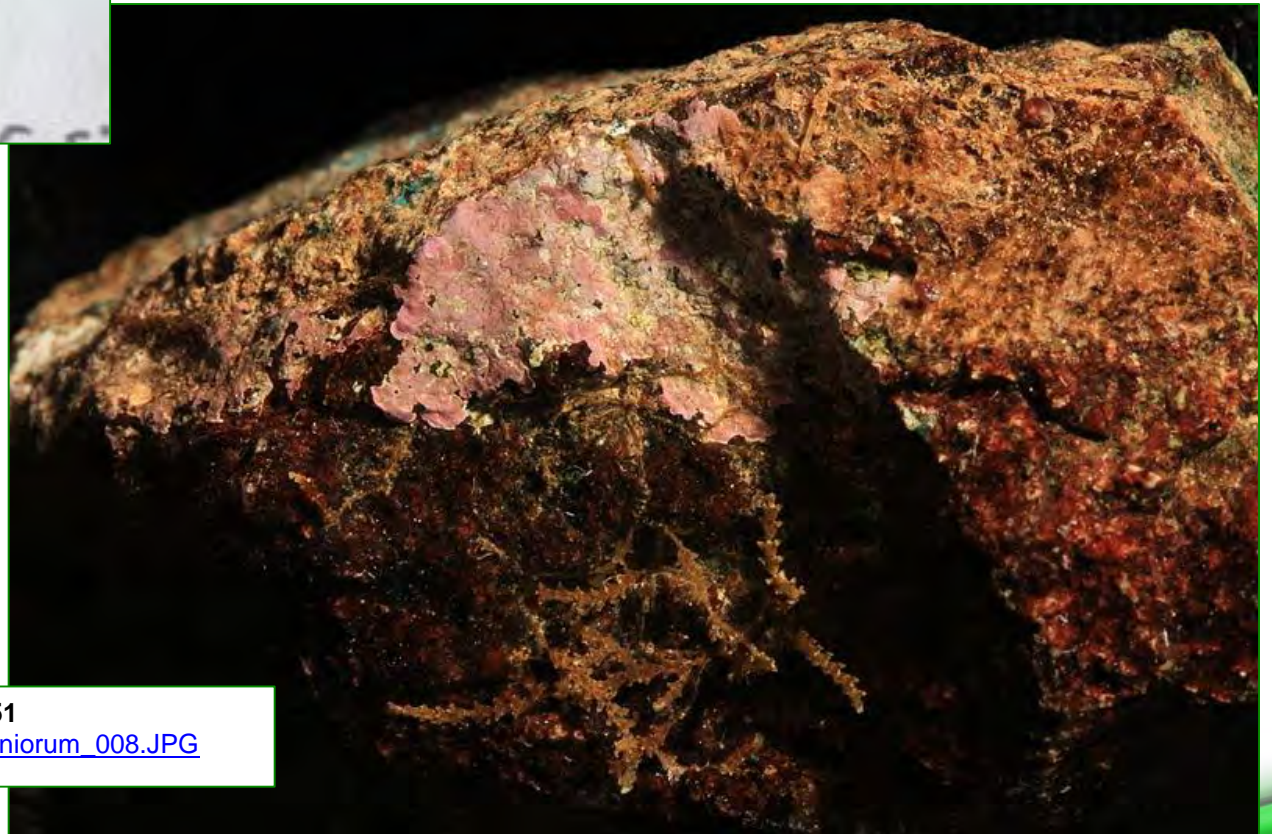
*Gelidium spathulatum* (Kützinger) Bornet, 1892 (microscop detail)

[http://images.algaebase.org/\\_mediafiles/algaebase/5964B9371dd0025AD7Pii1D27DBA/NADBCsdJb7L7.jpg](http://images.algaebase.org/_mediafiles/algaebase/5964B9371dd0025AD7Pii1D27DBA/NADBCsdJb7L7.jpg)





*Halothrix lumbricalis* (Kützing) (Reinke, 1888)  
[http://www.boldsystems.org/index.php/Taxbrowser\\_Taxonpage?taxid=472913](http://www.boldsystems.org/index.php/Taxbrowser_Taxonpage?taxid=472913)



*Hildenbrandia crouaniorum* J.Agardh, 1851  
[http://commons.wikimedia.org/wiki/File:Hildenbrandia\\_crouaniorum\\_008.JPG](http://commons.wikimedia.org/wiki/File:Hildenbrandia_crouaniorum_008.JPG)



***Jania longifurca* Zanardini, 1841**  
<http://www.marinespecies.org/photogallery.php?album=766&pic=14861>



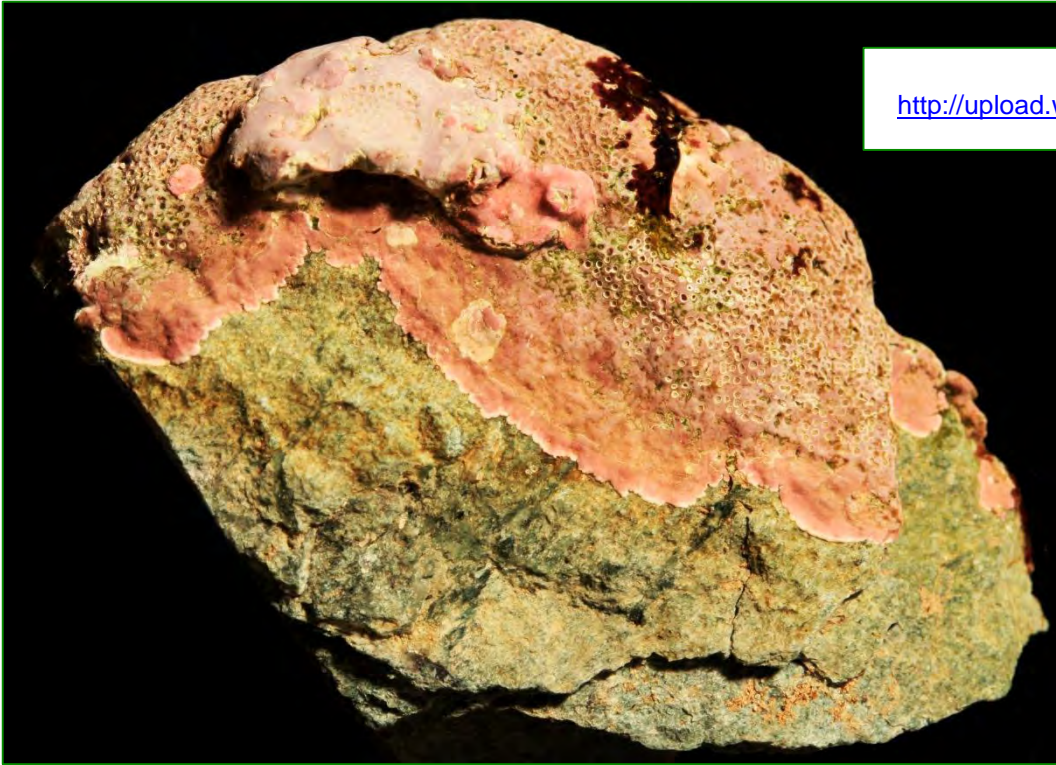
***Laurencia caspica* Zinova et Zaberzhinskaya, 1967**  
<http://marine-world7.blogspot.ro/2011/11/red-seaweed-in-caspian-sea.html>



***Laurencia intermedia* (Yamada, 1931)**  
<http://uni2008.web.fc2.com/htm/kaisou3ko.html>



***Liagora viscida* (Forsskål) C. Agardh, 1822**  
<http://www.notteesale.it/images/010fotoschede/alghe/schalgaviscida.htm>



***Lithophyllum orbiculatum* (Foslie) Foslie, 1900**  
[http://upload.wikimedia.org/wikipedia/commons/e/e2/Lithophyllum\\_orbiculatum\\_037.jpg](http://upload.wikimedia.org/wikipedia/commons/e/e2/Lithophyllum_orbiculatum_037.jpg)



***Peyssonnelia rosa-marina* Boudouresque et Denizot (1973)**  
[http://underwater.meanders.eu/2008greece/eng/underwater2b\\_025.html](http://underwater.meanders.eu/2008greece/eng/underwater2b_025.html)



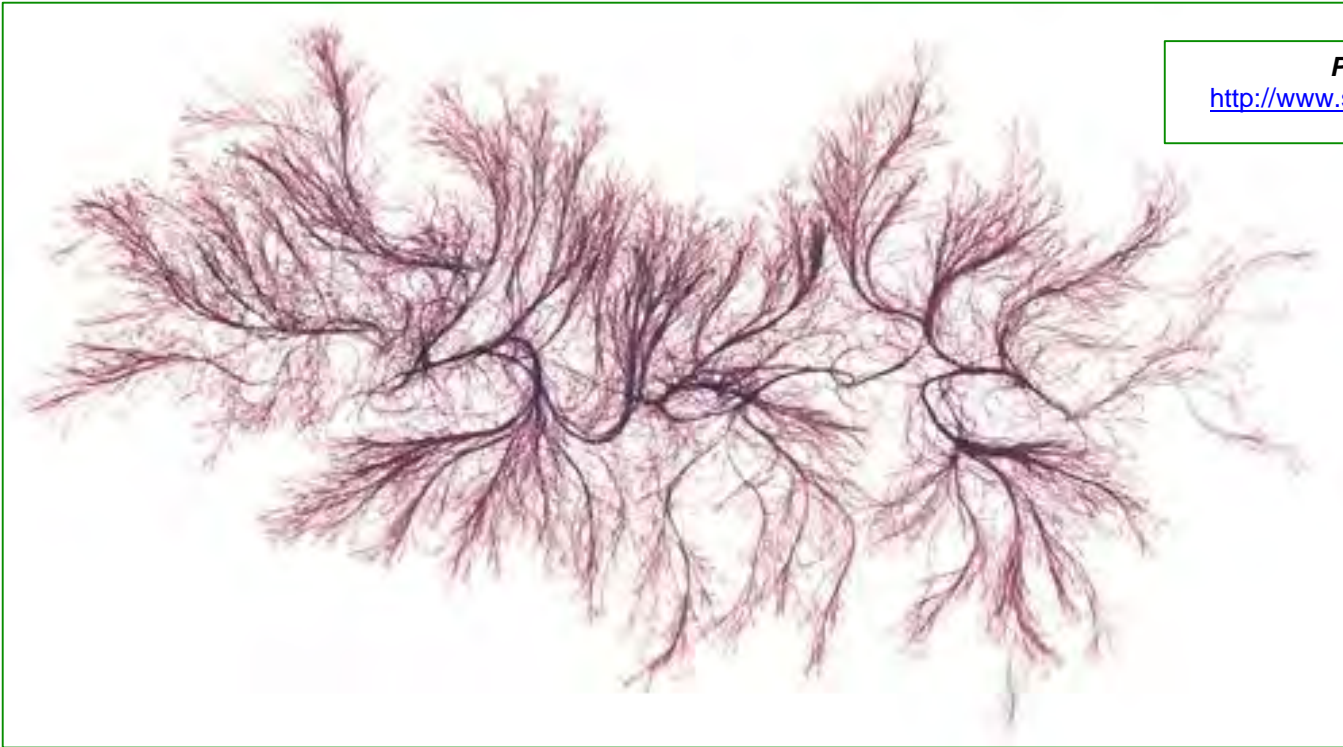
***Pilayella littoralis* (Linnaeus), (Kjellman, 1872)**  
[http://www.seaweedafrica.org/search/images/view/?img\\_id=38748](http://www.seaweedafrica.org/search/images/view/?img_id=38748)  
<http://botany.natur.cuni.cz/algo/images/Hiddensee2012/micro/pylaiellalittoralis.html>



*Polysiphonia fucoides* (Hudson) Greville, 1824  
[http://www.biopix.com/polysiphonia-fucoides\\_photo-107290.aspx](http://www.biopix.com/polysiphonia-fucoides_photo-107290.aspx)



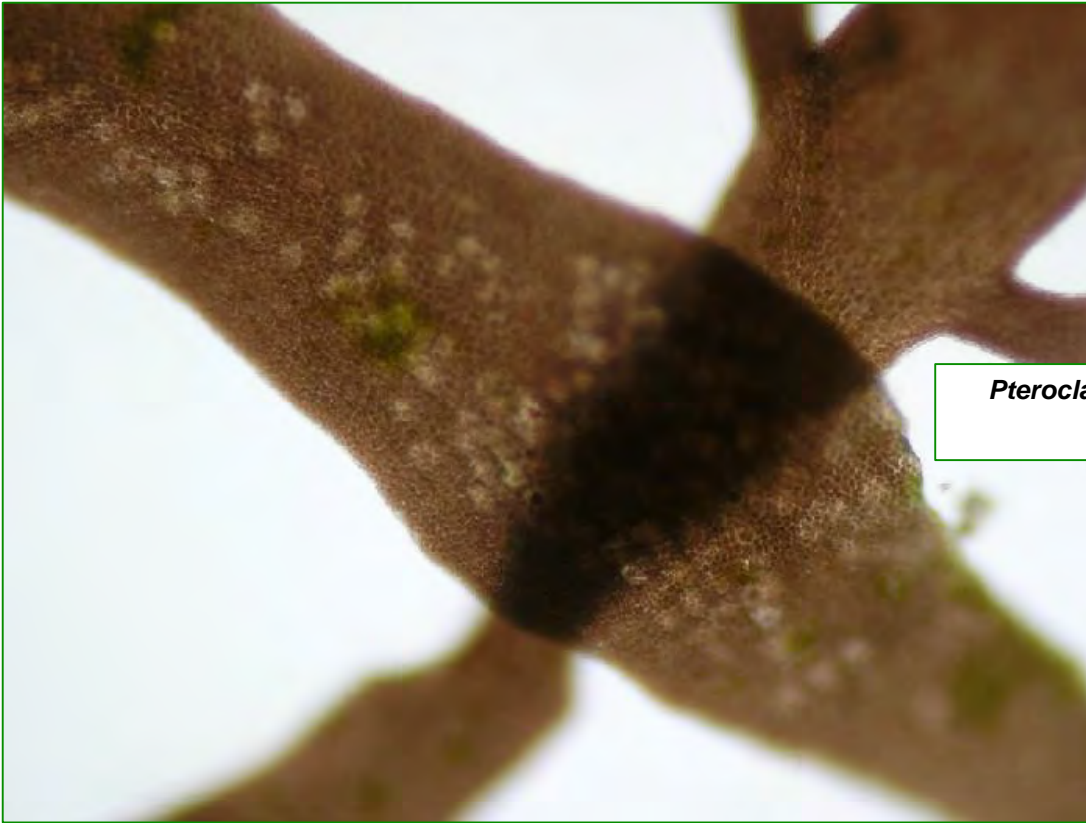
*P. fucoides*  
microscopic detail



***Polysiphonia paniculata* (Montagne, 1842)**  
<http://www.seaweedsofalaska.com/species.asp?SeaweedID=109>



***Porphyra umbilicalis* Kützing, 1843**  
[http://upload.wikimedia.org/wikipedia/commons/2/26/Porphyra\\_umbilicalis\\_Helgoland.JPG](http://upload.wikimedia.org/wikipedia/commons/2/26/Porphyra_umbilicalis_Helgoland.JPG)



*Pteroclatiella melanoidea* (Schousboe ex Bornet) Santelices et Hommersand, 1997  
<http://www.marinespecies.org/aphia.php?p=image&id=14961nd.JPG>







***Punctaria tenuissima* (C.Agardh) Greville, 1830**  
[http://www.boldsystems.org/index.php/Taxbrowser\\_Taxonpage?taxid=369863](http://www.boldsystems.org/index.php/Taxbrowser_Taxonpage?taxid=369863)

***Sargassum hornschuchii* C.Agardh, 1820**

[http://doris.ffesm.fr/fiche2.asp?fiche\\_numero=1688](http://doris.ffesm.fr/fiche2.asp?fiche_numero=1688)

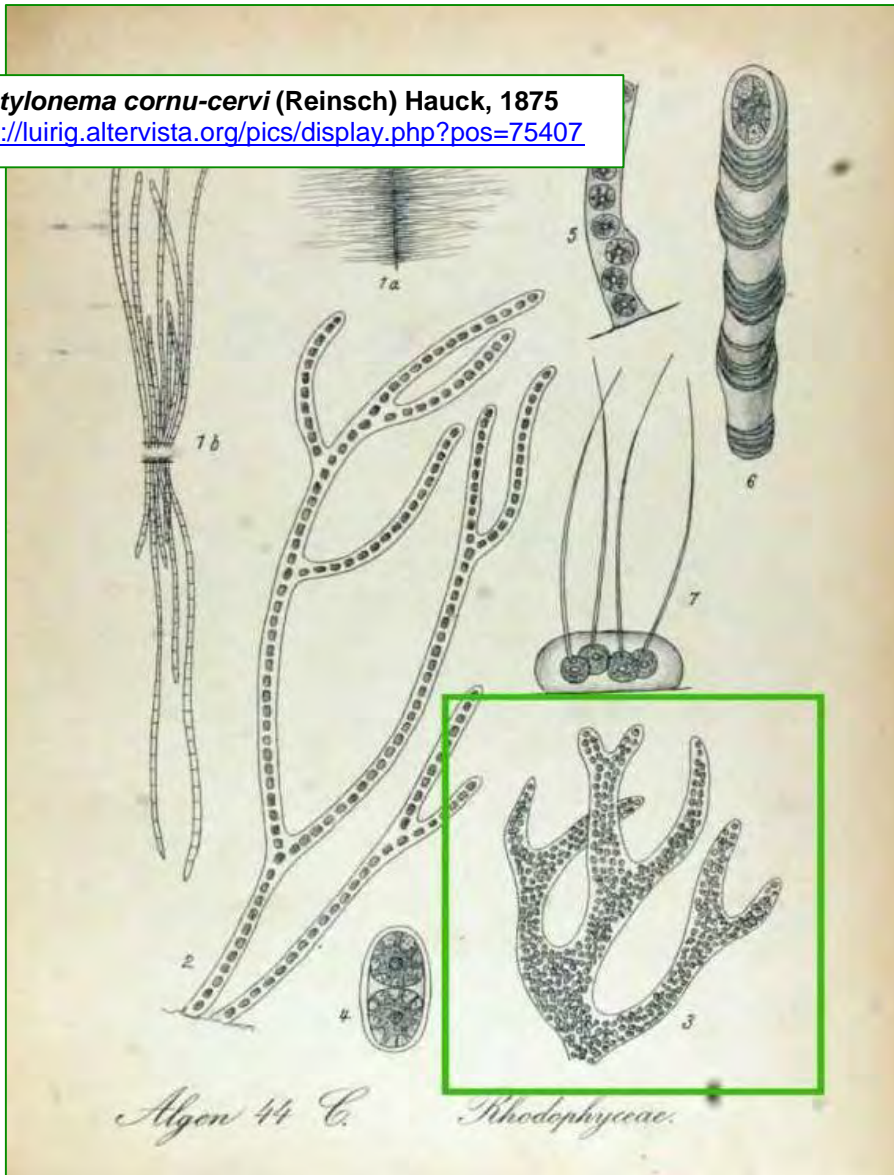


***Ulva lactuca* Linnaeus, 1753**

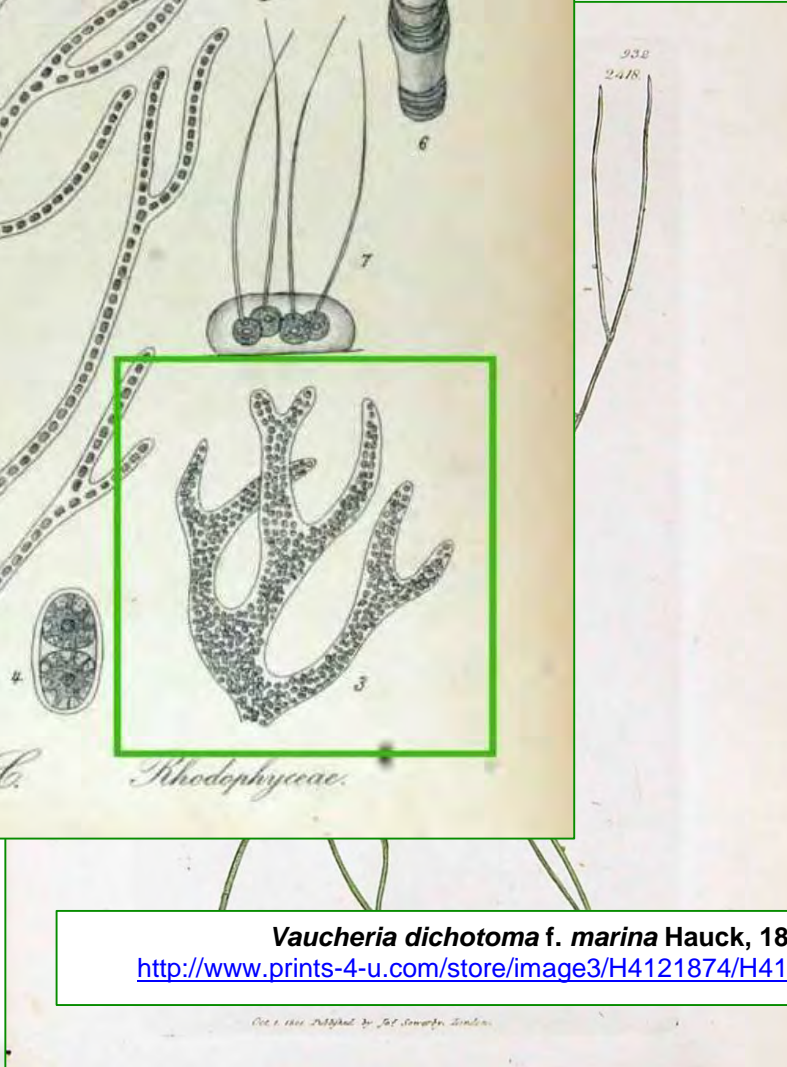
[http://es.wikipedia.org/wiki/Ulva\\_lactuca#mediaviewer/Archivo:Meersalat-Ulva-lactuca.jpg](http://es.wikipedia.org/wiki/Ulva_lactuca#mediaviewer/Archivo:Meersalat-Ulva-lactuca.jpg)



***Stylonema cornu-cervi* (Reinsch) Hauck, 1875**  
<http://luirig.altervista.org/pics/display.php?pos=75407>



***Vaucheria dichotoma* f. *marina* Hauck, 1884**  
<http://www.prints-4-u.com/store/image3/H4121874/H4121874212.jpg>



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