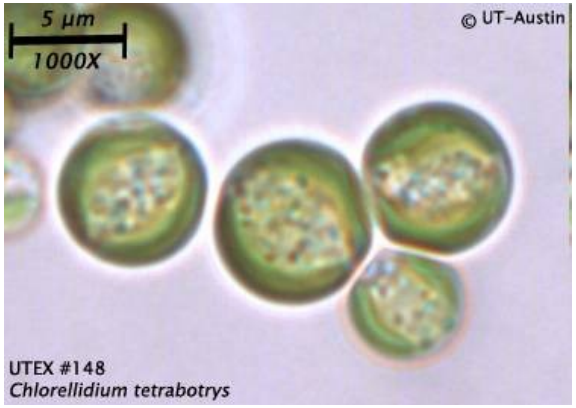
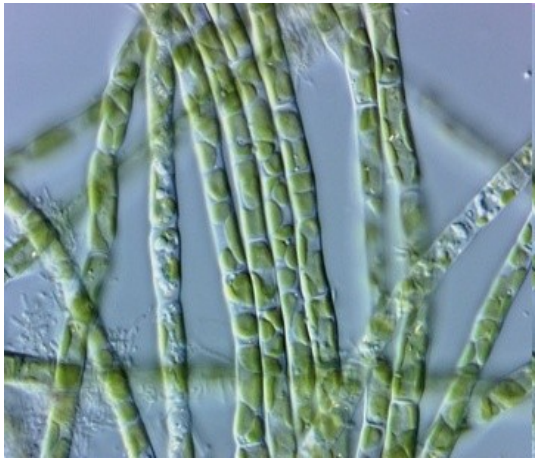
Xanthophyceae (různobrvky)

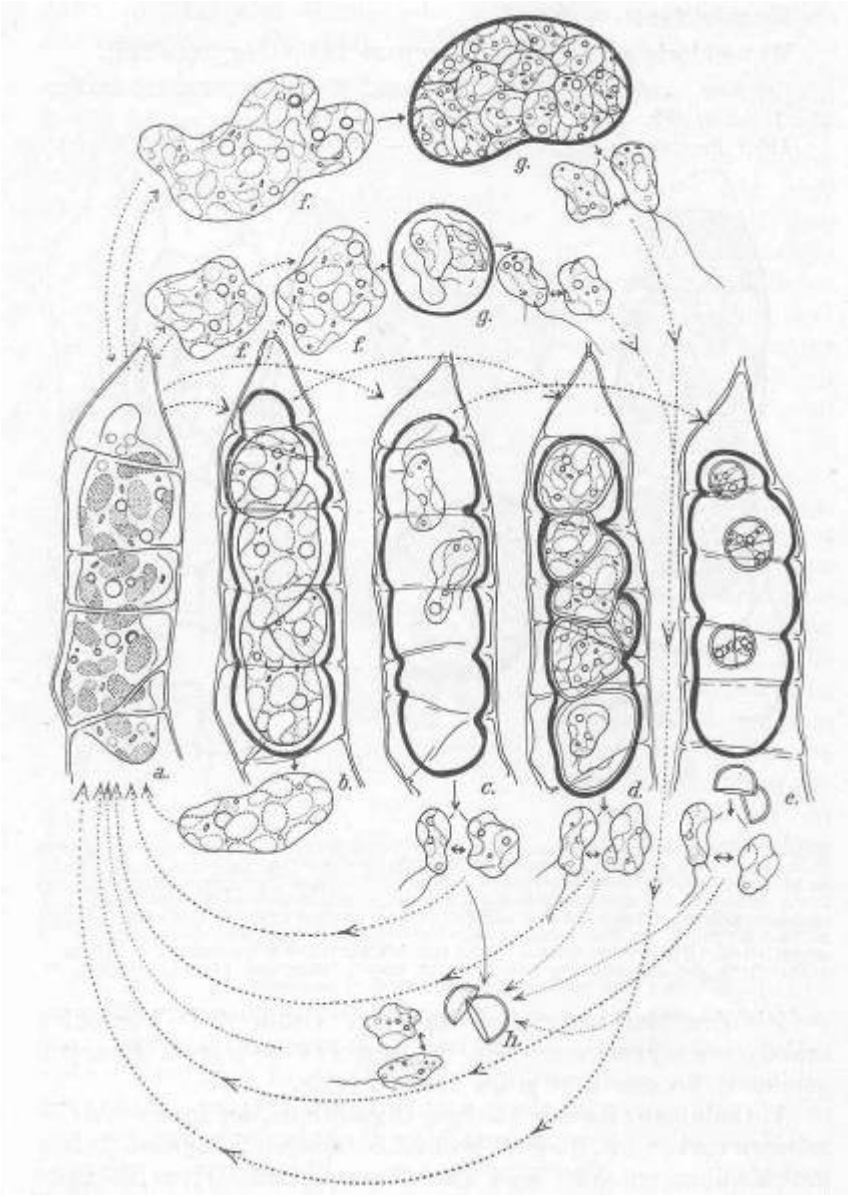




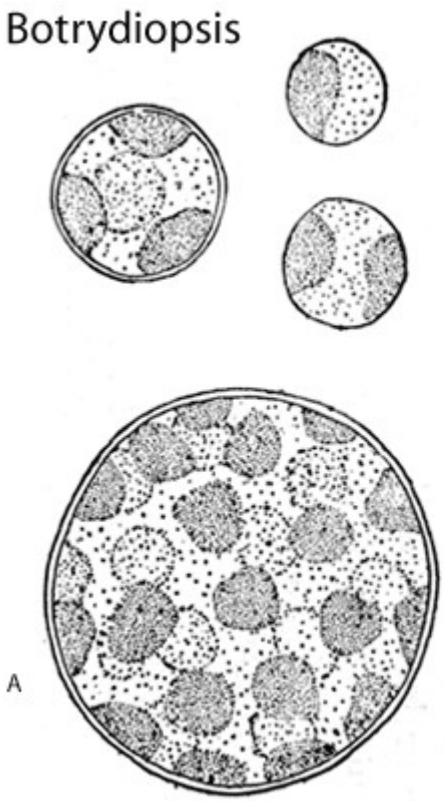
- possibly about 900 species, mostly terrestrial and freshwater; most taxa asexual or with cryptic sexual reproduction
- genera *Vaucheria* and *Botrydium* have oogamic or isogamic sexual process

Adolf Pascher

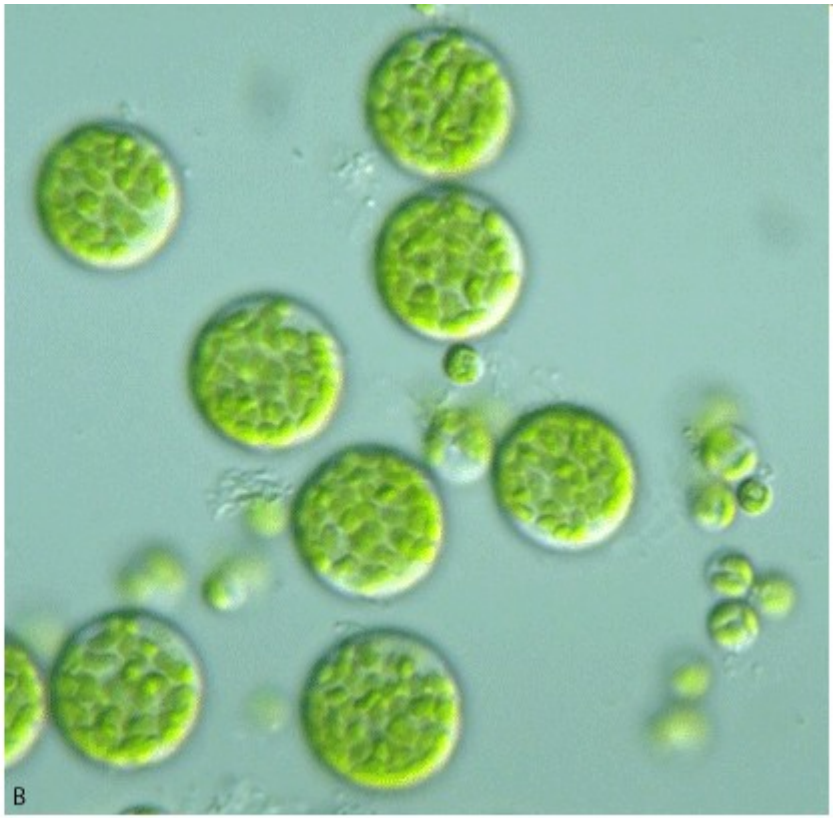
Myxochloris [sphagnicola]



Botrydiopsis

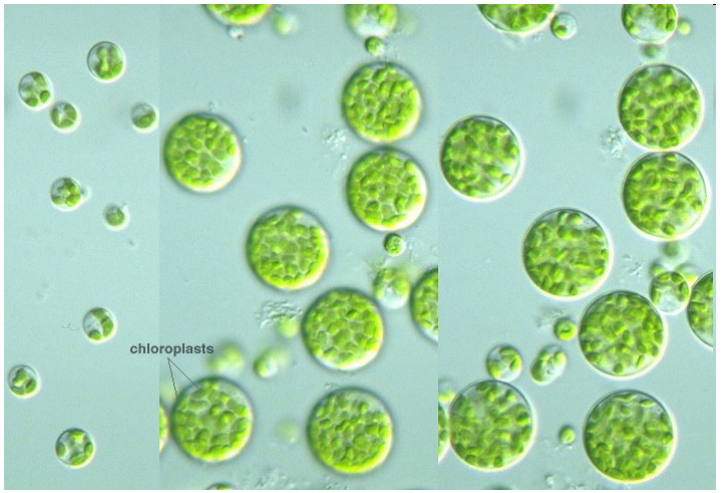


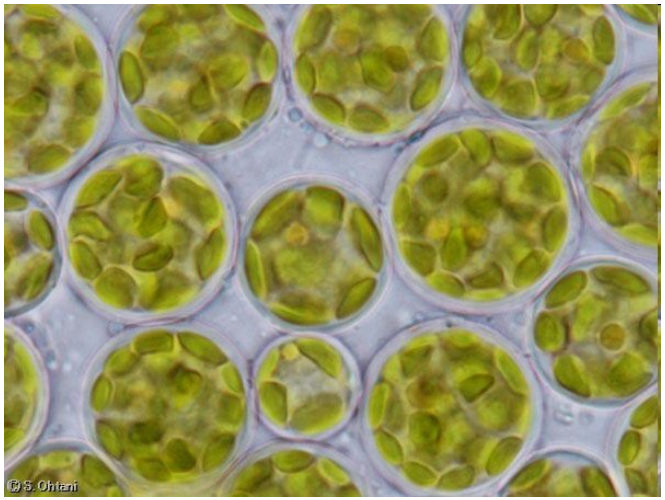
A after Smith (1950)



B © Y. Tsukii, see http://protist.i.hosei.ac.jp/Protist_menuE.html

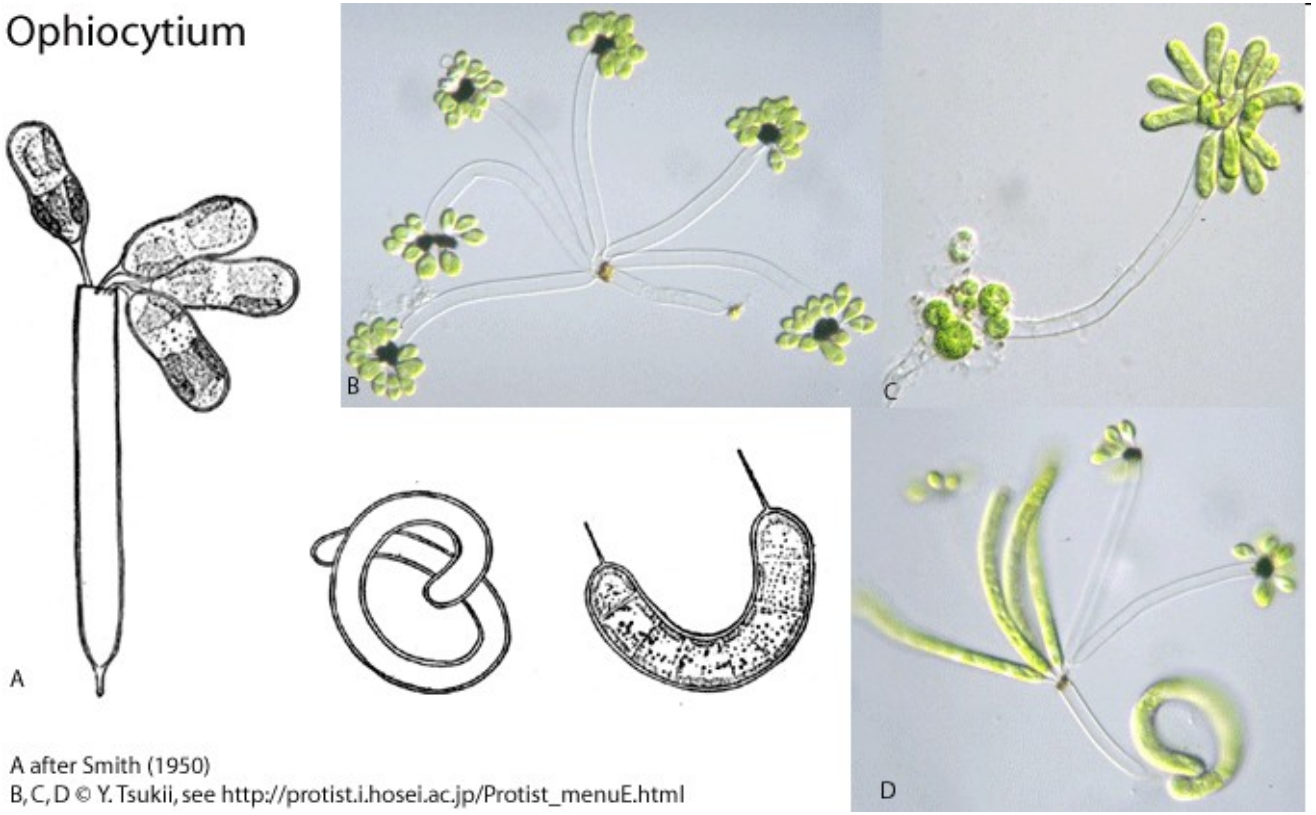
multiple plastids coupled with multiple nuclei – so called **coenocytes**



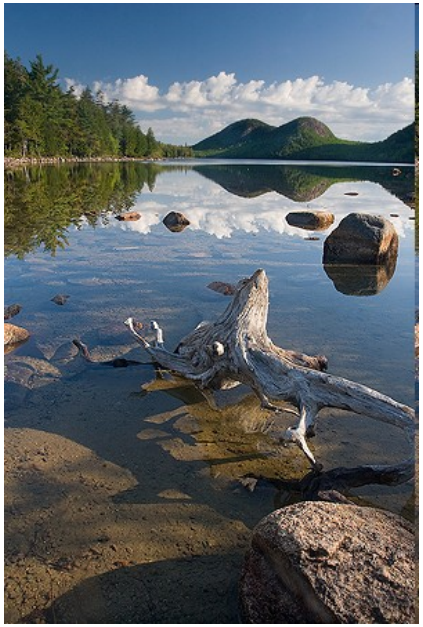


Ophiocytium

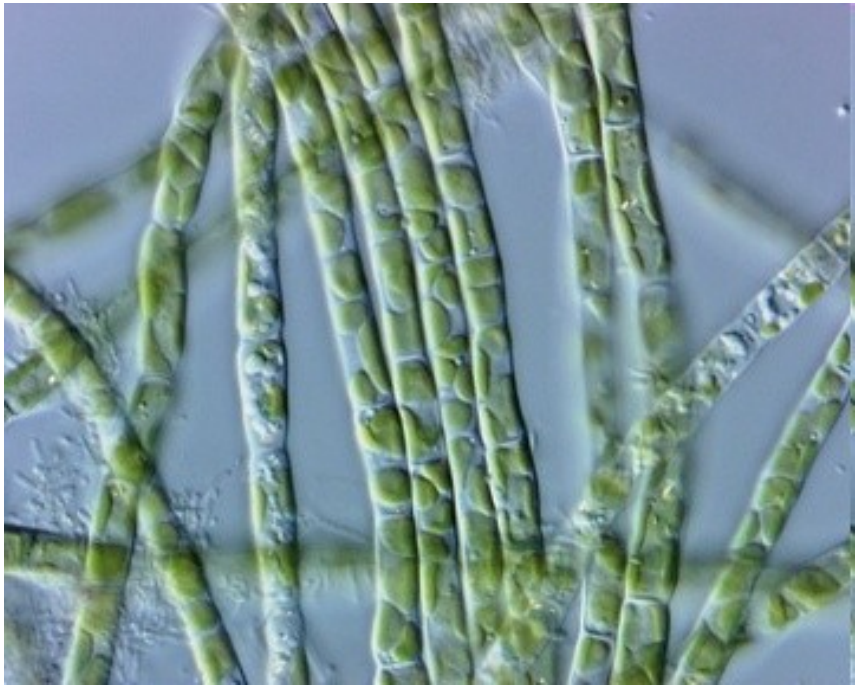
freshwater phytoplankton

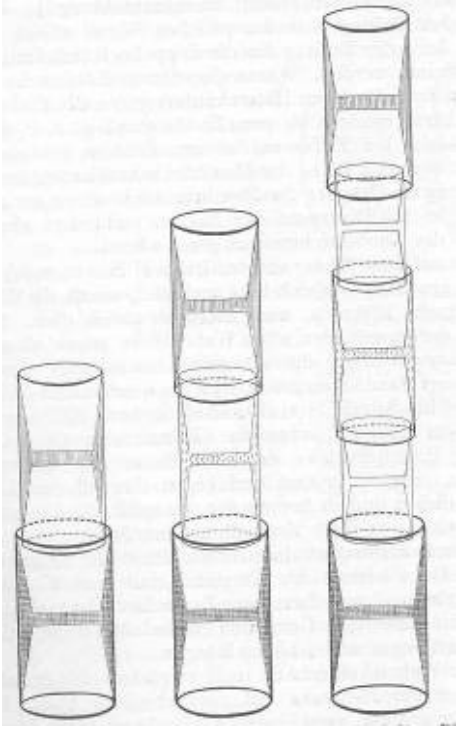


A after Smith (1950)
B, C, D © Y. Tsukii, see http://protist.i.hosei.ac.jp/Protist_menuE.html



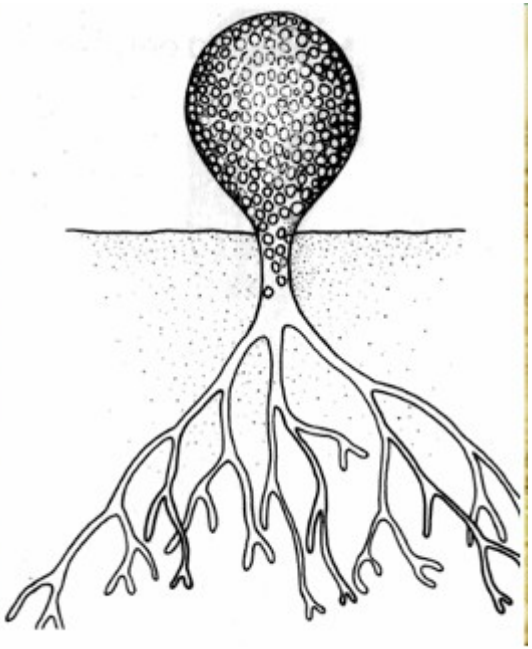
Tribonema, Xanthonema, Heterococcus





H - kusy

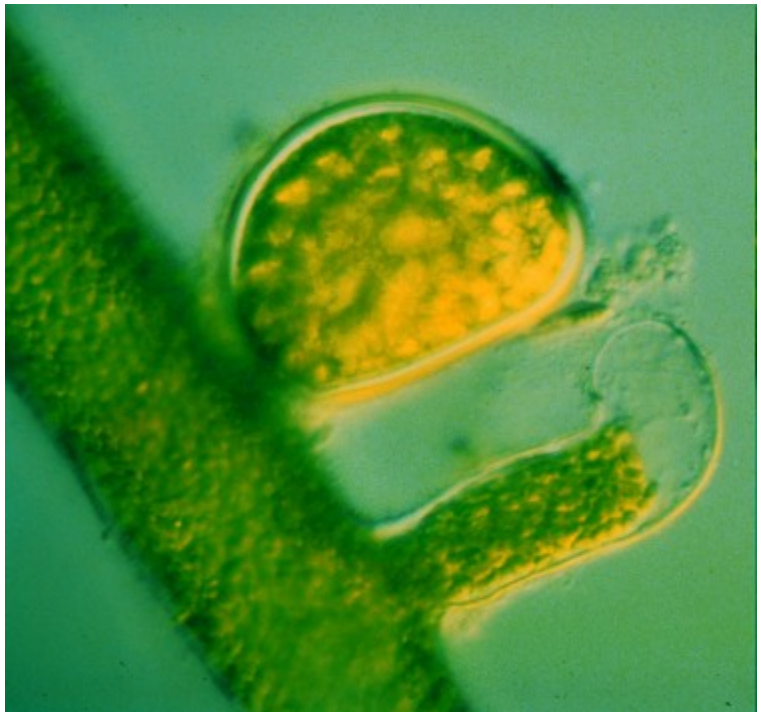
Botrydium



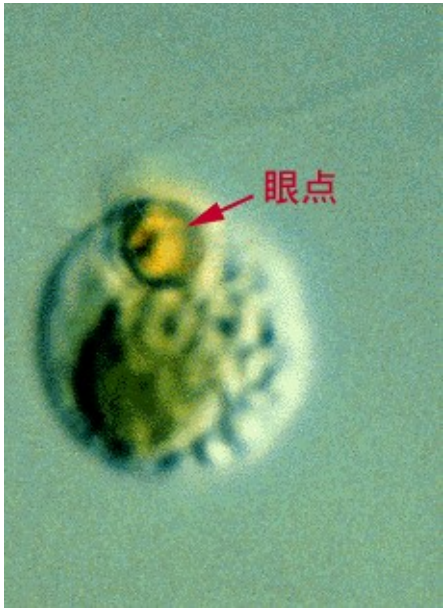
All after Entwisle et al. (1997)

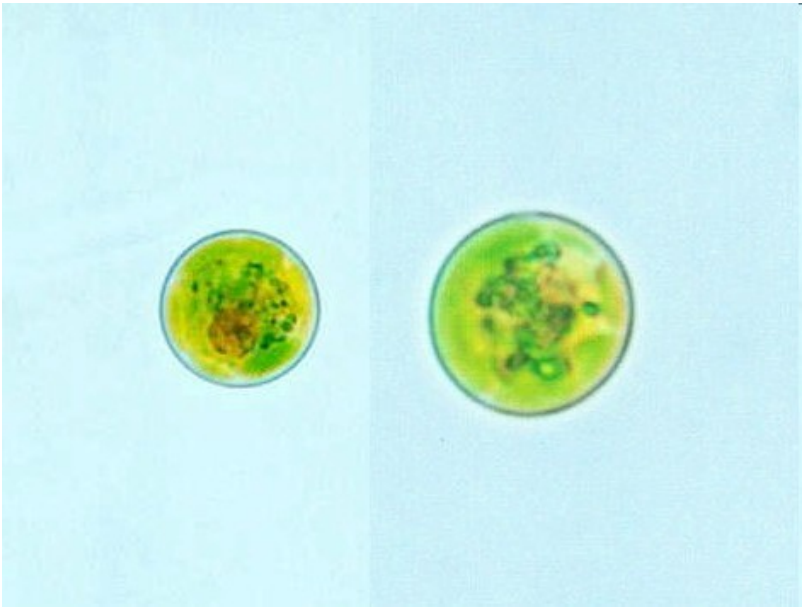
coenocytic thallus

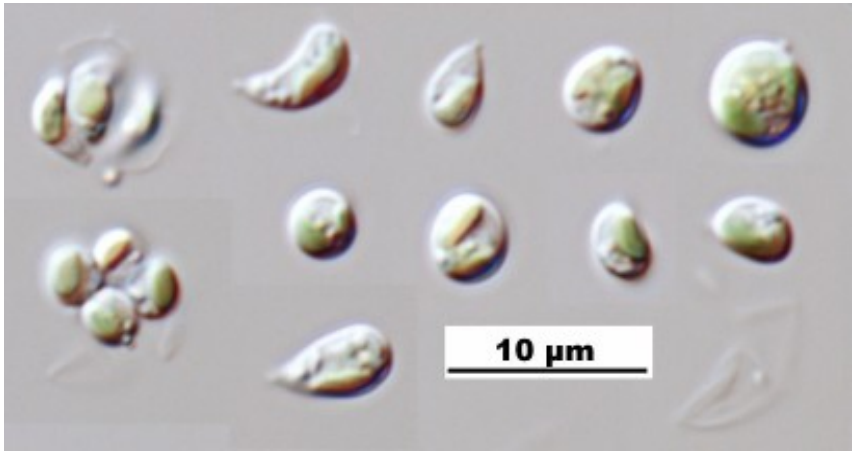
Vaucheria



Eustigmatophyceae







cryptic secxual reproduction
occurring in soil, freshwater and marine habitats
most of the diversity probably not yet discovered

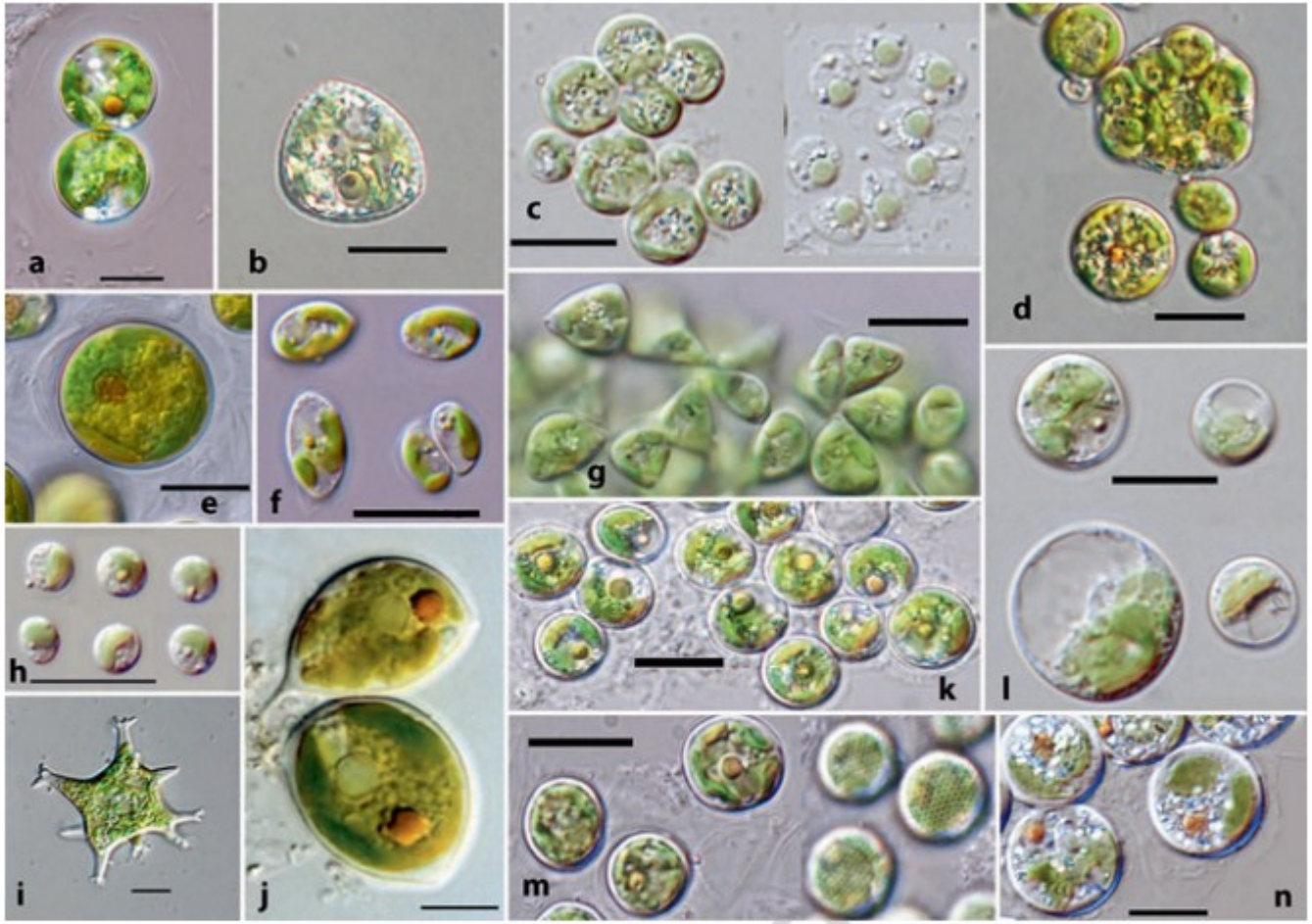


Fig. 2 Light micrographs of representative Eustigmatophyceae. (**a**) *Chlorybotrys* sp. UP3 5/31-7m (Eustigmataceae). (**b**) *Goniochloris sculpta* SAG 29.96 (Clade IIb). (**c**) Unidentified strain Mary 8/18 T-4d (Clade Ia); vegetative cells (*left*) and zoospores (*right*). (**d**) *Pseudellipsoidion edaphicum* CAUP Q 401 (*Pseudellipsoidion* group). (**e**) *Eustigmatos polyphem* (Eustigmataceae group). (**f**) *Monodus unipapilla* Skal1 4/27-2w (Monodopsidaceae). (**g**) Unidentified strain Itas 8/18 S-5d (Clade IIb). (**h**) *Nannochloropsis limnetica* CCMP 2271 (Monodopsidaceae). (**i**) *Pseudostaurastrum* sp. strain 10,174 (*Goniochloridales*). (**j**) *Characiopsis acuta* ACOI 456 (Eustigmataceae group). (**k**) Unidentified strain Pic 8/18 T-15d (Clade IIc). (**l**) Unidentified strain Pic 9/21 T-1d (Clade IIc). (**m**) Unidentified strain Chic 10/23 P-37 (Clade IIa), illustrating wall sculpting (*right*). (**n**) Unidentified strain WTwin 8/18 T-15d (Clade IIc). *Bars* = 10 μm

Eliáš et al., 2017, Handbook of Protists

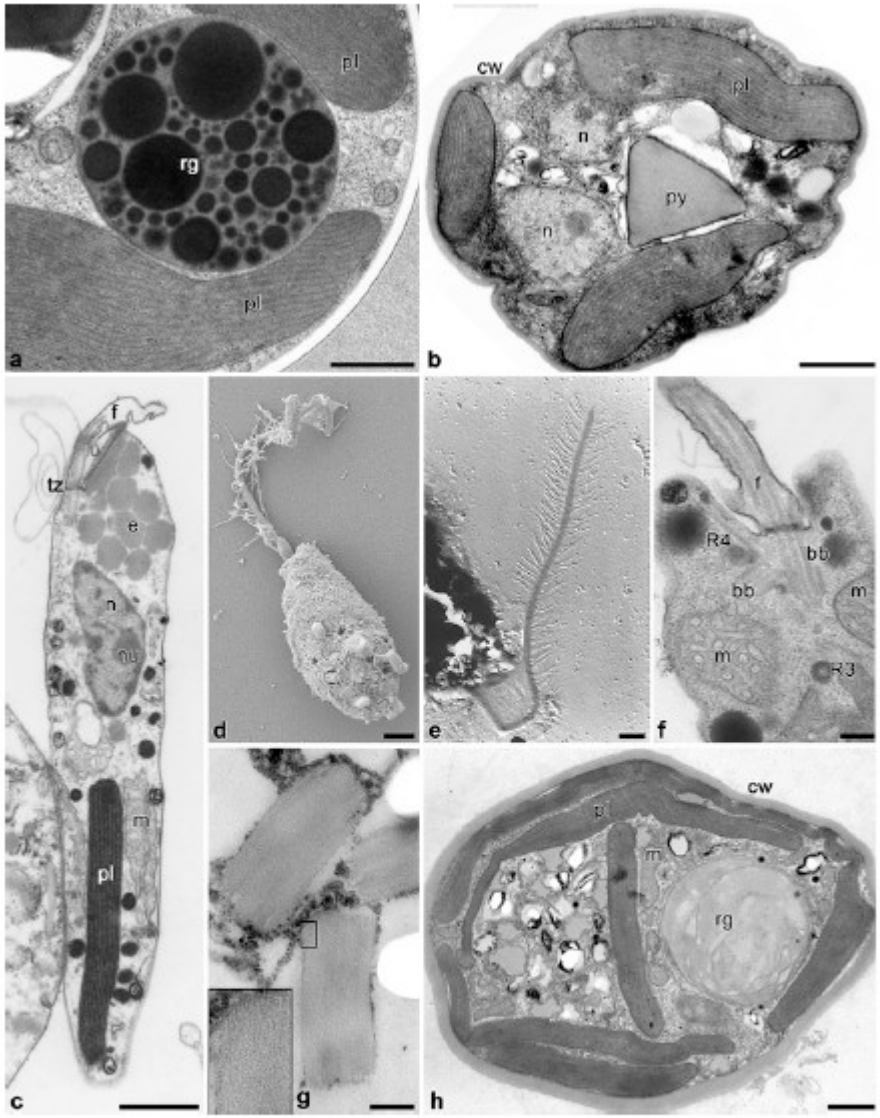
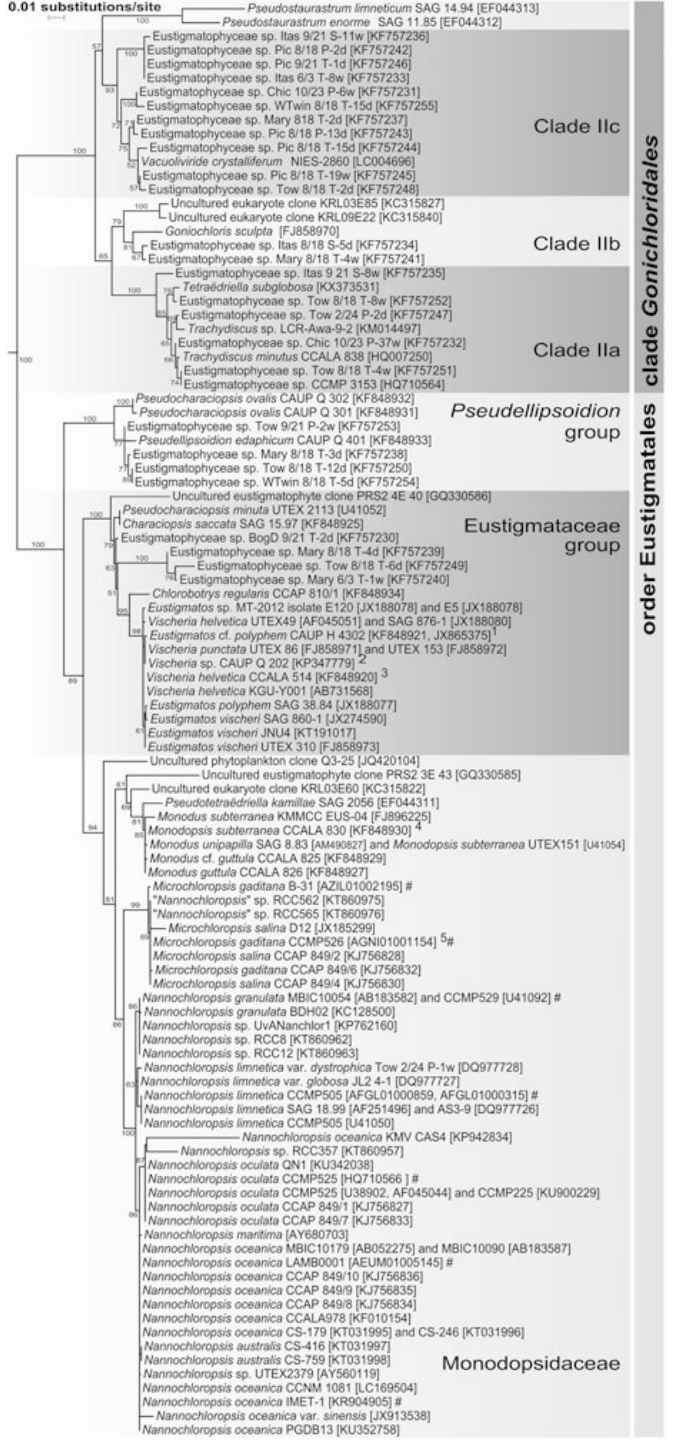


Fig. 3 Cell ultrastructure in the Eustigmatophyceae. (**a**) Detail of a plastid (without the girdle lamella) and a reddish globule of *Vischeria helvetica* (*pl* plastid, *rg* reddish globule). (**b**) Section of a vegetative cell of *Eustigmatos magna*, presumably on a way to cytokinesis (note the two nuclei; *cw* cell wall, *n* nucleus, *p* pyrenoid, *pl* plastid). (**c**) Zoospore of *Vischeria helvetica* (*e* eyespot, *f* flagellum, *m* mitochondrion, *n* nucleus, *nu* nucleolus, *pl* plastid, *tz* transitional zone of the flagellum). (**d**) Zoospore of *Trachydiscus minutus* in a scanning electron microscope. (**e**) Detail of the flagellum bearing mastigonemes, *Vischeria stellata*. (**f**) Longitudinal section of the flagellar apparatus of *Vischeria stellata* uniflagellate zoospore showing basal bodies with R3 and R4 flagellar



examples of (eustigmatophyte) mass cultures and photobioreactores - primarily Nannochloropsis

Nature Beta Technologies Ltd, Eilat, Israel

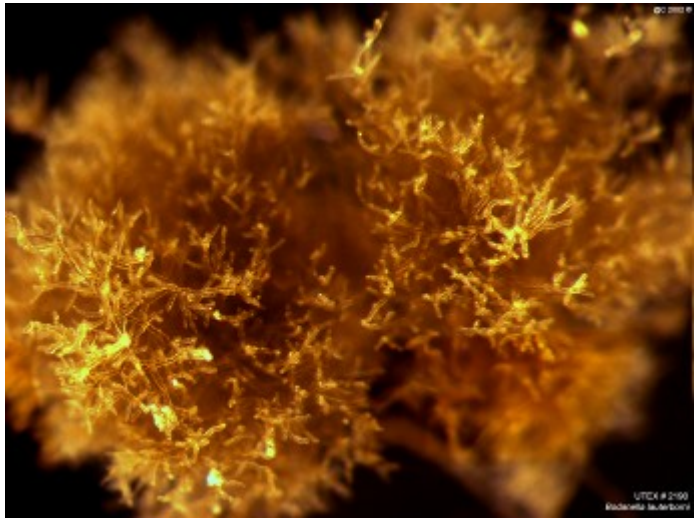
source of arachidonic acid (ARA) and eicosapentaenoic acid (EPA)

Nannochloropsis farms for animal food production (fish aquacultures, etc.)

additional links:
https://meticulousblog.org/top-companies-in-nannochloropsis-market/
https://finance.yahoo.com/news/global-nannochloropsis-market-2021-2028-150600787.html

Greenwell et al, 2010, J Royal Soc

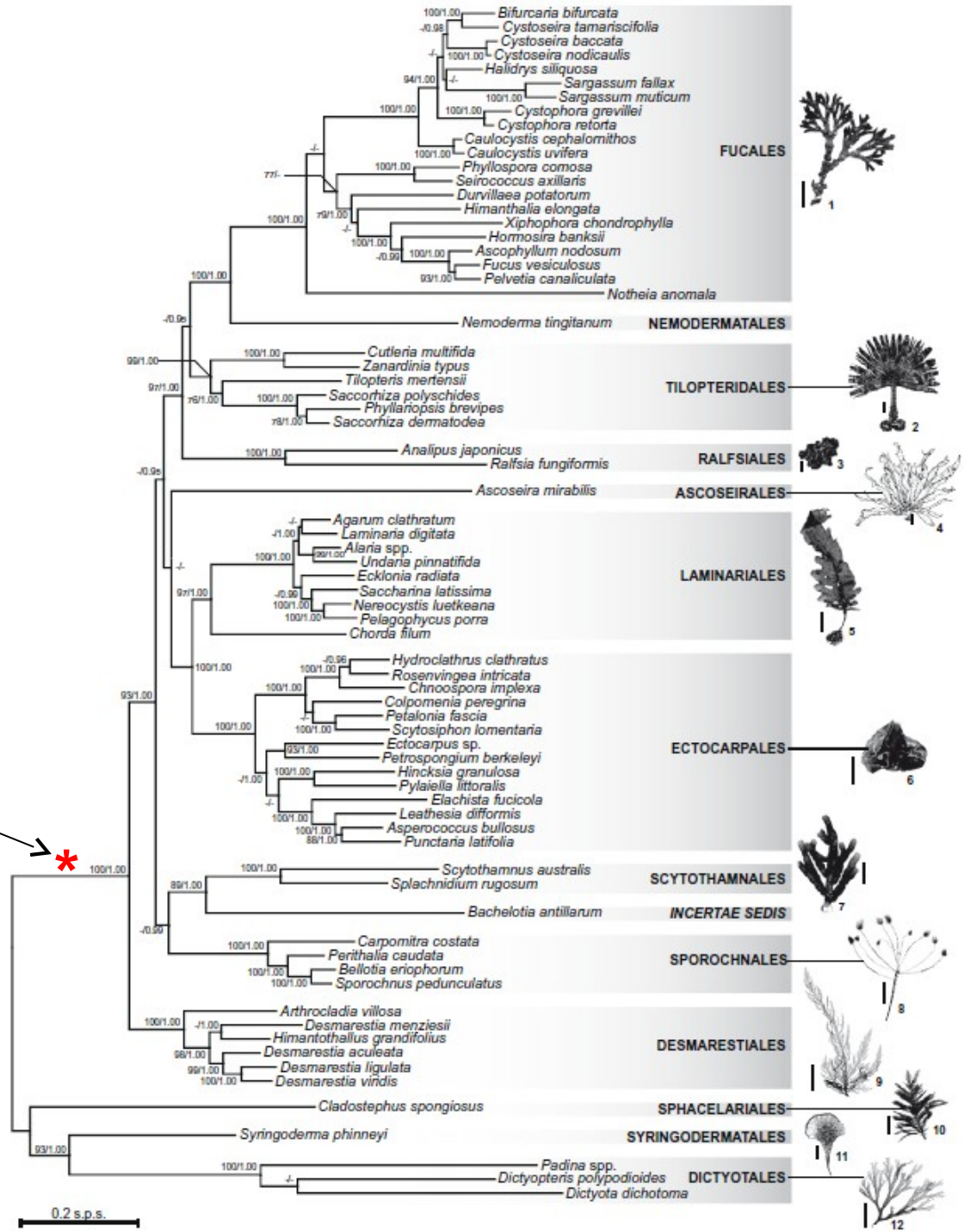
Phaeophyceae - chaluhy



- about 2000 species are known,
- only 3 genera freshwater
- all the others live in marine eulittoral and sublittoral
- heterotrichal to complex macroscopic thalli,
- fucoxanthin – brown carotenoid pigment;
- obscure plosascharides in cell walls – production of alginates;
- maricultures, source of iodine in food webs

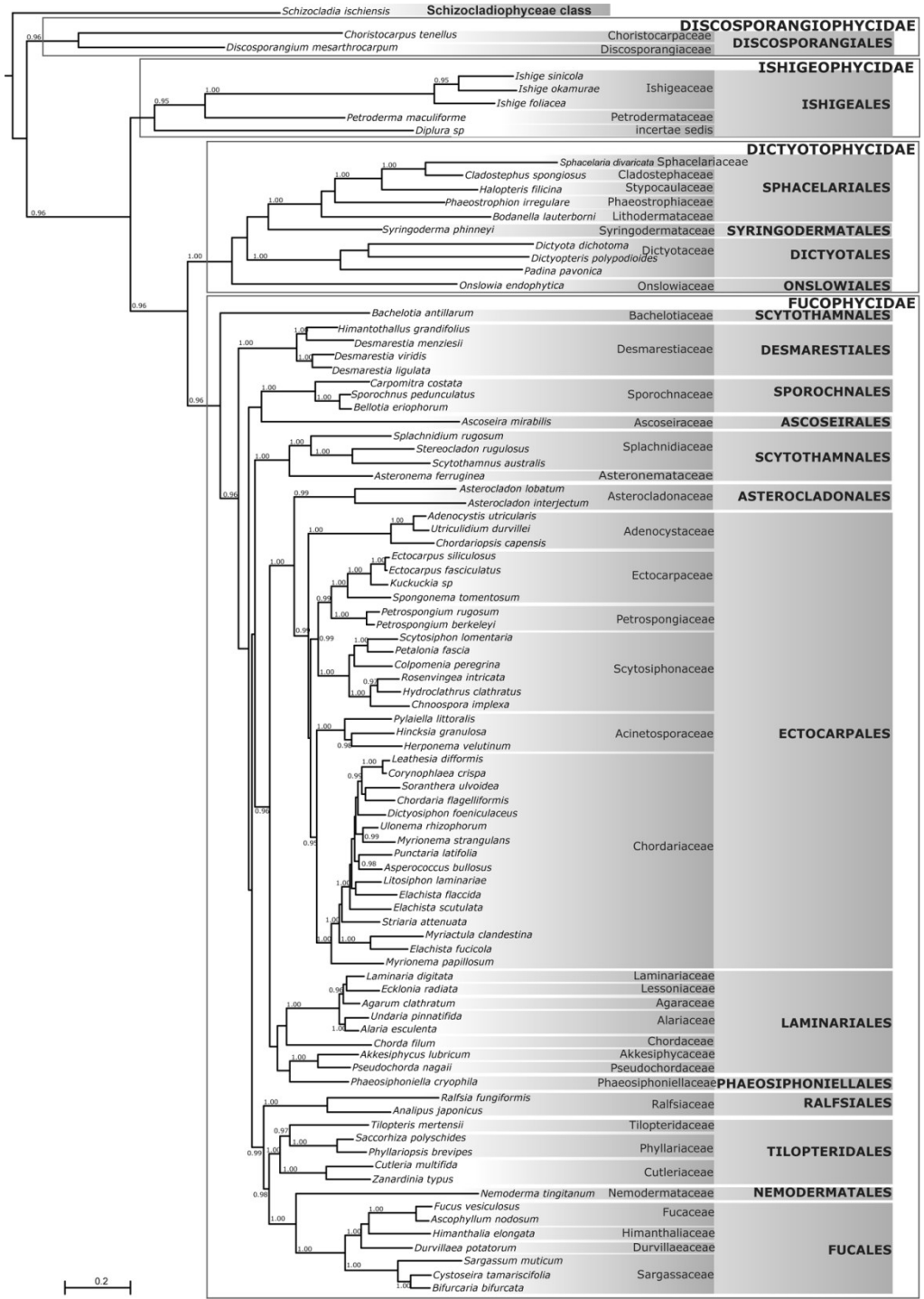
Phylogeny of Phaeophyceae

(ML tree, 10 genes)



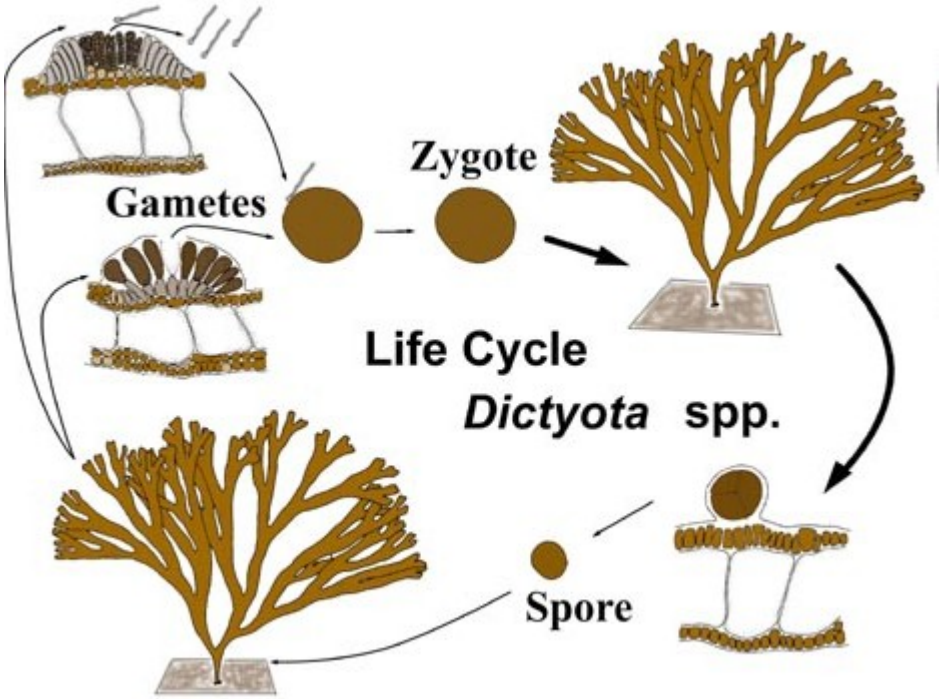
heteromorphic life cycle

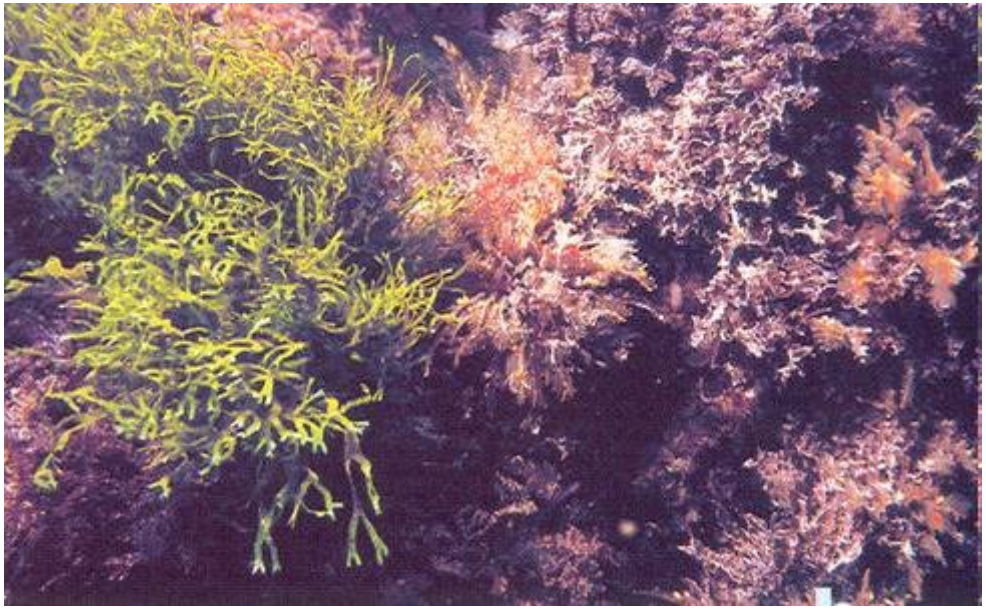
Silberfeld et al., 2010,
Mol. Phyl. Evol. 56: 659-674.



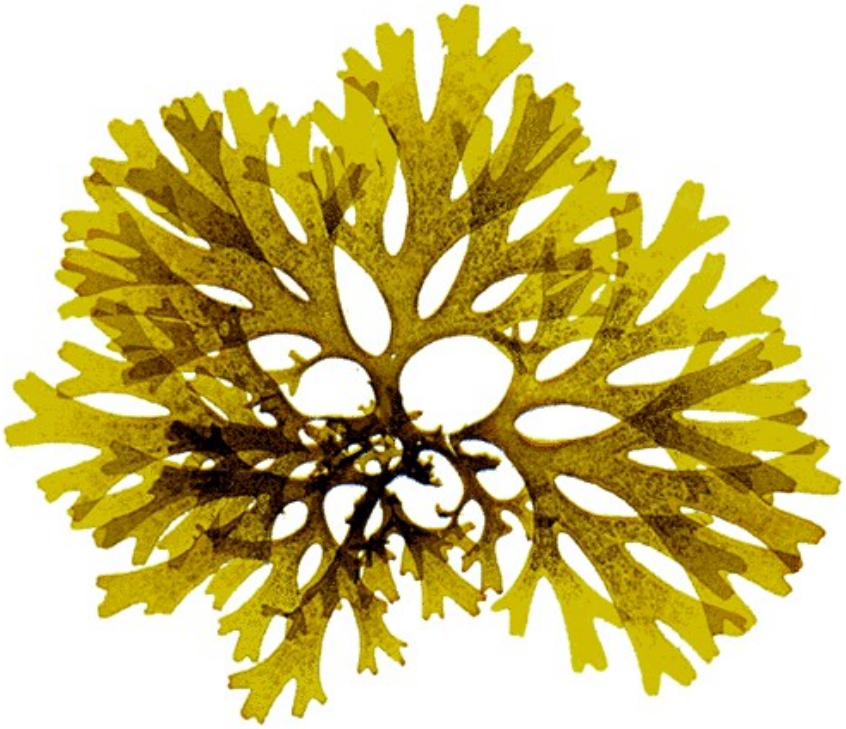
Silberfeld et al., 2014,
Crypt. Algol. 35: 117-156.

Dictyota

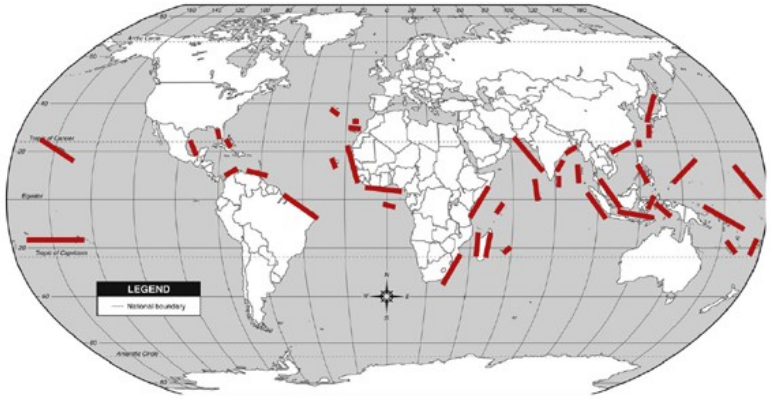


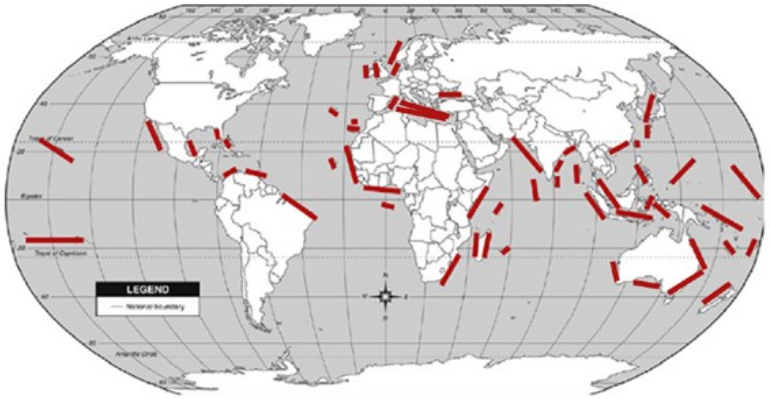


Dictyota bartayresiana

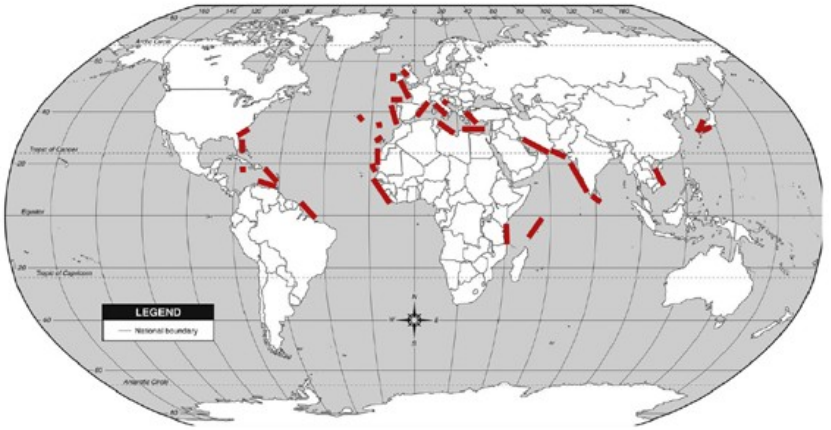


Dictyota dichotoma





Dictyopteris



shade-loving species, sheltered habitats

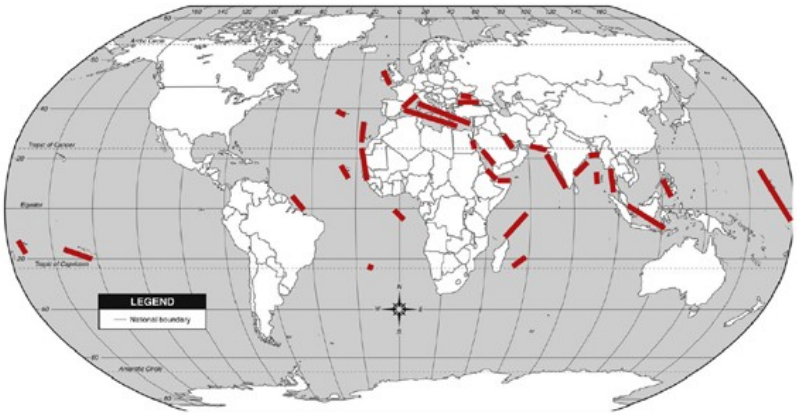
Dictyopteris polypodioides

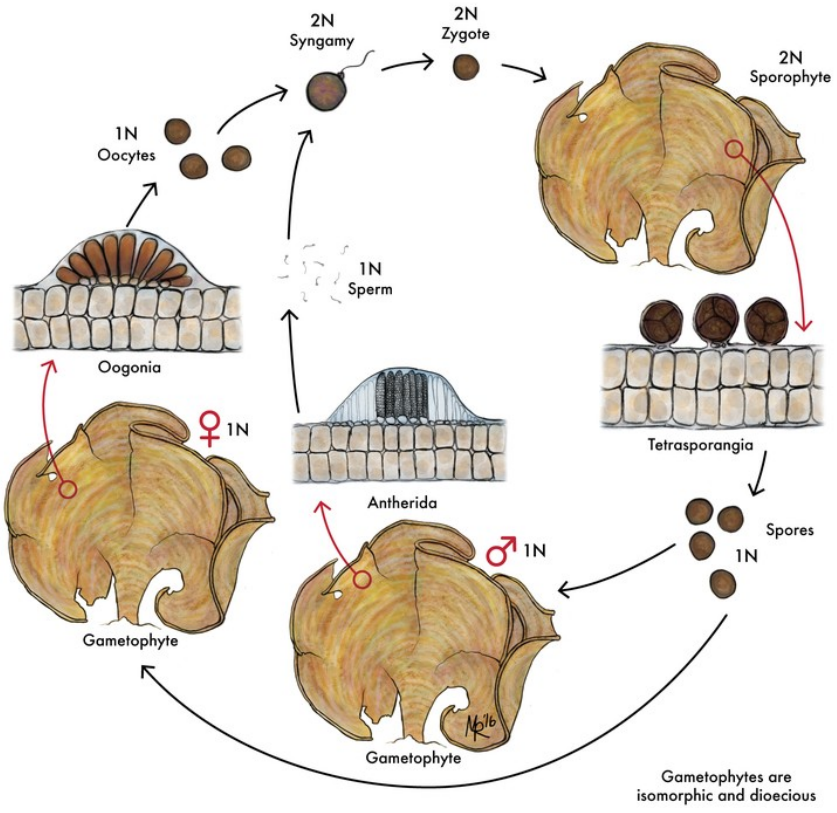
Padina

cosmopolitan sublittoral genus;
often in ruderal localities of disturbed tropical ecosystems ;
calcified thalli


Dolong
Gulf of Tomini
Padang
Teku
Bunta
Ampana
Luwuk
Matindok
Pulau Peleng
SULAWESI
TENGGARA
Banggai
Kolonodale

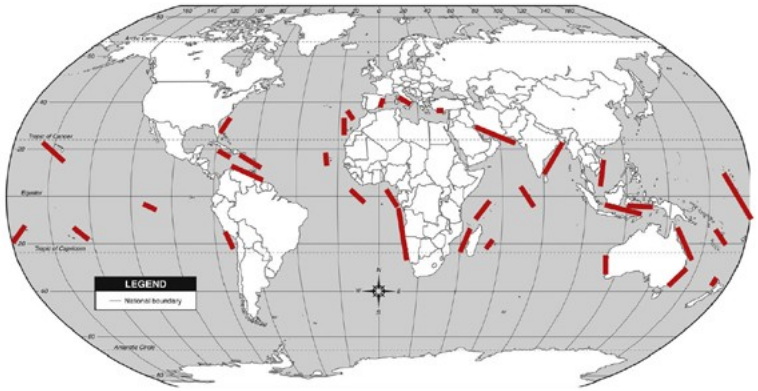
Padina pavonica





frequent Mediterranean species,
upper sublittoral

Lobophora

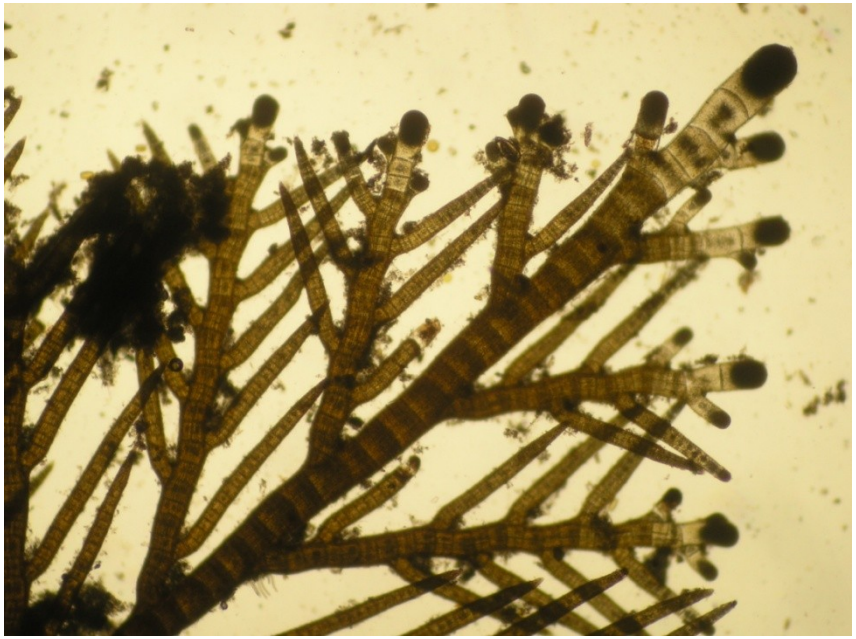


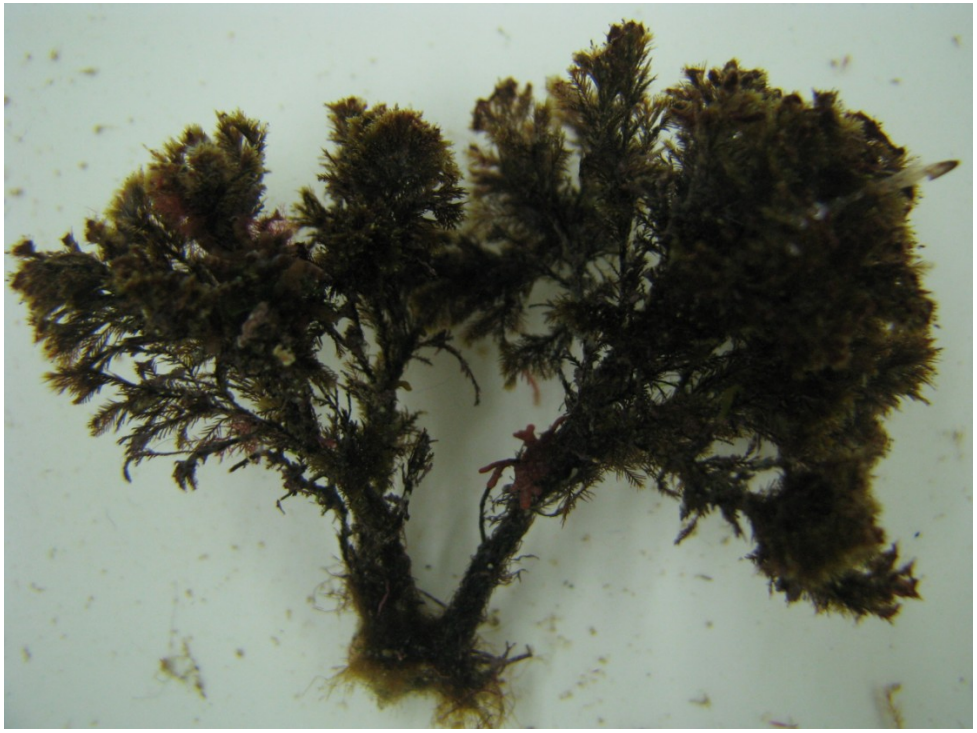
Lobophora variegata

Sphacelariales

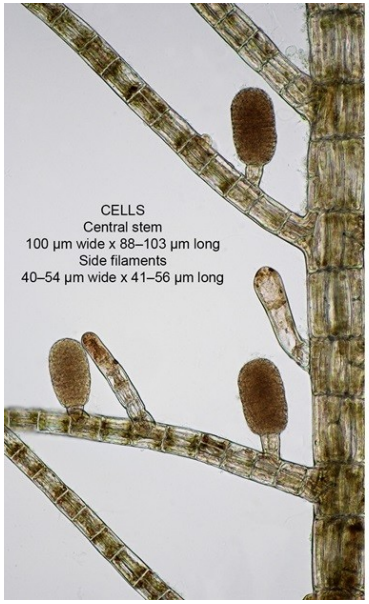
Halopteris, Stypocaulon, Sphacelaria

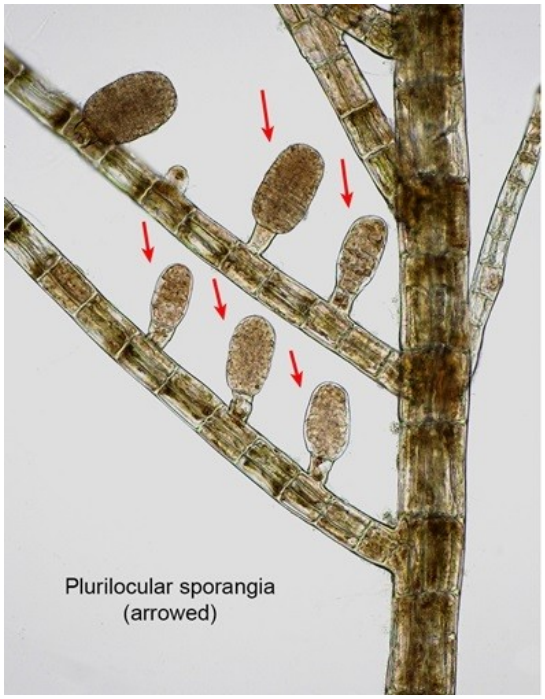
some of the most frequent phaeophyceans in the Mediterranean and European Atlantic coast

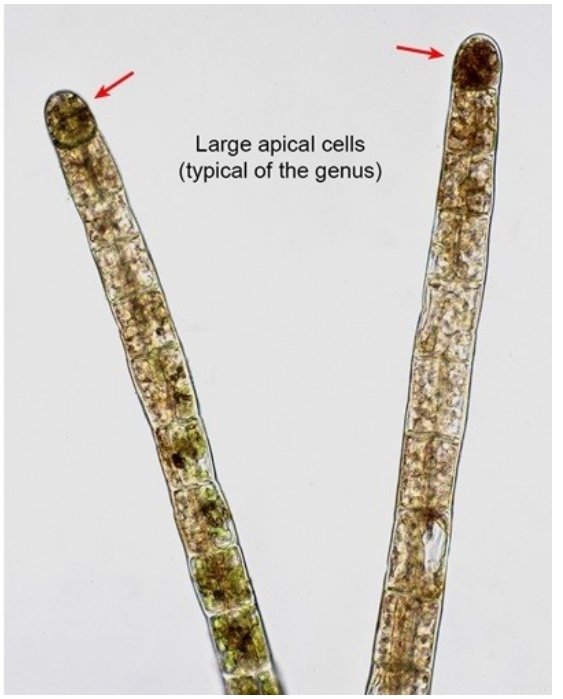


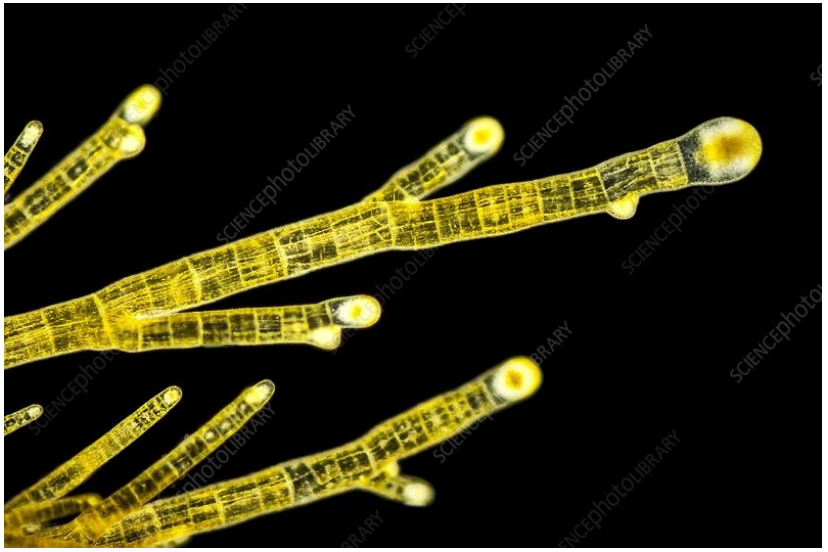


Sphacelaria



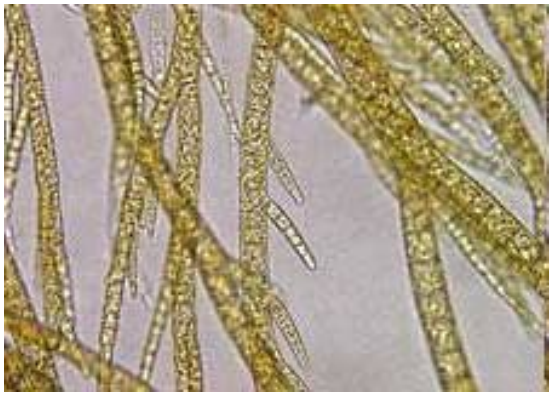


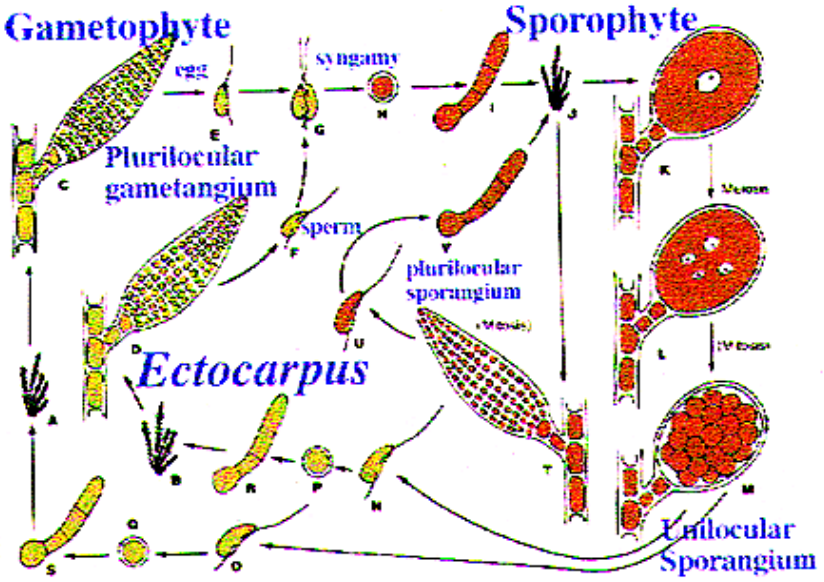




Ectocarpales

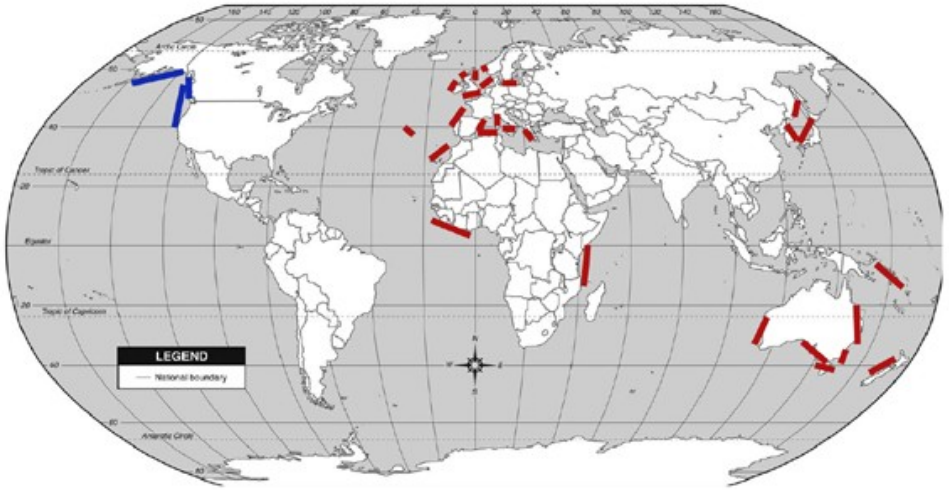
Ectocarpus





heterotrichal thallus, (almost) isomorphic life cycle, marine and brackish sublittoral

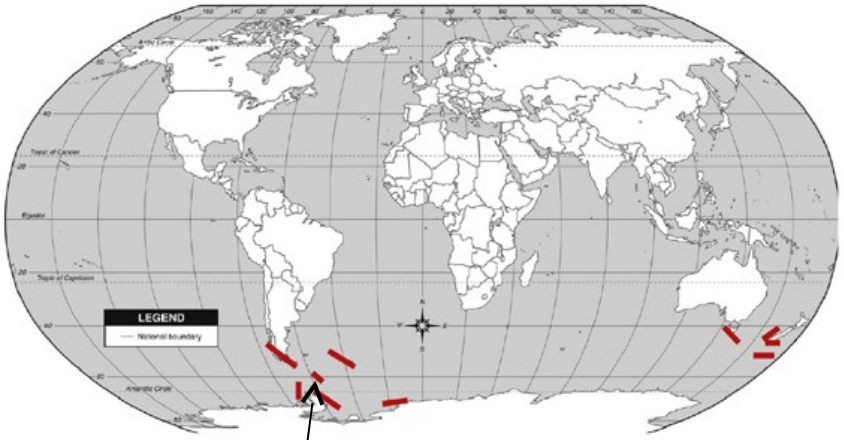
Colpomenia



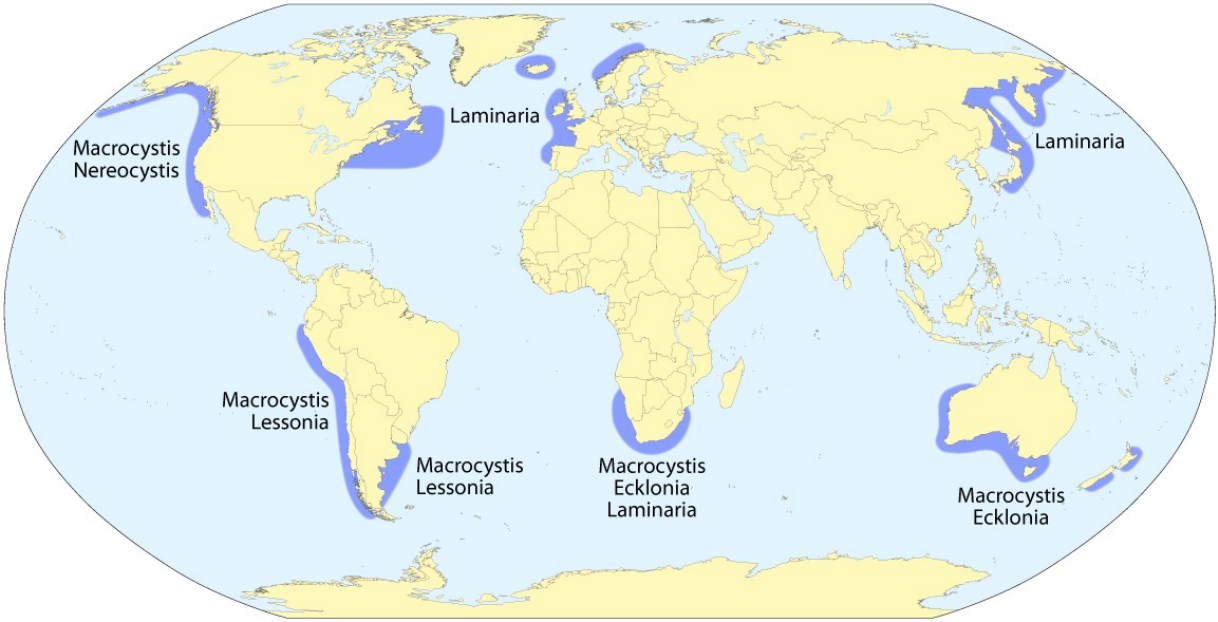
Colpomenia peregrina

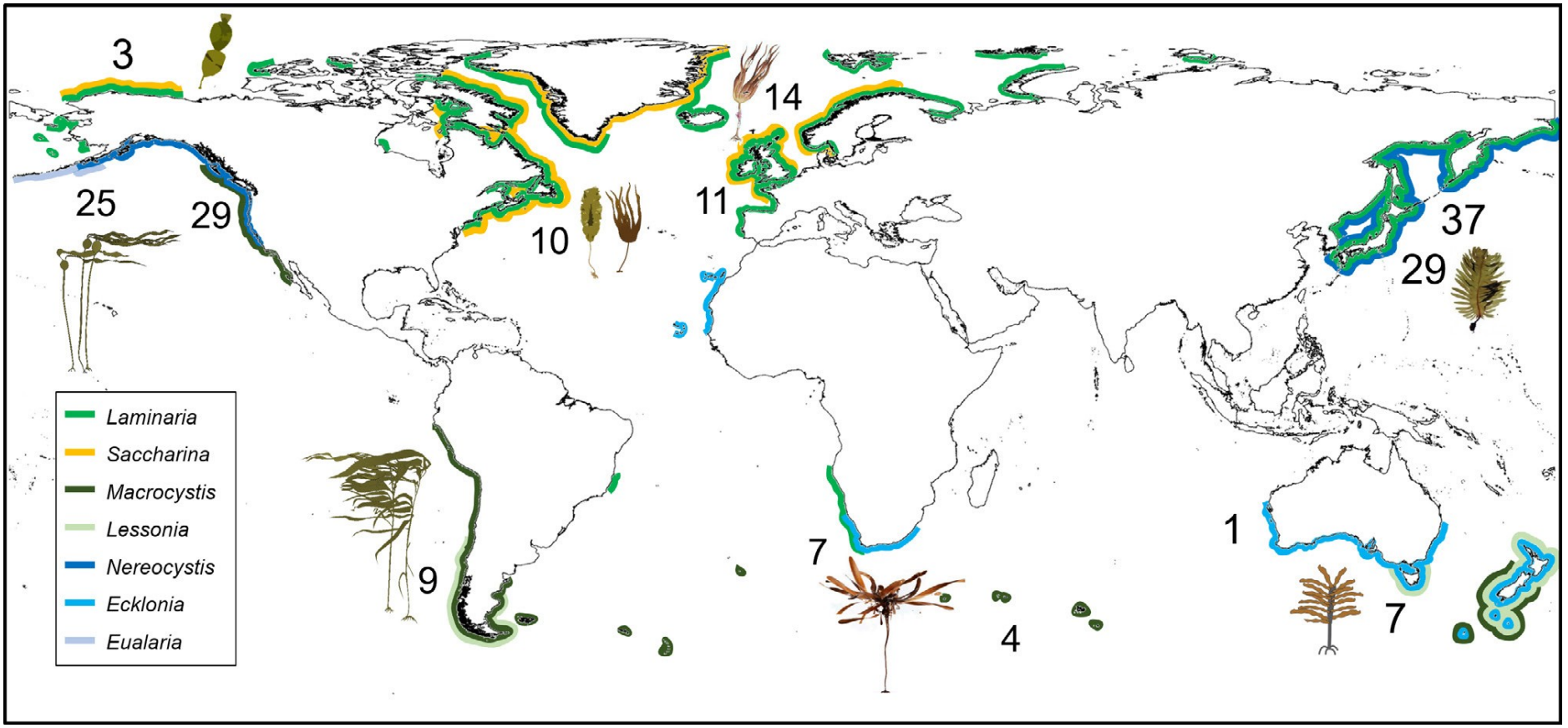
invasive lineage in subtropical seas, origin in N Pacific

Adenocystis



Kelp ecosystems

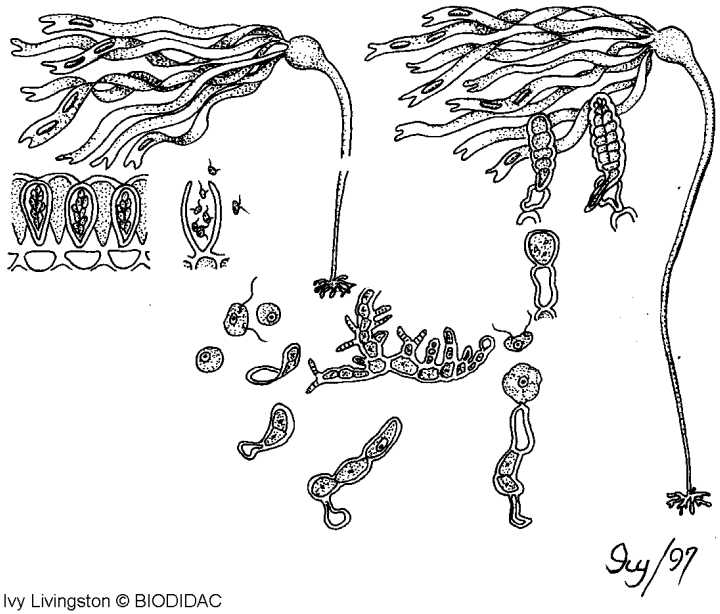




Wernberg et al., 2019, World Seas

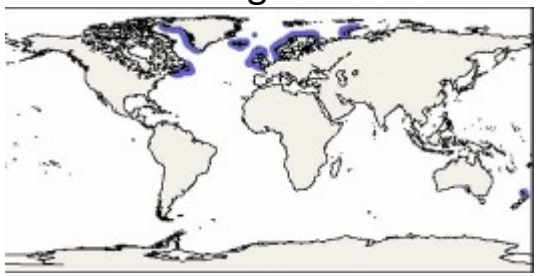
Laminariales

Laminaria

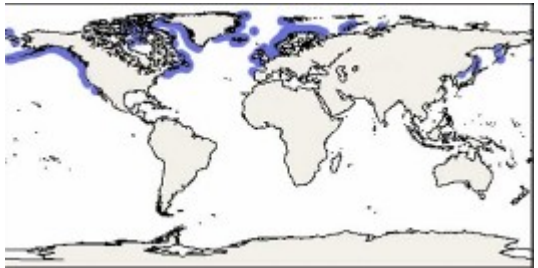


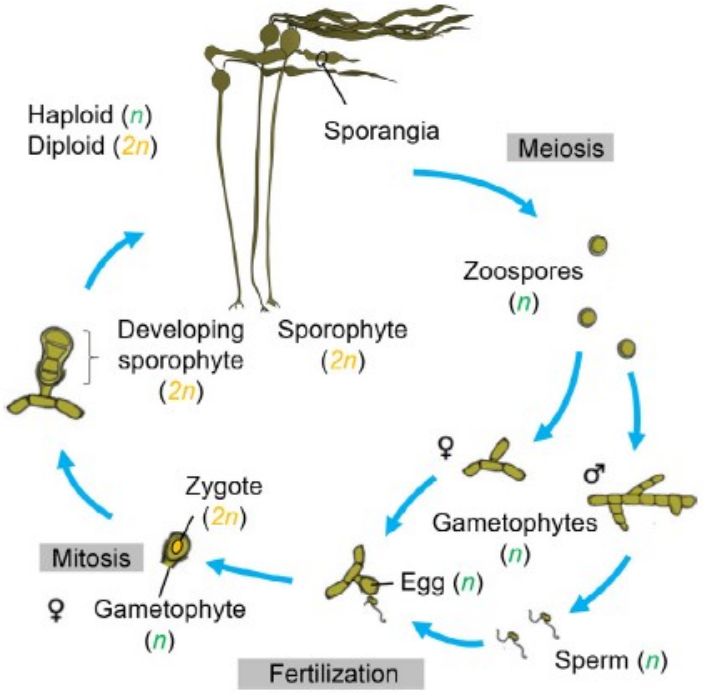
Ivy Livingston © BIODIDAC

L. digitata

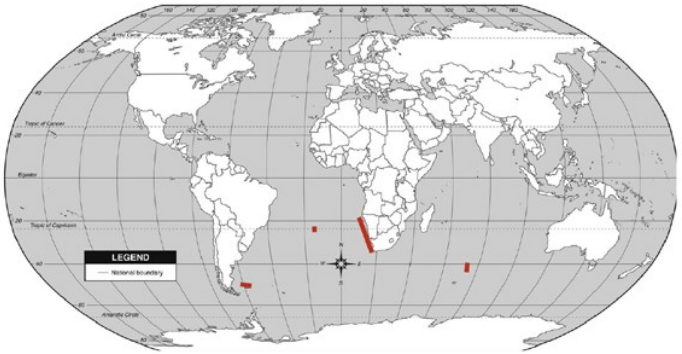


L. saccharina





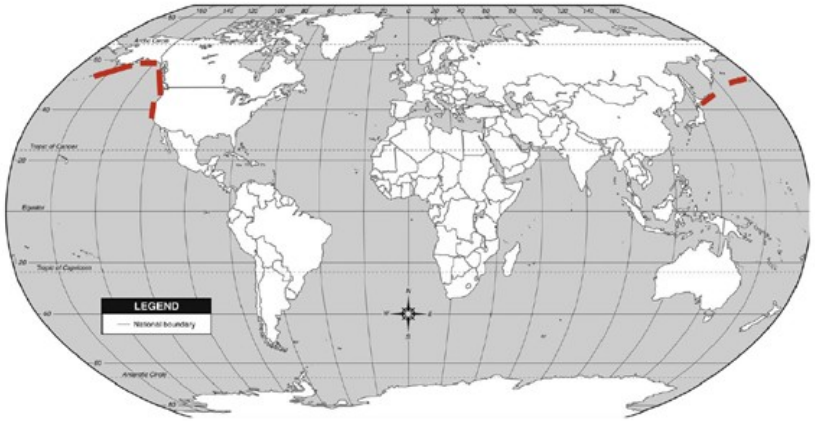
Ecklonia



E. maxima

key genus of kelp forests on S Hemisphere

Alaria

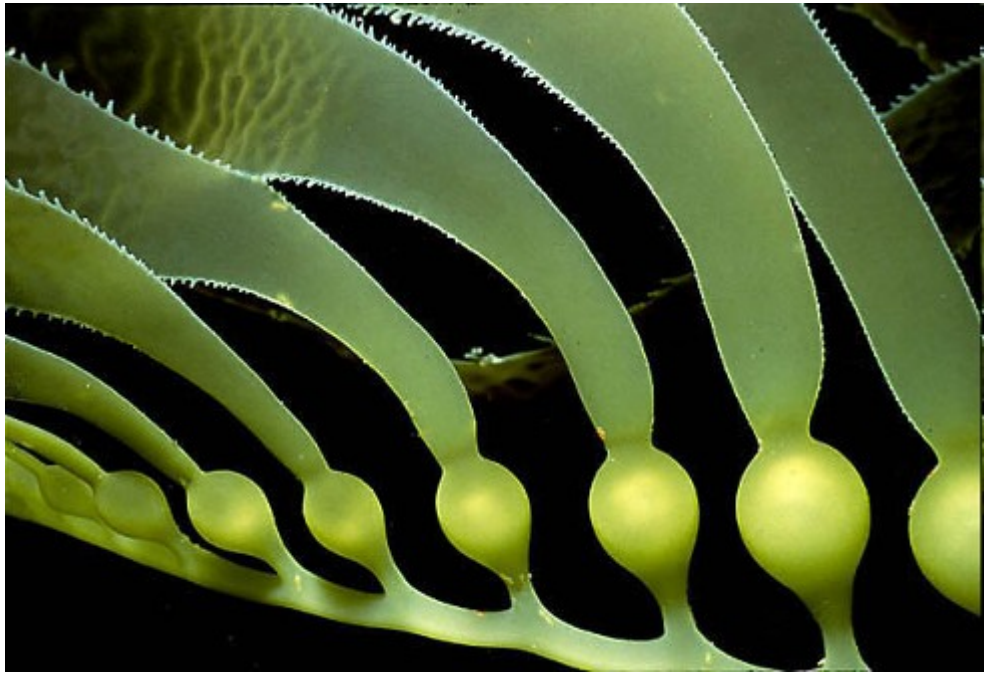


A. marginata

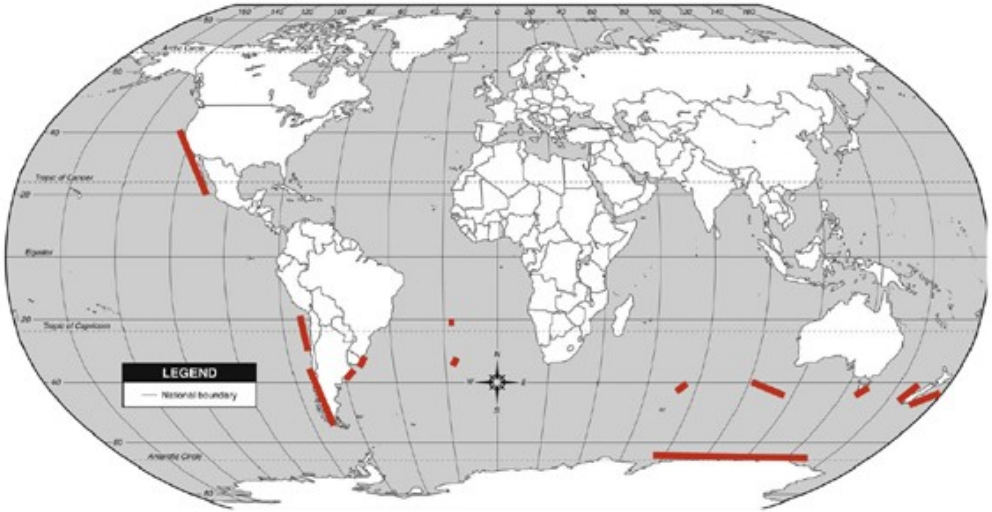
mostly Pacific genus (Alaska, Aleutian Islands, E Siberia)

intertidal a subtidal kelp communities (N/W Pacific)

Macrocystis

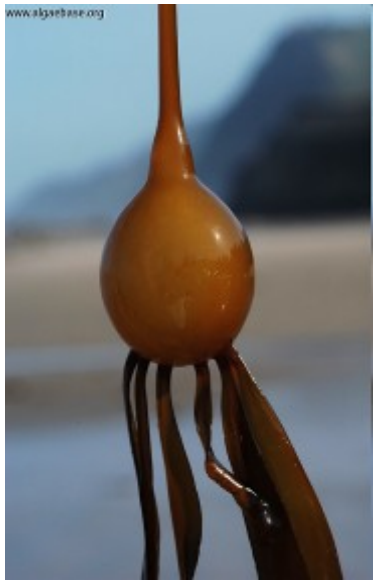


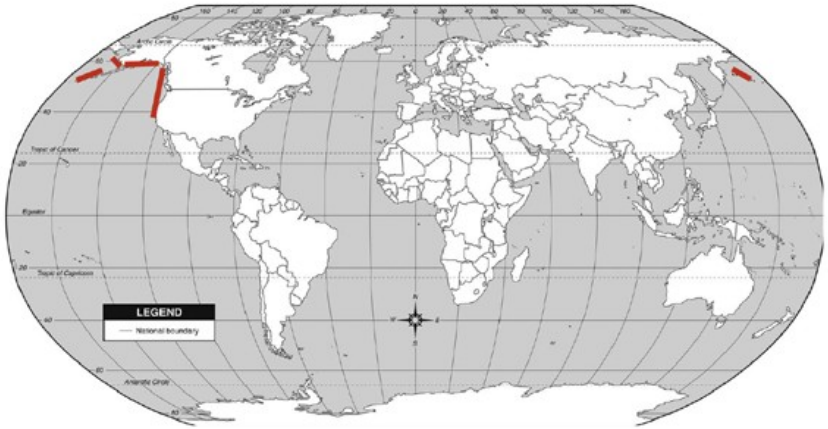
dominant circum-antarctic genus (+ Pacific coast of America)



M. pyrifera

Nereocystis (luetkeana)





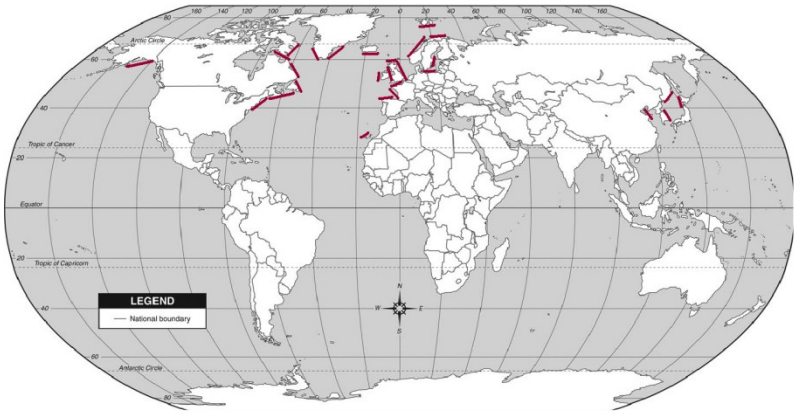
Postelsia palmaeformis
(diminutive palm kelp)

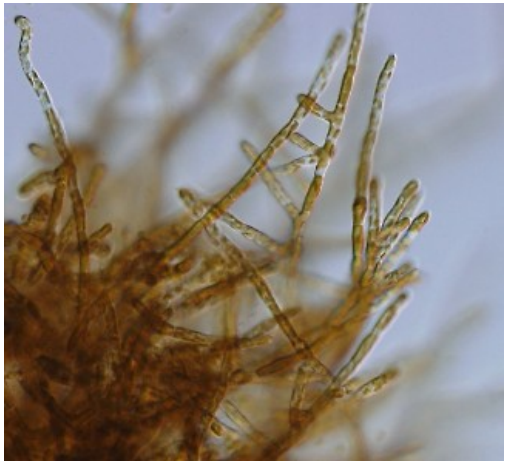
Pacific coast of North America
intertidal (i.e. frequently exposed to dessication)

Chorda

vegetative sporophyte (seasonal),
hollow tubes (filled by air),
unicellular paraphyses

http://www.marlin.ac.uk

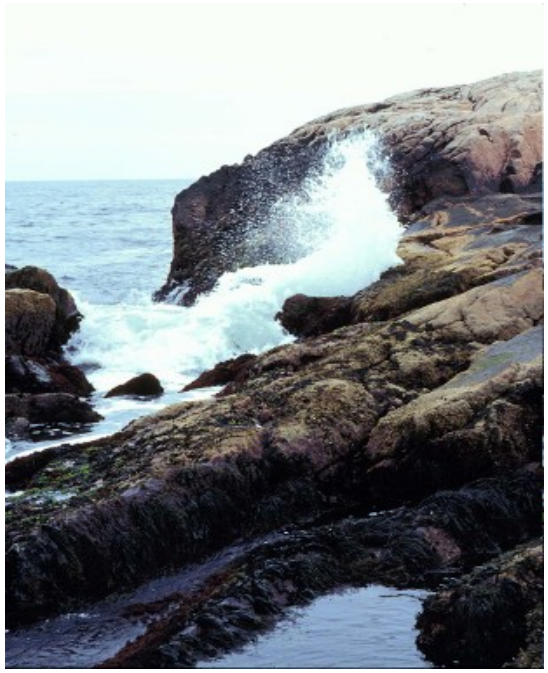


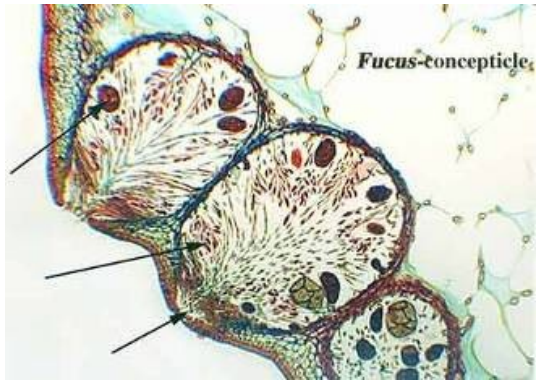


Ch. filum

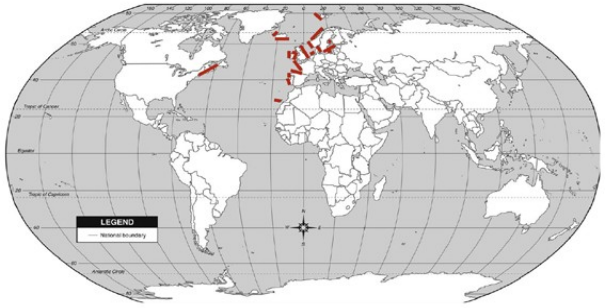
Fucales

Fucus

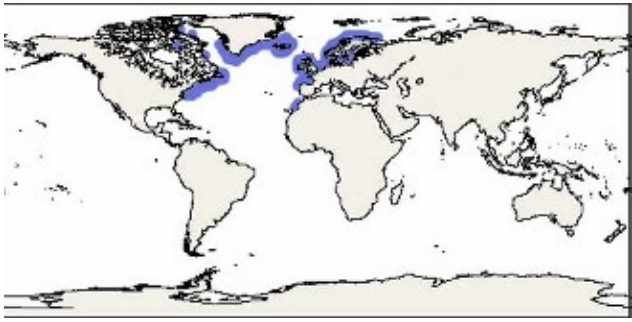




diplontic life cycle;
receptacles, conceptacles

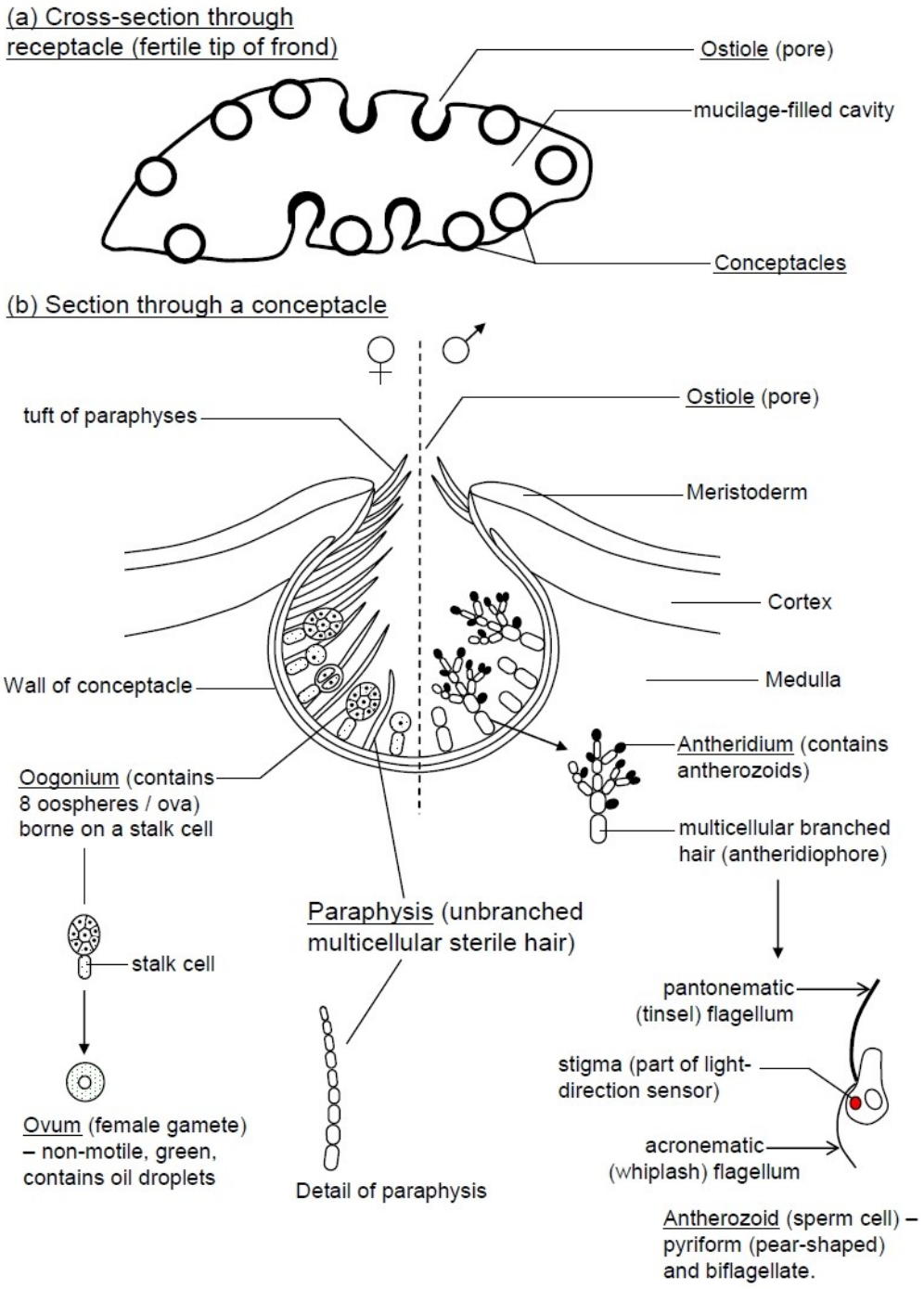


F. serratus



F. vesiculosus

Fucales
details of sexual reproduction



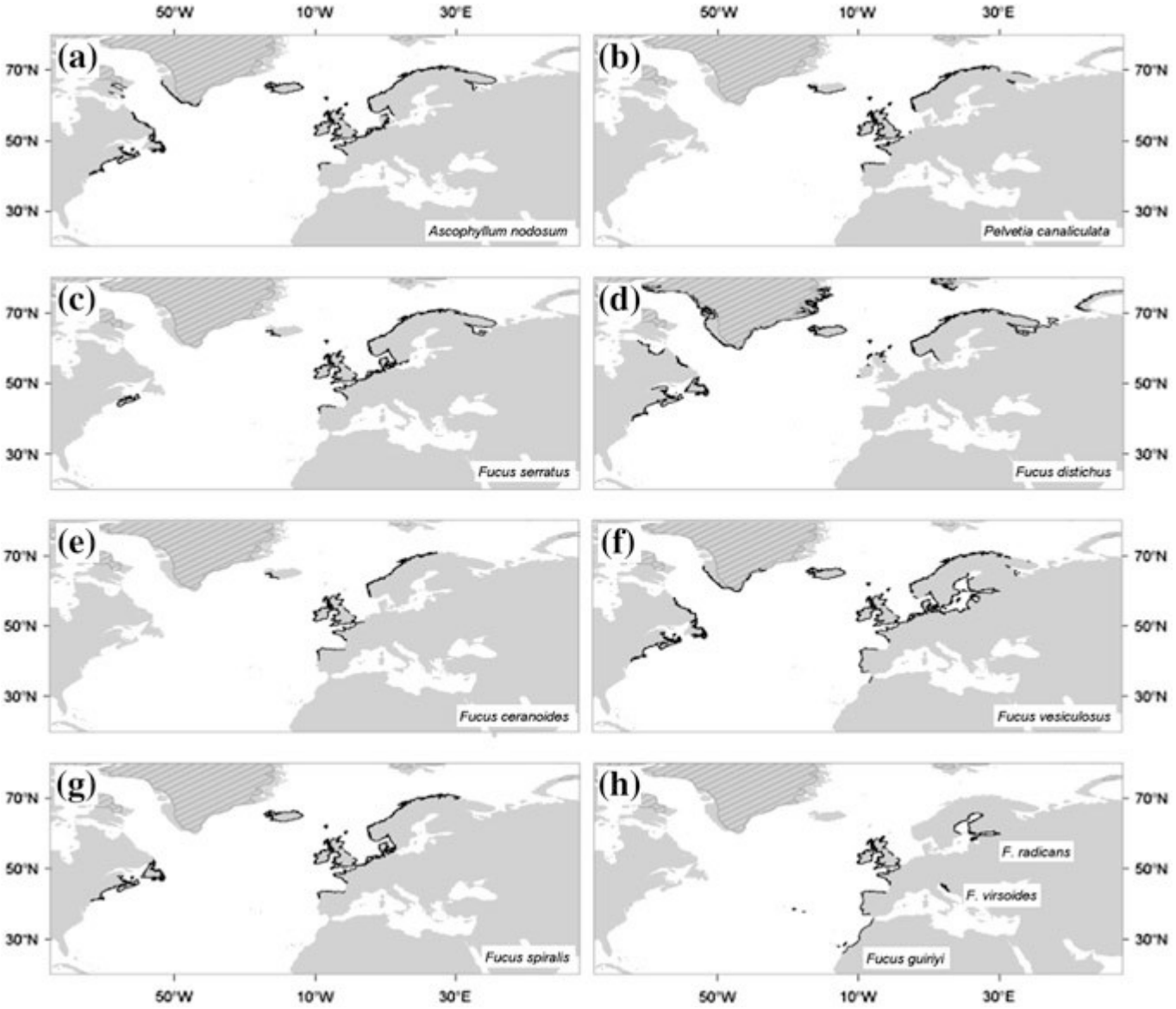
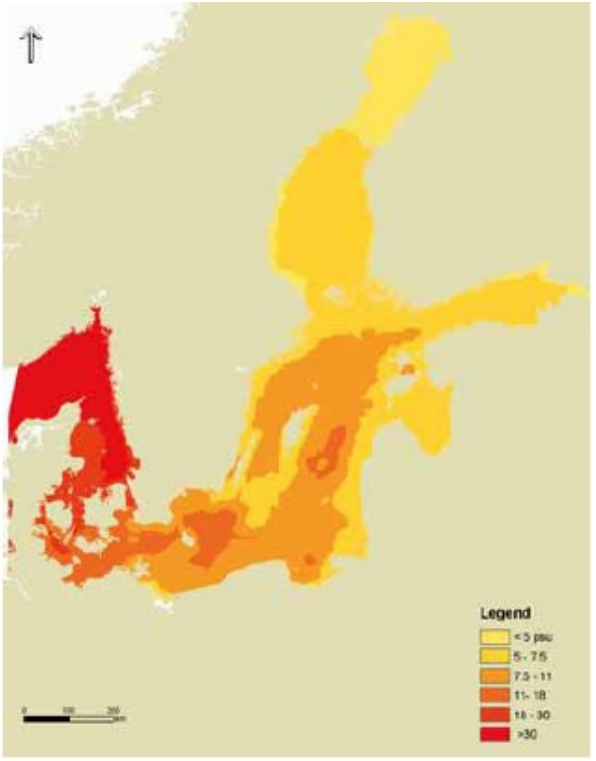


Fig. 11.2 Distribution of Fucaceae species in the North Atlantic. *Dashed areas* depict permanent ice. The distributions of *Fucus distichus* (native all around the Arctic) and *F. spiralis* also include the North Pacific, although the latter appear to have been recently introduced there

Neiva et al., 2016, Seaweed Phylogeography

Three *Fucus* species are key organisms of the Baltic ecosystems



http://www.visayards.com/66

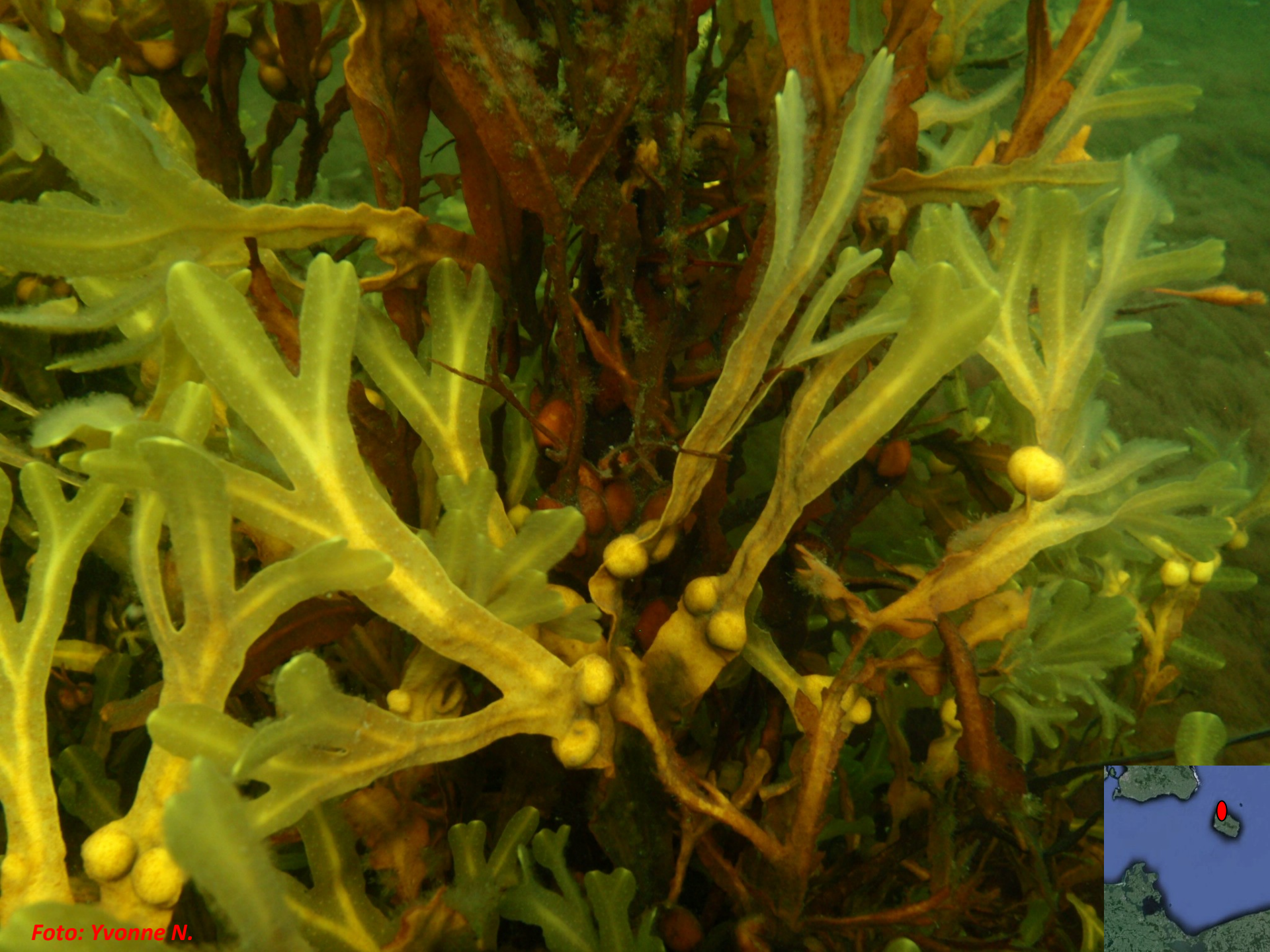


Foto: Yvonne N.

Foto: Yvonne N.

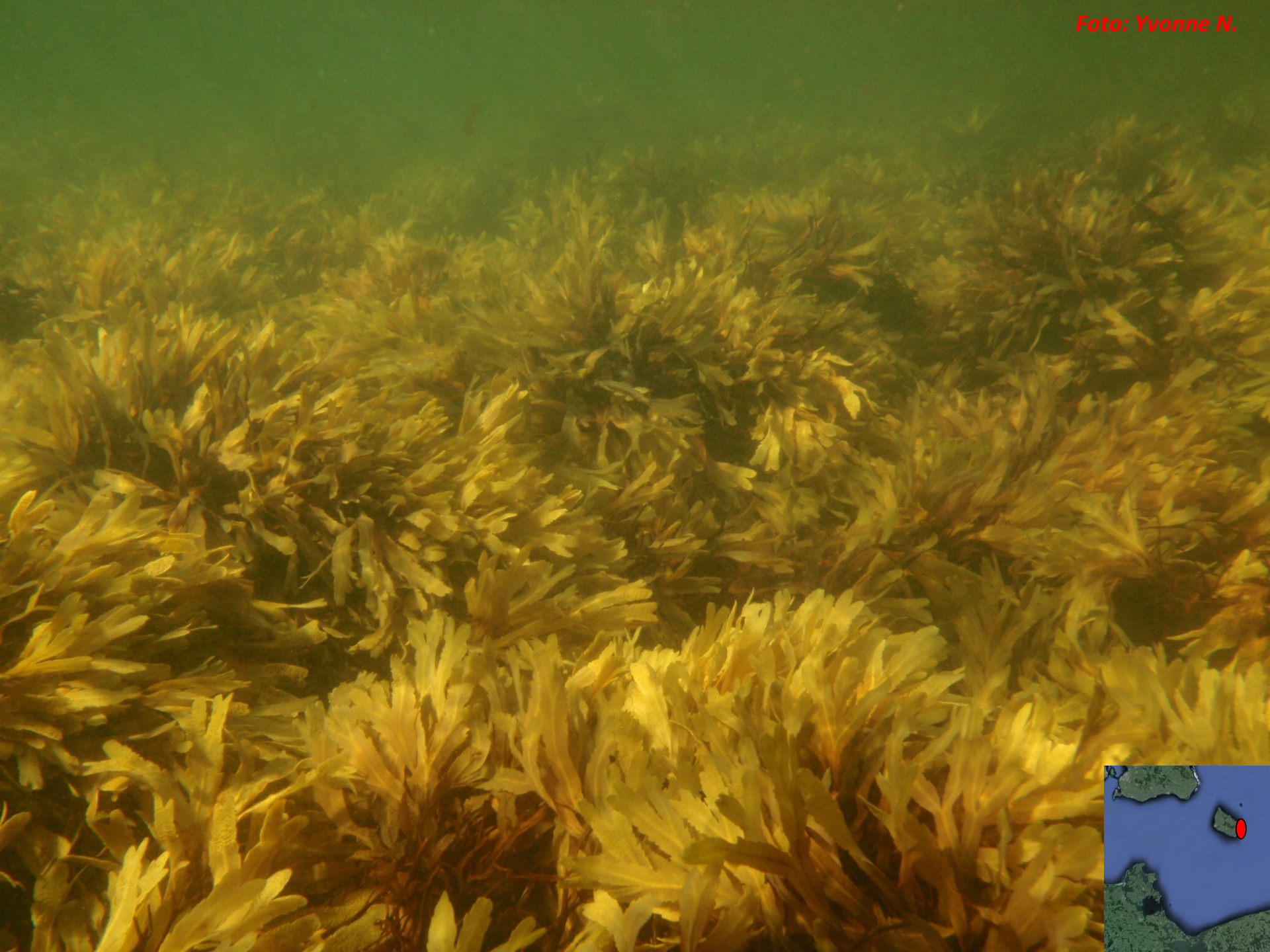


Foto: Yvonne N.

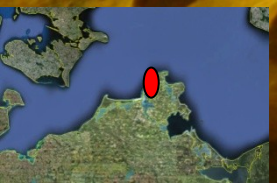
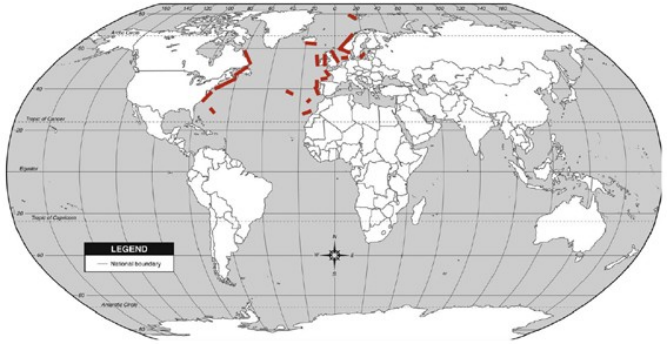


Foto: Yvonne N.

Ascophyllum

one of the dominant algae of the eulittoral/upper sublittoral of W European coasts (e.g. W Ireland)

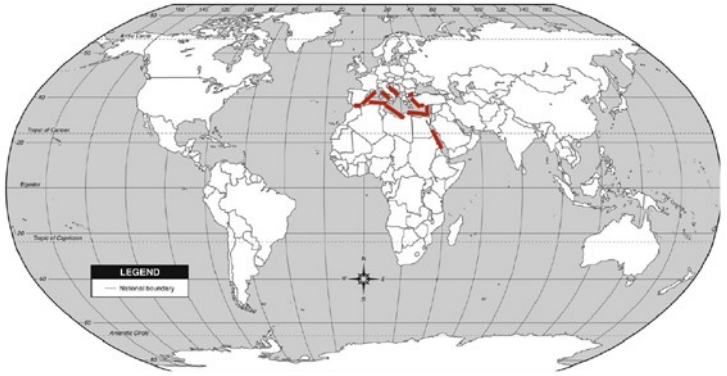


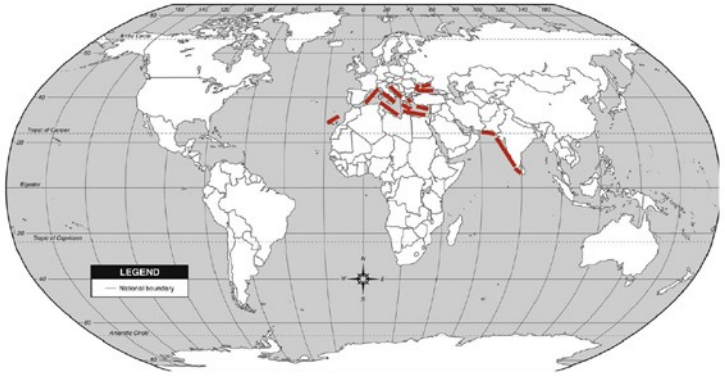
A. nodosum

Cystoseira

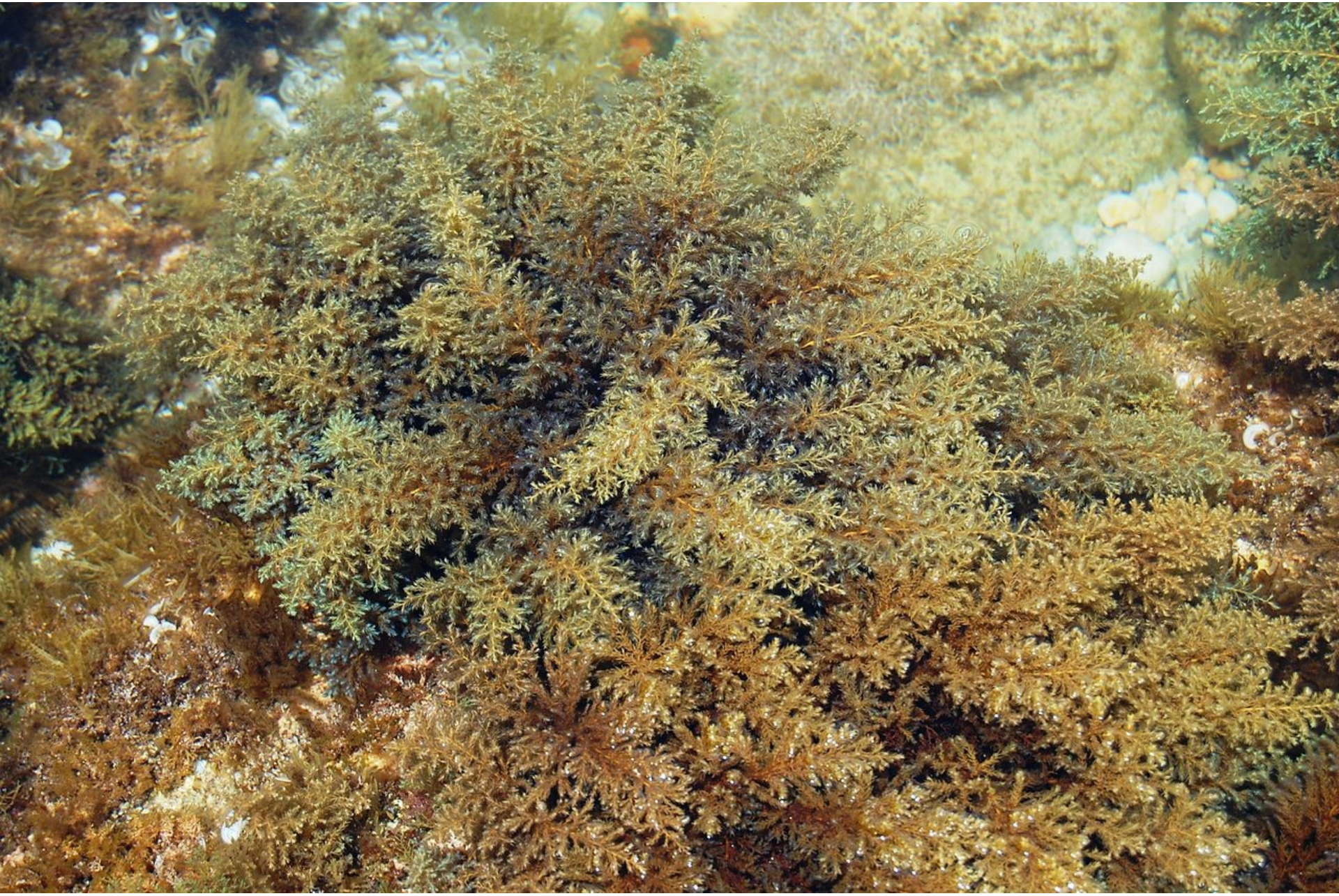
C. amentacea

C. barbata





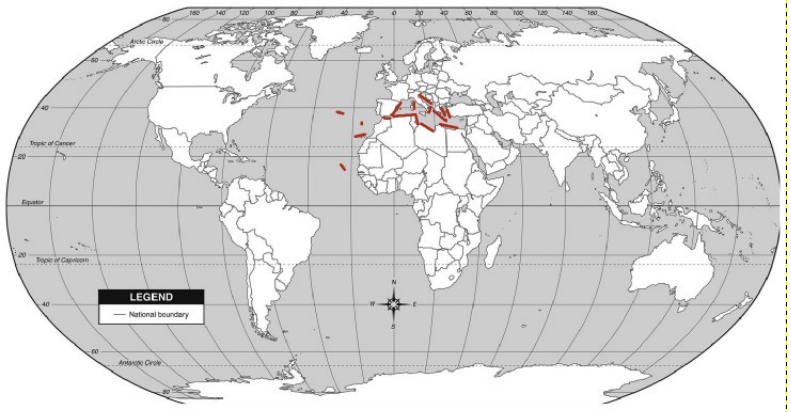
species-rich and abundant genus in the Mediterranean



Wikipedia

C. barbata

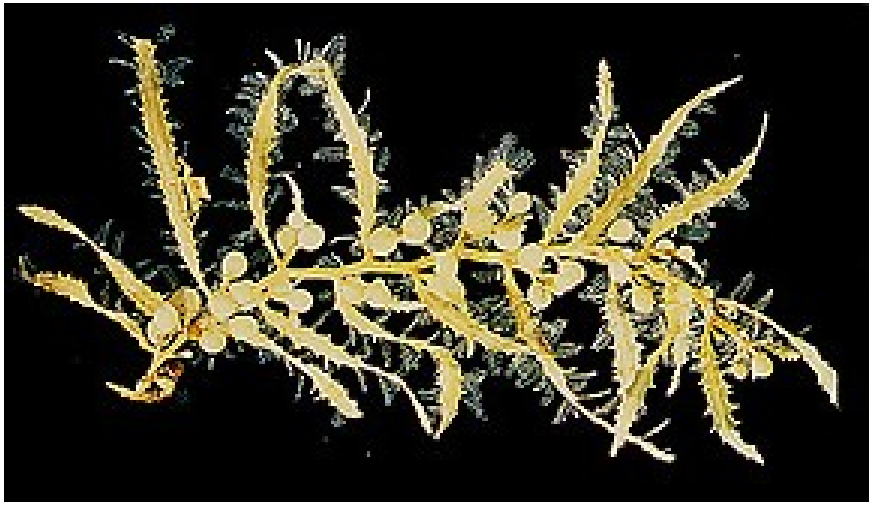
www.algaebase.org



C. compressa

www.algaebase.org, www.azalas.de

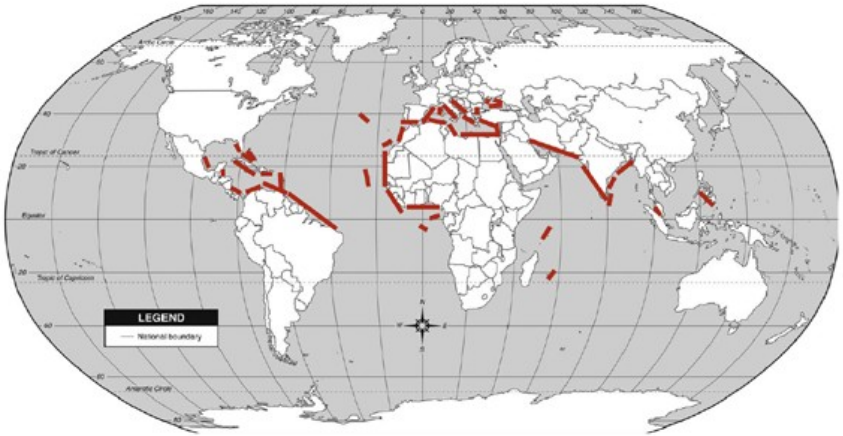
Sargassum



most taxa in the tropics;
a few subtropical /warm temperate species;

bentic and pelagic species

S. natans, S. fluitans



S. vulgare

S. muticum – an invasive species along W European coasts

some examples of biotechnological and food-processing utilization of Phaeophyceae

kombu – *Laminaria*
wakame – *Undaria*
hiziki - *Hizikia*

alginates