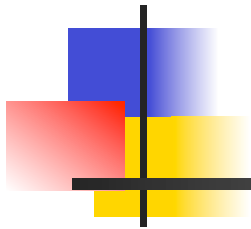


Características, Aplicaciones y Usos de las Algas



Ricardo J. Haroun Tabraue
Centro de Biodiversidad y Gestión Ambiental,
Universidad de Las Palmas de Gran Canaria

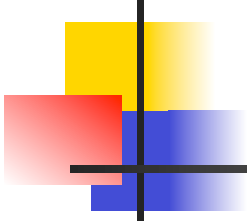
Organizado por:



Con la colaboración de:



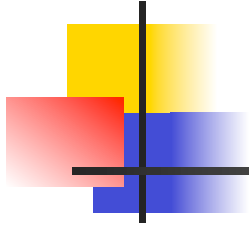
Las Algas: Usos y Aplicaciones. Madrid, 14 de marzo de 2012



INDICE

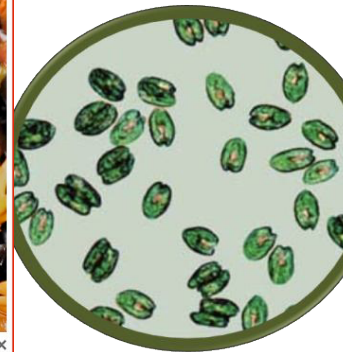
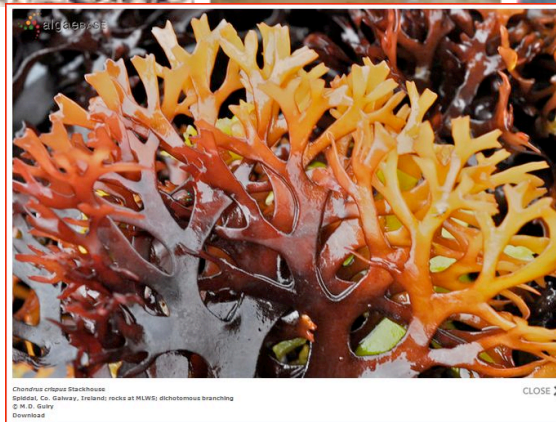
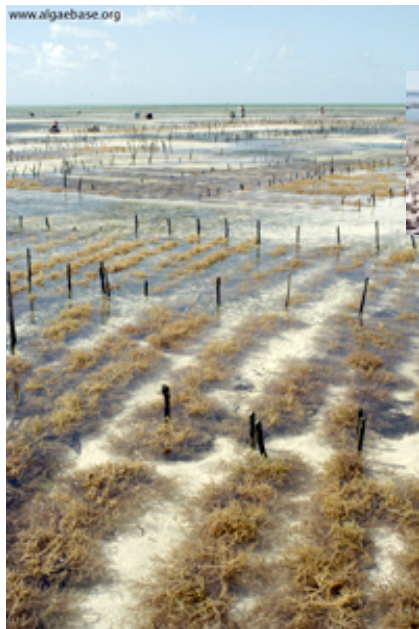
- Biodiversidad Algal
 - Sistemática
 - Zonación / Biogeografía
- Importancia Algas
- Aplicaciones y Usos
 - Grupos principales de algas cultivadas
 - Cultivos integrados

BIODIVERSIDAD ALGAL

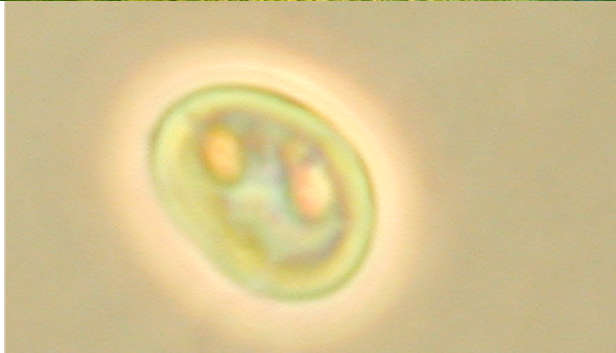
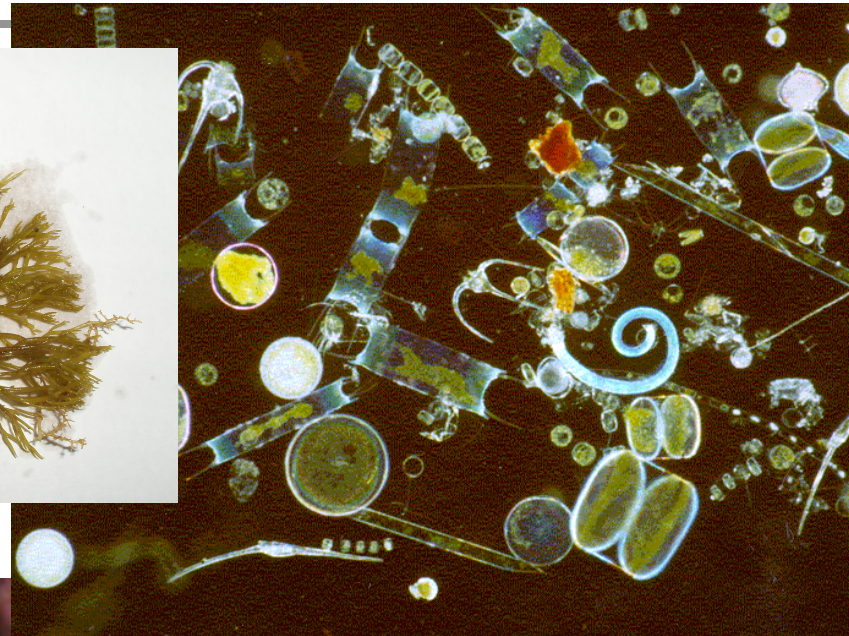
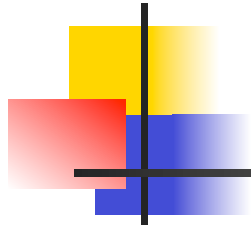


Algae are very diverse photosynthetic organisms, mainly living in aquatic habitats, without roots and leafs, and which also lack vascular tissues

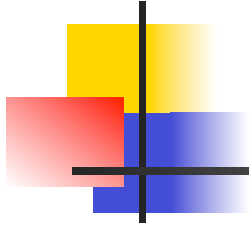
van den Hoek et al., 1998



BIODIVERSIDAD ALGAL



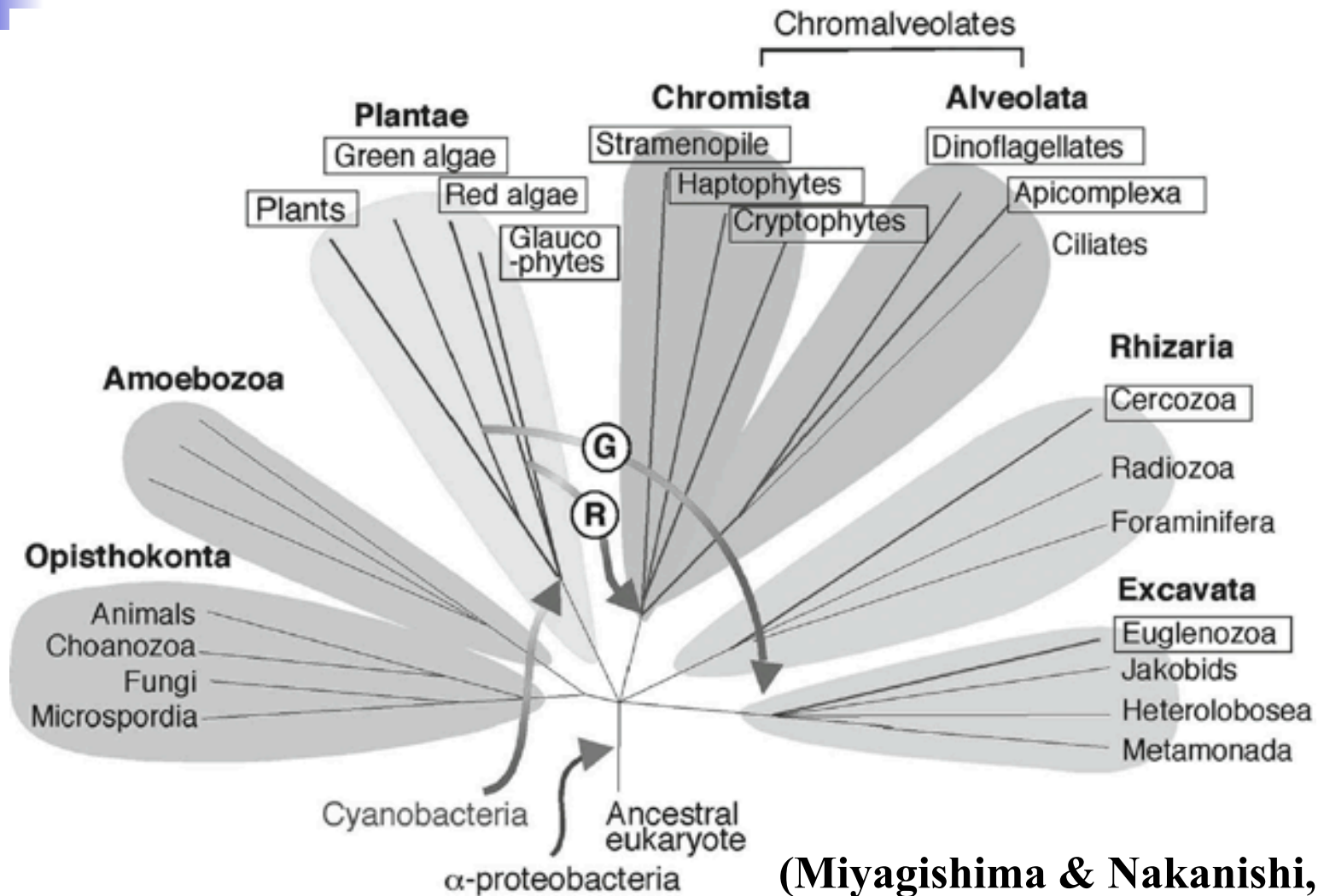
Sistemática



- Morfología general: unicelular, colonial, filamentosa, etc.
- Características bioquímicas:
 - Tipo y combinación de pigmentos fotosintetizadores
 - Productos de reserva
 - Paredes celulares
- Citología:
 - Estructura cloroplastos
 - Células flageladas o no
- Datos moleculares

(van den Hoek et al., 1998; Yang & Boo, 2006; Reyes-Prieto et al. 2007)

Relaciones filogenéticas de los eucariotas y origen de los cloroplastos



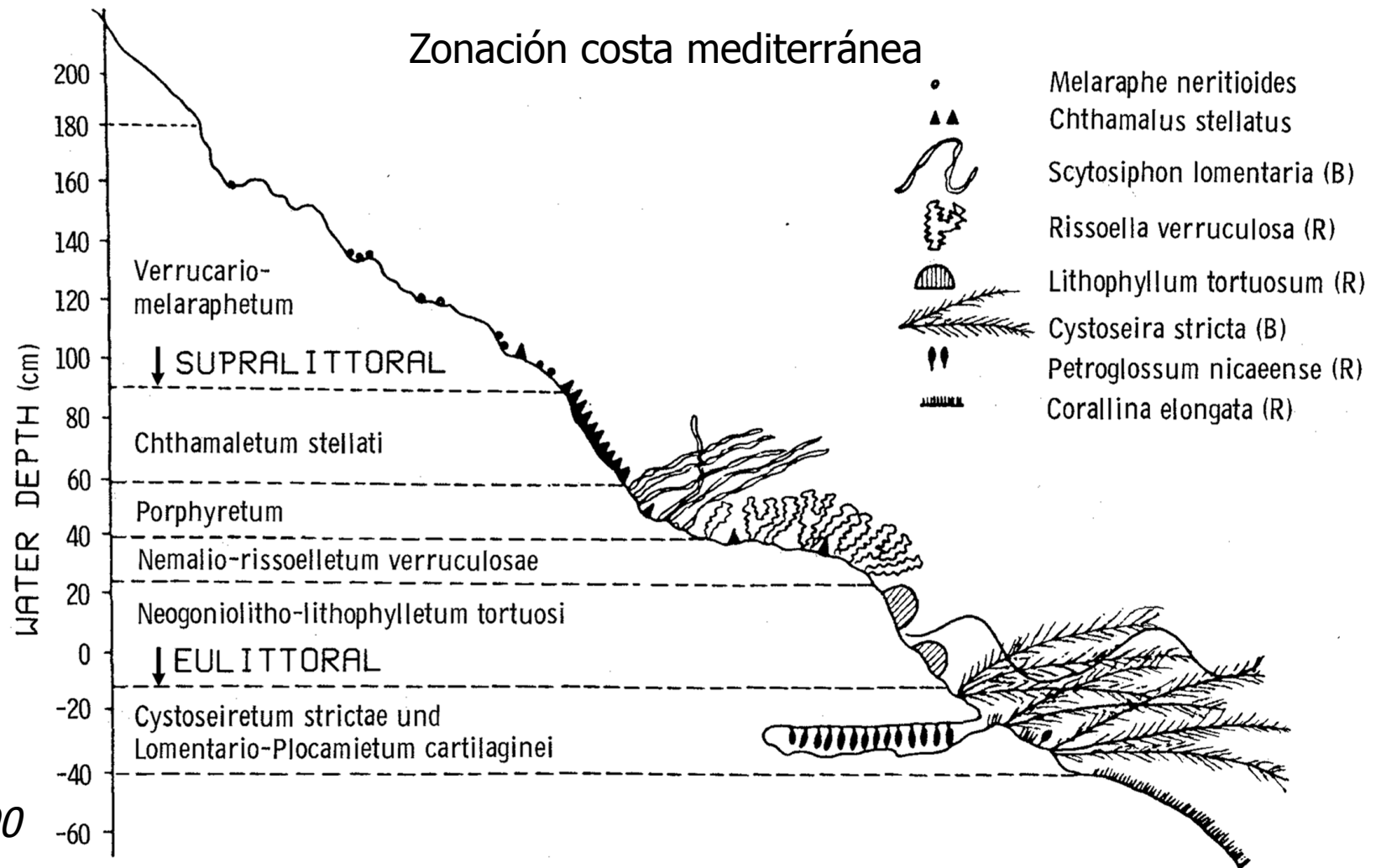
(Miyagishima & Nakanishi, 2010)

ALGAL GROUP	GENERA	SPECIES
CYANOPHYTA (= CYANOBACTERIA)	150	2,000
PROCHLOROPHYTA	3	< 20
GLAUCOPHYTA	3	< 10
RHODOPHYTA	500-600	5,000-5,500
HETEROKONTOPHYTA (= CHROMOPHYTA)		
CHRYSTOPHYCEAE	200	1,000
XANTHOPHYCEAE	100	600
EUSTIGMATOPHYCEAE	7	12
BACILLARIOPHYCEAE	250	100,000
RAPHIDOPHYCEAE	9	< 20
DICTYOCOPHYCEAE	1	2
PHAEOPHYCEAE	265	1,500-2,000
HAPTOPHYTA	75	500
CRYPTOPHYTA	12	200
DINOPHYTA (= DINOFLAGELLATES)	130	2,000
EUGLENOPHYTA	40	> 800
CHLORARACNIOPHYTA	2	2
CHLOROPHYTA	500	8,000

Tamaño # grupos algales

van den Hoek et al., 1998

Patrones de zonación



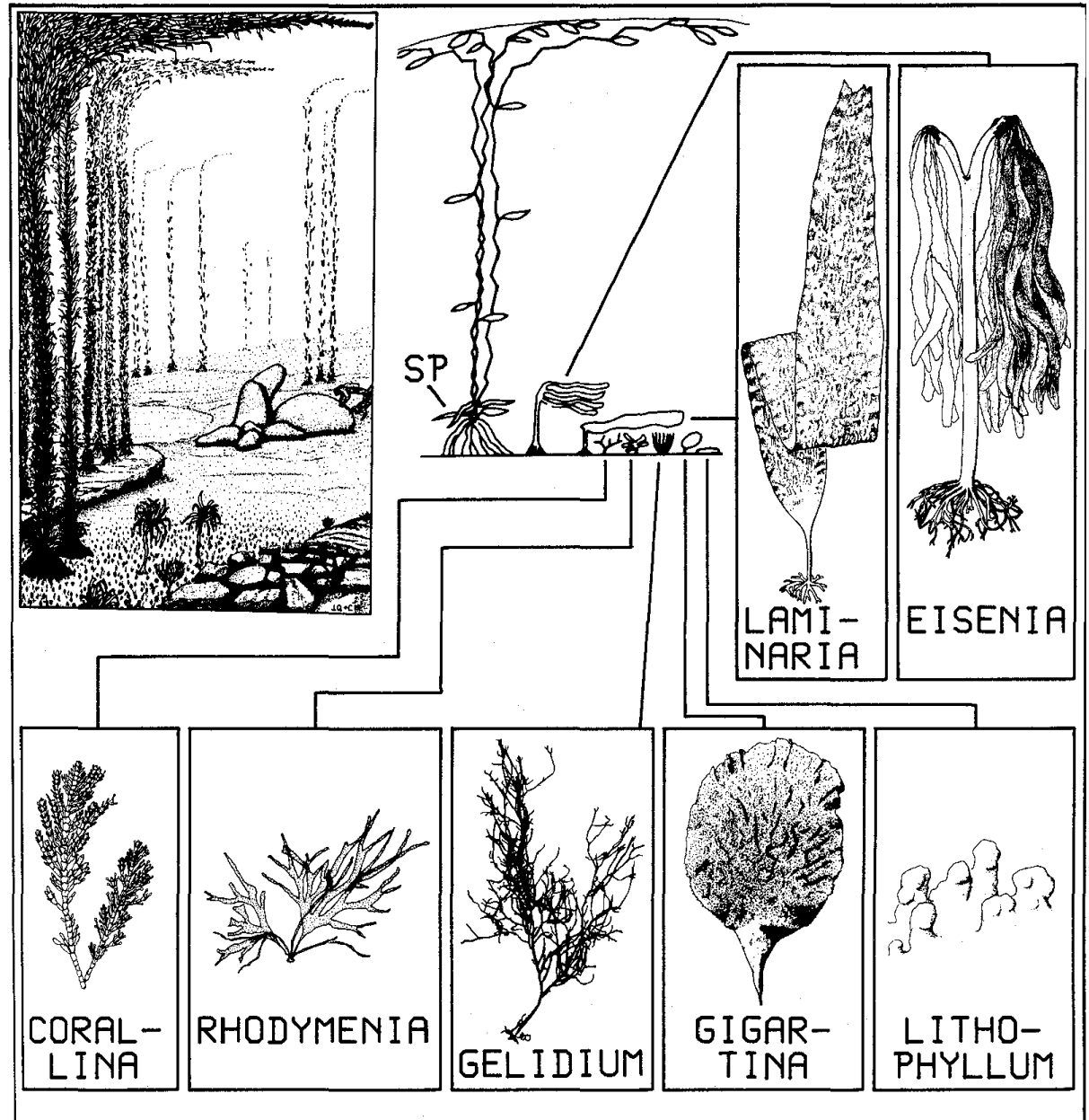
Lüning, 1990

Patrones de zonación

Bosques de Kelp,
Macrocystis pyrifera

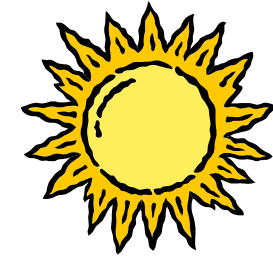
Costa pacífica de
California

Lüning, 1990

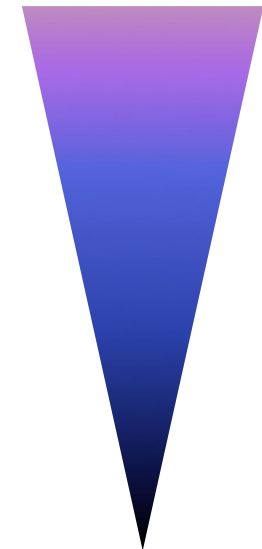


Patrones de zonación

Luz en el mar

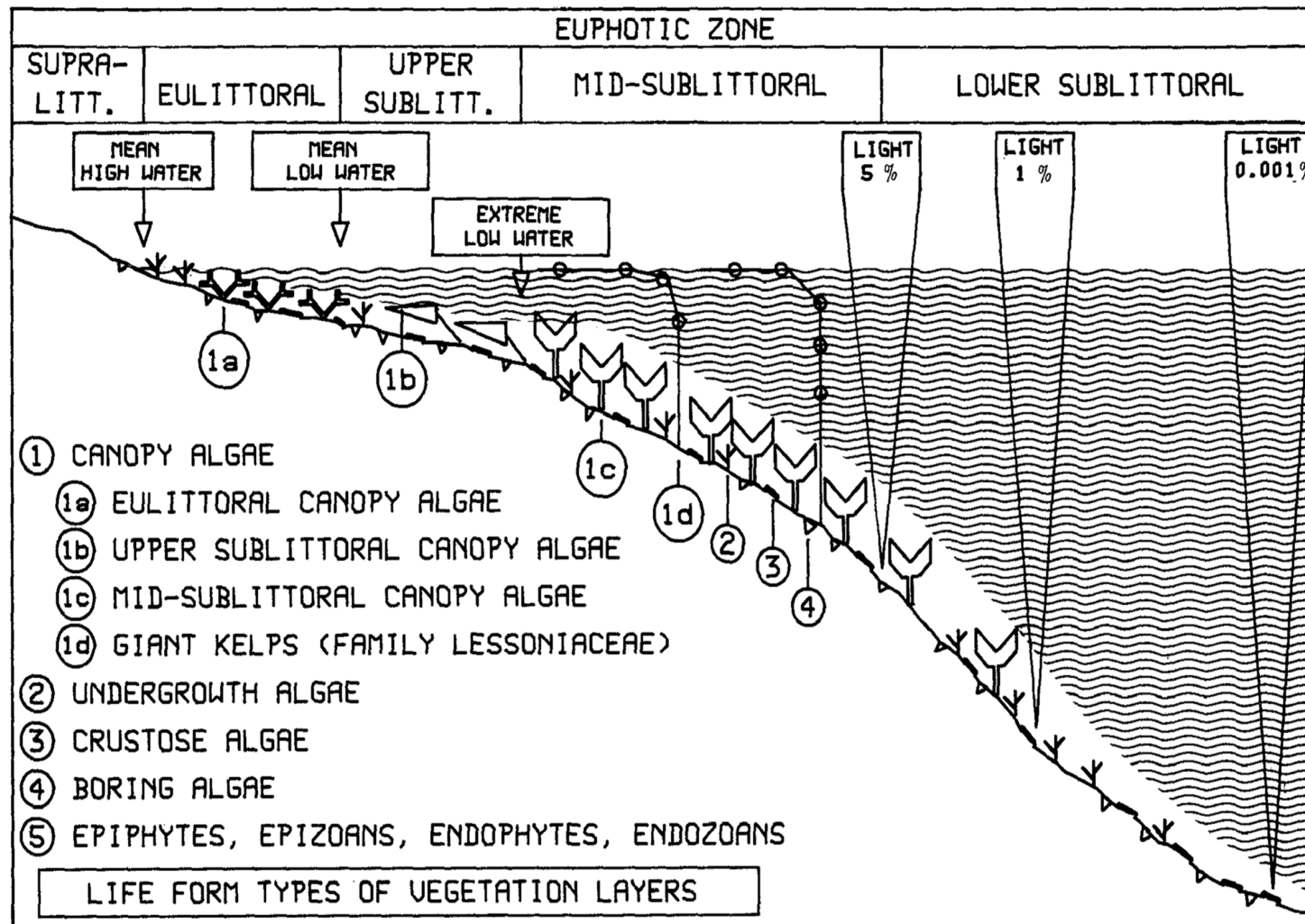


Light Profile

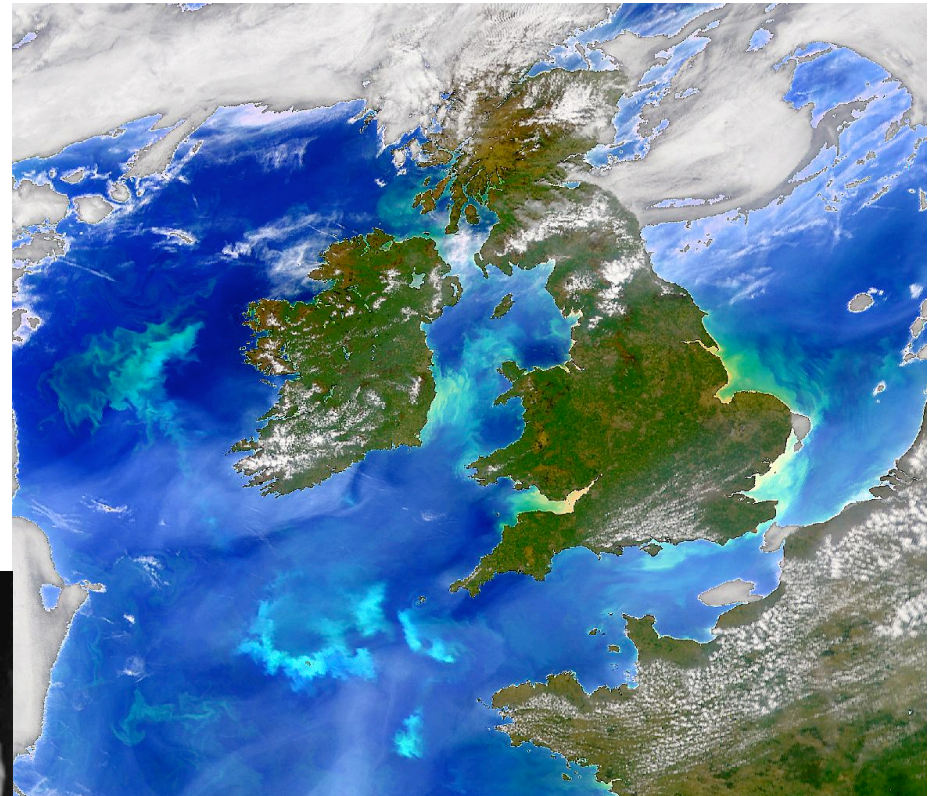
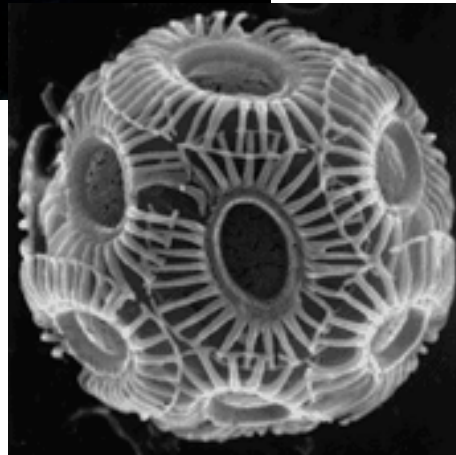
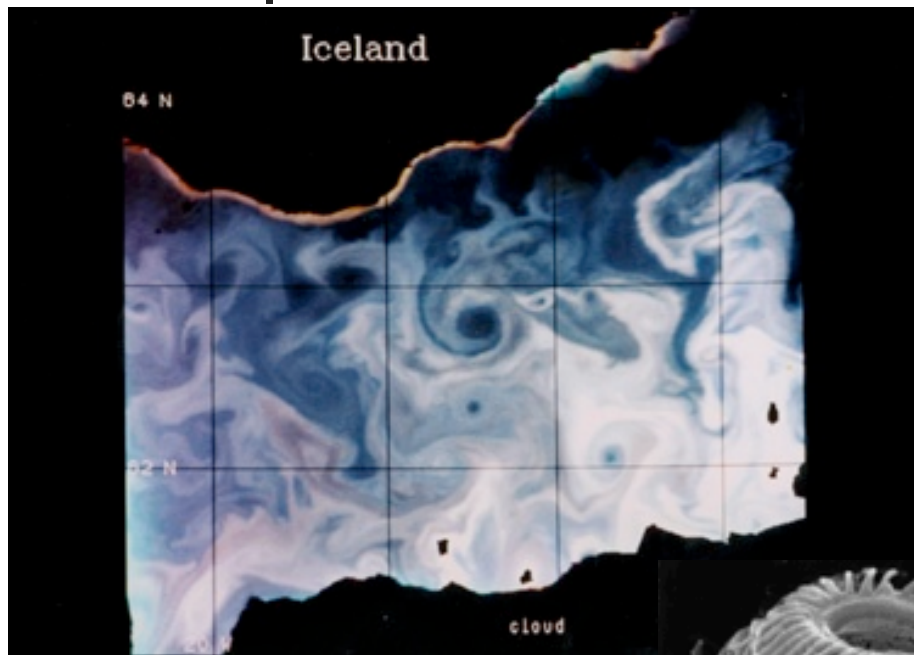
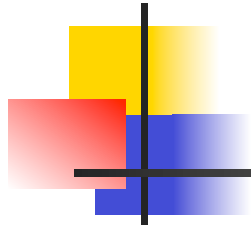


Average
Maximum Depth
150 m

Lüning, 1990



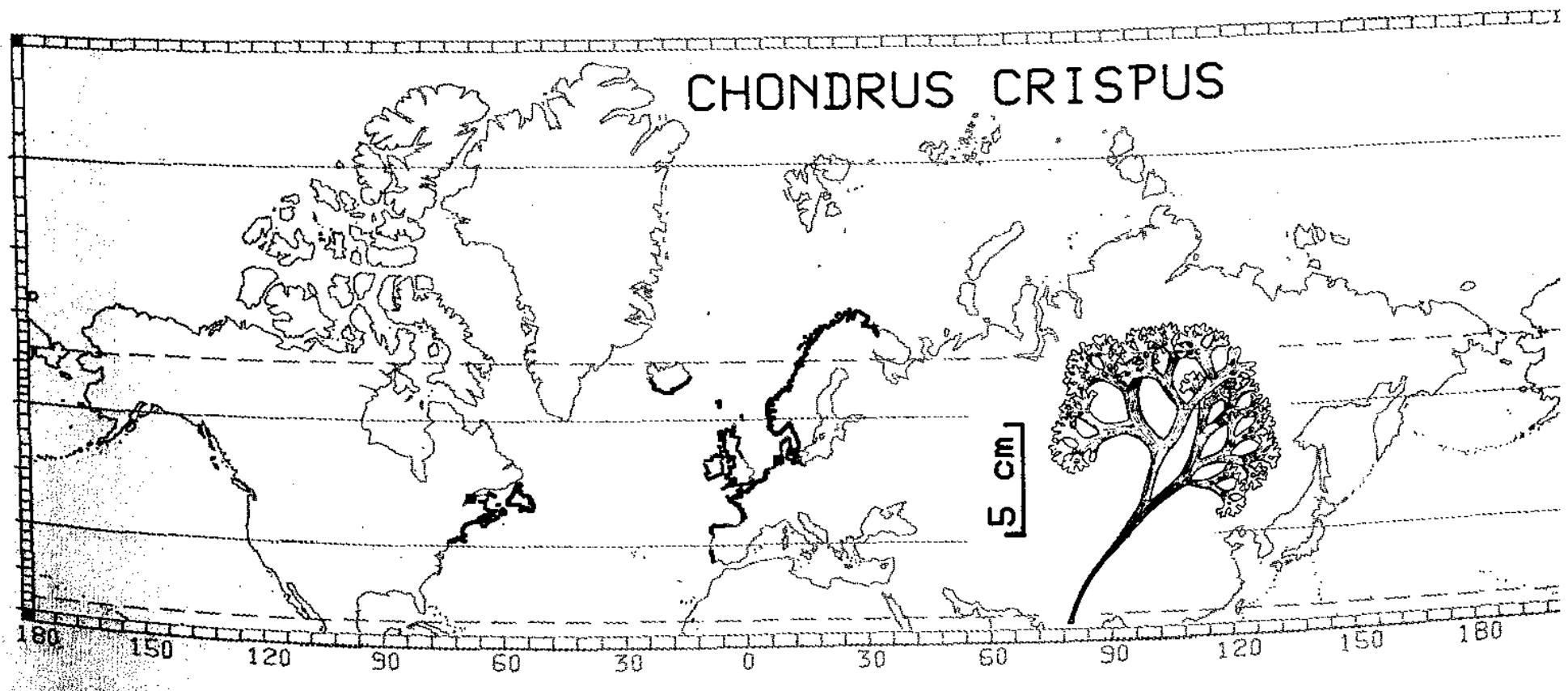
Aspectos biogeográficos



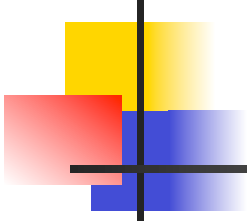
Emiliana huxleyi

Coccolitoforido (Haptophyta)

Aspectos biogeográficos

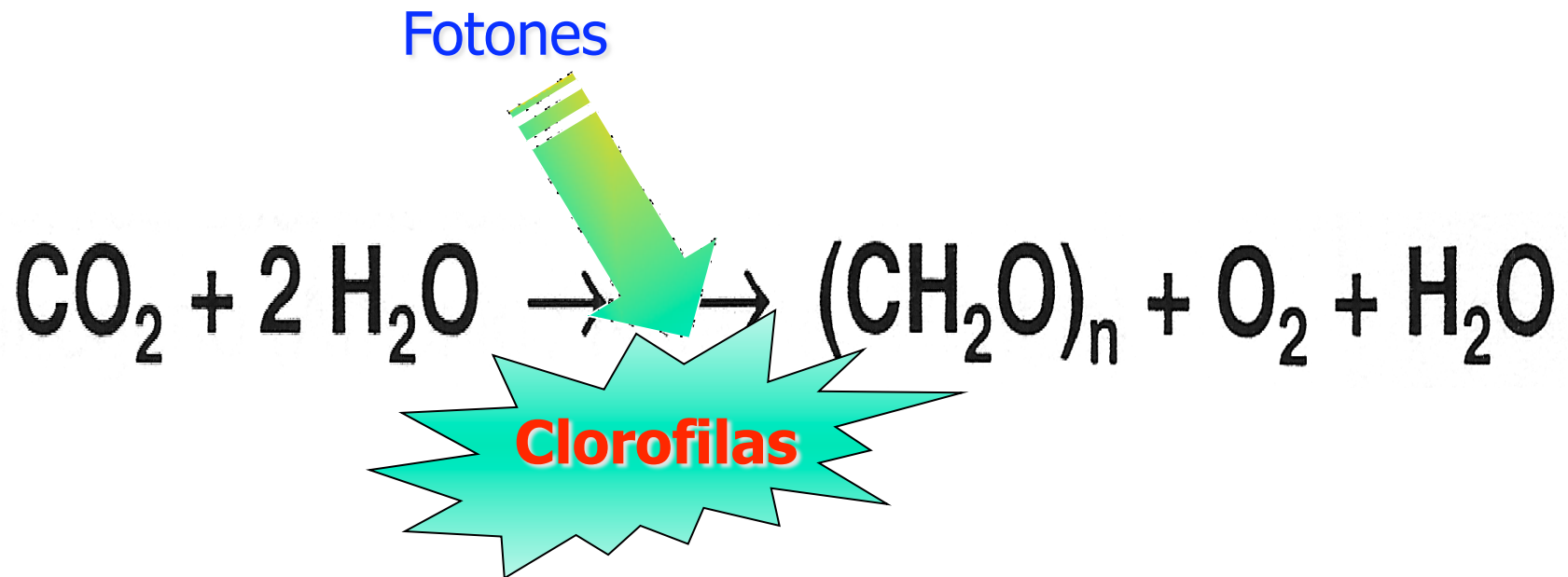


Lüning, 1990



Importancia de las algas

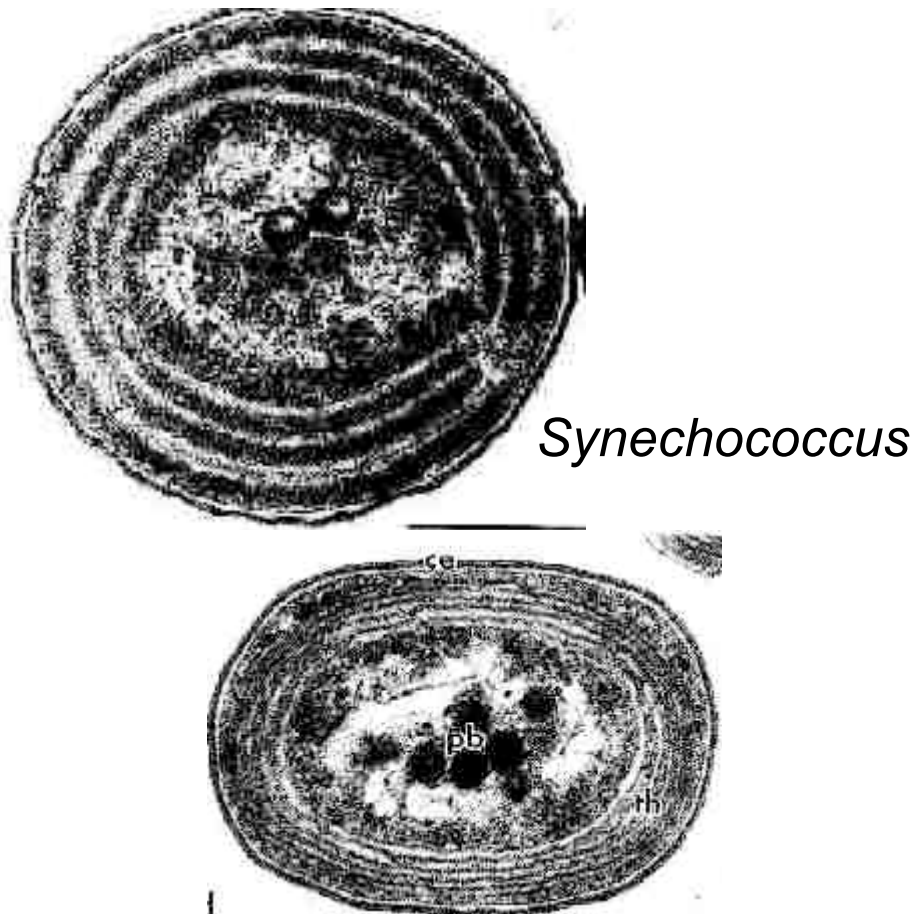
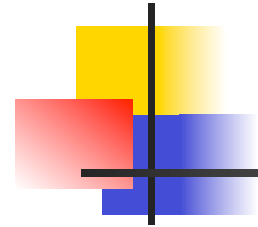
- Ecuación de la Fotosíntesis



Pn: g DW m⁻² d⁻¹; mg Cl a L⁻¹ s⁻¹

Importancia de las algas

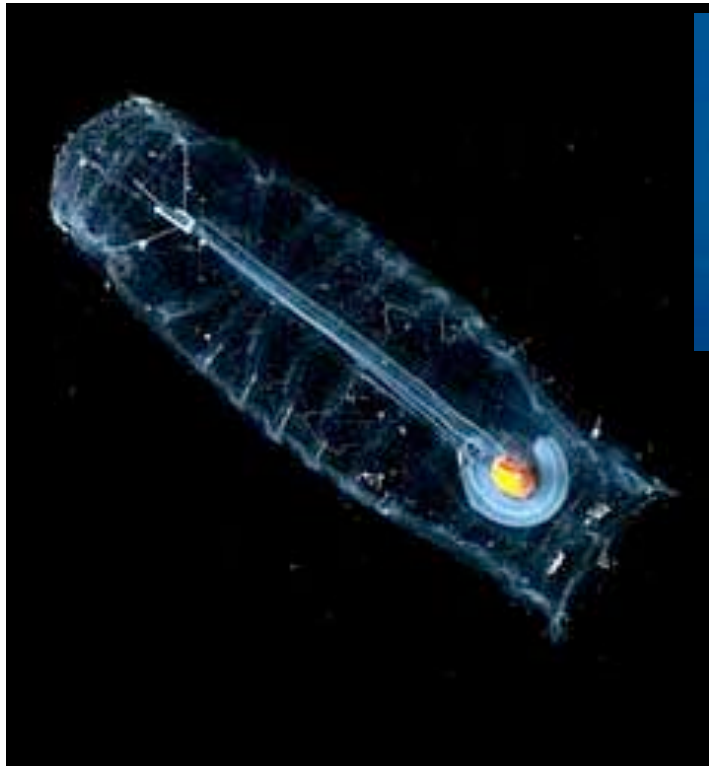
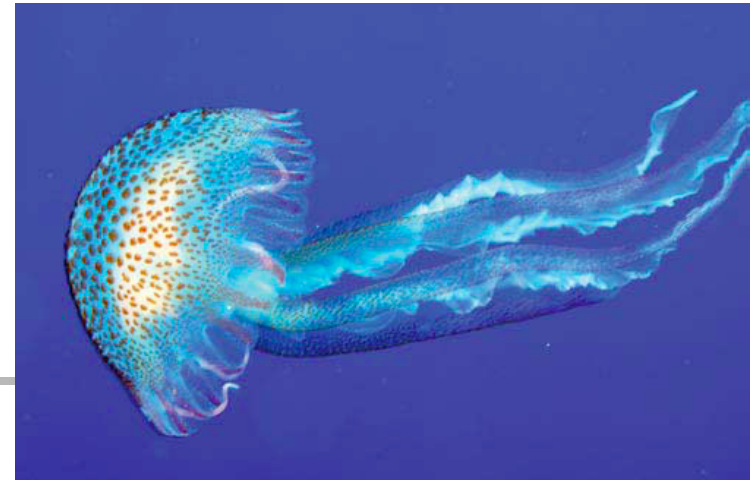
Producción de biomasa



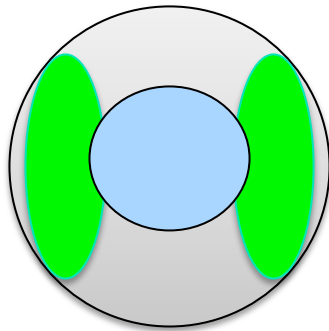
Prochlorococcus y *Synechococcus* pueden ser responsables de hasta $\frac{2}{3}$ del CO_2 fijado en los océanos → $\frac{1}{3}$ de la producción primaria total en la Tierra.

Importancia del Fitoplancton

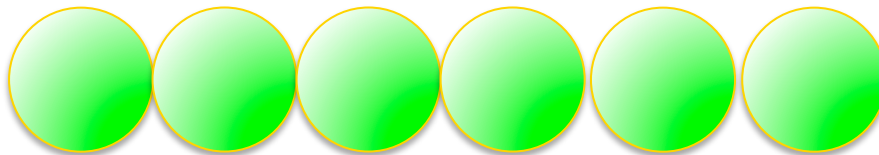
(1) Alimento para multitud de animales en los océanos



Importancia del Fitoplancton

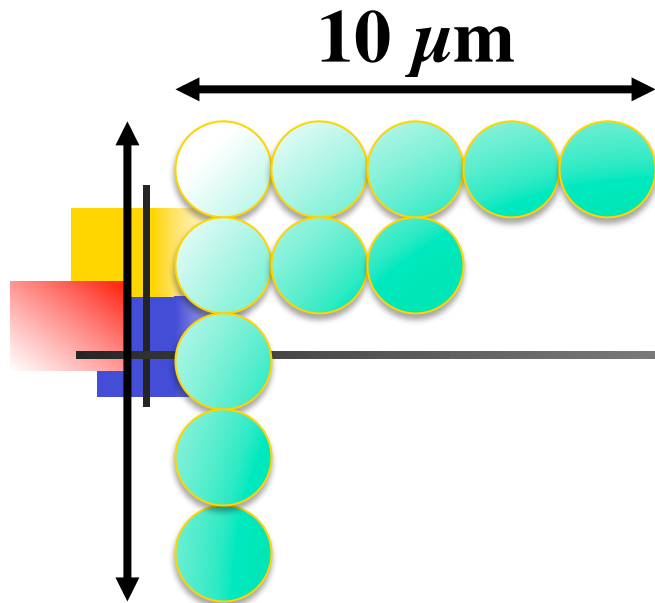


- 10^{25} cels. en los océanos
- Diámetro cel. medio $2 \mu\text{m}$

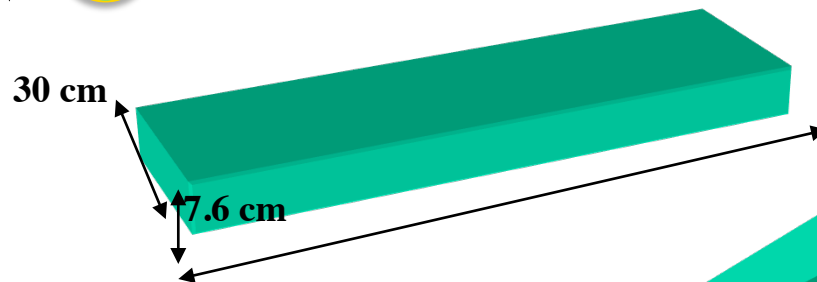


Ida y vuelta entre la Tierra y la Luna

!!1.000 Millones de veces!!



Si colocamos las cels. en un plano bidimensional, tendría 30 cm de ancho x 7,6 cm de grosor ... y se extendería a lo largo de ???

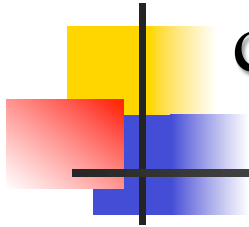


¡384,000 Km!

De la Tierra a la Luna



Las células del fitoplancton se dividen
 $\pm$ una vez al día, entonces ¿que ocurre
cada día?



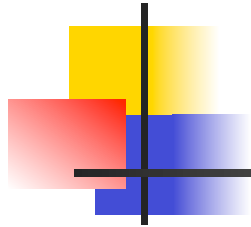
¿Tenemos 2 “tablones” diarios?

**No, uno de ellos es comido por
zooplancton, peces, ...**

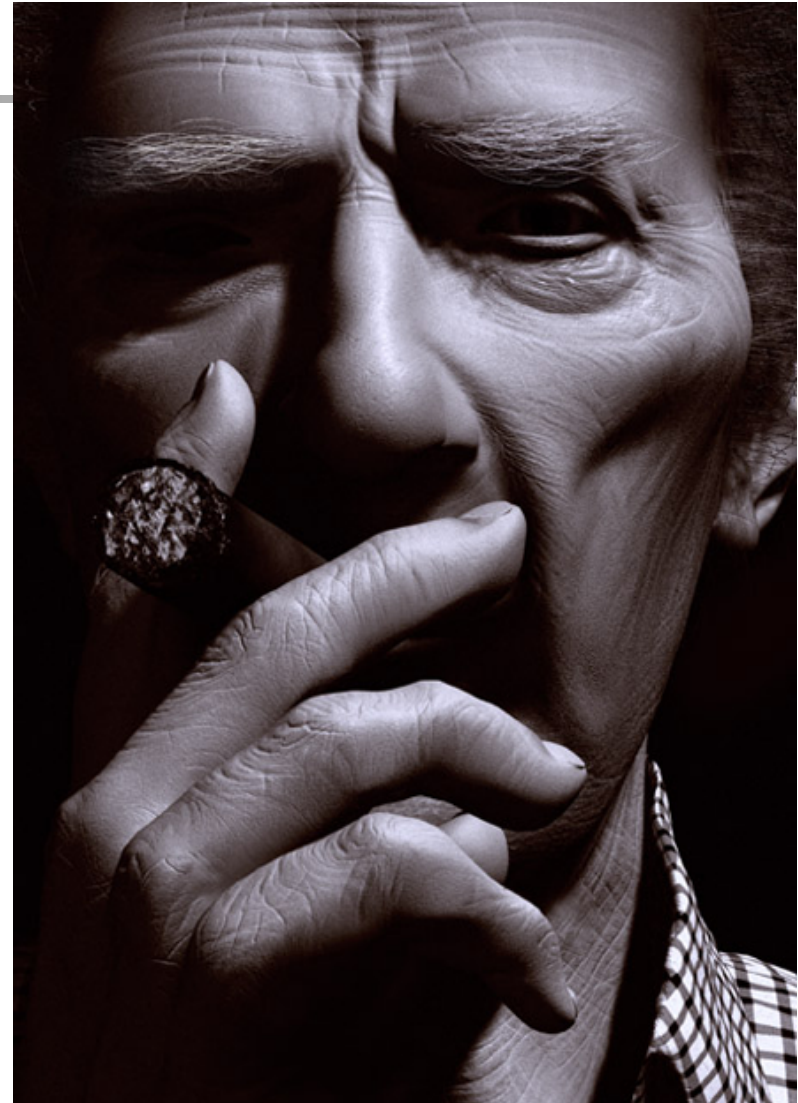
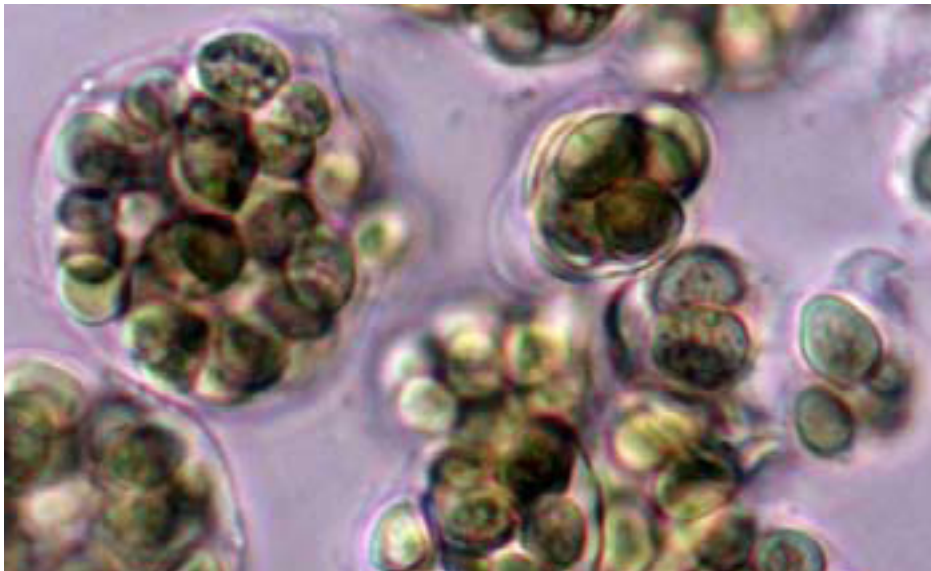
**Este “tablón diario” alimenta las
cadenas tróficas en los océanos**



Importancia del fitoplancton



(2) Produce $\pm$ 50 % del oxígeno atmosférico

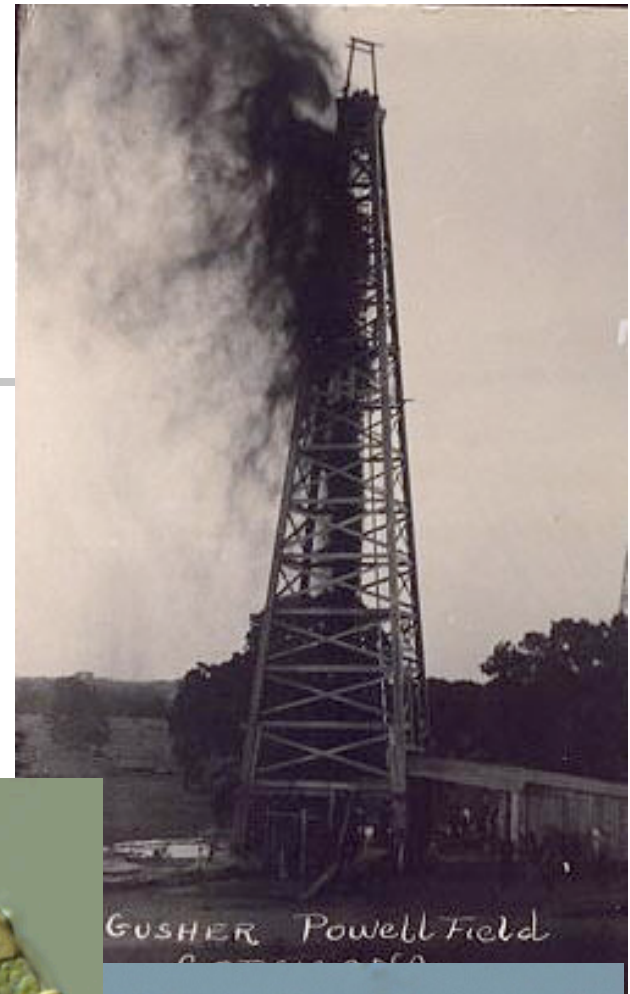


Importancia del fitoplancton

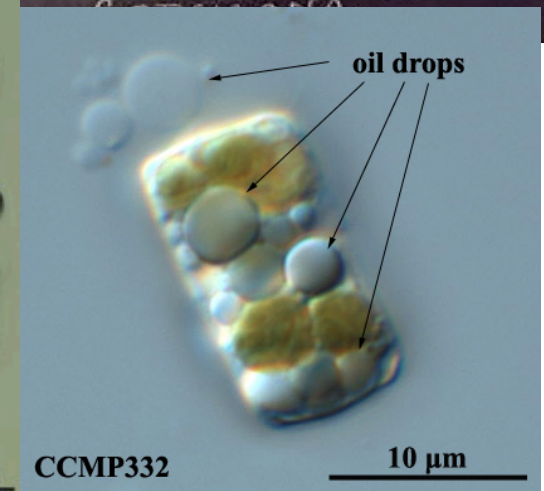
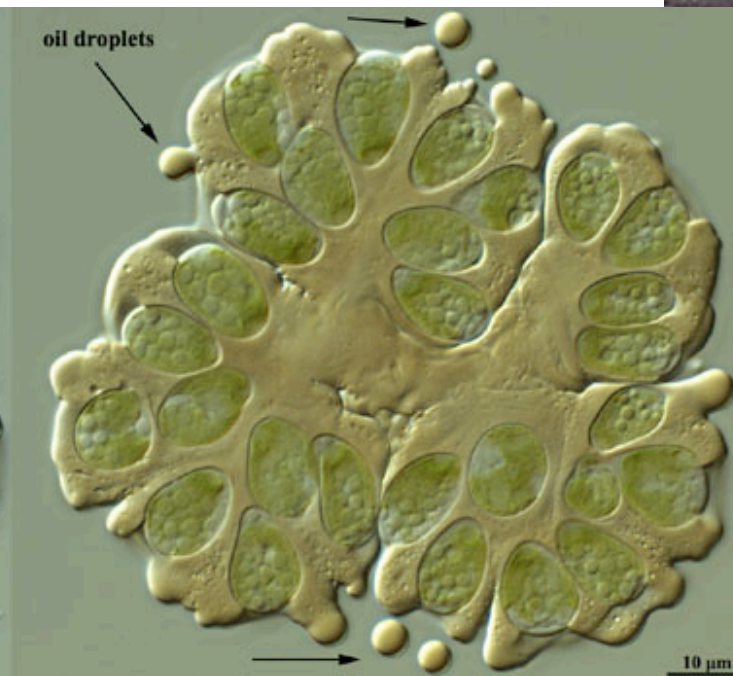
(3) Fuente de carbono:

- Petroleo
- Gas natural

Cyclotella

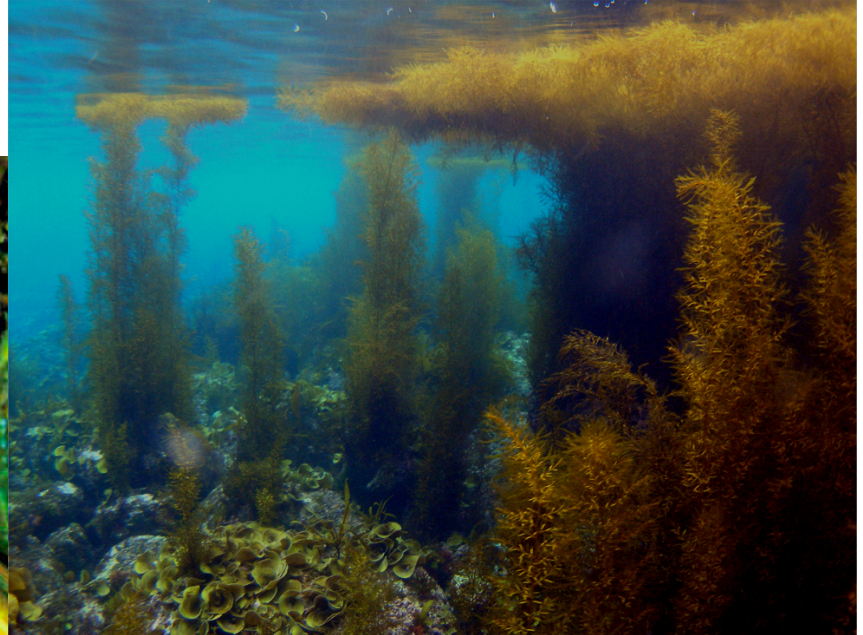


GUSHER Powell Field

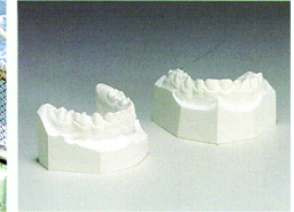
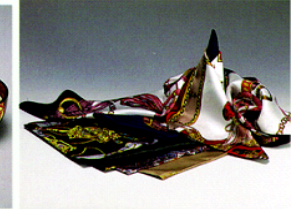
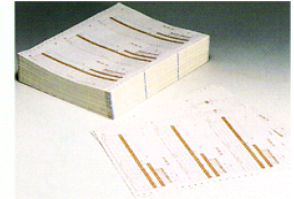
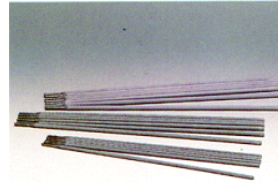


Importancia de las macroalgas

Alimento y hábitat para peces e invertebrados



Importancia macroalgas



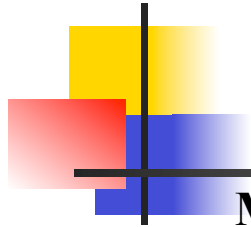
Productos industriales



Consumo humano



Aplicaciones y Usos Comerciales

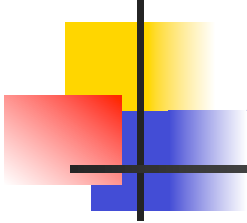


MICROALGAS

- ✓ **Alimentos en acuicultura (alimento para larvas, probióticos)**
- ✓ **Ingredientes para alimentos funcionales y nutraceuticos (PUFAs, oligosacáridos, antioxidantes, etc.)**
- ✓ **Farmacéuticas, cosméticas, agroquímicas, pigmentos,**
- ✓ **Biocombustibles, ...**

MACROALGAS

- ✓ **Alimento humano**
- ✓ **Alimento en acuicultura (, piensos, cultivos integrados).**
- ✓ **Ficocoloides**
- ✓ **Otros (farmacéuticos, cosméticos, agroquímicos, etc.)**



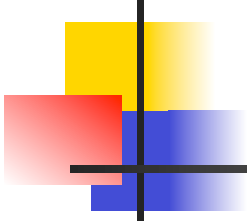
GRUPOS PRINCIPALES DE ALGAS MARINAS CULTIVADAS

- Microalgas

- Cianobacteria: *Spirulina*
- Verdes: *Dunaliella*, *Chlamydomonas*, *Nanochloropsis*
- Diatomeas: *Skeletonema*, *Navicula*
- Dinoflagelados: *Gymnodinium*, *Cryptocodinium*

- Macroalgas

- Pardas: *Laminaria*, *Undaria*, *Sargassum*
- Rojas: *Gracilaria*, *Eucheama*, *Kappaphycus*, *Meristotheca*, *Hypnea*
- Verdes:, *Ulva*, *Caulerpa*



Valor comercial de productos derivados de macroalgas

Main components of the world's seaweed industry and their value (in US\$) for 2004

Industry component	Raw material (wet tonnes)	Products (tonnes)	Value (US\$)
Sea-vegetables	8.59 million	1.42 million	5.29 billion
Kombu (<i>Laminaria</i>)	4.52 million	1.08 million	2.75 billion
Nori (<i>Porphyra</i>)	1.40 million	141 556	1.34 billion
Wakame (<i>Undaria</i>)	2.52 million	166 320	1.02 billion
Phycocolloids	1.26 million	70 630	650 million
Carrageenans	528 000	33 000	300 million
Alginates	600 000	30 000	213 million
Agars	127 167	7 630	137 million
Phycosupplements	1.22 million	242 600	53 million
Soil additives	1.10 million	220 000	30 million
Agrichemicals (fertilizers, biostimulants)	20 000	2 000	10 million
Animal feeds (supplements, ingredients)	100 000	20 000	10 million
Pharmaceuticals, nutraceuticals, botanicals, cosmeceuticals, pigments, bioactive compounds, antiviral agents, brewing, etc.	3 000	600	3 million

Source: Chopin and Sawhney (2009).

Nuevas aplicaciones en microalgas

Desarrollos
tecnológicos
Biocombustibles



Ejemplos de Colecciones Algales

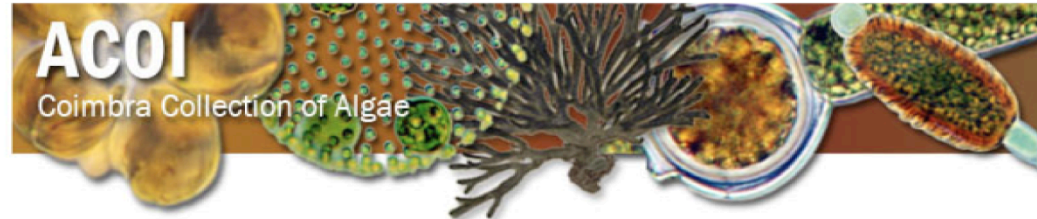


banco nacional de algas | españa
Gran Canaria - Islas Canarias

Centro de Biotecnología Marina
Universidad de Las Palmas de Gran Canaria



culturecollection
of algae and protozoa



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- Culture Kits, Media & Seawater >>
- Depositing Strains
- About CCMP >>
- Culturing Information >>
- Downloads & Links
- Contact Information

MICROBIAL CULTURE COLLECTION

At National Institute for Environmental Studies

Japanese page

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CTCCAS

Freshwater Algae Culture Collection

Canadian Phycological Culture Centre (CPCC)



SAG

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Algenkulturen Göttingen

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UTEX The Culture Collection of Algae

at The University of Texas at Austin

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GO

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Collection

Culture search

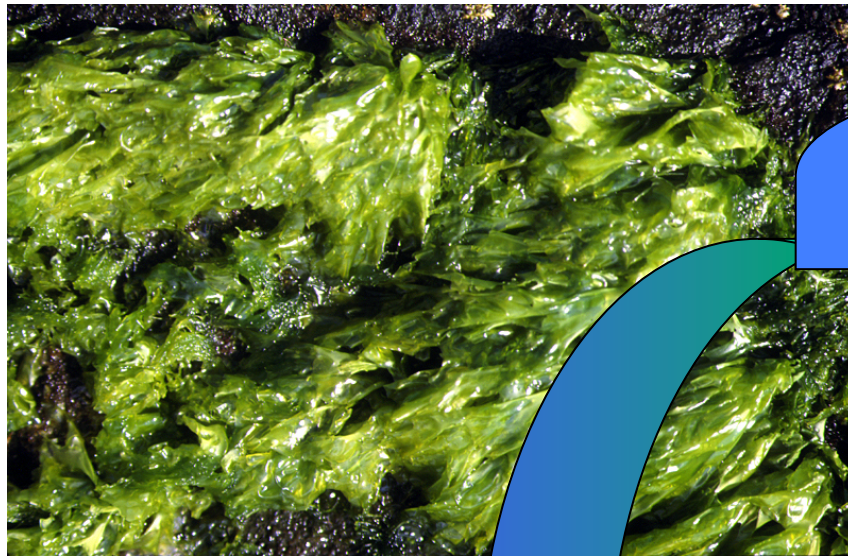
Media recipes

Ordering

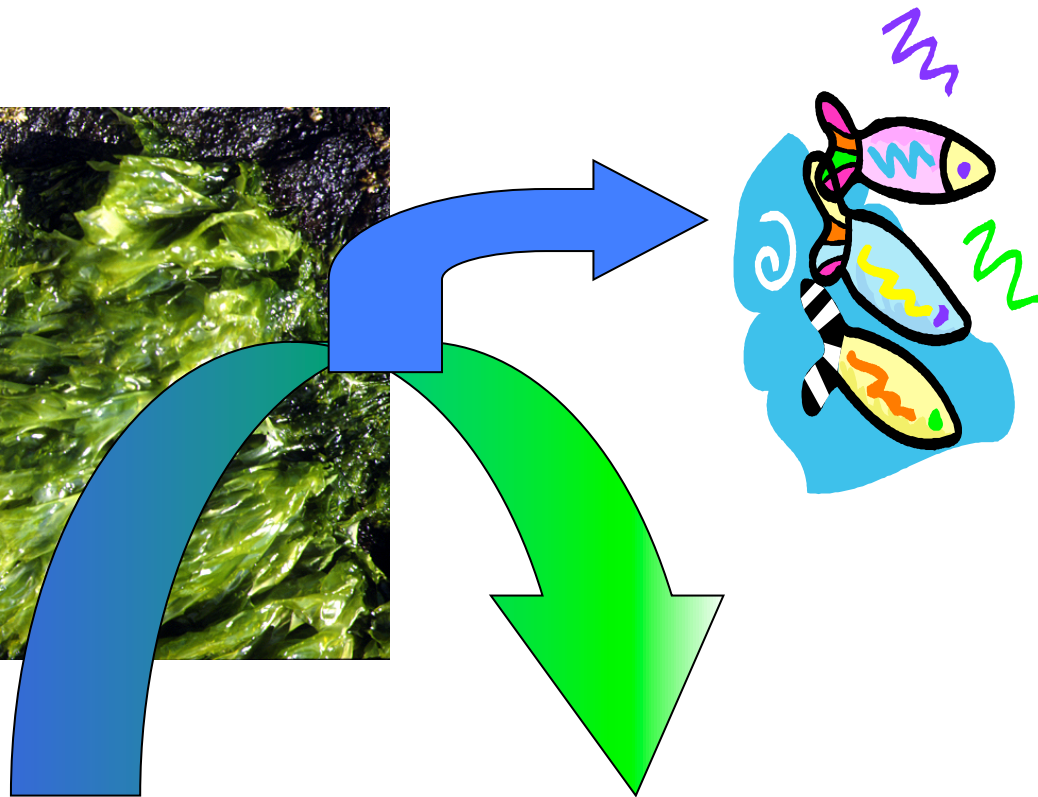
Depositing strains

Contact information

Macroalgas como sistemas de biofiltro

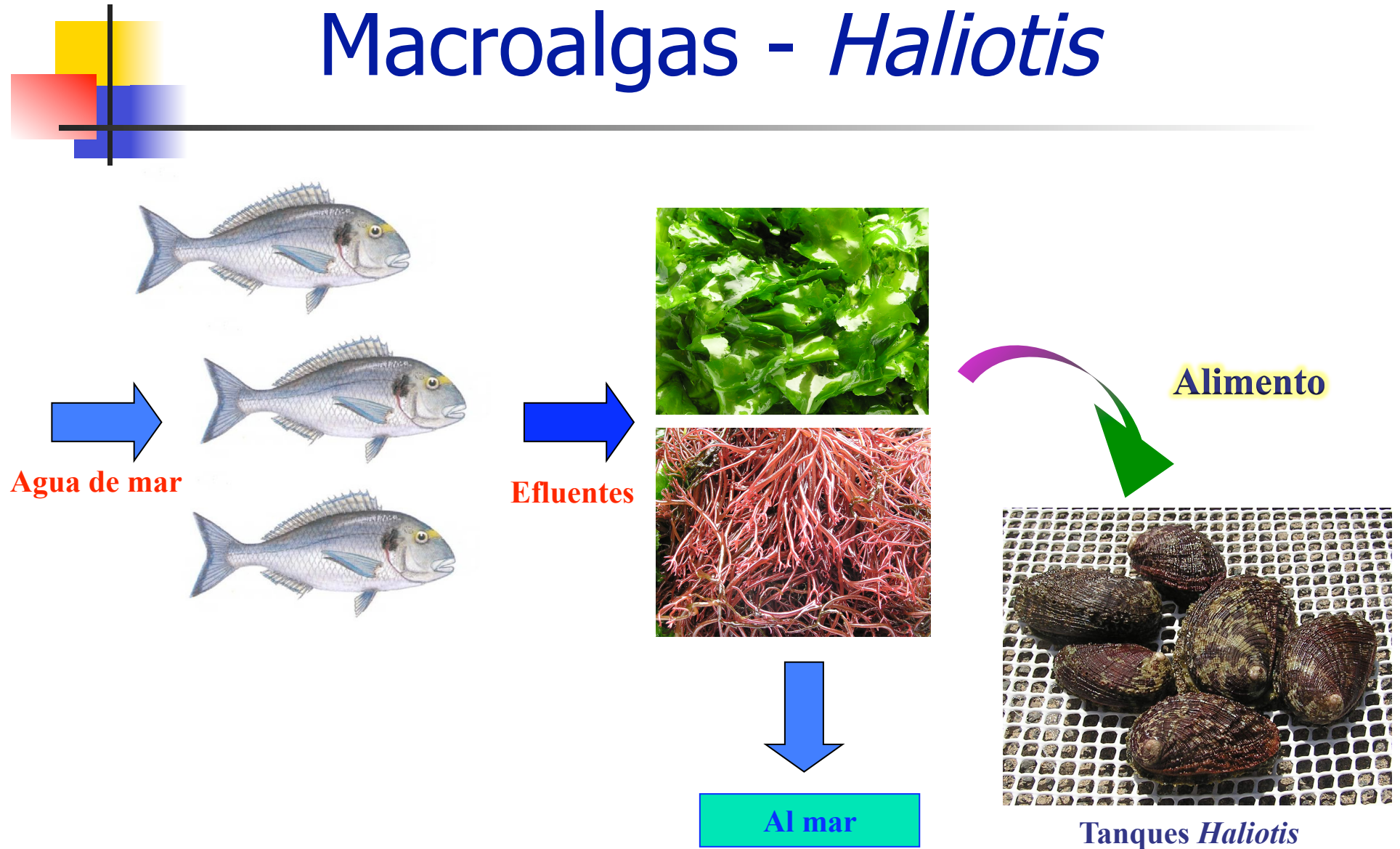


Effuentes

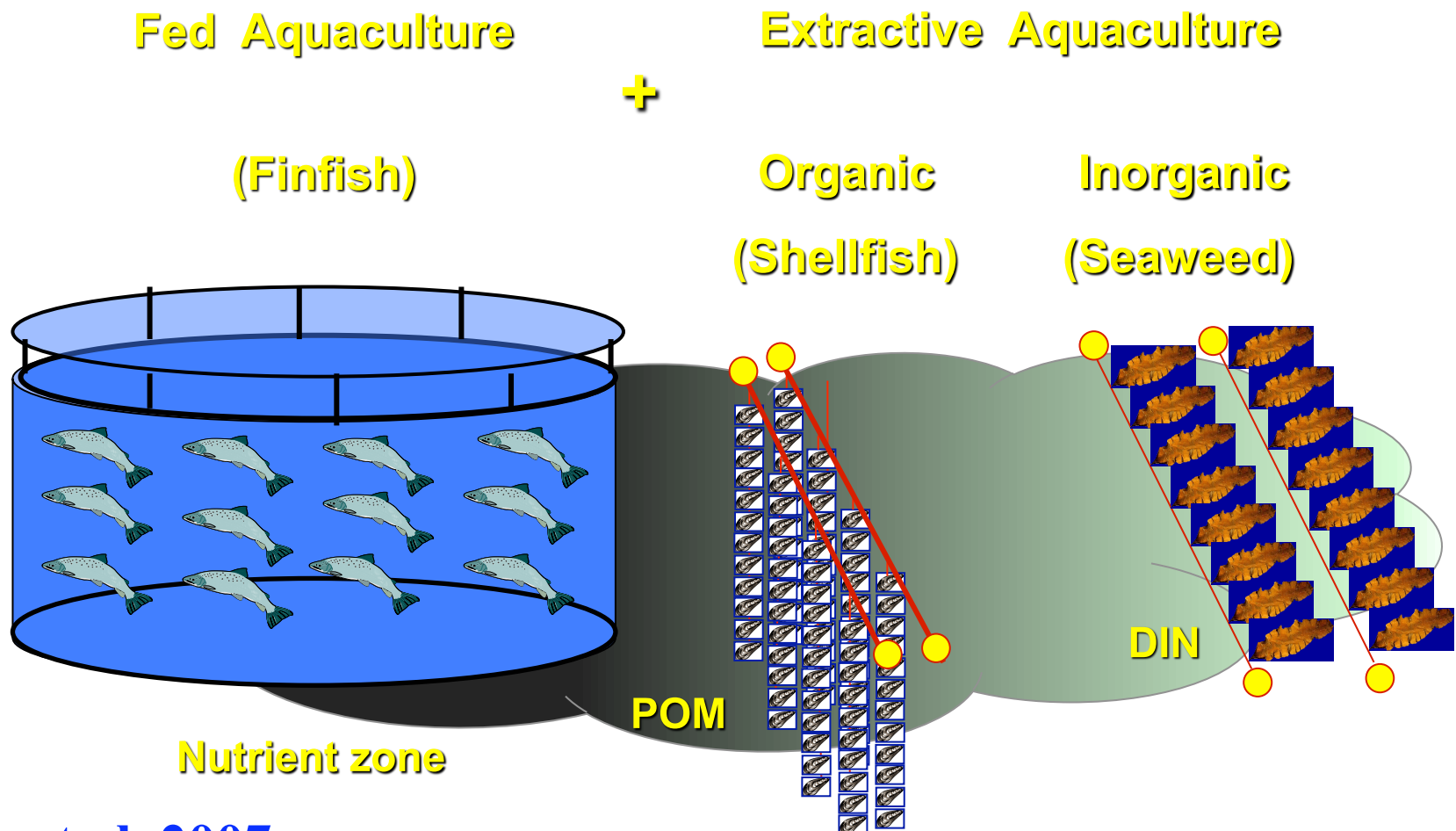


Biomasa algal

Cultivos Integrados Peces – Macroalgas - *Haliotis*



Cultivos Integrados Peces – Moluscos- Macroalgas (IMTA)



Chopin et al. 2007

Cultivos Integrados Peces – Moluscos - Macroalgas (IMTA)



New Brunswick, Canada



At UNB, we are PASSIONATE about sustainable aquaculture.

From your orange juice in the morning to your toothpaste in the evening, seaweeds are everywhere in your life! One of UNB's many passionate minds, Dr. Thierry Chopin is developing integrated aquaculture systems by combining fish, seaweeds and shellfish. His findings? Seaweeds and shellfish thrive on nutrients and food available in proximity to salmon farms. That means a biological and cost effective way to improve water quality and marine crop diversification for this significant component of the agro-food sector. We support the innovative practices researched by Dr. Chopin and his inter-disciplinary team.

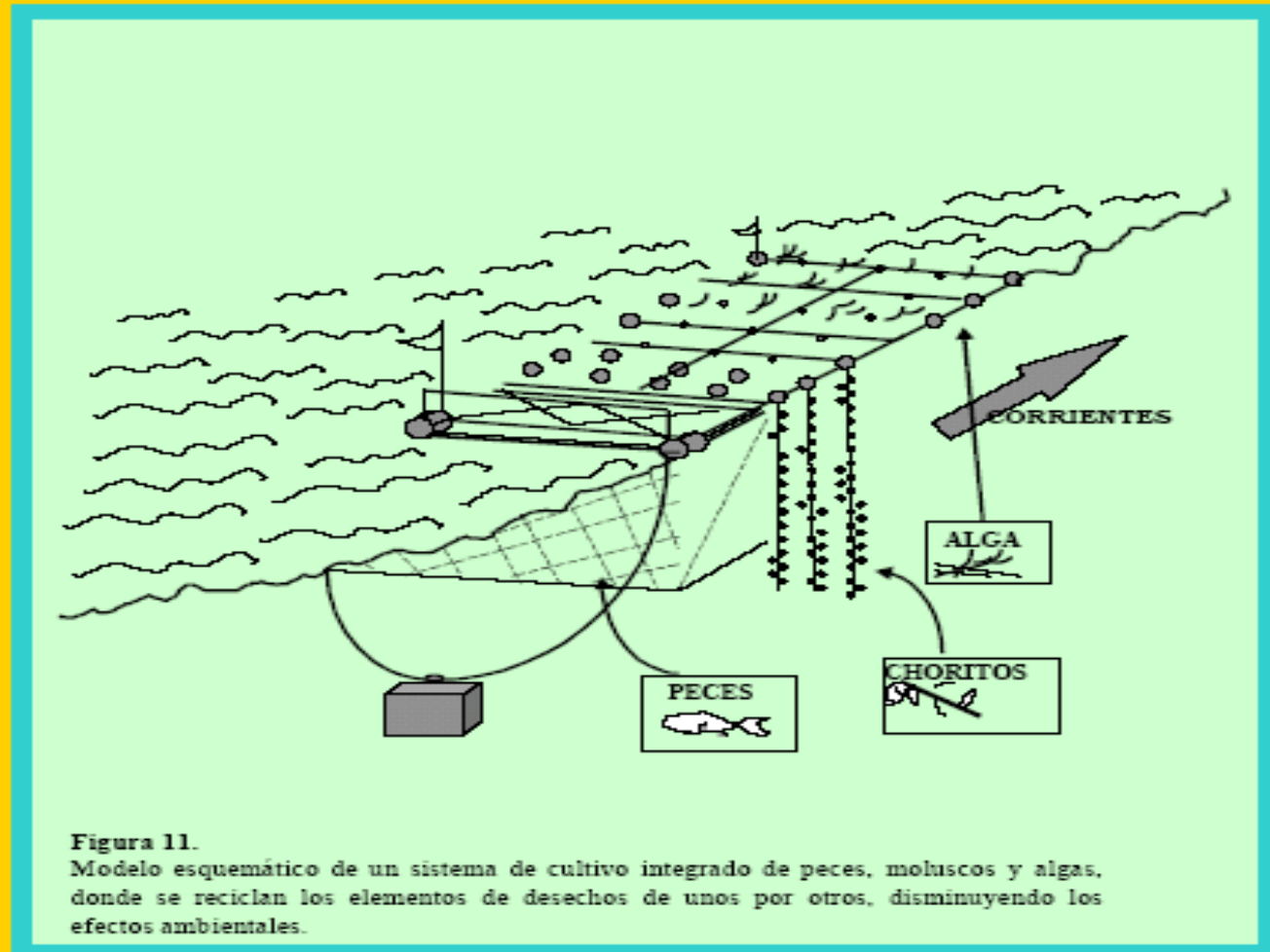
Research conducted at UNB is making a significant difference in New Brunswick and around the world. Funding for research activities at UNB grew more than 70 per cent in the last three years. Our dynamic growth in innovative technology, sciences and the humanities makes UNB home to over 50 per cent of all research conducted in New Brunswick.

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Cultivos Integrados Peces – Moluscos – Macroalgas (IMTA)

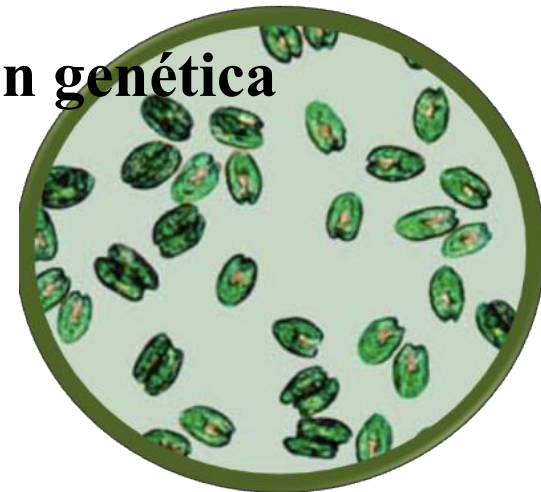


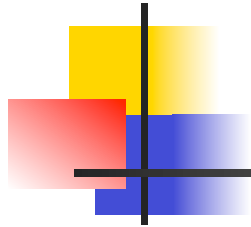
Chile,
Buschmann,
2009

PERSPECTIVAS FUTURAS

Aplicaciones en desarrollo

- ✓ Energía renovable (biofuels)
- ✓ Sistemas de Biolfiltro & IMTA
- ✓ Sistemas de soporte vital en vuelos espaciales
- ✓ Microalgas como sistemas de expresión genética
- ✓ Extracción de metabolitos activos
- ✓ Nuevos fertilizantes, ...





**Gracias
por su
atención**

rharoun@dbio.ulpgc.es

