

Plankton

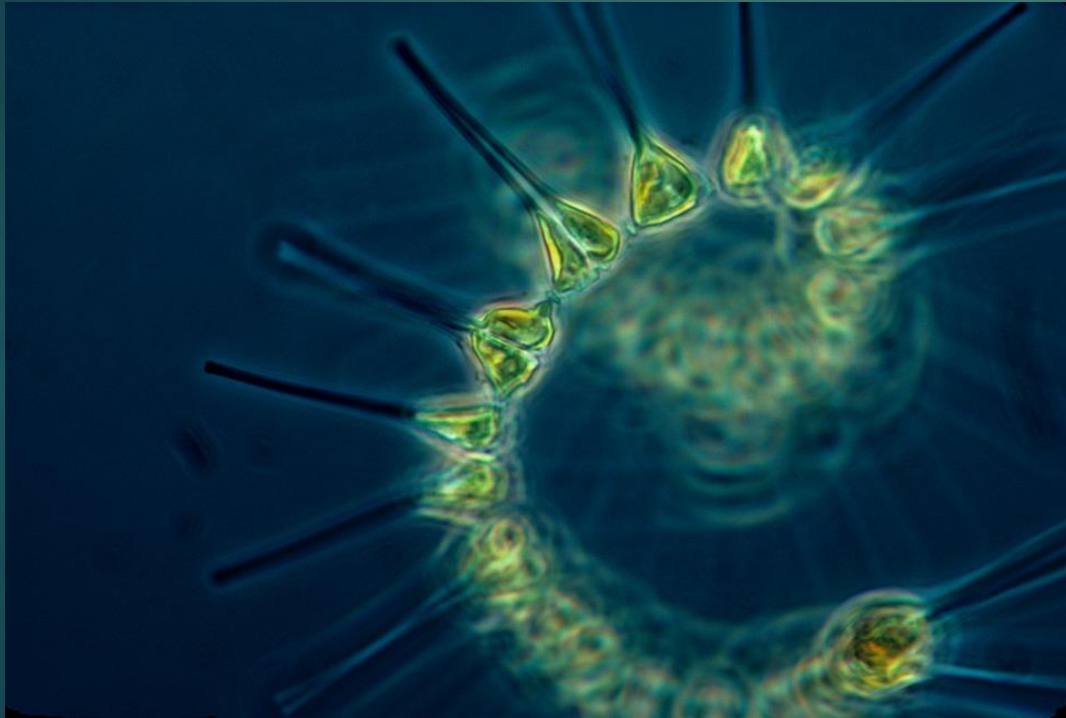


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Introduction

Plankton

- ▶ Definition: Organisms in the water that are not able to swim against the current
- ▶ largest ecosystem of the world
- ▶ only 30,000 (estimated) metazoan species
- ▶ low diversity compared to terrestrial ecosystems

Kinds of plankton by size

Femtoplankton	< 0.2 μm	virus, phage
Picoplankton	0.2 – 2 μm	bacteria, smallest phytoplankters
Nanoplankton	2 – 20 μm	phytoplankter, protozoans
Mikroplankton	20 – 200 μm	phytoplankter, protozoans
Mesoplankton	200 – 2000 μm	biggest protozoans, colony-forming phytoplankters, zooplankters (copepods)
Makroplankton	2mm – 2cm	big zooplankters
Megaplankton	> 2cm	biggest zooplankters

Trophic relations

Producers

- ▶ phytoplankton
- ▶ photosynthesis
- ▶ primary producers

Decomposers

- ▶ bacteria and fungi

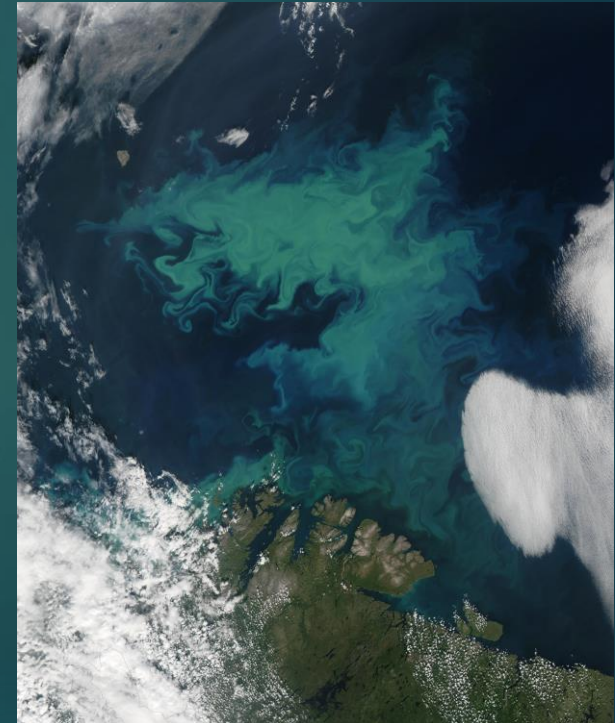
Consumers

- ▶ zooplankton
- ▶ no photosynthesis
- ▶ primary consumers
 - ▶ herbivorous zooplankton
- ▶ secondary or tertiary consumers
 - ▶ carnivorous zooplankton

Phytoplankton

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- ▶ photoautotrophic
- ▶ can only live in the photic zone
- ▶ abundance determined by amount of chlorophyll in the water
- ▶ diatoms and dinoflagellates (microplankton)
- ▶ base of the marine food web (may reach 50,000 cells per liter)
- ▶ bloom under special conditions → extremely large numbers



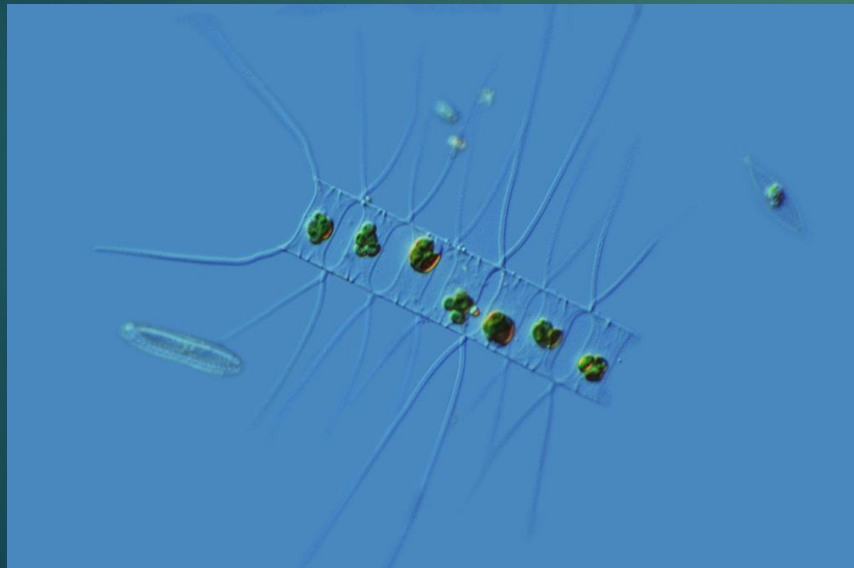
Phytoplankton

- ▶ **diatoms**

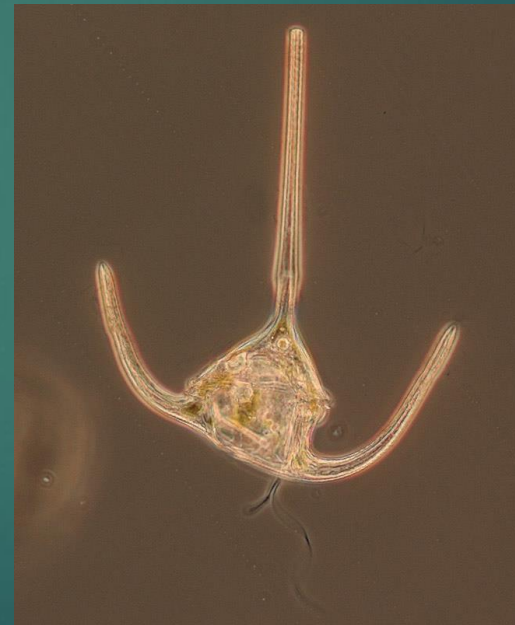
- ▶ largest group of primary producers
- ▶ 900 species in the mediterranean
- ▶ unicellular, form colonies

- ▶ **dinoflagellata**

- ▶ second largest group of primary producers
- ▶ unicellular and flagellated



Chaetocerus decipiens



Ceratium sp.

Zooplankton

- ▶ generally heterotrophic (feed on phytoplankton)
 - most species live in the photic zone
 - concentration of plankton in the upper 200m
- ▶ diel vertical migration
 - ▶ move up when sunlight appears and sink down upon sunset
- ▶ crustacean plankton dominates the zooplankton
 - ▶ (e.g. copepods, decapods,...)

Kinds of zooplankton

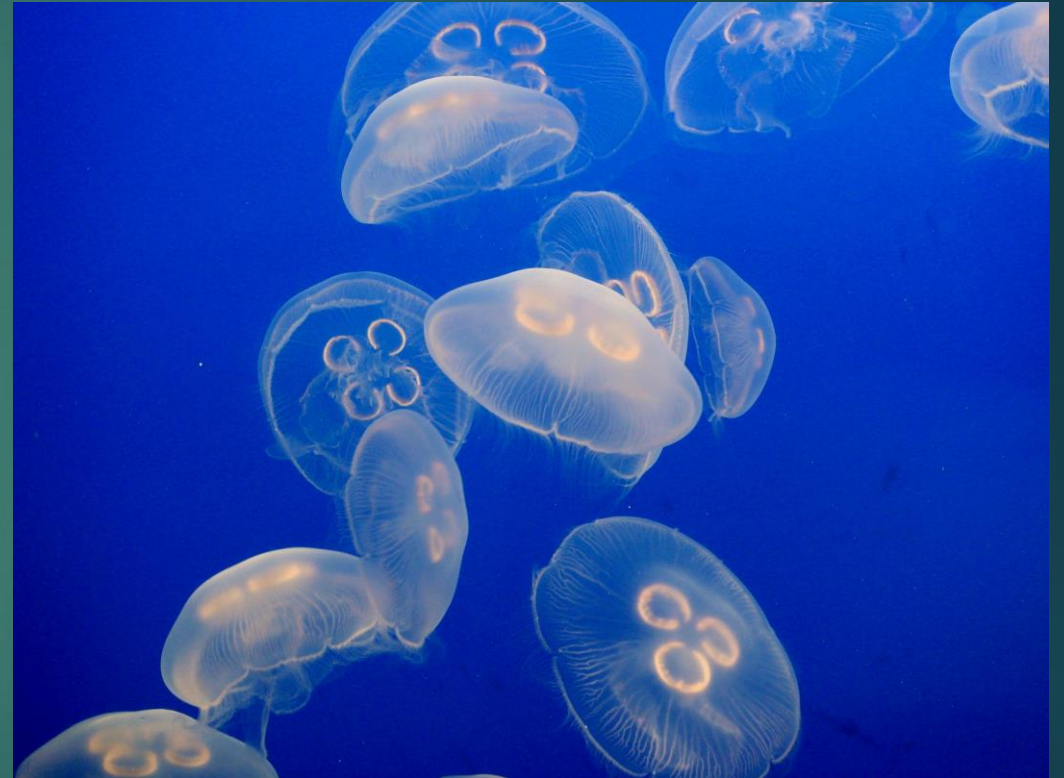
Gelatinous plankton

- ▶ e.g. cnidarians, some gastropods, polychaetes, tunicates, fish eggs and larvae,...
- ▶ bodies with an extremely high water and salt content
- ▶ part of the so called „marine snow“

Cnidaria

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- ▶ free-swimming medusae
- ▶ arises from polyp through budding
- ▶ medusae reproduce sexually
 - fertilized eggs develop into free-swimming planulae



Aurelia sp.

Meroplankton

- ▶ pelagic larvae of marine invertebrates
- ▶ stay in plankton for weeks or months
- ▶ may dominate the plankton community depending on the season

- ▶ e.g. american oyster
 - ▶ broadcasts 15 – 115 million eggs

- ▶ high mortality
 - ▶ most significant factor: predation
 - ▶ predators: e.g. scypho- and hydromedusae, shrimps,...

Meroplankton

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- ▶ Teleostei

- ▶ marine teleosts produce up to some hundred millions of eggs
- ▶ egg diameter mostly between 0.7 and 1.5mm



- ▶ Tunicates

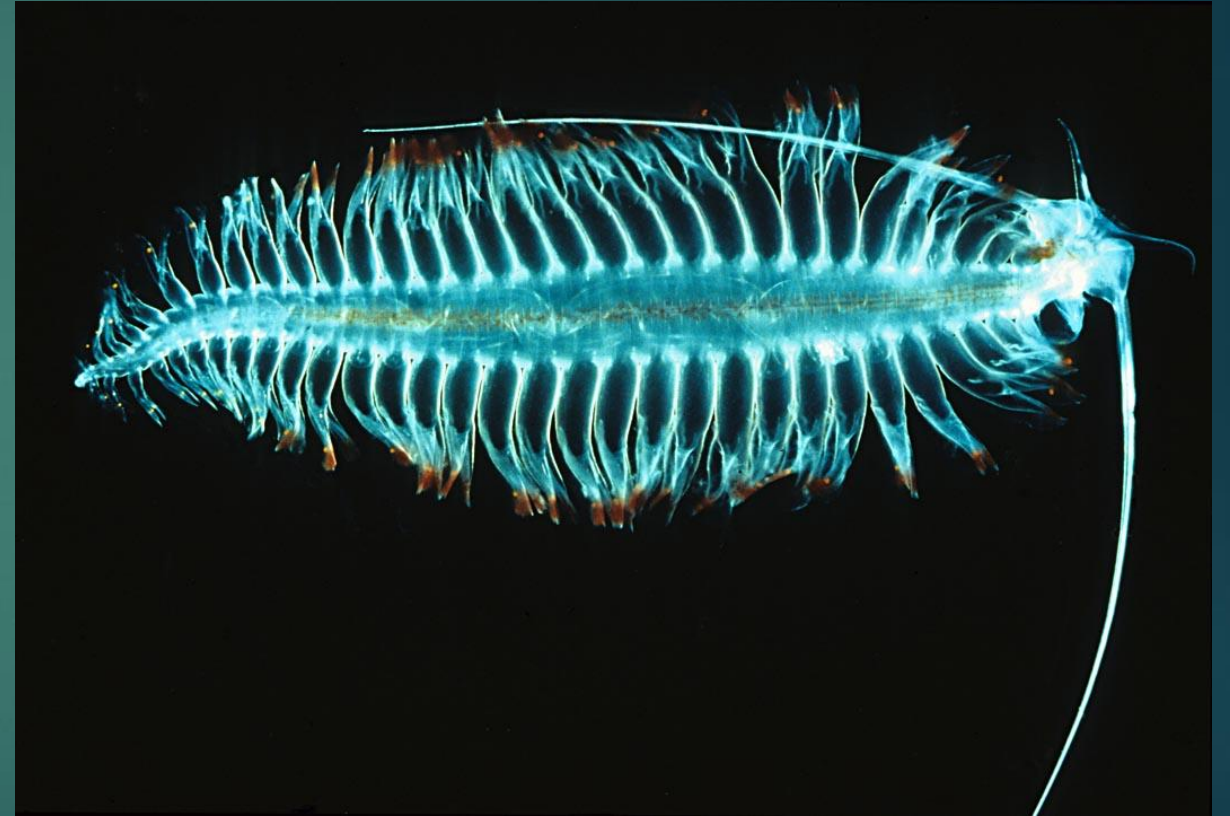
- ▶ swimming larvae length between 0.6 and 4.5mm.



Polychaeta

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- ▶ belong to annelida
- ▶ 9,000 species in the marine environment
- ▶ as larvae and mature males and females

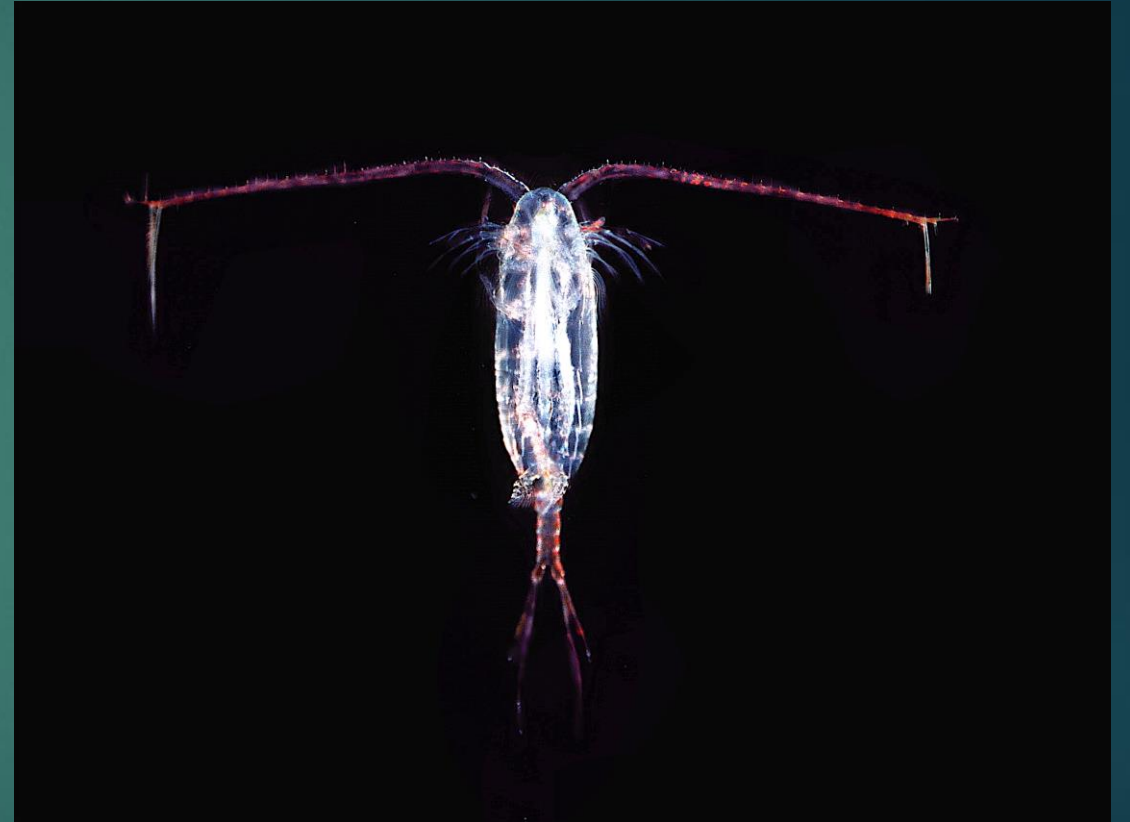


Tomopteris sp.

Copepods

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- ▶ crustaceans
 - ▶ taxon with highest species diversity
- ▶ belong to mesoplankton
- ▶ dominate the zooplankton
- ▶ free-living and parasitic species



Calanus sp.

The importance of plankton







Megaptera novaeangliae



Euphausia superba

- one humpback whale can eat up to 2 tons of krill in 24h
- feed on krill for one month

Marine snow

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- ▶ organic aggregates
 - ▶ gelatinous plankton (e.g. cnidarians, polychates,...)
 - ▶ zooplankton fecal pellets
 - ▶ zoo- and phytoplankton skeletons
 - ▶ zooplankton exuvia

- ▶ forms the sea floor of the abyssal plains

Marine snow

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is also known as marine snow.

<https://www.youtube.com/watch?v=a0n3U2pWITl>

Global warming

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- ▶ temperature is the most important exogenous factor on species distribution
- ▶ effect on species compositions in certain areas
 - neozoans
 - e.g. *Mnemiopsis leidyi* (invaded Black Sea and Caspian Sea)
 - no enemies
 - rapid population increase
 - drastic consequences for fish populations

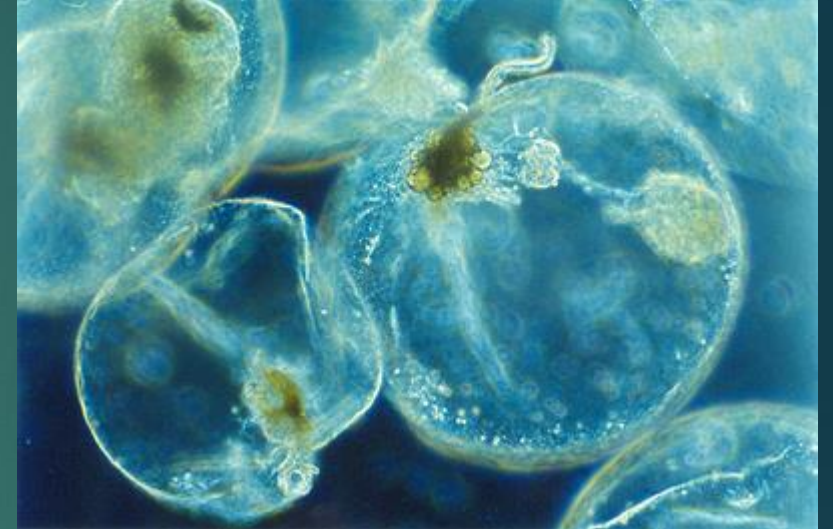


Mnemiopsis leidyi

Marine phosphorescence

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- ▶ bioluminescence
- ▶ among others by dinoflagellates (e.g. *Noctiluca scintillans*)
- ▶ light signal upon touch
- ▶ not always → dependent on concentration of bioluminescent organisms



Noctiluca scintillans

Marine phosphorescence

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<https://www.youtube.com/watch?v=KzJNOPA3-K8>

Picture citations

- ▶ [1] <https://pixabay.com/de/phytoplankton-plankton-1348508/>
- ▶ [2] <https://en.wikipedia.org/wiki/Zooplankton#/media/File:Zooplankton.jpg>
- ▶ [3] <https://earthobservatory.nasa.gov/images/13599/phytoplankton-bloom-near-norway>
- ▶ [4] <https://www.flickr.com/photos/microagua/31792890043>
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- ▶ [6] [https://upload.wikimedia.org/wikipedia/commons/d/d7/Aurelia_jellyfishes_Expl1602 - Flickr - NOAA Photo Library.jpg](https://upload.wikimedia.org/wikipedia/commons/d/d7/Aurelia_jellyfishes_Expl1602_-_Flickr_-_NOAA_Photo_Library.jpg)
- ▶ [7] Marinbiologische Exkursion Calvi Korsika 2010 – Bericht, S. 39
- ▶ [8] <https://commons.wikimedia.org/wiki/File:Tomopteriskils.jpg>
- ▶ [9] <https://commons.wikimedia.org/wiki/File:Copepodkils.jpg>
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- ▶ [11] <http://www.photolib.noaa.gov/htmls/sanc0612.htm>
- ▶ [12] https://de.wikipedia.org/wiki/Datei:Whale_shark_Georgia_aquarium.jpg
- ▶ [13] [https://de.m.wikipedia.org/wiki/Datei:Antarctic_krill_\(Euphausia_superba\).jpg](https://de.m.wikipedia.org/wiki/Datei:Antarctic_krill_(Euphausia_superba).jpg)
- ▶ [14] https://pl.wikipedia.org/wiki/Mnemiopsis_leidyi
- ▶ [15] https://en.wikipedia.org/wiki/Noctiluca_scintillans

Citations-videos

- ▶ <https://www.youtube.com/watch?v=a0n3U2pWITl>
- ▶ <https://www.youtube.com/watch?v=KzJNOPA3-K8>
- ▶ <https://www.youtube.com/watch?v=r8rSC9mX328>
- ▶ <https://www.youtube.com/watch?v=WRkxyROtjn4>

Citations

- ▶ Coastal Plankton – Photo Guide for European Seas 2nd edition by Otto Larink & Wilfried Westheide
- ▶ A Mechanistic Approach to Plankton Ecology by Thomas Kiorboe
- ▶ Marinbiologische Exkursion Calvi Korsika 2010 – Bericht
- ▶ Marinbiologische Exkursion Calvi Korsika 2014 - Bericht