

- Plankton -

Denizel Üreticiler ve Tüketiciler

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Başlıklar:

Çevresel etkiler (Fiziksel ve Kimyasal ortam)

Deniz Mikrobiyolojisi'ne giriş:

-Küçükten Büyüğe mikroorganizmalar-Plankton

Virüs, Bakteri, Fitoplankton, Zooplankton

Mikroorganizmalar arasındaki ilişkiler-ekosistem.

Biz neler yapıyoruz?



Fiziksel ortam

Işık,

Akıntılar,

Tuzluluk,

Yukarı - Aşağı taşınım hareketleri,

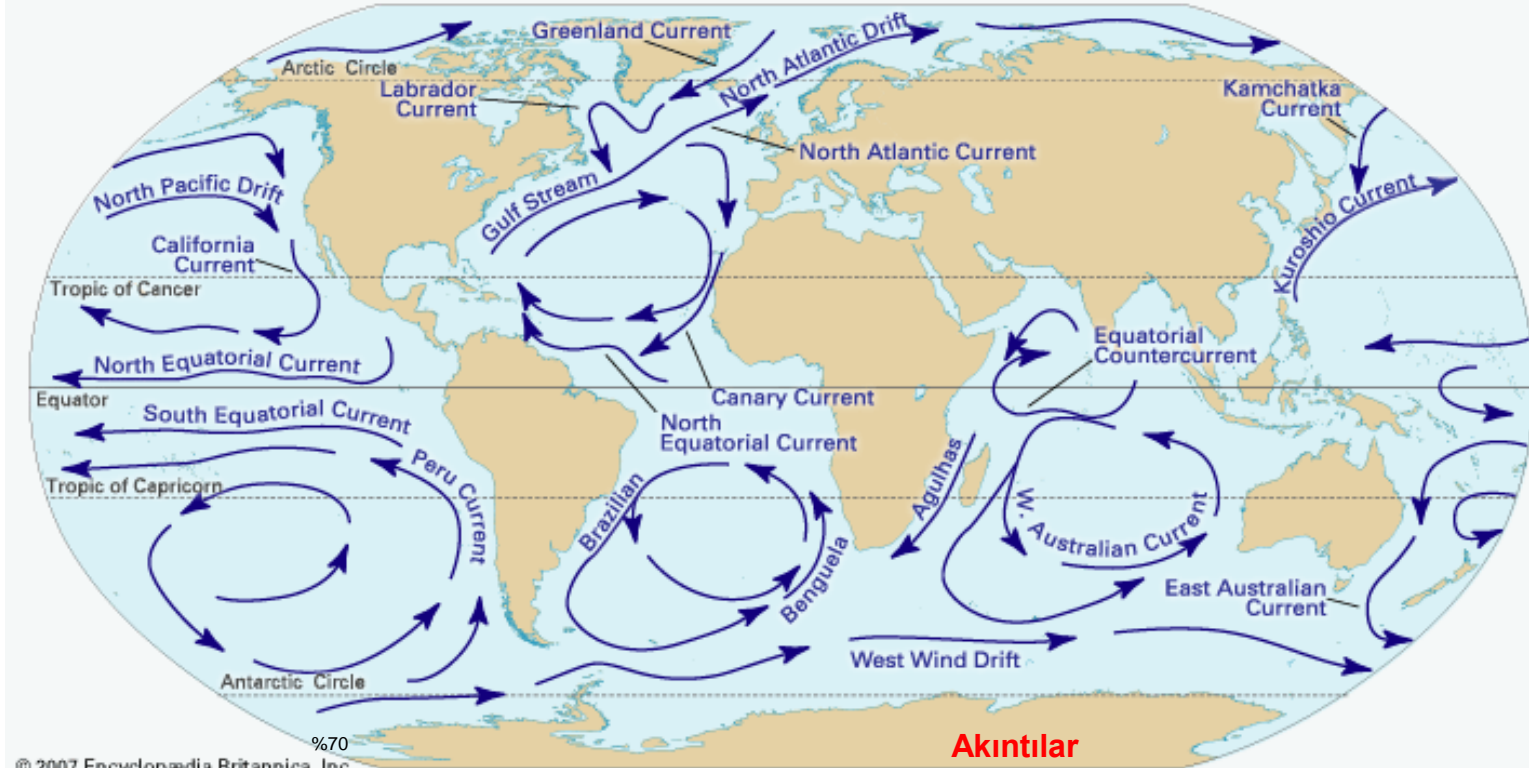
Sıcaklık,

Yoğunluk,

Dalgalar,

Batimetri,

Gel – Gitler,



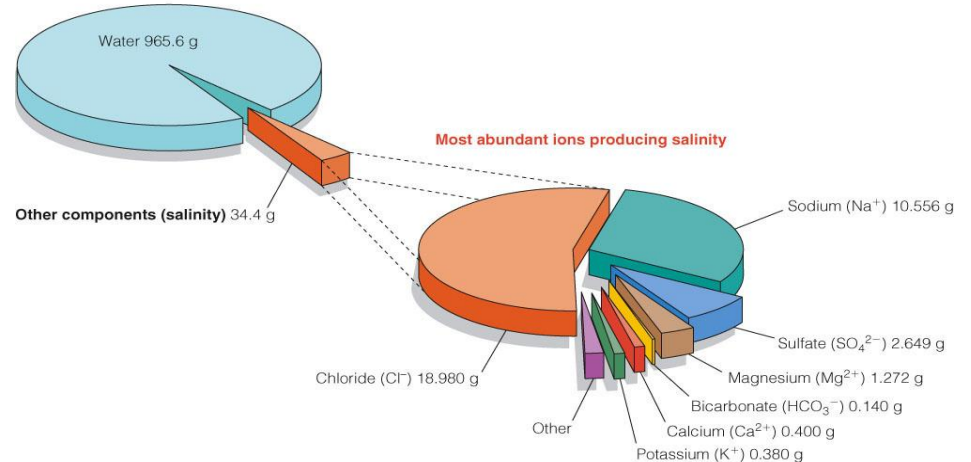
% 5 Baltık Denizi

≈ ‰ 35

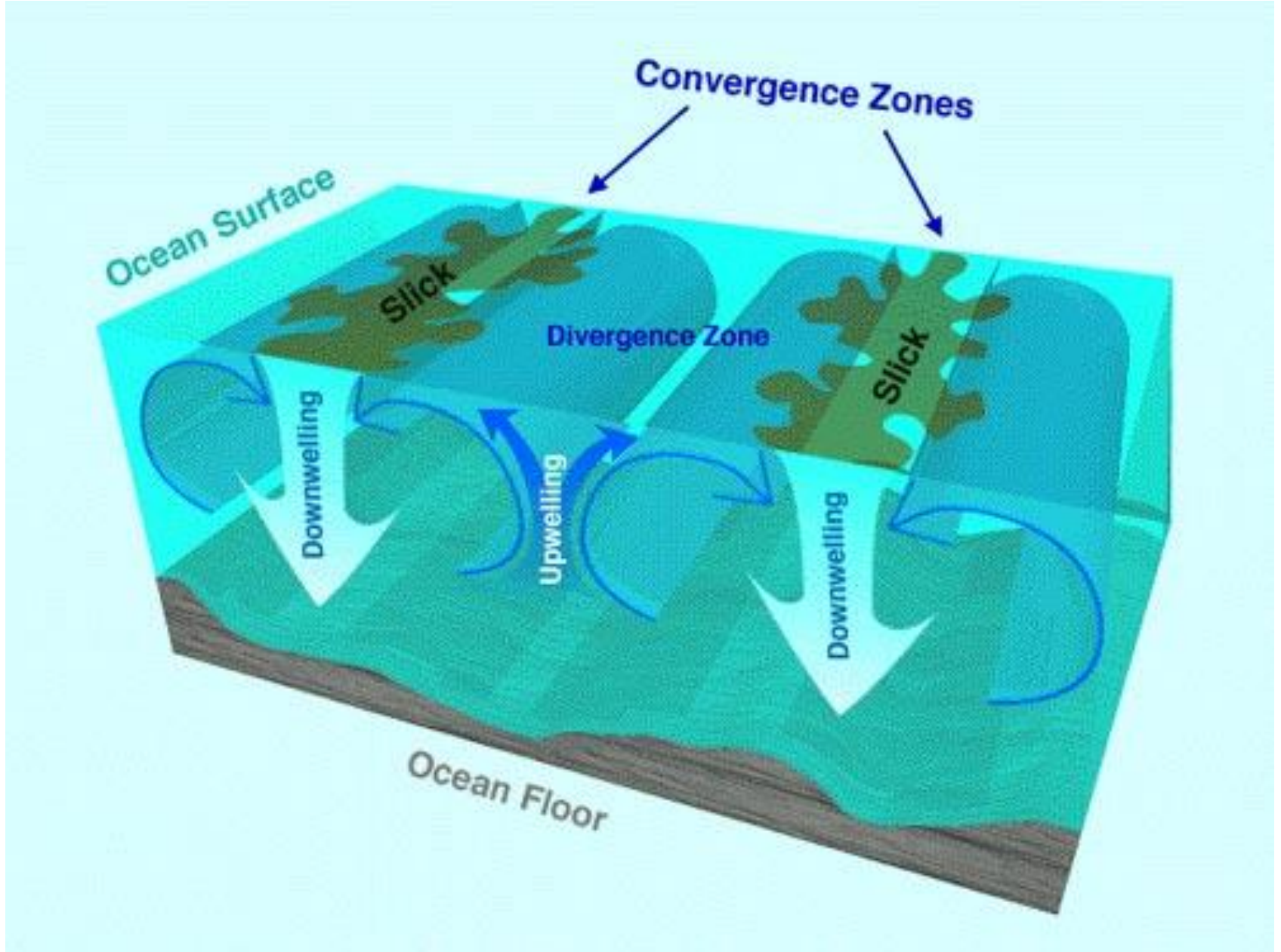
% 40 Kızıl Deniz



chemical ion	concentration ppm, mg/kg	part of salinity %
Chloride Cl	19345	55.03
Sodium Na	10752	30.59
Sulfate SO ₄	2701	7.68
Magnesium Mg	1295	3.68
Calcium Ca	416	1.18
Potassium K	390	1.11
Bicarbonate HCO ₃ ⁻	145	0.41
Bromide Br	66	0.19
Borate BO ₃	27	0.08
Strontium Sr	13	0.04
Fluoride F	1	0.003

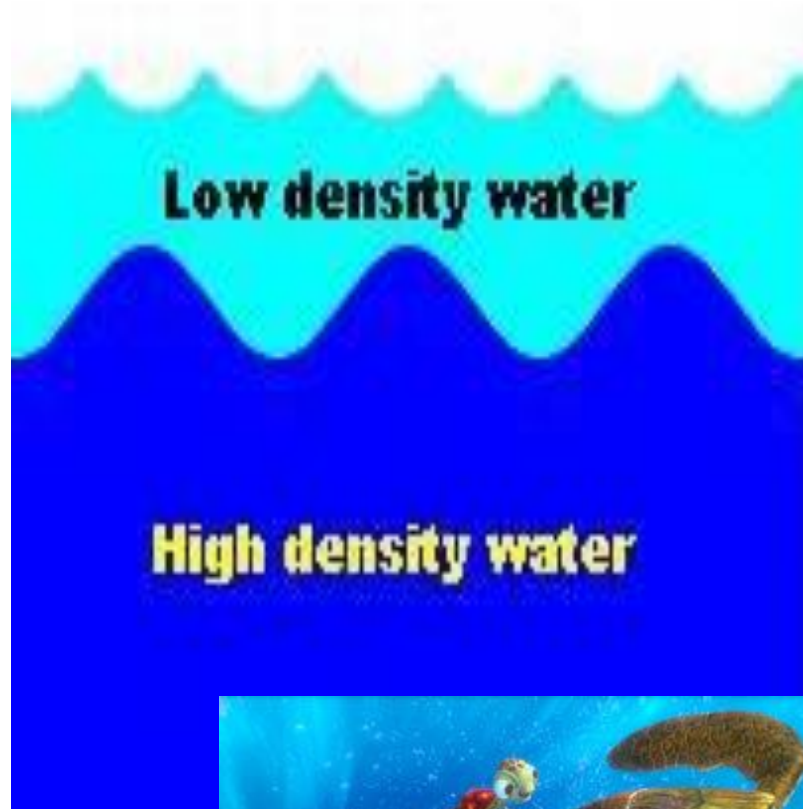


Yukarı - Aşağı taşınım hareketleri,



İç dalgalar

- Yüzey dalgaları 20 m kadar olabilir.
- İç dalgaların boyu 300 m yada daha büyüktür.
- İç dalgalar topografyadan kaynaklanır.

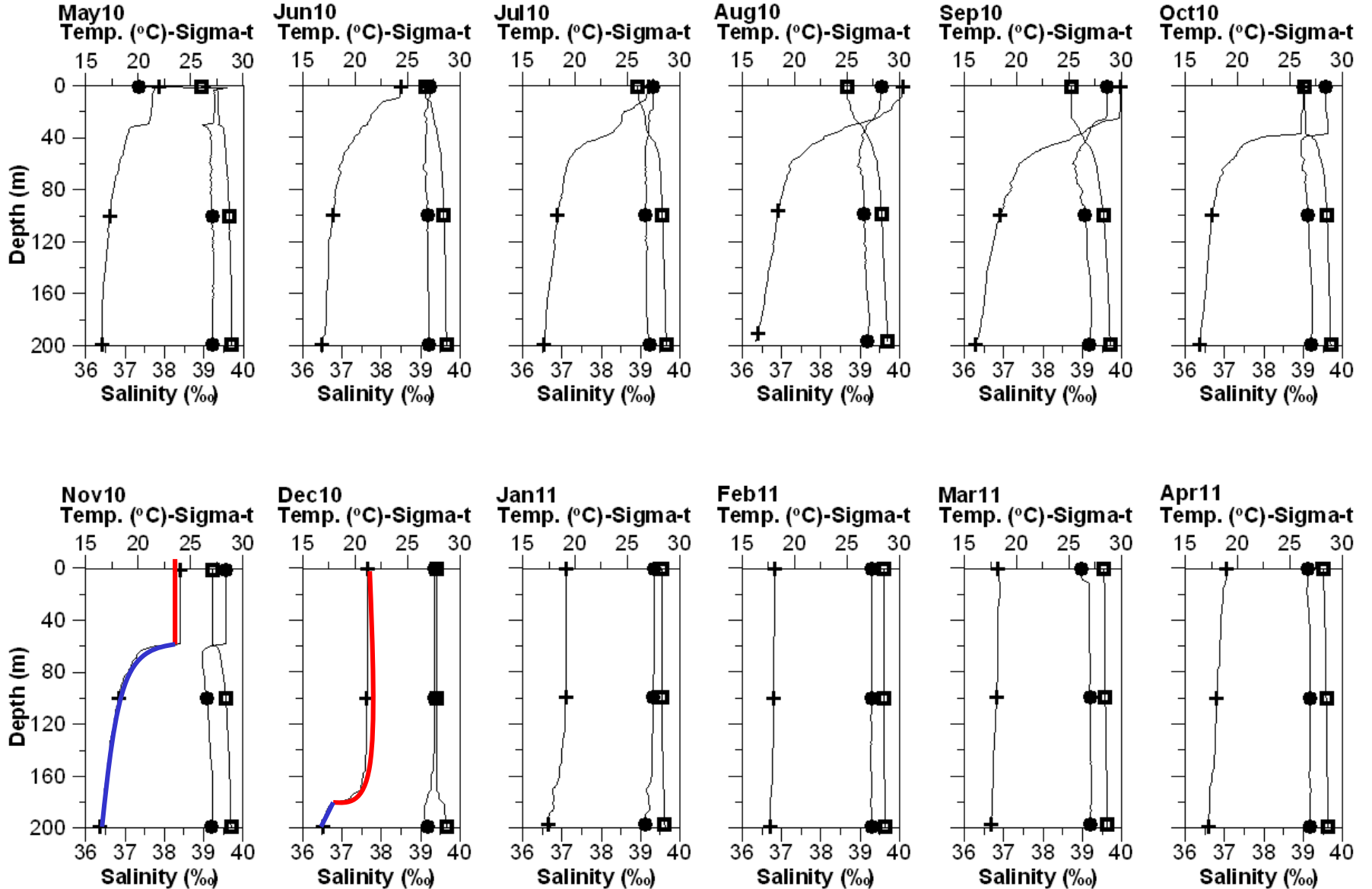


Yüzey dalgası

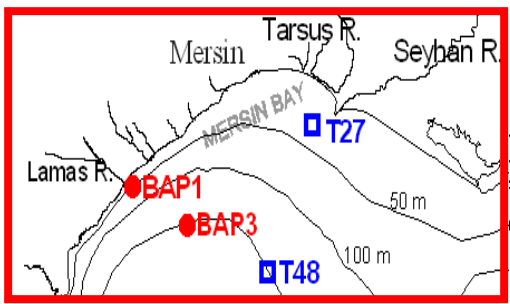
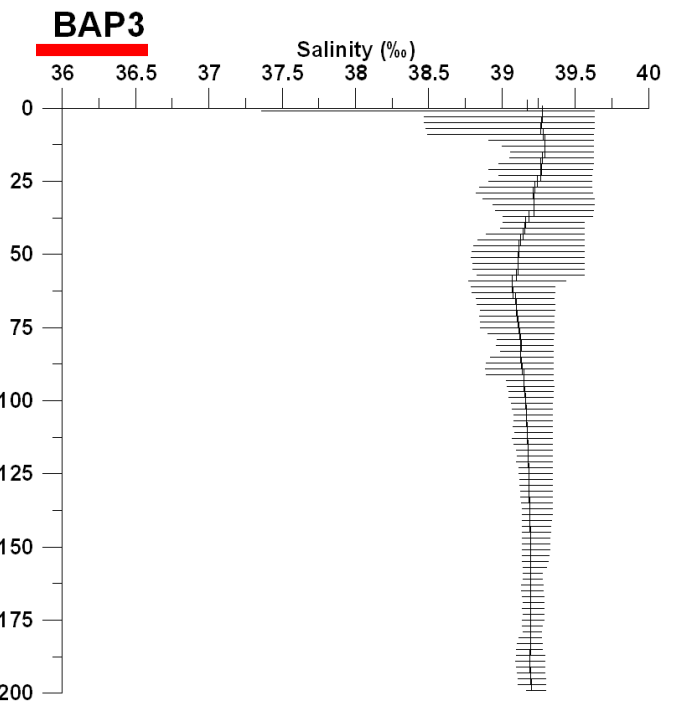
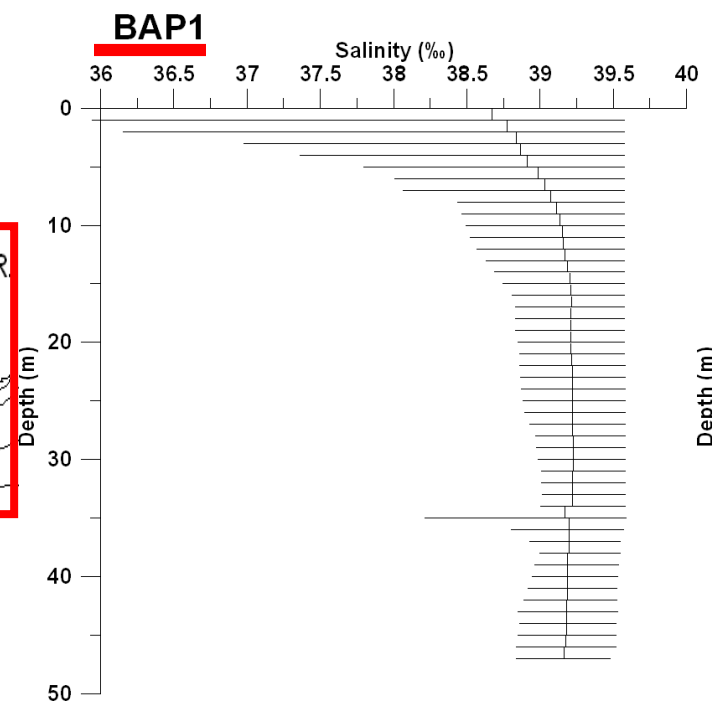
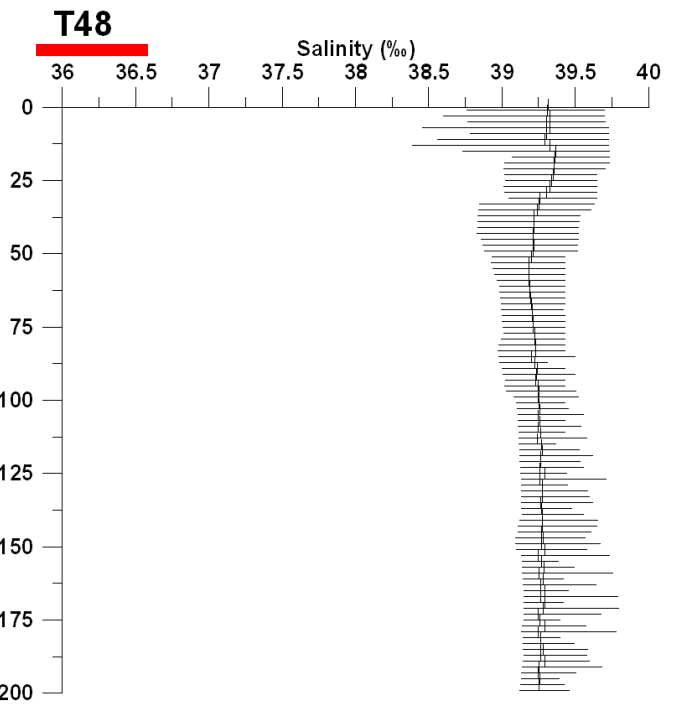
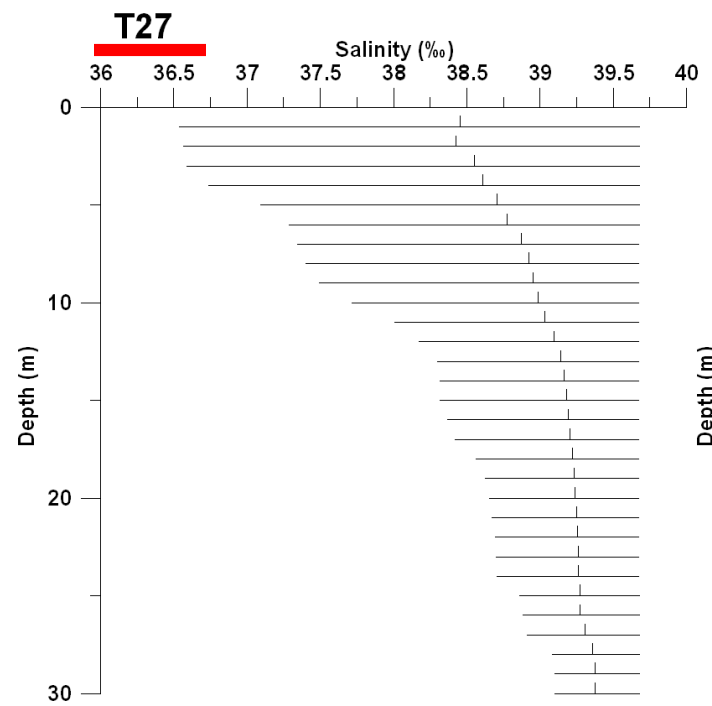
iç dalga



Kış Karışımı



Tuzluluk



Makro ve Mikro elementler – Besin tuzları

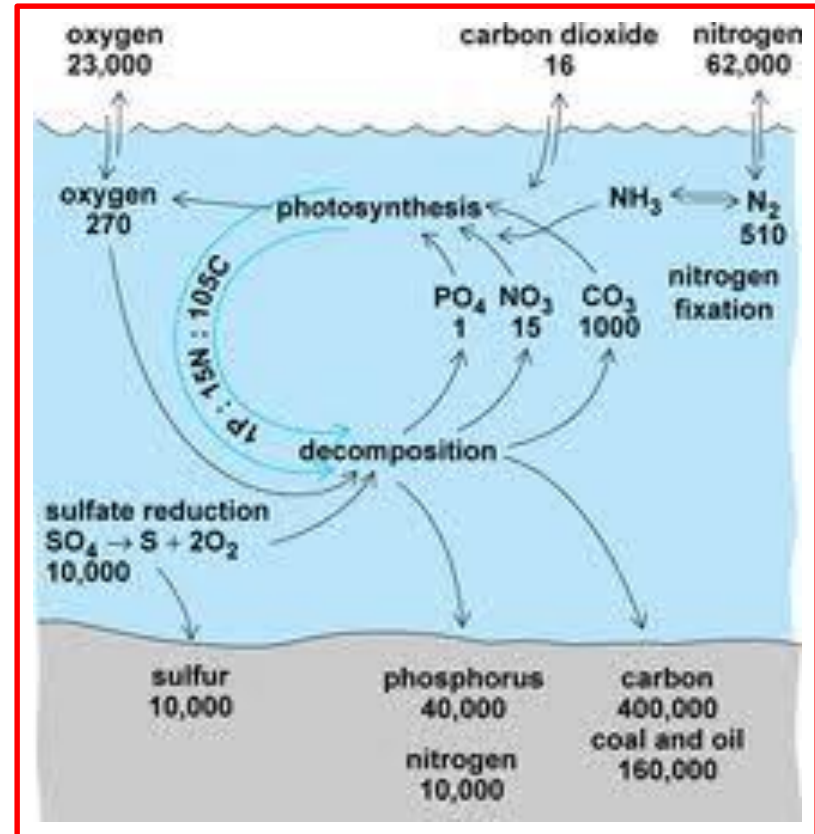
C, Mn, Cu, Zn, Si,
O, P, Mo, Cl,
H, Fe, V, Si, B,
Mg, N, Co, I,
K,

Çözünmüş maddeler İnorganik
Organik

Partikül maddeler İnorganik
Organik

pH,

Çözünmüş gazlar (CO₂, O₂, N₂)



Mikro-biyoloji

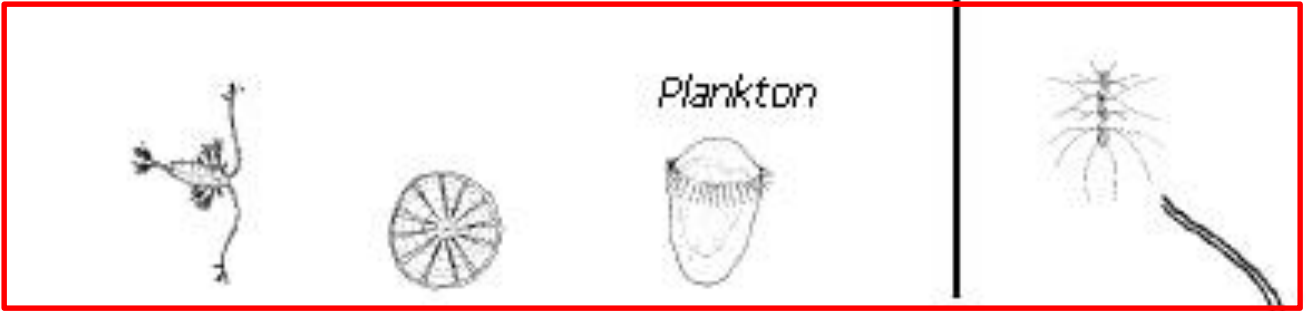
❖ Mikroorganizmaları ve onların aktivitelerini inceleyen bilim dalıdır.

Virüs,
Bakteri,
Mantar,
Protista,
Fito-plankton,
Zoo-plankton



“Planao” kelimesi yunancada gezinmek-dolaşmak anlamındadır. Akıntıya karşı yüzemeyen-sürüklenen organizmalara **plankton** denir.

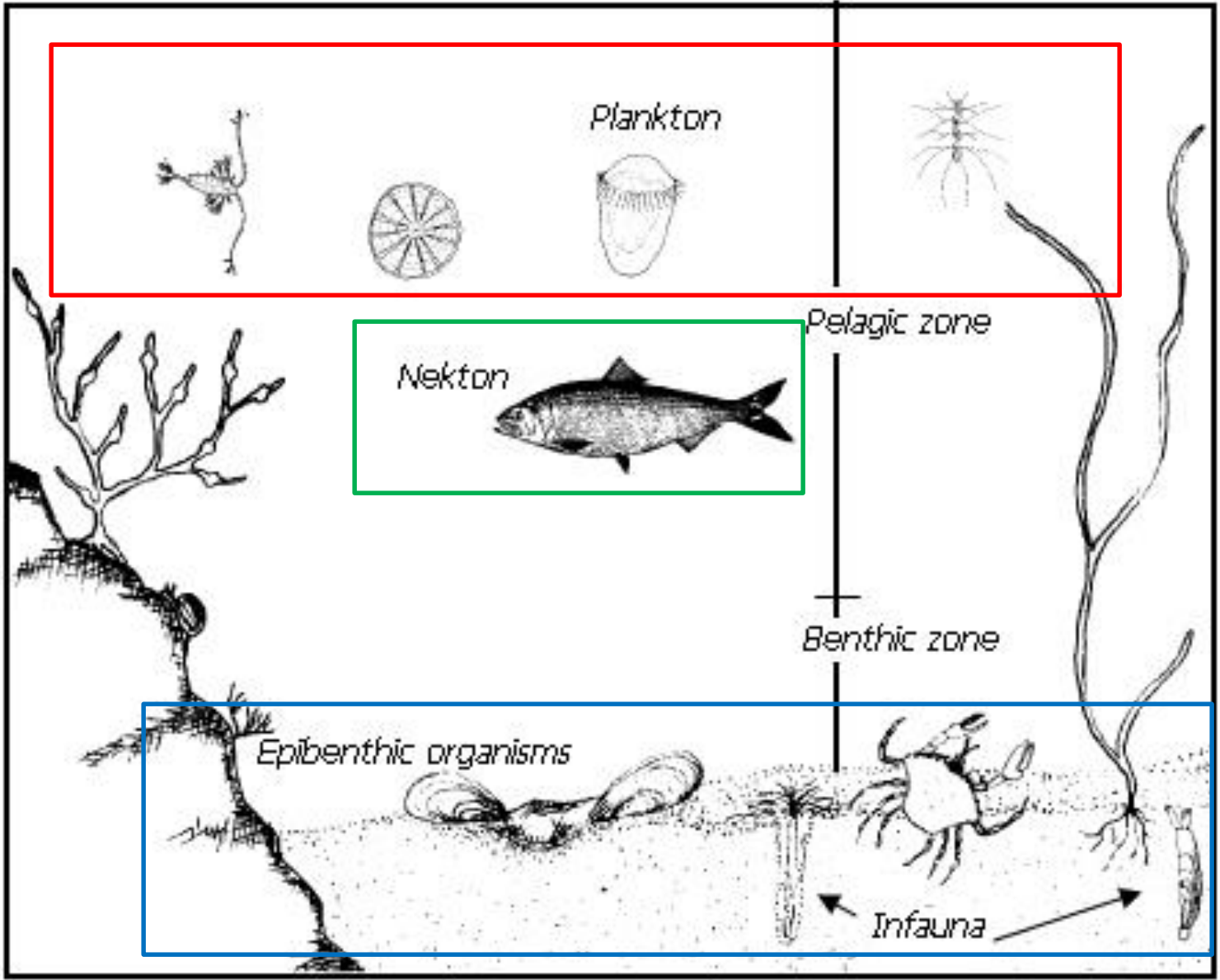
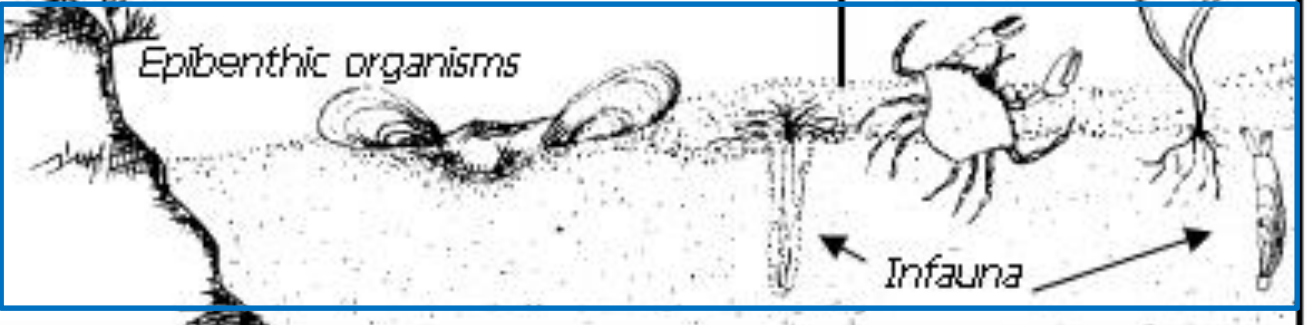
Plankton



Nekton



Bentoz



Plankton'un sınıflandırılması:



Büyüklik



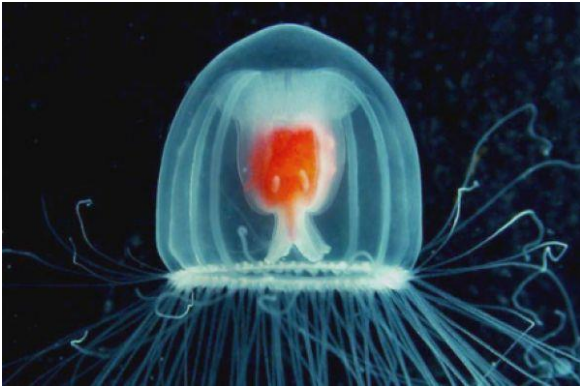
Habitat (yaşam alanı)



Taksonomi

Büyüklik:

- **Pikoplankton (0.2-2 μm)** bakterioplankton
- **Nanoplankton (2 - 20 μm)** protozoa
- **Mikroplankton (20 - 200 μm)** diatom, larva ve yumurtalar
- **Makroplankton (200 - 2,000 μm)** bazı yumurta ve genç balıklar
- **Megaplankton (> 2,000 μm)** deniz anası, mola mola (ay balığı-
dğrmntş)



Hücre Büyüklükleri

Virüs (nm) = 10^{-9} m (metre)

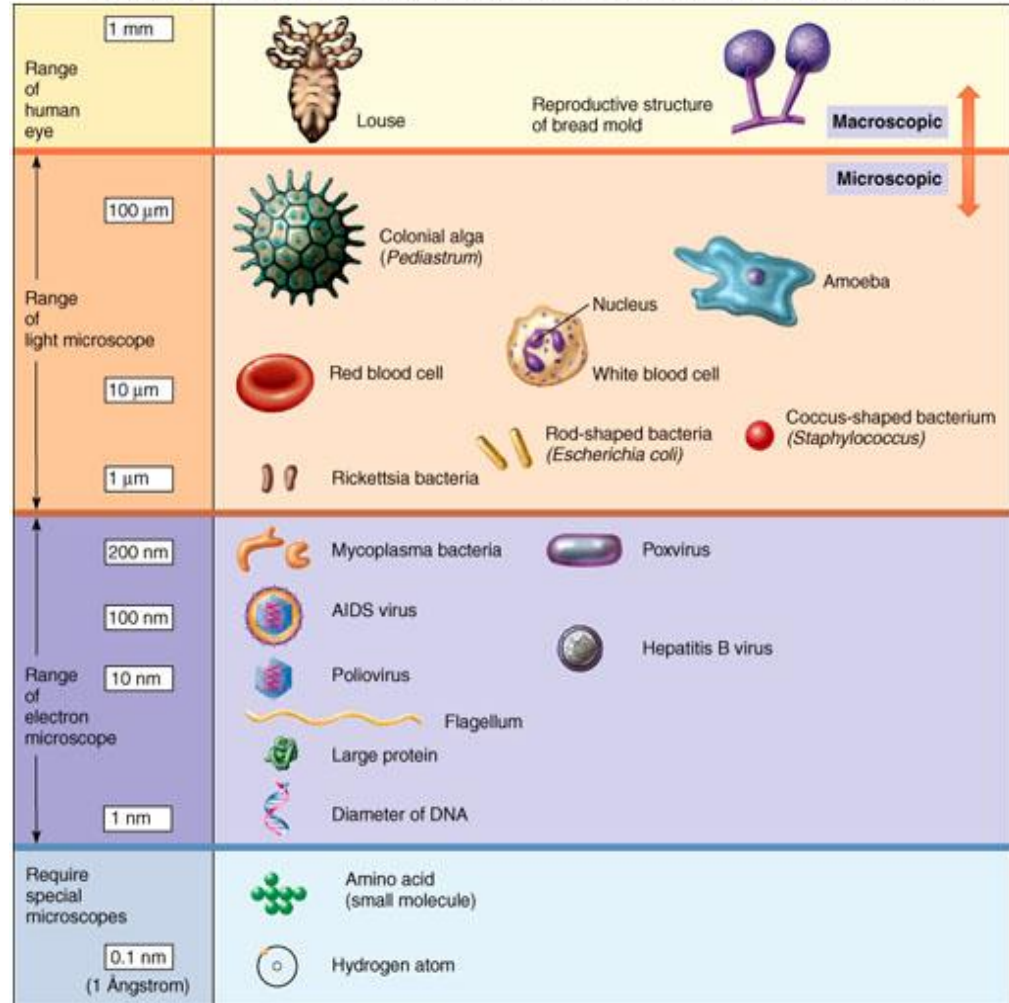
Bakteri (μm) = 10^{-6} m

Parazit-kurt (mm) = 10^{-3} m

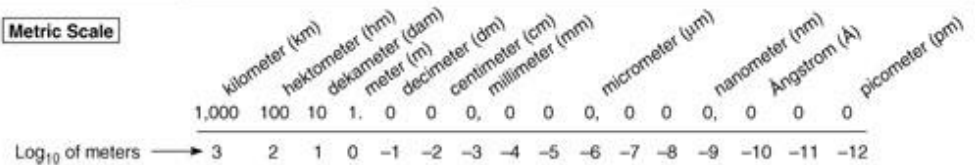
VS...

VS...

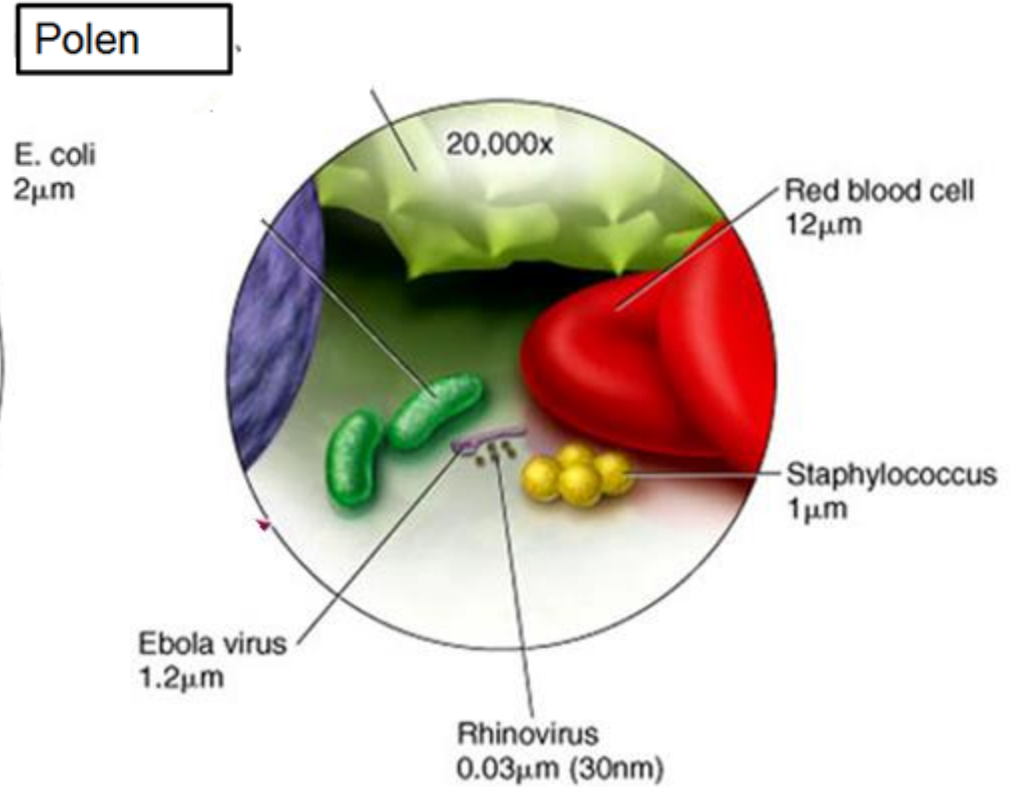
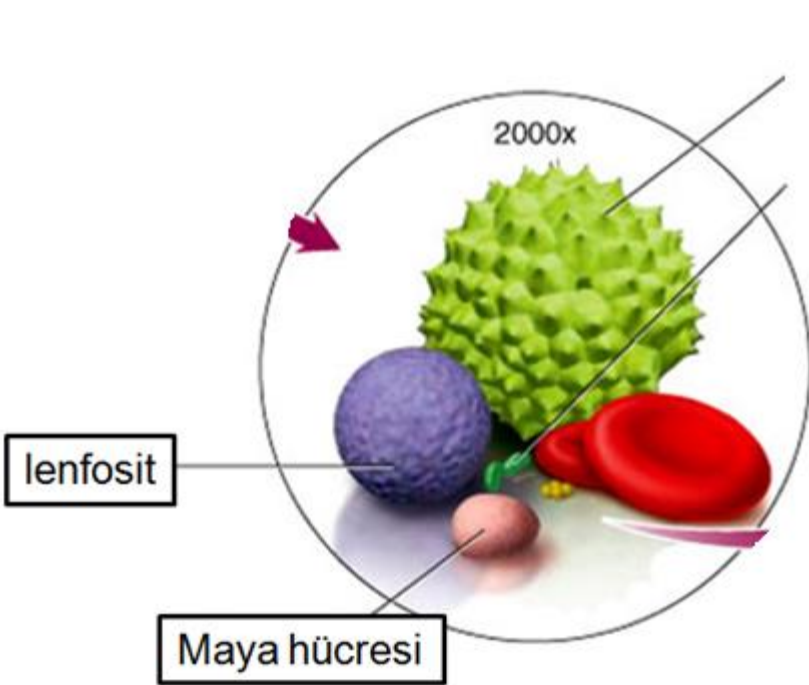
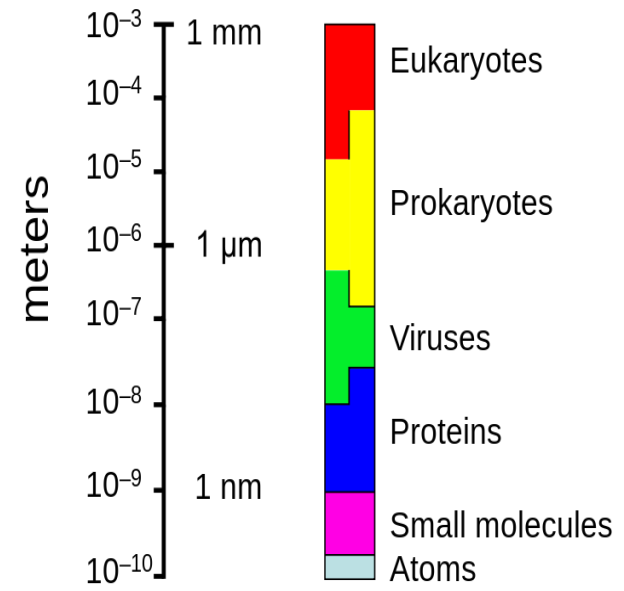
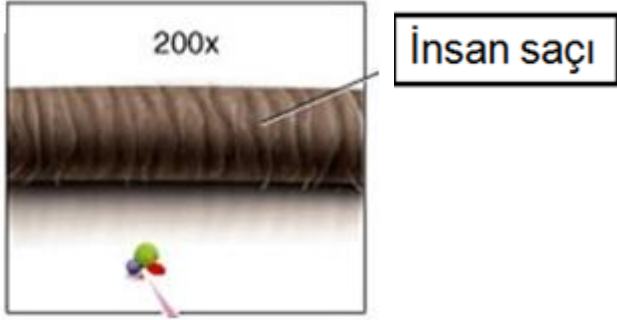
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Metric Scale



Nasıl kıyaslayabiliriz?

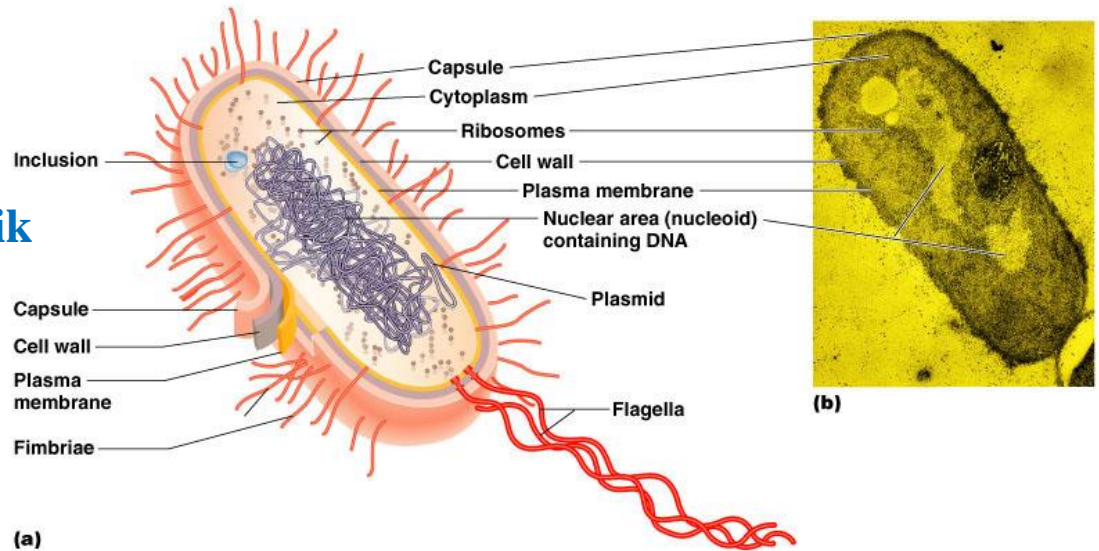


Genel özellikleri

- ❖ **Prokaryot** gerçek çekirdek zarları ve membrana bağlı organelleri yoktur
- ❖ **Ökaryot** zarla çevrili çekirdek ve organelleri vardır
- ❖ **Aselüler** organize bir hücre değildir, DNA yada RNA içeren protein kapsüller, yada protein parçaları

Hücre tipleri

Prokaryotik



(a)

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Ökaryotik

PLANT CELL

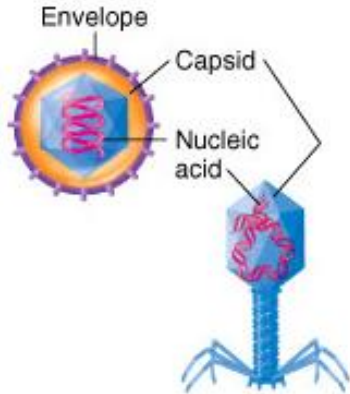
- Peroxisome
- Mitochondrion
- Golgi complex
- Microfilament
- Vacuole
- Microtubule
- Chloroplast
- Cytoplasm
- Ribosome
- Smooth endoplasmic reticulum
- Rough endoplasmic reticulum
- Plasma membrane
- Cell wall
- Nucleolus
- Nucleus

ANIMAL CELL

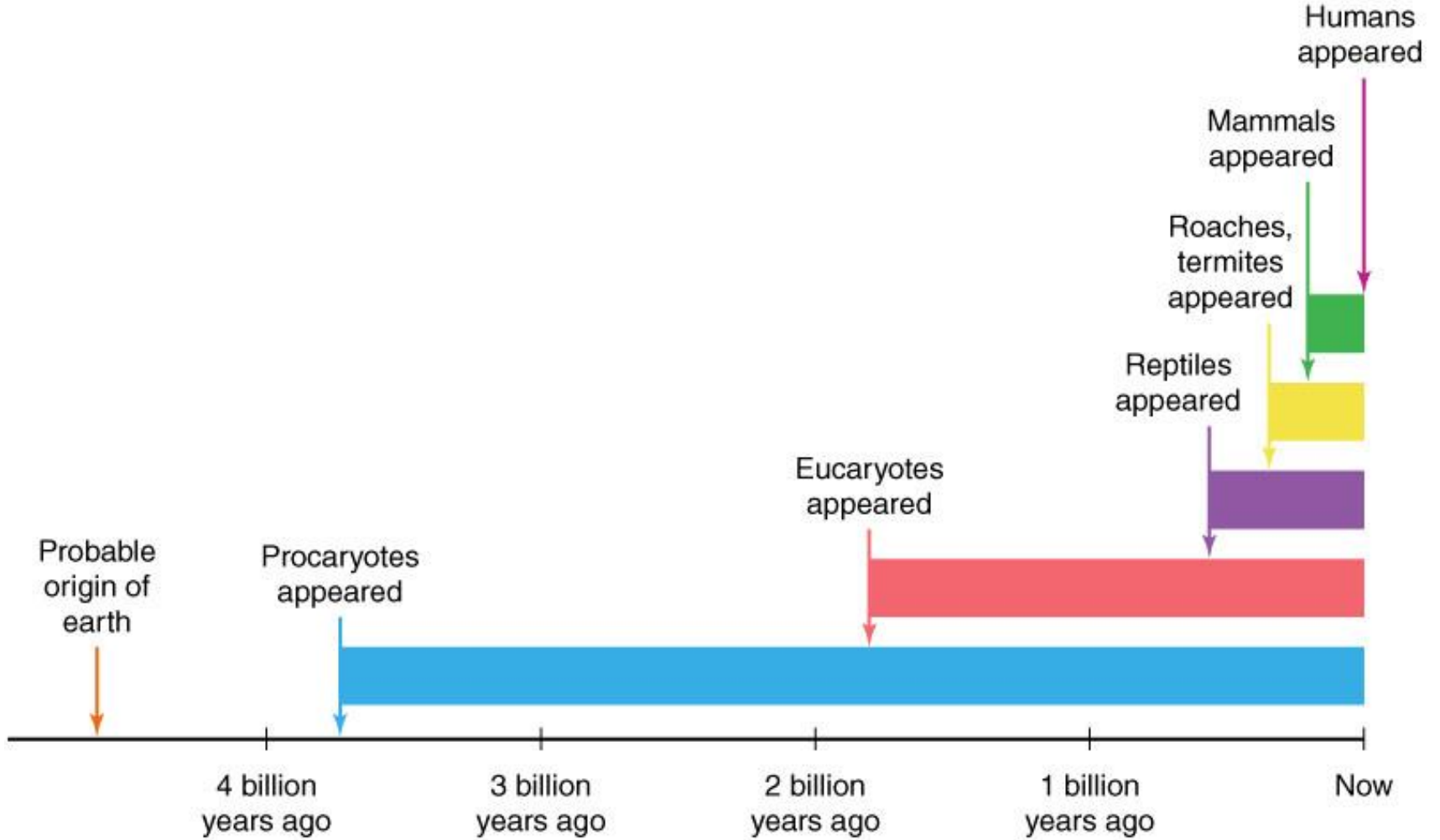
- Flagellum
- Nucleus
- Nucleolus
- Golgi complex
- Cytoplasm
- Basal body
- Microfilament
- Lysosome
- Centrosome: Centriole, Pericentriolar material
- Ribosome
- Microtubule
- Peroxisome
- Rough endoplasmic reticulum
- Mitochondrion
- Smooth endoplasmic reticulum
- Plasma membrane

(a) Highly schematic diagram of a composite eukaryotic cell, half plant and half animal

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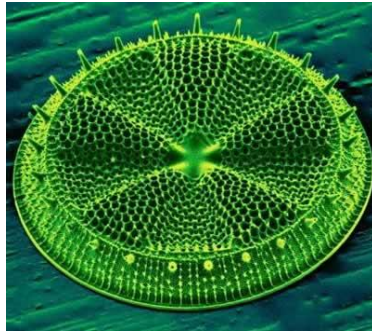
Aselüler



Evrimsel açıdan bakıldığında...Bakteriler 3.5 milyar yıl önce görülmeye başlanmıştır.

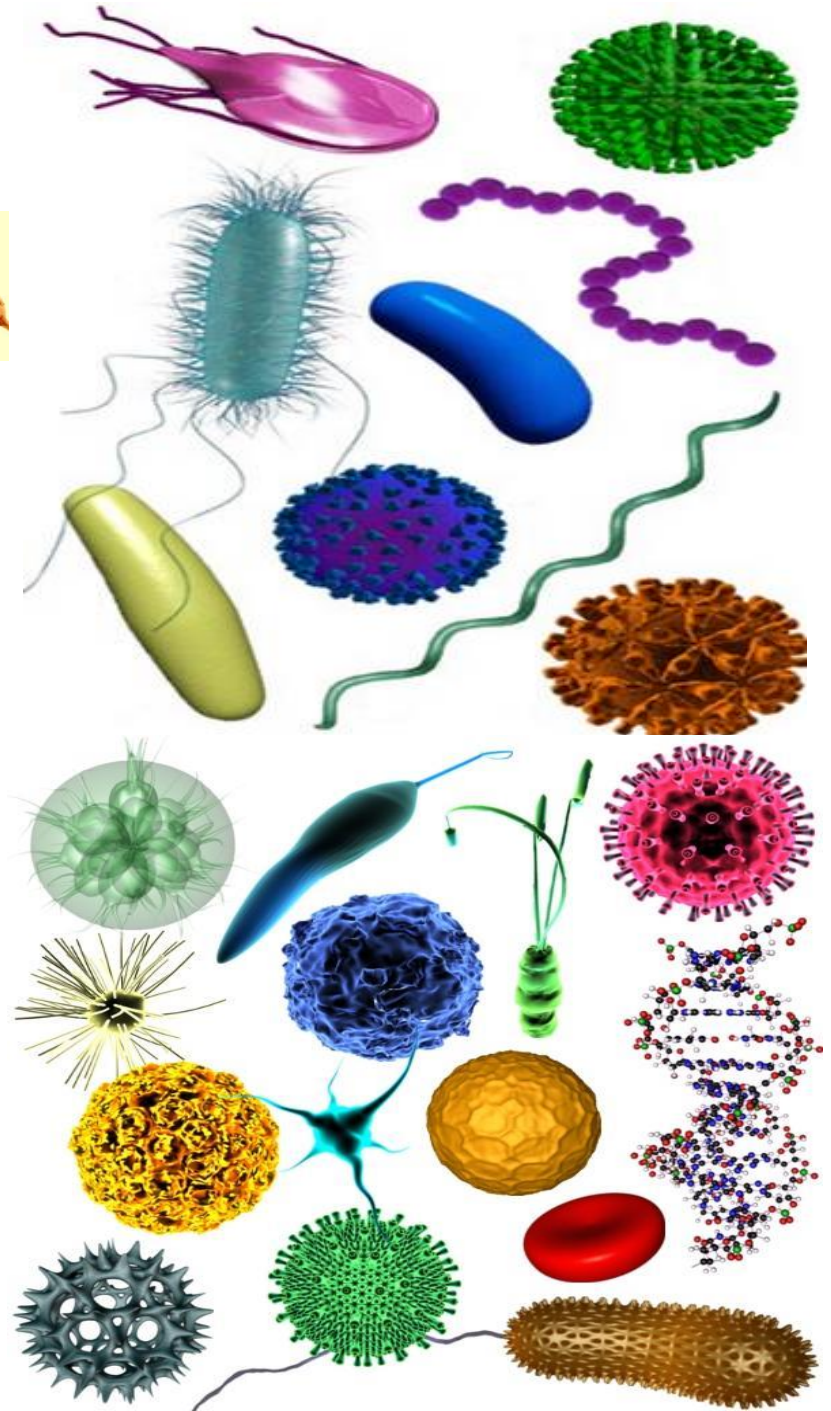
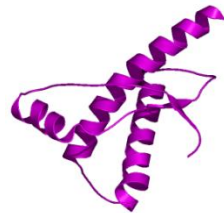
Habitat:

- **Holoplankton** - bütün hayatı plankton olarak geçer.
Ör. Deniz anası, diatom, kopepod
- **Meroplankton** - yaşamının belli bir süresi plankton olarak.
Ör. Balık ve yengeç larvaları, yumurtalar



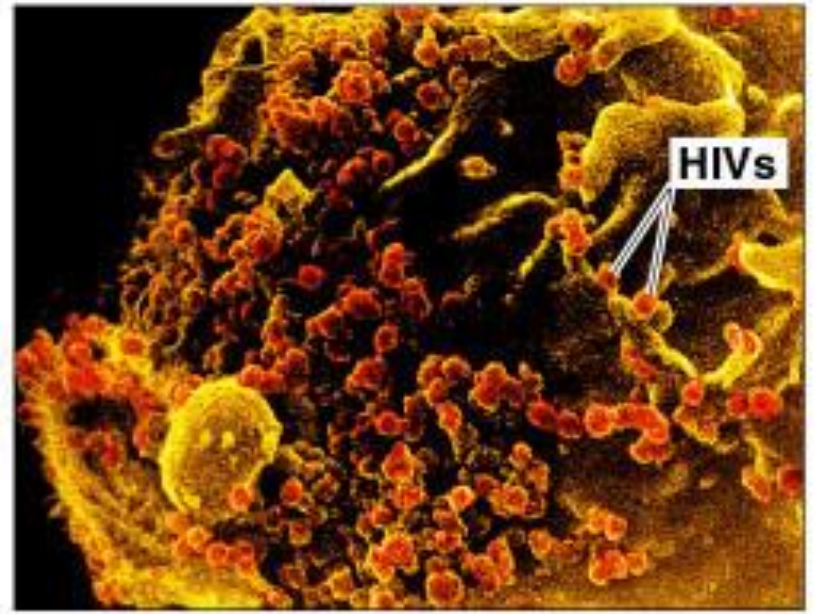
Mikroorganizmalar,

- Tek hücreli
- Çok hücreli
- Aselüler
 - virüs
 - viroids
 - prions-proteinaceous enfeksiyon partikülleri

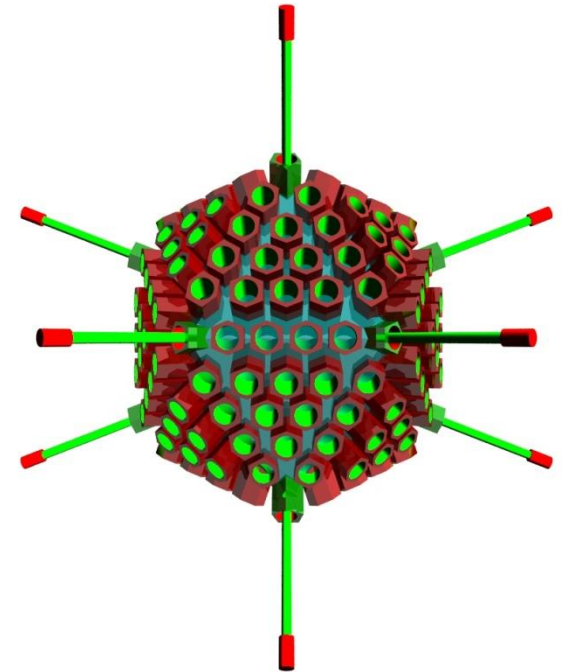
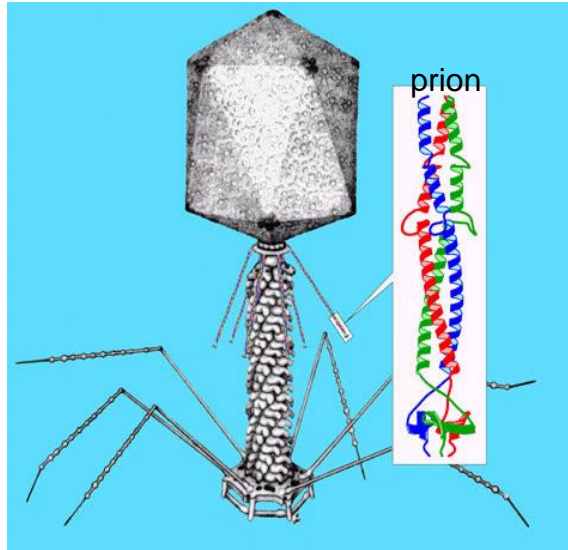


Virüs

- Aselular
- Mecburi hücre içi parazit
- DNA yada RNA
- Protein kılıf içinde bulunur



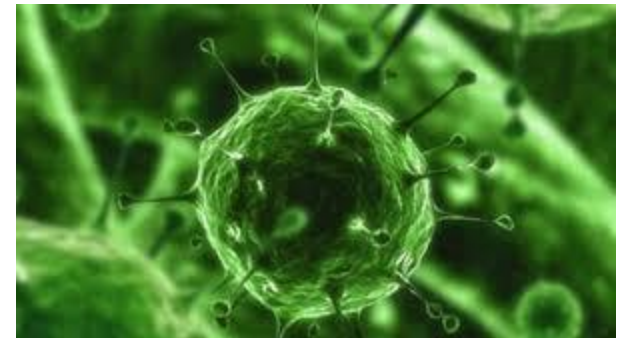
(e)



Bakteri



- Prokaryot
- Tek hücreli
- Fotosentez, Ayrıştırıcı, Parazit, Biyojeokimyasal (element) döngüler,
- ...
- ..
- .



Bakteri

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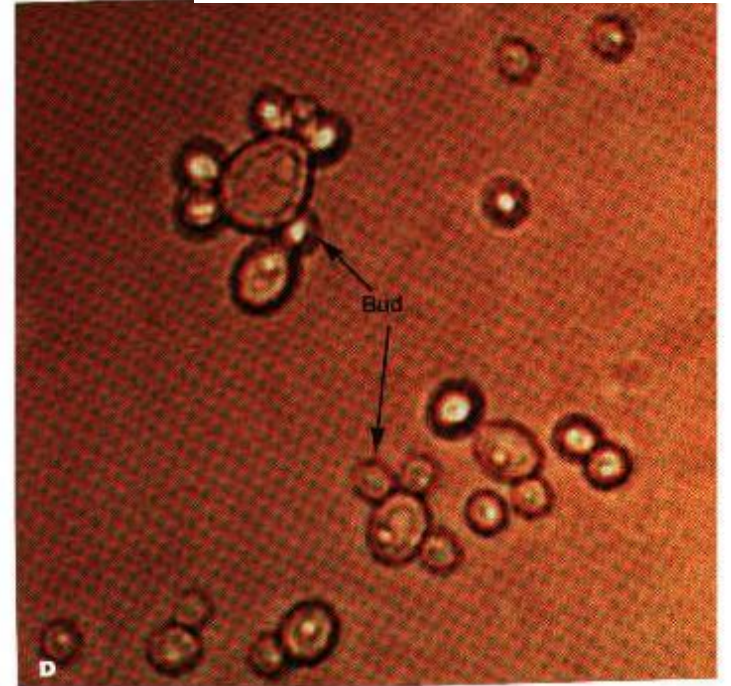
Şekillerine göre

- Kok
- Basil-çomak
- Spiral
- Bazıları kamçılı



Mantar

- Ökaryot
- Maya'ların dışındakiler çok hücreli
- Çürükçül



Protista

- Ökaryot
- Tek hücreli
- Parazit yada kendi başına
- Eşeyli yada eşeysiz üreme



(a)

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(b)

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(b)

Protista hareketine göre isimlendirilir

- **Amip - yalancı ayak**

ör. *Entamoeba histolytica* – amebic dysentery

- **Kamçılılar - kamçı**

ör. *Giardia lamblia* - giardiasis

- **Siliat - sil**

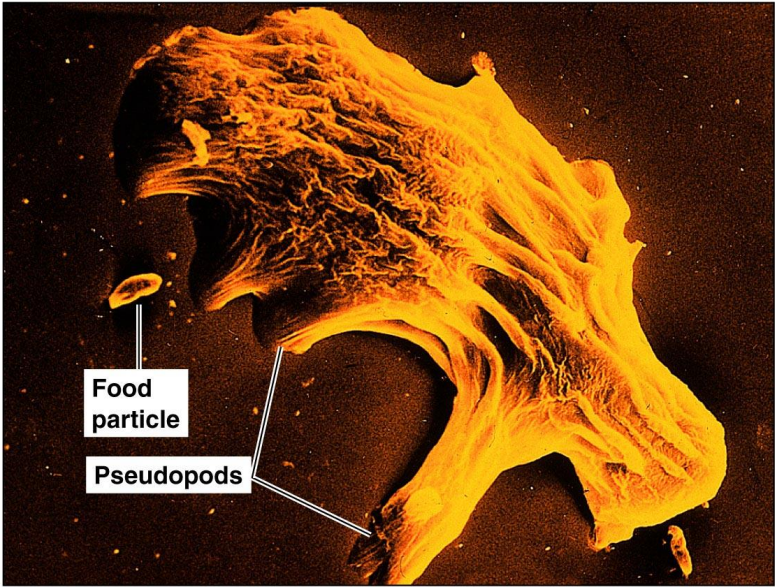
ör. *Paramecium*

- **Sporlular - hareketsiz**

ör. *Toxoplasma gondii* - toxoplasmosis

ör. *Plasmodium* - malaria

Amip

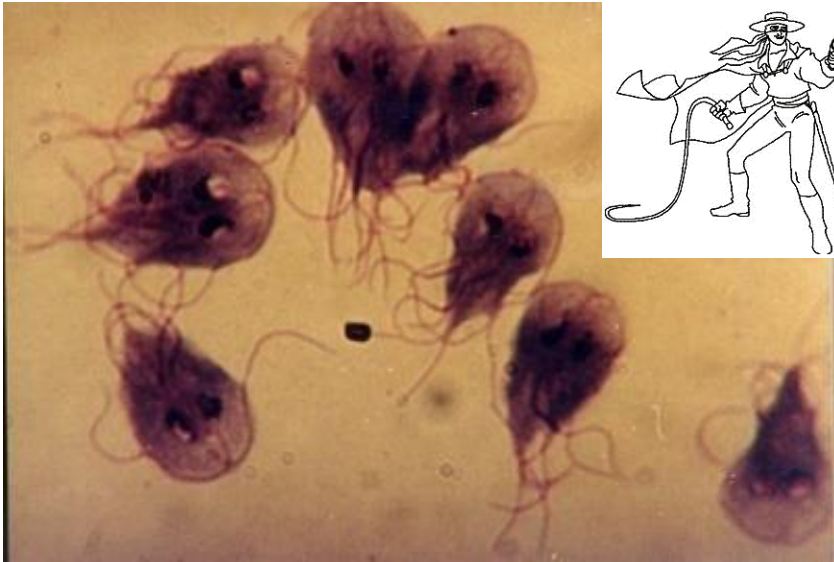


(c)

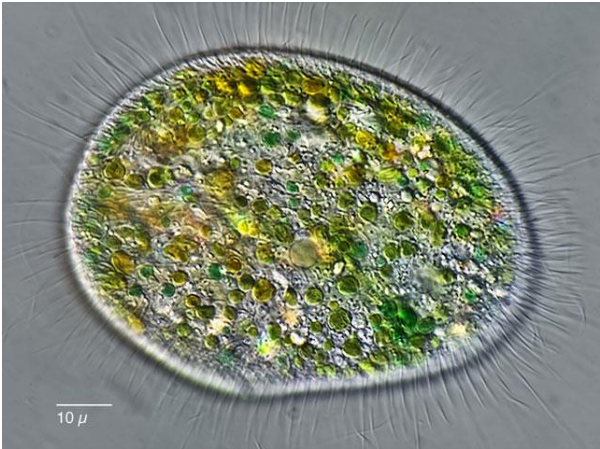
SEM 10 μ m

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Kamçılı



Siliat

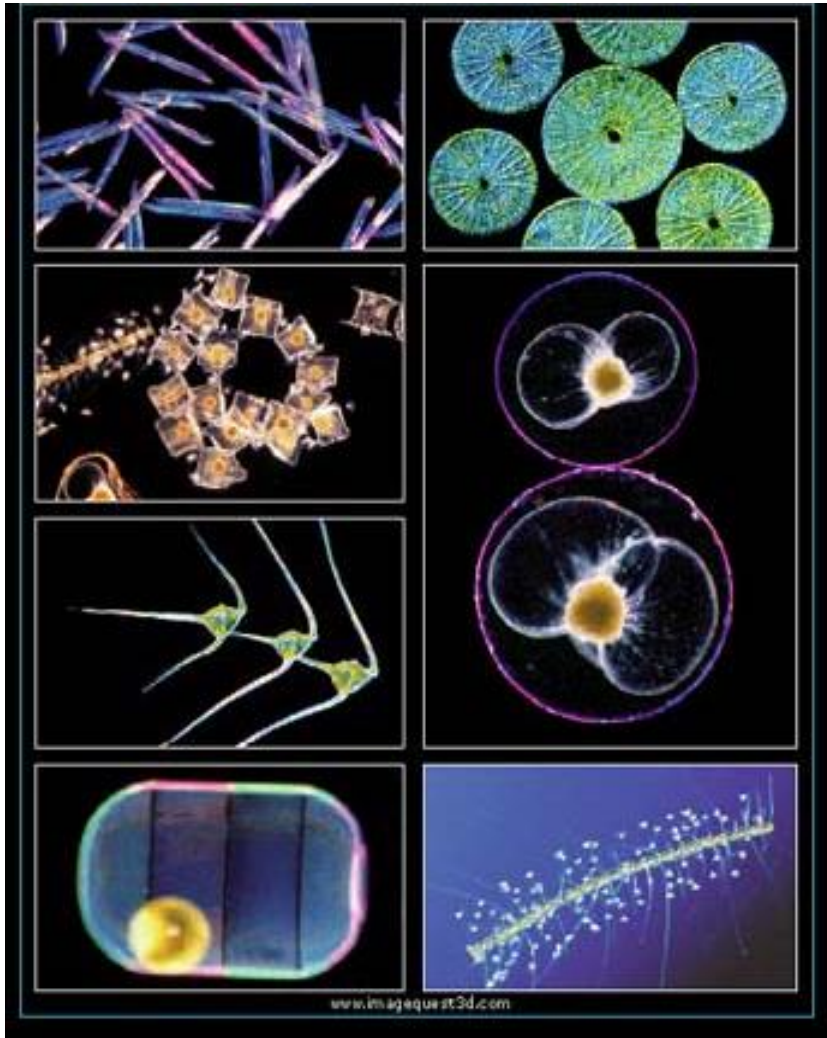


Sporlular



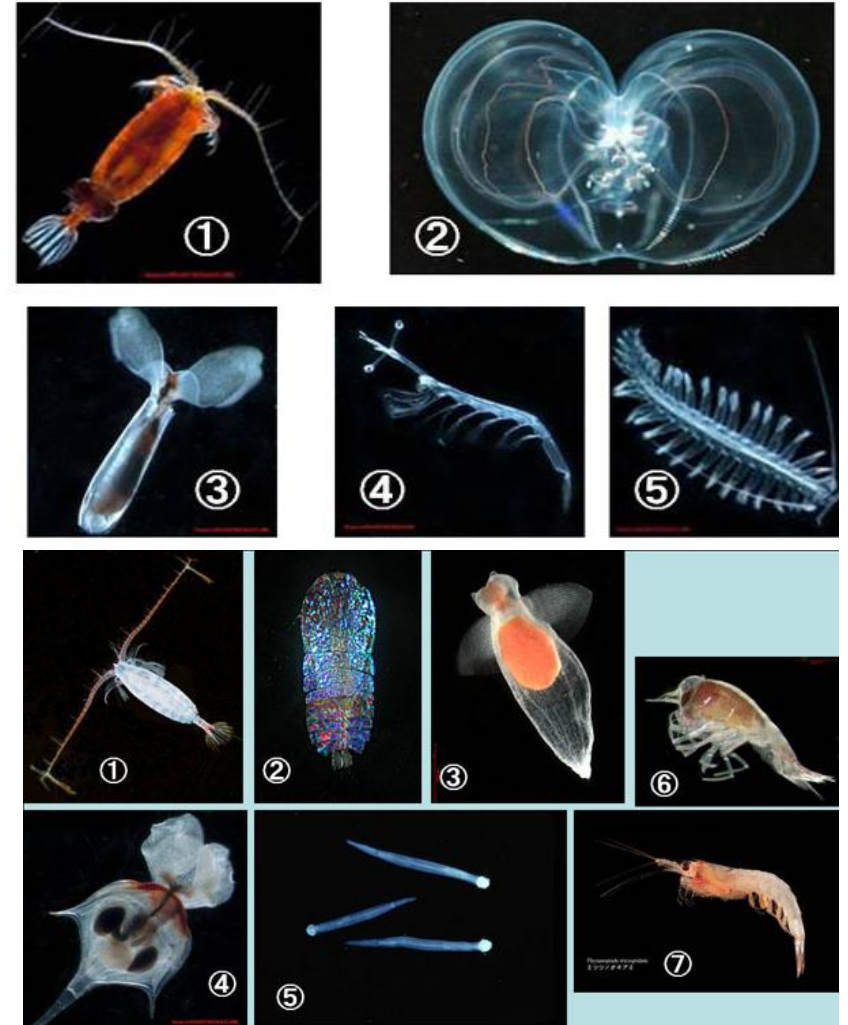
Fitoplankton

Bitki - Üreticiler



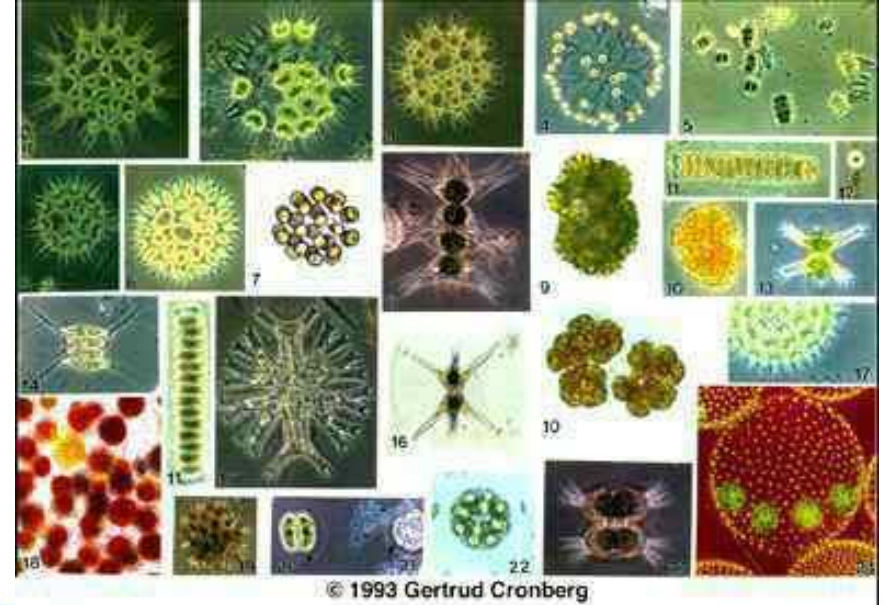
Zooplankton

Hayvan - Tüketiciler



FİTOPLANKTON - ÜRETİCİLER

- Ökaryot
- Fotosentetik
- Selüloz hücre duvarı
- Su yada toprakta bulunur
- Genelde tek hücreli



(a)



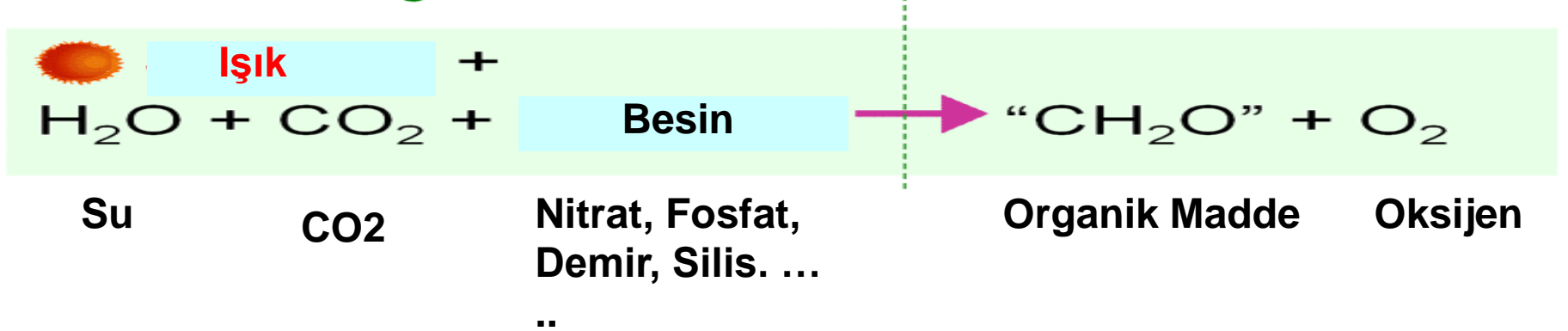
(b)



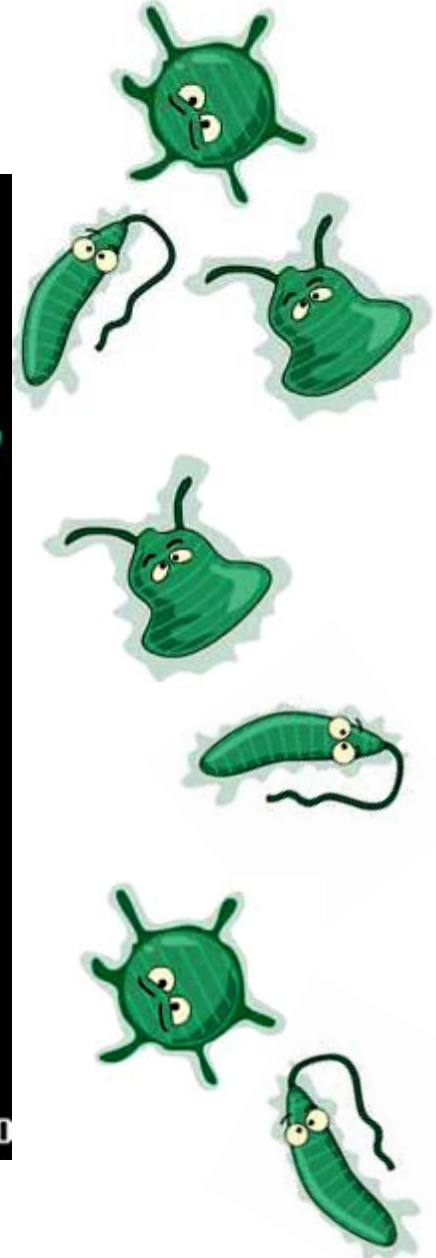
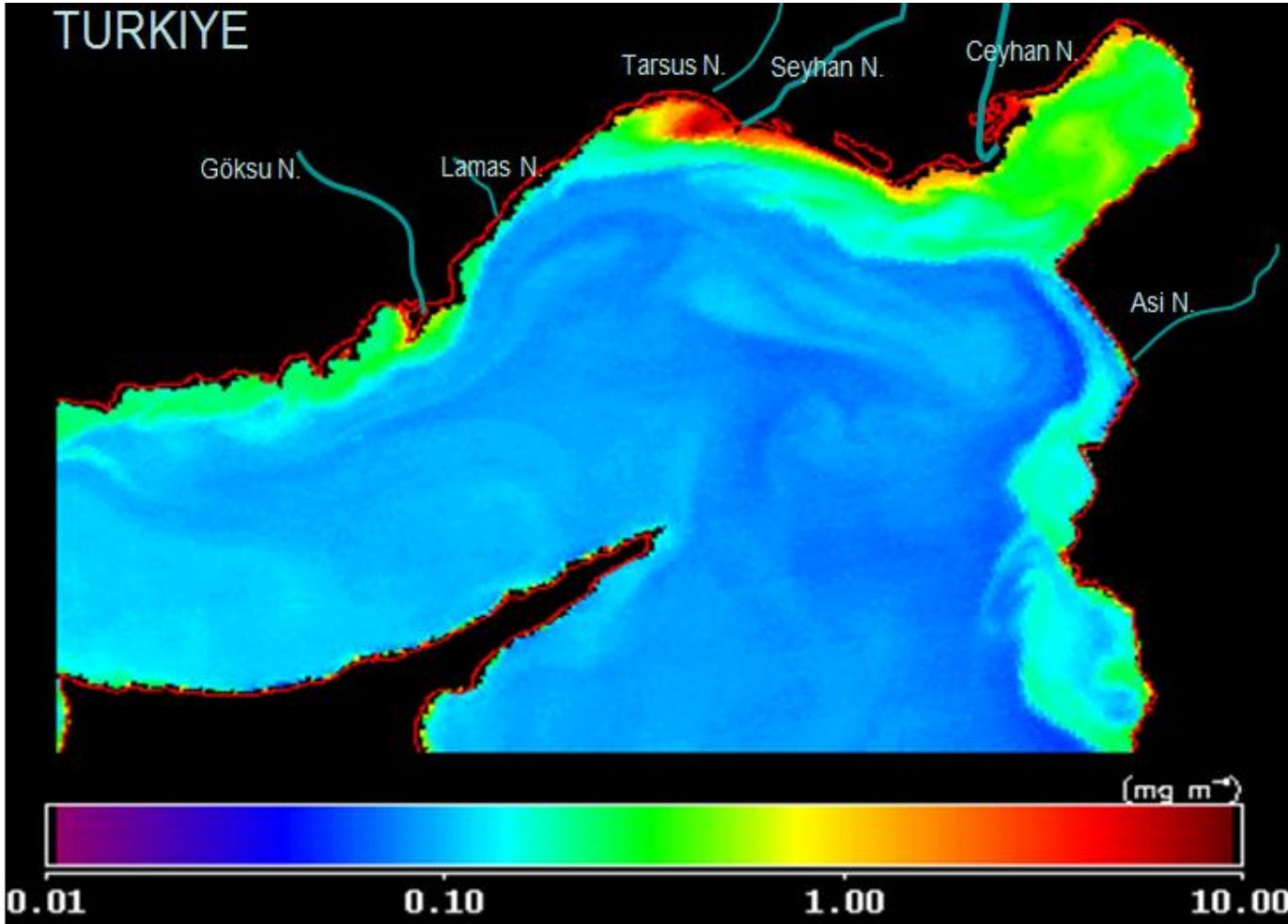
(c)

FİTOPLANKTON

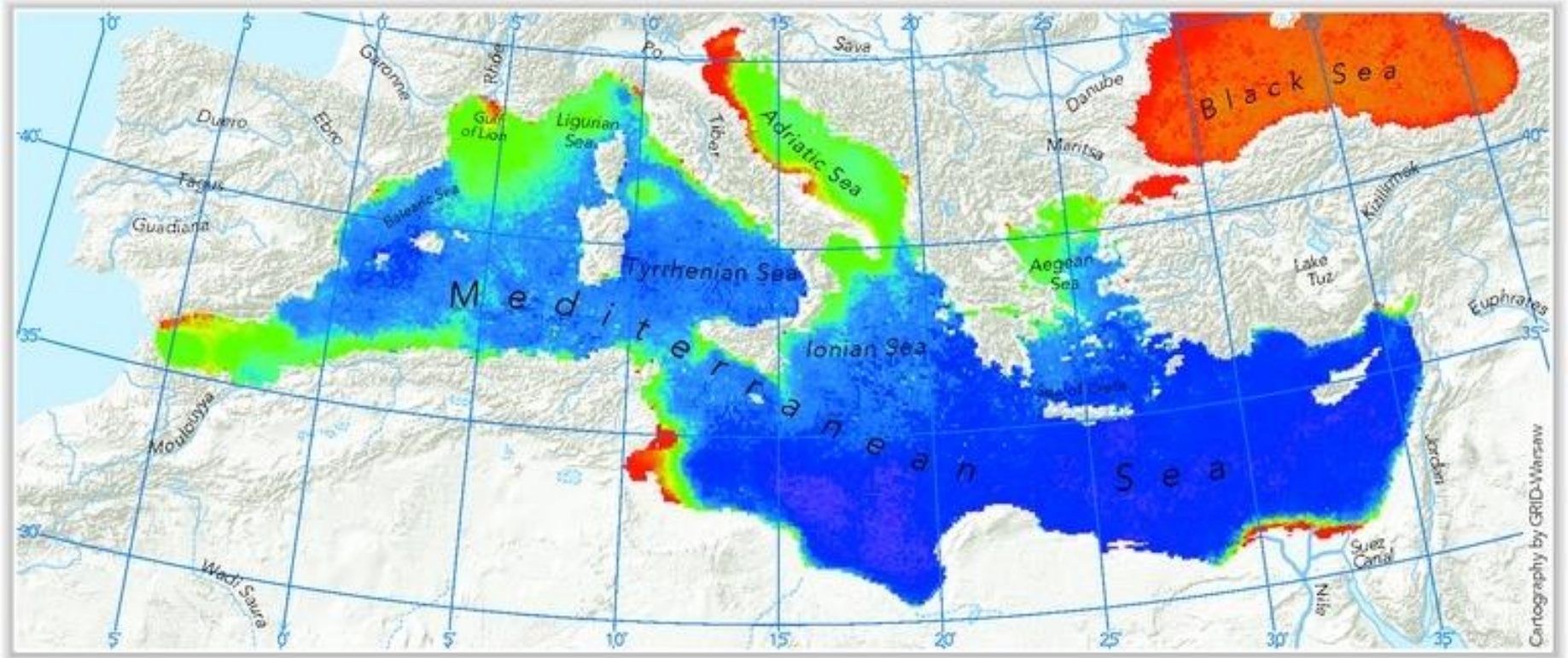
- Karadaki bitkiler gibi enerjilerini güneşten alırlar.
- Görünüş olarak çok çeşitlidirler.



- Onları uzaydan görebilirsiniz!!!



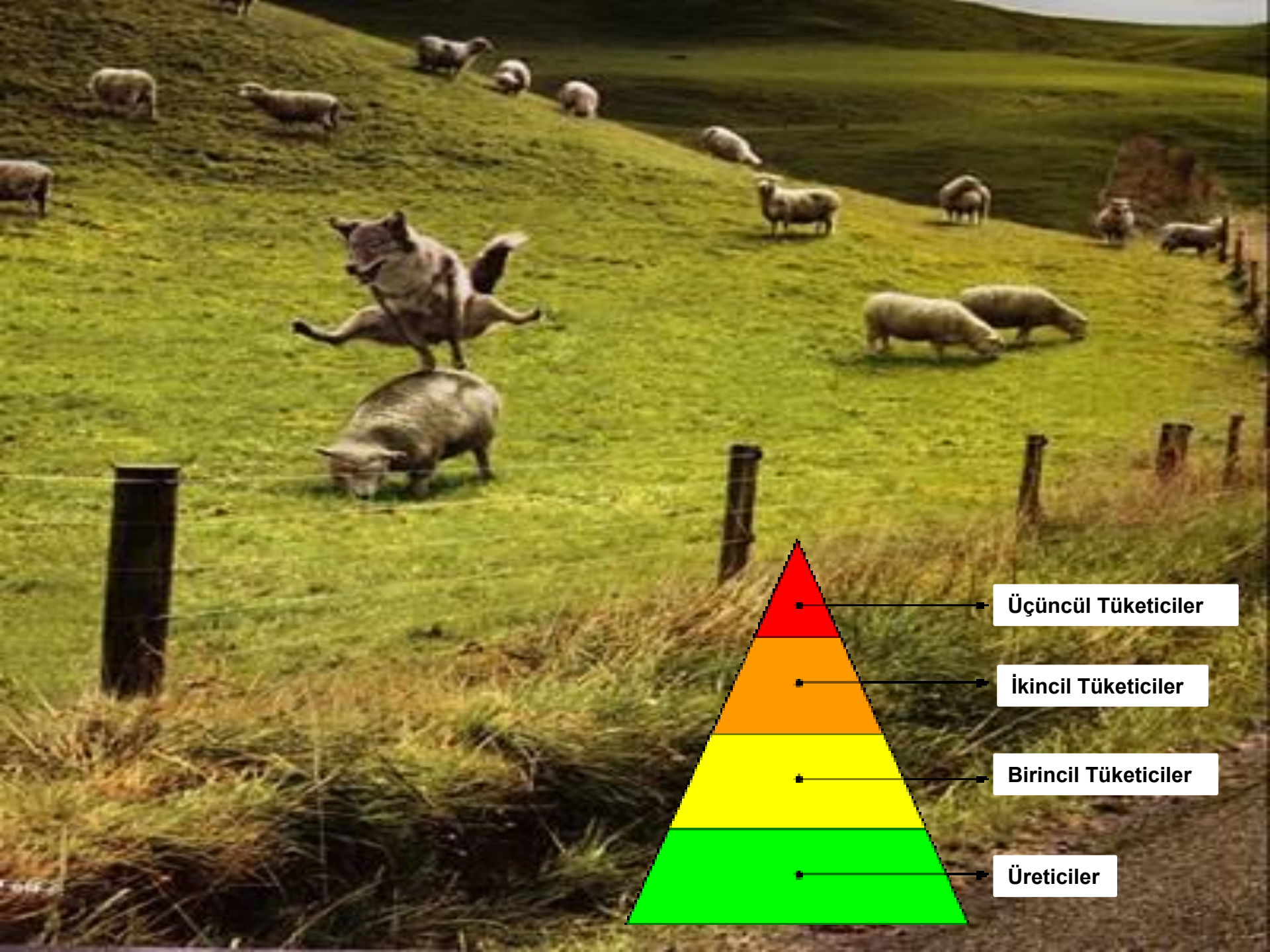
Ortalama yüzey klorofil konsantrasyonu (Sonbahar-1998)



Mean surface chlorophyll concentrations in Autumn 1998

0 250 km



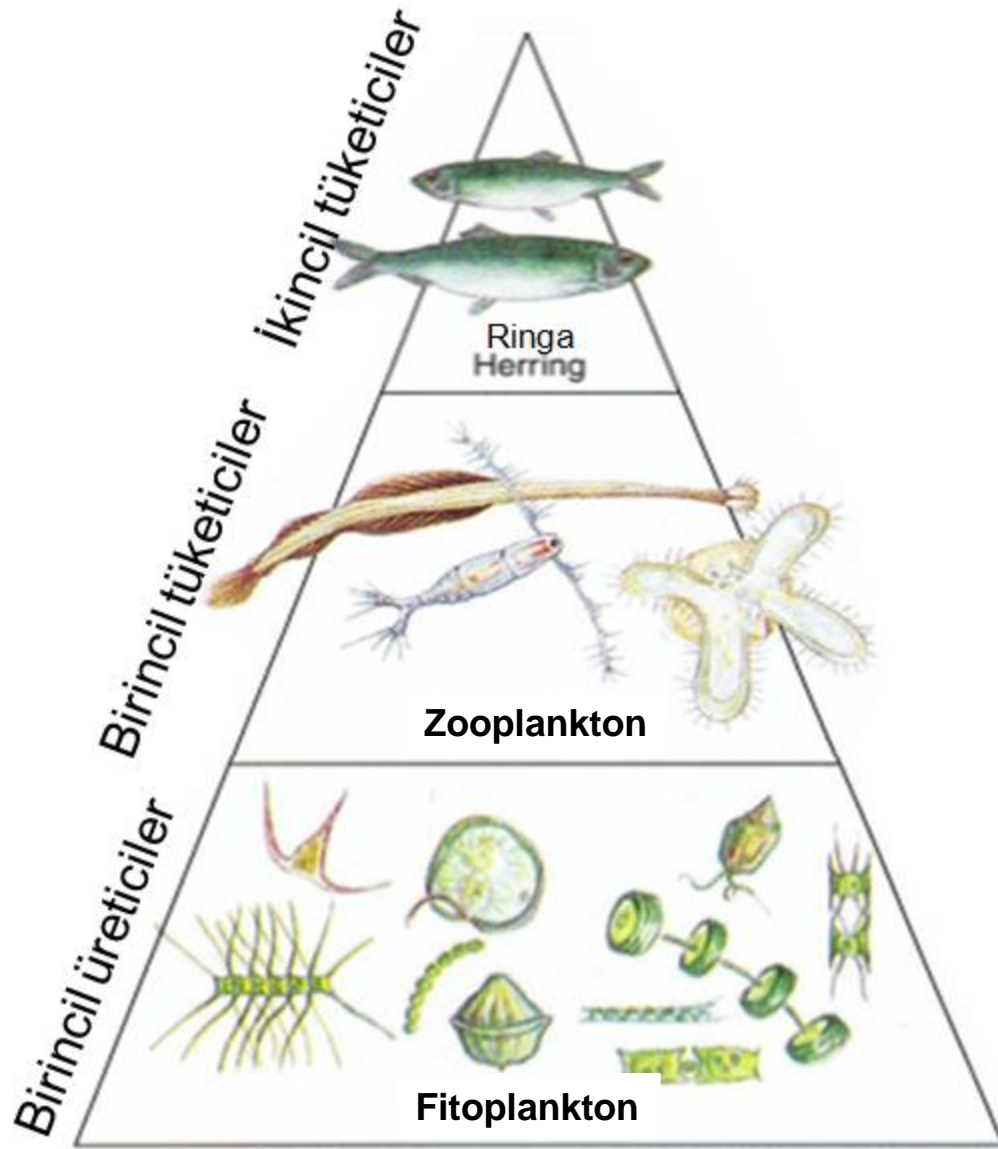
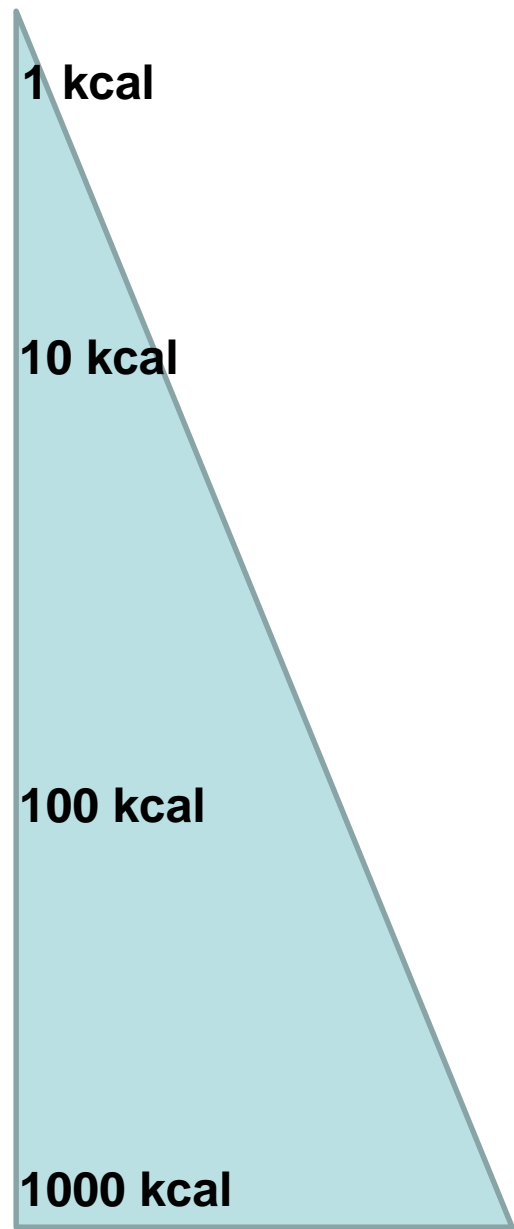


Üçüncül Tüketiciler

İkincil Tüketiciler

Birincil Tüketiciler

Üreticiler

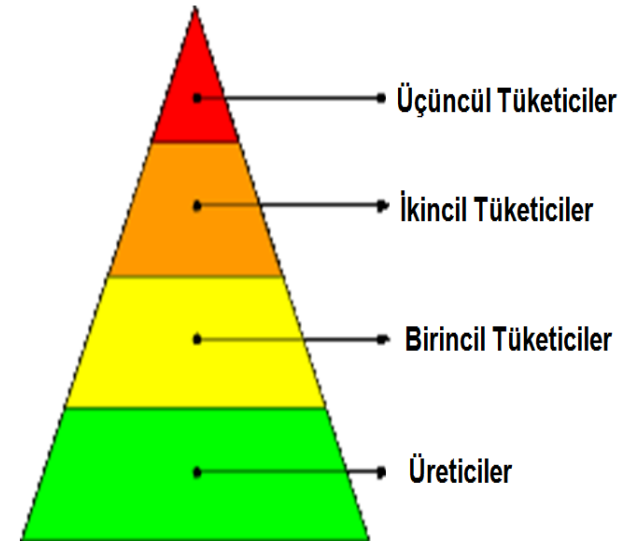
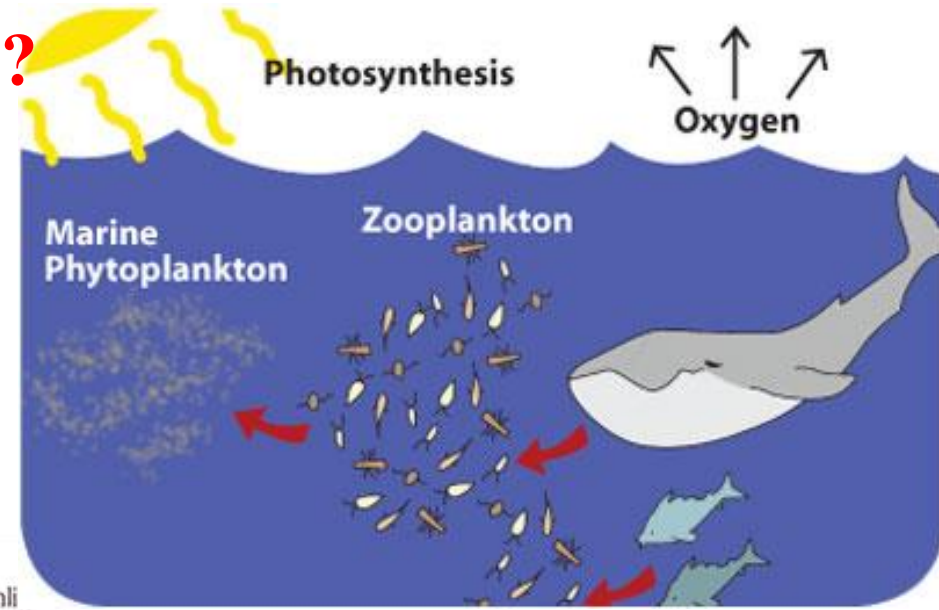


Birey vücut büyüklüğü artar

Birey sayısı azalır

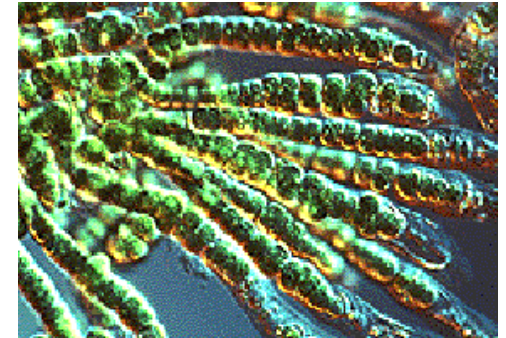
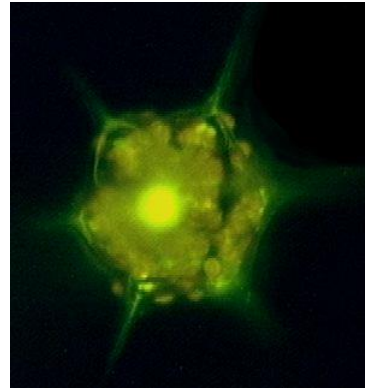
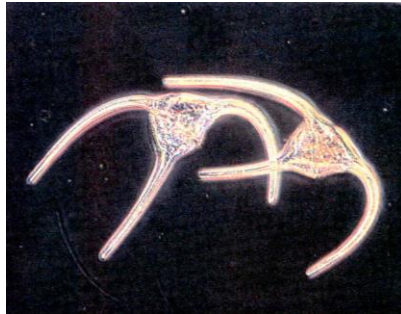
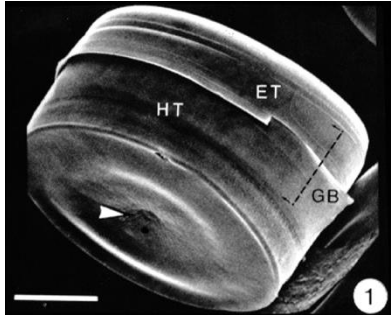
This text is positioned to the right of the pyramid, with an upward-pointing arrow. It describes the relationship between trophic levels: as the body size of individuals increases from the base to the top, the number of individuals decreases.

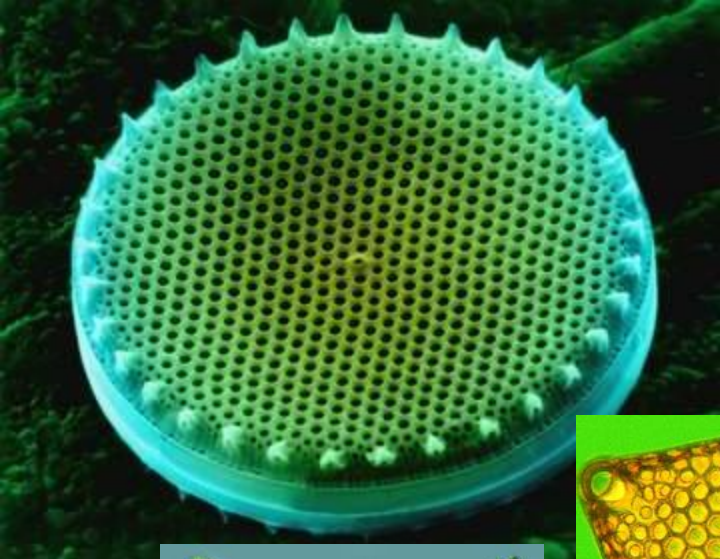
Fitoplankton neden önemlidir?



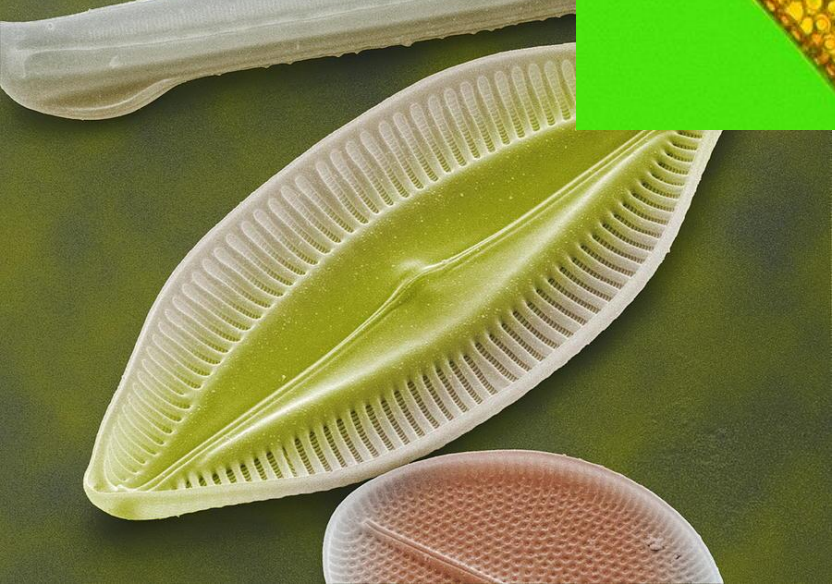
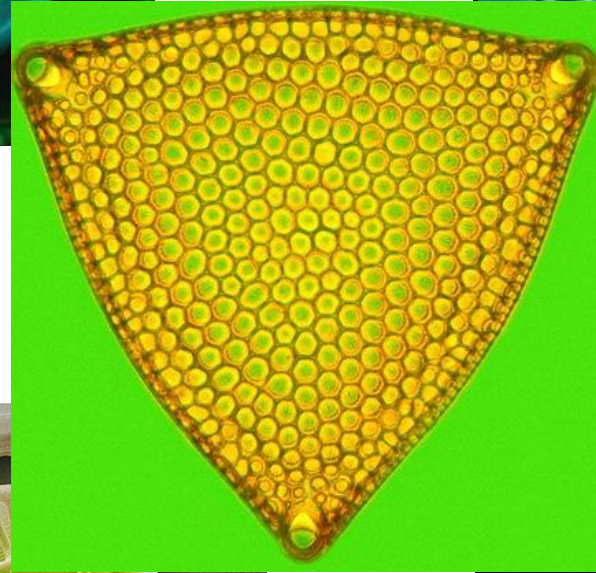
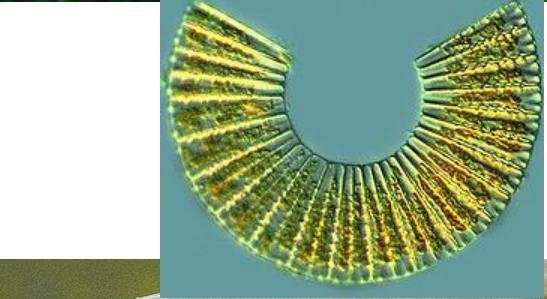
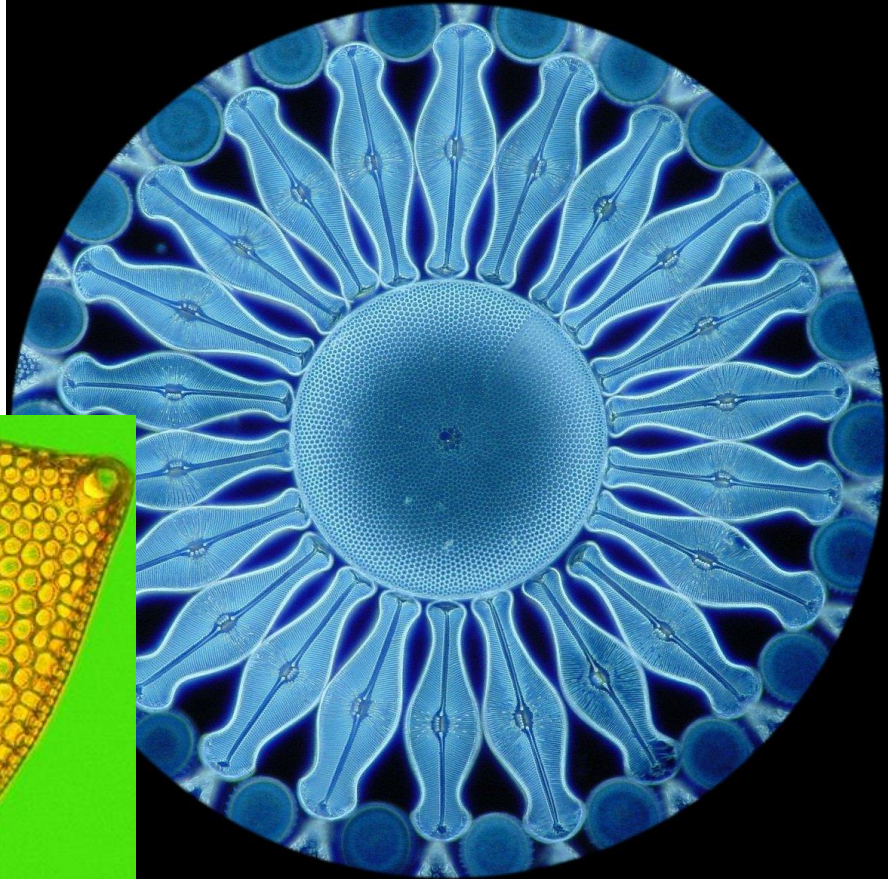
Bazı önemli fitoplankton grupları

- **Diatom:** ılıman ve soğuk sularda... silika kılıf yada kabuk-iskelet...
- **Dinoflagellat:** tropikal ve subtropikal sular...Yaz sezonunda ılıman denizlerde..
- **Coccolithophores (kokkolit):** tropikal...kalsiyum karbonat iskelet...
- **Silicoflagellat:** silika iç iskelet... Çok yaygındır, özellikle güney kutbunda...
- **Siyanobakteri (mavi-yeşil algler):** gerçek alg değildirler, acı ve sıcak sularda...
- **Yeşil Algler:** lagün ve kıyısuluların dışında yaygın değil...

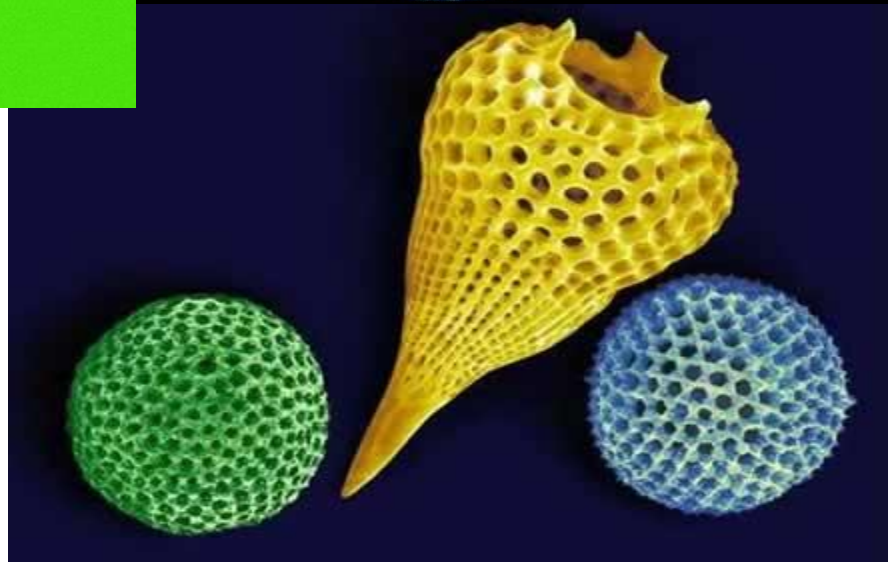




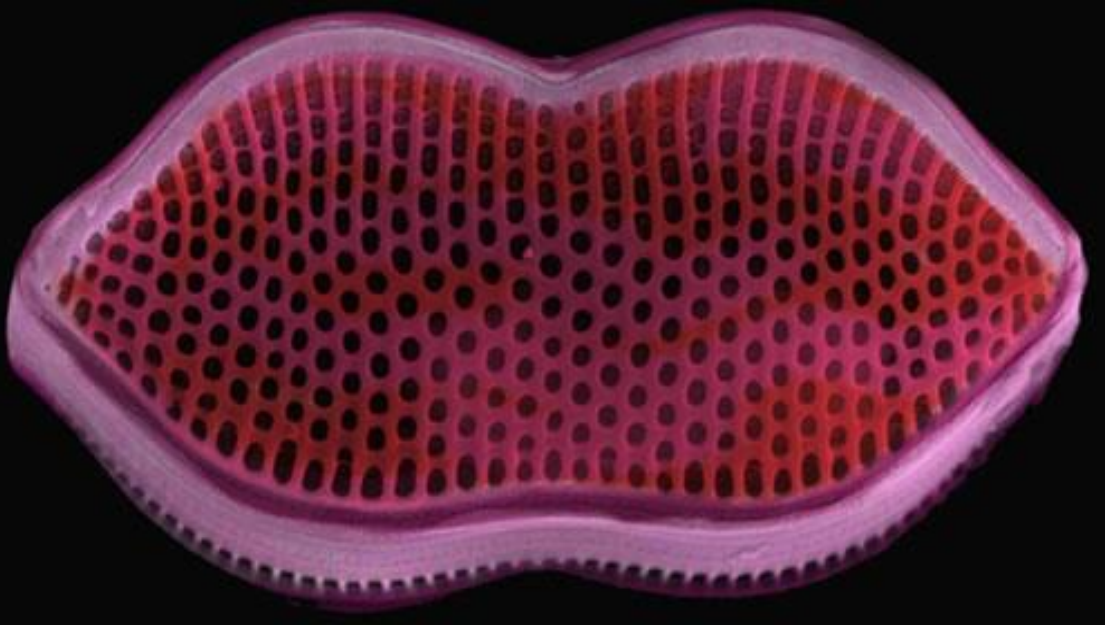
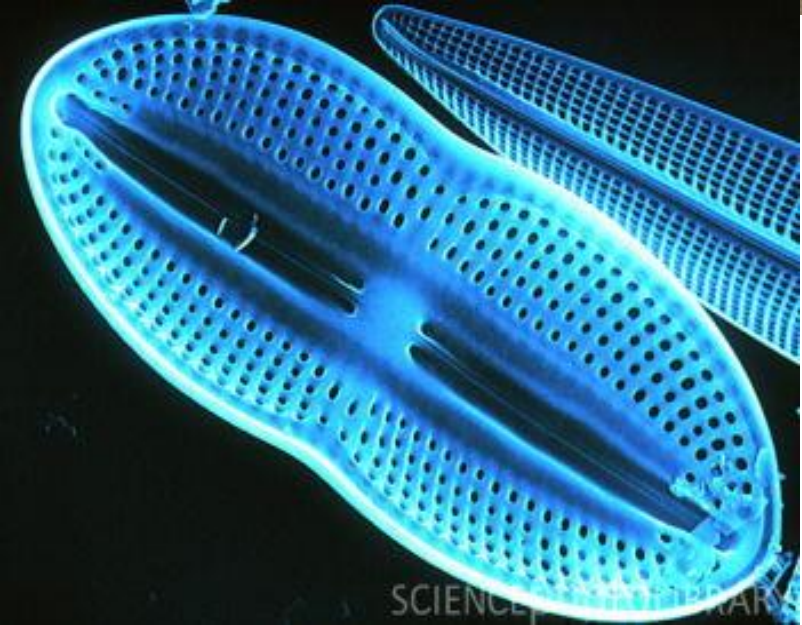
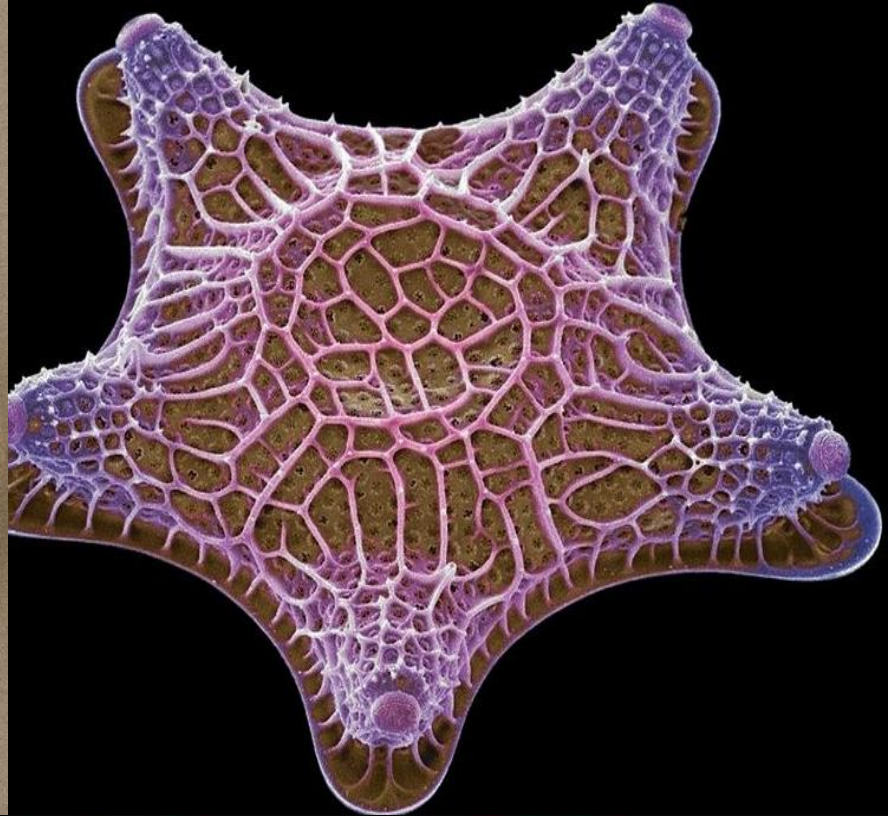
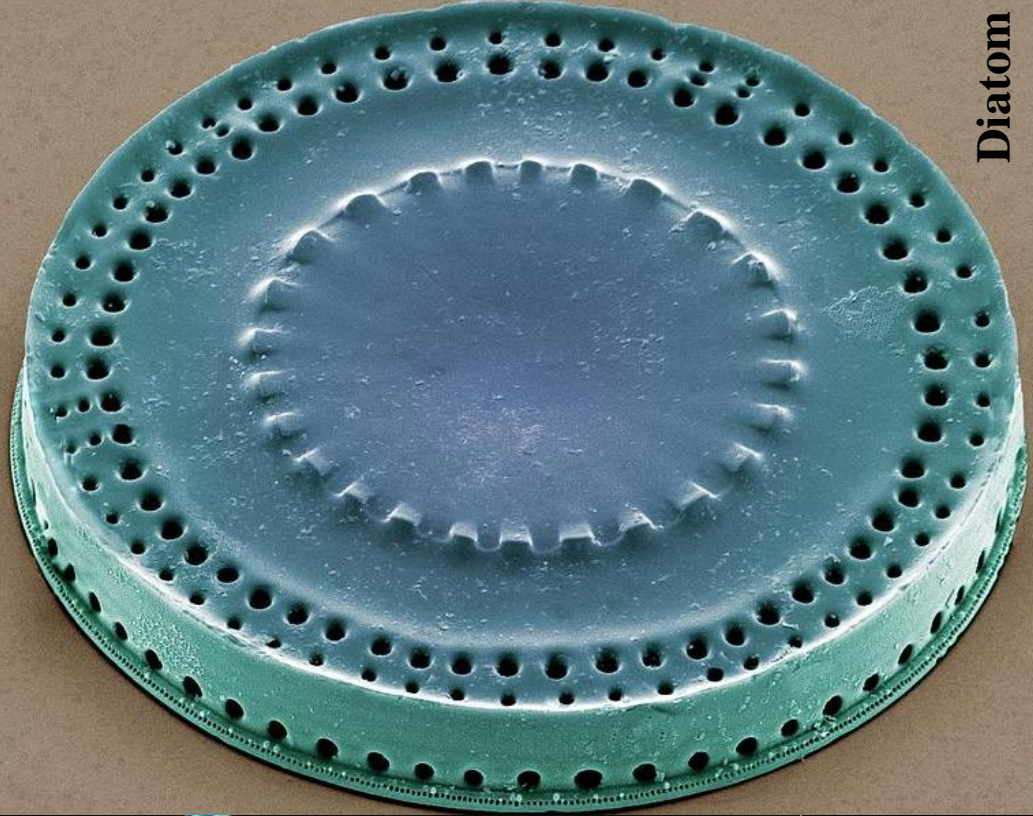
Diatom



Silisyum



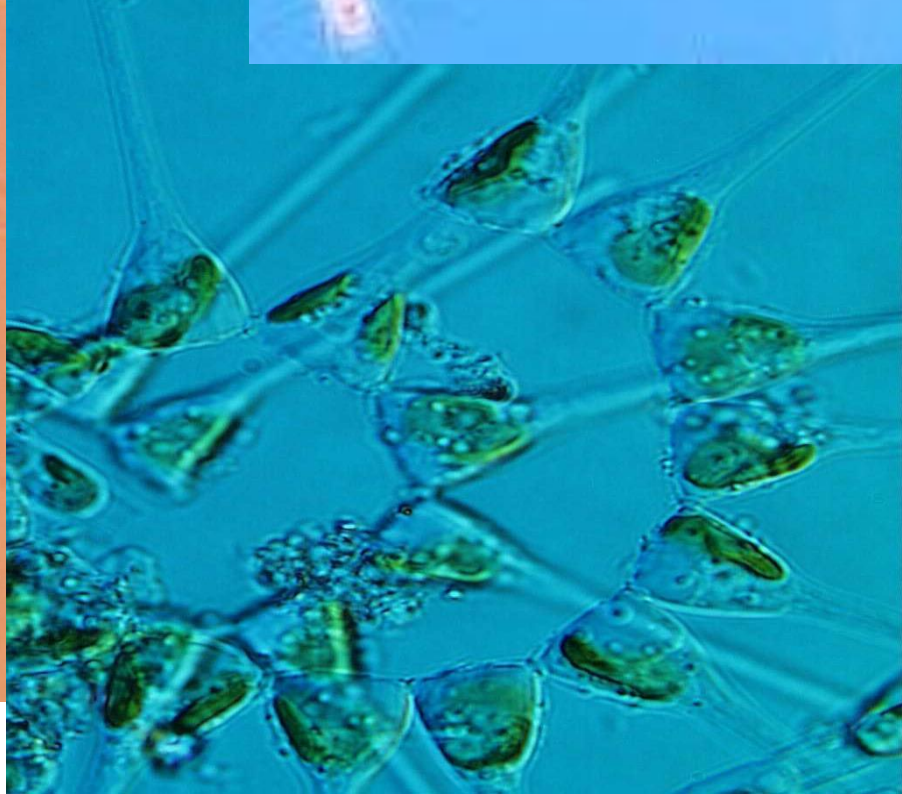
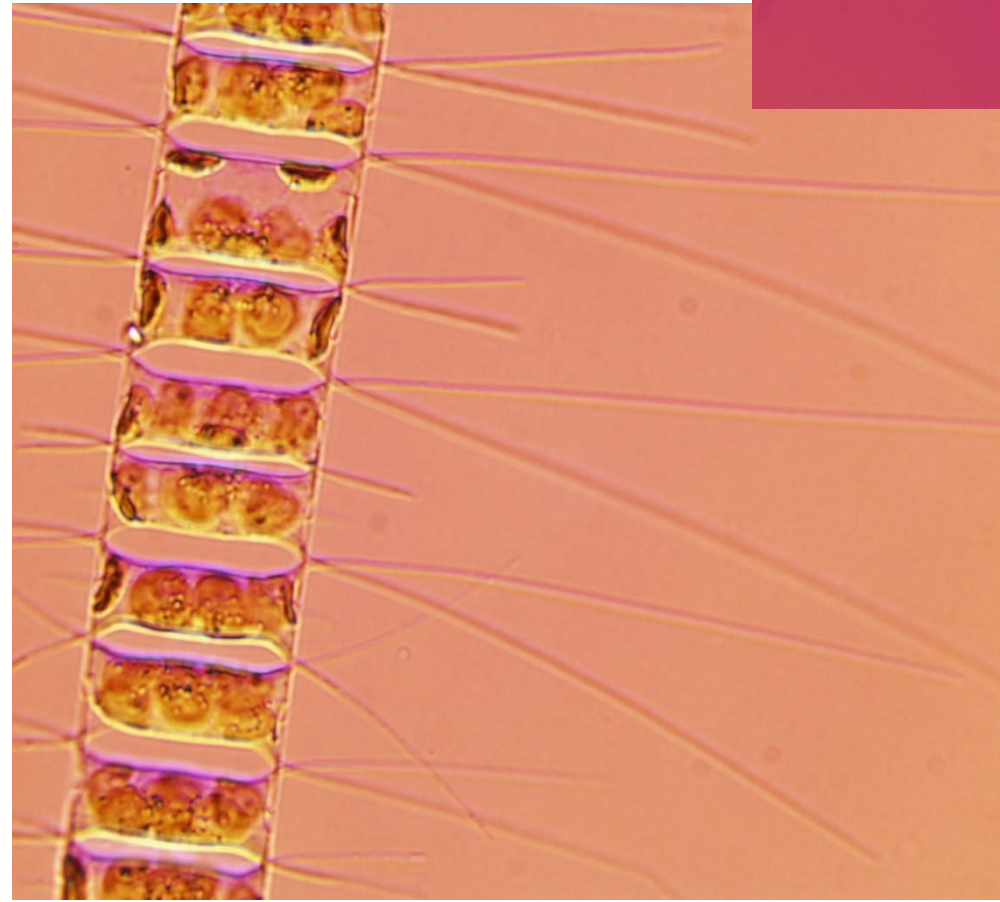
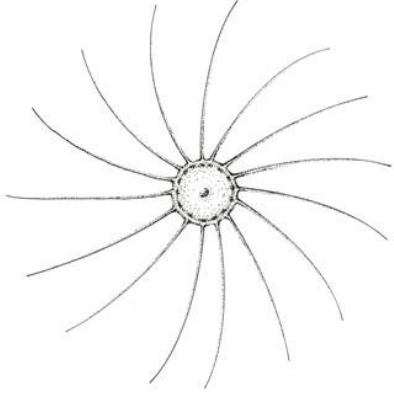
Diatom





Seta

Diatom

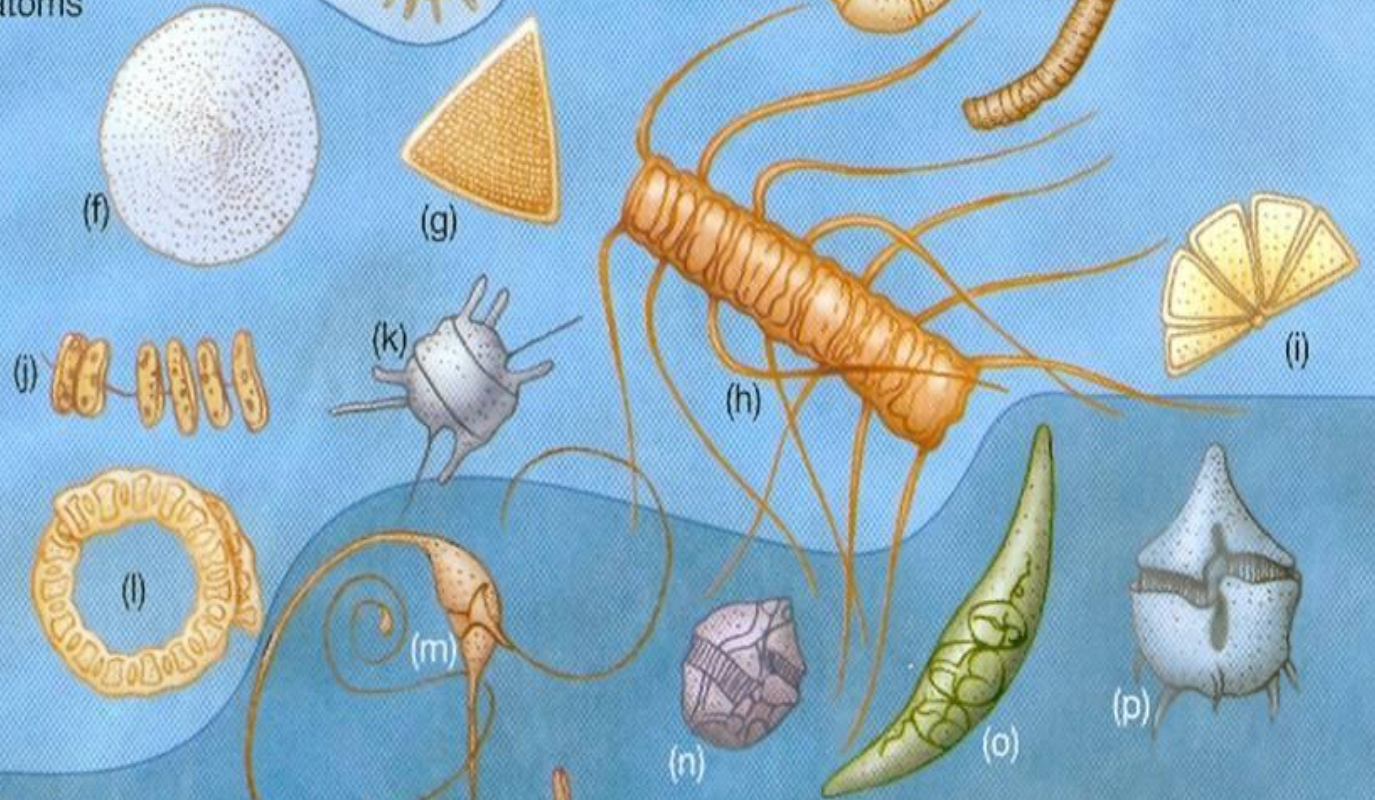


PHYTOPLANKTON

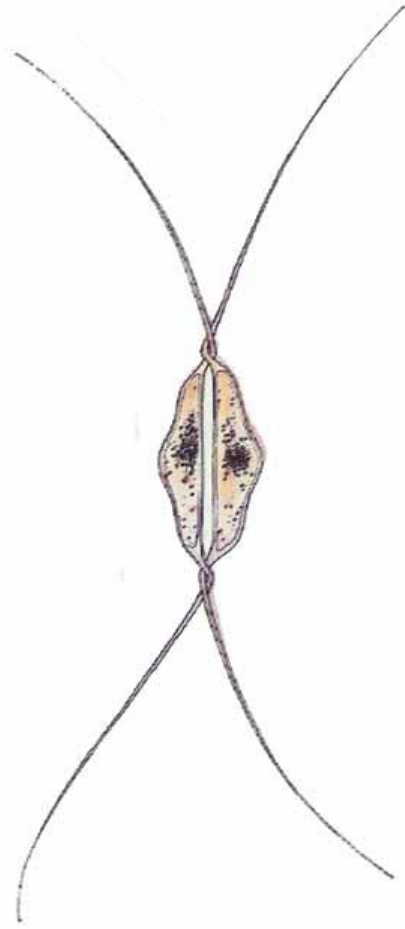
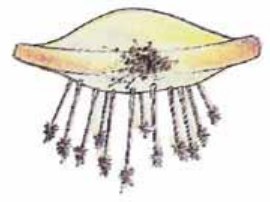
Coccolithophores



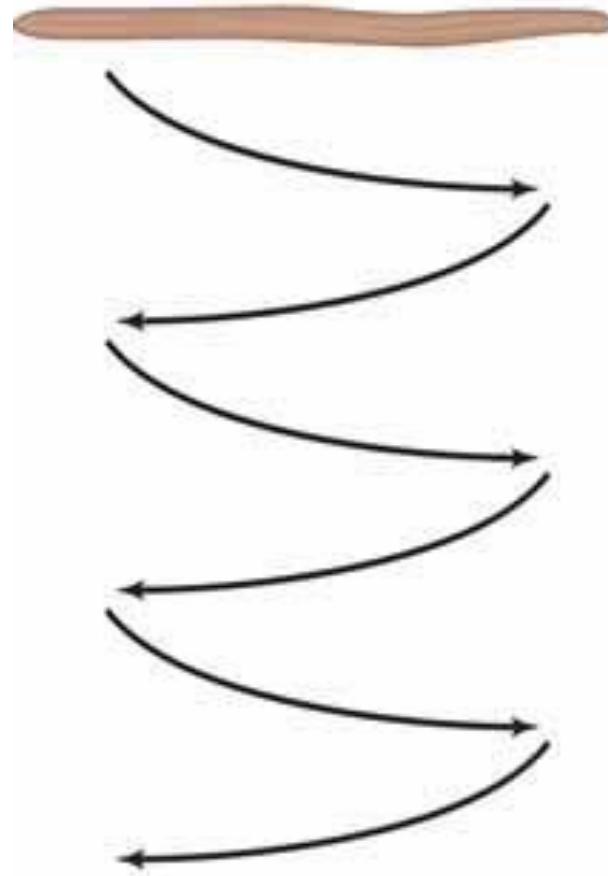
Diatoms



Dinoflagellates



•Batma

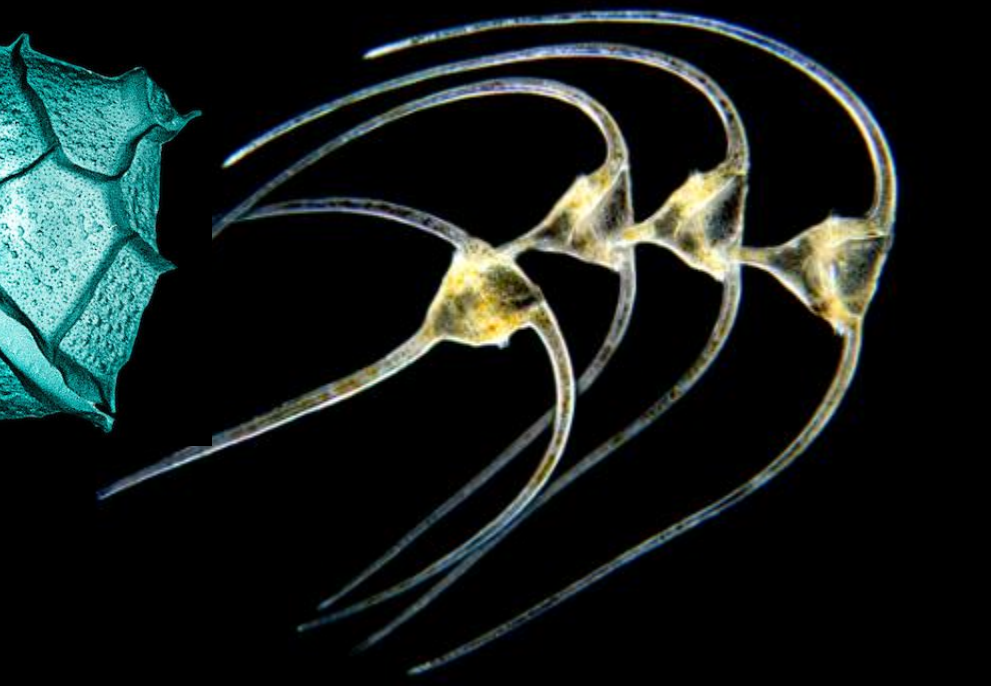
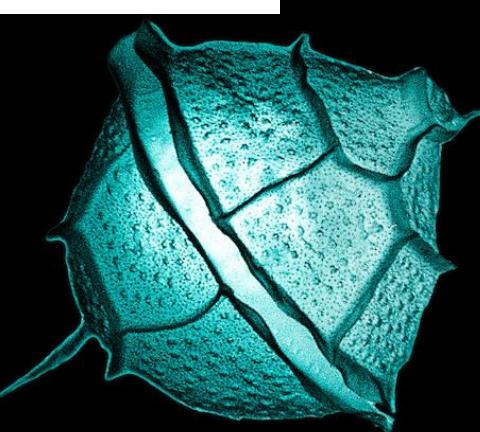
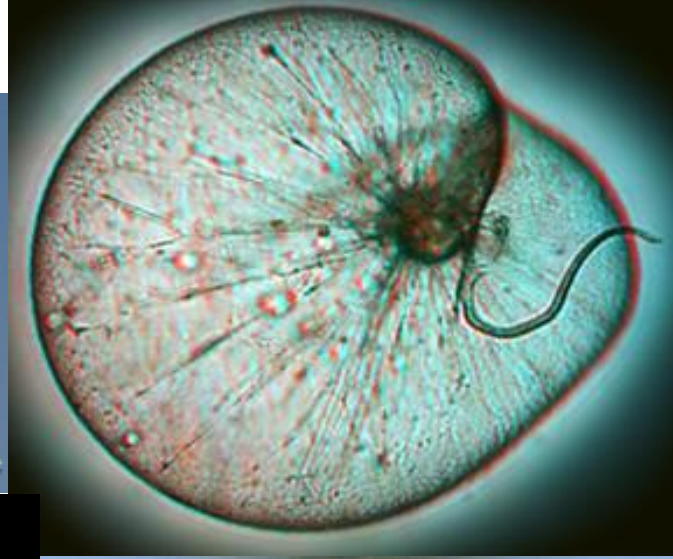


Diatom,
Rhizosolenia ve
Asterionella

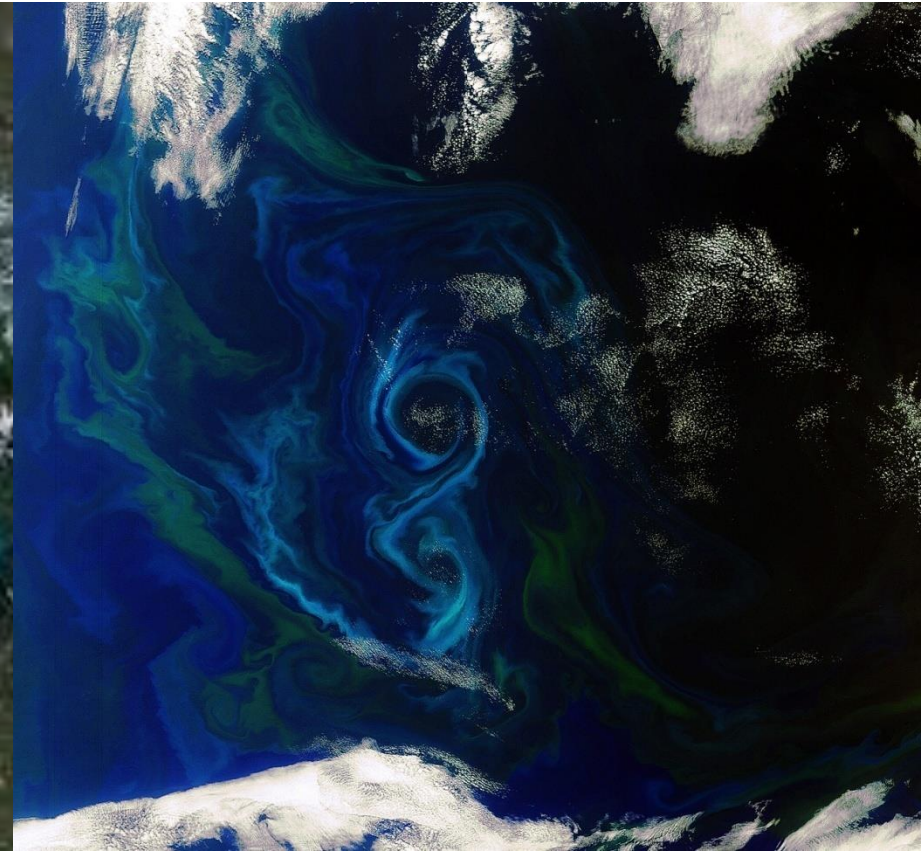


Dinoflagellat

Dino-Greek –fırıl fırıl dönmek; flagellum – Latin-kırbaç.




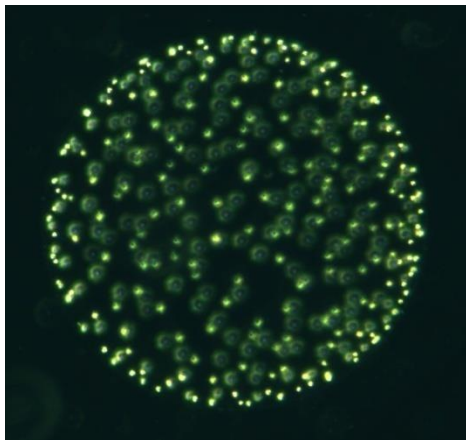
Fitoplankton Patlaması



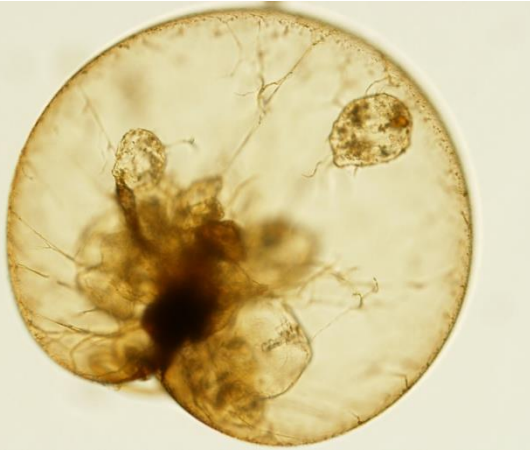
Phaeocystis



 algaeBASE



Noctiluca – Gece ışığı planktonu

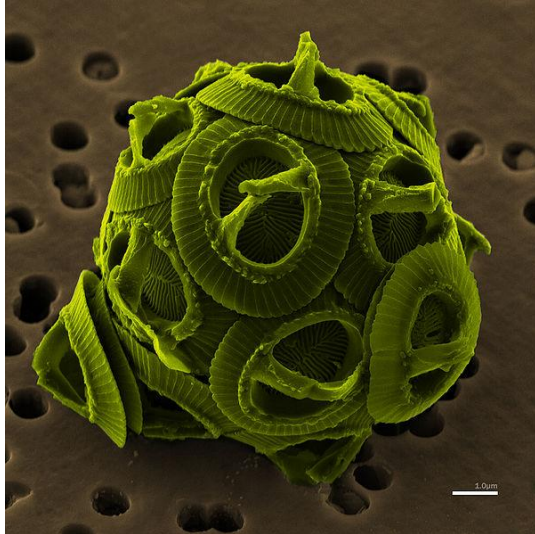


Coccolithophores

Kokkolit

Yağmur
damlaları?

Hidrojen disülfid



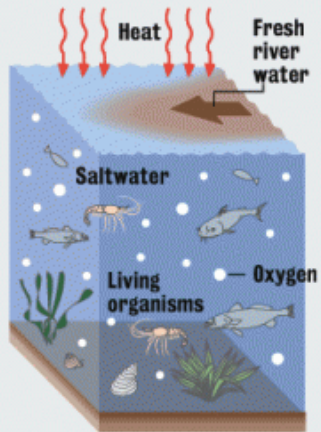
Red tide?

Dinoflagellat

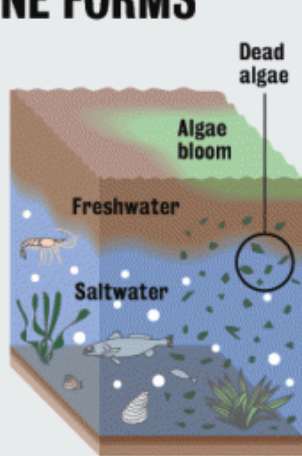




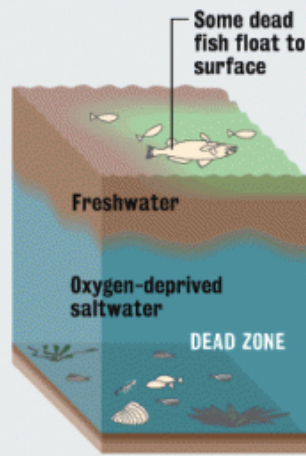
HOW THE DEAD ZONE FORMS



1 During the spring, sun-heated freshwater runoff from the Mississippi River creates a barrier layer in the Gulf, cutting off the saltier water below from contact with oxygen in the air.



2 Nitrogen and phosphorus from fertilizer and sewage in the freshwater layer ignite huge algae blooms. When the algae die, they sink into the saltier water below and decompose, using up oxygen in the deeper water.



3 Starved of oxygen and cut off from resupply, the deeper water becomes a dead zone. Fish avoid the area or die in massive numbers. Tiny organisms that form the vital base of the Gulf food chain also die. Winter brings respite, but spring runoffs start the cycle anew.

Source: Staff research

STAFF GRAPHIC BY DAN SWENSON





Zooplankton

Hayvansal plankton



Bazı önemli zooplankton tipleri

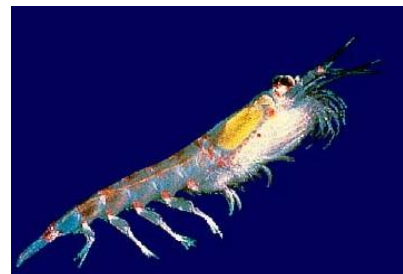
- Crustaceans: Copepod

Krill

Cladocera

Mysids

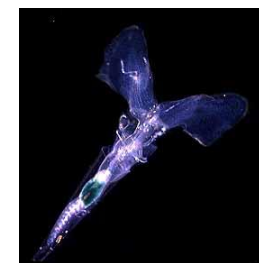
Ostracods



- Jellies

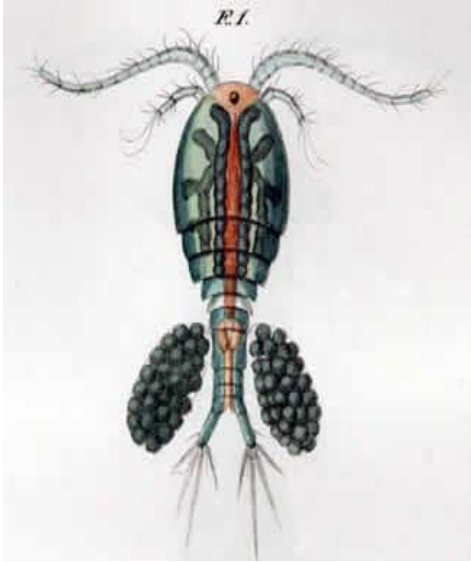
Cniderian (True jellies, Man-of-wars,
By-the-wind-sailors)

- Ctenophores (comb jellies)
- Urochordates (salps and larvacea)
- Worms (Arrow worms, polychaetes)
- Pteropods (planktonic snails)

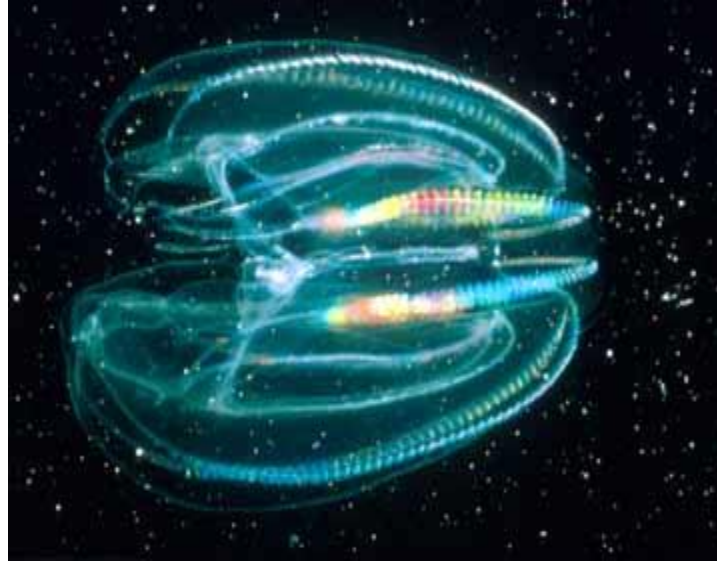


Zooplankton

Bu hayvanların bir kısmı hayatları boyunca sürüklenirler (holoplankton).



Copepod



Comb Jelly



Larvacean

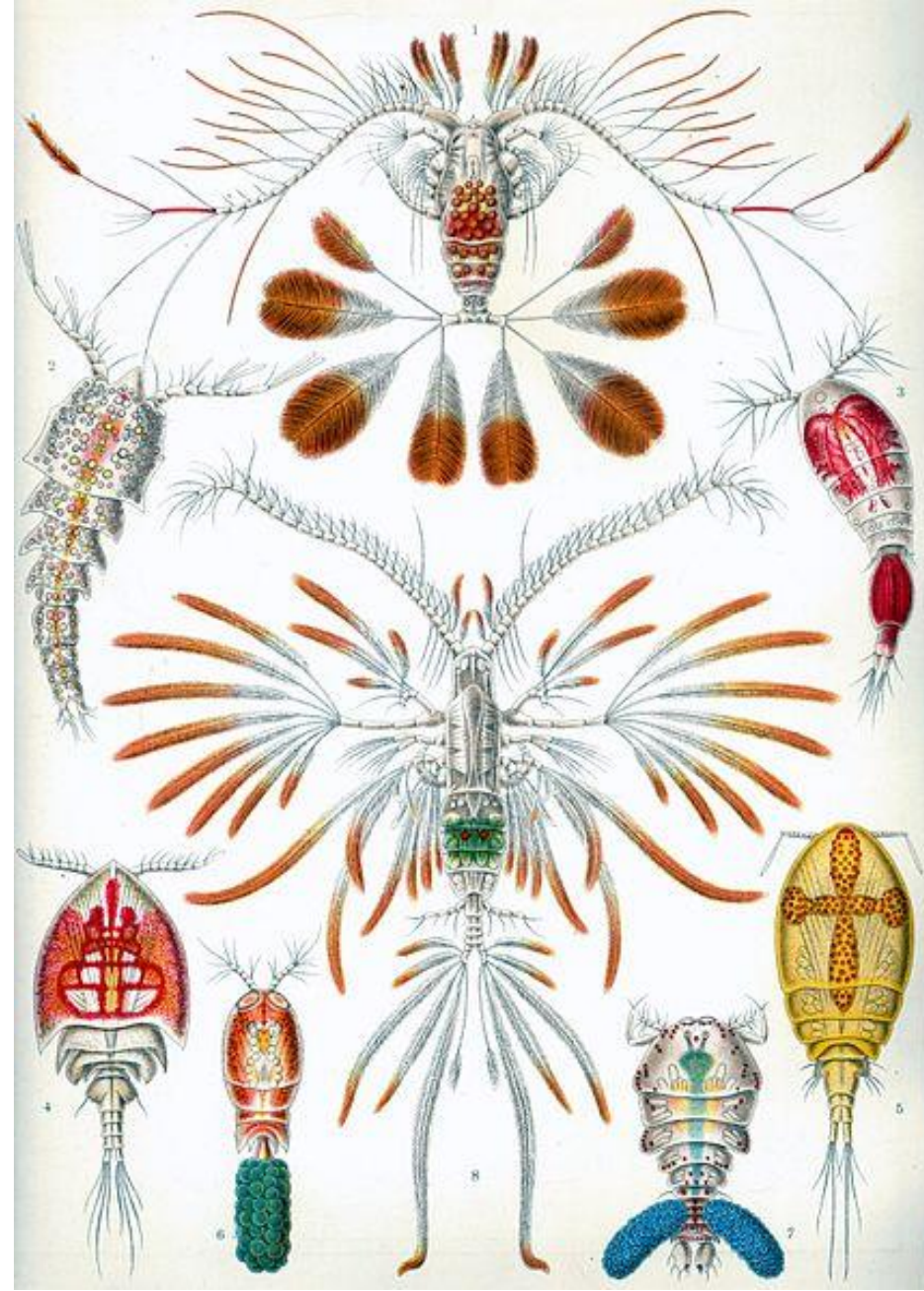
**Bazıları ise büyüyene kadar sürüklenir. (meroplankton)
... bebekler ve larvalar.**

Copepod

Holoplankton

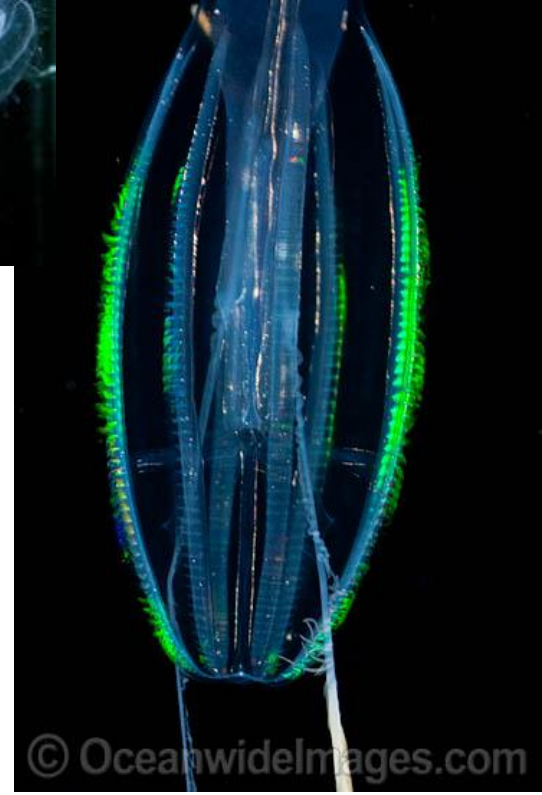
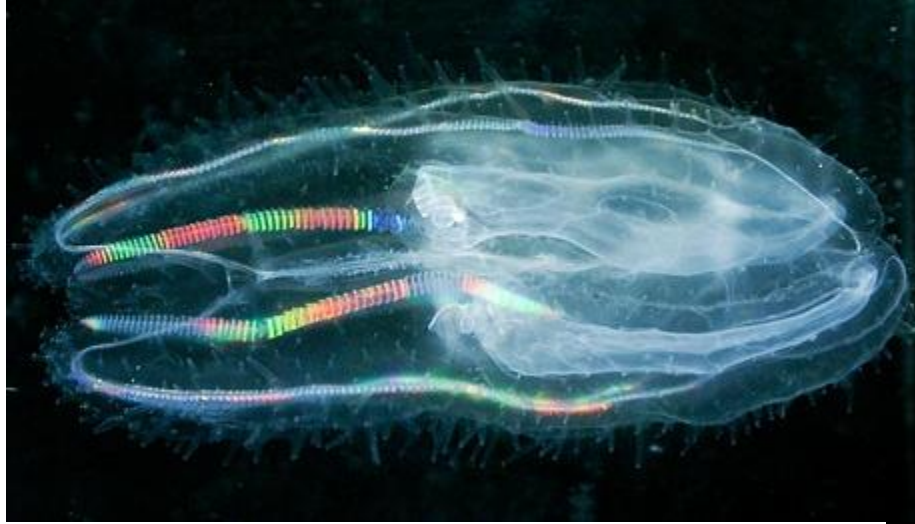
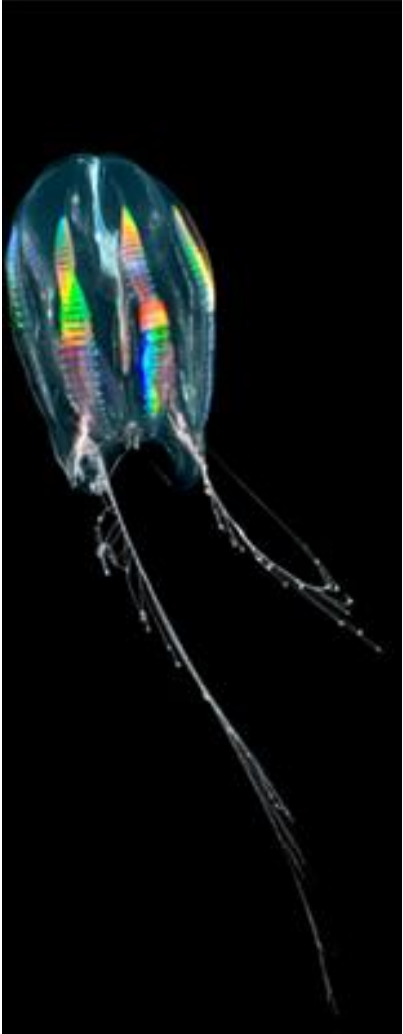
Yengeç ve Karides'le akraba

Çok farklı şekillerde ve boylarda olabilirler



Deniz anası

Akıntıya karşı yüzemezler. Holoplankton.



Deniz Kestanesi larvası ~ Pluteus

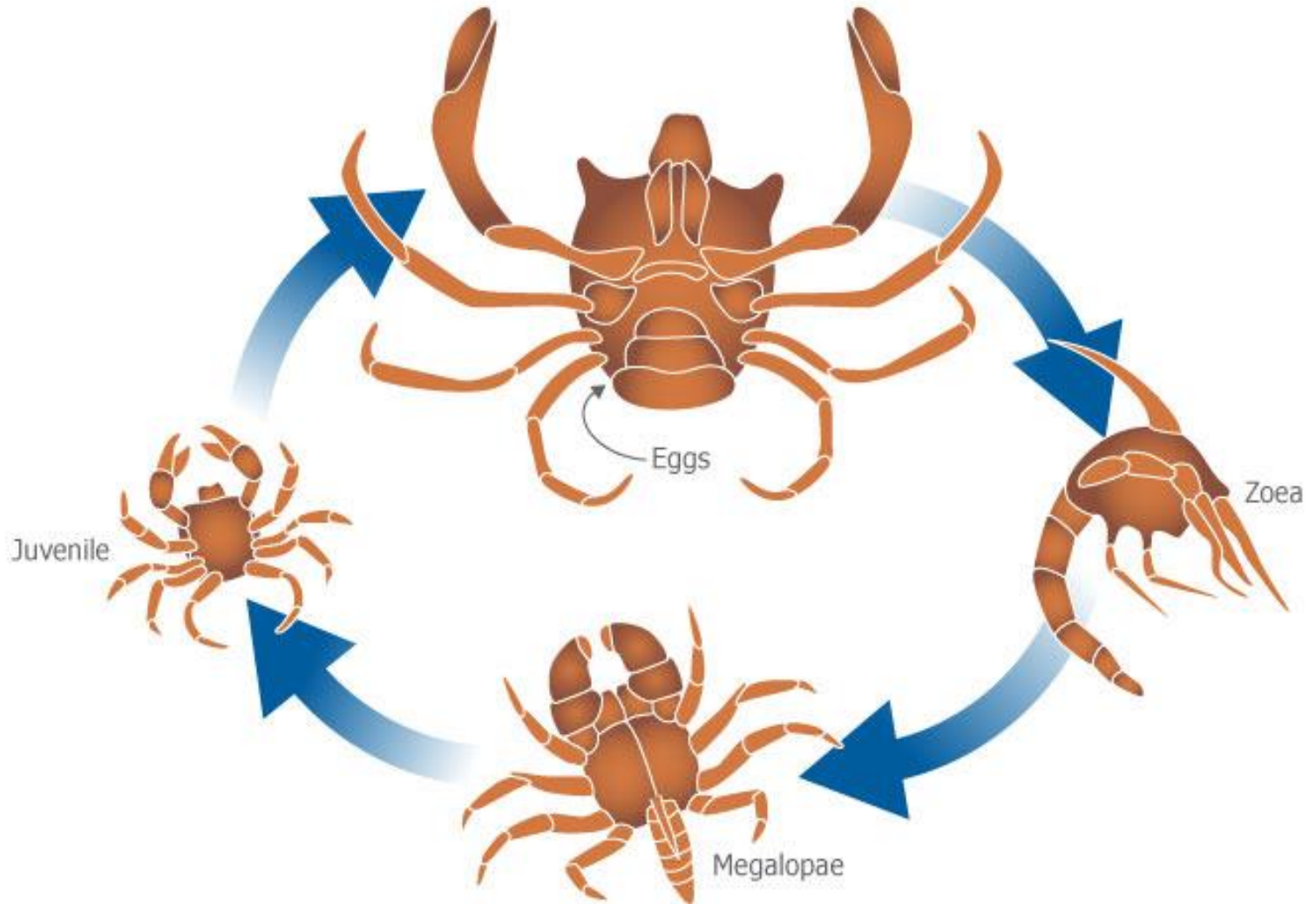


Meroplankton



~Zoea

Yengeç larvası

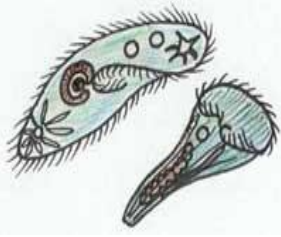


Deniz Sümüklü böceği larvası ~ Veliger

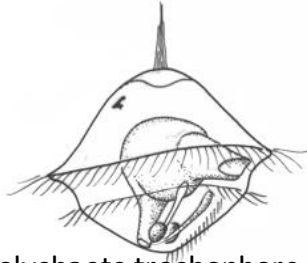




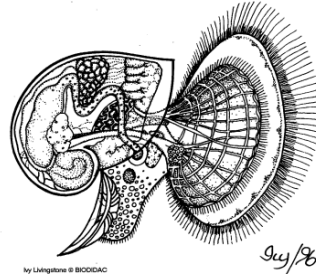
Siller



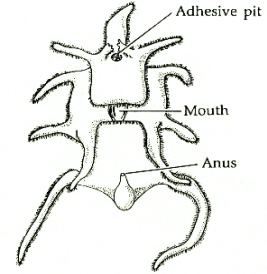
Ciliate



Polychaete trochophore

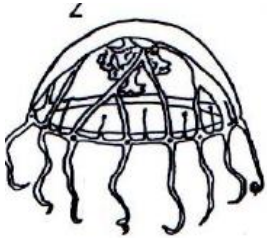


Mollusk larvae

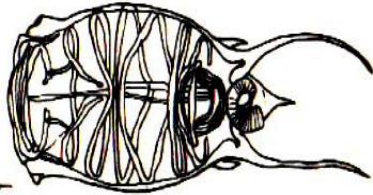


Echinoderm larvae

Kasımlarla



Medusae



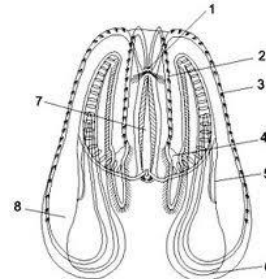
Salpa

Kanat



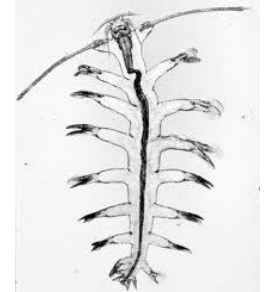
Pteropod

Lop



Ctenophore

Parapodia

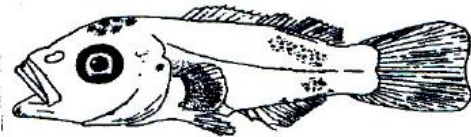


Polychaete

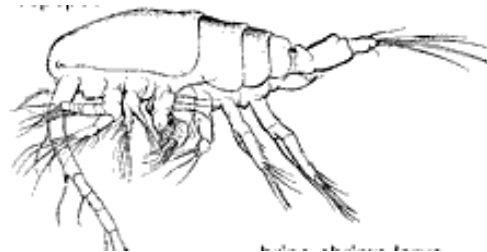
Yüzgeç



Fish larvae



Yüzme bacakları



Copepod

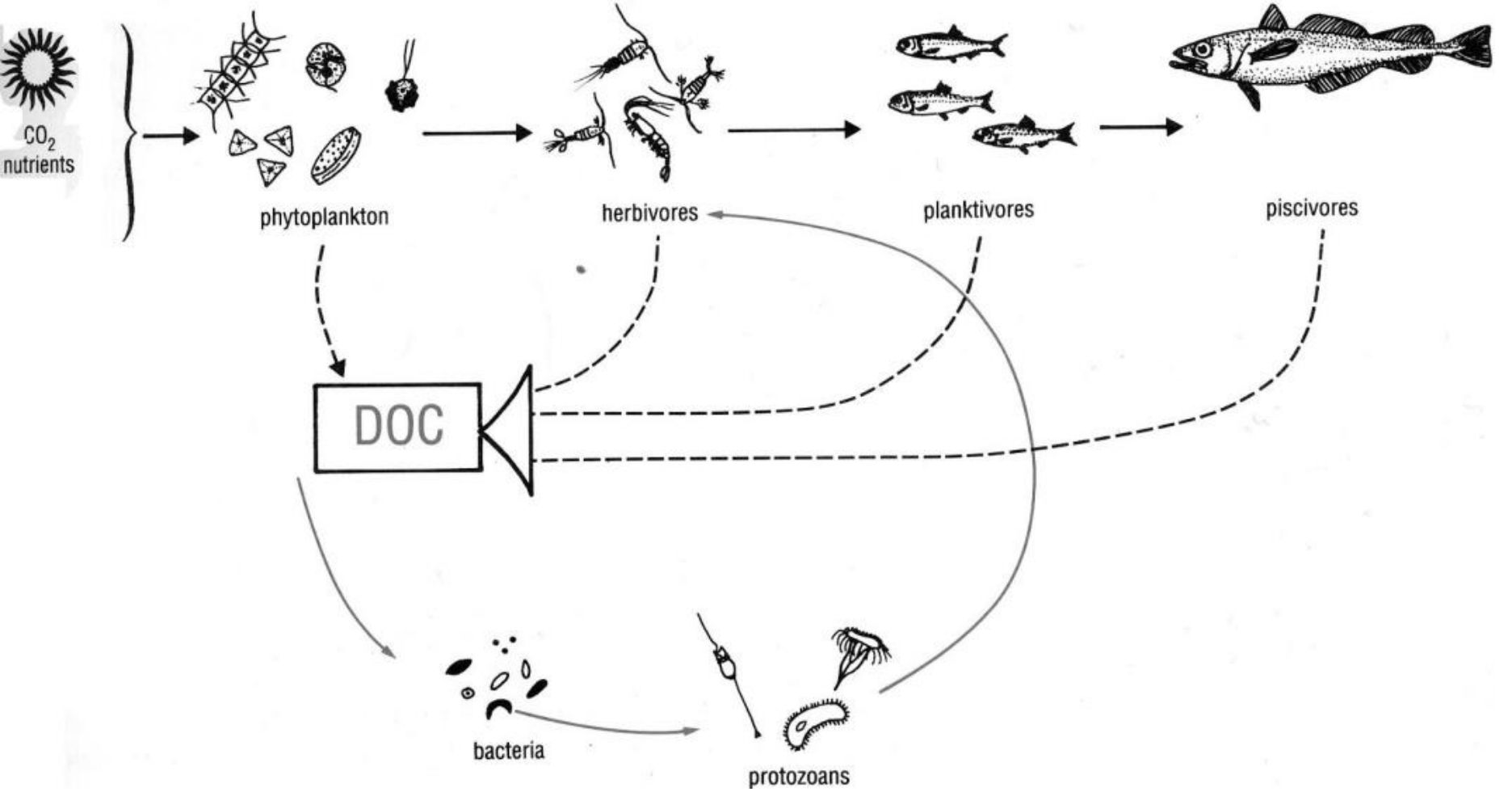
Zooplankton

Kim-i yer?

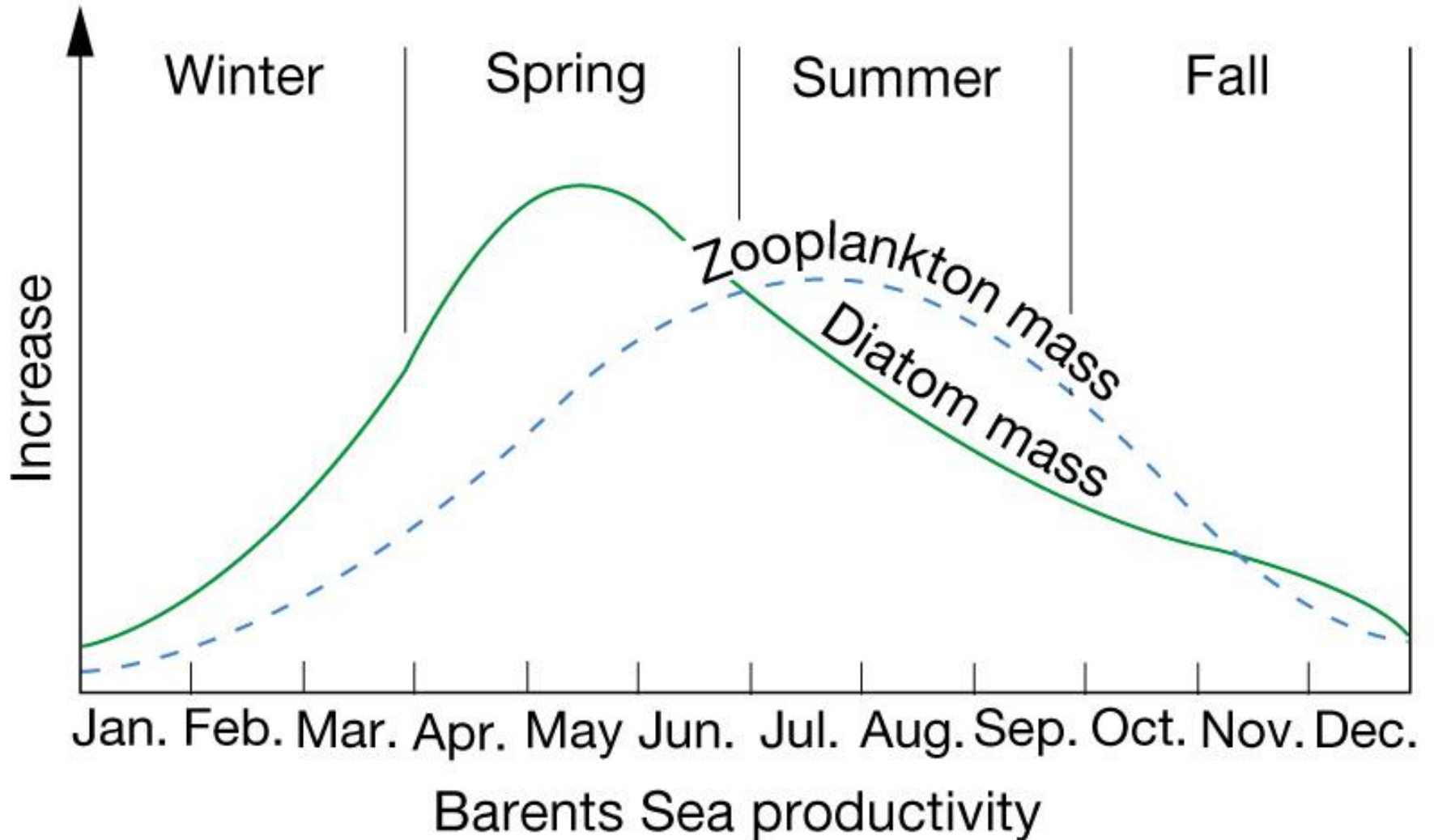


Beslenmelerine göre zooplankton 4 gruba ayrılır:

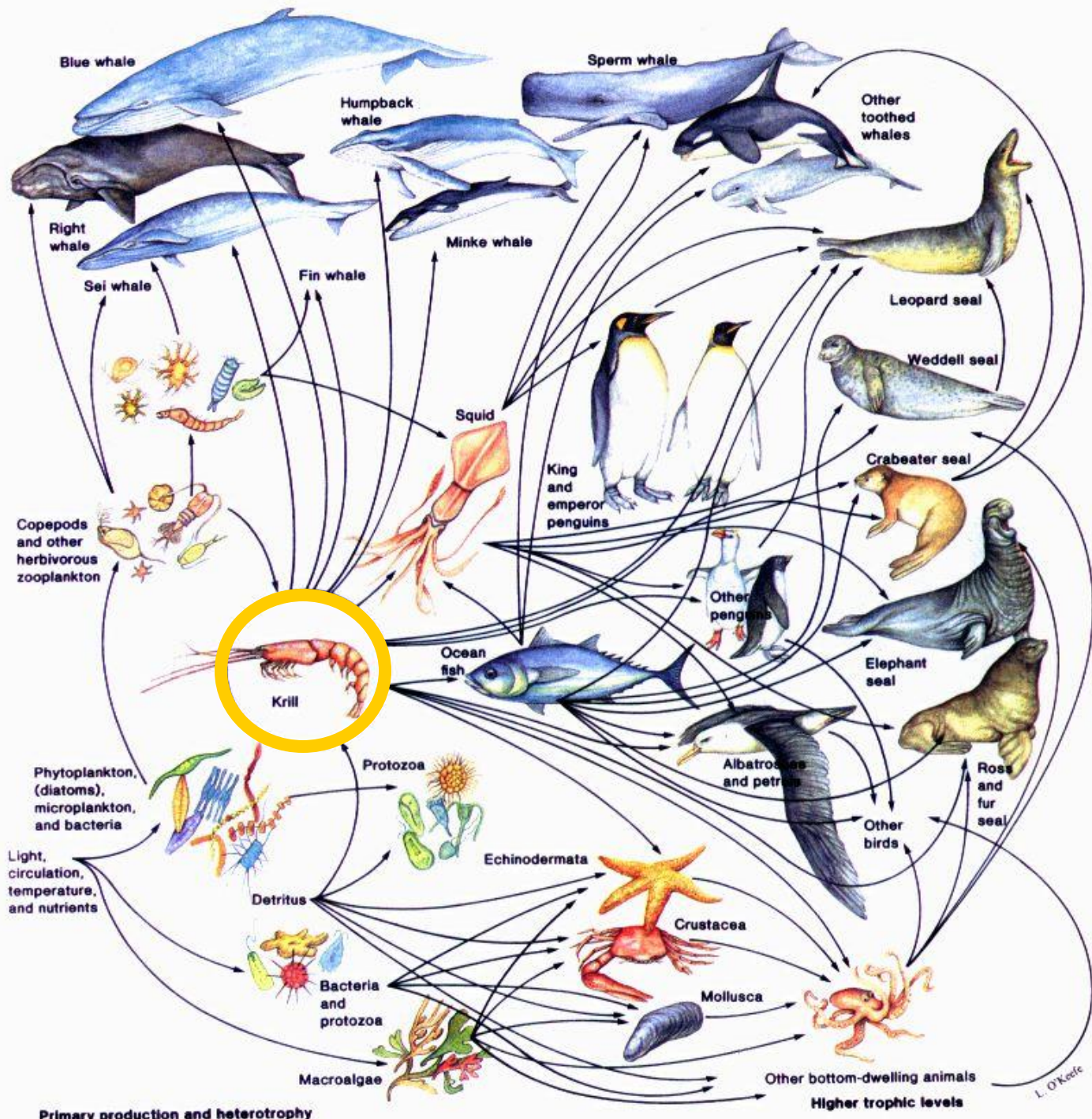
- **Herbivor:** Fitoplanktonla beslenir.
- **Karnivor:** Zooplanktonla beslenir.
- **Detrivor:** Ölü organik maddelerle (detritus).
- **Omnivor:** Fito, Zoo ve detritusla beslenir.



Av-Avcı ilişkisi

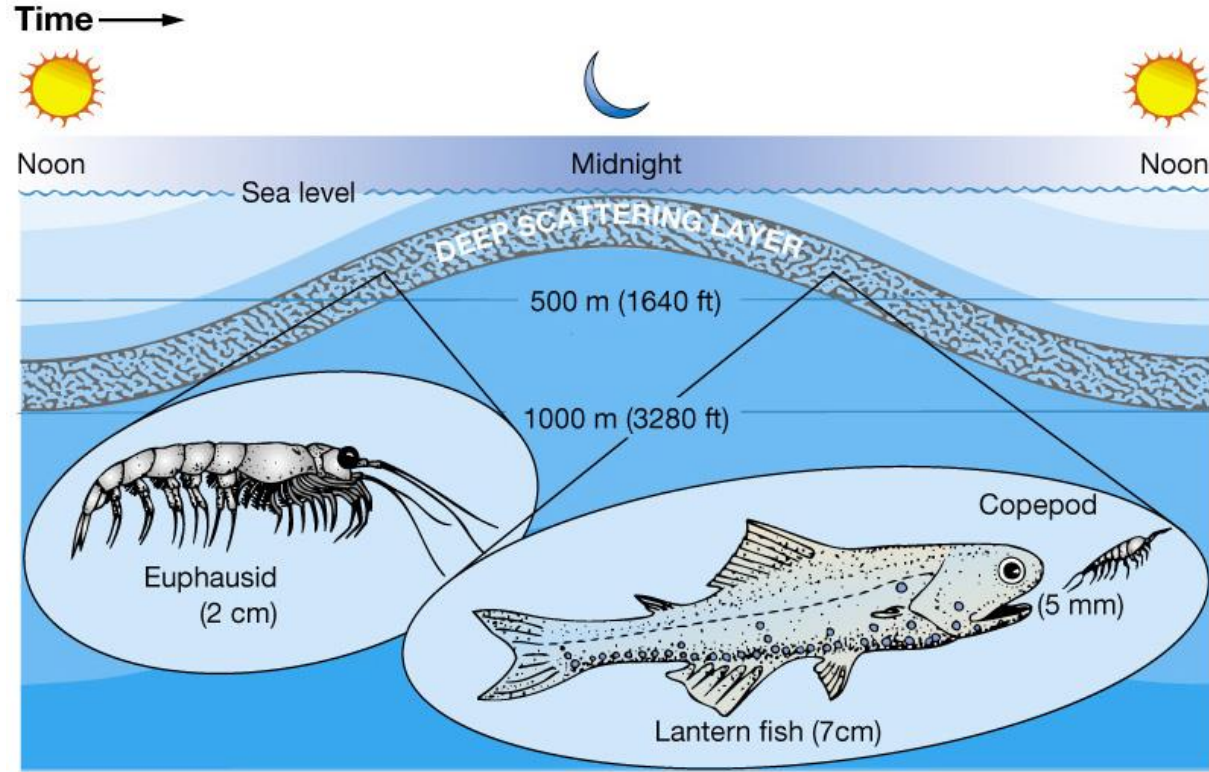


Kril'in Güney Kutup bölgesi besin zincirindeki önemi



Günlük Dikey Göç

Gündüzleri derin karanlık sularda avcılardan saklanırlar.



Günlük Dikey Göç

Her bir türün kendine özgü günlük ritmi vardır.

1.Gece Göçü

Gün batımında günde bir kez yukarı

2.Alacakaranlık Göçü(crepuscular periyod)

2 çıkış 2 iniş

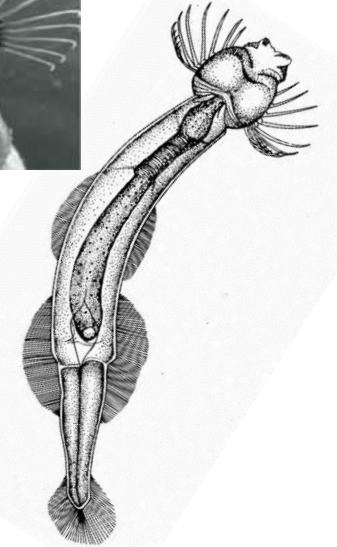
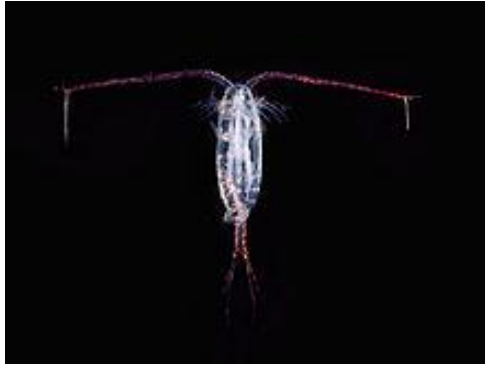
3.Ters Göç

Gün içinde çıkış, gece iniş

Günlük göçün avantajları

Antipredatör stratejisi, daha az görünür olma.

Gece su yüzeyine yaklaşır, gündüz derine giderler. Kopepod euphosiid'den, euphosiid'de chaetognath'tan kaçınır.



- Enerji korunur
- Yeni beslenme alanlarıyla karşılaşma
- Populasyondaki genetik materyal karışır
- Işıklı kısımda üretilen organik maddeler tabana doğru taşınır

Hatırlanacaklar

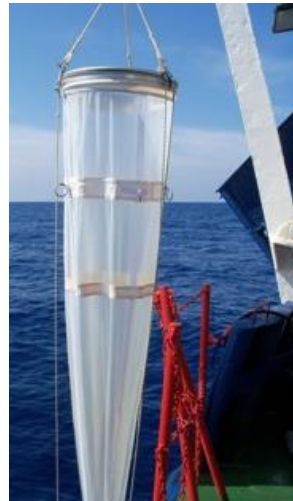
- ✓ Akıntıya karşı yüzemeyen organizmalara **plankton** denir.
- ✓ **Fito-** ve **Zoo-** plankton olarak iki gruba ayrılır.
- ✓ Şekilsel ve işlevsel olarak **çok çeşitlidirler**.
- ✓ **Fitoplankton** (bitkisel plankton) **besin piramidinin temelini oluşturur**.
- ✓ Fitoplankton birincil üreticidir.
- ✓ Mikroorganizmalar çevresel şartlara çok hızlı adapte olabilirler.
- ✓ Zooplankton (hayvansal plankton) birincil tüketicidir.
- ✓ **Holo-** ve **Mero-**plankton olarak iki gruba ayrılır.
- ✓ Fitoplankton ve Zooplankton arasında **av-avcı ilişkisi** vardır.
- ✓ Zooplankton enerjiyi fitoplankton'dan alıp bir üst kademeye aktarır.

Nansen bottle

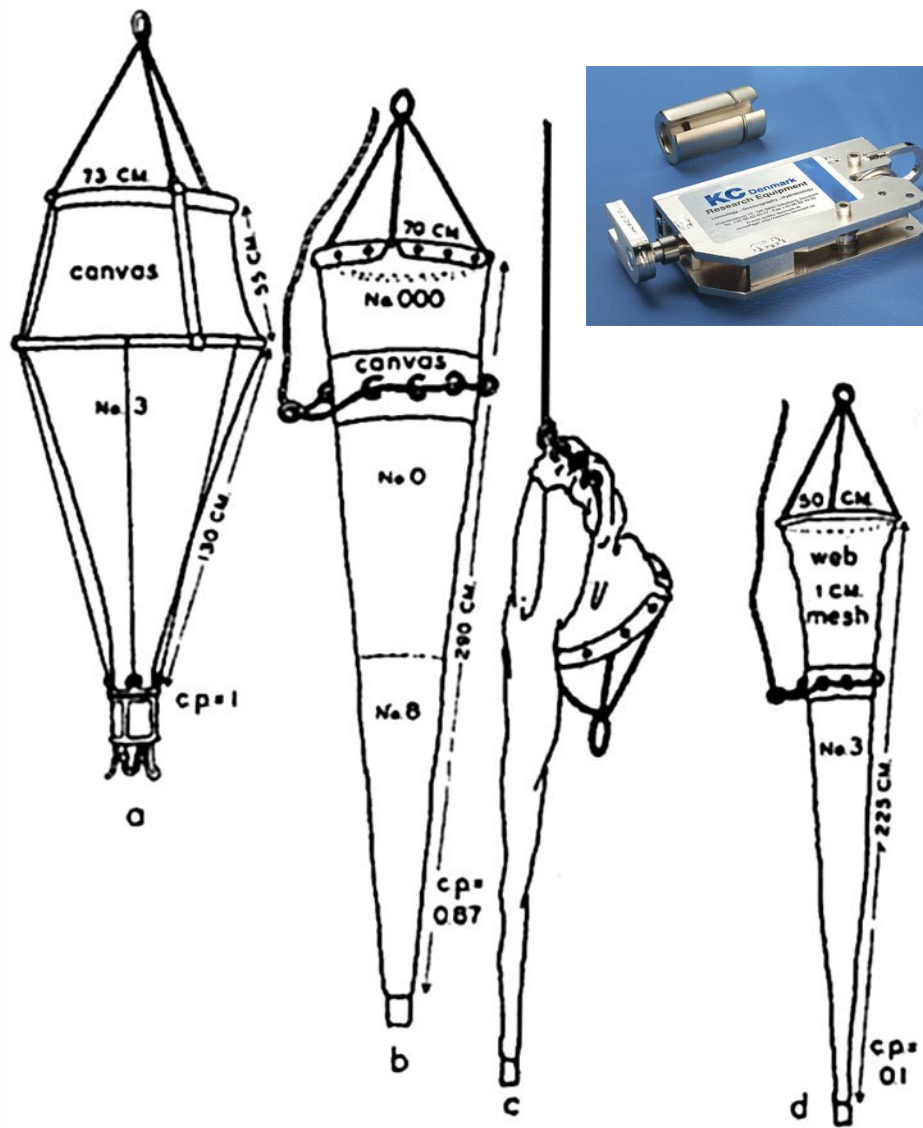


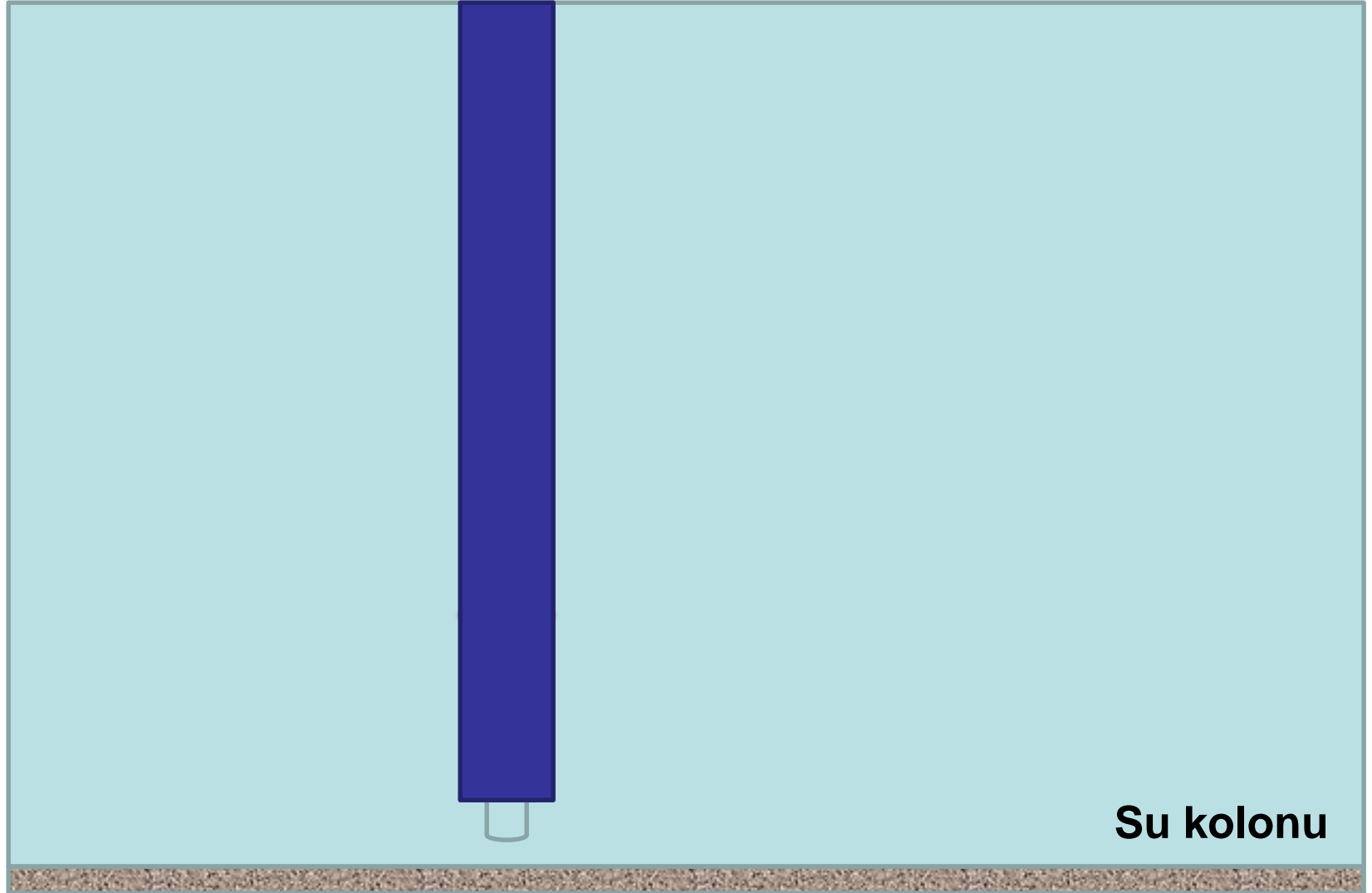
Collector

WP-2 net



Hensen net

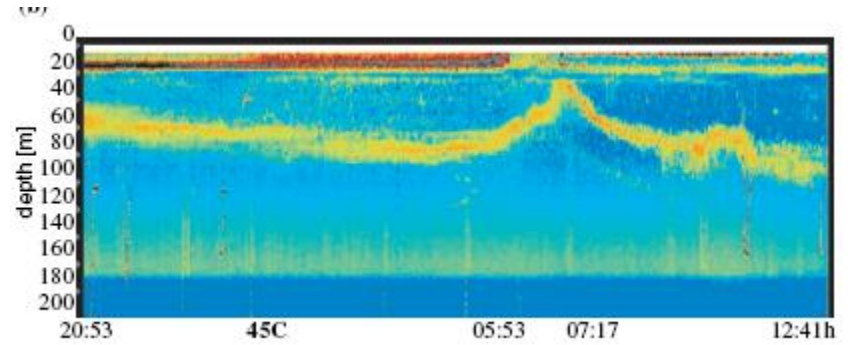




Su kolonu



Mikroskop



Akustik yöntem



Zooscan

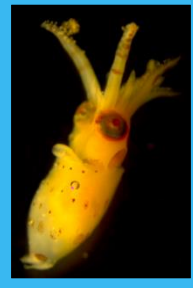


Optik yöntem

Kuzeydoğu Akdeniz'de bulunan bazı zooplanktonik organizmalar



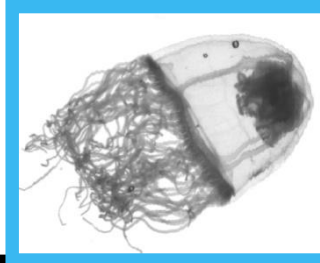
Amphipoda
(*Phronima* sp.)



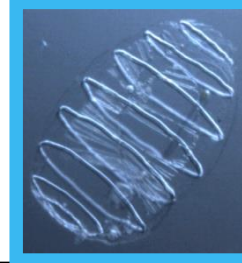
Cephalopoda
(*Octopus vulgaris*)



Stomatopoda
(*Rissoides desmaresti*)



Anthomedusae



Doliolid



Siphonophora



Copepoda
(*Farannnula* sp.)



Copepoda
(*Arietellus setosus*)



Copepoda
(*Calanoida*)



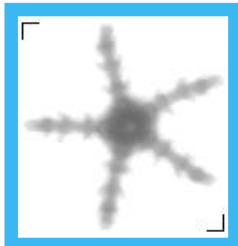
Copepoda
(*Sapphirina*)



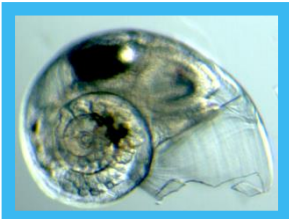
Decapoda
(*Lucifer typus*)



Decapoda



Echinodermata



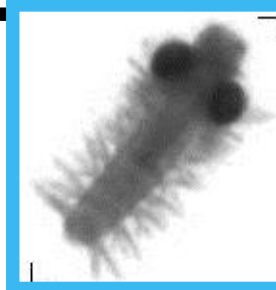
Gastropoda



Euthecosomata
(*Hyalocylis striata*)



Polychaeta
(*Tomopteris elegans*)



Polychaeta
(*Vanadis* sp.)



Fish larvae (Balık larvası)



Amphipoda (*Rhabdosoma* sp.)



Amphipoda (*Phronima* sp.)



Amphipoda (*Scina* sp.)



Amphipoda



Chaetognatha (*Flaccisagitta enflata*)



Appendicularia (*Oikopleura dioica*)



Cephalopoda (*Octopus vulgaris*)



Stomatopoda (*Rissoides desmaresti*)



Copepoda (*Farannnula* sp.)



Copepoda (*Candacia* sp.)



Copepoda (*Arietellus setosus*)



Copepoda (*Pontellina plumata*)



Copepoda (*Eucalanus* sp.)



Copepoda (*Centropages typicus*)



Copepoda (*Sapphirina* sp.)



Copepoda (*Calanoida*)



Copepoda (*Corycaeus* sp.)



Copepoda (*Sapphirina* sp.)



Copepoda (*Oithona* sp.)



Copepoda (*Labidocera* sp.)



Copepoda (*Copilia* sp.)



Decapoda (*Lucifer typus*)



Decapoda (*Acanthephyra* sp.)



Decapoda larvae



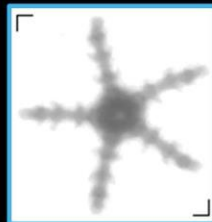
Decapoda (*Palinurus vulgaris*)



Decapoda (*Brachyura* larvae)



Decapoda



Echinodermata



Echinodermata (*Asteroidea* larvae)



Siphonophora



Siphonophora



Mysid



Fish larvae (Balik larvasi)



Fish larvae (Balik larvasi)



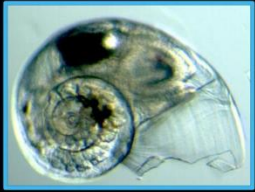
Fish larvae- Balik larvasi
(*Engraulis sp.*)



Fish egg-
Balik yumurtasi (*Engraulis sp.*)



Heteropod (*Firoloida sp.*)



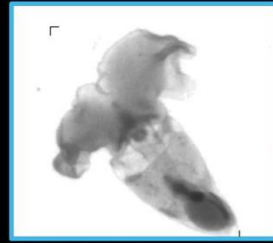
Gastropoda



Euthecosomata
(*Hyalocyllis striata*)



Euthecosomata (*Cresels sp.*)



Euthecosomata



Euthecosomata



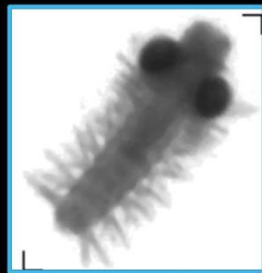
Siphonophora



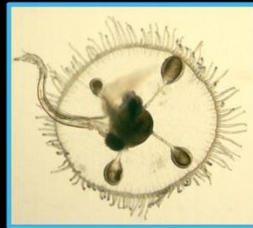
Polychaeta
(*Tomopteris elegans*)



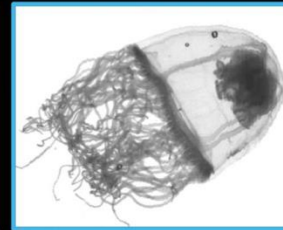
Polychaeta



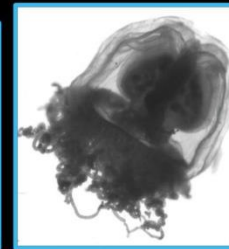
Polychaeta (*Vanadis sp.*)



Leptomedusae (*Obelia sp.*)



Anthomedusae



Anthomedusae



Doliolid



Teşekkürler