

COURSE : M.Sc MICROBIOLOGY

SUBJECT : MARINE MICROBIOLOGY

TOPIC : MARINE MICROBIAL DIVERSITY



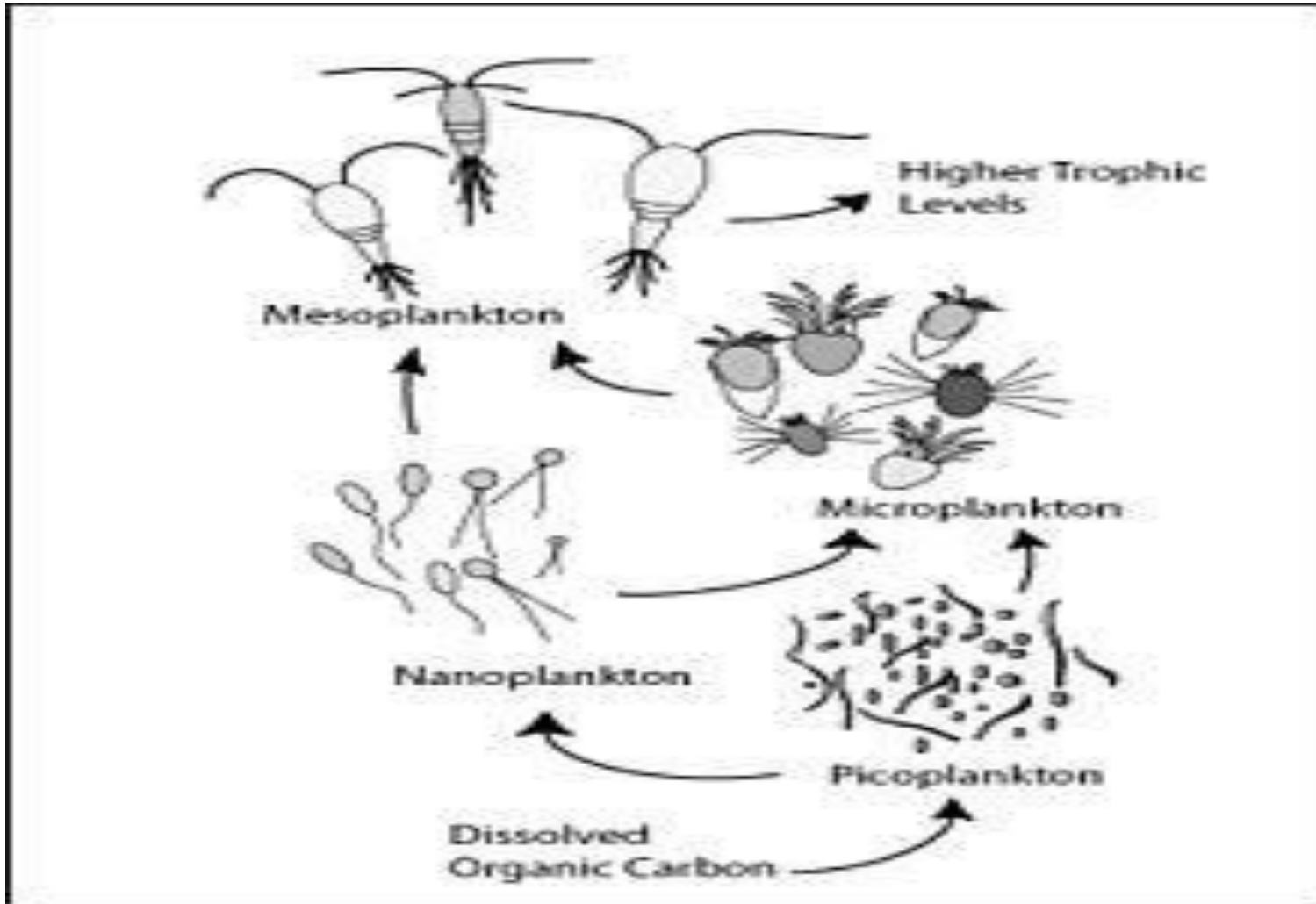
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MARINE MICROORGANISMS

- Marine microorganisms are defined by their habitat as the microorganisms living in a marine environment, that is, in the saltwater of a sea or ocean or the brackish water of a coastal estuary.
- Microorganisms are very diverse.
- In July 2016, scientists reported identifying a set of 355 genes from the last universal common ancestor (LUCA) of all life, including microorganisms, living on Earth.
- Marine microorganisms constitute about 70% of the biomass in the sea.

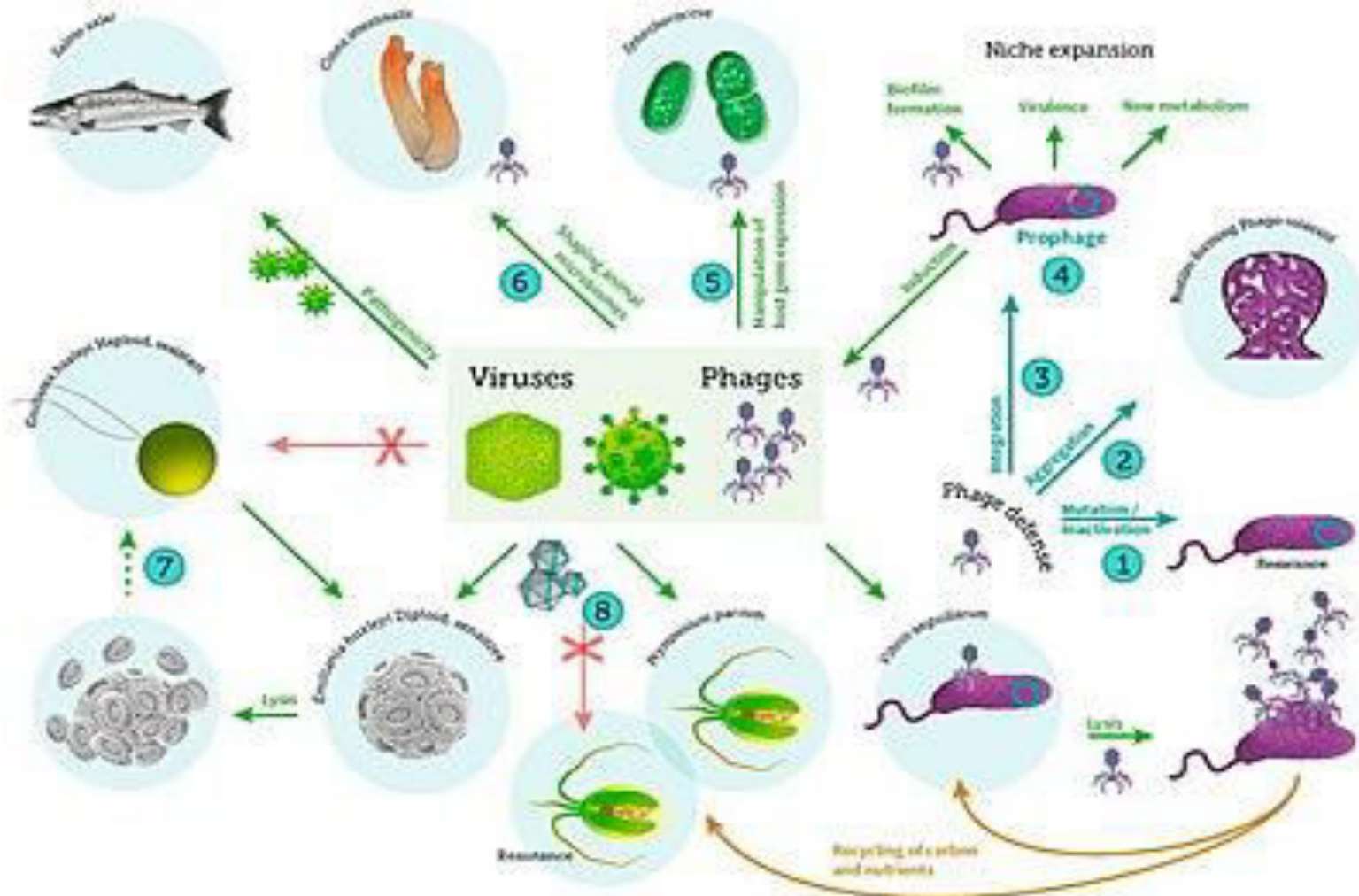
MARINE MICROBIAL LOOP



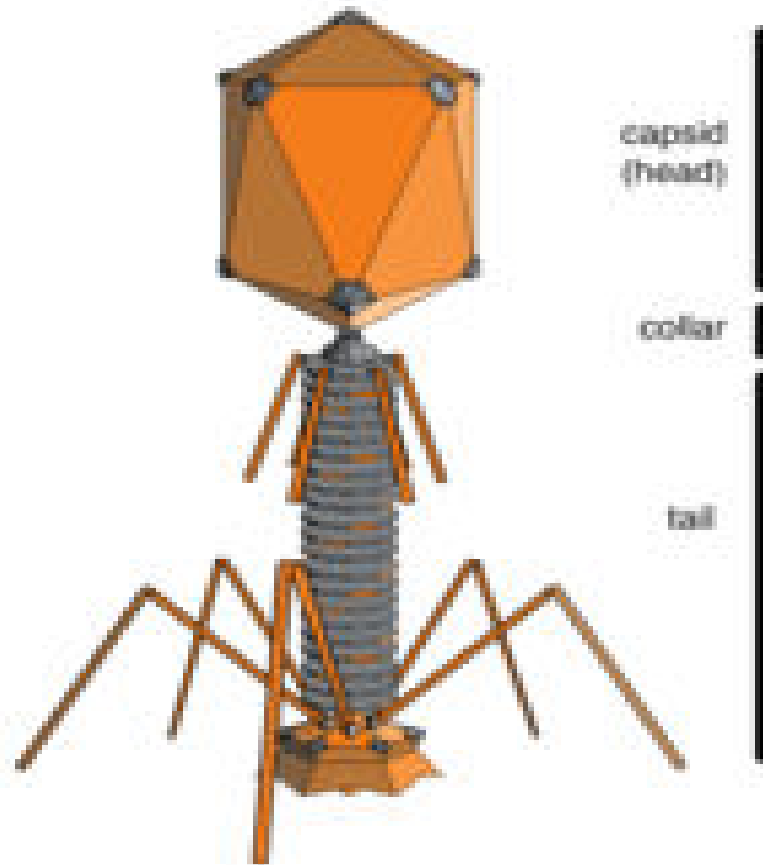
MARINE VIRUSES

- A virus is a small infectious agent that replicates only inside the living cells of other organisms. Viruses can infect all types of life forms, from animals and plants to microorganisms, including bacteria and archaea.
- Microorganisms make up about 70% of the biomass in the sea.
- It is estimated that viruses kill approximately 20% of this biomass each day; consequently, viruses are one of the most important mechanisms of recycling carbon and nutrient cycling in the marine environment.
- Viruses can also be a primary factor in the rapid destruction of algal blooms such blooms can be detrimental to other marine life.
- The number of viruses in the oceans decreases further offshore and deeper into the water where there are fewer host organisms.

MARINE VIRUSES



BACTERIOPHAGE



MARINE BACTERIA

- Bacteria constitute a large domain of prokaryotic microorganisms.
- Typically a few micrometres in length, bacteria have a number of shapes, ranging from spheres to rods and spirals.
- Bacteria were among the first life forms to appear on Earth, and are present in most of its habitats.
- Bacteria inhabit soil, water, acidic hot springs, radioactive waste, and the deep portions of Earth's crust.
- The largest known bacterium, the marine *Thiomargarita namibiensis*, can be visible to the naked eye and sometimes attains 0.75 mm (750 μm)

VIBRIO VULNIFICUS, A VIRULENT BACTERIUM FOUND
IN ESTUARIES AND ALONG COASTAL AREAS



CYANOBACTERIA



MARINE ARCHAEA

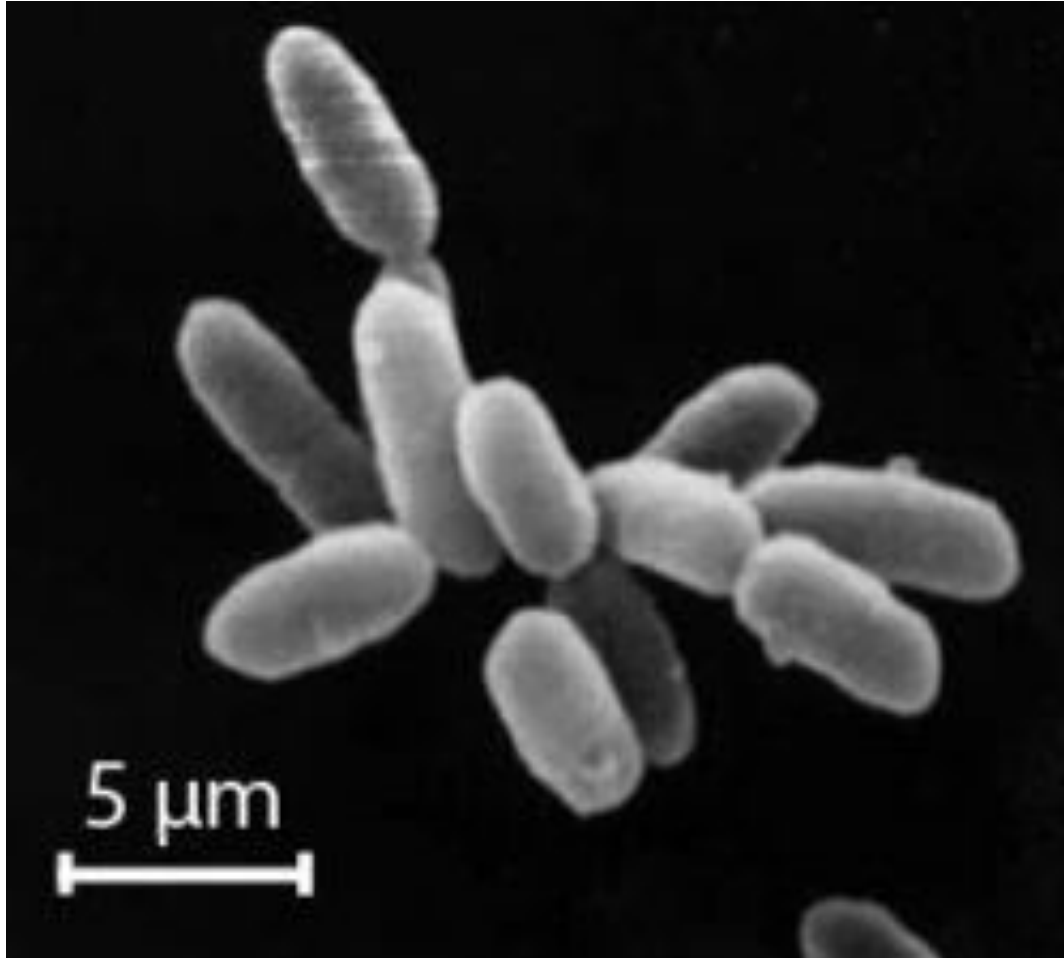
- The archaea (Greek for *ancient*) constitute a domain and kingdom of single-celled microorganisms. These microbes are prokaryotes, meaning they have no cell nucleus or any other membrane-bound organelles in their cells.
- Archaea were initially classified as bacteria, but this classification is outdated. Archaeal cells have unique properties separating them from the other two domains of life, Bacteria and Eukaryota.
- The Archaea are further divided into multiple recognized phyla. Classification is difficult because the majority have not been isolated in the laboratory and have only been detected by analysis of their nucleic acids in samples from their environment.



ARCHAEA WERE INITIALLY VIEWED AS EXTREMOPHILES LIVING IN HARSH ENVIRONMENTS, SUCH AS THE YELLOW ARCHAEA PICTURED HERE IN A HOT SPRING, BUT THEY HAVE SINCE BEEN FOUND IN A MUCH BROADER RANGE OF HABITATS.



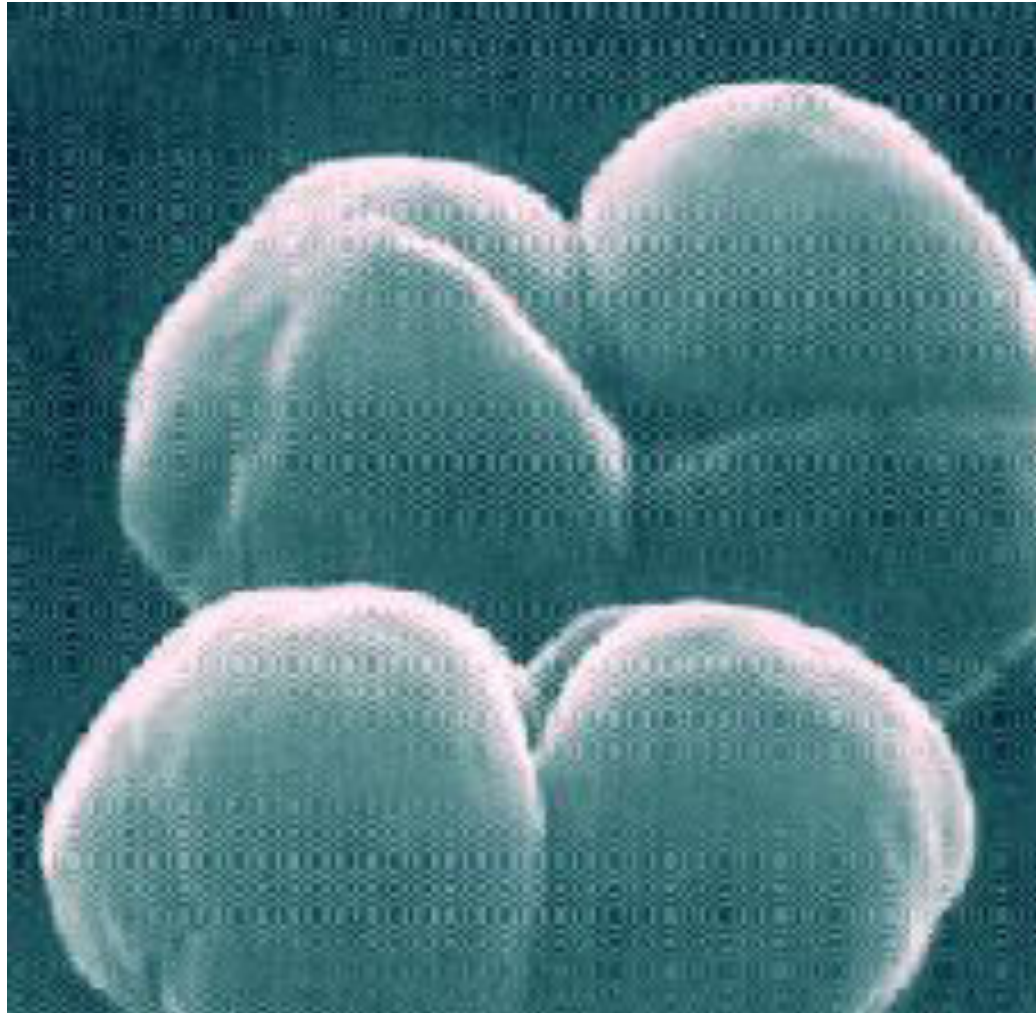
HALOBACTERIA FOUND IN WATER SATURATED OR NEARLY SATURATED WITH SALT, ARE NOW RECOGNIZED AS BEING ARCHAEA.



The flat and square-shaped cells of the archaea *Haloquadratum walsbyi*



METHANOSARCINA BARKERI



MARINE PROTISTS

- Protists are eukaryotes that cannot be classified as plants, fungi or animals. They are usually single-celled and microscopic.
- Protists include amoebae, ciliates, red algae, euglena, phytoplankton such as diatoms and dinoflagellates, and slime molds.
- Protists are a highly diverse group of organisms currently organised into 18 phyla, but they are not easy to classify.
- Studies have shown a high protist diversity exists in oceans, deep sea-vents and river sediments, which suggests a large number of eukaryotic microbial communities have yet to be discovered.

SINGLE-CELLED ALGA, *GEPHYROCAPSA*
OCEANICA



MARINE MICROALGAE

- Algae can grow as single cells, or in long chains of cells. Green algae are a large group of photosynthetic eukaryotes that include many microscopic organisms.
- Green algae include unicellular and colonial flagellates as well as various colonial, coccoid, and filamentous forms. There are about 6000 species

ASSORTED DIATOMS FOUND LIVING BETWEEN CRYSTALS OF ANNUAL SEA ICE IN ANTARCTICA



MARINE FUNGI

- Over 1500 species of fungi are known from marine environments.
- These are parasitic on marine algae or animals, or are saprobes on algae, corals, protozoan cysts, sea grasses, wood and other substrata, and can also be found in sea foam.
- Spores of many species have special appendages that facilitate attachment to the substratum.
- A very diverse range of unusual secondary metabolites is produced by marine fungi.
- Marine yeasts are also found, even in deep-sea environments.

MARINE ASCOMYCETE FUNGUS



LICHEN ON A ROCK IN A MARINE SPLASH ZONE. LICHENS ARE MUTUALISTIC ASSOCIATIONS BETWEEN A FUNGUS AND AN ALGA OR CYANOBACTERIUM.

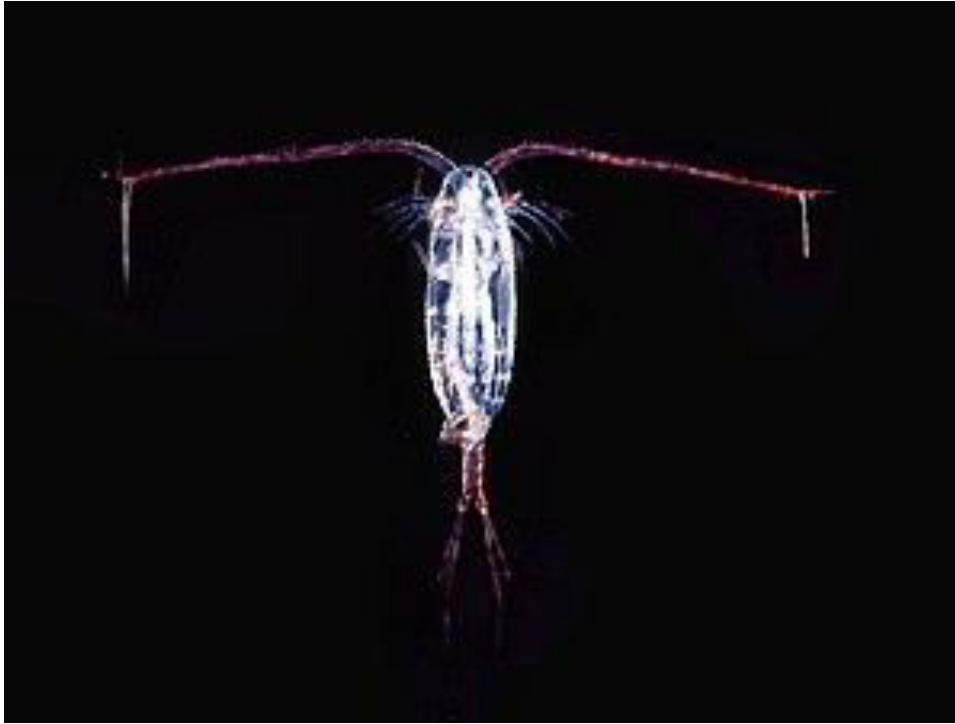


MARINE MICROANIMALS

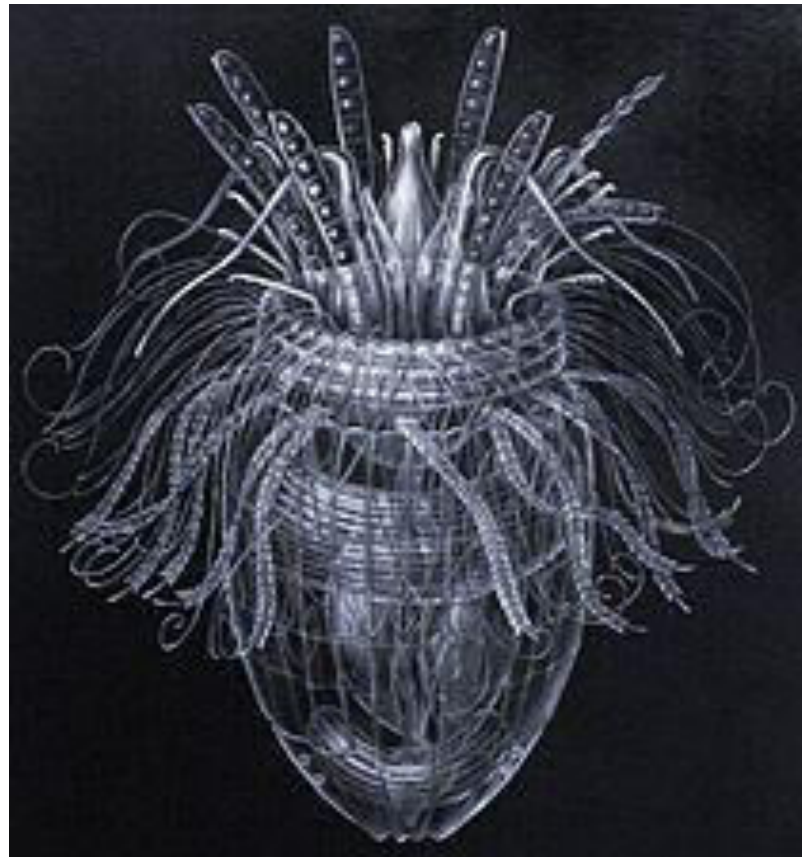
- Microscopic adult marine crustaceans include some copepods, cladocera and water bears. Some marine nematodes and rotifers are also too small to be seen with the naked eye, as are many loricifera, including the recently discovered anaerobic species that spend their lives in an anoxic environment.
- Copepods contribute more to the secondary productivity and carbon sink of the world oceans than any other group of organisms.



OVER 10,000 MARINE SPECIES ARE COPEPODS,
SMALL, OFTEN MICROSCOPIC CRUSTACEANS



ARMOURED *PLICILORICUS ENIGMATICUS* OF
THE PHYLUM LORICIFERA LIVE IN THE SPACES
BETWEEN MARINE GRAVEL



QUESTION AND ANSWER

???



- 1. Which of the following zones have considerable rooted vegetation?
 - a) littoral zone
 - b) limnetic zone
 - c) profundal zone
 - d) benthic zone

- Answer: a
Explanation: There is usually a fairly large littoral zone along the shore which has considerable rooted vegetation and includes regions where light penetrates to the bottom.

- 2. Which of the following layer is composed of soft mud or ooze?
 - a) Photic zone
 - b) Limnetic zone
 - c) Benthic zone
 - d) Profundal zone

- Answer: c
Explanation: The benthic region is composed of soft mud or ooze at the bottom. Profundal region exists at much greater depths of the water body whereas littoral zone is present along the shore.



- 3. In which of the following seasons does the nutrient concentration fall at a drastically lower level?
 - a) Winter
 - b) Spring
 - c) Summer
 - d) Autumn

- Answer: c
Explanation: Occurrence of algal blooms during the spring and autumn results in lowering the nutrient concentration during summers.

- 4. Rapidly expanding urbanization makes it difficult to generalize upon typical microbial flora of streams.
 - a) True
 - b) False

- Answer: a
Explanation: The drastic environmental changes in streams and rivers created by rapidly expanding urbanization on the one hand and changes in farming practices on the other make it impossible to generalize upon typical or characteristic microbial flora.



- 5. The coastal adjunct of the marine ecosystem is _____
 - a) stream
 - b) estuary
 - c) river
 - d) lake

- Answer: b
Explanation: An estuary is the coastal adjunct of the marine ecosystem. It is a semi-enclosed coastal body of water which has a free connection with the open sea.

- 6. The Chesapeake Bay, one of the world's major estuarine system serves as the receiving basin for how many rivers?
 - a) 4
 - b) 6
 - c) 3
 - d) 9

- Answer: d
Explanation: The Chesapeake Bay, one of the world's major estuarine system serves as the receiving basin for nine major rivers, draining much of southern New York State, Pennsylvania, Maryland and Virginia.





Thank you

