Marine Habitats: Physical Conditions of Marine Life

Main Concepts – Physical Factors of Marine Life

All life is composed of only 23 chemical elements - four elements make up 99% of mass = oxygen, hydrogen, carbon, and nitrogen.

>Marine life is completely dependent on its surrounding physical environment for a dynamic exchange of the above nonliving materials essential to life.

Material reservoirs that supply the global-scale biogeochemical cycles include water, carbon, oxygen, nitrogen, phosphorous, and silica.

> Physical environment where community of organisms live is called a *habitat*.

> There are a number of physical factors within a marine habitat that control the types and numbers of marine organisms.

Physical factors include sunlight, water temperature, available nutrients, salinity, dissolved gases, water pressure, and pH

Certain physical factors that are super critical for the survival of an organism is termed a "limiting factor".

Ocean's biological pump is the dynamic interaction between phytoplankton, zooplankton, decomposers, sunlight, nutrients, and dissolved gasses – essential to health of marine food webs and earth climate

Marine habitats, or ocean zones, are classified by several criteria: sunlight, distance from the shore, water depth, bottom type, and water temperature.



Everything is Connected to Everything Else











There is an intimate relationship between the living and nonliving world on earth – essential to life in the ocean

Life on Planet Earth

Photosynthesis Plants

Phytoplankton + CH₂O

CH₂O organic carbon Respiration

CH,O

organic carbon

H,O

water

Animals Bacteria

 chlorophyll

CO₂ carbon dioxide

Solar Energy

H,O

water

Energy and heat

õ



The Marine Physical Factors

✓ Sunlight

- ✓ Water depth
- ✓ pH
- ✓ Temperature
- ✓ Salinity
- ✓ Density
- ✓ Oxygen
- ✓ Nitrate

✓ Carbon





Water Temperature







The Carbon Cycle

Global Carbon Cycle Photosynch Respirateo

Gas Exchange Between Air and Ocean

Net Accumulation in Ocean

> Photosynthesis Respiration

Circulation

The Carbon Cycle



Sources: Center for climatic research, Institute for environmental studies, university of Wisconsin at Madison; Okanagan university college in Canada, Department of geography; World Watch, November-December 1998; Climate change 1995, The science of climate change, contribution of working group 1 to the second assessment report of the intergovernmental panel on climate change, UNEP and WMO, Cambridge press university, 1996.

The Carbon Cycle

Global Carbon Cycle Respiration

Combustion

Gas Exchange Between Air and Ocean

Net Accumulation in Ocean

> Photosynthesis Respiration

Circulation

Geological Reservoir

Nitrogen Cycle



1) The nitrogen cycle supplies nitrate nutrients to photosynthesizing organisms like phytoplankton, seaweeds and plants.

2) Nitrogen compounds move from one reservoir to another via chemical and transport processes.

Phosphorous Cycle



- 1) The phosphorous cycle supplies phosphate nutrients to photosynthesizing organisms like phytoplankton, seaweeds and plants.
- 2) Phosphorous compounds move from one reservoir to another via chemical and transport processes.

Plankton and the Nutrient Cycles

- The plankton in the marine food webs are important in driving the nutrient cycles
- Source Both living and nonliving components make up the nutrient cycles
- Sacteria also play a key role in the nutrient cycles as decomposers of organic matter (dead bodies and fecal material) back into reusable nutrients.



Marine Life Food Cycles

Two overlapping food cycles in the marine world "Classic" loop "Microbial" loop

Classic" loop includes nutrients, phytoplankton and herbivores.

* "Microbial" loop includes phytoplankton, bacteria, microherbivores and organic matter.

Classic" loop depends on the "microbial" food loop

* "Microbial" loop is also known as the "oceanic biological pump"





The Ocean's Microbial Food Web

The most important biological activity in the ocean occurs at the microbial level = the plankton organisms

The players include the primary producers, the primary consumers, and the decomposers

All three players are critical to the entire marine food web and the nutrient cycles



Microbial Food Web

Stewart NMEA July 2004 (20)

From Jackson Texas A&M University

Ocean's Biological Pump

The ocean's "biological pump" is the foundational level in the complete marine food web and in driving the nutrient cycles

South living and nonliving components are in dynamic exchange within the ocean's biological pump

The ocean's biological pump is crucial for all life on Earth

The ocean's biological pump affects Earth's climate









Habitat Classification Schemes



- > Intensity of Sunlight
- > Distance from Shoreline
- > Bottom vs. Water Column
- > Water depth to Bottom
- > Tide zone levels



Zones of Marine Environments



Classification by Depth of Sunlight Penetration



Habitat Classification - Distance from Shore



Habitat Classification – Water Column versus Bottom Zones



Living Conditions in Marine Habitats



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Discussion

