
Professional Certificate in Plankton Ecology

Planktonic Role in Climate Change.

Plankton play a crucial role in the Earth's climate system through their interactions with the atmosphere, oceans, and other marine organisms. Understanding the role of plankton in climate change is essential for predicting future climate scenarios and implementing effective mitigation strategies. In this course, we will explore key terms and vocabulary related to the planktonic role in climate change, providing a comprehensive overview of the mechanisms by which plankton influence climate dynamics.

1. Plankton

Plankton refers to a diverse group of microscopic organisms that drift or swim in the ocean, encompassing both phytoplankton (plant-like organisms) and zooplankton (animal-like organisms). These organisms form the base of the marine food web and play a critical role in carbon cycling and nutrient dynamics in the ocean.

2. Phytoplankton

Phytoplankton are photosynthetic organisms that convert carbon dioxide into organic matter through photosynthesis. They are the primary producers in marine ecosystems, responsible for generating a significant portion of the oxygen we breathe and serving as a food source for higher trophic levels.

3. Zooplankton

Zooplankton are heterotrophic organisms that feed on phytoplankton and other small particles in the water column. They play a crucial role in transferring energy from primary producers to higher trophic levels, including fish, marine mammals, and seabirds.

4. Climate Change

Climate change refers to long-term shifts in global temperature and weather patterns, primarily driven by human activities such as burning fossil fuels, deforestation, and industrial processes. The increase in greenhouse gas emissions leads to global warming, sea level rise, and changes in precipitation patterns, impacting ecosystems and human societies worldwide.

5. Carbon Cycle

The carbon cycle is the process by which carbon is exchanged between the atmosphere, oceans, land, and living organisms. Phytoplankton play a significant role in the marine carbon cycle by sequestering carbon dioxide from the atmosphere and converting it into organic matter through photosynthesis.

6. Photosynthesis

Photosynthesis is the biochemical process by which plants, algae, and some bacteria convert light energy into chemical energy, producing oxygen and organic compounds from carbon dioxide and water. Phytoplankton rely on photosynthesis to generate energy for growth and reproduction.

7. Primary Production

Primary production refers to the synthesis of organic matter by autotrophic organisms, such as

phytoplankton, through photosynthesis. It represents the base of the marine food web and provides energy for all other trophic levels in the ecosystem.

****8. Nutrient Cycling****

Nutrient cycling involves the movement and transformation of essential nutrients, such as nitrogen, phosphorus, and iron, in marine ecosystems. Phytoplankton require these nutrients for growth and metabolism, and their availability can limit primary productivity in the ocean.

****9. Biological Pump****

The biological pump is a mechanism by which carbon is transferred from the surface ocean to the deep ocean through the sinking of organic particles. Phytoplankton fix carbon dioxide in surface waters, which is then exported to depth when these particles sink, effectively sequestering carbon in the ocean.

****10. Climate Feedbacks****

Climate feedbacks are interactions between different components of the Earth's climate system that either amplify or dampen the effects of external forcing, such as greenhouse gas emissions. Changes in plankton abundance and distribution can act as feedback mechanisms that influence the rate of climate change.

****11. Ocean Acidification****

Ocean acidification is the ongoing decrease in pH of the Earth's oceans due to the absorption of carbon dioxide from the atmosphere. Increased carbon dioxide levels lead to lower pH and reduced carbonate ion concentrations, affecting the ability of marine organisms, including plankton, to build calcium carbonate shells.

****12. Albedo****

Albedo is the reflectivity of a surface, with higher albedo values indicating greater reflectance of sunlight. Changes in plankton abundance and composition can alter the albedo of the ocean surface, influencing the amount of solar radiation absorbed or reflected back into the atmosphere.

****13. Harmful Algal Blooms****

Harmful algal blooms are rapid increases in the population of certain phytoplankton species, often toxic, that can have detrimental effects on marine ecosystems and human health. Climate change can exacerbate the frequency and intensity of harmful algal blooms, leading to ecosystem disruptions and economic losses.

****14. Marine Heatwaves****

Marine heatwaves are prolonged periods of anomalously warm sea surface temperatures that can have widespread impacts on marine ecosystems, including coral bleaching, fish migrations, and changes in plankton distribution. These events are becoming more frequent and severe due to global warming.

****15. Microbial Loop****

The microbial loop is a trophic pathway in marine ecosystems involving the recycling of organic matter by bacteria, protists, and other microorganisms. Plankton play a key role in the microbial loop by releasing dissolved organic carbon and nutrients that support microbial growth and nutrient cycling in the ocean.

****16. Climate Resilience****

Climate resilience refers to the ability of ecosystems and societies to withstand and recover from the impacts of climate change. Understanding the role of plankton in climate dynamics is essential for enhancing the resilience of marine ecosystems and adapting to changing environmental conditions.

****17. Remote Sensing****

Remote sensing is the use of satellite-based sensors and other technologies to monitor Earth's surface and atmosphere from a distance. Remote sensing techniques are valuable for studying plankton distribution, abundance, and productivity over large spatial scales and long time periods.

****18. Biogeochemical Models****

Biogeochemical models are computational tools that simulate the interactions between biological, chemical, and physical processes in marine ecosystems. These models are used to predict the responses of plankton communities to climate change and assess their impacts on carbon cycling, nutrient dynamics, and ecosystem health.

****19. Ecological Forecasting****

Ecological forecasting involves using scientific data and models to predict the future state of ecosystems and the impacts of environmental changes. Forecasting the responses of plankton to climate change is essential for informing management decisions, conservation efforts, and sustainable resource use in marine environments.

****20. Citizen Science****

Citizen science involves the participation of non-professional scientists in scientific research and data collection. Engaging citizen scientists in monitoring plankton populations and environmental conditions can provide valuable insights into long-term trends, spatial patterns, and community dynamics, enhancing our understanding of plankton's role in climate change.

By familiarizing ourselves with these key terms and concepts related to the planktonic role in climate change, we can deepen our understanding of the complex interactions between marine organisms, biogeochemical processes, and climate dynamics. Through this course, we will explore the challenges and opportunities associated with studying plankton ecology in the context of a changing climate, and develop strategies for mitigating the impacts of climate change on marine ecosystems.