Chronicle of Aquatic Science
Open Access Peer Reviewed Journal
Vol. 1, Issue 7
https://chronicleofaquaticscience.in/

Popular Article
Singh et al. (2023)
Manuscript Id: CoAS_V1IS7_02

OPEN ACCESS

Plankton and Their Role in Marine Ecosystems

Basant Singh*[1] and Omkar Sahu[2]
[1]Fisheries Polytechnic, Rajpur, Dhamdha- 491331
[2]College of fisheries Dholi, Muzaffarpur, Bihar, India

Corresponding Author
Basant Singh
Email: basantsingh.bs88@gmail.com

(Received- 02.11.2023, Revised- 21.11.2023, Accepted- 29.11.2023, Published: 04.12.2023)

How to cite this article:

Singh, B. and Sahu, O. 2023. Plankton and Their Role in Marine Ecosystems. *Chronicle of Aquatic Science* 1(7): 10-14.

ABSTRACT

The most common metazoan on Earth are small planktonic sea copepods, measuring less than one millimetre in length. Planktonic organisms such as Oncaea, Oithona, and Corycaeus; adults and copepodites of calanoid taxa like Paracalanus, Clausocalanus, and Acartia; and Microsetella's tonic harpacticoids and nearly every copepod species' nauplii. Underestimating the quantity and biomass of zooplankton, the effect of copepod grazing on phytoplankton primary production, zooplankton and materials, and trophic interactions in the sea might result from failing to properly account for small copepods. Compared to adults of bigger copepod species, including those in the genus Calanus, the feeding ecology of little copepods is not as well understood. Furthermore, rather than information on offshore species, the majority of feeding data for small copepods pertains to coastal genera like Acartia. While it is commonly believed that small copepods, such as nauplii, mostly eat minute phytoplankton cells, the majority of this knowledge derives from raising or feeding experiments conducted on restricted laboratory diets. Few studies of copepods actually feeding on natural phytoplankton and microzooplankton found in the water have been conducted, but some of them have shown surprising results. Small copepods are crucial components of the microbial cycle, essential grazers of phytoplankton, and prey for larger pelagic carnivores such as ichthyoplankton, resulting in their vital linkages in the marine food webs.

KEYWORDS

Plankton, Marine ecosystems, aquaculture

Introduction

In marine ecosystems, phytoplankton and zooplankton play critical role. The food webs on which practically all larger animals depend are fed and sustained by these small organisms. The primary production of phytoplankton determines the size, composition, and productivity of zooplankton, which in turn determines the viability of fisheries and other economic activities. Phytoplankton absorb large amounts of dissolved CO2 through photosynthesis, in addition to serving as food for herbivorous zooplankton. Zooplankton is an essential component of the biogeochemical cycles because it eats phytoplankton and transports carbon through the upper to the deep ocean, from where it is stored for many thousands of years.

The most significant element influencing phytoplankton development in the seas is the quantity of nutrients in the euphotic zone, along with light. Climate-related changes may also have a direct effect on zooplankton abundance and composition, changing dominant species distribution, altering the structure of the zooplankton communities, and affecting the frequency, intensity, and efficiency of zooplankton reproductive cycles. Whether spawning occurs in close geographic and temporal vicinity to phytoplankton and zooplankton food bloom determines a lot about the recruitment performance of fish stocks. It is predicted that variations in upper-ocean temperature will impact when, where, and how blooms of phytoplankton and zooplankton peak density occur, hence influencing the amount of plankton that fish larvae and juveniles can consume. The distributional range of zooplankton can vary significantly depending on the climate and other hydrographic factors. Since warm-water species are smaller than those from higher latitudes, temperature changes can affect the size distribution, life history pattern, and nutrient content of zooplankton assemblages.

Abundance and distribution of phytoplankton

There has been reported to be a yearly decline in phytoplankton standing stock of as much as one percent of the the median phytoplankton biomass worldwide. modifications in phytoplankton standing stock were not found to be significantly influenced by nutrient concentrations. A major influence on the annual mean spring production may come from modifications to the hydrography and currents brought about by large-scale climatic variability. Over the past ten years, there has been a rise in phytoplankton standing stock in deep ocean areas. It is challenging to distinguish between the effects of eutrophication, fishing, and temperature changes on the biomass of phytoplankton and species structure. A mixture of climate conditions, such as water temperature, sun radiation and wind speed, control the severity of cyanobacteria surface blooms.

Community structure

Regional climatic variability has been connected to changes in the composition of the phytoplankton community, as evidenced by the CPR survey data, which show a decrease in diatom abundance and a rise in dinoflagellate abundance in reaction to increasing ocean temperatures. The abundance of the armoured dinoflagellate Ceratium has decreased in the most common species, including *C. furca*, *C. fusus*, and *C. horridum*. In some parts of the North Sea, increased records of hazardous algal bloom (HAB) taxa have been documented in recent decades, coinciding with the growth in dinoflagellates. It is thought that these variations, which could just be the consequence of a shift in the centre of the HAB distribution, are related to geographic regions climate change, which includes changes in salinity and temperature. (Hiromi *etal*., 1988).

Rising temperature at higher latitudes appear to be facilitating the expansion of warmwater plankton and possibly certain HAB species. During times of relatively mild temperatures, for example, In fossil records, species similar to the poisonous *G catenatum* and *L polydiometra* have been found in increasing densities. Many phytoplankton species' metabolic and growth rates increase with increased temperature within species-specific physiological limitations. Increases of 1–2°C may not affect the equilibrium between the metabolism (respiration) and development (via photosynthesis), while larger changes may result in a decrease in primary output. The kind of phytoplankton species (cold or warm adaptation) and the geographical location will determine the changes.

Soil weathering, agricultural practises, and additional human endeavours all contribute to high amounts of dissolved nutrients in river runoff. Increased summer flash floods may lead to a sporadic influx of nutrients into coastal water that is lacking in nutrients, affecting the period and quantity of the summertime phytoplankton blooms. Changes in the intensity and frequency of local prevailing winds will influence the amount of newly introduced nutrients supplied to the euphotic region and fresh primary production. Wind mixing activities should be reduced by enhanced sea surface heat and thermal stratification.

Abundance and distribution of zooplankton

The geographic distribution of fairly large zooplankton (such as Calanus spp.) has had an important effect on total abundances of zooplankton and biomass. Climate and environmental effects on mesozooplankton may have been significantly impacted by this change in food web structure, which redirected the transfer of energy from the pelagic the environment to the benthos. Changes in zooplankton abundance are thought to be caused by salinity, eutrophication, temperature, pelagic fish predation and nonindigenous planktonic invertebrates. Changes in temperature in the ocean will also have an indirect impact on the mesozooplankton's standing stock, primarily influencing winter survival and summer growth/reproduction because the number of planktivorous fish stocks in that region has expanded dramatically in recent years, stronger predation pressure has resulted. Increased division leads to increased young Calanuscopepodites and tiny copepod production and survival. There are indicators that the number of pelagic *cnidarians* and *ctenophores* (gelatinous zooplankton predators, or "jellyfish") has grown globally in recent years. Since many jellyfish species are difficult to collect and grow, little is known about their ecological influence on zooplankton ecosystems, particularly fish larvae.

Community structure

Temperature changes have had the largest impact on organisms living surface layer, while salinity variations have the biggest impact on those dwelling deeper in the water column. Consequently, the pelagic food web may be significantly altered by the predicted prolonged periods with greater water temperature and less salinity throughout the summer, which would favour the development of copepods like *Acartia spp.* and rotifers. higher temperatures in the winter may have an impact on copepods, cladocerans, and rotifers overwintering resting stages in sediment (Landry, VL Fagerness, 1985).

Phenology and life history

Climate change has caused changes in the phenology (the timing of occurrence) of many zooplankton taxa. Different species, groups of functions, and levels of trophic structure have experienced different phenological changes, which may have an impact on prey-predator relationships. In oceans, the phytoplankton and zooplankton populations altered significantly; For instance, the abundance of dinoflagellates rose while that of diatoms declined, and there were notable changes in the total biomass of major copepod species—which are essential to fish diets—observed. Variations in copepod density had a significant impact on major fish species biomass, fisheries and landings. Pseudocalanusacuspes-dominated copepod population changed to *Acartia spp*.-dominated due to increased temperature and decreased salinity. This alteration in environment was linked to a freshening and stratification of coastal waters, which resulted in alterations in phytoplankton, zooplankton and higher-trophic-level species' diversity and seasonal cycles. The elimination of top predators due to overfishing would have a cascade impact on the plankton (Checkley, 1980).

Effects on higher trophic levels: fisheries implications

Given the significance of several species of zooplankton as food for fish larvae and juveniles, the timing of spawning of fish and zooplankton blooms is critical. Fish spawning, egg growth rates, phytoplankton and zooplankton bloom timing may all be affected by climate change. Climate change may therefore be the cause of the poor recruiting that conventional fisheries targeting fish like cod, plaice (*Pleuronectesplatessa*), and herring (*Clupeaharengus*). Current climate change has caused a shift in the seasonal timing of phytoplankton and zooplankton production, which may have an effect on species of predators such as fish. It is predicted that regional variations in both primary and secondary pelagic production will result from global warming, which will have an indirect impact on carbon capture, oxygen production, and the biogeochemical cycle.It is also inevitable for pH to change, with colder waters typically having the lowest pH levels. All of these changes may have an impact on dependent species like seabirds and mammals, as well as further tax already-stressed fisheries. Climate change may also have an impact on the existence and abundance of both transient (meroplanktonic) and permanent (holoplanktonic) zooplankton species. The number of phytoplankton and meroplankton (especially sea urchin larvae) has increased in lockstep with the rise in sea temperature. This alteration of foodweb structure, thought to be caused by the meroplankton's competitive exclusion of the holozooplankton, may have reduced energy transmission to top pelagic predators (such as fish) while increasing energy transmission to the benthic organisms. Indicators of a rise in jellyfish occurrences, since jellyfish feed on the eggs and larvae of economically important fish, outbreak of jellyfish might eventually reduce the amount of fish biomass obtainable to fisheries.

Conclusions

The abundance, variation, structure of communities, and population growth of phytoplankton and zooplankton exhibit important fluctuations, according to an investigation of plankton timeseries. These planktonic events seem to be adjusting to climate changes, which are mostly caused by warming of the air and sea surface temperature (SST) and the accompanying hydrodynamic changes. Variations in phytoplankton and zooplankton groups at the bottom of the marine pelagic food web may affect the highest trophic levels, even though synchronisation between predator and prey (match – large variation) plays a major part (bottom – up regulation of the marine pelagic environment) in the recruiting of the greatest predators, including seabirds, fish, and mammals. These changes may be brought about by human activity pressures, such as fishing, and may also work in together with climate change.

REFERENCES

Checkley DM. (1980) The egg production of a marine plank- tonic copepod in relation to its food supply: laboratory studies. Limnol. Oceanogr. 25: 430-446.

Hiromi J, T Nagata, S Kadota. (1988). Respiration of the small planktonic copepod Oithonadavisae at different temperatures. Bull. Plankton Soc. Jpn. 35: 143-148.

Landry MR, JM Lehner-Fournier, VL Fagerness. (1985). Predatory feeding behavior of the marine cyclopoid copepod Corycaeusanglicus. Mar. Biol. 85: 163-169.

COPYRIGHT