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Biodiversity of copepods in marine ecosystem-a review

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SUMMARY

To assess and record biodiversity and community dynamics, precise species and community identification is necessary. Copepods are a fascinating and extensively researched group in terms of biodiversity and ecosystem functioning due to their immense taxonomic and ecological diversity, as well as a wide variety of behaviors, morphologies, and life cycles. Additionally, due to their short life cycles and quick responses to changing environments, they are helpful indicators of ecosystem health and status in the face of environmental change. In the context of managing and conserving marine biodiversity, this research emphasizes the richness of copepods in marine environments.

Keywords: Marine ecosystem, Copepods, Biodiversity

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INTRODUCTION

Biodiversity is an important topic for study (Panhwar *et al.*, 2022; Muhammad *et al.*, 2022; Ndlovu *et al.*, 2023). When we study the marine ecosystems we largely focus on higher vertebrates and neglect the importance of small species (Mazzochi and Paffenhoper, 1998). Among small species Copepoda is a highly abundant, vast and diversified group of crustaceans. Over 13000 species of this group have been recognized and described (Boxshall and Halsey 2004; Boxshall and Defaye 2008), and many more are discovered each year. Copepods are also rich metazoans represented about 60-80% biomass of marine zooplanktons (Casanova *et al*., 1982). They are also a diverse group of holozooplanktons, with around 2000 species in the pelagic environment as documented (Harris *et al*., 2000; Mauchline, 1998). They are thought to be out number any other multi-cellular group of animal phyla such as insects and nematode in the terms of individuals (Hardy 1970; Verity and Smetacek., 1996). Copepoda is very ancient group diverged from other members of arthropods from388-522 million year ago (Regier, 2005).

They inhibited in all aquatic environments from man made to natural waters and dominant components of all freshwater as well as marine water resources. Copepods exists in diverse morphological body forms with smaller size adults less than <0.1mm (*e.g. Sphaeronellopsis monothrix*, ostracods parasite) to large ones

exceeds up to 23cm *(Penella balaenopterae*, whales parasite). Copepods also have diverse forms in nature start from free living to grazers and others with symbiotic relationship. More than half of copepods have symbiotic relationships with other creatures ranging from small transients to fully grown parasites. Such abundance of copepods is due to certain factors including 1. Cosmopolitan distribution, 2. Important part of marine feed webs, 3. Preservation and sampling biasness and 4. Profound growth in laboratory (Richardson, 2008).

This variety and abundance of copepods is due to colonization of these planktonic individuals in ocean water (Boxshall and Halsey, 2004). These tiny free living planktonic lifeforms acquire wide variety of aquatic habitats and can withstand harsh environmental conditions of temperature and salinity. They are the most significant component of aquatic ecosystem food chains and food webs, as well as a vital source of food for fish.They maintains the balance of phytoplankton populations and nutrients. They are crucial in transmitting energy from producers to higher tropic levels. They filter the water by feeding large number of bacterial species (Wroblewski, 1980). Some copepods are thought to be bio-indicator of masses in water (Zheng *et al*., 1992; Lan *et al*., 2004).

The important biological and economical benefits of the copepods have been thoroughly described (Huys and Boxshall, 1991) but the knowledge about the diversity of marine copepods is less and scattered in different bio-geographical regions. There is data list of 13 major marine ecosystems that have some information about the fauna of copepods (Mauchline, 1998) but rest of information about marine ecosystems is largely incomplete. There are certain factors that affect the copepods diversity patterns in marine environments including Chlorophyll a (Connell and Orias, 1964), temperature (Rutherford *et al.*, 1999), seasonal environmental variations (Begon *et al*. 1996; Rex *et al.*, 2000; Woodd-Walker *et al.*, 2002), physical and chemical properties of the ocean (Ruddiman, 1969). Diversity analysis is one of the most important aspects of any specie. Being the crucial biological parameter biodiversity is involved in determining the both environmental structure and functionality. Biodiversity assessment is the pre-requisite of any conservation project or goals. Diversity patterns with causes and consequences are important to understand the ecological and evolutionary processes (Levin, 1992).

CHINA

Chen and Liu (2016) investigated the biodiversity of pelagic copepods in the Yellow and East China Seas. They identified 250 copepod species, of which 5 orders, 70 genera and 33 families are recognized. They also noticed that variety changed with the seasons. They discovered that the distribution patterns of copepods differed significantly between the Yellow Sea and the East China Sea. The East China Sea has larger species taxonomic diversity, abundance, and evenness than the Yellow Sea, whereas the Yellow Sea had better overall taxonomic features than the East China Sea.

ARABIAN SEA

Kazmi (2004) provided the data about the diversity of copepods from Shore and offshore waters of Pakistan.All reported copepodsbelong to 61 genera containing 109

species. *Copilia mirabilis*, *Acartia hamata* , *Porcellidium viride* and *Laophonte cornuta* copepods species were recorded first time from Arabian sea. *Porcellidium viride*w as also observed as a new record of phytal specie.

Abbasi *et al*. (2017) determined the copepods diversity in coastal waters of Arabian Sea of Pakistan at day and night time. Three major groups of copepods were observed as Herpacticoid, Calanoid and Cyclopoid. Other environmental factors were also calculated viz., Water temperature, air temperature, Ph, salinity, Do and transparency. Copepods density showed positive correlation with these environmental factors. Overall study revealed highest density of copepods in coastal waters at day time that promote the growth of fish.

PALAU

Saitoh *et al*. (2011) provided the insight about the community structure and pelagic copepods diversity from the coastal areas as well as Marine lakes of the Palau.They identified the copepods from 36 texa upto genus or species levels belong to Poecilostomatoida, Calanoida, Cyclopoida and Harpacticoida. They classified the copepods into three groups based on their habitat 1. meromictic lakes, 2. holomictic lakes with shallow basin, 3.holomictic lakes with deep basins.

ARCTIC OCEAN

Errhiif *et al*. (1997) studied the variety, abundance, and community structure of marine copepods along the Indian coast of the Arctic Ocean.They observed highest copepods density between Antarctic divergence and convergence. They identified about 80 copepods species in this entire survey. Copepods large species contributed very less in this survey while small species were dominant in Antarctic and sub Antarctic regions. Antarctic convergence zone showed higher biodiversity while divergence zone was less in copepods diversity.

ATLANTIC SEA

Beaugrand *et al*. (2002) used species biogeography and association to assess the diversity of calanoid copepods from the Atlantic and adjacent oceans. They established the species associations with the help of the Multivariate analysis and indicator value method.They determined nine associations of copepods species. They proposed that by using species relationships, copepods may be utilized to study long-term changes in marine ecosystems as a result of human or climate change influence.

REFERENCES

Abbasi M.J., Abbasi Z., Khokhar F.N., Siddiqui A. 2017 . Studies on day-night distribution, composition and abundance of copepod groups in Manora waters along Karachi coast of North Arabian sea, Pakistan.2:83-88.

Beaugrand G., Ibañez F., Lindley A., Philip C. Reid. 2002 . Diversity of calanoid copepods in the NorthAtlantic and adjacent seas: species associations and biogeography.232:179–195.

Begon, M., Harper, J. L. and Townsend, C. R. 1996. individuals, populations and communities. Oxford, UK Blackwell Science Ltd.

Boxshall GA, Defaye D 2008 Global diversity of copepods Crustacea: Copepoda in fresh water. Hydrobiologia 595: 195–207.

Boxshall G., Halsey, S. 2004 . An Introduction to Copepod Diversity. The Ray Society, London, 966.

Casanova J., Casanova F., Dueret F, Rampal J. 1982 . Biomasse et composition chimique et faunistique du zooplankton du sector senegambien Campagne CINECA de la “Thalasse”, aout. Rapports et procès-verbaux des réunions / Conseil International pour l’exploration de la Mer 180: 266–269.

Chen Hj, LIU GX. 2016 . Biodiversity of Pelagic Copepod in the Yellow Sea and East China Sea. 45:1086-1093.

Connell, J. H. &Orias, E. 1964. The ecological regulation of species diversity. Am. Nat. 98:399–414.

Hardy, A. 1970.The Open Sea. The World of Plankton. London: Collins.

Harris RP, Wiebe PH, Lenz J, Skjoldal HR, Huntley M 2000 . ICES Zooplankton Methodology Manual.

Huys R, Boxshall GA 1991 . Copepod Evolution. The Ray Society, London, 468 pp.

Lan, Y. C., Shih, C., Lee, M. A., and Shieh, H. Z. 2004. Spring distribution of copepods in relation to water masses in the northern Taiwan Strait. Zoological Studies, 43: 332–343.

Mauchline J 1998 . The Biology of Calanoid Copepods. Academic Press, England, 710 pp. Levin, S. A. 1992 The problem of pattern and scale in ecology.73:1943–1967.

Mazzochi, M.G. and Paffenhoper, G.A., 1998. First observation on the biology of Clausocalanus furcatus Copepod: Calanoida . Journal of Plankton Research, 20: 331-342.

Muhammad, N., S.M.Z.u. Abideen. 2022. Diversity of fishes of head Marala, Punjab, Pakistan. Journal of Wildlife and Ecology. 6: 58-63.

Ndlovu, M., G. S. Chiyangwa, N. Eisen, and A. Chanyandura. 2023. Influence of mining on herbivore occurrence in Mufurudzi Safari Area, Zimbabwe. Journal of Wildlife and Ecology 7 3 :109-120.

Panhwar, W.A., R. Sultana, I. Khatri. 2022. An annotated checklist of praying mantises Mantodea from Pakistan-a review. Journal of Wildlife and Ecology. 6: 48-57.

Regier, J., Shultz, J., Kambic R., 2005. hexapods are terrestrial crustaceans and maxillopods are not monophyletic Proceedings of the Royal Society of London, Biological Sciences.272:395-401.

Rex, M. A. Stuart, C. T. and Coyne, G. 2000. Latitudinal gradients of species richness in the deep-sea benthos of the North Atlantic. 97: 4082–4085.

Richardson, A. J. 2008 . In hot water: zooplankton and climate change. 65: 279-295

Ruddiman, W. F. 1969. Recent planktonic foraminifera: dominance and diversity in North Atlantic surface sediments. Science 164: 1164–1167.