GESA
GLOCAL ENVIRONMENT & SOCIAL ASSOCIATION

International Journal of Biological Innovations
http: //ijbi.org.in | http://www.gesa.org.in/journals.php
https://doi.org/10.46505/IJBI.2023.5107
IJBI 5(1): 91-102 **(2023)**
E-ISSN: 2582-1032

STATUS OF PLANKTON AND BENTHOS IN THE AQUACULTURE FIELD OF BANGLADESH

Binay Kumar Chakraborty

Mud eel, Mud crab, Aquaculture and Management Centre
Department of Fisheries, Bangladesh
Bangladesh Agricultural University, Mymensingh, Bangladesh

**Corresponding author:* bborty@gmail.com

Article Info:
Research Article
Received
20.12.2022
Reviewed
28.02.2023
Accepted
31.03.2023

Abstract: Phytoplankton is a key food item in both aquaculture and mariculture. Phytoplankton is utilized as food for the animals in aquaculture directly. The plankton are collected from a body of water or cultured. Phytoplankton is used as a food stock for the production of rotifers and also used to feed molluscs, pearl oysters and giant clams. Plankton is divided into two groups belonging to phytoplankton and zooplankton. Phytoplankton has chlorophyll to capture sunlight, and they use photosynthesis to turn it into chemical energy. Zooplankton is a small floating or weakly swimming organism. Zooplankton moves vertically in the water column each day, feeding on the phytoplankton, small floating plants such as algae. Zooplankton serves as an intermediary species in the food chain, transferring energy from planktonic algae to the larger invertebrate predators and fish. Benthos is the community of organisms that live on, in, or near the seabed, river, lake or stream bottom, also known as the benthic zone. This community lives in or near marine or freshwater sedimentary environment, from tidal pools along the foreshore, out to the continental, and then down to the abyssal depths.

Keywords: Benthos, Compound microscope, Phytoplankton, Plankton, Zooplankton.

Cite this article as: Chakraborty B.K. (2023). Status of Plankton and Benthos in the Aquaculture field of Bangladesh. *International Journal of Biological Innovations*. 5(1): 91-102. https://doi.org/10.46505/IJBI.2023.5107.

INTRODUCTION

The word 'plankton' comes from the Greek for 'drifter' or 'wanderer.' An organism is considered plankton if it is carried by tides and currents, and cannot swim well enough to move against these forces. Some plankton drifts this way for their entire life cycle. Others are only classified as plankton when they are young, but they eventually grow large enough to swim against the currents. Plankton is usually microscopic, often less than one inch in length, but they also include larger species like some crustaceans and jellyfish. Phytoplankton is a key food item in both aquaculture and mariculture. Phytoplankton is utilized as food for the animals (Verma *et al.*, 2016a). In mariculture, the phytoplankton is naturally occurring and is introduced into enclosures with the normal circulation of seawater. In aquaculture, phytoplankton must be obtained and introduced directly. The plankton can either be collected from a body of water or cultured, though the former method is seldom

used. Phytoplankton is used as a food stock for the production of rotifers (McVey *at al.*, 1993), which are in turn used to feed other organisms. Phytoplankton is also used to feed molluscs, pearl oysters and giant clams (Verma *et al.,* 2016b). The planktons are the aquatic resources (Chakraborty *et al.,* 2021).

Scientists classify plankton in several ways, including by size, type, and how long they spend drifting. But the most basic categories divide plankton into two groups: phytoplankton (plants) and zooplankton (animals). They show diversity as well as seasonal variation (Prakash *et al.,* 2015; Verma and Prakash, 2020). In the present exploration, the author tried to study the status of Plankton and Benthos in the Aquaculture field of Bangladesh.

MATERIALS AND METHODS

A plankton net (made of very fine mesh) was used to collect plankton. A plankton net drag to allow water to pass through but plankton cannot pass through. Phytoplankton and zooplankton are two types of planktons, found in water. Plankton samples collected and preserved it in a 3 - 5% formalin solution. Author used an eye dropper to collect a few drops of the sample and placed in a petri dish. A slide of the sample was prepared and observed it under a compound microscope with low and high power objectives. A drop of water put under a microscope to examine and identify plankton and its shape, color, and swimming ability. At last data of specimens was prepared and the specimens were identified using the Plankton Identification Chart.

RESULTS AND DISCUSSION

Phytoplankton

Phytoplanktons are the autotrophic (self-feeding) components of the plankton community and a key part of ocean and freshwater ecosystems. The name comes from the Greek words φυτόν (*phyton*), meaning 'plant' and πλαγκτός (*planktos*), meaning 'wanderer' or 'drifter' (Pierella *et al.,* 2020). Phytoplankton is microscopic organisms that live in watery environments, both saline and fresh water. Phytoplankton has chlorophyll to capture sunlight, and they use photosynthesis to turn it into chemical energy. They are food for other plankton and small fish, as well as larger animals such as whales. Phytoplankton gets their energy from carbon dioxide through photosynthesis (like plants) and so is very important in carbon cycling.

Role of phytoplankton

In the diagram on the right, the compartments influenced by phytoplankton include the atmospheric gas composition, inorganic nutrients, and trace element fluxes as well as the transfer and cycling of organic matter via biological processes (Fig. 1 and Table 1). The photo-synthetically fixed carbon is rapidly recycled and reused in the surface ocean, while a certain fraction of this biomass is exported as sinking particles to the deep ocean, where it is subject to ongoing transformation processes, e.g., remineralization (Heinrichs *et al.,* 2020).

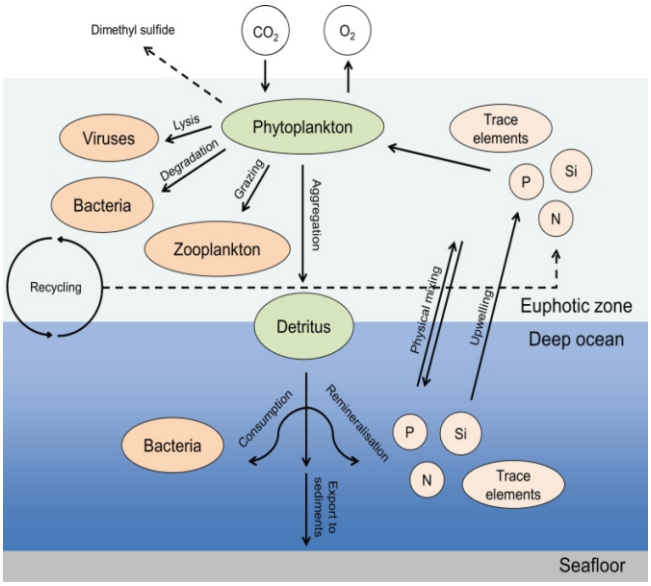
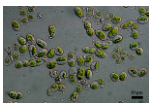
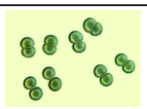
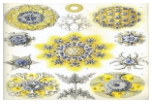
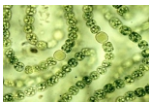
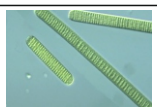
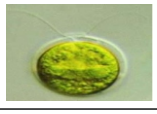
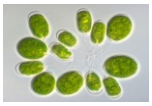
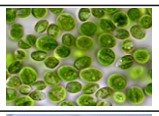
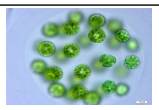
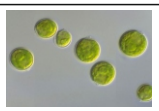
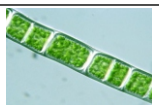
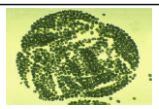
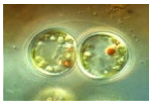
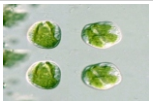
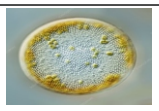
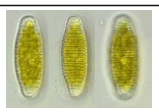
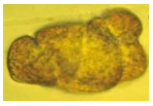
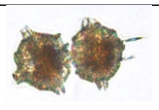
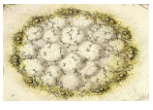


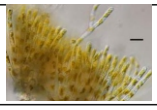
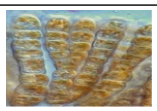
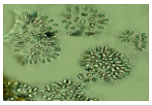
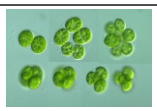
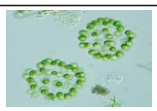
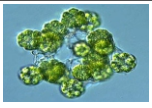
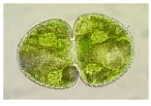
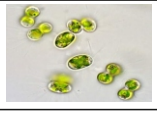
Fig.1: Role of phytoplankton on various compartments of the marine environment (Heinrichs *et al.,* 2020).

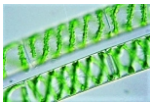
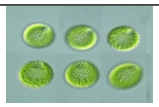
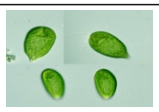
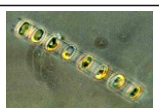
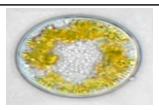
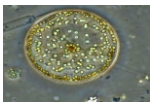
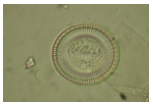
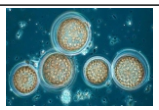
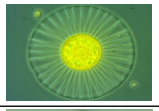
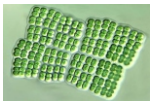
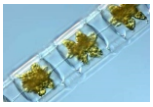
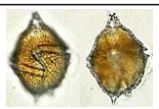
The taxonomic identification from single-specimen images has experimented a remarkable research interest in many recent works, and achieved satisfactory results on several identification targets. In this sense, some works have focused on the phytoplankton identification at the genus level (Lai *et al.,* 2016; Zheng *et al.,* 2017), while others are focused on the accurate identification of a limited set of target species (Dunker *et al.,* 2018; González *et al.,* 2019).

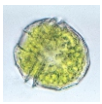
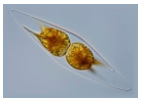
Table 1: A common list of important Phytoplankton.

S. No.	Family	Scientific name	Figure	Habitat
1.	Chroococcaceae	*Anacytis* sp.		Freshwater and marine
2.	Chroococcaceae	*Chroococcus* sp.		Freshwater
3.	Collosphaeridae	*Sphaerozoum* sp.		Freshwater
4.	Nostocaceae	*Anabaena* sp.		Freshwater
5.	Nostocaceae	*Nostoc* sp.		Fresh- and coastal
6.	Gloeotrichiaceae	*Gloeotrichia* sp.		Freshwater
7.	Hydrodictyaceae	*Pediastrum* sp.		Freshwater
8.	Oscillatoriaceae	*Oscillatoria* sp.		Freshwater and marine
9.	Euglenaceae	*Euglena* sp.		Freshwater and coastal
10.	Euglenaceae	*Trachelomonas* sp.		Freshwater
11.	Tabellariaceae	*Diatoma* sp.		Freshwater
12.	Phacaceae	*Phacus* sp.		Freshwater
13.	Volvocaceae	*Volvox* sp.		Freshwater
12.	Chlamydomonadaceae	*Chlamydomonas* sp.		Freshwater
14.	Chlamydomonadaceae	*Carteria* sp.		Freshwater and marine
15.	Radiococcaceae	*Gloeocystis* sp.		Freshwater

16.	Sphaerocystidaceae	*Sphaerocystis* sp.		Freshwater
17.	Scenedesmaceae	*Coelastrum* sp.		Freshwater
18.	Chlorellaceae	*Chlorella* sp.		Freshwater
19.	Volvocaceae	*Eudorina* sp.		Freshwater
20.	Chlamydomonadaceae	*Carteria* sp.		Freshwater
21.	Microsporaceae	*Microspora* sp.		Freshwater
22.	Microcystaceae	*Microcystis* sp.		Freshwater
23.	Eustigmatales	*Chlorobotrys* sp.		Freshwater
24.	Chromulinaceae	*Chromulina* sp.		Brackish and marine
25.	Coscinodiscaceae	*Coscinodiscus* sp.		Freshwater
26.	Fragilariaceae	*Diatoma* sp.		Freshwater and marine
27.	Gymnodiniaceae	*Gymnodinium* sp.		Freshwater and brackish water
28.	Gonyaulacea	*Pyrodinium* sp.		Marine sp
29.	Ceratiaceae	*Ceratium* sp.		Freshwater and marine
30.	Pantanelliidae	*Xiphosphaera* sp.		Marine
31.	Collosphaeridae	*Sphaerozoum* sp.		Marine

32.	Stypocaulaceae	*Halopteris* sp.		Marine
33.	Goniodomataceae	*Bodanella* sp.		Freshwater
34.	Ectocarpaceae	*Ectocarpus* sp.		Marine
35.	Lithodermataceae	*Heribaudiella* sp.		Freshwater
36.	Cutleriaceae	*Cutleria* sp.		Marine
37.	Coelosphaeriaceae	*Coelosphaerium* sp.		Marine
32.	Staphylinidae	*Acrothrix* sp.		Marine
38.	Bangiaceae	*Bangia* sp.		Freshwater and marine
39.	Lemaneaceae	*Lemanea* sp.		Freshwater
40.	Oocystaceae	*Oocystis* sp.		Freshwater
41.	Chlorellaceae	*Dictyosphaerium* sp.		Freshwater
42.	Scenedesmaceae	*Coelastrum* sp.		Freshwater
43.	Desmidiaceae	*Staurastrum* sp.		Freshwater
44.	Desmidiaceae	*Cosmarium* sp.		Freshwater
45.	Desmidiaceae	*Cosmocladium* sp.		Freshwater
46.	Euglenaceae	*Trachelomonas* sp.		Freshwater

47.	Zygnemataceae	*Spirogyra* sp.		Freshwater
48.	Vacuolariaceae	*Vacuolaria* sp.		Marine
49.	Vacuolariaceae	*Gonyostomum* sp.		Freshwater
50.	Melosiraceae	*Melosira* sp.		Freshwater
51.	Skeletonemataceae	*Skeletonema* sp.		Marine and coastal
52.	Stephanodiscaceae	*Cyclotella* sp.		Marine and fresh water
53.	Thallassiosiraceae	*Porosira* sp.		Freshwater, brackish and marine
54.	Thalassiosiraceae	*Thalassiosira* sp.		Freshwater, brackish and marine
55.	Spirulinaceae	*Spirulina* sp.		Fresh, Brackish and Marine water
56.	Stephanodiscaceae	*Cyclotella* sp.		Freshwater, brackish and marine
57.	Coscinodiscaceae	*Coscinodiscus* sp.		Marine and brackish water
58.	Thalassiosiraceae	*Planktoniella* sp.		Marine and brackish water
59.	Asterolampraceae	*Asterolampra* sp.		Marine
60.	Merismopediaceae	*Merismopedia* sp.		Marine and fresh water
61.	Lithodesmiaceae	*Lithodesmium* sp.		Marine and freshwater
62.	Gonyaulacaceae	*Gonyaulax* sp.		Marine and freshwater

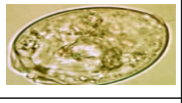
63.	Peridiniaceae	*Peridinium* sp.		Marine and freshwater
64.	Dinophysiaceae	*Dinophysis* sp.		Marine and brackish water
65.	Pyrocystaceae	*Pyrocystis* sp.		Marine
66.	Gymnodiniaceae	*Gymnodinium* sp.		Marine and brackish water
67.	Noctilucaceae	*Noctiluca* sp.		Marine
68.	Dictyochaceae	*Dictyocha* sp.		Marine

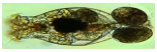
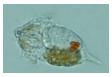
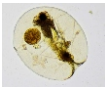
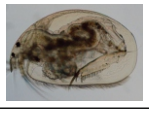
Zooplankton

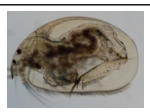
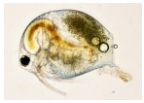
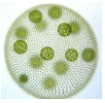
Zooplanktons are heterotrophic (sometimes detritivorous) plankton (cf. phytoplankton). Plankton is organisms drifting in oceans, seas, and bodies of freshwater. The word *zooplankton* is derived from the Greek *zoon* (ζῷον), meaning 'animal', and *planktos* (πλαγκτός), meaning 'wanderer' or 'drifter' (Thurman, 1997). Individual zooplanktons are usually microscopic, but some (such as jellyfish) are larger and visible to the naked eye. Zooplankton, small floating or weakly swimming organisms that drift with water currents and, with phytoplankton, make up the planktonic food supply upon which almost all oceanic organisms are ultimately dependent.

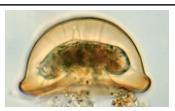
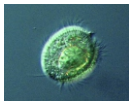
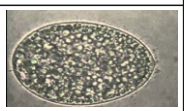
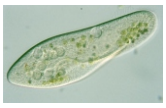
Zooplankton moves vertically in the water column regularly, feeding on the phytoplankton, small floating plants such as algae, near the surface of the water. Zooplankton has adapted various mechanisms to float in the water column and protect them from predation. Some, such as larval crustaceans, have spikes that protect them and allow more surface area for better flotation. The zooplankton community is an important element of the aquatic food chain. These organisms serve as an intermediary species in the food chain, transferring energy from planktonic algae (primary producers) to the larger invertebrate predators and fish who in turn feed on them (Table 2).

Table 2: A common list of important Fresh water, brackish water and marine water zooplankton.

S. No.	Types	Family	Scientific name	Figure	Status
1.	Rotifer	Collothecidae	*Collotheca* sp.		Freshwater
2.	Rotifer	Trochosphaeridae	*Filinia* sp.		Freshwater (Pennak, 1978)
3.	Rotifer	Gastropodidae	*Ascomorpha* sp.		Freshwater
4.	Rotifer	Chydoridae	*Chydorus* sp.		Freshwater

5.	Rotifer	Brachionidae	*Brachionus* sp.		Freshwater and brackish water
6.	Rotifer	Brachionidae	*Platyias* sp.		Freshwater occasionally brackish and marine water
7.	Rotifer	Lecanidae	*Monostyla* sp.		Freshwater
8.	Rotifer	Brachionidae	*Keratella* sp.		Marine, brackish and freshwater
9.	Rotifer	Synchaetidae	*Synchaeta* sp.		Marine sp.
10.	Rotifer	Asplanchnidae	*Asplanchna* sp.		Freshwater
11.	Rotifer	Brachionidae	*Anuraeopsis* sp.		Freshwater
12.	Rotifer	Synchaetidae	*Polyarthra* sp.		Freshwater
13.	Rotifer	Testudinellidae	*Testudinella* sp.		Marine and freshwater
14.	Cladoceran	Polyphemidae (Baird, 1845)	*Polyphemus* sp.		Freshwater
15.	Cladoceran	Leptodoridae	*Leptodora* sp.		Freshwater
16.	Cladoceran	Sididae	*Diaphanosoma* sp.		Freshwater
17.	Cladoceran	Silvanidae	*Camptocerus* sp.		Data deficient
18.	Cladoceran	Chydoridae	*Alona* sp.		Freshwater
19.	Cladoceran	Chydoridae	*Oxyurella* sp.		Freshwater
20.	Cladoceran	Sididae	*Diaphanosoma* sp.		Freshwater

21.	Cladoceran	Chydoridae	*Alona* sp.		Freshwater
22.	Cladoceran	Chydoridae	*Oxyurella* sp.		Freshwater
23.	Cladoceran	Daphniidae	*Daphnia* sp.		Freshwater
24.	Cladoceran	Moinidae	*Moina* sp.		Freshwater
25.	Cladocerans	Bosminidae	*Bosmina* sp.		Freshwater
26.	Copepoda	Diaptomidae	*Diaptomus* sp.		Freshwater
27.	Copepoda	Diaptomidae	*Allodiaptomus* sp.		Freshwater
28.	Copepoda	Diaptomidae	*Heliodiaptomus* sp.		Freshwater
29.	Copepoda	Diaptomidae	*Phyllodiaptomus* sp.		Freshwater
30.	Copepoda	Diaptomidae	*Paradiaptomus* sp.		Freshwater
31.	Copepoda	Diaptomidae	*Spicodiaptomus* sp.		Freshwater
32.	Copepoda	Diaptomidae	*Rhinediaptomus* sp.		Freshwater
33.	Copepoda	Diaptomidae	*Neodiaptomus* sp.		Freshwater
34.	Copepoda	Cyclopidae	*Cyclops* sp.		Freshwater
35.	Copepoda	Cyclopidae	*Mesocyclops* sp.		Freshwater
36.	Protozoa	Goniaceae	*Gonium* sp.		Freshwater
37.	Protozoa	Volvocaceae	*Volvox* sp.		Freshwater

38.	Protozoa	Euglenaceae	*Euglena* sp.		Fresh and brackish water
39.	Rizopoda	Arcellidae	*Arcella* sp.		Freshwater
40.	Rizopoda	Ciliata	*Urotricha* sp.		Freshwater
41.	Rizopoda	Frontoniidae	*Frontonia* sp.		Marine and freshwater
42.	Rizopoda	Holophryidae	*Holophrya* sp.		Freshwater
43.	Rizopoda	Parameciidae	*Paramecium* sp.		Freshwater

Benthos

Benthos, also known as benthon, from Greek *benthos* 'depth of the sea', is the community of organisms that live on, in, or near the seabed, river, lake or stream bottom, also known as the benthic zone. This community lives in or near marine or freshwater sedimentary environments, from tidal pools along the foreshore, out to the continental, and then down to the abyssal depths. Because light is absorbed before it can reach deep ocean-water, the energy source for deep benthic ecosystems is often organic matter from higher up in the water column that drifts down to the depths. This dead and decaying matter sustains the benthic food chain; most organisms in the benthic zone are scavengers or detritivores.

The term *benthos*, coined by Hackel in 1891, comes from the Greek noun βένθος 'depth of the sea'. *Benthos* is used in freshwater biology to refer to organisms at the bottom of freshwater bodies of water, such as lakes, rivers, and streams. There is also a redundant synonym, benthon (Nehring and Albrecht, 1997). A common list of important Banthos is given below in table 3.

Table 3: A common list of important Benthos.

S. No.	Order	Family	Scientific name	Figure	Status
1.	Benthos	Naididae	*Tubifex* sp.		Freshwater
2.	Benthos	Chironomidae	*Chironomus* sp.		Freshwater
3.	Benthos	Simuliidae	*Simulium* sp. (Latreille, 1802)		-
4.	Benthos	Corixidae	*Corixa* sp.		Freshwater
5.	Benthos	Sialidae	*Sialis* sp.		Freshwater

6.	Benthos	Asellidae	*Asellus* sp.		Freshwater
7.	Benthos	Lymnaeidae	*Lymnaea* sp.		Freshwater
8.	Benthos	Sphaeriidae	*Sphaerium* sp.		Freshwater
9.	Benthos	Glossiphoniidae	*Helobdella* sp.		Freshwater
10.	Benthos	Erpobdellidae	*Erpobdella* sp. (Blainville, 1818)		Freshwater
11.	Benthos	Chaoboridae	*Chaoborus* sp.		Freshwater
12.	Benthos	Ampullariidae	*Pila* sp.		Freshwater
13.	Benthos	Unionidae	*Marginallis* sp.		Freshwater

Phytoplankton is important because natural food organisms supplement manufactured feed. This is particularly important for small post larval crustaceans and fingerling fish soon after stocking. Phytoplankton is an important source of dissolved oxygen for aquatic lives.

CONCLUSION

Phytoplankton increases the dissolved oxygen in the pond water and reduces toxic gases like ammonia, nitrate, hydrogen sulfide, methane, carbon-dioxide, etc. It maintains the quality of pond water and reduces the amount of toxic substances. Plankton is used as a natural food for fish. Plankton provides fish shade to protect fish from sunlight and reduces cannibalism. It helps to reduce the population of pathogens and microorganisms by competing for the nutrients available in the water. So, phytoplankton plays an important role in stabilizing the ecosystem of the pond or water bodies and keeping the water quality at the bearable level.

ACKNOWLEDGMENT

The author gratefully acknowledges to the Department of Fisheries, Bangladesh to collect the sample from different places of the country.

REFERENCES

1. **Chakraborty B.K., Verma A.K. and Muniya S.** (2021). Present Status of Aquatic Resource and Its Catch of Mogra River in Bangladesh. *Sustainable Marine Structures.* 3 (2): 26-38. http://dx.doi.org/10.36956/sms.v3i2.436
2. **Dunker S., Boho D., Wäldchen J. and Mäder P.** (2018). Combining high-throughput imaging flow cytometry and deep learning for efficient species and life-cycle stage identification of phytoplankton. *BMC Ecol.* 18:51. 10.1186/s12898-018-0209-5.
3. **González P., Castaño A., Peacock E.E., Díez J., Del Coz J.J. and Sosik H.M.** (2019). Automatic plankton quantification using deep features. *J. Plankton Res.* 41:449-463. 10.1093/plankt/fbz023.
4. **Haeckel E.** (1891). Plankton-Studien. Jenaische Zeitschrift für Naturwissenschaft 25 / (Neue Folge) 18: 232-336. BHL.
5. **Heinrichs M.E., Mori C. and Leon D.** (2020). Complex Interactions Between Aquatic Organisms and Their Chemical Environment Elucidated from Different Perspectives.

YOUMARES 9-the Oceans: Our Research, Our Future. pp. 279-297. 10.1007/978-3-030-20389-4_15.

6. **Lai Q.T.K., Lee K.C.M., Tang A.H.L., Wong K.K.Y., So H.K.H. and Tsia K.K.** (2016). High-throughput time-stretch imaging flow cytometry for multi-class classification of phytoplankton. *Opt. Express.* 24:28170-28184. 10.1364/OE.24.028170.
7. **McVey J.P., Nai-Hsien C. and Cheng-Sheng L.** (1993). CRC Handbook of Mariculture Vol. 1: Crustacean Aquaculture. New York: CRC Press LLC, 1993.
8. **Nehring S. and Albrecht U.** (1997). Benthos und das redundante Benthon: Neologismen in der deutschsprachigen Limnologie. *Lauterbornia*. 31: 17-30.
9. **Prakash S., Verma A.K. and Prakash S.** (2015). Seasonal variation of zooplankton and zoobenthos population in Alwara lake of District Kaushambi (UP) India. *The Journal of Zoology Studies*. 2(5):13-16.
10. **Thurman H.V.** (1997). Introductory Oceanography. Upper Saddle River, NJ, USA: Prentice Hall.
11. **Pierella Karlusich, Juan José, Ibarbalz, Federico M. and Bowler Chris** (2020). Phytoplankton in the *Tara* Ocean. *Annual Review of Marine Science*. 12 (1): 233-265. 10.1146/annurev-marine-010419-010706.
12. **Verma A.K. and Prakash S.** (2020). Zooplankton Diversity in Guthia Taal, Wetland of Bahraich (U. P.), India. *International Journal of Zoology and Research.* 10 (2): 09-18. 10.24247/ijzrdec20202.
13. **Verma A.K., Prakash S. and Mishra B.K.** (2016a). Phytoplankton diversity in Alwara lake of district Kaushambi (U.P.). *Journal of Entomology and Zoology Studies*. 4(1): 170-172.
14. **Verma A.K., Kumar S. and Prakash S.** (2016b). Seasonal Correlation between physico-chemical factors and phytoplankton density in Alwara taal of Kaushambi, U. P., India. *International Research Journal of Biological Sciences.* 5(3): 40-45.
15. **Zheng H., Wang R., Yu Z., Wang N., Gu Z. and Zheng B.** (2017). Automatic plankton image classification combining multiple view features via multiple kernel learning. *BMC Bioinform*:18. 10.1186/s12859-017-1954-8.