Review on Macrozoobenthos as Indicator Species in Evaluation of pollution Level of Riverine System

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Abstract:

Most of the riverine systems are influenced by human activity, resulting into heavy load of pollutants. Aquatic biodiversity of flora and fauna disturb with change in physico-chemical parameter of water are observed.Water bodies are the habitat of benthic ,aquatic, and terrestrial organism out of these macrobenthos have sedentary lifestyle and pollutants are accumulated in benthic substrate which exert more pressure on community of macrozoobenthos ,thus depend upon quality of water different diversity of macrozoobenthos are observed in different riverine system.In this review paper study , it is observed that some taxa survive with high dissolved oxygen- Insecta(Ephemeroptera, Plecoptera, Trichoptera) and crustacea , some taxas are survive with moderate amount of dissolved oxygen-Insecta,crustacea,mollusca, platyhelminthes.   And some of them survive in very poor amounts of dissolved oxygen are annelida,mollusca, and insect. this study shows that different taxa reside in different habitat. which help to evaluate the level of pollution and health of the riverine system.

Introduction

In India and throughout the world most of the riverine water systems are heavily loaded with pollutants. These pollutants are introduced by humans, performing different activities that interfere with the habitat of aquatic flora and fauna which results in biological problems.

Aquatic flora and fauna consist of benthic, aquatic, and terrestrial habitat. Benthic habitat occupied by the macrozoobenthos. Pollution added in water gets settled down at bottom; it influence the macrozoobenthos diversity. Among all biotic community benthic fauna shows variations in the diversity according to change in the physic-chemical change in water due to pollutants(M.D.Mahdi 2018).As pollution affects the

biodiversity of aquatic community and species composition changes from natural species to tolerant species (Mengzhen xu 2013). In recent studies it is observed that when pristine river changes toward the polluted river diversity of benthic organisms changes from sensitive taxa to resistant taxa (Lallebialla tampo et al 2021). Pollution indication of water also depend on DO(dissolve Oxygen) concentration in water,ie clean water: sensitive species(Water spiders, Scuds,Stoneflies, Alderflies,Mayflies, Caddisflies) slightly polluted water: some what tolerant species (Craneflies, aquatic sowbug,Crayfish,Dragonflies,Turbllaria), moderately polluted water: tolerant species (Midges,Black fillies, Leeches, aquatic worms, Sow bugs) and highly polluted water: Extremely tolerant species (aquatic Worm,Tubifex worm,Leeches ,snail Chironomid Larvae,Pulmonate)   these observations given by Ruchita Haldar et al (2016)

This review literature elaborates the knowledge of macrozoobenthos with respect to quality of water. It helps for better understanding of the health of the riverine system in India.

Review of literature

Sr.No.	Year	Author	Topics of Research	Results
1	2003	Sobhana Paul & N .C .Nandi	Studies on intertidal macro zoobenthoes of Hugli river in and around Calcutta in relation to water and soil condition.(Zoological survey of India)	Observe the pollution status of Hugli river by correlation analysis of physico-chemical parameter with benthic fauna, by PEARSON'S correlation coefficient, major groups are Polychaeta, Oligochaeta, Crustacean, and Gastropodas.Total 44 species recorded.
2	2006	A .Beauger & et al	Distribution of macro invertebrates assemblages in reach of River Allier(France),In relation to river bed characteristics.	The Macro invertebrates assemblages were discriminated by substrate, velocity & depth .Habitat exploitation appeared complex.
3	2010	A.W.Chavan and A.A.Dhamani	Diversity of Benthic Macro invertebrates in wainganga river near	29 species of macro invertebrates identified among Gastropoda are dominant

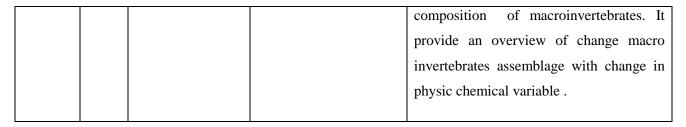|				Bramhapuri, dist Chandrapur(M.S.)	(11sp.) Insects (6 sp.), Pelecypoda(5sp.) Annelida (5sp.) Nematoda(2sp.)
4	2012	Vipin Vyas & et al	Distribution of Macrozoobenthos in River Narmada near water Intake point.		Total 35 taxa, belongs to11 sp. Mollusca,2Annilida, 22 Arthropoda. Loss of macrozoobenthic distribution due to construction of water intake point which cause habitat alteration.
5	2013	Sudhir Bhandarkar & et al	A Study on species diversity of benthic macro invertebrates in fresh water lotic system in Gadchiroli district Maharashtra.		By using Shannon-Weiner index value and Morgef diversity index pollution status of river studied Shannon Weiner index value 1.2 to2.9 in studied ecosystem shows moderate pollution Morgef index value0.5067to 3.7934 site 1 shows healthy body and higher species diversity value. 0.7721 to 1.9067showes poor species diversity and nutrient material.
6	2013	Mengzhen xu et al	Effect of pollution on macro invertebrates and water quality bioassesement.		Pollution affects the biodiversity of aquatic community and the species composition changes from natural species to tolerant species.
7	2014	S.G.Gedekar & et al	Study of macro invertebrates as a biological indicator of pollution in river Wainganga at markhandadeo village tah.chamorshi Dist.Gadchiroli.		24 species recorded from 3 phyla viz.Annilida (3 sp.), Arthropoda (12 sp.)and Mollusca(9sp.).Chironomus larvae, limnodrillus sp. And Lymnaea sp.in aboundance indicates pollution status.

8	2014	Julious D.Elias et al	Study on Freshwater macro invertebrates of some Tanzanian River as aBasis for developing biomonitorin Index for assessing pollution in tropical African Region.	In Kalimanjaro region Tanzania 15 sites of 5 river studied High no. of taxa in order Ephemeroptera 8sp. Odonata 8sp. Dipteral 7 sp. And Trichoptera 6 sp. With greater diversity f macro invertebrates families offer a wide range of tolerance to pollution.
9	2015	M.I. Thokar et al	Macro zoobenthos community pattern and diversity in relation to water quality status of stream Rambiara.	This study shows that tempreture ,water, velocity,turbidity ,dissolve oxygen and nature of bottom substratum play major role in determining the macro invertebrates diversity.
10	2016	Denes Schmera et al	Functional diversity :A review of methodology and current knowledge in fresh water macro invertebrates research.	Most paper quantified functional diversity using biological trait, among feeding habit most common trait due to link between feeding and ecosystem function. Most studies shows strong impact of environmental factors as well s human impact on functional diversity.
11	2016	Golwalkar et al	Diversity of benthic macro invertebrates in four tributaries of river Narmada in the central zone India.	In stastical procedure value of **Shanon-Wieners diversity index** 1.12 minimum and 2.10 maximum value observed. It shows all sites are under moderate pollution. **Pielou`s eveness index value** ranged from 0.67 to 0.96 shows eqitabity in the apportionment of individual among the species at all station . **Margalef`s Diversity index value** 0.94 minimum and 3.58 maximum

				Large index value shows healthy water body and 1.0 shows increased pollution damage should be suspected.
12	2016	Ruchita Haldar et al	Significance of macro invertebrates as an indicator of environmental pollution	Indication of pollution by macroinvertebrates is classified as. **Clean water** . Placoptera, Mgaloptera, Diptera, Argyroneta aquation, Ephemeroptera, Trichoptera **Moderate polluted water** Insecta, Crustacea, Mollusca, Platyhelminthes **Fairly polluted water** Midges(dipteral – chironomidae) Mollusca- snail ,annelid- leech. **Sevearely polluted water** Annelida ,oligocheata leech ,snail
13	2017	Ankit kumar et al	Diversity of macrozoobenthos in Dudhi river – a Tributary of river Narmada in central zone india.	26 taxa are recorded ,arthropods(77%) are dominant than mollusca(23%) Shanon`s diversity index found between 1.53 to2.28 indicates alterartion in habitat structure.
14	2018	James abah et al	Assesment of Zambezi River water quality using macro invertebrates population diversity	Assessment of micro invertebrates based on pollution tolerance sensitive scale reveled 54.84% highly tolerance ,40.32%moderately tolerance,4.84% very low tolerance to pollution categories.
15	2018	M.D.Mahadi et al	Macrobenthos as Indicator of pollution in river Jhelum of Kashamir Himalayas.	River shows appreciable change in chemical parameter as it recived heavy load of nutrients from catchment area . In response to change Annilida,Mollusca,and

				Diptera with representative species of Tubifex,Limnodrillus ,Erpobdela, Corbicula,Chironomous larva are consider to be bio indicator of pollution.
16	2018	Ishita Ganguly et al	Macro invertebrates &its impact in assessing water quality of rivreine system: a case study of Mahanadi river,Cuttack,India.	A total 484 taxa were identified 244 Taxa bivalves, 184 taxas gastropods.presence of high no. of pollution tolerant taxa and pollution sensitive taxa(Ephemeroptera, Plecoptera,Trichoptera, and Chironomidae)indicates risk of water pollution.
17	2021	Dilipkumar Yadav et al	Population dynamic of macrozoobenthos of Chittaura Jhee, wet land of Bahraich district UP.India.	Present study28 genera of macrozoobenthos were recorded out of annelida 9 sp., Arthropoda 9 sp., Mollusca 10 sp. Annelida are dominant sp.fallowed by Mollusca,arthopodes.Benthic population constituted of Tubifex sp. Fallowed by gammarus sp.,pila,branchioura,lumbricuius sp.and chironomus sp.
18	2021	Lallebilla tampo et al	Benthic macroinvertebrates as ecological Indicator :Their sensitivity to the water quality and human disturbances in a tropical river.	21 water quality parameter and macroinvertebrates data collected among three groups **Sensitive taxa:** Ephemeroptera, plecoptera, Tricoptera, & odonata taxa. **Resistance taxa:** Oligochaeta, Hirudinea, Dipera, and Pulmonate taxa. **Tolerent taxa:**

					Prosobranchia, Bivolvia, Lepidoptera, Heteroptera, Coleoptera.
19	2022	Shreya Roy et al	Macrobenthic pollution bio indicator for ecological monitoring in riverine ecosystem.		In this study 4 major eco-physico-chemical parameter correlated to entire stretch of Ganga River are – Total Nitrogen, Total phosphate , Total chlorophyll and soil organic carbon. 69 species recorded from river Ganga out of 13 species belongs to Mollusca and Arthropoda ,Annelida observed to be influence by pollution indicating parameter.Strong – ve correlation of Mekongia crassa with total phosphate indicates as an essential aquatic riverine indicator species.
20	2022	Augustine ovie Edegbene et al.	Identified and classifying sites and Maroinvertebrates taxa in to pollution categories in an afrotrophic riverine system : A mulltivarieate approach.		In River Ringim Nigeria 12 taxa are studied from 4 sites and 9 taxa categories as highly vulnerable to pollution are- Notonectidae, Leuctridae, Tacniopterygidae, Unionidae, Leptophlebiidae and Atyidae. This study also gives classification based on vulnerability and resistance level in study area.
21	2022	Abhilasha Bhawsar	Correlation between macro invertebrates and physic-chemical parameter in the Narmada River		This study based on correlation matrix showed that in any aquatic ecosystem physic-chemical parameter of water , land use factor as tempreture, food resources play an important role in determining the richness ,distribution and species

				composition of macroinvertebrates. It provide an overview of change macro invertebrates assemblage with change in physic chemical variable .

Conclusion :

On the basis of the review study, it is informed that various research work was conducted on macrozoobenthos as a pollution indicator. the health of the riverine system is going to diminish. The statement proved its trueness on the basis of observation of physico-chemical parameter values beyond the range and its variation, macrozoobenthic diversity and availability of pollution indicator species.

Benthos show their availability as sensitive taxa (with high DO) to resistance taxa (moderate DO) and tolerant taxa (poorly DO)

Insect and crustaceans are observed as sensitive taxa. Molluscs are resistant taxa, annelids are tolerant taxa. This review study showed that, tubifex, Limnodrilus, Carbicula, Chironomus larva, monodia messa,lymnaea sp., Hirudinaria are considered as pollution indicator species these help to analyzed pollution status of riverine system

This Review study will help to know the interrelationship among biological and physico-chemical parameters which will result in calculating the trophic status and helps to take preventive measures to sustain life of the river. .

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