

Physico-chemical Properties of Water and Fish Diversity

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ABSTRACT

Water first-rate is vital for a hit aquaculture improvement. Anthropogenic sports mostly because of commercial and agricultural sports are the important sources of water pollutants in an aquatic environment. Interaction of numerous physical and chemical parameters of water are attributed to the distribution, composition and abundance of aquatic organisms and their dating with abiotic issue of the water surroundings. Fish popular nicely-being is undoubtedly correlated with water nice and longtime exposure of fish to water pollutants may additionally intrude with normal boom and replica and now and again cause the useless of fish. Routine measurement of the important water physicochemical residences is highly wanted for the overall welfare of fish and for the boom of aquaculture enterprise.

Figure : 00

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Introduction

Water is appeared as a customary and the most vital solvent to the existence of all living organisms including man. It is a crucial natural aid required for human agreement styles, agricultural in addition to business sports. Unfortunately in wealth-producing activities, water turns into a sink for dumping of waste materials which deteriorates its favored functions. Small and medium scale industries and agricultural sports contributed a lot to wastes generation and disposal in aquatic surroundings. Interactions of bodily and chemical properties of water contributed to the composition, distribution and abundance of aquatic organisms, it offers a perception in to the connection between organisms and their environment and can be used to decide water pleasant and productivity of the water frame. Physicochemical attributes of water could assist in coming across the layout and characteristic of water environment to its living organisms. Availability of sure chemical factors in water might also end result to an effect to biotic component of the water⁴.

Appropriate equilibrium of bodily, chemical properly as biological additives of a water frame is a vital requirement for a success fish production and consequently occurrence or absence of a given detail in an aquatic habitat may be a determining aspect inside

the popular productiveness of that water body, it is able to determine the class of dwelling organisms that might be presence inside the water body. Reported that high quantity of silica in a water favours high diatoms population, while excessive species diversity of snails is probably associated with availability of calcium in the said water frame⁴. Water with high best is needed to the complete life of fish as it provides the essential requirement for the welfare of fish together with reproduction, respiration, feeding and increase. Stable water fine is necessary in keeping the biodiversity of aquatic animals together with fish, impairment of the water exceptional can cause decline in fish manufacturing or even make it not possible. Fish trendy well-being is strongly associated with the water great of an aquatic environment. Long length exposure of aquatic organisms to environmental pollutants with viable effects on boom and replica are vital considerations of fish farmers³⁵.

Temperature

Temperature is a vital physical parameter in an aquatic surroundings because many organic and chemical strategies are temperature dependent. It is one of the environmental conditions affecting fish increase and survival. When water temperature increases, the evaporation and volitization of chemical substances also

increase, however conversely the solubility of gases inclusive of oxygen decreases. Temperature is the maximum effortlessly and often measured field parameter but can't provide certain records on the overall health fame of aquatic system; it is able to simply provide the early signal on different water parameters. When the water temperature is excessive, the breathing price of aquatic animals increases, additionally the decomposition of organic remember that required oxygen². Temperature of the water impacts the overall properly-being of fish in aquatic environment; changes in water temperature affect food abundance in water and adjustments within the entire increase pattern of fish and later reason the migration of fish inside the water column. Sudden increase in water temperature can consequences to boom in respiratory metabolism and also elevated renovation strategy and speedy weight loss, however every so often increase in temperature can increase fish feeding rate, digestion and feed conversion performance. Temperature affects the oxygen availability of water, price of hydrophytes photosynthesis, frame metabolism of aquatic animals; and the sensitivity of organisms to toxic waste, parasites and sicknesses. Fish are uncovered to many stresses, is due to the fact that fish frame temperature differs with ambient temperature as a consequence of ectothermic behavior which have an effect on their widespread body physiology and therefore cannot deplete greater body heat through perspiration however achieves this by means of motion among locations with exceptional water temperatures to reap highest quality temperature for its survival. Different fish species required one-of-a-kind top-rated temperature degrees for normal sports and frame metabolism including feeding, swimming, boom and duplicate³³.

Dissolved Oxygen

Dissolved oxygen (DO) is one of the maximum crucial indicator of water first-rate in any aquatic environment, huge percentage of aquatic organisms attain oxygen directly from the water in preference to gasping from ecosystem. Dissolved oxygen concentration in water can deliver special records at the health fame of the water frame; this is due to the fact maximum aquatic organisms can stay and grow best while the dissolved oxygen awareness is beneficial. Any discount in dissolved oxygen level out of doors the most effective circumstance of a specific fish species could end result to fish stress. Dissolved oxygen degree and now and again fish stocking density are among major prerequisite for a hit aquaculture improvement. Fish required oxygen just like terrestrial organisms in order to hold regular body metabolism, motion, feeding and biosynthesis, oxygen availability in water is fairly

restrained in comparison to environment wherein there is abundant oxygen and fish can get oxygen from water through gill surface vicinity most effective and it's so narrowed in maximum fish species^{5,35}. Dissolved oxygen content in water can have an effect on fish increase sample as well as feed utilization efficiency, decrease fish growth rate correlated definitely with decrease dissolved oxygen awareness and fish feed conversion efficiency is better below excessive dissolved oxygen attention. Growth pattern of *Nile tilapia* changed into greatly reduced due to low dissolved oxygen availability. The want for oxygen for any aquatic organism is apparent. Aquatic organisms react to the quantity of dissolved oxygen to be had, low dissolved oxygen may be a limiting factor, but the fish might also live on if formerly acclimatized to low oxygen. Dissolved oxygen constantly act interactively with other elements inclusive of temperature and pH. Dissolved oxygen in water surroundings is one of the most important components of aquatic structures, it's miles required for the metabolism of cardio organisms, and it impacts inorganic chemical reactions. Oxygen is regularly used as an indicator of water best, excessive oxygen awareness usually imply exact water first-rate. Oxygen enters water *via* diffusion throughout the water surface, with the aid of rapid movement together with waterfalls or riffles in streams (aeration) or as a byproduct of photosynthesis by using aquatic flowers. In well known, the awareness of dissolved oxygen could be the end result of biological interest in the water column^{5,39}.

Photosynthesis by means of aquatic vegetation will increase the DO in the course of day light and the DO levels will fall at some point of the night time. In natural waters, guy-made contamination, or natural fabric could be consumed by using microorganisms. A circumstance of low oxygen degree in a water environment is seemed as hypoxia, it occurs in all water bodies in the international receiving high vitamins load because of anthropogenic sports, which causes reduced breathing charge, decreased increase fee and every so often even loss of life of aquatic animals relying on the species sensitivity as fish is extra touchy in comparison to crustaceans, annelids and bivalves²⁰.

Transparency

Transparency is the opposite of turbidity that is a degree of water clarity, the less substances suspended in water the higher mild can penetrate through it and the better the transparency. Heavy rainfall within the tropic, normally after a protracted length of drought, results in washing of soils, debris, and vitamins in to the aquatic environment consisting of rivers, streams, lakes, ponds and seas, thereby reducing the transparency of the water,

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but the lines of nutrients every so often will increase the water productiveness, but whilst exceed the specified degree may additionally resulted to eutrophication that is an excessive boom of algae in aquatic surroundings. The inverse courting between water readability and rainfall is probably attributed to increased allochthonous organic count added by way of flooding in the course of the wet season. Suspended substances encompass soil particles, algae, plankton, microbes, and other substances are the important reasons of higher turbidity in maximum aquatic surroundings, boom in water turbidity can raise water temperature; due to the fact the suspended debris absorb more heat and this in turn reduces the awareness of dissolved oxygen (DO), warmer water holds less dissolved oxygen than cold water²².

Hydrogen ion Concentration (pH)

The pH of water is a degree of hydrogen ion that causes acidity and alkalinity on a scale of zero-14 with 7 being the neutral state. It is been used universally to explicit the intensity of the acid or alkaline situation of a solution. Very low and excessive pH ranges may additionally lessen replica in fish, occasionally associated with loss of life. Acidity and alkalinity loss of life factors are about at pH four and eleven respectively, pH values starting from 6.5-9.0 are discovered to be maximum suitable for fish production⁴⁴. The pH of an aquatic ecosystem is crucial due to the fact it is carefully connected to biological productiveness, despite the fact that the tolerance of character species varies, pH values between 6.5 and 8.5 generally imply accurate water fine. Most vertebrates which include fish have mean blood pH of 7 and therefore a comparable water pH of around 7.0 to eight. Fish might be below pressure if the water pH is just too acidic (below 5) or while it's far too alkaline (above 10). Respiration by means of aquatic vegetation affect every day water pH fluctuation, during the day time there is sufficient dissolved oxygen due to photosynthesis and the dissolved oxygen attention declines after sunset^{27,28,44}.

Alkalinity

Alkalinity refers to potential of aqueous media to interact with the hydrogen ions to be had, in recognize to water, alkalinity is happening due to the presence of carbonate, bicarbonate or hydroxide compounds in water including magnesium, calcium, sodium and potassium. Alkalinity is an associated idea that is generally used to indicate a gadget's ability to buffer in opposition to acid influences and buffering capability is the capacity of water to resist or hose down modifications in pH. It is also an index of efficient potential of the water. Measuring alkalinity is vital in figuring out a water body's potential

to neutralize acid pollution from rainfall or waste water. Alkalinity is stimulated *via* rocks and salty commercial waste water discharge. Alkalinity is a bye manufactured from bicarbonate and carbonate after dissolution of limestone, calcium silicate or feldspars. Low concentrations of alkalinity because of water acidity or hardness are not suitable for fish survival because it's impair with the hatching of the fish eggs, this is due to the fact most fish species hatch their eggs at a most fulfilling pH circumstance usually across the neutral pH. Alkalinity of water is very critical because photosynthetic interest of aquatic organisms at some point of the day time can boost the pH to be too alkaline in a low alkalinity and poorly buffered waters¹⁶.

Phosphorous

Phosphorus is regarded as one of the maximum crucial vitamins restricting the boom of autotrophic organism which are the primary producers and supply of vitamins in an aquatic device. It happens solely as phosphate in each herbal in addition to wastewater. In tropical water bodies, phosphorous is limited in deliver and any moderate boom in phosphorous deliver can adjust the nutrient deliver in water, those encompass excessive flora boom, algal bloom, lower in dissolved oxygen content and lifeless of aquatic animals including fish. Phosphorous additionally contributed to the lifestyles of all dwelling organisms, this is because cellular phosphate compounds get strength generated from meals fed on and rework it to regular body activities including locomotion, duplicate and increase. Phosphorous occurs completely as phosphate in a herbal aquatic environment most of which dissolve and the remaining suspended will increase water turbidity and adjust the water nice. Phosphorous is most of the restricting vitamins in natural water frame, this is due to the reality that it takes place in very low concentration and it's miles been quick taken up *via* aquatic flowers²⁶.

Nitrogen

Nitrogen is crucial supply of nutrients for both aquatic vegetation and animals, that is due to its contribution in the formation of main ingredients of protein. Nitrogen happens in aquatic environment in each organic and inorganic bureaucracy and the availability of every shape is generally determined with the aid of organic interest. Nitrogen-fixation because of sports of blue-inexperienced algae (cyanobacteria) and a few species of micro organism that convert dissolved molecular N₂ to ammonium (NH₄⁺). Aerobic micro organism convert NH₄⁺ to nitrate (NO₃⁻) and nitrite (NO₂⁻) through nitrification, and anaerobic or facultative micro organism convert NO₃⁻ and NO₂⁻ to N₂ fuel *via* the procedure of denitrification. Primary manufacturers

assimilate inorganic N as NH_4^+ and NO_3^- and organic N is again to the inorganic nutrient pool *via* bacterial decomposition and excretion of NH_4^+ and amino acids through dwelling organisms. Nitrogen is the maximum restricting nutrient of algae boom, consisting one to 10 percent (1-10%) of dry weight of algae. Surface run-off broadly speaking from agricultural farmlands due to agricultural fertilizers waste, residence preserve waste, conversion of nitrite to nitrate due to oxidation of nitrogenous ammonia and domestic waste are the most important resources of nitrogen to aquatic surroundings. Excretion by way of aquatic animals in a cage way of life in rivers, streams and lakes is also contributing in producing extra nitrogen in to herbal aquatic habitat¹³⁻¹⁵.

Electrical conductivity

Conductivity is the measure of water capability to bring electric current, and therefore electrical conductivity of water is directly proportional to its dissolved mineral count number content. Conductance will increase because of increase in overall salt content inside the water; conductivity is measured in Siemen per centimeter. Most freshwater environments have conductivity values ranging between 10 and 100 $\mu\text{S}/\text{cm}$ which is approximately equivalent to five to seven hundred TDS/L. High conductivity in water is indicating the presence of large amount of dissolved salts which may additionally damage the fish species inside the water environment. Suspended particles affect ion availability in water more often than not *via* absorption and desorption consequences of the ions discovered at the surface of suspended matter. Water conductivity depends on the availability of cations and anions inside the water, mobility and valence of the ions and occasionally also on the temperature of the water¹⁶.

Ammonia

Ammonia is a shape of nitrogen been effectively used by aquatic flora, it's main an critical source of nutrient for phytoplankton; it is also the important endproduct of protein catabolism excreted *via* aquatic animals. Temperature and pH of water are important parameters in figuring out the content material of overall ammonia happening in un-ionized shape, a pH increase of 1 unit brings approximately ten-fold increase within the content material of un-ionized ammonia. Increase in ammonia content material of water is related to poor fish growth, increase in fish vulnerability to sicknesses and subsequently the dying of the fish. Ammonia is released in to water after decomposition and excretion from aquatic animals¹⁷.

One can't imagine life in absence of water. Water is life. We understand that Origin of the existence

has taken location from water. Entire biological manner takes location inside the presence of water. Hence water is the crucial need of life. Hippocrates (460 BC to 354 BC), the father of medication, said, "Water contributes plenty of health" and asserted that the rainwater ought to be boiled and filtered before its use, in any other case it might have a awful scent and motive harshness. In 1971, the primary version of the Encyclopedia Britannica described a filter, as a "Steiner" commonly made of bulbous of filtering paper in the form of funnel so that it will separate the gross particles from water and render it liquid¹⁹. Herodotus in his storybook tells approximately the King of Persia 'Cyrus the high-quality', each time went for any warfare, constantly took boiled water in his silver flagons with him. When observation and effects proved some water illnesses and infections, then in 1852, a law was enforced in London that, "all potash water henceforth should be filtered". Approximately less than 10 gradual sand water filtration plants had been commissioned nearby 1900. Later a part of nineteenth century became the period, when human beings got here to realize that the relative concentration of ammonia, nitrogen, nitrate nitrogen, nitrite and alkaloid nitrogen are pollution indicators of water, through Physico-chemical analysis^{8,13,14,19,38,43}.

Fish Diversity

The river is an incredibly rich and numerous surroundings and any water high-quality evaluation have to recognize this range and it's pretty clean that the distinguishing function of describing water first-class in rivers and streams is the motion of the water, greater or much less hastily, in a downstream path. Pollution is a vexing trouble in growing countries in which the population is growing unexpectedly, development demands are exquisite, and governments have other funding priorities³⁸. Pollutants which include oxides of nitrogen and sulfur dioxide which integrate within the surroundings to form acid rain have pervasive consequences on each freshwater and land ecosystems. Acid rain lowers the pH of rivers and streams. Acidic waters kill many acid-tolerant fish. The pollution also makes water wrong for ingesting, recreation, agriculture and enterprise and eventually diminishes the classiness of rivers. The infected water destroys aquatic life and reduces its reproductive skills and affects the physico-chemical characteristics of water which performs an essential function in algal biodiversity and population dynamics of planktons. The planktons constitute the range foundation of nutrient cycle of an aquatic surroundings. They play an important function in keeping right equilibrium between biotic and abiotic components of an aquatic ecosystem. The water is diagnosed in phrases of its physical, chemical and organic

Keeping in view of the goal of the look at on the biodiversity of the fishes of River with special reference to physico-chemical situations, the present examine reviews the details of the beyond and gift studies on fish range, fish trap and estimation of planktons as well as various algae and research on pollutants parameters and so forth. Several attempts were made to discover the productivity and periodicity of the phytoplankton in terms of the physical and chemical characteristics of the river. The chemical analyses of the water and estimates of the wide variety of phytoplankton had been made on samples collected fortnightly. The phytoplankton has proved to be eutrophic and polymixic in nature²¹. Diatoms formed the biggest bulk, blue-greens being the second major constituent whilst the inexperienced algae formed the 1/3 so as of abundance with, however, big wide variety of species. A specific phytoplankton periodicity has been noticed and determined to be seasonal in individual. Correlations between the phytoplankton periodicity and populace maxima, with the habitat factors discovered depletion of nutrients like, nitrogen, phosphate, silica, carbon, magnesium and sulphates. Changes in the phytoplankton populations have been surely glaring extra on the subject of physical than to chemical situations of the water. Changes in water-stage, transparency and temperature affected the boom of the phytoplankton. High alkalinity and buffering capacity ended in preferential increase of diatoms and blue-green algae. Rich phosphates and silicates coupled with moderate nitrogen contents were responsible for excessive phytoplankton yields in summer season and wintry weather seasons. The abundance of blue-greens may be because of the higher values of pH, temperature, dissolved organic count, phosphate, nitrogen, and comparatively excessive values of dissolved oxygen. Green algae showed a huge variety of adaptability however could not expand in any abundance^{1,2,9,21}.

The look discovered that high-quality of pumping station, however deteriorated after receiving pollutant load from city at Kanpur. The recommendations were putting in of the remedy flowers by way of various pollutants-producing industries. Physicochemical homes of fish hemoglobins were isolated from Gulf of Mexico species. The observations concluded that the Vertical starch-gel electrophoresis at pH 8.6 discovered particular hemoglobin multiplicity in maximum haemoglobin hemolysates remoted from thirteen Gulf of Mexico fish species. All hemoglobins remoted are tetramers based upon gel filtration chromatography. Isothermal denaturation inside the presence of urea indicates huge differences inside the denaturation and unfolding

behavior at 25°C. The giant Root results were determined underneath pH 7. Zero for character hemoglobin additives of menhaden, Brevoortia patronus, and the striped bass, *Morone saxatilis*. Large differences within the price of autoxidation have been decided for a few of the hemoglobins tested and the two species of catfish, *Arius felis* and *Bagre marinus*, possessed the maximum stable hemoglobins and lowest price of autoxidation in comparison to the opposite species of fish studied¹⁰.

The presence of a hundred and forty fish species within the river above Farraka include fish water paperwork, even as the decrease component is ruled by means of estuarine species. Important fin fish species from the factor of view of fisheries and their distribution recorded inside the river are *Aorichthys seenghala*, *Bagarius bagarius*, *Catla catla*, *Cirrhinus mrigala*, *Clupisoma garua*, *Eutropiichthys vacha*, *Gudusia chapra*, *Labeo rohita*, *Labeo bata*, *Labeo calbasu*, *Mastacembelus armatus*, *Mystus cavasius*, *Chitala chitala*, *Notopterus notopterus*, *Ompok bimaculatus*, *Puntius sarana*, *Puntius sophore Rita rita*, *Schizothorax richardsonii*, *Sperata aor*, *Tor tor*, *T. Putitora* and *Wallago attu*. Middle stretch (Kanpur to Patna) are *Aorichthys seenghala*, *Bagarius bagarius*, *Catla catla*, *Cirrhinus reba*, *Cirrhinus mrigala*, *Clarias batracus*, *Clupisoma garua*, *Eutropiichthys vacha*, *Gudusia chapra*, *Heteropnestes fossilis*, *Labeo rohita*, *Labeo bata*, *Labeo calbasu*, *Macrognathus aral*, *Macrognathus pancalus*, *Mastacembelus armatus*, *Mystus cavasius*, *Mystus vittatus*, *Nandus nandus*, *Chitala chitala*, *Notopterus notopterus*, *Ompok bimaculatus Ompok pabda*, *Pangasius pangasius*, *Puntius sarana*, *Puntius sophore*, *Rita rita*, *Sperata aor*, *Tenualosa ilisha* and *Wallago attu*. Lower stretch (Sultanpur to Katwah) are *Aorichthys seenghala*, *Bagarius bagarius*, *Catla catla*, *Channa panctatus*, *Channa marulia*, *Channa striatus*, *Cirrhinus reba*, *Cirrhinus mrigala*, *Clarias batracus*, *Clarias gareipinus*, *Clupisoma garua*, *Eutropiichthys vacha*, *Gudusia chapra*, *Heteropnestes fossilis*, *Labeo rohita*, *Labeo bata*, *Labeo calbasu*, *Macrognathus aral*, *Macrognathus pancalus*, *Mastacembelus armatus*, *Mystus cavasius*, *M. Bleekeri*, *Mystus vittatus*, *Nandus nandus*, *Chitala chitala*, *Notopterus notopterus*, *Ompok bimaculatus Ompok pabda*, *Pangasius pangasius*, *Puntius sarana*, *Puntius sophore*, *Rhinomugil corsula*, *Rita rita*, *Setipinna phasa*, *Siloinia silondia*, *Sperata aor*, *Tenualosa ilisha*, and *Wallago attu*. Estuarine stretch (Nabadwip to Diamond harbour/Roychowk) are *Bagarius bagarius*, *Catla catla*, *Channa panctatus*, *Channa marulia*, *Channa striatus*, *Cirrhinus mrigala*, *Clarias batracus*, *Clarias gareipinus*, *Clupisoma garua*, *Eutropiichthys vacha*, *Gudusia chapra*, *Heteropnestes fossilis*, *Labeo rohita*, *Labeo bata*, *Labeo calbasu*, *Latescalcaifer*, *Macrognathus aral*,

*Macroglythos pancalus, Mastacembelus armatus, Mystus cavasius, M. Bleekeri, M. Gulio, Mystus vittatus, Nandus nandus, Chitala chitala, Notopterus notopterus, Pangasius pangasius, Polynemus paradiscus, Puntius sarana, Rhinomugil corsula Rita rita, Silonia silondia, Sperata aor, Tenualosa ilisha, and Wallago attu, Marine stretch (Haldia to Sagar) are Harpodon neherrus, Latescalcaifer, liza parsia, M. Gulio, Ompok pabda, Pangasius pangasius, Polynemus paradiscus, Rhinomugil corsula, Rita rita, Tenualosa ilisha and Tenualosa ilisha*³⁰⁻³⁴.

The sediment quality evaluation of Ganga River at Kanpur city where effluents from tannery industries are discharged. Sediment samples from upstream and downstream region have been gathered and analyzed for heavy metals and toxicity bioassay. The best of water and sediment inside the river gadget is seriously laid low with pollutants which input through drains that deliver domestic in addition to industrial effluents. These business and domestic waste waters, besides different pollutants additionally contain excessive attention of heavy metals. Because of adsorption, hydrolysis and co-precipitation simplest a small part of free metallic ions stay dissolved in water and a large quantity of them get deposited within the sediment. The sediment from Bithoor and Jajmau region of Kanpur segment of Ganga river have been analyzed for metals (As, Cd, Cr, Cu, Fe, Mn, Ni, Pb, V and Zn) In metallic stages in sediment accrued from downstream Jajmau vicinity have been better than up stream vicinity. The growth in awareness was maximum for the metals except As and Pb which confirmed no exchange and Cr which showed a dramatic growth in concentration in sediment from down move location. The accumulation of Cr in sediment at Jajmau place become 30-fold better than in sediment from upstream Bithoor region. Sediment elutriates have been additionally analyzed for the 10 decided metals (As, Cd, Cr, Cu, Fe, Mn, Ni, Pb, V and Zn) as analyzed within the sediment samples. Trace steel analysis of sediment elutriates showed that the concentrations of trace metals eluted had been extraordinarily low, as incorporation of metals in sediment restriction their bioavailability^{10,12,31,32,34,41}.

The variety of fishes, distribution patterns, abundance, risk, and habitat reputation in one-of-a-kind stretches of river Gomti. Of the fifty six species belonging to 20 families and forty two genera have been amassed from numerous sampling websites, vulnerable (VU) class. Six major categories of habitat have been identified and pattern of fish assemblage and dominant genera in each habitat studied. Considerable differences were observed in the fish species richness and relative abundance (RA) of the species inside the unique

sampling web sites of river Gomti. Shannon Wiener biodiversity index has been calculated for the fishes indicating large variant ($p < 0.05$) across the river. Apart from Indian Major Carps (*Labeo rohita, Catla catla, Cirrhinus mrigala*), *Chitala chitala, Notopterus notopterus, Ompok pabda, O. Bimaculatus, Labeo bata, L. Calbasu, Cirrhinus reba, Channa marulius, Bagarius bagarius, and Clupisoma garua*) were the important species. All the species have been reported for the first time in this river. Indiscriminate catch, poisoning, using of fine mesh sized nets, dumping of sewage, siltation, water abstraction, changing land use pattern, decreased water discharge, and exotic species threaten the fish diversity. Urgent need exists for taking up research on the priority fish species and their habitat. Restoration measures have been proposed based on ecosystem scale approach for fish biodiversity conservation^{7,17,25}.

The habitat ecology, species diversity; distribution and different indices of fish biodiversity management in a Central India river basin relation between fish species richness with the hydrological attributes showed good relationship and water depth, dissolved oxygen and pH were found the most important variables in shaping fish assemblage. The study shows that the River supports considerable diversity of the fishes and is important for conservation and about 34% fish fauna is threatened being either vulnerable or endangered. It was assessed that the river supports considerable percentage of food fish (89.47%), ornamental fish (49.12%) and sport fish (5.26%). Among the eight major types of fish habitats identified along the entire stretch of river, open river, shallow water and deep pools were habitats contributing maximum diversity^{7,37}.

The mid stream water quality of Ganga river as influenced by aerially - driven heavy metals at Varanasi, India. Twelve sampling stations were selected along a 20 km long stretch of the river. Mid stream sub-surface water samples collected at fortnightly intervals from all the sites were acid digested and analyzed for Cd, Cr, Cu, Ni, Pb and Zn. The data revealed that the mid-stream water of river Ganga at Varanasi is invariably contaminated by heavy metals. Highest concentrations of Cd, Cr, Cu, Ni and Pb were recorded during winter and that of Zn during summer season. The overall concentration of heavy metals in water showed the trend : Zn > Ni > Cr > Pb > Cu > Cd. Concentrations of all of the heavy metals were high in down – circulate sampling stations.. Although the concentrations of these metals in water remained below the permissible limits of Indian standards for drinking water, levels of Cd, Ni and Pb at three stations, were above across the world recommended (WHO) most admissible concentrations (MAC). These observations recommend that use of such

water for ingesting may additionally cause capability fitness threat in lengthy-run. The look at has similarly relevance in information the surroundings - water interaction in polluted surroundings and for control of water bodies even those situated far away from direct anthropogenic discharge^{15,36}.

Conclusion

Physicochemical properties of water appeared as good indicator of water best. Different fish species have unique required most efficient range for all of the physicochemical parameters in which fish body metabolism may be affected when a particular parameter isn't always appropriate for regular increase and development. Effluent from agriculture, enterprise and domestic waste need to be handled before discharging in to the aquatic environment in order to limit the prevalence of pollutants and to have a legitimate aquaculture production. An ecological look of river

Varuna in Varanasi and river Gomti in Jaunpur with unique connection with physicochemical traits and planktonic algae. Diversity in relation to river pollutants has also been studied. The individuals of Bacillariophyceae had been most dominant and Cyanophyceae ruled in wintry weather months. Euglenophyceae contributors had been poorly represented however members of Chlorophyceae have been now not a great deal widespread. The algal population become additionally better in the river. The present day repute of ecology and biodiversity of the river. It was found that the fish catch in keeping with kilometre stretch in the river has declined substantially and species composition has modified extra in favour of non carps and miscellaneous species. It has additionally been determined that some uncommon fishes have gained a foothold in the atmosphere at beneficial stretches, in which flows have considerably decreased due to abstraction of water from the principle river.

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