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IJIEMR Transactions, online available on 26th Dec 2022. Link :http://www.ijiemr.org/downloads.php?vol=Volume-11&issue=Issue 12

10.48047/IJIEMR/V11/ISSUE 12/109

TITLE: A STUDY OF SEASONAL DYNAMICS OF GANGES RIVER

Volume 11, ISSUE 12, Pages: 819-827

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A STUDY OF SEASONAL DYNAMICS OF GANGES RIVER

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ABSTRACT

Water is one of the nature's most important gifts to mankind. It is essential and most precious commodity for life. Our natural heritage like rivers, seas and oceans has been exploited, mistreated and contaminated. Water is one of the basic needs of the mankind and is a vital resource used for various activities such as drinking, irrigation, fish production, industrial cooling, power generation and many other activities. It is important to systematically study the status of pollution of the rivers in relation to various anthropogenic activities as river water has been used as drinking water, for mankind. Pollution is the creation of wastes by man's activity and Nature's inability to absorb it. Increased human Activities over the recent past years are imposing a greater stress on these ecosystems, resulting in changing their features. There is a progressive Deterioration of water quality throughout the world. The causative factors responsible for degradation of water quality need to be evaluated so as to take proper steps before the situation becomes worst and uncontrollable. The Ganga is one of the important rivers of North India. Due to abundant availability of water throughout the year, it has played an important role in the development of Indian civilization and economy. According to Indian mythology it is known as a holy river. It's highly fertile food grain yielding basin supports agriculture to a great extent. The Ganga River is one of the most sacred river in India is being polluted by many sources.

KEYWORDS: Seasonal Dynamics, Ganges River, natural heritage, pollution

INTRODUCTION

Ganga the holy river of India is best ex fresh water ecosystem and it originate from gangotri from uttarakand.covering the distance of 2525 km fall into gangasagar (west Bengal)river ganga is the largest and very important river of Indian along with it tributary. River Ganga is known to be purity of symbol but in today's scenario it is highly polluted and pollution continually increasing in congested area of UP.

Water place the vital role in humans.it is the basic need of man kind.it is use various activities such as drinking, industrial cooloing.fish production,irrigation,power generation and many more activities are there which is to study systematically the status the pollution of the river in relation to various entroprogenic activities which have been used for mankind's.
The tremendous pressure on fresh water

recourse increasing as the population of Kanpur is increasing rapidly resulting in the increasing in development in areas at joining the river it is know that increases silt and nutrient load detroit the water bodies hence it is thought to consider to assist the water quality of river ganga with respect to water parameter.

The Ganga is a 2525 km long river crossing the northern part of the Indian craton. The Ganges river basin houses about 40% of the Indian population (Ganga River Basin Environment Management Plan, 2012d). As recorded in the year 2000, approx. 500 million people were living by the basin of river Ganga. By 2030 the population is expected to reach to 1 billon as per Markandya and Murthy in 2004. The 15th National census survey, conducted and estimated the Indian population at 1,210,854,977 by the official Census Organization of India, and decadal growth rate 17.64% in 2011 (census2011.co.in. The Ganga river provides help and support to livelihoods to many people with a wide range of ecosystems. The discharge of the Ganga has extreme seasonal variations due to the monsoon (Singh et al., 2007). In addition with their dams,barrages,household water supply irrigation etc.are the main barrier of river ganga to flow in high ways it helps in maintain the ecosystem also.the river is becoming highly polluted due to the arthropogenic. From several other point urban wastewater, industrial wastes and pollutants and spread out sources are set free into the Ganges with limited or no treatment (Ganga River Basin Environment Management Plan, 2012d). The cities of Middle region of Ganga especially Kanpur and Varanasi are the major contributors to this problem (Haentjens, 2017). Ganges river water quality have been already published a large number of papers dealing. (e.g.; Aktar et al., 2010; Arora et al., 2013; Baghel et al., 2005; Beg & Ali, 2008; Chaudhary et al., 2017; Ganga River Basin Environment Management Plan, 2012d; Gupta et al., 2009; Haentjens, 2017; Haritash et al., 2016; Khatoon et al., 2013; Khwaja et al., 2001; Kumar et al., 2010; Purkait et al., 2009; Rai et al., 2010; Sankararamakrishnan et al., 2005; Sarkar et al., 2007; Semwal & Akolkar, 2006; Sharma et al., 2014; Shweta & Satyendra, 2015; Sood et al., 2008; Thareja et al., 2011; Tiwari et al., 2016; Trivedi et al., 2010; Yadav & Srivastava, 2011). However, compared to the size and importance of the Ganga, the amount of research is still limited. In addition, many of these studies are already outdated, due to the rapid increase in Indian waste and wastewater emission, and do not represent the current situation anymore. The Ganga River Basin Environment Management Plan has provided a long-term analysis of Ganga water quality (2012d) and Haentjens (2017). The quality of water in river Ganga deteriorates downstream. Kanpur and Varanashi are the two hotspots of pollution and poor water quality. The cities of mid Ganga river's water quality improves but never gain its original state (Haentjens, 2017). Main study subject of Ganges water quality is a; however, a thorough analysis of the anthropogenic pollution along Kanpur city is still continuing.

Over the Indian subcontinent, from the

himalayas towards the Bay of Bengal, Ganga is flowing. The Ganga river basin covers an area of 1086 x 106 km2, encompassing the Himalaya organic belt, northern Indian carton and the Ganga alluvial plain (Singh et al., 2007). The Ganga river drainage network consists of a wide range of rivers acting as tributaries (Singh et al., 2007). Based on their source area, these rivers can be classified in three categories: 1. Himalayan Source Rivers, 2. Ganga alluvial plain source river, and 3. Northern Indian carton source rivers (Singh, 1996, 2004). In downstream the discharge of Ganga rapidly increases due to significant inputs from these tributaries (Singh et al., 2007). The Ganga system is located on the Indian subcontinent; its source originates in the Himalayan organic belt. Together with the Brahmaputra, the Ganga River is responsible for the creation of the Ganga; Brahmaputra delta (Singh et al., 2007) The Ganga alluvial plain has a humid subtropical climate with four seasons:

1. Winter (January- March),

2. Summer (April-May),

3. Monsoon (June-September)

4. Post-monsoon (October-December)

(Singh et al., 2007; Singh, 2009**)**. Visualizes the climate of four major Indian cities along the Ganges (India Meteorological Department,). Due to monsoon rainfall, the Ganga river discharge is prone to strong seasonal variations. Discharges are often described as monsoon, post-monsoon, winter and summer (Das Gupta, 1984). During the monsoon season, heavy rainfall occurs everywhere in the basin (Singh et al., 2007). During this period, 70 to 80% of the annual rainfall occurs (Singh et al., 2007). For the other part of the year, dry conditions prevail and large amounts of water are lost through evapotranspiration (Singh et al., 2007). Each km2 of the Ganga river basin receives about one million m3 of water per year as rainfall. Nearly 30% is lost to evapotranspiration, 20% goes to the groundwater, and 50% is available as surface water in the basin (Das Gupta, 1984). Eventually, this surface water flows to the Ganga-Brahmaputra delta and the Bay of Bengal. Singh et al. (2007) provides an extensive analysis of Ganges river hydrology; visualizes the annual hydrograph of the Ganges, and provides seasonal flow variations and maximum discharge values from several stations, including Kanpur city, along the Ganges. In addition, the Ganga River Basin Environment Management Plan (2012d) provides monthly rainfall and river flow data from the Ganga at Farakka.

The main causes of creation of wastes by man’s activity and nature’s inability to absorbs pollution. Increased human activities over the recent last years are imposing a bigger stress on these ecosystems Soil invertebrates also affecting the soil structure by burrowing and excavation in search of food and shelter. Soil invertebrates actively transport the excavated/ingested soil and deposit on the soil surface or in voids with in the soil. The ingested soil material often comprised of plant litter and animal tissue. The soil animals also use excreta, mucous or salivary secretions to line burrows and

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collect the plant litter, animal dung, carrion etc., from the surface for food and incorporate them into the soil with or without digestion.

Life history of invertibrate

The study of invertebrate drift has become an important adjunct to traditional methods of investigating stream insect life histories (Anderson, 1966). For several species, it has been observed that the greatest drift occurs in the younger life cycle stage (Anderson, 1966, Elliott, 1967,6, Waters, 1969, b). This is an essential ingredient of Miller's "colonization cycle", although it is possible that it is important to many species as a dispersal mechanism, even if the adults do not make an upstream migration, since it may result generally in a more efficient distribution of the young. However, Bishop and Hynes (1969, a) felt the relative lack of larger individuals in the drift was due to selective predation by fish. The converse of the above has been more frequently observed, i.e., a higher relative propensity to drift during the later and larger life cycle stages (Anderson, 1967, Elliott, 1967, a, Miller, 1966, a, Ulfstrand, 1968). High behavioral drift at night also often includes relatively larger specimens (Anderson and Lehmkuhl 1968). Several reasons for this may be postulated. First, growth in biomass is often greatest during later life cycle stages, which may place the greatest intensity of population pressure upon available living space. The consequent increase in intra – specific competition may result in increased activity and drift. Secondly, the greater activity, and consequent drift, of these later stages may function to distribute adults to all areas of the steam suitable for reproduction. Third, the larger organism, protruding into the current farther, may be thus more susceptible to dislodgement (Schwarz, 1970). Finally increased drift may result from pre-pupation and pre-emergence activity as the mature larvae and nymphs move to stream banks, preferred bottom types or areas of current velocity more suitable for the actual emergence. For example, the drift measured at different points in the life cycle has indicated lateral migrations at certain stages (Anderson, 1967, Elliott, 1967).

The presence of pupae, exuviae, adults and egg. Masses are often reported in drift collections (Anderson, 1967, Elliott, 1967, Elliott, 1968,Thomas, 1970, Tobias and Thomas, 1967, Weninger, 1968).

The distribution, interaction and adaptation of an organization is shaped by environmental variability in time and space (Wiens 1986). The basic characteristic of a running water system is spatiotemporal variability (Minshall 1988; Poff and Ward 1990). The primary source of variability and disturbance are flow fluctuations and extreme conditions such as floods (Cowell et al. 2004). Changes in community composition and structure and severe population losses can be caused by high discharge events (Hart and Finelli 1999; Lytle et al. 2008) freshwater macroinvertebrates are used as an indicator of urban stream ecosystem condition throughout the world (Beavan et al. 2001; Paul and Meyer 2001; Walsh et al. 2001). This has been based on the relative ease of collection, identification of specimens and the sensitivities to pollution and environmental disturbance that many invertebrate taxa display (Chessman 2003). Seasonal variability is well known to influence the distribution and abundance of various invertebrate taxa and the composition of communities (Brooks 2000; Leung et al. 2012; Sporka et al. 2006). For example in many parts of the northern hemisphere where cold winters are followed by short warm summers, significant seasonal variation in both invertebrate community structure and the abundance of many invertebrate taxa has been documented (Sporka et al. 2006) . Due to flow variation resulting from the cyclical wet and dry nature of the ecosystem, invertebrates in tropical monsoonal streams are exhibiting strong seasonal variation (Leigh 2012; Mesa 2012) . The commonness or rarity of a species relatively to other species in a given community or a single tropical level is described as Relative species abundance (Lawson and Olusanya, 2010). The key elements of biodiversity are species richness and abundance. It also relates to a number of different species in a specific area and is the fundamental unit that is used to access the homogeneity of enviornment Lawson and Olusanya (2010). They are commonly used in conservation studies to determine the sensitivity of ecosystem and their species. This study is done with an objective to determine the seasonal variation of aquatic macro invertebrates from river Okpokwu, which will provide an insight on the abundance of species in the river.

Correlation of population and production

Some of the early observations of large quantities in the drift (Berner, 1951, Hemsen, 1956, Miller, 1954) forced some speculation as to its function in population dynamics and how a stream invertebrate community adapts to such an apparent high rate of attrition. In one of the earliest discussions of drift, Denham (1939) suggested that overcrowding and competition were contributing factors. Miller, in proposing his colonization cycle, suggested that as small larvae grew and required greater space, they were forced to seek new space, the consequence being downstream drift and therefore colonization of all suitable habitat through the stream's course. Thus, drift acted as a means of keeping population densities down to the carrying capacity of the stream bottom, as well as providing a means by which all a stream's suitable areas could be colonized. Rise to postulates in upstream return is due to extreme quantities of drift that reduces population densities below the carrying capacity but very little literature is available to suggest the same. Alternative explanation in that, while drift may maintain population densities down to carrying capacity levels, it does not further reduce densities to the point of requiring an upstream return, and that the high drift rates observed are the result of high rates of production that tend to exceed the carrying capacity.

Arguments for both positions have been largely hypothetical, for it is extremely difficult to devise the critical experiments necessary for firm conclusions. Nevertheless, recent information has appeared which bear upon the problem.

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Miller's "Colonization Cycle" Miller's originally proposed "Colonization Cycle" consisted of the upstream flight of adults for oviposition, with a concentration of eggs and young larvae in an upper reach, the downstream drift of immature to colonize all suitable habitats, and an upstream return of the adults to complete the cycle (Miller, 1954). The main emphasis of Miller's paper appeared to be upon drift as a colonizing mechanism; but subsequent discussion in the literature emphasized the upstream flight of adults and whether such a return was necessary as a compensating factor for drift. The two elements of the hypothesis are not mutually required, i.e., drift of immature could well function as distribution mechanism event though the adults did not undertake an upstream flight and oviposition occurred randomly along the stream course.

Relation to Production:

As an alternative to the requirement of upstream compensation for drift, it has been suggested that the attrition by drift amounts only to that which is produced more than the stream bottom carrying capacity, and that the reminder is sufficient as to require no upstream compensation (Waters, 1961). For a species adapted to the bottom type of the given section, the drift is often greater leaving the section than that entering it, the difference being equivalent to that quantity produced in the section (less any other removal or mortality), as has been observed for they may fly, Baetis vagans, on a riffle (Waters 1962, Waters 1966). An extension of this hypothesis is that the level of drift is of some function of the rate of production and that mean drift rate might be used as an index to the productive capacity of a stream's benthos.

This production hypothesis was made originally based on a comparison of drift rates and other production indices among a group. Stream of varying productive capacity, over only a summer period, in which the drift was greater in those streams considered to be the more productive (Waters, 1961). A similar relationship was observed in European streams, (Hemsen, 1956, Miller, 1970,), each of these cases involving only two streams, however. Unfortunately, this type of comparison has not been repeated on a broader basis in terms of number of streams and duration of observations Pearson (1970) has made direct comparison between drit and production rates for the caddisfly, Oligophlebodes sigma, and the mayfly, Baetis bicaudatus, in a Utah mountain stream, among several stations sampled, he showed a positive correlation between production rate and drift for O. sigma but not for B. bicaudatus.

There is little evidence that benthic populations are reduced by behavioral drift in upstream reaches to "depopulated" levels and several observations have been made specifically of the absence of such reduction, even with high drift (Elliott, 1967, a, Elliot, 1968, b, Miller, 1954, Pearson, 1970, Schuhmacher, 1969, Ulfstrnd 1968). In one instance where drifting mayfly nymphs (along with gammarids) were experimentally removed from a stream, standing crops remained essentially constant (Waters, 1965).

Fish nutrition and feeding

The relationship between invertebrate drift and fish feeding has been of considerable interest to fisheries managers as well as to other stream ecologists. An obvious hypothesis is that fish constitute a sort of "drift sampler" (Mclay, 1970), utilizing drifting invertebrates because they are moving and therefore more accessible as prey (Denham, 1939). The significance of this type of feeding may be a greater efficiency in food transfer from the invertebrate to the carnivorous fish level, and thus higher fish production, than with bottom foraging alone. Early studies on drift had as their objective the determination of available fish food (Idle, 1942, Lennon, 1941, Needham, 1928). Direct observations of fish feeding on drift in natural streams have been made by several investigators (Bailey, 1966, Jenkins, 1969, Miller 1954) in some cases with skin - dividing gear Keenleyside (1962) direct observations have also been made in flowing aquaria and artificial stream (Kalleberg, 1958, Mason, 1969). In one case, significant feeding of brook trout on the day drifting caddisfly larvae, Brachycentrus americanus, was observed during the daylight period. Salmonids, particularly, select and defend territories which are best suited for the interception of drift, the size and location of the territory is determined by the drift density and patterns of drift in the water currents (Jenkins, 1969, Kalleberg, 1958, Mason, 1969).

Many investigators have compared fish stomach contents with the composition of drift and benthos and found selective feeding on drift (Bailey, 1966, Elliott, 1967, Maciolek and Needham, 1952). The degree of such selectivity differs among fish species (Keenleyside, 1962, Miller, 1954, Peterson, 1966), and there appears to be a varying utilization of bottom foods as well as drift (Tusa, 1969, Warren et al., 1964). Young salmonid fry appears to depend most heavily on drift and as the fish grow larger there is relatively greater dependence on bottom foraging (Elliott, 1970, b, Frost and Brown, 1967).

CONCLUSION

During the course of the present study the seasonal variations of the fauna was recorded. An examination of the observation presented in table 27 and 28 showed that the maximum number of protozoans, aschelminthes, platyhelminthes and annelids were collected in summer season while maximum arthropods were observed in winter months.surprisingly enough; the maximum number of in vertebrates was recorded during the monsoon.

Protozoans which were collected during all the seasons were Euglena sp. Colpedium sp. Didinium sp. Halteria sp., Paramecium sp.,Spirostomus sp., Stentor sp. and Vorticella sp., Amoeba sp. was collected during winters at Jajmau Bodo sp. was collected only during winter season at all the sites except Bhairav ghat and Bhagwat Das ghat. Ceratium sp. was collected in winter and summer season at Permut and Jajmau Bridge. Pleuronema sp. was recorded only during summer at Bhairav ghat ad Permut ghat.

Among rotifers, Brachionus falcutus, Branchionus quadridentata, Keratella cochlearis, Keratella procurva and Keratella tropica were common during all the seasons. Some varieties of rotifers were collected during winter month only, i.e., Diaschiza sp. at Bhairav ghat and Jajmau Bridge, Rotaria vivipera at Bhagwat Das ghat and Jajmau Bridge and Rotifer neptiunis at Bhairav ghat, Bhagwat Das ghat and Jajmau Bridge. Among nematodes, Dorylaimus stagnalis and Rhabolaimus sp. were recorded during both winter and summer seasons while Hedrures brythosi was collected during the post monsoon season. Quimperia lanceolata was observed only druing summer at Bhagwat Das ghat and Jajmau Bridge.

Among platyhelminhes mostly parasites were collected during the except Diphylobothrium talium which was found during post monsoon season at Jajmau Bridge only. Among annelids, Tubifex sp. was observed Tubifex sp. was observed to be common in all the season while Dero sp., Glossophonia sp. and Helobdella Stegnalis were collected only during the summer. Ozobranchus jantseanus was collected during winter at Permut and Jajmau Bridge. Nais sp. was seen during winter and summers both. Crustacean genera like Bosmina sp., Cyclops sp., Centrocypris sp., Cypris sp. Diatomus sp., Macrobrachium lammerrei, Monia sp., Nauplius larva were observed during all the seasons at all the sites. Argulus sp. And Pratelphusa sp. were collected only during summer. Canthocamptus sp.was observed only during the post monsoon period. Among Odonata demsel fly nymph was observed during winter only dragon fly nymphwas collected during both the winter and post monsoon period.

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