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# Species association of *Hilsa* in the lower stretch of the River Ganges and their existing water quality

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**Abstract**
Species association can be identified using data-mining technique. The species that can be catchable in single micro netting is considered as species association. This happens in nature by experimental netting. In all different combinations species associations of *Hilsa ilisha* are namely *M. rosenbergii A. aor R. rita, E. vacha, R. corsula, G. guris, W. attu, L. rohita, L. bata, C. catla, C. mrigala, A. coila, C. garua, N.(Chitala) chitala, N. notopteru, P. paradisus, M. vittatus, P. saphore, P pama*. The daring species may be associated even with major catfishes. As these species are found to be whether non harmful, associated and identified in the river stretch of Berhampore to Ulberia of lower stretch of river Ganges. Water quality database including assessment of available species in lower part of this stretch of river Ganges is carried out in this research study.

**Keywords:** Species association, Data-mining, *Hilsa ilisa*, Lower stretch of river Ganges

## 1. Introduction
The Ganga River has an unique diversity of fish species throughout its flowing stretch. However, the fish species available in a particular stretch of this river is not totally similar with that of other stretch. This variation in fish species composition of the Ganga river is well documented (Jhingran, 1975) [5]. As fishery forming species are aquatic habitat oriented, so it is quality of water in a riverine stretch that determines their distribution. Different fish species need particular physico–chemical quality of water in which they survive, grow and reproduce. It is reported (Sabo *et al*, 1991) [9] that the effect of physicochemical factors on density of fish species. Likewise, Reash and Jimmie (1990) [8] have pointed out the influence of water quality parameters on abundance and richness of the fish species. Donaldson (1975) [4] has critically evaluated the association of physicochemical factors with maturation and spawning of fishes in riverine environment. It is also well known that the activity of nitrifying and denitrifying bacteria is greatly influenced by the physico-chemical quality of water in an aquatic environment (Jun *et al*, 2000) [6]. Matthews (1998) [7] has demonstrated that the local fish assemblage and dynamics in a river is dependent on environmental stress as well as capability of the fish species to cope up with the changing water quality. According to Anon (1999) [1], the number of fish species identified in a river stretch is very useful for fishery enhancement programme and good data base creation. All the inland fish species survive in certain range of water quality parameters. These ranges provide optimal condition for growth and reproduction. Under extreme fluctuation of physico-chemical quality of water, the fish species are either shifted or eliminated from the environment.
The main objective of the present investigation is to find out the ecological requirements of the available catfishes and their breeding ground identification in the lower stretch of the Ganga River.

## 2. Materials and Methods
Present study was carried out over a flowing lower stretch of 250 km in West Bengal of the Ganges River during the period 2002 to 2006. The whole stretch was divided into four sectors (Berhampur, Palta, Dakshineswar and Uluberia) for the purpose of sample collection. Monthly sampling of forty-nine parameters (water quality, microbial loads and pesticides) was carried out for each selected site by following standard American Public Health Association APHA methodology (APHA, 1992) [2]. The fish catch composition of catfishes was recorded on spot at random sampling basis from the fishermen operated craft and gear. Major catfishes available were recorded. The collected data of all the studied parameters were pooled and statistically analyzed.

## 3. Results and Discussion

The present findings on water quality parameters, microbial load and pesticides is presented in detail in Table 1, 2 and 3. However graphical presentation of the seasonally varied water quality parameters are given in Fig.1 to 7. Likewise for microbial load it is in Fig. 8 to 11 is given. Ecological trends (Fig 1 to Fig. 11) plotting the monthly mean values during the four years of study are presented in this communication.

A total of three major catfishes have been found in the studied river stretch (Berhampur to Uluberia). These species are found to be ideally suited in the obtained range of physicochemical parameters (Table1) of water. Fish species diversity in relation to physicochemical condition of water was reported from Plum Creek drainage basin (Whiteside and McNatt, 1972) [10]. The Table 2, indicates the associative microbial loads on the fish species and Table 3 denotes pesticide tolerance. The ranges of water quality parameters as communicated here can be considered for optimum growth, survival and physiological requirement of the cited species.

As no mortality of these recorded fish species have been noticed during the entire course of study, so the values of pesticides and heavy metals as presented in Table 3 can be considered as the permissible limit for growth and development of the catfishes.

Braaten and Guy (1999) [3] has specifically indicated the relationship between physicochemical quality of water and abundance of fishes from their study in tributary confluences of lower Channelized Missouri River. The existence of optimum water quality is very important for a good fish assemblage (Woiwodge, 1996) [11]. It is here by concluded that the obtained range of water quality, microbial load, heavy metals and pesticides can be considered as the suitable ecological criteria for the mentioned three catfishes. This communication is expected to be helpful in future fishery enhancement and conservation of catfishes in the investigated as well as in other rivers of same water quality ranges.

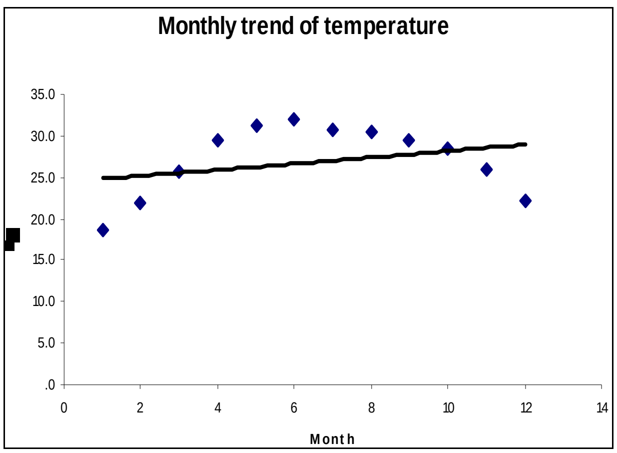


**Fig 1:** Water temperature of investigated stretch.

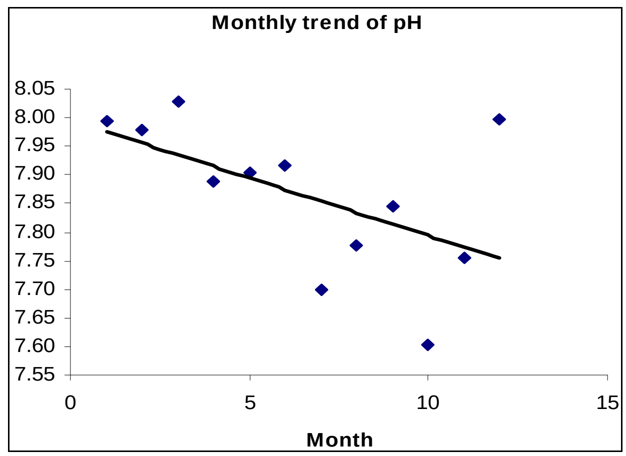


**Fig 2:** Water pH of investigated stretch.

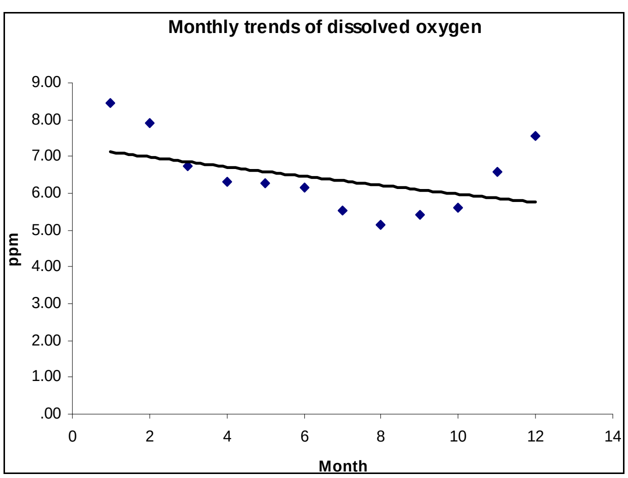


**Fig 3:** Dissolved oxygen of water in the investigated stretch.

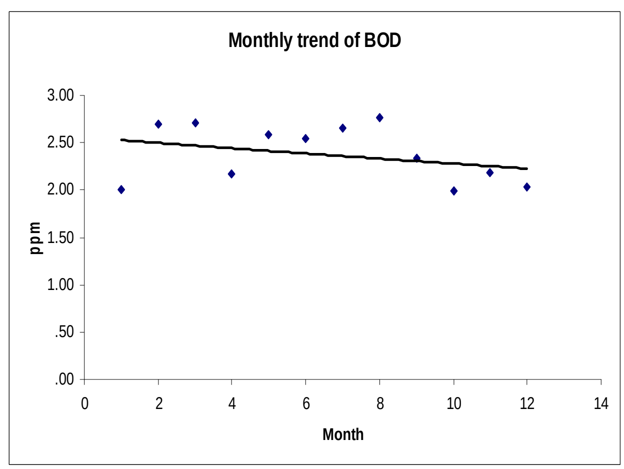


**Fig 4:** BOD of water in the investigated stretch.

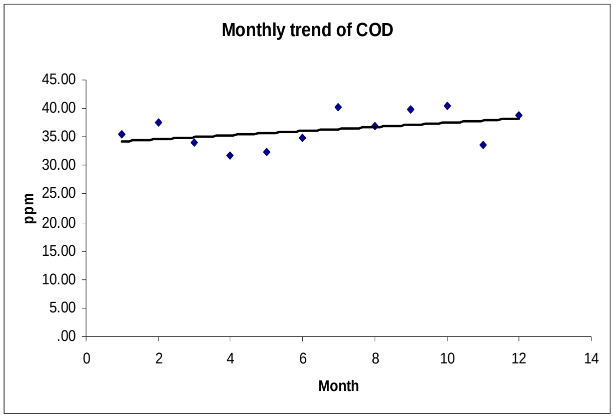


**Fig 5:** COD of water in the investigated stretch.

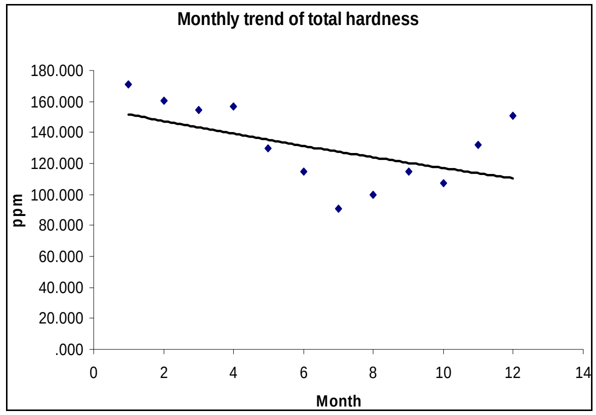


**Fig 6:** Total hardness of water in the investigated stretch

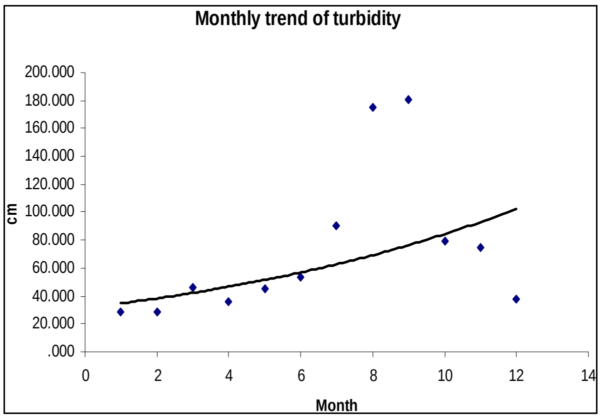


**Fig 7:** Turbidity of water in the investigated stretch

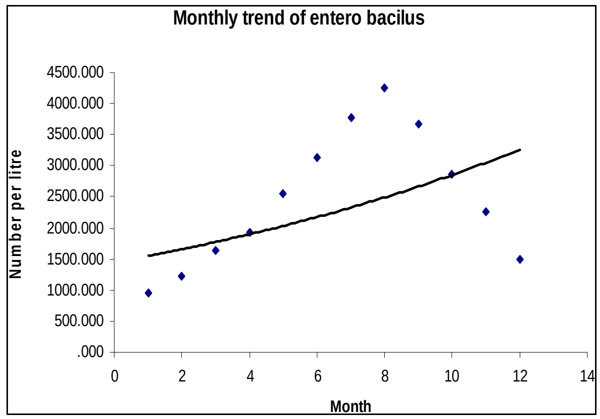


**Fig 8:** Entero bacillus content in the investigated stretch

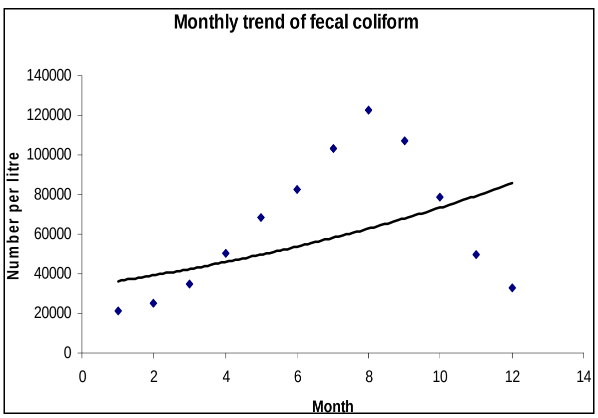


**Fig 9:** Fecal coliform content in the investigated stretch

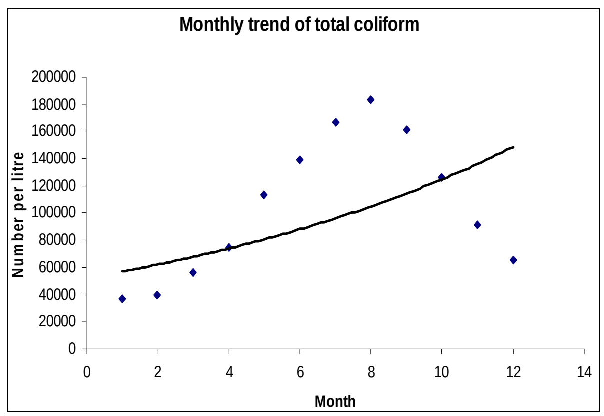


**Fig 10:** Total coliform content in the investigated stretch

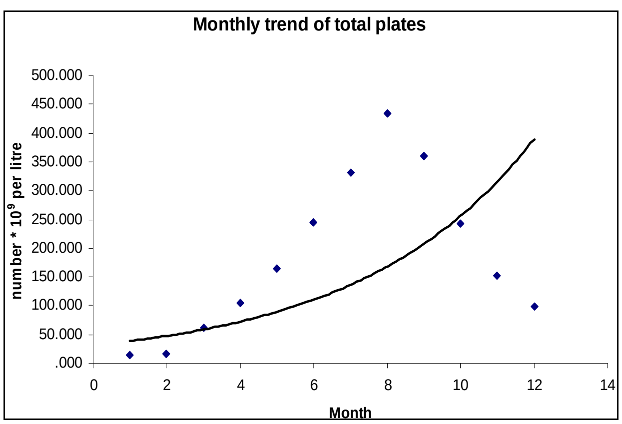


**Fig 11:** Total plate count of bacteria in the investigated stretch

**Table 1:** Water quality of the Ganga River in the investigated stretch.

| Water quality parameters | Minimum | Maximum | Mean |
|---|---|---|---|
| Water Temperature( ºC) | 16 | 33.5 | 27.167 |
| P<sup>H</sup> | 7.06 | 8.7 | 7.865 |
| DO (ppm) | 2.75 | 10.5 | 6.472 |
| BOD(ppm) | 0.6 | 6.6 | 2.389 |
| COD(ppm) | 12 | 76 | 36.316 |
| Turbidity(cm) | 4.3 | 654 | 72.991 |
| Sulphate(ppm) | 6.45 | 78.9 | 18.799 |
| Conductivity (µs/cm) | 0.15 | 0.66 | 0.339 |
| Chloride(ppm) | 1.25 | 51.23 | 13.830 |
| Na(ppm) | 0 | 112.97 | 14.473 |
| Ca(ppm) | 2.4 | 96.06 | 26.345 |
| Mg(ppm) | 0.98 | 46.83 | 20.220 |
| Alkalinity(ppm) | 50 | 196 | 126.587 |
| Total hardness(ppm) | 60 | 254 | 131.872 |
| Phosphate(ppm) | 0.02 | 2.86 | 0.331 |
| Ammonium-nitrogen(ppm) | 0.004 | 2.49 | 0.312 |
| Nitrate-nitrogen(ppm) | 0.005 | 2.22 | 0.425 |
| Total-nitrogen(ppm) | 0.27 | 20.12 | 3.103 |
| Fe(ppm) | 0 | 6.20 | 1.361 |
| Mn(ppm) | 0 | 2.72 | 0.288 |
| Zn(ppm) | 0 | 0.37 | 0.071 |

**Table 2:** Microbial loads of the Ganga River in the investigated stretch

| Microbial loads | **Minimum** (Nosl$^{-1}$) | **Maximum** (Nos.l$^{-1}$) | **Mean** (Nos.l$^{-1}$) |
|---|---|---|---|
| Total coliform | 1200 | 400000 | 104711 |
| Fecal coliform | 500 | 300000 | 64808 |
| Total plates | $0.2x10^9$ | $800x10^9$ | $185x10^9$ |
| Entero bacillus | 200 | 9000 | 2479 |

**Table 3:** Heavy metals and pesticides content of the Ganga River in the investigated stretch.

| Heavy metals/Pesticides | Min(ppm) | Max(ppm) | Mean (ppm) |
|---|---|---|---|
| Cu | 0 | 0.11 | 0.011 |
| Cd | 0 | 0.04 | 0.004 |
| Cr | 0 | 1.71 | 0.053 |
| Ni | 0 | 0.375 | 0.049 |
| Pb | 0 | 1.35 | 0.098 |
| HCH1 | 0 | 1.14 | 0.019 |
| HCH2 | 0 | 18.65 | 0.959 |
| HCH3 | 0 | 1.86 | 0.045 |
| HCH4 | 0 | 1.69 | 0.056 |
| Total-HCH | 0 | 18.65 | 1.079 |
| pp-DDE | 0 | 2.09 | 0.045 |
| Op-DDD | 0 | 3.69 | 0.046 |
| Op-DDT | 0 | 0.48 | 0.008 |
| pp-DDT | 0 | 0.45 | 0.006 |
| Total DDT | 0 | 3.69 | 0.105 |
| Endo-1 | 0 | 2.23 | 0.027 |
| Endo-2 | 0 | 1.52 | 0.014 |
| Endo-S | 0 | 0.40 | 0.006 |
| Endo-T | 0 | 2.23 | 0.047 |
| Total Organo-chlorine | 0 | 18.78 | 1.231 |
| Dimethoid | 0 | 3.132 | 0.082 |
| Methyl parathion | 0 | 3.05 | 0.219 |
| Malathion | 0 | 4.83 | 0.369 |
| Total Organo-phosphorus | 0 | 6.28 | 0.671 |

## 4. Conclusion
The simplified technique of identifying species association is through experimental netting, fish catch with micro nets of single effort. This association can be kept in database in all possible way the same is determined using data-mining. However in recent days species association can be identified with water camera, if needed.


## 5. Acknowledgement
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