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Investigation on Eutrophication of Taroda *Nala* at Nanded (India) through Physico-Chemical Analyses of Water and Composition of Planktonic Community within the Aquatic Ecosystem

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Abstract

The present paper embodies an investigation on chemical and physical quality parameters of water and the composition of phytoplankton and zooplankton community as related to eutrophication processes and their consequences in aquatic ecosystem of the study area. Experiments were carried out on samples from an oxbow canal (known locally in Hindi language as nala) at Taroda village of Nanded (India) and were analyzed and interpreted. This research work identified anthropogenic eutrophication as a key ecological problem for the Taroda nala. Results from phosphate concentration and the composition of planktons confirmed serious eutrophic condition. High dissolved solids, total hardness, calcium and magnesium hardness and ions like chloride and magnesium show deterioration of water quality. The percent composition of phytoplankton classes found in the water body in a descending order is: Chlorphyceae and Bacillariophyceae > Cyanophyceae > Zygnematophyceae > Flagilariophyceae > Ulvophyceae, Treboxiphyceae and Euglenoidea. The dominant trend of zooplankton in the present investigation is as follows: Bronchipoda > Maxillopoda and Monogononta > Ciliatea and Ostracoda. The physico-chemical analyses of water samples and the phytoplankton and zooplankton structures present within the water were correlated with pollution and eutrophication of Taroda nala.

Keywords: Physico-chemical analysis, water, plankton, eutrophication.

Introduction

Nowadays eutrophication is a growing pollution problem to freshwater ecosystems and produce harmful ecological consequences[1-2]. Eutrophication (Greek: “ευτραφής” meaning well nourished) – in its more generic definition that applies to both fresh and marine waters – is the process of enrichment of waters with plant nutrients that stimulates aquatic primary production and in its more serious manifestations leads to visible algal blooms, algal scums, enhanced benthic algal growth of submerged and floating macrophytes[3]. We simplify the definition of eutrophication as the response to natural or cultural addition of nutrients in excess to an aquatic ecosystem. Freshwater quality degradation due to the cultural (anthropogenic) eutrophication is one of the most prevalent environmental problems worldwide[2,4-7]. Agricultural run-off carrying fertilizers, untreated sewage effluent, pollution from septic systems and sewers, and other human-activities increase the flow of both inorganic and organic substances into water bodies. Eutrophication relates to the rapidly increasing nutrients, primarily include nitrogen and phosphorous in the form of their nitrates and phosphates respectively. It is therefore necessary to understand scientific fundamentals of the eutrophication of waters with special reference to nitrogen and phosphorus. Of the two, phosphorus is considered to be the major factor in Eutrophication. It is a growth limiting factor for algae in freshwaters. Humankind has increased the rate of phosphorus cycling on Earth[8]. Hence, phosphorus is regarded as the main culprit in cases of aquatic primary production in lakes or canals subjected to "point source" pollution from sewage pipes. Studies conducted in the *Experimental Lakes Area* in Ontario (Canada) have confirmed a relationship between the addition of phosphorus and the rate of eutrophication[9].

Exceeding aquatic vegetation disrupts normal functioning of the ecosystem by causing scarcity of dissolved oxygen needed for fish to survive. The water turns cloudy and coloured with a bright shade of green, yellow, reddish or brown. Eutrophication thus decreases the value of rivers, ponds, lakes, canals, etc. Human health problems can occur where eutrophic conditions exist near residential areas and interfere with drinking water treatment[10].

Blue-green algae, or cyanobacteria, are contributors to Eutrophication[11]. Eutrophication disturb the balance of water ecosystems by increasing the quantity of phytoplankton and also by changes in phytoplankton community structure. An increase in frequency of harmful algal blooms is observed. Use of ecological indicators describing species richness and species diversity as pollution indicators have been used by research workers since seventies[12-14]. These indicators, though influenced at times by environmental factors, give information on the community structure. Phytoplankton and zooplankton community composition and structures are affected by Eutrophication; these communities are used as the indicator of changing status of an aquatic ecosystem[15-17]. Hypoxia or even anoxia is the last stage of eutrophication[18] which is often characterized as dystrophy.

At first, we observed bright green coloured water at Nanded's Taroda Naka *nala* sampling site which, we supposed, might have caused by an excessive algal growth or cyanobacteria. This showed high nutrient concentrations and phytoplankton production in the waters. At Taroda *nala*, the entry of nutrients was due to the dumping of waste vegetables, nutrient-rich run-off and in-flow from Taroda's Wednesday open market, and also the influx of sewage water from surrounding areas. This has subsequently led to heightened biological production in the water body and is a cause of concern for the local inhabitants. In order to assess the eutrophication and the deterioration of water quality, we report herein the research findings on investigating eutrophication of Taroda *nala* at Nanded (India) through physico-chemical analyses and identification and frequency of phytoplankton and zooplanktons and their characteristic relevance. The research results have the merit of summarizing and reporting this extensive field information to confirm the "eutrophic" status of the *nala*.

Material and Methods

Study Area: For this research work, the water samples were collected from the *nala* (nala meaning oxbow canal) site at *Naka* (meaning "road traffic tax-collection" toll-point) area of *Taroda Khurd* (village) in Nanded city in India.

Geographical location of Experimental Site: The town - Nanded is a District headquarters located in the south-eastern part of Maharashtra State in (Republic of) India. It has an airport and it is also served by the South Central Railways. Nanded is on the *Nagpur – Hyderabad National Highway No. 1* and is connected well to other parts of the State through private and public transportation means. The geographical coordinates of Nanded are: Latitude: 19^0 9' 0" North and Longitude: 77^0 20' 0" East. Figure 1 shows satellite view of the Taroda *nala* (Nanded).

The study area i.e. the *nala* belongs to Purna Water Project of the Government flowing through the *Taroda khurd* village and finally joining the Aasana River. The area experiences a climate with three distinct summer, rainy, and winter seasons. The summer extends from February to May, the rainy (monsoon) season from June to September and the winter from mid October to February. This seasonal variation could affect the ecosystem of the *nala*. But the study area is polluted mainly due to vegetable open-market held weekly on Wednesdays and also due to the rapid urbanization of the area, the un-treated municipal sewage water, solid waste, agriculture run-off, etc. Upon literature survey, the authors found out that there is no information is available on the water quality parameters, level of pollution and the composition of plankton community of this *nala*. This aquatic ecosystem poses a threat to the health of people living nearby. So keeping all these facts in mind Taroda naka *nala* was chosen for a detailed research study.

Figure-1
Satellite view of Eutrophicated *nala* [Courtesy: Map from www.google.com]

(a)

(b)

Figure-2

(a) Photograph of eutrophicated *nala*. (b). Eutrophicated *nala* and the presence of dog and pig in the study area

Samples and Sampling: Water samples were collected in polythene containers from the Taroda *nala* in the last week of June 2012 taking few equipments and chemicals on the site as well as in the laboratory.

Physico-Chemical Analyses: The temperatures of the samples were noted at the sampling point itself. Analyses were carried out for various physico-chemical water quality parameters. pH, Electrical Conductivity (EC), Total Dissolved Solids, Total Hardness, Total Alkalinity, Phenolphthalein Alkalinity, Salinity, Calcium Hardness, Magnesium Hardness, Dissolved Oxygen, Carbon Dioxide, Calcium, Magnesium, Phosphate, chloride, Phosphate, Sulphate, etc. were analyzed using standard techniques and procedures[19]. Double distilled water was used for the preparation of solutions and the chemicals used for the analyses were of Analytical Reagent (AR) grade.

Identification and Composition of Phytoplankton and Zooplankton Community: The qualitative and quantitative evaluation of unfiltered, unstrained water samples were done by using plankton net made of bolting cloth with 30 meshes/cm. The Plankton samples were preserved in 100 ml polythene bottles by fixing them in 4% formalin. A dilution upto 40 ml was made with double distilled water. The observations were taken under inverted microscope. The procedure was repeated 5 times to get an average. The identified species were expressed in number per liter. In aquatic ecosystem, zooplanktons play critical role not only as primary consumers but also as food for higher organisms. Zooplanktons are used as indicators of the trophic status of a water body. Dominance and abundance of the species was analyzed as per the scientific literature. A species was considered abundant when the number of individuals was higher than the mean density of all occurring species and dominant when their numerical density was higher than 50% of the total number of individual present[20].

Results and Discussion

Eutrophication is a relationship between increased nutrient concentrations in water bodies and increase of plankton community. Nowadays, cultural eutrophication is the culprit in case of freshwater pollution worldwide and this is a rapidly increasing problem of aquatic ecosystems in India as well.

Singh et al., studied water quality and eutrophication status of Mansar, Surinsar, Dal, Tsomoriri and Tsokar lakes of Jammu and Kashmir (India) in the Himalayan region during 1998-99. They also studied Renuka lake of Himachal Pradesh in the year 2006. The eutrophication status in all lakes has been assessed using phosphate data, which showed Mansar, Tsomoriri and Surinsar under eutrophic, Dal, Tsokar and Renuka lakes under hyper-eutrophic condition[21].

Sunkad and Patil analyzed the water quality of Fort Lake, Belgaum, Karnataka (India) and reported that the phosphate in the lake was 7.2-13.6 mg/L due to sewage and cause eutrophication[22].

Bahura found phytoplankton community comprised of algal groups; Bacillariophyta and Chlorophyta represented by total 22 genera. They found highest numbers of genra (10) from Cyanophyta, 6 genera each from two groups Bacillariophyta and Chlorophyta. This study was done at highly eutrophicated temple tank, Bikaner, Rajasthan (India) during the summer season of 1989[23].

A case study[24] on Ranchi Lake (India) showed eutrophication with the percent composition of various phytoplankton classes in a descending order are as: Cyanobacteria > Bacillariophyceae > Chlorophyceae > Euglenophyceae > Chrysophyceae > Xanthophyceae.

The sequence, phytoplankton – zooplankton – carnivores forms the classical food web in aquatic ecosystem. Eutrophication can greatly alter the structure of zooplankton communities. Hence, zooplankton has been used as an indicator of trophic state of aquatic body[25]. Though the physical and chemical parameters help in characterizing water quality, there are doubts about the reliability of these variables because chemical affecting water quality interact with each other and with the environment surrounding it and so their concentrations show wide fluctuations spatially and or seasonally[26].

Taroda *nala* waters are influenced mainly by terrestrial inputs from the nearby agricultural land and anthropogenic activities from the residential areas developed around the canal. All these mechanisms lead to nutrient transformations, nutrient uptake and phytoplankton growth proceeding at a very high rate. Due to the discharge of agricultural runoff, sewage, decomposition of vegetable waste from market, solid waste and slow flow of water within the water body forms bad odour/nuisances and invites animals, insects, flies and mosquitoes. This *nala* becomes a source of diseases. This suggests that the trophic status of this *nala* should not be considered as a static entity.

Analyses of water quality parameters of Taroda *nala* are presented in table 1 while the consequences of nutrient enrichment are displayed in table 4. Phytoplankton and zooplankton from the water samples are listed in table 2 and 3 respectively.

The average total dissolved solid observed from water sample is 2502 mg/L. The average of Electrical conductivity recorded from water samples are 120 uS/cm. The average of pH noted from water sample is 7.5. The free carbon dioxide was absent in water sample. The average total hardness obtained from water sample is 875 mg/L. The mean value of calcium hardness observed from water sample is 56.1 mg/L. The estimated magnesium hardness of water samples in an average is 179 mg/L. The phenolphthalein alkalinity for water samples is 25 mg/L. The observed average total alkalinity of water sample is 125 mg/L. The obtained average salinity of water sample is 2052 mg/L. The dissolved oxygen is absent. The estimated chloride of water samples in an average 1136 mg/L. The average phosphate concentration investigated from water sample is 3.36 mg/L. The average sulphate concentration investigated from water sample is 144 mg/L. The mean calcium content observed from water sample is 56.1 mg/L. The average magnesium content noted from water sample is 179 mg/L. The magnesium ratio is 1.78 %. Concentration of phosphate and absence of dissolved oxygen indicates Eutrophication.

Twenty-eight (28) phytoplankton genera recorded represent various classes viz: Chlorophyceae (7); Bacillariophyceae (7); Cyanophyceae (5); Zygnematophyceae (4); Flagillariophyceae (2); Ulvophyceae (1); Trebouxiphyceae (1) and Euglenoidea (1) were recorded. Higher % of phytoplanktons such as Bacillariophyceae, Chlorophyceae and Cyanophyceae confirms the eutrophication of water body.

A total thirteen zooplankton genera, three belonging to class Monogononta (Phylum: Rotifera), five to Branchiopoda (Phylum: Arthropoda; Sub-phylum: Crustacea), three to Maxillopoda (Phylum: Arthropoda; Sub-phylum: Crustacea), two to Ostracod (Phylum: Arthropoda; Sub-phylum: Crustacea) and one to Ciliatea – protozoan group (Domain: Eukaryote/Eukarya; Kingdom: Chromalveolata, Phylum: Ciliophora) were recorded.

Discussion in detail: The study area is the canal at Taroda *Naka* area flowing through the Taroda village. The canal was originally built by the Government identifying the need to bring a large agricultural region under full irrigation and also by identifying the potential of the Taroda village as a link between Aasna river and Purna river basin under the "Purna Project." It can be characterized as an oxbow *nala* originated by hydro-technical regulation of canal from Purna river basin project; second, it is now being totally ignored and disconnected from the original project; third, it is surrounded by urbanized residential areas and nearby agricultural fields influenced by fertilizers leaching; fourth, it is being converted into a dumping ground for solid waste, particularly vegetable waste from the weekly Wednesday open vegetable market held in the study area. To the best of authors' knowledge, there was no previous data available or no scientific study carried out on this aquatic body.

Similar to the field of human health protection, the assessment and protection of environmental health requires an adequate system where indicators and regulations are employed for successful monitoring[27]. This study aimed at analyzing the physical, chemical, and biological components of the water in Taroda *Naka* as related to eutrophication processes. Water samplings from the last week of June 2012 were carried out, analyzed and interpreted. The results showed small variations in the pH and EC values of the *nala* water. In the case of this *nala*, for the first time "quality status" is defined as integration between "chemical status" and "ecological status," the latter still in need of further description. Hence eutrophication of fresh water areas is of great importance. The objective of this study was to determine the present status of the Taroda *nala* with respect to water quality and the abundance and species percent composition of phytoplankton and zooplankton. In this research project, water pollution has been assessed using physico-chemical analyses and plankton composition data which showed the ecosystem of Taroda *nala* under serious eutrophic condition. Aquatic ecosystem of the study area was found undergone noteworthy alterations of plankton communities as a result of eutrophication and oxygen deficiency. This was confirmed by the plankton as identified in the study and their characteristics (diversity and percent composition) serving as the reliable indicators of eutrophication processes. We confirm from our results that the canal is eutrophic with a very bad water quality in respect to primary productivity and biomass, abundance of the blooming species and frequency of blooms.

Table-1
Water quality parameters of Eutrophicated *nala* at Taroda, district Nanded, Maharashtra, India

Sr. No.	Water Parameters	Methods Used	Eutrophicated nala	Permissible limit (WHO)
1	Total Dissolved Solids	Evaporation method	2502	500
2	Electrical conductivity	Conductometry	120 uS/cm	250 uS/cm
3	pH	pH Meter	7.5	6.5-8.5
4	Carbon Dioxide	Titrometry	BDL	---
5	Total Hardness	EDTA method	875 mg/L	150-500
6	Calcium Hardness	EDTA method	56.1 mg/L	---
7	Magnesium Hardness	EDTA method	179 mg/L	---
8	Phenolphthalein Alkalinity	Acid Titration	25 mg/L	---
9	Total Alkalinity	Acid Titration	125 mg/L	200
10	Salinity	Titrometry	2052 mg/L	---
11	Dissolved oxygen	Winkler's method	BDL	>4
12	Chloride	Argentometric	1136 mg/L	250
13	Phosphate	Stannous chloride	3.36 mg/L	---
14	Sulphate	Turbidometry	144 mg/L	500
15	Calcium	EDTA method	56.1 mg/L	75
16	Magnesium	EDTA method	179 mg/L	30
17	Magnesium Ratio	-----	1.78 %	>50

Table-2
The occurrence of phytoplankton from Eutrophicated *nala* of Taroda, district Nanded, Maharashtra, India

Sr. No.	Phytoplankton	Occurrence
	Chlorophyceae	
1	*Oedogonium*	Dominant
2	*Ankistrodesmus*	Dominant
3	*Chlamydomonas*	Dominant
4	*Hydrodictyon*	Dominant
5	*Carteria*	Sub-dominant
6	*Pandorina*	Frequent
7	*Volvox*	Dominant
	Bacillariophyceae	
8	*Stauroneis*	Dominant
9	*Diatoma*	Dominant
10	*Diadesmis*	Rare
11	*Frustulia*	Dominant
12	*Didymosphenia*	Rare
13	*Navicula*	Dominant
14	*Nitzschia*	Frequent
	Zygnematophyceae	
15	*Spirogyra*	Dominant
16	*Closterium*	Dominant
17	*Zygnema*	Frequent
18	*Cosmarium*	Dominant
	Flagilariophyceae	
19	*Fragilariforma*	Dominant
20	*Fragilaria*	Frequent
	Cyanophycae	
21	*Anabaena*	Dominant
22	*Oscillatoria*	Frequent
23	*Nostoc*	Sub-dominant
24	*Mycrocystis*	Dominant
25	*Spirulina*	Sub-dominant
	Ulvophyceae	
26	*Ulothrix*	Rare
	Treboxiphyceae	
27	*Chlorella*	Dominant
	Euglenoidea	
28	*Euglena*	Dominant

Table-3
The occurrence of zooplankton from Eutrophicated *nala* of Taroda, district Nanded, Maharashtra, India

Sr. No.	Zooplankton	Occurance
	Maxillopoda	
1	*Cyclops*	Dominant
2	*Diaptomus*	Sub-dominant
3	*Mesocyclops*	Sub-dominant
	Monogononta	
4	*Branchionus*	Dominant
5	*Keratella*	Dominant
6	*Filinia*	Dominant
	Ciliatea	
7	*Paramecium*	Dominant
	Ostracoda	
8	*Cypris*	Dominant
	Bronchiopoda	
9	*Daphnia*	Sub-dominant
10	*Moina*	Sub-dominant
11	*Bosmina*	Sub-dominant
12	*Ceriodaphnia*	Sub-dominant
13	*Diaphanosoma*	Sub-dominant

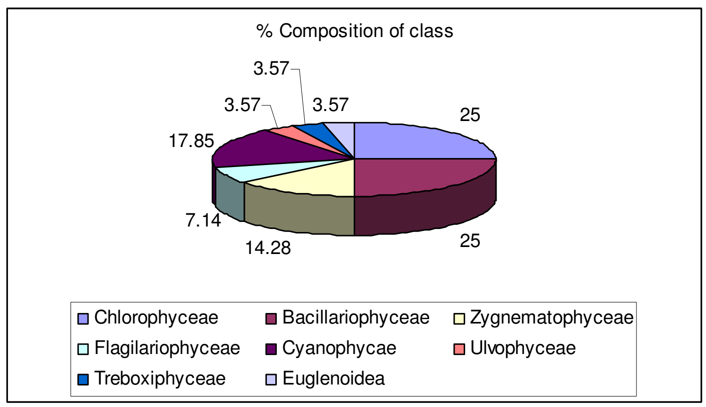

Figure-3
Classwise percent composition of Phytoplankton in the study area

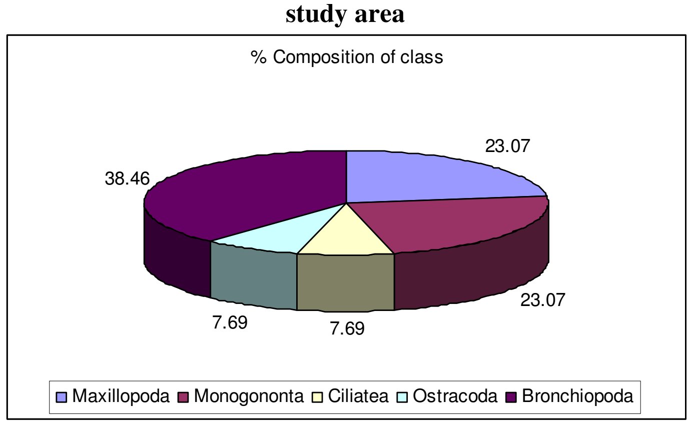

Figure-4
Percentage contribution of zooplanktons over the study area

Table-4
Consequences of Nutrient enrichment

Sr. No.	Consequences	Intensity
1	Algal bloom	Maximum
2	Blue green colouration	Maximum
3	Odour	Maximum
4	Mosquito production	Medium
5	Reduction in use	To the greatest extent

We found phytoplankton community comprised of algal groups: Chlorophyceae, Bacillariophyceae, Zygnematophyceae, Flagilariophyceae, Cyanophyceae, Ulvophyceae, Treboxiphyceae and Euglenoidea represented by total 28 genera. They are found with highest numbers 7 genera each from two groups Chlorophyceae and Bacillariophyceae, 5 genera from group Cyanophyceae, four genera from Zygnematophyceae, two genera from group Flagilariophyceae, one genus each from Ulvophyceae, Treboxiphyceae and Euglenoidea. The percentage of the various classes in a descending order are as follows: Chlorophyceae (25) and Bacillariophyceae (25) > Zygnematophyceae (14.18) > Flagilariophyceae (7.14) > Cyanophyceae (17.85) > Ulvophyceae (3.57) > Treboxiphyceae (3.57) > Euglenoidea (3.57)All the results are summarized in Table 2 and Figure 3. The number of species recorded of Taroda *nala* recorded during the present research is low when compared to as anticipated in bright green coloured and odorous and stagnant water body such as this. Many zooplankton species might have disappeared as a consequence of algal toxins especially of Cyanophyceae.[20] It is evident that with eutrophication some tolerant species may flourish assuming nuisance proportions. This is clearly observed in here. The records of phytoplankton and zooplankton occurrence are summarized in table 2 and 3.

The presence of small Arthropoda (Class: Branchipoda) or Cladocerans such as *Ceriodaphnia* sp. in waters is one of the characteristic of higher eutrophic nature of the water body and related to the interference of filamentous or toxic blue-green algae, which dominate the phytoplankton under eutrophic conditions[28].

Generally rotifers are easily carried away by water which facilitates easy dispersal[29-31]. Therefore a reason for this restricted distribution could be that there is minimum mixing of water in the east part of the eutrophicated *nala* and also that the *nala* at times is getting curtailed in between and thence not continuously flowing towards the Aasna river. A further observation in rotifer distribution is that some species prefer the deep water than surface waters and tend to avoid direct sunlight. However, the absence of Anuraeopsis sp. from the surface samples cannot be entirely explained by avoidance of direct sunlight suggesting the influence of other factors in governing its distribution[32-35].

Zooplankton assessment of the Taroda *nala* is an important indicator of aquatic community structuring and water quality. Total thirteen zooplankton genera were found; among which three belonged to Monogononta, five genera from Branchiopoda, three from Maxillopoda, two from Ostracoda and one genus from Ciliatea. This study was done during the summer season of 2012. The percentage of the various classes in a descending order is as follows: Bronchipoda (38.46) > Maxillopoda (23.07) and Monogononta (23.07) > Ciliatea (7.69) > Ostracoda (7.69). All the relevant results are summarized in Table 3 and Figure 4. Among the Bronchipoda found, Daphnia, Moina, Bosmina, Ceriodaphnia, Diaphanosoma were the species found sub-dominant. Three species were found from the class Maxillopoda. Cyclops was dominant and the other two Diaptomus and Mesocyclops were sub-dominant. Among Monogononta, Branchionus, Keratella, Filinia were present and were found to be dominant. From Ciliata, only one and that to dominant species Paramecium was found. Ostracoda Cypris is found dominant and it was the only one species found from the group Ostracoda.

Dominant species were rotifer *Keratella, Branchionus, and Filinia.* The first two species are common inhabitants of highly trophic lakes; and the latter is a typical in plankton of hypertrophic ponds[36-37]. Abundance is a more sensitive indicator of changes in trophic level than species composition.[38] Rotifers domination, in terms of diversity and abundance, in eutrophicated *nala* accord with observations in typical lake-like water bodies of higher trophic level. Rotifer species *Keratella, Filinia*, and *Brachionus* sp. and their abundance suggest high trophic level in the *nala.* Predators find it very difficult to prey Rotifers due to their small sizes and also because of low water transparency. Higher rotifer abundance in *nala* waters is therefore clearly observed in Taroda *nala* at Taroda Khurd, Nanded (India) at present confirming serious eutrophication of the water body.

The values of measured physical and chemical parameters and plankton composition could be influenced by the summer season, except transparency and dissolved oxygen. In order for us to control this eutrophication, monitoring variables related to this phenomenon, good knowledge of its dynamics and the ability to carry out experimental comparisons among various different sites of the water body and thereby to assess the trends in the ecosystems are necessary. There is, actually, a need for the system development on qualitative- quantitative indicators for functioning as an early warning system for eutrophication and possible spreading of this phenomenon to formerly unaffected areas.

As rightly pointed out by Hooper[39] there is not much value in having indicators that tell us that *"the barn has just burned down.* On the ground of the consideration mentioned above the authors here propose that in case of Taroda naka *nala* waters, the local Government authority should adopt a continuous or at least seasonal monitoring of ecosystem and frame water quality control measures that identify and estimate slow creeping changes in the ecosystem arising from relatively mild eutrophication. The author(s) here propose that: It is advantageous to be able to compare the experiments and results from eutrophication and pollution of water bodies from various parts of the world using the same parameters or indicators[40]. It is therefore required to measure water quality parameters and eutrophication *in situ* using portable probes.

To the best of our knowledge, cleanup measures have never been taken by the local Government *Panchayat* (and now Muncipal Council) and so the site is being converted into a dumping ground. Stagnant water is allowed to collect more nutrients than bodies with replenished water supplies. Hot summer season causes the drying of canal and by doing so increases nutrient concentration and subsequent eutrophication blooms. The rate of water renewal might play a critical role in here. Phosphorus removal measures should be employed especially for industrial and municipal discharges being added continuously to aquatic ecosystems. Such efforts were made in Finland and had a 90% removal efficiency[41].

To summarize: i. The study determined the eutrophic status of the Taroda *nala* with respect to analyses of some water quality parameters, species composition and structures of phytoplankton and zooplankton community correlated with polluted water quality and high eutrophication of Taroda *nala.* Figure 2 (a) shows a photograph of eutrophicated Taroda *nala*. ii. The major cations (Ca^{2+}, Mg^{2+}), major anion (Cl^-) and values of salinity not in line with permissible limits assigned by the WHO for drinking water; hence, the Taroda *nala* water should not be considered good for drinking or any such domestic use for that matter. iii. Increased dissolved solids, total hardness, calcium hardness and magnesium hardness and ions like chloride and magnesium show deterioration of water quality. iv. The plankton count is high and the eutrophication is not limited to the *nala* but extending to surrounding areas of the *nala*. Predominance of zooplankton species are found to vary from herbivores (such as cladoceran) to consumers (such as rotifers) that characterize a detritic food chain[20]. v. High nutrient concentration, hot summer season with high sun illuminations, suitable pH, temperature, and the low velocity of water could all be the combination of factors that trigger the eutrophication processes. All these conditions provide ideal environment for big variations of algal species to grow and increase in numbers forming algal blooms. Nevertheless, the occurrence of eutrophication blooms is almost extreme i.e. dystrophic in Taroda *nala*. vi. This *nala* has undergone continuous eutrophication as evident from dog and pig that one could observe feeding on this trophic water body. [figure 2 (b)]. vii. The Taroda *nala* water quality was affected by the municipal discharges and weekly open market waste dumping in the area (e.g. addition of nutrients exceeding the capacity of the ecosystem) rather than with the effects of natural influence. The phosphate concentration confirms the addition of responsible factor for eutrophication. viii. Water treatment plant should be built to purify the water be sure if the water was safe for drinking and other domestic application or irrigation purposes.

Conclusion

Present research work concludes that the Taroda *nala* at Nanded is eutrophicated and polluted aquatic body due to discharge of agricultural runoff, vegetable waste from nearby market, sewage and solid waste. Higher amount of nutrients are increasing eutrophication with dystrophic condition. The present paper discussed chemical and physical quality parameters of water and the dynamics of phytoplankton and zooplankton as related to eutrophication processes and their consequences in aquatic ecosystem of the study area. Results from phosphate concentration and the composition of planktons confirm the Eutrophication. Increased dissolved solids, total hardness, calcium and magnesium hardness and ions like chloride and magnesium show deterioration of water quality. From the study of plankton diversity of *nala* concluded that about twenty-eight genera of phytoplankton and thirteen different genera of zooplankton are found in this water body. Cyanobacteria and Bacillariophyceae dominate the phytoplankton community in the aquatic ecosystem under study. One of the reasons to define such dynamics is zero availability of oxygen and free carbon dioxide. The percentage of various phytoplankton classes in a descending order are as follows Chlorphyceae and Bacillariophyceae > Cyanophyceae > Zygnematophyceae > Flagilariophyceae > Ulvophhyceae and Treboxiphyceae and Euglenoidea. in the canal water. The Dominant trend of zooplankton in the present investigation is as follows: Bronchipoda > Maxillopoda and Monogononta > Ciliatea and Ostracoda. The phytoplankton and zooplankton community structures were correlated with water quality, and eutrophication of Taroda *nala*.

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