CHAPTER-4

4.1 DISCUSSION

4.2 CONCLUSION

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Lakes and ponds are very well known fresh water ecosystem. They widely consume for fish culture and aquaculture practices. The water quality of such ecosystem is responsible for the survival of aquatic life. Each organism has different and specific optimum range to tolerate the water quality parameters within they can survive, grow and reproduce. Outside of these optimum ranges they exhibit poor growth, erract behavior, disease and mortality.

Now a day's ponds and lakes are hugely affected by industrialization, urbanization development activities to cope up with the population explosion. In the urban area ponds and lakes are majorly affected by the dumping of sewage, running off untreated domestic water, agricultural waste effluents of chemical industry, human habitation and anthropogenic activities. Such contents introduces organic matter, heavy metal, toxic substances and pollutants, which creates enrichment of nutrients resulting eutrophication, disturbs and damage the water quality and its ecosystem (Soni et al, 2008). Therefore, monitoring of ponds and lakes of the urban areas is the necessity of present day. In light of this fact proposed study is selected, to know the water quality and soil quality of the ponds with special reference to fish population.

Temperature affects the chemical and biological reactions in water. The rise in temperature of water accelerates chemical reactions, reduces solubility of gases and elevates metabolic activity of organisms. Many aquatic organisms are sensitive to changes in water temperature. After the observations of water quality parameters of **Dhobi Talav** it can be said that water temperature were maximum in summer and minimum in winter. Due to low water level, clear atmosphere, high solar radiation the temperature was high during summer season. Similar observations were reported by Swaranlatha and Rao (1998) and Shastri and Pendse (2001). It showed high significant positive correlation with pH and high significant negative correlation with DO throughout the study period (2012-13 and 2013-14). The pH found alkaline in nature, alkaline pH has been considered to be good for the growth

of flora in the reservoir (Wetch 1952). It was maximum in summer could be attributed to phytoplankton maxima which resulted in blooms (Jana, 1973) and minimum in winter in both the years. The range of pH was suitable for fish production (ICAR, 2011). It showed high significant negative correlation with DO in both the years and high significant positive correlation with Chloride in the second year.

Acidity was maximum in monsoon, may be rain water contains acids which get mix into ponds through running of surface water and minimum in summer may be low level of water due to evaporation. It showed significant negative correlation with chloride and Total hardness throughout out the study period. Alkalinity was maximum in summer in both the years due to decreased water level raised temperature, and increased productivity (Seenayya 1971). It was minimum in monsoon in first year and winter in second year. Boyd (1982) advocated that total alkalinity should be more than 20 mg/l in fertilized ponds as fish production increases with increase in total alkalinity. It showed significant positive correlation with Total Hardness and Calcium hardness in first year and showed significant negative correlation with DO in second year.

Dissolved oxygen acts as a limiting factor in fresh water ecosystem, because it is the single limnological parameter which exhibits the health of water body in terms of biotic and trophic status. DO shows inverse relation with temperature (Yadav et al (1987)). It was maximum in winter may be low temperature allows higher diffusion of oxygen gas in the water and due to low temperature most of aquatic organisms exhibit hibernation so they consume less oxygen for metabolic activity thus DO was high in winter season. It was minimum in summer due to higher temperature with solar radiation both the years. It showed significant negative correlation with chloride in second year. Higher concentration of chloride considered as an index of pollution in fresh water ecosystem. In present study Chloride was maximum in summer and minimum in monsoon similar trend was reported by Jindal (2002). It showed significant positive correlation with Total

hardness throughout the study period. Hardness is an important parameter for determining the quality of water. It is majorly the sum of calcium hardness and

	Temp	pH	Acidity	Alkalinity	DO	Chloride	TH	Ca	Mg	Phosphate	Nitrate	TS
Temp	1	0.9611	-0.2890	-0.2147	-0.9766	0.4870	0.2540	0.0254	0.4812	-0.3356	-0.1734	0.3819
pH		1.0000	-0.4673	-0.0909	-0.9782	0.6070	0.3913	0.1719	0.5180	-0.4871	-0.3087	0.2307
Acidity			1.0000	-0.4643	0.4045	-0.7506	-0.7962	-0.6878	-0.4858	0.6421	0.5155	0.6331
Alkalinity				1.0000	0.1491	0.4489	0.7290	0.7601	0.2256	-0.3061	-0.4957	-0.5930
DO					1.0000	-0.6029	-0.3384	-0.1490	-0.4475	0.4773	0.3241	-0.2648
Chloride						1.0000	0.8263	0.6583	0.5974	-0.6106	-0.6929	-0.5319
TH							1.0000	0.8768	0.5883	-0.5065	-0.5841	-0.6740
Ca								1.0000	0.1270	-0.4824	-0.7152	-0.6496
Mg									1.0000	-0.2335	-0.0023	-0.2979
Phosphate										1.0000	0.6440	0.4074
Nitrate											1.0000	0.4102
Total Solids												1.0000

Correlation Table of Dhobi Talav 2012- 13

	Temp	pH	Acidity	Alkalinity	DO	Chloride	TH	Ca	Mg	Phosphate	Nitrate	Total Solids
Temp	1	0.8994	-0.5715	0.7974	-0.9850	0.7858	0.5830	0.3738	0.6237	-0.0545	-0.1061	0.4051
pH		1.0000	-0.7673	0.6164	-0.8670	0.8342	0.5830	0.2901	0.7243	-0.1888	-0.2269	0.4051
Acidity			1.0000	-0.4748	0.5574	-0.8976	-0.7380	-0.6175	-0.6125	0.6451	0.6284	0.3196
Alkalinity				1.0000	-0.8163	0.6795	0.6085	0.6149	0.3753	-0.1170	-0.2225	0.3623
DO					1.0000	-0.7790	-0.6215	-0.4142	-0.6456	0.1198	0.1515	-0.3919
Chloride						1.0000	0.8542	0.7140	0.7098	-0.5873	-0.5745	-0.0863
TH							1.0000	0.8675	0.7923	-0.7105	-0.7040	-0.2799
Ca								1.0000	0.3837	-0.6825	-0.6357	-0.3741
Mg									1.0000	-0.4817	-0.5271	-0.0608
Phosphate										1.0000	0.9190	0.5584
Nitrate											1.0000	0.5109
Total Solids												1.0000

Correlation Table of Dhobi Talav2013 - 14

magnesium hardness into the water which comes from leaching of rocks and soil through running of rain water and mixes into the pond (Paul and Mishra, 2004). Total hardness was maximum in summer may be due to evaporation, water becomes condensed and the salt occurs at higher concentration. Hardness was minimum in monsoon. It showed significant positive correlation with Calcium hardness in first and second year but showed significant positive correlation with Magnesium hardness and significant negative correlation with Nitrate in second year. Calcium hardness was maximum in summer and was minimum in Monsoon throughout the study period. Magnesium hardness showed monthly variation. Jain et al (1996) indicated that any amount in access of 0.5 mg/L of phosphate is an indication of pollution. Here in the present study the total phosphorous was below the range i.e. the pond was not polluted. It was maximum in monsoon; minimum in summer similar observation was reported by Singh (1965). It showed high significant positive correlation with Nitrate throughout the study period. Total solids are the total of dissolved solids and suspended solids present into the water. These values were reported maximum in monsoon may be running off domestic sewerage, surface particles and running of human activities. It was minimum in winter in first and second years.

Temperature is one of the most important physical parameters, which controls the physiological activities and distribution of biota. The main source of temperature in water body is solar system. The water temperature of **Majam talav** were reported maximum in summer and minimum winter. Temperature exhibited inverse relation with DO and primary productivity thus primary productivity decreases in summer and increase in winter (Korai, 2008). It showed significant positive correlation with chloride and alkalinity and high significant negative correlation with DO in the first and second year. The pH values were maximum in summer and minimum in monsoon similar rend reported by Tripathi and Pandey (1989). Minimum pH was in monsoon was probably due to inflow of water which brings down the level of CO_2 and carbonates. It showed high significant negative correlation with acidity and significant positive correlation with the hardness of water, chloride and alkalinity throughout the study period. It was alkaline during the study period. Alkaline pH is indication of good amount of Phosphorus which is essential for growth of fishes and other aquatic organisms. Acidity was maximum in monsoon probably due to mixing of surface water containing domestic sewage, garbage, pollutants and acids from rain water. It was minimum in summer May be condence and low level of water. It showed high significant negative correlation with alkalinity, hardness of water and significant positive correlation with nitrate and DO in first and second year. Alkalinty occurs in water majorly due to presence of carbonates, bicarbonates and hydroxyl ion.

Alkalinity was maximum in summer, may be due to increased rate of organic decomposition, during which CO_2 is liberated, reacts with water and form HCO_3 {Harshey et al (1982)}.While it was minimum in monsoon probably dilution of pond with rain water. It showed significant positive correlation with Calcium hardness and showed significant negative correlation with DO, Phosphate and Nitrate during the study period.

DO is important in the production of aquatic life, decomposition and decay of organic matter. Its concentration in water is dependent upon temperature, dissolved salts, pollution load, photosynthetic activity and respiration rate (Tamot et al; 2008). It was maximum in winter and was minimum in summer and showed significant negative correlation with chloride during the investigation period. A low value of DO during summer was due to the higher catabolic rate of aquatic organisms and decrease in oxygen solubility at higher temperature. Oxygen levels never fell below 4.0 mg/l, which condisiderd to be the critical level for tropical fish rearing (Mallasen et al., 2012).The higher concentration of chloride is considered to be an indicator of higher pollution due to higher organic waste of animal excreta. Chloride was found highest in summer may be due to increased temperature, low level of water and sewage mixing and lowest value were recorded in monsoon. Total hardness was optimum in summer and minimum in monsoon. It showed high significant positive correlation with Calcium and Magnesiun hardness in first and second year but showed significant negative correlation with Nitrate in second year. Lucas and Southgate (2012) reported that the hardness value more than 50 mg/l is desirable for Tilapia culture. Calcium hardness and Magnesium hardness was reported highest in summer in the study period. Calcium hardness significant negatively correlated with Nitrate throughout the study period. Phosphate and Nitrate are an important nutrient for the maintenance of the fertility of water body. They are directly or indirectly affect the abundance and diversity of phytoplanktons and zooplanktons on which fish fed. The phosphate concentration as per WHO standard is 2.5 mg/l for drinking water. The acceptable value of phosphorus was reported 0.025 mg/l for Nile Tilapia by Santos et al. (2012). Total phosphorus and Nitrate values were noticed maximum in monsoon may be due to presence of detergents in sewage waste dumped in to the pond. Minimum values were found in winter and summer respectively, during the period of two years. Total solids values were reported maximum in monsoon may be due to discharge of domestic sewage and other anthropogenic activity {Parikh and Mankodi (2012)} and It was minimum in winter in first and second years.

In the present study **Danteswar talav** water temperature was gradually decreasing from monsoon to winter and increasing from winter to summer. Similar observations were recorded

for various lakes and reservoirs of India Narayana et al (2008) and Anita et al (2005). It was above the permissible limits by WHO (2004). Water temperature represented high significant negative relationship with Dissolve oxygen. The pH was above 7 during all months. The pH values showed that the water was alkaline in nature throughout the study period. Similar result was observed for fresh water urban pond Parikh et al (2012). The alkaline nature of pH may be the result of various biological activities Gupta et al (1996). The acidity present in water may be due to free CO_2 which showed monthly variation. The alkalinity was maximum in summer Harshey et al (1982) and minimum in monsoon. Dissolved Oxygen (DO) is the most important parameter which is directly affecting survival and distribution of flora and fauna of an ecosystem. It was maximum reported in winter and minimum reported in summer. Similar results were reported of some water ponds of Ayodhya Chaurasia and Pandey (2007). According to Patil and Dongare (2006) DO showed an inverse relationship with temperature which might be due to oxidation of oxygen. During summer may be due to high temperature, high metabolic rate of aquatic organism, DO was low. The higher concentration of chloride in summer may be due to high radiation, low level of water, increased temperature and lower concentration in monsoon due to dilution of pond with rain water. It showed positive relation with temperature. A chloride concentration above 60 mg\l indicates heavy pollution Adoni (1975). According to the above statement the pond water was polluted. Total hardness showed significant monthly variation. The average value was found in the present investigation is in the range of 121-180 mg/l, which fall in the category of hard water Kannan (1991). It is not useful for drinking purpose. Calcium is found abundantly in all natural water. Calcium hardness was found minimum in rainy season and maximum in winter. The higher concentration of calcium may be due to inflowing sewage from surrounding areas. Magnesium hardness showed significant positive correlation with total hardness. The phosphate concentration did not show definite monthly variation. The higher concentration of phosphate may be due to presence of detergents in sewage waste dumped in the pond and washing clothes, cleaning of the utensils at the pond Prasannakumari et al (2000). Nitrate concentration was found highest in monsoon and lowest in summer. The nitrate values were high in monsoon may be due to surface run off and domestic sewage specially washing activities. Total solids values were exhibited that it was within the permissible limits. The concentration of total solids was constantly increased in summer to rainy season.

Soil is most important component which provides nutrients as well as substratum to the aquatic organisms in any aquatic ecosystem. It plays an important role in regulating the concentration of nutrients through leaching in the pond water (Adhikari, 2003).

The nature of soil depends on its pH values. Soil pH is also important because it controls the microbial actions inside soil Hesse (1971) . After the observations of soil parameters the results exhibited that **Dhobi talav** soil pH values were high in summer season and low in monsoon season. It showed significant positive correlation with Nitrate-N in first year and Phosphate-P in second year. While Majam Talav soil parameter exhibited that the pH values were increasing in summer and decreasing in monsoon and indicates high significant positive correlation with phosphate-P in second year. The soil pH was high in summer and low during monsoon possibly due to redox changes in the soil and water column apart from the influence of freshwater (Ramanathan, 1997). It was alkaline in the nature during the investigation period. pH range 7 to 8 is good for the growth of fish Devi et al (2013).

Phosphate-P and Nitrate-N act as a important nutrients which are essential to fertilize the soil of the pond. These nutrients regulates through water cycle. Dhobi Talav soil Phosphate-P values were maximum in summer in both the year and minimum in monsoon in first year and winter in second year. It exhibited significant positive correlation with Nitrate-N in first year. While Nitrate-N values were optimum in summer and minimum in monsoon during the period of investigation. While at the site of **Majam Talav** the soil phosphate-p and Nitrate-N values were highest in summer and lowest in monsoon in both the year. The soil Phosphate-p showed significant positive correlation with Nitrate-N in during the study period. Mahajan and Billore (2014) reported that Phosphate and Nitrate were maximum in summer season and gradually decreases through winter season to rainy season. It has also revealed that Nitrate and Phosphate concentration of soil affected due to agricultural runoff and anthropogenic activities by surrounding the pond.

The fish population analysis was carried out through getting the morphometric and morphological characteristics and condition factor of fishes of the study sites during the investigation. For such investigation 480 fishes were analyzed during the study period from each study site.

Morphometric analysis is based on a set of measurements which represent size and shape variation and are continuous data. In fish morphometric character represent one of the major keys for determining their systematic, growth variability and various population parameters.

Condition factor compares the wellbeing or goodness of a fish. It is based on the hypothesis that heavier fish of a given length are in better condition (Bagenal and Tesch, 1978). It has been used as an index of growth and feeding intensity of fishes (Fagade, 1979). It decreases with increases in length (Bakare, 1970).

In the present research work the comparative study of fish population of the Dhobi Talav and Majam talav were carried out through morphometric, morphological characteristic and getting condition factor of the fishes. The range of total length and standard length of the fishes of Dhobi talav were found smaller than Majam talav. This indicates that the biomass of the fishes of Dhobi talav was low. The average value of weight of the fishes revealed that Majam talav fishes were heavier than the Dhobi talav that means fishes of Majam talav having good content of body mass. Due to good content of body mass the fishes of Majam talav have good market value which increases its economic importance.

The length-weight relationships is represented by the cube law $W = aL^b$ {Lecren (1951)}. When b = 3 or close to 3, growth in fish is said to be isometric i.e fish become more robust with increasing length. Similarly when b is far less or greater than 3, growth in the fish is allometric i.e. the fish becomes thinner with increasing length King, (1996). If b>3 i.e. Positive allometric and if b<3 i.e. Negative allometric Morey et al (2003).When b<3 the fish grows faster in length than weight and when b>3 the fish grows faster in weight than in length Forse, Pauly, (Eds.) (2011). So according to the above statement in the present investigation the b values of the fishes of Dhobi talav and Majam talav were less than 3 (i.e. b<3). This indicates that the growth pattern of the fish population was negative allometric, which means that fish grows faster in length than weight and becomes thinner with increasing length. But in the year 2013-14 the b value of the fishes of Majam talav was close or near to 3. This indicates that in the year 2013-14 the growth pattern of the fish population of Majam talav was isometric, i.e. fish become more robust with increasing length. The correlation values of total length and weight of the fishes of both ponds revealed that they were positively significant correlated to each other and showed liner relationship through graph. The similar correlations were also found with the standard length and weight of fishes of both ponds.

Condition factor gives information when comparing two populations living in certain feeding, density, climate, and other conditions; when determining the period of gonad maturation; and when following up the degree of feeding activity of a species to verify whether it is making good use of its feeding source (Weatherley, 1972).

The average values of condition factor K was above 1 exhibit that health of the fishes were in good condition AlhadiIghwela et al; (2011). According to that the fishes of both ponds revealed that the fishes were both ponds were in good condition. But the fishes of Majam talav were heavier than the fishes of Dhobi talav, it means that Majam talav fishes were in better condition than the Dhobi talav during the study period. Condition factor also revealed that the climate conditions were suitable for the density of the fishes. The density of fishes was reported high at the Majam talav.

On the other hand the data of length–weight relationships of the fishes of Danteshwar pond and Sama pond revealed that there were positive correlation between length and weight. The range of the length of the fishes showed that the population size of Sama pond is bigger than Danteswar pond. The b (regression coefficient) values were less than 3 which indicate that the growth pattern of the fish population was negative allometric i.e. the fish become more slender as they increase in length. All the studied fishes were in good condition shown by the averages of condition factor K of the fishes of both ponds.

4.2 CONCLUSION

The fresh water ecosystems are the good sources of rearing fish culture and aquaculture. They provides habitat to aquatic flora and fauna, but now a days due to urbanization, increasing population and industrialization such ecosystem have disturbed at their tropic level which affects the sustainment of aquatic life so it is necessary to monitoring lentic ecosystem such as ponds and lakes time to time so that the flora and fauna of aquatic ecosystem will stay with its environmental condition. The environmental condition exhibits by physiochemical and biological parameters of water and soil of an aquatic ecosystem. This environmental condition also governs the biota and tropic status of aquatic ecosystem.

In the present investigation after the analysis of physico-chemical properties of water and soil revealed that such properties creates the environmental conditions for aquatic medium and affect the flora and fauna of ecosystem. It has been noticed that some water quality parameter such as pH, DO, Chloride, temperature and hardness of water were suitable for the growth of fishes. Therefore a trend found by the fish population of the study sites.

Nitrate and Phosphate marked as a growth indicator of fishes in the investigation. The average of Nitrate and Phosphate of soil and water of Majam Talav was higher than Dhobi Talav, thus the fishes of Majam Talav was heavier in weight and good growth and shows better condition. Due to higher concentration of Total solids of water the density and growth of fishes were low at Dhobi Talav.

Most of all the parameters were maximum in summer and minimum in monsoon and winter exhibited seasonal fluctuations through which growth of fishes were affected seasonally. Finally it can be assumed that environmental conditions of the study sites create interrelation between the fish population and aquatic ecosystem. Evaluation of the relationship between environmental conditions and existing fish population of lentic ecosystem isbeneficial for pisciculture practice.