Synopsis of the Ph. D. Thesis entitled

"ASSESSMENT OF BIOTIC COMPONENTS WITH SPECIAL REFERENCE TO FISH POPULATION OF LENTIC ECOSYSTEM"

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INTRODUCTION:

Fresh water is a renewable and vulnerable resource on the earth having a great role in sustenance of life of all living organisms of the environment and maintaining the balance of nature. In various activities like aquaculture, agriculture, hydropower, fisheries and industries, the water resources are being used by human being on the large scale. Due to the unplanned urbanization and industrialization, all water resources have been reached to a point of crisis and requirement of water for all living organisms is a serious problem today.[1]

The quality of water is described by its physical, chemical, and microbial characteristics and affects directly or indirectly by physico-chemical parameters.[2, 3]Water quality and its parameters are very essential for current information about the concentration of various solutes,it provides the basis for judging the suitability of water for its designated uses and to improve existing conditions. The study of physico-chemical parameters could help in understanding the structure, function and metabolic events in a particular aquatic ecosystem.[4,5] These parameters changes widely due to many factors like source of water, type of pollution, seasonal fluctuations. Therefore a regular monitoring of fresh water bodies not only checks water from deterioration, but also provides a scope to assess the current investments for pollution prevention and control.

A healthy aquatic ecosystem is dependent on the maintenance of physico-chemical properties of water and its biological diversity. Water quality play an important role in aquaculture because its imbalances can causes stress, poor growth and mortality of culture species.[6]

Fresh water ecosystems are of two general types: Lotic (running water) habitat and Lentic (still or stagnant water) habitat. Lentic ecosystem (such as ponds, lakes, wetlands, bogs, marshes, swamps) is one of the most productive ecosystems with respect to aquatic plants and animals in the biosphere and plays a significant role for sustainment.

For present investigation, Tilapia (*Oreochromis mossaimbicus*) were selected as fish model because,Tilapia is one kind of global cultured fish species, which has more than 4000 years history of aquaculture.[7] It has high adaptability to the environment such as tolerance to high salinity, lower dissolved oxygen and high density, fast growth even fed on natural food or cheap formula feeds, short reproduction cycle and natural spawning in the culture condition. It can also be termed plastic animals in the sense that whereas most animals exhibit certain size, life span and a general pattern of growth, their growth rate and maximum obtainable size may be seriously affected by the physical and biological composition of their environment.[8,9] The present work has been carried out on the morphometric aspects such as length-weight relationship and condition factor of Tilapia from Lentic ecosystem.

The length-weight relationships of fishes are of importance in population assessments and are related to the metabolism in each species with the environment where they live. It is an importanttool in aquaculture and fishery management.

This relationship serves three purposes viz.,i)determines the type of the mathematical relationship between two variables so that if one variable is known the other could be computed, ii)the relative condition can be estimated to assess general well being of the fish and type of growth i.e. whether isometric or allometric and iii)helps to the potential yield per recruit in the study of fish population dynamics.[10]

This synopsis presents the summary of few of the important components of the research work carried out,other elements like experimental data, graphs, values, figures and photographs etc. with results will be discuss in the thesis.

OBJECTIVES:

The objectives of the study are:

1. To assess physico-chemical status of the Lentic ecosystem.
2. To understand biology of fish population of the identified sites.
3. To establish interrelationship between environmental conditions and fish population.

Study Sites:

In Vadodara city there are a large number of water bodies. All of these are fresh water bodies. Some of them are natural urban pond and some of them are artificial tank. Most of them are located near temple, surrounded by the slum areas and human habitation, where this resource being used by inhabiting people around it for various activities like bathing, washing clothes, fishing, and dumping sewage etc.The primary selection of the criteria of the study sites were availability of fish and water throughout the study period.

For the present study the following ponds were selected as the study sites (Table 1):

1. Danteshwar pond
2. Sama pond
3. Majam Talav
4. Dhobi Talav

Table 1:   The geo-location of the study sites

Sr. No.	Study sites	Latitude	Longitude
1.	Danteshwar pond	22^0 16' 34.37" N	73^0 12' 39.78" E
2.	Sama pond	22^0 20' 554" N	73^0 12' 177" E
3.	Majam Talav	22^0 18' 45.55" N	73^0 12' 29.08" E
4.	Dhobi Talav	22^0 18' 45.86" N	73^0 13' 09.69" E

These are perennial permanent urban ponds, surrounded by slum area and utilized by surrounding inhabitants for various activities. The fishing activities were taking places regularly and availability of water was good at these ponds throughout the study period, which is the necessity of investigation of research work.

METHOD AND MATERIALS:

The physico-chemical study of water could help to understand the structure and function of particular water body in relation to its inhabitants.For assessment of physico-chemical status,the study sites were visited monthly for sample collection. The water parameter like Temperature, pH, Acidity, Alkalinity, Dissolved Oxygen, Chloride, Total Hardness, Calcium Hardness, Magnesium Hardness, Phosphate, Nitrate and Total Solids were assessed throughout the investigation period.   Water samples were collected from various sites at random from the ponds in the morning time between 7 to 8 am in plastic bottles. Water temperature was recorded by standard centigrade thermometer on site.

For the estimation of dissolved oxygen, water samples were collected separately in 300 ml BOD bottles and oxygen was fixed by using Winkler's reagent at the time of sampling on field. pH was recorded by standard pH meter. All other remaining parameters were analyzed immediately on return to the laboratory by Titrimetry methods. The physico-chemical parameters for water quality were assessed using standard methods.[11,12]

For the study of soil quality parameters, the soil samples were analyzed monthly. Samples were collected with the help of scoop up to the depth of 15 cms, kept in polythene bags, return to the laboratory and drying it. The dried soil was grinded and sieved through 2 mm mesh sized sieve then used for further analysis. The parameters like soil pH, Phosphate and Nitrate were estimated through the standard methods.

For understanding the biology of fish population, the Tilapia (*Oreochromis mossaimbicus*) was selected as fish model due to its easy availability throughout the study period at the selected sites.

The following measurements and observations were recorded for each sample:

   a. Total length in centimeters.
   b.   Standard length in centimeters.
   c.   Total weight in grams.

Length was measured with the help of thread and scale (in cm).Weight was measured with help of an electronic weighing balance to the nearest 0.01 gram (in gm).

The relationship between the length (L) and weight (W) of fish was expressed by equation

$W = a L^b$

Where W= weight of fish in gram, L=total length (TL) of fish in cm. a=Constant (intercept), b = the length exponent (slope)

When expressed in Logarithm:

Log W=Log a + b Log^L i.e. y = A+Bx, where

Y = Log W, B = n (regression coefficient) and X =Log L.

The "a" and "b" values were obtained from a linear regression of the length and weight of fish. The condition factor (K) of the experimental fish was estimated by using Fulton's condition factor: K= W/L3*100.[13]

Where K= condition factor, W= weight of fish (g), L= length of fish (cm).

The correlation (r^2) that is the degree of association between the length andweight was computed from the linear regression analysis: R = r^2

RESULTS AND DISCUSSION:

In this research work two such ponds i.e. DhobiTalav and Majam Talav were majorly investigated for the period of two year to find out the relationship between the environmental conditions and existing fish population with their patternof growth and wellness. The work on the sites like the Danteshwar pond and Sama pond was also carried out for the test purpose and the data were used for comparison.

The water parameter like Water Temperature, pH, Acidity, Alkalinity, Dissolved Oxygen (DO), Chloride, Total Hardness, Calcium Hardness, Magnesium Hardness, Phosphate, Nitrate and Total Solids were assessed throughout the study period of the selected sites.

The averageof the mention parameters of the water body of Danteshwarpond, were within the permissible limits for potable water standards of WHO [14] except water temperature and pH.The waterwasalkaline in nature shown by the pH values and water temperature exhibit high significant negative correlation with dissolve oxygen throughout the study period. Phosphate and nitrate were positively correlated to each other.Phosphate and nitrate showed negative correlation with most of the all parameters. Magnesium hardness showed significant positive correlation with total hardness. Nitrate was negative significantly correlated with total hardness. Acidity was zero in the month of May.

The physico-chemical parameters of the water of Majam Talav indicate that average of calcium and magnesium hardness were above the permissible limits of IS10500:2012 except all the mention parameters.On the other hand averages of all the water quality parameters of Dhobi Talav were within the permissible limits of IS 10500:2012 except magnesium hardness.

The comparative study of water parameters of MajamTalav and Dhobi Talav reveals that the averages of most of the all parameters (specially chloride and total hardness) of Dhobi Talav were higher than the Majam Talavexcept water temperature, pH, DO, Phosphate and Nitrate throughout the study period. Dissolved oxygen showed Inverse relation with temperature, pH values indicate that the water was alkaline in nature; Phosphate and nitrate were positively correlated. The water temperature and pH of Dhobi Talav showed high positive significant correlation.

The pH value from 7 to 9 is best for pond fish culture.[15]In the present investigation the pH values were vary from 7 to 9 in above sites which indicates that these sites are good for fish culture.

The soil quality parameters such as pH, Phosphate-P and Nitrate-N were analyzed during the investigation of the study sites.The average of pH indicates that soil were alkaline throughout the study period of Dhobi Talav and Majam Talav.Alkaline soil absorbs more phosphorus from soil so it is the positive factor for productivity. The Phosphate-P and Nitrate-N of soil of Majam Talav showed positive significant correlation during study period. The pH of soil of MajamTalavexhibits high positive significant correlation with Phosphate-p. In the year 2012-13 the pH and Phosphate-P of soil of Dhobi Talav showed positive significant correlation with Nitrate-N and on the other hand in the year 2013-14 the pH and Phosphate-P of soil were positive significant correlated.

Morphometric analysis such as length-weight relationships, growth patterns, condition factors and Regressioncoefficients of the fishes of the selected sites were assessed throughout the investigation.

A total of 240 specimens were collected and analyzed per year during 2012-14 from the Majam Talav and Dhobi Talav.The regression line from the graphs of length-weight relationships represented linear relationship between length (total and standard) and total weight and the data were very close to the line which revealed close relation between length and weight of fishes of both ponds.The range of total length and standard length of fishes of both ponds indicates that the population size of Majam Talav is bigger than Dhobi Talav because the growth and condition of fishes are affected by the water quality of the resources[16].

The length-weight relationships is represented by the cube law $W = aL^b$ {Le cren(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[17].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[18]. If b>3 i.e. Positive allometricand if b<3 i.e. Negative allometric[19] .When b<3 the fish grows faster in length than weight and when b>3 the fish grows faster in weight than in length.[20]

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.There was positive significant correlation has been reported between length and weight of the fishes of both ponds. The average values of condition factor K of all the studied specimens were above one during the study period, which exhibits that health of the fishes were in good condition.[21]

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 thanDanteshwar 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.

SIGNIFICANCE OF WORK

1. This work will reveal the impact of water and soil quality on fish population growth with different environmental condition.
2. Environmental status map can be generated for the Lentic ecosystem under the study to utilize for GIS.
3. Evaluation of the relationship between environmental conditions and existing fish population of lentic ecosystem will beneficial for pisciculture practice.

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PUBLICATIONS AND PRESENTATIONS

PUBLICATIONS

1. **Pathak Neelam B.** and Mankodi P.C.Hydrological status of Danteshwar Pond Vadodara, Gujarat, India. Published in *International Research Journal of Environment Sciences*, Vol.2(1), 43-48.(2013).

2. **Pathak Neelam B.,** Parikh Ankita N. and Mankodi Pradeep C. Morphometric Analysis of Fish Population from Two Different Ponds of Vadodara City, Gujarat, India. *Res. J. Animal, Veterinary and Fishery Sci.1* (6), 6-9.(2013).

PRESENTATIONS

1. Oral presentation on "Morphometric analysis of fish population from two different ponds of Vadodara city" at XXIV- Gujarat Science Congress, Ahmedabad (2010).

2. Poster presentation on "Assessment of physico-chemical status of Danteshwar pond, Vadodara city" at 12th Annual Conference of Society of Science and Environment, Inter-disciplinary Approaches in Environmental Sciences, The M.S University of Baroda, Vadodara (2010).

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