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Hydrological studies in Varaha reservoir, Kalyanapulova Visakhapatnam District

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Abstract
In the present study an attempt has been made on physico-chemical characteristics of Varaha reservoir, located in Kalyanapulova, Ravikamatam mandal, Visakhapatnam district of Andhra Pradesh. Reservoirs, the most important freshwater resource, have the potential to substantially augment the inland fish production of the country. Functional parameters of an ecosystem attributes to the ecological significance and resulting from the interactions between its physical, chemical and biological components. Physico-chemical characteristics of Varaha reservoir were analyzed at monthly intervals for a period of 3 years. In India reservoirs constitute an important inland fishery source.

Keywords: Varaha Reservoir, physico-chemical characteristics, temperature, dissolved oxygen

Introduction
The Varaha Reservoir Project was constructed across the Varaha River. The project is located near the Kalyanapulova, Ravikamatham Mandal, and Visakhapatnam District to irrigate a total ayacut of 4,484 acres in the District of Visakhapatnam and/or to, generates - MW of power/ provides drinking water to 7 villages in the one Mandal and one district. Kalyanapulova reservoir was constructed in the year 1970 for irrigation purpose, but serious attempts were made on the fishery development or academic aspects such as the changing water quality parameters or the influence of environment on the biotic and abiotic communities. Hydrological studies were conducted on Varaha reservoir, located in Cheemalapadu village, Ravikamatam mandal, Visakhapatnam district during 2009 to 2012. The data on water temperature showed a correlation to the seasonal cycle of variations of atmospheric air.

In India reservoirs constitute an important inland fishery source. As opposed to large multipurpose reservoirs, medium reservoirs like the Varaha reservoir impounded by damming small intermittent water sources serve as storage of the surface run-off for irrigational needs. The state of Andhra Pradesh has small, medium and large reservoirs and Varaha reservoir is one of the medium reservoirs. The river Varaha originated in the Sannivaram Reserved Forest in Visakhapatnam District River Varaha constitutes two streams viz. Varaha and Sarpa river these two streams join at Kailaspatnam village from the point of confluence, this river is known as Varaha till it bifurcates into two branches just before empting into a salt crack adjoining bay of Bengal. This reservoir was formed by closing a narrow river physical with an Earthen dam for a length 1210 Mts with an impounding capacity of 0.431 Mcft with the Co-ordinates – Longitude: 82^{0}-40^{l}-30^{ll}, Latitude 17^{0}–48^{l}- 30^{ll}. The project work picked up in the year 1964 to obvious reasons and there after the main components of the project i.e. spillway regulator and head sluice were taken up and completed in all respects in between the period from 1975, simultaneously to certain extent water was first released during the year 1982. This project is intended to create Irrigation potential to an extent of 4,484 acres spread over in Visakhapatnam. Varaha reservoir project near Kalyanapulova village was constructed with an estimated amount of Rs.138.60 Lac. The total extent of ayacut contemplated is 4,484 Acres in Visakhapatnam District. The original contemplated ayacut is for one crop including Khariff Wet. As per the newly adopted as the ayacut under this project is 4484 Acres under the jurisdiction of Narsipatnam Sub Division, Narsipatnam. The ayacut is being maintained by Narsipatnam Sub Division under Visakhapatnam District. The Varaha reservoir is very good example for a natural ecosystem, offering the primary producers, secondary producers and the consumers. In the present studies an attempt is made to evaluate the details of various tropic levels, primarily to work out the fishery support offered by the Varaha reservoir to humankind such a study was not dealt with earlier due to

the difficulty in approach to the reservoir, because of its geographic location in a deep forest area. Attempts were also made to evaluate the potential of Varaha reservoir to develop as a center for reservoir fishery.

The first limn logical report from India on the seasonal conditions governing the pond life is that of Prasad (1916) from Punjab. After 2 decades, Pruthi (1993) [12] studied the seasonal changes of the physico- chemical characteristics of freshwater tank in the Indian museum, Calcutta. Sewell (1934) [15] worked on the seasonal variations in plankton in the same area. Later many workers contributed to the hydro biological conditions of fresh water bodies in various parts of the country. Among them mention made of Ganapathi (1940, 1956, 1960) [2, 3, 4] Gonzalves (1946) [6], Gevrey *et al.,* (2001) [5]. The works cited above mostly deals with the hydro biological conditions of ponds, tanks, reservoirs and lakes for shorter duration

Materials and Methods

Kalyanapulova reservoir has some unique features because of its situation in the forest area and also because of the human populations and their professional competitions. Some of the people living upstream of the Varaha river cultivate seasonal crops like study was conducted for a period of 3 years, 2009 – 2012. The wooden boat was used for travelling in the reservoir and for collection of various samples for chemical analysis of water. Water and plankton samples were collected once in every month. The surface water samples were collected from a few inches below the surface. Samples of water from the bottom were collected with the help of a polythene bottles. The parameters like atmospheric temperature, water temperature, pH and electro conductivity were analyzed with the help of thermometer and water analysis kit developed by E1-Products. Measurement of transparency was done by sacchidic. Sample for dissolved oxygen determination was collected in 250 ml capacity BOD bottles and fixed by Winkler's A & B solutions at the station. For estimation of B.O.D (biological oxygen demand), water samples were collected in 500ml water bottles, fixed for 5 days at 20^0 centigrade in a B.O.D incubator and dissolved oxygen was determinant by the Winkler's method described above. Total alkalinity was determined by titration with standard N/20 hydrochloric acid by using phenolphthalein and methyl orange as indicators. Salinity was estimated employing in the method suggested by Harvey (1945). The hardness of water was determined by titration with EDTA solution for estimation of water and waste water (American public health association, 1971, 1985) [1].

Results

The physico-chemical conditions of Varaha reservoir are diverse, very unique and are well acclaimed for its endemism. The ecological studies on the reservoir has been investigated to know the physico-chemical and biological parameters which includes diversity and distribution of phytoplankton, zooplankton and fish fauna, period of three years and the reservoir is discussed with an emphasis on their significance and inter relationship with fish diversity and also their adverse effect on the enhancement of fish production. The parameters studied were atmospheric (ambient) temperature, water temperature, pH, electro conductivity, transparency, total alkalinity, total hardness, dissolved oxygen.

The climate of Visakhapatnam district is semi-arid characterized by precipitation during south-west monsoon season (June to September). The data on rainfall of June 2009 to July 2012, it is revealed that the highest rainfall occurred during south-west monsoon season followed by winter season and least rainfall observed during the summer season. The literature revealed that different regions receive variable precipitation and hence meteorological factors governing the physico-chemical properties of the reservoir which in turn influence planktonic population and all these factors have direct influence on the fish production. The high atmospheric and water temperature was noted in summer and minimum in winter. During the summer season the high water temperature may be due to reduction in water level and high solar radiation and atmospheric temperature. Whereas low temperature in winter may be due to low atmospheric temperature and short day period.

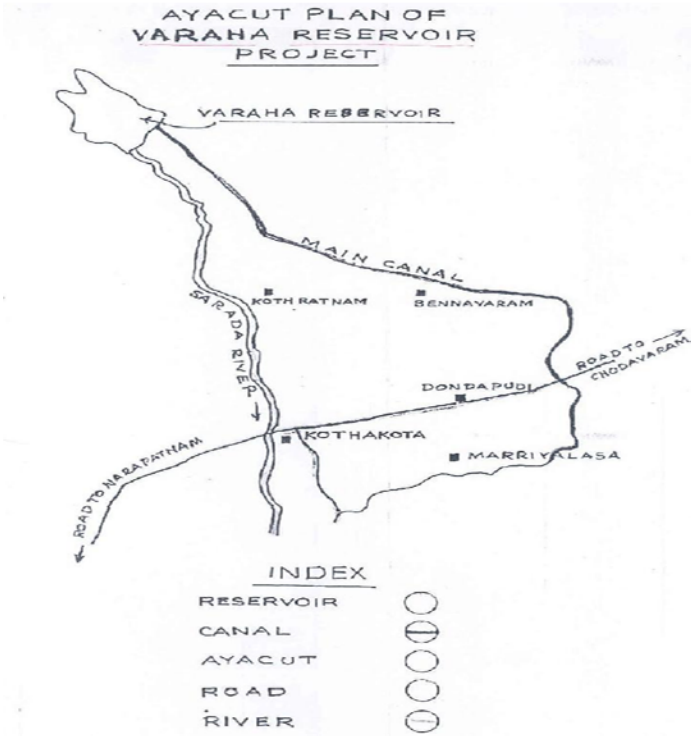
The average value of temperature was recorded the year 2009 to 2012 is 22 ^{0}c to 34 ^{0}c. The average of total alkalinity is in the reservoir present is 149 ppm. About hydrogen ion concentration (pH) of water, the maximum pH. was recorded during in the month of May and minimum in the month of August. The pH. range of 7.2 to 7.7 is most suitable for fish culture. In the present investigation, the minimum pH value is recorded during winter and maximum during summer season. During monsoon high value of pH may be due to high temperature in the tank and minimum during winter season may be due to short day length and decrease in photosynthetic activities.

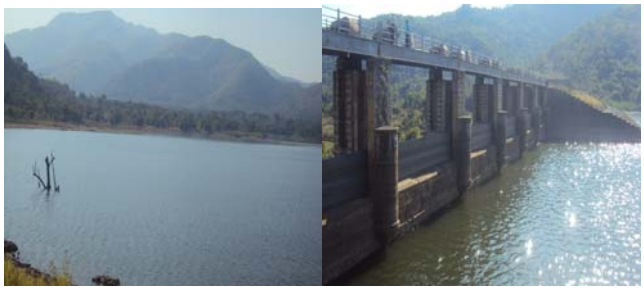
In the present investigation, the amount of dissolved oxygen (DO) of the reservoir water varied from 5.2 to 6.9mg/lit during the period of study. Diurnal variations were noted in the dissolved oxygen content with peak values during the noon hours. The minimum value of DO was recorded in the month of May and maximum in the month of July. The values were observed high during rainy and winter as low temperature favored dissolution of DO. Low DO during summer in the present investigation was probably due to two reasons. In summer at high temperature rate of oxidation of organic matter in water increase and oxygen was consumed in the process, secondly at higher temperature the water had a lesser oxygen holding capacity and surplus oxygen was lost to the atmosphere. The presents of chlorides in the reservoir average value is 52.60 mg/lt and the organic matter of the reservoir is 232.273 mg/lt.

The value of alkalinity is 149 ppm. The maximum alkalinity was noted down during month of January and minimum during September. Total hardness ranged between 82 to 96 ppm. The minimum value of hardness was recorded the month of January and maximum in May. The hardness values were maximum during rainy season, may be due to leaching of rocks in catchment area. The average value of phosphates present in the reservoir is 164- 190 mg/lt. and the average value of total nitrates present in the reservoir is 37.55 mg/lt.

Table 1: Average Results of the Water Analysis in the Year 2009 – 2012

S. No	Water Quality Parameters	Composition
1.	Temperature	22 ^{0}C – 34 ^{0}C
2.	Ph	7.2 – 7.7
3.	Transparency	250/320 cm
4.	Chloride	58.66 mg/lt
5.	Organic Matter	232 - 273 mg/lt
6.	Total Alkalinity	128 - 149 ppm
7.	Total Hardness	82 - 96 ppm
8.	Phosphates	166 - 190 mg/lt
9.	Nitrates	3.7 - 5.5mg/lt





Varaha reservoir, Kalyanapulova

Discussion

Harvesting the rivers for irrigation and hydroelectric generation is main focus of reservoir development. A number of small, medium and large river valley projects have come into existence in the regard. The results of these projects are the creation of reservoirs, which are very good resources for development of inland fisheries. However, this vital resource is not used to its capability as far as the fishery is concerned.

The production of a reservoir is determinant by the environment parameters such as the soil quality, water quality, and the vegetation. In a tropical country like India, the geographical climate, topography and a number of physiographic parameters play a vital role in the intrinsic production potential. (Narasimhulu and Benarjee, 2013) [9] Varaha reservoir is situated and surrounded by hills with green forest throughout the year. The soils of Varaha reservoir are very much fertile because of its content of rock phosphates, magnesium, manganese, mica, limestone etc. Which are abundant in the close by hills, deposits of these are the common occurrence in rainy season. This is the main reason for high fertility of Varaha reservoir water as indicated by rich phytoplankton and zooplankton growth.

During monsoon high value of PH may be due to high temperature in the tank and minimum during winter season may be due to short day length and decrease in photosynthetic activities. Manjare *et al*. (2010) [8] also reported the maximum PH was recorded in summer and minimum in winter season. The value of alkalinity is 149 ppm. The maximum alkalinity was noted down during month of January and minimum during September. The present findings are similar with the finding of workers like Kulshrestha *et al*. (1992) [16].

The temperature of the river in 2009 to 2012 shows a closer correlation to the seasonal cycle or variation of the atmospheric air. The water temperature increased gradually from January to May and later decreased during the monsoons. This was due to the influx of water from uplands.

Decay of the organic materials due to the dumping of coconut husks and wooden logs result in the formation of black silt which mixed with sand, line the entire reservoir bed. This layer adversely affects the production of benthic fauna which normally constitute the food of fishes. Further, the silt may also destroy the bottom nesting of some of the fishes inhabiting the reservoir. Singh *et al*., 1993 [17] have discussed the seasonal fluctuations in the do content of varies water bodies in India at length.

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