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Research Article

INFLUENCE OF PHYSICO-CHEMICAL FACTORS ON FISH PRODUCTIVTY AT KASAR SAI DAM, PUNE

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Abstract: In the present study, attempts have been made to understand the influence on fish productivity due to changes in the physico-chemical characteristics of the Kasar Sai Dam, constructed mainly for irrigation purposes at Kusgaon, near Hinjewadi, Pune (Maharashtra). The study was conducted from the month of December 2009 till the month of October 2011. The observations were carried out at every alternate month for better understanding. The influence of various physico-chemical parameters, such as water temperature, pH, dissolved oxygen, alkalinity, chlorides and suspended solids on the fish productivity with respect to seasonal variations were observed. The Plankton availability was also recorded. The study was aimed to improve the fish productivity so that the natives can be benefitted. The outcomes of this study were tabulated and analyzed to improve the water quality and fish production

Keywords: Physico-chemical, Kasar Sai dam, Fish fauna, Fish production.

INTRODUCTION

Fresh water is the most precious resource for the life. But, it is the most exploited resource also. In fact, out of total water available on the earth, the fresh water availability is just 3%. It includes the ground water and surface water both. The fresh water available on the surface is only 1% of it. The Fresh Water resources are being used for various purposes, i.e., agricultural, industrial, household, recreational, environmental activities, etc. Virtually all of these human uses require fresh water. Imagination of the life without water is next to impossible. The fresh water bodies like rivers, lakes, ponds, dams, etc. should be maintained properly. The pollution of such bodies will have to be minimized. The improvement in water quality and the development of fisheries in these fresh water resources needs to be increased with the help of the scientific developments[1].

The water quality depends on the physico chemical parameters. Various inputs containing minerals, solids, wastes, etc., disturbs the water quality. The biota distribution and the physico-chemical characteristics of any aquatic ecosystem have a direct relation. They are influenced by each other and controlled by a number of natural regulatory mechanisms. Any changes in these characteristics affect the fish fauna and Plankton distribution in the water body.

Considering the importance of inland fishery, researchers have studied various aspects of reservoir fisheries. Few of them are on Chilka lake[2], Stanley Reservoir[3], Sardarsagar[4], Kandhar tank[5], some fresh water Ponds of Dhar Town[6], Halali River Reservoir[7], Underground water analysis in Gwalior City[8] and Sama Pond[9], etc.

As per the available records, no scientific study was recorded on this water body till date. The objective of this study was to provide a quantitative and qualitative record of the fish fauna, fish productivity and water quality with respect to the seasonal changes. Few suggestions were made for the improvement of the fish production so as to uplift the economic condition of the natives.

MATERIALS AND METHODS

The Dam:

The Kasar Sai dam is situated at Kusgaon near Hinjewadi, Pune. It is located in 18^{0} 37.30' 13" N Latitude and 73^{0} 39.22' 55" E Longitude. This dam is built on a natural source of water. A seasonal water stream surrounded by hills and fields was developed into a fresh water resource by constructing a dam. It has a spread area of approximately 336 hectare, mainly constructed for irrigational purposes. The rainfall in the catchment area is approximately between 20.61 cm to 112.64 cm, per annum. Gross water storage is 17.38 m^3 and the live water storage is 16.06 m^3. It has three radial gates for water release. (Information provided by the Department of Irrigation, Govt. of Maharashtra). (Fig. 1.0) A non-functional mineral water factory, poultry and a sugar factory is situated near by it.

Sample Collection and Analysis:

A detailed survey of dam site was conducted. Inputs regarding fish fauna, adjoining areas, fish catch, sources of water pollution, etc. were collected from the local fishermen and the fishing contractor at the dam. The personnel of irrigation and fisheries departments were also consulted. Based on the data obtained and the survey, five locations were selected for sampling, of which

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only three are considered here.

Fig.1.0:

Water Sampling:

The samples of Dam Water, Plankton and Fish fauna were collected at every alternate month, from December' 2009 to October' 2011. The samples collected from the Village site, Factory site and the Tail end of the dam side are discussed here.

The parameters like water temperature and pH were analyzed with the help of thermometer and the digital pH meter respectively. Samples of water were collected in the sampler bottles to determine the parameters like Alkalinity, Dissolved Oxygen, Suspended Solids and Chloride contents. The analysis of the physico-chemical parameters was conducted as per the standard methods[10, 11].

Plankton Sampling:

The Phytoplanktons and Zooplanktons, collections were made with the help of Plankton net. The filtering cone was made up of Nylon bolting silk plankton net (No. 25 mesh size 50 µ) was used for collection. The collected samples were transferred to sampler bottles and were fixed with 5% formalin. The Zooplanktons and Phytoplanktons were identified[12, 13].

Fish Sampling:

The fish sampling was carried out with the fishing contractor by using boats and the rubber tubes. Fishing nets of stretched mesh sizes were used for fishing. The fish production details were observed and the quantum was confirmed with the fishing contractor. The variations in fish productivity with respect to seasons were noted. The fishes were identified[14, 15]and were further confirmed by experts of department of fisheries.

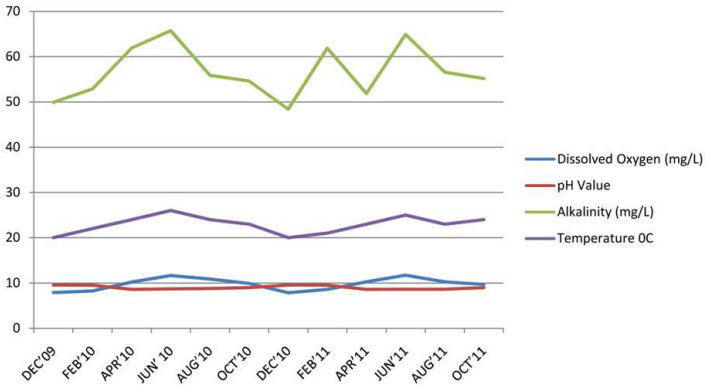
RESULTS

Physicochemical Parameters:

The observed physico chemical water parameters were tabulated and analyzed to understand the variations in water quality. Similarly the variations in the fish fauna were also observed and efforts were made to understand the correlation between them, if any. A comparative study of parameters was done to understand the seasonal fluctuations. The fish productivity considering the seasonal changes was also observed. The parameters observed of the three locations are tabulated as Table 1, Graph 1, Table 2, Graph 2 and Table 3, Graph 3.

TABLE 1.0 - Observations at the Village Side of the Dam

Sr. No.	Month	Dissolved Oxygen (mg/L)	pH Value	Alkalinity (mg/L)	Temperature °C
1	DEC'09	7.87	9.54	49.89	20
2	FEB'10	8.21	9.53	52.85	22
3	APR'10	10.18	8.57	61.88	24
4	JUN' 10	11.62	8.69	65.73	26
5	AUG'10	10.87	8.75	55.85	24
6	OCT'10	9.88	8.95	54.63	23
7	DEC'10	7.83	9.55	48.38	20
8	FEB'11	8.58	9.52	61.85	21
9	APR'11	10.25	8.58	51.82	23
10	JUN'11	11.71	8.61	64.88	25
11	AUG'11	10.23	8.62	56.56	23
12	OCT'11	9.67	8.97	55.14	24



Graph.1: Graphical representation at the Village side of the dam

Dissolved Oxygen (DO):

The values of DO fluctuate from 7.83 mg/l to 11.85 mg/l. The maximum value (11.85 mg/l) was recorded in the month of June (summer) and minimum value (7.83 mg/l) was recorded in the month of December (winter).

pH:

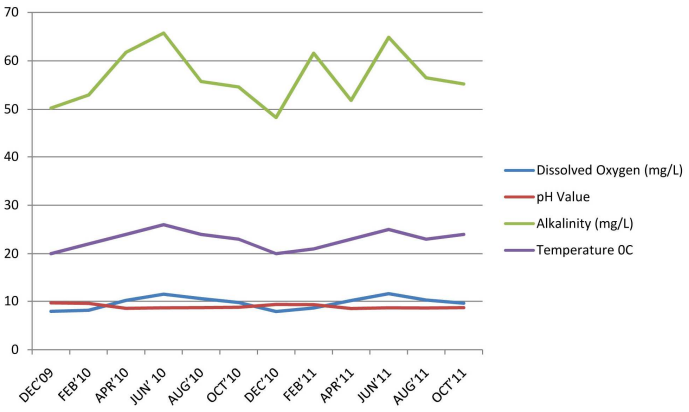
The pH values were ranging from 8.12 to 9.65. The maximum pH value (9.65) was recorded in the month of December (winter) and minimum (8.12) in the month of April. The same results were also observed in a study conducted in a lake.

Alkalinity:

Total alkalinity ranges from 48.28 mg/l to 65.86 mg/l. The maximum value (65.86 mg/l) was observed in the month of June (summer) and minimum value (48.28mg/l) in the month of December (winter).

TABLE 2.0 - Observations at the Tail end of the Dam

Sr. No.	Month	Dissolved Oxygen (mg/L)	pH Value	Alkalinity (mg/L)	Temperature °C
1	DEC'09	7.93	9.65	50.23	20
2	FEB'10	8.13	9.53	52.92	22
3	APR'10	10.18	8.52	61.72	24
4	JUN' 10	11.45	8.63	65.71	26
5	AUG'10	10.56	8.68	55.73	24
6	OCT'10	9.76	8.75	54.6	23
7	DEC'10	7.89	9.32	48.28	20
8	FEB'11	8.62	9.3	61.56	21
9	APR'11	10.13	8.49	51.82	23
10	JUN'11	11.56	8.63	64.83	25
11	AUG'11	10.27	8.59	56.47	23
12	OCT'11	9.59	8.68	55.2	24



Graph.2: Graphical representation at the tail end side of the dam

Temperature:

The water temperature ranges from 20°C in the month of December (winter) to 26°C in the month of June (summer).

Chlorides Contents and Suspended Solids:

The values of chloride contents and suspended solids found to be almost negligible in the collected water samples.

Planktons:

The phytoplankton species observed in the water body were green algae like Chlorella spp., Volvox spp., spirogyra spp. and very less Zooplanktons found in the water body were Rotiphers, Cyclops and Dephni. In few samplings the Zooplanktons were absent.

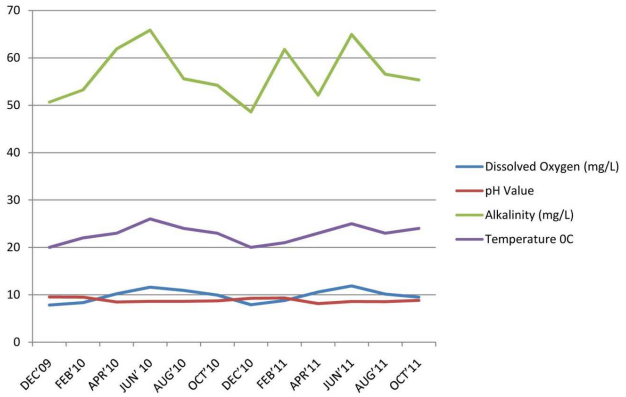
Fish Fauna and Productivity:

The fishing was done during all the seasons. Very limited fish fauna was observed in the water body. Almost twelve fish species and few crabs were found in the water body. Few local fishes were also observed in the rainy season. The fishes found in the water body were major carps, exotic carps and crabs.

The fishes found in the dam are Puntius spp., Catla spp., Labeo spp., Tilapia spp., Mastacembelus spp., Goby spp., Macrobium spp. (Giant Prawn), Mystus spp., Cirrhinus spp., Cyprinus spp., Crabs, and Non Paenied Prawns. The quantum of the fish productions was also observed.

TABLE 3.0 Observation at the Factory side of the Dam

Sr. No.	Month	Dissolved Oxygen (mg/L)	pH Value	Alkalinity (mg/L)	Temperature °C
1	DEC'09	7.83	9.53	50.65	20
2	FEB'10	8.34	9.51	53.22	22
3	APR'10	10.19	8.47	61.88	23
4	JUN' 10	11.59	8.61	65.86	26
5	AUG'10	10.92	8.59	55.59	24
6	OCT'10	9.91	8.71	54.23	23
7	DEC'10	7.89	9.25	48.58	20
8	FEB'11	8.78	9.33	61.79	21
9	APR'11	10.57	8.12	52.12	23
10	JUN'11	11.85	8.58	64.95	25
11	AUG'11	10.14	8.53	56.56	23
12	OCT'11	9.47	8.81	55.34	24



Graph.3: Graphical representation at the Factory side of the dam

DISCUSSION

Physicochemical Parameters

In the summer season the higher DO was observed. It may be due to increase in temperature. The longer days and intense sunlight, during summer helps to accelerate photosynthesis rate. The Phytoplankton utilizes Carbon dioxide and gives off oxygen. The Oxygen level is comparatively lesser during winter season may be due to lower photosynthesis rate. It is supported by other studies[16, 17].

The variation in water temperature varies the pH value of water. Most of the bio-chemical and chemical reactions are influenced by the pH value of the water body. The reduced rate of photosynthetic activities reduces the assimilation of carbon dioxide and bicarbonates which are ultimately responsible for increase in pH during winter season. Similar results were also observed in a study conducted at a reservoir[17].

The maximum alkalinity was observed in June (summer) due to increase in bicarbonates in the water. Similar results were also reported that the alkalinity was maximum in summer and minimum in winter due to higher photosynthetic rate[18].

It was observed that during summer, temperatures of the water body were higher due to comparatively lower water levels, higher atmospheric temperatures and clear atmosphere. The temperature of water body plays a very important role. It influences the chemical, biochemical and biological characteristics of the water body. In summer season, the longer day timings and higher temperatures increase the rate of photosynthesis, which helps to improve other related physicochemical parameters and intern the fish fauna and productivity[19, 20].

The negligible values of chloride contents and suspended solids in water samples may be due to absence of any polluting industry in nearby areas. The sewage content was also negligible as the area is sparsely populated and has a better sewage system.

Plankton:

The planktons are the major food source for the fishes in the water body. The depth of the dam does not allow the sunlight to penetrate and may be obstructing the plankton growth. Limited species of Phytoplankton[21] and Zooplanktons[22] were observed in the water body.

Fish Fauna and Productivity:

In the present water body the fish production was observed approximately 250 to 350 kg per month from December to February and raises up to 1000 kg per month from March to May. These figures indicate that the fish production increases in summer season and reduces in winter season. Considering the size of the water body, i.e., a catchment area of 336 Hectares, the fish production is very less.

The reduction in fish productivity during winter season may be due to the lower temperatures, lesser Dissolved oxygen levels, lower alkalinity, increase in pH values and reduction in natural food availability of the water body. The cumulative result of all these factors badly affects the fish productivity in winter season.

The higher values of temperature, Dissolved oxygen levels and Alkalinity of the water body along with lower pH values help to increase in the fish productivity during summer season as compared to the winter season.

CONCLUSION

On the basis of the findings of the present study, it can be concluded that the physicochemical parameters of the dam water are not that suitable for the fish production.

To improve the fish productivity and water quality some strict actions[23] needs to be taken. Fertilization of the dam water body may help to improve the alkalinity. As the water body that has the alkalinity more than 100 ppm is called as a productive water body[24]. By further reducing pollution from surrounding areas, eradicating aquatic weeds, predatory fishes may help to improve the fish production.

The depth of the dam does not allow the Sun light to penetrate into it and obstructs the plankton growth. The rocky bottom and bushes in the dam water also limits the plankton growth. The fish culture practices can be introduced in the present water body. Cage culture may be suitable to improve the fish productivity in the dam water.

Based on the results of the present study it can be stated that, the fish productivity of the Kasar Sai dam can be improved, if the physicochemical parameters of the water body are maintained at required levels[25]. This will help in uplifting of the economic condition of the natives. However, further detailed pilot studies are required for the improvement of the water quality and fish productivity.

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