A Study on Water Quality Assessment and Fish Diversity in the Nizam Sagar Dam

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Abstract

Construction of the Nizam Sagar Dam, which spans the Manjira River, a tributary of the Godavari River located between the villages of Achampet (Nizamabad) and Banjapalle in Telangana's Nizamabad district, was completed in 2008. The dam was built in 1923 by the rulers of the old Hyderabad State, Mir Osman Ali Khan, and is still in use today. This inquiry has attempted to estimate a total of sixteen physico-chemical parameters along with Pearson correlation and a total of nineteen distinct species of fishes in an effort to better understand the relationship between them. According to the findings, all of the chosen physico-chemical parameters are within the permitted limits of standard techniques developed by the American Public Health Association and the American Water Works Association.

Keywords: *Physico-chemical, Zooplankton and fish, Nizam Sagar, Manjira River.*

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1. INTRODUCTION

Aqueous solutions are one of the most prevalent chemicals on the planet. It is necessary for the life of all plants and animals, but as human populations rise and demand more water of good quality for residential needs and commercial activity, this valuable resource is becoming more endangered. Lake ecosystem protection is essential not only for maintaining the public and economic health of our nation, but also for conserving and restoring the natural environment for all aquatic and terrestrial living creatures.

According to the definition, an ecosystem is "the complex of a community of organisms and the environmental functioning of the community as an ecological unit." In a dynamic system, the biotic and abiotic components are continually acting and reacting upon one another, resulting in structural and functional changes in both the organism and the environment. Water ecosystems are composed of interacting species that are reliant on one another and their water environment for nutrients (such as nitrogen and phosphorus) as well as protection from predators and disease. Whether in a pond, lake, river, or ocean, an aquatic ecosystem is defined as one that is dependent on water for its existence. Biological factors (such as fish, planktons, annelids and other aquatic animals) and their interactions with their environment (which may be generally referred to as the abiotic factor) are both considered in this context. Aquatic ecosystems, which cover more than 70% of the earth's surface, are not only the most prominent characteristics of the planet, but they are also very varied in terms of species and complicated in terms of the interactions between their physical, chemical, and biological components.

The physico-chemical and biological characteristics of inland water bodies in India, such as lakes, tanks, and ponds, are subject to unique seasonal changes. When it comes to determining the quality of water, physico-chemical and biological characteristics are quite significant. The investigation of various water bodies is critical in the knowledge of the metabolic activities that take place in aquatic ecosystems. The parameters impact one another as well as the sediment parameter, and they are also responsible for regulating the amount and distribution of flora and animals. [1] Although the history of fish introduction stretches back several hundred years, little is known about the factors that influence the success or failure of an introduced species, and the ecological repercussions of imported species have been inadequately recorded (Mahesh, 2014).

With the overexploitation of the human population, as well as the concerns of starvation, the fish fauna has risen in significance in recent years. This is due to the high protein content of their flesh, and at the same time, fish byproducts are very important in terms of economics across the globe.

2. LITERATURE REVIEW

Akuskar S. K. and Gaikwad A. V. (2006), Dhanegaon, Maharashtra, India, conducted a physico-chemical examination of the backwater from the Manjra Dam on the Manjra River. Between July and December 2003, they chose two sample location locations, one in Bhalgaon and the other in a storage facility, for research purposes. pH, DO, TDS, conductivity, turbidity, COD, alkalinity, and total hardness were all measured and it was discovered that the pH ranges from 6.8 to 7.8 depending on the water source. A range of 400 to 650 mho/cm is seen in the conductivity of the material. The concentration of DO was determined to be between 4 and 9 mg/L. The total hardness was found to be in the range of 135 to 165 mg/L. The concentration of COD was changed between 85 and 150mg/lit. Based on these physicochemical factors, they determined that the water at both the Bhalgaon point and the storage water is not drinkable and needed treatment.

S. Hussain et al (2012), In the period August 2009 to July 2010, researchers looked at the change in physicochemical properties of Manjra dam water over a period of one year. The Manjra dam, which spans the river Manjra in Dhanegaon, was built to control floodwaters. Manjra Dam is of particular significance since it provides water to a portion of Beed District, as well as parts of Latur District, among other places. pH, DO, TDS, conductivity, turbidity, sulphate, chloride, calcium, magnesium, and total hardness were all measured and studied throughout the experiment. They discovered that the pH ranges between 7.8 to 8.72, and that the pH is greatest in the month of February and lowest in the month of June. Its conductivity ranges from 98 to 462 micrometres per centimetre of length. The concentrations of DO and sulphate range from 4 to 8.2 mg/L and 13 to 56 mg/L, respectively. The total hardness was found to be in the range of 65 to 136 mg/L. It was concluded that the water from the Manjra dam is not contaminated, but that it does need primary treatment since the values are extremely near to the desired limit based on the physico-chemical criteria listed above.

P. C. Mane et al (2013) Throughout the year 2009-2011, they investigated "Spectrophotometric assessment of chromium and copper concentration from Manjra Dam in Maharashtra, India." and discovered There was a research conducted on the Manjara dam, which is located in the hamlet of Dhanegaon, in the Kaij Taluka of the Beed District of Maharashtra, India. The greatest amount of chromium was found to be 0.018 mg/L and the lowest amount was found to be 0.0013 mg/L, while the highest amount of copper was found to be 0.0035 mg/L and the lowest amount was found to be 0.0086 mg/L.

N. M. Sahajrao and R. G. Pawale (2015) During the period of January to December in 2013, the study "Assessment Of Some Selected Heavy Metals From Manjra River Water At Biloli In Nanded District,

Maharashtra, India" was carried out to determine heavy metals iron, zinc, manganese, and copper in the Manjara River at Biloli taluka in Nanded District, Maharashtra state of India for the period of January to December. According to the findings of the study, the pH levels recorded were within the permitted range of 6.5 to 8.5. The concentration of heavy metals from the Manjara River near Biloli is arranged in the following sequence: Zn > Fe > Mn > Cu (in descending order). As a result of the diluting impact of rain water and surface water runoff, it was discovered that heavy metal concentrations were greater in the summer season and lower in the rainy season during the study.

V. V Naiknaware and S. Abed (2015) During the month of December 2011, the "Physico-chemical examination of the Manjra River near Kallam" was carried out. There were five different areas where they gathered water. Water Temperature, pH, chloride, fluorides, alkalinity, total solids, and total hardness were all measured, as well as other parameters. It has been discovered that the pH ranges between 6.9 and 7.4, and the temperature ranges between 260 and 320 degrees Celsius. The total hardness was found to be in the range of 120 to 340 mg/L. Fluoride concentrations ranged from 0.28 to 0.40 mg/lit depending on the source. The content of chloride ranged between 12 and 124 mg/liter. These physico-chemical factors led to the conclusion that the water at the Bhoigalli and Malegaon sites was more contaminated than at the other locations.

3. MATERIAL AND METHODS

Study Area

The Nizam Sagar dam is a man-made reservoir that was built in 1923 by Mir Osman Ali Khan, the last monarch of the Nizam dynasty to rule over India. The dam is situated between the villages of Achampet and Banjapally in the district of Nizamabad. In terms of latitude and longitude, it is located at 18o.19° (N) and 76o.56° (E). Dam's catchment area is 21.633 square kilometres (8376 square miles), and its entire length is 5273 metres, with a depth of 21 feet. The dam's catchment area is 21.633 square kilometres (8376 square miles). In its initial form, this project was intended to use 58.0 TMC of water to irrigate 2, 31, 339 acres in the Banswada, Bodhan, Nizamabad, and Armoor Taluks of the Nizamabad District, a total of 2, 31, 339 acres.

Water samples were collected on a regular basis to allow for the determination of physico-chemical parameters. Collections were made on certain days in each month with two separate permanent stations, each with a different collection method. To investigate several physico-chemical and biological characteristics, surface samples were obtained with the use of a clean plastic container. In this investigation, all of the sample collection and observation took place in the early hours (6:00 to 8:00 am), and although certain parameters were computed at the collection location, others were estimated in a laboratory setting over the whole time period. Water samples obtained for the aim of estimating different parameters were transported to the laboratory and submitted to examination as soon as feasible after collection. For the estimate of parameters, the Standard Methods for Estimation of (Water and Waste Water 20th Edition, 1998 (APHA, AWWA)) [2] were used.

Ichthyofauna (fishes)

The fish were caught using gill nets, drag nets, hand nets, and cast nets, with the sole assistance of the local fishermen's association of Achampet and Banjapally villages in the process. The fish were photographed shortly after being collected, and the specimens were stored in 10% formalin after being given an abdominal incision, before being sent to the laboratory for identification. The fish specimens were identified using conventional identification keys, which are available online.

4. RESULTS AND DISCUSSION

Tables 1 and 2 show the findings of the current inquiry on the fluctuation of physico-chemical parameters obtained from two distinct stations, respectively.

Table 1: Monthly Variation of Physico-Chemical Parameters of Nizam Sagar Dam during the Year 2014-15 at Station A

Month/ parameter	AT	WT	TRANS	TURB	TDS	EC	PH	DO	CO2	TA	TH	CL	S	P	BOD	COD
FEB-14	23.4	22.2	60.2	10	170	869	8.2	6.6	32.7	226	68	86	9.8	0.68	4.6	12.8
MAR-14	28.8	27.2	70.6	10	168	886	8.0	6.9	28.6	238	72	92	11.2	0.76	4.8	10.2
APR—	30.0	28.6	69.2	10	126	91	7.9	7.8	46.3	246	86	98	10.	0.7	5.2	9.6

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MAY-14	32.2	31.2	66.6	9	110	868	7.6	7.4	52.6	258	92	90	8.2	0.60	5.8	8.2
JUN-14	30.1	28.2	48.6	12	224	836	7.7	5.2	62.3	196	138	62	8.4	0.41	3.8	11.6
JUL-14	26.9	24.2	40.4	14	308	810	7.2	4.2	68.8	110	142	58	7.3	0.36	4.0	13.6
AUG-14	28.2	26.8	42.6	15	380	798	7.4	4.0	70.2	85	146	68	7.7	0.28	3.0	13.2
SEP-14	26.2	25.1	38.2	17	360	800	7.4	4.8	56.6	75	130	64	8.0	0.22	3.2	12.6
OCT-14	24.2	22.3	32.3	21	310	776	7.8	5.1	48.8	148	122	78	7.1	0.32	3.4	9.6
NOV-14	21.3	20.0	46.8	13	294	760	7.7	5.6	33.6	160	128	90	6.4	0.39	4.2	10.6
DEC-14	19.8	18.2	50.6	11	268	740	7.9	5.0	30.2	172	136	84	6.9	0.46	3.6	9.8
JAN-15	20.2	18.9	52.2	11	220	748	8.0	5.4	30.8	210	112	80	6.8	0.48	3.2	10.0

Table 2: Monthly Variation of Physico-Chemical Parameters of Nizam Sagar Dam during the Year 2014-15 at Station B

Month/parameter	**AT**	**WT**	**TRANS**	**TURB**	**TDS**	**EC**	**PH**	**DO**	**CO2**	**TA**	**TH**	**CL**	**S**	**P**	**BOD**	**COD**
FEB-14	23.5	22.1	61.4	11	172	862	8.0	6.8	34.2	236	72	80	8.2	0.62	3.3	13.2
MAR-14	28.9	27.8	72.8	10	170	892	8.1	7.2	30.2	246	78	88	10.2	0.78	3.8	11.2
APR—14	30.1	28.2	70.4	11	122	920	8.0	8.1	48.6	248	90	90	9.2	0.78	4.2	10.2
MAY-14	32.2	31.2	68.8	10	112	870	7.5	7.8	54.2	260	96	82	7.6	0.62	4.4	9.6
JUN-14	30.3	28.4	52.2	11	218	832	7.6	5.8	63.2	202	142	56	7.0	0.42	3.2	12.8
JUL-14	27.0	25.3	41.4	15	310	830	7.4	7.8	69.3	112	148	52	7.0	0.38	3.0	13.2
AUG-14	28.4	27.4	43.6	14	386	810	7.5	5.1	72.4	88	150	60	7.1	0.30	3.2	13.6
SEP-14	26.4	25.2	40.0	15	366	802	7.4	5.4	63.2	76	138	60	7.4	0.24	3.8	13.2
OCT-14	24.6	22.6	32.6	22	306	780	7.9	5.3	52.2	152	136	72	6.2	0.34	3.4	10.1
NOV-14	21.6	19.2	47.0	14	298	768	7.7	6.2	33.8	168	132	84	6.0	0.38	4.6	10.8
DEC-14	19.8	18.1	50.8	11	272	742	7.8	6.1	32.6	180	142	80	6.2	0.48	4.0	10.0
JAN-15	20.3	18.9	54.2	10	226	752	8.1	6.8	33.2	218	118	72	6.4	0.46	4.4	11.0

Table 5: List of different types of identified fishes at Nizam Sagar Dam during the year 2014-15

S. No	**Order**	**Family**	**Scientific Name**	**Common Name**	**Vernacular Name**	**Population status**	**IUCN status**
1	Cypriniforme	Cyprinidae	*Catla catla*	Catla	Botchea	A	LC

	s						
2			*Labeo rohita*	Rohu	Erramosu	A	LC
3			*Cyprinus carpio*	Common corp	Bangarutheega	A	LC
4			*Cirrhinus mrigala*	Mrigal	Mrigala	A	LC
5			*Puntius sarana*	Olive barb	Gandaparaka	R	LC
6			*Puntius sophore*	spot fin swampy barb	Buddaparaka	A	LC
7			*Salmostoma bacaila*	Large minnow	Chandamama	R	LC
8		Cobitidae	*Lepidocephalus guntea*	Guntea loach	Vuliche	C	LC
9	Siluriformes	Bagridae	*Mystus aor*	Mystis	Jella	A	LC
10		Siluridae	*Wallago attu*	Boal	Valuga	C	NT
11		Claridae	*Clarius batrachus*	Batchwa vache	Marupu	C	LC
12		Heteropneustidae	*Heteropneustes fossilis*	Stinging cat fish	Ingulikam	R	LC
13	Osteoglossiformes	Notopteridae	*Notopterus notopterus*	Grey feather back	Cheppu thatta	R	LC
14	Channiformes	Channidae	*Channa marulias*	spotted snake head	Korramatta	A	LC
15			*Channa punctatus*	Giant Snake head	Pubomme	R	LC
16			*Channa striatus*	Banded snakehead	Bomme	R	LC
17	Perciformes	Mastacembelidae	*Mastacembelus armatus*	Zig zag spiny eel	Papera	A	LC
18		Anabantidae	*Trichogaster fasciatus*	Banded gourami	pamplet	R	LC
19		Cichilidae	*Oreochromis mossambicus*	Mozambique tilapia	Chinna guraka	R	NT

PH

pH values at station A varied between 7.2 and 8.2 throughout the current inquiry, whereas pH values at station B were between 7.4 and 8.1. The highest values were recorded in the month of February at station A and the lowest values were documented in the month of March 2014 at station B. The highest values were recorded in the month of February at station A and the lowest values were recorded in the month of March 2014 at station B. Temperature, salinity, and pressure are all influenced by environmental conditions like as humidity. Surrender Reddy and colleagues (2015) [14] found findings that were similar to theirs.

At both sites, pH values were shown to be positively connected with TRANS, EC, DO, TA, CL, S, P, and BOD concentrations, respectively.

Dissolved Oxygen

Station A had dissolved oxygen levels of 4.0 to 7.8 mg/liter, whereas Station B had dissolved oxygen values of between 5.1 and 8.1 mg/liter. During the course of this investigation, the greatest and lowest values were reported at both sites in April and August, respectively. In addition to water chemistry and biological activities, oxygen availability changes throughout the year (Balakrishna et al., 2013b) [15].

AT, WT, TRANS, EC, pH, TA, CL, S, P, and BOD were all positively linked with dissolved oxygen at both sites.

Free Carbon Dioxide

At station A, carbon dioxide concentrations varied from 28.6 to 68.8 mg/liter, whereas at station B, they ranged from 30 to 72.4 mg/liter. The investigation found the greatest values in July 2014 at Station A, the lowest values in March 2014 at both Stations A and B, and the highest values in August 2014 at Station B. TDS, EC, TH, and COD were all positively linked with CO2 concentrations at both sites, as were the following parameters: AT, WT, TURB, TDS, and TDS.

Total Alkalinity

An alkaline water body's buffering ability is referred to as its alkalinity. Total alkalinity readings varied from 75 to 258 mg/liter at station A and 76 to 260 mg/liter at station B throughout the current experiment. Maximum values were found in May 2014 at stations A and B, while minimum values were found in September 2014 at both locations.

At both sites, the total alkalinity values are linked favourably with AT, WT, TRANS, EC, pH, DO, CL, S, P, and BOD.

Total Hardness

At station A, total hardness values varied from 68 to 146 mg/lit, whereas at station B, values ranged from 72 to 150 mg/lit. It was found that August 2014 was the peak month for both stations A and B, with the lowest values reported in February 2014. Polyvalent metallic ions dissolved in water are the culprit. (Vijaykumar et al., 2009) [16] found comparable findings to the ones presented here.

TRUB, TDS, CO2, and COD are all favourably linked with Total Hardness levels at both sites.

Chloride

Chloride has a significant impact on the quality of water in a given area. At station A, chloride concentrations varied from 58 to 98 mg/liter and at station B, from 52 to 90 mg/liter. In this research, the greatest and lowest values were reported at both sites in the month of April and July, respectively. Evaporation of water causes the concentration of chlorides to rise throughout the summer months. [17] From Pakhal Lake in Warangal, Telangana, (Reddy et al., 2009) found similar findings.

At both sites, chloride concentrations are positively linked with the following parameters: TRANS, EC, pH, DO, TA, S, P, and BOD.

Sulphate

Sulphate concentrations varied from 6.4 to 11.2 mg/liter at station A and 6.0 to 10.2 mg/liter at station B throughout the current experiment. In this research, the greatest values were recorded at station A and B in March 2014, whereas the lowest values were obtained at both stations in November 2014. It's usual to find sulphate in water because minerals from soil and rocks dissolve in water. According to (Balakrishna et al., 2013c) [18], the findings presented here support their findings.

There is a positive correlation between the sulphate readings at both sites and the aforementioned variables.

Phosphate

Station A had phosphate levels ranging from 0.22 to 0.78 mg/lit, whereas station B had values ranging from 0.24 to 10.2 mg/lit throughout the current study's examination. At both stations A and B, the greatest values were recorded in April 2014, whereas the lowest values were found in September 2014, according to this research. In fresh water, the presence of phosphate implies contamination by sewage and industrial wastes. Phosphorus concentrations in Thane city lakes ranged from 0.01 mg/liter to 0.79 mg/liter (Pejaver and Gurav 2008) [19]. There is a favourable correlation between phosphate levels and AT, WT, EC and pH, DO and TA and CL, S and BOD at both sites.

Biological Oxygen Demand

The quantity of oxygen used by bacteria to stabilise organic materials is known as biochemical oxygen demand. Biological Oxygen Demand (BOD) values varied from 3.0 to 5.8 mg/liter at station A and 3.0 to 4.6 mg/liter at station B throughout the current experiment. Most significant changes were found in May 2014 at Station A and November 2014 at Station B, while the lowest changes were found in May 2014 at Station A and July 2014 at Station B, according to this research.

A positive correlation exists between the biochemical oxygen demand values at station A and those at station B in relation to the variables AT, WT, TRANS, EC, pH, DO, TA, CL, S, and P. This is true for station A as well as station B.

Chemical Oxygen Demand

Chemical oxygen demand values varied from 8.2 to 13.6 mg/liter at station A and 9.6 to 13.6 mg/liter at station B throughout the current experiment. Maximum values were recorded in July 2014 at Station A and in August 2014 at Station B in this investigation, whereas minimum values were obtained in May 2014 at both Stations A and B. It is usual practise to perform the chemical oxygen demand test to estimate the concentration of organic molecules in water. There have been similar findings by Balakrishn Dhatrika in 2012.

5. CONCLUSION

Work done on the Manjra River to improve water quality is examined. As a result of human activities, industrial effluents and agricultural runoff in the Manjra River, the water quality has declined. The Manjra River sees very little development. Because of this, a water quality monitoring programme must be implemented at a regional and seasonal level. In order to maintain the water supply, regular monitoring of river water quality is essential.

The results of this study show that a number of physico-chemical parameters are within the acceptable limits of the APHA and WHO. As a consequence of these findings, we may conclude that the water in this dam is clean and abundant in aquatic life.

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