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Research Paper Ecology

Management Of Water And Eco Sustainability Assessment Of Godavari River From Maharashtra State For Sustainable Utilization

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ABSTRACT

Survey of Godavari river water in Maharashtra state is carried out to know the present status of water and its quality, pollution, manmade construction and other activities in Godavari river valley. Identification of human intervention is carried out after selecting location for biological monitoring was done. Assessment of river water bodies with reference to species diversity of flora and fauna including micro invertebrates, benthos and avifauna was done in three different seasons' summer, monsoon and winter. The seasonal study knows the impact of lotic environment on the diversity of flora and fauna in different species of enrich its wild population. Godavari river water pollution invariably altered the water quality, inturn influencing biogeochemical cycles, diversity, biomass and overall tropodynamics.

Key word : Godavari river, Eco-sustainability, Tropodynamics, Biomass.

Introduction

India is blessed with unparalleled resources of rivers, reservoirs, estuaries, lakes, ponds and flood wetlands. Water is one of the most natural resources for all the living organisms, weather unicellular or multi cellular, since it is required for various domestic purposes irrigation, shipping, power generation and industries. The man's influence on these water bodies caused by rapid cutting of surrounding vegetation, thus increasing silt and nutrient load, disposal of sewage and industrial waters, use for defecation, cultural activities, and agriculture chemicals greatly increased the quantity of nutrients and organic input into a water body. The water quality of the rivers and reservoir varies from time to time and place to place, due to interaction of local factors, in the absence of any in depth knowledge about the water quality and ill effects the inhabitants rare prone to disease and health problems.

In the present study attempt was made to study eco-sustainability assessment of Godavari river water flowing in Maharashtra from Nasik to Nanded by studying zooplankton and phytoplankton quantification and their seasonal abundance and bird Fauna for their seasonal diversity to indicate the sustainability of water from drinking point of view.

Material and Methods

Survey of Godavari river water bodies was carried out to assess the zooplankton and phytoplankton quantification and their seasonal abundance and bird Fauna for their seasonal diversity to indicate the sustainability of water quality at different stations of upper and lower Godavari to know the present status of Water Quality. Nearly of about 12 sampling stations were selected after survey from upper Godavari and lower Godavari river basin approximately at the distance of 50 km, as per the guidelines of Maharashtra Pollution Control Board and Central Pollution Control Board.

The analysis of samples was carried out in the research laboratory. The survey of Godavari river water is carried out with references to species diversity of flora and fauna and birds such as location, nature of catchment area and main human activities. Seasonal population density of flora and fauna (Trivedy et.al. 1987) was also carried out qualitatively to evaluate their biotic potential. The dams constructed over Godavari river water are rich in bird fauna that includes some migratory species an ecologically important landmark. The study on bird habits, habitat, number and seasonality were studied by regular field visits to the Gangapur dam, Nandur-Madhmeshwar dam and Jaikwadi dam during the morning hours between 6.30 to 9.30 am. The birds were also observed sometimes in the evening hours by using the binoculars of magnification 8 x 30. Special features of residential and non residential birds and their habit and habitat along with their seasonal dominance were studied. The identification of birds in summer, monsoon and winter was carried out according to Salim Ali (1996). Birds visiting the dams as a visitor in winter, summer and monsoon and same passes through the dam are also recorded. Effects of seasonal changes in diversity parameters of the dams, which are the major regulatory force in determining the population density of birds, were also studied.

Results and Discussion

Water quality characteristics were carried out in summer, monsoon and winter from different locations all along the Godavari river bed from Nashik to Nanded the river end of Maharashtra (Table 1 & 2).

The temperature recorded at high levels in summer due to increasing temperature in the surrounding environment and reduction of water flow into the river. Whereas, dissolved oxygen, BOD and COD were at low levels. Dissolved oxygen was high in winter due to the increased water level and low turbidity and also due to increased biotic activity like photosynthesis of algal biomass. In monsoon, alkalinity at high levels where as pH was at low level.

Table 1: Seasonal Variations in Physico-Chemical Parameters of the water at different stations along the bank of Godavari River from Maharashtra

Station	Temperature °C			pH			Electrical conductivity mhos/cm			Alkalinity mg/l		
	S	M	W	S	M	W	S	M	W	S	M	W
S 1	23.03 ±2.33	27.03 ±0.80	25.55 ±0.45	7.97 ±0.46	7.70 ±0.37	7.89 ±0.35	238.83 ± 0.42	224.47 ±16.17	232.58 ±0.705	482.20 ±14.86	472.05 ± 5.93	459.16 ± 2.45
S 2	30.19 ±1.33	28.42 ±0.37	24.62 ±0.69	6.73 ±0.83	6.97 ±0.12	7.24 ±0.13	310.62 ±0.28	259.62 ±0.83	289.50 ±0.48	513.6 ±10.12	480.0 ±0.83	489.34 ± 0.89
S 3	29.48 ± 0.68	28.62 ± 0.89	23.42 ± 0.38	6.81 ± 0.42	7.14 ± 0.30	7.2 ± 0.11	258.3 ± 0.07	250.15 ± 0.24	261.3 ± 0.18	503.4 ± 0.66	437 ± 0.11	462.39 ± 0.48
S 4	30.1 ± 0.3	29.26 ± 0.66	25.23 ± 0.08	6.93 ± 0.65	7.34 ± 0.72	7.24 ± 0.14	264.4 ± 0.08	255.25 ± 0.92	258.6 ± 0.48	468.9 ± 1.48	451.6 ± 2.93	402.68 ± 4.62
S 5	29.6 ± 0.8	26.6 ± 0.38	21.42 ± 2.24	7.47 ± 0.8	7.68 ± 0.32	7.94 ± 0.49	268.3 ± 0.69	238.2 ± 0.89	252.6 ± 0.12	524.3 ± 12.3	496.4 ± 8.26	478.9 ± 6.20
S 6	30.24 ± 0.14	27.5 ± 0.59	20.4 ± 0.43	7.3 ± 0.42	7.7 ± 0.40	7.4 ± 0.82	259.3 ± 0.36	242.3 ± 0.34	260.3 ± 0.59	484.3 ± 8.80	469.1 ± 3.22	438.3 ± 1.29
S 7	30.5 ± 0.35	28.28 ± 0.18	22.62 ± 0.64	7.98 ± 0.49	7.73 ± 0.36	7.94 ± 0.64	242.6 ± 0.42	228.47 ± 6.12	236.3 ± 2.38	523.8 ± 11.3	489.6 ± 2.32	456.3 ± 3.32
S 8	28.2 ± 0.12	26.28 ± 0.18	24.29 ± 1.26	7.53 ± 0.94	7.43 ± 0.48	7.48 ± 0.26	232.6 ± 1.20	227.3 ± 3.21	231.2 ± 0.25	418.2 ± 0.82	434.9 ± 2.32	449.3 ± 0.89
S 9	29.6 ± 2.19	27.28 ± 0.18	24.63 ± 0.39	7.96 ± 1.26	7.6 ± 0.49	7.78 ± 0.78	249.3 ± 3.92	229.4. ± 4.12	232.4 ± 4.36	429.3 ± 0.78	398.2 ± 2.62	338.3 ± 6.78
S 10	30.2 ± 0.38	28.29 ± 0.68	25.34 ± 0.54	7.42 ± 0.42	7.62 ± 0.58	7.26 ± 0.12	224.6 ± 0.26	218.9 ± 2.48	215.62 ± 0.28	402.68 ± 0.74	349.2 ± 2.69	369.2 ± 4.33
S 11	29.6 ± 0.2	27.5 ± 0.59	25.23 ± 0.08	7.98 ± 0.49	7.47 ± 0.8	7.14 ± 0.30	249.3 ± 3.92	227.3 ± 3.21	236.3 ± 0.59	512.2 ± 0.93	496.2 ± 2.72	469.2 ± 4.24
S 12	30.2 ± 0.49	28.62 ± 0.34	27.62 ± 0.92	7.46 ± 0.39	7.32 ± 0.49	7.5 ± 0.23	258.9 ± 0.60	239 ± 0.89	243 ± 0.70	486.3 ± 2.5	472.6 ± 0.69	480.2 ± 2.69

Table 2: Seasonal Variations in Physico-Chemical Parameters of the water at different stations along the bank of Godavari River from Maharashtra

Station	Nitrate (mg/l)			Dissolved Oxygen (mg/l)			BOD (mg/l)			COD (mg/l)		
	S	M	W	S	M	W	S	M	W	S	M	W
S 1	2.69 ± 0.33	4.18 ± 1.38	3.82 ±0.66	8.32 ±0.42	8.69 ±0.93	9.13 ±1.32	3.46 ±0.22	2.85 ±0.62	2.48 ±0.38	18.68 ±3.62	10.09 ±2.62	15.54 ±1.08
S 2	6.21 ± 0.86	6.73 ±2.29	5.93 ±3.03	7.39 ±0.49	7.82 ±1.42	8.51 ±0.63	14.46 ±1.48	13.83 ±2.85	12.57 ±0.67	23.62 ±0.89	20.74 ±2.69	22.43 ±4.16
S 3	5.38 ± 0.89	5.43 ±0.74	5.52 ±0.98	7.75 ±1.42	7.79 ±2.69	7.93 ±0.42	13.03 ±3.04	11.93 ±0.68	11.58 ±1.42	48.43 ±2.48	21.57 ±0.98	41.19 ±1.08
S 4	5.32 ± 1.32	5.53 ±0.69	4.84 ±1.38	7.69 ±2.34	7.42 ±0.78	7.83 ±1.62	12.68 ±1.53	10.73 ±0.72	10.10 ±1.42	52.57 ±0.28	38.36 ±0.95	44.31 ±2.63
S 5	5.98 ± 0.63	6.03 ±2.21	5.43 ±0.69	8.34 ±0.73	8.09 ±0.46	8.12 ±4.43	10.62 ±1.63	10.52 ±0.74	10.60 ±0.66	53.48 ±3.46	34.58 ±2.31	39.42 ±1.46
S 6	4.93 ± 0.83	4.78 ±1.19	4.08 ±0.52	7.02 ±3.22	7.29 ±0.82	7.38 ±1.93	10.89 ±0.48	9.92 ±0.83	9.58 ±0.89	64.08 ±5.57	49.53 ±3.13	53.41 ±0.98
S 7	4.85 ± 1.16	5.00 ±1.01	4.10 ±0.30	6.75 ±0.52	7.44 ±0.81	7.94 ±0.18	12.53 ±1.37	11.90 ±0.40	11.53 ±1.29	70.04 ±6.37	35.32 ±4.35	51.56 ±10.70
S 8	5.32 ± 1.72	4.91 ±0.46	4.32 ±0.82	6.42 ±0.58	6.68 ±0.93	6.63 ±0.18	13.42 ±0.69	12.46 ±2.42	12.03 ±0.88	68.32 ±4.31	52.46 ±3.32	50.68 ±0.39
S 9	4.23 ± 0.74	4.05 ±0.68	3.85 ±0.29	5.93 ±0.43	5.98 ±0.18	6.48 ±0.57	11.88 ±0.95	11.13 ±1.42	10.89 ±0.68	53.69 ±0.94	39.16 ±2.09	46.47 ±2.08
S 10	4.08 ± 0.32	4.13 ±0.62	3.89 ±0.48	5.86 ±0.66	6.06 ±0.42	6.34 ±0.18	9.48 ±0.16	9.40 ±0.46	8.86 ±0.23	49.47 ±2.28	28.49 ±1.39	42.83 ±1.69
S 11	5.02 ± 0.83	4.88 ±0.74	4.38 ±0.62	6.06 ±0.57	6.38 ±0.68	6.40 ±0.32	12.40 ±3.18	11.63 ±0.57	11.24 ±0.65	56.45 ±4.39	38.32 ±3.63	44.49 ±0.98
S 12	5.51 ±0.39	5.02 ±0.68	4.86 ±0.82	6.34 ±1.41	6.51 ±0.67	6.46 ±0.12	12.49 ±0.83	11.38 ±0.98	11.08 ±0.49	44.82 ±1.93	28.72 ±1.06	33.08 ±0.98

The pH was ranged between 6.73 to 7.93 which is favorable to life in the water body. pH plays an important role in the interaction between heavy metals and parameters such as carbonates, bicarbonates, hardness and organic compound. The increase in alkalinity during summer may be due to agricultural runoff in addition to the domestic wastes from nearby villages. The higher alkalinity of water also may be due to the accumulation of carbonate salts from surrounding and removal of carbon dioxide due to excessive photosynthesis. The observed low values of dissolved oxygen from the locations studied from river water might be attributed to the activity of domestic sewage causing anoxic conditions due to decay of organic matter. The maximum values of dissolved oxygen in winter were probably accounted due to progressive lowering of turbidity resulting in resumption of photosynthetic activity in the river water at particular locations.

In winter, high values of COD indicated high organic load in to the water bodies and high organic waste disposal on the shore of the river and municipal waste discharge into the water body. Low COD concentrations in summer due to strength of population in relation to dilution available from clear water flow. The untreated domestic sewage are being dumped into the river resulting in accumulation of large amounts of organic matter thereby giving a high biological oxygen demand, while the lower values of BOD from summer indicated the retaining capacity of water to recover from pollution stress or organic substance

Four major groups of zooplankton (Rotifera, Copepoda, Cladocera and Ostracoda) were studied the diversity and seasonal abundance. Zooplanktons like 7 species of Rotifera, 5 species of Copepoda, 5 species of Cladocera and 3 species of Ostracoda were identified

Figure 1: Plate 1 (Rotifera)

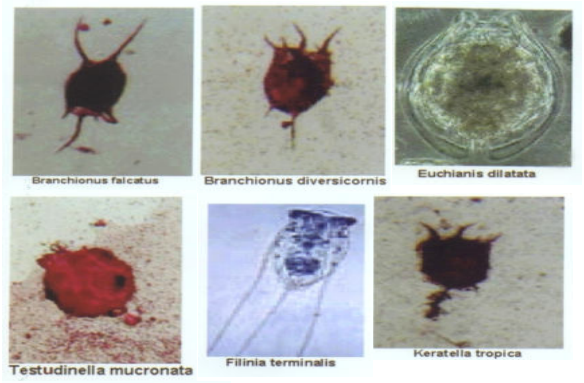


Figure 2: Plate 2 (Cladocera)

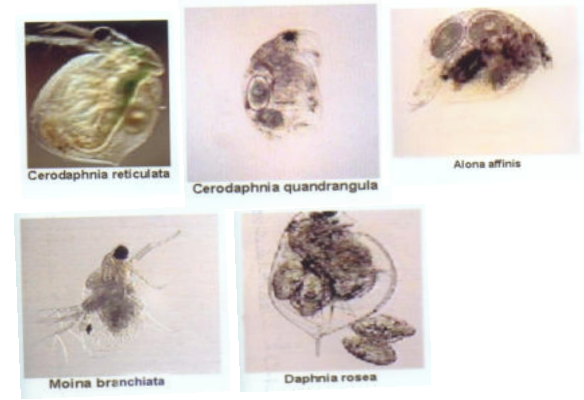
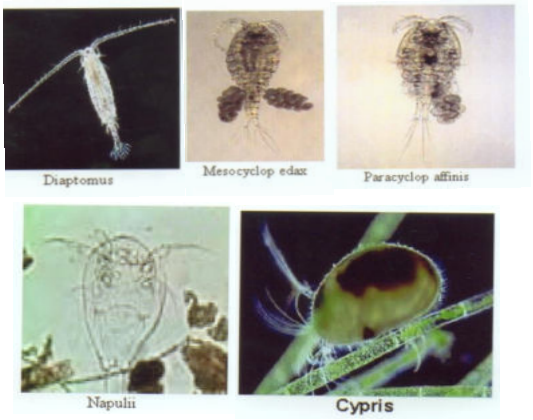


Figure 3: Plate 3 (Copepoda)



Population of total zooplankton increased in monsoon due to dilution effect and favorable environmental conditions like moderate temperature and abundance of food (Particulate matter and fine detritus). Component wise population density studies revealed that winter population of two groups Rotifers and Cladocerans were highest while Ostracoda was the lowest.

Among the groups of Zooplanktons, the population density showed variations due to their adaptability to seasonal changes in water quality, availability to food and predatory pressure. The study on ecology of plankton of different water bodies is very helpful to their general economy and basic nature. All waters are known to be characterized by qualitative fluctuations in phytoplankton. The planktonic population in present study varied qualitatively and quantitatively depending on depth of water bodies, site, time, season, source of water and its organic and inorganic content, geological, biological and climatic factors (Sirsat et.al 2004; Pawar et.al., 2006; Kamath et.al., 2006; Dahiwale, 2008).

In the present study among the group of phytoplanktons the Chlorophyceae were recorded maximum flowed by Bacilloriphyceae, Euglenophyceae and Cynophyceae

Figure 4: PLATE IV (Phytoplankton)

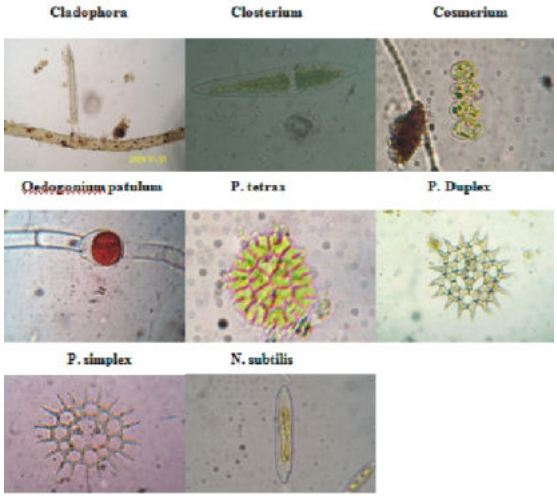
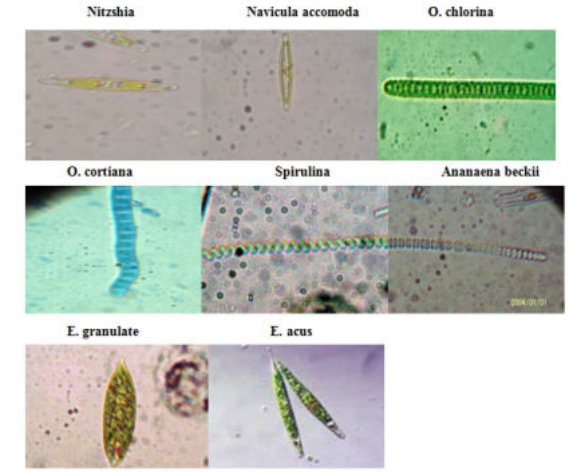


Figure 5: PLATE V (Phytoplankton)



In summer and monsoon at all stations the Chlorophyceae was maximum followed by Bacilloriophyceae, Cynophyceae and Euglenophyceae. However, in winter Bacilloriophyceae was maximum followed by Chlorophyceae, cynophyceae and Euglenophyceae.

Some plankton population disappeared at a specified period and reappeared during other period. This disappearance may be due to the fact that some species occur in spores, under favorable conditions spore germinate and appear as plankton (Dahiwale, 2008).

In the present study it is observed that 10 genera of Chlorophyceae, 6 genera of Bacilloriophyceae, 5 genera of Cynophyceae and 4 genera of Euglenophyceae. Chlamydomonas, Cladophora, Oedogenium and pediastream species were dominant from Chlorophyceae probably due to favourable environmental conditions (Kumawat and Jawale 2003; Yeole and Patil 2003; Pawar et.al. 2006) Low phytoplankton's specially Euglenophyceae was observed to be less in quantity in almost all the stations during all the seasons (Somani and Pejavar, 2003).

The Bacilloriophyceae was maximum in summer and minimum in monsoon in almost all the stations. The production of phytoplankton is directly correlated with phosphate, silicates as well as nitrogen (Borse et.al. 2000). Cyanophyceae are found generally on rocks or soil forming a blackish crust when dried out. It contains Chlorophyll a Phycobicyanin and other pigments help the algae to synthesize their own food from carbon dioxide and water in presence of sunlight (Bhadran, 2001).

The Euglenophyceae are in greater number at organically polluted water bodies. Munawar (1974) observed blue green algae and euglenoid flagellater's were mostly associated with organically rich effluents, low in dissolved oxygen. In the present study, Euglenophyceae was found to be maximum in summer and minimum in winter water in almost all stations due to sufficient amount of dissolved oxygen and good amount of nutrients (Pendse et.al., 2000). The temperature ranged 28-350 C, low pH and high iron content are also favorable factors for the growth of Euglenophyceae (Borse et.al., 2000; Pendse et.al. 2000; Bhadran, 2001).

Birds are part of the natural habitat of the Indian Subcontinent, a region teeming with winged residents. In India, there is no off-season for birds. Native birds in particular are more or less perennially visible. The bird migration and distribution during the last several decades have emphasized questions relating to the mechanisms and development (proximal causation) of migration, whereas questions, relating to the evolution and function (ultimate causing) of migration and distribution have received considerably less attention from ornithologists. The proximal causation bias has failed to emphasize the diversity of avian migration system that has evolved as a result of temporal and spatial changes in the environment. Bird habitats particularly within the lake area seem to be strongly influenced by climatic changes and immediate human impact. The restriction could be the immediate result either of active selection for habitats that give protection from predators, or of direct differential predation (Patil and Yardi, 2006). To conserve birds and their habitats, there is a need to understand their life cycles, their habitat requirements and the environments in which they live.

The drainage of marshes for land reclamation and the pollution of lakes from effluent discharges have affected the water bodies, thus deteriorating the environment still further; with the degradation of habitats have brought about changes in the distribution of quite a few species of birds, especially graminiovers and insectivores. The true effect of these changes in the environment to the avifauna can only be evaluated after a careful and detailed study.

The survey of birds conducted has been prepared to ascertain the status of bird population in an area. Gangapur, Nandur Madhameshwar and Jaikwadi Dam are the freshwater lakes on the Godavari River with mudflats, open water, water edges, midstream rocks and islands, grass and scrubs, meadows and pastureland, woodland. Overall 60 residential and 21 nonresidential species has recorded in the present study. Most of the bird species were observed in winter due to more food availability and favorable climatic conditions.

Purple moorhen and Coot were the common residential birds observed. The non residential birds like the Lesser Whistling Teal, Spoonbill, ruddy Shelduck, Pintail, Gargany, Shoveller, Red Crested Pochard, Brahminy Kite, Little Stint, wagtails, etc are observed in winter in the Dam. Among non residential birds Pintail is essentially a freshwater duck and it feeds on young shoots of water plants, its head below water and long tail elevated, thus affording eyes means of identifications. Colonial Water birds like coot, cormorant, moorhen, egrets in the Nandur Madhameshwar dam and Jaikwadi Dam are birds that are social in their behavior in that they generally forage and roost.

Table 3: Some of the Residential birds observed at Gangapur, Nandur Madhameshwer and Jaikwadi Dam on Godavari River.

Sr. No.	Scientific Name	Common Local Name
1.	Phalacrocorax	Little Cormorant
2.	Aredola grayii	Pond Heron
3.	Nycticorax nycticorax	Night Heron
4.	Babuculus ibis	Cattle Egret
5.	Egreta garzetta	Little Egret
6.	Ciconia epicopus	White necked stork
7.	Pseadibis papildosa	Black ibis
8.	Pledis rakinellus	Glossy ibis
9.	Elgnus caeruleus vociferous	Black winged kite
10.	Milvus migrans govinda	Pariah kite
11.	Accipiter bactiys	Shikra
12.	Accipiter nisus nisosimills	Sparrow hawk
13.	Amaurornis phoenicuras	Whiter breasted waterhen
14.	Porophyrio porophyrio	Purple Moor hen
15.	Fulica atro	Coot
16.	Hydrophsianus	Pheasant tailed jacana
17.	Vanellus idicus	Red wattled lapwing
18.	Vanellus malabaricus	Yellow wattled lapwing
19.	Treron phoenicoptera	Green pigeon
20.	Sterptopelia decaocta	Spotted dove
21.	Streptopelia senegalensis	Little brown dove
22.	Psittacide eapatria	Alexandrine parakeet
23.	Psittacula krameri	Roseringed parakeet
24.	Eudynamys scocopacea	Koel
25.	Tyto alba	Barn lwl
26.	Apus offinis	House swift
27.	Ceryle rudis	Lesser pied kingfisher
28.	Alcedo atthis	Small blue kingfisher
29.	Halcyon smyrnesls	White breasted kingfisher
30.	Merops oriontalis	Green bee-eater
31.	Vpupa epops	Hoppe
32.	Megalaima haemacephala	Crimson breasted barbet
33.	Picoides mahrattensis	Marath wood pecker
34.	Erem opterix grisea	Black billed finch-lark
35.	Hirundo concolor	Dusky crag martin
36	Lanius excabitor	Grey shrike
37.	Lanius vittatus	Baybacked shrike
38.	Oriolus oriolus	Golden oriole
39.	Dicrururus adsimilis	Black drango
40.	Sturnus pagodarum	Brahminy myna
41.	Acridotheres tristis	Common myna
42.	Corvus splendens	House crow
43.	Pericrocotus cinnamomeus	Scarlet minivet
44.	Aeqithina tiphia	Iora
45.	Pycnonotus cater	Red vented bulbul
46.	Turodides caudatus	Common babbler
47.	Rhipidura cureola	White browned fantail flycatcher
48.	Terpsiphone paractisi	Paradise flycatcher
49.	Prinia socialis	Ashy wren wrabbnler
50.	Orthotomus	Tailor bird
51.	Saxicola caprata	Pied bush chat
52.	Saxicoloides fulicata	Indian robin
53.	Parus major	Grey tit
54.	Zosterops palpebrosa	White eye
55.	Passer domesticus	Hose sparrow
56.	Petronia xanthocollis	Yellow throated sparrow
57.	Ploceus philippinus	Baya weaver bird
58.	Estrilda amandava	Red munia
59.	Melophus lathami	Creasted butings
60.	Nectarina asiatica	Purple sunbird

Table 4: Some of the Non-residential birds observed at Gangapur, Nandur Madhameshwer and Jaikwadi Dam on Godavari River.

Sr. No.	Scientific Name	Common Local Name
1.	Platalea leucoroidea	Spoonbill
2.	Dendrocygna javanica	Lesser whistling teal
3.	Tadorna ferruginea	Ruddy shelduck
4.	Anas acuta	Pintail
5.	Anas poecilorhyncha	Spotbill or Grey duck
6.	Anas auerquedula	Gargany or bluewinged teal
7.	Anas crecca	Common Teal
8.	Anas clypeata	Shoveller
9.	Natta rufina	Redcreasted Pochard
10.	Aythya ferina	Common Porchard
11.	Aythya nyroca	White-eyed Pochard
12.	Aythya fuligula	Tufted pochard
13.	Charadrius dubius	Little ringed polover
14.	Tringa tetanus	Com,mon rd shank
15.	Calidris minuta	Little stint
16.	Himantopus himantopusq	Black wined stilt
17.	Clamator jacobinus	Pied creasted cuckoo
18.	Picoides nanus	Pigmy wood peckers
19.	Motacilla citreola	Yellow headed wagtail
20.	Motacilla flava	Yellow wagtail
21.	Motacilla cinera	Grey wagtail

Conclusion

There is definite indication of serious changes in the habitat conditions and breeding behavior of the birds in the Dams constructed on Godavari River due to domestic pollutional effect. Large infestations of weeds and successions of plant growth have resulted in the loss of much of the area of the lake, destroying considerable habitat for wetland species, Remedial measures should be taken to control plant growth, which includes the manual removal of weeds. Efforts should take to remove siltation. As these dams have a unique treasure, it has been maintained over the year as the habitat for numerous species. As an artificial area the site requires considerable management efforts to maintain the conditions necessary to continue to attract wildlife.

The following measure should be followed by concern may accomplish the objectives that -

- There is a need for a policy on conservation of urban water bodies.
- The public pressure on development of new technologies an defective management of water resources must be sustained.
- Urgent steps should be taken for successful water conservation on efficient use of water. Section 2 of the water (prevention and control of Pollution) Act, 1974 needs expansion so as to include alternation of physical structure of water bodies as a potential cause of water pollution and such an alternation should be made cognizable offence attracting several punishments.
- The volunteers of religious groups, Social Associations, NGOs shall canvass about the detrimental effects of immersion of idols of God in the urban water.
- The executive wing of the Government shall be made responsible for any lethargy on their part and failing to protect river water bodies while implementing various environment protections laws.
- The people should act as watchdogs and it is their duty to ensure that the conservation of river water bodies becomes a reality.
- The scientific studies carried out so far were with limnological emphasis, concentrating on the bio-limnological aspects and dealt with the interrelationship of the lake biota with physicochemical characteristics. There shall be investigation of the sociological factors being and changing characteristics of the river lakes and their water sheds.
- River water management is relatively new but fast emerging concept in the face of unprecedented degradation of aquatic ecosystem all over the world in general and urban centers in particular. A proper strategy can be adopted for protection and conservation of water body like Godavari River that includes a set of administrative measures complimented with steps to rehabilitate the ecosystem by implementing a number of biotechnological correctives.

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