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ZOOPLANKTON DIVERSITY AND PHYSICOCHEMICAL PARAMETERS OF PUS DAM WASHIM, (M.S.) INDIA

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ABSTRACT

Pus Dam is one of the minor project which is an earthfill dam on Pus River near Pusad, Yavatmal district in the state of Maharashtra in India. Zooplankton community structure is very much essential to manage the reservoir for pisciculture, therefore, the present work was undertaken for a period of six month i.e. from Octobers 2015 to March 2016. Present investigation revealed the occurrence several physicochemical parameters like Dissolved Oxygen, Total hardness, Alkalinity, pH and Temperature all such parameters are observed and god quality for the fisheries cultivation along with these parameters zooplankton diversity are also observed, near about 27 species of zooplankton, out of which 4 species belonging to Cladocera, 2 to Copepoda, 20 to Rotifera and a single to Ostracoda. The overall population was dominated by Rotifera.

KEYWORDS :Pus Dam, Zooplankton Diversity.

INTRODUCTION:

Zooplankton constitutes important food item of many omnivorous and carnivorous fish. The larvae of carps feed mostly on zooplankton. Zooplankton also plays a very important role in the food chain as they are in the second of the tropic level as primary consumers and also as contributions to the next tropic level. Zooplankton are of great importance and basically essential in fish culture. Sunkad and Patil (2004).

Zooplankton are microscopic free floating animals which play a vital role in aquatic food web.

They are choice food of fishes in general and juveniles in particular. They graze heavily on algae, bacteria and minute invertebrates. Zooplankton communities are typically diverse and occur in almost all lakes and ponds. Zooplanktons are highly sensitive to environmental variation, as a result change in their abundance, species diversity or community composition can provide important indication of environmental change or disturbance.

Submerged and floating water plants serve a number of important functions. In wetlands, a well-developed macrophyte community provides shelter against predation for vulnerable prey species like small zooplankton and fishes (Crowder and Cooper, 1982 and Batzer, 1998). In addition, macrophytes are usually covered with epiphytes that are grazed upon by several invertebrates that are themselves an important fraction of the diet of many fishes and birds (Batzer and Wissinger, 1996).

Pailwan et al., (2008) studied the limnological features, plankton diversity and fishery status of three fresh water perennial tanks of Kolhapur District (M.S.) and revealed 67 species of phytoplankton, 35 species of zooplankton. Moreover fishery activities are observed as an extensive type and tanks under investigation are categorized under natural fertility. Agarwal and Thapliyal (2005) have reported the pre-impoundment studies on physico-chemical and biological characteristics of Rivers Bhagirathi and Bhilangana their study confirms the influence of these abiotic factors on zooplankton population. The influence of environmental and biotic interactions on the composition, abundance and dynamics of zooplankton have also mentioned by Wetzel, 2001; Fernandez-Rosado and Lucena, 2001. Zabbey et al., (2008) highlighted studies which involved regular or periodic investigation into the ecology of water to provide insight into the status of the physical and chemical indices for monitoring purposes, Adeniji and Ovie (1996) on the other, focused on the availability of natural food as an important factor governing fish recruitment and production in the world.

Bhuiyan et al., (1998) and Cottenie et al., (2001) worked on the physicochemical condition and seasonal variation of zooplanktons. Ovie (1995) reported that among others, physico chemical factors are known to be major factors influencing zooplankton species richness of different ecosystems. Mukhopadhyay et al., (2007) studied the aspect of zooplankton diversity in relation to physico-chemical environment of the east Calcutta wetlands, a Ramsar site of Kolkata city, India which is heavily contaminated by industrial and municipal wastewater and the study revealed the occurrence of fifteen species of rotifers. Planktons and zoobenthos play an important role in lake ecosystems as a main determinant of hydro-biological production and community structure (Sprules and Munawar 1991).

Dengina and Sokalova (1968) in their review of zooplankton composition in Lake Ladoga listed two hundred rotifer taxa, which account for about 53% of the total number of zooplankton taxa recorded in the lake.

Somani and Pejaver (2004) has studied the density of total zooplankton in Masunda Lake of Thane and observed copepods as the largest contributor followed by rotifers and cladocera. Dejan et al., (2004) reported that precipitation or turbidity, have been identified as critical factors in the development of zooplankton. Habitat wise abundance of zooplankton showed marked difference in rainfed rice-fish system (Das and Sinhababu, 1999).

Qualitative analysis of the zooplankton reservoir and phytoplankton was made. Mukhopadhyay et al., (2007) has studied the aspects of zooplankton diversity in relation to physic-chemical environment of five selective sites of East Kolkata city, India which is heavily contaminated by industrial wastewater. Preliminary survey of plankton in Irrukkangudi reservoir, Virudhunagar district, T.N., India was carried out by Kanagasabapathi and Rajan (2010) and reported twenty six different species of phytoplankton belonging to six classes and twenty five different species of zooplankton

belonging to four classes Rotifera, Cladocera, Ostracoda and Copepoda.. Rajagopal et al., (2010) studied the zooplankton diversity and physico-chemical conditions in three perennial ponds of Virudhunagar district, Tamilnadu and they reported positive significant correlation between the zooplankton population and physico-chemical parameters like, temperature, alkalinity, phosphate, hardness and biological oxygen demand, whereas negatively correlated with rainfall and salinity. The study revealed that the presence of certain species like, Monostyla sp., Keratella sp., Lapadella sp., Leydigia sp., Moinodaphnia sp., Diaptomus sp., Diaphanosoma sp., Mesocyclopes sp., Cypris sp. And Brachionus sp. is considered to be biological indicator for eutrophication. Ali et al., (1989).

Mustapha (2009) evaluated the fisheries potentials and productivity of a small shallow tropical African reservoir. Marshall and Maes (1994) estimated that yields from tropical shallow; managed reservoirs averaged 30-150 kg/ha/year; while deep reservoirs averaged 10-50kg/ha/year.

MATERIAL AND METHODS

Pus reservoir is the minor project which is an earthfill dam on Pus River near Pusad, Yavatmal district in the state of Maharashtra in India. It is situated in 20.00574380N latitude and 77.45060920 E longitudes. The height of the dam above its lowest foundation is 42 m (138 ft) while the length is 744 m (2,441 ft). The volume content is 1,980 km^3 (480 cu mi) and gross storage capacity is 113,920.00 km3 (27,330.86 cu mi)

Irrigation is the main purpose of the reservoir but presently it has been used for fish culture and main source of drinking water supply.

Four sampling stations will be selected along the periphery of the Pus Reservoir and will be named as Site I, Site II, Site III and Site IV. Zooplankton samples will be collected monthly in the early hours by towing plankton net of mesh size 25m for two successive years. Zooplankton samples will be preserved in 4% formalin indicating name of the sampling site, date, time of sampling, etc.

Fig. No. 1. Photo view of Pus Dam.

Samples will be observed under microscope and their lucid drawings will be prepared. Live

specimens will be observed under Phase Contrast Microscope. Photography will be done with the help of photographic device, Studio DC 10 plus. Species identification will be carried out by referring standard literatures. Species diversity index will be calculated by using standard formulae of Shannon and Weaver (1949) and while richness and evenness was estimated following the standard formulae of Pielue (1966).

Fishes will be collected by using different nets with the help of local fishermen and will be brought to laboratory for preservation. Identification will be carried out using standard literature. Water samples will be collected at the same time from all the selected sites following the instructions of APHA (1998) and will be analyzed for physicochemical parameters. Other Limnological aspects will be studied by using standard methods. The data collected will be analyzed statically.

RESULTS AND DISCUSSION:

The data on physico-chemical analysis of Pus Dam has been given in Table No.1.

Temperature:

During the study period water temperature varied from 26.16^{0}C ± 1.19^{0}C to 27.25 C ± 0.75^{0}C. Jayabhaye et al; Salve and Hiware , observed that during summer, water temperature was high due to low water level and clear atmosphere. Similar results were obtained in the present study.

pH:

The pH values ranges from 6.5 ± 0.12 to 9 ± 0.10. The maximum pH value was recorded in the month of August (monsoon) and minimum in the month of April (summer). pH was slightly neutral throughout study period.

Dissolved Oxygen:

The values of DO fluctuate from 3.63 ± 0.92 mg/l to 3.65 ± 0.969 mg/l. The maximum values were recorded in the month of October and minimum values in the month of August. The high DO in Month of October is attributed to increase in temperature and duration of bright sunlight.

The long days and intense sunlight during October seems to accelerate photosynthesis by phytoplankton, utilizing CO_2 and giving off oxygen. This accounts for the greater quantity of O2 recorded during October. The quantity is slightly less during August as reported by Masood Ahmed and Krishnamurthy

Carbon-dioxide:

The values of free Co2 range from 0.0 mg/l to 1.13 ±1.79 mg/l. The maximum value was recorded in the month of December and absent in the month of October. High carbandioxide is due to increase in the decomposition of organic matter, low temperature and photosynthetic activities of phytoplanktons. Absence of free carbondioxide is due to its utilization by algae during photosynthesis or carbonates present.

Total Hardness:

The values of hardness fluctuate from 45.25 ± 17.46 mg/l to 33.25 ± 13.15 mg/l. The maximum value was recorded in the month of December and minimum value in the month of October .

Table no.1 Monthly variation of physicochemical parameter

Physicochemical Parameter		Temperature (C^o)	PH	DO	CO2	Total hardness Mg/l	Alkalinity Of Carbonate	Alkalinity Of bicarbonate
Oct	S1	28	7	1.6	-	14	6	50
	S2	28	7	4.8	-	12	6	46
	S3	28	7	4.0	-	14	4	48
	S4	29	7	4.2	-	50	3.2	46
Nov	S1	25	7	4.0	0.1	43	5	54
	S2	24	7	4.0	0.2	44	4	52
	S3	26	7	2.6	0.2	40	2	40
	S4	24	7	2.4	0.4	56	4	46
Dec	S1	24	7	5.4	1.6	54	-	50
	S2	25	7	4.0	1.6	50	-	50
	S3	25	7	5.0	1.6	74	-	44
	S4	25	9	4.8	2.0	52	2	54
Jan	S1	25	7	4.6	-	38	-	40
	S2	26	7	4.4	-	39	2	54
	S3	25	7	4.2	0.2	38	4	56
	S4	27	8	2.2	0.1	48	2	58
Feb	S1	26	7	4.1	-	28	2	46
	S2	27	7	4.1	0.8	28	2	42
	S3	27	7	4.2	-	26	1	42
	S4	28	8	3.0	1.2	26	2.8	46
March	S1	27	7	4.2	0.4	30	2	42
	S2	27	7	4.2	0.4	26	2	42
	S3	27	7	4.2	-	26	2	42
	S4	28	9	2.9	1.0	26	4	48

Carbonate

Total alkalinity of carbonate ranges from 3.15± 0.965 mg/l to 2.77 ± 1.563mg/l. The maximum value was recorded in the month of August and minimum value in the month of January

Bicarbonate

Total alkalinity of bicarbonate ranges from 50.16± 6.630 mg/l to 46.33 ± 9.413mg/l. The value of bicarbonate is near about similar for all month.

Hydrogen ion concentration (pH) in surface waters remained nutral throughout the study period at all the stations with maximum value (9) during the summer seasons and minimum values (6.5) during monsoon. Generally, fluctuations in pH values during different seasons of the year is attributed to factors like removal of CO2 by photosynthesis through bicarbonate degradation, temperature by Karuppasamy and Perumal, 2000; Rajasegar, 2003. Dissolved oxygen: Variation in dissolved oxygen content wasfrom 3.63 ± 0.92 mg/l to 3.65 ± 0.969 mg/l. It is well known that the temperature (Vijayakumar et al., 2000). In the present investigation, higher values of dissolved oxygen were recorded during octomber months at all the stations. Higher dissolved oxygen concentration observed during the octomber might be due to the cumulative effect of higher wind velocity joined with heavy rainfall and the resultant freshwater mixing (Das et al., 1997). According to Reid (1961) the successful development and maintenance of a population of organism depends upon harmonious ecological balance between environmental conditions and tolerance of the organisms to variations in one or more of these conditions. The parameter of temperature is of utmost importance for its effect on controlling metabolism, species composition and reproduction of aquatic organisms. Temperature, a catalyst, a depresant, an activator, a stimulator, a controller, a killer is one of the most important and influential water quality characteristics to life in water.

The higher pH recorded in winter in some sites and lower in others may be attributed to increase and decrease in biogenic activities of the system. The pH of 7.4 to 9.0 in Pus Dam area is within safe range for aquatic life.

The absence of free C02 be attributed to the presence of larger populations of phytoplankton in these areas. Higher dissolved oxygen recorded in winter is due to lower water temperature compare to monsoon since dissolved oxygen showed inverse relationship with temperature as observed in this study and by several others(Gurumayum et al ,2000:Agarwal and Thapliyal(2005).Also fast flow of lotic portion allowed replenishment of oxygen. Higher dissolved oxygen during winter might also be due to photosynthetic activities at upper level. The total alkalinity recorded in winter can be due to biological activity in water and lower alkalinity in monsoon may be due to effect of rainfall in decreasing it as suggested by Mookherjeee & Bhattacharya (1949). Agarwal and Thapliyal(2005) also obtained maximum alkalinity during winter months in octomber. The total alkalinity value were always >50 in all sampling site According to Moyle(1946),water bodies having total alkalinity above 50mg/l can be considered productive and this present findings showed in reservoir as being productive during all seasons.

Higher hardness of the water in winter suggests that water is more productive during this season.

Sites	Temp	pH	DO	CO2	Total Hardness	CO_3	HCO_3
Oct	28.25 ± 0.5	7±0	3.65±1.41	0±0	22.5±18.4	4.8±1.42	47.5±1.91
Nov	24.75±0.96	7±0	3.25±0.87	0.15±0.13	45.75±7.0	3.75±1.3	48±6.32
Dec	24.75±0.5	7.5±1	4.8±0.59	1.7±0.2	57.5±11.1	0.5±1	49.5±4.12
Jan	25.75±0.96	7.25±0.5	3.85±1.11	0.075±4.9	40.75±4.9	2±1.6	52±8.16
Feb	27±0.82	7.25±0.5	3.85±0.57	0.5±0.6	27±1.2	1.95±0.74	44±2.3
Mar	27.25±0.5	7.5±1	3.88±0.65	0.45±0.41	27±2	2.5±1	43.5±3

During the six month Physico-chemical parameter of four sampling site there mean and stander deviation is given in Table no. 2.

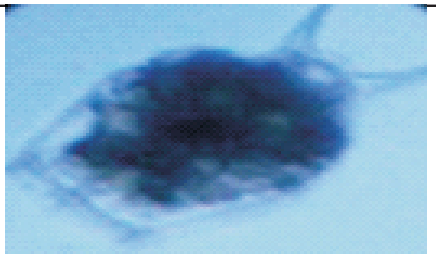
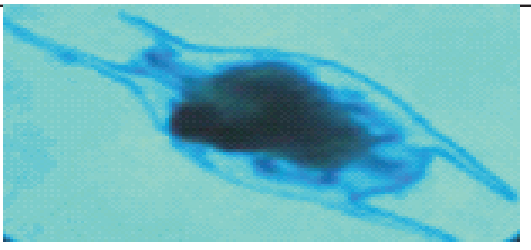
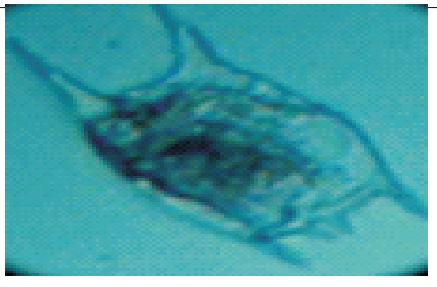
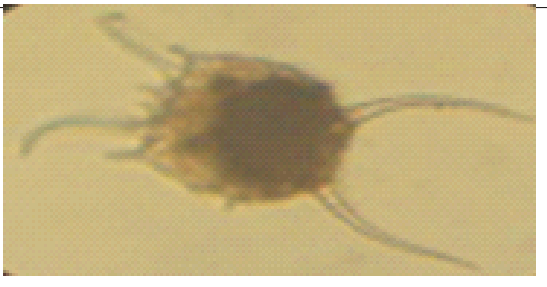
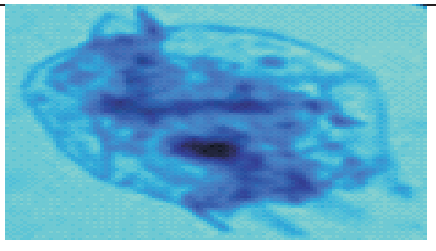
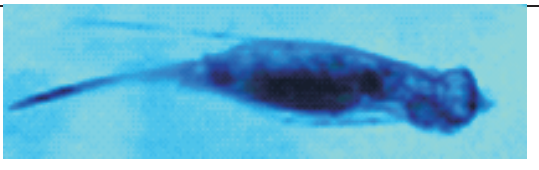
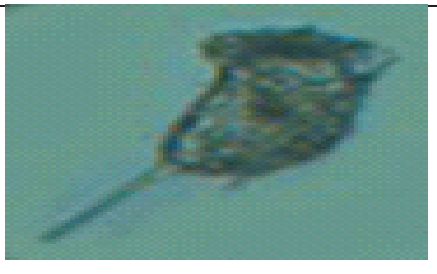
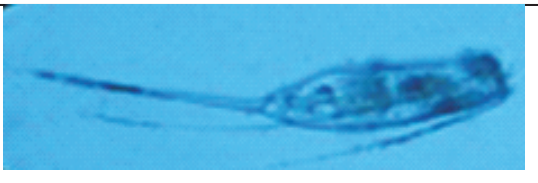
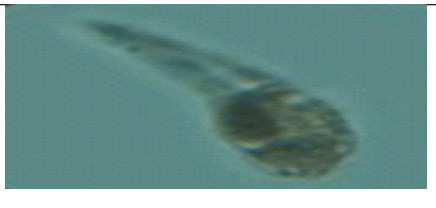
RESULTS AND DISCUSSION:

Zooplankton in Pus Dam have been noticed totally 27 different species of zooplankton belonging to four different classes namely Rotifera, Cladocera, Ostracoda and Copepoda.

Table 3: Occurrence of the zooplankton on different sampling sites.

Sr.No.	*Zooplankton*	S_1	S_2	S_3	S_4
Rotifera					
1	*Brachinous caudatus,*	+	-	+	+
2	*B. forficula*	+	+	-	-
3	*B. calyciflorus*	-	+	+	-
4	B. falcatus *typical*	+	-	-	+
5	*B. ureceolaris*	+	-	+	-
6	*Plationus patulus*	-	+	-	+
7	P. quadricornis *andhraensis*	-	+	+	+
8	*Keratella tropica*	+	+	+	-
9	*K. cochlearis*	-	+	+	-
10	*Euchlanis dilatata*	+	-	-	+
11	*Mytilina ventralis*	+	-	-	+
12	*L. leontina, (dorsal)*	-	+	+	-
13	*L.(M) bulla*	-	-	+	-
14	*L(M) decipiens*	+	-	-	+
15	*L(M) hamata*	+	-	+	-
16	*L(M) punctata*	-	+	+	+
17	*L(M) quadridentata*	-	+	+	-
18	*C. forficula*	+	-	-	+
19	*C. gibba*	-	-	-	+
20	*Aaplanchna brightwelli;*	+	-	-	+
Cladocera					
21	*Diaphanosoma excisum*	+	+	-	-
22	*Daphnia carinata*	+	-	+	+
23	*Ceriodaphnia Cornuta*	-	-	-	+
24	*Moina micrura*	+	+	-	+
Copepoda					
25	*Diaptomoid nauplius*	+	+	-	-
26	*Mesocyclops sp.*	+	+	-	+
Ostracoda					
27	*Stenocypris*	+	-	-	-

Photoplate No. 1.

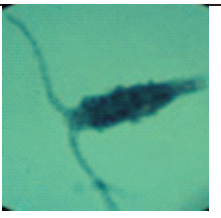
	
Brachionus caudatus	*Brachionus diversicornis*
	
Brachionus forficula	*Brachionus falcatus*
	
Brachionus calyciflorus	*Cephlodella mucronata*
	
Keratella tropica	*Filinia pejleri*
	
Conochilus arboreus	

PHOTOPLATE NO. 2

COPEPODA

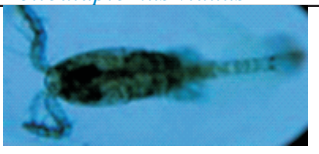
Mesocyclops sps.

Heliodiaptomus viduus



Undinula vulgaris

Mesocyclops sps.

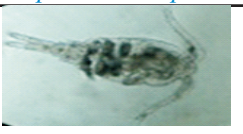


Cyclopoid copepod

Diaptomoid nauplius

Calanoid copepod

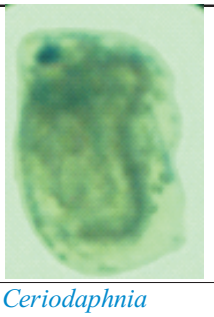
Thermocyclops sps.



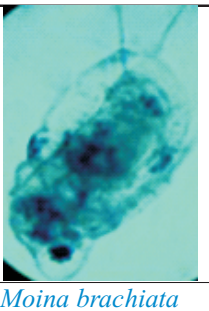
Mesocyclops sps.

CLADOCERA

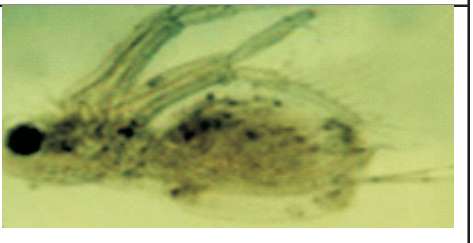
Moina micrura



Ceriodaphnia cornuta

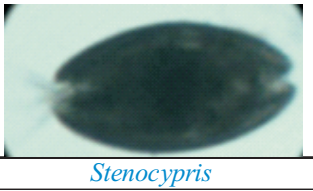


Moina brachiata



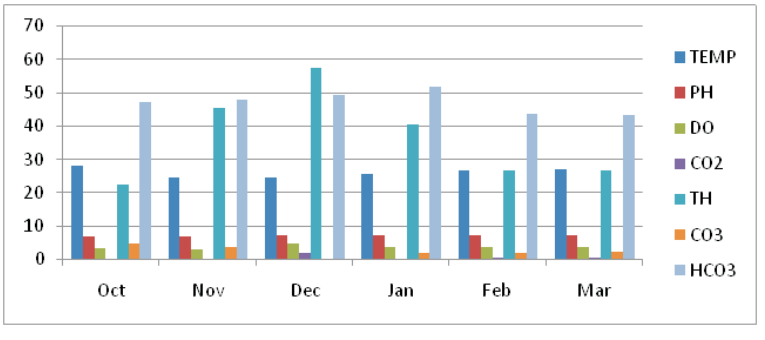
Diaphanosoma sarsi

OSTRACODA



Stenocypris

Graphical variation of Physico-chemical parameter During the Study Periods.



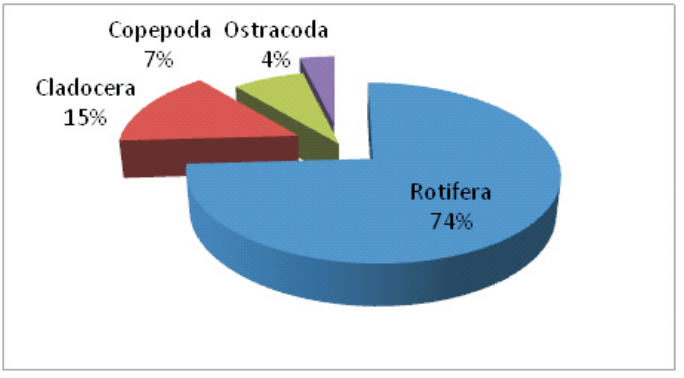


Fig. No.2. Diversity of Zooplanktons in Pus Dam

1. Rotifera

There are 20 species of rotifer observed during investigation .

Brachinous Caudatus, B. diversicornis , B. forficula , B. calyciflorus , B. falcatus , Cephalodella Mucrona, Conochilus arboreus Filinia pejleri ,Keratella tropica Sinatherina Testudinella Trichocera

2. Cladocera

There are 04 species of Cladocera observed during investigation, Ceriodaphnia Cornula , Diaphanosoma sarsi , Moina micrura ,Moina brachiata .

3. Copepoda

There are 02 species of Copepoda observed during investigation, Diaptomoid nauplius Mesocyclops sp.

4. Ostracoda

There is only one species of Ostracoda observed during investigation, Stenocypris.

IMPLICATIONS

This study will helpful to manage the reservoir properly. Biodiversity of the reservoir will be identified and steps towards the conservation of it will be taken if required.

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