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Study on zooplankton diversity with physicochemical parameters of Hukal river, Kodinar, Gujarat, India.

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Abstract: Plankton refers to plants and animals that drift with the ocean currents and fresh river water. they habitants in the open waters of the sea and fresh river water. Zooplankton (from Greek zoon, or animal) are Small protozoans or metazoans (e.g. crustaceans and other animals) that feed on other plankton and telonemia. Some of the eggs and larvae of larger animals, such as fish, crustaceans and annelids, are included in Zooplankton. Physico-chemical parameters are very important factors that play a significant role in river zooplankton diversity and fluctuation. We evaluated impact of Abiotic factor on plankton diversity during pre, middle and post winter analysis of Hukal River.

Key words: Physico-chemical property of water; Zooplankton; diversity of plankton

Introduction

Plankton is organisms which live suspended in the water of seas, lakes, ponds, and rivers, and They are not able to swim against the currents of water. This latter feature distinguishes plankton from nekton, community of actively swimming organisms like fish, larger cephalopods and aquatic mammals. Plankton form complex biotic communities which are functionally as diverse and show the same richness of interaction as terrestrial communities. Plankton is defined by their ecological niche rather than their phylogenetic or taxonomic classification. They provide a crucial source of food to larger, more familiar aquatic organisms such as fish.

The zooplankton is divided into two groups. Temporary plankton consists of planktonic eggs and larvae of members of the benthos and nekton, permanent plankton includes all animals that live their complete life cycles in a floating state and the temporary plankton particularly abundant in coastal areas, it is characteristically seasonal in occurrence, though variations in spawning time of different species ensure its presence in all seasons. They are absent in fresh water. The ciliate protozoans are represented mainly by the tintinnids, which are between 20 and 640 microns in size and sometimes occur in vast numbers. Oysters, mussels, other marine bivalves and snails begin life as planktonic larvae. The wing snails (Pteropoda) spend their entire life cycles as plankton. Crustaceans are the most important members of the zooplankton. They are the marine counterparts of insects on land as in the sea, the arthropods are the most diverse and numerous of all animal phyla. The copepod is important as food for the herring, and the euphausiid Euphausia superba, commonly known as krill, is the main food source for blue and fin whales in the Antarctic Ocean. These whales, particularly blue and finback whales, migrate to waters where spawning of these crustaceans occurs; and the rapid growth of these large mammals, feeding entirely on plankton.

In present study, we selected Hukal River of Kodinar taluka, Gir-somnath district, Hukal is most important and very useful river in kodinar taluka. River water is utilizing for many proposed for irrigation and cultivation of fish in river check dam water. We selected 11 abiotic parameters for investigation and studied their impact on Zooplankton diversity of river water. We selected two points for river water sampling and studied their Physico-chemical and plankton diversity during pre, middle and post winter during 2015-2016.

Materials and Methods

Sample collection site of Hukal River

Hukal River is Valuable River of Gir-Ghadhada taluka, this river also known as Sangavadi River. River pass out from Abhalvad Village and Join with another River. We selected two points for water sample collection, we collected 5-liter sample for physicochemical analysis approximately less than 2 feet of river water. Time and temperature measured during sampling and transferred all sample as soon as possible to laboratory for study further testing. We collected all samples during winter time and temperature range between 25 to 30^0C.

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Sample collection for Zooplankton Analysis
Collected 1 liter river water sample from two collection site with Plankton net (0.20 microne). After collection of river water samples, it's transferred as soon as possible to laboratory for Analysis. Add 4% formalin solution and stay it for 48 hrs, after incubation time period drop count Method is used for identified plankton diversity.

Physico-chemical parameters:

Color
Color in water may result from the presence of natural metallic ions (iron & manganese) humus and pit materials, planktons, weeds. Apparent color is determined on the original sample with thought filtration or centrifugation by Visual comparison method. We took water sample in clean test-tubes and visualize it that river water is clear or not.

Turbidity
The term "turbid" is applied to water containing suspended matter that interferes with the passage of light through to water. The turbidity in water is caused by suspended and colloidal matter such as clay, silt, finely divided organic and inorganic matter and microscopic organisms. Turbidity is an expression of optical property that causes light to be scattered and absorbed rather than transmitted.

Odor
Odor can measure by simple nose smell testing.

pH
pH is a term used rather universally to express the intensity of the acid or alkaline conditions of a solution. It is a way of expressing the hydrogen ion concentration.

Acidity
Acidity of water is it's quantity with strong base to a designated PH. Strong mineral acids, weak acid and hydrolyzing salts such as iron or aluminum sulfates may contribute to the measure acidity according to the method of determination. Acid contribute to the corrosiveness and influence chemical reactions and biological processes. Alkalinity: The alkalinity of water is a measure of its capacity to neutralize acids. The major portion of the alkalinity in natural water is caused by three major classes of materials: 1) Hydroxides 2) carbonates 3) bicarbonates. Auto PH meter is used for taking pH of river water sample.

Conductivity
Conductivity meter instrument is use for measuring conductivity of water sample.

Estimation of Total solid (T.S.)
Porcelain dish is used for this method; Heat it for 103 to 105 C for 1 hrs. Store and cool dish in desiccators until needed weight immediately before use. (Pre-weight) Shake the water sample very well and add 100ml of it in to evaporating Petri dish. Put evaporating dish in to oven at 103 to 105 C for overnight. Next day take out it from oven and cool it in desiccators dish would be having dried residues in it. Measure the weight of evaporating dish. (Post weight) Put the data or pre-weight and post weight of the dish in following equation and calculate the amount of total solid present in the sample.

Calculation:
mg total solids/L= (A-B).1000/Sample volume (ml)

Where,
A=post weight of dish (weight of dried residues +dish mg)
B= Pre-weight (weight of dish mg.)

Estimation of Total dissolved solid (T.D.S.)
Porcelain dish is used for this method; Heat it for 103 to 105 C for 1 hrs. Store and cool dish in desiccators until needed weight immediately before use. (Pre-weight) Shake the water sample very well and add 100 ml of it in to filtration device that is having glass fiber on it. Apply vacuum and filter out 100ml of sample. Collect the filtrate in to evaporating dish. Put evaporating Petri dish in to oven at 103 to 105 C for overnight. Next day take out it from oven and cool it in desiccators dish would be having dried residues in it. Measure the weight of evaporating dish. (Post weight) Put the data of pre-weight and post weight of the dish in following equation and calculate the amount of total solid present in the sample.
Calculation:

mg total dissolved solid/L= (A-B).1000/sample volume (ml)
Where,
A=Post weight of dish (weight of dried resdues+dish, mg)
B=pre-weight (weight of dish, mg)

Estimation of chloride in water sample
Sample preparation: Take 100ml of sample in 250ml conical flask. If chlorine is higher in the sample, dilute the sample and then take 100ml of diluted sample. If the sample is highly colored add 3ml Al (OH) $_3$ suspension, mix, settle and filter.
Titration: Set the pH of the sample in the range of 7-10 with the help of H_2SO_4 /NAOH.
Add 1ml K_2CrO4 indicator solution. Titrate it with standard AgNO3 Titrate to a pinkish yellow end point. Be consistent in end point recognition.
Calculation: [1] mg Cl/L= (A-B). N.35450/ml of sample (100ml)
Where, A=ml titration for sample, B=ml titration for blank, C=normality of AgNO5 (0.0141N)
[2] mg NaCl /L= (mg Cl/L).1.65

Total water hardness
Take 1ml of water samples than added few drops of the ammonium bisulphate solution add to black-T as indicator. We observed that water sample color is occurrence pink. Then added EDTA slowly drops by drop and water color is blue.
Calculation: Formula: 1000.1ml of used in EDTA/ml of water sample

Estimation of dissolved oxygen (D.O)
Collected river water samples in B.O.D. bottle having capacity of 300 ml. In this bottle add 1ml MnSo4 solution followed by addition of 1ml alkali iodide acid reagent. Stopper the bottle carefully to exclude and mix by inverting bottle a few times. When precipitate has settled sufficiently an (approximately Half the bottle volume.) To leave clear supernatant above the flask. Add 1ml concentrated H_2So_4. Res topper the bottle and mix it thoroughly to completely dissolve the precipitates. Take 200ml of this mixture from bottle to flask. Add 1ml 2% starch solution as indicator. Titrate it with 0.025 $Na_2S_2O_3$ solutions. Record the end point, when the blue color of starch disappears. Calculation: V_1.0.1.1000/200 Where, v1=Burette no.

Estimation of biological oxygen demand (B.O.D)
Collected river water samples in B.O.D. bottle having capacity of 300 ml. In this bottle add 2ml MnSo4 solution followed by addition of 1ml alkali iodide acid reagent. Stopper the bottle carefully to exclude and mix by inverting bottle a few times. When precipitate has settled sufficiently an (approximately Half the bottle volume.) To leave clear supernatant above the flask. Add 2ml concentrated H_2So_4. Restopper the bottle and mix it thoroughly to completely dissolve the precipitates. Take 200ml of this mixture from bottle to flask. Add 2 ml 2% starch solution as indicator. Titrate it with 0.025 $Na_2S_2O_3$ solutions. Record the end point, when the blue color of starch disappears.

Calculation: V_1.0.1.1000/200
Where, V_1=A-B, A=Pre burette no.B=post burette no.

Results and Discussion

Hukal River is passing out near Abhalvad village and many other villages in Gir-Gadhada talukas, Gir-Somnath District. We carry out four-month study (pre, Middle and post winter Analysis) of River check dam water by performing Physico-chemical and Plankton Analysis. Water collected from check dam of Hukal River around under 2 fit. Physicochemical Analysis we included 9 parameters like Temperature, PH, Conductivity, T. S, T.D.S., D.O., B.O.D., water Hardness and chloride. Winter time temperature of river water in range 26.5^{0}C to 29.0^{0}C. PH range of river water is 7.8 to 9. 5. Higher pH value of river water noted on Dec-15 Month. After recorded results on pH of Hukal river water indicate some salts concentration higher compare to normal water (fig 1) and Conductivity of water range between 121.8 To 172.9µmho/cm higher conductivity values indicate salts concentration is higher in water sample. (fig: 2) Dissolved oxygen (D.O) and Biological oxygen demand (B.O.D) data indicated that dissolve oxygen level range 1.20 to 2.4 mg/lit in check dam water. Lover D.O. value indicates very poor condition for aquatic life inside the water (fig 4& fig 5). T.S. and T.D.S. data of water samples are higher and fluctuated during time period of Analysis. T. S. range of sample 1325 to 2570, Higher, TDS of samples range 550 to 900 mg/lit the data of T.S and T.D.S is higher than normal range its indicated water is not directly use for Agriculture and drinking purpose, Higher values is also dangerous for normal aquatic life. (fig 3) Water hardness is last parameter which conclude that salts quality in water samples like carbonate and many other salts in water sample is higher, Water hardness Range 155 to 273.0 mg/lit (fig 6)

Zooplankton analysis during time period we isolated 16 spp. of Zooplankton from Singoda River water. After completed analysis we calculated quantitative evaluation of all groups and prepared systematic classification of Zooplankton in river water. (Table: 03 &04) Our survey on plankton diversity and physiological property we submitted this report to Nagar palika of kodinar city.

Table 1: Physico-chemical analysis data

Date	24/11/2015		02/12/2015		24/01/2016		20/02/2016	
Location	1	2	1	2	1	2	1	2
Time	06:57P.M	5:02 P.M	4:30PM.	5:30PM.	5:15 P.M	6:20PM.	05:15PM.	06:20 PM.
Temp.	28.0C	27.0C	27.8'C	28C	26.5'C	27.8C	29.0'C	28.5C
Color	clear	clear	Turbid	turbid	Slitelyturbid	turbid	Clear	clear
Order	smelly	----	Smelly	-----	smelly	smelly	Smelly	----
Ph	7.9	7.8	9.5	9.0	9.21	8.7	8.61	9.1
Conductivity	134.2	130.5	125.9	121.6	146.5	144.4	172.9	169.1
T.S.	1450mg/lit	1325mg/lit	2570mg/lit	2430mg/lit	2010mg/lit	2012mg/lit	1570mg/lit	1458.9mg/lit
T.D.S.	760mg/lit	755mg/lit	600mg/lit	660mg/lit	550mg/lit	556mg/lit	900mg/lit	815mg/lit
D.O.	2.2mg/lit	2.4mg/lit	2.1mg/lit	2.01mg/lit	1.35mg/lit	1.20mg/lit	1.25mg/lit	1.20mg/lit
B.O.D.	0.5mg/lit	0.3mg/lit	0.7mg/lit	0.4mg/lit	0.4mg/lit	0.51mg/lit	0.2mg/lit	0.21mg/lit
Water Hardness	156mg/lit	135mg/lit	173mg/lit	161mg/lit	168mg/lit	155mg/lit	273.33mg/lit	251.0mg/lit
Chloride	82.47mg/lit	78.4mg/lit	24.79mg/lit	22.5mg/lit	40.94mg/lit	41.26mg/lit	64.97mg/lit	59.17mg/lit

Zooplankton variation during sampling time period:

Hukal River	Sampling Station	Abundance in units observed/liter	No. of species observed/total species	% of Diversity
24/11/2015	1	150	12/16	75.0
	2	161	14/16	87.5

Hukal River 02/12/2015	Sampling Station	Abundance in units observed/liter	No. of species observed/total species	% of Diversity
	1	155	13/16	81.25
	2	179	15/16	93.75
Hukal River 24/01/2016	**Sampling Station**	**Abundance in units observed/liter**	**No. of species observed/total species**	**% of Diversity**
	1	180	15/16	93.75
	2	145	13/16	81.25

Hukal River 20/02/2016	Sampling Station	Abundance in units observed/liter	No. of species observed/total species	% of Diversity
	1	149	13/16	81.5
	2	181	15/16	93.75

Quantitative Evaluation of Zooplankton in Singoda River water during winter study:

No	Name of species	Abundance in no./li of Hukal river at two station		Representation by group and individual genus/species		
	Zooplankton	**1**	**2**	**Total**	**AVG**	**% total**
1	*Clytemnesera Scutellated*	10	15	25	12.5	6.5
2	*Euterpina acccutifrons*	12	10	22	11	5.7
3	*Macroselella Gracilis*	12	6	18	9	4.6
5	*Microsetella Rosea*	9	15	24	12	6.2
6	*Acrocalanyo Gibber*	13	14	27	13.5	7.04
7	*Tortanus Barbules*	12	13	25	12.5	6.5
8	*Pseudodioptomus Serricaredatus*	12	10	22	11	5.7
9	*Pontella Danae*	13	15	28	14	7.3
10	*Temara Discudata*	17	14	31	15.5	8.0
11	*Oncaea Venulsta*	15	10	25	12.5	6.5
12	*Oncaea Mediterranea*	12	17	29	14.5	7.57
13	*Oithonidae Spinirostris*	13	12	25	12.5	6.5
14	*Tintinnopsis tocantinensis*	14	10	24	12	6.2
15	*A.nardqvisti*	14	14	28	14	7.3
16	*Cresis Aricala*	20	10	30	15	7.8
	Total Zooplankton	**198**	**185**	**383**	**191.5**	**100**

	Phylum	Class	Oder	Family	Spp.
Zooplankton	Arthropoda	Maxilopoda	Harpacticoida	Peltiidae	*Clytemnesera Scutellated*
				euterpiniae	*Euterpina acccutifrons*
				Miraciidae	*Macroselella Gracilis*
				Ectinojomatidae	*Microsetella Rosea*
				Paracalanidae	*Acrocalanyo Gibber*
				Tortanidae	*Tortanus Barbules*
			Calanaida	Pseudodia ptomidae	*Pseudodioptomus Serricaredatus*
				Pontella	*Pontella Danae*
				Termaridae	*Temara Discudata*
			Poecilostomataida	Oncaeidae	*Oncaea Venulsta*
					Oncaea Mediterranea
			Cyclopoida	Oithonidae	*Oithonidae Spinirostris*
	Ciliophara	Spirotrichea	Tinnopsis	Codonellidae	*Tintinnopsis tocantinensis*
			Tintinnida	Oithonidae	*A.nardqvisti*
	Mollusca	Gestropoda	Thecosomata	Cavaliniidae	*Cresis Aricala*
	Chordata	Thaliacea	Salpida	Salpidae	*C.acicula*

Systematic account of zooplankton in Hukal river

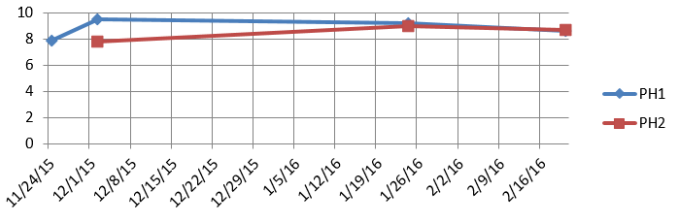

Fig.1: Analysis of PH of collected river water

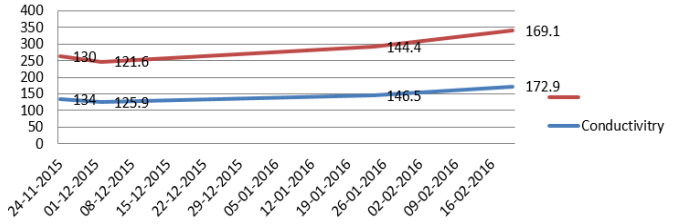

Fig.2: Analysis of Conductivity of collected river water

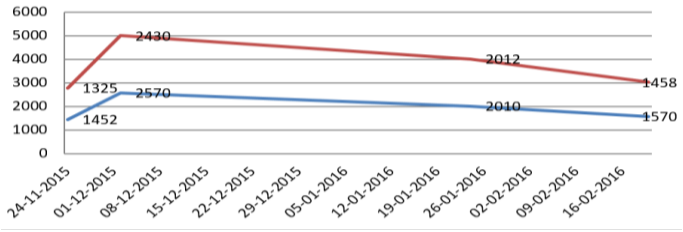

Fig.3: Analysis of T.S and T.D.S of collected river water (mg/Lit)

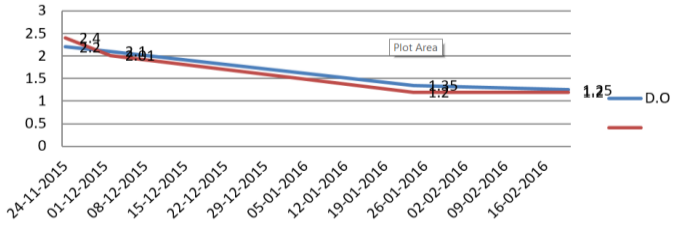

Fig.4: Analysis D.O of collected river water

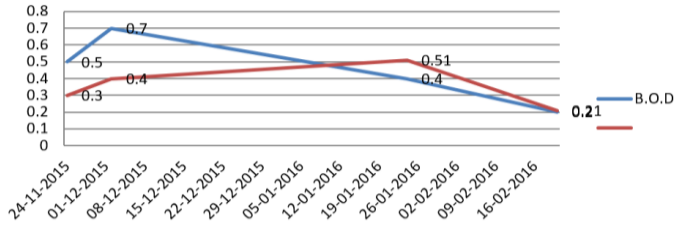

Fig.5: Analysis of B.O.D of collected river water

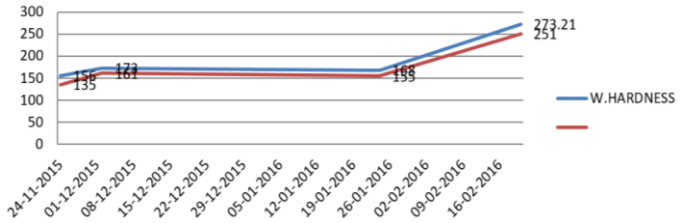

Fig. 6: Analysis of Water Hardness of collected water

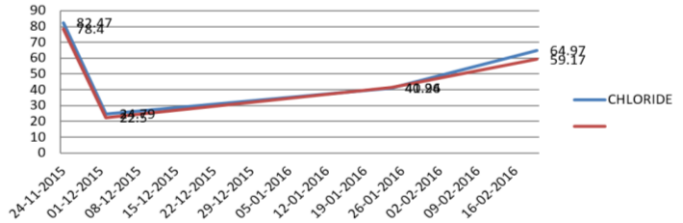

Fig.7: Analysis chloride of collected river water

Conclusion

Hukal River is important River of Gir-Gadhada talukas in Gir-somnath district. It is also known as Sangavadi River in Gir-Gadhada talukas, Gir-somnath District. Gujarat, river water is use for many purpose as in agriculture or aquaculture and also use as potable water in some areas, during study of physicochemical Parameter we noticed that salt concentration to higher and pH become alkaline during different sampling time period that is not good for water physical and biological property. If we use this water for Agricultural/aquaculture purpose, we need special treatment to river water due that negative impact is overcome.

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