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RESEARCH ARTICLE

STUDY ON PHYSICOCHEMICAL PROPERTIES AND THEIR IMPACT ON ZOOPLANKTON DIVERSITY OF SINGODA 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 Singoda River

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 Calaanuslinmarchicus is important as food for the herring, and the euphausiid Euphausia superba, commonly known

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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 Singoda River of Kodinar taluka, Gir-somnath district, Singoda is most important and very useful river in kodinar taluka. River water is utilize 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 Method:-

Sample collection site of Hukal River:-

Singoda River is Valuable River of kodinar taluka,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 ^{0}C.

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 AgNO3 (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 magnisium hydroxid 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 managnishy droxid 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:-

Singoda River is Imperative River of kodinar taluka, Gir-Somnath District. We carry out four month study (pre, Middle and post winter Analysis) of River water by performing Physico-chemical and Plankton Analysis study. Water collected from Singoda River approximately under 2 fit. Physicochemical Analysis we included 11 parameters like Temperature, PH, Conductivity ,T.S,T.D.S. ,D.O.,B.O.D. ,water Hardness and chloride (Table:01) .Winter time temperature of river water in range 28.^{0}C to 29^{0}C. PH range of river water is 7.96 to 9.5 Rivers. Higher pH of river noted on Dec-24 Month. After analysis of recorded data pH of Singoda river water is higher than normal water which indicate some salts concentration higher compare to normal water.(fig 1) Conductivity of water range between 125.9 To 172.9 μmho/cm. higher conductivity of the sample recorded on month Feb-16, higher conductivity indicates higher salts concentration is dissolve in water sample. (fi 2) Dissolved oxygen (D.O) and biological oxygen demand (B.O.D) data indicated that dissolve oxygen level range 1.25 to 2.2 in check dam water. Lover D.O. value indicates not good condition for aquatic life inside the water. (fig 4 & fig 5) T.S. and T.D.S. data of water samples are higher and fluctuate more during time period of Analysis. T.S.range of sample 1450 to 2570 mg/lit, TDS of samples range 550 to 900 mg/lit .the data indicate that 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 another parameter which indicated salts quality in water samples like carbonate and many other salts in water sample. Water hardness Range 156.00 to 273.63 mg/lit higher range 273.63 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.

Physico-chemical analysis data:-

DATE	24/11/15		2/12/15		24/1/16		20/2/16	
LOCATION	1	2	1	2	1	2	1	2
TIME	6.57 PM.	7:12 PM.	4.30 PM.	5:05 PM.	5.15 PM.	5:31 PM.	3.15 PM.	3:45 PM.
TEMP.	28'C	28.3C	27.8'C	28C	26.5'C	26C	29 C '	28.5
COLOR	Clear	clear	Turbid	Slitly	Slidely turbid	turbile	Clear	clear
ORDER	smelly	smelly	smelly	-	smelly	smelly	Smelly	-
PH	7.96	7.8	9.5	9.3	9.21	9.1	8.61	8.5
CONDUCTIVITY	134.2	135.1	125.9	121.7	146.5	147.4	172.9	170.1
T.S.	14500 mg/lit	15252 mg/lit	25700 mg/lit	24300 mg/lit	20100 mg/lit	21123 mg/lit	15700 mg/lit	14,500 mg/lit
T.D.S.	760 mg/lit	765 mg/lit	600 mg/lit	650 mg/lit	550 mg/lit	575 mg/lit	900 mg/lit	905 mg/lit
D.O.	2.2 mg/lit	2.4 mg/lit	2.1 mg/lit	2.01 mg/lit	1.35 mg/lit	1.20 mg/lit	1.25 mg/lit	1.20 mg/lit
B.O.D.	0.5	0.7	0.7	0.6	0.4 mg/lit	0.51	0.2 mg/lit	0.21

	mg/lit		mg/lit					
WATER HARDNESS	156 mg/lit	145 mg/lit	173 mg/lit	171 mg/lit	500 mg/lit	450 mg/lit	273.33 mg/lit	321.0 mg/lit
CHLORIDE	82.47 mg/lit	79.2 mg/lit	24.99 mg/lit	32.1 mg/lit	40.94 mg/lit	43.25 mg/lit	64.97 mg/lit	50.12 mg/lit

Zooplankton variation during sampling time period:-

Singoda River (24/11/2015)	Sampling Station	Abundance in units observed/liter	No. of species observed/total species	% of Diversity
	1	198	13/16	81.25
	2	200	14/16	87.5

Singoda River (02/12/2015)	Sampling Station	Abundance in units observed/liter	No. of species observed/total species	% of Diversity
	1	170	14/16	87.5
	2	190	13/16	81.5
Singoda River (24/01/2016)	Sampling Station	Abundance in units observed/liter	No. of species observed/total species	% of Diversity
	1	200	14/16	87.5
	2	205	12/16	75.00

Singoda River (20/02/2016)	Sampling Station	Abundance in units observed/liter	No. of species observed/total species	% of Diversity
	1	197	14/16	87.5
	2	209	15/16	93.75

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

No	Name of species	Abundance in no./li of singoda river at two stationa		Representation by group and induvilual genus/species		
	Zooplankton	1	2	Total	AVG	% total
1	Clytemnesera Scutellated	12	20	32	16	7.4
2	Euterpina acccutifrons	15	8	23	11.5	5.6
3	Acrocalanyo Gibber	15	16	31	15.5	7.4
4	Tortanus Barbules	14	10	24	12	5.6
5	Pseudodiaptomus Durivilli	12	11	23	11.5	5.6
6	Pontella Danae	16	13	29	14.5	7.00
7	Temara Discudata	12	14	26	13	6.08
8	Farronula Gibbula	13	19	33	16.5	7.94
9	Codonellopsis Ostenreldii	15	09	24	12	5.6
10	Globigerina rubescence	15	18	33	16.5	7.94
11	Evadne Nardmanni	9	14	23	11.5	5.6
12	Penillia Avirostris	18	14	32	16	7.4
13	Pycnogonid	22	19	41	20.5	9.8
14	Lucifer Hanfenii	12	10	22	11	5.1
15	Hypara	12	8	20	10	4.69
16	Tetraphyla	10	12	22	11	5.1
	Total Zooplankton	**222**	**205**	**427**	**213.6**	**100**

Systematic Account of Zooplankton in Singoda river.

Zooplankton	Phylum	Class	Oder	Family	Spp.
	Arthropoda	Maxilopoda	Harpacticoida	Peltiidae	Clytemnesera Scutellated
				euterpiniae	Euterpina acccutifrons
			Calanaida	Paracalanidae	Acrocalanyo Gibber
				Tortanidae	Tortanus Barbules
				Pseudodia ptomidae	Pseudodiaptomus Durivilli
				Pontella	Pontella Danae
				Termaridae	Temara Discudata
			Poecilostomatoida	Carycacidae	Farronula Gibbula
			Tintinnida	Codonellopsidae	Codonellopsis Ostenreldii
			Globigenida	Globigerinidae	Globigerina rubescence
		Branchiopoda	Diplostraca	Podonidae	Evadne Nardmanni
				Sididae	Penillia Avirostris
		Pynogoda	Pantopoda	-------	Pycnogonid
		Malacostrala	Decapoda	Luciferidae	Lucifer Hanfenii
			Amphipoda	Lyperiidae	Hypara
	Cnidaria	Hydrozoa	Trachymedusal	Geryoniidae	Tetraphyla

Fig.1:- Analysis of PH of collected river water

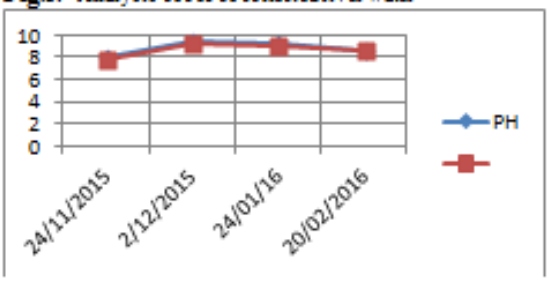


Fig. 4:- Analysis D.O of collected river water

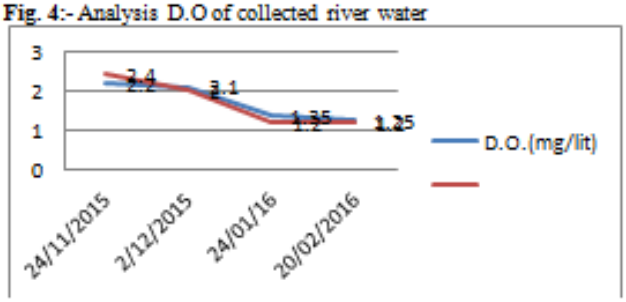


Fig.2:- Analysis of Conductivity of collected river water

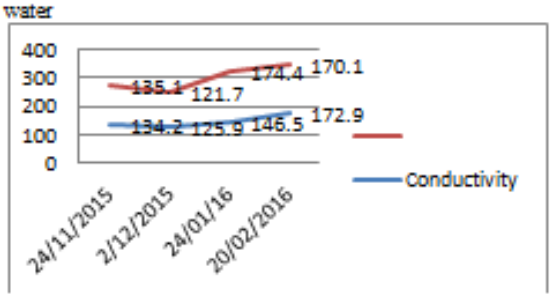


Fig.5:- Analysis of B.O.D of collected river water

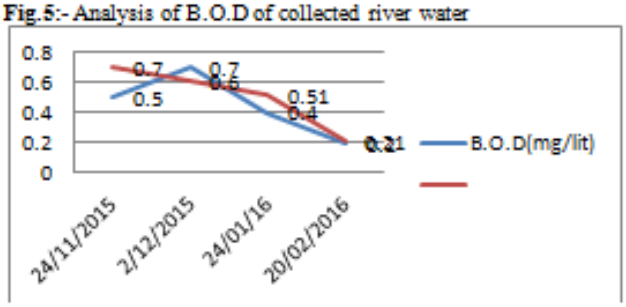
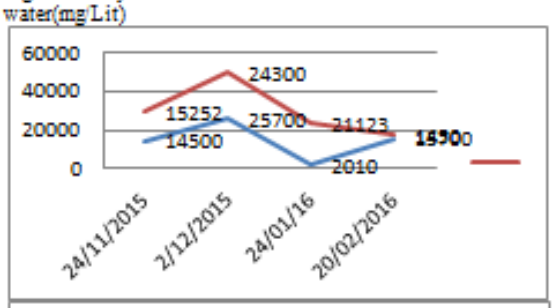


Fig.3:- Analysis of T.S and T.D.S of collected river water(mg/Lit)



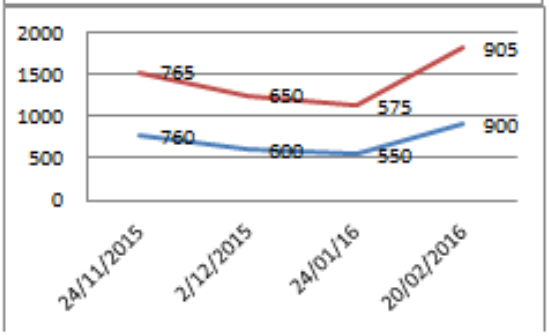


Fig. 6:- Analysis of Water Hardness of collected water

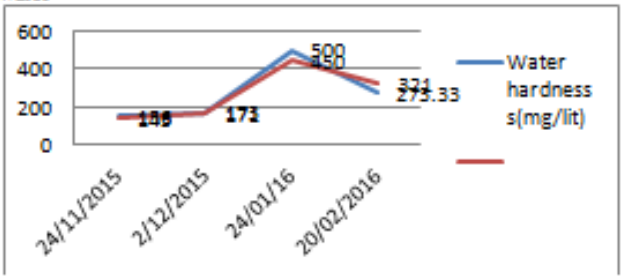
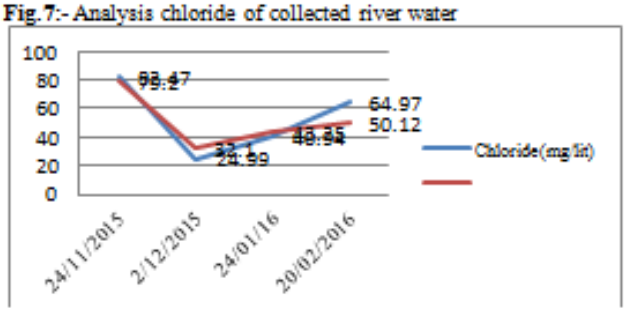


Fig.7:- Analysis chloride of collected river water



Conclusion:-

Singoda River is Key River of kodinar taluka in Gir-somnath district. Gujarat, river water is use for many purpose as in agriculture or aquaculture and use as potable water in some areas, during study of physicochemical parameter we noticed that salt concentration is 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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