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Effect of Selected Abiotic Factors on Fish Growth in Micro-Water Sheds of Southern Rajasthan (Dungarpur)

M. L. Ojha[1*], A. K. Suman[1], V. P. Saini[2] and S. R. Surnar[2]

[1]Department of Aquaculture, College of Fisheries,

[2]Aquaculture Research and Seed Unit, Directorate of Research,

Maharana Pratap University of Agriculture and Technology, Udaipur – 313001, India

*Corresponding Author E-mail: mlojha2005@yahoo.co.in

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ABSTRACT

The present study was carried out to investigate abiotic factors on fish growth in micro-water sheds of Dungarpur district. The average water quality parameters of all the selected micro-watersheds were significance between the water bodies. It indicated that the water of selected micro-water sheds were congenial and moderately productive from the fisheries point of view. The physico-chemical and primary productivity revealed a significant impact on fish growth parameters such as gain weight, length gain and SGR. Comparatively higher net weight, net length and SGR were recorded for Catla (1103.3 gm) followed by than rohu (932.16 gm) and Mrigala (830.10 gm). The specific growth rate of catla was (2.16 %) in Valota followed by Khaliya (2.09 %). The lower SGR was noticed in Negala (1.99 %) followed by Kundi-Ka-Naka (2.00 %). The average primary productivity fluctuated between the selected micro shed in southern Rajasthan region of Dungarpur district.

Key words: *Abiotic factors; Primary productivity; Specific growth rate; Dungarpur.*

INTRODUCTION

India has vast freshwater resources in the form of both lentic and lotic ecosystems. The lentic ecosystems include ponds, lakes, tanks and reservoirs. The perennial reservoirs play an important role in domestic, agriculture and aquaculture. The lentic ecosystems have long attracted attention of ecologists both for their importance as a source of drinking water and the development of fisheries. The total water resources of India (73.59 lakh hectares) include 19521 Kilometers of rivers and canals, 29.07 lakh hectares reservoirs, 24.14 lakh hectares of tanks and ponds, 7.98 lakh hectares of flood plains, lakes and derelict water and 12.40 lakh hectares of brackish water[1].

Rajasthan is the India's largest state in terms of area and is also one of the most diverse states where tradition and royal glory meet in a riot of colors. Rajasthan is also endowed with varied surface freshwater resources like reservoirs, seasonal and a couple of perennial rivers, canals, small tanks and ponds.

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In an earlier estimate Rajasthan was having around 4.23 lakh hectares of water area. Out of this, large and medium reservoirs constitute about 2.47 lakh hectares of water area, small reservoirs and ponds contribute 1.76 lakh hectares. Whereas, 0.30 lakh hectare water area is available in the form of rivers and canals[2].

In Rajasthan and especially southern Rajasthan a sizable number of micro-watersheds have been constructed primarily for the purpose of rain water harvesting and for increasing irrigation facilities. Though, these water resources were initially created for irrigation/water harvesting purpose, but now these aquatic resources are serving multipurpose, i.e. domestic, irrigation, fisheries. Due to the increasing interest of local masses in fish culture, micro- watersheds are the first choice as these resources are easily available with local tribes of this region. The RTADCF Ltd. Udaipur has initiated fish farming in micro-water sheds with participation of local tribes. Though, quality seed and other facilities are provided by the RTADCF to farmers, but they are unable to get good returns, as the production and productivity reported by them is very low.

MATERIAL AND METHODS

The present study was carried out during January 2016 to June 2016 with a view to investigate the dynamics of selected abiotic factors in selected micro-water sheds of southern Rajasthan, its relation with fish growth and primary productivity. For this purpose, laboratory studies were conducted in *Aquaculture Research and Seed Unit, Directorate of Research and College of Fisheries, MPUAT, Udaipur* while field study was conducted itself in the field.

Experimental Area

The proposed study was conducted on selected micro-water sheds of southern Rajasthan mainly Dungarpur district (Fig. 1). Geographical location and area of the selected micro-water sheds is presented in Table 1.

Collection of Water Sample

To monitor the status of water quality (Physico-chemical) in selected micro-watersheds, water samples were collected during at an interval of 45 days. The surface water sample was collected using wide mouth sterile transparent plastic bucket. The water samples were secured in one liter plastic bottles with air tight cap. A total of 12 Physico-chemical parameters *viz*. temperature, pH, DO, TDS, conductivity, hardness, free carbon-dioxide, alkalinity, salinity, nitrate-nitrogen, orthophosphate and ammonium-nitrogen by using standard method[3].

Biological Parameter

Primary Productivity

Primary productivity was measured on site at all the water bodies following light and dark bottles method. For this purpose, glass stoppered black and white BOD bottles of 250 ml were used. The bottles were suspended about 15 cm below the waterline. The incubation period was kept one hours. Oxygen (O_2) estimations in the BOD bottles were made using Dissolved oxygen meter (HACH HQ 30). The calculation was done as under

Gross Oxygen Production (GOP) mg l^{-1} = LB-DB

Net Oxygen Production (NOP) mg l^{-1} = LB-IB

Community Respiration (CR) mg l^{-1} = IB-DB

Gross Primary Productivity (GPP), Net Primary Productivity (NPP) and Rate of Community Respiration (RQ) were calculated as follows:

A. GPP gC/m³/hr = GOP×0.375/PQ×h

B. NPP gC/m³/hr = NPP×0.375/PQ×h

C. RQ gC/m³/hr = RQ×0.375/PQ×h

Where, LB = Dissolved oxygen in light bottle

DB = Dissolved oxygen in dark bottle

IB = Dissolved oxygen in initial bottle

H = Duration of incubation or exposure

1.2 = A constant

0.375 = A factor value (1 g of oxygen is equal to 0.375 g carbon).

PQ – Photosynthetic Quotient (Normally PQ value of 1.2 is considered for field experiments).

Fish growth studies:

The water bodies are maintained by local tribes for fish culture and RTADCF, Ltd Udaipur is providing inputs and technical assistance too. The selected water bodies were stocked with IMC fingerling @ 2500 nos/ha in the ratio of 3:4:3 of Catla, Rohu and Mrigala. The initial respective size of catla, rohu and mrigala fingerling was 7.2±0.05 cm/ 6.19±0.01g, 8.00±0.03 cm/5.32±0.02g and 6.9±0.09 cm/4.85±0.02g. The seed was stocked during 4th October to 19th October 2015. Though the final harvesting has yet not started but the random sample with cast and drag nets were done to monitor the growth performance of stocked seed. On the basis of initial size of seed stocked and size (length and weight) of harvested/sampled fish growth rate performance was estimated as below.

1. Net Weight Gain

NWG (gm) = Final weight – Initial weight x 100/ Initial weight.

2. Net Length Gain

NLG (cm) = Final length – Initial length x 100/ Initial length

3. Specific Growth Rate (SGR)

Specific Growth Rate = Ln (Final weight) – Ln (initial weight) × 100/ Day of culture period

Statistical Analysis

The data collected was processed for usual important statistical parameter (Range and Mean) for drawing specific conclusion.

RESULTS

During study period appreciable variations have occurred in the water quality of micro-water sheds. As such the results pertaining to range and mean values of Physico-chemical parameters, and primary productivity are presented in Tables 2 to 3. The growth performance of Indian major carps has been depicted in Table 4

Water Quality Parameters

Water Temperature

The water temperature varied between a minimum of 25°C at Kundi-Ka-Naka and maximum of 31.25°C in Beda-Ka-Naka. The statistical results shows that temperature had positive relationship with DO, conductivity, alkalinity, salinity, TDS, hardness and nitrate nitrogen, whereas negative relationship with GPP, NPP, RQ, HPO_4^{-3} and ammonia (Table 2).

pH

In general, the water of all the micro-water sheds remained alkaline throughout the study period. The pH value of water varied between a minimum of 7.7 in Valota and a maximum of 10.6 in Pagara. The statistical correlation of pH with other parameter is depicted in (Table 4.3) which indicated positive relationship with temperature, DO, free CO2, conductivity, salinity, TDS, HPO_4^{-3}, GPP, NPP and RQ while negative relationship with alkalinity, hardness nitrate-nitrogen and ammonia.

Dissolved Oxygen

Dissolved oxygen (DO) is an important environmental parameter for the survival of aquatic life. DO affect the growth, survival, distribution, behavior and physiology of fishes and other aquatic organisms. The dissolved oxygen concentration in all the micro-water sheds remained above the critical level of 4 mg/l. The maximum (9.36 mg/l) value of dissolved oxygen was observed in Pagara, while the minimum (6.84 mg/l) was noticed in Ladsore (Table 2). The statistical relationship of DO with selected water quality parameters has been shown in the (Table 2). A positive relationship with temperature, conductivity, pH, alkalinity, salinity, TDS, hardness, ammonia, NPP and a negative relationship with GPP, RQ, HPO_4^{-3} and NO_3-N was calculated.

Electric Conductivity

Conductivity is an index of the total ionic content of water, and therefore indicates freshness or otherwise of the water. The electrical conductivity of micro-water sheds recorded in the present study, ranged between 338 and 970 mS/cm with a minimum in Valota pond and a maximum in Pagara. The average conductivity was also recorded to be lowest and highest in Valota and Pagara respectively (Table 2). It indicate a positive relationship with temperature, DO, alkalinity, salinity, TDS, hardness, ammonia, GPP and a negative

relationship with NPP, RQ, HPO_4^{-3} and NO_3-N.

Total Alkalinity

In general, the values of total alkalinity in micro-water sheds ranged between 38 and 141 mg/l with lowest in Kundi K - Naka and highest in Hariyala (Table 2). Which indicated that total alkalinity shows positive relationship with DO, temperature, conductivity, salinity, TDS, hardness, ammonia, NO_3-N, GPP and RQ.

Total Hardness

In general, the values of total hardness in micro-water sheds fluctuated between 72 and 164 mg/l with lowest in Kundi- Ka- Naka and highest in Nagela. Similarly, the average values of total hardness were also found to be lowest and highest in Kundi- Ka- Naka and highest in Nagela (Table 2). The statistical results shows that the total hardness had positive relationship with temperature, DO, conductivity, alkalinity, salinity, TDS and negative relationship with free CO_2, pH, GPP, NPP, RQ, HPO_4^{-3}, NO_3-N and ammonia (Table 2).

Salinity

Salinity is the measurement of the ionic composition of any water body. In general, salinity values in micro-water sheds were between 0.1 ppt and 0.4 ppt with lowest in Nareli and highest in Pagara. Similarly, the average values of salinity were also found to be lowest and highest in Kalighati and highest in Pagara (Table 4.1). The statistical results shows that the salinity had positive relationship with temperature, DO, pH, conductivity, alkalinity, TDS, hardness and negative relationship with GPP, NPP, RQ, HPO_4^{-3}, NO_3-N and ammonia.

Total Dissolved Solid

The average values of total dissolved solids (TDS) in different micro-water sheds. In general, the total dissolved solid values in micro-water sheds fluctuated between a minimum of 164 mg/l and a maximum of 479 mg/l in Khaliya and Ladsore respectively.

Nitrate Nitrogen (NO_3-N)

The range values of nitrate-nitrogen in micro-water sheds have been depicted in (Table 2). The respective highest (0.2475 mg/l) and lowest (0.136 mg/l) values of nitrate-nitrogen were observed in Valot and Hariyala.

Orthophosphate (HPO_4^{-3})

The orthophosphate concentration in micro-water sheds varied between 0.08 mg/l to 0.185 mg/l (Table 2) with lowest in Kundi- Ka- Naka and highest in Ladsore respectively. The statistical results shows that The orthophosphate had positive relationship with pH, free CO_2, GPP, NPP, RQ, ammonia and negative relationship with temperature, conductivity, salinity, TDS, hardness, NO_3-N (Table 2).

Ammonia

The higher concentration of ammonia is an indication of toxicity in natural water. In the present study, the concentration of ammonia from 00 to 0.6 mg/l with mean values of 0.0 to 1.34 mg/l. the highest ammonia content was noticed in Ladsore (Table 2). The statistical results indicated that ammonia had positive relationship with DO, free CO_2, alkalinity HPO_4-^{3}, GPP, NPP and RQ.

Primary Productivity

The primary productivity (GPP, NPP and RQ) values in selected micro-water shed is depicted in Table 3. Whereas, the mean values of primary productivity are also given in Figures 1 to 3. The highest (0.23 $gC/m^3/hr$) and lowest (0.07 $gC/m^3/hr$) values of GPP were observed in Nareli and Kundi-Ka-Naka respectively. The statistical relationship of GPP was found to be positive with pH, DO, CO_2, total alkalinity HPO_4^{-3}, ammonia, RQ and negative relationship with temperature, TDS, conductivity, hardness, salinity and nitrate-nitrogen (Table 3).

The maximum (0.14 $gC/m^3/hr$) value of NPP was observed in Khaliya, while the minimum of (0.03 $gC/m^3/hr$) was noticed in Nagela (Table 3). The statistical results indicated that NPP had positive relationship with pH, DO, free CO_2, HPO_4^{-3}, ammonia, RQ and negative relationship with temperature, TDS, salinity, conductivity, total hardness, total alkalinity and NO_3-N (Table 3).

The highest (0.12 $gC/m^3/hr$) and lowest (0.02$gC/m^3/hr$) values of RQ were observed in

Nareli and Hariyala respectively. The statistical relationship of RQ with selected water quality parameters has been shown in the (Table 3), it indicated a positive relationship with pH, alkalinity, free CO_2, NO_3-N, HPO_4^{-3}, ammonia, GPP and negative relationship with TDS, hardness, salinity, temperature, DO, conductivity.

Fish Growth

The data pertaining to growth of three Indian major carp's *viz. Catla catla, Labeo rohita* and *Cirrhinus mrigala* are presented in Table 4. The results of fish growth parameters (Net weight gain, net length gain and specific growth rate) from selected micro-watersheds are presented in Table 4. The net weight gain of Catla, Rohu and Mrigala varied between 724.29 to 1103.3gm, 628.31 to 932.16gm and 391.27 to 830.10gm respectively with minimum in Nagela (Catla), Pagara (Rohu and Mrigala) and maximum in Valota (Catla, Rohu and Mrigala). The highest of 30.16 (Catla), 24.33cm (Rohu) and 27.89cm (Mrigala) and lowest of 17.40cm (Catla), 14.02cm (Rohu) and 9.60cm (Mrigala) net length gain for Catla, Rohu and Mrigala were observed maximum in Valota (Catla, Rohu and Mrigal) and lowest in , Nagela, Ladsore and Pagara. The respective highest SGR were observed (2.16, 2.15, and 2.15) in Valota and lowest (1.99, 1.99, and 1.83) lowest specific growth rate were noticed in Nagela (Catla) Pagara and Ladsore (Rohu) and Pagara (Mrigala) respectively.

DISCUSSION

Physico-chemical condition of water as a substances and its mechanical action as a medium have their own importance for the living complex. Reid[4] pointed out that whole of the aquatic life in the river, tank, pond and reservoir is governed by the interaction of a number of physical and chemical conditions. Temperature is the degree of hotness or coldness in the body of a living organism either in water or on land. As fish is a cold blooded animal, its body temperature changes according to that of the environment, affecting its metabolism and physiology? This ultimately affecting the production. Higher temperature increases the rate of bio-chemical activity of the micro biota, plant respiratory rate, and so increase in oxygen demand. It further cause decreased solubility of oxygen and also increased level of ammonia in water. In the present study, the water temperature ranged between 25°C to 33.8°C in different micro-watersheds. These values resulted around the optimal water temperatures (28 - 30 ^oC) within which maximal growth rate, efficient food conversion, best condition of fish, resistance to disease and tolerance of toxins (metabolites and pollutants) are enhanced. Similar range of water temperature is reported by Bhatnagar and Devi[5].

The source of EC may be an abundance of dissolved salts due to poor irrigation management, minerals from rain water runoff, or other discharges. In the study period, electrical conductivity reported to be in the range of 240 µS/cm is found to be in (Kalighati) and 1076 µS/cm in (Pagara). Sreenivasan[6], Bajpai and Tamot[7], were opined that water bodies receiving domestic sewage have higher values of electrical conductivity, so it is true in case of Pagara. Balai[8] observed positive relation of EC with total alkalinity. Meena, *et al*.[9] also reported correlation of EC with GPP, RQ and total alkalinity. As per Divedi and Pandey[10], the main sources of free CO_2 are mainly decomposition of organic matter and respiration of plants and animal. In the present study, free CO_2 was absent in most of the water bodies. Similar results from Rajasthan water were also reported by Gupta and Sharma[11], Ujjainia, *et al*.[12,8]. The presence of CO_2 in micro-watersheds (Gorcha and Kalighati) can be attributed to the fluish of nutrients and organic matter rich urban sewage.

The higher primary productivity found in the present study may be assigned to high concentration of nutrient, high temperature and high photosynthesis during summer months. Gupta[13] also found primary productivity (0.19 $gC/m^3/h$ GPP) in the Daya reservoir.

While working on physico-chemical and biological aspect of Rajasthan water[14].

Chouhan and Sharma[15] have also reported the similar trends. Thus the productivity and fish growth trends reported from different micro-water sheds further intensifies the findings of these researches[16]. Significantly higher growth rate of IMCs in selected micro-water sheds due to physico-chemical parameters also reported by Ujjania[17]. From the discussion and results of water quality parameters, its relationship with primary productivity and effect of these parameters on fish growth, it is appropriate to that place where some water bodies are between "mild eutrophic to eutrophic".

Table 1: List of selected water bodies and their geographical location

Water Shed Name	Area(ha)	Longitude	Attitude	MSL
Beda-Ka-Naka	20	23°53.455'N	73°38.903'E	301
Ladsore	10	23°42.371'N	73°42.366'E	309
Pagara	12	23°52.279'N	73°49.797'E	272
Hariyala	6	23°51.724'N	73°58.092'E	222
Nagela	10	23°51.371'N	73°55.099'E	278
Valota	16	23°46.926'N	73°49.658'E	235
Kundi-Ka-Naka	10	23°47.131'N	73°40.352'E	310
Khaliya	10	23°39.539'N	73°32.211'E	231
Nareli	10	23°39.913'N	73°31.103'E	214
Bandela	10	23°51.385'N	73°55.106'E	278

Table: 2. Range and mean (in parenthesis) values of water quality parameters in selected micro-water sheds of southern Rajasthan

Water body	Temperature (°C)	pH	DO (mg/l)	CO_2 (mg/l)	Conductivity (µS/Cm)	Alkalinity (mg/l)	Hardness (mg/l)	Salinity (ppt)	TDS (mg/l)	NO_3-N (mg/l)	HPO_4^{-3} (mg/l)	NH_3 (mg/l)
Beda-Ka-Naka	30.7-31.8 (31.25)	7.4 – 8.9	7.57-10.19	ND	528-581 (584.5)	92-98 (95)	62-82 (72)	0.2-0.2 (0.2)	214-230 (222)	0.123-0.173	0.001-0.13	0-0.1 (0.05)
Ladsore	26-30.8 (28.4)	8.9 – 9 (8.95)	6.14-7.54	ND	444-476 (460)	112-130 (121)	138-140 (139)	0.2-0.2 (0.2)	429-529 (479)	0.135-0.192	0.16-0.21	0-1.34 (0.67)
Pagara	29.07-31.8 (30.435)	10.6–10.6	8.94-10.32	ND	876-1076 (970)	104-140 (122)	120-124 (122)	0.4-0.5 (0.45)	345-346 (345.5)	0.107-0.201	0.05-0.06	0-0 (0)
Hariyala	29.4-31.2 (30.2)	8.9 – 10.4	8.40-10.36	ND	709-711 (710)	122-160 (141)	142-196 (169)	0.3-0.3 (0.3)	301-308 (304.5)	0.07-0.201	0.05-0.12	0-0.02 (0.01)
Nagela	27.9-32 (29.95)	8.6 – 10.2	8.51–8.73	ND	621-633 (627)	100-128 (114)	154-170 (162)	0.3-0.2 (0.25)	127.7-170	0.128-0.187	0.11-0.21	0-0 (0)
Valota	26.3-32.5 (29.4)	7.2 – 8.2	8.2 – 8.28	ND	353-359 (356)	70-92 (81)	100-118 (109)	0.2-0.1 (0.15)	139.8-224	0.091-0.404	0.07-0.07	0-1.23 (0.615)
Kundi-Ka- Naka	25-29.3 (27.15)	9.7 – 10.4	7.33 – 9.5	ND	291-504 (397.5)	36-40 (38)	64-70 (67)	0.1-0.2 (0.15)	278-309 (293.3)	0.084-0.139	0.06-0.1 (0.08)	0-0.001 (0.0005)
Khaliya	31-31.3 (31.15)	8.1-9.2 (8.65)	5.82-8.79	ND	573-635 (604)	90-114 (102)	160-190 (175)	0.2-0.3 (0.25)	161.4-164	0.142-0.209	0.02-0.09	0-0.45 (0.225)
Nareli	28.6-29.8 (29.2)	10-10.4 (10.2)	4.38-10.46	ND	335-341 (338)	50-52 (51)	68-70 (69)	0.1-0.1 (0.1)	191.4-196.7	0.155-0.251	0.05-0.31	0-0 (0)
Bandela	25.4-30.8 (28.1)	7.7 -9.7 (8.7)	6.57-8.18	ND	397-408 (402.5)	74-100 (87)	140-156 (148)	0.1-0.2 (0.15)	155.3-298	0.173-0.183	0.05-0.1 (0.075)	0-0.03 (0.015)

Table 3: Range and mean values for primary production of selected micro-watersheds in southern Rajasthan

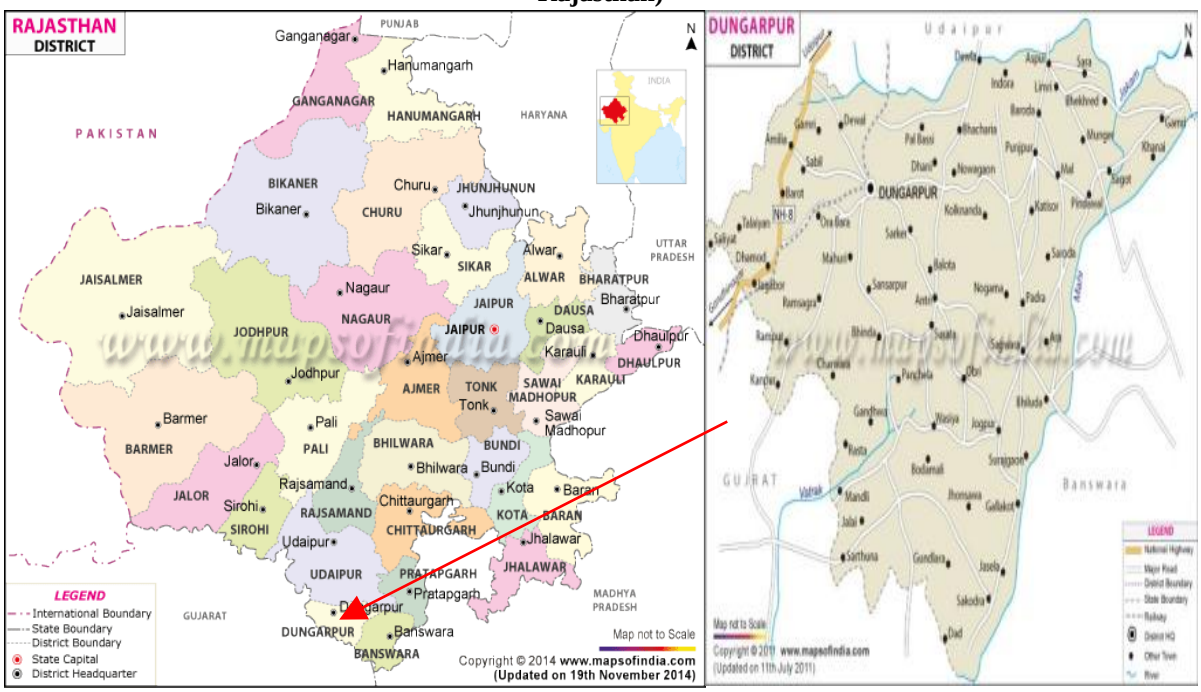
S.No.	Water-shed name	GPP ($gC/m^3/h$)	NPP ($gC/m^3/h$)	RQ ($gC/m^3/h$)
4.	Beda -Ka -Naka	0.07-0.28 (0.18)	0.01-0.2 (0.11)	0.06-0.08 (0.07)
5.	Ladsore	0.13-0.28(0.20)	0.03-0.19 (0.11)	0.08-0.09 (0.09)
6.	Pagara	0.04-0.19 (0.11)	0.02-0.13 (0.07)	0.02-0.06 (0.040
7.	Hariyala	0.09-0.14 (0.11)	0.06-0.13 (0.09)	0.01-0.03 (0.02)
8.	Nagela	0.07-0.18 (0.12)	0.02-0.05 (0.03)	0.06-0.12 (0.09)
9.	Valota	0.07-0.11 (0.09)	0.04-0.05 (0.05)	0.02-0.06 (0.04)
10.	Kundi Ka Naka	0.05-0.09 (0.07)	0.02-0.06 (0.04)	0.03-0.03 (0.03)
11.	Khaliya	0.21-0.22 (0.22)	0.12-0.15 (0.14)	0.06-0.10 (0.08)
12.	Nareli	0.20-.0.27 (0.23)	0.08-0.16 (0.12)	0.11-0.13 (0.12)
13.	Bandela	0.07-0.17 (0.12)	0.03-0.12 (0.08)	0.03-0.05 (0.04)

Table 4: Growth summary of carps (Catla, Rohu and Mrigal) in selected micro-watersheds of southern Rajasthan

Water Body	Species	Weight(g)			Length (cm)			SGR (%)
		Initial	Final	NWG	Initial	Final	NLG	
Beda-Ka-Naka	Catla	6.19±0.01	926.67	920.48	7.2±0.05	31.20	24.00	2.09
	Rohu	5.34±0.02	700.00	694.66	8.0±0.03	24.14	16.14	2.03
	Mrigal	4.85±0.01	613.59	608.74	6.9±0.09	25.57	18.67	2.02
Ladsore	Catla	6.19±0.01	818.10	811.91	7.2±0.05	27.55	20.35	2.04
	Rohu	5.34±0.02	638.46	633.12	8.0±0.03	22.02	14.02	1.99
	Mrigal	4.85±0.01	494.17	489.32	6.9±0.09	20.59	13.69	1.93
Pagara	Catla	6.19±0.01	768.57	762.38	7.2±0.05	25.88	18.68	2.01
	Rohu	5.34±0.02	633.65	628.31	8.0±0.03	21.85	21.85	1.99
	Mrigal	4.85±0.01	396.12	391.28	6.9±0.09	16.50	9.60	1.83
Hariyala	Catla	6.19±0.01	919.05	912.86	7.2±0.05	30.94	23.74	2.08
	Rohu	5.34±0.02	730.77	725.43	8.0±0.03	25.20	17.20	2.05
	Mrigal	4.85±0.01	584.47	579.62	6.9±0.09	24.35	17.45	2.00
Nagela	Catla	6.19±0.01	730.48	724.29	7.2±0.05	24.60	17.40	1.99
	Rohu	5.34±0.02	705.77	700.43	8.0±0.03	24.34	16.34	2.04
	Mrigal	4.85±0.01	542.72	537.87	6.9±0.09	22.61	15.71	1.97
Valota	Catla	6.19±0.01	1109.52	1103.3	7.2±0.05	37.36	30.16	2.16
	Rohu	5.34±0.02	937.50	932.16	8.0±0.03	32.33	24.33	2.15
	Mrigal	4.85±0.01	834.95	830.10	6.9±0.09	34.79	27.89	2.15
Kundi-Ka-Naka	Catla	6.19±0.01	756.19	750.00	7.2±0.05	25.46	18.26	2.00
	Rohu	5.34±0.02	662.50	657.16	8.0±0.03	22.84	14.84	2.01
	Mrigal	4.85±0.01	487.38	482.53	6.9±0.09	20.31	13.41	1.92
Khaliya	Catla	6.19±0.01	927.62	921.43	7.2±0.05	31.23	24.03	2.09
	Rohu	5.34±0.02	652.88	647.54	8.0±0.03	22.51	14.51	2.00
	Mrigal	4.85±0.01	682.52	677.67	6.9±0.09	28.44	21.54	2.06
Nareli	Catla	6.19±0.01	825.71	819.52	7.2±0.05	27.80	20.60	2.04
	Rohu	5.34±0.02	706.73	701.39	8.0±0.03	24.37	16.37	2.04
	Mrigal	4.85±0.01	540.78	535.94	6.9±0.09	22.53	15.63	1.96
Bandela	Catla	6.19±0.01	812.38	806.19	7.2±0.05	27.35	20.15	2.03
	Rohu	5.34±0.02	723.08	717.74	8.0±0.03	24.93	16.93	2.05
	Mrigal	4.85±0.01	634.95	630.10	6.9±0.09	26.46	19.56	2.03

NWG= Net Weight Gain; NLG= Net Length Gain; SGR= Specific Growth Rate

Fig. 1: Geographical location and area of selected micro-water shed of Dungarpur district (Southern Rajasthan)



CONCLUSION

The present survey is immediately helpful to understand the physico-chemical parameter of micro water shed of Dungarpur district of Southern Rajasthan. They are as well affecting the nearby land and flora fauna. Physico-chemical parameters of the industrial effluents were found higher than the permissible limit. Thus, the present work, monitoring of physico-chemical parameters, its relationship with primary productivity and effect of these parameters on fish growth, it is appropriate to that place where some water bodies are between "mild eutrophic to eutrophic".

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