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STUDY OF PHYSICO-CHEMICAL PARAMETERES AND BREEDING BIOLOGY OF Macrobrachium malcolmsonii IN GANGA RIVERINE WATER

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ABSTRACT-

This study was carried out on Ganga river near Varanasi to access the physiochemical parameters i.e. Temperature, pH, Free carbon dioxide, Carbonate alkalinity, Biocarbonate alkalinity and Chloride of three sites.Site-1,Site-2& Site-3. The sex-wise segregation of *Macrobrachium malcolmsonii* was recorded for the study of composition of males and females in different month throughout the year .The breeding biology and percentage composition have been studied in relation to this parameters..

Key words-Ganga river, physiochemical parameters, *M.malcolmsonii*, percentage composition

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INTRODUCTION

Water is one of the essential components for survival of living organism. It covers r nearly three fourth of the surface of the earth. Fresh water is the most precious resource on earth. Today, the easy availability of fresh water is a major problem as 80% rivers are getting polluted (S.lata et al,2018). Ganga is the largest and holy river in India. About 40% population lives in the river Ganga basin in India. As it covers more than 26% of the country's area in its basin in the north and drains 25% of the annual run-off. Ganga river with 0.861 million km^2 basins having diversified population of fish fauna which is considered to be the backbone of capture fishery (Jhingran, 2003). It begins from the snow bound height of the Himalaya nearly 4000 meters above the sea level and drains into Bay of Bengal after passing through Kanpur and Varanasi city and enters into Bihar. (A.K sing et al, 2009).The river supports abundant biological wealth, characterized by its rich fisheries and faunal diversity. Fish and prawns are widely used to evaluate the health of aquatic ecosystems because pollutants are building up in the food chain and are responsible for adverse effects and death in the aquatic systems. There is a fluctuating trend of water quality attributed to the flow conditions in the river which affect the aquatic organism.

There are several freshwater prawn species recorded in r Gangaiver. Five decades ago, the distribution and availability of the Ganga river prawns was reported for four species up to Kanpur with adequate quantity and year around availability (Jhingran, 1956). But two major Macrobrachium species i.e. *M. malcolmsonii* and *M. gangeticum* are distributed and available in limited months at middle stretch of the river Ganga (Jhingran and Ghosh, 1978). *Macrobrachium malcolmsonii* is the second largest freshwater prawn, which is considered the candidate species in aquaculture. *Malcolmsonii* having local commercial value and used to be developed for better market (New and Valenti, 2000). Sex ratio and size structure constitute information basic to assessing reproductive potential and estimating stock size of populations (Vazzoler 1996).The aim of the present study is to document the physicochemical parameter of river Ganga near Varanasi in different sites was studied.

MATERIALS METHODS

Water quality

Water samples were collected from three selected sites of the river Ganga around Varanasi at 6am in 10 lit glass bottles at monthly intervals for monitoring the physico- chemical parameters. The samples were collected and immediately preserved by adding 0.5ml chloroform and transported carefully to the Central Institute of Freshwater Aquaculture, Bhubaneswar laboratory for chemical analysis .The samples were analyzed for major physico–chemical parameters like Temperature, pH DO, Free carbon dioxide, Carbonate alkalinity, Biocarbonate alkalinity and Chloride by following the methods of (APHA, 1975).

Temperature

The water temperatures was recorded daily during morning (6 AM), noon (12 PM) and evening (6 PM) by a mercury thermometer graduated in celcius from 0°-50 °C.

Transparency

Transparency of the river water was measured by means of secchi disc and results were computed as follows:

Where,

A = Depth at which secchi disc disappears

B = Depth at which secchi disc reappears

Water pH

pH of the sample was recorded in the laboratory by Lovibond pH comparator using phenol red indicator. Ten ml water sample was taken in special glass tubes provided with the apparatus and 0.5 ml phenol red indicator was added. The mixed liquid was then stirred gently to develop the colour. The developed colour was matched against the standard disc using Lovibond comparator. Then the pH value was recorded as per match on the standard disc.

Dissolved oxygen

Dissolved oxygen was fixed soon after collection by adding 2ml each of manganous sulphate ($MnSO_4$) and alkaline pottassium iodide (KOH and KI) solution. The precipitate was then dissolved by adding concentrated H_2SO_4 (Sp. Qr. 1.54) and then transported to the laboratory for analysis. There after sample was titrated against N/40 sodium thiosulphate in the presence of starch as an indicator (Unmodified Winkler's method). Calculation was done using the following formula:

$$\text{Dissolved oxygen (mg/l)} = \frac{\text{ml titrate x N x 200}}{\text{V}}$$

Where,

N = Normality of sodium thiosulphate

V = Volume of the sample titrated

Free carbon dioxide

Free carbon dioxide was estimated at the sites quickly with all precautions to avoid its volatility. Analysis was done by volumetric method by titrting the sample with N/44, NaOH using phenolphthalein as an indicator. The value was computed as :

$$\text{Free carbon dioxide} = \frac{\text{(ml x N) of NaOH x 1000 x 44}}{\text{Volume of sample taken (mg/l)}}$$

Where, N = Normality of NaOH

Carbonate alkalinity

Carbonate alkalinity was determined by titrating the sample with N/50 sulphuric acid using phenophthalien as an indicator and the values were computed as under.

$$\text{Carbonate alkalinity (mg/l)} = \frac{\text{(AxN) of } H_2SO_4 \text{ used x 1000 x 50}}{\text{ml. of sample taken}}$$

Where,

A = ml of H_2SO_4 used

N = Normality of H_2SO_4

Bicarbonate alkalinity

Bicarbonate alkalinity was recorded by titrating the samples with N/50 sulphuric acid using methyl orange as an indicator, value was calculated as follow

$$\text{Bicarbonate alkalinity (mg/l)} = \frac{(A \times N) \text{ of } H_2SO_4 \times 1000 \times 50}{\text{Volume of sample taken}}$$

Where,

A = ml of H_2SO_4 used

N= Normally of H_2SO_4

Chloride

The chloride concentration was analyzed by titrating the sample with 0.05 N silver nitrate using potassium chromate as an indicator and the values were computed as per following formula:

$$\text{Chloride ((mg/l)} = \frac{(\text{ml} \times N) \text{ of } AgNO_3 \times 1000 \times 35.5}{\text{Volume of sample taken}}$$

Where,

N = Normality of $AgNO_3$

Percentage composition

The percentage composition and annual catch of commercially important prawn species *Macrobrachium malcolmsonii* were recorded .The prawn species in landing was done through random sampling.

RESULT AND DISCUSSION

Physicochemical parameters

Growth, multiplication's and survival of the resident aquatic organisms is greatly influenced by the change in ecological parameters. Monthly fluctuations in various water quality parameters recorded.

Temperature

The surrounding atmospheric temperature influences in the variations in the ambient water temperature at different period. Monthly water temperature variations at three sites recorded (Tables 1) . Minimum water temperature recorded in Site-3 in the month of January is 20 °C. However, maximum water temperature was in Site-2 in the month of July 32.5°C . The mean water ± and SD temperature recorded at Site 1, 2 and 3 was 28.0±3.51, 28.29± 3.69 and 27.52± 3.62 . A marked fluctuations were observed in surface water temperature in all the three selected sites of river Ganga., which indicated gradual increase from January to July. It declined gradually from August onwards. Temperature variations is in the riverine system is not only influencing the physico-chemical characteristics of the water body but also influence the distribution and abundance of inhabitant flora and fauna (Soundarapandian et al., 2009). According to Maheshkumar and Prabhakar (2012). Water temperature is effects on the chemistry and biological activities of organisms in water. Temperature was found to correspond with atmospheric air temperature which react on water bodies quickly to change resulting in the subsequent increase or decrease of its water temperature (Welch, 1952; Dasgupta, 1993). High temperature values of river water recorded during summer and monsoon months which have been reported by several workers (Lakshmi narayana, 1959; Pahwa and Mehrotra, 1966; Rai, 1974 a; Agrawal et al, 1976; Rai , 1978; Narayan , 1980; Ravichandran, 1985; Singh and Srivastava, 1988).

Transparency

The studied sites of river Ganga received adequate sunlight and transparency dropped from 5.23 to 17.67 cm except from June, July, August, September and October, however, rest of the months, it was in a normal range. Among three sites, the value was between 8.33 – 37 cm at Site 1,10.33 – 39.16 cm at Site 2 and 12.67 cm to 35.5 cm at Site 3. The mean value of all the three sites varied from 20.65 ± 3.51cm at Site 1, 23.77 ±9.51 cm at Site 2 and 19.58 ± 7.81 cm at Site 3. (Table 1) The transparency of water is dependent upon silt, micro organisms, suspended organic detritus and mineral ions (Mc Combie, 1953). In the present study, transparency was recorded lowest during monsoon and highest in winter and summer. Similar

observations are made by Pahwa and Mehrotra (1966). Sikandar and Tripathi (1983); Singh and Srivastava (1988). . The transparency of water gradually increased in April due to reduction of water flow in the river which favoured with effective sedimentation (Sangu et al. 1983; Singh and Srivastava, 1988; Srivastava, 1991). The transparency in river water exhibit an inverse relationship with rainfall and current flow during monsoon period reported by Prasad and Saxena (1980) and Jhingran (1983).

pH

pH serves as indicator of acidity and alkalinity, which measures the hydrogen ion concentration in the water. The pH value of river water of selected Site 1 ranged between 7.5 – 8.6 with a mean value of 8.20 ± 0.31, while it was maximum 8.55 in March whereas in November pH value was 7.5-7.6. Almost similar trend was followed in other two sites also. Mean and ±SD value was 8.22 ± 0.23 in Site-2 and 8.09± 0.31in Site-3. The month wise pH value presented in (Tables 1). It is an important factor in chemical and biological systems and is closely related to respiration and photosynthesis. Davis (1955) and Singh and Swarup (1979) attributed the importance of pH as chemical factor in an aquatic ecosystem. throughout the period of study. Similar observations are made by Sikandar and Tripathi (1988) which studying the river water at Varanasi. Nair et al. (1989) reported maximum pH during winter followed by summer and monsoon season.

Dissolved oxygen

The dissolved oxygen in water medium reported to be an important factor, which plays an important role to assess the water quality. Dissolved oxygen plays a bivolal role in assessing the water quality of aquatic ecosystem. Dissolved oxygen is directly influenced by the rate of photo system and inversely by the rate of respiration as well as rate of decomposition Increase DO value depends on the quality and volume of the water. In this study , the minimum DO was recorded 5.6 ppm, 5.46 ppm and 5.18 ppm from Site 1, 2 and 3 respectively in the month of July (Tables 1) Maximum DO during the same period was 8.39 ppm in April, 9.04 ppm in March and 9.32 ppm in February/April recorded from the Site 1, 2 & 3 respectively.(Table-1). Lower range of DO found during monsoon months while higher with peak observed in winter months. Mean and SD value in three sites ranged between 6.63± 0.84, 6.88± 0.95 and 7.19 ±1.41. Similar observations are made by Agrawal et al (1976) , Rai (1978), Kant and Raina (1990) and

Srivastva (1991) . In running water ecosystem saturation of atmospheric oxygen is more intense as compared to confined water.

Free CO_2

Free carbon dioxide is a major acidity component in natural water . The highest values in summer night be due to the de composition of organic matters, addition of acidic substance and hydrolysis of salts caused by higher temperature (Munawar , 1970) . Absence of Free CO_2 found during the month of March and April at Site 1, February, March and April at Site 2 and in April and May at Site 3.It is indicated differences in biotic community at a particular period of time at three different sites. Significantly at Site 2 in the month of February, free CO_2 value was found nil, whereas at Site 3 during the same month it was highest. Mean ± SD values in varied from 9.75± 6.49,7.61 ± 5.13 and5.30± 3.72 in Site-1,Site-2 and Site-3 respectively.Available free CO_2 in a water system is the outcome of catabolic activities more especially takes place with respiration in the system. The relationship between dissolved oxygen and free carbon dioxide is reported to be inverse by many workers (Saha et al 1985). Munawar (1970) has stated that the relationship between dissolved oxygen and carbon dioxide is difficult for smaller water bodies.

Carbonate CO_3

The Carbonates and Sulphates of Calcium, Magnesium and Carbon dioxide tension in aquatic medium govern its pH .Wide fluctuations in carbonate content have been recorded from all the three sites throughout the years. While it was 0 mg/l in August and November, 20.8 mg/l in January at Site 1, at Site 2 the range was 0 mg/l in August and 16 mg/l in January at Site 3 in Nov it was 0 mg/l. to 22.4 mg/l in June. Monthly average ± SD varies from 8.25± 6.21 in site-1, 9.79± 4.92 in site 2 and 11.04 ± 5.45 in site-3. .(Table 1)Predominantly winter months showed maximum carbonate content in the water as compared to summer and rainy season.

Bicarbonates

The biocarbonates (HCO_3) contents increase or decreases during space and time. Under present study minimum and maximum range of bicarbonate was 77.8 mg/l (July) – 159.6 mg/l. (Dec). 71.1 mg/l (July) – 160 mg/l (January) and 80 mg/l (April)– 205.0 mg/l (June) at Site 1, 2 and 3 respectively. (Table-1). Monthly fluctuations in HCO_3 contents in river Ganga. Mean SD

± values at Site I was 122.21± 28.46, 120.38± 26.95at site 2 and 130.15± 38.58 at Site 3. Monthly fluctuation in HCO_3 concentration was recorded from three sites. The result obtained in the present study is in conformity with those obtained by Pawa and Mehrotra (1966),Singh (1983), Reddy and Venkateswarlu , (1987) , Singh and Srivastava (1988) , Kant and Raina (1990) and Srivatava (1991) . The total alkalinity of water is mainly caused by the cations of Ca, Mg , Na , K, NH4 and Fe combined either with carbonates and / or bicarbonates or occasionally as hydroxides (Jhingran ,1983).

Chloride

The chloride concentration ranged 3.66 – 13.07 mg/l, 3.55 – 17.04 mg/l and 3.89 – 13.77 mg/l at Site 1, 2 and 3 respectively. The mean SD values at Site 1, 2 and 3 were 8.32 ± 2.49, 11.03± 4.69 and 10.55± 5.45 respectively (Table-1). **S**easonal trend in fluctuation of chloride contents in the Ganga river is also reported by Pawa and Mehrotra (1996) , Agrawal et al , (1976) , Rai (1978) , Sikander and Tripathy (1983) and Srivastva (1991) . Chakraborty et al . (1959) notice similar trend of chloride in Yamuna river at Allahabad**.**

Percentage composition

The annual *Malcolmsonii* catch of three different Sites of river Ganga near Varanasi was recorded. The overall catch composition of *Malcolmsonii* indicate*d* 14% in Site-1,17% in Site- 2 and 21% in Site-3 (Fig.1).

Breeding biology & maturation

Adult male and female specimens of *Macrobrachium malcolmsonii* were found in the middle stretch of river Ganga around Varanasi of three sites, with size ranged from 60 – 235mm. However, post-larvae, juveniles and younger prawns below 60 mm were not recorded around all the sites. The adult prawns larger than 60 mm appeared in May and continued till the end of October. However, the availability of berried prawns was started from last week of May and their population increased during the middle of the monsoon in August and September. Which was recorded the peak period for their breeding. The sex wise *M. malcolmsonii* number in different size group during different months were recorded (Tables 2).The occurrence of berried females and adult prawns of this species was very much related with the rise and fall of flood water in the river. *M. malcolmsonii* specimens were available in small numbers in the catches during the monsoon months collected from the fisherman. Total number of Malcolmsonii

catched six month from May to October were 51.2, 90.6,114.2 in site-1,site-2 & site-3 respectively (Fig-2).

The occurrence of berried females indicated the maturation and breeding of *M. malcolmsonii* observed during last week of May and continued till the end of October. *M. malcolmsonii* found to attain maturity at sizes of 70 mm and above in river Ganga whereas at 83 mm in Hooghly and 68 mm in Godavari river system and 81 – 85 mm in Kolleru lake (Rajyalakshmi, 1980; Rao, 1986). However, Ibrahim (1962a), Patel et al., (1984) have reported a smaller size ranged from 41 – 58 mm in river Godavari and Mahanadi Ojat (Gujrat). The specimens measuring 155-235 mm observed during pre and post monsoon were mostly males. However, females in the size range of 90 to 155 mm were dominant during the middle of the monsoon and encountered till the end of October (Table 2) Individuals ranging from 60 – 95 mm were recorded. However, prolong breeding, 9 months from April to December with peak during August to November (Rao, 1986). Ibrahim (1962 b) made similar observation in river Godavari. However, this period restricted to 5 – 6 months from May to October in river Mahanadi as well as under pond condition (Kanaujia, 1999; Kanaujia and Mohanty, 1994); Rao (1986, 1991), Kanaujia et al. (1999) studied the maturity stages of ovary in *M. malcolmsonii* and *M. rosenbergii* and reported the stages of the ovarian development. Based on the color and the size of the ovary in relation to carapace cavity and diameter of the ova which has been recognized with four maturity stages of ovary. The breeding of *M. malcolmsonii* observed from May to October which was evident with the appearance of berried females in the catch. However, in other riverine system it was reported from April to November depending upon the climatic condition specially water temperature. *M. malcolmsonii* breeding in the present study recorded from May to October was evident with the appearance of berried females in the catch. However, breeding in different reverine systems depending upon the climatic conditions specially water temperature. Breeding may be induced under controlled condition while maintaining the water temperature (Kanaujia et al. 1999). The breeding of this species has been found to be similar with *M. rosenbergii* and *M. gangeticum* (Ling and Meircan, 1961a). Occurrence of berried females larger in size 190 mm indicated for no migration for breeding similar observations are made by Ibrahim (1962a) while studying in the stretches of Godavari river system. The phenomenon of breeding activity throughout the Kolleru lake reported by Rao (1986) indicated

that the species do not perform the breeding migration towards the estuary as reported in *M. rosenbergii.*

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CONCLUSION-

Physico chemical parameters of an aquatic ecosystem are constantly fluctuating which have an impact on the organism residing in the system. In the present work the breeding biology and percentage composition of fresh water prawn have been studied in relation to this parameters which have direct impact on their biology and life history.

REFERENCE

Agrawal, D. K., Gaur, S. D., Sen, P.C and Marwah, S .M. 1976. Bacteriological studies of Ganges water at Varanasi. *Indian J. Med . Res* . 64 (3): 374 –383

Chakraborty, R.C , Ray, P. and Singh, S.B., 1959. A quantitative study of the plankton and the physico chemical condition of the river Yamuna at Allahabad , 1954 –55 . *Indian J . Fish.* 6 (1) : 186. 203.

Davis , C.C., 1955. The marine and fresh water plankton. Michigan State University Press.

Dasgupta, M. 1993. Limnology of two freshwater ponds of Imphal Manipur. Indian Journal of Fishery, 40 (4): 256-261.

Goulder, R., 1969. Interaction between the rates of production of a fresh water macrophyte and phytoplankton in a pond. Oki's. 20: 300 –309.

Ibrahim, K. H., 1962a. On the early embryonic development of *M. malcolmsonii* (H. M. Edwards) and *M. Scabriculus* (Heller) from river Godavari. Sci. and Cult., 28 (5): 232-233.

Ibrahim, K. H., 1962b. Observations on the fishery and biology of the freshwater prawn *Macrobrachium malcolmsonii* (H. M. Edwards) of river Godavari Indian J. Fish. 9(2) : 433 – 467.

Jhingran, V. G. 1956. The capture fishery of river Ganga at Buxar (Bihar, India) in the years 1952 – 1954. Indian Journal of Fisheries. 3(1): 197-215.

Jhingran, V. G. and Ghosh K. K. 1978. The fishery of Ganga river system in the context of Indian aquaculture. Aquaculture.14: 141- 149

Jhingran . V . G., 2003 . Fish and Fisheries of India . Hindustan Publishing Corporation (India) Delhi .

Kanaujia, D. R. and Mohanty, A. N., 1996. Prospects of both mono and mixed culture of *Macrobrachium malcolmsonii*. Fishing Chimes, 15 (12) : 33-35.

Kanaujia, D. R., 1998. Emerging technologies in seed production of *Macrobrachium malcolmsonii* (H. M. Edwards), *In* : Proc Current and Emerging Trends in Aquaculture . Edt. P. C. Thomas, Daya Publishing House, New Delhi; 148-159.

Kanaujia, D. R. and Mohanty, A. N., 1999. Role of temperature variation on larval growth and post larval production of *Macrobrachium malcolmsonii* (H.M. Edwards). J. Aqua. Trop. 14 (3): 187-192.

Kanaujia, D. R., Yadav, V. and Mohanty, A. N., 1994. Use of salt stock solution for seed production of *Macrobrachium malcolmsonii*. National Meet on Aqua-farming system Practices and Potentials 10 – 11 Feb. SPS – 13

Kant, S. and Raina, A. K., 1990. Limnological Studies of two ponds in Jammu II. Physico-chemical parameters. J. Environ. Biol. 11(2) : 137-144.

Ling, S. W. and Merican, A.B.O., 1961. Notes on the life and habits of the adults and larval stages of *Macrobrachium rosenbergii*. *Proc. Indo-Pac. Fish. Coun*., 9(2) : 55 – 60.

Mc Combie, A.M., 1953. Factor influencing the growth of phytoplankton. J. Fish Res. Bd. Can. 10(5) : 253-283.

Munawar, M., 1972. Ecological studies of Euglenineae in certain polluted and unpolluted environment. Hydrobiol. 39(3) : 307-320.

Nair, C. M., Thampy, D. M., Sebastian, M. J. and Syamlal, P., 1989. Mass production of seed of the giant freshwater prawn, *Macrobrachium rosenbergii* (De man). National Seminar on Forty Years of Freshwater Aquaculture in India. (Abs) 7-9 Nov.1989, CIFA, Bhubaneswer SIII/5.

Narayan , K., 1980. Hydro-biological studies on river Cooum (Madras , South - India) with special reference to aquaculture : Ph. D. Thesis University of Madras, Madras

Patel, R. I., Prasad, M. N. and Mansuri, A. P., 1984. Length-weight relationship and relative condition factor of prawn, *Palaemon malcolmsonii* (Edwards), from river Ojat of Saurashtra (Gujarat). Indian J. Fish., 31 (1).

Pahwa , D.V. and Mehrotra, S .M., 1966. Observations on fluctuations in the abundance of plankton in relations to certain hydrological conditions of river Ganga . Proc . Nat . Acad . Sci . India . 34B : 157 –189.

Prasad , B . N. and Saxena, M. 1980. Ecological study of blue green algae nin River Gomati . *Indian Jr . Environ . Hlth* . 22 (2) : 151 –168 .

Reid , G. K., 1961. Ecology of inland waters and estuaries.Renald Publication Corporation , New York , 375 pp.

Rai, L. C., 1978. Ecological studies of algal communities of the Ganges River at Varanasi. *Indian J. Ecol.* 6(I) :1 – 6.

Rai, H., 1974. Limnological studies on the River Yamuna at Delhi, India, Part I Relation between the chemistry and the state of pollution in the River Yamuna. *Arch. hydrobiol*. 73(3) : 369 – 393

Rao, K. J., 1986a. Studies on maturation, breeding, fecundity and sex ratio in *Macrobrachium malcolmsonii* (H. Milne Edwards) from Kolleru lake. *J. Aquat. Biol.* 4 (2): 62-72.

Rao, K. J., 1991. Breeding and larval rearing of the freshwater prawn *Macrobrachium malcolmsonii* (H. Milne Edwards*), Journal of Aquaculture in Tropics*, 6 : 99 – 106.

Reddy, P. M. and Venkateswarlu, V. 1987. Assessment of water quality and pollution in the river Tungabhadra , near Kurnool Andhra Pradesh . J. Environ. Biolk . 8 (2): 109 – 119.

Rajyalakshmi, T., 1980. Comparative study of the biology of the freshwater prawn *Macrobrachium malcolmsonii* of Godavari and Hoogly river system. In : *Proceeding of Indian National Science Academy*, B 46(1) : 72 – 899.

Ravichandran, S., 1985. Limnological studies on Buckingham Canal, Madras, India with special reference to sewage pollution, Ph.D. Thesis University of Madras, Madras.

Radheyshyam, 1988. Physicochemcial environment, community structure and community metabolism in swamp and newly constructed ponds in swampy area. Ph.D. Thesis, Utkal University, Vani Vihar, Bhybaneswar, Orissa., 413 pp.

Saha,, L.C. and Choudhary, S. K., 1985. Phytoplankton density in relation to abiotic factors of a pond at Bhagalpur. *Comp. Physiol. Ecol*. 10(2) : 98-100.

Sneh Lata,1Anuraag Mohan and 2D.R. Khanna ,2018 Physico-chemical characteristics of River Ganga at Chandighat in Haridwar .*IOSR Journal of Applied Chemistry (IOSR-JAC)* 11(1) PP 22-27

Subrahmanyam, M., 1974a. Farming potentials of the Indian river prawn, *Macrobrachium malcolmsonii*. Sea
Food Expot. J.,6 (3): 1- 4

Sikandar, Mohd. and Tripathi, B. D., 1983. Physico chemical characteristic of Ganga water at Varanasi, *River Ecology and Humen Health* 53. 61, Edited by R.S.Ambsht and B.D. Triapthi. *National Environ. Conserv. ation*. Varanasi.

Singh, S. R. and Swarup, K. 1979. Limnological studies of Suraha lake (Ballia) II. The Periodicity of phytoplankton. *The J. Ind. Bot. Soc.* 58 (4) : 319 – 329

Singh, S. R., 1983. Observations on the seasonal variation in the water quality of Dah Lake (Ballia). *Proc. Nat. Sci. Acad. India* 53(B) : (II) : 142-149

Srivastava, V. K., 1991. Ecological studies of Ganga river (between Buxar and Ballia) in relation to distribution
and abundance of *Macrobrachium birmanicum choprai* (Tiwari). Ph.D. Thesis. Purvanchal University,
Jaunpur, U.P., 200 pp

Singh, S. R., 1983. Observations on the seasonal variation in the water quality of Dah Lake (Ballia). *Proc. Nat. Sci. Acad.* India 53(B) : (II) : 142-149.

Singh, S. R. and Srivastava, V. K. 1988. Variation in water quality of Ganga river between Buxar and Ballia. Poll.
Res. 7(3-4) : 85-92

Vazzoler AEAM. 1996. Reproduction biology of teleostean fishes: theory and practice. Maringa´: EDUEM, Brazilian Society of Ichthyology. p. 1–169

Weiss, R. F., Carmack, E.C. and Koropalov, V. M., 1991. Deep water renewal and biological production in Lake Baikal. Nature. Vol.349, 21 Feb., 665-669.

Welch. P.S., 1952. Limnology. Mc Graw Hill. New York, 538 pp.

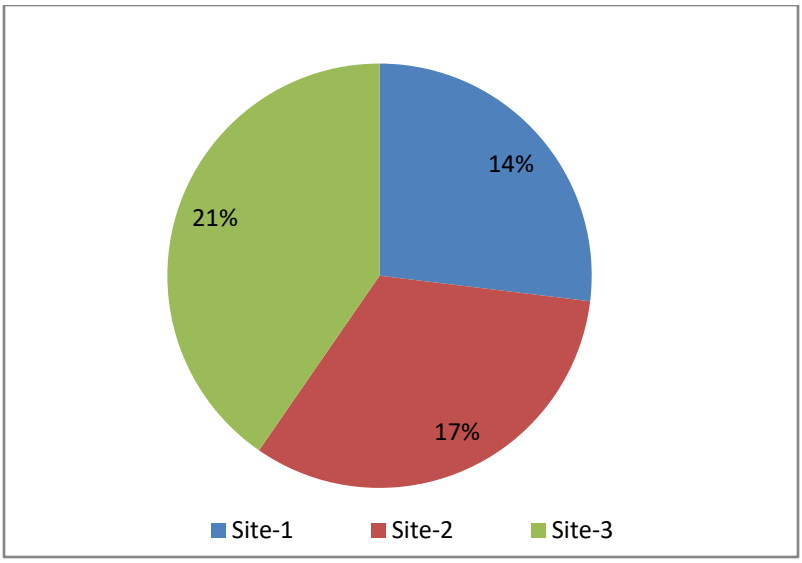

Fig 1.-Percentage composition (%) of *M.malcolmsonii* recorded in river Ganga near Varanasi at three study sites

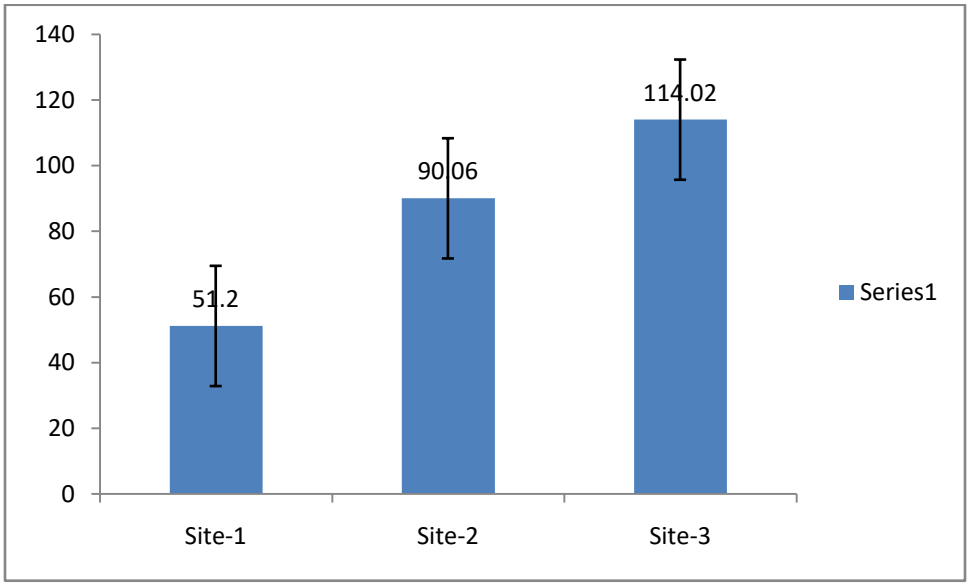

Fig 2- Total prawn catch of *M.macolmsonii* at selected sites of river Ganga

SITE-1 (I st Year)													
Month	Jan	Feb.	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec	Mean±SD
Temp. (°C)	20.5	24.5	27.2	29.5	30.5	31.5	32	31.5	29.5	28.4	26.7	24.3	28.0±3.51
Trans. (cm)	28.5	32	19.66	21.16	16.66	37	8.33	10.66	13.5	17.67	14.2	28.16	20.65±8.96
pH	8.5	8.5	8.55	8.6	8.2	8.05	8.28	8.4	8.14	8.2	7.5	7.9	8.20±0.31
D. O. (mg/l)	6	5.6	8.39	6.63	6.06	6.2	5.9	6.34	6.48	6.76	7.2	8	6.63±0.84
CO_2 (mg/l)	14	10	0	0	12	18	18	15	14	8	4	4	9.75±6.49
CO_3^- (mg/l)	20.8	7.2	2	5.2	13.2	12.2	9.5	0	6.8	7.8	0	14.4	8.25±6.21
HCO_3^- (mg/l)	159.2	136.8	138	88.8	145.8	121.1	77.8	86.8	96.2	124.2	132.3	159.6	122.21±28.46
Chloride (mg/l)	8.52	13.07	8.82	8.89	8.59	9.3	7.72	4.62	3.66	6.83	9.2	10.65	8.32±2.49
SITE-2													
Month	Jan	Feb.	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec	Mean±SD
Temp. (°C)	21	23.5	28.7	27.5	30	32.5	32.5	31.8	30.5	28.9	28.5	24.1	28.29±3.69
Trans. (cm)	33.33	29.66	32.33	29.66	39.16	29.33	10.33	15.5	12.67	15.84	16.63	20.83	23.77±9.51
pH	7.84	8.2	8.5	8.45	8.1	8.15	8.25	8.25	8.2	8.3	7.5	7.8	8.22± 0.23
D. O. (mg/l)	6.77	7.83	9.04	7.01	6.63	6.55	5.46	5.86	6.44	6.84	6.45	7.76	6.88±0.95
CO_2 (mg/l)	10.2	0	0	0	11	8.3	5.15	14.3	12.4	8.3	9.7	12	7.61±5.13
CO_3^- (mg/l)	16	4.4	11	8	17	15	10.8	0	7.6	7.2	8.5	12	9.79±4.92
HCO_3^- (mg/l)	160	138.6	84	136	141	131	71.1	95.3	101.4	136.8	113.3	136.1	120.38±26.95
Chloride(mg/l)	14.06	15.62	16.47	17.04	14.2	13.21	8.8	3.55	4.26	6.96	8.3	9.98	11.03±4.69
SITE-3													
Month	**Jan**	**Feb.**	**Mar**	**April**	**May**	**June**	**July**	**Aug**	**Sept**	**Oct**	**Nov**	**Dec**	**Mean±SD**
Temp. (°C)	20	23.1	25	29	28.1	30	30.5	30.5	32.2	30.2	26.6	25.1	27.52±3.62
Trans. (cm)	21.3	20.17	16.55	24	32	35.5	13.5	12.67	8.67	15.33	16.4	18.9	19.58±7.81
pH	7.4	8.54	8.34	8.2	8.1	8.2	8.05	8.2	8.35	8.26	7.6	7.8	8.09±0.31
D. O. (mg/l)	7.9	9.32	7.7	9.32	8.2	6.57	5.18	5.62	5.75	6.32	6.32	8.08	7.19±1.41
CO_2 (mg/l)	7	9.2	11.2	0	0	8.3	5.2	4.8	7.3	7.3	1.6	1.8	5.30±3.72
CO_3^- (mg/l)	14	7.2	11.6	10	16.8	22.4	8.4	8.9	10	10	0	13.2	11.04±5.45
HCO_3^- (mg/l)	184	132.8	73.4	80	135.6	205.6	110.6	154	100.6	133	134.6	117.6	130.15±38.58
Chloride (mg/l)	8.24	12.28	18.8	13.31	19.17	13.77	14.22	4.69	3.89	3.89	6.8	7.64	10.55±5.45

Table-1 Physico chemical parameters of three sites in one year

Table 2: Sex ratio and percentage of different sizes groups of *M. malcolmsonii* among the commercial catch

Size group	No. of males	% age of Male	No. of Female	% age of Female
60	12	28	30	71
61-65	27	24	87	76
66-70	26	18	111	82
71-75	25	19	95	81
76-80	49	34	77	61
81-85	47	43	113	57
86-90	61	35	114	65
91-95	44	40	65	60
96-100	56	39	80	59
101-105	48	32	102	68
106-110	64	32	136	68
111-115	45	26	122	74
116-120	41	19	177	81
121-125	30	17	148	83
126-130	25	18	114	82
131-135	23	20	93	80
136-140	30	21	95	56
141-145	37	28	113	75
146-150	55	37	91	63
151-155	78	40	117	60
156-160	49	47	56	53
161-165	89	50	89	50
166-170	108	60	72	40
171-175	83	79	22	21
176-180	81	85	14	15
181-185	53	88	7	12
186-190	37	95	2	5
191-195	24	97	1	3
196-200	14	99	1	1
201-205	15	100	-	-
206-210	18	100	-	-
211-215	20	100	-	-
216-220	11	100	-	-
221-225	8	100	-	-
226-230	9	100	-	-
231-235	7	100	-	-