J. Exp. Zool. India Vol. 14, No. 2, pp. 651-655, 2011 *ISSN 0972-0030*

STUDIES ON WATER QUALITY OF PRAVARA RIVER IN RELATION TO PISCICULTURE, AHMEDNAGAR DISTRICT, MAHARASHTRA

B. A. Pawar, A. K. Pandarkar* and A. N. Shendge**

Department of Zoology, P.V.P. College, Pravaranagar, Tal. Rahata, Ahmednagar - 413 713, India.
*Department of Zoology, New Arts, Commerce and Science College, Ahmednagar - 414 001, India.
**Department of Zoology, Tuljaram Chaturchand College, Baramati, Pune - 413 102, India.
e-mail : ba_pwr2007@rediffmail.com

(Accepted 24 January 2011)

ABSTRACT- The present work deals with the water quality of Pravara river in Ahmednagar district, Maharashtra during July 2008 to June 2009 in order to assess its suitability for pisciculture. Various physico-chemical parameters determined reveals that seasonal fluctuations in water temperature, dissolved oxygen, pH and nitrite in all the season were within the favourable limits for fish and fisheries practices. However, very low level of alkalinity during winter to summer at station-I, chloride during all the season at station-I and III and during winter and monsoon at station-II, hardness during summer at station-I, calcium in all the season at all the stations and magnesium during all the season at station-I and III and during monsoon at station-II and high level of alkalinity during post-monsoon at station-II, chloride during summer at station-II, hardness during post-monsoon and summer at station-II and phosphate during winter to monsoon at all the stations were recorded. These parameters need to be modifying in order to favour the fish culture.

Key Words : Pravara river, water quality, pisciculture.

INTRODUCTION

Water quality in rivers is vital for human health and for maintenance of biotic and ecological integrity. Clean water is a sine quanon for the development of fishery resources. But today due to various anthropogenic activities, the river water usually receives untreated sewage, domestic waste, industrial and agricultural effluents that results in pollution of several rivers in India and abroad. Sand-Jensen (2001) remarked that the nutrient input was highest from the towns and agricultural fields and it has increased dramatically during the last few decades.

The pollution adversely affects the water quality and its biota including fish community. Domestic effluents continuously resulting in degradation of this habitat at alarming rate (Zingde *et al,* 1994). Contamination of water bodies might lead to a change in their trophic status and render them unsuitable for aquaculture. Hence, regular monitoring of physico-chemical and biological water quality parameters is essential to determine status of water body with reference to pisciculture. Earlier studies on water quality parameters of some rivers and dams in relation to fish culture were made by Muley and Patil (2006), Laishram *et al* (2007), Saksena *et al* (2008) and Raut *et al* (2010). Pravara river passes through Ahmednagar district of Maharashtra state. It receives agricultural run off, domestic waste and municipal sewage. However, no investigation is so far taken upon the water quality of this river and its impact on fish culture. Hence, in the present study an attempt has been made to study the water quality in relation to pisciculture in Pravara river.

MATERIALS AND METHODS

Pravara river is an important tributary of Godavari, Ahmednagar district, Maharashtra. Some smaller dams are constructed across the river for the purpose of water resource for drinking, agriculture, domestic uses and fisheries. Present study was conducted in about 85 km stretch of Pravara river. Along the stretch of river three sampling stations were selected. Station-I was Shendi reservoir, just behind the Bhandardara dam, Station-II was Akole reservoir, 50 km down stream of station-I and Station-III was Jorve reservoir, 35 km down stream of station-II.

For determining physico-chemical conditions, monthly water samples were collected between 8.45 to 9.00 am at station-I, 11.15 to 11.30 am at station-II and 12.45 to 1.00 pm at station-III from July 2008 to June 2009 in polythene bottles. For the estimation of dissolved oxygen content, the water sample was fixed immediately on the field in DO bottles and estimated in the laboratory using modified Winkler's method (Golterman *et al,* 1978). Temperature and pH was recorded on the field by centigrade thermometer and pen pH meter (Elico LI 613) respectively. The alkalinity, chlorides, hardness, calcium and magnesium were estimated by titration and nitrite

and phosphate by spectrophotometer (Elico, SI 171 mini Spec) on the same day in the laboratory (Golterman *et al,* 1978; APHA *et al,* 1985).

RESULTS AND DISCUSSION

The present investigation involves the assessment of a Pravara river in Akole and Sangamner taluka by selecting three reservoirs in order to find out its suitability for pisciculture. Monthly variations of physico-chemical parameters of Pravara river at different stations are shown in fig. 1. The data was divided in to four seasons, representing monsoon (June-September), post-monsoon (October-November), winter (December-February) and summer (March-May) and is presented in table 1.

Physico-chemical parameters like pH, temperature, dissolved oxygen, ammonia-nitrogen, phosphorus and chlorides have a greater influence on the survivability of the fishes (Devi Prasad *et al,* 2009). In the present study water temperature ranged from 19 (November and February, at station-I) to 30°C (April-May, at station-III). It was minimum (19.67°C) during winter at station-I and maximum (29.67°C) during summer at station-III. Similar results were also reported by Muley and Patil (2006) and Gupta *et al* (2009). Sharma and Gupta (1994) had reported that fish growth was better at a temperature range of 14.5 to 38.6°C. The water temperature in Pravara river was found ideal for fish growth and productivity.

Tarzwell (1957) has suggested that a minimum of 3 mg/l dissolved oxygen is necessary for healthy fish and other aquatic life. In the present study dissolved oxygen ranged between 4.48 (August, at station-I) to 10.92 mg/l (February, at station-II). It was minimum (5.01 mg/l) in post-monsoon at station-I and maximum (8.68 mg/l) during winter at station-II and summer at station-III. This level of oxygen in the river should be able to support good flora and fauna. Similar observations were recorded by Singh and Rai (1999) in river Ganga, Hiware and Jadhav (2001) in river Manjara and Rafeeq and Khan (2002) in river Godavari.

pH ranged between 7.1 (February, at station-I) to 9.3 (May, at station-III). It was minimum (7.37) during winter at station- I and maximum (9.07) during summer at station-III. The pH was found to be on the alkaline side throughout the study period which favours the growth of fishes (Swingle, 1967). Alkaline pH was also observed by Shaikh and Yeragi (2004) in river Tansa during whole study period.

Alkalinity ranged between 42 (January, at station-I) to 440 mg/l (March, at station-II). It was minimum (43.33 mg/l) during winter at station-I and maximum (305.00 mg/l) during post-monsoon at station-II. High alkalinity (305 mg/l) during post monsoon at site-II is probably because of addition of waste.

Chloride ranged between 4.644 (November and January, at station-I and January, at station-II) to 126.315 mg/l (March, at station-II). It was minimum (5.428 mg/l) during post-monsoon at station-I and maximum (59.75 mg/l) during summer at station-II. The chloride concentration was quite low in this river at station-I and III which reflects that there is very less amount of organic waste of animal origin. However, chloride content of site-II was markedly higher in comparison to other two sites which are indicative of a high degree of pollution by organic matter.

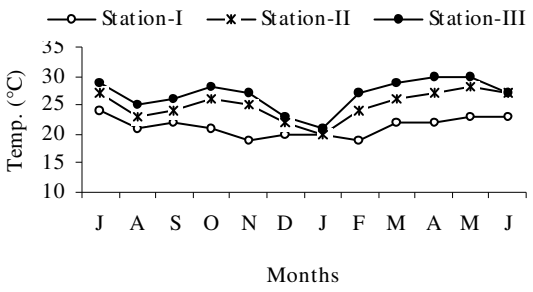
Total hardness ranged between 24 (January, at station-I) to 470 mg/l (March, at station-II). It was minimum (27.33 mg/l) during summer at station-I and maximum (290.00 mg/l) during post-monsoon at station-II. Relatively higher values of hardness were recorded at station-II. The higher total hardness content was recorded maximum during post-monsoon season at all the three sites. It may be due to low water level and addition of calcium and magnesium salts from detergents and soaps used for cloth washing by the villagers.

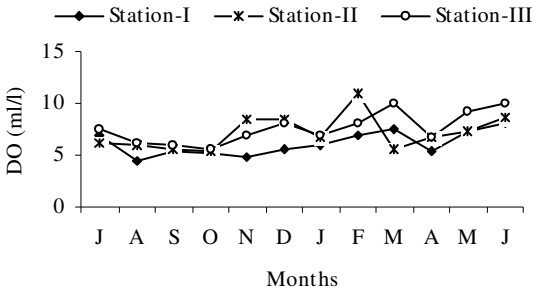
The calcium level in the river ranged between 7.214 mg/l (January, at station-I) to 51.302 mg/l (July, at station-II). It was minimum (8.818 mg/l) during winter-summer at station-I and maximum (37.392 mg/l) during post-monsoon at station-III. Calcium content increased from summer to post-monsoon at all the stations. It was supposed that the input of domestic and other sewage waste from the adjacent town might be responsible to increase calcium content (Sati and Paliwal, 2008).

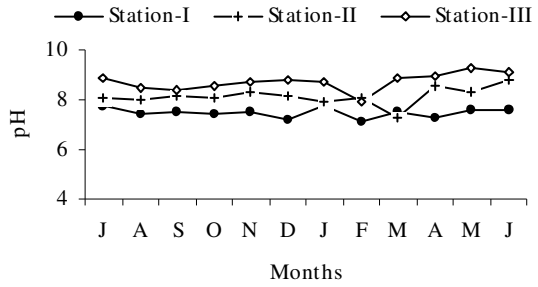
Magnesium ranged between 0.483 mg/l (April and June, at station-I) and 100.04 mg/l (March, at station-II). It was minimum (1.30 mg/l) during summer at station-I and maximum (40.82 mg/l) during summer at station-II. The data reveals high concentrations of bicarbonates of calcium and magnesium at station-II in all the seasons (except calcium during post-monsoon) possibly due to the regular deposition of large quantities of organic and inorganic wastes in to the river from the urban areas.

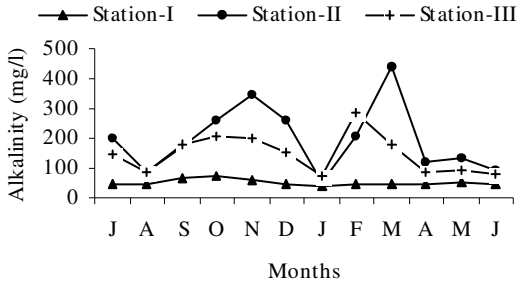
Nitrite ranged between 0.002 mg/l (August and April-May, at station-I) to 0.467 mg/l (December, at station-II). It was minimum (0.003 mg/l) during summer at station-I and maximum (0.333 mg/l) during post-monsoon at station-II.

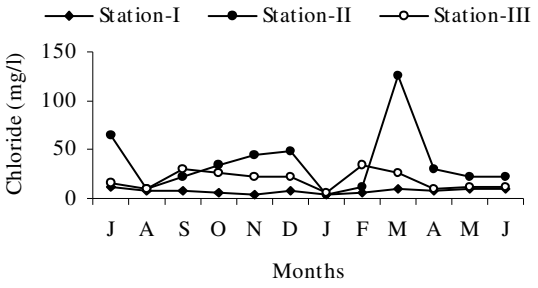
Phosphate ranged between 0.107 mg/l (November, at station-I and December, at station-II) to 3.300 mg/l (April, at station-III). It was minimum (0.149 mg/l) during post-monsoon at station-I and maximum (2.818 mg/l)

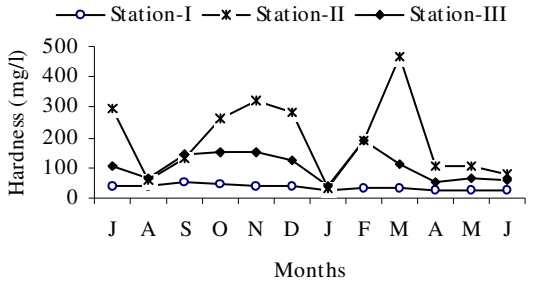


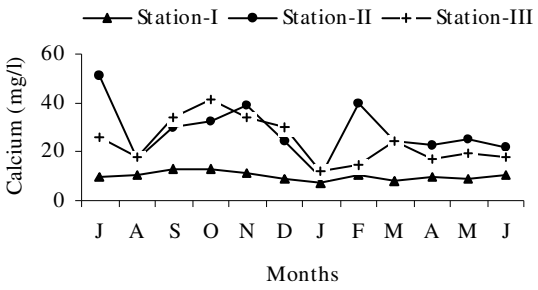


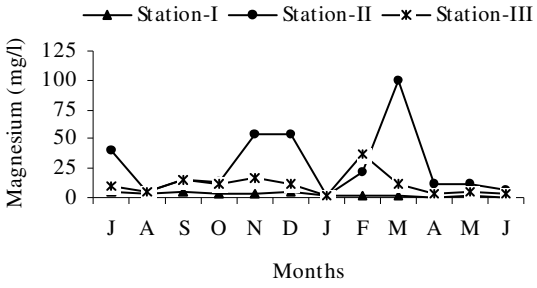


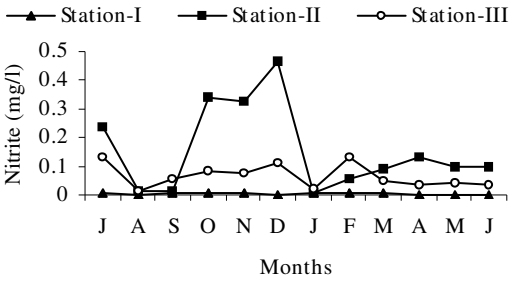












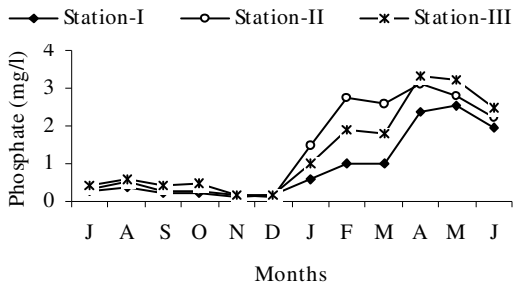


Fig. 1 : Monthly variation of physico-chemical parameters of Pravara river during July 2008 to June 2009.

Table 1 : Seasonal variation of physico-chemical parameters of Pravara river during July 2008 to June 2009.

Sr. No.	Parameter	Station	Season			
			Monsoon	Post-monsoon	Winter	Summer
1.	Temp. (0C)	I	22.50 ± 1.29	20.00 ± 1.41	19.67 ± 0.58	22.33 ± 0.58
		II	25.25 ± 2.06	25.50 ± 0.71	22.00 ± 2.00	27.00 ± 1.00
		III	26.75 ± 1.71	27.50 ± 0.71	23.67 ± 3.05	29.67 ± 0.58
2.	Dissolved oxygen (ml/I)	I	6.23 ± 1.64	5.01 ± 0.27	6.16 ± 0.74	6.72 ± 1.22
		II	6.58 ± 1.42	6.85 ± 2.19	8.68 ± 2.11	6.53 ± 0.85
		III	7.42 ± 1.20	6.25 ± 1.06	7.75 ± 0.65	8.68 ± 1.75
3.	pH	I	7.57 ± 0.17	7.45 ± 0.07	7.37 ± 0.38	7.47 ± 0.15
		II	8.27 ± 0.36	8.20 ± 0.14	8.07 ± 0.15	8.07 ± 0.68
		III	8.72 ± 0.33	8.65 ± 0.07	8.47 ± 0.49	9.07 ± 0.21
4.	Alkalinity (mg/I)	I	52.50 ± 11.93	67.00 ± 7.07	43.33 ± 1.15	48.67 ± 4.16
		II	139.50 ± 55.60	305.00 ± 60.81	172.67 ± 107.93	232.67 ± 179.7
		III	125.00 ± 47.96	202.50 ± 3.53	172.67 ± 109.9	120.00 ± 52.11
5.	Chloride (mg/l)	I	9.52 ± 2.44	5.43 ± 1.11	6.19 ± 1.42	9.27 ± 0.93
		II	29.95 ± 23.51	39.05 ± 7.82	21.98 ± 23.88	59.75 ± 57.74
		III	17.65 ± 8.38	25.18 ± 2.77	20.43 ± 14.42	16.72 ± 8.10
6.	Hardness (mg/l)	I	41.00 ± 9.86	43.50 ± 4.95	31.33 ± 8.08	27.33 ± 2.31
		II	143.00 ± 106.49	290.00 ± 42.43	169.33 ± 126.27	226.67 ± 210.7
		III	96.00 ± 40.53	152 ± 2.83	117.33 ± 76.22	77.33 ± 29.14
7.	Calcium (mg/l)	I	10.822 ± 1.39	12.174 ± 1.35	8.818 ± 1.60	8.818 ± 0.80
		II	29.859 ± 15.24	35.716 ± 5.04	24.582 ± 15.24	23.780 ± 1.22
		III	23.647 ± 7.67	37.392 ± 5.27	18.704 ± 9.56	20.040 ± 3.67
8.	Magnesium (mg/l)	I	3.41 ± 1.99	3.52 ± 0.84	2.27 ± 1.85	1.30 ± 1.02
		II	16.70 ± 16.74	33.64 ± 29.00	26.34 ± 26.38	40.82 ± 51.28
		III	9.02 ± 5.24	13.60 ± 3.49	17.23 ± 18.34	6.66 ± 4.89
9.	Nitrite (mg/I)	I	0.004 ± 0.001	0.006 ± 0.001	0.006 ± 0.001	0.003 ± 0.001
		II	0.089 ± 0.10	0.333 ± 0.001	0.178 ± 0.25	0.107 ± 0.02
		III	0.060 ± 0.05	0.079 ± 0.001	0.086 ± 0.06	0.041 ± 0.01
10.	Phosphate (mg/l)	I	0.693 ± 0.85	0.149 ± 0.06	0.569 ± 0.44	1.953 ± 0.82
		II	0.843 ± 0.93	0.181 ± 0.07	1.437 ± 1.32	2.818 ± 0.27
		III	0.966 ± 0.99	0.295 ± 0.23	1.002 ± 0.87	2.764 ± 0.84

during summer at station-II. Phosphate concentration increases towards downstream during rainy season due to heavy influx of domestic sewage, detergents and agricultural effluents (Muley and Patil, 2006). Phosphate concentration in the present investigation was found to be higher (except post-monsoon) than the standard permissible limit. The high concentration of nutrients in the river water may be attributed to the fact that river receives huge amount of domestic and municipal sewage and solid waste from the Akole and Sangamner towns.

The comparison of the water quality of Pravara river with limits laid down by fresh water quality criteria for fish and fisheries practices (Chandra Prakash, 2001) suggested that, the river water may be considered suitable for fish culture as the seasonal fluctuations in water temperature, dissolved oxygen, pH and nitrite in all the

season and alkalinity during monsoon to post-monsoon at station-I, in winter to monsoon at station-II and in all the season at station-III, chloride during post-monsoon only at station-II, hardness during monsoon to winter at station-I, in monsoon and winter at station-II and in all the season at station-III, magnesium during post-monsoon to summer at station-II and phosphate only during post-monsoon at all the stations are within the desirable limits for fish and fisheries practices. However, very low level of alkalinity during winter to summer at station-I, chloride during all the season at station-I and III and during winter and monsoon at station-II, hardness during summer at station-I, calcium in all the season at all the stations and magnesium during all the season at station-I and III and during monsoon at station-II and high level of alkalinity during post-monsoon at station-II, chloride during summer at station-II, hardness during post-monsoon and summer at station-II, and phosphate during winter to monsoon at all the stations were recorded. These parameters need to be modifying in order to favour the fish culture.

It was found that the Pravara river was suffering from the domestic type of pollution and the most of the parameters showed their peak values at station-II (Akole reservoir). Hence, it is suggested that station-II and also III in some extent should be protected from the anthropogenic activities for preventing further deterioration in the water quality of the river. Some of the measures, which demand immediate attention, are the : 1) Treatment of sewage and solid waste from Akole and Sangamner town and surrounding human settlements, 2) An improved sanitation and waste disposal programme needs to be initiated and 3) Change the agriculture practice in order to reduce the non-point pollutants from this source. Organic farming in these areas may be encouraged.

ACKNOWLEDGEMENTS

Authors are thankful to Principal, P.V.P. College, Pravaranagar for providing requisite facilities for completion of this work. The financial assistance received from UGC, Western Regional Office, Pune is gratefully acknowledged.

REFERENCES

APHA (1985) *Standard methods for the examination of water and wastewater.* American Public Health Association. Washington. 15.

Chandra Prakash (2001) *Status of soil and water quality parameters in brood stalk management.* Course manual, CAS Training programme on Brood stock Management and Genetic selection in Fish seed production (Feb-March, 2001), CIFE, Mumbai. pp. 73.

Devi Prasad, A G, Venkataramana, G V and Thomas, M (2009) Fish diversity and its conservation in major wetlands of Mysore. *J. Environ. Biol.* **30** (5), 713-718.

Golterman, H L, Chlymo, R S and Ohanstand, M A M (1978) *Methods for physical and chemical analysis of fresh water.* IBP Handbook No. 8, Backwell Scientific Pub. Oxford, London, Edinburgh, Melbourne, Second edn. pp. 172-178.

Gupta, M, Palliwal, A and Dubey, R (2009) Physico-chemical status of river Yamuna at Firozabad, UP. *Uttar Pradesh J. Zool.* **29** (2), 239-243.

Hiware, C J and Jadhav, B V (2001) Biological studies of Manjar river near Kalam, district Osmanabad, Maharshtra, India. *J. Aqua. Biol.* **16,** 11-13.

Laishram, K, Haobijam, D and Rajkumari, G (2007) Pollution status and conservation strategies of Moirang river, Manipur with a note on its aquatic bio-resources. *J. Environ. Biol.* **28** (3), 669-673.

Muley, D V and Patil, I M (2006) A study of water quality and fish diversity of Pauna river, Maharashtra. *J. Aqua. Biol.* **2** (1), 68-75.

Rafeeq, M A and Khan, A M (2002) Impact of sugar mill effluents on the water quality of the river Godavari near Kandakurthi village, Nizamabad district, Andhra Pradesh. *J. Aqua. Biol.* **17,** 33-35.

Raut, K S, Shinde, S E, Pathan, T S, Kachre, S V and Sonawane, D L (2010) Fish diversity in relation to physico-chemical properties of Chandrapur dam in Parli- V., district Beed, M.S., India. *Flora and Fauna.* **16** (1), 115-122.

Saksena, D N, Garg, R K and Rao, R J (2008) Water quality and pollution status of Chambal river in national Chambal sanctuary, Madhya Pradesh. *J. Environ. Biol.* **29** (5), 701-710.

Sand-Jensen, K (2001) Freshwater ecosystems. Human impact on. In : *Encyclopedia of Biodiversity. Vol. 3.* (Ed. : S A Levin). Academic Press, New York. pp. 89-108.

Sati, S C and Paliwal, P C (2008) Physico-chemical and bacteriological analysis of Kosi river water in Central Himalaya. *Poll. Res.* **27** (1), 179-183.

Shaikh, N and Yeragi, S G (2004) Some physico-chemical aspects of Tansa river of Thane district, Maharashtra. *J. Aqua. Biol.* **19,** 99-102.

Sharma, L L and Gupta, M C (1994) Some aspects of limnology of Awarchand reservoir, Rajasthan. Physical parameters. *Pollut. Res.* **13,** 16-19.

Singh, B N and Rai, S (1999) Physico-chemical studies of Ganga river at Varanasi. *J. Environ. Pollut.* **6,** 43-46.

Swingle, H S (1967) Standardization of chemical analysis for water and pond mud. *FAO Fish. Rep.* **44** (4), 397-421.

Tarzwell, C M (1957) Water quality criteria for aquatic life. In : *Biological problems in water pollution.* (Ed. O S). Dept of Health Education and Welfare. P.H.S. pp. 246-272.

Zingde, M D and Sabnis, M M (1994) Pollution induced dial variability in water quality of Mahim. *Environ. & App. Biol.* **4,** 227-278.