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Growth of Indian major carps reared in treated wastewater of petrochemical industry

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Abstract
Growth of Indian major carps (*Catla catla*, *Labeo rohita* and *Cirrhinus mrigala*) reared in Guard pond containing treated wastewater of petrochemical industry (Oil and Natural Gas Corporation, Hazira, India) was investigated. Fingerlings of selected species were stocked at 9000/ha in ratio of 1:4:2 and reared for one year. Growth parameters viz., total length, standard length and weight of fishes were also measured quarterly. During the study period it was observed that catla attained 35.69±0.36 cm total length, 28.32±0.31 cm standard length and 546.54±18.96 gm weight; rohu attained 36.13±0.36 cm total length, 29.12±0.17 cm standard length and 551.46±17.23 gm weight while mrigal attained 33.50±0.22 cm total length, 27.56±0.21 cm standard length and 385.00±8.89 gm weight. Study revealed that maximum growth was observed in rohu compared to other fish (catla and mrigal) due to abundance of phytoplankton which is food rohu. Water qualities of treated water of ONGC were conducive for fish farming and growth of fishes was satisfactory.

Keywords: growth, petrochemical industry, treated wastewater, catla, rohu and mrigal

Introduction
Industries plays important role in economic development of country. Gujarat is most important industrialized of India. Surat is also known as economic capital of Gujarat where industries like ONGC, IOC, KRIBHCO, Reliance, ESSAR and L&T are located. From these, Oil and Natural Gas Corporation (ONGC), Hazira in one of the important petrochemical industry at the bank of Tapi River in Surat and uses huge amount of water for refining process and produce wastewater. The industry has set up the treatment plant where physical, biological and chemical methods are applied to treat the wastewater to maintain water quality and this treated wastewater were used for aquculture purposes. Sewage contain nutrient that stimulate growth of aquatic plants (Allen, 1985) [2] and enhance production of natural food for fish. Sondhia (2008) reported that sewage water reduces production cost by substituting chemical fertilizers and feeds while providing useful nutrients recycled encouraged fish growth. Growth and other biological aspects of fresh water fish *Labeo rohita*, *Clarias batrachus* and *Catla catla* in effluent of Saga industry were investigated by respectively. Fish culture in sewage reported by Bhatia (1970) [6], Ghosh *et al*. (1973) [10], Prabhavathy (1988) [17], Jhingran and Ghosh (1988) [11], Manna *et al*. (2001) [14], Bhatia and Jana (2006) [5], Mota (2009) [15], Nwabueze (2013). Only few study notes are available except Gadhia and Gadhia 1999 [9] who have studied impact of treated petrochemical industry effluent on fish growth.
In present paper, growth of Indian major carps in treated wastewater of petrochemical industry was discussed. This study will be useful in understanding the relationship of growth of fish with water quality of treated wastewater of ONGC.

Materials and Methods
For this study, cemented pond (24.5 x 24.5 x 1.5 m) at ONGC, Hazira (Surat) was used to store treated wastewater before releasing into Tapi River. The same pond was stocked with 700 fingerlings of Indian major carps (catla, rohu and mrigal) in the ratio of 1:4:2 and reared for one year. The growth parameters (length and weight) from randomly collected fish specimens were measured at every four month with help of measuring tape and single pan balance and further analysis was done to following the method of LeCren (1951) [13].

Result and Discussion

Fishes grown in the treated wastewater were healthy, without sign of mortality and infection. Average total length and weight of catla were (11.68 ± 0.56 cm, 22.70 ± 3.25 gm), rohu (6.77 ± 0.25 cm, 3.90 ± 0.38 gm) and mrigal (9.26 ± 0.21 cm, 8.65 ± 0.32 gm) were observed at the time of stocking while after one year growth was observed very significant i.e. for catla (35.69 ± 0.36 cm, 546.54 ± 18.96 gm), for rohu (36.13 ± 0.36 cm / 551.46 ± 17.23 gm) and for mrigal (33.50 ± 0.22 cm / 385.00 ± 8.89 gm) length and weight respectively (Table 1). This growth attained by catla 3-4 times more in terms of total length and standard length and 25 times more in terms of weight; attained by rohu 5-6 times more in terms of total length and standard length and 135 times more in terms of weight while it was 3-4 times more in terms of total length and standard length and 45 times more in terms of weight for mrigal.

In present study high rate of survival and suitable environment for fish were observed. The results on growth are verified by earlier findings of Ghosh *et al*. (1973) [10], Gadhia and Gadhia (1999) [9], Manna *et al*. (2001) [14], Bhakta and Jana (2006) [5] and Nwabueze (2012) [16]. The observations of less growth of catla in comparison to rohu which is in corroboration with the findings of Sarig (1956), Ghosh *et al*. (1973) [10] and Sinha (1988) [19]. Gadhia and Gadhia 1999 [9] and reported high growth of rohu compared to catla and mrigal in treated wastewater of petroleum industry which is similar to results of present study that may be due to higher population density of phytoplankton. Ghosh *et al*. (1973) [10] reported lower growth of catla and Bhakta and Jana (2006) [5] reported higher growth of rohu in sewage fed fisheries.

Table 1: Growth performance of Indian major carps in treated wastewater of petrochemical industry

Species	Parameter	November 2009		December 2010	
		Min. - Max.	Mean ± SE	Min. - Max.	Mean ± SE
C. catla	TL (cm)	8.00 - 13.75	11.68 ± 0.56	32.00 - 38.50	35.69 ± 0.36
	SL (cm)	5.75 - 11.25	9.70 ± 0.57	25.50 - 31.50	28.32 ± 0.31
	WT (gm)	6.00 - 40.00	22.70 ± 3.25	400.00 - 740.00	546.54 ± 18.96
L. rohita	TL (cm)	5.00 - 9.50	6.77 ± 0.25	33.00 - 45.00	36.13 ± 0.36
	SL (cm)	3.75 - 8.00	5.09 ± 0.17	26.50 - 33.50	29.12 ± 0.27
	WT (gm)	2.00 - 10.00	3.90 ± 0.38	400.00 - 830.00	551.46 ± 17.23
C. mrigala	TL (cm)	5.50 - 13.80	9.46 ± 0.21	30.50 - 36.00	33.50 ± 0.22
	SL (cm)	4.55 - 10.50	7.61 ± 0.18	25.50 - 30.50	27.56 ± 0.21
	WT (gm)	4.00 - 13.00	8.65 ± 0.32	290.00 - 560.00	385.00 ± 8.89

TL - Total length, SL - Standard length, WT - Weight, Min. - Minimum, Max. - Maximum and SE - Standard error.

Conclusion

The findings of present research work it is concluded that the treatment process of ONGC is appropriate and supplied treated wastewater having sufficient nutrients for the normal growth of the reared fish. It also concluded that proper treated wastewater of petrochemical industry can be used for fish culture and it is the immerging and new concept in the management of environment and industries.

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