Research Paper

Volume : 3 | Issue : 5 | May 2014 • ISSN No 2277 - 8179

Physico-chemical characterization of intake, pond and discharge water of shrimp farms along the Nellore coast line of Andhra Pradesh

Biotechnology

KEYWORDS : shrimp farm, water quality, intake, pond, discharge, Nellore coast

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ABSTRACT

Nellore is regarded as shrimp capital of India, due to its high shrimp production. The present study aimed to establish the physical and chemical characteristics of the intake, culture pond and discharge water quality from shrimp farms along the coast line of Nellore District of Andhra Pradesh, India. It was observed that the overall water quality parameters like temperature, pH, turbidity, alkalinity, salinity, TSS, DO, COD, BOD5, Ammonia N, Nitrate N, Nitrite N, total N, total P, H2S were more in discharge water than that of pond water and intake water. The constant release of the untreated discharge water may lead to the pollution of nearby water bodies and also ground water pollution. Frequent monitoring of the water quality parameters and their maintenance within the permissible limits leads to sustainable shrimp farming.

INTRODUCTION

Due to high global demand and human consumption, large number of shrimp culture industries are being established rapidly in east cost of India (Kurian & Sebastian, 1994). Overcoming the major hurdles like disease outbreaks, pollution, the shrimp culture in India is a profitable business. Andhra Pradesh shares more than half of India's prawn production and had been started since 1987 (Zakir Hossain et al, 2002).

Availability of vast tracts of saline lands coupled with abundant quality of wild seeds and strong export demand for shrimp were initially responsible for attracting the entrepreneurs towards shrimp farming. As a consequence, hundreds of hectares of lands were brought under this venture. Aquaculture is gaining additional emphasis due to our concern in sustainability towards food security (Vidya Sagar Reddy &Vijaya, 2014).

A sufficient supply of good quality water is essential to any aqua culture operation. Water quality affects reproduction, growth, and survival of aquatic organisms, particularly shrimp (Chien Yew-Hu, 1992; Boyd, 1989). The criteria for good quality water vary by physical and chemical properties.

The culture practices in the terrestrial environment with seawater are the man's attempt to duplicate the natural cycle of shrimp similar in the estuarine conditions. In order to provide optimal growth of shrimp with high stocking density in small area, various artificial inputs in the form of feed, fertilizers and drugs are being used (Obire et al., 2008). The discharge of these effluents in to the environment poses a threat to the coastal ecosystem and its natural resources (Lee Nyanti, 2011). This work aims to monitor the water quality involving in shrimp culture i.e., intake, pond and discharge water.

METHODOLOGY:

Water samples were collected from villages - Mypadu, Koduru, Tummalapenta along the Nellore coast. All the Samples are collected in sterile polythene containers and were analysed for different parameters like, temperature, pH, turbidity, alkalinity, salinity, total suspended solids (TSS), DO, COD, BOD_5, Ammonia-N, Nitrate N , Nitrite N, Total N, Total P and H_2S (ASTM, 1986; APHA, 1992). Data presented as average values of six pond samples with standard deviation, collected at each village.

RESULTS AND DISCUSSION:

The values of Temperature, pH, Salinity, TSS, COD, BOD_5, Ammonia N, Nitrate N, Nitrite N, Total N, Total P, H_2S (Table 1) were more in Discharge water than Intake water in all the three villages (Fig 1). Similar results were reported by Joseph et al., (2002). DO of discharge water (3.5 ±0.36 ppm) was less than that of intake water (4.3 ±0.89 ppm) at Koduru.

Temperature (°C), pH, Turbidity, Alkalinity, Salinity, DO of Discharge water were lower when compared to Intake water at Tummalapenta village (Table 1). Increased in the Turbidity levels in pond water was observed when compared to Intake water, it may due to the feed, and shrimp activity. Higher COD, BOD_5 values 50.4±7.8, 29.5±4.01 (Mypadu), 65.9±5.8, 38.5±4.81 (Koduru), 70.1±5.9, 35.2±2.92 (Tummalapenta) in discharge water indicates the increase in the organic matter.

Turbidity, Alkalinity, COD, Ammonia, Nitrate N, Nitrite N, and total P of discharge water were higher in Tummalapenta than that of Mypadu and Koduru (Figure 1) and this may be due to the feed used during culture. In all the areas, the H_2S levels in intake water were found to be below detection level and detected in both Pond water and Discharge water (Table 1).

In this study, all the water quality parameters were observed to be within the safe environmental limits (Chen and Lei, 1990, MOEF, 1993). Ground water quality at the vicinity of shrimp farms must be monitored/studied as there is a chance of pollution (Ramesh Reddy, et al., 2008).

Table 1. Water quality analysis at different places along Nellore coast (Average values of 6 pond samples with Standard Deviation).

		Mypadu			Koduru			Tummalapenta		
S. No	Parameters	IW*	PW*	DW*	IW*	PW*	DW*	IW*	PW*	DW*
1	Temperature (°C)	28.1±1.62	29.0±1.1	28.2±1.42	29.0±0.93	31.0±0.11	29.5±0.62	28.5±0.93	29.3±0.52	28.6 ±0.95
2	pH	8.1±0.10	8.3±0.15	8.2±0.13	8.2±0.27	8.4±0.14	8.3±0.11	8.3±0.23	8.4±0.16	8.1 ±0.19
3	Turbidity (NTU)	5.8±0.80	20.1±3.22	31.3±4.51	8.0±0.63	35.2±4.52	41.6±7.11	9.0±0.753	36.1±4.16	49.1 ±8.37
4	Alkalinity (ppm)	89.9±11.42	101.2±12.11	111.1±14.32	92.3±10.63	105.2±11.45	107.1±28.24	98.9±10.52	111.2±16.21	112.0 ±30.23
5	Salinity (ppt)	23.5±4.41	25.9±3.32	24.8±4.21	27.8±5.21	28.1±4.67	27.5±4.93	30.3±6.13	31.2±4.92	29.1 ±5.13

6	TSS (ppm)	0.79±0.02	60.1±5.42	86.1±6.21	0.83±0.05	53.4±6.12	91.2±7.56	0.81±0.04	62.1±7.52	89.4 ±8.31
7	DO (ppm)	5.2±0.90	6.5±0.31	5.4±0.42	4.3±0.89	5.1±0.31	3.5±0.36	5.7±0.78	6.1±0.43	4.36 ±0.31
8	COD (ppm)	4.5±0.81	43.1±10.5	50.4±7.8	3.4±0.85	52.1±6.5	65.9±5.8	3.6±0.98	65.2±9.8	70.1 ±5.9
9	BOD_5 (ppm)	4.4±0.92	26.9±1.85	29.5±4.01	5.1±1.21	36.9±3.52	38.5±4.81	4.3±0.78	30.1±3.51	35.2 ±2.92
10	Ammonia N (ppm)	0.001±0.001	0.053±0.01	0.069±0.05	0.001±0.03	0.061±0.009	0.071±0.04	0.011 ±0.002	0.061±0.02	0.081 ±0.02
11	Nitrate N (ppm)	0.022±0.01	0.161±0.02	0.179±0.03	0.040±0.01	0.153±0.03	0.170±0.04	0.049±0.02	0.171±0.03	0.182 ±0.02
12	Nitrite N (ppm)	0.021±0.069	0.091±0.08	0.1±0.03	0.019±0.01	0.078±0.06	0.099±0.02	0.023±0.01	0.112±0.01	0.149 ±0.03
13	Total N (ppm)	0.07±0.02	0.92±0.21	1.32±0.54	0.09±0.01	1.12±0.36	1.79±0.61	0.11±0.04	1.22±0.28	1.75 ±0.75
14	Total P (ppm)	0.04±0.01	0.18±0.05	0.31±0.08	0.03±0.02	0.21±0.04	0.35±0.09	0.06±0.09	0.21±0.01	0.35 ±0.11
15	H_2S (ppm)	BDL	0.012±0.005	0.017±0.004	BDL	0.015±0.003	0.018±0.002	BDL	0.016±0.002	0.017 ±0.001

IW = Intake Water, PW = Pond Water, DW = Discharge Water, BDL= Below detection Level, * = values are significantly different (p≤0.05)

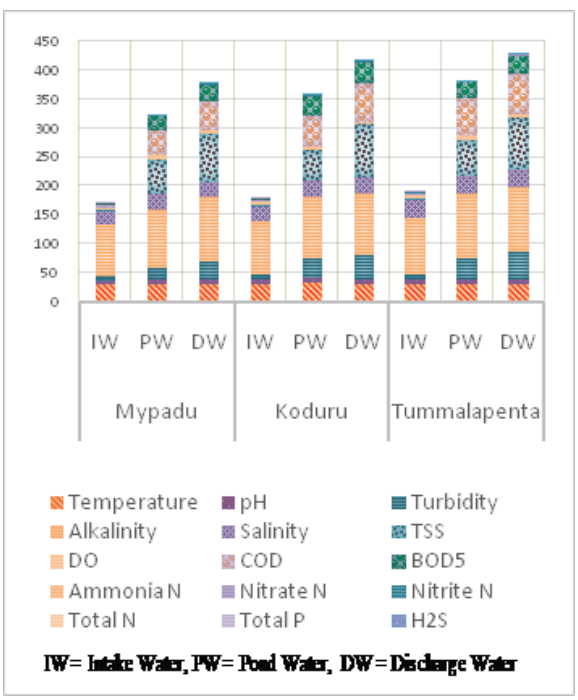

Figure 1: Water quality analysis at different places along Nellore coast

CONCLUSION:

Increased levels of the parameters were recorded in discharge water as compared to pond water in all the study areas. Though the levels of all the parameters under study were within the permissible limits, constant release may contaminate the nearby water bodies. Using the feed with minimum required amounts of nitrogen and phosphorous must be practiced. The best method for preventing the water quality problems in shrimp farming is to treat the waste water before releasing them into the surroundings. Constant monitoring of the water quality of nearby water bodies (including drinking water) must be done for sustainable shrimp culture.

REFERENCE

[1] APHA. (1992), "Standard methods for the examination of water and waste-water",. American Public Health Association, Washington, D.C. 18th.ed. | [2] ASTM (1986), "Annual Book of ASTM Standards American Society for Testing and Materials Water and Environment". Water and Environmental Technological Series Vol. 11-01.Water (I), Philadelphia, U.S.A. | [3] Boyd, C.E. (1989), "Water quality management and aeration in shrimp farming". Fisheries and allied aqua culture department. Auburn University, Alabama. (2).83. | [4] Chen. Jiann-Chu and Lei Shun-Chiang. (1990), "Toxicity of ammonia and nitrite to Penaeus monodon Juveniles", J . World Aquaculture Society. 2 l (4), 300-305. | [5] Chien Yew-Hu. (1992), "Water quality requirements and management for marine shrimp culture". Proceedings of the special session on shrimp farming world aquaculture Society, Baton Rouge, L.A, U.S.A. | [6] Joseph, K.O., Muralidhar, M., Gupta, B.P., and Krishnani, K. K. (2002), "Characterisation of intake, pond and outlet water of creek and Seawater based shrimp farms in Nellore district of Andhra Pradesh", Aquacult. 3 (I), 51-59. | [7] Kurian, C.V., and Sebastian, VO. (1994), "Prawns and prawn fisheries of India",4th edition, Hindustan publishing corporation (India), Delhi. | [8] Lee Nyanti., George Berundang ., and Ling Teck Yee. (2011), "Shrimp Pond Effluent Quality during Harvesting and Pollutant Loading Estimation using Simpson's Rule". International Journal of Applied Science and Technology. Vol. 1 No. 5. 208-213. | [9] MOEF Notification – "General standards for discharge of environmental pollutants part A- Effluents", 19th May, 1993. | [10] Obire, O., Ogan, A., and Okigbo, R. N. (2008), "Impact of fertilizer plant effluent on water quality". Int. J. Envir. Sci. Tech. (Iran). 5 (1): 107-118. | [11] Ramesh Reddy, P., Okigbo , R.N., Madhusoodan sai, A., and Radha, L. (2008), "Ground water pollution due to aquaculture in east coast region of Nellore district, Andhra Pradesh, India". African Journal of Environmental Science and Technology. 2 (3), pp. 046-050. | [12] Vidya Sagar Reddy., G., and Vijaya, C. H. (2014), "Protein Profiles of Selected Commercial Fresh Water Fishes of Nellore, India". International Journal of Scientific Research.Volume.3, Issue.4. | [13] Zakir Hossain. Md, Miss Wutjanun Muttitanon, Nitin K., Tripathi, and Mike Phillips. (2002). Monitoring shrimp farming development from the space: a RS and GIS approach in Kandleru creek area, Andhra Pradesh, India. Published in: (Map Asia.2002). http://www.fao.org/fishery/gisfish/cds_upload/1142609239465_Hossain_et_al_2002_208.pdf. |