QUALITY OF GROUND WATER IN THE VICINITY OF SHRIMP FARMS OF ANDHRA PRADESH AND TAMIL NADU

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ABSTRACT

In order to assess the quality of ground water adjacent to shrimp farms, a survey was conducted in coastal areas of Nellore district of Andhra Pradesh and South Arcot district of Tamil Nadu during August 1996 and March 1997, respectively. Water samples were collected from drinking water wells in villages at various distances from the farms and were analysed for total dissolved solids (TDS) and chloride concentration. The values of chloride and TDS content of bore well waters ranged from 410 to 4900 and 800 to 9600 mg/l, respectively in Nellore district. Only in one village of Nellore district, the drinking water contained chloride and TDS beyond limits permissible for potable water. In South Arcot district, chloride and TDS content of bore well water ranged from 198.8 to 1604.6 and 870.4 to 4121.6 mg/l, respectively. Only one bore well situated 500 m away from shrimp farm has potable water. Salinisation of drinking water in coastal villages could not be totally attributed to shrimp farming because salinisation of drinking water in coastal villages is known to occur much before the initiation of shrimp farming.

KEY WORDS: Ground water quality, Total dissolved solids, Chlorides.

INTRODUCTION

Brackishwater aquaculture in India essentially comprised of shrimp culture is an age-old practice in low-lying inter-tidal areas of West Bengal and Kerala. With the advent of scientific shrimp farming, the tide-fed traditional culture was changed to pump-fed extensive and semi-intensive systems of farming in the elevated areas. Such shifting of the systems resulted in shrimp farms being located near agricultural lands in nearby villages. Because of this, shrimp farming was accused of leading to soil and ground water salinisation.

The present study was therefore undertaken to assess the impact of coastal aquaculture on the quality of ground water in a few village bore wells around shrimp farms in Nellore district of Andhra Pradesh and South Arcot district of Tamil Nadu.

MATERIALS AND METHODS

A survey of coastal shrimp farms in Nellore district of Andhra Pradesh and South Arcot district of Tamil Nadu was conducted during August 1996 and March 1997, respectively. The farms in Nellore district are both seawater based and creek/canal water based, where as the farms in south Arcot district mainly depend on creek/canal water as the source. The seawater based farms draw water from the sea through long concrete jetties with length varying from 150 to 1500 m. The extent of the farms in both the districts based on the holding size is presented in Table 1. A total of 4,366.35 ha of brackishwater area was under culture in Nellore district of Andhra Pradesh out of the total available area of 13,915 ha. Out of 816 farms, only 10 farms with a total area of 483 ha are seawater based while the remaining 806 farms with an area of 3,882 ha are creek/canal water based. In South Arcot district, about 60% of the farms are below 2 ha. A total area of 614.4 ha is under culture and corporate bodies with large water spread area are not seen in this district.

The present study areas include six villages - four seawater based farms (Venkateswarapattupalem Gavallapalem, Pattapalem, Thupilipalem - 3 bore

wells from each village) in Nellore district and two creek /canal water based farms (Subbauppalavadi - 1 bore well, Teethampalayam - 4 bore wells) in South Arcot district. Drinking water sources were selected randomly in these villages to assess the quality of ground water. Samples were collected in triplicate from 17 bore wells adjacent to shrimp farms at various distances in both the districts. Water samples were analysed for two important parameters namely total dissolved solids (TDS) and chloride content (APHA, 1989). Since earlier studies (Joseph *et al.*, 1995) have indicated that the water quality characteristics such as pH, turbidity and alkalinity of well waters in coastal shrimp farming areas are generally within permissible range, only two important indicators of drinking water quality viz., TDS and chloride were chosen for the present study. Standard deviation and correlation between distance from farm and water quality variables were calculated by statistical analysis (Gomez and Gozem, 1984).

RESULTS AND DISCUSSION

The average concentration of total dissolved solids (TDS) and chloride content in bore well waters of the Nellore district ranged from 800 to 9,600 mg/l and 410 to 4,900 mg/l, respectively (Table 2). The TDS and chloride concentrations registered a decreasing trend as the distance increases from the farm. Considering the permissible levels (Rangwala, 1990) of TDS (500-1500 mg/l) and chloride (200-600 mg/l), only five bore wells (two bore wells at Gavallapalem and Thupilipalem villages and three at Pattapalem village) are not suited for potable purpose. In all the bore wells, though there was a slight increase in TDS and chloride levels closer to the farm, they are all within the tolerable limits. In the present study, in most of the villages of Nellore district, the average distance between the farm and the village ranges from 500 m to 1.5 km.

In south Arcot district average TDS and chloride content of bore well waters ranged from 870.4 to

Table 1. Classification of shrimp farm holdings in Nellore and South Arcot districts.

Type of holding	Nellore district		South Arcot district	
	No. of farms	Total area (ha)	No. of farms	Total Area (ha)
Corporate bodies	16	1126.82	-	-
Above 5 ha	95	1621.6	19	292.6
Between 2 & 5 ha	144	662.4	40	168.4
Less than 2 ha	561	955.53	85	153.4
Total	816	4366.35	144	614.4

Table 2. Quality of drinking water in bore wells nearer to shrimp farms of Nellore district, Andhra Pradesh (Average values with standard deviation)

Village name	Distance from farm (m)	Total Dissolved Solids (mg/l)	Chloride (mg/l)
Venkateswarapattupalem	200	1171±19.27	500 ±7.88
	350	1060±11.36	480±9.92
	500	960±15.52	420±4.55
Gavallapalem	100	1650±7.42	680±8.78
	200	868±12.72	460±4.09
	500	800±9.93	410±5.05
Pattapalem	200	9600±4.14	4900±16.40
	400	4749±5.04	1800±12.95
	600	4012±8.01	1600±11.84
Thupilipalem	100	1700±4.58	700±5.68
	350	1200±5.12	520±5.87
	500	1010±8.04	460±2.53

4121.6 mg/l and 198.8 to 1604.6 mg/l, respectively (Table 3). Only one bore well situated in Teethampalayam village at a distance of 500 m away from the shrimp farm has potable water. The salinisation of ground water in coastal villages is known to occur much before the initiation of shrimp farming. Shrimp culture is practiced mostly in salinated areas where, practically no fresh water sources exist nearby. The hydrology of the coastal areas has been reported to be of ground water of high salinity and lack of adequate fresh surface or ground water much before the advent of scientific shrimp farming. Seawater back flow brings in considerable amount of dissolved salts and contami-

nates the local water bodies (Bhattacharya and Singh, 1999; Singh, 1999). Ramnad district in Tamil Nadu is a typical example where drinking water suitability has been an acute problem for centuries. The Government of Tamil Nadu initiated steps for installing desalinisation plants in the district for making available drinking water even before the advent of present system of shrimp farming in the district (Chandran, 1998). In Nellore district, almost all the farms visited during the survey have made arrangements for the supply of drinking water to nearby villages as a welfare measure. In some shrimp farms good drinking water is available with in the farm complex itself.

Table 3. Quality of drinking water in bore wells nearer to shrimp farms of South Arcot District, Tamil Nadu (Average values with standard deviation)

Village name	Distance from farm (m)	Total dissolved solids (mg/l)	Chloride mg/l
Subbauppalavadi	200 m	4121.6 ± 11.4	1604.6 ± 6.52
Teethampalayam	200 m	2163.2 ± 9.67	667.40 ± 2.38
	200 m	2617.6 ± 8.66	852.0 ± 4.80
	200 m	3104.0 ± 8.51	1093.4 ± 4.39
	500 m	870.4 ± 6.73	198.8 ± 3.30

Table 4. Correlation matrix between water quality variables and distance of bore wells away from shrimp farms

Village/ Variable	Distance from farm (m)	Total Dissolved Solids (mg/l)	Chloride (mg/l)
ANDHRA PRADESH			
Venkateswarapattupalem			
Distance from farm (m)	1		
Total Dissolved Solids (mg/l)	-0.999	1	
Chlorides (mg/l)	-0.961	0.952	1
Gavallapalem			
Distance from farm (m)	1		
Total Dissolved Solids (mg/l)	-0.743*	1	
Chlorides (mg/l)	-0.808*	0.995	1
Pattapalem			
Distance from farm (m)	1		
Total Dissolved Solids (mg/l)	-0.920	1	
Chlorides (mg/l)	-0.892	0.997	1
Thupilipalem			
Distance from farm (m)	1		
Total Dissolved Solids (mg/l)	-0.993	1	
Chlorides (mg/l)	-0.990	0.999	1
TAMIL NADU			
Teethampalayam			
Distance from farm (m)	1		
Total Dissolved Solids (mg/l)	-0.916	1	
Chlorides (mg/l)	-0.887	0.997	1

All the correlations are significant at $P \leq 0.05$
* - Not significant (($P \geq 0.05$)

Correlation matrix among distance of bore wells away from the farms, TDS and chloride content of bore well waters is given in Table 4. In Subbauppalavadi village of South Arcot district, correlations were not calculated being samples were collected from one bore well only. In all the villages TDS and chloride contents were negatively correlated with distance of bore wells away from the farm. However this correlation was not significant in bore well waters of Gavallapalem village ($P \geq 0.05$). Chloride content and TDS concentration had significant positive correlation ($P \leq 0.05$) in all bore well waters.

Shrimp farming has been targeted as the cause for salinisation of drinking water wells in costal areas, which can't be true in all the circumstances. The quality of bore well waters before the initiation of shrimp farms is not well documented. According to a report submitted by NEERI to MPEDA after a detailed study and analysis of the issue, there is no salinisation of drinking water wells because of shrimp farms as these farms mostly remain in hard clayey soil and the seepage is almost nil or in its minimum percentage (Chandran, 1998). Many times the range and severity of this adverse effect has been exaggerated, possibly due to the high visibility of the aquaculture sector, failure to distinguish between actual and hypothetical hazards and inadequate coverage of its beneficial impact (Jerald, 1996).

CONCLUSION

Potable water is a genuine basic need of any human inhabitation and care should be taken to see that this basic need is not curtailed in any way. Monitoring the quality of drinking water source adjacent to shrimp farm areas before and during culture period should be made mandatory for all new projects which will throw light on the effect if any, if shrimp farming in salinisation of drinking water wells.

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