



## Survey of Water Parameters in Rajgarh City, Rajasthan for Shrimp Farming

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### Abstract

Different water quality parameters of shrimp ponds were measured from various survey sites in Rajgarh, Rajasthan. The different water quality parameters estimated were Salinity, Carbonate, Bicarbonate, Total alkalinity, Total Hardness, pH, Potassium, Calcium, Calcium hardness and Magnesium. One factorial analysis through Completely Randomized Design (CRD) was applied to analyse the data.

**Keywords:** Minerals, Pond, Quality, Shrimp, Water Parameters

### Introduction

India is cashing on demand by increasing the area under shrimp aquaculture. During the year 2019-20, the total shrimp production in India was 6,39,896 tons and shrimps of value Rs. 34152.03 crores were exported from India (Handbook of Fisheries Statistics, 2020). Penaeid shrimps are found primarily in four marine basins: the Indo-West Pacific, the eastern Pacific and the eastern and western Atlantic (Holthuis, 1980; Dall *et al.*, 1990). White legged shrimp (*Litopenaeus vannamei*) farming in India is primarily centered in coastal states ranging from Gujarat to West Bengal; however, the majority of critical inputs like feed, seed and other farm inputs are produced in Tamil Nadu and Andhra Pradesh (TNAU, 2014) from where they are transported to other shrimp farming states, including the recently emerging inland saline aquaculture areas in Haryana, Punjab and Rajasthan.

### Materials and Methods

The physico-chemical parameters of water collected from the ten different sites of Rajgarh, Rajasthan shrimp culture ponds (Fig. 1) were estimated on monthly basis during the study period and the data was pooled to find a mean value of each parameter during the study period. pH, Salinity, Carbonate, Bicarbonate, Total alkalinity, Total hardness, Calcium hardness, Calcium, Magnesium, Potassium, were studied following the standard methods outlined by APHA (1998) (Fig. 3). The data was analysed using OPSTAT software and One factorial analysis through Completely Randomized Design (CRD) was applied to analyse the data.

### Results and Discussion

The water parameters of ten samples from Rajgarh, Rajasthan are represented in table 1. S1, S2 and so on represents the water sample from site 1, site 2 and so on. The table revealed that optimum salinity for shrimp farming should range between 5-25 ppm. The range of salinity of the samples was found to lie between 15-24 ppm. The salinity demands and tolerance to salinity fluctuations may change throughout penaeid shrimp life cycle. According to Boyd (1990) adult shrimp reach maturity, mate and spawn in water of salinities ranging from 28 to 35 ppt. Shrimp (Fig. 2) can withstand a wide range of temperatures, 15°C is the lower lethal limit and the upper limit of temperature is around 35°C - 40°C for short durations. Shrimp can survive temperatures as low as 24°C and as high as 32°C (90°F), temperatures outside of this range cause poor growth and stress (Boyd, 1990).

The optimum concentration of carbonate and bicarbonate should lie between 10-40 ppm and 80-100 ppm respectively. The survey revealed that most of the farms were having these parameters in the range of 0-54 ppm and 116-370 ppm. Highest total alkalinity estimated was 360 ppm at tenth farm which was quite high than optimum range of 100-200 ppm. The optimum concentration of carbonate and bicarbonate should lie between 10-40 ppm and 80-100 ppm respectively. The survey revealed that most of the farms were having these parameters in the range of 0-54 ppm and 116-370 ppm. Highest total alkalinity estimated was 360 ppm at tenth farm which was quite high than optimum range of 100-200 ppm.

Table 1: Water parameters of different survey sites

Similarly. Total hardness in water samples was also estimated. All the water samples showed nearly adequate range except at farm three where total

Water Parameters	Optimum range	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10
Salinity (ppt)	(5-25)	16	15	24	16	20	21	20	15	10	20
Carbonate (ppm)	(10-40)	24	44	24	24	6	0	0	38	0	54
Bicarbonate (ppm)	(80-100)	212	400	116	182	162	178	186	370	280	306
T. Alkalinity (ppm)	(100-200)	236	444	140	206	168	178	186	408	280	360
T. Hardness (ppm)	(2000-5000)	4620	2440	5380	4160	3840	4540	4680	2620	2760	3680
Ca Hardness (ppm)	(400-2000)	980	480	880	1180	1380	1320	1260	480	760	540
Calcium (ppm)	(1:3-1:4)	392	192	352	472	552	528	504	192	304	216
Magnesium (ppm)		884	476	1093	724	840	782	831	520	486	763
Potassium (ppm)	(Salinity X 6)	81.6	6.3	130.2	122.4	108	118.8	126	8.4	18.3	154.5
pH	(7.5-8.5)	8.2	7.8	8.4	8.2	8.2	8.4	8.2	7.8	7.8	8.4

hardness was slightly higher (5380 ppm) than the recommended range (2000-5000 ppm). Boyd (2002) and Ferreira *et al.* (2011) found that alkalinity concentrations should not go beyond 140 mg/l.

The mineral content in water was also estimated. Calcium and magnesium should be in a ratio of 1:3-1:4 for proper shrimp growth. It was found that the most farms were deviating from this ratio. The Calcium hardness of different samples ranged between 480 ppm to 1380 ppm. According to Wurts and Durborow (1992), calcium is essential in the moulting process of shrimp and it can influence the hardening of the newly formed shell. A preferable range of calcium tolerance by shrimps is 75 to 200 mg/l CaCO<sub>3</sub> (Wurts and Durborow, 1992).

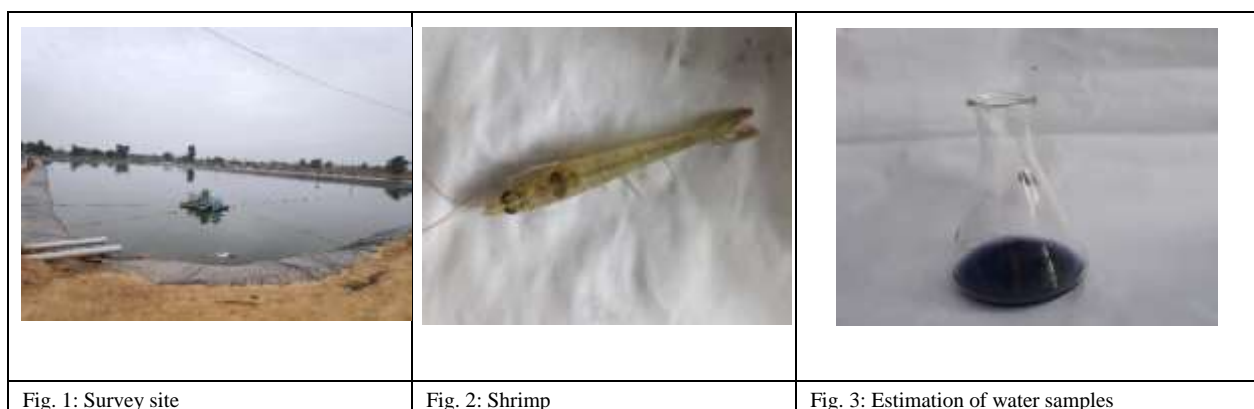


Fig. 1: Survey site

Fig. 2: Shrimp

Fig. 3: Estimation of water samples

The potassium content for adequate shrimp growth should be at least six times of the salinity. Similar to other water parameters pH is also an important factor whose optimum range is 7.5-8.5. Very acidic (pH <6.5) or very basic (pH >10.0) water is harmful for gills of shrimps and reduces the growth rates (Soewardi, 2007).

Table 2 revealed that the mean Salinity (ppt), Carbonate (ppm), Bicarbonate (ppm), Total alkalinity (ppm), Total hardness (ppm), Ca. hardness (ppm), Calcium (ppm), Magnesium (ppm), Potassium (ppm) and pH was 17.70, 21.40, 239.20, 260.60, 3872.00, 926.00, 370.40, 739.90, 87.45 and 8.14. Also standard error observed for each water parameter has been represented in table 2 (p=0.05; C.D= 307.86) (Table 2).

Table 2: Mean of various water parameters

Water Parameters	Mean	S.E.
Salinity (ppt)	17.70	1.27
Carbonate (ppm)	21.40	6.22
Bicarbonate (ppm)	239.20	29.97
T. Alkalinity (ppm)	260.60	34.11

<b>T. Hardness (ppm)</b>	3872.00	314.61
<b>Ca Hardness (ppm)</b>	926.00	111.40
<b>Calcium (ppm)</b>	370.40	44.56
<b>Magnesium (ppm)</b>	739.90	62.25
<b>Potassium (ppm)</b>	87.45	17.67
<b>pH</b>	8.14	0.08
<b>C.D.</b>	307.86	
<b>SE(m)</b>	109.39	
<b>SE(d)</b>	154.70	
<b>C.V.</b>	52.87	

## Conclusion

The survey revealed the range of different water parameters at Rajgarh, Rajasthan. Survey sites like 8,9 and 10 have some of the water parameters in inadequate range which might become the reason for low shrimp survival and hence less farmer's income consequently.

## References:

- APHA (American Public Health Association). (1998). In: Clescert, L., Greenberg, A., Eaton, A. (Eds.), *Standard Methods for the Examination of Water and Wastewater*. 20<sup>th</sup> edition. Washington, USA.
- Boyd, C. (2002). Management of bottom soil condition and pond water and effluent quality. *In: Lim, C., Webster, C.D. (Eds.), Tilapias: Culture, Nutrition, and Feeding*. The Haworth Press, Binghamton, New York.
- Boyd, C.E. (1990). *Water Quality in Ponds for Aquaculture* by Auburn University, Auburn, Alabama, 482 pp.
- Dall, W., Hill, B.J. and Rothlisberg, P.W. and Staples, D.J. (1990). The Biology of *Penaeidae*. *Advances in Marine Biology*, 27, 1-484.
- Ferreira, N., Bonetti, C. and Seiffert, W. (2011). Hydrological and Water Quality Indices as management tools in marine shrimp culture. *Aquaculture (Elsevier)*, 318, 425-433.
- Handbook on Fisheries Statistics. (2020). Department of Fisheries Ministry of Fisheries, Animal Husbandry & Dairying Government of India, New Delhi.
- Holthuis, L.B. (1980). Shrimps and prawns of the world. An annotated catalogue of species of interest to fisheries. FAO, Rome, 271 pp.
- Soewardi, K. (2007). The continuous pond culture management. *Aquaculture*, 21, 32-41.
- TNAU, 2014. Agritech Portal. Accessed on 11.1.23.
- Wurts, W.A. and Durborow, R.M. (1992). Interactions of pH, carbon dioxide, alkalinity and hardness in fish ponds. *Southern Regional Aquaculture Center*, Publication No. 464.