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Research Article

COMPARATIVE STUDY ON THE PHYSICOCHEMICAL CHARACTERISTICS OF *PENAEUS MONODON* CULTURE PONDS ALONG THE SOUTH EAST COAST OF TAMIL NADU

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ABSTRACT

Marine shrimp farming is a century-old practice in many Asian countries. Until a decade ago, this commodity was generally considered a secondary crop in traditional fish farming practices. In the traditional farming system, the ponds are stocked with fry either collected from the wild or concentrated through tidal water entering the ponds. Some improvements of the traditional farming methods have been made in the past years. In Aquaculture quality of water is one of the most important factors. The various physic chemical parameters of the unaffected and outbreak shrimp culture ponds were analysed. The parameters such as the pH and COD were significantly high ($p \geq 5$). But the salinity, DO, BOD, Calcium, Chloride, nitrate, phosphate & iron of the unaffected and outbreak ponds were significantly low ($p \leq 5$). Bacteria analysis of the unaffected ponds was very low but the outbreak ponds showed enormously higher counts. The blue green algae and Diatoms of unaffected and outbreak ponds were found to be significantly low ($p \leq 5$).

Keywords: Aquaculture, Physicochemical, Microbiological, *Penaeus monodon*, Culture Ponds

1. INTRODUCTION

Aquaculture is now the fastest growing food producing sector in the world [1]. Prawn fishery has advanced very much in several countries. In Aquaculture, quality of water is one of the most important factors. Aquaculture may be defined as husbanding aquatic organism in a controlled environment with relevant propagation method and rearing them in aquatic medium. Adverse environmental parameters can have direct or indirect effect on the growth. Changes in this environmental equilibrium in the shrimp becoming stressed the host and virulent pathogen. Depending on the nature and severity, the disease may cause mass mortality, reduced growth and make the cultured shrimp unsuitable for human consumption.

Diseases in hatcheries and farms are being increasingly recognized as major hurdles to successful and profitable industry. In majority of the farms, the intake and discharge are channeled to the same canal or creek or back water. This has created serious health problems in many hatcheries and farms in hatcheries high stocking densities, live feed use, water quality, disease carrier brood stock etc., are some of the important factors favoring outbreak of microbial diseases. Among the physicochemical parameters salinity, pH and dissolved oxygen are the important factors for the growth and survival of the shrimp. Asch and Sneca [2] studied water quality management in aquaculture. The tiger shrimp *Penaeus monodon* will survive and grow well in lower salinity in comparing with other penaeids. Boyd [3] discussed the relationship between CO_2 alkalinity, pH and water quality of aquaculture ponds. D'Souza *et al*. [4] reported that the various physicochemical parameters are associated with diseases in fish and shrimps in Goanestuaries. Rajasekar [5] analyzed the physico chemical characters of Vellar estuary in relation to shrimp farming. Singaravel *et al*. [6] analyzed the quality of irrigation water in the coastal areas of Cuddalore and Nagapattinam. Hence an attempt has been made to study the physic chemical characters and microbial flora of the normal and outbreak ponds along the South East Coast of South India.

2. MATERIAL AND METHODS

The water samples were collected from the culture ponds along the East coast of South India (Rameshwaram 9.17°N; 79.22°E to Cuddalore 11.43°N; 79.47°E) Tamilnadu from two crop seasons (2019). The samples for DO, BOD and COD were collected just below the surface water in order to avoid direct

contact with air. The temperature was recorded by using the Celsius Thermometer (Jensen Deluxe). The pH was recorded using digital pH meter. DO and BOD were estimated using Winkler's method [7], COD was estimated by using standard procedures. Salinity, Carbonate, Bicarbonate, Nitrate, Chloride, Calcium, Phosphate and iron were estimated [8]. *Vibrio* analyses were performed [9]. The isolates were subjected to routine bacteriological procedures. The results were compared with Bergey's manual of Determinative bacteriology and a set of keys for biochemical identification of environmental *Vibrio spp.* [11]. The isolates were characterized, enumeration of diatom and blue green algae were also performed.

3. RESULTS

The various physico chemical parameters of the unaffected and affected shrimp culture ponds were analyzed. The observations of the present study were represented in Table 1 and 3. The variations in pH during the study period were significantly high. In the unaffected ponds the minimum pH recorded was 7.4±0.1while the minimum pH was recorded in November, December and January 2019 (Fig. 1). But in the affected ponds the temperature fluctuated from 27.1±0.3 to 292±0.5°C (Fig. 2). The variation during the study periods was significantly low (F≤5). The salinity of the unaffected and affected ponds showed very narrow range of fluctuation. The variations between the affected and unaffected ponds were significantly low (F≤5) (Fig. 3). The bacterial counts of yellow and green colour colony of affected ponds were enormously high rate of bacteria (Table 2 and 4). The blue green algae and Diatoms counts were found to be significantly low (F≤5).

Table 1: Physico Chemical Parameters of the Unaffected Ponds

Month	Physico-chemical Parameters (mg/L^{-1}) (M±SD)							
	DO	BOD	COD	Ca	Cl_2	PO_4	NO_4	Iron
April	5.35±0.2	1.35±0.1	2.62±0.2	532.1±4.1	521.4±0.13	542.1±3.1	214.3±2.3	0.2±0.03
May	5.36±0.2	1.37±0.1	2.67±0.2	531.3±4.1	521.4±0.14	537.2±2.1	215.2±1.3	0.2±0.03
June	5.36±0.1	1.37±0.2	2.63±0.2	534.1±4.2	520.4±0.13	531.2±2.2	217.3±1.7	0.2±0.03
July	5.36±0.2	1.39±0.1	2.62±0.1	535.2±4.1	520.3±0.13	532.6±2.6	219.3±1.9	0.2±0.03
August	5.31±0.1	1.39±0.1	2.63±0.1	536.2±4.1	520.4±0.13	535.6±2.7	217.3±1.8	0.2±0.01
October	5.30±0.2	1.37±0.1	2.63±0.2	536.2±4.1	520.4±0.15	536.2±2.7	218.2±1.1	0.2±0.01
November	5.30±0.1	1.39±0.1	2.63±0.1	536.1±4.2	520.4±0.15	537.1±2.7	219.2±1.3	0.2±0.01
December	5.20±0.1	1.38±0.1	2.67±0.2	536.1±4.2	520.4±0.16	536.2±2.6	220.1±1.3	0.2±0.01

Values are expressed Mean ± Standard Deviation; n=6

DO - Dissolved Oxygen; BOD - Biochemical Oxygen Demand; COD - Chemical Oxygen Demand; Ca - Calcium; Cl_2- Chlorine; PO_4 – Phosphorous; NO_4 – Orthonitrate

Table 2: Microbial Parameters of the Unaffected Ponds

Month	No of Yellow Colonies	No of Green Colonies	No of Luminescent Colonies	BGA (%)	Diatom (%)
April	TFC	TFC	-	2.1±0.2	2.2±0.1
May	TFC	TFC	-	2.1±0.2	2.2±0.2
June	TFC	TFC	-	2.1±0.3	2.2±0.2
July	37.3±1.3	TFC	-	2.1±0.1	2.2±0.1
August	33.2±1.2	TFC	-	2.1±0.1	2.2±0.1
October	31.2±1.3	TFC	-	2.1±0.1	2.2±0.1
November	31.3±1.2	TFC	-	2.1±0.1	2.2±0.1
December	31.2±1.3	TFC	-	2.1±0.2	2.2±0.1

Values are expressed Mean ± Standard Deviation; n=6,

BGA - Blue Green Algae; TFC – Total Fungal Count

Table 3: Physico Chemical Parameters of the Affected Ponds

Month	Physico-chemical Parameters (mg/L^{-1}) (M±SD)							
	DO	BOD	COD	Ca	Cl_2	PO_4	NO_4	Iron
April	5.539±0.39	1.39±0.22	4.868±0.23	564.3±4.2	532.6±7.1	583.2±0.32	237.4±7.2	0.31±0.02
May	5.54±0.39	1.38±0.23	4.867±0.22	562.3±4.1	531.6±7.3	584.3±0.31	238.4±7.1	0.32±0.02
June	5.541±0.39	1.39±0.24	4.868±0.23	567.2±4.2	532.7±7.1	582.3±0.32	236.4±2.1	0.31±0.02
July	5.543±0.39	1.38±0.23	4.867±0.21	568.6±5.1	533.6±8.1	592.3±0.35	239.2±2.2	0.31±0.03
August	5.544±0.39	1.39±0.24	4.868±0.22	569.2±5.2	534.6±7.3	592.4±0.41	239.4±2.1	0.32±0.03
October	5.539±0.34	1.37±0.22	4.867±0.21	567.6±6.9	539.3±9.4	593.2±0.41	232.2±2.4	0.31±0.02
November	5.538±0.33	1.36±0.21	4.866±0.25	567.3±6.9	537.2±9.2	594.2±0.41	237.6±2.1	0.32±0.02
December	5.537±0.34	1.37±0.22	4.865±0.21	563.2±6.1	537.2±9.3	593.1±0.4	235.2±2.1	0.31±0.02

Values are expressed Mean ± Standard Deviation; n=6

DO - Dissolved Oxygen; BOD - Biochemical Oxygen Demand; COD - Chemical Oxygen Demand; Ca - Calcium; Cl2- Chlorine; PO4 – Phosphorous; NO4 - Orthonitrate

Table 4: Microbial Parameters of the Affected Ponds

Month	No. of Yellow Colonies	No. of Green colonies	No. of Luminescent Colonies	BGA (%)	Diatom (%)
April	243.2±1.2	225.2±1.3	261.3±1.4	1.2±0.2	1.3±0.3
May	173.4±1.3	142.5±1.4	163.6±1.5	2.2±0.2	2.3±0.3
June	45.2±1.4	39.5±1.5	76.6±1.6	2.4±0.3	2.5±0.4
July	TFC	TFC	TFC	2.4±0.4	2.6±0.5
August	82.6±1.5	79.5±1.4	105.4±1.5	1.6±0.5	1.7±0.6
October	245.3±1.3	272±1.2	TNC	1.4±0.3	1.5±0.4
November	TNC	TNC	TNC	1.2±0.2	1.4±0.3
December	TNC	TNC	TNC	1.2±0.1	1.3±0.2
April	TNC	TNC	TNC	1.2±0.1	1.3±0.2

Values are expressed Mean ± Standard Deviation; n=6

BGA - Blue Green Algae; TFC – Total Fungal Count; TNC – To Neumerous Count

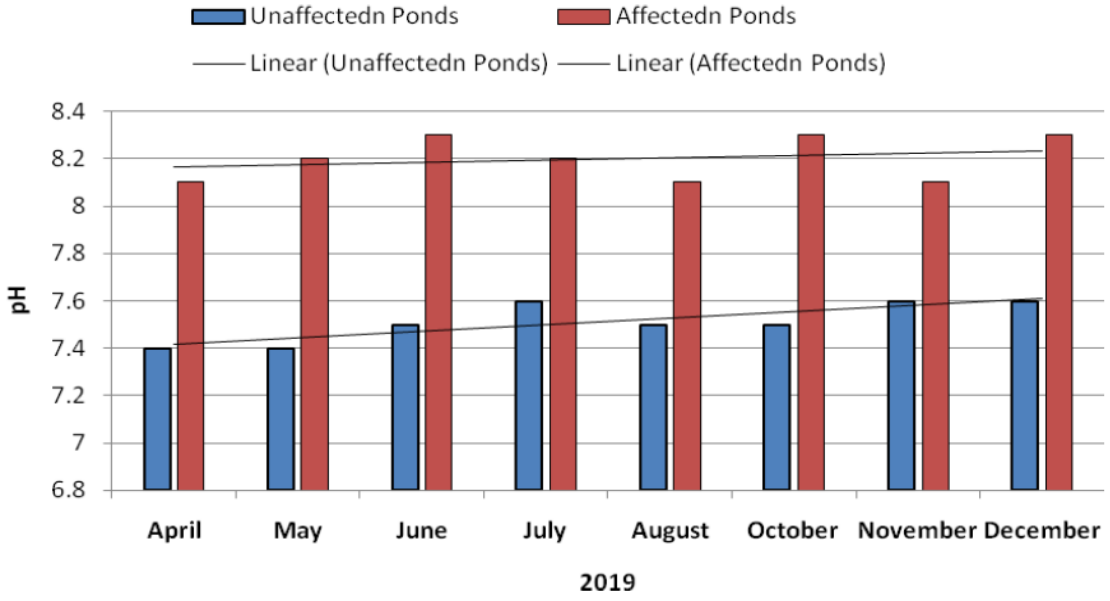

Fig. 1: pH of study period in unaffected and affected ponds water

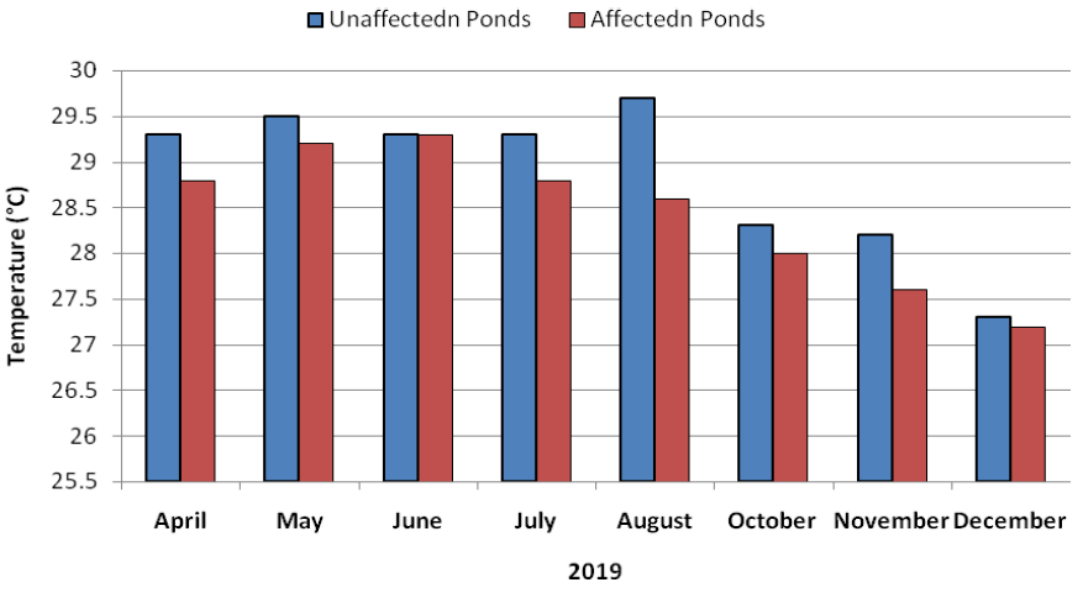

Fig. 2: Temperatures of study period in unaffected and affected ponds water

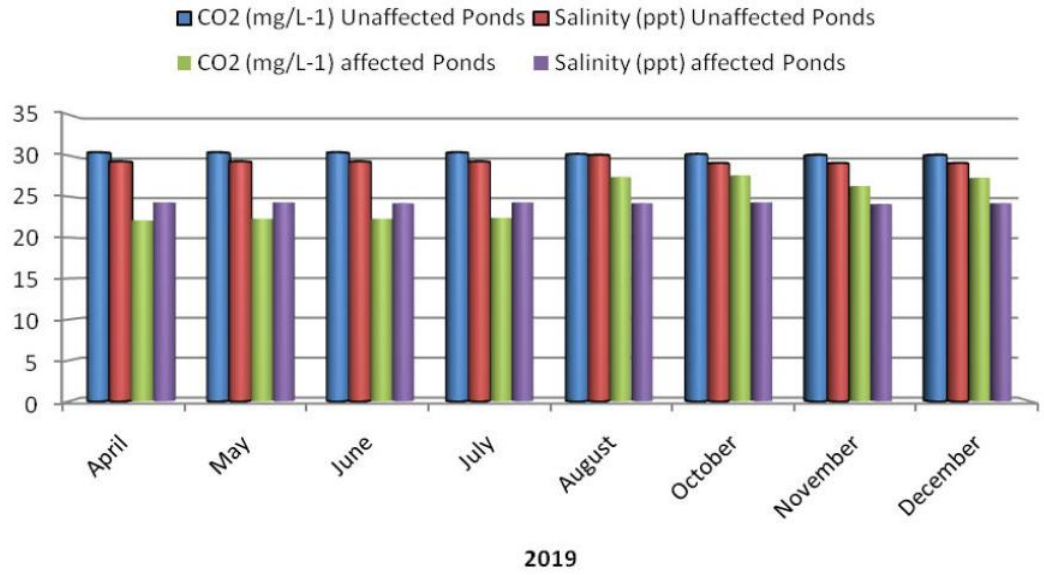

Fig. 3: CO_2 and Salinity of study period in unaffected and affected ponds water

4. DISCUSSION

Culture of aquatic organisms such as fishes, crustaceans, mollusks and echinoderms in selected water body, their harvest and trade is known as aquaculture [12]. In aquaculture practice, quality of water is one of the important factors [13]. Adverse environmental conditions can have direct or indirect effect on the growth of aquatic organisms [14]. The various physic-chemical parameters such as temperature, salinity, DO, NH_3 urea, turbidity, productivity of water, sunlight, daylength, rainfall, wind flow and season play an important role in growth and survival of the shrimp. Asch and Seneca [2] and Sudhakara rao [15] described that a complete understanding of the relationship between quality of water and aquatic productivity is essential for growth and production. The changes in salinity level showed changes in food intake and growth of *P. monodon* [16]. Boyd [3] observed that changes in CO_2 and pH influence the survival and food intake. Chakraborthi and Ravichandran [19] suggested that the optimum temperature increases the survival and growth of *P. monodon*. Suboptimal temperature affects the input

of feed, food conversion ratio, growth and survival [17]. The salinity is an abiotic factor having remarkable influence on the growth of shrimp [18]. The optimum salinity for *P. monodon* was 15 to 20 ppt in these salinity the growth rate and production was more [19; 20]. Shailaja and Rengarajan [21] observed the pH influences the growth and metabolism of the shrimp. Kenkre and D'Souza *et al.* [14] reported that the changes in the physic chemical characters cause diseases in the Goan estuaries. Diana *et al.* [22] reported that the alkalinity potentially limits the production. The increase in level of BOD of the affected ponds showed the possible rate of contamination [3, 23, 24].

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