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Role Of Stocking Densities On Growth Of *Litopenaeus Vannamei* In Low And High Saline Ponds Of Second Crop During 2018 From West Godavari District, Andhra Pradesh, India.

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ABSTRACT

The present study was aimed to establish the information on the growth rates of *L. vannamei* for one crop in ponds with low saline with low stocking, low saline with high stocking and high saline with low stocking, high saline with high stocking densities. The average values of pH, salinity, dissolved oxygen, ammonia and temperature in ponds with low saline and low stocking density were 7.92, 5, 5.4, 0.44 and 28.5 respectively. Whereas in ponds with low saline and high stocking density were 7.91, 6, 4.6, 1.0, and 28.9. Similarly the average values of pH, salinity, dissolved oxygen; ammonia and temperature in ponds with high saline and low stocking density were 8.31, 20, 4.9, 0.61, and 28.6 respectively. Whereas in ponds with high saline and high stocking density were 7.89, 18, 5.13, 0.66 and 28.2. It is evident from the present results that, the stocking density has inverse proportion with the growth. Low stocking density favours the production. In contrary high stocking density leads to lower the production rate.

Keywords: Stocking density, production, *L. vannamei*, salinity, Average weekly growth (AWG), West Godavari.

INTRODUCTION:

Overview of the Indian Fisheries Sector

Indian Fisheries Sector-Current Scenario:

India is the third largest fish producing country in the world and accounts for 7.96 percent of the global production. The total fish production during FY 2022-23 is estimated at 16.25 MMT with a contribution of 12.12 MMT from Inland sector and 4.13 MMT from Marine sector. The annual average growth rate in the Fisheries sector has been 7% over the last five years. The Fisheries sector plays an important role in the national economy and the share of Fisheries sector in the total Gross Value Added (GVA), at Constant prices, in 2022-2023 is estimated at Rs. 1,37,716 Crores that constitutes about 1.09 percent of the total national GVA and 6.72 percent of agricultural GVA Fisheries and aquaculture continue to be an important source of food, nutrition, income and livelihood to millions of people. The fisheries sector of India has shown an impressive growth rate of 9.03% (Constant Price: 2011-12) during the year 2015-16 to 2020-21. During FY 2021-22, export of marine products stood at 1.37 MMT and valued at Rs. 57,586.48 Crores (USD: 7.76 billion) with an impressive average annual growth rate of about 10% in recent years. As for overseas markets, USA continued to be the major importer of Indian seafood with an import worth USD 3371.66 Million, accounting for a share of 43.45 percent in terms of US dollar value.

In 2018, total fisheries potential of India was estimated at 22.31 MMT consisting of the Marine Fisheries potential at 5.31 MMT and the Inland Fisheries potential at 17 MMT. India is also a major producer of fish through Aquaculture and ranks second in the world after China. Inland fish production constitutes about 75 percent of the total fish production of the country. The fish production in the country has shown continuous and sustained increment since independence. During 2021-22, 77 percent of Marine Fisheries potential and 71 percent of the Inland Fisheries potential have been harnessed. Fish being an affordable and rich source of animal protein, is one of the healthiest options to mitigate hunger and nutrient deficiency. The sector has immense potential to double its exports. Thus sustained and focused attention is given to the fisheries sector by the Union Government through policy and financial support to accelerate its development in a sustainable, responsible, inclusive and equitable manner. India is also a major producer of fish through Aquaculture and ranks second in the world after China. Inland fish production constitutes about 75 percent of the total fish production of the country and annual growth rate of production has also been high. The fish production has increased from 5.66 MMT in 2000-01 to 8.67 MMT in 2011- 12 and further to 16.25 MMT in 2021-22. A shift from capture fisheries to aquaculture has been observed in Inland Fisheries during the last two and a half decades. Freshwater aquaculture with a share of 34 percent in Inland Fisheries in mid 1980 has increased to

about 76 percent in recent years.

Balakrishnan *et al.,* (2011) studied about the growth of cultured white leg shrimp *L. vannamei* in different stocking density from Bhimavaram, West Godavari district, Andhra Pradesh. Suriya *et al.,* (2016) reported about the stocking density, survival rate and growth performance of *Litopenaeus vannamei* in different cultured shrimp farms from Cuddalore District, Tamil Nadu. The optimal stocking density varies depending on the farm system and management practices. Stocking density range 1-3 shrimp/m^2 in extensive, 10-50 shrimp/m^2 in semi-intensive and up to 160 shrimp/m^2 in intensive farming systems. Stocking density is inversely proportional to shrimp growth. Therefore production is optimized by using appropriate stocking density for each farm.
The purpose of the present study is to estimate the growth rates of *L. vannamei* in low and high saline ponds with low and high stocking densities from the culture ponds of West Godavari district, Andhra Pradesh, India.

MATERIAL AND METHODS:

Description of the Study Area

Andhra Pradesh lies between 12°41' and 19.07°N latitude and 77° and 84°40'E longitude, and is bordered by Telangana, Chhattisgarh, and Orissa in the north, the Bay of Bengal in the East, Tamil Nadu to the south and Karnataka to the West. The Indian sub-continent along with the state of Andhra Pradesh as well as the coastal districts of Andhra Pradesh where coastal aquaculture is practiced.

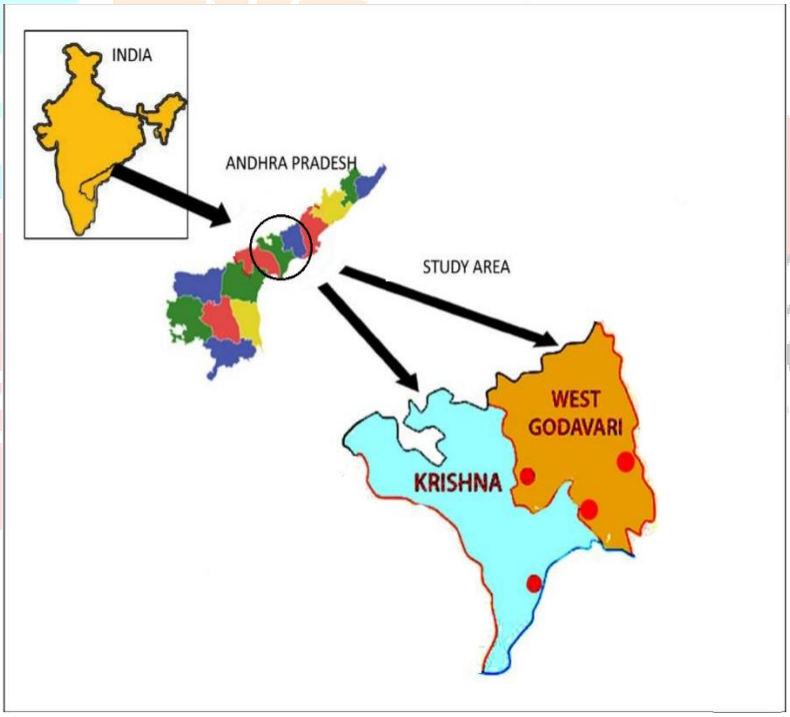
The study was undertaken in the district of West Godavari of Andhra Pradesh state second crop during 2018. Second crop of *Litopenaeus vannamei* culture in this study areas starts from July to September.

In selected district shrimp ponds was selected based on the salinity. The ponds containing more than 10 ppt were demarcated as “high saline” and less than 10 ppt demarcated as ‘low saline’.5 culture ponds in low saline low stocking densities, 5 ponds in low saline high stocking densities, 5 ponds in high saline low stocking densities and 5 ponds in high saline high stocking densities in different villages of both West Godavari and Krishna Districts were taken for the present study.

Locale of the Study

The present study was conducted during the year 2018 in the district of West Godavari of Southern Andhra Pradesh State presents the different agro-climatic zones. Second crop was studied in the selected district. The experiment was conducted in as completely randomized design (CRD) (Anil S Kotiya, et al., 2019).

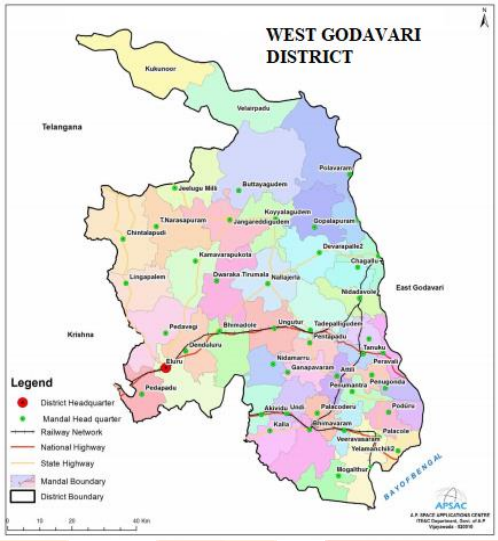
West Godavari district is the eastern most coastal district of the Andhra Pradesh it lies between 16-15' and 17-30' of the Northern latitude and 80-55' of the eastern longitude and average rainfall is 1076.20 mm it contribute by Southwest monsoon. West Godavari district in Andhra Pradesh is considered as the cradle of fisheries activities, in all the three sectors viz. Marine, Fresh and Brackish water fisheries. The West Godavari districts coast line is just 19 km long even though it's play a vital role to produce the fish and shrimp production and also it considered as hub of aquaculture. In the present study it is divided into two locations for convenience viz., High Saline, and Low Saline locations. Majority of shrimp production in Andhra Pradesh state comes from West Godavari district.



First stage selection – Identification of district

The present study was confined to central coastal district of Andhra Pradesh state where shrimp farming activities are large and reported high production by shrimp farmers. The intensity of *Litopenaeus vannamei* farming is predominantly more in small scale (<2 ha) areas where majority of the shrimp farmers are depending on shrimp aquaculture as their main livelihood.

Out of nine coastal districts, one district West Godavari was selected for the data collection as the first stage selection. While West Godavari and Krishna districts represents large shrimp cultivated area with wide ranges is Low saline with low stocking density, Low saline with high stocking density, High saline with low stocking density and High saline with high stocking density.



Selected District

Second Stage selection – Identification of villages

Based on the identified districts, which villages having more number of shrimp farmers, shrimp farming area and production available and different culture practices with in the villages, such villages were purposively selected for the study.

West Godavari District: Based on data availability entire work can segregated in to the following heads.

a) Low saline with low stocking density: it represents <10ppt and 15 to 25/M2 the villages are Mutyalapalli, Vempa, Gollavanitippa and Padamatipalem.

b) Low saline with high stocking density: it represents < 10 ppt and 30 to 50/M2 the villages are Ganapavaram, Attili, Undi, and Maarteru

c) High saline with low stocking density: it represents >10ppt and 15 to 25/M2 the villages are Lakshmipuram, Perupalem, Losari and Gootlapadu

d) High saline with high stocking density: it represents >10ppt and 30 to 50/M2 the villages are Juvvalapalem, Chinnamainivani lanka, Nagendrapuram and Yenuguvanilanka

RESULTS:

Growth vs Stocking Density

In West Godavari district, the average weekly growth ranged from 1.8 gms to 1.9 gms in low stocking ponds of low saline ponds in 2nd t crop and from 1.76 gms to 1.86 gms in high stocking ponds of low saline waters in 2nd crop in the year 2018 (Table 1).

Table 1. Growth Vs Stocking Density in Low Saline Ponds of West Godavari District in 2018.

DOC	2nd crop	
	AWG in Low stocking	AWG in High stocking
50	1.9	1.86
57	1.9	1.82
64	1.9	1.84
71	1.9	1.86
78	1.84	1.8
85	1.86	1.82
92	1.8	1.78
99	1.8	1.76

In the 2nd crop during 2018 in low saline low density ponds of West Godavari district the average pH, salinity, D.O, ammonia and temperatures observed were 7.92, 5ppt, 5.4ppm,0.44 ppm and 20^0C respectively. Whereas the average weekly growth is 1.86 gms at a stocking density of 20 pieces per square meter.

Table 2. Water quality parameters of Low saline, Low stocking density ponds of West Godavari District in 2nd crop during 2018 at every 7days intervals

Parameter/ District	pH	Salinity (ppt)	D.O. (ppm)	Ammonia (ppm)	Temperature (^{0}C)	Density (no/m^2)
50 DOC	7.92	5	5.4	0.44	28.5	20

Parameter/ District	pH	Salinity (ppt)	D.O. (ppm)	Ammonia (ppm)	Temperature (^{0}C)	Density (no/m^2)
57 DOC	8.0	5	5.2	0.44	28.4	20

Parameter/ District	pH	Salinity (ppt)	D.O. (ppm)	Ammonia (ppm)	Temperature (^{0}C)	Density (no/m^2)
64 DOC	8.1	5	5.2	0.43	28.5	20

Parameter/ District	pH	Salinity (ppt)	D.O. (ppm)	Ammonia (ppm)	Temperature (^{0}C)	Density (no/m^2)
71 DOC	8.0	5	5.4	0.43	28.5	20

Parameter/ District	pH	Salinity (ppt)	D.O. (ppm)	Ammonia (ppm)	Temperature (^{0}C)	Density (no/m^2)
78 DOC	8.1	5	5.2	0.44	28.6	20

Parameter/ District	pH	Salinity (ppt)	D.O. (ppm)	Ammonia (ppm)	Temperature (^{0}C)	Density (no/m^2)
85 DOC	8.2	5	5.2	0.41	28.7	20

Parameter/ District	pH	Salinity (ppt)	D.O. (ppm)	Ammonia (ppm)	Temperature (^{0}C)	Density (no/m^2)
92 DOC	8.1	4.9	5.3	0.42	28.5	20

Parameter/ District	pH	Salinity (ppt)	D.O. (ppm)	Ammonia (ppm)	Temperature (^{0}C)	Density (no/m^2)
99 DOC	8.0	4.9	5.2	0.43	28.6	20

Parameter/ District	pH	Salinity (ppt)	D.O. (ppm)	Ammonia (ppm)	Temperature (^{0}C)	Density (no/m^2)
50	7.92	5	5.4	0.44	28.5	20
57	8.0	5	5.2	0.44	28.4	20
64	8.1	5	5.2	0.43	28.5	20
71	8.0	5	5.4	0.43	28.5	20
78	8.1	5	5.2	0.44	28.6	20
85	8.2	5	5.2	0.41	28.7	20
92	8.1	4.9	5.3	0.42	28.5	20
99	8.0	4.9	5.2	0.43	28.6	20

In the 2nd crop during 2018 in low saline high density ponds of West Godavari district the average pH, salinity, D.O, ammonia and temperatures observed were 7.91, 6ppt, 4.6ppm, 1.0 ppm and 28.9^{0}C respectively. Whereas the average weekly growth is 1.82 gms at a stocking density of 40 pieces per square meter.

Table 3. Water quality parameters of Low saline, High stocking Density ponds of West Godavari District in 2nd crop during 2018 at 7days intervals

Parameter/ District	pH	Salinity (ppt)	D.O. (ppm)	Ammonia (ppm)	Temperature (^{0}C)	Density (no/m^2)
50 DOC	7.91	6	4.6	1.0	28.9	40

Parameter/ District	pH	Salinity (ppt)	D.O. (ppm)	Ammonia (ppm)	Temperature (^{0}C)	Density (no/m^2)
57 DOC	7.93	5	5.1	0.8	29.0	40

Parameter/ District	pH	Salinity (ppt)	D.O. (ppm)	Ammonia (ppm)	Temperature (^{0}C)	Density (no/m^2)
64 DOC	8.0	5	5.2	0.78	29.5	40

Parameter/ District	pH	Salinity (ppt)	D.O. (ppm)	Ammonia (ppm)	Temperature (^{0}C)	Density (no/m^2)
71 DOC	7.9	5	5.0	0.75	28.5	40

Parameter/ District	pH	Salinity (ppt)	D.O. (ppm)	Ammonia (ppm)	Temperature (^{0}C)	Density (no/m^2)
78 DOC	8.2	5	5.1	0.79	28.9	40

Parameter/ District	pH	Salinity (ppt)	D.O. (ppm)	Ammonia (ppm)	Temperature (^{0}C)	Density (no/m^2)
85 DOC	8.1	5	5.0	0.8	29.5	40

Parameter/ District	pH	Salinity (ppt)	D.O. (ppm)	Ammonia (ppm)	Temperature (^{0}C)	Density (no/m^2)
92 DOC	8.0	4.9	5.0	0.82	29.5	40

Parameter/ District	pH	Salinity (ppt)	D.O. (ppm)	Ammonia (ppm)	Temperature (^{0}C)	Density (no/m^2)
99 DOC	7.92	4.9	4.9	1.0	30.0	40

Parameter/ District	pH	Salinity (ppt)	D.O. (ppm)	Ammonia (ppm)	Temperature (^{0}C)	Density (no/m^2)
50	7.91	6	4.6	1.0	28.9	40
57	7.93	5	5.1	0.8	29.0	40
64	8.0	5	5.2	0.78	29.5	40
71	7.9	5	5.0	0.75	28.5	40
78	8.2	5	5.1	0.79	28.9	40
85	8.1	5	5.0	0.8	29.5	40
92	8.0	4.9	5.0	0.82	29.5	40
99	7.92	4.9	4.9	1.0	30.0	40

Growth vs Stocking Density

In West Godavari district, the average weekly growth ranged from 1.86 gms to 2.06 gms in low stocking ponds of high saline ponds in 2nd crop and from 1.74 gms to 2.0 gms in high stocking ponds of high saline waters in 2nd crop in the year 2018 (Table 4).

Table 4. Growth Vs Stocking Density in High Saline Ponds of West Godavari District in 2018.

DOC	2nd crop	
	AWG in Low stocking	AWG in High stocking
50	2.06	2
57	2.02	1.98
64	2.02	1.96
71	2	1.92
78	1.92	1.82
85	1.92	1.8
92	1.9	1.8
99	1.86	1.74

DISCUSSION:

The findings of the present study are clearly indicated that, the stocking densities have direct relation with the growth of the *L. vannamei.* Various researchers have reported on the growth and survival of *L. vannamei* in different salinities and stocking densities (Balakrishnan *et al.*, 2011; Suriya *et al.*, 2016; Parvathi and Padmavathi, 2018). Water quality parameters play a significant role in any culture systems. Good water quality parameters include adequate levels of dissolved oxygen, temperature, salinity and pH. Unutilized feed, metabolic wastes, faecal matter will also create some disturbance in quality of the water. Hence the quality of the water in culture operations is very prominent (Chakravarty *et al.*, 2016; Darwin *et al.*, 2017).

In the present study various salinities were tested in ponds with low and high stocking densities. The salinity ranges for the present study fluctuated between 6-18 ppt with respect to low and high saline ponds. However the *L. vannamei* can tolerates the salinities of 2-45 ppt as reported by (Parker *et al.*, 1974; Samocha *et al.*, 1998). Similarly the other water quality parameters like pH, temperature, D.O. and ammonia were recorded in low and high saline ponds against to various stocking densities. The average weekly growth parameters of *L. vannamei* were recorded against low saline and high saline ponds (Table 1, 4). The recorded growth values clearly indicated that, higher average weekly growth rate was noticed against low stocking densities and vice versa. Similar trends of results were reported in earlier studies by Suriya *et al.*, (2016) and Parvathi and Padmavathi, (2018).

CONCLUSION:

The stocking densities have direct relation with the growth of the *L. vannamei* higher average weekly growth rate was noticed against low stocking densities and vice versa.

Water quality parameters play a crucial role in any culture systems. Good water quality parameters i.e dissolved oxygen, temperature, salinity and pH; maintain its optimal levels throughout the culture period may favourable for gaining good growths of shrimp Unutilized feed, metabolic wastes, faecal matter will also create some disturbance in quality of the water. Hence the quality of the water in culture operations is very prominent

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