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IMPACT OF HYDROGRAPHICAL PARAMETERS ON BRACKISH WATER *Penaeus monodon* (TIGER SHRIMP) YIELD FROM MOGALLU VILLAGE, PALAKODERU MANDAL, WEST GODAVARI DISTRICT, ANDHRA PRADESH, INDIA.

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Abstract:

The demand for high protein value and low fat content is ever increasing and is need of the hour, human preference for aquatic food is also increasing. To meet the increasing demand, cultivation of such organisms has been increased now a days. Not only for the native lands but also for export purpose to other lands. The cultivation of fish, prawn and shrimp have contributed to Blue revolution by balancing the ecology and food chain so that sustainable development is achieved. Tiger shrimp culture has occupied major share in global shrimp production. Shrimp cultivation, in particular *Penaeus monodon* has gained attention commercially because it takes less time to attain marketable size, tolerance to wide range of salinity and high yield. The natural periphyton availability in the ponds triggered the healthy growth of the Tiger shrimp in the ambient waters**.**The hydrographic parameters influence the growth and survival of Tiger shrimp specially when cultivated in natural brackish water ponds. The parameters like pH, temperature, salinity, dissolved oxygen, alkalinity and mineral composition should be at optimum range to get a good crop which were studied in the present work at brackish water pond Mogallu village, Palakoderu mandal, West Godavari district, Andhra Pradesh in which monoculture of *P.monodon* was cultivated. The study was carried out for a period of four years from 2013 to 2016.

Key word: *P.monodon*, salinity, hydrographical parameters, tiger prawn, periphyton .

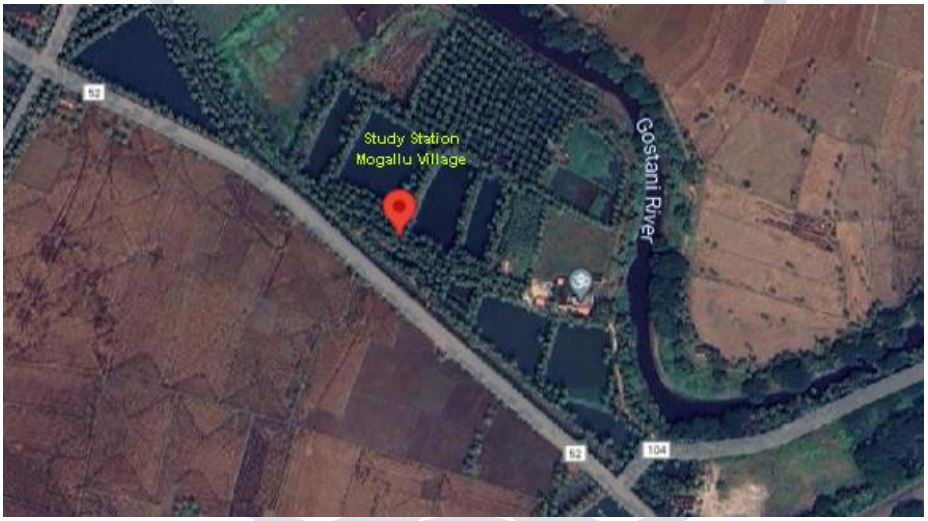
Introduction:

Asian Tiger shrimp *Penaeus monodon* can be identified by its overall rusty brown color and visible black and white banding on the back and tail regions. They can be withstand a wide range of salinities such as from 3 to 35 ppt and typically the juvenile can inhabit lesser salinity than adults. The temperature range is of narrow that is 25^0C to 32^0C.

Due to its adaptability to wide range of salinity and faster development, this shrimp has got much economic importance despite of easily prone to viral infections. This shrimp is grown for a span of 3 months in which the weight and size will be gained to be used commercially. Farmer is always at benefit when this crop is grown unless infected with virus. The growth of 40 shrimp/Kg is considered as a good crop and can be harvested. And for this count to reach it will take 3 months. Since it can withstand wide range of salinity fluctuations, there is an impact on its yield due to hydrographical parameters which were of major concern in the present study. The hydrographical parameters of brackish water pond were studied and their influence was observed on the yield of Tiger shrimp at Mogallu study station for a span of four years.The natural periphyton availability in the ponds triggered the healthy growth of the Tiger shrimp in the ambient waters, which is an advantageous point to the farmers as they need not much bother about the healthy growth of the shrimp. Periphyton is a complex mixture of autotrophic and heterotrophic microorganisms such as phytoplankton, zooplankton and heterotrophic microbes.

Materials and Methods:

The study area lies between LT-16.5807390, LG-81.5651640. It is situated in Palakoderu mandal West Godavari district which is shown as satellite map in figure 1.The main objective of this study is to check the impact of hydrographical parameters on the yield of *Penaeus monodon* (Tiger shrimp) at Mogallu brackish water pond, inspite of availability of natural periphyton. The study was conducted for a period of four years that is from 2013 to 2016. Hydrographical parameters studied are temperature, pH, dissolved oxygen, total total hardness, and the nutrients (phosphate, carbonates, bicarbonates, ammonia nitrite, calcium and magnesium) of the waters. The analyses were carried out employing standard procedures.



Source: Courtesy to Google maps

Figure 1:Satellite map of study station Mogallu village, Palakoderu mandal, Bhimavaram. W.G.D

Results and Analysis:

The hydrographical parameters were studied for twice a month in a year for the study period 2013 to 2016 and were tabulated from table 1 to 4. These were checked for every 15 days and were maintained throughout the year by standard procedures for getting a good crop without disturbing the natural brackish water pond environment. The samples were taken from Mogallu study station.

Table: 1:Hydrographical parameters of 2013 average

S.no	Parameters	Jan	Feb	Mar	Apr	May	Jun	Aug	Sep	Oct
1.	pH	8.05	7.95	8.0	8.05	7.95	7.95	7.95	7.95	7.9
2.	Salinity in **ppt**	6	5.5	5	5	5	5.5	5.5	5	5
3.	Carbonates in **%**	5	5	5	5	5	Nil	5	5	Nil
4.	Bicarbonates in **%**	230	240	210	217.5	220	250	250	245	240
5.	Calcium in **%**	180	170	195	185	205	255	220	180	180
6.	Magnesium in **%**	385	325	380	375	370	410	440	350	395
7.	Hardness in **ppm**	2355	2060	2350	2225	2085	1990	2610	2240	2050
8.	D.O in **ppm**	5.5	5.25	5.25	5.75	5.5	5.5	5.75	5	5.75
9.	Potassium in **ppm**	36.5	41	47	33	41.5	45	32.5	40	43.5

10.	Ammonia **ppm**	0.5	0.5	1.0	0.09	0.5	0.025	Nil	0.1	0.035
11.	Nitrites in **%**	0.10	0.05	0.05	0.05	0.55	Nil	0.05	Nil	0.775
12.	Temperature in **^{0}C**	29^0C	28.5^0C	30^0C	30^0C	30^0C	29^0C	28.5^0C	28.5^0C	28.5^0C

Table 1 showing various hydrographical parameter average values of Mogallu study station for the year 2013

Table:2:Hydrographical parameters of 2014 average

S.no	Parameters	Jan	Feb	Mar	May	Jun	Jul	Oct	Nov	Dec
1.	pH	7.95	7.85	8.0	8.05	7.95	7.9	7.95	7.95	7.9
2.	Salinity in **ppt**	6.5	5.5	5	6	5	5.5	5.5	5	5
3.	Carbonates in **%**	5	5	5	10	5	Nil	5	5	Nil
4.	Bicarbonates in **%**	230	240	210	217.5	220	250	250	245	240
5.	Calcium in **%**	180	170	195	185	205	255	220	180	180
6.	Magnesium in **%**	385	325	380	375	370	410	440	350	395
7.	Hardness in **ppm**	2490	2060	2350	2225	2085	1990	2610	2240	2050
8.	D.O in **ppm**	5.5	5.25	5.25	5.75	5.5	5.25	5.75	5	5.25
9.	Potassium in **ppm**	36.5	41	47	33	41.5	45	32.5	40	43.5
10.	Ammonia **ppm**	0.5	0.5	1.0	0.09	0.5	0.025	Nil	0.55	0.035
11.	Nitrites in **%**	0.10	0.05	0.05	0.05	0.275	Nil	0.05	0.275	0.775
12.	Temperature in **^{0}C**	29^0C	28.5^0C	29.5^0C	30^0C	28.5^0C	28.5^0C	28.5^0C	28.5^0C	28.5^0C

Table 2 showing various hydrographical parameter average values of Mogallu study station for the year 2014

Table:3:Hydrographical parameters of 2015 average

S.no	Parameters	Feb	Mar	Apr	Jun	Jul	Aug	Oct	Nov	Dec
1.	pH	7.9	8.0	8.0	8.05	7.95	7.9	7.85	7.95	7.85
2.	Salinity in **ppt**	6.5	6	5	6	5	5.5	5.25	5.5	5.5
3.	Carbonates in **%**	5	5	5	10	5	Nil	5	5	Nil
4.	Bicarbonates in **%**	230	240	210	217.5	220	250	250	245	240
5.	Calcium in **%**	180	170	195	185	205	255	220	180	180
6.	Magnesium in **%**	385	335	380	375	370	410	440	350	395
7.	Hardness in **ppm**	2690	2060	2350	2225	2085	1990	2610	2240	2050
8.	D.O in **ppm**	5.75	5	5.25	5.25	5.75	5.25	5.75	5	5
9.	Potassium in **ppm**	32	41	47	31	41.5	40	32.5	39	41
10.	Ammonia **ppm**	0.5	0.5	1.0	0.09	0.5	0.025	Nil	0.035	0.01
11.	Nitrites in **%**	0.10	0.05	0.05	0.05	0.275	0.035	0.05	0.275	0.09
12.	Temperature in **^{0}C**	28.5^0C	29^0C	30^0C	29.5^0C	29^0C	28.5^0C	28.5^0C	28.5^0C	28.5^0C

Table 3 showing various hydrographical parameter average values of Mogallu study station for the year 2015

Table:4:Hydrographical parameters of 2016 average

S.no	Parameters	Mar	Apr	May	Jun	Jul	Aug	Oct	Nov	Dec
1.	pH	7.95	8.1	8.0	7.95	8.0	7.9	7.9	7.9	7.9
2.	Salinity in **ppt**	5.5	6	6	5	5	5.5	5	5	5
3.	Carbonates in **%**	5	7.5	7.5	5	Nil	10	5	5	Nil
4.	Bicarbonates in **%**	220	250	230	212.5	212.5	250	242.5	245	240
5.	Calcium in **%**	190	170	152.5	190	135	200	170	185	205
6.	Magnesium in **%**	3675	335	332.5	380	270	350	340	345	395
7.	Hardness in **ppm**	2765	2170	2080	2100	2060	2045	1797	2100	2090
8.	D.O in **ppm**	5.75	5.25	5.25	5.25	5.25	5.5	5.5	5.75	5

9.	Potassium in **ppm**	35	36.5	44	32	39	40	32.5	35	40
10.	Ammonia **ppm**	0.2	0.08	0.595	0.05	0.1	0.01	Nil	Nil	0.01
11.	Nitrites in **%**	0.05	0.03	0.05	0.02	0.75	0.05	Nil	0.5	0.00045
12.	Temperature in ^{0}**C**	29.5^{0}C	29.5^{0}C	29.5^{0}C	29.5^{0}C	29.5^{0}C	29.5^{0}C	29^{0}C	29^{0}C	29.5^{0}C

Table 4 showing various hydrographical parameter average values of Mogallu study station for the year 2016

Table 5: Feed (Avanthi) and Growth patterns of Tiger Prawn during the study period 2013 to 2016

S.No	Average days	Average body weight(g)	Weight of 1000 prawn(Kg)	Feeding ratio (% of body weight)	Daily feed (grams)	Total feed Kg/week	Feeding frequency per day
1.	1-7	0.8	0.8	10.0	0.080	0.560	2
2.	8-14	1.5	1.5	9.0	0.135	0.945	2
3.	15-21	4.0	4.0	5.5	0.220	1.540	2
4.	22-28	6.0	6.0	5.0	0.300	2.100	3
5.	29-35	8.5	8.5	4.4	0.374	2.618	3
6.	36-42	10.0	10.0	4.1	0.410	2.870	3
7.	43-49	12.0	12.0	3.8	0.456	3.192	3
8.	50-56	15.0	15.0	3.4	0.510	3.570	3
9.	57-63	18.0	18.0	3.0	0.540	3.780	4
10.	64-70	21.5	21.5	2.6	0.559	3.913	4
11.	71-77	24.0	24.0	2.4	0.576	4.032	4
12.	78-84	27.0	27.0	2.3	0.621	4.347	4
13.	85-91	30.0	30.0	2.2	0.660	4.620	4

Table 5 showing the feed (Avanthi) provided and growth patterns of Tiger prawn from Mogallu study station during the study period 2013 to 2016.The crop is for 3 months and body weight was checked for every 7 days throughout the period till harvest. Average values have been taken regarding feed frequency, growth in grams as per the feed and feeding ratio as per the body weight of prawn.

Table 6: Total yield and harvest from 2013 to 2016 of Mogallu station

SNo	Parameters	Crop year			
		2013	**2014**	**2015**	**2016**
1.	**Acres**	10	5	4	10
2.	**Crop month**	April	October	March	August
3.	**No. of seed**	20 lakhs	15 lakhs	12 lakhs	25 lakhs
4.	**No. of dead**	1000	11000	1000	20000
5.	**Duration**	3 months	3 months	3 months	3 months
6.	**Count**	60/Kg	60/Kg	50/Kg	60/Kg
7.	**Harvest**	Good crop	Good crop	Good crop	Good crop
8.	**Yield in tons**	11.5 tons	28 tons	26 tons	62 tons

Table 6 showing the data of total yield and harvest of *Penaeus monodon* crop at Mogallu study station for the study period from 2013 to 2016

Table: 7: Periphytons and Microbes found in Mogallu brackish water pond

S.No	Periphyton	Microorganisms
1.	Chlorella	Protozoa
2.	Microcysts	Salmonella
3.	Hydra vulgaris	Pseudomonas
4.	Spirulina	Cyanobacteria
5.	Euglena	***

Table 7 showing the data of various Periphyton and microbes found in Mogallu study station

Table:8: Periphyton occurrence in the study period 2013 to 2016

S.No	Periphyton	2013	2014	2015	2016
1.	Chlorella	✓	✓	✓	✓
2.	Microcysts	✓	X	✓	X
3.	Hydra vulgaris	X	✓	✓	✓
4.	Spirulina	✓	✓	X	✓
5.	Euglena	✓	✓	✓	✓

Table 8 showing the data of various periphyton found in Mogallu study station for the study period 2013 to 2016

Table:9: Microorganisms occurrence in the study period 2013 to 2016

S.No	Microorganism	2013	2014	2015	2016
1.	Protozoa	✓	✓	X	X
2.	Salmonella	✓	X	✓	X
3.	Pseudomonas	✓	✓	✓	✓
4.	Cyanobacteria	✓	✓	✓	✓

Table 9 showing the data of various microbes found in Mogallu study station for the study period 2013 to 2016

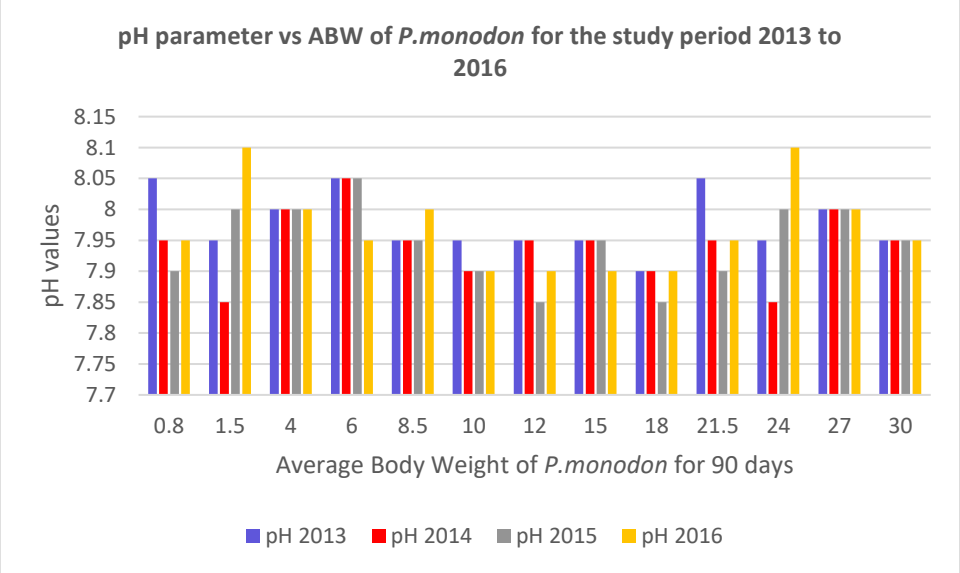


Figure 2: Graphical representation of pH parameter influence on average body weight of *P.monodon* for the study period 2013 to 2016.

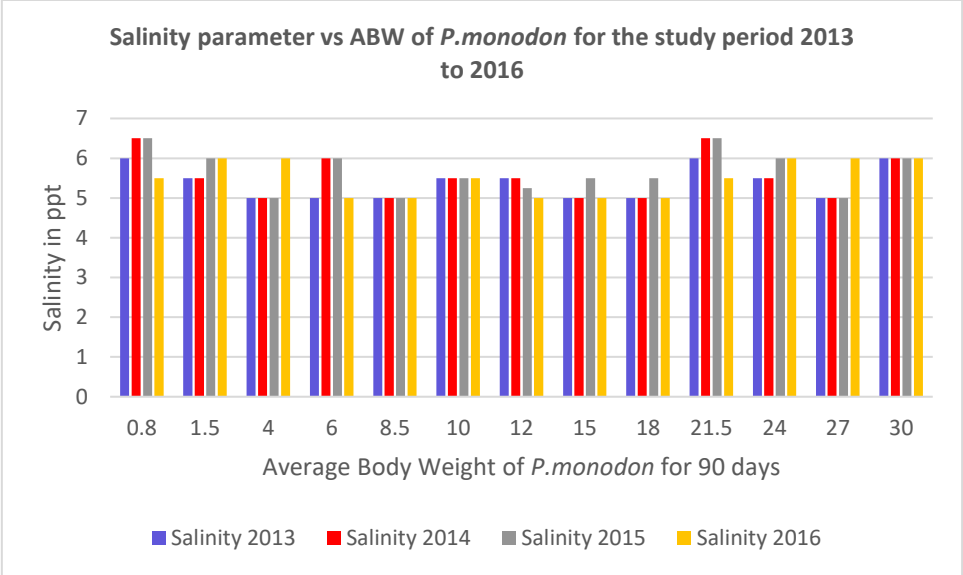


Figure 3: Graphical representation of salinity parameter influence on average body weight of *P.monodon* for the study period 2013 to 2016.

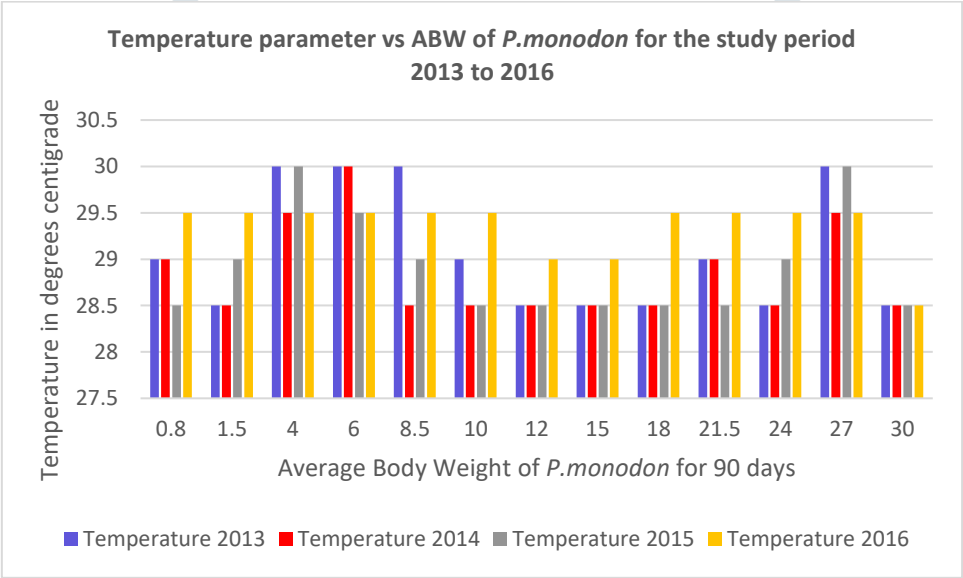


Figure 4: Graphical representation of temperature parameter influence on average body weight of *P.monodon* for the study period 2013 to 2016.

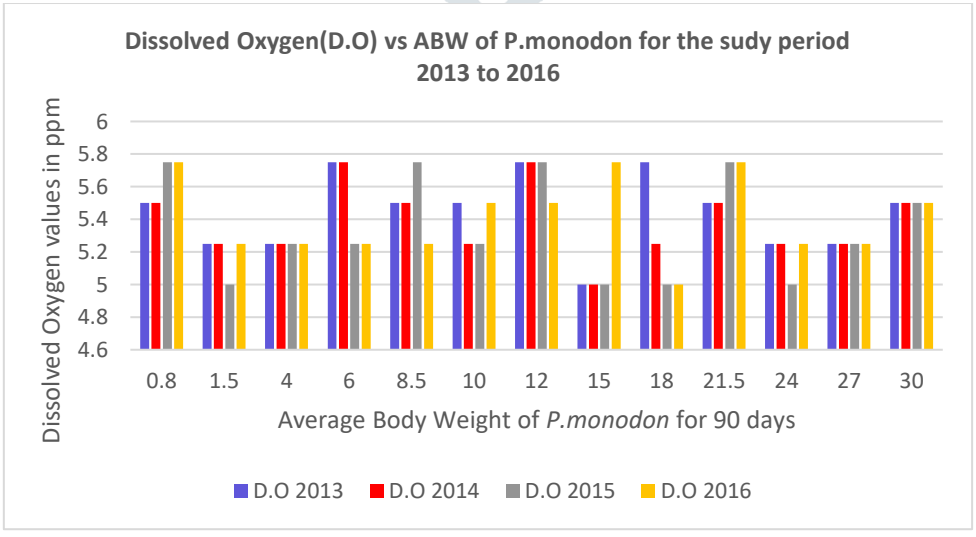


Figure 5: Graphical representation of dissolved oxygen parameter influence on average body weight of *P.monodon* for the study period 2013 to 2016.

Discussion:

Water is a major concern for the growth of organisms as it is considered as a natural nourishment for all living beings on earth. The natural ponds are enriched with deposits of variousminerals and the environment is suitable for culturing various aquatic organisms. In this regard the quality of water has gained more attention for the cultivation of desired organisms. Thus the hydrographical parameters directly or indirectly influence the growth and yield of *Penaeus monodon* in the present study, parameters like pH, temperature, dissolved oxygen and salinity levels of natural ponds decide the survival and yield of the shrimps **(Shigueno, 1972).**

The temperature has direct influence on the culturing of shrimp as the growth rate, survival, moulting , consumption of oxygen and metabolism of shrimp are effected, so the optimum temperature range was considered as 25^0C to 30^0C for culturing ponds and also beyond this range does not allow the organisms to survive (**Boyd, 1992)**. In the present study, the temperature range was observed as 29^0C and 30^0C for a span of four year study at Mogallu station. This shows that temperature is maintained at an optimum level during 2013-2016 for the optimum yield of the prawn which was shown in figure 4.

Another major abiotic factor contributing for shrimp culture is salinity, it is well known that *Peneaus monodon* can withstand wide range of salinity making it more suitable for commercial culturing(5-35 ppt), in the present study, the range of salinity is from 5 ppt to 6.5 ppt during the study period (2013-2016) which was shown in figure 3. As per the studies of **(Chen, 1990**)on *Penaeus monodon*, the survival range of salinity is 1 to 57 ppt and below that range, shrimps have serious effects on growth rate, osmotic adjustment, resistance and survival rate decline**(Li *et al.*, 2000).** The effect of salinity on *P.monodon* growth and survival decline was also studied by (**Yang 2008).** When the shrimps are cultured in natural ponds, salinity is the major factor, when beyond the range affects the immune system of shrimp making it more susceptible to diseases and infections **(Nikapitiya*et al.*, 2014).**

In general shrimps prefer acidic or neutral waters, they breed best in conditions of pH like 7.5-8.5. pH range of 7.85-9 is observed in the present study as shown in figure 2. The optimum pH recommended for *Peneaus monodon* cultivation is 7.5 to 8.5 (**Ramakrishna Reddy 2000)**.The environmental variable pH always has impact on the growth and metabolism of shrimp **(Shilaja K, Rangarajan, 1993).**

In the present study the Dissolved oxygen (DO) is maintained at a range of 5.0 to 5.75 as shown in the figure 5, and the optimum level of DO for better *Penaeus monodon* cultivation was 4 to 6.5, this may be due to continuous aeration in ponds in natural environment as reported by **(McGraw et al., 2001).**In a study by **Furtado *et al.* 2014,** the DO range was reported as 5.9 to 6.3 which was also proved to be best for intensive shrimp farming. Other parameters are in match with the standard values of previous studies and does not influence much in the growth and survival rates of *P.monodon.*

There is rich abundance of periphyton in the study area, this has monitored and balanced the abiotic factors to a great extent. As shown in tables 7,8,and 9 the Periphyton and microorganisms occurrence in the study station water are directly or indirectly supporting the natural pond environment suitable for the growth and survival of the organism when cultivated and it is also observed that the periphyton status in the ambient waters might be balancing the above parameters to a certain extent and moderate fluctuations in the said parameters were taken care of by the periphyton and microbial community.

Conclusion:

Penaeus monodon commonly known as Tiger shrimp is a commercial crop due to its advantages of tolerance to wide range of salinity and faster growth making it very beneficial for the farmer to grow this crop. The impact of hydrographical parameters on the growth and development of the shrimp were understood in this study. Various hydrographical parameters influence the survival and development of *P.monodon* in which majorly temperature, pH, salinity and dissolved oxygen play a vital role. The inorganic and organic components support for the growth of the organism whose optimum levels existing in the brackish water ponds are enough for the good crop yield. A good crop is said when the shrimp count is 40/Kg, but in the present study it has reached to 50 or 60 per Kg indicating good yield. It is observed in the present study that by encouraging the abundance of periphyton in the ambient waters, fluctuations in the hydrographic parameters can be controlled, as well as nutrient and oxygen rich environment can be created.

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