Cover Page

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ANALYSIS OF WATER QUALITY PARAMETERS AND THEIR EFFECT ON THE GROWTH OF LIPTOPENAEUS VANNAMEI AT SVR HATCHERY, TUNI, E. G. DT.

[1]Dr. P. Y. V. Satyanarayana, [2]Ms. Ch. D. Bhavani and [3]Mrs. G. Sunitha
[1]Reader & HOD of Zoology & Fisheries and [2&3]Lecturer in Zoology& Fisheries
[1,2&3]Sri Y N College (A)
Narsapur, Andhra Pradesh, India

INTRODUCTION

Aquaculture is the farming of fish, crustaceans, molluscs, aquatic plants, algae and other organisms. Aquaculture involves cultivating freshwater and saltwater populations under controlled conditions, and can be contrasted with commercial fishing which is the harvesting of wild fish, it is less commonly spelled aquiculture, and is also known as aqua farming. Mariculture refers to aquaculture practiced in marine environments and in underwater habitats. According to the food and agriculture organization aquaculture is understood to mean the farming of aquatic organisms including fish, molluscs, crustaceans, and aquatic plants. Particular kinds of aquaculture include fish farming, shrimp farming, oyster farming, mariculture, algal culture, and the cultivation of ornamental fish. Particular methods include aquaponics and integrated multi-tropic aquaculture, both of which integrate fish farming and aquatic plant farming. The present study was carried out at SVR Hatchery, Tuni, East Godavari, A.P.

ECOLOGICAL BENEFITS

- While some forms of aquaculture can be devastating to ecosystems, such as shrimp farming in mangroves, other forms can be very beneficial.
- Shellfish aquaculture adds substantial filter feeding capacity to an environment which can significantly improve water quality.
- A single oyster can filter 15 gallons of water a day, removing microscopic algal cells.
- By removing these cells, shellfish are removing nitrogen and other nutrients from the system and either retaining it or realizing it as waste which sinks the bottom.
- By harvesting these shellfish, the nitrogen, they retained is completely removed from the system.
- Raising and harvesting kelp and other microalgae directly remove nutrients such as nitrogen and phosphorus.
- Repackaging these nutrients can relieve entropic, or nutrient-rich, conditions known for their low dissolved oxygen which can decimate species diversity and abundance of marine life.
- Removing algal cells from the water also increase light penetration, allowing plants such as eel grass to reestablish themselves and further increase oxygen levels.
- Aquaculture is an area can provide for crucial ecological functions for the inhabitants.

Shrimp aquaculture is an industry that has experienced a vigorous and worldwide economic growth. The gradual increase of such activity is most prominent in tropical and subtropical countries. The share of Shrimp export is 17% among all the sea foods traded globally. Approximately, 80% of production is from aquaculture which is now almost entirely dominated by two species i.e., black tiger shrimp (Penaeus monodon) and the white leg Pacific shrimp (Liptopenaeus vannamei) (FAO, 2014). Moreover, shrimp aquaculture can help to reduce the pressure on over exploitation of wild stocks, in terms of natural resources protection. It is believed that the solution for the exploitation of natural resources is Aquaculture.

TAXONOMIC CLASSIFICATION OF L. vannamei

Phylum : Arthropoda
Subphylum : Crustacea
Class : Malacostraca
Sub class : Eumalacostraca
Super order : Eucarida
Order : Decapoda
Suborder : Dendrobranchiata
Super family : Penaeoidea
Family : Penaeidae
Genus : Litopenaeus
Species : vannamei

Cover Page

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According to Hickman, et al., (2006), Penaeid shrimps are within the largest phylum in the animal kingdom, the Arthropoda. Arthropods have an exoskeleton including rigid cuticle, chitin and proteins, which cover the whole animal. The subphylum Crustacean contains around 42,000 species, including lobsters, crabs, shrimp, pill bugs, krill, barnacles, water fleas, brine shrimp, copepods and ostracods. Shrimp, crayfish, lobsters and crabs are members of the order Decapoda, which is a part of the class Malacostraca. All farming shrimps coming under the Penaeidae family is referred to as Penaeid (FAO, 2006).

AIMS AND OBJECTIVES

- To culture the microalgae and artemia in in-vitro conditions.
- To study different stages of shrimp larvae.
- To study the growth and survival rate of shrimp larvae under different dietary conditions of phytoplankton and zooplankton.
- To study water quality parameters such as pH, salinity, temperature, dissolved oxygen, ammonia, etc.

The present study was carried out at SVR Hatchery, Tuni, East Godavari, Andhra Pradesh

MATERIALS AND METHODS

SELECTING SUITABLE SITES FOR A HATCHERY

Prior to the establishment of any shrimp hatchery, it is of primary importance to carry out a thorough feasibility study to determine the suitability of the proposed site. The main criteria followed are water quality, availability of spawners and site accessibility. For establishing large-scale modern hatcheries, the criteria for hatchery site selection must be rigidly followed because it is costly to change site when high financial inputs have already been committed. However, site selections for smaller hatcheries are less rigid than the bigger ones.

Criteria in the selection of a suitable site for a hatchery

- **Sea water supply**

The sea water used in a hatchery should be clean, clear and relatively free from silt. The water quality should be stable with minimal fluctuation in salinity. Suitable sites are usually found in sandy and rocky shore ecosystem where there is clean, clear and good quality sea water all year round. Sites not suitable for hatchery are swamps and muddy shores where the water becomes turbid during heavy rains or due to turbulence. Avoid river mouths where abrupt lowering of salinity often occurs during heavy rainfall. An added advantage of rocky and sandy shores is that good quality sea water is relatively near the shoreline thus reducing the cost of piping installation and pumping cost. The hatchery site should also be free from possible impact from any inland water discharges containing agricultural or industrial waste.

- **Availability of spawners**

Presence of spawners at the vicinity of the proposed site is of considerable advantage in ensuring consistent supply of spawners, reducing the cost of transportation which could affect the rate of spawning.

- **Availability of power source**

Electricity is essential to provide the necessary power to run equipment and other life support systems in the hatchery. Although some marine pumps and aerators can be driven directly by handy generators, the shrimp hatchery can therefore be operated in areas without electricity supply. However, it is more economical to operate it in areas where there is a reliable source of electricity. Installation of an on-site standby generator is absolutely necessary especially in areas where there are frequent lengthy power failures and fluctuations.

- **Freshwater supply**

Freshwater is essential for daily hatchery operation such as salinity adjustment, equipment maintenance and for domestic use.

- **Accessibility**

Ideally, a hatchery should be sited in areas where there are active shrimp farming operations so that the shrimp larvae produced can be easily transported and distributed to the grow-out ponds. Hence, the site chosen for hatchery establishment must be easily accessible to facilitate communication and transportation.

- **Climatic conditions**

A hatchery can be established in any climatical condition as long as the required rearing conditions can be adequately provided. However, all the commercial hatcheries take full advantage of nature in terms of energy source and supply of good quality water.

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Sunlight is the basic requirement for hatchery operations especially in the mass production of natural food used as feeds for the growing shrimp larvae.

Hatchery design equipment and construction facilities depends on design which determines target and size of rearing facility. According to production methods Taiwan has the S, M, R types based on stocking densities. Prawn hatcheries come about simple to sophisticated setup Mock and Neal 1974, Simion 1981, Treese 1985 and Lio 1986. Functional hatchery has the essential components such as maturation tanks, spawning tanks, Larval tanks, small and big tank system, Live food culture tanks, Water storage and filtration tank etc. Spawning activity that includes egg collection and treatment, hatching, larval rearing etc.

FEEDING

Nauplius stage: During this stage the nauplii utilize food stored in their yolk sac. For the typical system, diatoms are also supplied to the hatcheries tanks in order to make their population grow to the zoea stage.

Zoea stage: Larvae in this stage could be fed with various kinds of food. Normally they are fed with phytoplankton such as chaetoceros sp. From zoea 1-3 9 at the density of 10,000- 50,000 cells/ml. Artificial formulated feed, boiled egg yolk, milk or egg custard can be used as supplementary feed, but the grain size must suit to size of the mouth larvae

Mysis stage: For Mysis stage the larvae should be fed with rotifer (branchionus plicatilis) the number of rotifers required depends on the density of shrimp larvae. Usually the density of 5-10 rotifer/ml is adequate. Each larva consumes about 100-200 rotifers per day. If rotifers are not and microencapsulated feed can be fed to the Mysis larvae instead.

Post larvae: Rotifers, artemia and micro capsulated feeds are used to feed shrimp in the early stage of post larvae (about 4-5 days) and egg custard or shrimp meat, mussel or calm meat, screened fresh fish or cockle are used as food in the stage. Shrimp is fed 3-6 times a day, sometime an extra meal is given during the night.

WATER QUALITY ASSESSMENT

SALINOMETER

- A salinometer a device designed to measure the salinity or dissolved salt content of a solution.
- Since the salinity affects both the electrical conductivity and the specific gravity of a solution, a salinometer often consists of a hydrometer and some means of converting those readings to a salinity reading.
- A salinometer may be calibrated in either micromhos, a unit of electrical conductivity, (usually 0-22) or else directly calibrated for alt in grains per gallon (0-0.5).
- A reading of twice this may trigger a warning light in alarm.
- The demerit is salinometer shows density of water.
- In water oxygen is presented in dissolved form the DO levels are maintained during day time because of photosynthetic respiration of phytoplankton.
- During night time lack of photosynthesis the dissolved oxygen levels is decreased.
- Dissolved oxygen is a critical factor in larval rearing. During night time aerators are maintained for proper maintaining of dissolved oxygen.
- High mortalities can occur if aeration stops even only one hour. The DO levels are 6-8ppm
- DO is measured by Winkler's titration method.

THERMOMETER

- Temperature is measured by using thermometer
- Temperature directly affects the metabolic system of an organism.
- In Penaeid shrimps' eggs do not hatch at temperature lower than the 24-26c.temperature drops to the 24-31c molting takes more than week when temperature drops to the 24-26c. Water samples were preserved and processed for water quality analysis.

PH

Principle: pH was measured more accurately and conveniently with pH meter and combination of glass electrode.

Procedure: Water sample was taken into a clean glass beaker and pH was measured by dipping the electrode of the pH meter into it. The indicator of the pH meter shows the pH reading directly. The meter was calibrated routinely at pH 7.0 using appropriate buffer solutions and the accuracy was verified by testing a pH 9.2 buffer.

Salinity-Refract meter (salinometer): The salinity of the water samples was measured with the help of salinometer.

Cover Page

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Ammonia-N

Principle: Water sample is treated in alkaline citrate medium with sodium hypochlorite and phenol in the presence of sodium Nitroprusside which acts as a catalyzer. The blue indophenols color formed with ammonia is measured spectrophotometrically.

Reagents

- De-ionized water
- Phenol solution: dissolve 20gms of analytical grade phenol in 200ml of 95% V/V ethyl alcohol.
- Sodium Nitroprusside solution: dissolve 1.0g of sodium Nitroprusside Na_2Fe (CN) 5NO.2H2O, in 200 ml of de-ionized water. Store in a dark glass bottle. The solution is stable for at least one month.
- Alkaline solution: dissolve 100gms of sodium citrate and 5 gms of sodium hydroxide in 500 ml of de-ionized water. This solution is stable indefinitely.
- Sodium hypo chloride solution: oxidizing solution: mix 100ml of alkaline reagent and 25ml of sodium hypo chloride reagent prepare fresh every day.

Procedure: 50ml of sea water is taken into a conical flask using measuring cylinder. 2ml of phenol solution is added to it. Swirl to mix and then 2ml of Nitroprusside and 5ml of oxidizing solutions are added. Flasks were covered with aluminum foil to lesion the contamination by atmospheric ammonia and allow the flasks to stand at room temperature for 1hr in dark. The colour is stable for about 2hr after the reaction period. Absorbance was measured at 640nm using spectrophotometer.

Dissolved oxygen: The Winkler's method is relatively complicated and time consuming, but may be appropriate if the culture system is small and financial resources are limited. Dissolved oxygen meters are quick and convenient to sue, but expensive and require regular maintenance to function correctly. Calorimetric samplers or kits are reasonably accurate and suitable for field analysis, but sometimes difficult to interpret at night with limited light. If multiple readings are frequently taken a polar graphic meter, is the preferred method.

Principle: DO can be determined by Winkler's method. In this method divalent manganese solution followed by strong alkali is added to sample. Any D.O rapidly oxidizes equivalent amount divalent manganese to basic hydroxides of higher valancy states. When the solution is acidifies in the presence if iodide ions the oxidized manganese ions again revert to divalent state and iodine equivalent to standardize this sulphate solution.

Reagents

- Manganese sulphate (winkler's A) solution:
  Dissolve 480g $MnSO_4$ or 400g of $MnSO_4.2H_2O$ or 364g of $MnSO_4.4H_2O$ in distilled water and makeup the volume to 1 liter.
- Alkaline potassium iodide: (winkler's B) solution:
  Dissolve 500g of NaOH 150g of KI and 20g sodium Azide in distilled water and make up to volume of 1 liter.
- Standard sodium thiosulphate (0.025or n/40) solution dissolves 6.205g of na2s2o3.5h2o in distilled water and make up to volume of 1 liter.
- Starch indicator; make thin paste of about 1g of starch in cold water. Pour 200ml of boiling water in it and stir. Add 0.1 g of salicylic acid or 0,5 g sodium chloride of o.5 ml of formalin as preservation.

Procedure: Water sample is collected 100 ml glass Stopper sample bottle. Avoid contact of the sample with air. The bottle is completely filled without any bubbles. Immediately after collection, 1ml of magnesium sulphate solution is added by means of pipette dipping the end of the pipette at bottom and gradually pulling it near the surface of the water. 1ml of alkaline potassium iodide solution is added in a similar manner and allows the precipitate to settle. If the precipitate is whitish n color oxygen is very poor brown color indicated high dissolved oxygen. Then 1ml of concentrated sulphuric acid is added and the solution is allowed to stand for 5 minutes. From the solution, 50ml of the solution is transferred n to a conical flask and 0.025n sodium thiosulphate is added drop wise from a burette until the yellow color turns o straw color. Then4-6 drops of starch solution are added and the addition of thiosulphate is continued until the blue color turns to straw color and disappears then the readings noted.

Cover Page

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RESULTS

Table 1: Average survival rate of different larval stages

Nauplius	1,600,000(100%)
Zoea	1,312,000(82%)
Mysis	1,200,000(75%)
PL 1 – PL6	1,024,000(64%)
PL 6 –PL 12	8, 00,000 (54%)

PL- Post larvae

From Nauplius to PL 50 % survival rate occurs.

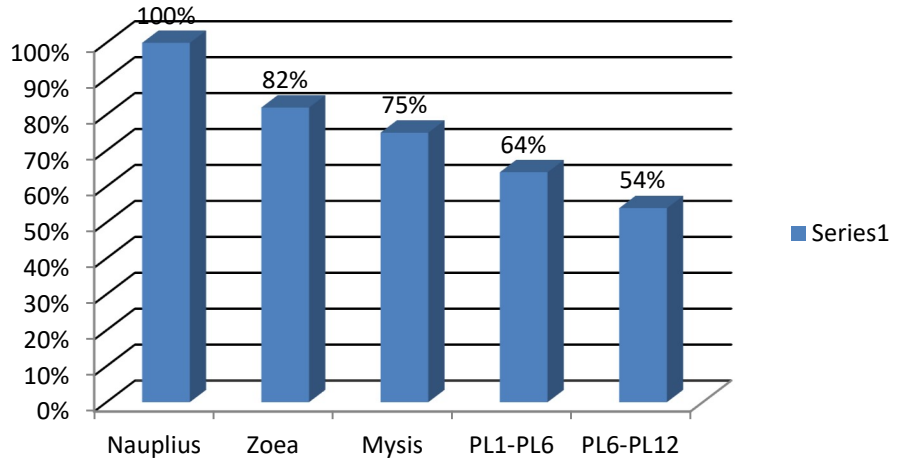

Figure 1: Graph showing decreasing the survival rate from Nauplius stage to PL- 12

Table 2: WATER QUALITY PARAMETERS

parameters	Tank 1	Tank 2	Tank 3	Tank 4	Tank 5
Salinity (ppt)	32	32	32	32	32
pH	8.1	8.1	8.2	8.2	8.2
Water temperature	31	31	31	31	31
Dissolved oxygen	5.58	6.19	5.73	6.10	5.70
Ammonia	0.16	0.14	0.17	0.15	0.17

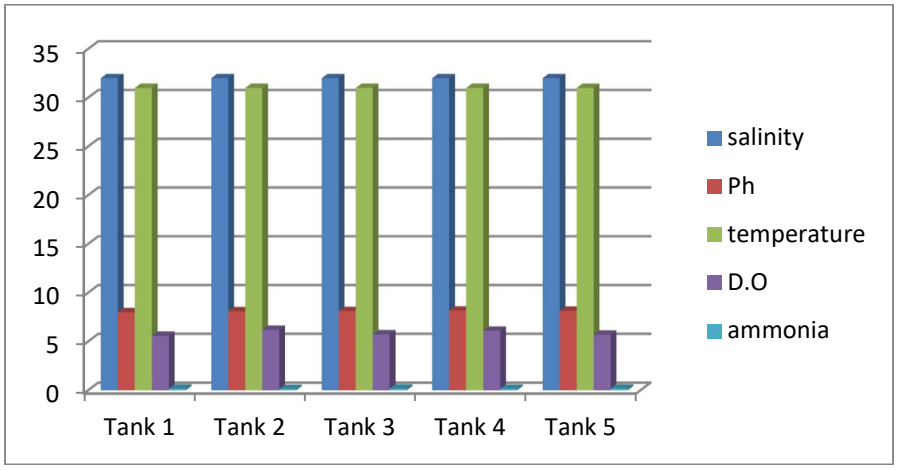

Figure 2: water quality parameters

Cover Page

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Table 3: AVERAGE LENGTH OF L.vannamei IN EXPERIMENTAL TANKS

	Pl -5	Pl-10	Pl-15	Pl-20
Tank 1	5.1	6.2	7.4	8.1
Tank 2	4.9	6.1	7.3	8.3
Tank 3	5.2	6.5	7.2	8.5
Tank 4	5.3	6.6	7.4	8.6
Tank 5	5.2	6.3	7.5	8.4

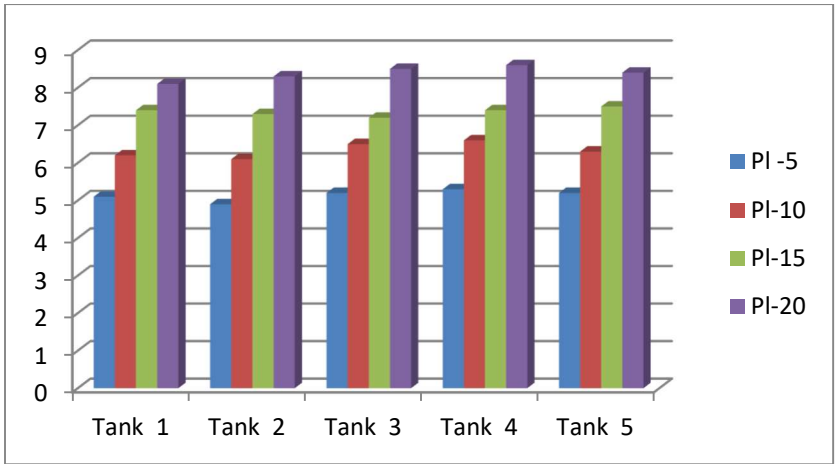

Figure 3: Graph showing length of L.vannamei in experimental tanks

DISCUSSION

Understanding the connection between water quality and aquatic productivity is absolutely essential for optimum growth and production. The quality of water during the culture period will go down mainly due to the accumulation of organic wastes produced by the animals and unutilized feed. Thus, in this study during the entire culture period some important water quality parameter as salinity, Ph, Dissolved oxygen and ammonia were monitored. Salinity is the most important factor influencing many functional responses of the organisms as metabolism, growth, migration, osmotic behavior, reproduction etc. the marine organisms maintain their internal salt concentration (salt concentration of blood and body fluids) by osmoregulation in shrimp hatchery the recommended salinity range is 28-35 ppt (kannupandi et al., 2002). in the present study the salinity was maintained at 30 ppt in all the experimental tanks. Similarly, Krishnaprakash (2007) also maintained the salinity for the larval rearing of P.monodon at 31 ppt during the culture period the ph was found to be 8.1 -8.2 in the entire experimental tanks and the temperature was to be in the range of 31°c in tanks. Similarly, kannupandi et al 2002 also that the required range of shrimp larval culture 8.2-8.5.

Dissolved oxygen in the larvae and adult animals rearing water is an important factor of the respiration of aquatic organisms and also maintain favorable chemical and hygienic environment of the water body moreover it also controls many oxidation reactions and maintain aerobic conditions in water. Because, when oxygen level is very low and anaerobic conditions exist, nitrate is reduced to ammonia, which will be toxic to the larvae or adult in the culture water and it also increase the pH furthermore low level of oxygen tension hampers metabolic performance in shrimp larvae and it will reduce the growth and finally cause huge mortality , so in this study the oxygen level in the culture medium was maintained in the desired range by aeration continuously during the whole culture period in L. vannamei culture where as checking the dissolved oxygen it was found to be higher in experimental tank 2 (6.19) followed by tank 4(6.10) .moreover the ammonia was found to be low in experimental tank 2 (0.14) followed by tank 4 (0.150). **Table & figure 2, 3.**

Kurmaly et al (1989**)** has stated that poorest algal diet in terms of survival and development of the larvae of shrimp fed with dunaliella sp,. Could be due to larger cell size of the algae when compared to diatom. Kuban et al 1985 reported that the survival rates growth is superior in larvae fed with artemia nauplii than microalgae alone. In the present study whereas monitoring the survival rate of the nauplii of L.vannamei it was found be higher in all the experimental tanks. At the end of the culture period pl 20 the average length of all the post larvae was found to be maximum higher in the experimental tank 4 where the animal fed with chaetoceros and enriched artemia.madhumathi and rangasamy 2011 also observed the similar results like high survival rate, length and weight of zoea-

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pl 1 of p. monodon fed with c.calcitrans and pl-1pl20 stages fed with c.calcitrans enriched artemia nauplii diets. They also stated that the zoea to pl1 of shrimps had high protein content of 51% followed by carbohydrates 6% and lipid 50% when it was fed with c.calcitrans.

CONCLUSION

Since the demand for shrimp products in the world markets continues to increase the continuous supply of healthy, inexpensive, and robust shrimp seed stocks to the farmers is important to maintain production of adult shrimp. Microalgae stay an important part of aquaculture production chain particularly for hatchery shrimp feed, in spite of expensive culture installation and high production cost.

From the result it is concluded that the use of live feed such as microalgae enriched with artemia will promote the successful production of shrimp farming in hatcheries and reduce the potential negative impacts of shrimp farming on the environment like organic matter accumulation, ammonofication, eutrophication and water toxicity and increase the productivity of farms. Shrimp culture productions provide a significant role in the fisheries sector of India and the seafood export of India mainly relies on shrimp production, though India produces considerable quantity of carp varieties. This study is very useful for rearing development and maintenance of shrimp culture to students, researchers and Aquacultures'.

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