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Salinity and temperature tolerance of snapping shrimps (*Alpheus* sp.)

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Abstract

This study aims to identify the survival rate of snapping shrimps at different levels of salinity. The different levels of salinity used were T_1-0ppt, T_2-10ppt, T_3-20ppt, T_4-25ppt, and T_5-35ppt) with three replications. The experiment was laid out in a Complete Randomized Block Design (RCBD) with five (5) treatments. One way ANOVA was used to test the significance among the treatments with the ratio of one liter per sample. Results showed that snapping shrimp at zero (0) percent ppt died at day 1. While other treatment such as the 10ppt got 53.3%, 20ppt (63.3%), 35ppt and 56.7% survival rate. Highest percent survival of 90% was obtained at 25ppt. The temperature and salinity are at optimum level which is 30.7% and 25ppt respectively. The level of tolerable salinity of the snapping shrimp is at 25 ppt as observed in the percent survival obtained. Results suggest that salinity stress test survival rate gives the fisher folks an avenue that snapping shrimps is a good potential for culture.

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Introduction

Snapping shrimp (*Alpheus* sp.) is locally known as "takla" and commonly identified as of the beneficial relationship with the gobies and other aquatic animals. They are dirty green colored crustacean that prowls the shallow waters of tropical seas. It has two claws, one resembling an oversized boxing glove which it uses to stun prey, such as small crab, by snapping the oversize claw shut (Roach 2001).

This species are sensitive in changing the water condition such as temperature, pH and salinity. They are easily affected by sudden changes and any water changes done with synthetic mixes should be gradual, doing no more than 10 to 20 percent at a time, allowing a day between changes. In adequate or improper acclimation will result in death through what is called salinity shock. Snapping shrimp are especially sensitive to chlorine or chloramines in city water supplies, so it's important to use a dechlorinator or ammonia neutralizer to remove these chemical.

The status of other shrimp production to culture management here in the Philippines has the highest power and transport cost in Asia. Consequently, its production cost is also the highest. The strategy that is now working for the Philippines is to produce the *L. vannamei* for the domestic market, and the *P. monodon* for the export market.

Water temperature and salinity are considered to be the main a biotic factor influencing oxygen consumption in aquatic animals (Vernberg, 1983). Crustaceans' metabolism is directly influenced by temperature fluctuations of the surrounding environment, as enzymatic reactions are temperature-dependent and crustaceans' body temperature is not internally regulated (Randall *et al.*, 1997). Within the tolerated temperature variation range, oxygen consumption rate increases constantly and regularly with temperature elevation. In general, an increase of 10°C results in oxygen consumption two to three times higher. Such increase is denominated thermal coefficient (Q10) and represents the degree of sensibility of an organism to temperature (Schmidt-Nielsen, 1999).

Salinity fluctuations also cause alterations in the metabolic rate as a result of a series of behavioral and physiological changes, such as osmoregulation. The need to maintain within strait limits the volume and the concentration of solutes in the body fluids, which invariably differ from that of the surrounding environment, compels the animals to keep adequate mechanisms to sustain the equilibrium, guarantee ionic and osmotic homeostasis, and protect internal tissues against oscillations of the surrounding environment with metabolic costs that can reflect on oxygen consumption (Mantel; Farmer, 1983). The study determines the significant tolerable salinity of snapping shrimp (*Alpheus sp.)* as indicated in their survival rate at different level of salinity 35, 25, 20, 10, 0 ppt.

Materials and methods

Research Design

The study was conducted to determine the tolerable salinity of snapping shrimp using the different salinity treatments T_1-0ppt, T_2-10ppt, T_3-20ppt, T_4-25ppt, and T_5-35ppt) with three replications. The experiment was laid out in a Complete Randomized Block Design (RCBD).

Research Environment

The experimental set-up was conducted at Desamparados Calape. This area was known to have a good source of available marine water and shaded that is free from a direct exposure to sunlight with the temperature ranges is at optimum level required by the samples. The power supply was also considered to maintain the amount of air supplied using the aeration since the set-up is not their natural habitat.

Research Procedure

The newly caught adult snapping shrimp was bought from a contact gatherer. In this study 50 pcs sample were used per replication. The following materials were prepared such as the marine water, freshwater, graduated cylinder, basins, aerator, thermometer, and refractometer. The snapping shrimp were handled with extra care to prevent minor injuries that could lead to diseases and could invite fungal infections. Snapping shrimp were stocked in a basin with aeration at different salinity ranges. Dilution is applied to obtain the exact salinity ranges.

Five basins per replications were laid in the floor having different salinity ranges. Each basin was stocked with 10 snapping shrimp with 10 liters of water. Aerator was used to supply oxygen. Temperature was monitored every morning and late afternoon.

Care and Maintenance

The experimental set-up was regularly monitored daily. Cleaning and changing of water in the basins were done every three days to remove the dirt.

Data Collection

Snapping shrimps were monitored daily from Day 1 to Day 7 to get the survival rate per day until such time that all shrimp was died. Water temperature was gathered early and late in the morning using thermometer to determine the minimum and maximum range that could affect their survival of snapping shrimp. Dilution was done to obtain the exact salinity range used in the study. Salinity was gathered every other hour to monitor the fluctuation of the water with the use of refractometer. Qualitative assessment especially the improvement and changes were noted. Data gathered was used as basis in the analysis and interpretation.

Statistical Analysis

To determine the significance of the snapping shrimp's characteristics particularly the survival rate at different levels of salinity one way ANOVA was used. Mean, percentages and simple frequency were also used.

Results and discussion

Survival Rate of Snapping Shrimp at Different Salinity Range

The survival of snapping shrimp was dependent on the salinity ranges of the water and its temperature. The change in temperature and the salinity range greatly affects the snapping shrimp mortality. Data shows that mortality start at 0 ppt or in the freshwater. All samples in freshwater died less than five (5) hours. Majority of the snapping shrimps did not tolerate with the treatment that has higher percentage of freshwater.

The number of shrimps tolerates the salinity stress varies to the amount of freshwater water added. there are 16 snapping shrimps survived for the 30 samples in 10ppt, while in 20ppt 19 survived, both 25ppt and 35ppt got 27 sample survived. Samples with shells cuts are majority died.

According to Ponce- Palafox *et al.* (1997) reported that within the optimum temperature range, tolerance to salinity is high and growth is unaffected. Therefore, in condition where these parameters cannot be properly controlled, the animal physiological needs must be considered for each given condition. Considering the temperatures, salinities and shrimp sizes tested, it can be concluded that the most adequate conditions comfort of juvenile *L. vannamei* in temperatures between 25 and 30°C would be salinities from 13 to 25%, where recommendation is to avoid the extreme ends and in temperatures below 20°C salinity above 25% would be ideal due to the impairment of the hyper osmoregulatory ability observed in lower salinities.

Temperature

The temperature result showed that samples in the 25ppt with the maximum temperature of 30.7 and minimum of 24.2 have the highest survival rate of 90%. The snapping shrimp had better tolerance to 25ppt salinity range than of the rest of the treatments. The best survival of snapping shrimp was found out at 25ppt with temperature ranges 24.22 to 30.7 with an average of 90% Table 1. Results give awareness to the interested person who wants to engage snapping shrimp's culture as their livelihood program. The result was supported by the study conducted by Chaitanawisuti *et al.* (2003), that the best salinity and temperature combination for the culture of shrimp were 29°C at 25, 30, 33, and 35ppt, and 29 °C at 25 and 30 ppt, respectively.

The lowest temperature occurred was observed during the 4th day because of the heavy rain. The highest temperature occurred in the 1st day because of the hot weather. Temperature is one factor controlling the speed of biochemical reactions. This is because the temperature can determine the metabolic rate of shrimp and other aquatic organisms.

Low temperatures will result in a lower metabolic system in contrast to the high temperature will spur a more rapid metabolism. The range of temperature is gathered daily to find out if it had effect on the survival of snapping shrimps at different salinity ranges. In the whole period of the study the minimum temperature of the five treatments was 24.2 and the maximum was 30.7.

Table 1. Survival rate of snapping shrimps at different levels of salinity.

Treatment	DAYS																				
	1			2			3			4			5			6			7		
	SS	S	%	SS	S	%	SS	S	%	SS	S	%	SS	S	%	SS	S	%	SS	S	%
0 ppt	30	0	0	30	0	0	30	0	0	30	0	0	30	0	0	30	0	0	30	0	0
10 ppt	30	25	83.3	30	22	73.3	30	18	60	30	16	53.3	30	16	53.3	30	16	53.3	30	16	53.3
20 ppt	30	27	90	30	22	73.3	30	19	63.3	30	19	63.3	30	19	63.3	30	19	63.3	30	19	63.3
25 ppt	30	30	100	30	27	90	30	27	90	30	27	90	30	27	90	30	27	90	30	27	90
35 ppt	30	22	73.3	30	18	60	30	17	56.7	30	17	56.7	30	17	56.7	30	17	56.7	30	17	56.7

SS-Stocks

S-survive

%-survival rate

The temperature increased and decreased because of the change of weather condition. Temperature is measured every morning and afternoon using thermometer. Samples in every treatment were placed in a basin with aeration. There was no feeding and water exchange during experiment.

The result is supported in the study by Chaitanawisuti *et al.*, 2003 that temperature had a greater influence on survival of shrimp than salinity and low water temperature (29°C) gave better shrimp survival than higher water temperature (33°C and 35 °C).

There is significant difference on the survival rate of snapping shrimps at different levels of salinity at 0.05 level of significance.

Data shows that at oppt or pure freshwater starting from day 1 all the sample died. The means between treatments indicates that 25ppt is significantly better from the rest of the treatments.

Conclusion

Most of the snapping shrimps died at day 1 at 0 ppt salinity. This is highly sensitive to chlorinated waters. The use of 25ppt has resulted to a higher survival rate for a one week period of study.

Recommendation

Fish farmers should engage in snapping shrimp culture using brackish water with a salinity range of 25ppt.

References

Chaitanawisuti N, Santhaweesuk W, Wattayakorn G. 2003. The combined effects of temperature and salinity on survival of postlarvae tiger prawn *Penaeus monodon* under laboratory condition. Retrieved on October 1, 2014.From http://www.scirp.org/journal/PaperInformation.aspx PaperlD=33747

Herberhorlz J, Schmitz B. 1998. Role of Mechano sensory stimuli. Retrieved on October 8, 2014. From http://www.scielo.br/pdf/bjoce/v57n4/v57n4a05.pdftra specific agonistic encounters of Snapping (*Alpheus heterochaelis*). The Biological Bulletin **195,** page 156-157

Nolan BA, Salmon M. 1970. The behavior and ecology of snapping shrimp (crustacean; *Alpheus heterochealis* and *Alpheus noraonni*). Forma et functio **2,** 289-335. Retrieved on February 8, 2014. From http://www.sms.si.edu/irlspec /Alpheus.

Roach J. 2001. Snapping shrimp stun Prey with flashy bang in National Geographic News. Retrieved on February 16, 2014. From http://www. bar.gov.ph/digest-home/digest-archives/127-2009-3rd-quarter/1391-julsep09-snapping-shrimp-10

Ponce-Palafox J, Martinez-Palacios CA, Ross LG. 1997. The effects of salinity and temperature on the growth and survival rates of juvenile white shrimp *Penaeus vannamei*, Boone, 1931. Aquaculture **157,** 107- 115

Schmidt-Nielsen. 1999. K. Fisiologia animal: Adaptação emeio ambiente. São Paulo: Ed. Livr. Santos,. P.600 Retrieved on October 8, 2014. From http://www.scielo.br/pdf/bjoce/v57n4/v57n4a05.pdf

Vernberg FJ, Vernberg WB. 1983. Respiratory adaptations. The Biology of Crustacea: Environmental adaptations. New York: Academic Press, p1-42 Retrieved on October 8, 2014.
http://www.scielo br/pdf/bjoce/v57n4/v57n4a05.pdf