

LARVAL REARING OF *RANINA RANINA*

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The spanner crab (also known as the "frog" or "kona" crab) is an edible crab species growing to a weight of about 1 kg. Its common name is derived from the spanner-like appearance of its claws, its postural similarity to a frog, and from its presence along the Kona coast of the island of Hawaii. Live spanner crabs are a pale tan to orange color, but turn to a characteristic strawberry red when cooked.

Research studies on this commercially important crab species, *R. ranina*, have been conducted for years. Studies on larval rearing of *R. ranina* from hatching to young crab showed a possibility (Abrea, 1988).

With the growing demand for crabs in the foreign market, it is expected that intensive farming of this crustacean will make it an important export item (Vicente, 1980). Thus the need for larval rearing technique from hatching to crab stage is necessary to supply young crabs to crab farmers.

Objectives

The project to rear *R. ranina* from hatching to crab stage involved the following specific objectives:

1. To determine the growth and survival of *R. ranina* larvae fed with *Artemia* sp. nauplii, *Brachionus* sp. and *Skeletonema* sp.

2. To determine some physico-chemical requirements for the culture of *R. ranina* larvae.

Review of Literature

The biology and culture of *R. ranina* are important aspects to be investigated when considering the aquaculture potential of the species. In investigating the culture potential of *R. ranina*, Vicente et al. (1986), obtained better survival using *Brachionus* sp. as feed compared to the survival when the larvae were fed with *Dunaliella* sp., clam juice, and egg yolk.

Several attempts were made to rear a number of zoea in aquarium facilities at the Southern Fisheries Research Center, with a major aim of providing the first description of the megalopa stage (Brown, 1986). The researcher used highly advanced aquarium systems and rooms had been equipped with thermostatically-controlled air conditioning and heaters, but none of the zoea stage reached megalopa.

In 1988, Abrea et al. were able to culture *R. ranina* larvae up to megalopa stage using *Brachionus* sp. and *Artemia* sp. as feed at water temperature of 30°C and 32 °C.

The following year, Rosal et al. observed that *R. ranina* larvae had the higher survival when fed with *Brachionus* sp. than when fed with *Artemia* sp.

Research Highlights

A. Collection and stocking of adult *R. ranina*

Adult *R. ranina* collected from Talisayan, Misamis Oriental and its adjacent waters were transported to the laboratory in sealed plastic bags containing air and seawater. They were then stocked in a one-ton capacity fiberglass tank and fed ad libitum with chopped cow liver. The tank water was changed daily. The crabs that developed ovaries were transferred into separate tanks.

B. Test for pH and salinity tolerances

Tests on desirable pH-salinity combinations were not implemented due to cloudiness of the culture medium at high pH and high salinity, and the presence of white precipitates, probably resulting from a reaction of sodium hydroxide added to seawater.

On the test for salinity tolerance, the seawater used was added with salt when salinity level was raised and by dilution with tap water when salinity was lowered. The levels of salinity were varied at 25, 30 and 32 ppt.

The larvae were stocked in 1 liter seawater at 15 individuals per liter in a 3 liter capacity plastic jars. The jars were submerged in a water bath to maintain the temperature at 26°C to 28°C. *Artemia* sp. was used as feeds. Every morning the larvae were individually transferred to another jar with fresh water medium. Three replicates were made for each salinity treatment.

Growth was observed in terms of molting and the larvae were headcounted during the daily transfer to record the survival.

C. Feeding experiment

Artemia sp. nauplii, *Brachionus* sp. and *Skeletonema* sp. were used as test feeds. *Artemia* sp. was fed to the larvae at 3 to 5 individuals per ml, *Brachionus* sp. at 10 to 15 individuals per ml, and *Skeletonema* sp. at 30,000 to 40,000 cells per ml.

The larvae were stocked in 1 liter seawater (32‰) at 15 individuals per liter in a 3 li capacity plastic jars. Temperature were maintained at 26°C to 28°C in a water bath. Three feeding treatments were made with 3 replicates per treatment.

The water was totally changed daily in the morning by transferring the larvae to a newly prepared container with seawater.

During the transfer, the number of swimming larvae were recorded.

Growth in both experiments were observed daily. Growth was in terms of molting.

D. Other experimental setups

Similar rearing of *R. ranina* was done in plastic basins.

The larvae were fed with *Artemia* sp. at 3 to 5 individuals and temperature was maintained at 30°C to 32°C.

The above setup was repeated later but the temperature was maintained at 26°C to 28°C.

E. General observations

Adult *R. ranina* specimens were collected solely from the coastal waters of Punta Santiago, Talisayan, Misamis Oriental. A total of 5 collection trips were made from April to October.

Twenty-five adults were collected of which only six were female.

Three berried females were collected on April and all hatched their eggs on the first week of May. The larvae were not used in the experiment due to high mortalities upon hatching and poor condition of the remaining 7,000.00 larvae. However, the larvae were cultured in plastic basins using *Brachionus* sp. as feed on the first three days and *Artemia* sp. during the later days and the water temperature was maintained at 30°C to 33°C.

Only 210 larvae survived after one week from hatching. The occurrences of molting were observed to be non-synchronous among the individual larvae of the same batch. Some molting larvae were observed impaired in their movement because their exuvia remained attached to their bodies. This phenomenon is common among crustaceans but no concrete explanation is available because of limited information. However, similar observations are reported for insect larvae, such as caterpillar. Accordingly,

partial molting is due to the failure of molting hormone to gain access to some body parts (Balinsky, 1975).

On June 12, 37 days after hatching, one zoea metamorphosed to megalopa stage but it died after a few hours. A closer look on the microscope revealed that the exuvium remained attached on its abdominal portion, especially on its legs.

On the first week of September, five berried crabs were observed in the holding tank, three of which being those individuals which had previously become berried and hatched their eggs in April.

On the 3rd week 2 crabs had their eggs detached; the other two were observed to have fungal infection on their eggs. The remaining one crab hatched its eggs on October 7 and produced about 5,000 larvae. The larvae were used in the experiments to determine the survival and growth of *R. ranina* larvae fed different feeds and the test to measure salinity tolerance. Some larvae were cultured in basins using *Artemia* sp. as feed and the water temperature maintained at 26°C to 28°C.

Almost the same result was obtained in this experiment as in the previous experiment conducted in April. But growth was somewhat slower and it took 59 days before a larva metamorphosed to megalopa stage. The delay in the metamorphose was probably due to low metabolism as a result of lower temperature. However, the megalopa was almost twice the size compared to the previous megalopa. The megalopa survived only for 4 days.

F. Salinity

Percentage survival of *R. ranina* larvae cultured at different salinity levels is presented in Table 1.

Table 1. Average daily percentage (%) survival and growth of *R. ranina* at different salinity levels.

	Salinity		Number of Days						
	LEVEL	0	1	2	3	4	6	7	
25 PPT	100	53.33	42.22	35.55	22.22	11.11*	0	-	
30 PPT	100	62.22	46.66	40.00	17.17*	8.89	4.4	-	
32 PPT	100	51.11	46.66	35.55	31.11*	22.22	22.22	-	

* Zoea 2

The larvae at 32‰ had the highest survival at day 6 followed by the survival at 30 ppt, and 25 ppt. However, no significant difference in daily survival at 5% level was found among treatments (Appendix Tables 3, 4, 5, 6, & 7).

Growth was observed to be synchronous in treatment 2 (30 ppt) and treatment 3 (32 ppt) based on the larval morphological development, pigmentation and molting.

G. Feeding

The data on mean percentage survival of *R. ranina* larvae fed with *Brachionus* sp., *Skeletonema* sp., and *Artemia* sp. are presented in Table 2.

Table 2. Average daily percentage (%) survival and growth of *R. ranina* larvae fed with the three diets.

	Date	Number of Days					
		4	5	6	7		
<i>Brachionus</i> sp.	100	33.33	17.55	9.55	2.00	2.00	0
<i>Skeletonema</i> sp.	100	46.66	15.33	6.44	2.00	0	0
<i>Artemia salina</i> sp.	100	51.11	46.66	35.55	31.11*	22.22	22.22

* Zoea 2

The larvae fed with *Artemia* sp. had high daily survival throughout the culture period followed by *Brachionus* sp. and *Skeletonema* sp. However, there was no significant difference on daily survival at 5% level until the 3rd day. The larvae fed with *Artemia* sp. exhibited highest survival, different from last year's result which showed that the larvae fed with *Brachionus* sp. gave higher survival than the *Artemia* sp.-fed larvae. Previous studies by other workers (Sulkin & Norma, 1976; Levine & Sulkin, 1984) reported convincing data that the chemical composition of *Artemia* sp. contains the essential nutrients that could satisfy the requirements for optimum development of brachyuran crab larvae such as *R. ranina*.

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APPENDIX TABLES

Table 1. Analysis of variance for percent survival of *R. ranina* larvae reared at different salinity level. Day 1.

Source of Variation (SV)	Degree of Freedom (DF)	Sum of Squares (SS)	Mean Squares (MS)	Computed F	Tabular 5%	F 1%
Treatment	2	74.533	37.267	0.335*	6.94	18.00
Experimental Error	6	688.045	111.341			
Total	8	742.578				

* - not significant

Table 2. Analysis of variance for percent survival of *R. ranina* larvae reared at different salinity level. Day 3.

Source of Variation (SV)	Degree of Freedom (DF)	Sum of Squares (SS)	Mean Squares (MS)	Computed F	Tabular (5%)	F (1%)
Treatment	2	3.864	1.932	0.025*	6.94	18.00
Experimental Error	6	468.158	78.026			
Total	8	472.022				

* - not significant

Table 3. Analysis of variance for percent survival of *R. ranina* larvae reared at different salinity level. Day 4.

Source of Variation (SV)	Degree of Freedom (DF)	Sum of Squares (SS)	Mean of Squares (MS)	Computed F	Tabular F (5%)	F 1%
Treatment	2	113.035	6.58	6.94*	18.00	18.00
Experimental Error	6	318.343	53.057			
Total	8	421.378				

* - not significant

Table 4. Analysis of variance for percent survival of *R. ranina* larvae reared at different salinity level. Day 5.

Source of Variation (SV)	Degree of Freedom (DF)	Sum of Squares (SS)	Mean of Squares (MS)	Computed F	Tabular F	F 1%
Treatment	2	183.288	91.644	1.220*	6.94	18.00
Experimental Error	6	450.833	75.139			
Total	8	634.122				

* - not significant

Table 5. Analysis of variance for percent survival of *R. ranina* larvae reared at different salinity level. Day 6.

Source of Variation (SV)	Degree of Freedom (DF)	Sum of Squares (SS)	Mean of Squares (MS)	Computed F	Tabular 5%	F 1%
Treatment	2	44.581	232.290	1.714*	6.94	18.00
Experimental Error	6	811.818	135.303			
Total	8	1276.399				

* - not significant

Table 6. Analysis of variance for percent survival of *R. ranina* larvae reared with different diets. Day 1.

Source of Variation (SV)	Degree of Freedom (DF)	Sum of Squares (SS)	Mean of Squares (MS)	Computed F	Tabular 5%	F 1%
Treatment	2	176.628	88.314	0.982*	6.94	18.00
Experimental Error	6	539.33	89.889			
Total	8	715.960				

* - not significant

Table 7. Analysis of variance for percent survival of *R. ranina* larvae reared with different diets. Day 2.

Source of Variation (SV)	Degree of Freedom (DF)	Sum of Squares (SS)	Mean of Squares (MS)	Computed F	Tabular F 5%	F 1%
Treatment	2	642.589	321.295	2.840*	6.94	18.00
Experimental Error	6	678.758	113.126			
Total	8	1321.347				

* - not significant

Table 8. Analysis of variance for percent survival of *R. ranina* larvae reared with different diets. Day 3.

Source of Variation (SV)	Degree of Freedom (DF)	Sum of Squares (SS)	Mean of Squares (MS)	Computed F	Tabular F 5%	F 1%
Treatment	2	763.978	381.989	3.290*	6.94	18.00
Experimental Error	6	696.541	116.090			
Total	8	1460.520				

* - not significant

Table 9. Analysis of variance for percent survival of *R. ranina* larvae reared with different diets. Day 4.

Source of Variation (SV)	Degree of Freedom (DF)	Sum of Squares (SS)	Mean of Squares (MS)	Computed F	Tabular 5%	F 1%
Treatment	2	1690.905	845.453	16.245	6.94	18.00
Experimental Error	6	312.270	52.045			
Total	8	2003.175				

Table 10. Analysis of variance for percent survival of *R. ranina* larvae reared with different diets. Day 4.

Source of Variation (SV)	Degree of Freedom (DF)	Sum of Squares (SS)	Mean of Squares (MS)	Computed F	Tabular 5%	F 1%
Treatment	2	1025.715	512.857	15.658	6.94	18.00
Experimental Error	6	196.517	32.753			
Total	8	1222.231				