Survival rate and nursing cost of *Macrobrachium rosenbergii* larvae nursed in rock salt water

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ABSTRACT: Naturally, Giant Freshwater Prawn *(Macrobrachium rosenbergii)* requires sea water of hatching stage. However, fisheries extension with regard to this prawn production in Northeast Thailand where is plentiful of rock salt water, has been conducted. A research study aimed to compare survival rate and nursing cost of prawn larvae nursed in rock salt water instead of natural sea water. The larvae were nursed in plastic boxes containing 50 litres of water volume. Four boxes contained rock salt water while the other four boxes contained natural sea water. Five thousand individuals of the larvae (100 individuals/l) were nursed in each box for 30 days. A comparative study between both types of nursing was conducted. The result found that survival rate of the larvae nursed in rock salt water was 1,488 individuals while those of natural sea water were 1,675 individuals with no significant difference. Regarding nursing cost, however, nursing in rock salt water showed significantly higher cost than nursing in natural sea water with the cost of 1,281.4 baht/box and 140.56 bath/box, respectively. The average difference is about 1,140.84 baht/box or 9 times difference.

Keywords: survival rate, rock salt water, natural sea water, nursing cost, Macrobrachium rosenbergii

Introduction

Giant Freshwater Prawn (*Macrobrachium rosenbergii*) is an aquatic animal that life cycle from hatching to post larva stage takes one month to live in brackish water (12-15 ppt salinity) (New and Singholka, 1982; Fugimura and Okamoto, 1996; New, 2002). As such, the prawn production in hatchery system is necessary to induce concentrate sea water (120-150 ppt salinity) to be diluted until it is in the optimum rage of salinity as mentioned. Most hatcheries are preferably located near the coastal areas. However, there are a number of Inland Fisheries Research Centres located in Northeast Thailand where is plentiful of underground rock salt but very far from the sea (Topark-ngarm, 2006), particularly at Bandoong district of Udon Thani. For the past 10 years, these research centres have purchased and carried high concentrate sea water from Chon Buri, and/or Samuth Songkram province. According to literature reviews, the basic property of rock salt contains similar components as in the composition of sea water (Parker et al., 1984; Tunsutapanich et al., 1987; Hirunchulha and Silapajarn, 2005). Therefore, adding some minerals into salted water released from the rock salt is feasible. This may improve the utilisation of this water to be used as medium for prawn hatchery instead of using natural sea water, particularly in Northeast Thailand. This study aimed to compare survival rate and nursing cost of *Macrobachium rosenbergii* larvae nursed in rock salt water instead of natural sea water.

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Materials and methods

Water samples taken from both sources, i.e. natural sea water and rock salt water were diluted to be at the concentration of 12 ppt (Musik et al., 1986) salinity. Chloride, sodium, sulfate, magnesium, potassium, and calcium ions dissolved were detected using Atomic Absorption Spectrophotometer (Franson, 1989). Mineral elements analysis from both water sources was compared to check baseline concentration of solution compounds. K_2SO_4, $MgSO_4$, $MgCl_2$, and $CaMg(CO_3)_2$ were filled into rock salt water as major mineral elements (Therachindakajorn, 2009) and then analysed again before using as medium for prawn hatchery whereas another rock salt water source was not added. The larvae were nursed in plastic boxes containing 50 litres of salt water. Four boxes contained rock salt water while the other four boxes contained natural sea water. Five thousand individuals of the larvae (100 individuals/l) were nursed in each box for 30 days. Steamed egg and *Artemia sp.* were used as feeds from larva until post lava stages. Survival rate detected from 3 treatments with 4 replications were compared under Duncan's Multiple Range Test (DMRT) at 95% confident level.

Results and discussion

From the analysis of major mineral elements in natural sea water and rock salt water, it was found that both chloride and sodium ions in rock salt water were higher concentration than that in natural sea water, on the other hand, sufate, magnesium, potassium, and calcium ions were lower (**Table 1**). Nevertheless, after adding potassiumsulfate (K_2SO_4), magnesiumsulfate ($MgSO_4$), magnesiumchloride ($MgCl_2$) and dolomite ($CaMg(CO_3)_2$) in rock salt water, the result showed that the concentration of major mineral elements dissolved was increased as shown in **Table 1**.

Table 1 Major mineral elements analysed from 3 treatments (mg/l)

Mineral elements	Natural sea water	Rock salt water	Minerals added rock salt water
Cl	7,615	7,945	8,952
Na	4,005	5,196	5,132
SO4	1,170	222	789
Mg	631	13	397
K	92	30	191
Ca	202	10	99

During 30 days of nursing, the results show that all prawn larvae reared in rock salt water died within the first day of observation whereas prawn larvae reared in both natural sea water and minerals added rock salt water were alive until post larva stage with the survival rates of 75.75 and 81.25, 61.50 and 63.25, 33.50 and 29.75, for 10, 20, and 30 days of nursing in sea water and

minerals added rock salt water, respectively. There was no significant difference of survival rates between nursing in sea water and rock salt water added minerals found in this study ($p>0.05$, Table 2).

Table 2 Survival rate of *Macrobrachium rosenbergii* nursed in natural sea water, rock salt water, and minerals added rock salt water (percent of survival rate ± SE)

Day	Sea water	Rock salt water	minerals added rock salt water
10	75.75±4.79a	0b	81.25±4.99a
20	61.50±7.42a	0b	63.25±3.10a
30	33.50±3.87a	0b	29.75±3.30a

Comparing among 3 treatments of nursing, the results indicated that average nursing fix cost was 11.65 bath/box for all treatments while variable cost of nursing in natural sea water, rock salt water, and minerals added rock salt water, were 510.01, 468.78, and 1650.91 bath/box, respectively. The variable cost of nursing in minerals added rock salt water is approximately 4 times higher than nursing in natural sea water as a result of laboratory grade chemical expense. Thus, using commercial grade is suggested to reduce variable cost in case of the future research.

Table 3 Nursing cost of *Macrobrachium rosenbergii* in natural sea water, rock salt water, and minerals added rock salt water

Cost	Natural sea water	Rock salt water	Rock salt water added minerals
Variable cost (bath/box)	510.01	468.78	1,650.91
The first hatching stage lavae	8.33	8.33	8.33
Natural sea water	45.57	-	-
Rock salt water	-	4.34	4.34
Chemicals	6.18	6.18	6.18
Minerals	-	-	1,182.13
Feed	74.93	74.93	74.93
Worker	375.00	375.00	375.00
Fixed cost	11.65	11.65	11.65
Box depreciation	7.90	7.90	7.90
Greenhouse depreciation	3.75	3.75	3.75
Total cost (baht/box)	521.66	480.43	1,662.56
Yield (individual/box)	1,675	0.00	1,487.50
Nursing cost (baht/ individual)	0.31	-	1.12

Conclusion and recommendation

Nursing Giant Freshwater Prawn (*Macrobrachium rosenbergii*) in rock salt water instead of natural sea water for inland fisheries is feasible to reduce transportation cost in the areas that are remotely located from coastal areas. However, adding mineral elements into rock salt water is necessary to improve baseline water quality required for prawn hatchery because rock salt water contains inadequate essential elements, i.e. sulfate, magnesium, potassium, and calcium ions; therefore, potassium sulphate, magnesium sulphate, magnesium chloride, and dolomite are recommended to be used regarding to the results. For future research, should be introduced to reduce production costs.

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