



Relative development achievement of male and female freshwater prawn *Macrobrachium tenellum* (Decapoda: Palaemonidae) refined in tropical earthen lakes

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Abstract

The purpose of the present study was to determine the performance growth and yield of male and female *Macrobrachium tenellum*, cultured in earthen ponds. A total of 6 earthen ponds containing $1,400 \pm 50.0 \text{ m}^2$ of water and a depth of 0.85 m were used. A total of 19,600 juvenile *M. tenellum* were introduced into each pond to a stocking density of 14 org m^{-2} . The final length, final weight, specific growth rate, weekly growth rate and yield presented significant differences ($P < 0.05$) between sexes, with the males exhibiting higher values of these indicators. The survival rate was higher in females (65.0%). The total yield obtained in this culture reached $1,603 \text{ kg ha}^{-1}$.

Keywords: *Macrobrachium tenellum*, specific growth rate, weekly growth rate, survival rate, feed conversion rate.

INTRODUCTION

Two species of freshwater prawns belonging to the genus *Macrobrachium*, *M. americanum* (Bate) and *M. tenellum* (Smith) have fishery importance in the tropical and subtropical coasts of the American Pacific. This latter species has been considered a good candidate for aquaculture due its biological characteristics distinct from other congeners, such as the capacity to tolerate high densities, lack of aggressiveness and cannibalism and ability to tolerate wide fluctuations in water temperature (16 to 32°C), salinity (up to 20 psu) and dissolved oxygen concentrations (0.5 to 5.59 mg L^{-1}), which increases its

economic importance (Guzmán-Arroyo, 1987; Ponce-Palafox et al., 2002; Vega-Villasante et al., 2011). Several studies on different aspects of aquaculture of *M. tenellum* such as growth performance, survival, diseases and descriptions of ectoparasites and polyculture systems have been reported (Sánchez, 1976; Martínez-Palacios et al., 1980; Guzmán-Arroyo, 1987; Ponce-Palafox et al., 2002, 2005; Vega-Villasante et al., 2011). This present study was designed to evaluate the growth performance and yield of male and female freshwater *M. tenellum* cultured in tropical earthen ponds.

MATERIALS AND METHODS

The experiment was conducted over a period of 144 days from May

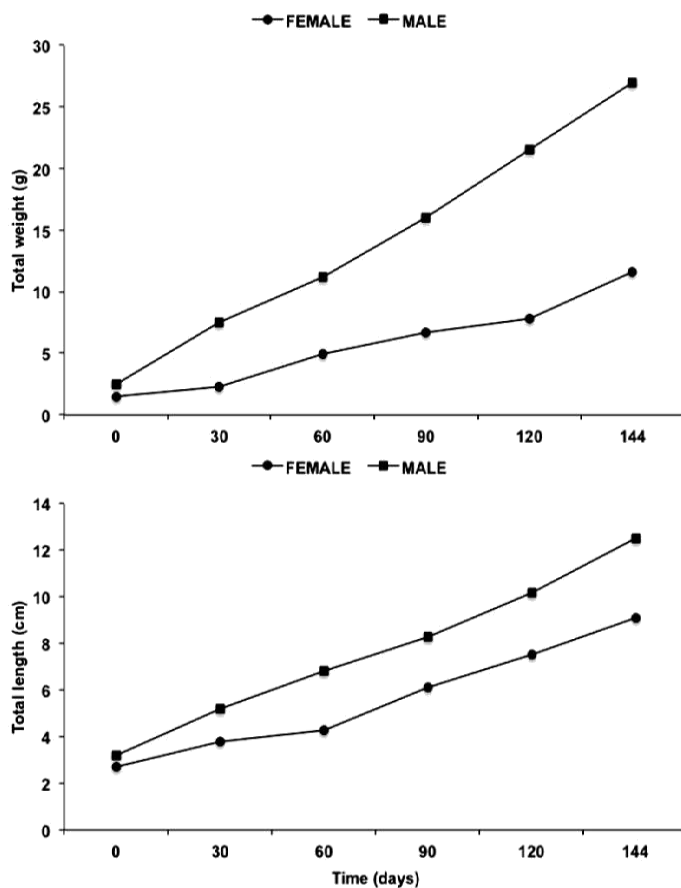


Figure 1. Total length (TL) and total weight (TW) growth in male and female *M. tenellum* freshwater prawns in earthen ponds.

to September 2011 in the Real de Acuitapilco Farm, which is located in Santa Maria del Oro, Nayarit, Mexico (21°20'35.02" N, 104°31'19.09"W), at 771 m above sea level. A total of 6 rectangular earthen ponds were used with 1,400 ± 20.0 m², with an average depth of 0.85 m. Initially, 19,600 freshwater prawn juveniles were introduced into each pond, maintaining a density of 14 org m⁻². The prawn juveniles were purchased from a nearby commercial hatchery and then transported to the experimental site equipped with aerators. The separation of the male and female juveniles of *M. tenellum* was done manually. The prawn juveniles of 1.9 ± 0.5 g females and 2.5 ± 0.7 g males were stocked according to the experimental design. The experiment was conducted in a completely randomised design into two different treatments with three replications in each: treatment-1 (AF) was conducted with the monoculture of all-female prawns and treatment-2 (AM) was conducted with the monoculture of all-male prawns.

The juveniles were fed shrimp commercial feed (25% protein) at 3% of the total weight, and every weekend, dry and fresh fish (*Poecilia sphenops*) cut into small pieces were incorporated into the diet. Every month, the water temperature, pH, Secchi disk transparency, maximum depth and dissolved oxygen concentration were determined according to the criteria proposed by Arredondo-

Figuroa and Ponce-Palafox (1998). Furthermore, the total length (TL) (from rostrum to telson) was measured with a precision calliper graduated in centimetres, and the total weight TW was also measured (with an Ohaus digital balance of 200 × 0.1 g capacity (Ohaus Corporation, Pine Brooks, NJ, USA)). At the end of the experiment, the weekly growth rate (WGR, g week⁻¹), yield (Y, kg ha⁻²) and survival rate (SR, %) were calculated. Similarly, the specific growth rate (SGR, % day⁻¹) and feed conversion rate (FCR) were estimated using the following formulas proposed by Adegboye (1983):

$$\text{SGR} = (\ln W_f - \ln W_i) \times 100 / T \text{ and } \text{FCR} = \text{FC}(\text{g}) / \text{GW}(\text{g}),$$

where Ln = natural logarithm; W_f = final weight; W_i = initial weight; T = time; GW = weight gain and FC = feed consumption.

At the end of the experiment, the adult freshwater prawns were harvested from each pond by netting repeatedly with a fine-meshed seine net. All of the prawns harvested from each pond were counted, measured and weighed to evaluate the growth and production performance of the manually segregated all-male and all-female giant freshwater prawns in pond culture systems. An ANOVA (Montgomery, 1997) was performed to determine the mean growth differences between males and females using a significance of P < 0.05.

RESULTS AND DISCUSSION

The mean water temperature was maintained between 28 and 32°C throughout the 144 days of culture. From day 44 to 144, the water temperature was increased from 28 to 32°C. The pH presented small changes from 6.5 to 7.1. The Secchi disk transparency ranged from 15.7 in July to 28.0 cm in August. The maximum depth of the ponds fluctuated from 81.7 to 88.6 cm, and the mean values of dissolved oxygen ranged from 5.5 to 6.5 mg L⁻¹ during the culture period.

Figure 1 shows the growth rate in TL for the males and females of *M. tenellum*. The TL after 144 days of culture was 27% higher in males, with a mean of 12.5 cm. The growth rate using the total weight (TW) of the males and females is presented in Figure 1. The final TW was 55.6% higher for males. The mean final TW was 11.6 g in females and 27.0 g in males.

The comparative growth and yield indicators among the males and females cultured in earthen ponds during 144 days are shown in Table 1. The final TL, final TW, specific growth rate (SGR), weekly growth rate (WGR) and total yield (TY) exhibited significant differences in both sexes (P < 0.05), and the males exhibited higher values of these indicators. However, the prawn females had a higher survival rate. The FCR and total TY were 1.5 and 1,603 kg ha⁻¹, respectively.

The water temperature was maintained at the optimum range of 28.0 to 32.0°C. Also the pH and Secchi disk depth were optimum for fish and crustacean pond cultures (Arredondo-Figuroa and Ponce-Palafox, 1998).

The results obtained in this work confirmed that in 144 days of culture, males grew 27% more in terms of TL and 55.6% more in terms of TW compared to females and reached a total length of 12.5 cm and a total weight of

Table 1. Growth performance of the freshwater prawn *M. tenellum* cultured in earthen ponds.

Indicator	Females (AF)	Males (AM)	DMF	Total
Culture time (days)				144
Density (org m ⁻²)				14
Initial total length (cm)	2.9±0.3 ^a	3.2±0.4 ^a	0.5	
Final total length (cm)	9.1±1.5 ^a	12.5±1.9 ^b	3.4	
Initial total weight (g)	1.9±0.5 ^a	2.5±0.7 ^a	1.5	
Final total weight (g)	11.6±3.3 ^a	27.0±6.8 ^b	15.4	
Specific growth rate (%)	1.42±0.1 ^a	1.53±0.3 ^b	0.11	
Weekly growth rate (g week ⁻¹)	0.58±0.09 ^a	1.35±0.25 ^b	0.77	
Feed Conversion Ratio	1.5	1.7		
Yield (kg ha ⁻¹)	481.53±10.9 ^a	1,121.54±50.9 ^b	640.0	1,603.07
Survival rate (%)	65.0±2.6 ^a	50.0±3.0 ^b	15.0	

Different superscript letters in a row indicate significant differences ($P < 0.05$); DMF = Difference of mean values between males and females.

27.0 g, similar to that reported by Román-Contreras (1979) in wild prawn populations. *M. tenellum* grew 50% less than *M. rosenbergii* in México (Ponce-Palafox, 1997). It is interesting to mention that extreme cases of organisms attaining a TW of 45 and 60 g were recorded in this experiment. Despite of the mean value of males, which reached 27.0 g, with an acceptable commercial size, *M. tenellum* exhibited great aquaculture potential.

The growth performance indicators registered in this investigation showed substantial differences between both sexes (Table 1). The differences in TL, FTW, SGR, WGR and TY were relevant, especially WGR and TY, with values of 0.77 g week⁻¹ and 640.0 kg ha⁻¹, respectively. From these data, it is recommended to develop a culture strategy to manage 100% male cultures, choosing juvenile sizes (between 1.5 and 2.0 g) with clear sex anatomical characteristics that permit the correct identification of males.

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