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# Crecimiento y sobrevivencia de la langosta Australiana *Cherax quadricarinatus* en condiciones de laboratorio.

# Growth and survival of the Australian redclaw lobster *Cherax quadricarinatus* under laboratory conditions.

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# Crecimiento y sobrevivencia de la langosta Australiana *Cherax quadricarinatus* en condiciones de laboratorio.

## Growth and survival of the Australian redclaw lobster *Cherax quadricarinatus* under laboratory conditions


## RESUMEN

Se realizaron estudios de laboratorio sobre la langosta australiana de agua dulce *Cherax quadricarinatus* (von Martens, 1868) durante 120 días para analizar los efectos de la dieta sobre el crecimiento y sobrevivencia. Se utilizaron tres acuarios de 90-L para cada una de las dietas: 1) alimento comercial con 30% proteína cruda (PC), 2), con 35% PC y 3) con 40% PC. La densidad juvenil inicial fue de 10 organismos por acuario. Fueron alimentados dos veces al día 10% de su biomasa. Con 40% PC los juveniles alcanzaron un peso máximo de 10.43 g y una longitud total de 8,64 cm; con 35% PC: llegaron a 6.77 g y 7.10 cm y con 30% PC: 5,97 g y 6,74 cm. Diferencias estadísticas no fueron observadas en langostas australianas cuando se alimentaron con las tres dietas. La langosta fue mantenida a una temperatura entre 27.0 y 33.4° C y el pH entre 7.7 y 8.2. La sobrevivencia fue como sigue: 47% con una dieta de 30% PC, 60% con 40% PC y de 53% con 35% PC. El factor de conversión de alimentos promedio para las diferentes dietas comerciales fue: 3.22:1 con 30% PC, de 2.9 con 35% PC, y 3.47:1 con 40 PC. El crecimiento de la langosta alimentada con 40% PC fue mayor, pero con 30% y 35% PC no mostraron diferencias significativas.


***Palabras clave:*** *Cherax quadricarinatus*, crecimiento, sobrevivencia, factor de conversión, densidad, dieta.

## ABSTRACT

Laboratory studies on the Australian redclaw lobster *Cherax quadricarinatus* (von Martens, 1868) were performed during 120 days to analyze dietary effects on growth, and survival. Three different diets were used: 1) commercial feed with 30% crude protein (CP), 2) with 35% CP, and 3) with 40% CP. Three 90-L aquaria were used for each of the diets; the initial juvenile density was 10 organisms per aquarium. They were fed twice daily 10% of their biomass. Using 40% CP, juveniles reached a maximum average weight of 10.43 g, a total length of 8.64 cm; with 35% CP: they reached 6.77 g and 7.10 cm, and with 30% CP: 5.97 g, and 6.74 cm. Statistical differences were not observed when they were fed three diets. The red claw was maintained at a temperature between 27.0 and 33.4° C and a pH between 7.7 and 8.2. Surviving was as follows: 47% with 30% CP diet, 60% with 40% CP, and 53% with 35% CP. The mean food conversion rate for the different commercial feeds was: 3.22:1 with 30% CP, 2.9:1 with 35% CP, and 3.47:1 with 40% CP. Growth of the red claw fed with 40% CP grows more, but with 30 and 35% CP do not show grows differences.


***Keywords:*** *Cherax quadricarinatus*, growth, survival, conversion factor, density, diet.

## INTRODUCTION

The Australian redclaw lobster *Cherax quadricarinatus* is native to the rivers of Queensland, Australia, and the South of Papua, New Guinea. Morales (1998) mentioned that this species has a high growth rate, reaching 400 g in 6 months, as well as a high fecundity, and spawns 3 to 5 times per year, producing between 300 and 800 eggs each time. In Australia from 1985 to 1990 the production of this lobster reached 500 mt with a value of 10 million Australian dollars, and for 1994 to 1995 the production reached to 4000 mt valuated in $80 million (Villarreal-Colmenares 2000).

For commercial production, Hutchings & Villarreal-Colmenares (1996) showed that an adequate protein level in the diet and adequate amount of food are necessary for the organism to reach a good size. Nutritional requirements, gonad development, growth and survival in the redclaw lobster were studied by Villarreal-Colmenares (2002) in Mexico, using different crude protein percentages in food. When dietary protein was

elevated from 13% to 18%, 25% or 32% crude protein (CP) Pavasovic, Anderson, Mather & Richardson (2007) found a general increase in the specific growth rate and the low-protein diet (13% CP) showed a high feed conversion factor.

The corresponding authority of Mexico (SEMARNAT) registered in its annual report a production of 3,000 kg/ha per cycle, obtained in 12 farms occupying 47.5 ha (Diario Oficial de la Federación, 2004). Villarreal-Colmenares & Naranjo (2006) mentioned a yield of 3500 kg/ha/cycle, in 2.5-3 cycles per year, and a final weight between 40 and 60 g and 60 and 90 g. The objective of this study was to examine dietary effects on growth and survival of the Australian redclaw lobster using three different protein concentrations of a commercial balanced food under laboratory conditions.

## MATERIALS AND METHODS

The temperature, was recorded with a thermometer of the Mercury brand Broken scale -20 to 110° C with an accuracy of ± 1 digit. PH-was determined with a potentiometer Corning brand with accuracy of ±1.

Three aquaria were set up per diet; the initial juvenile density was of 10 organisms per each 90-L aquarium in a recirculation system during 120 days. They were fed twice daily 10% of their biomass. Three different diets were used: 1) commercial feed Tilapia chow of Purina with 30% crude protein (CP), 2) Piasa´s camaronina with 35% CP, and 3) Purina´s Camaronina with 40% CP. Their ingredients are: fish meal, wheat meal, soya and wheat paste, fish oil, lecithin, vitamin A, B2, C, Ek3, thiamin (B1), riboflavin (B2), pyridoxine (B8), cyanocobalamine (B12), niacin, folic acid, inositol, iron, copper, zinc, manganese, selenium, iodine, antioxidant, calcium, phosphorous, cobalt, agglutinant (Table I).

**Table I .** Bromatologic analysis of the commercial food

| Content | Purina´s tilapia chow | Piasa´s camaronina | Purina´s camaronina |
|---|---|---|---|
| Moisture (max) | 12.0 | 12.0 | 12.0 |
| Protein (min) | 30.0 | 35.0 | 40.0 |
| Fat | 5.0 | 7.0 | 7.0 |
| Crude fiber | 5.5 | 3.0 | 3.0 |
| Ashes | 11.0 | 11.0 | 11.0 |
| Phosphorus | | 1.0 | |
| Calcium | | 1.5 | |
| F.E.N. | 36.5 | 32.0 | 27.0 |

Free extract of nitrogen (FEN) (100-content)

A least squares linear regression was applied to the length growth data for each treatment and then a coincident curves test was applied to assess statistical differences in growth (Haddon 2001). The redclaw lobster was maintained at a temperature between 27.0 and 33.4° C and a pH between 7.7 and 8.2. The initial weight ranged between 0.27 and 3.00 g and length between 3.08 and 3.13 cm. The rate of growth, based on total length (TL cm) (tip of the rostrum to distal end of the telson). The weight was recorded with a balance granataria GT 480 Ohaus (0.000 g) and measured in a Petri dish using millimetre paper, every 15 days (Figure 1). Survival was calculated as the number of organisms decreased for a given period using three different diets (Figure 1).

The feed conversion factor was estimated from three aquaria of each diet used according to Parker (1987), as FCA = Ac/lb; where FCR= feed conversion rate, Ac= food provided, Ib= increase in biomass (Table II).

The average water temperature was 30.28°C (27.0-33.4°C) and the average pH was 8.09 (7.7-8.4).

The average weight and length growth rates were higher with the higher protein diets (Figure 1). Juveniles reached a maximum average weight of 10.43 g and a total length of 8.64 cm with the 40% CP diet; with the 35% CP diet, these values were 6.77g and 7.10 cm, and with the 30% CP diet, they were 5.97g and 6.74 cm. The test of coincident curves revealed significant differences in length growth between 30% CP and 40% CP diets with P= 0.0227 and F=6.9225, as well as between 35 % CP and 40% CP diets with a P= 3.76E-5 and F=32.7464. There were no significant differences between 30% CP and 35% CP diets with P= 0.9999 and F=0.0045.

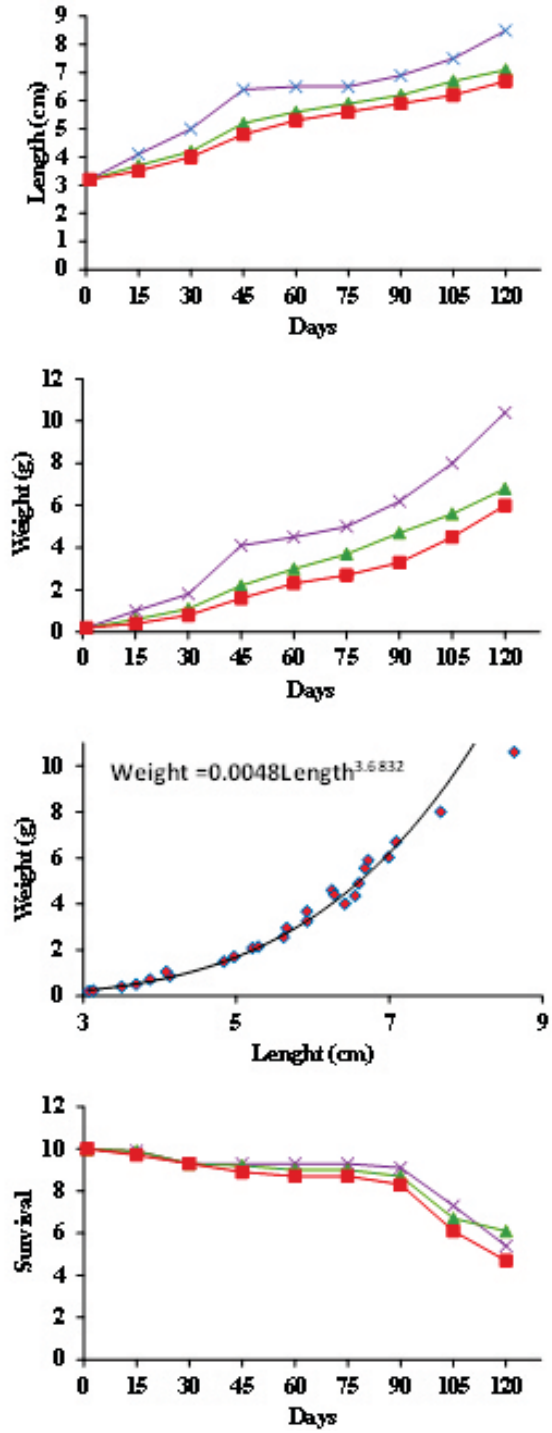


***Figure 1.-*** The average weight, length in days, weight-length relationship and survival. With 30% CP is represented by ■, with 35% CP is represented by ▲, and with 40% is represented by X.

***Table II. -*** Food Conversion rate (FCR) using three different aquaria of each diet used.

| Aquarium number | Provided food | | | Gain weight | | |
|---|---|---|---|---|---|---|
| | 30% | 35% | 40% | 30% | 35% | 40% |
| 1 | 7.11 | 8.1 | 10.55 | 2.24 | 2.2 | 3.12 |
| 2 | 5.21 | 5.7 | 10.16 | 1.53 | 2.1 | 3.07 |
| 3 | 4 | 5.3 | 9.83 | 1.53 | 2.1 | 2.6 |
| Total | 17.09 | 19.1 | 30.54 | 5.3 | 6.4 | 8.79 |
| FCR | 3.22 | 2.9 | 3.47 | 1 | 1 | 1 |

The three treatments gave the following weight-length relationship $Weight=0.0048Length^{3.68}$ and $R^2= 0.98$ (Figure 1).

During molting many redclaw lobsters were attacked by their partners. Survival did not show significant differences among the commercial feeds (Figure 1) with 30% CP diet, mean survival was 53%; with 35% CP diet, 40%; and with 40% CP diet, 47%; after 90 days mortality increased. The mean food conversion rate (FCR) for the different commercial feeds was: with 30% CP, 3.22:1; with 35% CP, 2.9:1; and with 40% CP, 3.47:1 (Table II).

## DISCUSSION

Meade & Watts (1997) and Jones (1995) stated that grow in *C. quadricarinatus* is influenced by temperature, oxygen, availability of food, competition for food, and space. The pH values used in this study coincide with the optimal range found by Swingle (1961). FAO (2013) mentioned that preferred temperature range is 23 ºC to 31 ºC and it will perish at <10 ºC and >36 ºC.

Cortés-Jacinto, Villarreal-Colmenares, Civera-Cerecedo & Martínez-Córdova (2003) reported that juveniles grew and survived fine with a diet of 31% CP; however Campaña-Torres, Martínez-Córdova, Villarreal-Colmenares, & Civera (2005) found that during the first 47 days survival and mean weight were higher using diets of 37% and 45% CP with 84.00 to 86.67% survival and 1.52 ± 0.11 to 1.60 ± 0.130 g. Also they found that there were statistical differences between 20.45 and 28.50% C.P. with 37.33 and 45.44% C.P., the level of protein in the diets have an effect in the productive response of the juveniles. In our study of 120 days using 40% CP survival was of 60% with a mean weight of 10.43 g, and a total length of 8.64 cm. The conclusion is that the growth and survival of redcraw lobster under culture conditions is better using diets with a protein content greater than 35%.

FAO (2013) mentioned that it is most effective to have a protein content of 25% and a lipid content of 8%; grow-out periods may vary between 6 months and 15 months depending on the redclaw market, redclaw are commonly marketed in 20 g size grades ranging from 30-50 g (FAO 2013).

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