



Evaluation of practical diets containing different protein levels on gonad development of female redclaw crayfish *Cherax quadricarinatus*

H. RODRÍGUEZ-GONZÁLEZ^{1,2}, H. VILLARREAL¹, M. GARCÍA-ULLOA³
& A. HERNÁNDEZ-LLAMAS¹

¹ Centro de Investigaciones Biológicas del Noroeste (CIBNOR), La Paz, B.C.S., México; ² Present address: Centro Interdisciplinario de Investigación para el Desarrollo Integral Regional Unidad Sinaloa (CIIDIR), Instituto Politécnico Nacional, Guasave, Sinaloa, México; ³ Laboratorio de Ciencias Marinas, Universidad Autónoma de Guadalajara, Barra de Navidad, Jalisco, México

Abstract

The effect of five experimental diets with different crude protein content (220, 270, 330, 390 and 450 g kg⁻¹) on gonad development of female *Cherax quadricarinatus* was tested under laboratory conditions. After 70 days, a significant linear relationship indicated that higher concentrations of protein and carbohydrates in the hepatopancreas were produced as the dietary crude protein increased ($P < 0.05$). There were significant responses of the gonadosomatic index, hepatosomatic index, biochemical composition of the gonad (protein, lipids, carbohydrates and energy) and frequency of secondary vitellogenic oocytes to dietary protein level, as indicated by significant fits of the quadratic equation to the observed experimental data. The optimal response of the criteria parameters corresponded to levels of crude protein in the range 284–355 g kg⁻¹. Overall, 330 g kg⁻¹ crude protein with a protein : energy ratio of 15.6 mg kJ⁻¹ was considered the most adequate concentration of dietary protein for gonad development and biochemical composition in female redclaw crayfish.

KEY WORDS: *Cherax quadricarinatus*, gonad development, practical diets

Received 7 May 2007, accepted 25 April 2008

Correspondence: Alfredo Hernández-Llamas, Centro de Investigaciones Biológicas del Noroeste (CIBNOR), Mar Bermejo 195, Colonia Playa Palo Santa Rita, La Paz, B.C.S. 23090, México. E-mail: ahllamas04@cibnor.mx

Introduction

The redclaw crayfish *Cherax quadricarinatus* is a large freshwater crustacean from Australia and Papua-New

Guinea (Sagi *et al.* 1997). Factors supporting aquaculture of this species are high growth and survival rates (Villarreal *et al.* 1999), simple reproduction (Jones 1995) and acceptance in the shellfish market (Villarreal & Peláez 1999).

Some studies have been conducted on its reproduction. Sagi *et al.* (1997) evaluated the effect of eye ablation on maturation, Abdu *et al.* (2000) described oocyte development and polypeptide dynamics during ovarian maturation, King (1993) determined potential fecundity in culture, Serrano-Pinto *et al.* (2003) described vitellogenin mRNA expression, and García-Guerrero *et al.* (2003a,b) described embryo development. However, there is still very little information on dietary requirements for broodstock.

Harrison (1997) mentions that dietary protein necessary for crustacean gonad maturation is likely to be higher than what is required for growth, since maturation is a process of intense protein metabolism. Diet plays an important role in crayfish broodstock condition (García-Ulloa 2000; Holdich 2002) and reproductive success (Bromage 1995; Harrison 1997). Energy and nutritional requirements must be adequately satisfied for the onset of gonad maturation. Nutrient reserves are mobilized and metabolized during maturation until oocyte enlargement (Harrison 1990) and sufficient and essential nutrients in the diet are critical.

Information on the protein level required for gonad maturation in crustacean species is scarce, and progress on formulation of maturation diets has been limited. For example, broodstock nutrition of marine shrimp still depends on fresh or fresh-frozen organisms such as *Artemia* biomass, polychaete worms, molluscs and other crustaceans (Deshimaru 1982; Alam *et al.* 1995; Cavalli *et al.* 1999; Lavens *et al.* 2000). Amount of dietary crude protein for