



MORPHOMETRIC OBSERVATIONS ON *ORCHESTIA SELKIRKI* STEBBING,  
1888 (PERACARIDA, AMPHIPODA) IN THE JUAN FERNÁNDEZ ISLANDS

BY

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INTRODUCTION AND METHODS

The crustacean communities on Chilean oceanic islands are characterized by the presence of endemic, Polynesian, and American species (González et al., 2008; Retamal & Moyano, 2010; Fernández et al., 2014; De los Ríos-Escalante & Ibáñez-Arancibia, 2016). The crustaceans of non-marine environments are characterized are widespread, such as was observed for Easter Island (Dumont & Martens, 1995; De los Ríos-Escalante & Ibáñez, 2015). For the Juan Fernández Islands the presence of the widespread copepod *Paracyclops fimbriatus* (Fischer, 1853) was observed (Brehm, 1936), and that species was also reported for ephemeral ponds on Easter Island (Dumont & Martens, 1995; De los Ríos-Escalante & Ibáñez, 2015). In addition, 13 species of non-marine Isopoda and one species of Amphipoda were observed for the Juan Fernández Islands (Stroual, 1960; González et al., 2008).

The Juan Fernández Islands are composed of the islands Alejandro Selkirk, Robinson Crusoe, and Santa Clara, and are located at 750 km from the continent, in the Pacific Ocean. These islands have an endemic perennial forest with small temporal streams as their unique inland-water sources (Niemeyer & Cereceda,

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1984). Literature reports about inland water crustaceans are restricted to these small streams (Schellenberg, 1935; Stroual, 1960), and recent studies are only based on literature reviews and comparison with other oceanic islands, as well as with the Chilean continental territory, the latter confirming the endemism of those species (González et al., 1998).

The aim of the present study now is to make a morphometric description of a population of *Orchestia selkirki* Stebbing, 1888, found in a so-called “Claro Verde”, that is a zone with *Myrceugenia fernandeziana* (Hook. & Arn.) Johow forest with small streams, and with many access difficulties due to a long mountain path and in addition access problems with respect to entry from the continent. This valley is located on Robinsoe Crusoe Island, one of the islands of the Juan Fernández archipelago (Pérez-González et al., 2014).

Field collections were conducted from 16 to 20 February 2011, using pitfall traps. The traps consisted of two plastic cups of  $7.4 \times 10.2$  cm and  $7.6 \times 12.0$  cm in size, respectively, placed one inside the other, so the smaller one was easy to be removed. This inner cup was filled to one-third of its capacity with a mixture of water (80%), ethanol (10%), and laundry detergent (10%), and the traps were operated for four consecutive days. Specimens were identified according to the descriptions of Schellenberg (1935).

Ten individuals of each sex from the collected specimens were measured, viz., for body length (BL), three measures of body width (BWA, BWB, BWC), lengths of the antennae (AL), and the length of the uropodal exopod (UEL), in accordance with the descriptions of Contreras et al. (2013) (fig. 1). In addition, a ratio between BL and, respectively, BWA, BWB, BWC, AL, and UEL was obtained for each sex. These measurements for each sex were compared using a non-parametric Mann-Whitney *U*-test (Zar, 1999; Nussbaum, 2005) using the software “R” (R Development Core Team, 2009).

## RESULTS AND DISCUSSION

The literature revealed that there are no significant differences between measurement parameters for both sexes of *Orchestia selkirki*, with the exception of the BL/BWA ratio (table I; fig 2). The use of morphometric analysis was described as an important tool for the study and characterization of species of Amphipoda (Esmacili-Rineh et al., 2016), their populations (Scapini et al., 1999; Contreras et al., 2013), and morphotypes (Iaciofano & Lo Bruto, 2016). Also, the morphometric variations observed can be explained as responses to environmental variations in the habitats of the amphipods (Longo & Mancinelli, 2013; Goos et al., 2014). The results obtained correspond to a sampling programme in which samples were

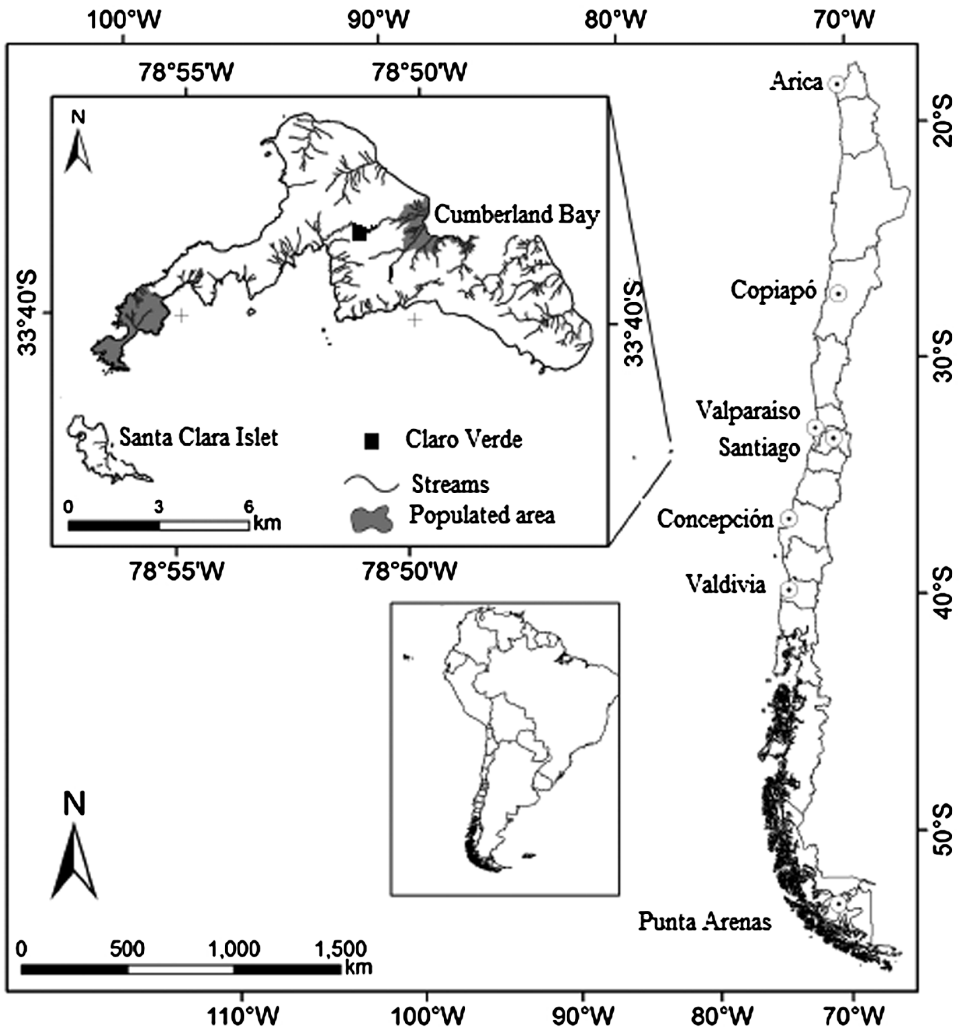


Fig. 1. Map of site mentioned in the present study (Adapted from: Perez-González et al., 2014).

collected in one short visit: they probably only show morphometric variations that are due to seasonal changes.

In this scenario (table I), no differences have been found between the two sexes of *O. selkirki*, with the exception of the BL/BWA ratio. The results obtained would indicate the existence of only few differences in morphometric parameters, which would agree with corresponding findings of Scapini et al. (1999), as well as with the results of Contreras et al. (2013) based on the marine amphipod *Orchestoidea tuberculata* Nicolet, 1849.

The presence of non-marine amphipods on the Juan Fernández Islands involves three species, two of which, i.e., *Transorchestia chilensis* (H. Milne Edwards,

TABLE I

Morphometric parameters measured (in mm) for males and females of *Orchestia selkirki* Stebbing, 1888 and the results of the Mann-Whitney *U*-test (\**P* < 0.05, significant difference)

Parameter	Females	Males	<i>P</i>
BL	10.8 ± 2.0	9.9 ± 1.9	0.211, n.s.
LA	4.5 ± 0.5	4.6 ± 0.8	0.849, n.s.
UEL	2.8 ± 0.9	2.9 ± 0.9	0.649, n.s.
BWA	1.1 ± 0.2	1.4 ± 0.6	0.128, n.s.
BWB	1.9 ± 0.4	1.7 ± 0.4	0.879, n.s.
BWC	0.9 ± 0.3	0.9 ± 0.3	0.909, n.s.
BL/LA	2.42 ± 0.23	2.18 ± 0.23	0.999, n.s.
BL/UEL	4.16 ± 0.98	3.58 ± 0.80	0.280, n.s.
BL/BWA	10.16 ± 1.49	7.44 ± 1.74	0.004*
BL/BWB	5.91 ± 0.84	5.82 ± 0.72	0.910, n.s.
BL/BWC	12.90 ± 2.58	11.86 ± 1.96	0.123, n.s.

n.s., not significant.

1840) and *Transorchestia gracilis* (Chilton, 1921), have been reported for Robinson Crusoe Island, but without any detailed reports about their habitats or the altitude at which they have been found (Chilton, 1921). The third species concerns *Orchestia selkirki*, which was reported for the islands Robinson Crusoe and Alejandro Selkirk at 500 m a.s.l. (Schellenberg, 1935).

In conclusion, it is clear that the available data on the non-marine amphipods of these islands are scanty, whence it will be necessary to perform more, and also more detailed systematic studies that should involve examining spatial and temporal gradients, in order to properly study morphological variations in these species at the population and community levels.

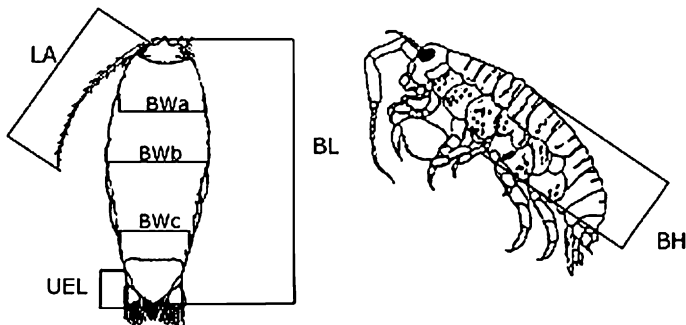


Fig. 2. Morphometric parameters considered in the present study of a population of *Orchestia selkirki* Stebbing, 1888: BL, body length; BH, body height; BW, respectively, a, b, c, three measures of body width; LA, length of the antennae; and, UEL, uropodal exopod length. [Modified from Contreras et al., 2013.]

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## REFERENCES

- BREHM, V., 1936. Mitteilungen von den Forschungsreisen Prof. Rahms. Mitteilung VI. Über die Cladocerenfauna des Titicaca und über einige neue Fundstellen bereits bekannter Copepoden. Zool. Anz., **114**: 157-159.
- CHILTON, C., 1921. A small collection of Amphipoda from Juan Fernández. In: C. SKOTSBERG (ed.), The natural history of Juan Fernández and Easter Island, **3**: 81-92. (Almquist & Wiksells, Uppsala).
- CONTRERAS, H., C. DUARTE, E. JARAMILLO & N. FUENTES, 2013. Morphometric variability in sandy beach crustaceans of Isla Grande de Chiloé, southern Chile. Rev. Biol. Mar. Ocean., **48**: 487-496.
- DE LOS RÍOS-ESCALANTE, P. & E. IBÁÑEZ, 2015. Inland water crustaceans of Easter Island. Crustaceana, **88**: 1061-1064.
- DE LOS RÍOS-ESCALANTE, P. & E. IBÁÑEZ-ARANCIBIA, 2016. A checklist of marine crustaceans known from Easter Island. Crustaceana, **89**: 63-84.
- DUMONT, H. J. & K. MARTENS, 1996. The freshwater microcrustacea of Easter Island. Hydrobiologia, **325**: 83-99.
- ESMAEILI-RINEH, S., F. HEIDARI, C. FISER & V. AKDMADI, 2016. Description of new endemic species of the genus *Niphargus* Schiödte, 1849 (Amphipoda: Niphargidae) from a karst spring in Zagros Mountains in Iran. Zootaxa, **4126**: 338-350.
- FERNÁNDEZ, M., P. PAPPALARDO, M. RODRÍGUEZ-RUIZ & J. C. CASTILLA, 2014. Synthesis of the state of knowledge about species richness of macroalgae, macroinvertebrates and fishes in coastal and oceanic waters of Easter and Salas y Gómez islands. Lat. Am. J. Aq. Res., **42**: 760-802.
- GONZÁLEZ, E. R., P. A. HAYE, M. BALANDA & M. THIEL, 2008. Lista sistemática de especies de peracáridos en Chile (Crustacea-Eumalacostraca). Gayana, **72**: 157-177.
- GOOS, J. M., R. D. COTHRAN & P. D. JEYASINGH, 2014. Subtle variation in phosphorus availability influences mating biology in *Hyalella* (Amphipoda: Hyallellidae) amphipods. Biol. J. Linnean Soc. London, **111**: 878-888.

- IACIOFANO, D. & S. LO BRUTTO, 2016. Re-description of *Orchestia stephenseni* Cecchini, 1928: designation of neotype and senior synonym to *Orchestia constricta* A. Costa, 1853 (Crustacea: Amphipoda: Talitridae) by reversal of precedence. *Zootaxa*, **4150**: 40-60.
- LONGO, E. & G. MANCINELLI, 2014. Size at the onset of maturity (SOM) revealed in length-weight relationships of brackish amphipods and isopods: an information theory approach. *Est. Coast. Shelf Sci.*, **136**: 119-128.
- NIEMEYER, H. & P. CERECEDA, 1984. Geografía de Chile. Hidrografía: 1-320. (Instituto Geográfico Militar, Santiago de Chile).
- NUSSBAUM, E. M., 2015. Categorical and nonparametric data analysis: 1-527. (Routledge, New York, NY).
- PÉREZ-GONZÁLEZ, A., M. J. RAMÍREZ, E. M. SOTO & J. PIZARRO-ARAYA, 2014. First harvestman record for the Juan Fernández archipelago, Chile, with morphological notes on *Acropsopilio chilensis* (Opiliones: Caddidae: Acropsopilioninae). *Zootaxa*, **3852**: 347-358.
- R DEVELOPMENT CORE TEAM, 2009. R: a language and environment for statistical computing. (R Foundation for Statistical Computing, Vienna).
- RETAMAL, M. A. & H. MOYANO, 2010. Zoogeografía de los crustáceos decápodos chilenos marinos y dulceacuícolas. *Lat. Am. J. Aq. Res.*, **38**: 302-328.
- SCAPINI, F., F. CAMPACCI & M. AUDOGLIO, 1999. Variation among natural populations of *Talitrus saltator* (Amphipoda): morphometric analysis. *Crustaceana*, **72**: 659-672.
- SHELLENBERG, A., 1935. Fauna chilensis, Amphipoden von Chile und Juan Fernandez. *Zool. Jahrb.*, **67**: 225-234.
- STROUHAL, H., 1961. Die Oniscoideen-Fauna der Juan Fernandez-Inseln. *Ann. Naturhist. Mus. Wien*, **48**: 185-244.
- ZAR, J. H., 1999. Biostatistical analysis: 1-165. (Prentice Hall, Upper Saddle River, NJ).