A New Species of Clam Shrimp *Eulimnadia* (Crustacea: Branchiopoda: Spinicaudata: Limnadiidae) from Northern Inland New South Wales

Brian V. Timms

Research Associate, Australian Museum, 10 William St., Sydney, 2000; and Centre for Ecosystem Science, School of Biological, Earth and Environmental Sciences, University of New South Wales, Kensington, NSW 2052, Australia. Email: brian.timms@unsw.edu.au

Published on 7 September 2022 at https://openjournals.library.sydney.edu.au/index.php/LIN/index

Timms, B.V. (2022). A new species of *Eulimnadia* (Crustacea: Branchiopoda: Spinicaudata: Limnadiidae) from northern inland New South Wales. *Proceedings of the Linnean Society of New South Wales* **144**, 103-108..

A new species of *Eulimnadia* is described from roadside table drains 51 km NNW of Moree, northwestern NSW. It is an androdioecious species with the characteristic spiniform projection at the ventroposterior angle of the telson, the cercopod divided into two unequal sections by a spine and only eight antennomeres in each flagellum of the second antenna. The egg, its most characteristic feature, is cylindrical and somewhat distorted by an incomplete second band of ridges and grooves, making it the second Australian species with a cylindrical egg.

Manuscript received 12 August 2022, accepted for publication 29 August 2022

KEYWORDS androdioecious reproduction, *Eulimnadia* characteristics, unique egg.

INTRODUCTION

Over recent years, nine new species of *Eulimnadia* have been described from Australia (Timms, 2015, 2016). In addition, 11 new species of *Eulimnadia* have been recognised genetically, but not described morphologically, from largely the same core study area of eastern Australia (Schwentner et al., 2015). This situation is somewhat facilitated by the dominant reproductive method of androdioecy in this genus (Weeks et al., 2009), so that many entities have narrow distributions composed mainly or apparently totally of hermaphrodites.

Bill Newcomen and family, cereal farmers on the Moree plains, northwestern New South Wales (NSW), noticed in recent wet La Niña years, a variety of large branchiopods (fairy, clam and shield shrimps) in their table drains and stock dams. These include the rapid development of a species of *Triops* and a new species of a clam shrimp of the genus *Eulimnadia*, described herein.

METHODS

Clam shrimps were collected with a pond net and preserved in 70% methylated alcohol. Eggs were air dried, mounted on aluminium stubs via carbon double sided tabs, gold sputter coated (Emitech K550) then the backscattered images taken using Phenom XL SEM.

SYSTEMATICS

Subphylum Crustacea Brünnich 1772
Class Branchiopoda Latreille 1917
Order Diplostraca Gerstaecker, 1866
Suborder Spinicaudata Linder, 1945
Family Limnadiidae Baird, 1849
***Eulimnadia* Packard 1874**

Type species

Eulimnadia agassizi Packard 1874

Eulimnadia gunyanna n.sp.
Figs 1,2A–C, 3–5.

Etymology

This species is named to celebrate the name of the property, a First Nations term of Gunyanna, meaning ‘flowing waters across the plains’ an appropriate description of local flooding; used as a noun in apposition.

Type Locality

New South Wales, 8.6 km NE of Garah and 51 km NNW of Moree, roadside table drain, Gunyanna Property, 29° 00’ 40.7"S, 149° 23’ 38.8”E.

Type Material

Holotype, putative hermaphrodite length 6.7 mm, collected 13 November 2021, Newcomen family, AM P106426.

Paratypes, 6 specimens, all putative hermaphrodites, lengths 6.0, 6.0, 6.2, 6.5. 6.8.and 7.0 mm, collected together with the holotype, AM P106427, AM P106428 (Fig. 1).

Diagnosis

Egg (Fig. 2A–C) diameter 90–120 µm, length 90–150 µm, irregularly cylindrical with circumferential incomplete band of ridges, generally vertically aligned; bands with 12–20 ridges /groove pairs, each band separated by prominent horizontal ridge that interrupts vertical ridge/groove sets of each band; both ends broadly discoidal, rims not projecting and flat, with 2–5 complete or incomplete grooves or depressions with rounded edges. Tertiary layer spongiform and microporous.

Adult. Usually with 16 telsonic spines of various sizes and 10 subequal cercopod setae.

Head (Fig. 3) with prominent ocular tubercle, dorsally with roundish compound eye occupying most (ca 75%) of surface. Rostrum a round bulge anteriorly. Naupliar eye insignificant, usually not visible and located within the rostrum. Dorsal organ posterior to ocular tubercle by about half its height, pedunculate with flattened apex at about 70° to peduncle, protruding similarly to ocular tubercle.

First antennae slightly longer than second antenna peduncle and with about 5 anterior lobes, each with numerous sensory setae, shorter than the lobes. Second antennae with spinose peduncle and each flagellum with 8 antennomeres. Each antennomere with 1–3 spines dorsally and 1–4 setae ventrally. Spines and setae least numerous distally.

Carapace (Fig. 4) colourless, generally clear, oval with anterior more rounded than posterior, sometimes with distinct depression dorsally at about one-sixth of its length at site of internal attachment of adductor muscles. One distinct growth line usually visible, sometimes more.

Thoracopods. Eighteen pairs of typical structure for *Eulimnadia*, decreasing in size and complexity posteriorly. Thoracopods VIII–X together with 2 or 3 much larger dorsal filaments visible. Trunk dorsum: segments 1–VIII inerm, IX–XIV inerm or 1 seta per segment, XV–XVIII with 1–5 spines decreasing in number posteriorly.

Telson (Fig. 5) with about 15 dorsal spines, but with 1 or 2 obscure, very small; first and fifth spines larger than remainder; this dorsal row terminating in large spiniform posterior projection as typical for

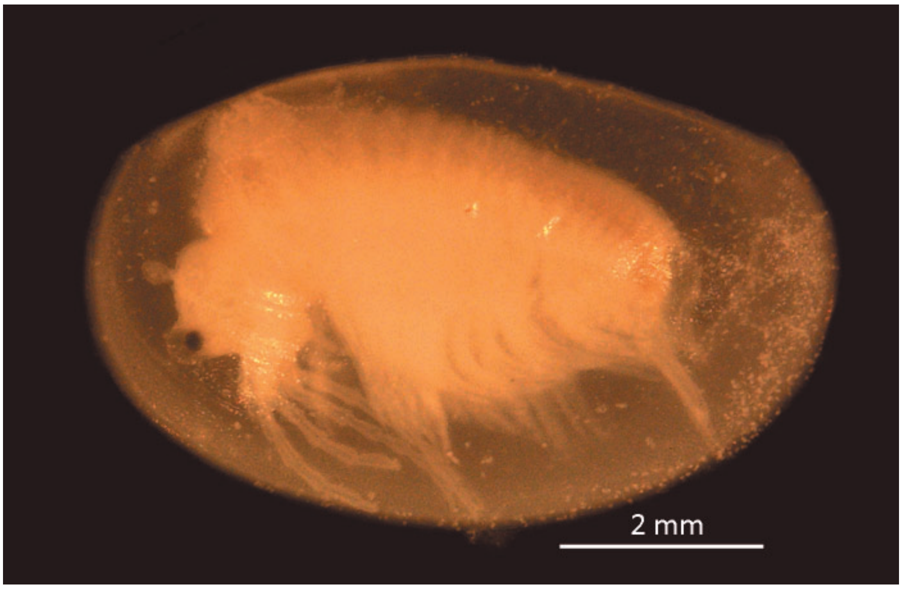

Figure 1. Adult *Eulimnadia gunyanna* n. sp. Paratype AM P106427

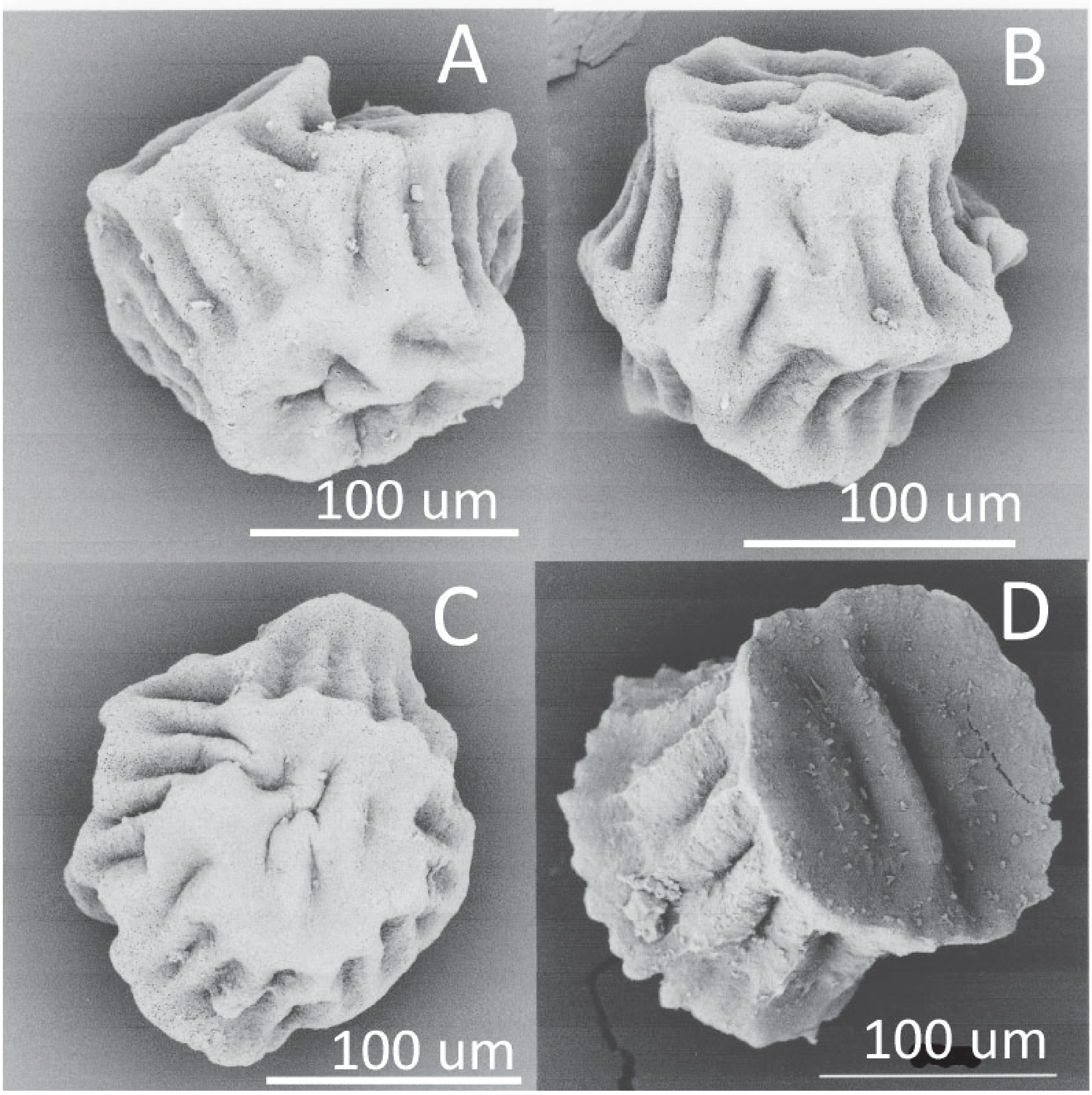

Figure 2. A,B,C, eggs of *Eulimnadia gunyanna* n.sp: D, egg of *E. australiaensis* (from Timms, 2015)

Eulimnadia. Telsonic spines inerm. Caudal filaments originating between 3rd and 4th spines, inserted on flat floor of telson, not on mound; posterior to fifth spine, dorsal floor steeply declivious, then bending distally towards base of cercopods. Cercopods with robust straight base, distal one-third narrowly concave to blunt terminus; basal two-thirds demarcated by small spine and bearing about 10 setae of subequal length. Setal length approximating thickness of cercopod basal section; setae geniculate, plumose. Ventroposterior angle of telson with stout, posteriorly projecting spine.

Comments

Firstly, given the physical site is over 500 km from the nearest location of any other genetically identified *Eulimnadia*, it is unlikely a previously recognised species has been described morphologically. Also where eggs of these were available, they are very different.

This limnadiid is easily accommodated within *Eulimnadia* as redefined by Timms and Rogers (2020). The spiniform projection at the ventroposterior angle of the telson of *E. gunyanna* is diagnostic, while two other characters, namely, the cercopod that is divided into two unequal sections by a spine at about 65–80% of its length, and the presence of eight antennomeres, are typical of Australian species of *Eulimnadia* (and many other world species of this genus), although

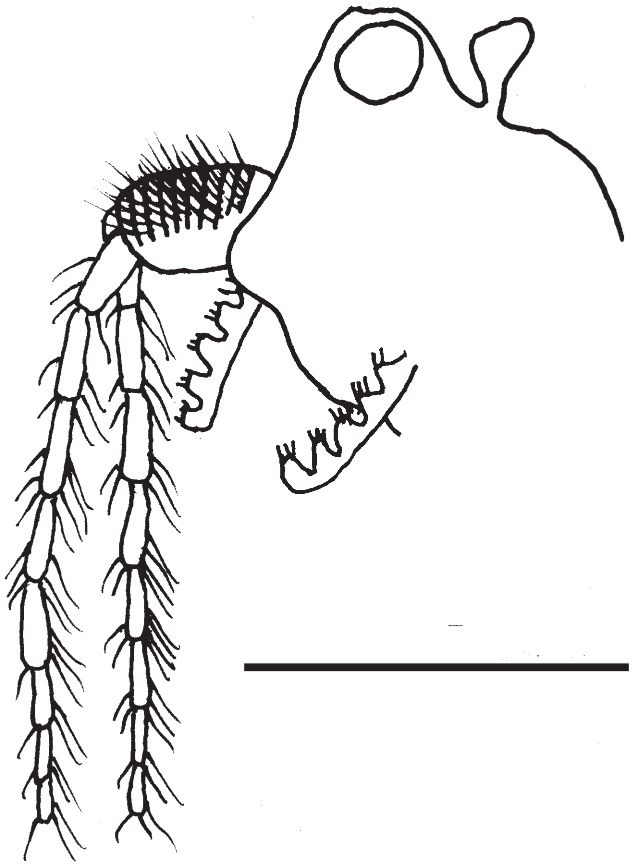

Figure 3. Head of *Eulimnadia gunyanna* n.sp. Scale bar 1mm.

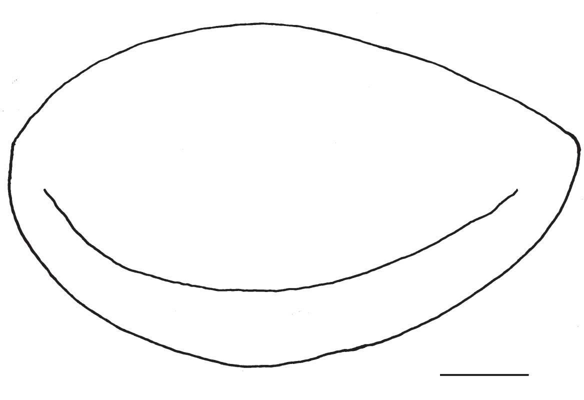

Figure 4. Carapace of *Eulimnadia gunyanna* n.sp. Scale bar 1mm.

these characters are not universally diagnostic (Timms and Rogers, 2020). The androdioecious mode of reproduction of the new species also suggests *Eulimnadia* rather than the allied genus *Paralimnadia*. Unfortunately the position of mating was not observed, as it too is diagnostic, being venter to venter in *Eulimnadia,* but in-line in *Paralimnadia* (Rogers et al., 2012).

Only minor individual variation was noticed in the few specimens of *E. gunyanna* studied. Greatest variation was evident in the relative position of the dorsal organ (cf. Figs. 1 and 3), ranging from half to twice its height posterior of the ocular tubercle. Compound eye size is variable, ranging from about 25% to 75% of the volume of the ocular tubercle, probably influenced by state of preservation. An occasional indentation in the anterior dorsal surface of the carapace is probably an expression of the relative state of the contraction of the adductor muscles and hence is a preservational artefact. Transparency of the carapace varied between specimens, from partially opaque to clear. Spination and setation of the second antennae varied between specimens, as is usual for *Eulimnadia* (Timms, 2016), but there was almost no variation in spination of the telson or setation of the cercopods. No studied specimen has the caudal filaments inserted on a mound, thus making this species atypical for *Eulimnadia* in this character (Timms, 2016; Timms and Rogers, 2020).

The egg is the most distinctive feature of *Eulimnadia gunyanna* n.sp., as is typical of the genus (Rogers et al., 2012) in which egg characteritics are species specific. No other Australian species, indeed world species, has a similar structure to that observed in *E. gunyanna* n.sp.. Its cylindrical structure suggests it is likely allied to the world group of species having cylindrical eggs (e.g. *E. columbiensis* Sars*, E. cylindrova* Belk*, E. geayi* Daday*, E. indrocylindrovam* Durga Prasad and Simhachalam*, E. insularis* Rogers and Cruz-Rivera*, E. ovilunata* Martin and Belk*, E. ovisimilis* Martin and Belk) (Belk, 1989, Martin and Belk,1989, Durga Prasad and Simhachalam, 2004, Pereira and Garcia, 2001, Rabet, 2010, Rogers and Cruz-Rivera, 2020). At least one Australian species, *E. australiensis* Timms (Timms, 2016), belongs to this group and *E. gunyanna* n.sp. appears to be another. *Eulimnadia gunyanna* n.sp. is distinctive by having an incomplete second band of ridge/ groove pairs circumferential of the egg. The end plates are similar enough to be accommodated within the cylindrical egg format. Compared to *E. australiensis*, which has a somewhat different egg (Fig. 2D) that

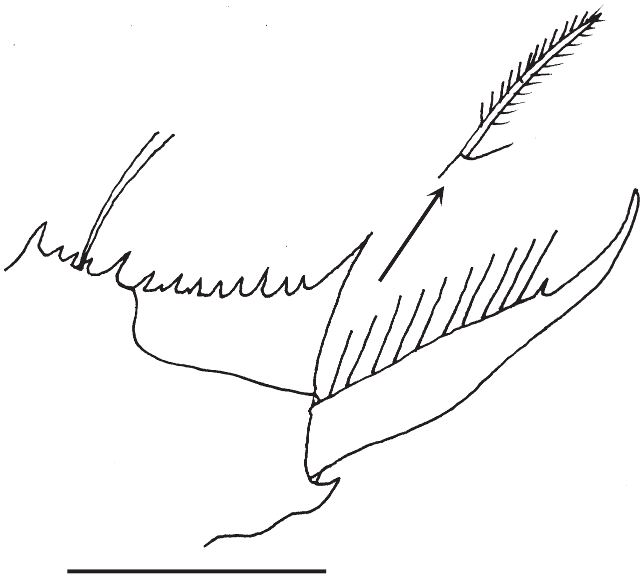

Figure 5. Telson of *Eulimnadia gunyanna* n.sp. Scale bar 1mm.

lacks the additional circumferential band. Other nine Australian species of *Eulimnadia* have round eggs, either surfaced with polygons of various sizes, numbers, depth and adornment (*E. contraria* Timms*, E, dahli* Sars*, E. gnammaphila* Timms*, E. hansoni* Timms*, E. pinocchionis* Timms*, E. taroomensis* Timms) or with grooves of different lengths and surface topography *(E. beverleyae* Timms*, E. canalis* Timms*, E. uluruensis* Timms*)* (Timms, 2016).

While some species of *Eulimnadia* worldwide are similar in many adult whole animal characteristics so that their only visible diagnostic feature is their egg, e.g. *Eulimnadia graniticola* Rogers, Weeks and Hoeh (Rogers et al., 2010) those in Australia are distinguishable, mainly on the nature of the cercopod setae and number of lobes in the first antenna. In this respect *E. gunyanna* n.sp. is distinguishable from the similar *E. australiensis* by having fewer and shorter cercopod setae (5-7 vs 10)(and cercopod setal length about half the diameter of the cercopod instead of being subequal). Other Australian *Eulimnadia* with 10-12 cercopod setae as in *E. gunyanna* n. sp. include *E. beverleyae, E. gnammaphila*, and *E. pinocchionis*. These differ from *E. gunyanna* n.sp. by setal length being twice the diameter of the cercopod in *E. beverleyae*, of mixed lengths in *E. gnammaphila* and one and a half times the diameter in *E. pinocchinis*. The remaining species differ from *E. gunyanna* n. sp. by having more or fewer cercopod setae and similarly in the number of first antennal lobes (see Table 2 in Timms (2016).

Little is known of the ecology of *E. gunyanna*. It probably hatches from resistant diapausing eggs soon after the table drains are flooded, reaches maturity in one to two weeks and dies after two to three weeks as the drains dry (Weeks et al., 1997). It is possible they are transported by the flowing flood water but generally only for short distances.

ACKNOWLEDGEMENTS

I thank the Newcomen family for noticing clam shrimp in their roadside table drains, for collecting some and for hospitality. Sue Lindsay of Macquarie University took the egg images, Claire Sives of the University of New South Wales captured the image of an adult shrimp while Christopher Rogers of Kansas University, Joan Powling and the referees improved the manuscript. I thank you all.

REFERENCES

Belk, D. (1989). Identification of species in the conchostracan genus Eulimnadia by egg shell morphology. Journal of Crustacean Biology 9(1): 115-125. DOI 10,2307/1548453

Durga Prasad, M.K and Simhachalam, G. (2004). *Eulimnadia indocylindrova* sp. nov. (Branchiopoda: Spinicaudata) from South India with a review of the genus *Eulimnadia* in the Indomalayan region. In: Proceedings of the International Conference. The Great Himalayas: Climate, Heath, Ecology, Management, and Conservation. Kathmandu. (no editor stated).

Martin, J.W. and Belk, D. (1989). *Eulimnadia ovilunata* and *E. ovisimilis*, new species of clam shrimps (Crustacea, Branchiopoda, Spinicaudata) from South America. *Proceedings Biology Society Washington.* **103(4)**: 894-900.

Pereira G, and García, J.V. (2001). A review of the clam shrimp family Limnadiidae (Branchiopoda, Conchostraca) from Venezuela, with the description of a new species. *Journal of Crustacean Biology* **21(3)**: 640-652.

Rogers, D.C. and Cruz-Rivera, E. (2020). A New *Eulimnadia* (Branchiopoda: Spinicaudata: Limnadiidae) from the US Virgin Islands. *Zoological Studies* **59**:42.DOI: 10.6620/ZS.2020:59-42.

Rogers, D.C., Rabet, N. and Weeks, S.C. (2012). Revision of the extant genera of Limnadiidae (Branchiopoda: Spinicaudata). *Journal of Crustacean Biology* **32(5):** 827-842. DOI 10.1163/1937240X-637212.

Rogers, D.C., Weeks, S.C. and Hoeh, W.R. (2010). A new species of *Eulimnadia* (Crustacea: Branchiopoda:

Diplostraca: Spinicaudata) from North America. *Zootaxa* **2413**: 61-68.
Schwentner, M., Timms, B.V. and Richter, S. (2015). Spinicaudata (Branchiopoda: Diplostraca) in Australia's arid zone: Unparalleled diversity at regional scales and within water bodies. *Journal of Crustacean Biology*. **35**: 366-378. DOI 10.1163/1937240X-00002339.
Timms, B.V. (2015). *Eulimnadia* (Branchiopoda: Spinicaudata) in Western Australia: three new species and a description of a rediscovered species. *Journal of Crustacean Biology* **35(3)**:441-453. DOI: 10.1163/1937240X-00002326.
Timms, B.V. (2016). A partial revision of the Australian *Eulimnadia* Packard, 1874 (Branchiopoda: Spinicaudata: Limnadiidae). *Zootaxa* **4066(4):**351-389. DOI 10.11646/zootaxa.4066.4.1
Timms, B.V. (2018). Three new species of spinicaudatan clam shrimps from Australia, all from gnammas (rock pools). *Zootaxa*. **4418**(2):136-148. DOI 10.11646/zootaxa4418.2.3.
Timms, B.V. and Rogers, D.C. 2020. Diagnosing *Eulimnadia* and *Paralimnadia* (Branchiopoda: Spinicaudata: Limnadiidae). *Zoological Studies* **59:38**. DOI:10.6620/ZS.2020.59-38.
Weeks, S.C., Chapman, E.G., Rogers, D.C., Senyo, D.M. and Hoeh, W.R. (2009). Evolutionary transitions among dioecy, androdioecy and hermaphroditism in limnadiid clam shrimp (Branchiopoda: Spinicaudata). *Journal of Evolutionary Biology* **22:**1781-1799.
Weeks, S.C., Marcus, V. & Alvarez, S. (1997). Notes on the life history of the clam shrimp, *Eulimnadia texana. Hydrobiologia* **359:** 191-197**.**

.