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Revision of the Australian *Ozestheria* Schwentner & Richter, 2015 (Crustacea: Branchiopoda: Spinicaudata) fauna, with the descriptions of 27 new species

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Abstract. We provide an extensive and comprehensive revision of the Australian species of the genus *Ozestheria* based on an integrative taxonomic approach. In this integrative approach, molecular genetic analyses (COI, 16S and ITS-2) were combined with geometric morphometric analyses of carapace shape, ornamental features and traditional taxonomic assessments including head, thoracopod, telsonic and furcal features as well as carapace length. Initial species delimitation was based on genetic data. Morphometric differences in their carapace shape were then examined and overall morphological differences assessed. The genetic data yielded a high number of previously unknown and morphologically highly similar species. Deciding which of these correspond to the currently known and accepted species or to one of the previously synonymized species or varieties was challenging. Historic type specimens were thus assigned to the respective genetically delimited species with the aid of carapace shape variables as predictors of species identity. The taxonomic descriptions of all known and accepted species are updated based on the original type material (if available). *Ozestheria dictyon* is treated as a junior synonym of *O. lutraria* (the original description of *O. dictyon* was based on juveniles of *O. lutraria*), *O. packardi* is treated as a species inquirenda (the original description is inadequate and the types are lost), *O. rufa* is treated as a valid species (formerly treated as species inquirenda) and three former varieties of *O. packardi* are raised to full species status: *O. cancellata* comb. nov., *O. minor* comb. nov. and *O. typica* comb. nov. Furthermore, 27 species of *Ozestheria* new to science are formally described: *O. barcaldinensis* sp. nov., *O. beleriandensis* sp. nov., *O. bourkensis* sp. nov., *O. carnegiensis* sp. nov., *O. christiani* sp. nov., *O. echidna* sp. nov., *O. frederikeae* sp. nov., *O. fuersichi* sp. nov., *O. gemina* sp. nov., *O. glabra* sp. nov., *O. henryae* sp. nov., *O. jiangi* sp. nov., *O. jonnae* sp. nov., *O. marthae* sp. nov., *O. matuwa* sp. nov., *O. ngamurru* sp. nov., *O. paralutraria* sp. nov., *O. pilbarensis* sp. nov., *O. quinlanae* sp. nov., *O. radiata* sp. nov., *O. richteri* sp. nov., *O. rincewindi* sp. nov., *O. selmae* sp. nov., *O. setifera* sp. nov., *O. sivesae* sp. nov., *O. timmsi* sp. nov. and *O. weeksi* sp. nov. With now 38 Australian species of *Ozestheria*, our results further underline the exceptional diversity of the Australian spinicaudatan fauna,

raising the total number of recognized spinicaudatan species to 97, nearly half of their worldwide known species diversity.

Keywords. Carapace ornamentation, clam shrimps, integrative taxonomy, morphometrics, taxonomy.

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Introduction

Australia harbors a very rich and diverse spinicaudatan fauna, especially in the vast arid and semiarid regions. Recent reviews, partly based on molecular genetic data, have substantially increased the number of formally recognized species over the last decade. The focus was mainly on Australian limnadiid genera (Timms 2009a, 2015, 2016a, 2016b; Schwentner *et al*. 2012a; Timms & Schwentner 2017, 2020) as well as eocyzids (sensu Schwentner *et al.* 2020) (Timms & Richter 2009; Schwentner *et al*. 2014; Tippelt & Schwentner 2018), but also within the cyzicid genus *Ozestheria* Schwentner & Richter, 2015 numerous undescribed species have been suggested by molecular genetic analyses (Schwentner *et al*. 2015a). In total, nearly one-third of the global spinicaudatan species diversity (formally described plus genetically identified species) occur in Australia (Schwentner *et al*. 2015b).

The systematics of Cyzicidae Stebbing, 1810 and its genera is confusing and debated (see Rogers 2020; Schwentner *et al*. 2020). The Australian species have been assigned to *Cyzicus* Audouin, 1837, *Caenestheria* Daday, 1913 and *Caenestheriella* Daday, 1913 (reviewed by Richter & Timms 2005) based on their rostrum shape as well as the length of the condyle and the width of the occipital notch. Phylogenetic analyses showed that these genera were not reciprocally monophyletic. The Australian cyzicid representatives appeared to constitute a separate clade (Schwentner *et al*. 2009, 2015a; Weeks *et al*. 2009), which was placed into the newly erected genus *Ozestheria* Schwentner & Richter, 2015. Subsequent molecular genetic analyses revealed that *Ozestheria* is not endemic to Australia but occurs also in Africa and Asia (Schwentner *et al*. 2020). This was further supported by the morphological diagnostic character of this genus, the claw-like shaped scales at the tip of the movable finger of the male claspers.

Currently, ten Australian species of *Ozestheria* are recognized (Richter & Timms 2005; Rogers 2020): *O. berneyi* (Gurney, 1927), *O. dictyon* (Spencer & Hall, 1896), *O. elliptica* (Sars, 1897), *O. lutraria* (Brady, 1886), *O. mariae* (Olesen & Timms, 2005), *O. packardi* (Brady, 1886), *O. pellucida* Timms 2018, *O. rubra* (Henry, 1924), *O. rufa* (Dakin, 1914) (though Rogers 2020 considered this a species inquirenda) and *O. sarsii* (Sayce, 1903). For *O. packardi* three varieties were described: *O. packardi* var. *cancellata* (Spencer & Hall, 1896), *O. packardi* var. *minor* (Spencer & Hall, 1896) and *O. packardi* var. *typica* (Spencer & Hall, 1896). Because 'intermediate forms' were mentioned by Spencer & Hall (1896) and the distribution records appeared identical, Richter & Timms (2005) suggested that these do not represent subspecies but varieties below subspecies level.

Molecular phylogenetic analyses based on the mitochondrial barcoding gene COI and three nuclear markers of up to 737 Australian individuals of *Ozestheria* delimited 14–27 species, depending on the employed species delimitation method and species concept (Schwentner *et al*. 2015a). The lower estimates were based on the stricter Biological and Hennigian Species Concepts, which require sympatric occurrences of putative sister species. Twenty-one species were genetically well separated with uncorrected *p*-distances in COI > 5.4%, though several included additional internal lineages (termed sublineages by Schwentner *et al*. 2015a), which might correspond to further species (up to 27 species

in total). These results suggest a much higher species diversity with multiple morphologically cryptic species, many of which had previously been assigned to *O. packardi*. A first morphological investigation (Hethke *et al*. 2023) of the ten most individual-rich species in the dataset of Schwentner *et al*. (2015a), which focused exclusively on carapace features (length and shape differences assessed using traditional and geometric morphometrics as well as ornamentation types), found significant differences even between closely related species.

Several of the original species' descriptions are very short and provide little information on the species' morphology. For example, only the carapaces of *O. lutraria* and *O. packardi* were described. Therefore, referring genetically delimited species to known species can be problematic in the presence of a large number of morphologically cryptic species (Schwentner *et al*. 2015a), especially as Spinicaudata are well known for their morphological variability (Straškraba 1965, 1966; Astrop *et al*. 2012; Brown *et al*. 2014; Huang & Chou 2015, 2017; Tippelt & Schwentner 2018; Hethke *et al*. 2021, 2023). Thus, detailed morphological revisions of the known species are needed; however, according to Richter & Timms (2005), type material was deposited only for *O. berneyi*, *O. elliptica*, *O. mariae*, *O. rubra* as well as for *O. pellucida*, while that of *O. dictyon*, *O. lutraria*, *O. packardi* (including that of its varieties *O. packardi cancellata*, *O. packardi minor* and *O. packardi typica*) and *O. sarsii* was reported as missing. Also, redescriptions were often based on material from localities that were several hundreds of kilometers from the original type localities (e.g., the redescription of *O. packardi* by Sars 1895).

In this study, we taxonomically revise the complete Australian fauna of *Ozestheria*. We studied the type material of as many species as possible – including a search for missing type material (Richter & Timms 2005) – to better define the known species. We focused on the specimens studied by Schwentner *et al*. (2015a), which were already pre-delimited into putative species by molecular genetic data. Additional newly collected or reared specimens were subjected to molecular genetic analyses to assess their species identity before including them in this taxonomic revision. This reverse taxonomic approach (e.g., Janssen *et al*. 2015) allows a much more precise separation of intraspecific variability from interspecific variation (e.g., Schwentner *et al*. 2012a), a frequent problem in spinicaudatan taxonomy. The new morphological data may further help to resolve some of the instances where molecular genetic species delimitation was questionable (e.g., whether sublineages represent distinct species) and aid in the assignment of the genetically delimited species to already described species. The latter is accomplished by classifying type material to the most probable genetically delimited species using geometric morphometrics and linear discriminant analysis, which allow an objective assignment.

Material and methods

The majority of studied specimens stems from Schwentner *et al*. (2015a), which all have been genetically studied and pre-assigned to species. In addition, a collection of specimens from Western Australia was provided by Kirsty Quinlan (Government of Western Australia, Department of Biodiversity, Conservation and Attractions) as well as material of another species, which was reared from Western Australian mud samples at The University of Akron, OH (provided by Stephen C. Weeks and MH). Unfortunately, not all of the Western Australian specimens could be successfully sequenced (see below and Supp. file 3 for details). We only included those specimens which either yielded good genetic data or which were collected together (same collection date and locality) with individuals that were successfully sequenced, and which corresponded in crucial morphological features (e.g., carapace ornamentation). All specimens were stored in 70% ethanol.

Known and putative type material of Australian species of *Ozestheria* (following Richter & Timms 2005; Timms 2018) was borrowed from the respective museums. For species without known type material, inquiries for material with collection details that correspond with the original descriptions were sent to various natural history museums: Australia Museum, Museums Victoria, Natural History Museum

London, Queensland Museum, South Australian Museum, Western Australian Museum and Natural History Museum (University of Oslo). Several other Norwegian museums – NTNU University Museum and Tromsø University Museum – were contacted as the type material of *O. elliptica* was not located in The Natural History Museum (University of Oslo) as had been suggested by Richter & Timms (2005). If suitable specimens were present, these were also requested as loans.

Molecular genetics

The majority of the specimens had been previously studied genetically and implications regarding species delimitation and phylogeography (Schwentner *et al*. 2015a) as well as phylogenetic relationships (Schwentner *et al*. 2020) have been discussed in detail and will not be repeated here. The goal here was to test whether the newly obtained specimens belong to previously delimited species or to currently unknown species.

DNA was extracted using the muscle connecting the two valves of the carapace or a few legs. The tissue was lysed with proteinase K and then cleaned up with paramagnetic beads (AmpliClean™), using the 1.5 × volume of beads, washing twice with 200 µl 80% ethanol and eluting the DNA in 50 µl H_2O. PCR amplification proved difficult, probably because most samples were not freshly collected (~10 years old) and not stored under conditions ideal to preserve the DNA. We targeted the mitochondrial COI and 16S rDNA and the nuclear ITS-2 (internal transcribed spacer 2). To overcome problems with fragmented DNA, new internal primers were designed to target shorter fragments (Table Primer). However, even with those, only some of the specimens could be successfully amplified and sequenced, and usually only one or two of the three gene fragments per specimen. Amplification of 28S rDNA and EF1-α was also tested (following Schwentner *et al*. 2015a) but failed.

PCR reactions (15µl) included 1.5 µl of each primer (10mM each), 7.5 µl 2 × QIAGEN Multiplex PCR Master Mix (Qiagen), 2 µl DNA extract and 2.5 µl H_2O (see Table 1 for a list of all primers). PCR cycling programs had the following temperature regimes, for COI: 95°C for 15 min, 35 cycles of 30 s at 95°C, 45 s at 46°C and 1 min at 72°C; for 16S: 95 °C for 15 min, 35 cycles of 30 s at 95°C, 45s at 50°C, 1 min at 72°C; for ITS-2: 95°C for 15 min, 31 cycles of 30 s at 95°C, 30 s at 50°C and 2 min at 72°C; each followed by a final elongation step of 5 min at 72°C.

PCR products were visualized on 1.5% agarose-TBE gels. Prior to sequencing, primers and dNTPs were inactivated with 0.6 µl shrimp alkaline phosphatase (rSAP, NEB) and 0.3 µl exonuclease I (NEB) (incubated for 15 min at 22°C and 20 min at 85°C). Cleaned PCR products were bidirectionally sequenced using the respective PCR primers with the Sanger sequencing service of Macrogen.

Electropherograms of both sequencing reactions were assembled in Geneious 10.2.6 (Biomatters Ltd), sanitized by eye and the resulting sequences aligned by gene using the MUSCLE algorithm implemented in Geneious. *Cyzicus tetracerus* was included as the outgroup in the COI and 16S alignments (no outgroup was included in the ITS-2 alignment, as putative outgroup sequences were so divergent that they negatively impacted the alignment with the many additionally introduced indels). The COI alignment was checked for indels and stop-codons in MEGA-X (Kumar *et al*. 2018). The ITS-2 alignment was manually curated due to the high number of indels. All newly generated sequences were submitted to GenBank (PQ426997–PQ427040, PQ427147–PQ427201, PQ433171–PQ433216; Supp. file 3).

Phylogenetic analyses were performed separately for each gene dataset with MrBayes 3.2.7a (Ronquist *et al*. 2012), with nruns = 4, nchains = 4 and $30*10^6$ generations, sampling every 1000 generations. The first 25% of generations were discarded as burn-in. The resulting trees were visualized with FigTree ver. 1.4.3. The resulting ITS-2 was mid-point rooted, the others with the outgroup. The objective of the phylogenetic analyses is to test whether specimens are grouped into identical clusters for each gene

Table 1. List of all COI, 16S and ITS-2 primers used in this study.

Primer	Sequence	Orientation	Reference
COI			
BF1	ACWGGWTGRACWGTNTAYCC	forward	Elbrecht & Leese (2017)
LCO1490	GGT CAA CAA ATC ATA AAG ATA TTG G	forward	Folmer *et al*. (1994)
LCO2	TCN ACH AAY CAT AAA GAY ATT GGA AC	forward	Schwentner *et al*. (2011)
LCOmid-Spini	GGD GCN GGN ACN GGN TG	forward	this study
BR2	TCDGGRTGNCCRAARAAYCA	reverse	Elbrecht & Leese (2017)
HCOoutout	GTA AAT ATA TGN TGN GCT C	reverse	Folmer *et al*. (1994)
HCO-MZ1-rev	CTT TVA TDC CNG TVG GSA CWG CRA TAA TYA T	reverse	Krebes *et al*. (2010)
HCO2198	TAA ACT TCA GGG TGA CCA AAA AAT CA	reverse	Folmer *et al*. (1994)
16S			
16Sar-L	CGC CTG TTT ATC AAA AAC AT	forward	Palumbi *et al*. (1991)
16Sb	CTC CGG TTT GAA CTC AGA TCA	reverse	Xiong & Kocher (1991)
16Srev-Spini	AAT CCA ACA TCG AGG TCG C	reverse	this study
ITS-2			
ITS3	GCA TCG ATG AAG AAC GCA GC	forward	White *et al*. (1990)
ITS2fw-cyzicidae	AGC TTC GCG CTC GGA CC	forward	this study
ITS28	CGC CGT TAC TAG GGG AAT CCT TGT AAG	reverse	Wagstaff & Garnock-Jones (1998)
ITS2revMid-cyzicidae	GAG CTG TTA CGC CGC GTT GCC	reverse	this study

to assess concordance and/or discordance between genes (especially between mitochondrial [COI and 16S] and nuclear [ITS-2] genes).

Species delimitation was based on the COI dataset and included a combination of distance (ASAP, Assemble Species by Automatic Partitioning; Puillandre *et al*. 2021) and phylogeny (GMYC, General mixed Yule Coalescent; Pons *et al*. 2006) based methods. ASAP was run using the default setting, using simple distances (*p*-distances). Some COI sequences spanned only about half of the targeted length, which might bias inferences of genetic distances. To reduce such biases, short sequences were removed if longer, genetically highly similar (only 1–2 mutations different) sequences were included. For GMYC, a ultrametric tree was generated with BEAST ver. 2.4.6 (Bouckaert *et al*. 2014), using a Yule coalescent prior and running the analysis for $20*10^6$ generations. Each haplotype was included only once. Convergence was assessed with Tracer ver. 1.7 (Rambaut *et al*. 2018) and the first 25% of retained trees discarded as burn-in. GMYC was run in RStudio (RStudio Team, 2020) with the single threshold option.

GMYC and ASAP were not run for the 16S and ITS-2 datasets because here the number of sequenced specimens per species is low (which can be problematic to properly separate intra- from interspecific divergence). Furthermore, the high prevalence of indels in ITS-2 greatly biases inferences of genetic distances.

Species descriptions

Morphological investigations were performed with a Leica SMZ25 microscope. Digital photographs were taken with a Nikon DS-Ri2 digital camera attached to the microscope and the NIS-Elements Br (Basic Research) software. To study the carapace ornamentation in greater detail, scanning electron microscopy (SEM) images were taken with a JEOL JSM-6610 LV. For this, one carapace valve of one male individual of each species was removed, transferred to 100% acetone via dilution series, air dried and then sputter coated with platinum. If sufficient specimen numbers were available, also the whole body of the respective specimen was subjected to SEM. To better visualize the rostrum, the left antennae were removed. All generated images and photos are publically available (https://doi.org/10.57756/y7sgcg).

If large numbers of individuals were available for a given species (Schwentner *et al*. 2015a), a subset of ~25 males and ~25 females each was selected for morphological assessment, taking care to include geographically and ecologically (as far as known) divergent populations. Juveniles were always excluded, except where specifically noted. Character states were summarized separately for males and females.

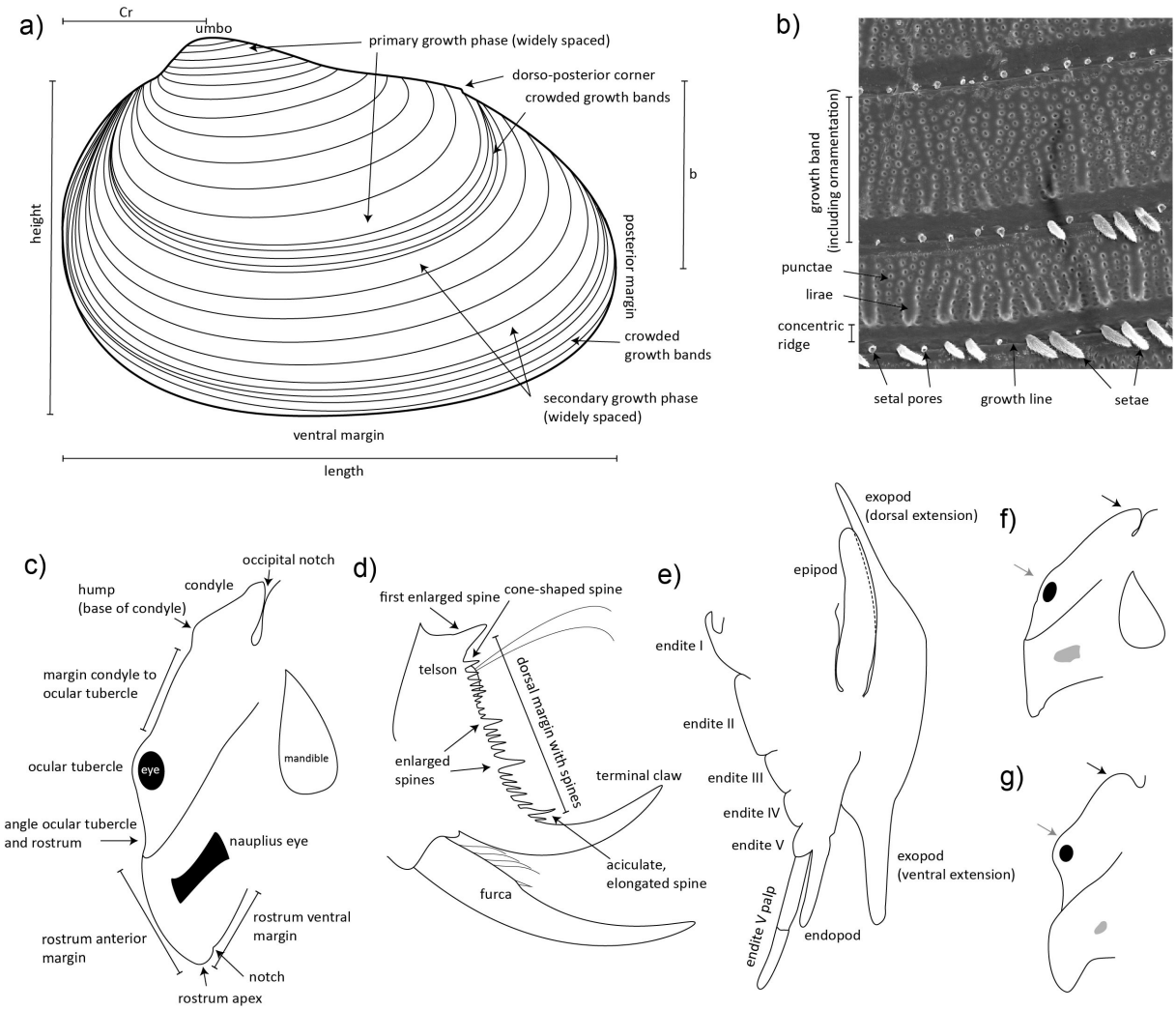


Fig. 1. Overview of morphological terms. All morphological terms and structures used in the species descriptions are depicted. **a**. Carapace. **b**. Carapace features including carapace ornamentation, concentric ridge weakly developed here. **c**. Head. **d**. Telson and furca. **e**. Thoracopod. **f**. Long condyle (black arrow) and weakly developed ocular tubercle (grey arrow). **g**. Short condyle (black arrow) and well developed ocular tubercle (grey arrow).

The first part of the species description includes a detailed description of the male morphology. In the following description of the female morphology, only differences observed in comparison to males are noted. An overview of the various morphological structures and the associated terms used herein is provided in Fig. 1. Measurable or countable characters are reported as ranges; if ten or more individuals of the same sex were available also the mean value is provided (this may vary among characters as some characters could not be studied in all individuals, e.g., when a certain structure was damaged).

Usually only the animals' left body half was studied (e.g., antennae, telson, carapace); when structures were damaged, they were assessed on the right body half instead – except for the telson spination as it is too dimorphic between body halves. Of antenna II only the anterior ramus was considered. The description of carapace ornamentation is based largely on light microscopic observations, and details seen only under the SEM (which thus have only been observed on a single individual per species) were added as side notes. We used ratios of carapace measurements to determine the umbo position (~ position of the larval valve) and the posterior greatest extension of the carapace. The relative position of the umbo in horizontal direction was determined by the ratio Cr/L (Fig. 1), with values < 0.25 being denoted as anterior and ≥ 0.25 as submedian; in vertical direction we distinguished between supramarginal, marginal and inframarginal (sensu Scholze & Schneider 2015). The specimen with the highest Cr/L value in our dataset ($= 0.35$; P.91741) yields a clearly submedian umbo position; hence, we include $Cr/L = 0.35$ in the submedian range and leave its upper limit open. The posterior greatest extension of the carapace was determined by the ratio b/H (Fig. 1) with values of < 0.35 being denoted as strongly supracurvate, 0.35–0.45 as supracurvate, $\geq$0.45–0.55 as equicurvate and > 0.55 as infracurvate. Further descriptive terms used for main carapace features (concentric ridge, growth line, growth band, secondary growth phase) and ornamental features (punctae, radial lirae, reticulation, serrate margins, setal pores) follow Hethke *et al*. (2023: table 2). The classification of polygonal ornamentation (reticulation) is based on mesh diameter (D): $D < 0.02$ mm: small reticulation, $D = 0.02$–0.07 mm: medium reticulation, and $D > 0.07$ mm: large reticulation (Sun & Cheng 2022).

We deliberately used non-quantitative descriptions for certain characteristics (e.g., exact growth band with onset or change of ornamental features, length of condyle, size of ocular tubercle, curvature of terminal claw etc.) as scoring these characters quantitatively would have been very laborious. Preliminary scoring suggested high intraspecific variability and thus potentially low taxonomic value.

Geometric morphometrics

Carapace shape differences among species of *Ozestheria* were assessed (1) to assign historic type specimens (known species) to molecularly delimited species and (2) to evaluate the taxonomic value of carapace shape in *Ozestheria*, following the morphometric approach outlined in detail in Hethke *et al*. (2023).

In a first step, we narrowed down the set of possible species by using a variable independent of carapace shape: condyle length. This was necessary as the full data set was too large to be handled by the Fourier programmes. We are aware that condyle shape does not define monophyletic groups within *Ozestheria* (Schwentner *et al*. 2020), but this was the single best independent character to define two roughly equally sized groups. To this end, we distinguished between individuals with short (twelve species; C, D1+2, D3, E, F, G, M, N, T, X1, X10, X11; 233 individuals + 15 historic type specimens) and long condyles (26 species; A, B, E, H1, H2, I, K, N, O, P, Q1, Q2, Q3, Q4, Q5, R, S, U, W, X2, X3, X4, X5, X7, X8, X9; 480 individuals + 17 historic type specimens). Species with condyles of intermediate lengths (E, N) were included in both morphometric analyses.

The acquisition of shape variables was based on Fourier shape analysis (specifically Fast Fourier Transformation) following Haines & Crampton (2000). The chosen settings are described in Hethke *et al*. (2023), which also includes a simulation study that determined the optimal number of harmonics for the analysis of clam shrimp; based on these results, we set the number of retained harmonics to eight in the Fourier shape analysis of the current study.

Pairwise relationships of the resulting 14 Fourier coefficients were examined (1) for each of the two datasets and (2) for each species using the Pearson correlation coefficient of R-function *pairs.panels()* of package *psych*.

Assigning the various species delimited herein to known species is in some cases challenging, due to the morphological similarity of many species and the lack of genetic, soft-part or carapace ornamental information for the historic type specimens. Linear discriminant analysis was chosen as prediction method for the species classification of historic type specimens, which performs well when the predictors are comparatively strongly correlated and when class membership is unbalanced (Brown & Mues 2012; Boedeker & Kearns 2019). Predictor variables are Fourier coefficients (shape variables) and the categorical outcome is 'species', coded using the lineage abbreviations of Schwentner *et al*. (2015a). Posterior probabilities were calculated for each historic type specimen, which identify the most probable species membership based on outline shape, and which sum to 1 across all species. They are derived using prior probabilities of species (class) membership specified according to the class proportions of the training sets. The shape files and corresponding files containing the *xy*-coordinates for each specimen are publically available (https://doi.org/10.57756/y7sgcg).

Abbreviations

AM = Australian Museum
HT = holotype
MV = Museums Victoria
NHM = Natural History Museum, London
NHMW = Naturhistorisches Museum Wien, Vienna
NT = neotype
SAM = South Australian Museum
ST = syntype(s)
WAM = Western Australian Museum
ZMUC = Zoologisk Museum, University of Copenhagen (now NHMD = Natural History Museum of Denmark)

Results

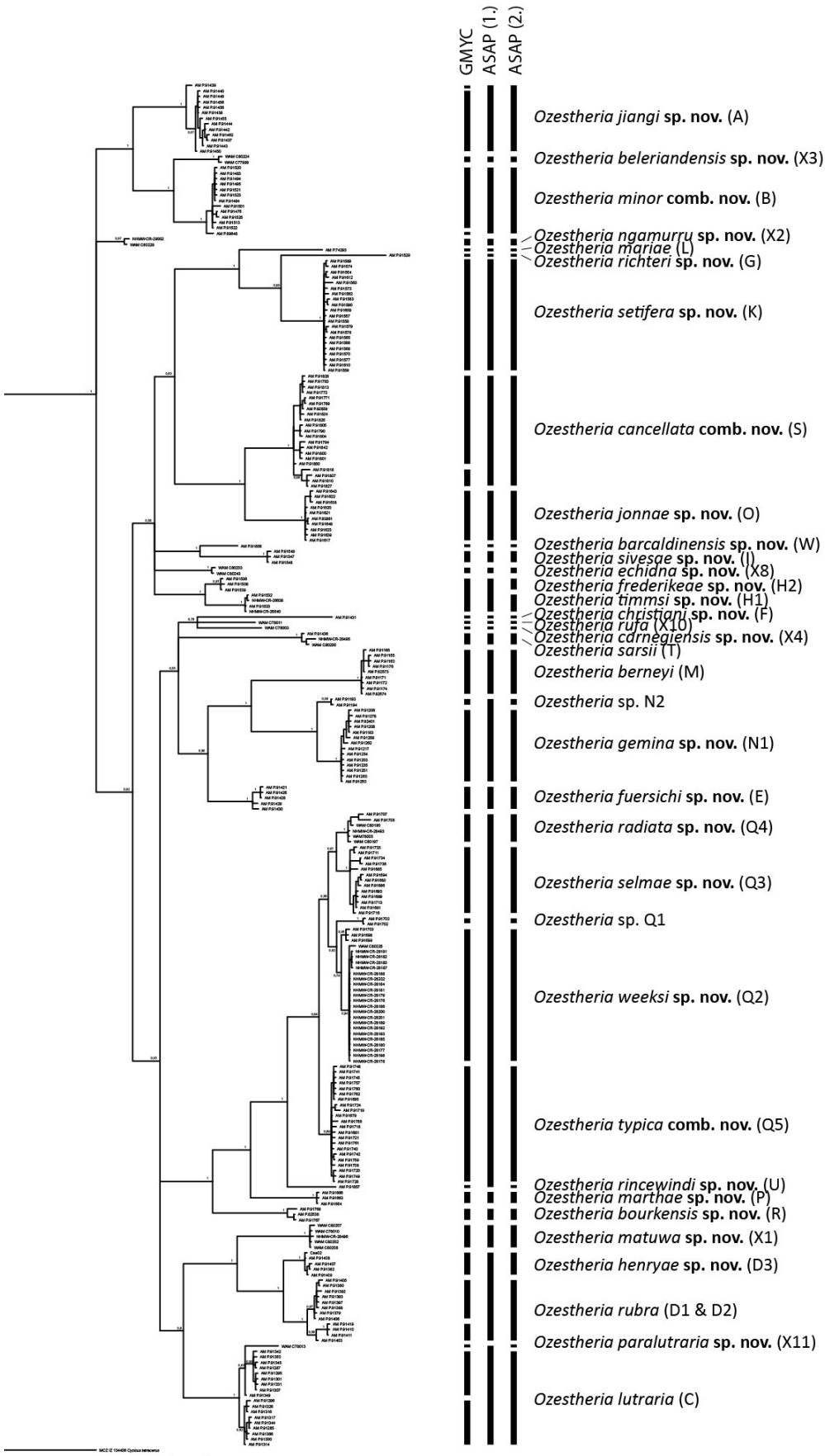
Type material

In addition to the known type material of various species of *Ozestheria* (Richter & Timms 2005), we were able to locate type material of *O. dictyon*, *O. sarsii*, *O. minor* comb. nov. and *O. typica* comb. nov. (see details in the respective species descriptions).

Molecular genetics

The species delimitation approaches of the COI data set suggested very different species numbers. With 41 putative species, GMYC had the highest species count (Fig. 2). ASAP suggests different species numbers depending on the applied barcode threshold. The partition with the best ASAP score (ASAP score 9.0; threshold distance 8.3%) resulted in 26 species and the second best partition (ASAP score 35;

Fig. 2 (next page). Bayesian phylogenetic analysis of COI. To reduce the number of terminals, only unique haplotypes were included from the Schwentner *et al*. (2015a) dataset; all newly sequenced specimens are included. Terminals are indicated by their respective collection numbers. Species partitions suggested by GMYC and ASAP are indicated, and for ASAP the two best-scoring partitions are indicated. Our final species interpretation closely followed the second best-scoring ASAP partition. In addition to the formal species name, the names used by Schwentner *et al*. (2015a) to identify genetically delimited species (e.g., A, B etc.; extended for the newly identified species, e.g., X1) are provided in parentheses.


GMYC
ASAP (1.)
ASAP (2.)
Ozestheria jiangi sp. nov. (A)
Ozestheria beleriandensis sp. nov. (X3)
Ozestheria minor comb. nov. (B)
Ozestheria ngamurru sp. nov. (X2)
Ozestheria mariae (L)
Ozestheria richteri sp. nov. (G)
Ozestheria setifera sp. nov. (K)
Ozestheria cancellata comb. nov. (S)
Ozestheria jonnae sp. nov. (O)
Ozestheria barcaldinensis sp. nov. (W)
Ozestheria sivesae sp. nov. (I)
Ozestheria echidna sp. nov. (X8)
Ozestheria frederikeae sp. nov. (H2)
Ozestheria timmsi sp. nov. (H1)
Ozestheria christiani sp. nov. (F)
Ozestheria rufa (X10)
Ozestheria carnegiensis sp. nov. (X4)
Ozestheria sarsii (T)
Ozestheria berneyi (M)
Ozestheria sp. N2
Ozestheria gemina sp. nov. (N1)
Ozestheria fuersichi sp. nov. (E)
Ozestheria radiata sp. nov. (Q4)
Ozestheria selmae sp. nov. (Q3)
Ozestheria sp. Q1
Ozestheria weeksi sp. nov. (Q2)
Ozestheria typica comb. nov. (Q5)
Ozestheria rincewindi sp. nov. (U)
Ozestheria marthae sp. nov. (P)
Ozestheria bourkensis sp. nov. (R)
Ozestheria matuwa sp. nov. (X1)
Ozestheria henryae sp. nov. (D3)
Ozestheria rubra (D1 & D2)
Ozestheria paralutraria sp. nov. (X11)
Ozestheria lutraria (C)

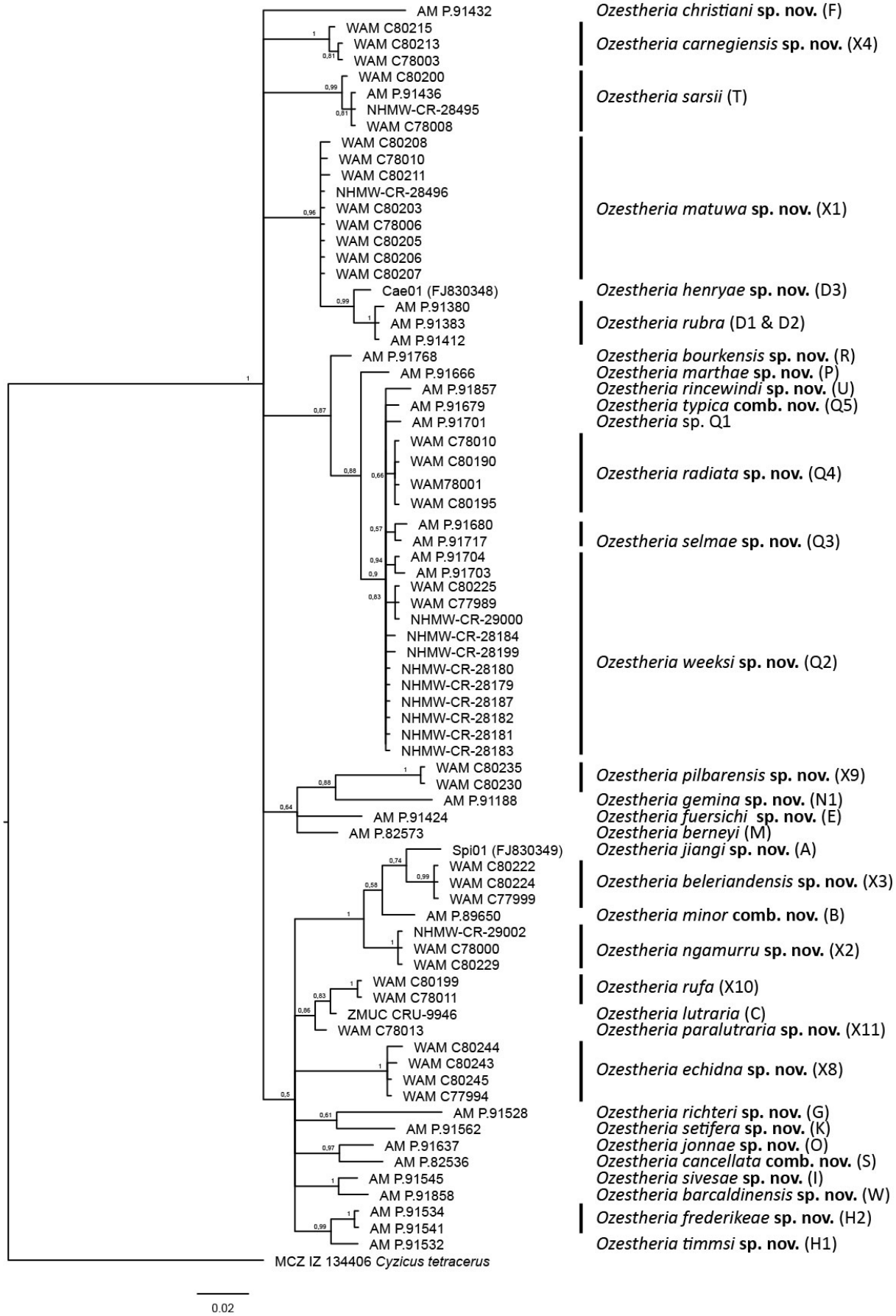
threshold 2.5%) in 35 species (Fig. 2). The majority of individuals were assigned to identical species clusters in all three approaches, differences in species delimitation involved instances of closely related species and/or species with comparatively high intraspecific genetic diversities.

The 35 species partition of ASAP comes closest to the proposed species by Schwentner *et al*. (2015a), where species delimitation has already been discussed in detail. As this also fits best with the 16S and ITS-2 data (see below), we will focus predominantly on this species hypothesis. There were a few notable differences to Schwentner *et al*. (2015a): *Ozestheria* sp. D1 and D2 are clustered into a single species and seven additional and clearly differentiated species were delimited among the newly sequenced individuals in the COI dataset (in the following *O.* sp. X1, *O.* sp. X2, *O.* sp. X3, *O.* sp. X4, *O.* sp. X8, *O.* sp. X10 and *O.* sp. X11). All of these delimited putative species formed well supported monophyletic groups in the phylogenetic analysis (Fig. 2); only *O.* sp. X11 was nested within *O.* sp. C despite genetic distances of 4.2–4.9% (Supp. file 4). COI *p*-distances usually exceeded 10% among species pairs, in most cases even 15% (Supp. file 4). Exceptions with lower pairwise COI *p*-distances are: *O*. sp. D1–D3 (~4–5%); *O*. sp. H1 and H2 (5.2–6.3%); *O*. sp. X3 and B (8.4–9%); *O*. sp. X11 and C (4.2–4.9%); *O*. sp. U and Q1–5 (~8–11%); *O*. sp. Q1–Q5 (~3–6.5%; see details below); *O*. sp. N and N2 (4.0–4.9%).

The 16S and ITS-2 analyses largely mirrored the COI results (it should be noted that not all markers could be amplified for all putative species; Figs 3–4), including the species pairs with COI *p*-distances below 10% (with the potential exception for *O*. sp. Q1–Q5, see below). Two additional species, for which no COI data was available, were genetically clearly differentiated from all other species: *O.* sp. X5 (only ITS-2 available) and *O.* sp. X9 (16S and ITS-2). *Ozestheria* sp. X11 and *O. lutraria* are well differentiated in 16S and ITS-2 (Figs 3–4). *Ozestheria* sp. X1 is closely related to *O*. sp. D1–D3 (Figs 2–4) with COI *p*-distances of ~12–14% (Supp. file 4) and consistent differentiation in 16S and ITS-2.

Ozestheria sp. Q1–Q5 comprises five closely related species (interspecific COI *p*-distances ~3–6.5%). This was already reported by Schwentner *et al*. (2015a). A number of additional specimens of *O*. sp. Q2 and *O*. sp. Q4, for which only four and two specimens were previously available, respectively, are now included. This also provides a better understanding of intra- and interspecific genetic distances in this complex of closely related species. COI intraspecific distances are up to 0.2% (Q1), 2.8% (Q2), 2.1% (Q3), 2.1% (Q4), and 1.7% (Q5), whereas interspecific COI *p*-distances are ≥3% (Table 2; Supp. file 4). In 16S the number of mutations is rather low; therefore, not all of these species are well separated from each other; only *O*. sp. Q3 and Q4 form monophyletic clades each (Fig. 3). Although the other species differ in certain mutations as well, those are too few for well-supported clades. In ITS-2 *O*. sp. Q1, Q3 and Q5 formed well supported clades (Fig. 4). *Ozestheria* sp. Q2 was also monophyletic, but with low support and extensive intraclade genetic variation, which was more or less evenly represented in all three of its populations. *Ozestheria* sp. Q4 was non-monophyletic with one individual (P.91706) clustering with *O*. sp. Q5 and *O*. sp. P (but with low support values). A visual inspection of the sequences shows that this cluster is supported by some nucleotide positions, but P.91706 shares several multi-nucleotide indels with the other *O*. sp. Q4 specimens, which are not present in *O*. sp. Q5 or *O*. sp. P. Such indels have no impact in Bayesian analyses, which might partly explain the non-monophyly of *O*. sp. Q4 in ITS-2.

Fig. 3 (next page). Bayesian phylogenetic analysis of 16S. All available sequenced specimens are included. Terminals are indicated by their respective collection numbers. In addition to the formal species name, the names used by Schwentner *et al*. (2015a) to identify genetically delimited species (e.g., A, B etc.; extended for the newly identified species, e.g., X1) are provided in parentheses.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WAM C80215
WAM C80213
WAM C78003
WAM C80200
AM P.91436
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WAM C78008
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WAM C78010
WAM C80211
NHMW-CR-28496
WAM C80203
WAM C78006
WAM C80205
WAM C80206
WAM C80207
Cae01 (FJ830348)
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AM P.91383
AM P.91412
AM P.91768
AM P.91666
AM P.91857
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AM P.91701
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WAM78001
WAM C80195
AM P.91680
AM P.91717
AM P.91704
AM P.91703
WAM C80225
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WAM C80229
WAM C80199
WAM C78011
ZMUC CRU-9946
WAM C78013
WAM C80244
WAM C80243
WAM C80245
WAM C77994
AM P.91528
AM P.91562
AM P.91637
AM P.82536
AM P.91545
AM P.91858
AM P.91534
AM P.91541
AM P.91532
MCZ IZ 134406 Cyzicus tetracerus
0.02
Ozestheria christiani sp. nov. (F)
Ozestheria carnegiensis sp. nov. (X4)
Ozestheria sarsii (T)
Ozestheria matuwa sp. nov. (X1)
Ozestheria henryae sp. nov. (D3)
Ozestheria rubra (D1 & D2)
Ozestheria bourkensis sp. nov. (R)
Ozestheria marthae sp. nov. (P)
Ozestheria rincewindi sp. nov. (U)
Ozestheria typica comb. nov. (Q5)
Ozestheria sp. Q1
Ozestheria radiata sp. nov. (Q4)
Ozestheria selmae sp. nov. (Q3)
Ozestheria weeksi sp. nov. (Q2)
Ozestheria pilbarensis sp. nov. (X9)
Ozestheria gemina sp. nov. (N1)
Ozestheria fuersichi sp. nov. (E)
Ozestheria berneyi (M)
Ozestheria jiangi sp. nov. (A)
Ozestheria beleriandensis sp. nov. (X3)
Ozestheria minor comb. nov. (B)
Ozestheria ngamurru sp. nov. (X2)
Ozestheria rufa (X10)
Ozestheria lutraria (C)
Ozestheria paralutraria sp. nov. (X11)
Ozestheria echidna sp. nov. (X8)
Ozestheria richteri sp. nov. (G)
Ozestheria setifera sp. nov. (K)
Ozestheria jonnae sp. nov. (O)
Ozestheria cancellata comb. nov. (S)
Ozestheria sivesae sp. nov. (I)
Ozestheria barcaldinensis sp. nov. (W)
Ozestheria frederikeae sp. nov. (H2)
Ozestheria timmsi sp. nov. (H1)

Table 2. Pairwise uncorrected COI *p*-distances among species within *O*. sp. Q (sensu Schwentner *et al.* 2015a). Species within *O*. sp. Q are very closely related and are now assigned to *O. selmae* sp. nov. (=Q3), *O. radiata* sp. nov. (=Q4), *O. typica* comb. nov. (=Q5) and *O. weeksi* sp. nov. (=Q2) (*O*. sp. Q1 has not been formally described due to a lack of sufficient specimens). Intraspecifc distances are provided along the diagonal. Genetic distances among all Australian species of *Ozestheria* are shown in Supp. file 4.

	***O. selmae* sp. nov.**	**O. radiata sp. nov.**	***O.* sp. Q1**	***O. weeksi* sp. nov.**	***O. typica* comb. nov.**
O. selmae sp. nov.	0–2.1				
O. radiata sp. nov.	3.3–6	0–2.8			
O. sp. Q1	4.6–5.6	4.9–6.5	0–0.2		
O. weeksi sp. nov.	3.1–5.8	4.2–6.6	3.3–4.6	0–2.1	
O. typica comb. nov.	4.2–6	3.5–6.8	5.2–6.2	3–4.3	0–1.7

Morphometrics

Species with short condyle

Bivariate relationships of shape variates (Fourier coefficients) can be comparatively strong in the full dataset containing twelve genetic species (Supp. file 1_1.3.1); but, when single species are examined, they are generally weak (Supp. file 1_1.3.2), indicating that all 14 Fourier coefficients (Supp. file 5) are informative for further species discrimination.

PC1, PC2, and PC3 explain 63.0%, 11.5%, and 7.4% of the variance in the dataset, respectively (Fig. 5; Supp. file 1_2.2). Most of the variance in the dataset (PC1) is driven by overall carapace shape, with species yielding elongated shapes at negative scores (e.g., *O.* sp. C and *O.* sp. X11) and more compact shapes (higher H/L ratio) at positive scores (e.g., *O.* sp. M and *O.* sp. E). PC2 is driven by umbo prominence and position, with prominent umbos in submedian position (*O. sarsii* and *O.* sp. X10) at negative scores and less prominent umbos in a more anterior position at positive scores. 7.4% of the variance is driven by the shape of the posterior margin, with more pointed (*O.* sp. T and *O.* sp. F) versus broadly rounded posterior margins (*O.* sp. E) at negative and positive scores, respectively.

The classification of the 15 historic type specimens of short-condyled species to genetically delimited species (Supp. file 1_4) was accomplished by using LDA as prediction method in combination with a visual assessment of the PCA plot (Fig. 5; Supp. file 1_2.2) and of the carapace ornamentation. For each historic type specimen, a set of genetically delimited species was predicted. To identify the most probable species among them, we then compared the ornamentation patterns of the type specimens with the most probable genetically delimited species. We were able to assign the type specimens of the historic species *O. dictyon*, *O. rubra*, and *O. rufa* to their respective classification results (*O*. sp. C, *O*. sp. D and *O*. sp. X10; probabilities of 100%, 97.8% and 100%, respectively) based on matching ornamentation patterns. Also, the original drawing of the "somewhat shrunk and distorted" carapace of *O. lutraria* (Brady 1886: 85) was most similar to (44.2%) but not typical of *O*. sp. C. The original drawing of *O. elliptica* was most similar to *O*. sp. X1 (68.6%) and *O*. sp. D (21.1%); however, the ornamentation patterns of these two genetically delimited species do not match the drawing of *O. elliptica*, which yields discontinuous polygonal mesh walls. The two drawings and the types of *O. berneyi* were most similar to *O*. sp. N and *O*. sp. D. While the ornamentation pattern of *O*. sp. D is clearly distinct from that of *O. berneyi*, that of *O*. sp. N is similar but does not quite match. Based on ornamental features, condyle length and biogeographical considerations, we thus assigned *O. berneyi* to the closely related species *O*. sp. M. The studied syntype of *O. berneyi* is rather small, lacking the extensive, crowded carapace

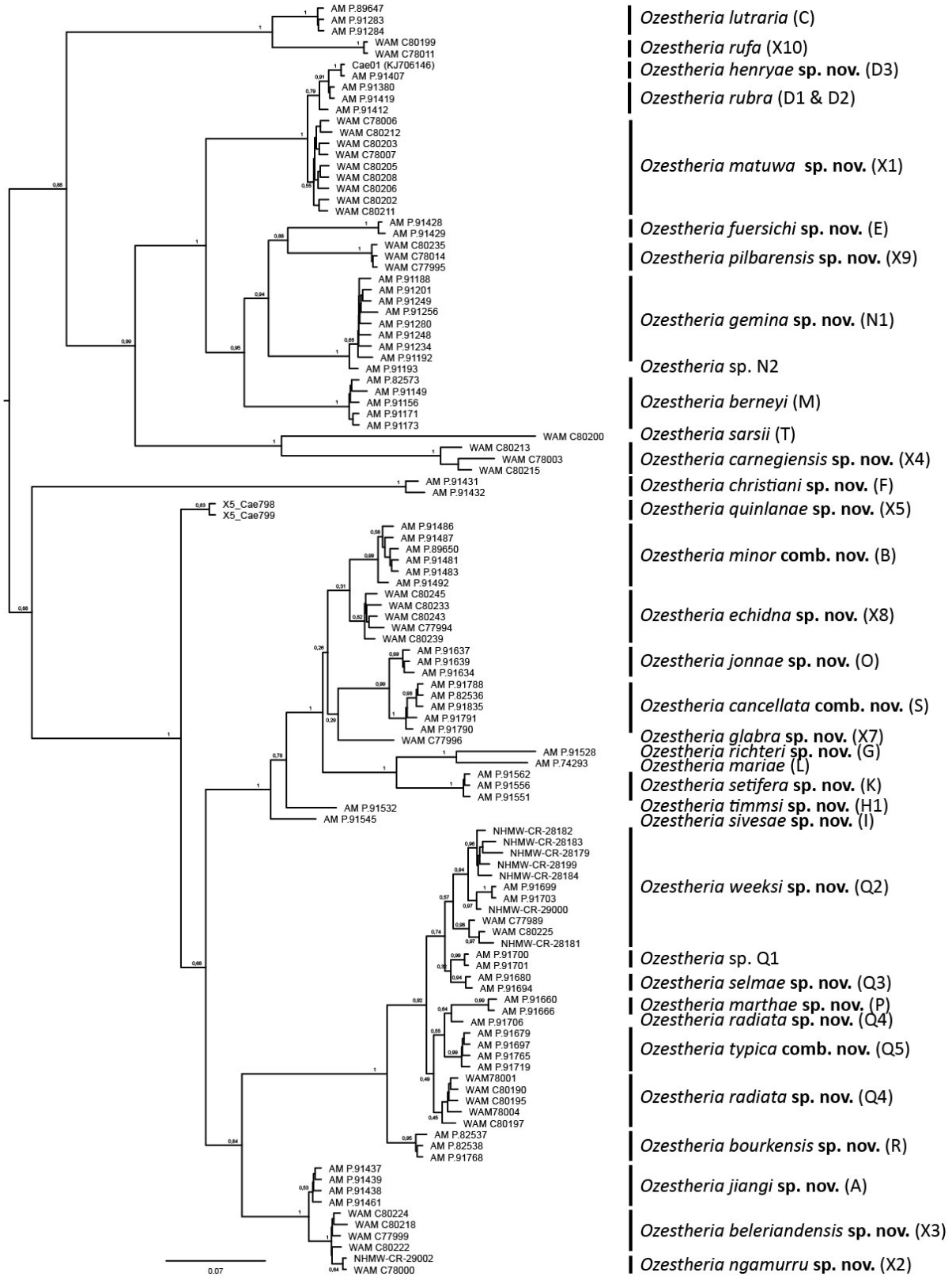

Fig. 4. Bayesian phylogenetic analysis of ITS-2. All available sequenced specimens are included. Terminals are indicated by their respective collection numbers. In addition to the formal species name, the names used by Schwentner *et al*. (2015a) to identify genetically delimited species (e.g., A, B etc.; extended for the newly identified species, e.g., X1) are provided in parentheses.

region present in the individuals of the training set of *O.* sp. M. The shape of the type of *O. sarsii* is most similar to that of *O.* sp. X10, with some probability that *O. sarsii* can be assigned to *O.* sp. T; both of the latter yield matching ornamentation patterns. The type of *O. pellucida* is distinct from all genetically delimited species in carapace shape and ornamentation. Shape results are further discussed together with ornamental and soft part features in the species remarks chapters.

Species with long condyle

Bivariate relationships of shape variates (Fourier coefficients) are generally weak in the full dataset containing 26 genetic species (Supp. file 2_1.3.1; including species documented by only a single individual), and even weaker when single species are examined (Supp. file 2_1.3.2), indicating that all 14 Fourier coefficients (Supp. file 6) are informative for further species discrimination.

PC1, PC2, and PC3 explain 38.6%, 19.8%, and 10.7% of the variance in the dataset, respectively (Fig. 6; Supp. file 2_2.3). Most of the variance is driven by species with subrectangular (e.g., *Ozestheria*

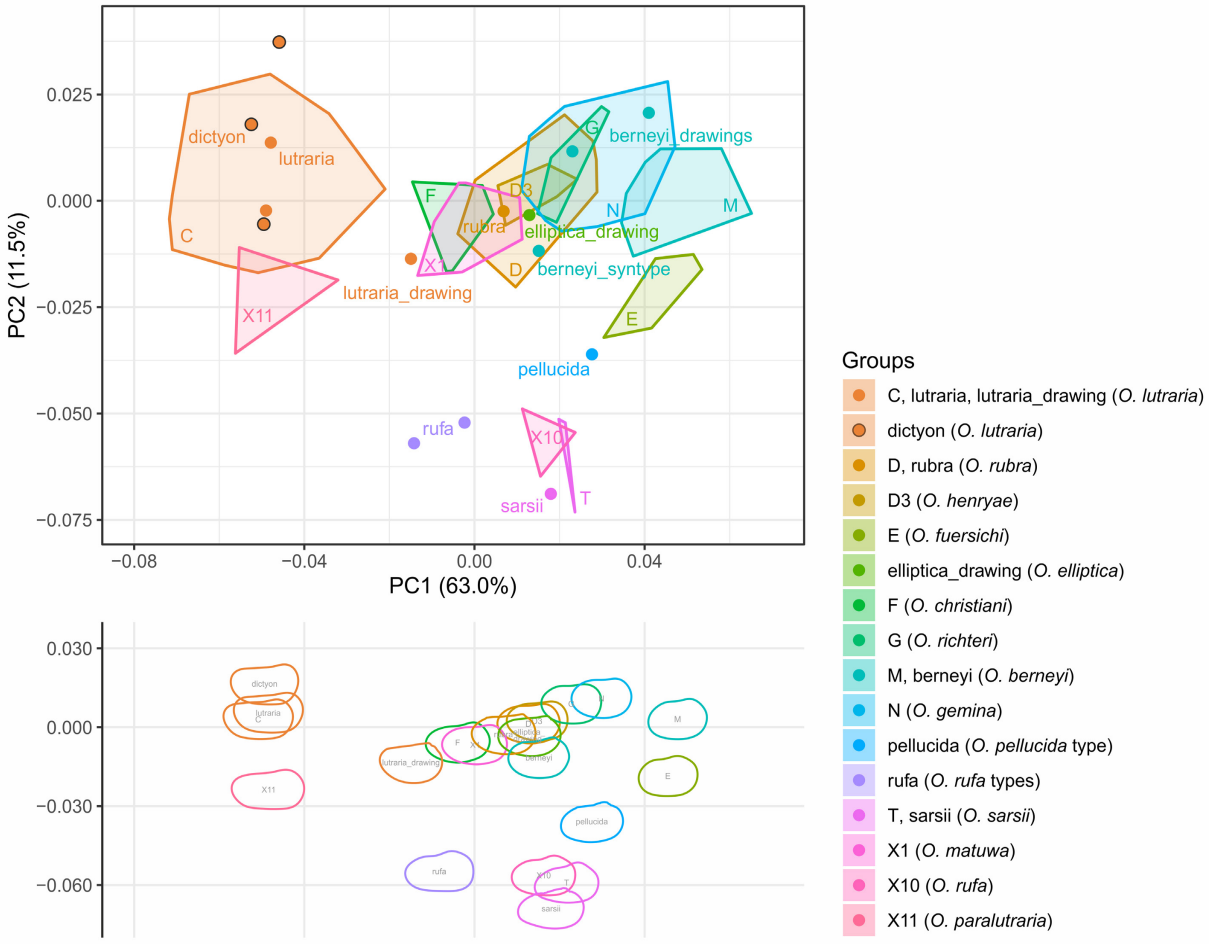

Fig. 5. Morphometrics of short-condyled species. Scores on **upper** PC1 and PC2 of Fourier shape coefficients of 248 outlines, including 233 new individuals and 15 historic type specimens, four of which are drawings of *Ozestheria elliptica* (Sars, 1897), *O. lutraria* (Brady, 1886) and *O. berneyi* (Gurney, 1927). One of the drawings of *O. berneyi* corresponds to the studied syntype. The names used by Schwentner *et al*. (2015a) to identify genetically delimited species (e.g., C, D etc.; extended for the newly identified species, e.g., X1) are provided. New specimens are represented by convex hulls, type specimens by data points. **lower**. Mean shape of each species, calculated based on up to 73 individuals per species.

sp. X2, *O.* sp. Q5) and oval (*O.* sp. N) shapes at negative and positive scores of PC1, respectively. The development of the ventral margin constitutes 19.8% of the variance in the dataset, with flat (e.g., *O. typica*) and broadly rounded (e.g., *O.* sp. H2 yielding a comparatively high H/L ratio) ventral margins at negative and positive scores of PC2.

The classification of the 16 historic type specimens of long-condyled species (*O. cancellate* comb. nov., *O. minor* comb. nov., *O. typica* comb. nov., *O. mariae*) to genetically delimited species (Supp. file 2_4) was accomplished by using LDA as prediction method in combination with a visual assessment of the PCA plot (Fig. 6) and of the carapace ornamentation. While a drawing of Spencer & Hall (1896) was classified for *O. cancellata*, we classified the mean shapes of the type specimens of *O. minor*, *O. typica* and *O. mariae* (five each). For each historic type specimen, a set of genetically delimited species was predicted. To identify the most probable species among these, we then compared the ornamentation patterns of the type specimens with the most probable genetically delimited species. For *O. cancellata*, *O. minor* and *O. typica*, we were able to assign one of the classification results (genetically delimited lineages) to one of these historic species based on matching ornamentation patterns, indicating that three of the genetic species can be assigned to historic species. For *O. mariae*, there was no match between classification results and ornamentation pattern; the species is thus not among the genetically delimited species. Shape results are further discussed together with ornamental and soft part features in the species remarks chapters.

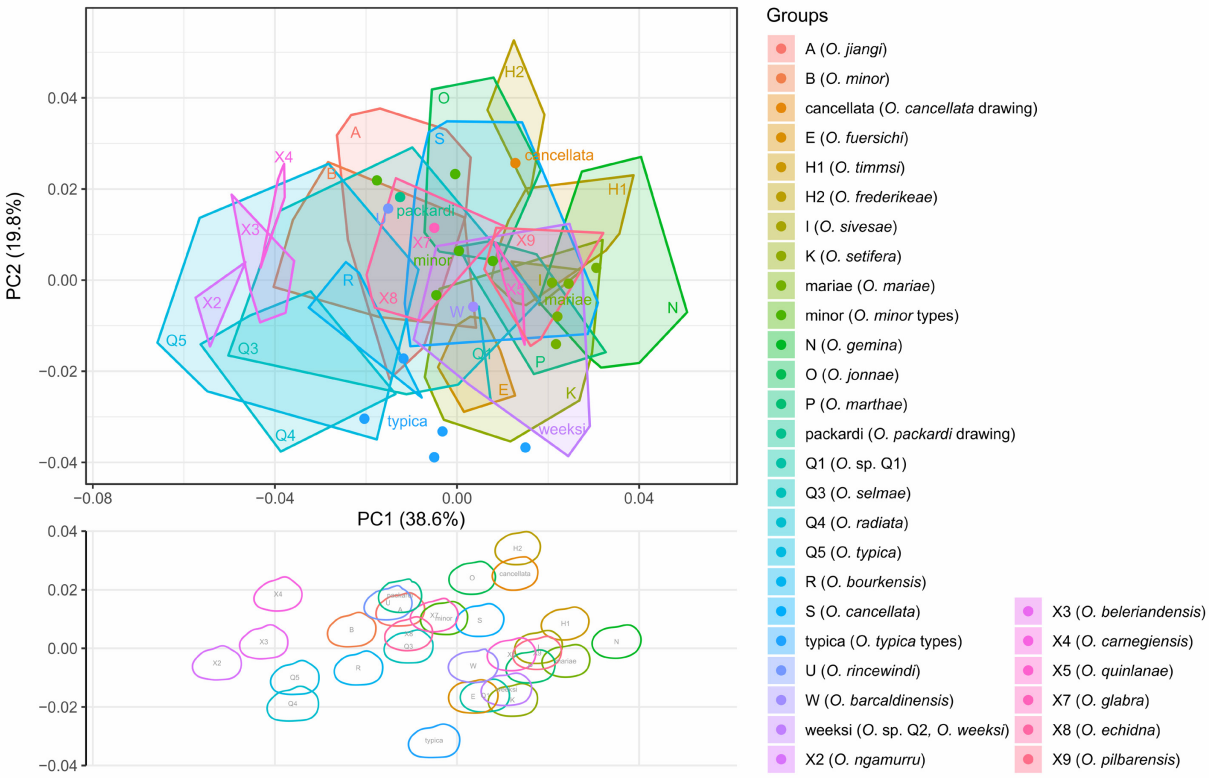

Fig. 6. Morphometrics of long-condyled species. **upper**. Scores on PC1 and PC2 of Fourier shape coefficients of 497 outlines, including 480 new individuals and 17 historic type specimens, two of which are drawings of *Ozestheria cancellata* (Spencer & Hall, 1896) and *O. packardi* (Brady, 1886). The names used by Schwentner *et al*. (2015a) to identify genetically delimited species (e.g., A, B etc.; extended for the newly identified species, e.g., X2) are provided. New specimens are represented by convex hulls, type specimens and species documented by a single specimen (U, W, X7) by data points. **lower**. Mean shape of each species, calculated based on up to 67 individuals per species.

Species descriptions

Superorder Diplostraca Gerstaecker, 1866
Order Spinicaudata Linder, 1945
Family Cyzicidae Stebbing, 1910

Genus ***Ozestheria*** Schwentner & Richter, 2015

Diagnosis (modified from Schwentner *et al*. 2015a and Rogers 2020)

Populations composed of males and females; amplexus is venter to venter. Umbo present, extending above dorsal margin (supramarginal). Carapace ornamentation highly variable, including lirae, reticulations or smooth ornamentation. Carapace coloration from yellow, to light brown, reddish-brown and dark brown. Head with condyle short or elongate, with wide or narrow occipital notch; frontal organ sessile. Rostrum without posterior margin. Juvenile with rostral spine, absent in adults. Claspers with slender, claw-like projections at the tip of the movable finger. Eggs attaching to prolonged exopods of thoracopods IX and X. Posterior trunk segments with several medial dorsoposterior spines per segment (very rarely last segment spineless). Cercopod with medial longitudinal setal row on proximal 40–60%. Setae plumose and either long or short. Setal row terminates with single spine.

Remarks

Rogers (2020) listed further diagnostic features, which we exclude from the genus diagnosis because these are either too variable to be diagnostic or we found that the range was greater than indicated in the diagnosis. For example, we excluded the character state "Ocular tubercle smoothly arcuate. Angle between rostrum and frons 150° to 170°." (Rogers 2020: 22), as the ocular tubercle can be variably expressed and the respective angle can vary from ~90° to 180°. Also, the height-length ratio is in fact much more variable than suggested in the diagnosis ("Carapace valve length ~1.5 times valve breadth (hinge to margin)"; Rogers 2020: 22).

Key to the Australian species of *Ozestheria* Schwentner, Just & Richter, 2015

One of the main characteristics is the length of the condyle, which had previously been used to separate the species into two genera, used here as the first distinguishing characteristic. Three species (*O. gemina* sp. nov., *O. carnegiensis* sp. nov. and *O. berneyi*) had intermediate long condyles; therefore, these are listed twice.

1. Condyle short, rarely dorsally extending, always leaving wide occipital notch (Fig. 25i) 2
– Condyle long, extending nearly to following trunk segment, leaving very narrow occipital notch (Fig. 13b); ornamentation on mid carapace never with well-defined polygonal reticulations (Fig. 24e–g showing reticulations) 15

2. Carapace ornamentation dominated by distinctive polygonal reticulations, only crowded growth bands may lack these (and larval valve due to abrasion) (Fig. 25g–h)..... 3
– Carapace ornamentation not dominated by reticulations (these may be present dorsally on the carapace); ornamentation including lirae and/or nodules or smooth 10

3. Ventral margin of carapace nearly straight (Fig. 25b); telsonic spines usually small (Fig. 25m) (larger spines mainly in juveniles) 4
– Ventral margin of carapace widely rounded, not straight (Fig. 15a); telsonic spines usually of varying size (including larger spines also in adults) 5

4. 24–27 complete thorax segments; adult telson usually with <15 spines (rarely exceeding 15, juveniles with more spines); largest known Australian species of *Ozestheria*, adults usually exceeding 10 mm ..... ***O. lutraria*** (Brady, 1886)
– 23–24 complete thorax segments; adult telson with >15 spines; adults reach ~9 mm ..... ***O. paralutraria*** sp. nov.

5. Walls of polygonal ornamentation not regular, single polygons often intermittent or with projections (Fig. 15e); known only from south-eastern Australia ..... ***O. christiani*** sp. nov.
– Walls of polygonal ornamentation never intermittent or with lateral projections, polygons with pit-like appearance (Fig. 22e) 6

6. Carapace ornamentation with polygons, which decrease in size and are slightly compressed ventrally within growth bands (Fig. 43a, f); secondary carapace ornamentation pit-like/rounded (visible best under SEM); male rostrum shorter and concentric ridges of carapace less strongly demarcated than in other species; known only from central Western Australia ..... ***O. sarsii*** (Sayce, 1903)
– Carapace ornamentation with polygons, which are not compressed ventrally within growth bands (Fig. 22e–g); secondary carapace ornamentation polygonal (visible best under SEM); male rostrum longer (more elongated) and concentric ridges of carapace stronger demarcated than in other species dominated by polygonal ornamentation (the following species are difficult to distinguish morphologically) 7

7. Telson with more spines (>20, up to 30); shorter carapace (length up to 7 mm); male antennule short, reaching to flagellomeres V–VII (unknown for *O. elliptica*) 8
– Telson with fewer spines (usually ~20, rarely up to 27); longer carapace (up to 9 mm, but not all individuals reach this size); male antennule longer, reaching to flagellomeres VII–X 9

8. Spines on mid telson slightly enlarged; furca with several setae; known only from northern Queensland ..... ***O. henryae*** sp. nov.
– All telsonic spines subequal in length; furca without setae; known only from north-eastern Western Australia ..... ***O. elliptica*** (Sars, 1897)

9. 22–23 complete thorax segments; male rostrum apex strongly rounded; occurs in central and eastern Australia ..... ***O. rubra*** (Henry, 1924)
– 22–24 complete thorax segments; male rostrum apex weakly rounded; occurs in Western Australia ..... ***O. matuwa*** sp. nov.

10. Male rostrum apex rounded (Fig. 14h); thorax with ≤21 complete segments 11
– Male rostrum apex pointed (acute angle) or protruding (Fig. 42j); thorax with ≥22 complete segments 13

11. Carapace ornamentation on wide growth bands dominated by punctae (Fig. 14f); large number of mostly crowded growth bands (>50); only known from central Western Australia ..... ***O. carnegiensis*** sp. nov.
– Carapace ornamentation on wide growth bands smooth, nodular, with depressions and/or lirae; carapace usually with <20 growth bands 12

12. Carapace ornamentation granular, nodular and pit-like, lacking lirae; carapace coloration whitish translucent; furca with many (~14) setae; only known from northern Western Australia ..... ***O. pellucida*** Timms 2018

– Carapace ornamentation dorsally smooth or with irregular depressions, from mid-carapace irregular, nodulous and inconspicuous lirae; carapace coloration dark brown (ventrally lighter); furca with few (~1) setae; only known from western Western Australia ..... ***O. richteri*** sp. nov.

13. Rostrum with small wing-like dorsal flange, anterior margin strongly convex in males, apex protruding (Fig. 42j); carapace length up to 10 mm; known only from central Western Australia ..... ***O. rufa*** (Dakin, 1914)
– Rostrum lacking dorsal flange, anterior margin straight or weakly convex, apex pointed or weakly rounded (not protruding) (Fig. 20j); carapace length < 8 mm 14

14. Mid-carapace ornamentation includes reticulations dorsally within growth bands, which transition into lirae ..... ***O. berneyi*** (Gurney, 1927)
– Mid-carapace ornamentation dominated by dorsally anastomosing lirae, no reticulations ..... ***O. gemina*** sp. nov.

15. Carapace ornamentation dorsally within growth bands smooth (Fig. 45e) 16
– Carapace ornamentation dorsally within growth bands with lirae, granular or punctate, never smooth 19

16. Most growth lines densely covered with stout setae (Fig. 45g); male rostrum anterior margin convex and apex strongly rounded (Fig. 45j) 17
– Setae predominately preserved ventrally and posteriorly on carapace (others broken off); male rostrum anterior margin nearly straight and apex weakly rounded and tapered (Fig. 46i) 18

17. Mid-carapace ornamentation with short, partly nodulous lirae ventrally within growth bands; setae mid-long; known from southern Queensland and northern New South Wales ..... ***O. setifera*** sp. nov.
– Mid-carapace ornamentation smooth and only with remnant lirae very close to the concentric ridge; setae very long; known from Western Australia ..... ***O. echidna*** sp. nov.

18. Mid-carapace ornamentation with highly anastomosing short lirae ventrally within growth bands, lirae separated by punctae; dorsally smooth area within growth bands increases in extension with each growth band; 19–21 complete thorax segments; female rostrum apex weakly pointed; no tubercle on ocular tubercle ..... ***O. sivesae*** sp. nov.
– Mid-carapace ornamentation with short parallel lirae ventrally within growth bands; dorsally smooth area within growth bands decreases in extension with each growth band; 19–23 complete thorax segments; female rostrum apex drawn out into acute tip; most individuals with small tubercle on ocular tubercle ..... ***O. jiangi*** sp. nov.

19. All or at least posterior ½ of telsonic spines long, elongated and aciculate (longer than anterior conical spines) (Fig. 30h–i); telson dorsal margin often strongly concave (following species are difficult to differentiate morphologically) 20
– Majority of telsonic spines short and conical, elongated and aciculate spines only posteriorly on telson (or not much longer than conical spines) (Fig. 47m); telson dorsal margin convex, straight or weakly concave (never strongly concave) 25

20. Apex female rostrum terminating in elongated, slightly wider tip (Fig. 31c, e) 21
– Apex female rostrum terminating in short, minutely pointed tip (Fig. 37i) 22

21. Anterior margin of rostrum straight in males and straight to weakly concave in females; mid-carapace lirae nodular in later juvenile stages ..... ***O. minor*** comb. nov
– Anterior margin of rostrum convex or straight in males and weakly concave and/or undulating in females ..... ***O. selmae*** sp. nov.

22. Male rostrum anterior margin concave; only occurring in Western Australia ..... ***O. radiata*** sp. nov.
– Male rostrum anterior margin straight or weakly undulating or convex 23

23. Male rostrum anterior margin straight or weakly undulating; occurring only in central Western Australia..... ***O. beleriandensis*** sp. nov.
– Male rostrum anterior margin convex 24

24. Telson with more spines (18–32); lirae well developed in mid-carapace; occurring in Western Australia, Northern Territory, South Australia and New South Wales ..... ***O. typica*** comb. nov.
– Telson with fewer spines (17–24); lirae heavily anastomosing and inconspicuous in mid-carapace; occurring only in northern New south Wales ..... ***O. bourkensis*** sp. nov.

25. 23 or more complete thorax segments 26
– 23 or fewer complete thorax segments 29

26. Male and female rostrum with strongly rounded apex, angle ≥ 90° (Fig. 47j–k); large carapace (reaching 8–11.5 mm); carapace ornamentation dominated by large, conspicuous punctate (with lirae forming in between in later growth bands); known only from northern Queensland ..... ***O. timmsi*** sp. nov.
– Male and female rostrum with pointed or weakly rounded apex, angle < 90° (Fig. 20 j–k); mid-sized carapace (reaching 4.5–8 mm); carapace ornamentation dominated by lirae, punctae present but tiny and poorly visible 27

27. Mid-carapace ornamentation dominated by dorsally anastomosing lirae, no reticulations.....
..... ***O. gemina*** sp. nov.
– Mid-carapace ornamentation includes reticulations (sometimes pit-like) dorsally within growth bands, which transition into lirae (Fig. 34d–g)..... 28

28. Apex of female rostrum pointed and drawn out into protruding tip; 4–5 short setae between two long setae on concentric ridges; reticulations on mid-carapace well defined and regular; known from central and eastern Australia ..... ***O. berneyi*** (Gurney, 1927)
– Apex of female rostrum pointed but not drawn out; short and long setae alternating or irregularly arranged on concentric ridges; reticulations on mid-carapace poorly defined and pit-like; known only from Western Australia ..... ***O. pilbarensis*** sp. nov.

29. Angle between ocular tubercle and rostrum ~90° (Fig. 27i–j) 30
– Angle between ocular tubercle and rostrum obtuse (> 120°) or nearly straight (rarely close to 90°) .
..... 32

30. Male antennule with ≤ 11 lobes; antenna with ~10 flagellomeres; hump at base of condyle; nauplius eye small ..... ***O. mariae*** (Olesen & Timms, 2005)
– Male antennule with ≥ 11 lobes; antenna with ≥ 12 flagellomeres; no hump at base of condyle; nauplius eye large 31

31. Can reach > 50 crowded growth lines; condyle distally rounded; carapace ornamentation dominated by punctae, only short and inconspicuous lirae ..... ***O. carnegiensis*** sp. nov.
– Up to 10 crowded growth lines; condyle distally acute; carapace ornamentation with punctae, but irregular lirae well visible (especially ventrally within growth bands) ..... ***O. quinlanae*** sp. nov.

32. Ocular tubercle well developed in males (Fig. 50h); hump at base of condyle present 33
– Ocular tubercle weakly developed in males (Fig. 18i); hump at base of condyle present or absent...
..... 35

33. Male rostrum apex with acute angle; male antennule with ~16 lobes; known only from south-eastern Australia (South Australia and New South Wales) ..... ***O. rincewindi*** sp. nov.
– Male rostrum with right or obtuse angle; male antennule with < 15 lobes 34

34. Line between condyle and ocular tubercle strongly concave; thorax with 21 complete segments; known only from northeastern Queensland ..... ***O. barcaldinensis*** sp. nov.
– Line condyle-ocular tubercle straight or only weakly concave; thorax with 19–20 complete segments; known only from Western Australia ..... ***O. weeksi*** sp. nov.

35. Carapace ornamentation: nodular lirae absent, lirae continuous (Fig. 12e–g) 36
– Carapace ornamentation: nodular lirae present (Fig. 19e)..... 40

36. ≥20 (usually ≥21) complete thorax segments 37
– ≤20 complete thorax segments 39

37. 22–31 telsonic spines; known from southern Queensland ..... ***O. frederikeae*** sp. nov.
– 9–24 telsonic spines 38

38. Female rostrum lacking dorsal indentation in anterior margin and straight or weakly concave ventral margin; widely distributed and common in central and eastern Australia... ***O. cancellata*** comb. nov.
– Female rostrum with dorsal indentation in anterior margin and convex ventral margin; known from northern Queensland ..... ***O. jonnae*** sp. nov.

39. Angle between male ocular tubercle and rostrum nearly straight; male rostrum anterior margin straight or weakly concave, apex pointed; known from central Western Australia..... ***O. ngamurru*** sp. nov.
– Angle between male ocular tubercle and rostrum obtuse (~120°); male rostrum anterior margin dorsally concave, apex strongly rounded; known from central Western Australia..... ..... ***O. glabra*** sp. nov.

40. Carapace ornamentation dorsally on carapace (early and late juvenile) with polygonal reticulations, nodular lirae on mid-carapace more pronounced; female rostrum lacking distinct rounded bulge at fronto-dorsal corner; mid-ventral margin of rostrum nearly straight; known from central Queensland ..... ***O. fuersichi*** sp. nov.
– Carapace ornamentation dorsally on carapace (early and late juvenile) punctate or granular, lirae on mid-carapace inconspicuous; female rostrum with distinct rounded bulge at fronto-dorsal corner; known only from mountainous regions of southern New South Wales..... ***O. marthae*** sp. nov.

Ozestheria barcaldinensis sp. nov.

urn:lsid:zoobank.org:act:1D00ADAC-B5C3-4FDC-AE26-23B89430783A

Fig. 7

Ozestheria sp. W – Schwentner *et al*. 2015a: figs 2, 6; 2020: 1–2.

Diagnosis

Ozestheria barcaldinensis sp. nov. is characterized by a long condyle and a narrow occipital notch; carapace ornamentation dorsally on carapace punctate (may appear granular), in following growth bands bearing strongly reticulating and anastomosing lirae forming ventrally within growth band, lirae become longer, less anastomosing and more pronounced with progressing growth bands posteriorly and continue to be strongly reticulating anteriorly; male rostrum with convex anterior margin, apex broadly rounded with obtuse angle, ventral margin straight; 11 (male) antenna I lobes reaching to antenna II flagellomeres V; 12 (male) antenna II flagellomeres; 21 complete thorax segments; 15 telsonic spines,

anterior spines conical, posterior spines thin, aciculate and increasing in size posteriorly, one larger spine interspersed; 9 furcal setae.

Differential diagnosis

Ozestheria barcaldinensis sp. nov. can be differentiated from many other species of *Ozestheria* by the narrow occipital notch and long condyle in combination with the carapace ornamentation (dominated by punctate ornamentation dorsally on carapace, transitioning to distinct, subparallel lirae during ontogeny), except from *O. cancellata* comb. nov., *O. minor* comb. nov., *O. typica* comb. nov., *O. fuersichi* sp. nov., *O. marthae* sp. nov., *O. selmae* sp. nov., *O. radiata* sp. nov., *O. bourkensis* sp. nov., *O. jonnae* sp. nov., *O. rincewindi* sp. nov., *O. ngamurru* sp. nov., *O. beleriandensis* sp. nov., *O. quinlanae* sp. nov., *O. glabra* sp. nov., *O. pilbarensis* sp. nov. and *O. weeksi* sp. nov., and differentiating these species can be difficult. *Ozestheria minor*, *O. typica*, *O. bourkensis*, *O. selmae*, *O. radiata*, and *O. beleriandensis* can be differentiated by having at least the posterior half of the telsonic spines elongate and aciculate, and *O. fuersichi* by its polygonal reticulations on the first few growth bands and punctae between widely spaced lirae. The strongly convex anterior margin and obtuse (not rounded but angular) apex of the male rostrum differentiates *O. barcaldinensis* from *O. cancella*, *O. minor*, *O. typica*, *O. fuersichi*, *O. marthae*, *O. selmae*, *O. rincewindi*, *O. ngamurru*, *O. beleriandensis*, *O. quinlanae*, *O. glabra*, *O. pilbarensis* and *O. weeksi*. Also, the dorsal extension of the exopod is shorter than the epipod in the male 3. thoracopod of *O. barcaldinensis*.

Etymology

The species is named after the Barcaldine region in central Queensland, where the species is known to occur.

Type material

Holotype

AUSTRALIA – **Queensland** • 1 ♂; swamp on Texas Station, 72 km N of Jericho; 23°02′37.5″ S, 145°52′34.6″ E; 14 Feb. 2010; M. Schwentner, C. Sieves and B.V. Timms leg.; GenBank no: KJ706083 (COI); AM P.91858.

Type locality

Australia, Queensland, swamp on Texas Station, 72 km N of Jericho, 23°02′37.5″ S, 145°52′34.6″ E.

Description

Male (holotype)

Carapace (Fig. 7a–c). Length 4.1 mm, height 2.5 mm. Coloration lightly yellowish-brown. 19 growth lines, 17 widely spaced and two crowded.

Carapace shape. Dorsal margin straight, dorsoposterior corner rounded. Posterior margin broadly rounded, suboval, equicurvate (b/H 0.47). Ventral margin broadly rounded. Umbo position anterior (Cr/L 0.24).

Carapace ornamentation (Fig. 7d–g). Larval valve and dorsal growth bands granular or punctate (under SEM clearly punctate). From mid-dorsal carapace, growth bands with strongly anastomosing and reticulating lirae, giving pit-like appearance. Reticulations elongate, more pronounced anteriorly and medially; posteriorly lirae subparallel and less reticulating but anastomosing. On ventral carapace, lirae short, pronounced and subparallel. Concentric ridges raised; smooth in early ontogenetic stages and with nodules in moniliform rows in later ontogenetic stages. Setae filiform, only few preserved (under SEM single row of setal pores along all growth lines).

Head (Fig. 7h). Condyle long, distally acute, occipital notch narrow. Condyle with anterobasal hump. Margin between condyle and ocular tubercle concave. Ocular tubercle well developed, forming obtuse angle with rostrum. Anterior margin of rostrum convex, ventral margin straight, apex broadly rounded and obtuse. Naupliar eye triangular. Antenna I with eleven lobes, reaching to antenna II flagellomere V. Antenna II anterior ramus with twelve flagellomeres.

Thorax. 22 segments, 21 thoracopod-bearing and one limbless segment not reaching dorsal margin. Last twelve thoracopod-bearing segments with dorsal extensions bearing spines. Dorsal extensions increasing in size posteriorly over successive segments. Spines thin and elongate, central spines stronger and broader in posterior segments.

Thoracopod III (Fig. 7j). Endite I short and curved dorsally. Endites II–V broad, decreasing in size. Endite V two-segmented, basal segment shorter than endopod. Exopod ventral extension slightly overreaching endopod, dorsal extension slightly shorter than epipod. Epipod long, cylindric.

Telson (Fig. 7i). 15 spines. First spine (anterior) enlarged. Fourth spine enlarged, others subequal in length. First ten spines broad, conical, straight; subsequent five spines slender, elongate, aciculate and directed posteriorly. Last spines extend beyond terminal claw base. Terminal claw strongly curved, more strongly curved on right body half. Telson dorsal margin nearly straight, posteriorly concavely curved.

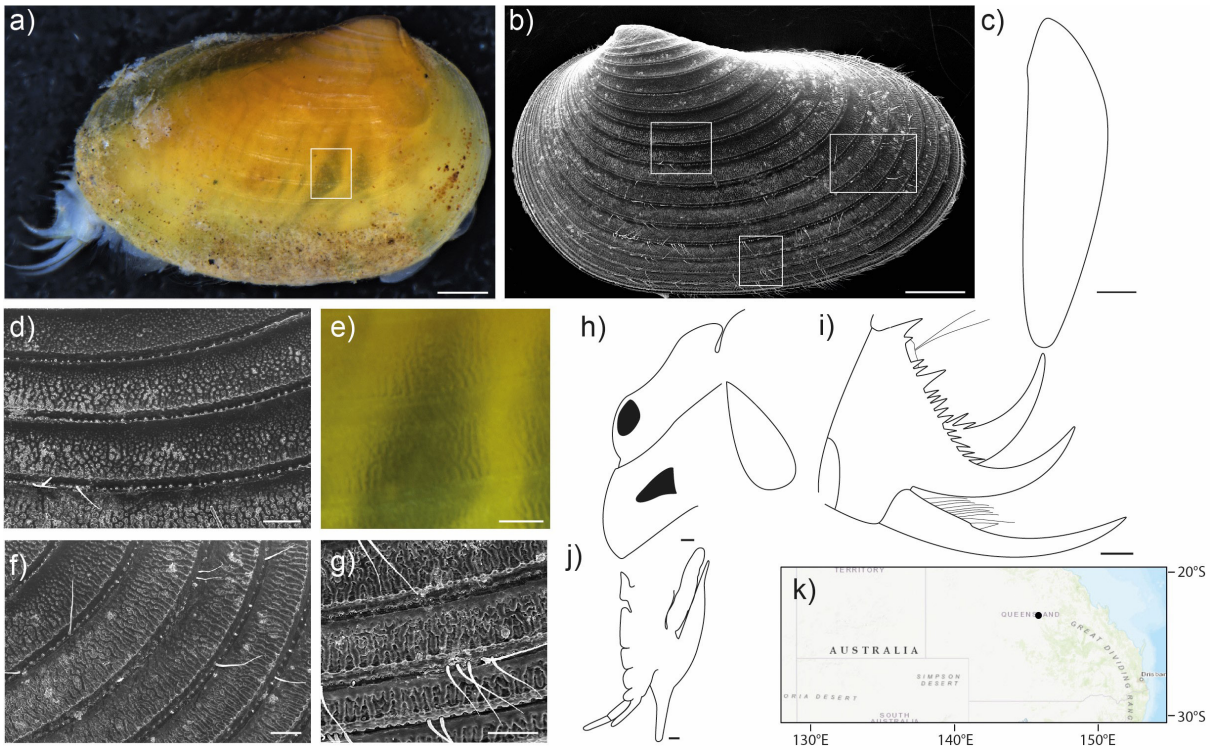

Fig. 7. *Ozestheria barcaldinensis* sp. nov., male, holotype (P.91858). **a**. Carapace. **b**. Carapace, SEM. **c**. Carapace, dorsal view (right valve only). **d–g**. Carapace ornamentation (positions marked in a, b by rectangles). **d**. Mid-carapace, SEM. **e**. Mid-carapace. **f**. Posterior carapace, SEM. **g**. Ventral carapace with crowded growth lines, SEM. **h**. Head (antennae not shown). **i**. Telson. **j**. Third left thoracopod (exopod damaged). **k**. Distribution map (produced in ArcMap 10.7; Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS user community). Scale bars: a–c = 0.5 mm; d–j = 0.1 mm.

Furca (Fig. 7i). Proximally with dorsomedial longitudinal row of 9 setae, row ending distally in a single conical spine. Distal part ~⅔ of furca length, with numerous small denticles.

Female

Unknown.

Distribution (Fig. 7k)

Currently known only from its type locality in central Queensland about 50 km S of Lake Galilee.

Remarks

Only a single male is known. The carapace shape of *Ozestheria barcaldinensis* sp. nov. (Fig. 6) is distinct from most other species and is closely associated with *O. minor* comb. nov., *O. setifera* sp. nov., *O. selmae* sp. nov., *O. cancellata* comb. nov. and *O. weeksi* sp. nov.

Ozestheria beleriandensis sp. nov.

urn:lsid:zoobank.org:act:5562280D-059B-4179-91EB-A205B1A67AE9

Fig. 8

Diagnosis

Ozestheria beleriandensis sp. nov. is characterized by a long condyle and a narrow occipital notch; carapace ornamentation dorsally on carapace punctate (may appear granular), in following growth bands anastomosing lirae forming ventrally within growth band, lirae become longer, less anastomosing and more pronounced with progressing growth bands, lirae terminate in nodule; male rostrum with weakly undulating or straight anterior margin, apex pointed (not rounded) and acute (~70°–80°), ventral margin weakly concave, rarely with anterior notch; female rostrum with weakly concave (slightly undulating or nearly straight) anterior margin, apex rectangular and weakly drawn out into acute tip, ventral margin straight or weakly convex; 12–16 (male) or 10–12 (female) antenna I lobes reaching to antenna II flagellomeres VII–IX (male) or IV–V (female); 12–14 (male) or 12 (female) antenna II flagellomeres; 19–20 complete thorax segments; 23–34 telsonic spines, anterior spines small and conical with usually one larger spine interspersed, posterior spines elongate, aciculated and increasing in size posteriorly; 7–11 furcal setae.

Differential diagnosis

Ozestheria beleriandensis sp. nov. can be differentiated from many other species of *Ozestheria* by its ornamentation (dominated by punctate ornamentation dorsally on carapace, transitioning to distinct, subparallel lirae during ontogeny), except from *O. cancellata* comb. nov., *O. minor* comb. nov., *O. typica* comb. nov., *O. fuersichi* sp. nov., *O. jonnae* sp. nov., *O. marthae* sp. nov., *O. selmae* sp. nov., *O. radiata* sp. nov., *O. rincewindi* sp. nov., *O. barcaldinensis* sp. nov., *O. ngamurru* sp. nov., *O. bourkensis* sp. nov., *O. quinlanae* sp. nov., *O. glabra* sp. nov., *O. pilbarensis* sp. nov. and *O. weeksi* sp. nov., and differentiating these species can be difficult. *Ozestheria beleriandensis* differs from *O. cancellata*, *O. fuersichi*, *O. jonnae*, *O. marthae*, *O. rincewindi*, *O. barcaldinensis*, *O. ngamurru*, *O. quinlanae*, *O. glabra*, *O. pilbarensis* and *O. weeksi* by having at least the posterior half of telsonic spines long, elongated and aciculate (in the other species fewer telsonic spines are long and aciculate and more spines shorter and conical) and by the shape of the female rostrum (weakly concave anterior margin and apex drawn out into a pointed tip). *Ozestheria typica* and *O. bourkensis* have smaller carapace sizes and of the male rostrum the anterior margin is more strongly concave and the apex rounded. In *O. minor* the apex of the male rostrum has a slightly more acute angle and is often more strongly extending and pointing downwards, and *O. beleriandensis* has a more pronounced larger spine midlength on the telson. *Ozestheria selmae* sp. nov. has usually more complete thorax segments (20–22 vs 19–20) and

the anterior margin of the female rostrum is more strongly concave and slightly undulating. *Ozestheria radiata* sp. nov. has a straighter ventral carapace margin, a more strongly developed ocular tubercle and the apex of the male rostrum is rounded.

Etymology

The species name derives from the mythical Beleriand, which was a region in the West of J.R.R. Tolkien's Middle-earth. *Ozestheria beleriandensis* is known from Western Australia.

Type material

Holotype

AUSTRALIA – **Western Australia** • 1 ♂; Lake Carnegie (Windidda 2); 26°15′52.7″ S, 122°16′29.23″ E; 4 Jun. 2020; D.J. Cale leg.; GenBank no: PQ427012 (COI); WAM C77999.

Paratypes

AUSTRALIA – **Western Australia** • 1 ♂, 2 ♀♀; same data as for holotype; GenBank nos: PQ427011 (COI); WAM C80222 to C80224 • 1 ♂; same data as for holotype; NHMW-ZOO-CR-28499.

Other material examined

AUSTRALIA – **Western Australia** • 4 ♂♂, 1 ♀; pool on Ex-Earaheedy Station, 200 km NE of Wiluna; 25°36′13.1″ S, 121°28′29.7″ E; 6 Feb. 2012; B.V. Timms leg.; WAM C77998, WAM C80218 to C80221.

Type locality

Western Australia, Lake Carnegie (Windidda 2), 26°15′52.7″ S, 122°16′29.23″ E.

Description

Males

Carapace (Fig. 8a, c–d). Length 5.0–5.7 mm (HT: 5.7 mm), height 3.0–3.5 (HT: 3.5 mm). Coloration red-orange to brown, crowded growth bands lighter. 42–68 (HT: 68) growth lines, 14–32 (HT: 16) widely spaced and 10–54 (HT: 52) crowded; some individuals with secondary growth phase.

Carapace shape. Dorsal margin straight, distinct or rounded dorsoposterior corner. Posterior margin broadly rounded, suboval, equicurvate (b/H 0.51–0.55, HT: 0.53). Ventral margin widely rounded. Umbo position submedian (Cr/L 0.30–0.32, HT: 0.32).

Carapace ornamentation (Fig. 8e–g). Larval valve and directly following growth bands punctate. In following growth bands, shallow and anastomosing lirae forming between punctae; lirae becoming more pronounced, subparallel and dominating with progressing growth bands; from about mid carapace, lirae terminating in nodules on concentric ridges in moniliform row. Crowded growth bands with short, parallel, distinct lirae all terminating in nodule, if crowded growth bands too densely spaced only nodules visible and no lirae. Concentric ridges slightly raised, with moniliform nodules on the dorsal margin. Setae filiform, preferentially preserved on the midposterior and posteroventral part of carapace (setal pores in single row along all growth lines under SEM).

Head (Fig. 8j). Condyle long, distally acute, occipital notch narrow. Condyle with weak or without anterobasal hump (HT: absent). Margin between condyle and ocular tubercle slightly convex to straight. Ocular tubercle weakly developed, forming obtuse (~150°) to nearly straight angle with rostrum. Anterior margin of rostrum weakly undulating or straight (HT: undulating). Apex pointed (not rounded) and acute (~70–80°), in some individuals pointing downwards. Ventral margin of rostrum weakly concave, rarely with anterior notch. Naupliar eye subtriangular. Antenna I long with 12–16 lobes (HT: 14), reaching to antenna II flagellomeres VII–IX (HT: IX). Antenna II with 12–14 flagellomeres (HT: 14).

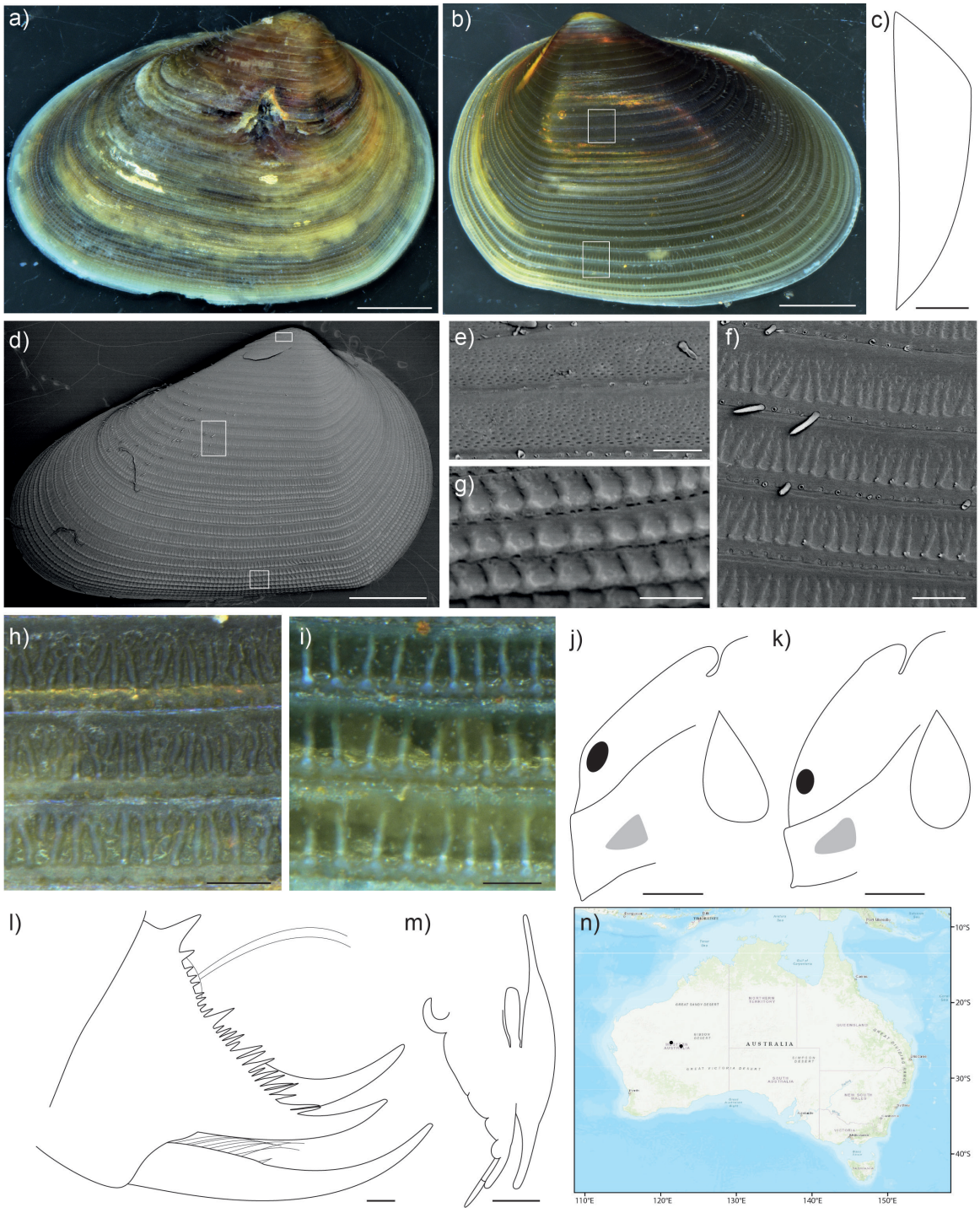

Fig. 8. *Ozestheria beleriandensis* sp. nov. **a–d**. Carapace. **a**. Male, holotype (WAM C77999). **b**. Female (WAM C80221). **c**. Dorsal view male, holotype (right valve only; WAM C77999). **d**. Male (WAM C80218), SEM. **e–g**. Carapace ornamentation (male WAM C80218; positions marked in d by rectangles), SEM. **e**. Dorsal carapace. **f**. Mid-carapace. **g**. Ventral carapace. **h–i**. Carapace ornamentation (female WAM C80221; positions marked in b by rectangles). **h**. mid-carapace. **i**. Ventral carapace. **j–k**. Head (antennae not shown). **j**. Male, holotype (WAM C77999). **k**. Female, paratype (WAM C80222). **l**. Telson, male, holotype (WAM C77999). **m**. Male, third left thoracopod (holotype, WAM C77999). **n**. Distribution map (produced in ArcMap 10.7; see caption Fig. 7 for sources). Scale bars: a–d = 1 mm; e = 0.05 mm; f–i, l = 0.1 mm; j–k, m = 0.5 mm.

Thorax. 19–20 segments (HT: 29), 19–20 (HT: 19) thoracopod-bearing and 1–0 (HT: 1) posterior limbless segment not reaching dorsal margin. Most thoracopod-bearing segments with dorsal extension bearing numerous short and stout spines.

Thoracopod III (only WAM C77999; Fig. 8m). Endite I short and curved dorsally. Endites II–V broad, decreasing in size. Endite V palp two-segmented, basal segment shorter than endopod. Exopod ventral extension subequal in extension to endopod, dorsal extension wide, narrowing distally, overreaching epipod. Epipod long, cylindric.

Telson (Fig. 8l). 23–34 spines (HT: 26). First (anterior) spine enlarged. Spines on anterior ¼–½ of telson short, thin, conical, subequal in length; following spines increasing in size, becoming thinner, longer, aciculate and more closely spaced; usually one larger spine interspersed between smaller spines. Telson dorsal margin straight or concave. Right terminal claw more strongly curved than left.

Furca (Fig. 8l). Proximally with dorsomedial longitudinal row of 8–9 (HT: 9) setae, row ending distally in a single conical spine. Distal part ⅔ of furcal length, with numerous small denticles.

Females

Overall appearance as in males. Carapace (Fig. 8b) length 5.4–5.6 mm, height 3.4–3.5 mm; 46–60 growth lines, 14–25 widely spaced and 15–46 crowded (some individuals with secondary growth phase); Cr/L 0.30–0.32 and b/H 0.51–0.53. Angle between head and rostrum nearly rectangular. Rostrum (Fig. 8k) anterior margin weakly concave (slightly undulating or nearly straight); apex rectangular, pointed and weakly drawn out into acute tip; ventral margin straight or weakly convex. Antenna I with 10–12 small lobes, lobes smaller than in males; reaching to antenna II flagellomeres IV–V. Antenna II with 12 flagellomeres. Telson with 28–29 dorsal spines; left and right terminal claws equally curved or right slightly stronger curved. Furca with 7–11 setae.

Distribution (Fig. 8n)

Ozestheria beleriandensis sp. nov. is known from two localities in central Western Australia.

Remarks

The carapace shape of *Ozestheria beleriandensis* sp. nov. (Fig. 6) is distinct from that of most other species and overlaps with *O. minor* comb. nov., *O. selmae* sp. nov., *O. radiata* sp. nov. (marginally), *O. typica* comb. nov., *O. ngamurru* sp. nov. (marginally) and *O. carnegiensis* sp. nov.

Ozestheria berneyi (Gurney, 1927)

Figs 9–10

Estheria berneyi Gurney, 1927: 61–64, figs 2–3.

Eocyzicus berneyi – Brtek 1997: 44.
Caenestheria berneyi – Richter & Timms 2005: 346.
Ozestheria sp. M – Schwentner *et al*. 2015a: figs 2, 6. — Hethke *et al*. 2023: fig. 10.
Ozestheria cf. *berneyi* (M) – Schwentner *et al*. 2020: figs 1–2.
Ozestheria berneyi – Rogers 2020: 23.

Diagnosis

Ozestheria berneyi is characterized by a short condyle and wide occipital notch; a rounded ventral carapace margin; carapace ornamentation with polygonal reticulations on larval valve and early growth bands, following growth bands with reticulations dorsally and nodular lirae ventrally (lirae increase in

length in later growth bands); male rostrum anterior margin weakly convex, apex rounded with acute angle (~60–90°), ventral margin concave; female rostrum anterior margin weakly convex to straight, apex pointed and drawn out with acute angle (~70–90°), ventral margin weakly concave; 12–19 (males) or 11–17 (female) antenna I lobes reaching to antenna II flagellomeres III–X (male) or III–IV (female); 10–15 (male) or 11–14 (female) antenna II flagellomeres; 23–24 complete thorax segments; 14–29 telsonic spines, spines mostly small, conical and subequal in size and spacing, 1–3 larger spines interspersed; 5–13 furcal setae.

Differential diagnosis

Ozestheria berneyi can be easily distinguished from most other Australian species of *Ozestheria* by the combination of its carapace shape and ornamentation (combination of reticulations and lirae), the pointed male rostrum apex and the telsonic spination (many small spines with 1–3 larger spines interspersed), except from *O. fuersichi* sp. nov. and *O. gemina* sp. nov. *Ozestheria gemina* has a longer condyle and the carapace ornamentation lacks the polygonal reticulations dorsally within growth bands in mid-carapace. *Ozestheria fuersichi* is smaller (carapace length 3.7–5.1 mm), has a nearly straight ventral carapace margin, carapace ornamentation stronger dominated by lirae (lacking polygonal reticulations on mid carapace), and the female rostrum has a concave anterior margin.

Type material

Syntype

AUSTRALIA – **Queensland** • 1 ♂; Longreach; Apr. 1922; R. Gurney leg.; raised from dried mud by Gurney, mud collected probably in 1921 or 1922 by F.L. Berney; BMNH1929.3.14.2.

Gurney described a male and a female; only the male is stored at the Natural History Museum London; the fate of the female is unknown; the male syntype is probably a young adult (the carapace is short, nearly translucent and with few crowded growth bands, the claspers are relatively weakly developed) and the head is detached from the body and damaged.

Other material examined

AUSTRALIA – **New South Wales** • 3 ♂♂, 2 ♀♀; highway past Bourke, next to Lake Lauradale; 29°50′29.1″ S, 145°37′26.1″ E; 18 Feb. 2010; M. Schwentner, C. Sieves and B.V. Timms leg.; AM P.82573, P.82574, P.91164 to P.91166 • 1 ♂, 4 ♀♀; Bloodwood Station, Lower Crescent pool; 29°32′34.5″ S, 144°51′31.6″ E; 19 Jan. 2010; M. Schwentner and B.V. Timms leg.; AM P.91167, P.91168, P.91171 to P.91173 • 1 ♀; Bloodwood Station, Vosper Pool; 29°32′03.9″ S, 144°50′37.7″ E; 19 Jan. 2010; M. Schwentner and B.V. Timms leg.; AM P.91170 • 1 ♀; budgery pool; 29°23′02.2″ S, 144°49′00.2″ E; 20 Jan. 2010; M. Schwentner and B.V. Timms leg.; AM P.91181 • 1 ♂; claypan-like W of Engonia; 29°18′32.8″ S, 145°44′06.9″ E; 21 Jan. 2010; M. Schwentner and B.V. Timms leg.; P.91169. – **South Australia** • 1 ♂; old small dugout 105 km E of Marla; 27°10′00.2″ S, 134°33′07.2″ E; 11 Mar. 2011; M. Schwentner and B.V. Timms leg.; AM P.91179. – **Queensland** • 2 ♂♂, 2 ♀♀; 2 km E of Led Nappers crossing; 29°31′41.7″ S, 146°08′30.1″ E; 21 Jan. 2010; M. Schwentner and B.V. Timms leg.; AM P.91175 to P.91178 • 2 ♀♀; borrow pit, Lochern National Park; 24°05′57.6″ S, 143°13′41.1″ E; 10 Jan. 2010; M. Schwentner and B.V. Timms leg.; AM P.91147, P.91148 • 1 ♀; yapunyah pool 36 km N of highway; 27°49′09.6″ S, 144°09′26.5″ E; 28 Feb. 2011; M. Schwentner and B.V. Timms leg.; AM P.91163 • 1 ♂; rocky quarry 83 km N of highway; 27°27′31.4″ S, 144°22′12.2″ E; 28 Feb. 2011; M. Schwentner and B.V. Timms leg.; AM P.91180 • 2 ♂♂; marsilea swamp 2 km E of Boulia; 22°54′40.7″ S, 139°55′30.0″ E; 4 Mar. 2011; M. Schwentner and B.V. Timms leg.; AM P.91154, P.91155 • 2 ♂♂, 1 ♀; old borrow pit 8 km E of Boulia; 22°55′44.6″ S, 139°58′23.7″ E; 4 Mar. 2011; M. Schwentner and B.V. Timms leg.; AM P. 91156 to P.91157, P.91159 • 1 ♂; old borrow pit 8 km E of Boulia; 22°55′44.6″ S, 139°58′23.7″ E; 4 Mar. 2011; M. Schwentner and B.V. Timms leg.; NHMW-ZOO-CR-28487 • 2 ♂♂;

dead shrub old borrow pit, 113 km S of Mount Isa; 21°34′21.0″ S, 139°11′58.4″ E; 4 Mar. 2011; M. Schwentner and B.V. Timms leg.; AM P.91149, P.91150.

Additional material (not examined)

AUSTRALIA – **Queensland** • 1 ♂; 2 km E of Led Nappers crossing; 29°31′41.7″ S, 146°08′30.1″ E; 21 Jan. 2010; M. Schwentner and B.V. Timms leg.; AM P.91174 • 2 ♂♂; yapunyah pool 36 km N of highway; 27°49′09.6″ S, 144°09′26.5″ E; 28 Feb. 2011; M. Schwentner, C. Sieves and B.V. Timms leg.; AM P.91161, P.91662 • 1 ♂, 2 ♀♀; marsilea swamp 2 km E of Boulia; 4 Mar. 2011; M. Schwentner and B.V. Timms leg.; AM P.91151 to P.91153 • 1 ♂; old borrow pit 8 km E of Boulia; 22°55′44.6″ S, 139°58′23.7″ E; 4 Mar. 2011; M. Schwentner and B.V. Timms leg.; AM P.91160.

Type locality

Australia, Queensland, Longreach.

Description

Males

Carapace (Fig. 9a, c–d, g). Length 4.3–7.8 mm (ST: 4.3 mm, mean: 5.6 mm), height 2.6–4.9 mm (ST: 2.6 mm, mean: 3.5 mm). Coloration light-yellow-brown/ocher to darker reddish-brown or semitranslucent (ST), outer margin lighter. 17–63 (ST: 17, mean: 31) growth lines, 15–22 (ST: 16, mean: 17) widely spaced and 3–48 (ST: 3, mean: 14) crowded; ST with 3 more closely spaced growth bands from 7th growth line, followed by 4 widely spaced growth bands and a second crowded region (probably a secondary growth phase).

Carapace shape. Dorsal margin straight, distinct dorso-posterior corner. Posterior margin broadly rounded, weakly suboval (more circular than in many other species), equicurvate (b/H 0.48–0.53, ST: 0.48, mean: 0.51). Ventral margin broadly rounded. Umbo position anterior (Cr/L 0.20–0.25, ST: 0.22, mean: 0.22).

Carapace ornamentation (Fig. 9e–f, h–k). Larval valve and first few growth bands with shallow reticulations forming mainly irregular pentagons or hexagons. From mid-dorsal carapace, medium reticulations turning into pronounced lirae ventrally within growth bands (under SEM punctae or secondary reticulations between main reticulations and lirae apparent and lirae nodular). Lirae becoming longer and more pronounced on successive growth bands, but irregular reticulations persist dorsally on all wide growth bands or appear as anastomosing lirae posteriorly on the carapace. Some lirae intermittent, not reaching concentric ridge, or intercalating ventrally on growth bands. Crowded growth bands very narrow, without apparent ornamentation (intermittent lirae visible under SEM); secondary growth phase of ST with widely spaced, irregular and intermittent lirae. Concentric ridges raised, lined dorsally by minute nodules in moniliform rows. Filiform and short, stout setae (Fig. 9l); usually 4–5 spiniform setae followed by one filiform seta (in many individuals only few and mostly filiform setae preserved); under SEM a single irregular row of setal pores along all growth lines.

Head (Fig. 10a, c, e). Condyle short and weakly protruding, distally rounded; occipital notch wide. Condyle lacking anterobasal hump. Margin between condyle and ocular tubercle straight to slightly concave. Ocular tubercle weakly developed (rarely stronger developed), forming obtuse angle of varying degrees (mostly ~110°–140°, but ranging from close to rectangular to nearly straight; ST: ~110° [derived from Gurney 1927]) with rostrum. Anterior margin of rostrum weakly convex (sometimes nearly straight). Apex rounded, acute (~60–90°). Ventral margin of rostrum concave. Naupliar eye elongated, subtriangular to subrectangular with rounded margins. Antenna I long with 12–19 lobes (ST: 18; mean: 15), reaching to antenna II flagellomeres III–X (ST: VIII; mean: VIII). Antenna II with 10–15 flagellomeres (ST: 12; mean: 13).

THORAX. 23–25 (ST: 23; mean: 24) segments, 23–24 (ST: 23; mean: 23) thoracopod-bearing and none to one (ST: none) posterior limbless segment not reaching dorsal margin. Dorsal extensions with numerous short, stout spines; these increase in size and decrease in numbers posteriorly.

THORACOPOD III (only P.91159; Fig. 10f). Endite I short and curved dorsally. Endites II–V broad, decreasing in size. Endite V palp two-segmented, basal segment subequal in length to endopod. Exopod ventral extension subequal in extension to endopod, dorsal extension wide, narrowing distally, overreaching epipod. Epipod long, cylindric.

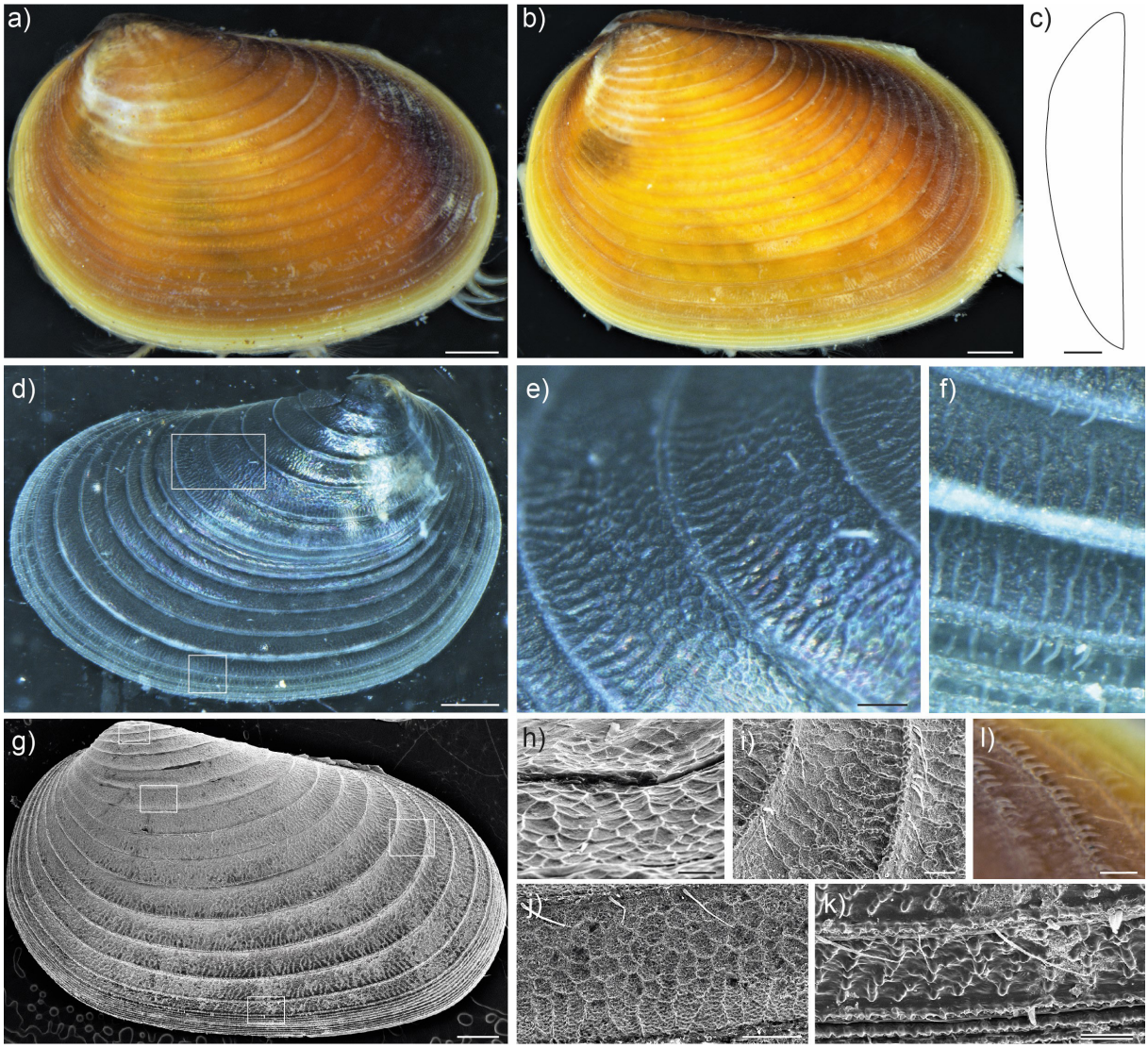

Fig. 9. *Ozestheria berneyi* (Gurney, 1927). **a–d**. Carapace. **a**. Male (P.91159). **b**. Female (P.91156). **c**. Male, dorsal view (only left valve shown; P.91159). **d**. Carapace male syntype (BMNH1929.3.14.2). **e–f**. Carapace ornamentation of male syntype (BMNH1929.3.14.2; positions marked by rectangles in d). **e**. Dorso-posterior carapace. **f**. Ventral carapace. **g**. Male (P.91157), SEM. **h–k**. Carapace ornamentation of male paratype (P.911157; positions marked in g by rectangles), SEM. **h**. Dorsal carapace. **i**. Posterior carapace. **j**. Dorsomedian carapace. **k**. Ventral carapace. **l**. Carapace setation female paratype (P.91156). Scale bars: a–d, g = 0.5 mm; e–f, i–k = 0.1 mm; h = 0.02 mm.

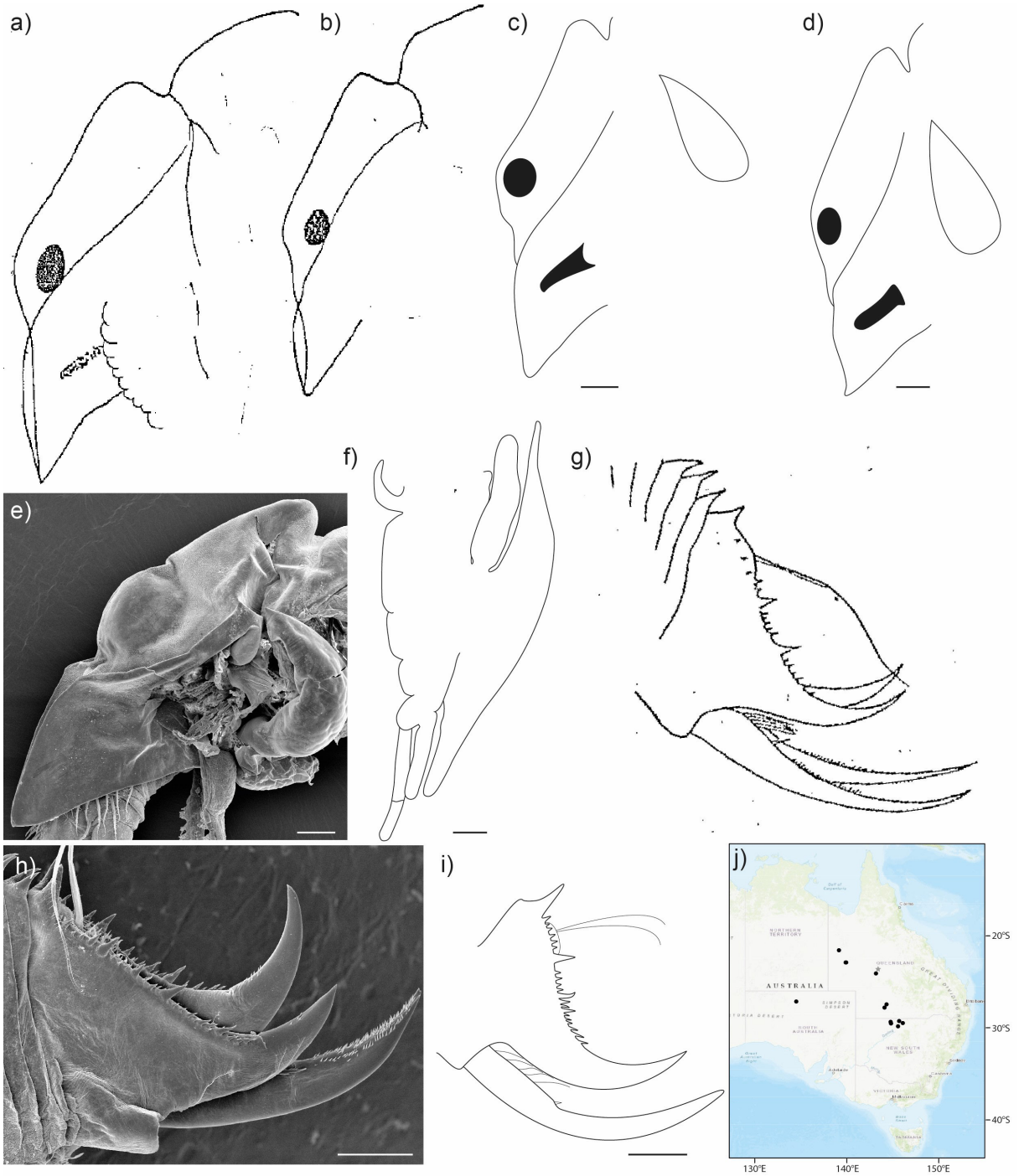

Fig. 10. *Ozestheria berneyi* (Gurney, 1927). **a–e**. Head (antennae not shown). **a**. Male, original drawing by Gurney (1927). **b**. Female, original drawing by Gurney (1927). **c**. Male (P.91159). **d**. Female (P.91156). **e**. Male (P.91157), SEM. **f**. Male, third right thoracopod (P.91159). **g–i**. Telson. **g**. Male, original drawing by Gurney (1927). **h**. Male (P.91157), SEM. **i**. Male (P.91159). **j**. Distribution map (gray star indicates the type locality; produced in ArcMap 10.7; see caption Fig. 7 for sources). Scale bars: c–f, h–i = 0.2 mm.

Telson (Fig. 10g–i). 14–29 spines (ST: 19, mean: 21). First (anterior) spine enlarged. Spines conical, spines on posterior ~⅕ slightly thinner and more drawn out (aciculate). Most spines small (compared to telson size) and subequal in size and spacing, few (usually 1–3) slightly larger spines interspersed in anterior ⅔ of telson (largest situated in the central part of the telson). Anteriormost spines not arranged along dorsal margin but slightly lateral. Dorsal margin nearly straight, anteriorly sometimes weakly convex. Right terminal claw more strongly curved than left.

Furca (Fig. 10g–i). Proximally with dorsomedial longitudinal row of 6–13 (ST: 7, mean: 9) setae, row ending distally in a single conical spine. Distal part ½–⅔ of furcal length, with numerous small denticles.

Females

Overall appearance as in males. Carapace (Fig. 9b) length 4.5–7.3 mm (mean: 5.7 mm), height 2.8–4.5 mm (mean: 3.5 mm); 15–27 (mean: 21) growth lines, 14–22 (mean: 16) widely spaced and 1–10 (mean: 5) crowded; Cr/L 0.19–0.23 (mean: 0.20) and b/H 0.47–0.52 (mean: 0.50). Anterior margin of rostrum weakly convex to straight (Fig. 10b, d); apex with acute angle (~70–90°), pointed, drawn out into protruding tip; ventral margin weakly concave. Antenna I with 11–17 small lobes (mean: 14), lobes smaller than in males; reaching to antenna II flagellomeres III–IV (mean: III). Antenna II with 11–14 flagellomeres (mean: 12). 23–25 (mean: 24) thoracopod-bearing segments, 23–24 (mean: 23) thoracopod-bearing and none to one posterior limbless segment not reaching dorsal margin. Telson with 17–26 (mean: 20) dorsal spines; left and right terminal claws equally curved. Furca with 5–10 setae (mean: 8), distal part ½–¾ of furcal length.

Distribution (Fig. 10j)

Ozestheria berneyi is widely distributed in the (semi)arid regions of eastern and central Australia. It has been most recorded from northern New South Wales and southern and western Queensland (e.g., catchments of the Georgina River and the central Cooper Creek) but also from northern South Australia.

Remarks

Schwentner *et al*. (2015a) suggested that either *O*. sp. M or N might represent *O. berneyi*. By studying the type material, we were able to identify *O*. sp. M as *O. berneyi*; *O*. sp. N is being described as *O. gemina* sp. nov. There are several strong arguments for *O*. sp. M representing *O. berneyi*: the carapace ornamentation (including polygonal reticulations dorsally within growth bands and the intermittent nodular lirae), and the length of the condyle (which is more elongated in *O. gemina*); also, *O*. sp. M was collected close to the type locality of *O. berneyi*. Only the carapace shape is a notable outlier (Supp. file 1_3.5 & 4.8). The original drawings of the male and female carapace by Gurney (Supp. file 1_4.6–4.7) were classified as *O*. sp. N (=*O. gemina*; probability 97.4% and 99.7%, typicality scores 0.89 and 0.05). The available syntype, however, was classified as *O*. sp. D1+D2 (=*O. rubra*; probability 87.7%, typicality score 0.00) and with 8.4% probability (0.00 typicality) as *O*. sp. N (=*O. gemina*). Our geometric morphometric analyses (Fig. 5) were restricted to adult-only datasets, and the length of the specimens of the *O*. sp. M training set ranged between 4.5 mm and 7.8 mm, while the studied syntype specimen is 4.3 mm in length and, thus, probably a relatively young adult that does not show the characteristic very narrow growth bands in the crowded carapace region, which has a significant effect on carapace shape by extending the posteroventral margin.

Ozestheria bourkensis sp. nov.
urn:lsid:zoobank.org:act:C29BB36B-13F0-4068-8659-A76389D2BFB9
Fig. 11

Ozestheria sp. R – Schwentner *et al*. 2015a: figs 2, 6; 2020: figs 1–2.

Diagnosis

Ozestheria bourkensis sp. nov. is characterized by a long condyle and a narrow occipital notch; carapace ornamentation dorsally on carapace punctate, in following growth bands anastomosing lirae forming ventrally within growth band, lirae become longer and more pronounced with progressing growth bands (continue to be strongly anastomosing); male rostrum with weakly convex anterior margin, apex broadly rounded with angle close to 90°, ventral margin straight, with or without notch close to apex; female rostrum anterior margin undulating, apex drawn out to a fine pointed tip, ventral margin straight; 13 (male) or 8 (female) antenna I lobes reaching to antenna II flagellomeres VIII (male) or IV (female); 10 (female) antenna II flagellomeres; 20–21 complete thorax segments; 17–24 large telsonic spines, anterior spines conical, posterior spines larger, thinner, aciculate and increasing in size; 6 furcal setae.

Differential diagnosis

Ozestheria bourkensis sp. nov. can be differentiated from many other species of *Ozestheria* by the narrow occipital notch and long condyle in combination with the carapace ornamentation (dominated by punctate ornamentation dorsally on carapace, transitioning to distinct, subparallel lirae during ontogeny), except from *O. cancellata* comb. nov., *O. minor* comb. nov., *O. typica* comb. nov., *O. fuersichi* sp. nov., *O. jonnae* sp. nov., *O. marthae* sp. nov., *O. selmae* sp. nov., *O. radiata* sp. nov., *O. rincewindi* sp. nov., *O. barcaldinensis* sp. nov., *O. ngamurru* sp. nov., *O. beleriandensis* sp. nov., *O. quinlanae* sp. nov., *O. glabra* sp. nov., *O. pilbarensis* sp. nov. and *O. weeksi* sp. nov., and differentiating these species can be difficult. *Ozestheria bourkensis* differs from *O. cancellata*, *O. fuersichi*, *O. jonnae*, *O. marthae*, *O. rincewindi*, *O. barcaldinensis*, *O. ngamurru*, *O. quinlanae*, *O. glabra*, *O. pilbarensis* and *O. weeksi* by having at least the posterior half of the telsonic spines long, elongate and aciculate (in the other species fewer telsonic spines are long and aciculate and more spines shorter and conical) and by the shape of the female rostrum (undulating and apex drawn out into a minutely pointed tip). In *O. selmae*, *O. radiata*, *O. beleriandensis*, and *O. minor* lirae are more defined in growth bands of later ontogenetic stages (less anastomosing than in *O. bourkensis*). *Ozestheria minor* yields a straighter line between condyle and ocular tubercle and females have more lobes and flagellomeres on antennae I and II. In *O. selmae* and *O. minor* the apex of the female rostrum is not as minutely pointed. *Ozestheria typica* usually has more telsonic spines and the angle between the ocular tubercle and rostrum is obtuse in males (vs rectangular). In male *O. beleriandensis* the angle between the ocular tubercle and rostrum is obtuse (vs rectangular) and the anterior margin of the rostrum straight or slightly undulating, but convex in *O. bourkensis*.

Etymology

The species is named after Bourke, a town in northern New South Wales as both known localities of *O. bourkensis* sp. nov. are ~50–80 km N of Bourke.

Type material

Holotype

AUSTRALIA – **New South Wales** • ♂; temporary pool next to highway past Bourke (~170 km to Hungerford); 29°51′22″ S, 145°38′49″ E; 18 Jan. 2010; M. Schwentner and B.V. Timms leg.; GenBank no: KJ705362 (COI); AM P.82538.

Paratypes

AUSTRALIA – **New South Wales** • 2 ♀♀; same data as for holotype; GenBank nos: KJ705361, KJ705994 (COI); AM P.82537, P.91767.

Other material examined

AUSTRALIA – **New South Wales** • 1 ♂ roadside claypan; 29°31′42.5″ S, 146°12′20.5″ E; 21 Jan. 2010; M. Schwentner and B.V. Timms leg.; AM P.91768.

Type locality

Australia, New South Wales, temporary pool next to highway past Bourke (~170 km to Hungerford), 29°51′22″ S, 145°38′49″ E.

Description

Males

Carapace (Fig. 11a, c–d). Length 3.9 mm, height 2.4 mm. Coloration lightly yellowish-brown, slightly darker at umbo, lateral margin whitish. 18– 25 (HT: 25) growth lines,15–16 (HT: 15) evenly spaced, and 2–10 (HT: 10) crowded.

Carapace shape. Dorsal margin straight, posterior corner present, but not distinct. Posterior margin broadly rounded, sub-oval, equicurvate (b/H 0.47–0.51, HT: 0.51). Ventral margin nearly straight. Umbo position submedian (Cr/L 0.27–0.31, HT: 0.31).

Carapace ornamentation (Fig. 11e–g). Larval valve granular to punctate. In dorsal part of carapace growth bands densely punctate. In following growth bands, the interspaces between punctae raised, forming shallow, indistinct, highly anastomosing and reticulating lirae; lirae appear first only ventrally within growth bands and extend in length in consecutive growth bands, continuing to be dorsally anastomosing in anterior and ventral part of carapace resulting in a nodular or pitted appearance. Crowded growth bands with well defined, parallel short lirae forming deep pits. Concentric ridges slightly raised and smooth in dorsal and mid-carapace, with nodules in moniliform row on concentric ridges of crowded growth bands. No setae visible, with setal pores in single row along all growth lines (visible under SEM).

Head (Fig. 11h). Condyle long, distally acute; occipital notch narrow. Condyle with anterobasal hump. Margin between condyle and ocular tubercle concave. Ocular tubercle well developed, forming obtuse angle with rostrum (close to 90°). Anterior margin of rostrum widely convex, ventral margin straight, with or without notch close to apex (HT: without), apex broadly rounded, angle close to 90°. Naupliar eye triangular. Antenna I with 13 lobes, reaching to antenna II flagellomere VIII. Antenna II damaged.

Thorax. 20 thoracopod-bearing segments, no limbless segment. Last fourteen thoracopod-bearing segments with dorsal extensions bearing spines. Dorsal extensions increasing in size posteriorly over successive segments. Spines thin and elongate, central spines stronger and broader in posterior segments.

Thoracopod III (only P.82538). Endite I short and curved dorsally. Endites II–V broad, decreasing in size. Endite V palp two-segmented, basal segment longer than endopod. Exopod ventral extension subequal to slightly larger in extension to endopod, dorsal extension wide, narrowing distally, overreaching epipod. Epipod long, cylindric.

Telson (Fig. 11j–k). 22–24 spines (HT: 22). First (anterior) spine enlarged. Spines on anterior third or half of telson shorter and conical, unequal in size, spines on posterior half slightly larger, thinner, drawn out. Anterior third to half of dorsal margin nearly straight to slightly convex, posteriorly slightly concavely curved. Right terminal claw more strongly curved than left.

Furca (Fig. 11j–k). Proximally with dorsomedial longitudinal row of 6 setae, row ending distally in a single conical spine. Distal part ⅔ of furca length, with numerous small denticles.

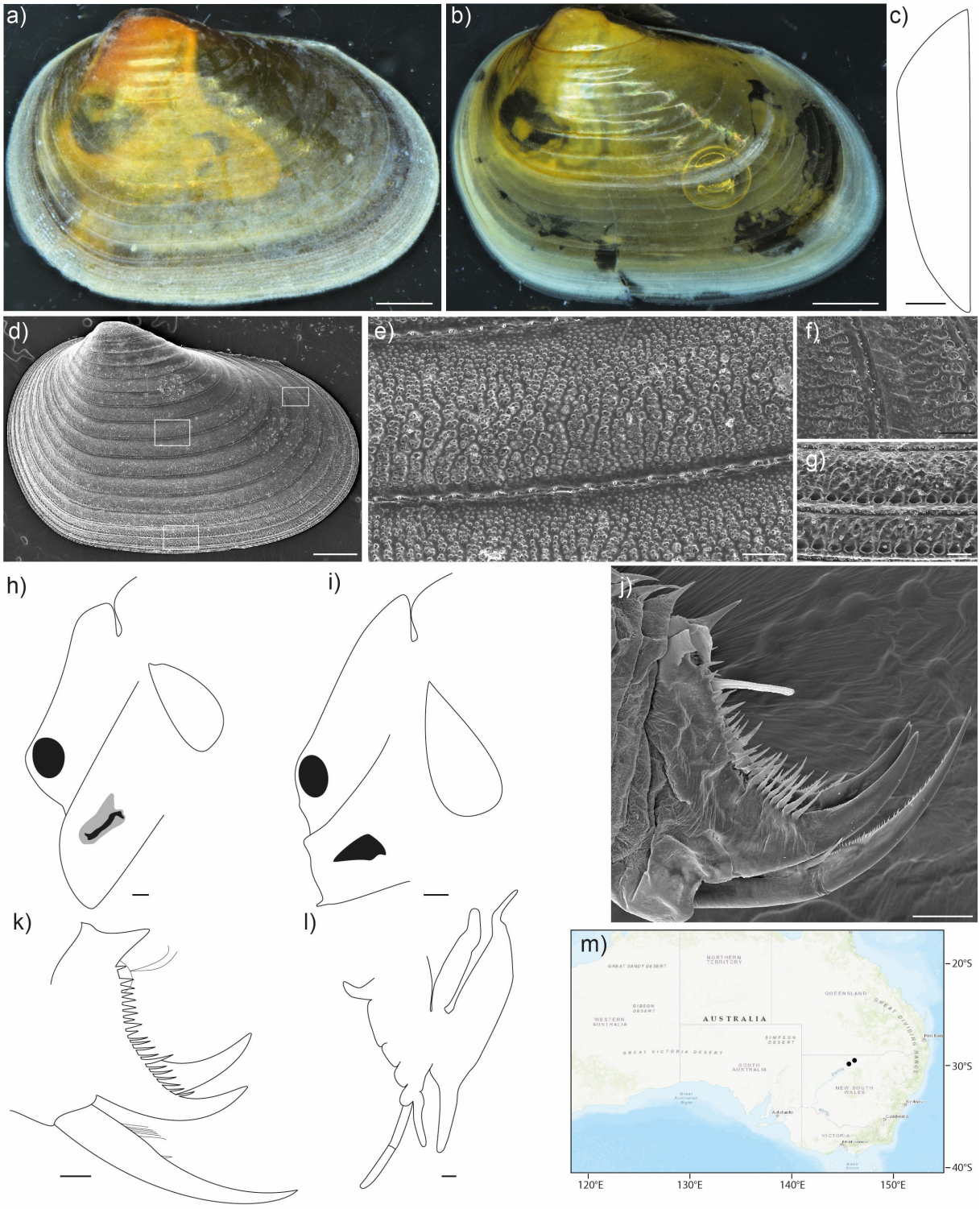

Fig. 11. *Ozestheria bourkensis* sp. nov. **a–d**. Carapace. **a**. Male, holotype (P.82538). **b**. Female, paratype (P.91767). **c**. Dorsal view male, holotype (right valve only; P.82538). **d**. Male, paratype (P.91768), SEM. **e–g**. Carapace ornamentation (P.91768; positions marked in d by rectangles), SEM. **e**. Mid-carapace. **f**. Posterior carapace. **g**. Ventral carapace. **h–i**. Head (antennae not shown). **h**. Male, holotype (P.82538). **i**. Female, paratype (P.91767). **j–k**. Telson. **j**. Male, paratype (P.91768). **k**. Male, holotype (P.82538). **l**. Male, third right thoracopod (holotype, P.82538). **m**. Distribution map (produced in ArcMap 10.7; see caption Fig. 7 for sources). Scale bars: a–d = 0.5 mm; e–g = 0.05 mm; h–l = 0.1 mm.

Females

Overall appearance as in males. Carapace (Fig. 11b) length 3.4–3.9 mm, height 2.1–2.4; 23–26 growth lines, of these 14–16 widely spaced and 7–12 crowded; Cr/L 0.26–0.29 and b/H 0.53–0.55. Hump at base of condyle absent; margin between condyle and ocular tubercle straight; ocular tubercle weakly developed with nearly straight line to rostrum (Fig. 11i). Antenna II 10 flagellomeres. Rostrum dorsally protruding, anterior margin undulating; apex drawn out to a fine pointed tip; ventral margin straight. 21 segments, all of these thoracopod-bearing and none limb-less, not reaching dorsal margin. Telson with 17 dorsal spines (furca was damaged and not assessed).

Distribution (Fig. 11m)

Currently known only from two localities in northern New South Wales.

Remarks

Because only few specimens were available, the morphological variability of the species is not well characterized. The carapace shape of *Ozestheria bourkensis* sp. nov. (Fig. 6) is distinct from those of most other species and overlaps partly with those of *O. jiangi* sp. nov., *O. minor* comb. nov., *O. selmae* sp. nov., *O. radiata* sp. nov., and *O. typica* comb. nov.

Ozestheria cancellata (Spencer & Hall, 1896) comb. nov.
Figs 12–13

Estheria packardi var. *cancellata* Spencer & Hall, 1896: 237–238, figs 11–12.

Caenestheriella packardi var. *cancellata* – Daday 1914: 120–121.
Cyzicus packardi var. *cancellata* – Brtek 1997: 48.
Ozestheria packardi (in part) – Richter & Timms 2005: 347. — Rogers 2020: 24.
Ozestheria sp. S – Schwentner *et al*. 2015a: figs 2, 6; 2020: figs 1–2. — Hethke *et al*. 2023: fig. 11.

Diagnosis

Ozestheria cancellata comb. nov. is characterized by a long condyle and a narrow occipital notch; carapace ornamentation dorsally on carapace punctate (may appear granular), in following growth bands bearing prominent lirae forming ventrally within growth band, lirae become longer and more pronounced within progressing growth bands, lirae terminate in small nodule on concentric ridges (not visible in all specimens); male rostrum with straight to convex anterior margin, apex rounded with angle close to 90°, ventral margin with slight notch anteriorly and straight to weakly concave mid-length; female rostrum anterior margin straight (rarely weakly concave or weakly convex), apex rectangular (neither rounded nor drawn out), ventral margin nearly straight (only weakly concave); 10–15 (male) or 9–13 (female) antenna I lobes reaching to antenna II flagellomeres IV–IX (male) or II–V (female); 10–16 (male) or 11–16 (female) antenna II flagellomeres; 21–22 complete thorax segments; 12–24 small telsonic spines, anterior spines conical and equally spaced with 2–4 larger spines interspersed (usually in anterior half or two-thirds of telson), posterior spines slightly thinner, aciculate and slightly drawn out; 4–14 furcal setae.

Differential diagnosis

Ozestheria cancellata comb. nov. can be differentiated from many other species of *Ozestheria* by the narrow occipital notch and long condyle in combination with the carapace ornamentation (dominated by punctate ornamentation dorsally on carapace, transitioning to distinct, subparallel lirae during ontogeny), except from *O. minor* comb. nov., *O. typica* comb. nov., *O. fuersichi* sp. nov., *O. jonnae* sp. nov., *O. marthae* sp. nov., *O. selmae* sp. nov., *O. radiata* sp. nov., *O. bourkensis* sp. nov., *O. rincewindi* sp. nov.,

O. barcaldinensis sp. nov., *O. ngamurru* sp. nov., *O. beleriandensis* sp. nov., *O. quinlanae* sp. nov., *O. glabra* sp. nov., *O. pilbarensis* sp. nov. and *O. weeksi* sp. nov., and differentiating these species can be difficult. *Ozestheria minor*, *O. typica*, *O. bourkensis*, *O. selmae*, *O. radiata*, and *O. beleriandensis* can be differentiated by having at least the posterior half of the telsonic spines long, elongated and aciculate. *Ozestheria cancellata* has more complete thorax segments (21–22) than *O. typica*, *O. radiata*, *O. ngamurru*, *O. beleriandensis*, *O. glabra*, *O. weeksi*, *O. rincewindi*, and *O. bourkensis*, but fewer than *O. pilbarensis*. The apex of the female rostrum of *O. cancellata* differs from that of *O. marthae*, *O. weeksi* and *O. quinlanae* by not being drawn out into a pointed tip. *Ozestheria fuersichi* differs by its polygonal reticulations on the first few growth bands and widely spaced, nodular lirae that disappear on crowded growth bands, the elongate and slender male rostrum and distinctly larger interspersed telsonic spines. *Ozestheria barcaldinensis* has fewer telsonic spines and the anterior margin of the male rostrum is more strongly convex and in *O. jonnae* the female anterior margin of the rostrum has a dorsal notch.

Type material

Neotype (here designated)

AUSTRALIA – **Northern Territory** • ♂; Old borrow pit 85 km N of Kulgera; 25°05′54.4″ S, 133°11′54.0″ E; 10 Mar. 2011, M. Schwentner and B.V. Timms leg.; GenBank no: KJ706023 (COI); AM P.91796.

Other material examined

AUSTRALIA – **New South Wales** • 4 ♂♂; Muella Station, Upper Lake Eliza; 29°25′46.0″ S, 145°04′12.6″ E; 31 Mar. 2009; M. Schwentner and B.V. Timms leg.; AM P.91784 to P91787 • 2 ♂♂, 1 ♀; Muella Station, Yantabulla black box swamp; 29°20′17.8″ S, 145°00′09.7″ E; 31 Mar. 2009; M. Schwentner and B.V. Timms leg.; AM P.91770 to P.91771 • 2 ♂♂, 2 ♀♀; Muella Station, Yantabulla black box swamp; 29°20′17.8″ S, 145°00′09.7″ E; 20 Jan. 2010; M. Schwentner and B.V. Timms leg.; AM P.91845 to P.91848 • 1 ♂; Tiltargara; 31°51′09.9″ S, 144° 52′22.4″ E; 22 Jan. 2010; M. Schwentner and B.V. Timms leg.; raised later from sediment; AM P.91792 • 1 ♀; excavated area W of Yarrabundai; 33°07′28.5″ S, 147°32′09.8″ E; 23 Jan. 2010; M. Schwentner and B.V. Timms leg.; AM P.91838 • 2 ♂♂, 3 ♀♀; thoura poplar box swamp; 29°16′11.2″ S, 144°40′25.3″ E; 24 Feb. 2011; M. Schwentner, S. Richter and B.V. Timms leg.; AM P.91829 to P.91833. – **Northern Territory** • 1 ♂, 2 ♀♀; same data as for neotype; GenBank nos: KJ706021, KJ706024, KJ706025 (COI); AM P.91794, P.91797, P.91798 • 1 ♀; same data as for neotype; GenBank no: KJ706022 (COI); NHMW-ZOO-CR-28491 • 1 ♂, 1 ♀; south Henbury Crater; 24°34′22.7″ S, 133°08′53.4″ E; 29 Mar. 2010; M. Schwentner and B.V. Timms leg.; raised later from sediment; AM P.91790, P.91791 • 1 ♂, 4 ♀♀; borrow pit next to Barrow Creek; 21°29′14.2″ S, 133°54′49.0″ E; 7 Mar. 2011; M. Schwentner and B.V. Timms leg.; AM P.91799 to P.91803. – **South Australia** • 1 ♀; borrow pit 90 km S of border; 26°49′22.0″ S, 133°19′44.7″ E; 10 Mar. 2011; M. Schwentner and B.V. Timms leg.; AM P.91804 • 1 ♂; dugout 55 km east of Marla; 27°18′21.3″ S, 134°07′15.9″ E; 11 Mar. 2011; M. Schwentner and B.V. Timms leg.; AM P.91793. – **Queensland** • 1 ♀; Thunda Lake; 25°25′46.0″ S, 143°08′13.8″ E; 8 Apr. 2009; M. Schwentner and B.V. Timms leg.; raised later from sediment; AM P.91839 • 1 ♂; coolabah swamp, Cravens Peak (site M2); 23°22′04.7″ S, 138°35′53.5″ E; 16 Apr. 2007; J. Powling leg.; AM P.91850 • 3 ♂♂, 2 ♀♀; Currawinya National Park, quarry at boundary to national park; 28°59′49.9″ S, 144°12′01.9E; 26 Feb. 2011; M. Schwentner, S. Richter and B.V. Timms leg.; AM P.91819 to P.91823 • 4 ♂♂, 1 ♀; rocky quarry 83 km N of highway; 27°27′31.4″ S, 144°22′12.2″ E; 28 Feb. 2011; M. Schwentner and B.V. Timms leg.; AM P.91812 to P.91816 • 1 ♂, 1 ♀; dead shrub old borrow pit, 113 km S of Mount Isa; 21°34′21.0″ S, 139°11′58.4″ E; 4 Mar. 2011; M. Schwentner and B.V. Timms leg.; AM P.91810, P.91811 • 1 ♂, 4 ♀♀; borrow pit, slightly turbid, 93 km S of Mount Isa; 21°23′46.5″ S, 139°07′22.7″ E; 4 Mar. 2011; M. Schwentner and B.V. Timms leg.; AM P.91805 to P.91809.

Additional material (not examined)

AUSTRALIA – **New South Wales** • 5 ♂♂; Muella Station, Muella Vegetated Pool 4; 29°30′00.7″ S, 144°54′59.6″ E; 31 Mar. 2009; M. Schwentner and B.V. Timms leg.; AM P.91775 to P.91779 • 2 ♂♂, 3 ♀♀; Muella Station, Lismore Bore; 29°31′50.7″ S, 144°59′28.1″ E; 19 Jan. 2010; M. Schwentner and B.V. Timms leg.; AM P.82536, P.82536, P.91842 to P.91844 • 4 juvs; Muella Station, Lower Lake Eliza; 29°25′28.9″ S, 145°03′41.8″ E; 22 Feb. 2011; M. Schwentner, S. Richter and B.V. Timms leg.; AM P.91834 to P.91837 • 3 ♂♂, 2 ♀♀; Muella Station, Carrols Bore; 29°29′08.7″ S, 144°59′13.0″ E; 31 Mar. 2009; M. Schwentner and B.V. Timms leg.; AM P.80858, P.91780 to P.91783 • 4 juvs; Bloodwood Station, Pine Pool near Harolds Tank; 29°22′25.2″ S, 144°49′12.6″ E; 8 Jun. 2007; B.V. Timms leg.; AM P.91851 to P.91854 • 1 juv.; Bloodwood Station, western fence N of Titanic; 29°24′58.4″ S, 144°46′52.8″ E; Mar. 2006; B.V. Timms leg.; AM P.91774 • 2 juvs; Yantabulla black box swamp; 29°20′17.8″ S, 145°00′09.7″ E; 20 Jan. 2010; M. Schwentner and B.V. Timms leg.; AM P.91769, P.91773 • 1 ♀; excavated area W of Yarrabundai; 33°07′28.5″ S, 147°32′09.8″ E; 23 Jan. 2010; M. Schwentner and B.V. Timms leg.; AM P.91856 • 2 juvs; borrow pit, 30 km E of Bourke; 30°19′00.5″ S, 146°06′58.4″ E; 10 Jun. 2007; B.V. Timms leg.; AM P.91840, P.91841. – **Queensland** • 1 juv.; Rockwell Station, grassy pool S of N Blue Lake; 28°50′53.8″ S, 144°57′47.3″ E; 9 Jun. 2007; B.V. Timms leg.; AM P.91855 • 2 juvs; Rockwell Station, Coolibah swamp; 28°54′03.2″ S, 144°59′22.6″ E; 1 Mar. 2009; M. Schwentner and B.V. Timms leg.; AM P.91788, P.91789 • 4 juvs; flood out of dam, 84 km S of Thargomindah; 28°39′46.7″ S, 143°48′40.8″ E; 26 Feb. 2011; M. Schwentner and B.V. Timms leg.; AM P.91824 to P.91827 • 1 ♂, 1 ♀; dugout 21 km E of Thargomindah; 28°02′05.2″ S, 144°03′15.7″ E; 27 Feb. 2011; M. Schwentner and B.V. Timms leg.; AM P.91817, P.91818.

Type locality

Spencer & Hall (1896) did not specify a type locality but generally stated where they collected *O. packardi* and its newly described subspecies as "Common in water-holes along the Finke and its tributaries, also in the Macumba and Stevenson Rivers". As the type material is lost and the exact locality unknown, we designated a neotype. The new type locality is: Australia, Northern Territory, old borrow pit 85 km N of Kulgera, 25°05′54.4″ S, 133°11′54.0″ E.

Description

Males (Fig. 12a, c–d, i–j)

Carapace. Length 3.8–7.2 mm (NT: 4.4 mm, mean: 5.5 mm), height 2.2–4.7 (NT: 2.8 mm, mean: 3.4 mm). Coloration light to dark reddish-orange, outer margin lighter (yellow whitish). 21–60 (NT: 32, mean: 36) growth lines, 13–26 (NT: 18, mean: 19) widely spaced and 3–36 (HT: 14, mean: 17) crowded.

Carapace shape. Dorsal margin straight, distinct dorso-posterior corner. Posterior margin broadly rounded, equicurvate (b/H 0.48–0.55, mean: 0.52). Ventral margin widely rounded. Umbo position anterior to submedian (Cr/L 0.21–0.29, mean: 0.26).

Carapace ornamentation (Fig. 12e–h, k). Larval valve and following growth bands (approximately ⅛–⅓ of carapace) granular (under SEM punctate with inconspicuous anastomosing fine lirae). In following growth bands more prominent lirae forming ventrally within growth bands between punctae, lirae initially shallow, hardly anastomosing. From about mid-carapace lirae distinct, subparallel, spanning full growth bands (under SEM, punctae gradually disappearing between lirae). Crowded growth bands with short, distinct lirae; lirae terminating in pronounced nodule on concentric ridges (not visible in all specimens, best visible under SEM). Concentric ridges slightly raised. Setae spiniform, preferentially preserved on the midposterior and posteroventral part of carapace; on outer margin of carapace sometimes filiform setae. Setal pores in single row along all growth lines.

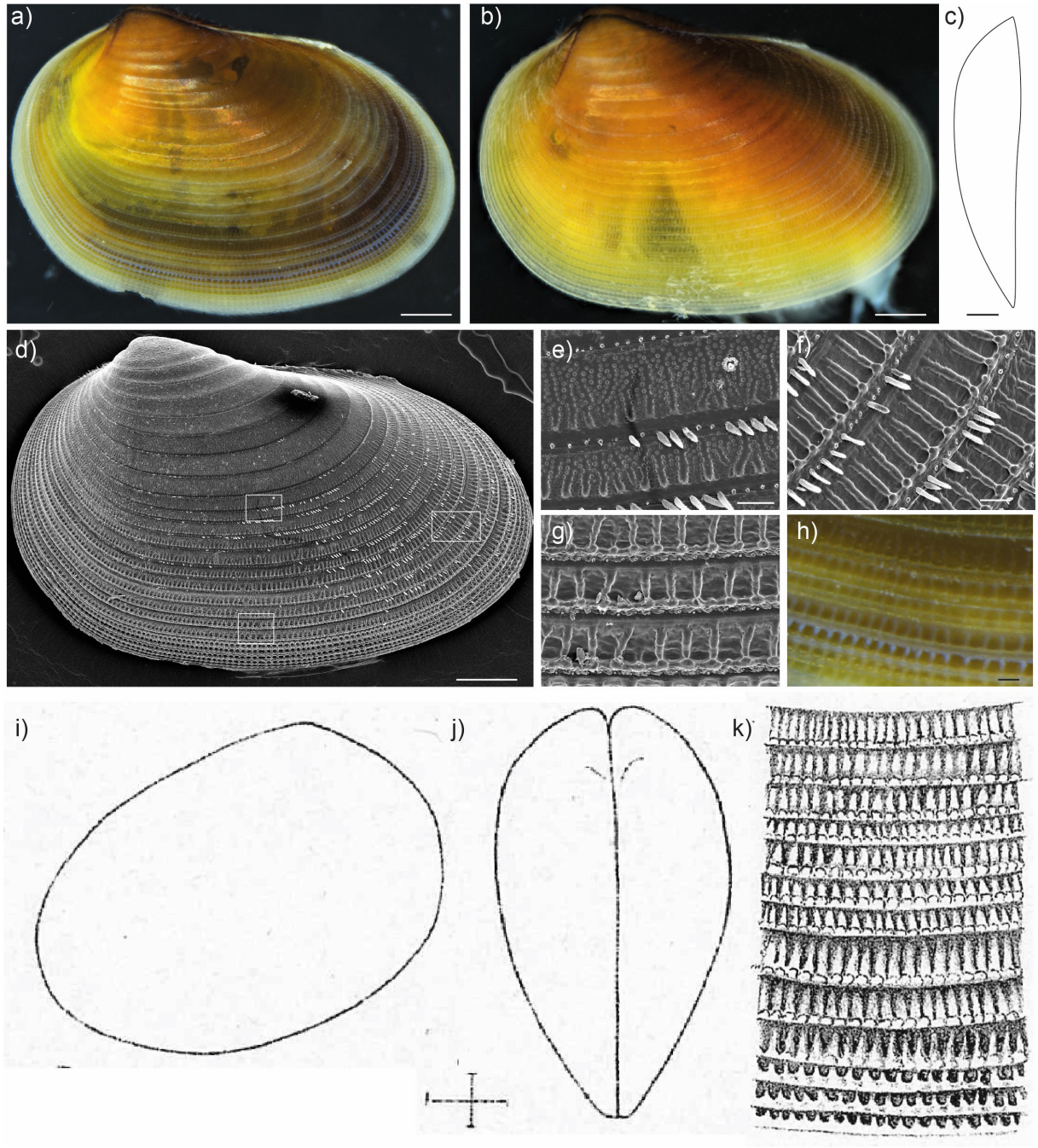

Fig. 12. *Ozestheria cancellata* comb. nov. (Spencer & Hall, 1896). **a**. Carapace (male neotype, P.91796). **b**. Carapace (female, P.91794). **c**. Carapace, dorsal view (left valve only, male neotype, P.91796). **d–g**. Male (P.91797), SEM. **d**. Carapace. **e**. Mid-carapace ornamentation (position marked in d by rectangle). **f**. Posterior carapace ornamentation (position marked in d by rectangle). **g**. Ventral carapace ornamentation, crowded growth lines (position marked in d by rectangle). **h**. Mid-ventral carapace ornamentation (male neotype, P.91796). **i–k**. Original drawings by Spencer & Hall (1896). **i**. Carapace. **j**. Carapace, dorsal view. **k**. carapace ornamentation. Scale bars: a–d = 0.5 mm; e–h = 0.05 mm.

Head (Fig. 13a–c). Condyle long, distally rounded or elongated; occipital notch narrow. Condyle with weakly to strongly developed anterobasal hump. Margin between condyle and ocular tubercle straight to concave. Ocular tubercle weakly developed; forming obtuse (~120–170°) angle with rostrum. Small tubercle ventrally below eye in most specimens (HT: present). Anterior margin of rostrum straight to convex. Apex rounded, close to 90°. Ventral margin of rostrum with slight notch anteriorly, straight to weakly concave at midlength. Naupliar eye large and elongated, subtriangular to subrectangular (with rounded angles) or suboval. Antenna I long with 10–15 lobes (NT: 12; mean: 13), reaching to antenna II flagellomeres IV–IX (NT: VIII; mean: VII). Antenna II with 10–16 flagellomeres (HT: 13; mean: 13).

Thorax. 21–22 (HT: 22; mean: 22) segments, 21–22 (HT: 21; mean: 21) thoracopod-bearing and none to one (HT: one) posterior limbless segment not reaching dorsal margin. Dorsal extensions with numerous short setae, central setae usually longer; in posterior segments number of setae decreasing, becoming shorter and stouter.

Thoracopod III (only P.91796). Endite I short and curved dorsally. Endites II–V broad, decreasing in size. Endite V palp two-segmented, basal segment longer than endopod. Exopod ventral extension subequal in extension to endopod, dorsal extension wide, narrowing distally, overreaching epipod. Epipod long, cylindric.

Telson (Fig. 13f–g). 17–24 spines (NT: 18; mean: 19). First (anterior) spine enlarged. Spines small, conical, equally spaced, two to four larger spines interspersed (usually in anterior half or two-thirds of telson). Spines subequal in size, posterior-most spines slightly thinner, aciculate, slightly drawn out.

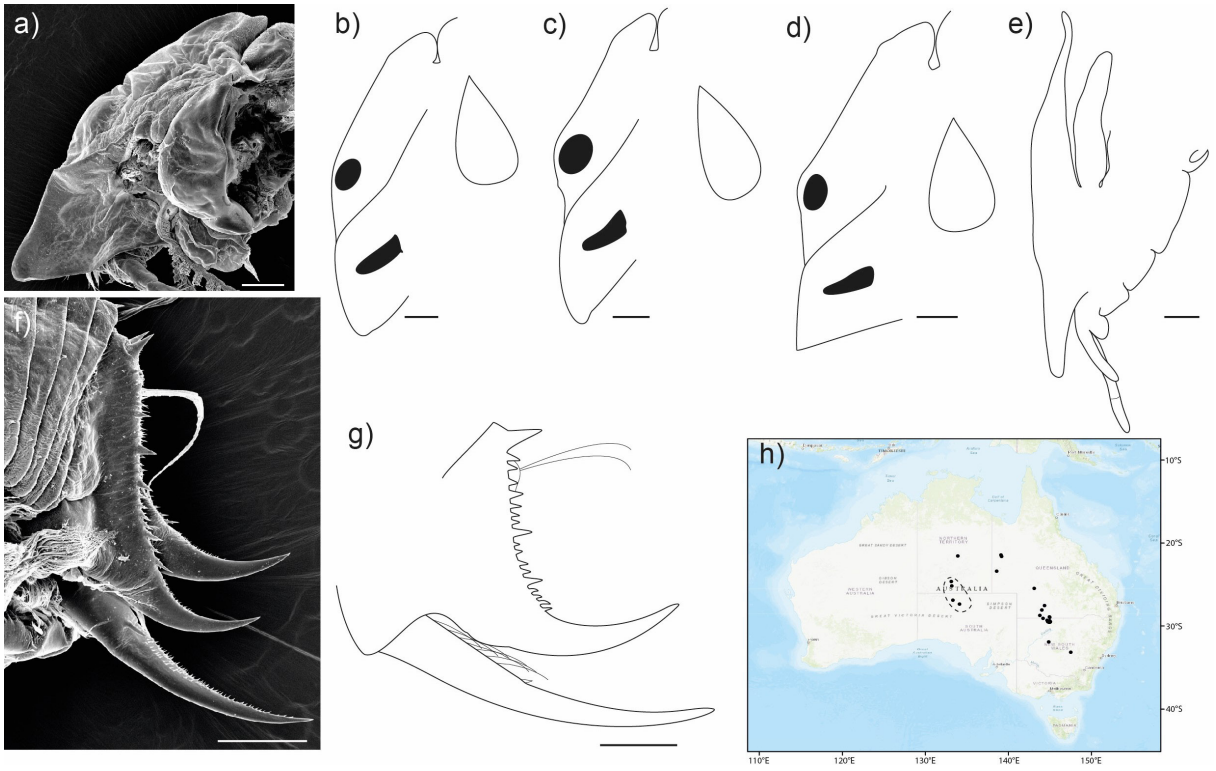

Fig. 13. *Ozestheria cancellata* comb. nov. (Spencer & Hall, 1896). **a–d**. Head (antennae not shown). **a**. Male (P.91797), SEM. **b**. Male, neotype (P.91796). **c**. Male (P.91770). **d**. Female (P.91794). **e**. Third left thoracopod (male neotype, P.91796). **f–g**. Telson. **f**. Male (P.91797), SEM. **g**. Male (P.91770). **h**. Distribution map (produced in ArcMap 10.7; see caption Fig. 7 for sources). Scale bars: a–g = 0.2 mm.

Anterior two-thirds of dorsal margin nearly straight, posteriorly slightly concave. Right terminal claw more strongly curved than left.

Furca (Fig. 13f–g). Proximally with dorsomedial longitudinal row of 5–14 (HT: 7; mean: 8) setae, row ending distally in a single conical spine. Distal part ½–¾ of furcal length, with numerous small denticles.

Females

Overall appearance as in males. Carapace (Fig. 12b) length 3.7–6.4 mm (mean: 5.2 mm), height 2.3–4.3 mm (mean: 3.3 mm); 18–52 (mean: 34) growth lines, of these 13–31 (mean: 22) widely spaced and 3–32 (mean: 12) crowded; Cr/L 0.21–0.29 (mean: 0.25) and b/H 0.48–0.56 (mean: 0.52). Ocular tubercle forming obtuse, nearly straight (~160–170°) angle with rostrum (Fig. 13d). Anterior margin of rostrum usually straight, rarely weakly concave or weakly convex; rostrum apex rectangular (neither rounded nor drawn out); ventral margin nearly straight, only weakly concave. Antenna I with 9–13 small lobes (mean: 10), lobes smaller than in males; reaching to antenna II flagellomeres II–V (mean: III). Antenna II with 11–16 flagellomeres (mean: 13). 21–22 (mean: 22) segments, 21–22 (mean: 21) thoracopod-bearing and none to one posterior limbless segment not reaching dorsal margin. Telson with 12–24 (mean: 19) dorsal spines; left and right terminal claws equally curved or right stronger curved. Furca with 4–11 setae (mean: 6).

Distribution (Fig. 13h)

Ozestheria cancellata comb. nov. is a common species and widely distributed across (semi)arid central and eastern Australia. It occurs in various waterbody types including black box swamps and was predominately found in artificial pools (e.g., borrow pits, dams or quarries).

Remarks

Ozestheria cancellata comb. nov. was originally described as one of three varieties of *O. packardi* by Spencer & Hall (1896). Previous workers (e.g., Richter & Timms 2005; Rogers 2020) have synonymized these varieties with *O. packardi*. However, the large cryptic species diversity, which was revealed by molecular genetic analyses within *O. packardi* (Schwentner *et al*. 2015a), strongly suggested that *O. cancellata* and the other varieties represent valid species. No type specimens are known of *O. cancellata*, and its original description is rather superficial and focuses exclusively on carapace features: length variables, number of growth bands, and ornamental features. Nevertheless, based on its several morphological similarities and the geographic distributions we are highly confident that of the many *O. packardi*-like species highlighted by Schwentner *et al*. (2015a), *Ozestheria* sp. S is conspecific with *O. cancellata*. Morphological similarities include foremost the conspicuous liral ornamentation in later ontogenetic stages; Spencer & Hall explicitly mentioned the pronounced nodules on concentric ridges arranged in a moniliform way, as well as the large number of growth lines (Spencer & Hall reported 30–50) and the spination of the telson (Spencer & Hall reported "spines of the telson are fewer in number than in var. *typica* and very irregular in shape and size"). The reported size difference between the specimens Spencer & Hall (1896) studied and the herein studied material most likely represents an age difference.

In the morphometric analyses of the carapace shape, the original drawing of *O. cancellata* comb. nov. by Spencer & Hall (1896) can be assigned to *O. jonnae* sp. nov. or *O. cancellata* (Supp. file 2_4.2). Also, *O. cancellata* is distinct from *O. radiata* sp. nov., *O. typica* comb. nov., *O. bourkensis* sp. nov., *O. ngamurru* sp. nov., *O. beleriandensis* sp. nov., *O. carnegiensis* sp. nov. but the species occupies a central position in the morphospace of *Ozestheria* and thus overlaps partly with numerous other species in the PCA (*O. jiangi* sp. nov., *O. minor* comb. nov., *O. fuersichi* sp. nov., *O. setifera* sp. nov., *O. sivesae* sp. nov., *O. timmsi* sp. nov., *O. frederikeae* sp. nov., *O. gemina* sp. nov., *O. jonnae*, *O. marthae* sp. nov., *O. selmae* sp. nov., *O. barcaldinensis* sp. nov., *O. weeksi* sp. nov., *O. quinlanae* sp. nov., *O. glabra* sp. nov., *O. echidna* sp. nov., *O. pilbarensis* sp. nov.; Fig. 6).

To clarify the taxonomic status of *O. cancellata* comb. nov., it was deemed necessary to designate a neotype, in particular in the light of the many new described species, some of which are morphologically similar to *O. cancellata*, and the fact that the species had previously been synonymized with other species. There is no evidence that the original material collected by Spencer & Hall is preserved in any collection; requests to relevant collections yielded no such material. The original type locality was very poorly defined and a specimen from that region was selected as a neotype, which closely matches the original description by Spencer & Hall.

Ozestheria carnegiensis sp. nov.
urn:lsid:zoobank.org:act:16235DFE-FAC3-4158-B253-6F1FF8B4D8B9
Fig. 14

Diagnosis

Ozestheria carnegiensis sp. nov. is characterized by an elongate, but strongly rounded condyle with a narrow occipital notch (which is wider than in most species with a long condyle); carapace ornamentation dominated by punctae, in later growth bands nodular and very inconspicuous lirae (best seen under SEM) forming between dominant punctae, concentric ridges weakly developed and punctate; male rostrum with strongly convex (sometimes undulating) anterior margin, apex rounded with nearly rectangular angle, ventral margin weakly concave; 11–15 (male) antenna I lobes reaching to antenna II flagellomeres VIII–X (male); 12–14 (male) antenna II flagellomeres; 19–20 complete thorax segments; 11–20 telsonic spines, widely and irregularly spaced, varying in length with several larger spines interspersed, anteriorly broad, conical and posteriorly thinner and elongated, increasing in size posteriorly, most spines rather large; 7–8 furcal setae.

Differential diagnosis

Ozestheria carnegiensis sp. nov. can be differentiated from all other species of *Ozestheria* by the length of the condyle (which is somewhat intermediate between the typically short or long condyle) and the carapace ornamentation, which is dominated by punctae with a very inconspicuous transition to a lirae-dominated ornamentation on growth bands of the secondary growth phase. Other species with such a punctae-dominated carapace ornamentation are *O. timmsi* sp. nov. and *O. frederikeae* sp. nov., which both have longer condyles and a larger number of complete thorax segments (≥21 vs 19–20), antenna II flagellomeres (≥14 vs ≤14) and telsonic spines (17–31 vs 11–20), and distinct carapace shapes with more convexly curved ventral margins. *Ozestheria gemina* sp. nov. has a similar condyle length but differs in carapace ornamentation (well-developed lirae, fewer and less dominant punctae), rostrum shape and telson spination (spines smaller, usually only 2–3 larger interspersed). Moreover, *Ozestheria carnegiensis* sp. nov. appears to be the only species with a short, nodular epipod in most thoracopods.

Etymology

The species is named after Lake Carnegie, the only locality where the species has been recorded so far.

Type material

Holotype

AUSTRALIA – **Western Australia** • ♂; Lake Carnegie (Windidda 2); 26°15′52.7″ S, 122°16′29.23″ E; 4 Jun. 2020; D.J. Cale leg.; GenBank no: PQ427040 (COI); WAM C78003.

Paratypes

AUSTRALIA – **Western Australia** • 3 ♂♂; same data as for holotype; WAM C80213, WAM C80214, WAM C80215 • 1 ♂; same data as for holotype; NHMW-ZOO-CR-28497.

Type locality

Western Australia, Lake Carnegie (Windidda 2), 26°15′52.7″ S, 122°16′29.23″ E.

Description

Males

Carapace (Fig. 14a–d). Length 5.7–6.4 mm (HT: 6.1 mm), height 3.5–4.0 mm (HT: 3.8 mm). Coloration light brownish, crowded growth bands lighter. ~70 (in most individuals the carapace was covered in thick layer of dirt and algae, preventing detailed study of carapace features) growth lines, ~16 widely spaced and ~55 crowded.

Carapace shape. Dorsal margin straight, distinct dorso-posterior corner. Posterior margin broadly rounded, suboval, equicurvate to infracurvate (b/H 0.54–0.61, HT: 0.61). Ventral margin widely rounded. Umbo position submedian (Cr/L 0.31–0.35, HT: 0.33).

Carapace ornamentation (due to very thick layer of dirt and fungi, difficult to study; Fig. 14e–g). Larval valve probably punctate. In the dorsal and median part of the carapace, growth bands punctate; in later growth bands very short, inconspicuous nodular lirae appearing between punctae (best visible under SEM), lirae not reaching across full growth band width. Crowded growth bands and growth bands of the secondary growth phase with short, inconspicuous, subparallel lirae. Concentric ridges shallow, punctate, with smooth dorsal and smooth to serrate ventral margins. No obvious setae preserved (setal pores in single row along all growth lines under SEM).

Head (Fig. 14h). Condyle long, distally rounded; occipital notch narrow (but wider than in most species with a long condyle). Condyle lacking anterobasal hump. Margin between condyle and ocular tubercle concave. Ocular tubercle well developed, forming obtuse angle (~100–110°) with rostrum. Anterior margin of rostrum strongly convex, sometimes undulating. Apex rounded with nearly rectangular angle. Ventral margin of rostrum with slight notch anteriorly and weakly concave mid-length. Naupliar eye large and subtriangular. Antenna I long with 11–15 lobes (HT: 11), reaching to antenna II flagellomeres VIII–X (HT: X). Antenna II with 12–14 flagellomeres (HT: 14).

Thorax. 21–22 (HT: 21) segments, 19–20 (HT: 20) thoracopod-bearing and none to two (HT: one) posterior limbless segments not reaching dorsal margin. Most segments with dorsal extensions bearing several short spines, especially on last segments spines very short and inconspicuous.

Thoracopod III (only WAM C78003; Fig. 14j). Endite I short and curved dorsally. Endites II–V broad, decreasing in size. Endite V palp two-segmented, basal segment shorter than endopod. Exopod ventral extension subequal in extension to endopod, dorsal extension wide, narrowing distally, greatly overreaching epipod. Epipod very short, rounded, nodular.

Telson (Fig. 14i). 11–20 spines (HT: 20). First (anterior) spine enlarged. Spines on anterior ⅔ of telson broad, conical; following spines becoming longer and slightly thinner. Spines vary in size, overall large-sized, several particularly large spines interspersed. Dorsal margin anterior ⅔ straight to slightly concave, then concave. Right terminal claw more strongly curved than left.

Furca (Fig. 14i). Proximally with dorsomedial longitudinal row of 7–8 (HT: 7) setae, row ending distally in a single conical spine. Distal part ½ of furcal length, with numerous small denticles.

Female

Unknown.

Distribution

Ozestheria carnegiensis sp. nov. is known from a single locality in central Western Australia.

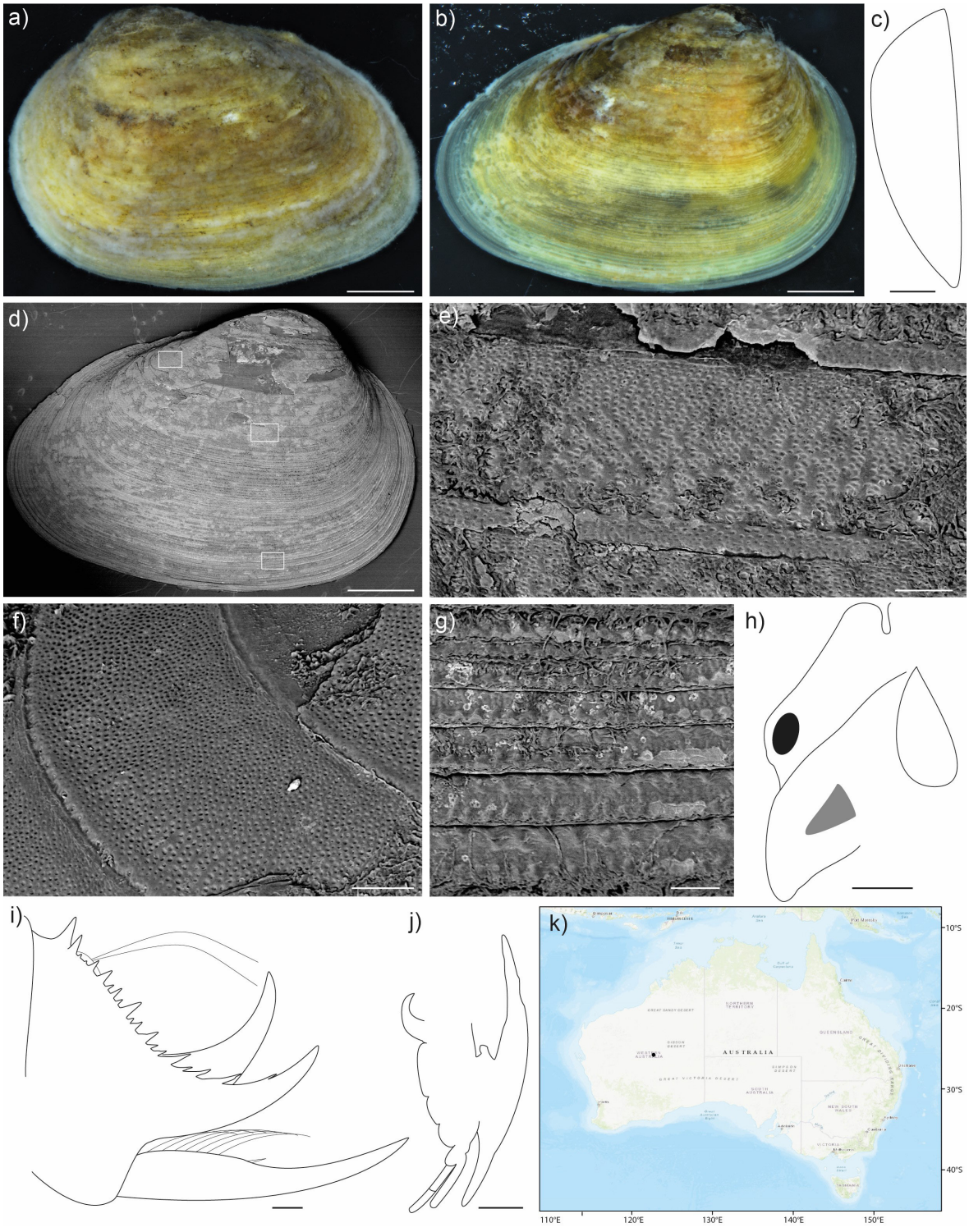

Fig. 14. *Ozestheria carnegiensis* sp. nov. **a–d**. Carapace. **a**. Male, holotype (WAM C78003). **b**. Male, paratype (WAM C80213). **c**. Dorsal view, male, holotype (left valve only; WAM C78003). **d**. Male, paratype (WAM C80213), SEM. **e–g**. Carapace ornamentation (male paratype WAM C80213; positions marked in d by rectangles), SEM. **e**. Mid-carapace. **f**. Posterodorsal carapace. **g**. Ventral carapace. **h–j**. Male, holotype (WAM C78003). **h**. Head (antennae not shown). **i**. Telson. **j**. Third left thoracopod. **k**. Distribution map (produced in ArcMap 10.7; see caption Fig. 7 for sources). Scale bars: a–d = 1 mm; e–g = 0.05 mm; h, j = 0.5 mm; i = 0.1 mm.

Remarks

Currently, only males are known. In most individuals the carapace was covered by a thick layer of dirt and algae, preventing detailed study of carapace features. The extremely short epipod observed at the third thoracopod of the holotype appears like a damage or growth defect; however, also most other thoracopods of this and all other specimens have similarly short epipods. In some specimens these are slightly longer (about twice the length seen in the holotype), but still much smaller than in all other species. The claspers and a few more posterior thoracopods have the long and elongated epipods observed in all other species.

Because only few specimens were available, the morphological variability of the species is not well characterized. The carapace shape of *O. carnegiensis* sp. nov. (Fig. 6) is distinct from that of most other species and overlaps with those of *O. beleriandensis* sp. nov., *O. typica* comb. nov., and *O. selmae* sp. nov.

Ozestheria christiani sp. nov.
urn:lsid:zoobank.org:act:ED04772A-3C1F-4DCA-8725-76752888C3E3
Fig. 15

Ozestheria sp. F – Schwentner *et al*. 2015a: figs 2, 6.

Ozestheria sarsii – Schwentner *et al*. 2020: figs 1–2.

Diagnosis

Ozestheria christiani sp. nov. is characterized by a short condyle and wide occipital notch; a rounded ventral carapace margin with well-defined most ventral point; carapace ornamentation with large, well-developed polygonal reticulations, many polygons intermittent and with small projections towards the polygon's center, each polygon without secondary ornamentation (best seen under SEM); male rostrum with convex anterior margin, apex rounded, ventral margin with anterior hump then strongly concave, pointing apex downwards; 20–23 (male) antenna I lobes reaching to antenna II flagellomeres VI–VII (male); 10–11 (male) antenna II flagellomeres; 22–23 complete thorax segments; 15–18 small spines, anterior spines conical spines, posterior spines elongate and aciculate; 7–12 furcal setae.

Differential diagnosis

Ozestheria christiani sp. nov. can be easily differentiated from most other species of *Ozestheria* by the shape and ornamentation of the carapace as well as the telson spination. The morphologically most similar species are *O. sarsii*, *O. rufa*, *O. paralutraria* sp. nov. and *O. lutraria.* These can be easily differentiated by their ornamentation, as the polygonal reticulations of *O. christiani* are partly intermittent and with small projections towards the polygon's center.

Etymology

The species is named after Christian Pott, the partner of MH.

Type material

Holotype

AUSTRALIA – **South Australia** • ♂; dugout on Wentworth Road, about 15 km W of Lake Victoria; 33°53′03.4″ S, 140°58′39.1″ E; 13 Mar. 2011; M. Schwentner and B.V. Timms leg.; GenBank no: KJ705663 (COI); AM P.91434.

Paratypes

AUSTRALIA – **South Australia** • 3 ♂♂; same data as for holotype; GenBank nos: KJ705660 to KJ705662 (COI); AM P.91431 to P.91433 • 1 ♂; same data as for holotype; GenBank no: KJ705664 (COI); NHMW-ZOO-CR-28479.

Type locality

South Australia, dugout Wentworth Road, about 15 km W of Lake Victoria, 33°53′03.4″ S, 140°58′39.1″ E.

Description

Males

Carapace (Fig. 15a–c). Length 8.9–10.5 mm (HT: 8.9 mm), height 5.0–6.1 mm (HT: 5.0 mm). Coloration dark brown, with lighter ventral margin and lighter (yellowish) spot on mid-frontal carapace. 21–23 (HT: 22) growth lines, 13–15 (HT: 14) widely spaced and 6–9 (HT: 8) crowded.

Carapace shape. Dorsal margin straight, dorso-posterior corner rounded. Posterior margin broadly rounded, suboval, supracurvate to equicurvate (b/H 0.39–0.46, HT: 0.40). Ventral margin strongly curved, with clearly defined point of greatest extension. Umbo position anterior (Cr/L 0.18–0.21, HT: 0.21).

Carapace ornamentation (Fig. 15d–e). Larval valves appear smooth (probably artifact due to abrasion). Each growth band with medium to large polygonal reticulations with each polygon usually being a pentagon, hexagon or heptagon. Many polygons not fully closed and with additional lirae projecting into the polygon's center. No secondary reticulation visible under SEM. Crowded growth bands without apparent ornamentation, but with uneven texture. Concentric ridges raised. No setae visible, under SEM setal pores in single row along posterior growth lines.

Head (Fig. 15f–g). Condyle short, rounded; occipital notch wide. Condyle lacking anterobasal hump. Margin between condyle and ocular tubercle concave. Ocular tubercle well developed, forming obtuse, close to 90° angle with rostrum. Small tubercle ventrally below eye in most specimens (HT: present). Anterior margin of rostrum convex. Apex strongly rounded with obtuse angle, followed by ventral indentation (lacking in one individual). Ventral margin of rostrum with hump following indentation, then deeply concave with obtuse angle about half-length, pointing apex slightly downwards. Naupliar eye small, triangular. Antenna I long with 20–23 lobes (HT: 22), reaching to antenna II flagellomeres VI–VII (HT: VI). Antenna II with 10–11 flagellomeres (HT: 11).

Thorax. 23–24 (HT: 24) segments, 22–23 (HT: 22) thoracopod-bearing and 1–2 (HT: two) posterior limbless segments not reaching dorsal margin. Dorsal extensions with numerous short spines, decreasing in number posteriorly. In posterior segments central spines stouter.

Thoracopod III (only P.91434; Fig. 15j). Endite I short and curved dorsally. Endites II–V broad, decreasing in size. Endite V palp two-segmented, basal segment shorter than endopod. Exopod ventral extension subequal or slightly longer in extension to endopod, dorsal extension wide, narrowing distally, overreaching epipod. Epipod long, cylindric.

Telson (Fig. 15h–i). 15–18 spines (HT: 15). First (anterior) spine enlarged. Spines conical, posteriorly slightly thinner, drawn out and aciculate. Most spines small (compared to telson size), few (usually 1–3) slightly larger spines interspersed in anterior half of telson. Anterior most spines not arranged along dorsal margin but slightly lateral; spacing of spines irregular, usually widely spaced. Anterior half to two-thirds of dorsal margin nearly straight, posteriorly concavely curved. Right terminal claw more strongly curved than left.

Furca (Fig. 15h–i). Proximally with dorsomedial longitudinal row of 7–12 (HT: nine) setae, row ending distally in a single conical spine. Distal part ⅓ of furcal length, with numerous small denticles.

Female

Unknown.

Distribution (Fig. 15k)

The species is known only from its type locality, an artificial pool in south-eastern South Australia.

Remarks

Currently, only males are known. Schwentner *et al*. (2020) wrongly identified this species as *O. sarsii*. A comparison with the respective type material showed that *O. christiani* sp. nov. is not conspecific with *O. sarsii*. This was further corroborated by the classification based on carapace shape, where the probability that *O. sarsii* can be assigned to *O. christiani* was 0% with a typicality of 0.0. The carapace shape of *O. christiani* (Fig. 5) is distinct from that of most other species and overlaps partly with those of *O. rubra* and *O. matuwa* sp. nov.

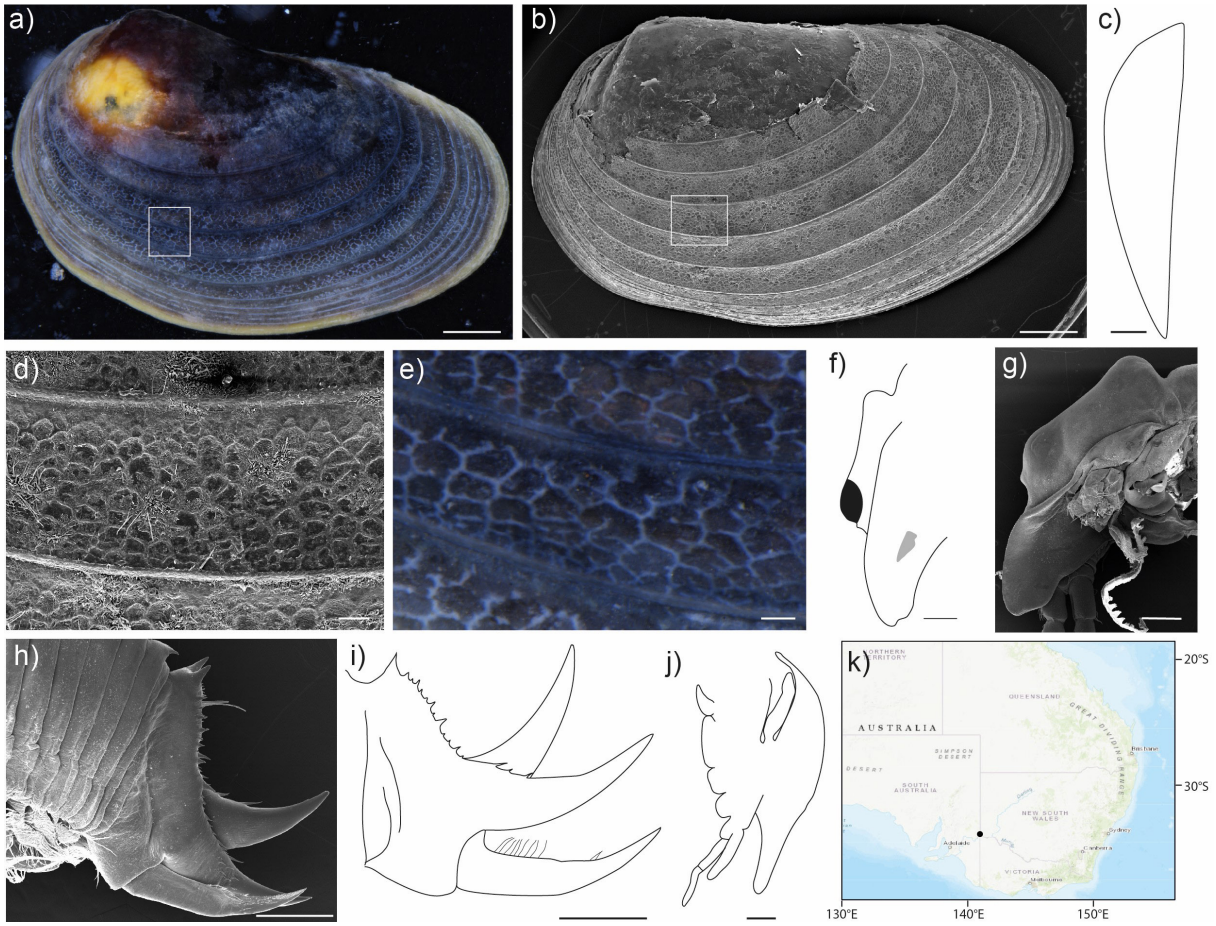

Fig. 15. *Ozestheria christiani* sp. nov. **a**. Carapace (male, holotype, P.91434). **b**. Carapace (male paratype, P.91433), SEM. **c**. Carapace, dorsal view (right valve only, male, holotype, P.91434). **d–e**. Carapace ornamentation (positions marked in a and b by rectangles). **d**. Mid-carapace, (male paratype, P.91433), SEM. **e**. Mid-carapace (male, holotype, P.91434). **f–g**. Head (antennae not shown). **f**. Male, holotype (P.91434). **g**. Male, paratype (P.91433), SEM. **h–i**. Telson. **h**. Male, holotype (P.91434). **i**. Male, paratype (P.91433), SEM. **j**. Third left thoracopod (male, holotype, P.91434). **k**. Distribution map (produced in ArcMap 10.7; see caption Fig. 7 for sources). Scale bars: a–c = 1 mm; d–e = 0.1 mm; f–j = 0.5 mm.

Ozestheria dictyon (Spencer & Hall, 1896) ≡ ***Ozestheria lutraria*** (Brady, 1886)

Type material

Syntypes

AUSTRALIA – **South Australia** • 8 juvs; James Range, Palm Creek; Spencer & Hall (?) leg.; MV J53359.

Type locality

South Australia, James Range, Palm Creek.

Remarks

Ozestheria dictyon is a junior synonym of *O. lutraria* (for details see remarks of *O. lutraria*). The original description of *O. dictyon* was based solely on juveniles, which were erroneously identified as adults.

Ozestheria echidna sp. nov.

urn:lsid:zoobank.org:act:09E54F6C-67ED-45FE-8DE6-6167AF1C7BA6

Fig. 16

Diagnosis

Ozestheria echidna sp. nov. is characterized by a long condyle and a narrow occipital notch; a broadly rounded ventral carapace margin; carapace ornamentation dorsally on carapace punctate, following growth bands smooth with short lirae ventrally within growth bands, lirae decrease in size in following growth bands (lirae absent in growth bands of later ontogenetic stages); carapace setae very long and thick, very densely arranged along most concentric ridges, giving the whole carapace a furry or pelt like appearance (setal pores of broken off setae clearly visible under stereo microscope); male rostrum with weakly convex anterior margin, apex rounded with right angle, ventral margin strongly concave, pointing apex downwards; female rostrum anterior margin straight or undulating, apex right angle (not rounded or drawn out into acute tip), ventral margin weakly concave or weakly convex; 9–14 (male) or 8–15 (female) antenna I lobes reaching to antenna II flagellomeres IV–IX (male) or IV–V (female); 11–16 (male) or 12–16 (female) antenna II flagellomeres; 19–21 complete thorax segments; 31–44 telsonic spines, most spines aciculate, densely spaced, usually no larger spines interspersed, slightly increasing in length posteriorly; 4–11 furcal setae.

Differential diagnosis

Ozestheria echidna sp. nov. can be easily differentiated from most other Australian species of *Ozestheria* by the dense setation of the carapace (in most other species the majority of setae are broken off) and the characteristic carapace ornamentation with the extensive smooth band dorsally within growth bands and only short ventral lirae (lirae completely missing ventrally on carapace). *Ozestheria setifera* sp. nov. also has a dense carapace setation, but it has shorter and thinner setae, more pronounced and nodular lirae on the growth bands (which do not decrease in size ventrally on carapace) and fewer telsonic spines (18–31 vs 28–44). *Ozestheria jiangi* sp. nov. and *O. sivesae* sp. nov. also have smooth bands in their carapace ornamentation, but their growth bands contain prominent lirae (separated by punctae in *O. sivesae*) ventrally on the carapace; they also lack the dense setation and differ in the shape of the male and female rostrum.

Etymology

The species is named after an iconic Australian animal, the echidna, due to the thick, dense and long spines on the species' carapace. Echidna is a junior homonym that has become the common word for this species group; noun in apposition.

Type material

Holotype

AUSTRALIA – **Western Australia** • ♂; Chaddolinna Pool, 5 km E of Mulga Downs; 22°18′0.1″ S, 118°49′32.5″ E; 13 Mar. 2007; A.M. Pinder leg.; WAM C77994.

Paratypes

AUSTRALIA – **Western Australia** • 1 ♂, 2 ♀♀; same data as for holotype; WAM C80241 to C80243 • 1 ♂; same data as for holotype; NHMW-ZOO-CR-29004.

Other material examined

AUSTRALIA – **Western Australia** • 1 ♂, 1 ♀; 14 Mile Pool, 114 km N of Newman; 22°33′13″ S, 119°51′49.1″ E; 15 Mar. 2016; A.M. Pinder leg.; WAM C80233, C80232 • 4 ♂♂, 1 ♀; Paradise Pool, 61 km SW of Pardoo; 20°22′35″ S, 119°25′21″ E; 13 Sep. 2014; B.V. Timms leg.; WAM C77992, C80237 to C80240 • 4 ♂♂; Moorimoordinina Native Well, 118 km S of Nullagine; 22°30′48″ S, 119°46′15.4″ E; 10 Apr. 2008; A.M. Pinder leg.; WAM C77991, C80244 to C80246.

Type locality

Western Australia, Chaddolinna Pool, 5 km E of Mulga Downs, 22°18′0.1″ S, 118°49′32.5″ E.

Description

Males

Carapace (Fig. 16a, c). Length 5.3–7.3 mm (HT: 6.7 mm, mean: 6.3 mm), height 3.1–4.5 mm (HT: 4.0 mm, mean: 3.8 mm). Coloration varying from light orange-brownish to light reddish-brown; outer margin lighter. 34–65 (HT: 43; mean: 48) growth lines, 12–58 (HT: 34; mean: 35) widely spaced and 3–37 (HT: 9; mean: 14) crowded; also, wide growth bands rather densely spaced.

Carapace shape. Dorsal margin straight, dorso-posterior corner rounded. Posterior margin broadly rounded, suboval, equicurvate (b/H 0.48–0.52; HT: 0.49, mean: 0.51). Ventral margin broadly rounded. Umbo position submedian (Cr/L 0.25–0.30; HT: 0.26, mean: 0.27).

Carapace ornamentation (compare Fig. 16e–f). Larval valve and first few growth bands granular or punctate (puntate under SEM), in some individuals inconspicuous lirae forming between punctae. Following growth bands, dorsally within growth bands smooth, ventrally with short lirae; lirae decrease in extension in progressing growth bands (lirae become so reduced that they are only visible when terminating in the concentric ridge). Ornamentation usually concealed by setae. Crowded growth bands without apparent ornamentation. Concentric ridges shallow; under SEM smooth, appears serrated dorsally where the short lirae terminate. Setae very long and thick, very densely arranged along most concentric ridges, giving the whole carapace a furry or pelt-like appearance; setal pores of broken off setae clearly visible under stereo microscope; setal pores in irregular row along all growth lines.

Head (Fig. 16i). Condyle long, distally rounded; occipital notch narrow. Condyle with anterobasal hump. Margin between condyle and ocular tubercle straight to weakly concave. Ocular tubercle weakly developed, forming obtuse (~150°) angle with rostrum. Anterior margin of rostrum weakly convex. Apex rounded with right angle. Ventral margin of rostrum strongly concave, pointing apex downwards. Naupliar eye subtriangular, varying in size. Antenna I long with 9–14 lobes (HT: 13; mean: 12), reaching to antenna II flagellomeres IV–IX (HT: IX; mean: VII). Antenna II with 11–16 flagellomeres (HT: 15; mean: 14).

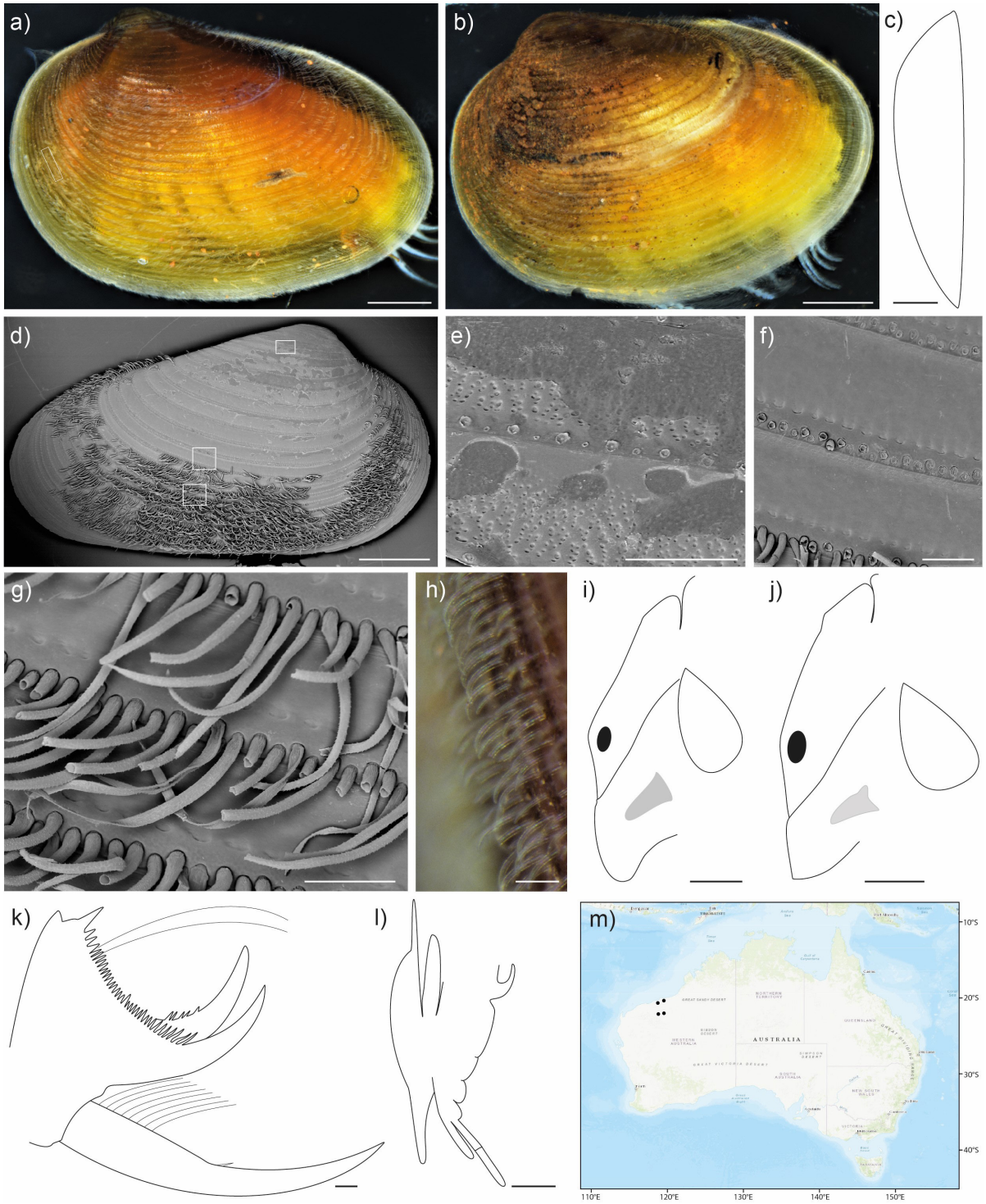

Fig. 16. *Ozestheria echidna* sp. nov. **a–d**. Carapace. **a**. Male, holotype (WAM C77994). **b**. Female, paratype (WAM C80243). **c**. Dorsal view, male, holotype (right valve only; WAM C77994). **d**. Female, paratype (WAM C80242), SEM. **e–g**. Carapace ornamentation (female paratype WAM C80242; positions marked in d by rectangles), SEM. **e**. Dorsal carapace. **f**. Mid-carapace. **g**. Mid-ventral carapace. **h**. Carapace setation (male, holotype, WAM C77994). **i–j**. Head (antennae not shown). **i**. Male, holotype (WAM C77994). **j**. Female, paratype (WAM C80243). **k**. Telson (male, holotype, WAM C77994). **l**. Male, third left thoracopod (holotype, WAM C77994). **m**. Distribution map (produced in ArcMap 10.7; see caption Fig. 7 for sources). Scale bars: a–d = 1 mm; e–g, j–k = 0.1 mm; h–i, l = 0.5 mm.

Thorax. 20–21 (HT: 20, mean: 21) segments, 19–21 (HT: 19; mean: 20) thoracopod-bearing and one to no posterior limbless segment, not reaching dorsal margin. Most thoracopod-bearing segments with spine bearing dorsal extensions.

Thoracopod III (only WAM C77994; Fig. 16l). Endite I short and curved dorsally. Endites II–V broad, decreasing in size. Endite V palp two-segmented, basal segment subequal to endopod. Exopod ventral extension subequal in extension to endopod, dorsal extension wide, narrowing distally, overreaching epipod. Epipod long, cylindric.

Telson (Fig. 16k). 28–44 spines (HT: 35; mean: 35). First (anterior) spine enlarged. Following spines slender, elongate; most anterior spines slightly conical, posterior spines aciculate; densely and regularly spaced, usually no larger spines interspersed; increasing in length posteriorly. Dorsal margin concave or undulating. Right terminal claw more strongly curved.

Furca (Fig. 16k). Proximally with dorsomedial longitudinal row of 4–11 (HT: 8, mean: 9) setae, row ending distally in a single conical spine. Distal part ~⅔ of furcal length, with numerous small denticles.

Females

Overall appearance as in males. Carapace (Fig. 16b, d) length 5.6–6.7 mm, height 3.4–4.4 mm; 34–63 growth lines, 26–55 widely spaced and 3–8 crowded; Cr/L 0.26–0.29; b/H 0.48. Angle between head and rostrum nearly straight to obtuse (~150°) (Fig. 16j). Rostrum frontal margin straight or slightly undulating. Apex with right angle, not rounded; ventral margin varying from weakly concave to weakly convex. Antenna I with 8–15 small lobes, lobes smaller than in males; reaching to antenna II flagellomeres IV–V. Antenna II with 12–16 flagellomeres. Telson with 31–38 dorsal spines; left and right terminal claws usually equally curved, sometimes right stronger curved. Furca with 8–14 setae.

Distribution (Fig. 16m)

Ozestheria echidna sp. nov. is known from four geographically relatively close localities in northwestern Western Australia.

Remarks

The carapace shape of *Ozestheria echidna* sp. nov. (Fig. 6) is distinct from that of most other species and overlaps partly with those of *O. jiangi* sp. nov., *O. minor* comb. nov., *O. jonnae* sp. nov., *O. marthae* sp. nov., *O. selmae* sp. nov., *O. typica* comb. nov., *O. cancellata* comb. nov., *O. weeksi* sp. nov., and *O. glabra* sp. nov.

Ozestheria elliptica (Sars, 1897)

Fig. 17

Estheria elliptica Sars, 1897: 12–17, fig. 2.

Estheria elliptica – Sayce 1903: 252, 255. — Henry 1924: 122, 134. — Gurney 1927: 63–64.
Cyzicus ellipticus – Wolf 1911: 254. — Dakin 1914: 295.
Caenestheria elliptica – Daday 1914: 56, 96–98. — Richter & Timms 2005: 344–345.
Eocyzicus ellipticus – Brtek 1997: 49.
Ozestheria elliptica – Rogers 2020: 23.

Diagnosis

Ozestheria elliptica is characterized by a short condyle and wide occipital notch; a rounded ventral carapace margin; carapace ornamentation with large, well-developed polygonal reticulations; female

rostrum with slightly drawn-out apex; 10 (female) antenna I lobes reaching to antenna II flagellomeres IV; 12 (female) antenna II flagellomeres; 22 or 23 complete thorax segments; ~28 small, unequally sized and spaced conical telsonic spines; no furcal setae.

Differential diagnosis

A morphological differentiation of *O. elliptica*, *O. rubra*, *O. henryae* sp. nov. and *O. matuwa* sp. nov. is difficult, though at least *O. rubra*, *O. henryae* and *O. matuwa* can be easily separated genetically via COI (no genetic data for *O. elliptica* available) (Fig. 2). Sars' (1897) illustration of *O. elliptica* shows interrupted and discontinuous polygonal mesh walls, which would distinguish this species from *O. rubra*, *O. henryae* and *O. matuwa*; whether these represent inaccuracies in the drawing or a true ornamental feature will have to be evaluated in future studies. *Ozestheria elliptica* and *O. henryae* tend to be smaller (length up to ~7.5 mm, the other species up to ~9 mm) with a shorter male antenna I (reaching to antenna II flagellomeres V–VII [unknown for *O. elliptica*], while reaching to about VII–X in the other species), a less strongly concave rostral ventral margin (in males) and more telsonic spines (> 20–30, and up to 16–28 though usually ~20 in the other two species). *Ozestheria elliptica* differs from *O. henryae* by having no setae on the furca and by all telsonic spines being subequal in length (vs mid and posterior spines slightly enlarged). *Ozestheria rubra* differs from *O. matuwa* in the number of complete thorax segments (22–23 vs 22–24) and the shape of the male rostrum apex, which is more strongly rounded in *O. rubra*. The four species differ in their geographic distributions: *O. elliptica* occurs in northern Western Australia, *O. rubra* occurs along the border region of Queensland and New South Wales as well as central Australia, *O. matuwa* in Western Australia and *Ozestheria henryae* in central Queensland.

The four species together can be easily distinguished from other species of *Ozestheria* by the elliptical shape of the carapace (with an evenly rounded ventral margin), the large polygonal, reticulating carapace ornamentation, polygonal secondary ornamentation within each polygon of the primary ornamentation and the relatively large number of telsonic spines. The very well-defined polygonal ornamentation on all wide growth bands clearly differentiates these four species from most other species with short and rounded condyles: *O. berneyi*, *O. pellucida*, *O. sarsii*, *O. rufa*, *O. richteri* sp. nov., and *O. christiani* sp. nov. Furthermore, the ornamentation of *O. christiani* is less regular, with the walls of single polygons often being intermittent or with small extensions reaching into the polygon's center, and *O. christiani* has fewer antenna II flagellomeres (10–11 vs 12–16). *Ozestheria rufa* differs further by the lower number of telsonic spines. *Ozestheria sarsii* differs in the overall shape of the carapace, the shape of the female rostrum (rounded apex), the telson spination (larger number of spines), and *O. paralutraria* sp. nov. differs by its straight ventral carapace margin, the shape of the male and female rostrum and smaller telsonic spines. *Ozestheria lutraria* can be differentiated by the larger number of thorax segments (25–27 vs 22–24), the telsonic spines (fewer, usually smaller and less regularly spaced), irregular ornamentation on crowded growth bands and the secondary growth phase, and the carapace shape.

Material examined

None (the following description is based on the description of Sars and his detailed drawings, who studied a single adult female raised from dried sediments).

Type locality

Western Australia, shallow depression about 40 miles E of Roebuck Bay.

Description

Female

Carapace (Fig. 17a). Length 4.9 mm, height 3.0 mm (Sars reported a height of 3.2 mm but that probably included the umbo). Coloration dark reddish-brown, outer margin lighter. 25 growth lines, 14 widely spaced and 11 crowded.

Carapace shape. Dorsal margin straight, rounded dorso-posterior corner. Posterior margin broadly rounded, suboval, supracurvate (b/H 0.38). Ventral margin widely rounded. Umbo position anterior (Cr/L 0.21).

Carapace ornamentation (Fig. 17b). Each growth band with large, well-developed reticulations, forming polygonal mesh across each growth band. Ornamentation uniform across all non-crowded growth bands, crowded growth bands with short radial lirae. Concentric ridges raised. Setae spiniform; preferentially preserved on ventral and posterior parts of the carapace.

Head (Fig. 17c). Condyle rounded, short, only weakly protruding; occipital notch wide. Condyle lacking anterobasal hump. Margin between condyle and ocular tubercle concave. Ocular tubercle well developed, forming obtuse (~120°) angle with rostrum. Anterior margin of rostrum straight to slightly concave. Apex with nearly rectangular angle, apex weakly drawn out and rounded. Antenna I long with 10 lobes, reaching to antenna II flagellomere IV. Antenna II with 12 flagellomeres.

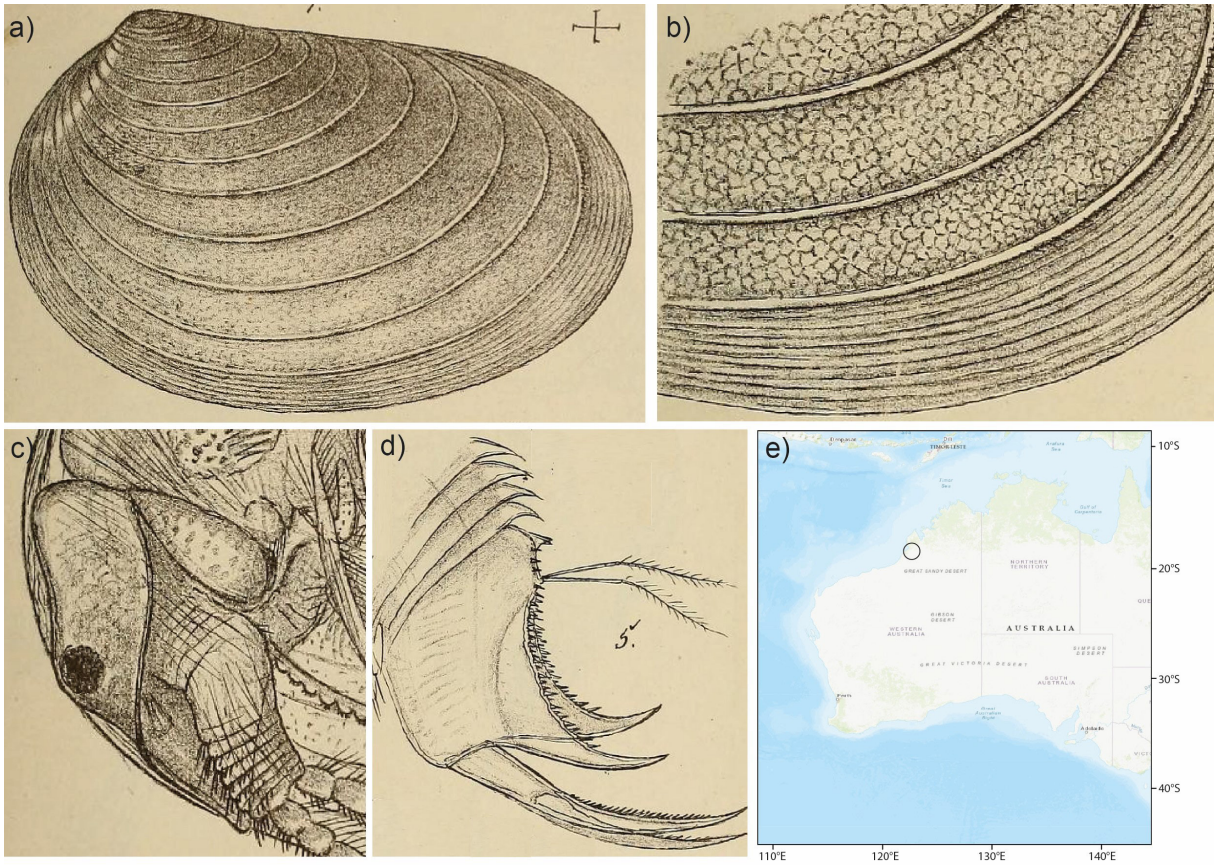

Fig. 17. *Ozestheria elliptica* (Sars, 1897). **a–d**. Original drawings by Sars (1897). **a**. Carapace. **b**. Carapace ornamentation. **c**. Head. **d**. Telson. **e**. Map (circle depicts the type locality).

Thorax. 22 or 23 thoracopod-bearing segments. Mid to posterior thoracopod-bearing segments with spine bearing dorsal extensions. Dorsal extensions increasing in size posteriorly over successive segments; spines mostly short, in posterior segments with fewer spines and central spines stouter but shorter.

Telson (Fig. 17d). ~28 spines. First (anterior) spine enlarged. Spines conical or aciculate, subequally spaced, anterior spines smaller, spines of unequal size. Dorsal margin s-shaped: anteriorly slightly convex, posteriorly concavely curved. Right terminal claw slightly stronger curved than left.

Furca (Fig. 17d). No proximal setae, a single conical spine. Distal part ¾ of furcal length, with numerous small denticles.

Distribution (Fig. 17e)

Ozestheria elliptica is known only from its type locality in northern Western Australia.

Remarks

Richter & Timms (2005) suggested that syntypes may be housed in the Zoological Museum (Oslo). The respective collection holds three individuals labeled as *Estheria elliptica*; however, the collection details do not match those of Sars and the respective species identification may be of more recent origin. No other contacted Norwegian (Natural History Museum University of Oslo, NTNU University Museum and Tromsø University Museum) or Australian (AM, MV, SAM and WAM) museum hosted potential types of this species.

The illustration of *O. elliptica* by Sars (1897) suggests interrupted and discontinuous polygonal mesh walls, which would distinguish this species from *O. rubra*, *O. henryae* sp. nov. and *O. matuwa* sp. nov. Sars did not mention such discontinuity in the polygonal mesh in his otherwise detailed description, suggesting that these represent inaccuracies in the drawing. This may be solved when the species is collected again.

Henry (1924) differentiated *O. elliptica* from *O. rubra* by a "marginal area of the carapace with crowded concentric striae" in the former. These so-called concentric striae are the crowded growth lines at the carapace's outer margin (see Sars 1897: pl. 2). Henry did not observe or draw any crowded growth lines; however, they are present in the type specimen of *O. rubra* as well as in most other *O. rubra* specimens examined herein, showing that this character is not suitable for the distinction of the two species.

In the geometric morphometric analyses (Fig. 5), *O. elliptica* is distinct from most other species and most similar to *O. matuwa* sp. nov. (68.6% probability) and *O. rubra* (21.1%). However, typicality scores were rather low with 0.28 and 0.11, respectively.

No genetic data is available for *O. elliptica* and also males are currently unknown.

The species has not been recorded since the first description by Sars (1897); all other reports are probably related to morphologically similar species (e.g., *O. rubra*, *O. henryae* sp. nov. or *O. matuwa* sp. nov.). Due to the clear geographic separation, it is unlikely that one of the species with similar morphological characteristics (*O. rubra*, *O. henryae* or *O. matuwa*) is conspecific with *O. elliptica*.

Ozestheria frederikeae sp. nov.
urn:lsid:zoobank.org:act:115FEB5B-8E8B-4979-B524-087E7023A7C5
Fig. 18

Ozestheria sp. H2 – Schwentner *et al*. 2015a: figs 2, 6.

Diagnosis

Ozestheria frederikeae sp. nov. is characterized by a long condyle and a narrow occipital notch; carapace ornamentation dominated by pit-like punctae, in later growth bands lirae forming between punctae; female rostrum with undulating anterior margin, apex rounded, nearly rectangular (in some individuals protruding), ventral margin straight to convex (sometimes concave mid-length); 12–14 (female) antenna I lobes reaching to antenna II flagellomeres III–IV (female); 14–17 (female) antenna II flagellomeres; 21–22 complete thorax segments; 22–31 telsonic spines, spines small with ~2 larger spines interspersed, anteriorly conical and posteriorly thin and aciculate; 6 furcal setae.

Differential diagnosis

Ozestheria frederikeae sp. nov. can be differentiated from all other species of *Ozestheria* by the combination of the carapace ornamentation (dominated by pit-like punctae), carapace shape, rostrum shape and telson spination. Species with similar carapace ornamentation are *O. timmsi* sp. nov. and *O. carnegiensis* sp. nov. *Ozestheria timmsi* differs by having a larger carapace (7.9–11.5 mm vs 6.1–7.0 mm), more antenna flagellomeres (15–22 vs 14–17) and more complete thorax segments (23–24 vs 21). *Ozestheria carnegiensis* differs by having a slightly shorter and more rounded condyle, less distinct lirae on the carapace, fewer antenna flagellomeres (≤14 vs ≥14) and larger and fewer (11–20 vs 22–31) telsonic spines.

Etymology

The species is named after Frederike Korth, the wife of MS – for everything.

Type material

Holotype

AUSTRALIA – **Queensland** • ♀; turbid pool 80 km S of Charleville; 27°04′59.0″ S, 146°01′42.2″ E; 17 Feb. 2010; M. Schwentner, C. Sieves and B.V. Timms leg.; GenBank no: KJ705769 (COI); AM P.91541.

Paratypes

AUSTRALIA – **Queensland** • 3 ♀♀; same data as for holotype; GenBank nos: KJ705767, KJ705770, KJ705771 (COI); AM P. 91539, P.91542, P.91543 • 1 ♀; same data as for holotype; GenBank no: KJ705768 (COI); NHMW-ZOO-CR-28481.

Additional material (not examined)

AUSTRALIA – **Queensland** • 5 juvs; big pool on Meandarra Road; 27°22′43.9″ S, 150°01′18.1″ E; 12 Feb. 2010; M. Schwentner, C. Sieves and B.V. Timms leg.; AM P.91534 to P.91538.

Type locality

Australia, Queensland, turbid pool 80 km S of Charleville, 27°04′59.0″ S, 146°01′42.2″ E.

Description

Females

Carapace (Fig. 18a–c). Length 6.1–7.0 mm (HT: 7.0 mm), height 4.3–4.7 (HT: 4.6 mm). Coloration reddish- or orange-brown, crowded growth bands lighter. 46–52 (HT: 46) growth lines, 16–22 (HT: 20) widely spaced and 26–32 (HT: 26) crowded; in some individuals ~2–3 widely spaced growth bands recurrently interspersed between crowded growth bands (secondary growth phase).

Carapace shape. Dorsal margin straight, dorso-posterior corner rounded. Posterior margin widely rounded, suboval, equicurvate to infracurvate (b/H 0.50–0.57, HT: 0.50). Ventral margin widely and equally rounded. Umbo anterior to submedian (Cr/L 0.23–0.26, HT: 0.24).

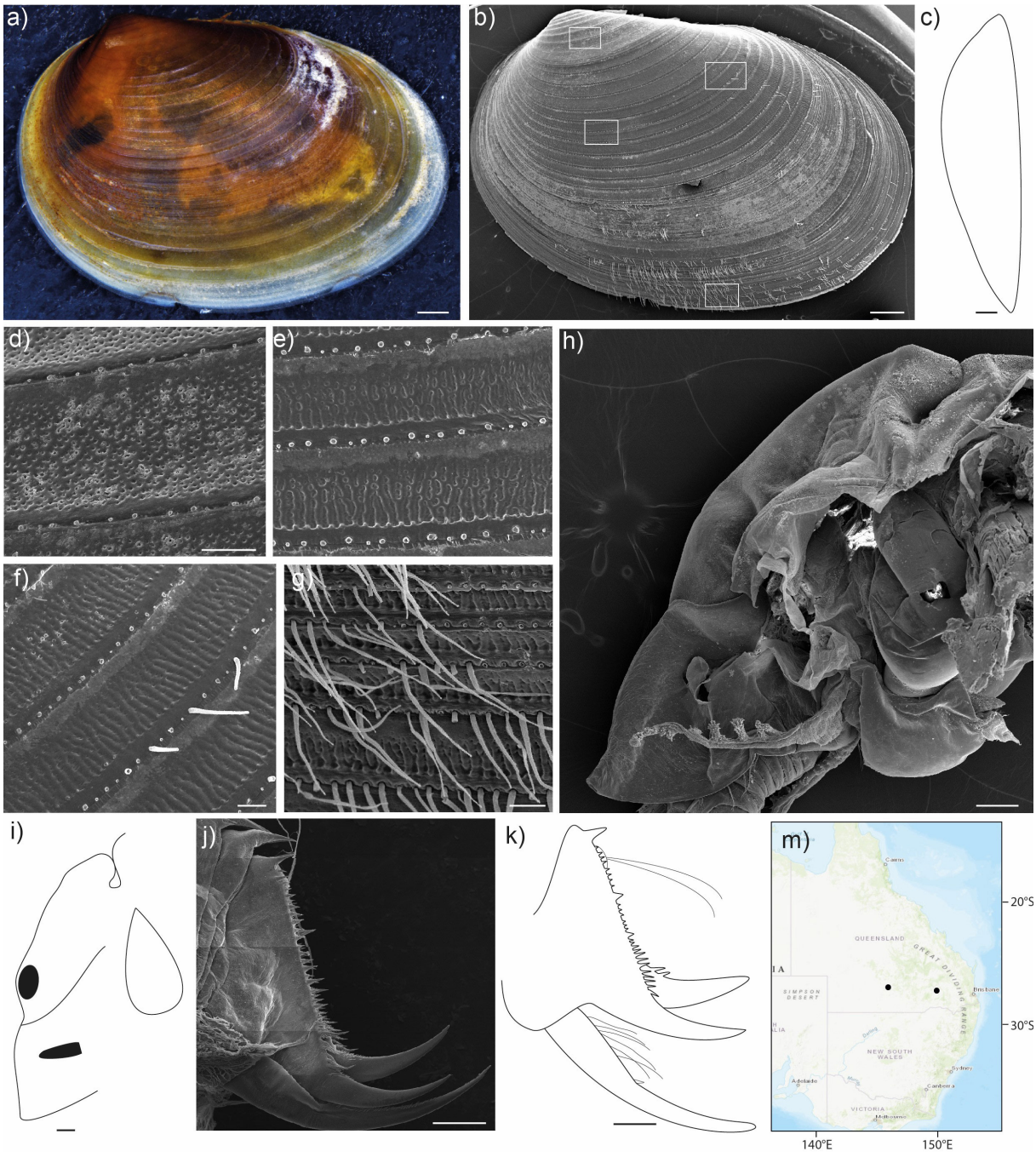

Fig. 18. *Ozestheria frederikeae* sp. nov. **a–c**. Carapace. **a**. Female, holotype (P.91541). **b**. Female, paratype (P.91542), SEM. **c**. Female, holotype, dorsal view (only left valve shown; AM P:91541). **d–g**. Carapace ornamentation of female paratype (P.91542; positions marked in b by rectangles), SEM. **d**. Dorsal carapace. **e**. Mid-carapace. **f**. Posterodorsal carapace. **g**. Ventral carapace. **h–i**. Head (antennae not shown). **h**. Female, paratype (P.91542), SEM. **i**. Female, holotype (P.91541). **j–k**. Telson. **j**. Female, paratype (P. 91542), SEM. **k**. Female, holotype (P.91541). **m**. Distribution map (produced in ArcMap 10.7; see caption Fig. 7 for sources). Scale bars: a–c = 0.5 mm; d–g = 0.05 mm; h–k = 0.2 mm.

Carapace ornamentation (Fig. 18d–g). Larval valve and first few growth bands smooth to finely granulated, under SEM finely punctate. Subsequent growth bands with irregular, poorly defined pits (punctae-like). From about mid-carapace, space between punctae raised to lirae, increasing in size on subsequent growth bands (giving the punctae an elongate, oval appearance under SEM). Crowded growth bands often too closely spaced for apparent ornamentation, else poorly defined lirae. Concentric ridges slightly raised (dorsally serrated under SEM and with small nodules in moniliform row). Setae filiform, preferentially preserved close to ventral margin; under SEM a single row of setal pores along all growth lines.

Head (Fig. 18h–i). Condyle long, distally rounded; occipital notch narrow. Condyle with weak anterobasal hump. Margin between condyle and ocular tubercle straight. Ocular tubercle weakly developed, forming obtuse (~120°) to nearly straight angle with rostrum. Anterior margin of rostrum undulating: dorsally weakly convex, ventrally weakly concave. Apex rounded, nearly rectangular (in some individuals protruding). Ventral margin of rostrum straight (HT) to convex (sometimes concave mid-length). Naupliar eye elongated, subtriangular to subrectangular (rounded edges). Antenna I long with 12–14 lobes (HT: 14), reaching to antenna II flagellomeres III–IV (HT: IV). Antenna II with 14–17 flagellomeres (HT: 14).

Thorax. 21–22 (HT: 21) segments, 21 thoracopod-bearing and none to one (HT: none) posterior limbless segments not reaching dorsal margin. Mid and posterior thoracopod-bearing segments with spine bearing dorsal extensions. Dorsal extensions increase in size posteriorly over successive segments. Spines short and stout, in posterior segments central spines increase in size and the total number of spines decreases.

Telson (Fig. 18j–k). 22–31 spines (HT: 29). First (anterior) spine enlarged. Spines mostly tiny, conical; posterior ⅓ with slightly thinner, larger and more drawn-out spines. Spines subequal in length and spacing, few (usually two) slightly larger spines interspersed in anterior ⅔ of spines. One or a few anterior spines not arranged along dorsal margin but slightly lateral. Dorsal margin nearly straight, not concavely curved. Right terminal claw more strongly curved than left, claws notably slender.

Furca (Fig. 18j–k). Proximally with dorsomedial longitudinal row of 6 setae, row ending distally in a single conical spine. Distal part ½–⅔ of furcal length, with numerous small denticles.

Males

Unknown.

Distribution (Fig. 18m)

The species is known only from two localities in southern Queensland close to the border to New South Wales. These populations are separated by ~400 km; thus, further populations can be assumed in this region.

Remarks

So far, only females have been collected. The second population identified by Schwentner *et al*. (2015a) yielded only juveniles.

Because only few specimens were available, the morphological variability of the species is not well characterized. The carapace shape of *O. frederikeae* sp. nov. (Fig. 6) is distinct from that of most other species and partly overlaps with *O. timmsi* sp. nov. (marginally), *O. jonnae* sp. nov., *O. cancellata* comb. nov.

Ozestheria fuersichi sp. nov.

urn:lsid:zoobank.org:act:862B6BE4-936F-4F8A-A2F0-B8BB4581CE5B

Fig. 19

Ozestheria sp. E – Schwentner *et al*. 2015a: figs 2, 6; 2020: figs 1–2.

Diagnosis

Ozestheria fuersichi sp. nov. is characterized by a long condyle and a narrow occipital notch; carapace ornamentation on larval valve and first growth bands tiny polygonal reticulation, following growth bands

with widely spaced subparallel lirae, punctae (hardly visible) between lirae; male rostrum with weakly convex to straight anterior margin, apex pointed with acute angle (~60°) rarely rounded, ventral margin concavely curved; female rostrum with concave anterior margin, apex weakly drawn out and pointed with acute angle (~70–80°), ventral margin weakly convex to straight; 13–14 (male) or 10–16 (female) antenna I lobes reaching to antenna II flagellomeres VI–VIII (male) or IV–V (female); 10–12 (male) or 11–14 (female) antenna II flagellomeres; 22 complete thorax segments; 19–25 telsonic spines, spines short with 1–4 larger spines interspersed, anterior spines conical, posterior spines increase slightly in size and are longer, drawn out, aciculate and more closely spaced; 6–10 furcal setae.

Differential diagnosis

Ozestheria fuersichi sp. nov. can be differentiated from many other species of *Ozestheria* by the narrow occipital notch and long condyle in combination with the carapace ornamentation (dominated by punctate ornamentation dorsally on the carapace, transitioning to distinct, subparallel lirae during ontogeny), except from *O. cancellata* comb. nov., *O. minor* comb. nov., *O. typica* comb. nov., *O. jonnae* sp. nov., *O. marthae* sp. nov., *O. selmae* sp. nov., *O. radiata* sp. nov., *O. bourkensis* sp. nov., *O. rincewindi* sp. nov., *O. barcaldinensis* sp. nov., *O. ngamurru* sp. nov., *O. beleriandensis* sp. nov., *O. quinlanae* sp. nov., *O. glabra* sp. nov., *O. pilbarensis* sp. nov. and *O. weeksi* sp. nov., and differentiating these species can be difficult. *Ozestheria fuersichi* differs from these species in having polygonal ornamentations on the ontogenetically earliest growth bands (shared only with *O. pilbarensis*), widely spaced lirae that are not continuous but a row of nodular structures (only seen under SEM), in the shape of the male rostrum (which is more elongated and slender than in the other species), the shape of the female rostrum (with a concave anterior margin which curves the apex anteriorly) and the spination of the telson with several distinctly larger spines interspersed (though this is also present in some of the other species).

Etymology

The species is named after German paleontologist Franz T. Fürsich, honoring his significant contributions to invertebrate paleontology, which sparked MH's curiosity in fossil clam shrimp.

Type material

Holotype

AUSTRALIA – **Queensland** • ♂; Barcaldine Region, pool next to Lake Dunn; 22°36′16.4″ S, 145°40′21.8″ E; 14 Feb. 2010; M. Schwentner, C. Sieves and and B.V. Timms leg.; GenBank no: KJ705655 (COI); AM P.91426.

Paratypes

AUSTRALIA – **Queensland** • 1 ♂, 1 ♀; same data as for holotype; GenBank nos: KJ705653, KJ705656 (COI); AM P.91424, P.91427 • 1 ♀; same data as for holotype; GenBank no: KJ705654 (COI); NHMW-ZOO-CR-28478.

Other material examined

AUSTRALIA – **Queensland** • 1 ♂; old dugout close to Lake Dunn; 22°36′12.9″ S, 145°40′26.6″ E; 14 Feb. 2010; M. Schwentner, C. Sieves and B.V. Timms leg.; AM P.91420 • 3 ♀♀; old borrow pit, Monklands Road; 23°37′34.8″ S, 146°21′11.7″ E; 14 Feb. 2010; M. Schwentner, C. Sieves and B.V. Timms leg.; AM P.91421 to P.91423.

Type locality

Australia, Queensland, Barcaldine Region, pool next to Lake Dunn, 22°36′16.4″ S, 145°40′21.8″ E.

Description

Males

Carapace (Fig. 19a–c). Length 3.7–4.3 mm (HT: 3.7 mm), height 2.3–2.7 mm (HT: 2.3 mm). Coloration light brown, outer margin lighter. 19–21 growth lines (HT: 19), 15–18 (HT: 16) widely spaced and 3–6 (HT: 3) crowded.

Carapace shape. Dorsal margin straight, distinct dorso-posterior corner. Posterior margin broadly rounded, weakly extending posteriorly, supracurvate to equicurvate (b/H 0.46–0.49, HT: 0.46). Ventral margin nearly straight. Umbo position submedian (Cr/L 0.26–0.27, HT: 0.26).

Carapace ornamentation (Fig. 19d–e). Larval valve and following few growth bands covered in mesh of shallow, poorly visible polygonal reticulations, mostly tetragons, pentagons and hexagons. Following growth bands with widely spaced, subparallel lirae; lirae dorsally often anastomosing or confluent, with shorter lirae intercalating on the ventral part of each growth band (predominantly in the posterior region of the carapace), under SEM lirae not continuous but formed by a series of nodular structures; punctae interspersed between lirae (but poorly visible under incident light). Crowded growth bands lacking apparent ornamentation (punctate under SEM). Concentric ridges raised. Setae filiform, under SEM a single row of setal pores along all growth lines.

Head (Fig. 19g). Condyle long, distally rounded; occipital notch narrow. Condyle with weakly developed or absent anterobasal hump. Margin between condyle and ocular tubercle straight to weakly concave. Ocular tubercle weakly developed, forming obtuse angle with rostrum (~120°). Anterior margin of rostrum weakly convex to straight (HT: weakly convex). Ventral margin of rostrum concavely curved with obtuse angle about half-length, pointing apex slightly downwards; apex pointed, acute (~60°), rarely rounded. Naupliar eye large and elongated, subrectangular with irregular margins to subtriangular or suboval. Antenna I with 13–14 lobes (HT: 14), reaching to antenna II flagellomeres VI–VIII (HT: VIII). Antenna II with 10–12 flagellomeres (HT: 11).

Thorax. 22–23 (HT: 22) segments, 22 thoracopod-bearing and none to one (HT: none) posterior limbless segment not reaching dorsal margin. Dorsal armature with thin and elongated spines, becoming shorter and stouter in posterior segments.

Thoracopod III (only P.91426; Fig. 19f). Endite I short and curved dorsally. Endites II–V broad, decreasing in size. Endite V palp two-segmented, basal segment sub-equal to endopod. Exopod ventral extension shorter in extension to endopod, dorsal extension wide, narrowing distally, overreaching epipod. Epipod long, cylindric.

Telson (Fig. 19i). 19–23 spines (HT: 20). First (anterior) spine enlarged. Spines short, conical, subequal in size and spacing, slightly increasing in size posteriorly, with 1–4 (HT: 4) larger spines interspersed; posterior most spines slightly larger, drawn out and aciculate. Dorsal margin nearly straight. Terminal claws subequally curved.

Furca (Fig. 19i). Proximally with dorsomedial longitudinal row of 8–10 (HT: eight) setae, row ending distally in a single conical spine. Distal part of ~⅔ of furca length, widely curved, with numerous small denticles.

Females

Very similar to males. Carapace length 4.4– 5.1 mm, height 2.7 – 3.2 mm. 17–19 growth lines, of these 15–18 widely spaced and 0–3 crowded; Cr/L 0.24–0.28 and b/H 0.44–0.49. Ocular tubercle and rostrum form nearly straight angle (Fig. 19h). Anterior margin of rostrum concave, apex weakly drawn out, pointed, with acute angle (~70–80°), ventral margin weakly convex to straight. Antenna I with 10–16 indistinct lobes, reaching to antenna II flagellomeres IV–V. Antenna II with 11–14 flagellomeres. Telson 19–25 spines (Fig. 19j), shape and arrangement as in males. Furca bearing 6–10 setae.

Distribution (Fig. 19k)

The species occurs in central Queensland, in the northern regions of the Cooper Creek catchment.

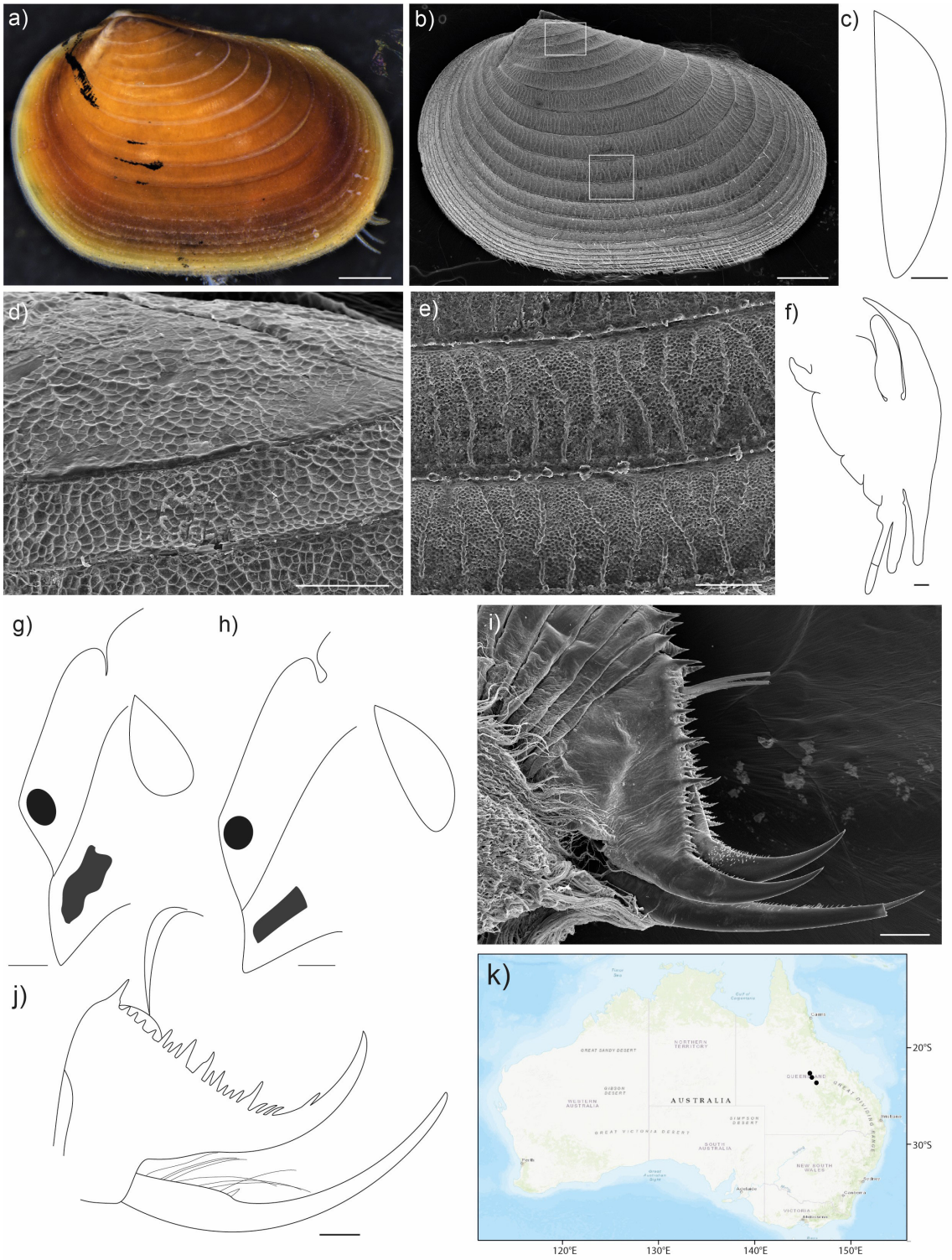

Fig. 19. *Ozestheria fuersichi* sp. nov. **a**. Carapace (male, holotype, P.91426). **b**. Carapace (male paratype, P.91427), SEM. **c**. Carapace, dorsal view (right valve only, male, holotype, P.91426). **d–e**. Carapace ornamentation (male paratype, P.91427; positions marked in b by rectangles), SEM. **d**. Dorsal carapace. **e**. Mid-carapace. **f**. Third left thoracopod (male, holotype, P.91426). **g–h**. Head (antennae not shown). **g**. Male, holotype (P.91426). **h**. Female, paratype (P.91424). **i–j**. Telson. **i**. Male, paratype (P.91427). **j**. Female, paratype (P.91424). **k**. Distribution map (produced in ArcMap 10.7; see caption Fig. 7 for sources). Scale bars: a–c, g = 0.5 mm; d–f, i–j = 0.1 mm; h = 0.2 mm.

Remarks

The carapace shape of *Ozestheria fuersichi* sp. nov. (Fig. 6) is distinct from all that of other species in the analysis of short-condyled species (Fig. 5). In the analysis of long-condyled species, *O. fuersichi* overlaps partly with *O. minor* comb. nov., *O. selmae* sp. nov., *O. cancellata* comb. nov. and *O. weeksi* sp. nov. and fully with *O. setifera* sp. nov.

Ozestheria gemina sp. nov.

urn:lsid:zoobank.org:act:13753FE1-0128-4CB7-A344-E4F776360B0A

Fig. 20

Ozestheria sp. N1 – Schwentner *et al*. 2015a: figs 2, 6.
Ozestheria cf. *berneyi* (N) – Schwentner *et al*. 2020: figs 1–2.
Ozestheria sp. N – Hethke *et al*. 2023: fig. 11.

Diagnosis

Ozestheria gemina sp. nov. is characterized by a medium long condyle and rather narrow occipital notch; a rounded ventral carapace margin; carapace ornamentation with polygonal reticulations on larval valve and early growth bands, following growth bands with anastomosing lirae, which become more pronounced and regular in later growth bands, where lirae terminate before the concentric ridge, punctae between lirae; male rostrum anterior margin straight to weakly convex, apex pointed with acute angle (~45–60°, rarely close to 90°), ventral margin deeply concave with obtuse angle about half-length; female rostrum anterior margin straight to slightly convex (sometimes undulating), apex pointed (~45–60°) and drawn out into acute tip, ventral margin weakly concave; 12–22 (males) or 13–18 (female) antenna I lobes reaching to antenna II flagellomeres VI–X (male) or III–VIII (female); 11–15 (male) or 11–15 (female) antenna II flagellomeres; 23–25 complete thorax segments; 14–24 telsonic spines, spines mostly small, conical and subequal in size and spacing, 2–3 (up to 5) larger spines interspersed; 5–15 furcal setae.

Differential diagnosis

Ozestheria gemina sp. nov. can be easily distinguished from most other Australian species of *Ozestheria* by the combination of its carapace shape and ornamentation (combination of reticulations and lirae), the pointed male rostrum apex and the telsonic spination (many small spines with 2–5 larger spines interspersed). Morphologically most similar are *O. fuersichi* sp. nov. and *O. berneyi*. *Ozestheria berneyi* has a shorter condyle and the carapace ornamentation has polygonal reticulations dorsally within growth bands. *Ozestheria fuersichi* is smaller (carapace length 3.7–5.1 mm), has a nearly straight ventral carapace margin, carapace ornamentation with more widely spaced, nodular lirae, and the female rostrum has a concave anterior margin.

Etymology

The species name derives from the Latin word '*geminus*' ('the twin'), referring to its similarity to its sister species *O. berneyi*.

Type material

Holotype

AUSTRALIA – **Queensland** • ♂; Yapunyah pool 36 km N of highway; 27°49′09.6″ S, 144°09′26.5″ E; 28 Feb. 2011; M. Schwentner and B.V. Timms leg.; GenBank no: KJ705433 (COI); AM P.91204.

Paratypes

AUSTRALIA – **Queensland** • 1 ♂, 1 ♀; same data as for holotype; GenBank nos: KJ705435, KJ705436 (COI); AM P.91206 to P.91207 • 1 ♂; same data as for holotype; GenBank no: KJ705435 (COI); NHMW-ZOO-CR-28475.

Other material examined

AUSTRALIA – **Queensland** • 1 ♂; Yarromere Station, Morra Creek (M1); 21°28′51.9″ S, 145°49′34.0″ E; 3 Apr. 2009; M. Schwentner and B.V. Timms leg.; AM P.91250 • 1 ♂; roadside claypan; 29°31′42.5″ S, 146°12′20.5″ E; 21 Jan. 2010; M. Schwentner and B.V. Timms leg.; AM P.91232 • 1 ♂, 1 ♀; grassy turbid swamp; 27°41′52.4″ S, 146°45′44.7″ E; 18 Feb. 2010; M. Schwentner, C. Sieves and B.V. Timms leg.; AM P.91257, P.91258 • 2 ♂♂, 2 ♀♀; *Cyclestheria* grassy swamp; 27°40′48.8″ S, 146°38′02.7″ E; 18 Feb. 2010; M. Schwentner, C. Sieves and B.V. Timms leg.; AM P.91225, P.91226, P.91251, P.91252 • 1 ♂, 2 ♀♀; dugout 21 km E of Thargomindah; 28°02′05.2″ S, 144°03′15.7″ E; 27 Feb. 2011; M. Schwentner and B.V. Timms leg.; AM P.91208 to P.91210. – **New South Wales** • 1 ♂, 1 ♀; Bloodwood Station, Upper Crescent Pool; 29°32′33.6″ S, 144°52′16.5″ E; 30 Mar. 2009; M. Schwentner and B.V. Timms leg.; AM P.91188, P.91189 • 2 ♂♂, 1 ♀; Bloodwood Station, Lower Crescent Pool; 29°32′34.5″ S, 144°51′31.6″ E; 19 Jan. 2010; M. Schwentner and B.V. Timms leg.; AM P.91233 to P.91235 • 2 ♀♀; Gidgee Lake; 29°33′10.4″ S, 144°50′12.7″ E; 19 Feb. 2010; M. Schwentner, C. Sieves and B.V. Timms leg.; AM P.91227, P.91228 • 3 ♂♂, 1 ♀; cane grass swamp SE of Woolshed; 29°31′35.3″ S, 144°51′39.2″ E; 21 Feb. 2011; M. Schwentner, S. Richter and B.V. Timms leg.; AM P.91221 to P.91224 • 2 ♀♀; Bloodwood Station, Vosper Pool; 29°32′03.9″ S, 144°50′37.7″ E; 19 Jan. 2010; M. Schwentner and B.V. Timms leg.; AM P.91246, P.91247 • 1 ♂, 1 ♀; Muella Station, Muella Vegetated Pool 3; 29°30′12.0″ S, 144°55′37.4″ E; 31 Mar. 2009; M. Schwentner and B.V. Timms leg.; AM P.91190, P.91191 • 1 ♀; Muella Station, Muella Vegetated Pool 4; 29°30′00.7″ S, 144°54′59.6″ E; 31 Mar. 2009; M. Schwentner and B.V. Timms leg.; AM P.91186 • 2 ♂♂, 2 ♀♀; Muella Station, Upper Lake Eliza; 29°25′46.0″ S, 145°04′12.6″ E; 31 Mar. 2009; M. Schwentner and B.V. Timms leg.; AM P.91187, P.91229 to P.91231 • 2 ♂♂; Muella Station, Lismore Bore; 29°31′50.7″ S, 144°59′28.1″ E; 19 Jan. 2010; M. Schwentner and B.V. Timms leg.; AM P.91239, P.91240 • 1 ♂; Yungerina black box swamp; 29°26′09.1″ S, 145°04′40.3″ E; 20 Jan. 2010; M. Schwentner and B.V. Timms leg.; AM P.82534 • 4 ♀♀; Yantabulla black box swamp; 29°20′17.8″ S, 145°00′09.7″ E; 20 Jan. 2010; M. Schwentner and B.V. Timms leg.; AM P.91242 to P.91245 • 1 ♂; Mitchell Highway 152 km from Bourke; 31°11′45.0″ S, 146°51′31.4″ E; 18 Jan. 2010; M. Schwentner and B.V. Timms leg.; AM P.81401 • 1 ♂; Mitchell Highway, 40 km N of Nyugen; 31°11′45,9″ S, 146°51′30,1″ E; 1999; S. Richter and B.V. Timms leg.; AM P.91208 • 1 ♂; claypan-like W of Engonia; 29°18′32.8″ S, 145°44′06.9″ E; 21 Jan. 2010; M. Schwentner and B.V. Timms leg.; AM P.91241 • 1 ♂, 1 ♀; pool S of Gerara; 29°13′51.4″ S, 146°18′22.6″ E; 21 Jan. 2010; M. Schwentner and B.V. Timms leg.; AM P.82577, P.82578 • 1 ♂, 1 ♀; excavated area W of Yarrabundai; 33°07′28.5″ S, 147°32′09.8″ E; 23 Jan. 2010; M. Schwentner and B.V. Timms leg.; AM P.91236, P.91237 • 2 ♂♂, 3 ♀♀; thoura poplar box swamp; 29°16′11.2″ S, 144°40′25.3″ E; 24 Feb. 2011; M. Schwentner, S. Richter and B.V. Timms leg.; AM P.91211 to P.91215.

Additional material (not examined)

AUSTRALIA – **New South Wales** • 5 juvs; Muella Station, Lower Lake Eliza; 29°25′28.9″ S, 145°03′41.8″ E; 22 Feb. 2011; M. Schwentner, S. Richter and B.V. Timms leg.; AM P.91216 to P.91220 • 1 juv.; Muella Station, Carrols Bore; 29°29′08.7″ S, 144°59′13.0″ E; 31 Mar. 2009; M. Schwentner and B.V. Timms leg.; AM P.P.80859 • 1 ♀; Yantabulla black box swamp; 29°20′17.8″ S, 145°00′09.7″ E; 20 Jan. 2010; M. Schwentner and B.V. Timms leg.; AM P.91203 • 1 ♂; Bloodwood Station, Lower Crescent Pool; 29°32′34.5″ S, 144°51′31.6″ E; 19 Jan. 2010; M. Schwentner and B.V. Timms leg.; AM P.91248 • 1 ♀; Bloodwood Station, Gidgee Lake; 29°33′10.4″ S, 144°50′12.7″ E; 19 Feb. 2010; M. Schwentner, C. Sieves and B.V. Timms leg.; AM P.91196 • 2 ♀♀; Bloodwood Station, Freshwater Lake; 29°29′14.7″ S, 144°49′59.0″ E; 19 Feb. 2010; M. Schwentner, C. Sieves and B.V. Timms leg.; AM P.91201, P.91202 • 2 juvs; Bloodwood Station, western fence N of Titanic; 29°24′58.4″ S, 144°46′52.8″ E; Mar. 2006; B.V. Timms leg.; AM P.91183, P.91184 • 1 ♂, 2 ♀♀, 1 juv.; Tiltargara; 31°51′09.9″ S, 144° 52′22.4″ E; 22 Jan. 2010; M. Schwentner and B.V. Timms leg.; raised from sediment; AM P.91238, P.91197 to P.91199. – **Queensland** • 1 juv.; Rockwell Station, Busters black box swamp, Blue Lakes; 28°47′53.9″ S,

145°00′58.5″ E; 31 Mar. 2009; M. Schwentner and B.V. Timms leg.; AM P.91185 • 1 juv.; Yarromere Station, Morra Creek (M1); 21°28′51.9″ S, 145°49′34.0″ E; 3 Apr. 2009; M. Schwentner and B.V. Timms leg.; AM P.91192 • 1 ♀; *Cyclestheria* grassy swamp; 27°40′48.8″ S, 146°38′02.7″ E; 18 Feb. 2010; M. Schwentner, C. Sieves and B.V. Timms leg.; AM P.91195.

Type locality

Australia, Queensland, Yapunyah pool 36 km N of Highway, 27°49′09.6″ S, 144°09′26.5″ E.

Description

Males

Carapace (Fig. 20a, c–d). Length 4.6–7.5 mm (HT: 4.6 mm, mean: 6.1 mm), height 2.6–4.7 mm (HT: 2.6 mm, mean: 3.8 mm). Coloration varying from yellowish to yellow-orange, red-orange and light brown; outer margin lighter. 15–52 (HT: 22, mean: 25) growth lines, 15–24 (HT: 17, mean: 18) widely spaced and 0–34 (HT: 5, mean: 7) crowded.

Carapace shape. Dorsal margin straight, distinct or rounded dorso-posterior corner. Posterior margin broadly rounded, suboval (more circular than in many other species), supra- to equicurvate (b/H 0.43–0.48; HT: 0.48, mean: 0.46). Ventral margin broadly rounded. Umbo position anterior (Cr/L 0.20–0.25; HT: 0.20, mean: 0.21).

Carapace ornamentation (Fig. 20e–g, i). Larval valve and first few growth bands with shallow, inconspicuous reticulations (poorly visible in many specimens, may appear granular) forming mainly irregular pentagons or hexagons. Reticulations gradually replaced by lirae in first few growth bands. Lirae subparallel, strongly anastomosing or branching, becoming more pronounced and regular on growth bands of later ontogenetic stages, where they terminate before the concentric ridge (only seen in SEM). Lirae can be inconspicuous, especially on lighter colored carapaces. Under SEM, fine punctae visible between lirae in early ontogenetic stages, which are irregular to absent in later ontogenetic stages. Crowded growth bands with pronounced, parallel lirae, anteriorly nodular and intermittent (visible predominately under SEM). Concentric ridges raised; under SEM smooth in early ontogenetic stages and with nodules at the upper margin in moniliform row in later ontogenetic stages. Spiniform as well as filiform setae present (mainly preserved on outer concentric ridges), usually ~5 spiniform setae between two filiform ones; setal pores in single row along all growth lines.

Head (Fig. 20j). Condyle medium long, distally rounded; occipital notch spacing intermediate between narrow and wide. Condyle lacking anterobasal hump. Margin between condyle and ocular tubercle straight to strongly concave (HT: weakly concave). Ocular tubercle weakly developed, forming obtuse angle (ranging from nearly straight to nearly rectangular; HT: nearly rectangular;) with rostrum. Anterior margin of rostrum straight to weakly convex. Apex pointed, acute (~45–60°; rarely close to 90°), but not drawn out. Ventral margin of rostrum deeply concave with obtuse angle about half-length, pointing apex slightly downwards. Naupliar eye elongated, shaped suboval to sub-triangular. Antenna I long with 12–22 lobes (HT: 17, mean: 18), reaching to antenna II flagellomeres VI–X (HT: VIII, mean: VIII). Antenna II with 11–15 flagellomeres (HT: 10, mean: 12).

Thorax. 23–25 (HT: 25, mean: 24) segments, 23–25 (HT: 24, mean: 24) thoracopod-bearing and none to two (HT: one) posterior limbless segment not reaching dorsal margin. Last ~16 thoracopod-bearing segments with spine or setae bearing dorsal extensions. Dorsal extensions increasing in size posteriorly over successive segments (until ~10th last segment). Armature starts with small setae, which increase in size and number over following ~6 segments, following segments with fewer setae and central large spines. Posterior segments with few stout spines.

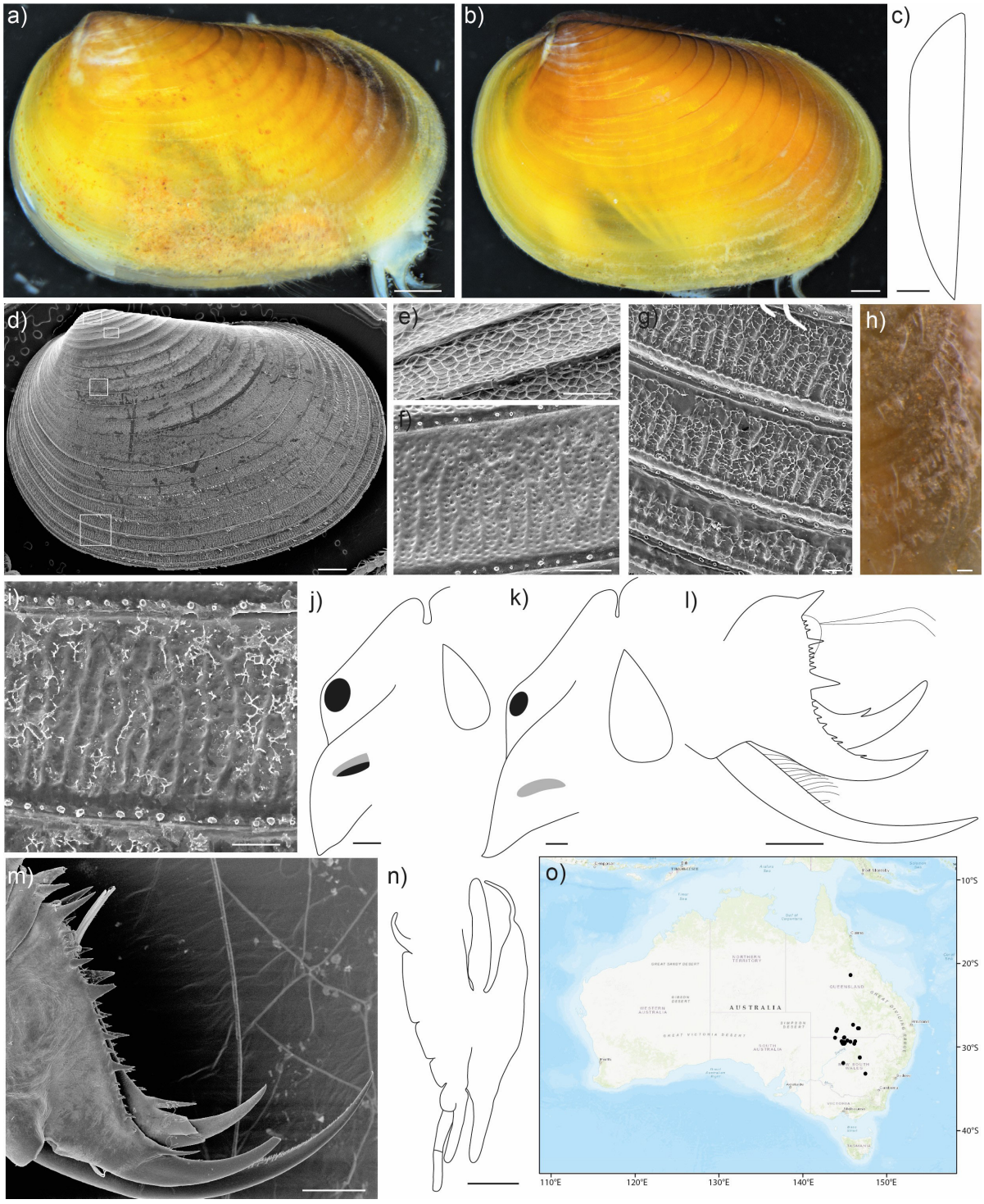

Fig. 20. *Ozestheria gemina* sp. nov. **a–d**. Carapace. **a**. Male, holotype (P.91204). **b**. Female, paratype (P.91206). **c**. Male, holotype, dorsal view (only left valve shown; P.91204). **d**. Male, paratype (P.91207), SEM. **e–g**, **i**. Carapace ornamentation of male paratype (P.91207; positions marked in d by rectangles), SEM. **e**. Dorsal carapace. **f**. Dorsal carapace. **g**. Ventral carapace. **i**. Mid-carapace. **h**. Carapace setation mid-carapace (P.91229). **j–k**. Head (antennae not shown). **j**. Male, holotype (P.91204). **k**. Female, paratype (P.91206). **l–m**. Telson. **l**. Male, holotype (P.91204). **m**. Male, paratype (P.91207), SEM. **n**. Male, paratype third right thoracopod (P.91205). **o**. Distribution map (produced in ArcMap 10.7; see caption Fig. 7 for sources). Scale bars: a–d, n = 0.5 mm; e–h = 0.05 mm; i–m = 0,2 mm.

Thoracopod III (only P.91205; Fig. 20n). Endite I short and curved dorsally. Endites II–V broad, decreasing in size. Endite V palp two-segmented, basal segment shorter than endopod. Exopod ventral extension subequal in extension to endopod, dorsal extension wide, narrowing distally, overreaching epipod. Epipod long, cylindric.

Telson (Fig. 20l–m). 15–21 spines (HT: 17, mean: 19). First (anterior) spine enlarged. Following spines mostly tiny, conical, usually 2–3 (rarely up to five; HT: 2) larger spines interspersed (of these usually one of intermediate size) in anterior ⅔ of telson length. Sometimes an additional enlarged, aciculate spine posteriorly. Spines equally spaced. Dorsal margin usually straight, sometimes posterior ¼ curved. Right terminal claw more strongly curved at tip than left terminal claw in most individuals, sometimes both equally curved.

Furca (Fig. 20l–m). Proximally with dorsomedial longitudinal row of 5–15 (HT: 11, mean: 11) setae, row ending distally in a single conical spine. Distal part ~⅔ of furcal length, with numerous small denticles.

Females

Overall appearance as in males. Carapace (Fig. 20b) length 4.5–7.8 mm (mean: 6.8 mm), height 2.7–4.8 mm (mean: 4.2 mm); 17–31 (mean: 23) growth lines, of these 14–24 (mean: 18) widely spaced and 0–13 (mean: 4) crowded. Anterior margin of rostrum straight to slightly convex, sometimes undulating (Fig. 20k). Apex pointed (~45–60°), drawn out into acute tip; ventral margin only weakly concave, overall rostrum shape trapezoidal. Antenna I with 13–18 (mean: 16) small lobes, lobes smaller than in males; reaching to antenna II flagellomeres III–VIII (mean: VI). Antenna II with 11–15 flagellomeres (mean: 13). 23–25 (mean: 24) segments, of these 23–25 (mean: 24) thoracopod-bearing and none to one posterior limb-less segment not reaching dorsal margin. Telson with 14–24 (mean: 19) dorsal spines; left and right terminal claws usually equally curved, sometimes right more strongly curved. Furca with 5–13 setae (mean: 9).

Distribution (Fig. 20o)

Common and widely distributed in the arid regions of central and northern New South Wales and southern Queensland (e.g., catchments of Murray-Darling Basin, Bulloo River), rarely northern Queensland (northern Cooper Creek catchment). This species lives in a wide variety of habitats, ranging from clear freshwater lakes to vegetated swamps, poplar box swamps, turbid claypans and cane grass swamps, and hyposaline lakes.

Remarks

Schwentner *et al*. (2015a) suggested that either *O.* sp. M or N might represent *O. berneyi*. By studying the type material, we were able to identify *O*. sp. M as *O. berneyi* (for details see remarks of *O. berneyi*). The authors furthermore suggested that *O.* sp. N comprises two closely related species (*O.* sp. N1 and N2). Only two specimens of *O*. sp. N2 were available (which might not be fully grown), which does not allow proper assessment of the species morphological variability and putative differentiation from *O*. sp. N1. Therefore, we decided not to formally describe *O*. sp. N2 in this publication and also did not include them in the formal description of *O. gemina* sp. nov.

Because of its intermediate-sized condyle, *O. gemina* sp. nov. was included in the geometric morphometric analyses of the short-condyle as well as of the long-condyle species (Figs 5–6). In both analyses, *O. gemina* was largely distinct and overlapped partly with *O. berneyi*, *O. rubra*, *O. henryae* sp. nov. and *O. richteri* sp. nov. (*O. richteri* was fully included in *O. gemina*) of the short-condyled species and partly with *O. timmsi* sp. nov., *O. setifera* sp. nov., *O. sivesae* sp. nov., *O. mariae*, *O. marthae* sp. nov.,

O. cancellata comb. nov., *O. weeksi* sp. nov., and *O. pilbarensis* sp. nov. of the long-condyled species. In the analysis of long-condyled species, *O. gemina* forms the extreme shape at positive scores along PC1.

It is notable that presumably older males (those with more crowded growth bands) tend to have a more strongly rounded rostrum apex.

Ozestheria glabra sp. nov.
urn:lsid:zoobank.org:act:C7EABB87-12D9-4F66-8C8F-5FEECF5D1C4F
Fig. 21

Diagnosis

Ozestheria glabra sp. nov. is characterized by a long condyle and a narrow occipital notch; carapace ornamentation dorsally on carapace punctate (may appear granular), in following growth bands anastomosing lirae forming ventrally within growth band, lirae become longer, less anastomosing and more pronounced with progressing growth bands, lirae terminate in nodule; male rostrum with straight anterior margin, apex broadly rounded with right angle, ventral margin weakly convex with pronounced anterior notch; 13 (male) antenna I lobes reaching to antenna II flagellomeres VIII (male); 16 (male) antenna II flagellomeres; 20 complete thorax segments; 11 telsonic spines, most spines small and conical with one larger spine interspersed, most spines crowded anteriorly on telson (spination pattern may be a growth defect); 11 furcal setae.

Differential diagnosis

Ozestheria glabra sp. nov. can be differentiated from many other species of *Ozestheria* by the narrow occipital notch and long condyle in combination with the carapace ornamentation (dominated by punctate ornamentation dorsally on carapace, transitioning to distinct, subparallel lirae during ontogeny), except from *O. cancellata* comb. nov., *O. minor* comb. nov., *O. typica* comb. nov., *O. fuersichi* sp. nov., *O. marthae* sp. nov., *O. selmae* sp. nov., *O. radiata* sp. nov., *O. bourkensis* sp. nov., *O. jonnae* sp. nov., *O. barcaldinensis* sp. nov., *O. ngamurru* sp. nov., *O. beleriandensis* sp. nov., *O. quinlanae* sp. nov., *O. rincewindi* sp. nov., *O. pilbarensis* sp. nov. and *O. weeksi* sp. nov., and differentiating these species can be difficult. *Ozestheria glabra* has fewer complete thorax segments than *O. cancellata* and *O. jonnae*, more antenna II flagellomeres, and the male rostrum has a more convex anterior margin and rounded apex than *O. ngamurru*.

Etymology

The species name derives from the Latin word '*glaber*' ('smooth'), referring to the conspicuous gap in telson spination.

Type material

Holotype

AUSTRALIA – **Western Australia** • ♂; Carnarvon Range Gully, 118 km E of Kumarina; 25°05′17.4″ S, 122°39′37.4″ E; 20 Mai 2013; K. Quinlan leg.; WAM C77996.

Type locality

Western Australia, Carnarvon Range Gully, 118 km E of Kumarina, 25°05′17.4″ S, 122°39′37.4″ E.

Description

Male (holotype)

Carapace (Fig. 21a–c). Length 7.1 mm, height 3.9 mm. Coloration brown. 59 growth lines, of these 17 widely spaced in the primary growth phase, 7 crowded growth lines, 10 widely spaced growth lines of secondary growth phase and 25 crowded growth lines.

Carapace shape. Dorsal margin straight, dorso-posterior corner rounded. Posterior margin broadly rounded, suboval. Ventral margin broadly rounded. Umbo position submedian (Cr/L 0.28).

Carapace ornamentation (Fig. 21d–h). Larval valve and dorsal growth bands punctate (best visible under SEM). In following growth bands, subparallel and weakly anastomosing lirae form ventrally within growth bands between punctae, lirae become more prominent and longer in subsequent growth bands. From about mid-carapace lirae distinct, subparallel (less anastomosing), spanning full growth bands and terminating in distinct nodule on concentric ridge. Crowded growth bands with short, distinct lirae. Growth bands of secondary growth phase with distinct, subparallel, slightly nodular lirae terminating in distinct nodule. Concentric ridges raised. No setae preserved (under SEM single row of setal pores along all growth lines).

Head (Fig. 21i). Condyle long, distally rounded; occipital notch very narrow. Condyle with weakly developed anterobasal hump. Margin between condyle and ocular tubercle straight. Ocular tubercle weakly developed, forming obtuse angle (~120°) with rostrum. Frontal margin of rostrum straight, ventral margin weakly convex with pronounced anterior notch, apex rounded with right angle. Naupliar eye large, subtriangular, strongly rounded anteriorly. Antenna I with 13 lobes, reaching to antenna II flagellomere VIII. Antenna II anterior ramus 16 flagellomeres.

Thorax. 21 segments, 20 thoracopod-bearing and one limbless segment not reaching dorsal margin. From about midbody, thoracopod-bearing segments with dorsal extensions bearing spines.

Thoracopod III (only WAM C77996; Fig. 21k). Endite I short and curved dorsally. Endites II–V broad, decreasing in size. Endite V palp two-segmented, basal segment shorter than endopod. Exopod ventral extension subequal in extension to endopod, dorsal extension wide, narrowing distally, overreaching epipod. Epipod long, cylindric.

Telson (Fig. 21j). 11 spines. First spine (anterior) enlarged. Most spines small, conical, and sub-equal in length and crowded at the anterior end of the telson; one larger spine interspersed and one aciculate spine posteriorly with wide gap between this and all other spines. Spination pattern appears to be a growth defect. Terminal claw strongly curved, more strongly curved on right body half. Dorsal margin nearly straight, posteriorly concavely curved.

Furca (Fig. 21j). Proximally with dorsomedial longitudinal row of 11 setae, row ending distally in a single conical spine. Distal part ~½ of furca length, with numerous small denticles.

Distribution (Fig. 21l)

Currently known only from its type locality in central Western Australia.

Remarks

The carapace shape of the single specimen of *Ozestheria glabra* sp. nov. (Fig. 6) is associated with that of *O. jiangi* sp. nov., *O. minor* comb. nov., *O. jonnae* sp. nov., *O. selmae* sp. nov., *O. echidna* sp. nov., and *O. cancellata* comb. nov.

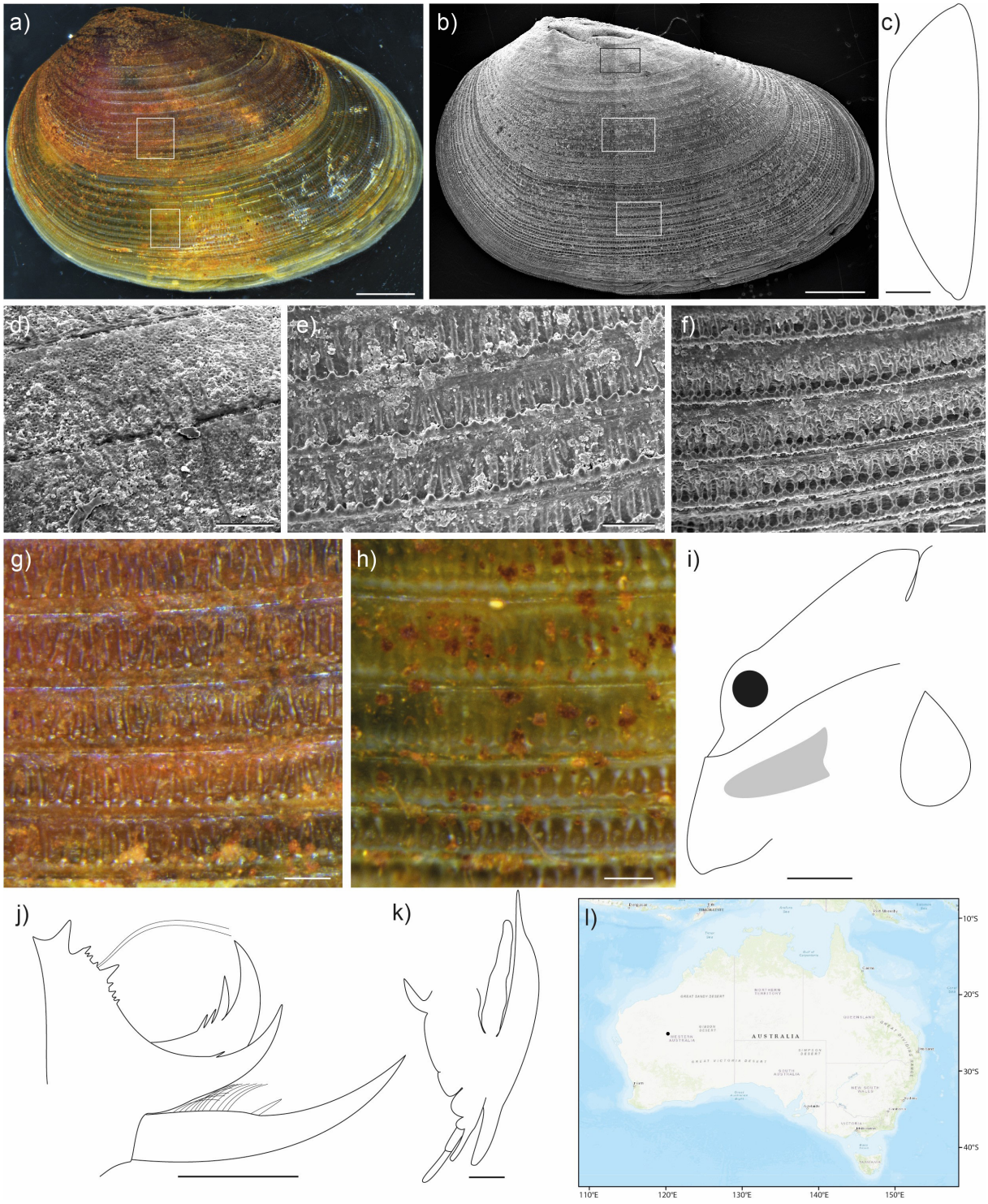

Fig. 21. *Ozestheria glabra* sp. nov., male, holotype WAM C77996. **a**. Carapace. **b**. Carapace (SEM. compound of three images). **c**. Carapace, dorsal view (left valve only). **d–h**. Carapace ornamentation; positions marked in a and b, respectively, by rectangles). **d**. Dorsal carapace, SEM. **e**. Mid-carapace, SEM. **f**. Ventral carapace (secondary growth phase), SEM. **g**. Mid-carapace. **h**. Ventral carapace (secondary growth phase). **i**. Head (antennae not shown). **j**. Telson. **k**. Third left thoracopod. **l**. Distribution map (produced in ArcMap 10.7; see caption Fig. 7 for sources). Scale bars: a–c = 1 mm; d–h = 0.1 mm; i–k = 0.5 mm.

Ozestheria henryae sp. nov.
urn:lsid:zoobank.org:act:26EFE2F6-F832-45F9-AD47-50E142A3EDA8
Fig. 22

Ozestheria sp. D3 – Schwentner *et al*. 2015a: figs 2, 6.
Ozestheria rubra – Schwentner *et al*. 2020: figs 1–2.

Diagnosis

Ozestheria henryae sp. nov. is characterized by a short condyle and wide occipital notch; a rounded ventral carapace margin; carapace ornamentation with medium to large, well-developed polygonal reticulations, each polygon with polygonal secondary ornamentation (best seen under SEM); male rostrum with strongly convex anterior margin, apex strongly rounded with acute (nearly rectangular), ventral margin concave, pointing apex downwards; female rostrum anterior margin slightly s-shaped, apex pointed (not elongated or drawn out), ventral margin slightly concave; 14–18 (male) or 14 (female) antenna I lobes reaching to antenna II flagellomeres V–VII (male) or III (female); 14–16 (male) or 13 (female) antenna II flagellomeres; 22 complete thorax segments; 21–30 small, unequally sized and spaced conical telsonic spines, spines in the central part of the telson enlarged; 5–6 furcal setae.

Differential diagnosis

See differential diagnosis of *O. elliptica*.

Etymology

The species is named in honor of Marguerite Henry (1895–1982), who was one of the few female Australian zoologists and taxonomists in the early 20th century. She described one species of *Ozestheria* – *Ozestheria rubra* (Henry, 1924). *Ozestheria henryae* sp. nov. is probably the sister species to *O. rubra*. For details on her scientific life and achievements see Damkaer (2014).

Type material

Holotype

AUSTRALIA – **Queensland** • ♂; Lake Galilee; 22°25′37.3″ S, 145°42′13.4″ E; 15 Feb. 2010; M. Schwentner, C. Sieves and B.V. Timms leg.; GenBank no: KJ705637 (COI); AM P.91408.

Paratypes

AUSTRALIA – **Queensland** • 2 ♂♂, 1 ♀; same data as for holotype; GenBank nos: KJ705610, KJ705610, KJ705636 (COI); AM P.91381, P.91382, P.91407 • 1 ♂; same data as for holotype; GenBank no: KJ705638; NHWM-CR-28476.

Type locality

Australia, Lake Galilee, 22°25′37.3″ S, 145°42′13.4″ E.

Description

Males

Carapace (Fig. 22a, c–d). Length 5.4–7.3 mm (HT: 6.9 mm), height 3.3–4.3 mm (HT: 4.3 mm). Coloration light. 17–23 (HT: 23) growth lines, 17–20 (HT: 20) widely spaced and 0–3 crowded.

Carapace shape. Dorsal margin straight, distinct dorso-posterior corner. Posterior margin broadly rounded, supracurvate (b/H 0.40–0.41, HT: 0.40). Ventral margin widely rounded. Umbo position anterior (Cr/L 0.19–0.22, HT: 0.22).

Carapace ornamentation (Fig. 22e–h). Larval valve with shallow reticulations. Each growth band with medium to large, well-developed, strongly raised reticulations. Reticulations form polygonal mesh

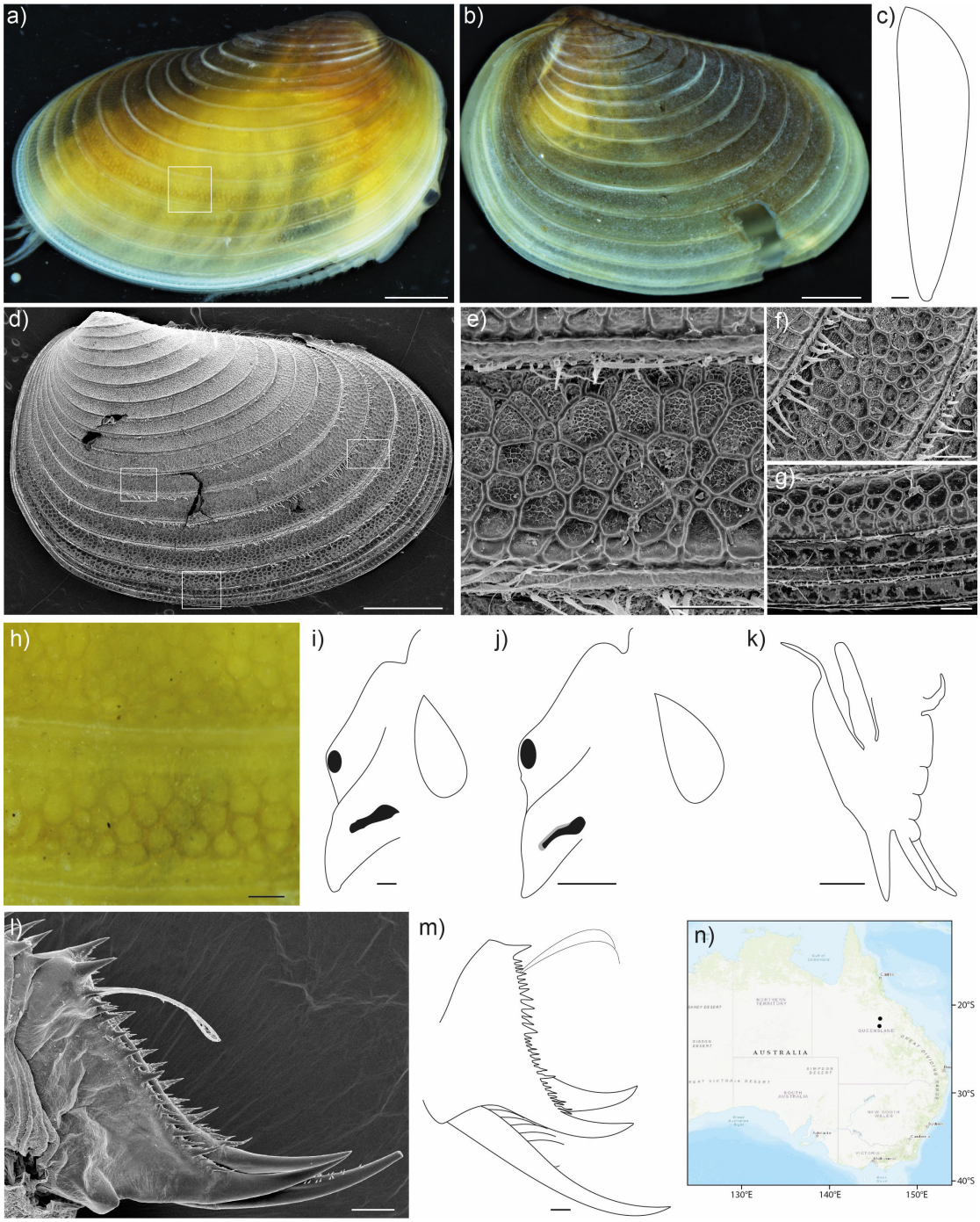

Fig. 22. *Ozestheria henryae* sp. nov. **a**. Carapace (male, holotype, P.91408). **b**. Carapace (female paratype, P.91381). **c**. Carapace, dorsal view (right valve only, male, holotype, P.91408). **d–g**. Male, paratype (P.91407), SEM. **d**. Carapace. **e**. Mid-carapace ornamentation (position marked in d by rectangle). **f**. Posterior carapace ornamentation (position marked in d by rectangle). **g**. Ventral carapace ornamentation, including crowded growth lines (position marked in d by rectangle). **h**. Mid-carapace ornamentation (male, holotype, P.91408). **i–j**. Head (antennae not shown). **i**. Male, holotype (P.91408). **j**. Female, paratype (P.91381). **k**. Third left thoracopod (male, holotype, P.91408). **l–m**. Telson. **l**. Male, paratype (P.91407), SEM. **m**. Male, holotype (P.91408). **n**. Distribution map (produced in ArcMap 10.7; see caption Fig. 7 for sources). Scale bars: a–d = 1 mm; e–h, l = 0.1 mm; i–k = 0.5 mm; m = 0.2 mm.

across each growth band with each polygon usually being a pentagon, hexagon or heptagon. Polygon-size increasing during ontogeny, largest in the dorsal to median part of each growth band; under SEM secondary mesh or polygonal reticulation within each primary polygon (less strongly developed or absent ventrally within growth bands and on carapace). Ornamentation uniform across all non-crowded growth bands, crowded growth bands usually a single row of polygonal reticulations resulting in radial appearance. Concentric ridges raised. Setae mostly long and thick; preferentially preserved ventral and posterior parts of the carapace. Setal pores in single, irregular row along all growth lines.

Head (Fig. 22i). Condyle rounded, short, only weakly protruding; occipital notch wide. Condyle lacking anterobasal hump. Margin between condyle and ocular tubercle straight. Ocular tubercle well developed, forming obtuse (~90°–120°) angle with rostrum. Anterior margin of rostrum strongly convex. Apex strongly rounded, acute (nearly rectangular). Ventral margin of rostrum weakly concave, pointing apex slightly downwards; small notch anteriorly. Naupliar eye elongated, sub-triangular to sub-rectangular. Antenna I long with 14–18 (HT: 14) lobes, reaching to antenna II flagellomeres V–VII (HT: VII). Antenna II with 14–16 (HT: 14) flagellomeres.

Thorax. 22–23 (HT: 22) segments, 22 thoracopod-bearing and none to one posterior limbless segment not reaching dorsal margin. Mid to posterior thoracopod-bearing segments with spine bearing dorsal extensions. Dorsal extensions increasing in size posteriorly over successive segments; spines mostly short, in posterior segments with fewer spines and central spines stouter but shorter.

Thoracopod III (only P.91408; Fig. 22k). Endite I short and curved dorsally. Endites II–V broad, decreasing in size. Endite V palp one-segmented. Exopod ventral extension slightly overreaching endopod, dorsal extension wide, narrowing distally, overreaching epipod. Epipod long, cylindric.

Telson (Fig. 22l–m). 21–30 (HT: 30) spines. First (anterior) spine enlarged. Spines conical, subequally spaced, anterior spines smaller, followed by several larger spines close to the central part of the telson (with few interspersed smaller spines); posteriorly spines slightly thinner and more drawn out and increasing in length (last ~¼ of telson). Dorsal margin straight, posteriorly weakly concavely curved. Right terminal claw more strongly curved than left, in some individuals equally curved.

Furca (Fig. 22l–m). Proximally with dorsomedial longitudinal row of 5–6 (HT: 5) setae, row ending distally in a single conical spine. Distal part ⅔ of furcal length, with numerous small denticles.

Female

Overall appearance as in males. Carapace (Fig. 22b) length 6.8 mm, height 4.2 mm; 18 growth lines, these 16 widely spaced and 2 crowded; Cr/L 0.22 and b/H 0.4. Ocular tubercle forming nearly straight angle with rostrum (Fig. 22j). Anterior margin of rostrum slightly s-shaped (dorsally slightly convex, ventrally slightly concave); apex pointed (~45°), weakly drawn out; ventral margin weakly concavely curved. Antenna I with 14 small lobes, lobes smaller than in males; reaching to antenna II flagellomere III. Antenna II with 13 flagellomeres. 22 segments, all of these thoracopod-bearing. Telson with 26 dorsal spines; left and right terminal claws equally curved. Furca with 5 setae.

Distribution (Fig. 22n)

Ozestheria henryae sp. nov. is known only from the northern regions of the Cooper Creek catchment in central Queensland.

Remarks

Schwentner *et al*. (2020) wrongly identified this species as *O. rubra*. A comparison with the respective type material showed that *O. henryae* sp. nov. is not conspecific with *O. rubra.* So far only a single

female of *O. henryae* could be studied, so the intraspecific variability cannot be assessed for female characters (e.g., rostrum shape).

The carapace shape of *Ozestheria henryae* sp. nov. (Fig. 5) is distinct from that of most other species and overlaps fully with that of *O. rubra* and partly with those of *O. gemina* sp. nov., *O. matuwa* sp. nov. and *O. richteri* sp. nov.

Ozestheria jiangi sp. nov.
urn:lsid:zoobank.org:act:A52D9D02-6C4F-42E4-A638-7BEABE7D3A3E
Fig. 23

Ozestheria sp. A – Schwentner *et al*. 2015a: figs 2, 6; 2020: figs 1–2. — Hethke *et al*. 2023: fig. 10.

Diagnosis

Ozestheria jiangi sp. nov. is characterized by a long condyle and a narrow occipital notch; nearly straight ventral carapace margin; carapace ornamentation dorsally on carapace and dorsally within subsequent growth bands lacking (smooth, no punctae), short, well-developed radial lirae appearing ventrally within growth bands from about mid-dorsal carapace, lirae increasing in length in following growth bands; carapace setae long and thin (usually only few preserved ventrally and posteriorly on carapace); many individuals with small tubercle ventrally below eye; male rostrum with straight (sometimes undulating) anterior margin, apex rounded with acute angle (~45°), ventral margin strongly concave, pointing apex downwards; female rostrum anterior margin straight or undulating, apex drawn out into acute tip, ventral margin weakly concave; 14–19 (male) or 10–15 (female) antenna I lobes reaching to antenna II flagellomeres VII–X (male) or IV (female); 12–15 (male) or 12–14 (female) antenna II flagellomeres; 19–23 complete thorax segments; 15–28 telsonic spines, anteriorly short and thin, posteriorly (from about mid) aciculate and strongly increasing in size; 2–12 furcal setae.

Differential diagnosis

Ozestheria jiangi sp. nov. can be easily differentiated from most other Australian species of *Ozestheria* by its characteristic carapace ornamentation: within growth bands surface dorsally smooth and ventrally with well-defined, subparallel lirae, which increase in size within progressing growth bands (whereas the smooth area decreases in size). Other species with (partly) smooth growth bands are *O. echidna* sp. nov., *O. setifera* sp. nov. and *O. sivesae* sp. nov. These differ in the shape of the male and female rostrum and the spination of the telson (posterior spines longer in *O. jiangi*). Furthermore, *Ozestheria echidna* and *Ozestheria setifera* are characterized by a large number of densely arranged setae on the carapace (these are mostly broken off in *O. jiangi*), also *O. echidna* features only short lirae mid-dorsally and posteriorly on the carapace (ventrally on carapace growth bands predominantly smooth). While lirae in later growth bands become longer in *Ozestheria jiangi* they become shorter in *O. echidna*. *Ozestheria sivesae* and *O. setifera* have less regular (nodulous and/or intermittent) lirae. *Ozestheria sivesae* and *O. echidna* yield additional punctate ornamentation.

Etymology

The species is named after the Chinese paleontologist Baoyu Jiang, honoring his contributions to Chinese paleontology and his work on clam shrimp-rich Mesozoic lake deposits.

Type material

Holotype

AUSTRALIA – **Queensland** • ♂; Currawinya National Park, claypan halfway along northern fence of Bilby enclosure; 28°52′12.8″ S, 144°21′52.1″ E; 25 Feb. 2011; M. Schwentner, S. Richter and B.V. Timms leg.; GenBank no: KJ705681 (COI); AM P.91452.

Paratypes

AUSTRALIA – **Queensland** • 2 ♂♂, 1 ♀; same data as for holotype; GenBank nos: KJ705680, KJ705682, KJ705683 (COI); AM P.91451, P.91453, P.91454 • 1 ♂; same data as for holotype; GenBank no: KJ705684 (COI); NHMW-ZOO-CR-28477.

Other material examined

AUSTRALIA – **New South Wales** • 1 ♀; Bloodwood Station, cane grass swamp SE of woolshed; 29°31′35.3″ S, 144°51′39.2″ E; 21 Feb. 2011; coll. M. Schwentner, S. Richter and B.V. Timms leg.; AM P. 91462 • 1 ♂; claypan-like 19 km E of Engonia; 29°17′06.9″ S, 146°02′23.9″ E; 21 Jan. 2010; M. Schwentner and B.V. Timms leg.; AM P.91464 • 1 ♀; E of Lake Lauradale; 29°51′22″ S, 145°38′49″ E; 29 Mar. 2009; M. Schwentner and B.V. Timms leg.; AM P.91437 • 1 ♂; E of Lake Lauradale; 29°51′22″ S, 145°38′49″ E; 18 Jan. 2010; M. Schwentner and B.V. Timms leg.; AM P.91463. – **Northern Territory** • 1 ♂, 1 ♀; grassy Ilparpa claypan near Alice Springs; 23°45′17.1″ S, 133°48′00.0″ E; 8 Mar. 2011; M. Schwentner and B.V. Timms leg.; AM P. 91439, P.91440. – **Queensland** • 5 ♂♂; Currawinya National Park, Big Darko Claypan; 28°52′19.1″ S, 144°17′34.5″ E; 25 Feb. 2011; M. Schwentner, S. Richter and B.V. Timms leg.; AM P.91456 to P.91460 • 1 ♀; Currawinya National Park, bokeen cane grass swamp; 28°49′55.3″ S, 144°20′59.3″ E; 24 Feb. 2011; M. Schwentner, S. Richter and B.V. Timms leg.; AM P.91471 • 5 ♂♂; claypan 46 km E of Thargomindah; 28°05′16.0″ S, 144°16′01.7″ E; 27 Feb. 2011; M. Schwentner and B.V. Timms leg.; AM P.91446 to P.91450 • 1 ♂, 4 ♀♀; claypan 46.5 km W of Windorah; 25°20′20.1″ S, 142°12′20.9″ E; 2 Mar. 2011; M. Schwentner and B.V. Timms leg.; AM P. 91441 to P.91445.

Additional material (not examined)

AUSTRALIA – **New South Wales** • 1 juv.; Muella Station, Lower Lake Eliza; 29°25′28.9″ S, 145°03′41.8″ E; 22 Feb. 2011; M. Schwentner, S. Richter and B.V. Timms leg.; AM P.91461 • 2 juvs; claypan-like 19 km E of Engonia; 29°17′06.9″ S, 146°02′23.9″ E; 21 Jan. 2010; M. Schwentner and B.V. Timms leg.; AM. P.91472, P.91473. – **Queensland** • 5 juvs; Oakham claypan; 25°23′16.4″ S, 143°10′45.4″ E; 8 Apr. 2009; M. Schwentner and B.V. Timms leg.; AM P.91465 to P.91467, P.91438.

Type locality

Australia, Queensland, Currawinya National Park, claypan halfway along northern fence of Bilby enclosure, 28°52′12.8″ S, 144°21′52.1″ E.

Description

Males

Carapace (Fig. 23a, c–d). Length 4.3–7.3 mm (HT: 6.9 mm, mean: 6.3 mm), height 2.5–4.3 (HT: 4.1 mm, mean: 3.8 mm). Coloration orange to red-orange, crowded growth bands lighter, often whitish; colour returns in growth bands of the secondary growth phase. 18–42 (HT: 37, mean: 31) growth lines, 17–30 (HT: 18, mean: 23) widely spaced, in some individuals 3–4 additional widely spaced (secondary growth phase; HT: 4) among crowded, and 1–15 (HT: 15, mean: 8) crowded.

Carapace shape. Dorsal margin straight, distinct dorso-posterior corner. Posterior margin broadly rounded, suboval, equicurvate to infracurvate (b/H 0.51–0.59, HT: 0.56, mean: 0.55). Ventral margin nearly straight. Umbo position anterior to submedian (Cr/L 0.23–0.27, HT: 0.23, mean: 0.25).

Carapace ornamentation (Fig. 23e–f). Larval valve smooth. In the dorsal and median part of the carapace, growth bands smooth. Radial lirae appearing, thickening and lengthening on the ventral part of successive growth bands; on ventral and crowded growth bands no smooth parts visible. Lirae subparallel and ± equidistant on successive growth bands, also on growth bands of the secondary growth phase.

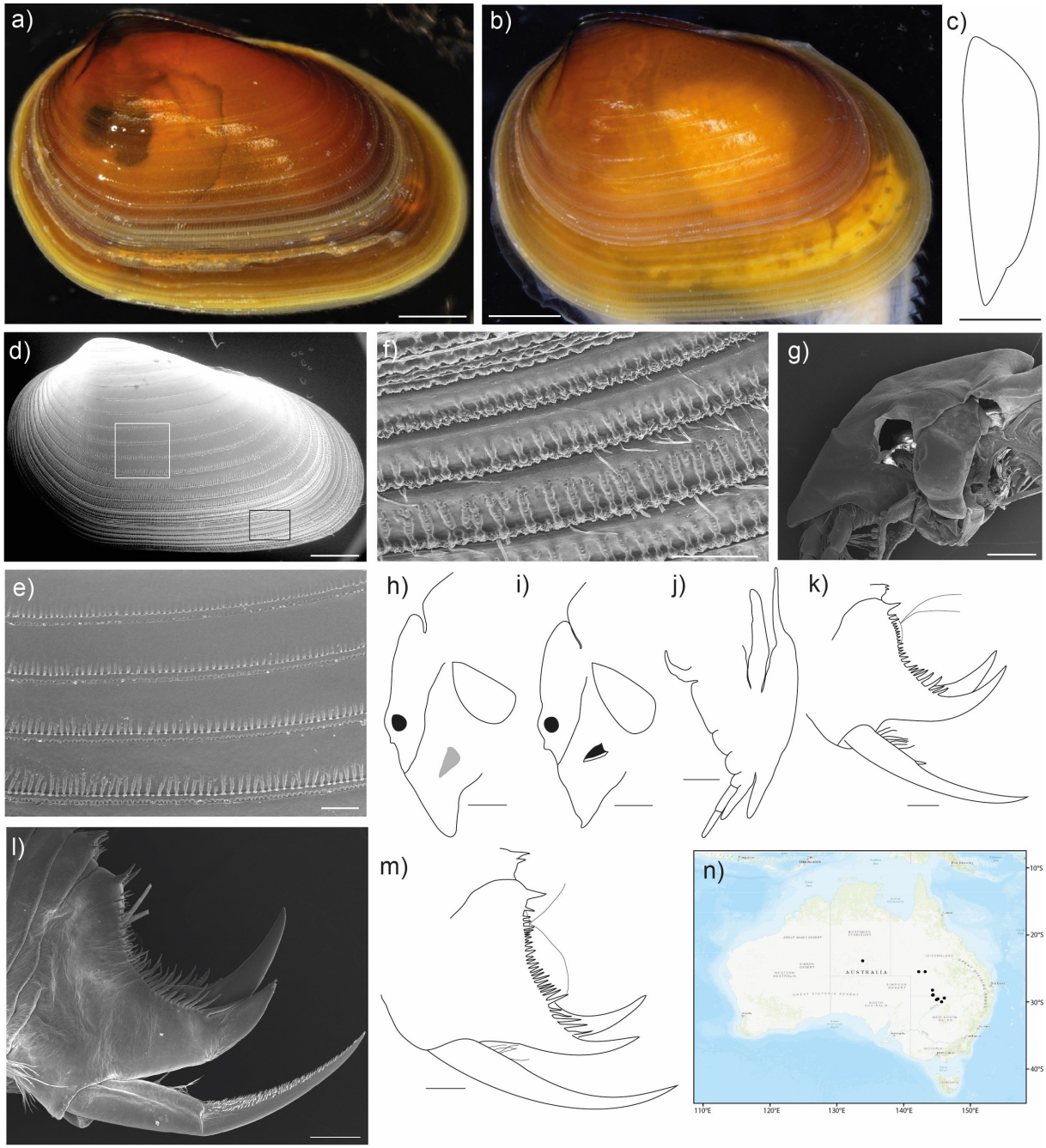

Fig. 23. *Ozestheria jiangi* sp. nov. **a**. Carapace (male, holotype, P.91452). **b**. Carapace (female paratype, P.91451). **c**. Carapace, dorsal view (right valve only, male, holotype, P.91452). **d–g**. Male, paratype (P.91454), SEM. **d**. Carapace. **e**. Mid-carapace ornamentation (position marked in d by rectangle). **f**. Ventral carapace ornamentation (position marked in d by rectangle). **g**. Head (antennae not shown). **h**. Head (male, holotype, P.91452). **i**. Head (female paratype, P.91451). **j**. Third left thoracopod (male, holotype, P.91452). **k–m**. Telson. **k**. Male, holotype (P.91452). **l**. Male, paratype (P.91454), SEM. **m**. Female, paratype (P.91451). **n**. Distribution map (produced in ArcMap 10.7; see caption Fig. 7 for sources). Scale bars: a–b, d = 1 mm; c, g–i = 0.5 mm; e–f, j–m = 0.2 mm.

Concentric ridges slightly raised, with moniliform nodules on the dorsal margin and a serrated ventral margin (the latter two not visible in all individuals, best seen under SEM). Setae filiform, preferentially preserved on the midposterior and posteroventral part of carapace (setal pores in single row along all growth lines under SEM).

Head (Fig. 23h). Condyle long, distally acute; occipital notch narrow. Condyle lacking anterobasal hump. Margin between condyle and ocular tubercle straight to slightly convex. Ocular tubercle weakly developed, forming obtuse, nearly straight angle with rostrum. Small tubercle ventrally below eye in most specimens (HT: present). Anterior margin of rostrum straight to weakly convex, sometimes undulating (HT: straight). Apex weakly rounded, acute (~45°). Ventral margin of rostrum deeply concave with obtuse angle about half-length, pointing apex slightly downwards. Naupliar eye triangular. Antenna I long with 15–19 lobes (HT: 17; mean: 16), reaching to antenna II flagellomeres VI–X (HT: IX; mean: VIII). Antenna II with 12–15 flagellomeres (HT: 13; mean: 13).

Thorax. 21–23 (HT: 22; mean: 22) segments, 21–22 (HT: 21; mean: 22) thoracopod-bearing and none to one (HT: one) posterior limbless segment not reaching dorsal margin. Last ~14 thoracopod-bearing segments with spine bearing dorsal extensions. Dorsal extensions increasing in size posteriorly over successive segments (until ~7th last segment). Spines short and stout, in posterior segments central spines stouter but shorter.

Thoracopod III (only P.91452; Fig. 23j). Endite I short and curved dorsally. Endites II–V broad, decreasing in size. Endite V palp two-segmented, basal segment shorter than endopod. Exopod ventral extension subequal in extension to endopod, dorsal extension wide, narrowing distally, overreaching epipod. Epipod long, cylindric.

Telson (Fig. 23k–l). 15–26 spines (HT: 24; mean: 22). First (anterior) spine enlarged. Spines on anterior half of telson short, thin, aciculate, subequal in length; one or a few anterior spines not on dorsal margin but slightly lateral. Spines on posterior half increasing in size, thin, aciculate and very closely spaced. Dorsal margin concavely curved, sometimes undulating (anteriorly convex, posteriorly concave). Right terminal claw more strongly curved than left.

Furca (Fig. 23k–l). Proximally with dorsomedial longitudinal row of 5–11 (HT: 7) setae, row ending distally in a single conical spine. Distal part ⅓–⅔ of furcal length, with numerous small denticles.

Females

Overall appearance as in males. Carapace (Fig. 23b) length 5.4–6.3 mm (mean: 5.8 mm), height 3.3–4.1 mm (mean: 3.6 mm); 22–38 (mean: 30) growth lines, of these 18–26 (mean: 22) widely spaced, in some individuals 4–5 additional widely spaced (secondary growth phase) among crowded, and 1–12 (mean: 10) crowded; Cr/L 0.21–0.28 and b/H 0.51–0.60. Apex of rostrum drawn out into acute tip, ventral margin only weakly concave, overall rostrum shape trapezoidal (Fig. 23i). Antenna I with 10–15 small lobes (mean: 13), lobes smaller than in males; reaching to antenna II flagellomeres III–IV (mean: IV). Antenna II with 12–14 flagellomeres (mean: 12). 20–23 (mean: 22) segments, of these 19–23 (mean: 22) thoracopod-bearing and none to one posterior limbless segment not reaching dorsal margin. Telson with 17–28 (mean: 22) dorsal spines; left and right terminal claws equally curved (Fig. 23m). Furca with 2–7 setae (mean: 5).

Distribution (Fig. 23n)

Common and widely distributed in the arid regions of northern New South Wales and southern and central Queensland (e.g., catchments of northern Murray-Darling Basin, Bulloo River or central Cooper Creek catchment) with few records in central Australia. This species lives exclusively in claypans or cane grass swamps, which usually are very turbid.

Remarks

The carapace shape of *Ozestheria jiangi* sp. nov. (Fig. 6) is distinct from that of most other species and overlaps partly with those of *O. minor* comb. nov., *O. selmae* sp. nov., *O. typica* comb. nov., *O. jonnae* sp. nov., *O. bourkensis* sp. nov., *O. cancellata* comb. nov., *O. rincewindi* sp. nov., *O. weeksi* sp. nov., *O. glabra* sp. nov., and *O. echidna* sp. nov.

Ozestheria jonnae sp. nov.
urn:lsid:zoobank.org:act:71618CD3-D915-4CCC-94D4-B170CFA699F8
Fig. 24

Ozestheria sp. O – Schwentner *et al*. 2015a: figs 2, 6; 2020: figs 1–2. — Hethke *et al*. 2023: fig. 11.

Diagnosis

Ozestheria jonnae sp. nov. is characterized by a long condyle and a narrow occipital notch; carapace ornamentation dorsally on carapace punctate, in following growth bands anastomosing lirae forming ventrally within growth band, lirae become longer, more pronounced and less anastomosing within progressing growth bands; male rostrum with weakly convex anterior margin, apex nearly rectangular, usually rounded, ventral margin usually with weak notch anteriorly then slightly convex; female rostrum anterior margin with dorsal indentation then slightly convex, apex rectangular and rounded, ventral margin convex; 10–15 (male) or 9–15 (female) antenna I lobes reaching to antenna II flagellomeres VI–VIII (male) or II–VI (female); 11–18 (male) or 11–18 (female) antenna II flagellomeres; 20–21 complete thorax segments; 9–24 telsonic spines of variable size and spacing, spines mostly conical, small and widely spaced with 1–3 larger spines interspersed, posterior spines thinner, elongated (aciculate); 2–14 furcal setae.

Differential diagnosis

Ozestheria jonnae sp. nov. can be differentiated from many other species of *Ozestheria* by the narrow occipital notch and long condyle in combination with the carapace ornamentation (dominated by subparallel and reticulating lirae), except from *O. cancellata* comb. nov., *O. minor* comb. nov., *O. typica* comb. nov., *O. fuersichi* sp. nov., *O. marthae* sp. nov., *O. selmae* sp. nov., *O. radiata* sp. nov., *O. bourkensis* sp. nov., *O. rincewindi* sp. nov., *O. barcaldinensis* sp. nov., *O. ngamurru* sp. nov., *O. beleriandensis* sp. nov., *O. quinlanae* sp. nov., *O. glabra* sp. nov., *O. pilbarensis* sp. nov. and *O. weeksi* sp. nov., and differentiating these species can be difficult, though *O. jonnae* differs from all of these species by an indentation dorsally on the anterior margin of the female rostrum. Furthermore, *O. minor* comb. nov., *O. typica*, *O. bourkensis*, *O. selmae* sp. nov., *O. radiata*, and *O. beleriandensis* can be differentiated by having at least the posterior half of the telsonic spines long, elongate and aciculate and *O. fuersichi* by its polygonal reticulations on the first few growth bands, the more widely spaced lirae on the carapace, the elongate and slender male rostrum and distinctly larger interspersed telsonic spines. The male rostrum of *O. jonnae* with its convex anterior and ventral margin and rounded apex has a more rounded appearance than those of *O. minor*, *O. fuersichi* sp. nov., *O. marthae* sp. nov., *O. rincewindi* sp. nov., *O. ngamurru* sp. nov., *O. beleriandensis*, and *O. pilbarensis* sp. nov. The number of antenna II flagellomeres in females of *O. jonnae* usually exceeds that of *O. typica*, *O. marthae*, *O. weeksi*, *O. bourkensis*, *O. beleriandensis*, *O. radiata*, and *O. selmae*.

Etymology

The species is named after Jonna Schwentner, the youngest daughter of MS.

Type material

Holotype

AUSTRALIA – **Queensland** • ♂; Yarromere Station, Morra Creek (M1); 21°28′51.9″ S, 145°49′34.0″ E; 3 Apr. 2009; M. Schwentner and B.V. Timms leg.; GenBank no: KJ705872 (COI); AM P.91644.

Paratypes

AUSTRALIA – **Queensland** • 1 ♂, 9 ♀♀; same data as for holotype; GenBank nos: KJ705353, KJ705860 to KJ705862, KJ705866, KJ705874 to KJ705877, KJ705879 (COI); AM P.80861, P.91632 to P.91634, P.91638, P.91643, P.91646–91649 • 1 ♀; same data as for holotype; GenBank no: KJ705859 (COI); NHMW-ZOO-CR-28484.

Other material examined

AUSTRALIA – **Queensland** • 2 ♂♂, 3 ♀♀; Yarromere Station, small pool (Y7); 21°34′38.6″ S, 145°48′07.7″ E; 4 Apr. 2009; M. Schwentner and B.V. Timms leg.; AM P.91622, P.91623, P.91635 to P.91637 • 2 ♀♀; Yarromere Station, small pool (Y8); 21°33′29.5″ S, 145°47′06.5″ E; 4 Apr. 2009; M. Schwentner and B.V. Timms leg.; AM P.91624, P.91625 • 1 ♂, 4 ♀♀; Yarromere Station, small pool (Y23); 21°34′26.9″ S, 145°46′46.4″ E; 4 Apr. 2009; M. Schwentner and B.V. Timms leg.; AM P.91626 to P.91627 • 2 ♂♂, 3 ♀♀; Yarromere Station, small pool (Y29); 21°30′38.8″ S, 145°48′48.1″ E; 5 Apr. 2009; M. Schwentner and B.V. Timms leg.; AM P.91617 to P.91621 • 1 ♂; pool close to Lake Dunn, 22°36′16.4″ S, 145°40′21.8″ E; 14 Feb. 2010; M. Schwentner, C. Sieves and B.V. Timms leg.; AM; P.91645.

Additional material (not examined)

AUSTRALIA – **Queensland** • 5 juvs; Lake Galilee; 22°25′37.3″ S, 145°42′13.4″ E; 15 Feb. 2010; M. Schwentner, C. Sieves and B.V. Timms leg.; AM P.91639 to P.91642, P.91650.

Type locality

Australia, Queensland, Yarromere Station, Morra Creek (M1), 21°28′51.9″ S, 145°49′34.0″ E.

Description

Males

Carapace (Fig. 24a, e–f). Length 5.2–8.1 mm (HT: 6.8 mm), height 3.2–5.3 mm (HT: 4.3 mm). Coloration dark reddish-brown, usually dorsal and central parts of carapace more reddish, other parts darker (sometimes nearly black), outer margin yellowish. 34–107 (HT: 41) growth lines, 12–28 (HT: 28) in first set of widely spaced growth lines, following crowded growth lines in many individuals with interspersed set of widely spaced (secondary growth phases) growth lines (up to two secondary growth phases).

Carapace shape. Dorsal margin straight, dorso-posterior corner distinct or rounded (HT: distinct). Posterior margin broadly rounded, suboval, equicurvate to infracurvate (b/H 0.46–0.56, HT: 0.46). Ventral margin widely rounded. Umbo position submedian (Cr/L 0.25–0.30; HT: 0.28).

Carapace ornamentation (Fig. 24c–d, g–h). Larval valve and first few growth bands appear smooth to granular, in some individuals with punctae (smooth and/or granular growth bands are an artifact of abrasion or dirt). Following growth bands punctate (may appear granular) dorsally within growth bands, and with anastomosing lirae forming ventrally within growth bands; with progressing growth bands lirae more pronounced and covering full growth band. Crowded growth bands with pronounced, parallel lirae, terminating in moniliform nodule on concentric ridge. Concentric ridges shallow. Setae filiform, mainly preserved close to carapace margin; under SEM a single irregular row of setal pores along all growth lines.

Head (Fig. 24j). Condyle long, distally acute (short and rounded in one individual); occipital notch narrow. Condyle with anterobasal hump. Margin between condyle and ocular tubercle straight to slightly

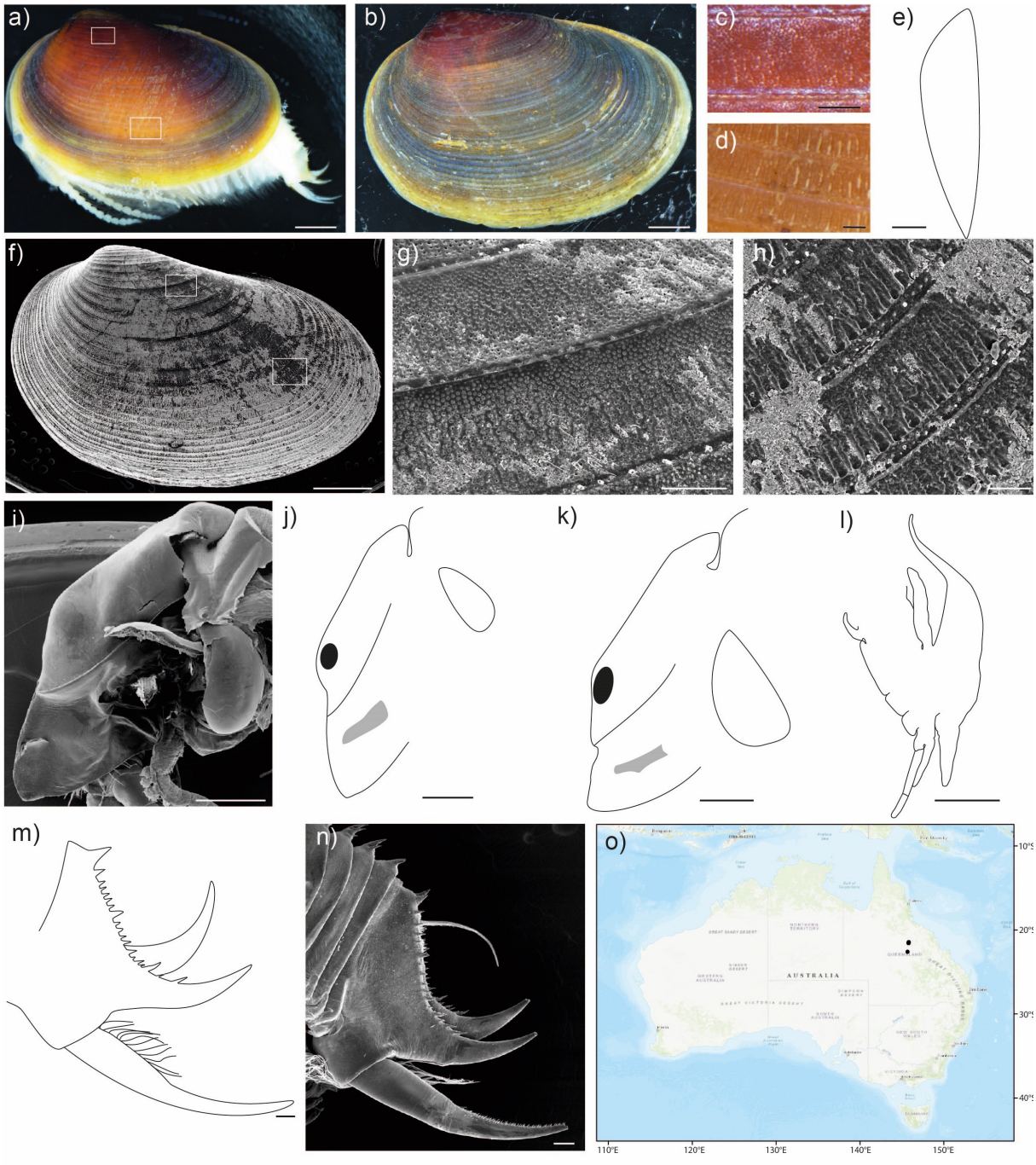

Fig. 24. *Ozestheria jonnae* sp. nov. **a**. Carapace (male, holotype, P.91644). **b**. Carapace (female paratype, P.91644). **c–e**. Male, holotype (P.91644). **c**. Punctae dorsally on carapace (position marked in a by rectangle). **d**. Lirae mid-ventrally on carapace (position marked in a by rectangle). **e**. Carapace, dorsal view (left valve). **f–h**. Male (AM P91628), SEM. **f**. Carapace. **g**. Punctae mid-dorsally on carapace (position marked in f by rectangle). **h**. Lirae posteroventrally on carapace (position marked in f by rectangle). **i**. Head (second antenna removed), SEM. **j**. Head (male, holotype, P.91644, antennae not shown). **k**. Head (female paratype, P.91633, antennae not shown). **l**. Third left thoracopod (male, P.91618). **m**. Telson (male, holotype, P.91644). **n**. Telson (male, AM P91628), SEM. **o**. Distribution map (produced in ArcMap 10.7; see caption Fig. 7 for sources). Scale bars: a–b, e–f, j–l = 1 mm; c–d, g–i, m–n = 0.1 mm.

concave. Ocular tubercle weakly developed, forming obtuse (~110–140°) angle with rostrum. Anterior margin of rostrum weakly convex. Apex nearly rectangular, usually rounded. Ventral margin of rostrum usually with weak notch anteriorly, then slightly convex. Naupliar eye subtriangular to suboval or subrectangular with rounded edges. Antenna I long with 10–15 lobes (HT: 13), reaching to antenna II flagellomeres VI–VIII (HT: VII). Antenna II with 11–18 flagellomeres (HT: 11).

Thorax. 21–22 (HT: 22) segments, 21 thoracopod-bearing and none to one (HT: one) posterior limbless segment not reaching dorsal margin. Last ~⅔ of thoracopod-bearing segments with spine bearing dorsal extensions. Dorsal extensions increasing in size posteriorly over successive segments (until ~7th last segment). Spines short and stout.

Thoracopod III (only P.91618; Fig. 24l). Endite I short and curved dorsally. Endites II–V broad, decreasing in size. Endite V palp two-segmented, basal segment longer than endopod. Exopod ventral extension subequal in extension to endopod, dorsal extension wide, narrowing distally, overreaching epipod. Epipod long, cylindric.

Telson (Fig. 24m–n). 15–21 spines (HT: 19). First (anterior) spine enlarged. Spines relatively evenly sized and spaced, mostly conical, small and widely spaced. 1–3 larger and stouter spines interspersed. Posterior spines thinner, elongate (aciculate), some enlarged and more irregularly spaced. Anterior two-thirds of dorsal margin nearly straight, posteriorly concavely curved. Right terminal claw more strongly curved than left (one individual with left claw more strongly curved).

Furca (Fig. 24m–n). Proximally with dorsomedial longitudinal row of 5–14 (HT: 12) setae, row ending distally in a single conical spine. Distal part ⅔ of furcal length, with numerous small denticles.

Females

Overall appearance as in males. Carapace (Fig. 24b) length 5.6–7.7 mm (mean: 6.8 mm), height 3.9–5.1 mm (mean: 4.5 mm); 32–72 (mean: 46) growth lines, 12–33 (mean: 22) widely spaced (primary growth phase), crowded growth bands often intermitted by widely space growth bands of secondary growth phase (up to four secondary growth phases); Cr/L 0.24–0.30 (mean: 0.26) and b/H 0.46–0.57 (mean: 0.52). Angle between head and rostrum usually obtuse as in males, rarely close to straight (Fig. 24k). Anterior margin of rostrum with dorsal indentation, then slightly convex; apex rectangular, less rounded compared to males; ventral margin strongly convex (rarely only weakly convex). Antenna I with 9–15 small lobes (mean: 11), lobes smaller than in males; reaching to antenna II flagellomeres II–VI (mean: IV). Antenna II with 11–18 flagellomeres (mean: 14). 21–22 (mean: 21) segments, 20–21 (mean: 21) thoracopod-bearing and none to one posterior limb-less segment not reaching dorsal margin. Telson with 9–24 (mean: 15) dorsal spines; left and right terminal claws equally curved or right slightly stronger. Furca with 2–10 setae (mean: 6).

Distribution (Fig. 24o)

Known only from central Queensland in the northern parts of the Cooper Creek catchment (in the region around Lake Galilee and Lake Dunn).

Remarks

The carapace shape of *Ozestheria jonnae* sp. nov. (Fig. 6) is distinct from that of most other species and overlaps partly with those of *O. jiangi* sp. nov., *O. minor* comb. nov., *O. timmsi* sp. nov. (marginally), *O. frederikeae* sp. nov., *O. marthae* sp. nov. (marginally), *O. selmae* sp. nov., *O. cancellata* comb. nov., *O. weeksi* sp. nov. (marginally), *O. quinlanae* sp. nov. (marginally), *O. glabra* sp. nov., *O. echidna* sp. nov. and *O. pilbarensis* sp. nov. (marginally).

Ozestheria lutraria (Brady, 1886)
Figs 25–26

Estheria lutraria Brady, 1886: 85, fig. b.
Estheria dictyon Spencer & Hall, 1896: 236, fig. 20.

Estheria lutraria – Spencer & Hall 1896: 234–235, fig. 20. — Sayce 1903: 254, 256, fig. 35. — Henry 1924: 121–122, 134.
Estheria dictyon – Sayce 1903: 255–256, fig. 36a. — Henry 1924: 122, 134.
Cyzicus dictyon – Wolf 1911: 254. — Dakin 1911: 295.
Cyzicus lutraria – Wolf 1911: 254. — Dakin 1911: 295.
?Caenestheria dictyon – Daday 1914: 105.
Caenestheria lutraria – Daday 1914: 56, 90–92, fig.11. — Richter & Timms 2005: 344.
Eocyzicus lutrarius – Brtek 1997: 49.
Ozestheria sp. C – Schwentner *et al*. 2015a: figs 2, 6. — Hethke *et al*. 2023: fig. 10.
Caenestheria dictyon – Richter & Timms 2005: 346.
Ozestheria lutraria – Schwentner *et al*. 2020: 1–2. — Rogers 2020: 23–24.
Ozestheria dictyon – Schwentner *et al*. 2020: figs 1–2. — Rogers 2020: 23.

Diagnosis

Ozestheria lutraria is characterized by a short condyle and a wide occipital notch; straight ventral margin of carapace and strongly supracurvate posterior margin; carapace ornamentation with large, well-developed polygonal reticulations, each polygon without secondary ornamentation (best seen under SEM); male rostrum with convex anterior margin, apex rounded with acute angle, ventral margin strongly concave, pointing apex downwards; female rostrum anterior margin weakly convex, apex pointed with weakly or strongly drawn-out tip, ventral margin strongly concave; 14–24 (male) or 14–20 (female) antenna I lobes reaching to antenna II flagellomeres III–VIII (male) or III–VIII (female); 13–17 (male) or 14–17 (female) antenna II flagellomeres; 24–27 complete thorax segments; 7–20 (adults usually ~11, juveniles more) usually very small and widely spaced, conical spines (spines in juveniles larger); 8–17 furcal setae.

Differential diagnosis

Ozestheria lutraria can be easily differentiated. It is the largest growing species (up to nearly 14 mm). The most characteristic features are the carapace shape (oblong, oval), the carapace ornamentation (large polygonal reticulations on all growth bands of the primary growth phase), the largest number of thorax segments (25–28) and telson spination. The morphologically most similar species are *O. rufa*, *O. paralutraria* sp. nov., *O. sarsii* and *O. christiani* sp. nov. *Ozestheria sarsii* differs by the shape of the male and female rostrum (i.e., rounded apex), the lower number of thorax segments and antennal lobes, and the polygons of carapace ornamentation of *O. christiani* are partly intermittent. *Ozestheria rufa* can be differentiated by the ornamentation (not all wide growth bands with polygonal reticulations) and the shape of the female rostrum (males currently unknown for *O. rufa*), whose ventral margin is not as strongly concave and whose apex is pointed, but not drawn out into an elongated tip. *O. paralutraria* can be differentiated by its fewer thoracic segments (24 vs 25–27 complete segments), more telsonic spines (16–18 in *O. paralutraria*, whereas *O. lutraria* rarely has more than 15), fewer setae on the carapace (in a single row vs in two rows along each concentric ridge in *O. lutraria*; best seen under SEM) and by length of the carapace (up to 9 mm vs > 10 mm in *O. lutraria*). Juveniles of *O. lutraria* may be confused with other species as their telsonic spines are unusually large and prominent, but the carapace shape is identical to those of the adults.

Type material

Neotype (here designated)
AUSTRALIA – **Queensland** • 1 ♂; Currawinya National Park, claypan halfway on northern fence of Bilby enclosure; 28°52′12.8″ S, 144°21′52.1″ E; 25 Feb. 2011; M. Schwentner, S. Richter and B.V. Timms leg.; GenBank no: KJ705517 (COI); AM P.91288.

Other material examined

AUSTRALIA – **New South Wales** • 1 ♂; E of Lake Lauradale; 29°51′22″ S, 145°38′49″ E; 29 Mar. 2009; M. Schwentner and B.V. Timms leg.; AM P.89647 • 1 ♂, 1 ♀; claypan-like West of Engonia; 29°18′32.8″ S, 145°44′06.9″ E; 21 Jan. 2010; M. Schwentner and B.V. Timms leg.; AM P.91353, P.91354 • 3 ♂♂, 1 ♀; Bloodwood Station, Georges Tank; 29°32′57.4″ S, 14°48′52.1″ E; 20 Jan. 2010; B.V. Timms leg.; AM P.91378, P.91366 to P.91369 • 4 ♂♂, 2 ♀♀; Muella Station, Lower Lake Eliza; 29°25′28.9″ S, 145°03′41.8″ E; 20 Jan. 2010; M. Schwentner and B.V. Timms leg.; AM P.82575, P.82576, P.91345 to P.91347, P.91352. – **Northern Territory** • 1 juv.; Ilparpa Claypan near Alice Springs; 13 Jan. 2010; J Van Der Reijden leg.; AM P.91378 • 3 ♂♂, 1 ♀; Ilparpa claypans near Alice Springs; 23°45′15.8″ S, 133°47′52.7″ E; 27 Jan. 2010; M. Schwentner and B.V. Timms leg.; AM P.91283, P.91341 to P.91343. – **Queensland** • 2 ♂♂, 1 ♀; same data as for neotype; GenBank nos: KJ705514, KJ705515, KJ705518 (COI); AM P.91285, P.91286, P.91289 • 1 ♂; same data as for neotype; GenBank no: KJ705516 (COI); NHMW-ZOO-CR-28488 • 2 ♂♂; Currawinya National Park, *Triops* claypan; 28°47′14.9″ S, 144°17′49.1″ E; 24 Feb. 2011; M. Schwentner and B.V. Timms leg.; AM P.91314, P.91315 • 2 ♂♂, 2 ♀♀; cane grass swamp 75 km E of Wyandra; 27°23′03.5″ S, 146°36′33.7″ E; 17 Feb. 2010; M. Schwentner and B.V. Timms leg.; AM P.91355 to P.91358 • 2 ♂♂; grassy turbid swamp 10 km from Bollon road junction; 27°41′52.4″ S, 146°45′44.7″ E; 18 Feb. 2010; M. Schwentner, C. Sieves and B.V. Timms leg.; AM P.91375, P.91376 • 3 juvs; black box claypan 58 km from Hungerford Road; 28°50′23.1″ S, 143°53′46.0″ E; 26 Feb. 2011; M. Schwentner, S. Richter and B.V. Timms leg.; AM P.91311 to P.91313 • 1 ♂, 4 ♂♂; claypan 46 km E of Thargomindah; 28°05′05.1″ S, 144°14′54.7″ E; 27 Feb. 2011; M. Schwentner and B.V. Timms leg.; AM P.91336 to P.91340 • 2 ♂♂, 2 ♀♀; claypan spring complex edge of Simpson Desert; 23°34′45.5″ S, 138°40′07.0″ E; 6 Nov. 2010; A. Emmett leg.; AM P.91306 to P.91309. – **South Australia** • 8 juvs; "South Australia"; syntypes of *Ozestheria dictyon*; MV J53359 • 4 ♂♂; vegetated stony dugout 34 km N of Marla; 27°05′26.8″ S, 133°28′16.2″ E; 10 Mar. 2011; M. Schwentner and B.V. Timms leg.; AM P.91316, P.91319 to P.91322 • 1 ♂, 2 ♀♀; old small dugout 105 km E of Marla; 27°10′00.2″ S, 134°33′07.2″ E; 11 Mar. 2011; M. Schwentner and B.V. Timms leg.; AM P.91302, P.91304, P.91305 • 1 ♂, 1 ♀; cane grass swamp 44 km W of Oodnadatta; 27°20′07.1″ S, 135°07′47.7″ E; 11 Mar. 2011; M. Schwentner and B.V. Timms leg.; AM P.91323, P.91325 • 2 ♂♂; Fogatys Claypan 60 km N of Oodnadatta; 27°03′21.4″ S, 135°14′57.2″ E; 11 Mar. 2011; M. Schwentner and B.V. Timms leg.; AM P.91295, P.91298 • 1 ♂, 4 ♀♀; claypan 16 km north Williams Creek; 28°52′03.6″ S, 136°11′08.6″ E; 12 Mar. 2011; M. Schwentner and B.V. Timms leg.; AM P.91326 to P.91330 • 2 ♂♂, 2 ♀♀; deepened claypan 19 km S of William Creek; 29°04′55.0″ S, 136°31′59.5″ E; 12 Mar. 2011; M. Schwentner and B.V. Timms leg.; AM P.91331 to P.91334 • 1 ♂, 1 ♀; Stevenson's Creek; Horn Expedition leg.; MV J53362.

Additional material (not examined)

AUSTRALIA – **New South Wales** • 1 ♂, 1 ♀; E of Lake Lauradale; 29°51′22″ S, 145°38′49″ E; 29 Mar. 2009; M. Schwentner and B.V. Timms leg.; AM P.80857, P.91344 • 2 ♂♂, 3 ♀♀; E of Lake Lauradale; 29°51′22″ S, 145°38′49″ E; 18 Jan. 2010; M. Schwentner and B.V. Timms leg.; AM P.91370 to P.91374 • 1 ♂, 3 ♀♀; claypan-like 19 km E of Engonia; 29°17′06.9″ S, 146°02′23.9″ E; 21 Jan. 2010; M. Schwentner and B.V. Timms leg.; AM P.91348 to P.91351 • 2 ♀♀; Bloodwood Station, Turkey claypan; 29°33′19.8″ S, 144° 50′17.8″ E; 19 Feb. 2010; M. Schwentner, C. Sieves and B.V. Timms leg.; AM P.91359, P.91360 • 1 ♂; Barnato Station, lake next to homestead at 80 km W of Cobar; 31°36′52.4″ S, 144°52′12.6″ E; 29 Mar. 2010; B.V. Timms leg.; raised from sediment; AM P.91284. – **Northern Territory** • 1 juv.; Ilpara Claypan Alice Springs; 23°45′16″ S, 133°47′49″ E; 13 Jan. 2010; J. van der Reijden leg.; AM P.91377. – **Queensland** • 3 ♂♂, 2 ♀♀; big claypan 41 km east Wyandra; 27°22′50.4″ S, 146°18′06.4″ E; 17 Feb. 2010; M. Schwentner, C. Sieves and B.V. Timms leg.; AM P.91361 to P.91365 • 1 ♂, 4 ♀♀; Currawinya National Park, turbid claypan S of North Kaponyee; 28°49′27.4″ S, 144°19′44.5″ E; 24 Feb. 2011; M. Schwentner, S. Richter and B.V. Timms leg.; AM

P.91290 to P.91294 • 2 ♀♀; Currawinya National Park, claypan at old Wyara Junction; 28°47′49.4″ S, 144°17′55.6″ E; 24 Feb. 2011; M. Schwentner, C. Sieves and B.V. Timms leg.; AM P.91317, P.91318 • 1 ♀; Currawinya National Park, Big Darko Claypan; 28°52′19.1″ S, 144°17′34.5″ E; 25 Feb. 2011; M. Schwentner, C. Sieves and B.V. Timms leg.; AM P.91335 • 1 juv.; black box claypan 58 km from Hungerford Road; 28°50′23.1″ S, 143°53′46.0″ E; 26 Feb. 2011; M. Schwentner, S. Richter and B.V. Timms leg.; AM P.91310 • 1 ♀; claypan 45 km E of Thargomindah; 28°05′15.0″ S, 144°15′47.0″ E; 27 Feb. 2011; M. Schwentner and B.V. Timms leg.; AM P.91300. – **South Australia** • 1 ♂; vegetated stony dugout 34 km N of Marla; 27°05′26.8″ S, 133°28′16.2″ E; 10 Mar. 2011; M. Schwentner and B.V. Timms leg.; AM P.91321 • 2 ♀♀; old small dugout 105 km E of Marla; 27°10′00.2″ S, 134°33′07.2″ E; 11 Mar. 2011; M. Schwentner and B.V. Timms leg.; AM P.91301, P.91303 • 1 ♀; cane grass swamp 44 km W of Oodnadatta; 27°20′07.1″ S, 135°07′47.7″ E; 11 Mar. 2011; M. Schwentner and B.V. Timms leg.; AM P.91324 • 2 ♂♂, 1 ♀; Fogatys Claypan 60 km N of Oodnadatta; 27°03′21.4″ S, 135°14′57.2″ E; 11 Mar. 2011; M. Schwentner and B.V. Timms leg.; AM P.91296, P.91297, P.91299.

Type locality

Brady (1886) noted "Cooper Creek, at Innamincka, Central Australia" as the locality. As the type material is lost and the exact locality unknown, we designated a neotype. The new type locality is: Australia, Queensland, Currawinya National Park, claypan halfway on northern fence of Bilby enclosure, 28°52′12.8″ S, 144°21′52.1″ E.

Description

Males

Carapace (Fig. 25a–b, d–f). Length 9.6–13.8 mm (NT: 11.0 mm, mean: 11.6 mm), height 5.0–7.3 mm (NT: 5.6 mm, mean: 6.0 mm). Coloration light brown to dark brown or dark reddish-brown, crowded growth bands lighter, yellowish to whitish (in juveniles carapace lightly colored, sometimes translucent). 16–25 (NT 21, mean: 20) growth lines, 12–18 (NT: 15, mean: 15) widely spaced and 1–9 (NT: 6, mean: 5) crowded.

Carapace shape. Dorsal margin straight, dorso-posterior corner distinct or rounded (NT: rounded). Posterior margin rounded, greatly extending posteriorly (giving the whole carapace an oval appearance), supracurvate to strongly supracurvate (b/H: 0.24–0.44, NT: 0.34, mean: 0.32). Mid-section of ventral margin nearly straight, posteriorly widely rounded. Umbo position anterior (Cr/L: 0.17–0.22, NT: 0.22, mean: 0.20).

Carapace ornamentation (Fig. 25g–h, see also Fig. 26d–e). Larval valve and first few growth bands appear smooth (might be due to abrasion). All other non-crowded growth bands with large reticulations. Reticulations form polygonal mesh across each growth band with each polygon usually being a pentagon, hexagon or heptagon. Under SEM, polygon centers smooth or granular, without secondary reticulations. Reticulations become irregular and transition to broken lines on growth bands of incipient carapace crowding; crowded growth bands very narrow, without obvious ornamentation (under SEM, crowded growth bands and secondary growth phase with inconspicuous, very fine anastomosing liral ornamentation). Concentric ridges raised. Setae very short, thin and inconspicuous, in many individuals none visible; under SEM two irregular rows of setae and corresponding setal pores along all growth lines.

Head (Fig. 25i–j). Condyle short, rounded only weakly protruding; occipital notch wide. Condyle lacking anterobasal hump. Margin between condyle and ocular tubercle straight, rarely slightly concave. Ocular tubercle weakly developed, rarely strongly developed; forming obtuse angle (~110–140°) with rostrum; angle close to 90° when ocular tubercle strongly developed. Anterior margin of rostrum convex. Apex rounded with acute angle (~70°). Ventral margin of rostrum deeply concave with obtuse angle about

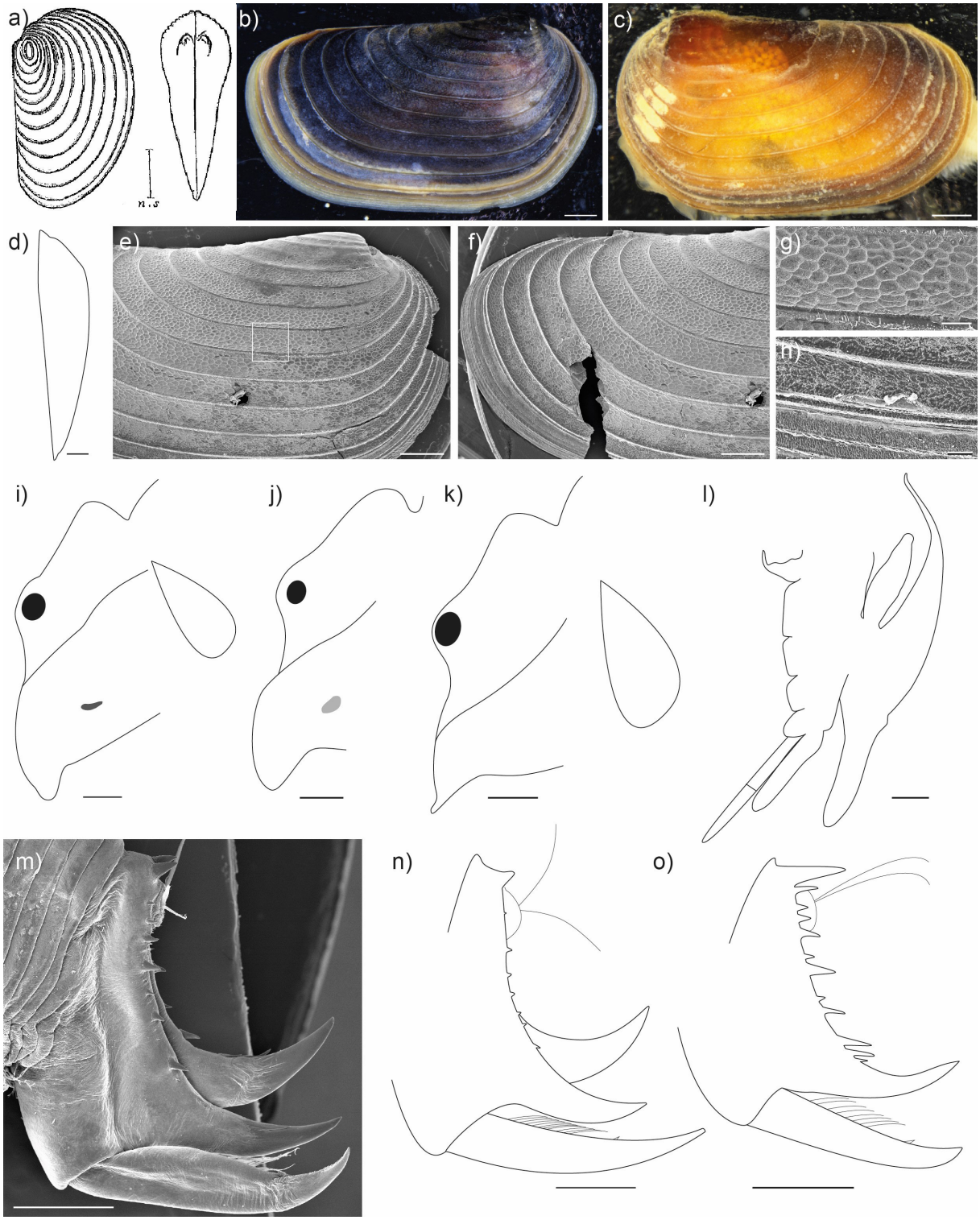

Fig. 25. *Ozestheria lutraria* (Brady, 1886). **a**. Original drawings of carapace by Brady (1886). **b**. Carapace (male neotype, P.91288). **c**. Carapace (female, P.91334). **d**. Carapace, dorsal view (right valve only, male neotype, P.91288). **e–h**. Carapace (male, P.91285), SEM. **e**. Anterior. **f**. Posterior. **g**. Ornamentation mid-carapace (position marked in e by rectangle). **h**. Ornamentation ventral carapace. **i–k**. Head (antennae not shown). **i**. Male, neotype (P.91288). **j**. Male (P.91319). **k**. Female (P.91289). **l**. Third left thoracopod (male neotype, P.91288). **m–o**. Telson. **m**. Male (P.91285), SEM. **n**. Male, neotype (P.91288). **o**. Female (P.91356). Scale bars: b–f = 1 mm; g–h = 0.2 mm; i–o = 0.5 mm.

half-length (sometimes anteriorly close to apex), pointing apex strongly downwards. Naupliar eye very small (rarely not visible), roundish to sub-triangular. Antenna I long, 14–24 lobes (NT: 21; mean: 20), reaching to antenna II flagellomeres III–VIII (NT: XI; mean: VII). Antenna II with 13–17 flagellomeres (NT: 15; mean: 15).

Thorax. 25–28 (NT: 26; mean: 26) segments, 25–27 (NT: 25; mean: 25) thoracopod-bearing and none to two (NT: one) posterior limbless segments not reaching dorsal margin. From about midbody, segments with minute dorsal extensions with few long spines, posteriormost segments usually without spines (juveniles with more extensive dorsal extensions and always with long spines on last segments).

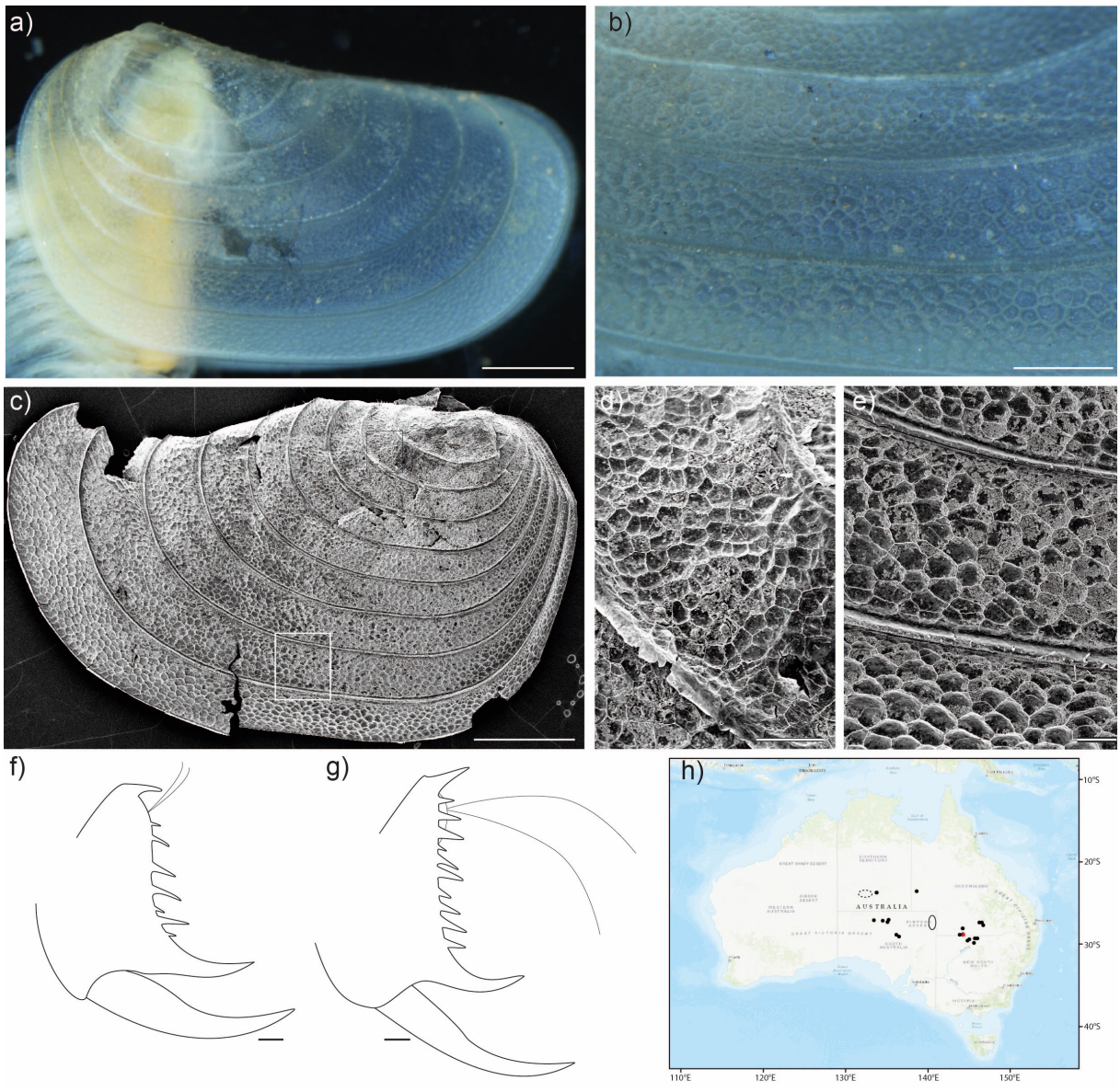

Fig. 26. *Ozestheria lutraria* (Brady, 1886). **a–f**. Several syntype specimens of *O. dictyon* (MV J53359; juveniles of *O. lutraria*). **a**. Carapace. **b**. Mid-carapace ornamentation. **c**. Carapace, SEM. **d**. Dorsal carapace ornamentation (position marked in c by rectangle). **e**. Ventral carapace ornamentation (position marked in c by rectangle). **f**. Telson. **g**. Telson of *O. lutraria*, juvenile (P.91378). **h**. Distribution map (original type locality indicated by circle; newly selected type locality of neotype indicated by red dot; type locality of *O. dictyon* indicated by dotted circle; produced in ArcMap 10.7; see caption Fig. 7 for sources). Scale bars: a, c = 1 mm; b = 0.5 mm; d–g = 0.1 mm.

Thoracopod III (only P.91288; Fig. 25l). Endite I short and curved dorsally. Endites II–V broad, decreasing in size. Endite V palp two-segmented, basal segment shorter than endopod. Exopod ventral extension subequal in extension to endopod, dorsal extension wide, narrowing distally, overreaching epipod. Epipod long, cylindric.

Telson (Fig. 25m–n). 9–20 (NT: 8, mean: 11) spines. First (anterior) spine enlarged. Spines conical. Spines widely and unequally spaced, varying in size, most spines small or tiny, in some individuals and especially juveniles spines larger and more prominent. Dorsal margin anteriorly (to about mid-length) straight, then evenly concavely curved. Right terminal claw more strongly curved than left.

Furca (Fig. 25m–n). Proximally with dorsomedial longitudinal row of 8–17 (NT: 11) setae, row ending distally in a single conical spine. Distal part ¼–⅓ of furcal length, with numerous small denticles.

Females

Overall appearance as in males. Carapace (Fig. 25c) length 9.0–13.0 mm (mean: 10.9 mm), height 4.7–6.9 mm (mean: 5.7 mm); 15–22 (mean: 17) growth lines, 12–17 (mean: 15) widely spaced, and 0–6 (mean: 2) crowded; Cr/L 0.17–0.23 (mean: 0.19) and b/H 0.27–0.40 (mean: 0.32). Ocular tubercle weakly developed, rarely strongly developed; forming obtuse angle (~110–140°) with rostrum (never close to rectangular; Fig. 25k). Anterior margin of rostrum weakly convex (less strongly than in males). Apex of rostrum drawn out into acute tip, protruding weakly to strongly from rostrum, apex forming acute angle ~45–70°. Antenna I with 14–20 small lobes (mean: 18), lobes smaller than in males; reaching to antenna II flagellomeres III–VIII (mean: V). Antenna II with 14–17 flagellomeres (mean: 15). 25–27 (mean: 26) thorax segments, 24–26 (mean: 25) thoracopod-bearing and none to two posterior limbless segment not reaching dorsal margin. Telson with 7–14 (mean: 11) dorsal spines (Fig. 25o); left and right terminal claws equally curved. Furca with 8–16 setae (mean: 12).

Distribution (Fig. 26h)

Common and widely distributed in the (semi)arid regions of central and eastern Australia. It lives mostly in very turbid claypans and cane grass swamps and is only rarely found in clearer water bodies.

Remarks

Brady's (1886) first description of *O. lutraria* was based only on dried carapaces. Spencer & Hall (1896) described the species in more detail based on newly collected specimens from central Australia (collected a few hundred kilometers W of Brady's specimens). In the same publication, Spencer & Hall also firstly described *O. dictyon.* Based on their descriptions and figures, the species were mostly distinguished by fewer thorax segments ('legs'), smaller overall size, larger and more pronounced spines on the telson, and a lighter (semitranslucent) carapace in *O. dictyon*. But they did not provide a direct comparison between the two species and mostly compared them to *O. packardi*. In our morphometric analyses, both species (including the type material of *O. dictyon* and the specimens of *O. lutraria* studied by Spencer & Hall) clearly overlapped (Fig. 5) and the types of *O. dictyon* were classified as *O. lutraria* with a probability score of 1. Moreover, juvenile specimens of *O. lutraria* studied by us clearly showed the morphological features otherwise associated with *O. dictyon*. Taken together, *O. dictyon* probably represents subadults or late juveniles of *O. lutraria*. As *O. lutraria* was described first, *O. dictyon* is a junior synonym of *O. lutraria*. This was already suggested by Dakin (1914); however, without providing any explanation and subsequent authors did not follow his suggestion.

Assigning *O. lutraria* to one of the species genetically differentiated by Schwentner *et al*. (2015a) was not as straightforward as anticipated. The species genetically differentiated as *O*. sp. C has been previously referred to as *O. lutraria* (e.g., Richter & Timms 2005). However, the original description of *O. lutraria* is very brief and based solely on a single dried-out "somewhat shrunk and distorted"

carapace (Brady 1886: 85). When we included the original drawing of *O. lutraria* by Brady (1886) in our geometric morphometric analyses, it was placed somewhat intermediate between *O. lutraria*, *O. matuwa* sp. nov., *O. henryae* sp. nov. and *O. christiani* sp. nov. (Fig. 5), with the highest similarity to *O. lutraria* (probabilities of 44.2%, 7.2%, 33.1% and 15.0%, respectively; Supp. file 1_4.2). But even for *O. lutraria*, the specimen represented an outlier shape. The differences between Brady's drawing and all other specimens of *O. lutraria* are a convex ventral margin and a less steeply inclined ventro-posterior margin in the drawing. Brady also described the carapace to be compressed behind the middle when seen from dorsal. Such a strong compression was observed neither in specimens of *O. lutraria* nor in any other studied species of *Ozestheria*. Probably the carapace distorted when drying out, leading to this posterior compression. There are two strong arguments in favor of *O.* sp. C representing *O. lutraria*. *Ozestheria* sp. C has the largest carapace of all the species studied herein and the size of Brady's specimen (H: ~6.4 mm, L: 11.1 mm) falls well within its size range and is even close to its mean values, whereas the carapaces of *O. christiani* sp. nov. and *O. paralutraria* sp. nov. are smaller than Brady's specimen. Furthermore, *Ozestheria* sp. C has been collected from a large number of localities all around (west, north and east) the former type locality at Innamincka in northern South Australia. *Ozestheria christiani* is known from a single locality in southern South Australia only, ~500 km from the former type locality of *O. lutraria*, and *O.* sp. X11 from an even more distant locality in northwestern Western Australia.

Genetically, *O. lutraria* is most similar to *O. paralutraria* sp. nov. with uncorrected *p*-distances in COI of only 4.2–4.9% (Supp. file 4).

Ozestheria lutraria shows remarkable ontogenetic changes between late juvenile (or subadult) stages and adults. This affected not only expected ontogenetic changes such as an increase in the number of thorax and antennal segments or the number of furcal setae, but also changes not necessarily associated with late ontogeny: with increasing age, spines on the dorsal extension on the last thorax segments are reduced, the spines on the telson decrease in size and become more conical (Fig. 25m–o) (juveniles with longer and more aciculate spines; Fig. 26f–g) and the distal portion of the furca decreases in size relative to the basal portion. A few adults still had spines on the dorsal extension or several larger spines on the telson and it is possible that these characters would have further changes with subsequent molts.

To clarify the taxonomic status of *O. lutraria*, it was deemed necessary to designate a neotype, particularly in the light of the many newly described species, some of which are morphologically similar to *O. lutraria*, and the newly established synonymy with *O. dictyon*. There is no evidence that the dried-up carapaces collected by Brady are preserved in any collection; requests to relevant collections yielded no such material and also Richter & Timms (2005) suggested that the original material was lost. No material from the type locality was available and a specimen from a comparable locality was selected. The neotype was selected to match both the original description of Brady as well as the redescription by Spencer & Hall as closely as possible.

Ozestheria mariae (Olesen & Timms, 2005)
Fig. 27

Caenestheriella mariae Olesen & Timms, 2005: 1–8, figs 1–4

Ozestheria sp. L – Schwentner *et al*. 2015a: figs 2, 6.
Ozestheria mariae – Schwentner *et al*. 2020: figs 1–2. — Rogers 2020: 24.

Diagnosis

Ozestheria mariae is characterized by a long condyle and a narrow occipital notch; carapace ornamentation with shallow, anastomosing, inconspicuous lirae in early ontogenetic stages, which become more pronounced and nodular in progressing growth bands (visible only under high magnification); a

lack of punctae on growth bands of early ontogenetic stages; angle between ocular tubercle and rostrum rectangular; male rostrum with convex anterior margin, apex strongly rounded with ~90° angle, ventral margin with anterior notch, otherwise straight; female rostrum anterior margin straight, apex weakly rounded, rectangular (not drawn out), ventral margin straight to weakly concave; 10–11 (male) or 8 (female) antenna I lobes reaching to antenna II flagellomeres V–VIII (male) or II (female); 10 (male and female) antenna II flagellomeres; 19–20 complete thorax segments; 8–14 telsonic spines, widely and irregularly spaced, subequal in length with 1–2 larger spines interspersed, posterior spines slightly increasing in size; 2 furcal setae.

Differential diagnosis

Ozestheria mariae can be differentiated from other species of *Ozestheria* with a long condyle by the combination of the ornamentation (shallow, inconspicuous lirae; lacking punctae), the rectangular angle between ocular tubercle and rostrum, the shape of the male and female rostrum, the number of complete thorax segments (19–20), the low number of antennule lobes and antenna flagellomeres (~10) and the number, size and distribution of telsonic spines. Morphologically most similar are *O. carnegiensis* sp. nov., *O. quinlanae* sp. nov. and *O. weeksi* sp. nov. (but punctae in carapace ornamentation; more antennule lobes and antenna flagellomeres), and *O. barcaldinensis* sp. nov. (but punctae in carapace ornamentation, lirae reticulating and pit-like; obtuse angle between ocular tubercle and rostrum). *Ozestheria mariae* yields a similar ornamental pattern as *O. setifera* sp. nov. with intermittent, nodular lirae on the lower part of mid-carapace growth bands while the upper part is smooth to granular, but differs in having fewer setae on the carapace, overall carapace shape and the number of telsonic spines.

Type material

Holotype (not examined)
AUSTRALIA – **Western Australia** • ♂; Gnamma pool on Bushfire Rock, near Hyden; 32°36″ S, 119°20″ E; Jun. 2003; B.V. Timms leg.; WAM C34418.

Paratypes (not examined)
AUSTRALIA – **Western Australia** • 1 ♀; same data as for holotype; ZMUC CRU-4854 • 1 spec.; same data as for holotype; AM P.68560.

Paratypes
AUSTRALIA – **Western Australia** • 3 ♂♂, 2 ♀♀; same data as for holotype; WAM C34420.

Type locality

Western Australia, Gnamma pool on Bushfire Rock, near Hyden, 32°36′ S, 119°20′ E.

Description

Males (information on holotype taken from Olesen & Timms 2005)
Carapace (Fig. 27a, c–d). Length 4.6–5.3 mm (HT: 5.2 mm), height 2.9–3.2 mm. Coloration larval valve and several following growth bands yellowish to dark brown colored, remainder whitish and semi-translucent. 21–28 growth lines (HT: ~16), 18–23 widely spaced and 3–9 crowded.

Carapace shape. Dorsal margin straight, dorso-posterior corner rounded. Posterior margin broadly rounded, suboval, supracurvate to equicurvate (b/H 0.43–0.50). Ventral margin broadly rounded. Umbo position submedian (Cr/L 0.28–0.29).

Carapace ornamentation (Fig. 27e–h). Larval valve granular (appears smooth under SEM due to missing outer cuticle layers). Following growth bands with shallow, inconspicuous, anastomosing lirae forming ventrally on growth bands, these become slightly more pronounced on later and crowded growth bands; under SEM the lirae dissolve into a series of small, nodular radial structures, rather than

continuous lirae. Crowded growth bands with sub-parallel lirae (under SEM also short and nodular). Lirae mostly terminate ventrally in comparatively large nodules on concentric ridge (best seen under SEM). Concentric ridges slightly raised. Setae thick and mid-long, preserved in large numbers in a single row along most growth lines (setal pores in two irregular rows mid-dorsally and one row along growth lines of later ontogenetic stages under SEM).

Head (Fig. 27i). Condyle long, distally acute; occipital notch narrow. Condyle with anterobasal hump. Margin between condyle and ocular tubercle weakly to strongly concave. Ocular tubercle well developed (in some individuals with small tubercle on ocular tubercle), forming nearly rectangular angle with rostrum. Anterior margin of rostrum convex. Apex strongly rounded with ~90° angle. Ventral margin of

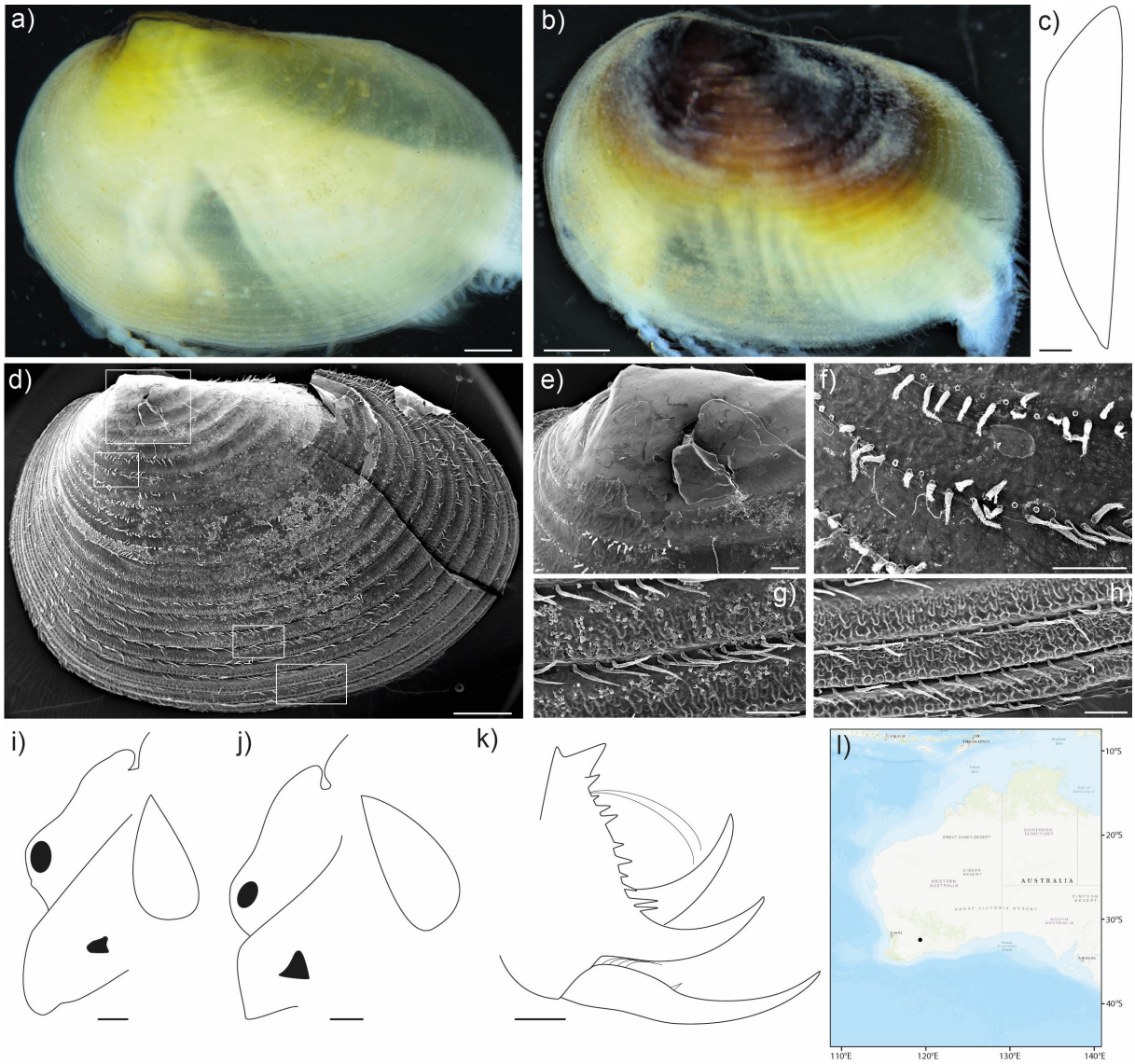

Fig. 27. *Ozestheria mariae* (Olesen & Timms, 2005), paratypes (WAM C34420). **a–d**. Carapace. **a**. Male. **b**. Female. **c**. Dorsal view (left valve only, male). **d**. Male, SEM. **e–h**. Carapace ornamentation (positions marked in d by rectangle), SEM. **e**. Larval valve and dorsal carapace. **f**. Mid-dorsal carapace. **g**. Mid-ventral carapace. **h**. Ventral carapace. **i–j**. Head, antennae not shown. **i**. Male. **j**. Female. **k**. Telson, male. **l**. Distribution map (produced in ArcMap 10.7; see caption Fig. 7 for sources). Scale bars: a–d = 0.5 mm; e–h = 0.1 mm; i–k = 0.2 mm.

rostrum with anterior notch, otherwise straight. Naupliar eye small roundish to sub-triangular. Antenna I long with 10–11 lobes (HT: ~11), reaching to antenna II flagellomeres V–VIII. Antenna II with 10 flagellomeres.

Thorax. 20 (HT: 19) segments, 19–20 thoracopod-bearing and none to one posterior limbless segment not reaching dorsal margin. Spines on dorsal extension relatively short and stout.

Thoracopod III (only WAM C34418, based on Olesen & Timms 2005). Endite I short and curved dorsally. Endites II–V broad, decreasing in size. Endite V palp two-segmented, basal segment subequal in length to endopod. Exopod ventral extension shorter in extension than endopod, dorsal extension wide, narrowing distally, overreaching epipod. Epipod long, cylindric.

Telson (Fig. 27k). 8–11 spines. First (anterior) spine enlarged. Most spines short, conical, subequal in length; one or two slightly larger spines interspersed; rather widely and irregularly spaced; posteriormost spines increasing in size, thin, aciculate. Dorsal margin straight. Right terminal claw more strongly curved than left.

Furca (Fig. 27k). Proximally with dorsomedial longitudinal row of 4 setae, row ending distally in a single conical spine. Distal part ~⅔ of furcal length, with numerous small denticles

Females

Overall appearance as in males. Carapace (Fig. 27b) length 3.6–4.2 mm, height 2.3–2.7 mm; 24 growth lines, 19–20 widely spaced and 3–5 crowded (in one individual 12 wide growth lines are followed by 5 crowded and then another 7 wide growth lines of a secondary growth phase; ornamentation of secondary growth phase with subparallel lirae); Cr/L 0.28 and b/H 0.45–0.49. Margin between condyle and ocular tubercle straight to strongly concave (Fig. 27j). Anterior margin of rostrum straight; apex weakly rounded, rectangular, not drawn out; ventral margin straight to weakly convex. Antenna I with 8 small lobes, lobes smaller than in males; reaching to antenna II flagellomere II. Antenna II with 10 flagellomeres. 20 segments, all thoracopod-bearing. Telson with 14 dorsal spines; left and right terminal claws equally or right stronger curved. Furca with 2 setae.

Distribution (Fig. 27l)

The species is known only from a few localities in southwestern Western Australia, all in small water bodies on rocky outcrops.

Remarks

Olesen & Timms (2005) assigned *O. mariae* to the genus *Caenestheriella* and distinguished it from the only other Australian species of *Caenestheriella* (now *Ozestheria*) accepted at that time – *O. packardi*. However, all the characters suggested are in fact shared by several other of the herein newly described species of *Ozestheria* (e.g., the hump at the base of condyle or the well-developed ocular tubercle), which are thus not sufficient to distinguish *O. mariae* from other species of *Ozestheria*.

In the geometric morphometric analyses of the carapace shape (Fig. 6), *O. mariae* is distinct from most other species and clusters with *O. sivesae* sp. nov., *O. setifera* sp. nov., *O. marthae* sp. nov., *O. cancellata* comb. nov., *O. weeksi* sp. nov., *O. pilbarensis* sp. nov., and *O. gemina* sp. nov. The mean shape of *O. mariae* is similar to that of *O. setifera* (54.3%), *O. gemina* (37.8%) and *O. quinlanae* sp. nov. (5.2%), which were associated with high typicality scores of 0.79, 0.77 and 0.84, respectively (Supp. file 2_4.8), but the ornamentation patterns of these species did not match that of *O. mariae*.

Ozestheria marthae sp. nov.
urn:lsid:zoobank.org:act:3099BC5D-8719-4618-A89B-188ED6DBFE7A
Fig. 28

Ozestheria sp. P – Schwentner *et al*. 2015a: figs 2, 6; 2020: figs 1–2.

Diagnosis

Ozestheria marthae sp. nov. is characterized by a long condyle and a narrow occipital notch; carapace ornamentation dorsally on carapace finely punctate to finely reticulated (ornamentation may appear granular rather than punctate), from about mid-carapace fine lirae forming between punctae, lirae become more pronounced (still rather inconspicuous) with progressing growth bands; male rostrum with weakly convex anterior margin, apex weakly rounded with acute angle (~70°), ventral margin anteriorly with small convex protrusion; female rostrum anterior margin slightly concave with distinct rounded bulge at fronto-dorsal corner, apex pointed, drawn out into acute tip, ventral margin weakly concave; 11–17 (male) or 10–15 (female) antenna I lobes reaching to antenna II flagellomeres IV–VII (male) or II–IV (female); 10–13 (male) or 9–12 (female) antenna II flagellomeres; 19–22 complete thorax segments; 15–27 telsonic spines, anterior spines conical with 2–3 larger spines interspersed (usually in middle of telson and the other among the last four spines), posterior spines thinner and drawn out; 3–8 furcal setae.

Differential diagnosis

Ozestheria marthae sp. nov. can be differentiated from many other species of *Ozestheria* by the narrow occipital notch and long condyle in combination with the carapace ornamentation (dominated by subparallel and reticulating lirae), except from *O. cancellata* comb. nov., *O. minor* comb. nov., *O. typica* comb. nov., *O. fuersichi* sp. nov., *O. jonnae* sp. nov., *O. selmae* sp. nov., *O. radiata* sp. nov., *O. bourkensis* sp. nov., *O. rincewindi* sp. nov., *O. barcaldinensis* sp. nov., *O. ngamurru* sp. nov., *O. beleriandensis* sp. nov., *O. quinlanae* sp. nov., *O. glabra* sp. nov., *O. pilbarensis* sp. nov. and *O. weeksi* sp. nov., and differentiating these species can be difficult, though in *O. marthae* lirae are intermittent and nodular (best seen under SEM). *Ozestheria marthae* differs by the presence of a fronto-dorsal bulge at the anterior margin of the female rostrum from all of these species except *O. weeksi*. *Ozestheria weeksi* has fewer complete thorax segments and fewer antenna I lobes (male and females). Furthermore, *O. minor*, *O. typica*, *O. bourkensis*, *O. selmae*, *O. radiata*, and *O. beleriandensis* can be differentiated by having at least the posterior half of the telsonic spines long, elongated and aciculate.

Etymology

The species is named after Martha Schwentner, the oldest daughter of MS.

Type material

Holotype

AUSTRALIA – **New South Wales** • ♂; Lake Cooltralantra, via Berridale; 36°15′56.8″ S, 148°53′16.4″ E; 2 Mar. 2010; M. Schwentner and C.Sieves leg.; GenBank no: KJ705888 (COI); AM P.91660.

Paratypes

AUSTRALIA – **New South Wales** • 1 ♂, 1 ♀; same data as for holotype; GenBank nos: KJ705887, KJ705889 (COI); AM P.91659, P.91661 • 1 ♂; same data as for holotype; GenBank no: KJ705890 (COI); NHMW-ZOO-CR-28485.

Other material examined

AUSTRALIA – **New South Wales** • 2 ♂♂, 2 ♀♀; claypan on Snowleigh Station; 36°40′52.6″ S, 149°00′00.5″ E; 13 Mar. 2010; M. Schwentner and C. Sieves leg.; AM P.91651 to P.91654 • 5 ♀♀; claypan on Snowleigh Station; 36°40′5″ S, 148°00′01″ E; 12 Apr. 2012; B.V. Timms leg.; AM P.91673

to P.91677 • 4 ♂♂; Avon Lake, Bungarby; 36°37′04.2″ S, 149°02′58.4″ E; 14 Mar. 2010; M. Schwentner and C. Sieves leg.; AM P.91655 to P.91658.

Additional material (not examined)

AUSTRALIA – **New South Wales** • 5 juvs; Killmacoola Lagoon; 36°16′23.9″ S, 148°55′53.3″ E; 2 Mar. 2010; M. Schwentner and C. Sieves leg.; AM P.91663 to P.91667 • 5 juvs; Salt Lake, Cooma; 36°21′47.8″ S, 148°57′10.7″ E; 3 Mar. 2010; M. Schwentner and C. Sieves leg.; AM P.91668 to P.91672.

Type locality

New South Wales, Lake Cooltralantra, via Berridale, 36°15′56.8″ S, 148°53′16.4″ E.

Description

Males

Carapace (Fig. 28a, c–d). Length 4.3–5.8 mm (HT: 5.8 mm), height 2.6–3.5 mm (HT: 3.3 mm). Coloration light orange-yellowish to dark orange/ocher, crowded growth band lighter, whitish. 13–19 (HT: 15) growth lines, 13–19 (HT: 15) widely spaced and none to three (HT: none) crowded.

Carapace shape. Dorsal margin straight, distinct dorso-posterior corner. Posterior margin broadly rounded, suboval, equicurvate (b/H 0.47–0.53, HT: 0.51). Ventral margin broadly rounded. Umbo position anterior (Cr/L 0.21–0.25, HT: 0.24).

Carapace ornamentation (Fig. 28e–g). Larval valve and following growth bands granular (finely punctate to finely reticulated under SEM). From about mid-carapace, shallow, irregular, fine lirae appear between punctae; becoming stronger, subparallel and conflating lirae on growth bands of later ontogenetic stages (lirae intermittent and nodular under SEM). On the posterior part of carapace, some lirae 'disappearing' before growth line, leading to a reduced liral density and irregular liral spacing. Crowded growth bands nodular with short lirae. Concentric ridges shallow and punctate (only seen under SEM). Setae filiform, preferentially preserved in the median and posterior parts of the carapace; under SEM setal pores in a single row and widely spaced.

Head (Fig. 28h–i). Condyle long, distally acute; occipital notch narrow. Condyle with weak anterobasal hump in a few individuals (usually absent). Margin between condyle and ocular tubercle straight to slightly concave (HT: straight). Ocular tubercle weakly developed, forming obtuse (~150–180°) angle with rostrum, rostrum protruding from head. Anterior margin of rostrum weakly convex. Ventral margin of rostrum with or without small anterior notch followed by small convex protrusion; apex weakly rounded, acute (~70°). Naupliar eye roundish-oval to subtriangular with rounded edges. Antenna I long with 11–17 lobes (HT: 12), reaching to antenna II flagellomeres IV–VII (HT: V). Antenna II with 10–13 flagellomeres (HT: 11).

Thorax. 20–23 (HT: 22) segments, 19–22 (HT: 21) thoracopod-bearing and none to one (HT: one) posterior limbless segment not reaching dorsal margin. Last ~14 thoracopod-bearing segments with spine-bearing dorsal extensions. Dorsal extensions increasing in size posteriorly over successive segments (until ~8th last segment). Spines short and stout, in posterior segments central spines stouter but shorter.

Thoracopod III (only P.91660; Fig. 28m). Endite I short and curved dorsally. Endites II–V broad, decreasing in size. Endite V palp two-segmented, basal segment subequal to endopod. Exopod ventral extension shorter than endopod; dorsal extension wide, narrowing distally, overreaching epipod. Epipod long, cylindric.

Telson (Fig. 28k–l). 15–22 spines (HT: 20). First (anterior) spine enlarged. Spines subequal in length, thin, conical, posteriormost spines thinner and drawn out. Two (rarely three) larger spines (~2 × in size) interspersed, one about half-length of telson and one posteriorly (usually among last four spines). Dorsal

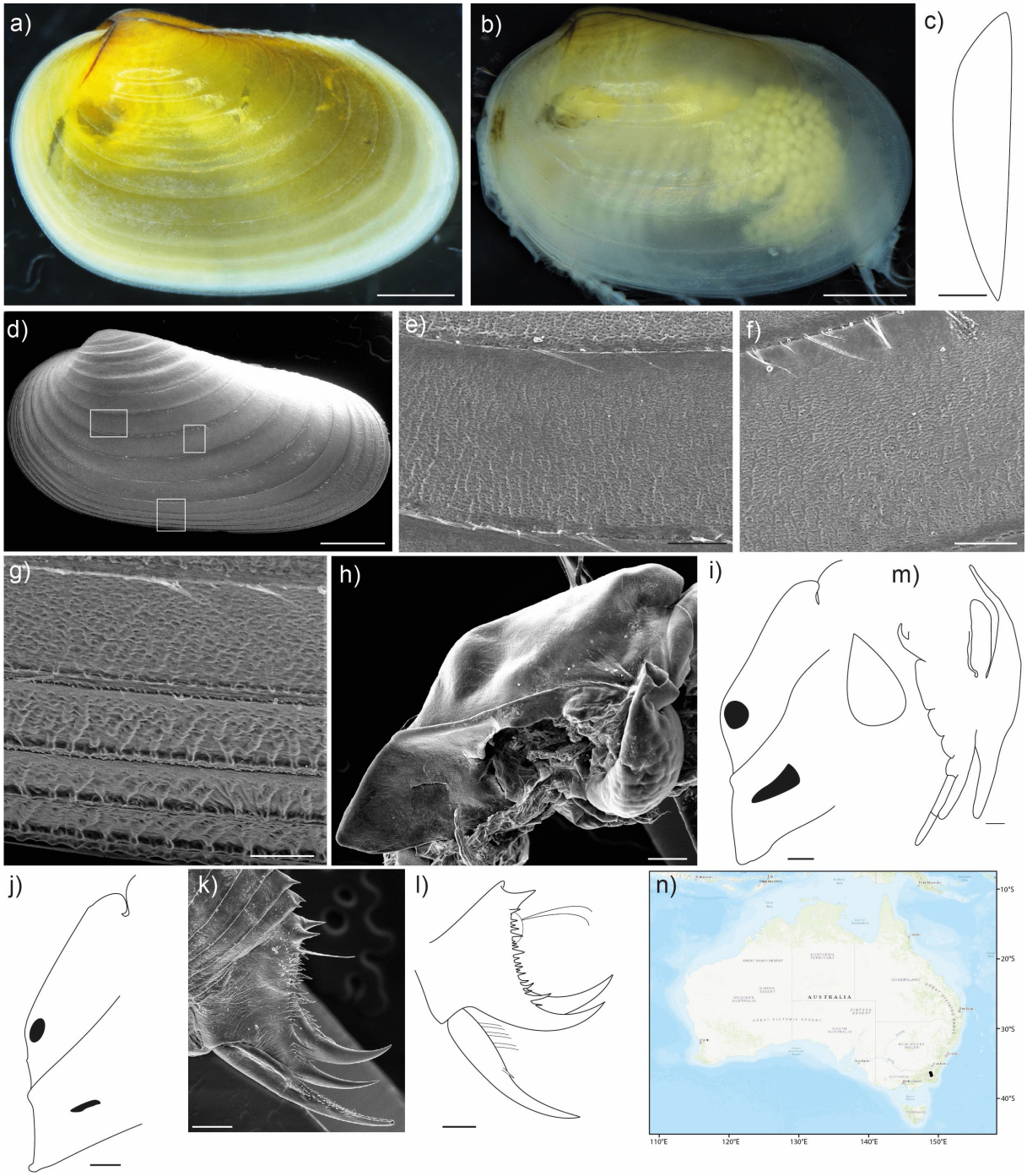

Fig. 28. *Ozestheria marthae* sp. nov. **a–d**. Carapace. **a**. Male, holotype (P. 91660). **b**. Female, paratype (P.91659). **c**. Dorsal view (male, holotype, P. 91660). **d**. Male, paratype (P.91661; ventral margin damaged), SEM. **e–g**. Carapace ornamentation of male paratype (P.91661; positions marked in d by rectangles), SEM. **e–f**. Mid-carapace. **g**. Ventral carapace. **h–j**. Head (antennae not shown). **h**. Male, paratype (P.91661), SEM. **i**. Male, holotype (P.91660). **j**. Female, paratype (P.91659). **k–l**. Telson. **k**. Male, paratype (P.91661), SEM. **l**. Male, holotype (P.91660). **m**. Third left thoracopod (male, P.91660). **n**. Distribution map (produced in ArcMap 10.7; see caption Fig. 7 for sources). Scale bars: a–d = 1 mm; e–g = 0.1 mm; h–m = 0.2 mm.

margin straight to slightly convex, posteriorly slightly concavely curved. Right terminal claw more strongly curved than left.

Furca (Fig. 28k–l). Proximally with dorsomedial longitudinal row of 4–8 (HT: 6) setae, row ending distally in a single conical spine. Distal part ½–⅔ of furcal length, with numerous small denticles.

Females

Overall appearance as in males. Carapace (Fig. 28b) length 4.9–6.6 mm, height 3.0–4.1. 12–22 growth lines, 11–19 widely spaced and none to three crowded, Cr/L 0.22–0.25 and b/H 0.43–0.57. Rostrum with distinct rounded bulge at fronto-dorsal corner, anterior margin slightly concave; apex pointed, drawn out into acute tip, which is slightly antero-dorsally curved, ventral margin weakly concave (Fig. 28j). Antenna I with 10–15 small lobes, lobes smaller than in males; reaching to antenna II flagellomeres II–IV. Antenna II with 9–12 flagellomeres. 21–23 segments, 21–22 thoracopod-bearing and none to two posterior limb-less segments not reaching dorsal margin. Telson with 18–27 dorsal spines; left and right terminal claws equally curved. Furca with 3–6 setae.

Distribution (Fig. 28n)

Ozestheria marthae sp. nov. is known only from the tablelands around Cooma and Berridale in southern New South Wales, where it occurs in a variety of habitats including freshwater and hyposaline lakes as well as claypans. It is possible that it occurs more widely in this mountainous area.

Remarks

The carapace shape of *Ozestheria marthae* sp. nov. (Fig. 6) is distinct from that of most other species and overlaps with those of *O. timmsi* sp. nov., *O. sivesae* sp. nov., *O. setifera* sp. nov., *O. mariae*, *O. gemina* sp. nov., *O. jonnae* sp. nov. (marginally), *O. selmae* sp. nov., *O. cancellata* comb. nov., *O. weeksi* sp. nov., *O. quinlanae* sp. nov., and *O. pilbarensis* sp. nov.

Ozestheria matuwa sp. nov.

urn:lsid:zoobank.org:act:4F91152F-FCDD-4306-9467-B580768A9FA0

Fig. 29

Diagnosis

Ozestheria matuwa sp. nov. is characterized by a short condyle and a wide occipital notch; a rounded ventral carapace margin; carapace ornamentation with large, well-developed polygonal reticulations, each polygon with polygonal secondary ornamentation (best seen under SEM); male rostrum with strongly convex anterior margin, apex rounded with acute to right angle, ventral margin concave, pointing apex downwards; female rostrum anterior margin straight or strongly convex, apex pointed (elongated, drawn out), ventral margin slightly concave; 12–19 (male) or 13–14 (female) antenna I lobes reaching to antenna II flagellomeres VII–IX (male) or III–IV (female); 11–14 (male) or 11–13 (female) antenna II flagellomeres; 22–24 complete thorax segments; 18–27 small, unequally sized and spaced conical telsonic spines, some spines in the central part of the telson enlarged; 3–14 furcal setae.

Differential diagnosis

See differential diagnosis of *O. elliptica*.

Etymology

The name is derived from Matuwa, the traditional owner's name for the Lake Carnegie area in the Martu language; noun in apposition.

Type material

Holotype

AUSTRALIA – **Western Australia** • ♂; Gidgi Lake, 20 km N of Kalgoorlie; 30°36′11″ S, 121°24′51.7″ E; 18 Feb. 2014; K. Quinlan leg.; GenBank no: PQ427000 (COI); WAM C78010.

Paratypes

AUSTRALIA – **Western Australia** • 2 ♂♂; same data as for holotype; GenBank nos: PQ426999, PQ427003 (COI); WAM C80207, C80208 • 1 ♂; same data as for holotype; GenBank no: PQ427001 (COI); NHMW-ZOO-CR-28496.

Other material examined

AUSTRALIA – **Western Australia** • 3 ♂♂, 1 ♀; Wetland 2.4 km S of Boondi Rock; 31°11′40.4″ S, 120°23′55.7″ E; 24 Feb. 2017; K. Quinlan leg.; WAM C78006, C80204 to C80206 • 1 ♂, 2 ♀♀; Lindsay Gordon Lagoon, SW of Lorna Glen Homestead; 26°15′45.2″ S, 121°29′51.2″ E; 18 Mar. 2017; K. Quinlan leg.; WAM C80202, C80203, C80201 • 4 ♂♂, 1 ♀; Wetland 50 km SW of Bullabulling (Goldfields Woodlands Conservation Park); 31°16′44.5″ S, 120°32′36″ E; 22 Feb. 2017; K. Quinlan leg.; WAM C78007, C80209 to C80212.

Type locality

Western Australia, Gidgi Lake, 20 km N of Kalgoorlie, 30°36′11″ S, 121°24′51.7″ E.

Description

Males

Carapace (Fig. 29a, c–d). Length 6.4–9.4 mm (HT: 9.4 mm, mean: 7.7 mm), height 3.5–5.3 (HT: 5.2 mm, mean: 4.3 mm). Coloration whitish to yellow-brownish or brown, crowded growth bands lighter, often whitish. 19–23 (HT: 22, mean: 21) growth lines, 15–20 (HT: 17, mean: 17) widely spaced and 2–7 (HT: 5, mean: 4) crowded.

Carapace shape. Dorsal margin straight, distinct dorso-posterior corner. Posterior margin broadly rounded, suboval, supracurvate to infracurvate (b/H 0.41–0.48, HT: 0.45, mean: 0.43). Ventral margin widely rounded. Umbo position anterior (Cr/L 0.21–0.24, HT: 0.24, mean: 0.22).

Carapace ornamentation (Fig. 29e–i). Larval valve with shallow reticulations. Each growth band with large, well-developed, strongly raised reticulations. Reticulations form polygonal mesh across each growth band with each polygon usually being a pentagon, hexagon or heptagon. Polygon-size increasing during ontogeny, largest in the median part of each growth band; under SEM secondary mesh or polygonal reticulation within each primary polygon (less strongly developed or absent ventrally within growth bands). Ornamentation uniform across all non-crowded growth bands, crowded growth bands either too narrow to show reticulation or with a single row of polygonal reticulations, sometimes resulting in radial appearance. Concentric ridges raised. Setae of varying length; preferentially preserved in ventral and posterior parts of the carapace. Setal pores in single, irregular row along all growth lines.

Head (Fig. 29j). Condyle short, distally rounded; occipital notch wide. Condyle lacking anterobasal hump. Margin between condyle and ocular tubercle straight to slightly concave. Ocular tubercle well developed, forming obtuse, nearly rectangular (~90–120°) angle with rostrum. Anterior margin of rostrum strongly convex. Apex weakly rounded, acute to nearly rectangular (~90°), pointing slightly downwards. Ventral margin of rostrum weakly to strongly concave (HT: strongly concave), in some individuals with notch anteriorly (HT: weakly developed). Naupliar eye elongated, subtriangular to subrectangular. Antenna I long with 12–19 lobes (HT: 16; mean: 15), reaching to antenna II flagellomeres VII–IX (HT: IX; mean: VIII). Antenna II with 11–14 flagellomeres (HT: 14; mean: 13).

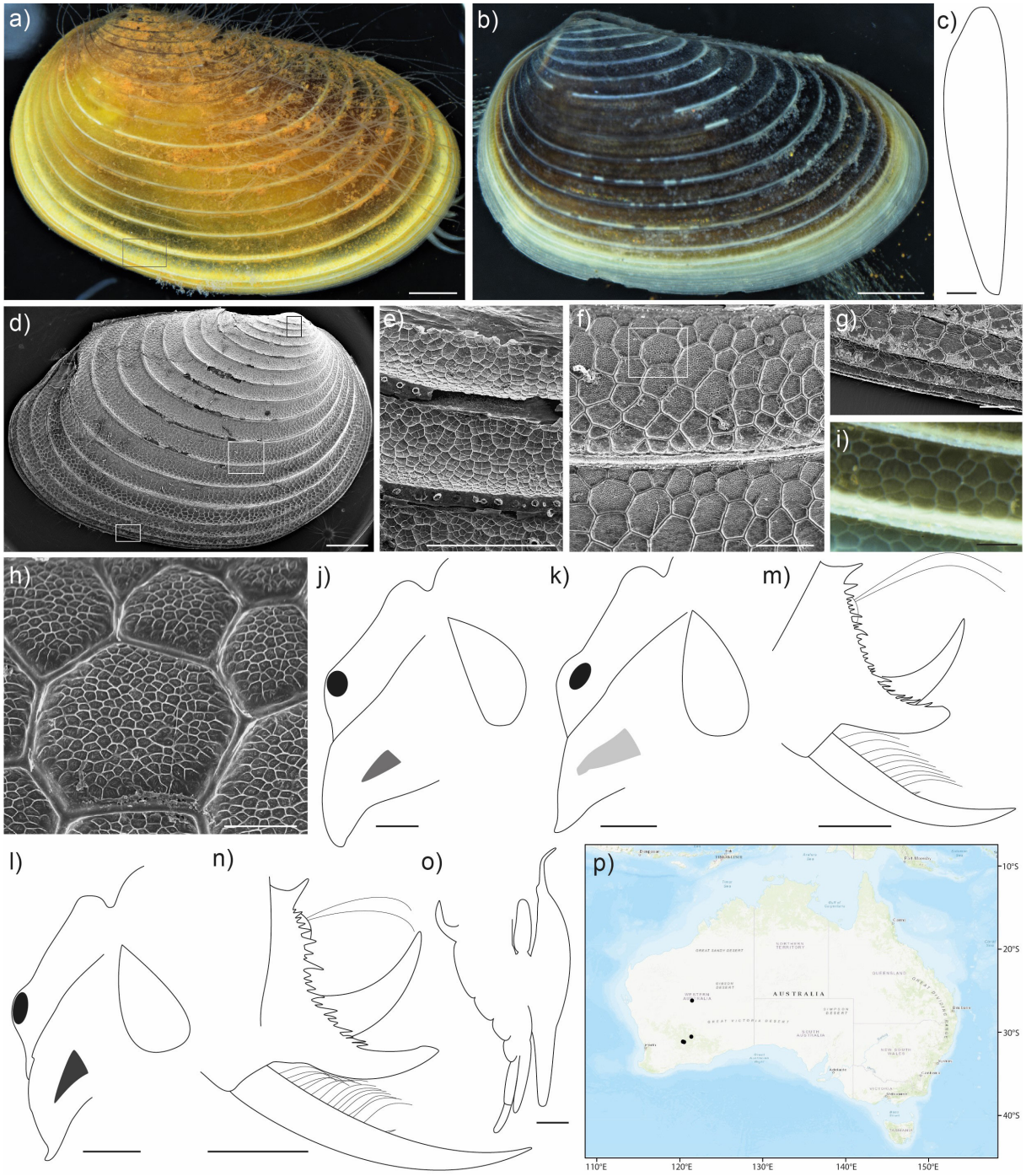

Fig. 29. *Ozestheria matuwa* sp. nov. **a–d**. Carapace. **a**. Male, holotype (WAM C78010). **b**. Female (WAM C80202). **c**. Dorsal view, male, holotype (left valve only; WAM C78010). **d**. Male, paratype (WAM C80208), SEM. **e–h**. Carapace ornamentation (male paratype WAM C80208; positions marked in a, d and f by rectangles), SEM. **e**. Dorsal carapace. **f**. Mid-carapace. **g**. Ventral carapace. **h**. Mid-carapace, detail. **i**. Carapace ornamentation (male, holotype WAM C78010), ventral. **j–l**. Head (antennae not shown). **j**. Male, holotype (WAM C78010). **k**. Female (WAM C80202). **l**. Female (WAM C80212). **m–n**. Telson. **m**. Male, holotype (WAM C78010). **n**. Male (WAM C80209). **o**. Third left thoracopod (holotype, WAM C78010). **p**. Distribution map (produced in ArcMap 10.7; see caption Fig. 7 for sources). Scale bars: a–d = 1 mm; e–g, i = 0.2 mm; h = 0.05 mm; j–o = 0.5 mm.

Thorax. 23–25 (HT: 24; mean: 24) segments, 22–24 (HT: 23; mean: 23) thoracopod-bearing and one (HT: one) posterior limbless segment not reaching dorsal margin. In most thoracopod-bearing segments dorsal extensions bearing several spines and setae, posterior segments with only few spines.

Thoracopod III (only WAM C78010; Fig. 29o). Endite I short and curved dorsally. Endites II–V broad, decreasing in size. Endite V palp two-segmented, basal segment shorter than endopod. Exopod ventral extension subequal to slightly shorter in extension to endopod, dorsal extension wide, narrowing distally, overreaching epipod. Epipod long, cylindric.

Telson (Fig. 29m–n). 18–27 spines (HT: 24; mean: 22). First (anterior) spine enlarged. Spines on anterior ½ to ¾ of telson short, conical, varying in size; posterior spines thinner, elongate, aciculate, increasing in size; aciculate spines preceded by a few (usually 2) particularly small spines; 1–4 larger spines interspersed. Dorsal margin straight or anteriorly convex, then concavely curved. Right terminal claw more strongly curved than left.

Furca (Fig. 29m–n). Proximally with dorsomedial longitudinal row of 8–14 (HT: 9, mean: 10) setae, row ending distally in a single conical spine. Distal part ⅓–⅔ of furcal length, with numerous small denticles.

Females

Overall appearance as in males. Carapace (Fig. 29b) length 5.6–7.4 mm, height 3.1–4.2 mm; 19–25 growth lines, 14–18 and 2–10; Cr/L 0.21–0.23 and b/H 0.42–0.47. Angle between ocular tubercle and rostrum obtuse (~120–150°) (Fig. 29k–l). Anterior margin of rostrum strongly convex to nearly straight (slightly undulating); apex with acute angle (~50°), pointed, drawn out into acute tip; ventral margin weakly concave. Antenna I with 13–14 small lobes, lobes smaller than in males; reaching to antenna II flagellomeres III–IV. Antenna II with 11–13 flagellomeres. 24 segments, of these 23 thoracopod-bearing and one posterior limb-less segment not reaching dorsal margin. Telson with 19–23 dorsal spines; right terminal claws stronger curved. Furca with 3–8 setae.

Distribution (Fig. 29p)

Ozestheria matuwa sp. nov. has been recorded in central and southern Western Australia.

Remarks

The carapace shape of *Ozestheria matuwa* sp. nov. (Fig. 5) is distinct from that of most other species and partly overlaps with those of *O. rubra*, *O. henryae* and *O. christiani* sp. nov.

Ozestheria minor (Spencer & Hall, 1896) comb. nov.
Figs 30–31

Estheria packardi var. *minor* Spencer & Hall, 1896: 238, fig. 21.

Caenestheriella packardi var. *minor* – Daday 1914: 121–122.
Cyzicus packardi var. *minor* – Brtek 1997: 48.
Ozestheria packardi (in part) – Richter & Timms 2005: 347. — Rogers 2020: 24.
Ozestheria sp. B – Schwentner *et al*. 2015a: figs 2, 6.; 2020: figs 1–2. — Hethke *et al*. 2023: fig. 10.

Diagnosis

Ozestheria minor comb. nov. is characterized by a long condyle and a narrow occipital notch; carapace ornamentation dorsally on carapace punctate, in following growth bands anastomosing lirae forming, lirae become longer, more pronounced and less anastomosing with progressing growth bands; male

rostrum with straight (rarely slightly undulating) anterior margin, apex acute angle (~45–60°), sometimes weakly rounded, ventral margin concave, pointing apex slightly downwards; female rostrum with straight anterior margin, apex rectangular and drawn out into small acute tip, ventral margin weakly concave; 10–16 (male) or 12–16 (female) antenna I lobes reaching to antenna II flagellomeres VI–X (male) or I–V (female); 11–15 (male) or 11–15 (female) antenna II flagellomeres; 19–23 complete thorax segments; 17–28 telsonic spines, spines on anterior third of telson thin and conical, following spines increasing in size, becoming longer, drawn out, aciculate and more closely spaced, all spines comparatively large; 4–10 furcal setae.

Differential diagnosis

Ozestheria minor comb. nov. can be differentiated from many other species of *Ozestheria* by the narrow occipital notch and long condyle in combination with the carapace ornamentation (dominated by punctate ornamentation dorsally on carapace, transitioning to distinct, subparallel lirae during ontogeny), except from *O. cancellata* comb. nov., *O. typica* comb. nov., *O. fuersichi* sp. nov., *O. jonnae* sp. nov., *O. marthae* sp. nov., *O. selmae* sp. nov., *O. radiata* sp. nov., *O. bourkensis* sp. nov., *O. rincewindi* sp. nov., *O. barcaldinensis* sp. nov., *O. ngamurru* sp. nov., *O. beleriandensis* sp. nov., *O. quinlanae* sp. nov., *O. glabra* sp. nov., *O. pilbarensis* sp. nov. and *O. weeksi* sp. nov., and differentiating these species can be difficult. *Ozestheria minor* differs from *O. cancellata*, *O. fuersichi*, *O. jonnae*, *O. marthae*, *O. rincewindi*, *O. barcaldinensis*, *O. ngamurru*, *O. quinlanae*, *O. glabra*, *O. pilbarensis* and *O. weeksi* in having at least the posterior half of the telsonic spines long, elongate and aciculate (in the other species fewer telsonic spines are long and aciculate and more spines shorter and conical) and by the shape of the male and female rostrum (in particular anterior margin and apex). The apex of the male rostrum of *O. beleriandensis* is pointed and never rounded (in *O. minor* slightly rounded) and in the female the apex is finer pointed. The male rostrum of *O. selmae* has a dorsal concave notch (not in all individuals) and a weakly convex anterior margin. *Ozestheria bourkensis* and *O. typica* have a more strongly concave line between the condyle and ocular tubercle, and the female antenna I and II have fewer lobes and flagellomeres. *Ozestheria radiata* has a more rounded rostral apex in the male and the female rostrum terminates in a finer point.

Type material

Syntypes

AUSTRALIA – **Northern Territory or South Australia** • 2 ♂♂, 9 ♀♀; Charlotte Waters Central Australia; Horn Expedition leg.; MV J54045.

Other material examined

AUSTRALIA – **New South Wales** • 2 ♂♂, 1 ♀; excavated area W of Yarrabundai; 33°07′28.5″ S, 147°32′09.8″ E; 23 Jan. 2010; M. Schwentner and B.V. Timms leg.; AM P.91513 to P.91515 • 2 ♂♂, 1 ♀; Bloodwood Station, Gidgee Lake; 29°33′10.4″ S, 144°50′12.7″ E; 19 Feb. 2010; M. Schwentner, C. Sieves and B.V. Timms leg.; AM P. 91487, P.91489, P.91490 • 1 ♀; Barnato Station, lake next to homestead, 80 km W of Cobar; 31°36′52.4″ S, 144°52′12.6″ E; 29 Mar. 2010; M. Schwentner and B.V. Timms leg.; raised from sediment; AM P. 91486. – **South Australia** • 2 ♂♂, 1 ♀; dugout 55 km E of Marla; 27°18′21.3″ S, 134°07′15.9″ E; 11 Mar. 2011; M. Schwentner and B.V. Timms leg.; AM P.91495, AM P.91496, P.91498 • 1 ♀; dugout 55 km E of Marla; 27°18′21.3″ S, 134°07′15.9″ E; 11 Mar. 2011; M. Schwentner and B.V. Timms leg.; NHMW-ZOO-CR-28490. – **Queensland** • 1 ♂; dead shrub near old borrow pit, 113 km S of Mount Isa; 21°34′21.0″ S, 139°11′58.4″ E; 4 Mar. 2011; M. Schwentner and B.V. Timms leg.; AM P.91500 • 4 ♂♂, 3 ♀♀; Sumana Station, small pool (H2); 22°18′29.6″ S, 145°21′56.7″ E; 2 Apr. 2009; M. Schwentner and B.V. Timms leg.; AM P.80862, P.91477 to P.91482 • 4 ♂♂, 1 ♀; N of Wyandra; 27°11′03.2″ S, 145°59′41.2″ E; 17 Feb. 2010; M. Schwentner, C. Sieves and B.V. Timms leg.; AM P.91493, P.91494, P.91506 to P.91508 • 3 ♂♂, 2 ♀♀; old borrow pit 8 km E of Boulia; 22°55′44.6″ S, 139°58′23.7″ E; 4 Mar. 2011; M. Schwentner and B.V. Timms leg.; AM P.91501 to P.91505.

Additional material (not examined)

AUSTRALIA – **New South Wales** • 1 ♀; Bloodwood Station, Vosper Pool; 29°32′03.9″ S, 144°50′37.7″ E; 30 Mar. 2009; M. Schwentner and B.V. Timms leg.; AM P.91476 • 2 juvs; Bloodwood Station, Gidgee Lake; 29°33′10.4″ S, 144°50′12.7″ E; 19 Feb. 2010; M. Schwentner, C. Sieves and B.V. Timms leg.; AM P.91487, P.91488 • 1 ♂; Muella Station, Muella Vegetated Pool 3; 29°30′12.0″ S, 144°55′37.4″ E; 31 Mar. 2009; M. Schwentner and B.V. Timms leg.; AM P.91552 • 1 juv.; big black box swamp; 29°10′19.4″ S, 145°22′41.3″ E; 21 Jan. 2010; M. Schwentner and B.V. Timms leg.; AM P.91526 • 1 juv.; Barnato Lake; 31°36′45.2″ S, 144°59′20.0″ E; 22 Jan. 2010; M. Schwentner and B.V. Timms leg.; raised from sediment; AM P.91491. – **South Australia** • 1 juv.; borrow pit 90 km S of border; 26°49′22.0″ S, 133°19′44.7″ E; 10 Mar. 2011; M. Schwentner and B.V. Timms leg.; AM P.91499. – **Queensland** • 1 ♂; Sumana Station, small pool (H2); 22°18′29.6″ S, 145°21′56.7″ E; 2 Apr. 2009; M. Schwentner and B.V. Timms leg.; AM P.80862 • 5 juvs; Sumana Station, small pool (H8); 22°18′29.5″ S, 145°23′00.3″ E; 3 Apr. 2009; M. Schwentner and B.V. Timms leg.; raised from sediment; AM P.89648 to P.89650, P.91474, P.91475 • 6 juvs; SW Bay of Galilee; 22°25′47.9″ S, 145°42′07.6″ E; 3 Apr. 2010; M. Schwentner, C. Sieves and B.V. Timms leg.; AM P.91483 to P.91485, P.91516 to P.91518 • 3 juvs; Thunda Lake; 25°25′46.0″ S, 143°08′13.8″ E; 8 Apr. 2009; M. Schwentner and B.V. Timms leg.; raised from sediment; AM P.91519 to P.91521 • 5 juvs; roadside claypan; 29°31′42.5″ S, 146°12′20.5″ E; 21 Jan. 2010; M. Schwentner and B.V. Timms leg.; AM P.91509 to P.91511, P.91524, P.91525 • 1 juv.; old dugout close to Lake Dunn; 22°36′12.9″ S, 145°40′26.6″ E; 14 Feb. 2010; M. Schwentner, C. Sieves and B.V. Timms leg.; AM P.91523.

Type locality

Spencer & Hall (1896: 237) did not specify a type locality but generally stated where they collected *O. packardi* and its newly described varieties as "Common in water-holes along the Finke and its tributaries, also in the Macumba and Stevenson Rivers". The label of the syntype collection states "Charlotte Waters Central Australia".

Description

Males

Carapace (Fig. 30a–c, e, g). Length 3.4–6.1 mm (ST: 3.3–3.6 mm; mean: 4.7 mm), height 2.0–3.9 mm (ST: 2.2–2.5 mm; mean: 2.9 mm). Coloration yellow-orange to red-orange or reddish-brown, outer margin lighter, whitish (syntypes lighter colored, but this is probably an artifact of the long storage). 18–63 (ST: 30–38, mean: 34) growth lines, 11–29 (ST: 11–14, mean: 20) widely spaced (rarely secondary growth phase with up to 23 additional widely spaced growth lines) and 2–28 (ST: 16–27, mean: 13) crowded.

Carapace shape. Dorsal margin straight, distinct or rounded dorso-posterior corner. Posterior margin broadly rounded, suboval, equicurvate to infracurvate (b/H 0.49–0.56, ST: 0.55, mean: 0.53) with greatest extension below midline. Ventral margin nearly straight, only slightly curved. Umbo position anterior to submedian (Cr/L 0.24–0.33, ST: 0.33, mean: 0.28).

Carapace ornamentation (Fig. 30f, h–i). Larval valve and growth bands in dorsal parts of carapace punctate or granular. In successive growth bands, poorly defined, irregular lirae forming ventrally. Within median growth bands, lirae dorsally lirae anastomosing and sometimes reticulating, ventrally subparallel, punctae between and along lirae. Further ventrally on carapace (including crowded growth bands), lirae more defined and subparallel; growth bands dorsally nodulous; the interspace between lirae with intermittent, nodular liral structures (visible mainly under SEM); liral structures in crowded growth bands appearing like radial ribs across multiple growth bands (not in all individuals). Under SEM additional small punctae visible across all growth bands. Concentric ridges slightly raised. Setae

filiform, preferentially preserved on ventral part of carapace. Setal pores in single row along all growth lines, forming serrate lower margins of concentric ridges in mid-carapace growth bands (visible under SEM).

Head (Fig. 31a–b, d). Condyle long, distally acute; occipital notch narrow. Condyle with or without weakly developed anterobasal hump. Margin between condyle and ocular tubercle straight to slightly concave or slightly convex. Ocular tubercle weakly developed, forming obtuse, nearly straight angle with rostrum. Anterior margin of rostrum straight, rarely slightly undulating. Ventral margin of rostrum with anterior notch; concave along midline, pointing apex slightly downwards; apex with acute angle (~45–60°), sometimes weakly rounded. Naupliar eye subtriangular, rarely oval. Antenna I long with 10–16 lobes (ST: 16; mean: 13), reaching to antenna II flagellomeres VI–X (ST: VIII–X; mean: VIII). Antenna II with 11–15 flagellomeres (ST: 12; mean: 13).

Thorax. 20–22 (ST: 22; mean: 21) segments, 19–22 (ST: 22; mean: 21) thoracopod-bearing and none to one (ST: none) posterior limbless segment not reaching dorsal margin. Last ~14 thoracopod-bearing segments with spine and/or setae bearing dorsal extensions. Setae/spines of dorsal extensions increasing in number posteriorly over successive segments (until ~7th last segment). Spines short and stout, in posterior segments central spines stouter but shorter than in preceding segments.

Thoracopod III (only P.91495; Fig. 31f). Endite I short and curved dorsally. Endites II–V broad, decreasing in size. Endite V palp two-segmented, basal segment shorter than endopod. Exopod ventral extension subequal in extension to endopod, dorsal extension wide, narrowing distally, overreaching epipod. Epipod long, cylindric.

Telson (Fig. 31g, i). 18–28 spines (ST: 20; mean: 23). First (anterior) spine enlarged. Spines on anterior third of telson short, thin, conical; following spines increasing in size, becoming longer, drawn out, aciculate and more closely spaced. Dorsal margin anteriorly straight (rarely convex), posterior ⅔ slightly concavely curved. Right terminal claw more strongly curved than left claw in most individuals, rarely both equally curved.

Furca (Fig. 31g, i). Proximally with dorsomedial longitudinal row of 4–10 (ST: 4; mean: 8) setae, row ending distally in a single conical spine. Distal part ⅔–¾ of furcal length, with numerous small denticles.

Females

Overall appearance as in males. Carapace (Fig. 30d) length 3.3–6.2 mm (ST: 3.3–3.7 mm; mean: 4.3 mm), height 2.2–4.1 mm (ST: 2.1–2.5 mm; mean: 2.8 mm); 17–46 (ST: 28–46, mean: 29) growth lines, 12–30 (ST: 12–19, mean: 19) widely spaced and 0–23 (ST: 13–27, mean: 10) crowded; Cr/L 0.26–0.32 (mean: 0.28) and b/H 0.48–0.57 (mean: 0.53). Anterior margin of rostrum straight; apex rectangular, drawn out into small acute tip; ventral margin only weakly concave (straighter than in males); overall rostrum shape trapezoidal (Fig. 31c, e). Antenna I with 12–16 (ST: 15–16, mean: 14) lobes, lobes smaller than in males and distally often fused (then number of lobes could not be counted); reaching to antenna II flagellomeres I–V (ST: IV–V, mean: III). Antenna II with 11–15 flagellomeres (ST: 11–12, mean: 13). 20–23 (ST: 21–23, mean: 21) segments, 20–23 (ST: 21–23, mean: 21) thoracopod-bearing and none to one posterior limbless segment not reaching dorsal margin. Telson with 17–26 (ST: 17–21, mean: 21) dorsal spines (Fig. 31h); left and right terminal claws equally curved. Furca with 4–8 setae (mean: 6).

Distribution (Fig. 31j)

Widely distributed in the arid regions of central and northern New South Wales, large parts of arid Queensland (e.g., catchments of northern and central Murray-Darling Basin, central and northern Cooper Creek catchment) as well as in central Australia. It is one of the few species which occurs in the northern

Cooper Creek catchment and areas further to the west or south. This species lives in a variety of habitats ranging from turbid claypans to various clear pools and lakes and even hyposaline lakes (e.g., Gidgee Lake). Noteworthy is the frequent occurrence in various artificial habitats (dugouts, borrow pits).

Remarks

Ozestheria minor comb. nov. was originally described as one of three varieties of *O. packardi* by Spencer & Hall (1896). Previous workers (e.g., Richter & Timms 2005; Rogers 2020) have synonymized these varieties with *O. packardi*. However, the large cryptic species diversity, which was revealed by molecular genetic analyses within *O. packardi* (Schwentner *et al*. 2015a), strongly suggested that *O. minor* and the other varieties represent valid species. A comparison between the syntypes and the genetically delimited species strongly suggests that *O. minor* corresponds to *Ozestheria* sp. B of Schwentner *et al*. (2015a). Most importantly, the shape as well as the ornamentation (also at the high-magnification SEM-level) of the carapaces is highly similar, including the fine punctae between lirae.

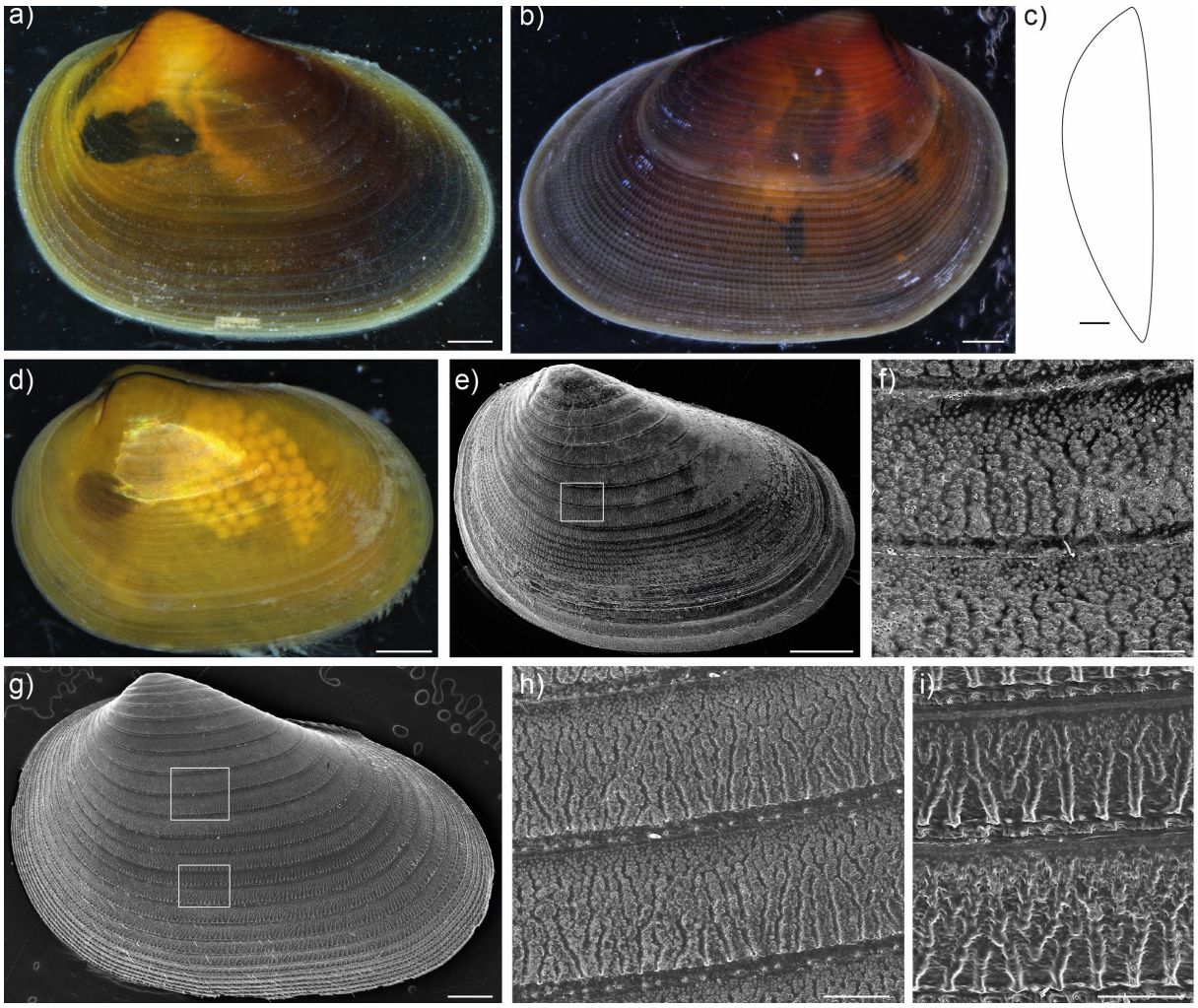

Fig. 30. *Ozestheria minor* comb. nov. (Spencer & Hall, 1896). **a–e**. Carapace. **a**. Male (P.91495). **b**. Male (P.91477). **c**. Dorsal view (left valve only, male, P.91495). **d**. Female, syntype (MV J54045). **e**. Male, syntype (MV J54045), SEM. **f**. Mid-carapace ornamentation (male syntype, MV J54045; position marked in e by rectangle), SEM. **g–i**. Male (P.91946). **g**. Carapace. **h**. Mid-carapace ornamentation (position marked in g by rectangle). **i**. Ventromedian carapace ornamentation (position marked in g by rectangle). Scale bars: a–e, g = 0.5 mm; f = 0.05 mm; h–i = 0.1 mm.

Also, the telsonic spines (majority of spines elongate and aciculate) as well as the shape of the female rostrum (apex drawn out, but tip not as minutely pointed as in several other species such as *O. typica* comb. nov. or *O. bourkensis* sp. nov.) correspond well to the description of *O. minor* by Spencer & Hall (1896). The carapace coloration of the syntypes appears lighter than in other specimens (light yellowish-

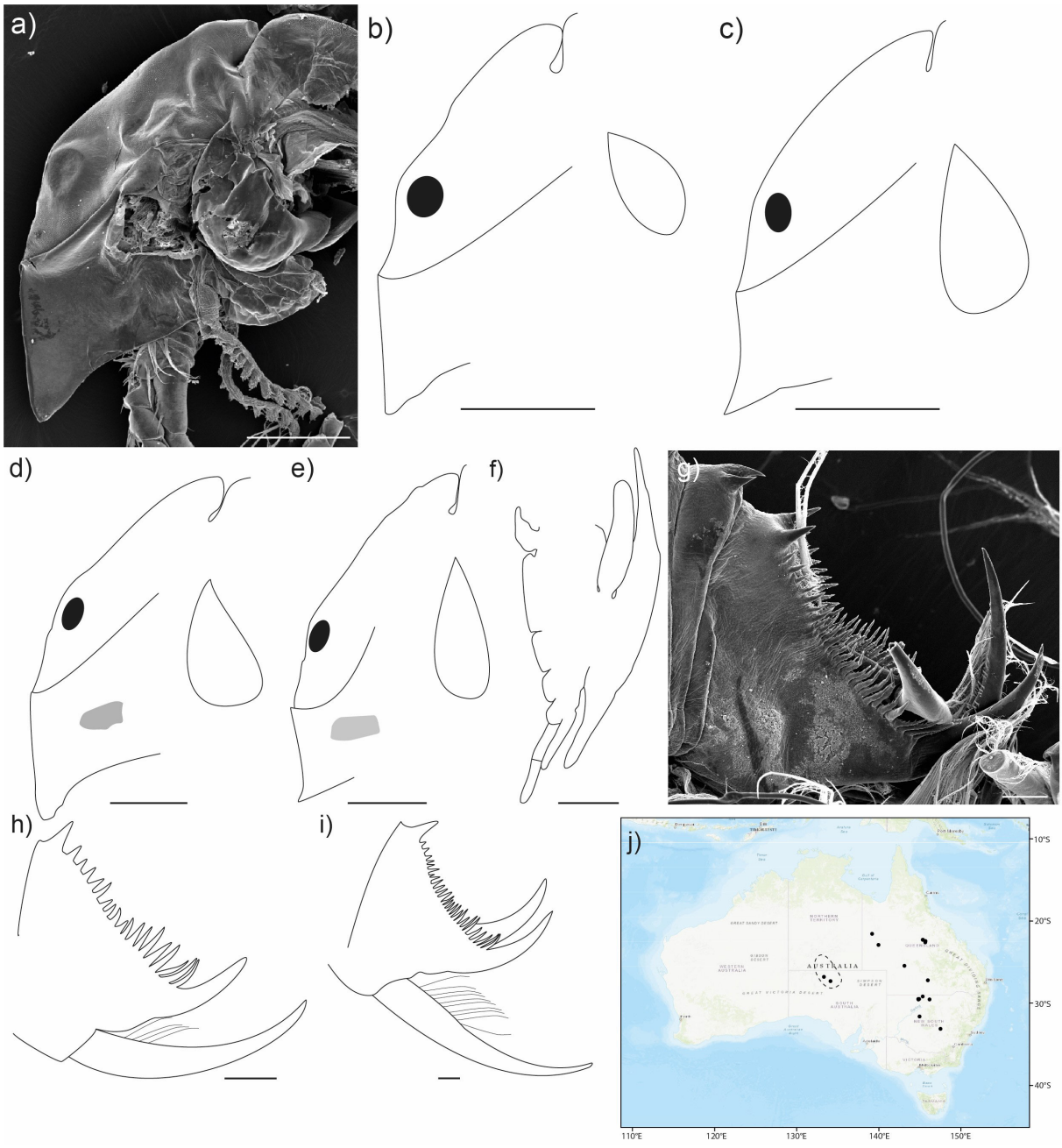

Fig. 31. *Ozestheria minor* comb. nov. (Spencer & Hall, 1896). **a–e**. Head (antennae not shown). **a**. Male (P.91496), SEM. **b**. Male, syntype (MV J54054). **c**. Female, syntype (MV J54045). **d**. Male (P.91495). **e**. Female (P.91498). **f**. Third left thoracopod (male, P.91495). **g–i**. Telson. **g**. Male (P.91496), SEM. **h**. Female, syntype (MV J54045). **i**. Male (AM P:91495). **j**. Distribution map (type locality indicated by dotted line; produced in ArcMap 10.7; see caption Fig. 7 for sources). Scale bars: a–f = 0.5 mm; g–i = 0.1 mm.

brownish). This may be due to the long storage in ethanol, as Spencer & Hall (1896: 237) described the coloration as "chestnut-brown with a broad, light band around the margin", which agrees well with the other specimens.

In the geometric morphometric analyses of the carapace shape (Fig. 6), *O. minor* comb. nov. partly overlaps with *O. jiangi* sp. nov., *O. jonnae* sp. nov., *O. selmae* sp. nov., *O. typica* comb. nov., *O. bourkensis*, *O. cancellata* comb. nov., *O. rincewindi* sp. nov., *O. weeksi* sp. nov., *O. glabra* sp. nov., and *O. echidna* sp. nov. Due to the overall similarities with other species in carapace shape, the classification of the mean shape of the syntypes of *O. minor* (Supp. file 2_4.4) suggested several species, including *O.* sp. B (sensu Schwentner *et al*. 2015a; probability 13.7%, typicality 0.52). Highest probabilities were observed for *O. cancellata* and *O. jonnae* (42.9% and 19.0%) and the highest typicalities scores for *O. frederikeae* sp. nov. (0.72), *O. jonnae* (0.60) and *O. cancellata* 0.58).

The type specimens were not specifically marked as types of *O. minor*. However, the historic labels accompanying the specimens explicitly identified them as "*Estheria packardi* var. *minor*" and stated the locality and expedition as "Charlotte Waters Horn Exp.", which makes it very likely that these are the type specimens collected and described by Spencer & Hall from the Horn Expedition.

Ozestheria ngamurru sp. nov.
urn:lsid:zoobank.org:act:AD8D90EC-8A18-4216-9FBC-26A5409008F5
Fig. 32

Diagnosis

Ozestheria ngamurru sp. nov. is characterized by a long condyle and a narrow occipital notch; carapace ornamentation dorsally on carapace punctate (may appear granular), in following growth bands anastomosing lirae forming ventrally within growth band, lirae become longer, less anastomosing and more pronounced with progressing growth bands, lirae terminate in nodule; male rostrum with weakly concave anterior margin, apex protruding with distinct nearly rectangular angle, ventral margin with convex bulge midlength; 12–14 (male) antenna I lobes reaching to antenna II flagellomeres VII–IX (male); 13–14 (male) antenna II flagellomeres; 19–20 complete thorax segments; 27–30 telsonic spines, anterior spines conical, posterior spines elongate and aciculate; 7–9 furcal setae.

Differential diagnosis

Ozestheria ngamurru can be differentiated from many other species of *Ozestheria* by the narrow occipital notch and long condyle in combination with the carapace ornamentation (dominated by punctate ornamentation dorsally on carapace, transitioning to distinct, subparallel lirae during ontogeny), except from *O. cancellata* comb. nov., *O. minor* comb. nov., *O. typica* comb. nov., *O. fuersichi* sp. nov., *O. marthae* sp. nov., *O. selmae* sp. nov., *O. radiata* sp. nov., *O. bourkensis* sp. nov., *O. jonnae* sp. nov., *O. barcaldinensis* sp. nov., *O. rincewindi* sp. nov., *O. beleriandensis* sp. nov., *O. quinlanae* sp. nov., *O. glabra* sp. nov., *O. pilbarensis* sp. nov. and *O. weeksi* sp. nov., and differentiating these species can be difficult. *Ozestheria ngamurru* sp. nov. differs from all these species in the shape of the male rostrum with its weakly concave anterior margin, weakly drawn-out apex and bulging ventral margin; moreover, *O. ngamurru* seems to have more widely spaced growth bands in the primary growth phase (21–27) than usually observed in these other species. Furthermore, *O. minor*, *O. typica*, *O. bourkensis*, *O. selmae*, *O. radiata*, and *O. beleriandensis* can be differentiated by having at least the posterior half of the telsonic spines long, elongate and aciculate and *O. fuersichi* by its polygonal reticulations on the first few growth bands and punctae between widely spaced lirae.

Etymology

The name is derived from ngamurru, the traditional owner's name for charcoal left in fire pits in the Martu language. The term is related to the Lake Carnegie area and has cultural significance, noun in apposition.

Type material

Holotype

AUSTRALIA – **Western Australia** • ♂; Lake Carnegie, Toonil Melaleuca Swamp; 26°10′21.8″ S, 122°56′25.4″ E; 8 Jun. 2020; D.J. Cale leg.; WAM C78000.

Paratypes

AUSTRALIA – **Western Australia** • 1 ♂; same data as for holotype; GenBank no: PQ427008 (COI); WAM C80229 • 1 ♂; same data as for holotype; GenBank no: PQ427007 (COI); NHMW-ZOO-CR-29002.

Type locality

Western Australia, Lake Carnegie (Toonil Melaleuca Swamp), 26°10′21.8″ S, 122°56′25.4″ E.

Description

Males

Carapace (Fig. 32a–c). Length 5.3–5.9 mm (HT: 5.9 mm), height 3.2–3.6 (HT: 3.6 mm). Coloration reddish-brown, crowded growth bands lighter. 53–58 (HT: 55) growth lines, 21–27 (HT: 27) widely spaced and 28–35 (HT: 28) crowded (the latter sometimes with widely spaced growth lines of secondary growth phase).

Carapace shape. Dorsal margin straight to curved, dorso-posterior corner rounded. Posterior margin broadly rounded, suboval, equicurvate to infracurvate (b/H 0.51–0.57, HT: 0.51). Ventral margin rounded. Umbo position submedian (Cr/L 0.32–0.37, HT: 0.33).

Carapace ornamentation (Fig. 32d–h). Larval valve and directly following growth bands punctate. In following growth bands, lirae forming between punctae; lirae becoming more pronounced and dominating with progressing growth bands. Lirae subparallel and ± equidistant on successive growth bands, not or very rarely anastomosing; from about mid carapace, punctae disappearing and lirae terminating in moniliform nodule on concentric ridge. Crowded growth bands and growth bands of secondary growth phase with short, parallel, distinct lirae all terminating in nodule on concentric ridges. Concentric ridges slightly raised, with moniliform nodules on the dorsal margin and an indistinct serrated ventral margin (best seen under SEM). Setae very short and spiniform (hardly visible); very few preserved, preferentially preserved on the ventral part of carapace (setal pores in single row along all growth lines under SEM).

Head (Fig. 32i). Condyle long, elongated, distally rounded; occipital notch narrow. Condyle with small anterobasal hump. Margin between condyle and ocular tubercle straight to slightly concave. Ocular tubercle weakly developed, forming nearly straight angle with rostrum. Anterior margin of rostrum weakly concave, distally protruding. Apex weakly drawn out, with distinct nearly rectangular angle. Ventral margin of rostrum with convex bulge midlength. Naupliar eye subtriangular, rather large. Antenna I long with 12–14 lobes (HT: 13), reaching to antenna II flagellomeres VII–IX (HT: VII). Antenna II with 13–14 flagellomeres (HT: 14).

Thorax. 20 segments, 19–20 (HT: 19) thoracopod-bearing and none to one (HT: none) posterior limbless segment not reaching dorsal margin.

Thoracopod III (only WAM C78000; Fig. 32k). Endite I short and curved dorsally. Endites II–V broad, decreasing in size. Endite V palp two-segmented, basal segment shorter than endopod. Exopod ventral extension shorter in extension than endopod, dorsal extension wide, narrowing distally, overreaching epipod. Epipod long, cylindric.

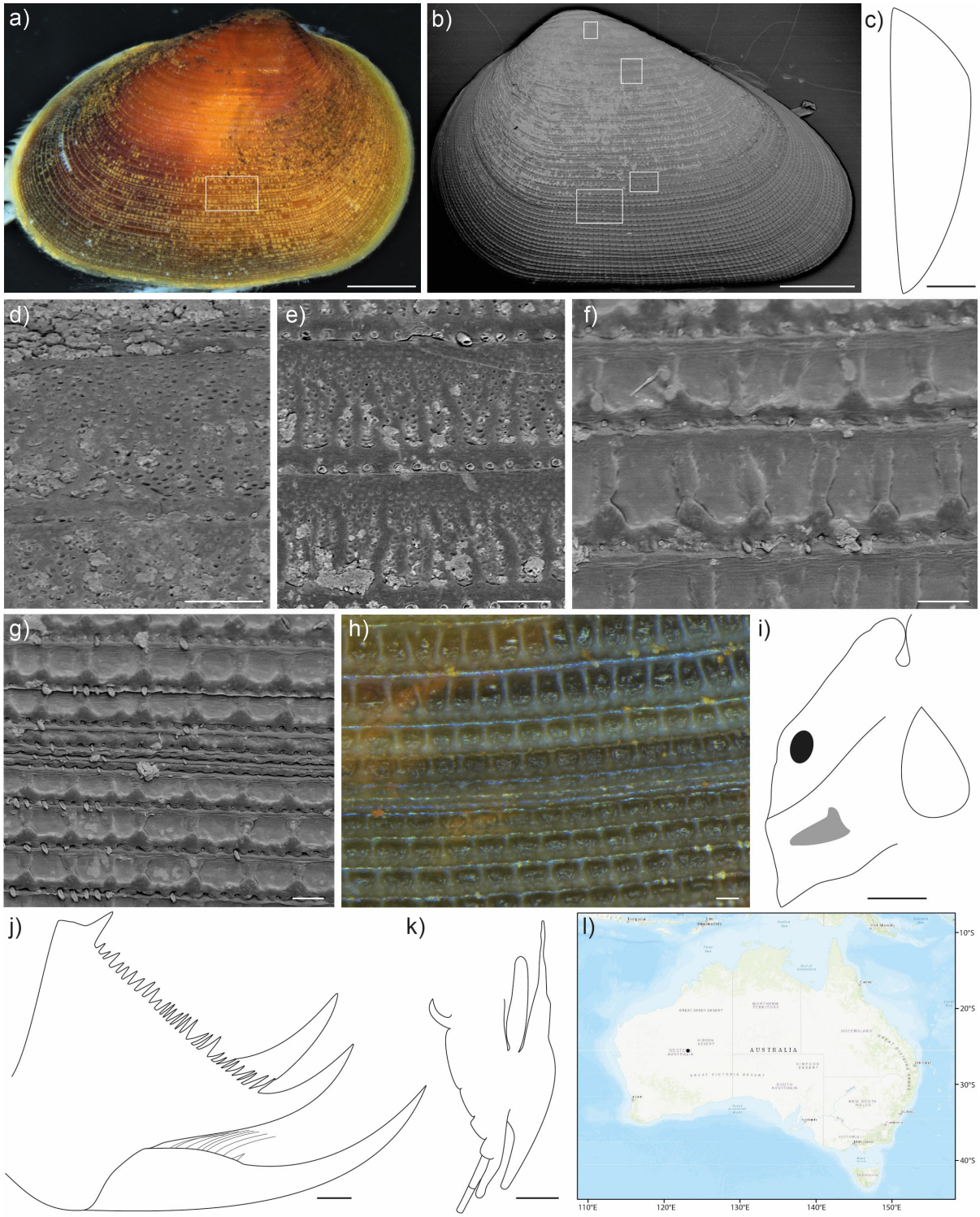

Fig. 32. *Ozestheria ngamurru* sp. nov. **a–c**. Carapace. **a**. Male, holotype (WAM C78000). **b**. Male, paratype (WAM C80229). **c**. Dorsal view male, holotype (right valve only; WAM C78000). **d–g**. Carapace ornamentation (male, paratype, WAM C80229; positions marked in b by rectangles), SEM. **d**. Dorsal carapace. **e**. Mid-dorsal carapace ornamentation. **f–g**. Mid-ventral carapace. **h**. Carapace ornamentation (male, holotype, WAM C78000), mid-ventral carapace. **i–k**. Male, holotype (WAM C78000). **i**. Head (antennae not shown). **j**. Telson. **k**. Third left thoracopod. **l**. Distribution map (produced in ArcMap 10.7; see caption Fig. 7 for sources). Scale bars: a–c = 1 mm; d–h = 0.05 mm; i, k = 0.5 mm; j = 0.1 mm.

Telson (Fig. 32j). 27–30 spines (HT: 30). First (anterior) spine enlarged. Spines on anterior half of telson wider and conical, following spines thinner, elongate and aciculate; all spines subequal in length and spacing. Dorsal margin straight or weakly concavely curved. Right terminal claw more strongly curved than left one.

Furca (Fig. 32j). Proximally with dorsomedial longitudinal row of 7–9 (HT: 8) setae, row ending distally in a single conical spine. Distal part ⅔–¾ of furcal length, with numerous small denticles.

Females

Unknown.

Distribution (Fig. 32l)

Ozestheria ngamurru sp. nov. is known from a single locality in central Western Australia.

Remarks

Currently only males are known. Because only few specimens were available, the morphological variability of the species is not well characterized. The carapace shape of *O. ngamurru* sp. nov. (Fig. 6) is distinct from that of most other species and overlaps fully with those of *O. typica* comb. nov. and marginally with *O. radiata* sp. nov. and *O. beleriandensis* sp. nov.

Ozestheria packardi (Brady, 1886) species inquirenda

Estheria packardi Brady, 1886: 85–86, fig. c.

Estheria packardi – Sars 1895: 28–29, figs 4–5. — Spencer & Hall 1896: 236–238, figs 9–14. — Sayce 1903: 250–252, 255, fig. 34. — Henry 1924: 121–122, 134.
Cyzicus (*Estheria*) *packardi* – Wolf 1911: 254. — Dakin 1914: 295.
Caenestheriella packardi – Daday 1914: 108, 116–120, fig. 20. — Richter & Timms 2005: 347.
Cyzicus packardi – Bishop 1967: fig. d. — Brtek 1997: 46.
Ozestheria packardi – Rogers 2020: 24.

Remarks

Since Sars' (1895) detailed redescription of *O. packardi*, it appeared to be the most ubiquitous and widespread of all Australian spinicaudatan species, being found in virtually all types of habitats throughout (semi)arid Australia (e.g., Timms *et al*. 2006; Timms 2009b). Every individual with a long condyle was attributed to this species. Already in 1896, Spencer & Hall described three varieties (var. *typica*, var. *minor* and var. *cancellata*), noting that these represent only the most extreme forms and that various intermediates had been observed (because of these intermediates they hesitated to raise these varieties to species). Subsequent authors usually regarded these varieties as junior synonyms of *O. packardi* (e.g., Richter & Timms 2005; Rogers 2020). Molecular genetics showed that the individuals with a long condyle (i.e., *packardi*-like) represent at least 14 different species. None of these can be safely attributed to the original description of *O. packardi*. In his original description, Brady (1886) only superficially described and depicted the carapace, which occupies a central position in *Ozestheria* morphospace (Fig. 6), completely ignoring the main body. He based the description on specimens from Lake Bonney and Fowler Bay (South Australia), which are > 500 km apart, noting some differences in carapace coloration (only one individual with a lighter marginal band), though it is not clear which were depicted. It is highly likely that Brady incorporated and mixed individuals of different species in the original description of *O. packardi*. Moreover, the long condyle, which has long served as the main identification character, was not mentioned by Brady; it first appears in the detailed redescription by Sars (1895). However, Sars did not study any types, but specimens collected near Hay in southern New South Wales which most likely belong to yet another species. In 1896, Sars further described the development of *O. packardi* in detail; however, based on specimens raised from mud collected in Sydney.

The original description of *O. packardi* is not adequate and all subsequently published redescriptions are probably based on other species. Thus, *O. packardi* has to be treated as a species inquirenda.

Ozestheria paralutraria sp. nov.
urn:lsid:zoobank.org:act:4DECD2EF-56DA-495A-B637-8BCA981B6BB6
Fig. 33

Diagnosis

Ozestheria paralutraria sp. nov. is characterized by a short condyle and wide occipital notch; a straight ventral carapace margin; a supracurvate posterior margin (b/H 0.32–0.38); carapace ornamentation with large, well-developed polygonal reticulations, center of each polygon smooth or with granular secondary ornamentation (best seen under SEM); male rostrum with strongly convex anterior margin, apex rounded with right angle, ventral margin strongly concave, pointing apex downwards; female rostrum anterior margin weakly convex, apex pointed and drawn out into acute tip, ventral margin weakly concave; 15 (male) or 13–18 (female) antenna I lobes reaching to antenna II flagellomeres VI–VIII (male) or V–VI (female); 14–15 (male and female) antenna II flagellomeres; 23–24 complete thorax segments; 16–27 very small and irregularly spaced, conical spines; 12 furcal setae.

Differential diagnosis

Ozestheria paralutraria sp. nov. is most similar to *O. lutraria* from which it can be differentiated by it having fewer thoracic segments (24 vs 25–27 complete segments), more telsonic spines (16–18 in *O. paralutraria*, whereas *O. lutraria* rarely has more than 15), fewer and longer setae on the carapace (in a single row vs in two rows along each concentric ridge in *O. lutraria*; best seen under SEM) and length of the carapace (up to 9 mm vs >10 mm in *O. lutraria*; n=4 vs n=73). *Ozestheria paralutraria* has a straight ventral carapace margin, which in combination with a short condyle is present only in *O. lutraria*, *O. fuersichi* sp. nov. and *O. rufa*. The carapace ornamentation of *O. rufa* features distinctly smaller reticulations in early growth bands and nodulous lirae in mid-carapace rather than the well-defined reticulations of *O. paralutraria*. *Ozestheria fuersichi* lacks the well-defined reticulation in mid-carapace. *Ozestheria paralutraria* can be further differentiated from most other species by the strongly supracurvate posterior carapace margin (b/H 0.32–0.38).

Etymology

The name is based on another morphologically similar species – *O. lutraria*. The Greek prefix '*para*' (meaning 'altered' or 'irregular') hints at the great morphological similarity of the two species.

Type material

Holotype

AUSTRALIA – **Western Australia** • ♀; K.P.W floodout, 22 km N of Wittenoom; 22°7′46.7″ S, 118°24′4.2″ E; 4 Aug. 2015; B.V. Timms leg.; GenBank no: PQ427013 (COI); WAM C78013.

Paratypes

AUSTRALIA – **Western Australia** • 1 ♂, 1 ♀; same data as for holotype; WAM C80216, C80217 • 1 ♂; same data as for holotype; NHMW-ZOO-CR-28498.

Type locality

Western Australia, K.P.W floodout, 22 km N of Wittenoom, 22°7′46.7″ S, 118°24′4.2″ E.

Description

Males

Carapace (Fig. 33a, c). Length 8.9–9.9 mm, height 4.4–5.0 mm. Coloration light yellow-orange, crowded growth bands lighter. 24–27 growth lines, 15–20 widely spaced and 9–17 crowded.

Carapace shape. Dorsal margin straight, distinct dorso-posterior corner. Posterior margin rounded, greatly extending posteriorly, supracurvate (b/H 0.36–0.38). Ventral margin straight. Umbo position anterior (Cr/L 0.21–0.24).

Carapace ornamentation (see also Fig. 33e–f). Larval valve and first few growth bands appear smooth (might be due to abrasion). All other non-crowded growth bands with medium to large reticulations. Reticulations form polygonal mesh across each growth band with each polygon usually being a pentagon, hexagon or heptagon. Under SEM (based on SEM of female carapace), polygon centers smooth or granular in late juvenile growth bands, without secondary reticulations. Ornamentation uniform across all non-crowded growth bands; reticulations become irregular and transition to broken lines on growth bands of incipient carapace crowding; crowded growth bands very narrow, without obvious ornamentation (under SEM, crowded growth bands with irregular, granular, lirae-like ornamentation). Concentric ridges raised. Setae short, thin and inconspicuous, in many individuals none visible; under SEM one row of setae and corresponding setal pores along all growth lines.

Head (Fig. 33g). Condyle short, rounded; occipital notch wide. Condyle with anterobasal hump. Margin between condyle and ocular tubercle straight. Ocular tubercle well developed, forming obtuse (~120°) angle with rostrum. Anterior margin of rostrum strongly convex. Apex rounded with nearly rectangular angle. Ventral margin of rostrum deeply concave, pointing apex downwards. Naupliar eye small, roundish. Antenna I long with 15 lobes, reaching to antenna II flagellomeres VI–VIII. Antenna II with 14–15 flagellomeres.

Thorax. 25 segments, 24 thoracopod-bearing and one posterior limbless segment not reaching dorsal margin. Only few segments with spine-bearing dorsal extensions, posterior segments lacking spines.

Thoracopod III (only NHMW-CR-28498; Fig. 33k). Endite I short and curved dorsally. Endites II–V broad, decreasing in size. Endite V palp two-segmented, basal segment shorter than endopod. Exopod ventral extension slightly shorter in extension to endopod, dorsal extension wide, narrowing distally, overreaching epipod. Epipod long, cylindric.

Telson (Fig. 33i). 16–18 spines. First (anterior) spine enlarged. All spines conical; spines small or tiny, irregular in size and spacing. Dorsal margin weakly concave. Right terminal claw more strongly curved than left.

Furca (Fig. 33i). Broken off in all studied males.

Females

Overall appearance as in males. Carapace (Fig. 33b, d) length 8.0–8.9 mm (HT: 8.9 mm), height 4.1–4.2 mm (HT: 4.2 mm); 17–18 (HT: 17) growth lines, 14–15 (HT: 14) widely spaced and 2–4 (HT: 3) crowded; Cr/L0.21–0.24 (HT: 0.24) and b/H 0.32–0.35 (HT: 0.35). Angle between ocular tubercle and rostrum obtuse (~160°) to straight (Fig. 33h). Anterior margin of rostrum weakly convex, apex drawn out into acute, pointed tip; ventral margin weakly concave. Antenna I with 13–18 small lobes (HT: 18), lobes smaller than in males; reaching to antenna II flagellomeres V–VI (HT: VI). Antenna II with 14–15 flagellomeres (HT: 14). 24–25 (HT: 24) segments, 23 thoracopod-bearing and one to two (HT: 1) posterior limbless segments not reaching dorsal margin. Telson with 16–27 (HT: 27) dorsal spines (HT: posteriormost spines tiny); left and right terminal claws equally curved (Fig. 33j). Furca with 12 setae, followed by single elongate spine; distal part ⅓–½ (HT: 1/3) of furcal length, with numerous small denticles.

Distribution (Fig. 33l)

Ozestheria paralutraria sp. nov. is known only from a single locality in northwestern Western Australia.

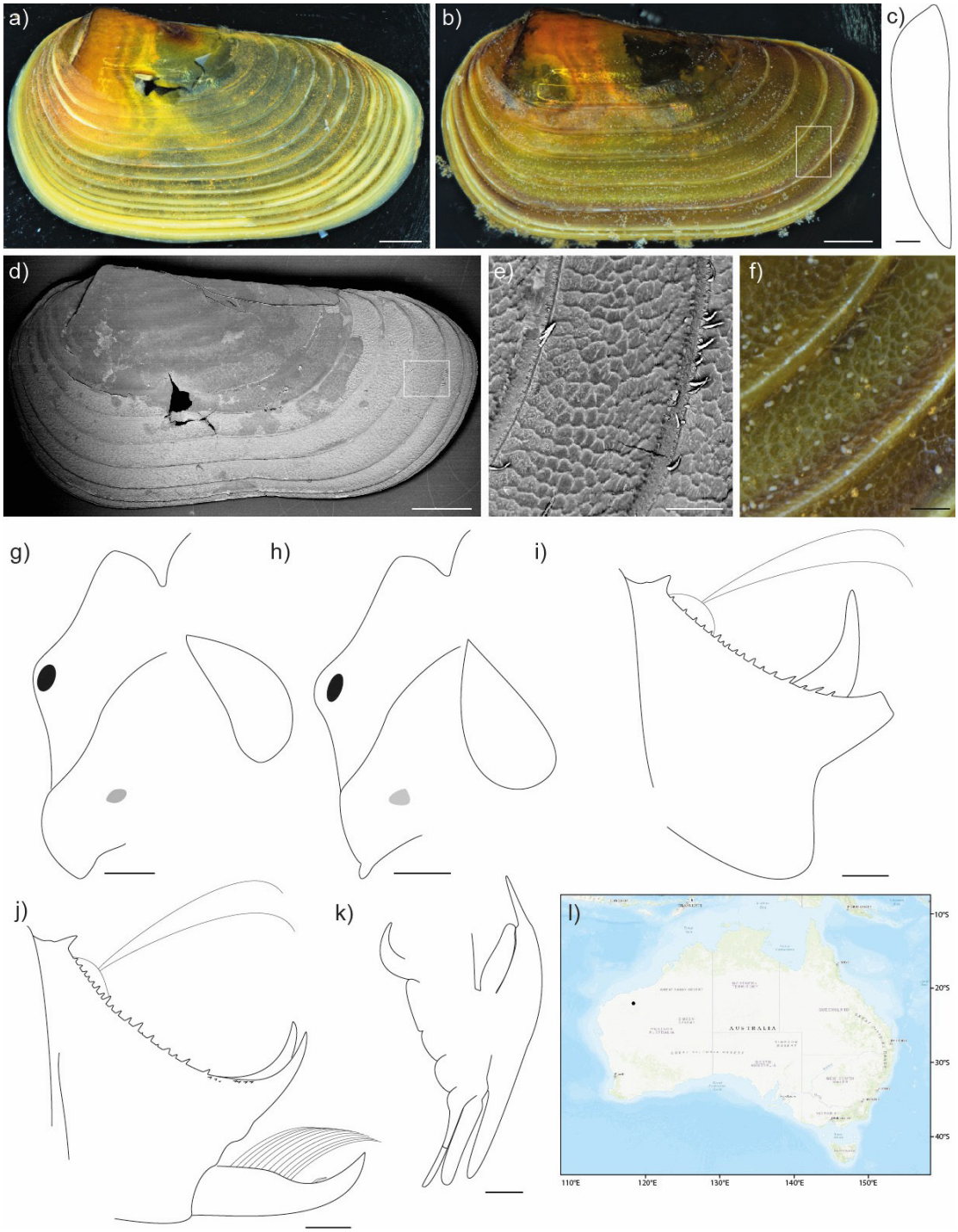

Fig. 33. *Ozestheria paralutraria* sp. nov. **a–d**. Carapace. **a**. Male, paratype (NHMW-ZOO-CR-28498). **b**. Female, holotype (WAM C78013). **c**. Dorsal view male paratype (left valve only; NHMW-ZOO-CR-28498). **d**. Female, paratype (WAM C80217), SEM. **e–f**. Carapace ornamentation (positions marked in b and d by rectangles). **e**. Posterior carapace, female paratype (WAM C80217), SEM. **f**. Posteroventral carapace, female, holotype (WAM C78013). **g–h**. Head (antennae not shown). **g**. Male, paratype (NHMW-ZOO-CR-28498). **h**. Female, holotype (WAM C78013). **i–j**. Telson. **i**. Male, paratype, furca broken off (WAM C80216). **j**. Female, holotype (WAM C78013). **k**. Male, third left thoracopod (paratype, NHMW-ZOO-CR-28498). **l**. Distribution map (produced in ArcMap 10.7; see caption Fig. 7 for sources). Scale bars: a–d = 1 mm; e–f, i–k = 0.2 mm; g–h = 0.5 mm.

Remarks

A female was selected as the holotype, because the telson and furca of each male were damaged. The carapace shape of *Ozestheria paralutraria* sp. nov. (Fig. 5) is distinct from that of most other species and overlaps partly with *O. lutraria*.

Ozestheria pellucida (Timms, 2018)
Fig. 34

Ozestheria pellucida Timms, 2018: 8–10, fig. 5.

Ozestheria pellucida – Rogers 2020: 24.

Diagnosis

Ozestheria pellucida is characterized by a short condyle and a wide occipital notch; a rounded ventral carapace margin; carapace whitish, translucent; carapace ornamentation nodular or granular with punctae to small reticulations dorsally within growth bands; male rostrum with convex anterior margin, apex strongly rounded with right angle, ventral margin convex; 10 (male) antenna I lobes reaching to antenna II flagellomere VII; 10 (male) antenna II flagellomeres; 21 complete thorax segments; 14 spines, spines on anterior half short and conical, posteriorly aciculate and increasing in size; 14 furcal setae.

Differential diagnosis

Ozestheria pellucida can be easily distinguished from other Australian species of *Ozestheria* with a short condyle by its carapace ornamentation and possibly carapace size and coloration as well as the shape of the male rostrum. The granular or nodular carapace ornamentation is unique for species with a short condyle, remotely similar only to *O. richteri* sp. nov. and *O. rufa*. However, *O. rufa* differs in the shape of their rostrum (more pointed and less rounded than of *O. pellucida*) and has larger carapace sizes (> 8 mm vs ~5 mm). In *O. richteri* the granular ornamentation is present only in later growth bands; it further has a clear hump at the base of the condyle (absent in *O. pellucida*), fewer (19 vs 21) complete thorax segments and a darker colored carapace. *Ozestheria pellucida* and *O. richteri* are the species with the shortest carapaces compared to other species with short condyles, though young individuals of other species will have similar sizes, of course. Similarly, the whitish translucent or pellucid carapace is characteristic for *O. pellucida* but also some individuals or populations of other species can have similar carapace colorations.

Type material

Holotype (not examined)
AUSTRALIA – **Western Australia** • 1 ♂; Kimberley, Gardner Plateau, rock pool; 14°47′28.8″ S, 126°30′32.1″ E; Mar. 2012; A. Cross leg.; WAM C72091.

Paratype (not examined)
AUSTRALIA – **Western Australia** • 1 ♂; same data as for holotype; WAM C72092).

Paratype
AUSTRALIA – **Western Australia** • 1 ♂; same data as for holotype; WAM C72092.

Type locality

Western Australia, Kimberley, Gardner Plateau, rock pool, 14°47′28.8″ S, 126°30′32.1E.

Description

Male

Carapace (Fig. 34a–c). Length 5.0 mm, height 2.8 mm. Coloration whitish-translucent. 14 growth lines, 13 widely spaced and 1 crowded.

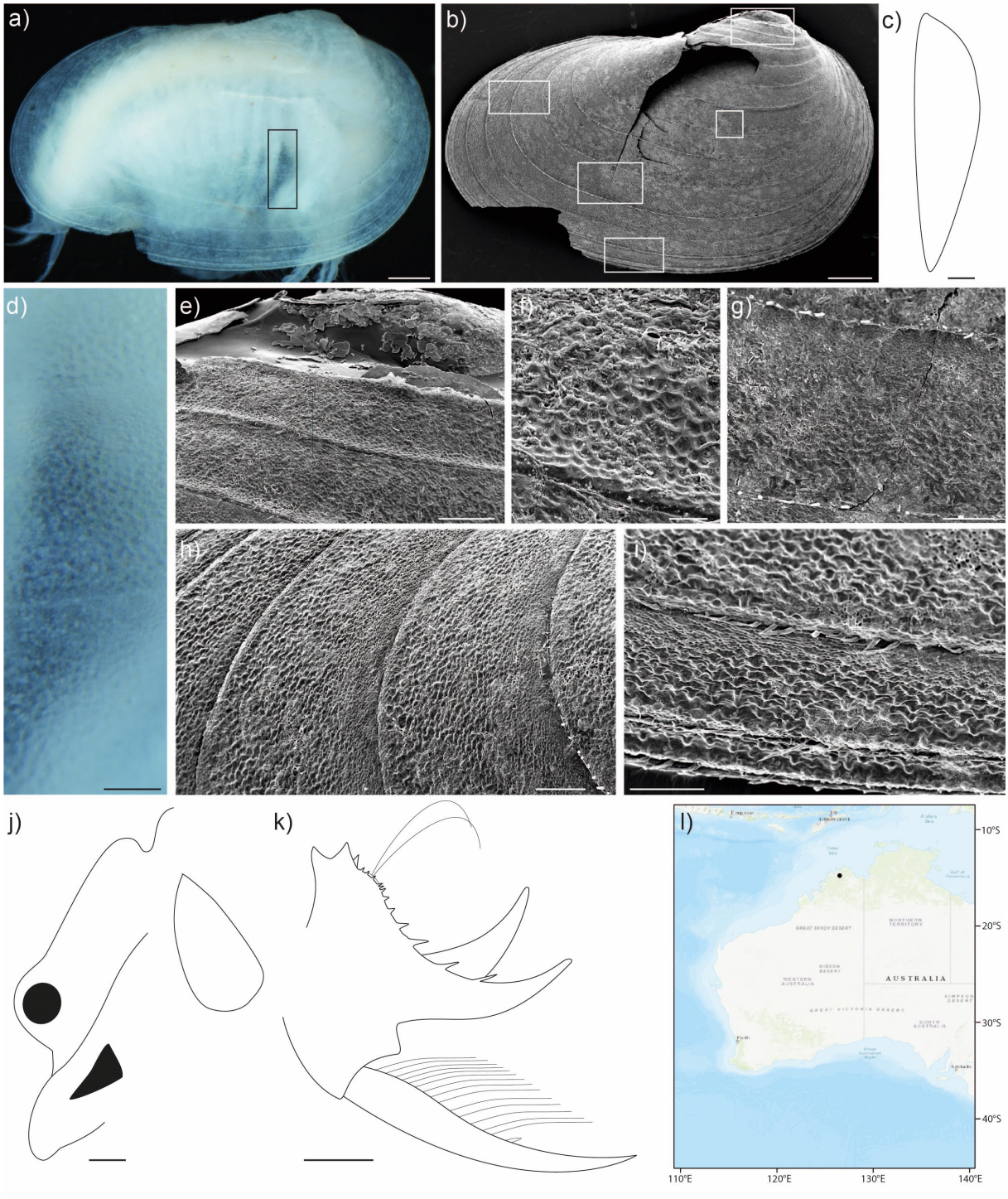

Fig. 34. *Ozestheria pellucida* Timms, 2018, male paratype (WAM C72092). **a**. Carapace. **b**. Carapace, SEM. **c**. Carapace, dorsal view (right valve only). **d**. Mid-carapace ornamentation (position marked in a by rectangle). **e–i**. Carapace ornamentation, SEM (positions marked in b by rectangles). **e**. Larval valve and dorsal carapace. **f**. Dorsal carapace. **g**. Mid-carapace. **h**. Posterior carapace. **i**. Ventral carapace. **j**. Head, antennae not shown. **k**. Telson. **l**. Distribution map (produced in ArcMap 10.7; see caption Fig. 7 for sources). Scale bars: a–c = 0.5 mm; d–i = 0.1 mm; j–k = 0.2 mm.

Carapace shape. Dorsal margin straight, distinct dorsoposterior corner. Posterior margin broadly rounded, suboval, equicurvate (b/H 0.54). Ventral margin widely rounded. Umbo position submedian (Cr/CL 0.28).

Carapace ornamentation (Fig. 34d–i). Ornamentation on all growth bands of granular appearance. Larval valve and following growth bands punctate to finely reticulated ('small reticulation', best seen under SEM); further ventrally on carapace, ornamentation nodular or granular with punctae dorsally on growth bands. No lirae visible. Concentric ridges shallow and punctate. Setae spiniform, preferentially preserved on the midposterior and posteroventral part of carapace (setal pores in single line along all growth lines under SEM).

Head (Fig. 34j). Condyle short, rounded, only weakly protruding; occipital notch wide. Condyle lacking anterobasal hump. Margin between condyle and ocular tubercle straight concave. Ocular tubercle well developed, forming obtuse, nearly rectangular angle (~100–120°) with rostrum. Anterior margin of rostrum widely convexly curved. Apex strongly rounded with nearly rectangular angle. Ventral margin of rostrum with notch anteriorly, then convex. Naupliar eye elongated, triangular. Antenna I long with 10 lobes, reaching to antenna II flagellomere VII. Antenna II with 10 flagellomeres.

Thorax. 22 segments, 21 thoracopod-bearing and one posterior limbless segment not reaching dorsal margin.

Telson (Fig. 34k). 14 spines. First (anterior) spine enlarged. Spines on anterior half of telson short, thin, conical, subequal in length; following spines increasing in size and more widely spaced, posterior-most spines elongate, aciculate. Dorsal margin anteriorly slightly convex, mid-section straight. Right terminal claw more strongly curved than left.

Furca (Fig. 34k). Proximally with dorsomedial longitudinal row of 14 setae, row ending distally in a single conical spine. Distal part ⅓ of furcal length, with numerous small denticles.

Distribution (Fig. 34l)

The species is known only from its type locality in northern Western Australia.

Remarks

So far, only males of *O. pellucida* are known and no genetic data is available. The most notable differences compared to the original description by Timms (2018) is the larger number of thoracic segments (22 vs 18) and furcal setae (14 vs 10) observed in the studied paratype. The latter is notable as Timms (2018) used this characteristic to distinguish *O. pellucida* from *O. packardi*, which according to Timms usually has more than 20 furcal setae. However, none of the various *O. packardi*-like species described herein (all species with a long condyle and a narrow occipital notch) has such a high number of furcal setae. Timms (2018) compared *O. pellucida* only against *O. packardi* and *O. mariae* in the diagnosis, the only two Australian species which formerly had been assigned to *Caenestheriella* due to their long condyle and a narrow occipital notch. However, *O. pellucida* clearly has a short condyle and wide occipital notch, features that were shared with all other Australian species of *Ozestheria* except *O. packardi* and *O. mariae* known at that time.

The carapace shape of *O. pellucida* is distinct from that of all other species (overall very low typicality scores) and is most similar to that of *O. fuersichi* sp. nov. (Fig. 5). Although *O. pellucida* was classified as *O*. sp. X10 (probability 92.6%, which probably represents *O. rufa*), this classification was not supported by the very low typicality score (0.00).

Ozestheria pilbarensis sp. nov.
urn:lsid:zoobank.org:act:60D47D2F-631C-4827-B60E-790AD149B197
Fig. 35

Diagnosis

Ozestheria pilbarensis sp. nov. is characterized by a long condyle and a very narrow occipital notch; carapace ornamentation dorsally on carapace polygonal (may appear granular), following growth bands with intensely anastomosing and branching lirae giving the impression of large pits or reticulations between lirae), lirae more pronounced posteriorly and ventrally on carapace; male rostrum with straight to slightly convex anterior margin, apex weakly rounded (not pointed) with acute angle (~70°), ventral margin concave with slight notch anteriorly; female rostrum with straight (becoming weakly concave ventrally) anterior margin, apex pointed (~70°) and not drawn out into acute tip, ventral margin nearly straight; 15–18 (male) or 13–19 (female) antenna I lobes reaching to antenna II flagellomeres X–XI (male) or V–X (female); 14–15 (male) or 13–15 (female) antenna II flagellomeres; 23–24 complete thorax segments; 21–33 mostly small telsonic spines, 1–2 larger spines interspersed, anterior spines conical, posterior spines elongated and aciculate, but not increasing in size; 10–15 furcal setae.

Differential diagnosis

Ozestheria pilbarensis sp. nov. can be differentiated from many other species of *Ozestheria* by the narrow occipital notch and long condyle in combination with the carapace ornamentation (dominated by punctate ornamentation dorsally on carapace, transitioning to distinct, subparallel lirae during ontogeny), except from *O. cancellata* comb. nov., *O. minor* comb. nov., *O. typica* comb. nov., *O. fuersichi* sp. nov., *O. marthae* sp. nov., *O. selmae* sp. nov., *O. radiata* sp. nov., *O. bourkensis* sp. nov., *O. jonnae* sp. nov., *O. rincewindi* sp. nov., *O. barcaldinensis* sp. nov., *O. ngamurru* sp. nov., *O. beleriandensis* sp. nov., *O. quinlanae* sp. nov., *O. glabra* sp. nov. and *O. weeksi* sp. nov., and differentiating these species can be difficult. However, *O. pilbarensis* differs from all these species by having more complete thorax segments (23–24) and from most of these species (except *O. fuersichi*) by having polygonal reticulations in the first (larval) growth bands.

Etymology

The species is named after the Pilbara region in Western Australia where the species lives.

Type material

Holotype

AUSTRALIA – **Western Australia** • ♂; Pilbara, Red Rock on Indee Station; 20°52′32.8″ S, 118°35′16.6″ E; 31 Jan. 2006; J. McRae leg.; WAM C78014.

Paratypes

AUSTRALIA – **Western Australia** • 1 ♂, 2 ♀♀; same data as for holotype; WAM C80234 to C80236 • 1 ♂; same data as for holotype; NHMW-ZOO-CR-29003.

Other material examined

AUSTRALIA – **Western Australia** • 1 ♂, 2 ♀♀; 14 Mile Pool, 114 km N of Newman; 22°33′13″ S, 119°51′49.1″ E; 15 Mar. 2016; A.M. Pinder leg.; WAM C77995, C80230, C80231.

Type locality

Western Australia, Pilbara, Red Rock on Indee Station, 20°52′32.8″ S, 118°35′16.6″ E.

Description

Males

Carapace (Fig. 35a, c–d). Length 6.5–6.8 mm (HT: 6.6 mm), height 3.9–4.1 mm (HT: 4.1 mm). Coloration varying from light brownish to yellow-orange and reddish-brown; outer margin lighter. 28–35 (HT: 28) growth lines, 16–24 (HT: 17) widely spaced and 9–19 (HT: ~11) crowded.

Carapace shape. Dorsal margin straight, distinct dorso-posterior corner. Posterior margin broadly rounded, suboval, supra- to equicurvate (b/H 0.44–0.52; HT: 0.45). Ventral margin broadly rounded. Umbo position anterior (Cr/L 0.23–0.25; HT: 0.23).

Carapace ornamentation (Fig. 35e–g). Larval valve and first few growth bands with shallow, inconspicuous, small reticulations (poorly visible in many specimens, may appear granular or punctate) forming mainly irregular pentagons or hexagons. Reticulations replaced by lirae in first few growth bands. Lirae subparallel, strongly anastomosing, reticulating and branching; lirae more pronounced posteriorly on carapace. Under SEM, fine punctae visible between lirae of non-crowded growth bands in mid-carapace. Crowded growth bands with pronounced, parallel lirae (visible predominately under SEM). Concentric ridges raised; under SEM smooth in early ontogenetic stages and with nodules at the upper margin in moniliform row in later ontogenetic stages. Spiniform as well as filiform setae present (mainly preserved ventrally on concentric ridges); setal pores in single row along all growth lines.

Head (Fig. 35h). Condyle long, distally rounded; occipital notch narrow. Condyle lacking anterobasal hump. Margin between condyle and ocular tubercle straight. Ocular tubercle weakly developed, forming obtuse, nearly right angle with rostrum. Anterior margin of rostrum straight to weakly convex. Apex weakly rounded (not pointed), acute (~70°). Ventral margin of rostrum concave with slight notch anteriorly. Naupliar eye elongate, suboval. Antenna I long with 15–18 lobes (HT: 18), reaching to antenna II flagellomeres X–XI (HT: XI). Antenna II with 14–15 flagellomeres (HT: 15).

Thorax. 24–25 (HT: 25) segments, 23–24 (HT: 24) thoracopod-bearing and one posterior limbless segment not reaching dorsal margin. Most thoracopod-bearing segments with spine bearing dorsal extensions.

Thoracopod III (only WAM C78014; Fig. 35k). Endite I short and curved dorsally. Endites II–V broad, decreasing in size. Endite V palp one-segmented. Exopod ventral extension subequal in extension to endopod, dorsal extension wide, narrowing distally, overreaching epipod. Epipod long, cylindric.

Telson (Fig. 35j). 23–28 spines (HT: 26). First (anterior) spine enlarged. Following spines mostly small, anteriorly slender, conical, unequal in size (one or two notably larger spines interspersed); posterior ⅔ or ¼ of spines more elongate, slender, aciculate, not increasing in length posteriorly. Spines equally spaced. Dorsal margin nearly straight. Right terminal claw more strongly curved.

Furca (Fig. 35j). Proximally with dorsomedial longitudinal row of 10–15 (HT: 15) setae, row ending distally in a single conical spine. Distal part ~⅔ of furcal length, with numerous small denticles.

Females

Overall appearance as in males. Carapace (Fig. 35b) length 6.4–7.3 mm, height 3.9–4.4 mm; 29–34 growth lines, of these 17–29 widely spaced and 5–13 crowded; Cr/L 0.21–0.23, b/H 0.46–0.49. Angle between head and rostrum obtuse (~110°) (Fig. 35i). Rostrum frontal margin straight, becoming weakly concave ventrally. Apex pointed (~70°), not drawn out into acute tip; ventral margin nearly straight. Antenna I with 13–19 small lobes, lobes smaller than in males; reaching to antenna II flagellomeres V–X. Antenna II with 13–15 flagellomeres. 25 thorax segments, 24 thoracopod-bearing and one posterior limbless segment not reaching dorsal margin. Telson with 21–33 dorsal spines; left and right terminal claws usually equally curved, sometimes right stronger curved. Furca with 8 setae.

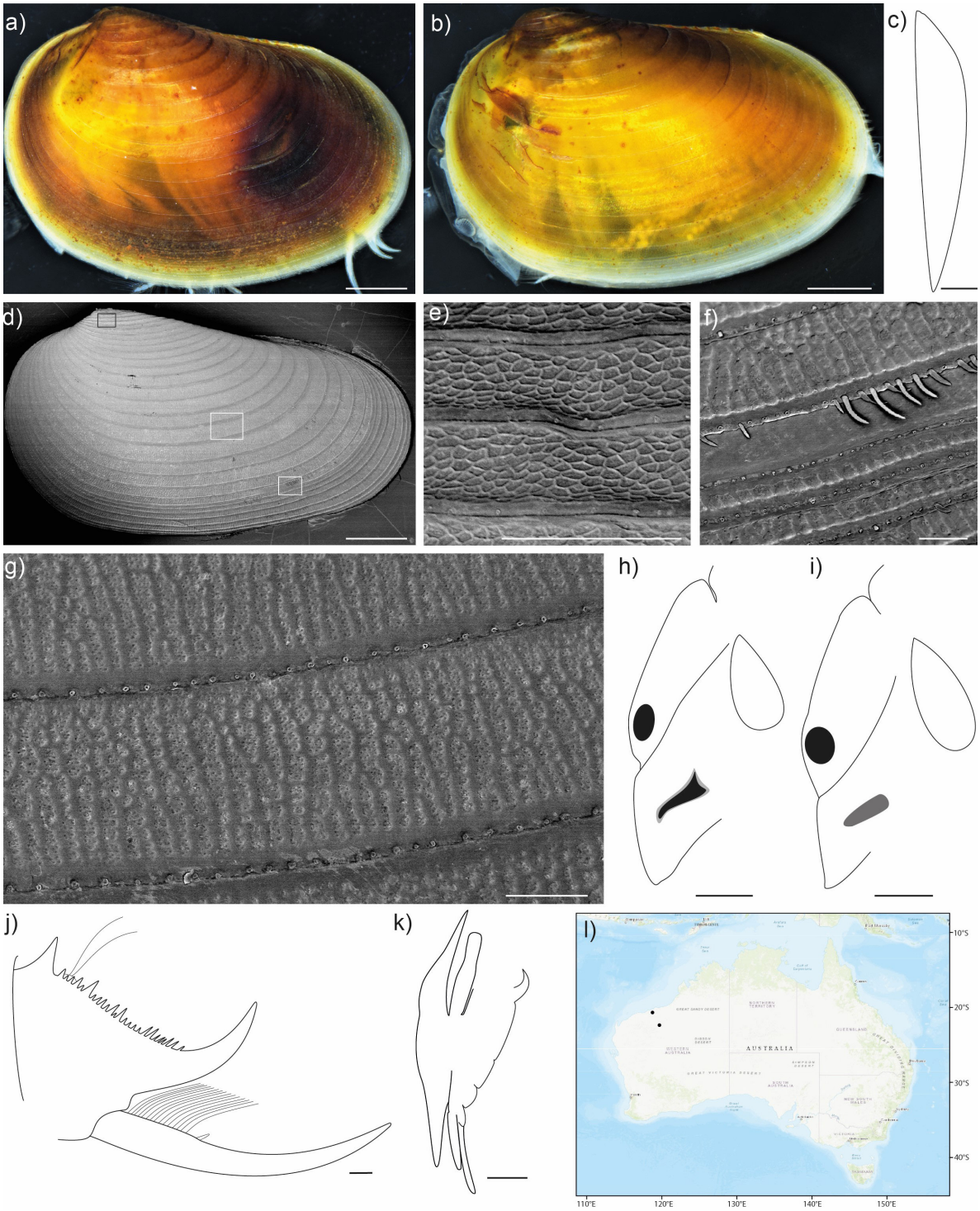

Fig. 35. *Ozestheria pilbarensis* sp. nov. **a–d**. Carapace. **a**. Male, holotype (WAM C78014). **b**. Female, paratype (WAM C80235). **c**. Dorsal view, male, holotype (right valve only; WAM C78014). **d**. Male (WAM C77995), SEM. **e–g**. Carapace ornamentation (male WAM C77995; positions marked in d by rectangles), SEM. **e**. Dorsal carapace. **f**. Ventral carapace. **g**. Mid-carapace. **h–i**. Head (antennae not shown). **h**. Male, holotype (WAM C78014). **i**. Female, paratype (WAM C80235). **j**. Telson, male, holotype (WAM C78014). **k**. Male, third right thoracopod (holotype, WAM C78014). **l**. Distribution map (produced in ArcMap 10.7; see caption Fig. 7 for sources). Scale bars: a–d = 1 mm; e–g, j = 0.1 mm; h–i, k = 0.5 mm.

Distribution (Fig. 35l)

Ozestheria pilbarensis sp. nov. is known only from two localities in the Pilbara region in northwestern Western Australia.

Remarks

The carapace shape of *Ozestheria pilbarensis* sp. nov. (Fig. 6) is distinct from that of most other species and overlaps partly with those of *O. timmsi* sp. nov., *O. sivesae* sp. nov., *O. setifera* sp. nov., *O. mariae*, *O. gemina* sp. nov., *O. jonnae* sp. nov., *O. marthae* sp. nov., *O. selmae* sp. nov., *O. cancellata* comb. nov., *O. weeksi* sp. nov., and *O. quinlanae* sp. nov.

Ozestheria quinlanae sp. nov.
urn:lsid:zoobank.org:act:C0BAAA4E-FB1D-4EAE-B0DB-79059E20534E
Fig. 36

Diagnosis

Ozestheria quinlanae sp. nov. is characterized by a long condyle and a very narrow occipital notch; carapace ornamentation dorsally on carapace punctate to finely reticulated (may appear granular), in following growth bands intensely anastomosing lirae forming within growth band, lirae become longer, slightly less anastomosing and more pronounced with progressing growth bands; male rostrum with straight to weakly convex anterior margin, apex rounded with nearly rectangular angle, ventral margin convex; female rostrum with straight or weakly undulating anterior margin, apex rectangular and drawn out into acute tip, ventral margin nearly straight to convex; 15–16 (male) or 15–19 (female) antenna I lobes reaching to antenna II flagellomeres VIII–X (male) or V–VII (female); 13–14 (male) or 14–15 (female) antenna II flagellomeres; 21 complete thorax segments; 14–18 telsonic spines, most spines small and conical with usually two larger spine interspersed, posterior spines aciculate; 5–9 furcal setae.

Differential diagnosis

Ozestheria quinlanae sp. nov. can be differentiated from many other species of *Ozestheria* by the narrow occipital notch and long condyle in combination with the carapace ornamentation (dominated by punctate ornamentation dorsally on carapace, transitioning to distinct, subparallel lirae during ontogeny), except from *O. cancellata* comb. nov., *O. minor* comb. nov., *O. typica* comb. nov., *O. fuersichi* sp. nov., *O. marthae* sp. nov., *O. selmae* sp. nov., *O. radiata* sp. nov., *O. bourkensis* sp. nov., *O. jonnae* sp. nov., *O. barcaldinensis* sp. nov., *O. ngamurru* sp. nov., *O. beleriandensis* sp. nov., *O. rincewindi* sp. nov., *O. glabra* sp. nov., *O. pilbarensis* sp. nov. and *O. weeksi* sp. nov., and differentiating these species can be difficult. *Ozestheria minor*, *O. typica*, *O. bourkensis*, *O. selmae*, *O. radiata*, and *O. beleriandensis* can be differentiated by having at least the posterior half of the telsonic spines long, elongate and aciculate. *Ozestheria quinlanae* differs from most of the abovementioned species by the low number of telsonic spines (14–18); *O. glabra* has fewer telsonic spines (but this appears to be a growth defect) and *O. barcaldinensis*, *O. marthae* and *O. jonnae* have similarly low numbers, but differ in the shapes of the male and female rostrum.

Etymology

The species is named in honor of Kirsty Quinlan (Department of Biodiversity, Conservation and Attractions), who kindly provided a large collection of Western Australian specimens of *Ozestheria*, which led to the discovery of many new species, including this one.

Type material

Holotype

AUSTRALIA – **Western Australia** • ♂; Lake Bryde, Pingrup; 33°21′11″ S, 118°49′22″ E; 6 Feb. 2012; D.J. Cale leg.; WAM C77988.

Paratypes

AUSTRALIA – **Western Australia** • 1 ♂, 1 ♀; same data as for holotype; WAM C80227, C80226 • 1 ♀; same data as for holotype; NHMW-ZOO-CR-29001.

Additional material (not examined)

AUSTRALIA – **Western Australia** • 1 empty carapace; same data as for holotype; WAM C80228.

Type locality

Western Australia, Lake Bryde, Pingrup, 33°21′11″ S, 118°49′22″ E.

Description

Males

Carapace (Fig. 36a, c–d). Length 6.0–6.7 mm (HT: 6.7 mm), height 3.7–4.1 (HT: 4.1 mm). Coloration orange-brown to dark brown, crowded growth bands lighter. 26–30 (HT: 30) growth lines, 17–24 (HT: 24) widely spaced and 6–9 (HT: 6) crowded.

Carapace shape. Dorsal margin straight, distinct dorso-posterior corner. Posterior margin broadly rounded, suboval, supracurvate to equicurvate (b/H 0.43–0.50, HT: 0.50). Ventral margin widely rounded. Umbo position submedian (Cr/L 0.25–0.28, HT: 0.28).

Carapace ornamentation (Fig. 36e–g). Larval valve granular or punctate (under SEM finely reticulated). Following growth bands punctate, shallow, intensely anastomosing lirae forming between punctae (under SEM lirae intermittent); lirae becoming more pronounced and less anastomosing in growth bands of later ontogenetic stages. Crowded growth bands with short, irregular lirae. Concentric ridges shallow. Setae mostly spiniform, few filiform setae interspersed, preferentially preserved on the ventral part of carapace (setal pores in single line along all growth lines under SEM).

Head (Fig. 36i). Condyle long, distally acute; occipital notch very narrow. Condyle with weak anterobasal hump. Margin between condyle and ocular tubercle concave. Ocular tubercle weakly developed, forming obtuse, nearly rectangular (~90–110°) angle with rostrum. Anterior margin of rostrum straight to weakly convex (HT: weakly convex). Apex rounded, nearly rectangular. Ventral margin of rostrum convex. Naupliar eye subtriangular, anteriorly rounded, sometimes very small. Antenna I long with 15–16 lobes (HT: 16), reaching to antenna II flagellomeres VIII–X (HT: X). Antenna II with 13–14 flagellomeres (HT: 14).

Thorax. 21 (HT: 21) segments, all thoracopod-bearing. Most segments with spine-bearing dorsal extensions with numerous spines and setae.

Thoracopod III (only WAM C77988; Fig. 36l). Endite I short and curved dorsally. Endites II–V broad, decreasing in size. Endite V palp two-segmented, basal segment subequal to endopod. Exopod ventral extension longer in extension to endopod, dorsal extension wide, narrowing distally, overreaching epipod. Epipod long, cylindric.

Telson (Fig. 36k). 14–18 spines (HT: 18). First (anterior) spine enlarged. Most spines short, thin, conical, subequal in length; a few (usually 2) slightly larger spines interspersed; most posterior spines thinner and aciculate, but not enlarged. Dorsal margin straight. Right terminal claw more strongly curved than left.

Furca (Fig. 36k). Proximally with dorsomedial longitudinal row of 5–9 (HT: 9) setae, row ending distally in a single conical spine. Distal part ⅔ of furcal length, with numerous small denticles.

Females

Overall appearance as in males. Carapace (Fig. 36b) length 6.6–8.0 mm, height 4.0–5.1 mm; 22–40 growth lines, 17–24 widely spaced and 5–16 crowded; Cr/L 0.24–0.25 and b/H 0.46–0.48. Anterior margin of

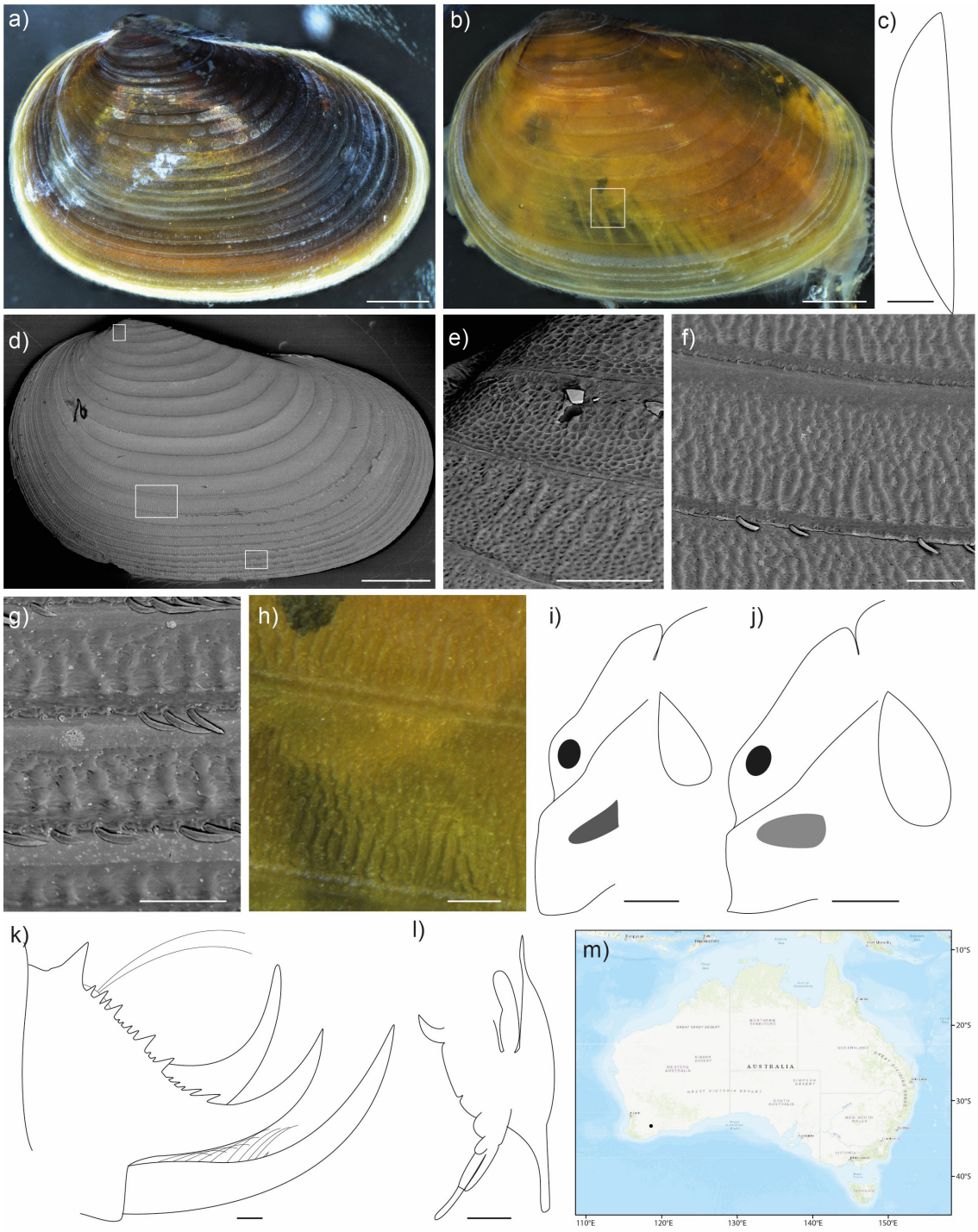

Fig. 36. *Ozestheria quinlanae* sp. nov. **a–d**. Carapace. **a**. Male, holotype (WAM C77988). **b**. Female, paratype (WAM C80226). **c**. Dorsal view, male, holotype (left valve only; WAM C77988). **d**. Male, paratype (WAM C80227), SEM. **e–g**. Carapace ornamentation (male paratype WAM C80227; positions marked in d by rectangles), SEM. **e**. Dorsal carapace. **f**. Mid-ventral carapace. **g**. Ventral carapace. **h**. Mid-ventral carapace ornamentation (female paratype WAM C80226; position marked in b by rectangle). **i–j**. Head (antennae not shown). **i**. Male, holotype (WAM C77988). **j**. Female, paratype (WAM C80226). **k**. Telson, male, holotype (WAM C77988). **l**. Male, third left thoracopod (holotype WAM C77988). **m**. Distribution map (produced in ArcMap 10.7; see caption Fig. 7 for sources). Scale bars: a–d = 1 mm; e–h, k = 0.1 mm; i–j, l = 0.5 mm.

rostrum straight or undulating; apex rectangular, drawn out into acute tip; ventral margin nearly straight to convex (Fig. 36j). Antenna I with 15–19 small lobes, lobes smaller than in males; reaching to antenna II flagellomeres V–VII. Antenna II with 14–15 flagellomeres. 21–22 segments, 21 thoracopod-bearing and none to one posterior limbless segment not reaching dorsal margin. Telson with 14–16 dorsal spines; left and right terminal claws equally curved. Furca with 7 setae, distal part ½ of furca length.

Distribution (Fig. 36m)

Ozestheria quinlanae sp. nov. is known from a single locality in southwestern Western Australia.

Remarks

Because only few specimens were available, the morphological variability of the species is not well characterized. The carapace shape of *Ozestheria quinlanae* sp. nov. (Fig. 6) is distinct from that of most other species and overlaps fully with those of *O. marthae* sp. nov., *O. weeksi* sp. nov. and partly with those of *O. timmsi* sp. nov., *O. setifera* sp. nov., *O. jonnae* sp. nov. (marginally), *O. selmae* sp. nov., *O. cancellata* comb. nov., and *O. pilbarensis* sp. nov.

Ozestheria radiata sp. nov.

urn:lsid:zoobank.org:act:13C3B4FB-34FF-4DEE-A553-F846124D3BBA

Fig. 37

Ozestheria sp. Q4 – Schwentner *et al*. 2015a: figs 2, 6.

Diagnosis

Ozestheria radiata sp. nov. is characterized by a long condyle and a narrow occipital notch; carapace ornamentation dorsally on carapace punctate (may appear granular), in following growth bands anastomosing lirae forming ventrally within growth band, lirae become more pronounced with progressing growth bands; male rostrum anterior margin weakly concave, straight or weakly undulating, apex strongly rounded with ~90° angle, ventral margin weakly convex or straight (with slight notch close to apex); female rostrum anterior margin nearly straight (slightly convex), apex nearly rectangular angle with drawn-out tip, ventral margin slightly concave or slightly convex; 11–14 (male) or 13–14 (female) antenna I lobes reaching to antenna II flagellomeres VI–IX (male) or II–IV (female); 10–12 (male) or 10–11 (female) antenna II flagellomeres; 19–20 complete thorax segments; 15–29 large and densely spaced telsonic spines, spines thin, elongate and aciculate, anteriormost spines slightly broader and shorter, spines increasing in length posteriorly, one slightly larger spine interspersed (at about mid-length of telson); 4–8 furcal setae.

Differential diagnosis

Ozestheria radiata sp. nov. can be differentiated from many other species of *Ozestheria* by the narrow occipital notch and long condyle in combination with the carapace ornamentation (dominated by punctate ornamentation dorsally on carapace, transitioning to distinct, subparallel lirae during ontogeny), except from *O. cancellata* comb. nov., *O. minor* comb. nov., *O. typica* comb. nov., *O. fuersichi* sp. nov., *O. jonnae* sp. nov., *O. marthae* sp. nov., *O. bourkensis* sp. nov., *O. rincewindi* sp. nov., *O. barcaldinensis* sp. nov., *O. ngamurru* sp. nov., *O. beleriandensis* sp. nov., *O. quinlanae* sp. nov., *O. glabra* sp. nov., *O. pilbarensis* sp. nov. and *O. weeksi* sp. nov., and differentiating these species can be difficult. *Ozestheria radiata* differs from *O. cancellata*, *O. fuersichi*, *O. jonnae*, *O. marthae*, *O. rincewindi*, *O. barcaldinensis*, *O. ngamurru*, *O. quinlanae*, *O. glabra*, *O. pilbarensis* and *O. weeksi* by having at least the posterior half of the telsonic spines long, elongate and aciculate (in the other species fewer telsonic spines are long and aciculate and more spines are shorter and conical) and by the shape of the male and female rostrum. *Ozestheria bourkensis* and *O. typica* have smaller carapaces, the male rostrum of *O. bourkensis* has

a convex anterior margin and the male rostrum of *O. typica* is less strongly rounded. In *O. minor* the male rostrum has a pointed (not rounded) apex and the female rostrum apex is drawn out into a larger acute tip. *Ozestheria beleriandensis* has a more rounded ventral margin of the carapace, less strongly developed ocular tubercles and the male rostrum has a pointed (not rounded) apex. *Ozestheria selmae* sp. nov. has more complete thorax segments (21–22 vs 20–21), a less strongly rounded male rostrum apex and the female rostrum apex is not as finely pointed.

Etymology

The species name derives from the Latin word '*radiatus*' ('radiant'), referring to the radial arrangement of the ornamental features on the carapace.

Type material

Holotype

AUSTRALIA – **Western Australia** • ♂; roadside scrape, 12 km W of Paynes Find; 29°17′07″ S, 117°34′01″ E; 20 Aug. 2011; B.V. Timms leg.; GenBank no: KJ705934 (COI); AM P.91706.

Paratype

AUSTRALIA – **Western Australia** • 1 ♀; same data as for holotype; GenBank no: KJ705935 (COI); AM P.91707.

Other material examined

AUSTRALIA – **Western Australia** • 2 ♂♂; Pool Pianto Road, Goongarrie National Park; 29°54′53.7″ S, 121°21′2.7″ E; 22 Feb. 2017; K. Quinlan leg.; WAM C78001, C80190 • 4 ♂♂, 1 ♀; Pool South of Lake Ballard; 29°27′31.9″ S, 120°36′51.4″ E; 21 Feb. 2017; K. Quinlan leg.; WAM C78004, C80191 to C80193 • 3 ♂♂; Silvers Lake, 8 km West of Lake Goongarrie; 29°59′42.7″ S, 121°3′54.1″ E; 22 Feb. 2017; K. Quinlan leg.; WAM C78005, C80195 to C80197 • 2 ♂♂; Silvers Lake, 8 km W of Lake Goongarrie; 29°59′42.7″ S, 121°3′54.1″ E; 22 Feb. 2017; K. Quinlan leg.; NHMW-ZOO-CR-28493, NHMW-ZOO-CR-28494.

Type locality

Western Australia, roadside scrape, 12 km W of Paynes Find, 29°17′07″ S, 117°34′01″ E.

Description

Male

Carapace (Fig. 37a, c–d). Length 3.5–5.7 mm (HT: 5.7 mm, mean: 4.3 mm), height 2.0–3.4 mm (HT: 3.4 mm, mean: 2.5 mm). Coloration ranging from light orange to yellowish-orange, outer margin lighter. 24–31 (HT: 31, mean: 27) growth lines, 11–17 (HT: 17, mean: 15) widely spaced and 9–15 (HT: 14, mean: 12) crowded.

Carapace shape. Dorsal margin straight, distinct dorso-posterior corner. Posterior margin broadly rounded, equicurvate (b/H 0.49–0.55, HT: 0.49, mean: 0.53). Ventral margin nearly straight in middle section. Umbo position anterior to submedian (Cr/L 0.27–0.32, HT: 0.27; mean: 0.29).

Carapace ornamentation (Fig. 37e–g). Larval valve and directly following growth bands finely punctate to finely reticulated (may appear granular; punctae best seen under SEM). Within following growth bands (about mid carapace), dorsal parts punctate, with shallow and strongly anastomosing lirae forming between punctae ventrally within growth bands (the onset and extent of lirae differs markedly between individuals). Lirae becoming more pronounced in progressing ontogenetic stages. Crowded growth bands with well-defined parallel short lirae forming deep pits. Concentric ridges shallow, with nodules

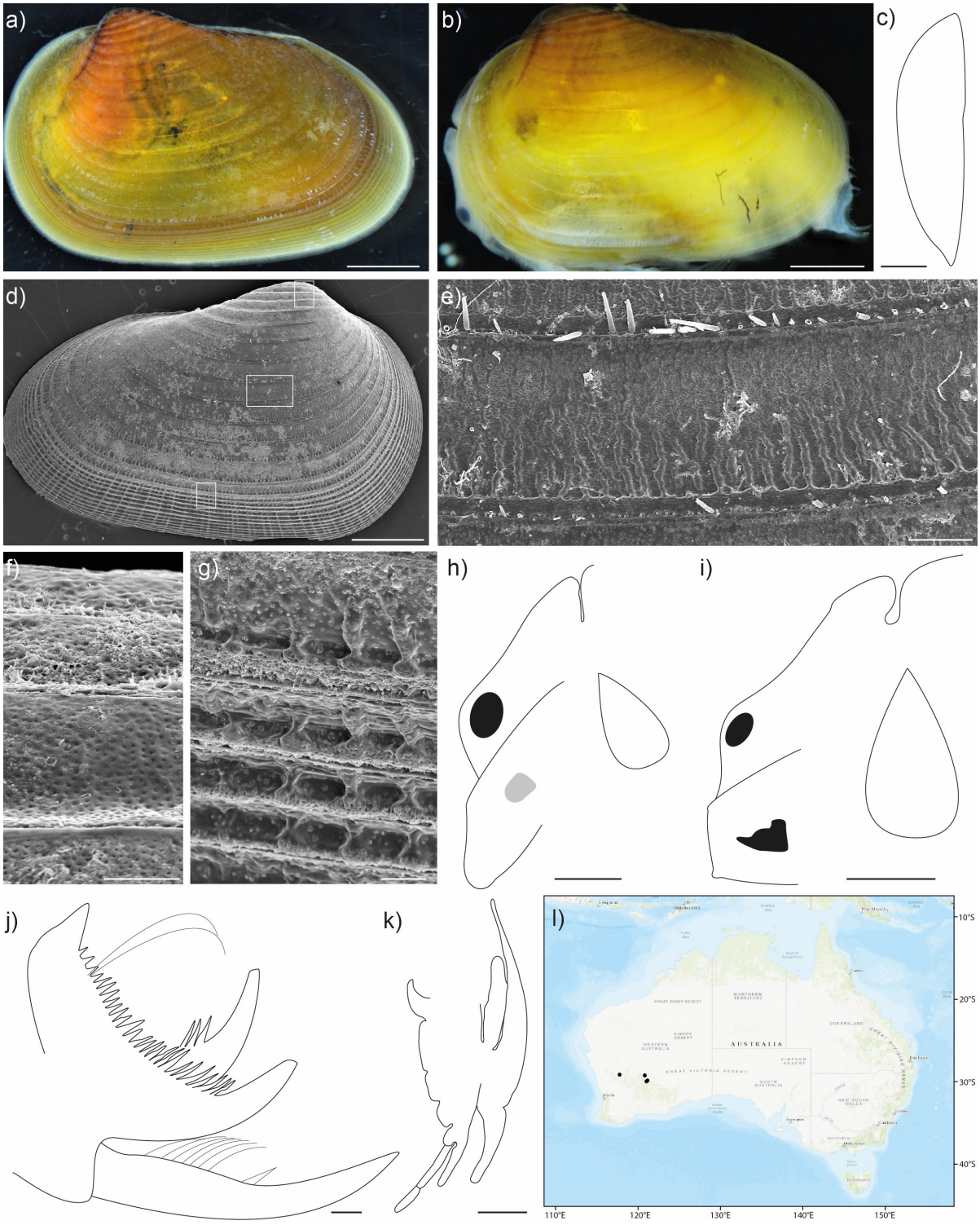

Fig. 37. *Ozestheria radiata* sp. nov. **a–d**. Carapace. **a**. Male, holotype (P.91706). **b**. Female, paratype (P.91707). **c**. Male, holotype, dorsal view (left valve only; P.91706). **d**. Male, holotype (P.91706), SEM. **e–g**. Carapace ornamentation of male, holotype (P.91706; positions marked in d by rectangles). **e**. Mid-carapace. **f**. Dorsal carapace. **g**. Ventral carapace. **h–i**. Head (antennae not shown). **h**. Male, holotype (P.91706). **i**. Female, paratype (P.91707). **j**. Telson, male, holotype (P.91706). **k**. Third right thoracopod, male, holotype (P.91706). **l**. Distribution map (produced in ArcMap 10.7; see caption Fig. 7 for sources). Scale bars: a–d = 1 mm; e, j = 0.1 mm; f–g = 0.05 mm; h–i, k = 0.5 mm.

at the upper margin in moniliform row in later ontogenetic stages. Setae mostly spiniform; preferentially preserved on ventral and posterior parts of the carapace, if any preserved. Setal pores in single row along all growth lines.

Head (Fig. 37h). Condyle long, distally acute; occipital notch narrow. Condyle with anterobasal hump. Margin between condyle and ocular tubercle straight to concave (HT: weakly concave). Ocular tubercle weakly to well developed, forming rectangular or obtuse angle with rostrum, which varies from ~90–160° (HT: ~90°). In some individuals rostrum dorsally protruding from head. Anterior margin of rostrum weakly concave (sometimes nearly straight) or undulating (dorsally concave, ventrally convex; HT: undulating). Ventral margin of rostrum with slight notch close to apex, posteriorly weakly convex or straight; apex strongly rounded, ~90°. Naupliar eye subtriangular or roundish. Antenna I long with 11–14 lobes (HT: 13), reaching to antenna II flagellomeres VI–IX (HT: VI). Antenna II with 10–12 flagellomeres (HT: 12, mean: 11).

Thorax. 20–21 (HT: 21, mean: 20) segments, 19–20 (HT: 20, mean: 19) thoracopod-bearing and one posterior limbless segment not reaching dorsal margin. Last ~13 thoracopod-bearing segments with spine bearing dorsal extensions.

Thoracopod III (only P.91706; Fig. 37k). Endite I short and curved dorsally. Endites II–V broad, decreasing in size. Endite V palp two-segmented, basal segment extending further than endopod. Exopod ventral extension shorter in extension to endopod, dorsal extension wide, narrowing distally, overreaching epipod. Epipod long, cylindric.

Telson (Fig. 37j). 21–29 spines (HT: 28; mean: 24). First (anterior) spine greatly enlarged. Following spines subequal in length, thin, elongate, aciculate (anterior ⅓ to ½ of spines slightly broader, shorter and slightly conical); posterior spines increasing in size; all spines very densely spaced; 1 slightly larger spine interspersed (about mid-length of telson). Dorsal margin slightly concave. Right terminal claw more strongly curved than left.

Furca (Fig. 37j). Proximally with dorsomedial longitudinal row of 4–8 (HT: 7, mean: 6) setae, row ending distally in a single conical spine. Distal part ⅔ of furcal length, with numerous small denticles.

Females

Overall appearance as in males. Carapace (Fig. 37b) length 3.8–5.2 mm, height 2.3–3.0 mm; 20–22 growth lines, 16–17 widely spaced and 3–6 crowded; Cr/L 0.28–0.29 and b/H 0.53–0.54. Ocular tubercle forming obtuse (~140–180°) angle with rostrum (Fig. 37i). Rostrum protruding dorsally in some individuals; anterior margin nearly straight (slightly convex); apex pointed, nearly rectangular angle, tip drawn out; ventral margin with slight notch close to apex, slightly concave or slightly convex; overall rostrum shape trapezoidal. Antenna I with 13–14 small lobes, lobes smaller than in males, often poorly separated from each other; reaching to antenna II flagellomeres II–IV. Antenna II with 10–11 flagellomeres. Telson with 15–23 dorsal spines; left and right terminal claws equally curved. Furca with 6 setae, distal part ⅔ of furcal length.

Distribution (Fig. 37l)

Ozestheria radiata sp. nov. occurs in southwestern Western Australia.

Remarks

Ozestheria radiata sp. nov. is part of a group of five very closely related species; see remarks on *O. typica* comb. nov. for details. The carapace shape of *O. radiata* (Fig. 6) is distinct from that of most other species and overlaps with those of *O. typica* and, partly, *O. selmae* sp. nov., *O. bourkensis* sp. nov., *O. ngamurru* sp. nov., and *O. beleriandensis* sp. nov.

Ozestheria richteri sp. nov.
urn:lsid:zoobank.org:act:35804CD8-1540-44C0-BB7D-F55A92D44692
Fig. 38

Ozestheria sp. G – Schwentner *et al*. 2015 a: figs 2, 6; 2020: figs 1–2.

Diagnosis

Ozestheria richteri sp. nov. is characterized by a short condyle with a hump at its base and a medium-wide occipital notch; a rounded ventral carapace margin; carapace ornamentation dorsally on carapace smooth or with irregular depression, from mid-carapace with granular or nodulous intermittent lirae; male rostrum with convex anterior margin, apex strongly rounded with right angle, ventral margin straight or with slightly convex hump; female rostrum anterior margin convex, apex strongly rounded, ventral margin convex with anterior notch; 9–11 (male) or 8–12 (female) antenna I lobes reaching to antenna II flagellomeres IV–V (male) or IV–V (female); 8–9 (male) or 9 (female) antenna II flagellomeres; 19 complete thorax segments; 10–17 large spines, varying in shape between conical and elongate and aciculate, unequal in size; 0–1 furcal setae.

Differential diagnosis

Ozestheria richteri sp. nov. can be differentiated from all other species by the shape of the condyle, rostrum and carapace ornamentation. It is the only species with a short condyle and wide occipital notch, which has a well-defined hump at the condyle base (this is usually only present in species with a longer condyle) and has fewer furcal setae (0–1) than most other species. The condyle is uniquely shaped by being short, but distally pointed. The broad male rostrum and nodular carapace ornamentation (present on growth bands of later ontogenetic stages) are shared only with *O. pellucida* and to a lesser degree *O. rufa* and no other short-condyled species. *Ozestheria pellucida* differs from *O. richteri* by the condyle shape, the lighter and pellucid carapace and the number of furcal setae (14 vs 0–1), and by the lack of liral ornamentation (well visible posteriorly on the carapace of *O. richteri*). *Ozestheria rufa* differs from *O. richteri* by the pointed, drawn-out rostral apex, the number of antenna I lobes (16–19 vs 8–12), the number of complete thorax segments (23–24 vs 19) and the number of furcal setae (6–15 vs 0–1).

Etymology

The species is named in honor of the German zoologist Stefan Richter. Without Stefan's contribution and support all the newly described species of *Ozestheria* would not have been discovered. He supervised and planned MS' PhD thesis, which lay the foundation for this publication, participated in collecting specimens and started MS' interest in these fascinating animals.

Type material

Holotype

AUSTRALIA – **Western Australia** • ♂; Paynes Find, Bullamanya Rock, pool 5; 29°09′50.9″ S, 117°39′40.4″ E; 20 Aug. 2011, B.V. Timms leg.; GenBank no: KJ705759 (COI); AM P.91531.

Paratypes

AUSTRALIA – **Western Australia** • 2 ♂♂, 1 ♀; same data as for holotype; GenBank nos: KJ705756 to KJ705758 (COI); AM P.91528 to P.91530 • 1 ♀; same data as for holotype; GenBank no: KJ705755 (COI); NHMW-ZOO-CR-28480.

Type locality

Western Australia, Paynes Find, Bullamanya Rock, pool 5, 29°09′50.9″ S, 117°39′40.4″ E.

Description

Males

Carapace (Fig. 38a, c–d). Length 4.8–5.1 mm (HT: 5.1 mm), height 2.9–3.1 mm (HT: 3.1 mm). Coloration dorsally dark brown to nearly black (~⅓–⅔ of carapace) with roundish dark area below umbo, fading into yellowish-brown ventrally. 15–17 growth lines, 13 widely spaced and 2–4 crowded.

Carapace shape. Dorsal margin straight, dorso-posterior corner rounded. Posterior margin widely rounded, supracurvate (b/H 0.39–0.44, HT: 0.44). Ventral margin widely rounded. Umbo position anterior to submedian (Cr/L 0.23–0.26, HT: 0.26).

Carapace ornamentation (Fig. 38e–g). Larval valve and following growth bands smooth, following growth bands appear smooth, partly with irregular depressions or very anastomosing lirae. From about mid carapace, with shallow, inconspicuous, subparallel, anastomosing lirae forming ventrally on growth bands (nodular under SEM, highly nodular with incipient crowding in the ventral and anterior part of the carapace). Concentric ridges shallow. Setae spiniform, preserved along carapace margin (under SEM setal pores along all growth lines, dorsally and medially on carapace with two alternating rows of setal pores on early concentric ridges, ventrally a single row).

Head (Fig. 38h). Condyle short, slightly elongate and pointed distally; occipital notch medium wide. Condyle with well-developed anterobasal hump. Margin between condyle and ocular tubercle weakly concave. Ocular tubercle well developed, forming obtuse angle with rostrum (close to 90°). Anterior margin of rostrum convex, protruding anteriorly. Ventral margin of rostrum nearly straight or with slightly convex hump mid-length (HT: with hump) with notch close to apex, apex broadly rounded, acute. Naupliar eye triangular. Antenna I with 9–11 (HT: 11) lobes, reaching to antenna II flagellomeres IV–V (HT: IV). Antenna II with 8–9 (HT: 9) flagellomeres.

Thorax. 20 segments, 19 thoracopod-bearing and one posterior limbless segment not reaching dorsal margin. Dorsal armature well developed in last eight segments, spines thin and elongated, central spines stronger and broader in posterior segments.

Thoracopod III (only P.91531; Fig. 38l). Endite I short and curved dorsally. Endites II–V broad, decreasing in size. Endite V palp two-segmented, basal segment shorter than endopod. Exopod ventral extension shorter in extension than endopod; dorsal extension wide, narrowing distally, overreaching epipod. Epipod long, cylindric.

Telson (Fig. 38j–k). 8–12 (HT: 12) spines. First (anterior) spine enlarged. Spines of highly variable size and spacing (mostly widely spaced, space increases posteriorly), varying in shape between broad, conical and elongate, slender, aciculate. Several larger spines interspersed among much smaller spines. Dorsal margin nearly straight, posteriorly slightly concavely curved. Right terminal claw more strongly curved than left.

Furca (Fig. 38j–k). Proximally with dorsomedial longitudinal row of 0–1 seta (HT: 1) setae, row ending distally in a single conical spine. Distal part ½ of furca length, with numerous small denticles.

Females

Very similar to males. Carapace (Fig. 38b) length 3.9–4.0 mm, height 2.5–2.6 mm. 16–17 growth lines, of these 12–14 evenly spaced and 3–4 crowded; Cr/L 0.23–0.24 and b/H 0.47–0.48. Ocular tubercle and rostrum form acute angle (~20–80°); rostrum anterior margin convex; apex widely rounded, rectangular (not drawn out), ventral margin convex with anterior notch (Fig. 38i). Antenna I with 8–12 indistinct lobes, reaching to antenna II flagellomeres IV–V. Antenna II with nine flagellomeres. Telson 16–17 spines, their shape, size and spacing as in males. Furca bearing 0–1 seta.

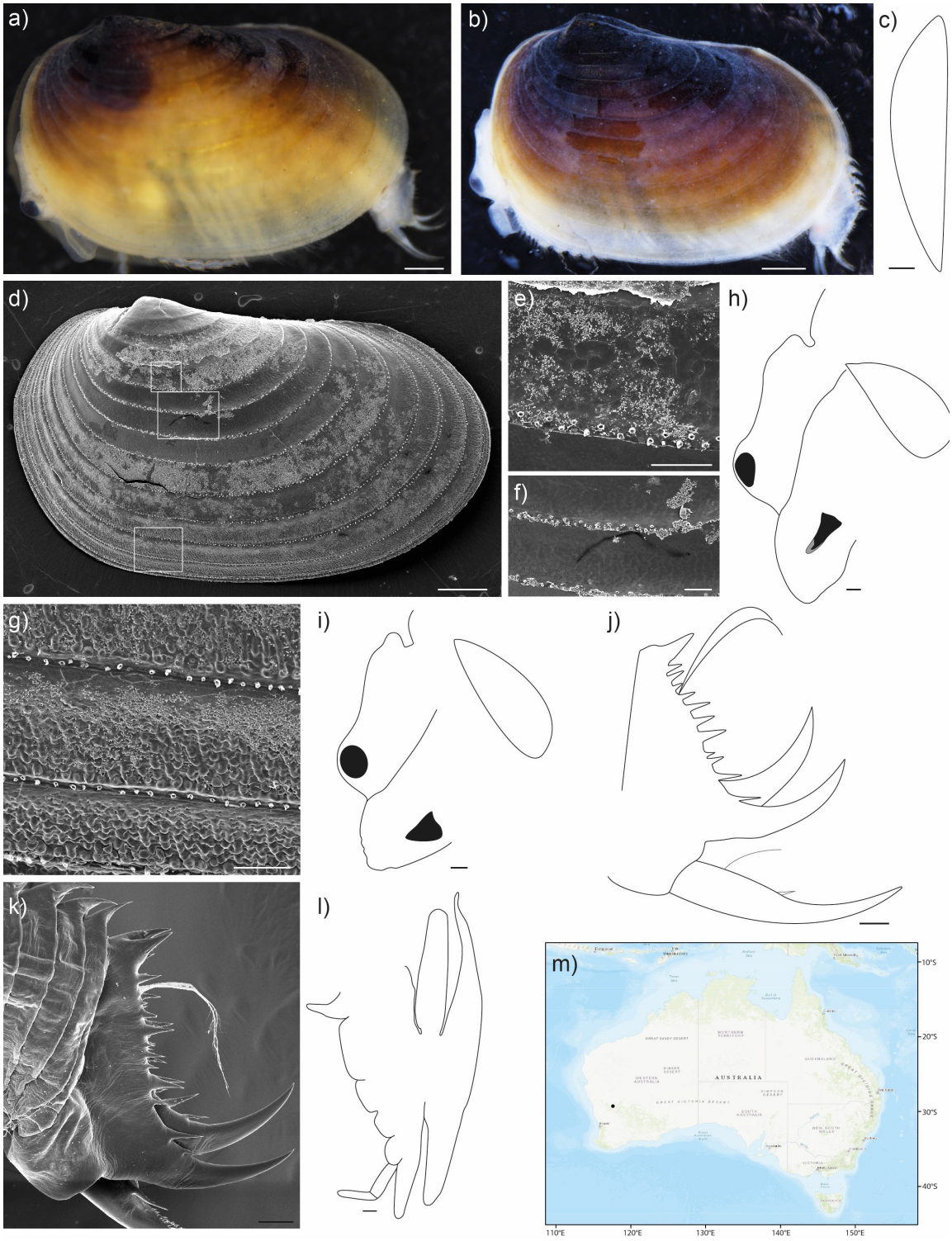

Fig. 38. *Ozestheria richteri* sp. nov. **a–d**. Carapace. **a**. Male, holotype (P.91531). **b**. Female, paratype (P.91528). **c**. Male, holotype, dorsal view (only left valve shown, P.91531). **d**. Male, paratype (P.91529), SEM. **e–g**. Carapace ornamentation of male paratype (P.91529; positions marked in d by rectangles). **e**. Mid-dorsal carapace. **f**. Mid-carapace. **g**. Ventral carapace. **h–i**. Head (antennae not shown). **h**. Male, holotype (P.91531). **i**. Female, paratype (P.91528). **j–k**. Telson. **j**. Male, holotype (P.91531). **k**. Male, paratype (P.91529), SEM. **l**. Male, holotype third right thoracopod (P.91531). **m**. Distribution map (produced in ArcMap 10.7; see caption Fig. 7 for sources). Scale bars: a–d = 0.5 mm; e–l = 0.1 mm.

Distribution (Fig. 38m)

Currently known only from its type locality in western Western Australia.

Remarks

The carapace shape of *Ozestheria richteri* sp. nov. (Fig. 5) is distinct from that of most other species and overlaps partly with those of *O. rubra*, *O. henryae* sp. nov., *O. berneyi* and *O. gemina* sp. nov.

Ozestheria rincewindi sp. nov.
urn:lsid:zoobank.org:act:9DAC8D31-4075-4931-8CF5-3B337B3AC641
Fig. 39

Ozestheria sp. U – Schwentner *et al*. 2015 a: figs 2, 6; 2020: figs 1–2.

Diagnosis

Ozestheria rincewindi sp. nov. is characterized by a long condyle and a narrow occipital notch; carapace length of 5.0 mm; carapace ornamentation dorsally on carapace punctate (may appear granular), in following growth bands anastomosing lirae forming ventrally within growth band, lirae become longer, less anastomosing and more pronounced within progressing growth bands; male rostrum with convex anterior margin, apex rounded with acute angle (close to 90°), ventral margin straight; 16 (male) antennule lobes reaching to antennal flagellomeres VIII (male); 10 (male) antennal flagellomeres; 20 complete thorax segments; 20 telsonic spines, anterior spines conical with two larger spines interspersed, posterior spines elongated and aciculate, increasing in size posteriorly; 8 furcal setae.

Differential diagnosis

Ozestheria rincewindi sp. nov. can be differentiated from many other species of *Ozestheria* by the narrow occipital notch and long condyle in combination with the carapace ornamentation (dominated by punctate ornamentation dorsally on carapace, transitioning to distinct, subparallel lirae during ontogeny), except from *O. cancellata* comb. nov., *O. minor* comb. nov., *O. typica* comb. nov., *O. fuersichi* sp. nov., *O. marthae* sp. nov., *O. selmae* sp. nov., *O. radiata* sp. nov., *O. bourkensis* sp. nov., *O. jonnae* sp. nov., *O. barcaldinensis* sp. nov., *O. ngamurru* sp. nov., *O. beleriandensis* sp. nov., *O. quinlanae* sp. nov., *O. glabra* sp. nov., *O. pilbarensis* sp. nov. and *O. weeksi* sp. nov., and differentiating these species can be difficult. *Ozestheria minor*, *O. typica*, *O. bourkensis*, *O. selmae*, *O. radiata*, and *O. beleriandensis* can be differentiated by having at least the posterior half of the telsonic spines long, elongated and aciculate and *O. fuersichi* by its polygonal reticulations on the first few growth bands and punctae between widely spaced lirae. The naupliar eye of *O. rincewindi* sp. nov. is situated more dorsally within the rostrum than in any other species of *Ozestheria* (where the naupliar eye is usually situated near the central part of the rostrum). In contrast to *O. cancellata*, *O. fuersichi* sp. nov., *O. marthae*, *O. jonnae*, *O. ngamurru* and *O. glabra* the ocular tubercle is well developed in males of *O. rincewindi*. *Ozestheria rincewindi* differs from *O. barcaldinensis* by having a straight (vs concave) margin between condyle and ocular tubercle and a more acute apex at the male rostrum.

Etymology

The species is named after Rincewind, a fictional character in the books by Terry Pratchett, who visited Discworld's equivalent of Australia.

Type material

Holotype

AUSTRALIA – **South Australia** • ♂; dugout Wentworth Road; 33°53′03.4″ S, 140°58′39.1″ E; 13 Mar. 2011; M. Schwentner and B.V. Timms leg.; GenBank no: KJ706082; AM P.91857.

Type locality

South Australia, dugout Wentworth Road, 33°53′03.4″ S, 140°58′39.1″ E.

Description

Male (holotype)

Carapace (Fig. 39a–d). Length 5.0 mm, height 3. 0 mm. Lightly brown colored, dorsally slightly darker (slightly reddish-brown). 25 growth lines, 18 widely spaced and seven crowded.

Carapace shape. Dorsal margin straight, distinct dorso-posterior corner. Posterior margin broadly rounded, equicurvate (b/H 0.54). Ventral margin broadly rounded, middle section relatively straight. Umbo position submedian (Cr/L 0.26).

Carapace ornamentation (Fig. 39d–f). Larval valve finely reticulated, dorsal growth bands punctate (may appear granular). From mid-dorsal carapace, growth bands with subparallel, anastomosing lirae forming ventrally within growth bands, which become progressively more pronounced and less anastomosing in

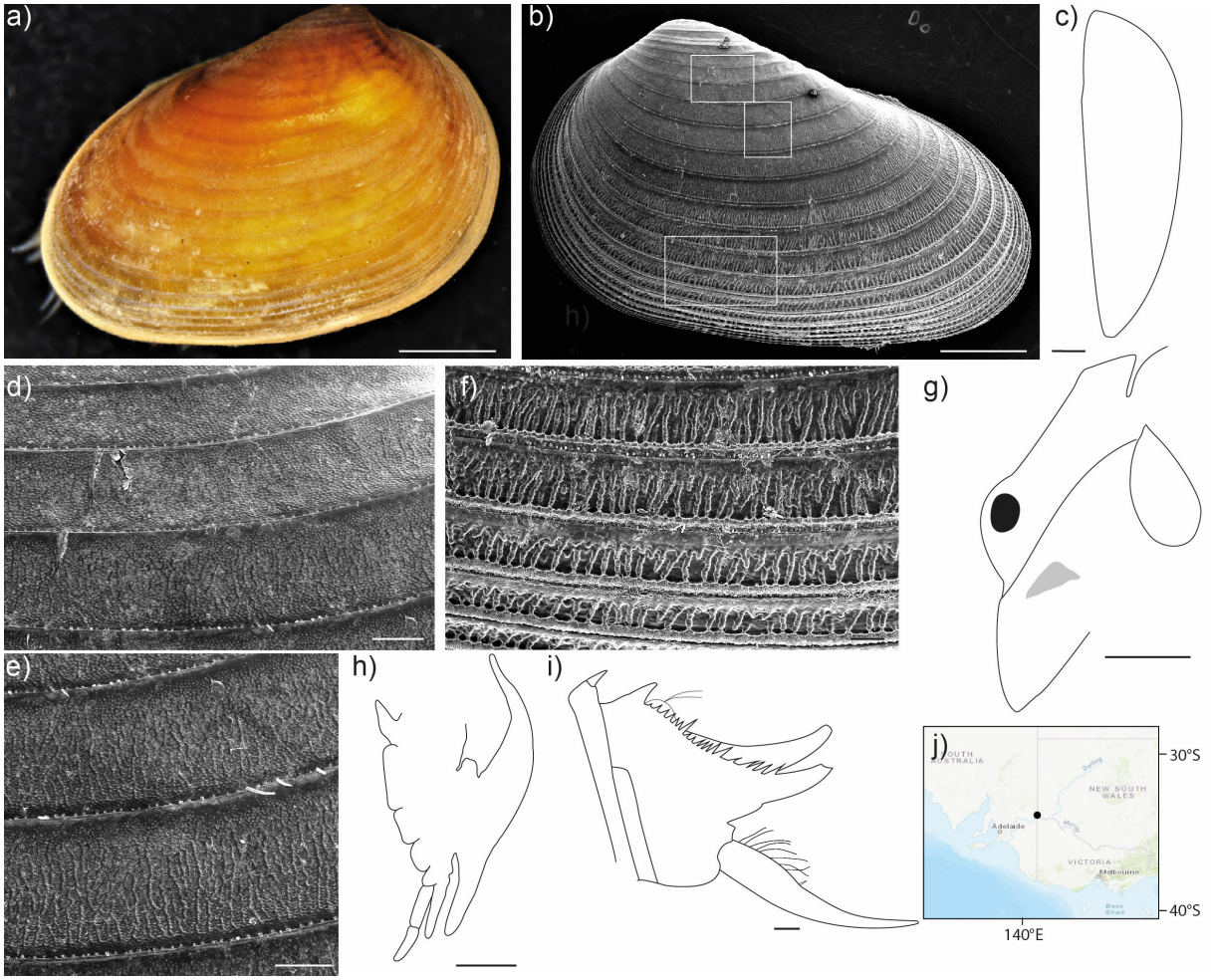

Fig. 39. *Ozestheria rincewindi* sp. nov., male, holotype (P.91857). **a**. Carapace. **b**. Carapace, SEM. **c**. Carapace, dorsal view (right valve only). **d–f**. Carapace ornamentation (positions marked in b by rectangle), SEM. **d**. Mid-dorsal carapace. **e**. Mid-carapace. **f**. Ventral carapace with crowded growth lines. **g**. Head (antennae not shown). **h**. Third left thoracopod. **i**. Telson. **j**. Distribution map (produced in ArcMap 10.7; see caption Fig. 7 for sources). Scale bars: a–c = 0.5 mm; d–i = 0.1 mm.

later ontogenetic stages (under SEM dense, fine punctae between lirae visible). Ventral and crowded growth bands with short, distinct lirae which terminate in nodules in moniliform row on concentric ridges (more pronounced posteriorly; nodule mainly visible under SEM). Concentric ridges only slightly raised. Setae spiniform (very few present), setae (pores) in single row along all concentric ridges (visible under SEM).

Head (Fig. 39g). Condyle long, distally acute; occipital notch narrow. Condyle with anterobasal hump. Margin between condyle and ocular tubercle straight. Ocular tubercle well developed, forming obtuse angle with rostrum. Anterior margin of rostrum convex, ventral margin straight; apex rounded, acute (close to 90°). Naupliar eye triangular. Antenna I with 16 lobes, reaching to antenna II flagellomere VII. Antenna II anterior ramus with ten flagellomeres.

Thorax. 21 segments, 20 thoracopod-bearing and one posterior limbless segment not reaching dorsal margin. Last 14 thoracopod-bearing segments with dorsal extensions bearing spines. Dorsal extensions increasing in size posteriorly over successive segments, most developed in last nine segments. Spines thin and elongate, stronger and broader in posterior segments.

Thoracopod III (Fig. 39h). Endite I short and curved dorsally. Endites II–V broad, decreasing in size. Endite V palp two-segmented, basal segment shorter than endopod. Exopod ventral extension subequal in extension to endopod, dorsal extension wide, narrowing distally. Epipod damaged.

Telson (Fig. 39i). 20 spines. First spine (anterior) enlarged. Following nine spines short with one larger spine interspersed, followed by two sets of spines with increasing sizes. Spines slender, elongate, aciculate. Last spines extend beyond base of terminal claw. Terminal claw slightly curved, more strongly curved on right body half (tips broken off). Anterior ⅔ of dorsal margin nearly straight, posterior third concavely curved.

Furca (Fig. 39i). Proximally with dorsomedial longitudinal row of eight setae, row ending distally in a single conical spine. Distal part ⅔ of furca length, with numerous small denticles.

Females

Unknown.

Distribution

Currently known only from its type locality in eastern South Australia.

Remarks

Only a single male specimen is known. The carapace shape of *Ozestheria rincewindi* sp. nov. (Fig. 6) is distinct from most other species and overlaps with that of *O. jiangi* sp. nov., *O. minor* comb. nov. and *O. echidna* sp. nov.

Ozestheria rubra (Henry, 1924)
Figs 40–41

Estheria rubra Henry, 1924: 121, 134–135, fig. 32.

Caenestheria rubra – Richter & Timms 2005: 346.
Ozestheria sp. D1 – Schwentner *et al*. 2015 a: figs 2, 6.
Ozestheria sp. D2 – Schwentner *et al*. 2015 a: figs 2, 6.
Ozestheria rubra – Rogers 2020: 24.

Diagnosis

Ozestheria rubra is characterized by a short condyle and wide occipital notch; a rounded ventral carapace margin; carapace ornamentation with medium to large, well-developed polygonal reticulations,

each polygon with polygonal secondary ornamentation (best seen under SEM); male rostrum with strongly convex anterior margin, apex rounded with right angle, ventral margin concave, pointing apex downwards; female rostrum anterior margin straight or weakly convex, apex pointed (in some individuals elongated, drawn out), ventral margin slightly concave; 13–22 (male) or 13–20 (female) antenna I lobes reaching to antenna II flagellomeres VII–X (male) or III–V (female); 12–15 (male) or 10–18 (female) antenna II flagellomeres; 22–23 complete thorax segments; 14–27 small, unequally sized and spaced conical telsonic spines, spines in the central part of the telson enlarged; 3–15 furcal setae.

Differential diagnosis

See differential diagnosis of *O. elliptica*.

Type material

Syntype

AUSTRALIA – **New South Wales** • 1 ♀; Goorimpa Station; 1923; Henry (?) leg.; AM P.6773.

Other material examined

AUSTRALIA – **New South Wales** • 2 ♂♂, 3 ♀♀; big lake near Cumeroo; 29°15′22.2″ S, 145°15′03.8″ E; 20 Jan. 2010; M. Schwentner and B.V. Timms leg.; AM P.91397 to P.91401 • 1 ♂, 4 ♀♀; Bloodwood Station, Gidgee Lake; 29°33′10.4″ S, 144°50′12.7″ E; 19 Feb. 2010; M. Schwentner, C. Sieves and B.V. Timms leg.; AM P. 91379, P.91389–91392 • 1 ♂, 1 ♀; Bloodwood Station, Woolshed Saltlake; 29°31′44.3″ S, 144°51′11.1″ E; 19 Feb. 2010; M. Schwentner, C. Sieves and B.V. Timms leg.; AM P.91393, P.91394 • 1 ♂; Bloodwood Station, Woolshed Saltlake; 29°31′44.3″ S, 144°51′11.1″ E; 19 Feb. 2010; M. Schwentner, C. Sieves and B.V. Timms leg.; NHMW-ZOO-CR-28489 • 1 ♂; Bloodwood Station, Roszkos Paleolake; 29°27′42.9″ S, 144°48′12.5″ E; 19 Feb. 2010; M. Schwentner, C. Sieves and B.V. Timms leg.; AM P.91380. – **Northern Territory** • 1 ♂, 4 ♀♀; island hyposaline lake 60 km N of Kulgera; 25°19′23.2″ S, 133°12′41.7″ E; 10 Mar. 2011; M. Schwentner and B.V. Timms leg.; AM P.91415 to P.91419 • 4 ♂♂, 2 ♀♀; lake 20 km W of Erldunda; 25°14′36.5″ S, 132°59′40.3″ E; 6 Mar. 2011; M. Schwentner and B.V. Timms leg.; AM P.91410 to P.91414, P.91396 • 1 ♂, 3 ♀♀; creek into Mygoora; 25°22′ S, 132°38′ E; 6 Apr. 2011; Low leg.; P.91383 to P.91386. – **South Australia** • 3 ♂♂, 1 ♀; quarry Pool Algebuckina; 27°54′13.9″ S, 135°48′47.1″ E; 12 Mar. 2011; M. Schwentner and B.V. Timms leg.; AM P.91387, P.91402 to P.91404.

Additional material (not examined)

AUSTRALIA – **New South Wales** • 3 juvs; Bloodwood Station, turbid marsilea swamp S of Junction Pool; 29°31′33.3″ S, 144°50′23.6″ E; 23 Feb. 2011; M. Schwentner, S. Richter and B.V. Timms leg.; AM P.91388, P.91405, P.91406.

Type localities

New South Wales, Marra and Budda Stations (Darling River) and Goorimpa Station (Paroo River; 29°34′ S, 144°17′ E).

Description

Males

Carapace (Fig. 40b–c, e–f). Length 6.7–9.3 mm (mean: 8.0 mm), height 3.3–5.5 mm (mean: 4.7 mm). Coloration brown to whitish (nearly translucent), outer margin lighter, whitish. 18–32 (mean: 23) growth lines, 13–20 (mean: 16) widely spaced and 2–14 (mean: 7) crowded.

Carapace shape. Dorsal margin straight, distinct dorso-posterior corner. Posterior margin broadly rounded, suboval, supracurvate (b/H 0.40–0.46; mean: 0.43). Ventral margin widely rounded. Umbo position anterior (Cr/L 0.17–0.22, mean: 0.20).

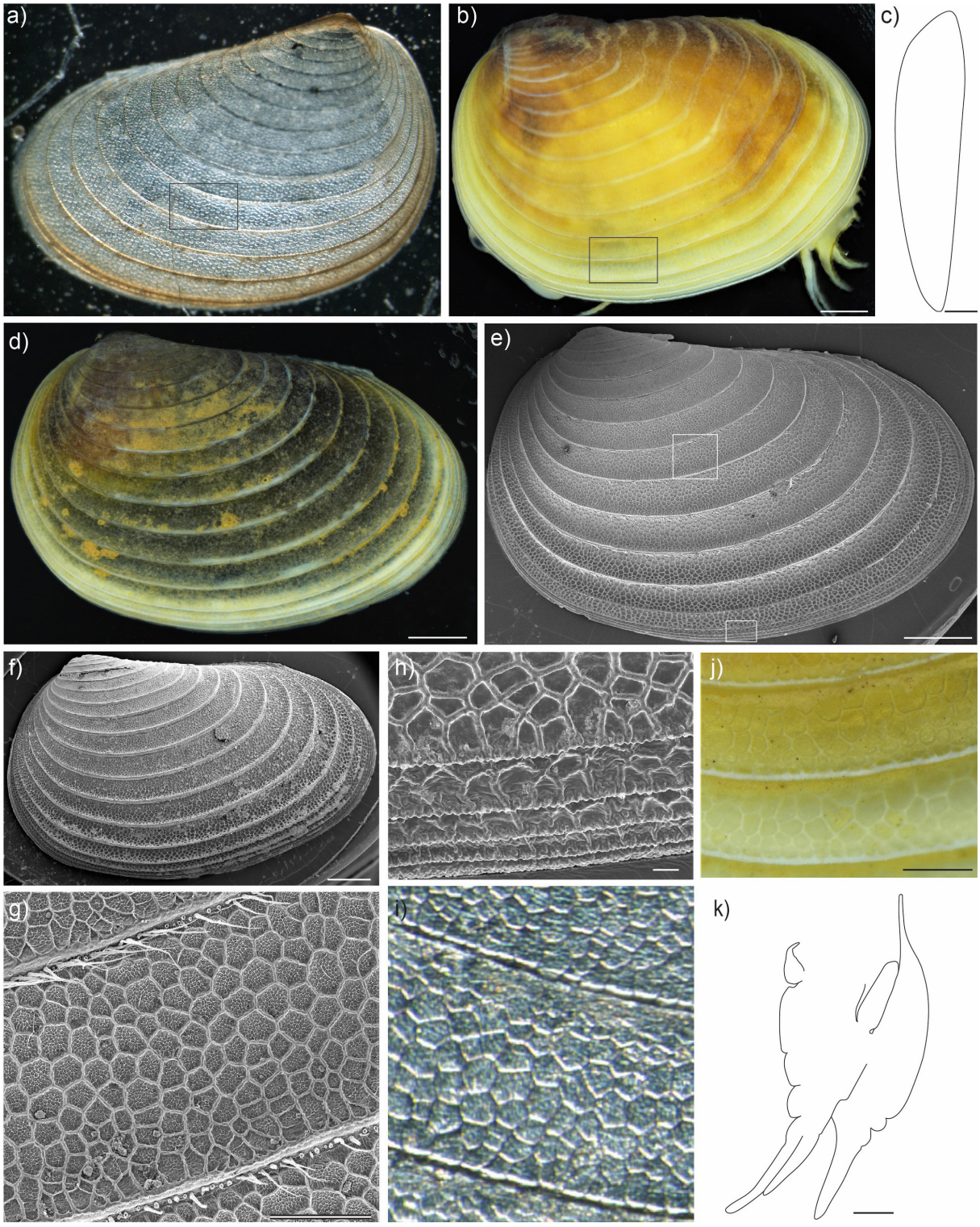

Fig. 40. *Ozestheria rubra* (Henry, 1924). **a–f**. Carapace. **a**. Female, syntype (P.6773). **b**. Male (P.91392). **c**. Dorsal view (right valve only, male, P.91392). **d**. Female (P.91412). **e**. Male (P.91394), SEM. **f**. Male (P.91411), SEM. **g–j**. Carapace ornamentation (positions marked in a, b, e by rectangles, respectively). **g**. Mid-carapace (male, P.91394), SEM. **h**. Ventral carapace (male, P.91394), SEM. **i**. Mid-ventral carapace (female syntype, P.6773). **j**. Ventral carapace (male, P.91392). **k**. Male, third right thoracopod (P.91392). Scale bars: b–f = 1 mm; g, i = 0.05 mm; j–k = 0.5 mm.

Carapace ornamentation (Fig. 40g–h, j). Larval valve with shallow reticulations. Each growth band with well developed, strongly raised, medium to large reticulations. Reticulations form polygonal mesh across each growth band with each polygon usually being a pentagon, hexagon or heptagon. Polygon-size increasing during ontogeny, largest in the dorsal to median part of each growth band; under SEM secondary mesh or polygonal reticulation within each primary polygon (less strongly developed or absent ventrally within growth bands and ventrally on carapace). Ornamentation uniform across all non-crowded growth bands, crowded growth bands usually a single row of polygonal structures resulting in radial appearance. Concentric ridges raised. Setae variable in size; preferentially preserved on ventral and posterior parts of the carapace. Setal pores in single, irregular row along all growth lines.

Head (Fig. 41a–c). Condyle rounded, short, only weakly protruding; occipital notch wide. Condyle lacking anterobasal hump. Margin between condyle and ocular tubercle straight or weakly concave. Ocular tubercle weakly to well developed, forming obtuse (~90°–120°) angle with rostrum. Anterior margin of rostrum strongly convex. Apex strongly rounded, nearly rectangular. Ventral margin of rostrum deeply concave with obtuse angle about half-length, pointing apex slightly downwards; small notch anteriorly in most individuals. Naupliar eye small or elongated, sub-triangular or roundish. Antenna I long with 13–22 (mean: 17) lobes, reaching to antenna II flagellomeres VII–X (mean: VIII). Antenna II with 12–15 (mean: 13) flagellomeres.

Thorax. 22–24 (mean: 23) segments, 22–23 (mean: 22) thoracopod-bearing and none to one posterior limbless segment not reaching dorsal margin. Mid to posterior thoracopod-bearing segments with spine bearing dorsal extensions. Dorsal extensions increasing in size posteriorly over successive segments; spines mostly short, in posterior segments with fewer spines and central spines stouter but shorter.

Thoracopod III (only P.91392; Fig. 40k). Endite I short and curved dorsally. Endites II–V broad, decreasing in size. Endite V palp one-segmented. Exopod ventral extension subequal in extension to endopod, dorsal extension wide, narrowing distally, overreaching epipod. Epipod long, cylindric.

Telson (Fig. 41g–h). 16–25 (mean: 20) spines. First (anterior) spine enlarged. Spines conical, subequally spaced, anterior spines smaller, followed by several (3–5) larger spines close to the central part of the telson (with few interspersed smaller spines); posteriorly spines slightly thinner and more drawn out and slightly increasing in size (last ⅓ of telson). Dorsal margin either slightly concave or s-shaped (anteriorly slightly convex, posteriorly concavely curved). Right terminal claw more strongly curved than left.

Furca (Fig. 41g–h). Proximally with dorsomedial longitudinal row of 4–15 (mean: 9) setae, row ending distally in a single conical spine. Distal part ½–⅔ of furcal length, with numerous small denticles.

Females

Overall appearance as in males. Carapace (Fig. 40a, d) length 5.3–9.0 mm (ST: 7.7 mm; mean: 7.1 mm), height 3.0–5.6 mm (ST: 4.4 mm; mean: 4.2 mm); 14–30 (ST: 17; mean: 20) growth lines, 13–20 (ST: 14; mean: 15) widely spaced and 0–15 (ST: 3; mean: 5) crowded; Cr/L 0.18–0.22 (ST: 0.20; mean 0.20) and b/H 0.37–0.47 (ST: 0.43; mean: 0.43). Ocular tubercle forming obtuse (~120°–180°) angle with rostrum. Anterior margin of rostrum straight to weakly convex or slightly undulating; apex pointed (not or only weakly rounded), in some individuals tip elongate, drawn out; ventral margin concavely curved (usually less strongly compared to males) or straight (Fig. 41d–f). Antenna I with 13–20 (ST: 19; mean: 16) small lobes, lobes smaller than in males; reaching to antenna II flagellomeres III–V (syntype: III; mean: IV). Antenna II with 10–18 (ST: 14; mean: 14) flagellomeres. 22–24 (ST: 22; mean: 23) segments, 22–23 (ST: 22; mean: 23) thoracopod-bearing and none to one posterior limbless segment not reaching dorsal margin. Telson with 14–27 (ST: 19; mean: 18) dorsal spines; left and right terminal claws equally curved. Furca with 3–10 setae (in majority of individuals furca damaged or broken off); distal part ½–¾.

Distribution (Fig. 41j)

Ozestheria rubra occurs in the central Paroo River and Darling River catchments in northern New South Wales as well central Australia (southern Northern Territory and northern South Australia). Several and maybe even all (not all water bodies have been studied for their water chemistry) habitats are hyposaline.

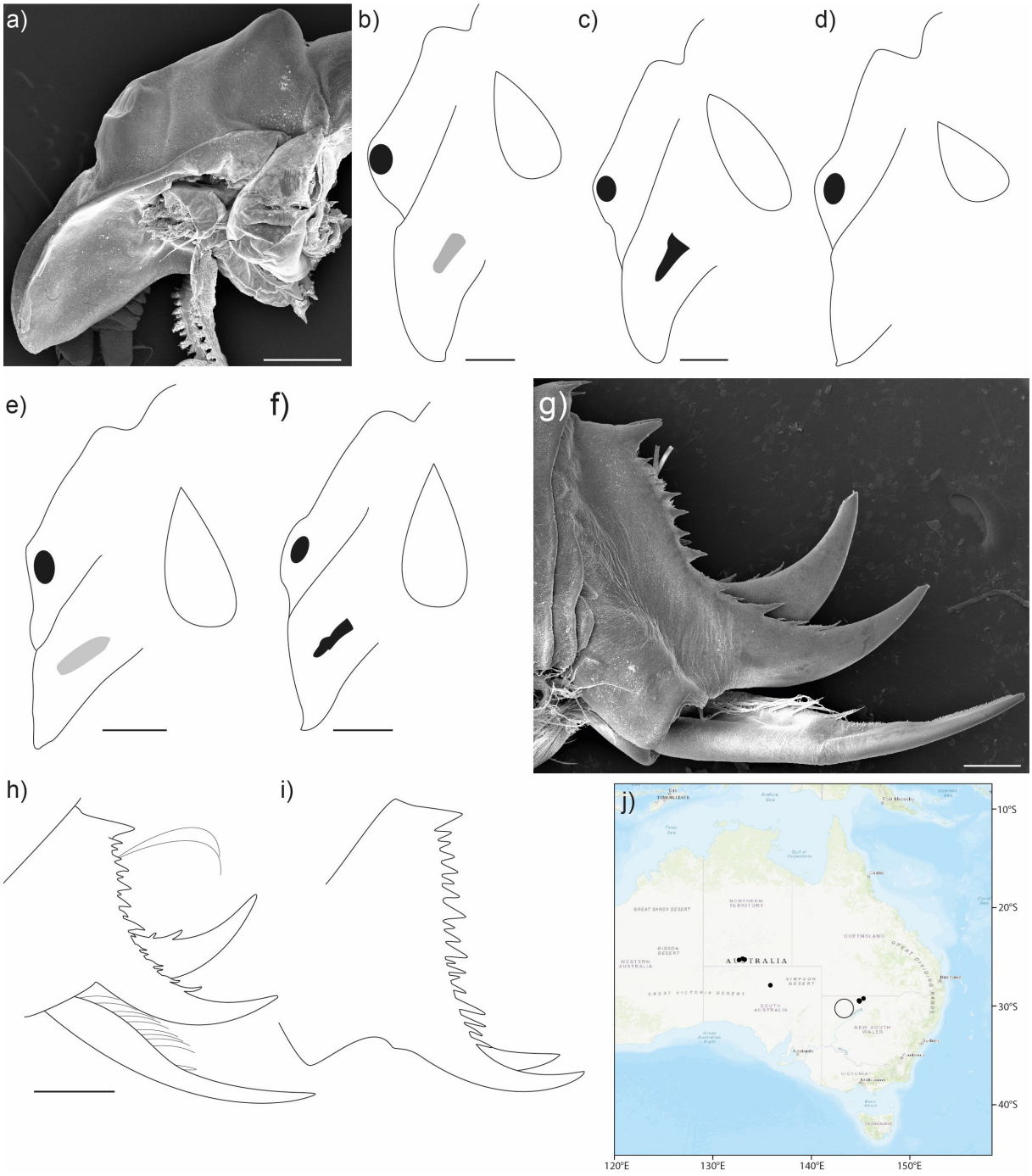

Fig. 41. *Ozestheria rubra* (Henry, 1924). **a–f**. Head (antennae not shown). **a**. Male (P.91394), SEM. **b**. Male (P.91392). **c**. Male (P.91410). **d**. Female, syntype (P.6773; nauplius eye was not visible). **e**. Female (P.91390). **f**. Female (P. 91412). **g–i**. Telson. **g**. Male (P.91394), SEM. **h**. Male (P.91392). **i**. Female, syntype (P.6773; furca broken off). **j**. Distribution map (circle depicts type localities; produced in ArcMap 10.7; see caption Fig. 7 for sources). Scale bars: a–c, e–f, h = 0.5 mm; g = 0.2 mm.

Remarks

The single type specimen in the collection of the Australian Museum (P.6773) is labeled as a syntype; however, no further type specimens are currently known. In the original description, Henry mentioned three stations from which the species was collected (Marra, Budda and Goorimpa Station). The available syntype is from Goorimpa Station.

The original description by Henry (1924) is based on a few individuals only and does not provide an overview of the intraspecific variability. In the original drawing the carapace is shown with a strong convex curvature along the dorsal margin; this was not observed in the studied syntype or any other individual (the margin was always straight; maybe the carapace was drawn from a slightly ventral perspective); nor does the umbonal region of the drawing match the types or other individuals studied here. Their umbos protrude above the dorsal margin and the larval valves are distinctly smaller than implied by the drawing (in the description, Henry did mention "prominent umbones"). Henry furthermore wrote that the carapace lacked "crowded concentric striae", which probably are what we refer to as "crowded growth lines". In fact, these are present in Henry's type specimens and in many other studied specimens and must have been overlooked by her. In Henry's drawing the telson is wrongly demarcated from the preceding thorax segments, giving the wrong impression that the telson bears three large spines before the actual spination (these are probably the dorsal extensions of the last thorax segments); also, the spines of the telson are depicted as very long, thin and aciculate. This does not agree with the situation in the syntype or the other studied specimens, where the anterior spines are usually smaller and more conical. Henry noted a "bright red to reddish-brown" color in living specimens. The studied syntype was nearly translucent and devoid of any obvious coloration. Several of the herein studied preserved specimens were also nearly translucent, others were brownish.

In the geometric morphometric analyses (Fig. 5), *O. rubra* is distinct from most other species and overlaps partly with *O. matuwa* sp. nov., *O. henryae* sp. nov., *O. richteri* sp. nov. and *O. gemina* sp. nov. in the PCA and LDA. The classification of the *O. rubra* syntype with *O.* sp. D1+D2 was strongly supported by a posterior probability of 97.8% and a typicality score of 0.96. The next highest typicality scores were 0.54 and 0.47 for *O. matuwa* and *O. henryae*, respectively, but the associated posterior probabilities were low (1.7% and 0.4%).

Schwentner *et al*. (2015a) delimited two genetic lineages (*O.* sp. D1 and D2), which are now summarized in *O. rubra*. The genetic differences between the two were rather low (COI uncorrected *p*-distances ≤4.2%), also compared to the other closely related species *O. matuwa* sp. nov. and *O. henryae* sp. nov., which showed distances of 5.4–14.3%. The only apparent morphological difference between *O.* sp. D1 and D2 are broader concentric ridges on the carapace in *O.* sp. D1, which does not warrant a separation into two species. Assigning *O.* sp. D1 and D2 to *O. rubra* is straightforward due to the morphological congruence and the shared geographic distribution.

Ozestheria rufa (Dakin, 1914)
Fig. 42

Cyzicus (*Estheria*) *rufa* Dakin, 1914: 295, 301–302, fig. 2.

Cyzicus (*Estheria*) *rufa* – Richter & Timms 2005: 347.
Ozestheria rufa – Rogers 2020: 24 (species inquirenda).

Diagnosis

Ozestheria rufa is characterized by a short condyle and a wide occipital notch; a nearly straight ventral carapace margin; carapace ornamentation dorsally on carapace with well-developed medium polygonal

reticulations, from about mid-carapace ornamentation comprising highly anastomosing nodulous or intermittent lirae (granular appearance); male rostrum with antero-dorsal wing-like flange and protruding, drawn-out apex; female rostrum anterior margin dorsally convex then straight, apex pointed or slightly rounded (not drawn out), ventral margin straight; 16–19 antenna I lobes reaching to antenna II flagellomeres VIII–X; 14–15 antenna II flagellomeres (all males); 23–24 complete thorax segments; 6–20 very small and often widely spaced, conical spines, posterior spines thinner and aciculate.

Differential diagnosis

Ozestheria rufa can be easily differentiated from most other species by the shape and ornamentation of the carapace as well as the male rostrum. The morphologically most similar species are *O. lutraria*, *O. paralutraria* sp. nov., *O. sarsii* and *O. christiani* sp. nov. It differs from these four species by its carapace ornamentation, which features finer reticulations and intermittent, nodulous, anastomosing lirae from about mid-carapace instead of reticulations. The apex of the female rostrum of *O. lutraria* and *O. paralutraria* is drawn out into an elongate tip. No other species of *Ozestheria* features the wing-like flange antero-dorsally on the male rostrum.

Type material

Syntypes

AUSTRALIA – **Western Australia** • 2 ♀♀; Lakeside, Boulder City; 9 Aug. 1913; W.B. Alexander leg.; WAM 7730.

Other material examined

AUSTRALIA – **Western Australia** • 3 ♂♂; Lake Carnegie, Toonil Pool; 26°10′27.3″ S, 122°56′16.9″ E, 8 Jun. 2020; D.J. Cale leg.; WAM C78011, C80198, C80199 • 1 ♂; Lake Carnegie, Toonil Pool; 26°10′27.3″ S, 122°56′16.9″ E, 8 Jun. 2020; D.J. Cale leg.; NHMW-ZOO-CR-28494.

Type locality

Western Australia, Lakeside, Boulder City.

Description

Males

Carapace (Fig. 42a). Length 10.6–11.3 mm (HT: 10.6 mm), height 5.9–6.2 (HT: 5.9 mm). Coloration reddish-orange, crowded growth bands lighter. 35–46 (HT: 46) growth lines 18–24 (HT: 24) widely spaced and 16–23 (HT: 22) crowded.

Carapace shape. Dorsal margin straight, distinct dorso-posterior corner. Posterior margin broadly rounded, suboval, equicurvate (b/H 0.45–0.49, HT: 0.46). Mid-section of ventral margin nearly straight, second growth phase widely rounded. Umbo position submedian (Cr/L 0.29–0.30, HT: 0.30).

Carapace ornamentation (Fig. 42f–i). Larval valve smooth (probably due to abrasion). In dorsal part of carapace, growth bands with strongly reticulating, net-like lirae. In following growth bands and the remainder of non-crowded growth bands, lirae less strongly reticulating, but still anastomosing; lirae intermittent (particularly dorsally within growth bands). Crowded growth bands too narrow to show ornamentation (granular, nodular under SEM). Concentric ridges slightly raised, broad, with moniliform nodules on the dorsal margin. Setae short and thin, rarely preserved (setal pores in one row along all growth lines under SEM).

Head (Fig. 42j). Condyle short, rounded; occipital notch wide. Condyle lacking anterobasal hump. Margin between condyle and ocular tubercle straight. Ocular tubercle weakly to well developed, forming

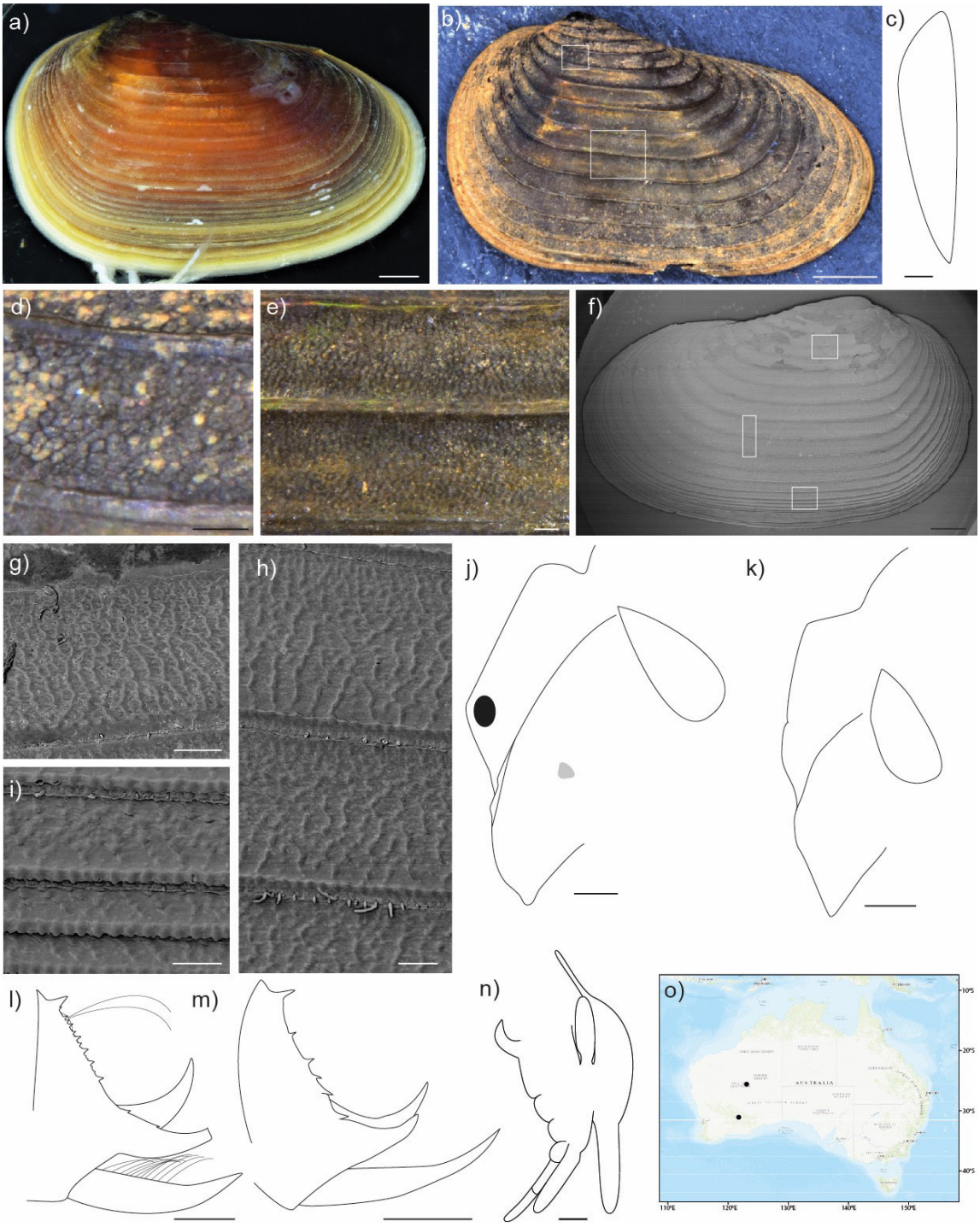

Fig. 42. *Ozestheria rufa* (Dakin, 1914). **a**. Carapace, male (WAM C78011). **b**. Carapace, female, syntype (WAM 7730). **c**. Carapace, dorsal view (left valve only) female syntype (WAM 7730). **d–e**. Carapace ornamentation (female, syntype, WAM 7730; positions marked in b by rectangles). **d**. Dorsal carapace. **e**. Mid-carapace. **f**. Carapace male (paratype WAM C780119), SEM. **g–i**. Carapace ornamentation (male, WAM C78011; positions marked in f by rectangles), SEM. **g**. Mid-dorsal carapace. **h**. Mid-carapace. **i**. Ventral carapace. **j–k**. Head (antennae not shown). **j**. Male (WAM C78011). **k**. Female, syntype (WAM 7730). **l–m**. Telson. **l**. Male (WAM C78011). **m**. Female, syntype (WAM 7730). **n**. Male, third left thoracopod (WAM C78011). **o**. Distribution map (produced in ArcMap 10.7; see caption Fig. 7 for sources). Scale bars: a–c, f = 1 mm; d–e, g–i = 0.1 mm; j–n = 0.5 mm.

obtuse angle (~110°) with rostrum. Anterior margin of rostrum strongly convex, antero-dorsally with small, wing-like flange. Apex protruding, pointed, weakly rounded, nearly rectangular. Ventral margin of rostrum weakly concave to straight, with small anterior notch. Naupliar eye small, roundish. Antenna I long with 16–19 lobes (HT: 19), reaching to antenna II flagellomeres VIII–X (HT: IX). Antenna II with 14–15 flagellomeres (HT: 14).

Thorax. 25–26 (HT: 26) segments, 23–24 (HT: 24) thoracopod-bearing and two posterior limbless segments not reaching dorsal margin. Only mid-body thoracopod-bearing segments with short spines or setae on dorsal extensions; posterior segments without dorsal spines or setae.

Thoracopod III (only WAM C78011; Fig. 42n). Endite I short and curved dorsally. Endites II–V broad, decreasing in size. Endite V palp two-segmented, basal segment shorter than endopod. Exopod ventral extension subequal in extension to endopod, dorsal extension wide, narrowing distally, overreaching epipod. Epipod long, cylindric.

Telson (Fig. 42l). 6–20 spines (HT: 20). First (anterior) spine enlarged. Spines very small, conical, variable in size and spacing. Posterior-most spine aciculate. Dorsal margin straight to weakly concave. Right terminal claw more strongly curved than left.

Furca (Fig. 42l). Proximally with dorsomedial longitudinal row of 6–15 (HT: 11) setae, row ending distally in a single conical spine. Distal part ⅓–½ of furcal length, with numerous small denticles.

Females (syntypes)

Carapace (Fig. 42b–c). Length 8.4–8.7 mm, height 4.5–4.6 mm. Coloration dark brown, nearly black. 18–19, of these 16 widely spaced and 2–3 crowded.

Carapace shape. Dorsal margin straight, dorso-posterior corner distinct. Posterior margin oval, greatly extending posteriorly, supracurvate (0.39–0.42). Ventral margin nearly straight. Umbo well developed, extending above dorsal margin, position submedian (0.28–0.29).

Carapace ornamentation. Larval valve and several following growth bands with irregular, nodulous, medium reticulation (mainly comprising pentagons, hexagons or heptagons). From about mid-carapace ornamentation transitioning to highly anastomosing nodulous lirae; lirae appear intermittent, resulting in granular appearance. Lirae become more pronounced ventrally and posteriorly on carapace. Concentric ridges well developed, raised and broad. No setae visible.

Head (Fig. 42k). Condyle rounded, short, only weakly protruding; occipital notch wide. Condyle lacking anterobasal hump. Margin between condyle and ocular tubercle straight. Ocular tubercle weakly (?) developed, forming obtuse (~–120°) angle with rostrum. Anterior margin of rostrum dorsally convex, otherwise straight. Apex pointed or slightly rounded (not drawn out), with acute angle (~70°). Ventral margin of rostrum straight.

Thorax. Last few segments without dorsal extensions or spines.

Telson (Fig. 42m). 6–9 spines. First (anterior) spine enlarged. All spines rather small. Anterior spines, conical, subequally and widely spaced; posterior spines slightly thinner, more drawn out and aciculate. Dorsal margin straight, last ~¼ concave. Left and right terminal claws equally curved.

Furca (Fig. 42m). Distal part ⅓–½ of furcal length, with numerous small denticles (number of setae cannot be determined as individuals were dried out).

Distribution (Fig. 42o)

Ozestheria rufa is known from central and southern Western Australia.

Remarks

The two female syntypes are in rather poor condition and appear to have dried out at some point in the past. For this reason, many taxonomically relevant characteristics (e.g., number of body or antennal segments, head shape) could not be assessed. Furthermore, both individuals have been removed from their carapaces, but the bodies and carapace halves were stored together, making it impossible to assign the respective carapace to each body. The latter is not very problematic as they are of similar size and morphologically highly similar. The carapace ornamentation could not be studied in detail due to firmly attached dirt, which could not be removed by strong and continuous sonification.

The original description of *O. rufa* by Dakin (1914) was brief and poorly illustrated. The carapace appeared much narrower and thus more oval. The head lacked the occipital notch (giving it a widely rounded appearance) and the rostrum was probably shown from antero-lateral, giving it a more pointed impression. Because all syntypes are female, their morphological features were described in detail and not abbreviated as for the females of other species.

We first hesitated to assign the genetically studied males (provisionally termed *O.* sp. X10) to *O. rufa*. In the geometric morphometric analyses of carapace shape (Fig. 5), *O. rufa* comb. nov. appears distinct from all other species and does not overlap with *O.* sp. X10 when individuals are plotted on the PC1–PC2 plane; however, they fully overlap on the PC2–PC3 plane (Supp. file 1_2.2). *Ozestheria rufa* was classified as *O.* sp. X10 (probability 100%), but the associated typicality score (0.04) was low. The apparent differences could also be an artifact of the overall low number of specimens in conjunction with sexual dimorphism. As the historic syntypes are both poorly preserved females and the freshly collected material all males, a direct comparison of soft body features (e.g., rostrum shape) was not possible. The caparace ornamentation, however, is highly similar. Together with the overall similarity in carapace shape, we decided that the more conservative approach to treat these as a single species is preferrable. More detailed future studies with more specimens and a better representation of males and females might clarify their species status.

Ozestheria sarsii (Sayce, 1903)
Fig. 43

Estheria sarsii Sayce, 1903: 252–253, 256, fig. 35.

Cyzicus sarsi – Wolf 1911: 254.
Cyzicus sarsii – Dakin 1914: 295.
Caenestheria sarsi – Daday 1914: 55, 57–59, fig. 2. — Richter & Timms 2005: 344.
Eocyzicus sarsii – Brtek 1997: 50.
Ozestheria sp. T – Schwentner *et al*. 2015a: figs 2, 6.; 2020: figs 1–2.
Ozestheria sarsii – Rogers 2020: 24.
Estheria sarsii – Henry 1924: 122, 134.

Diagnosis

Ozestheria sarsii is characterized by a short condyle and a wide occipital notch; a rounded ventral carapace margin; carapace ornamentation dorsally on carapace pit-like, in following growth bands with medium to large polygonal reticulations; male rostrum with convex anterior margin, apex strongly rounded with right angle, ventral margin concave; 13–16 (male) or 14 (female) antenna I lobes reaching to antenna II flagellomeres V–VII (male) or IV (female); 11–14 (male) or 13 (female) antenna II flagellomeres; 23–24 complete thorax segments; telson with 12–22 spines, anterior spines small and conical, posteriorly increasing in size and aciculate, few larger spines interspersed; 5–8 furcal setae.

Differential diagnosis

Ozestheria sarsii can be easily differentiated from most other species by the shape and ornamentation of the carapace as well as the telson spination. The morphologically most similar species are *O. lutraria*, *O. rufa*, *O. paralutraria* sp. nov. and *O. christiani* sp. nov. *Ozestheria lutraria* has more thorax segments (25–28 vs 24) and can grow larger (up to ~14 mm). The carapace ornamentation of *O. rufa* contains smaller, more irregular and less distinct polygonal reticulations, which transition into nodulous, highly anastomosing lirae from about mid carapace, and the apex of the female rostrum of *O. rufa* is less rounded and more angular and the male rostrum has a small, wing-like flange antero-dorsally on the anterior margin. *Ozestheria christiani* can be differentiated by its carapace ornamentation, whose medium to large polygonal reticulations are partly intermittent and with small projections into the polygon's center. *Ozestheria paralutraria* differs by having more thorax segments (25 vs 23–24), a more dorsal widest extension of the posterior carapace margin (b/H 0.36–0.38 vs 0.48–0.50) and by the shapes of the male and female (drawn out into pointed tip vs rounded) rostrum.

Type material

Holotype

AUSTRALIA – **Western Australia** • ♂; Murchinson, Lauke Aurean; Jan. 1896; J.T. Markes leg.; MV J203.

Other material examined

AUSTRALIA – **Western Australia** • 2 ♂♂; Lindsay Gordon Lagoon, SW of Lorna Glen Homestead; 26°15′45.2″ S, 121°29′51.2″ E; 18 Mar. 2014; K. Quinlan leg.; WAM C78008, C80200 • 1 ♀; same data as for preceding; NHMW-ZOO-CR-28495

Additional material (not examined)

AUSTRALIA – **Western Australia** • 1 juv.; Urumurdah Lake, near Lake Way; 26°40′11.5″ S, 120°20′22.6″ E; 2009; B.V. Timms leg.; reared from sediment; AM P. 91436.

Type locality

Western Australia, Murchinson, Lauke Aurean [the locality of this lake is unknown].

Description

Males

Carapace (Fig. 43a–c, e). Length 7.7–8.7 mm (HT: 7.8 mm), height 4.2–4.6 mm (HT: 4.2 mm). Coloration light yellow-brownish, crowded growth bands lighter (HT: yellowish; color could be faded). 14–21 (HT: 14) growth lines, 13–16 (HT: 13) widely spaced and 1–6 (HT: 1) crowded.

Carapace shape. Dorsal margin straight, distinct dorso-posterior corner. Posterior margin broadly rounded, suboval, equicurvate (b/H 0.49–0.50, HT: 49). Ventral margin widely rounded, posteriorly complanate. Umbo position submedian (Cr/L 0.26–0.28, HT: 0.27).

Carapace ornamentation (Fig. 43f–g). Larval valve and following growth bands with pit-like shallow medium reticulations (under SEM polygonal reticulations). From mid carapace, the reticulations become wider (large in last few non-crowded growth bands) and more pronounced, forming a polygonal mesh across each growth band with each polygon usually being a pentagon, hexagon or heptagon. The floor of each polygon with minute, pit-like depressions (best seen under SEM). Within growth bands ventral polygons (close to the following concentric ridge) dorso-ventrally compressed and decreasing in size. Crowded growth bands with irregular, granular ornamentation. Concentric ridges raised, with pitted/polygonal ornamentation. Setae spiniform; preferentially preserved on ventral parts of the carapace, setal pores in single line along all growth lines under SEM.

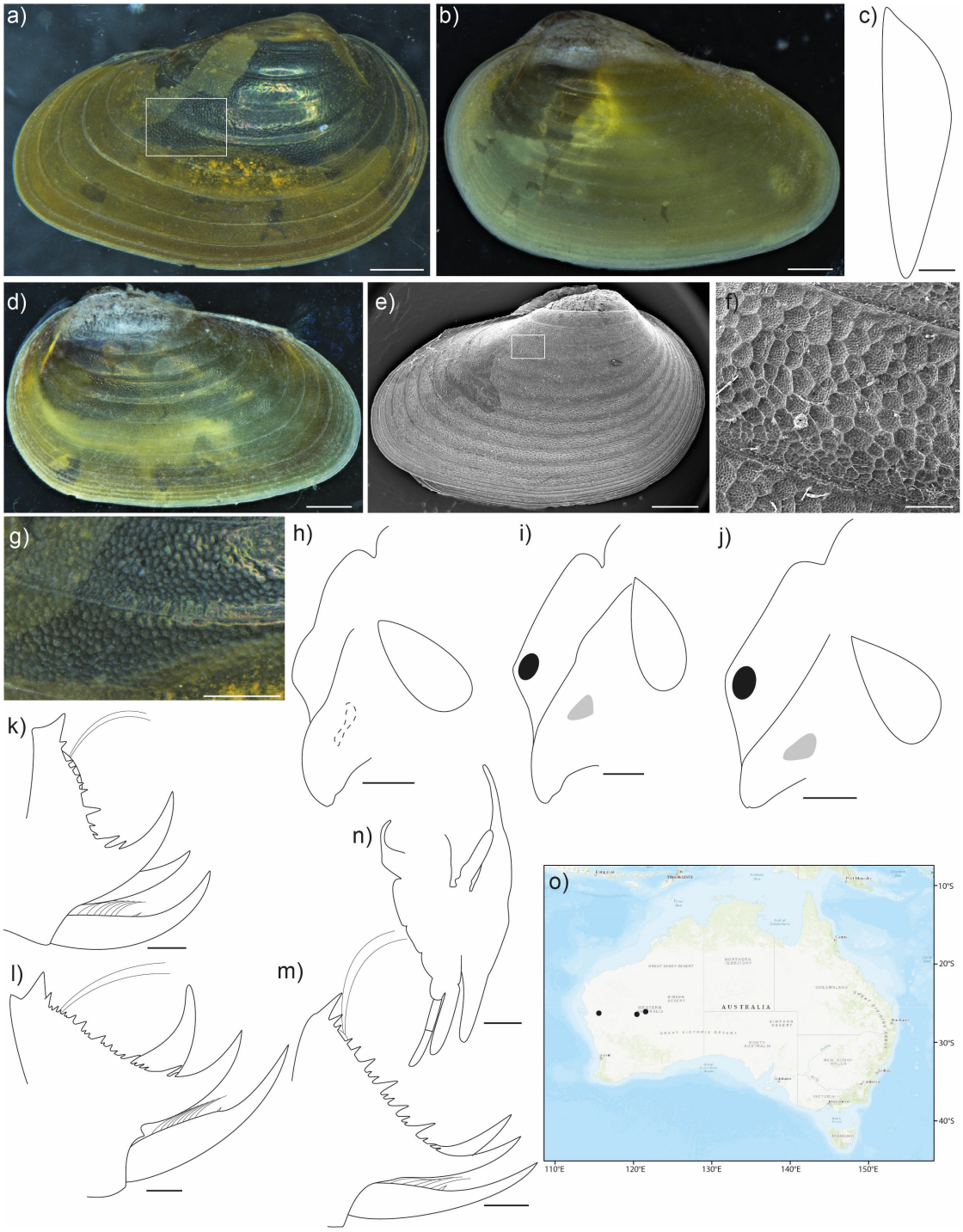

Fig. 43. *Ozestheria sarsii* (Sayce, 1903). **a–e**. Carapace. **a**. Male, holotype (MV J203). **b**. Male (WAM C78008). **c**. Carapace, Dorsal view male, holotype (MV J203, right valve only). **d**. Female (NHMW-ZOO-CR-28495). **e**. Male (WAM C80200), SEM. **f–g**. Carapace ornamentation (positions marked in a and e by rectangles). **f**. Mid-dorsal carapace, male (WAM C80200), SEM. **g**. Mid-carapace, male, holotype (MV J203). **h–j**. Head (antennae not shown). **h**. Male, holotype (MV J203). **i**. Male (WAM C78008). **j**. Female (NHMW-ZOO-CR-28495). **k–m**. Telson. **k**. Male, holotype (MV J203). **l**. Male (WAM C78008). **m**. Female (NHMW-ZOO-CR-28495). **n**. Male, third left thoracopod (WAM C78008). **o**. Distribution map (produced in ArcMap 10.7; see caption Fig. 7 for sources). Scale bars: a–e = 1 mm; f = 0.1 mm; g–j, n = 0.5 mm; k–m = 0.2 mm.

Head (Fig. 43h–i). Condyle rounded, short, only weakly protruding; occipital notch wide. Condyle lacking anterobasal hump. Margin between condyle and ocular tubercle straight to weakly convex. Ocular tubercle weakly to well developed, forming nearly rectangular to obtuse (~120°) angle with rostrum. Anterior margin of rostrum strongly convex. Apex strongly rounded, acute (~70°) to nearly rectangular. Ventral margin of rostrum with notch anteriorly; concave about half-length, pointing apex slightly downwards. Naupliar eye subtriangular, small (HT: naupliar eye not visible, may be faded). Antenna I long with 13–16 (HT: 16) lobes, reaching to antenna II flagellomeres V–VII (HT: VI). Antenna II with 11–14 (HT: 11) flagellomeres.

Thorax. 23–24 (HT: 24) segments, 23–24 (HT: 23) thoracopod-bearing and one or no posterior limbless segment not reaching dorsal margin. Mid to posterior thoracopod-bearing segments with spine bearing dorsal extensions. Posterior segments without dorsal extension or spines.

Thoracopod III (only WAM C78008; Fig. 43n). Endite I short and curved dorsally. Endites II–V broad, decreasing in size. Endite V palp two-segmented, basal segment shorter than endopod. Exopod ventral extension shorter in extension to endopod, dorsal extension wide, narrowing distally, overreaching epipod. Epipod long, cylindric.

Telson (Fig. 43k–l). 12–22 spines (HT: 12) spines. First (anterior) spine enlarged. Spines conical, irregularly spaced, anteriormost spine large, following spines small, one larger spine about ⅔ of telson length; posteriorly spines slightly thinner and more drawn out and increasing in size (last ~⅓ of telson). Dorsal margin straight or slightly convex anteriorly. Left or right (HT: left) terminal claw more strongly curved.

Furca (Fig. 43k–l). Proximally with dorsomedial longitudinal row of 5–8 (HT: 7) setae, row ending distally in a single conical spine. Distal part ½ of furcal length, with numerous small denticles.

Female

Overall appearance as in males. Carapace (Fig. 43d) length 7.8 mm, height 4.2 mm; 18 growth lines, 15 widely spaced and 3 crowded; Cr/L 0.24 and b/H 0.48. Anterior margin of rostrum slightly convex; apex strongly rounded, acute angle (~80°); ventral margin weakly concave, with small notch anteriorly (Fig. 43j). Antenna I with 14 small lobes, lobes smaller than in males; reaching to antenna II flagellomere IV. Antenna II with 13 flagellomeres. 24 segments, 24 thoracopod-bearing and no posterior limbless segment not reaching dorsal margin. Telson with 18 dorsal spines; left and right terminal claws equally curved (Fig. 43m). Furca with 5 setae.

Distribution (Fig. 43o)

Ozestheria sarsii is known from its type locality in western Western Australia and two localities in central Western Australia.

Remarks

The original type series comprises only a single male specimen, with no genetic information. In the geometric morphometric analyses of carapace shape (Fig. 5), *O. sarsii* is distinct from most other species and most similar to *O.* sp. T (Schwentner *et al*. 2015a) and *O. rufa*. The species assignment classified *O. sarsii* as *O*. sp. X10 (probability 97.3%; which probably represents *O. rufa*; Supp. file 1_4.10) or *O.* sp. T (probability 2.7%), though the classification was not supported by the very low typicality scores (0.02 and 0.003). The type specimens of *O. sarsii* and *O. rufa* differ considerably in their general morphology (e.g., shape male rostrum, telson spination and carapace ornamentation). *Ozestheria sarsii* has an overall strong morphological resemblance to *Ozestheria* sp. T (sensu Schwentner *et al*. 2015a) (e.g., the carapace ornamentation and shape, the shape of the male head and rostrum, the number of growth

lines and thorax segments) and their geographic distribution is similar, supporting their conspecifity. The holotype of *O. sarsii* differed from the other specimens mainly in the shape of the ventral carapace margin (which was more strongly curved, and which might have resulted in the low probability scores in the classification; however, in *O.* sp. T this character was variable, ranging from straight to slightly curved) and the strong curvature of the left telsonic claw. The latter is only rarely observed in *Ozestheria*, though we interpret it as an individual aberration rather than a diagnostic feature.

Ozestheria selmae sp. nov.
urn:lsid:zoobank.org:act:1052560B-D111-4FA3-9C7E-074F1D0B74BF
Fig. 44

Ozestheria sp. Q3 – Schwentner *et al*. 2015a: figs 2, 6. — Hethke *et al*. 2023: fig. 11.

Diagnosis

Ozestheria selmae sp. nov. is characterized by a long condyle and a narrow occipital notch; carapace ornamentation dorsally on carapace punctate (may appear granular), in following growth bands anastomosing lirae forming ventrally within growth band, lirae become longer, more pronounced and less anastomosing with progressing growth bands; male rostrum anterior margin weakly convex or straight (in some individuals dorsally with a slight concave notch), apex rounded or slightly pointed with ~60–90° angle, usually rounded, ventral margin weakly concave (with or without slight notch close to apex); female rostrum anterior margin slightly concave and undulating, apex nearly rectangular angle with drawn-out tip, ventral margin slightly concave; 10–15 (male) or 8–13 (female) antenna I lobes reaching to antenna II flagellomeres VI–VIII (male) or III–VI (female); 10–14 (male) or 9–12 (female) antenna II flagellomeres; 20–22 complete thorax segments; 15–37 large and densely spaced telsonic spines, first anterior spines slightly broader and conical, all other spines thin, elongate and aciculate, 1 (rarely 2) slightly larger spines interspersed (about mid-length of telson); 2–8 furcal setae.

Differential diagnosis

Ozestheria selmae sp. nov. can be differentiated from many other species of *Ozestheria* by the narrow occipital notch and long condyle in combination with the carapace ornamentation (dominated by punctate ornamentation dorsally on carapace, transitioning to distinct, subparallel lirae during ontogeny), except from *O. cancellata* comb. nov., *O. minor* comb. nov., *O. typica* comb. nov., *O. fuersichi* sp. nov., *O. jonnae* sp. nov., *O. marthae* sp. nov., *O. radiata* sp. nov., *O. bourkensis* sp. nov., *O. rincewindi* sp. nov., *O. barcaldinensis* sp. nov., *O. ngamurru* sp. nov., *O. beleriandensis* sp. nov., *O. quinlanae* sp. nov., *O. glabra* sp. nov., *O. pilbarensis* sp. nov. and *O. weeksi* sp. nov., and differentiating these species can be difficult. *Ozestheria selmae* differs from *O. cancellata*, *O. fuersichi*, *O. jonnae*, *O. marthae*, *O. rincewindi*, *O. barcaldinensis*, *O. ngamurru*, *O. quinlanae*, *O. glabra*, *O. pilbarensis* and *O. weeksi* by having at least the posterior half of the telsonic spines long, elongate and aciculate (in the other species fewer telsonic spines are long and aciculate and more spines shorter and conical) and by the shape of the male and female rostrum. *Ozestheria bourkensis* and *O. typica* have smaller carapaces and the apex of the female rostrum is drawn out into a smaller (minute) point. *Ozestheria minor* yields a straight (vs weakly convex) anterior margin of male rostrum, which always lacks the dorsal concave notch. *Ozestheria beleriandensis* usually has fewer complete thorax segments (19–20 vs 20–22) and the anterior margin of the female rostrum is less concave (nearly straight). *Ozestheria radiata* has fewer thorax segments (20–21 vs 21–22), a more strongly rounded male rostrum apex and a more finely pointed apex of the female rostrum.

Etymology

The species is named after Selma Hethke-Pott, the daughter of MH.

Type material

Holotype

AUSTRALIA – **South Australia** • ♂; dead shrub dam 1 km N of William Creek; 28°54′14.0″ S, 136°19′35.4″ E; 12 Mar. 2011; M. Schwentner and B.V. Timms leg.; GenBank no: KJ705945 (COI); AM P.91717.

Paratypes

AUSTRALIA – **South Australia** • 1 ♂, 1 ♀; same data as for holotype; GenBank nos: KJ705942, KJ705944 (COI); AM P.91714, P.91716 • 1 ♀; same data as for holotype; GenBank no: KJ705943 (COI); NHMW-ZOO-CR-28486.

Other material examined

AUSTRALIA – **New South Wales** • 2 ♂♂, 1 ♀; Barnato Lake; 31°36′45.2″ S, 144°59′20.0″ E; 22 Jan. 2010; M. Schwentner and B.V. Timms leg.; raised later from sediment; AM P.91688 to P.91690 • 2 ♂♂, 1 ♀; lake next to homestead at Barnato Station, 80 km W of Cobar; 31°36′52.4″ S, 144°52′12.6″ E; 29 Mar. 2010; raised later from sediment; M. Schwentner and B.V. Timms leg.; raised later from sediment; AM P.91680, P.91685 to P.91687 • 3 ♂♂, 1 ♀; Bloodwood Station, Roszkos Paleolake; 29°27′42.9″ S, 144°48′12.5″ E; 19 Feb. 2010; M. Schwentner and B.V. Timms leg.; AM P.91691 to P.91694. – **Northern Territory** • 1 ♂; S of Henbury Crater; 24°34′22.7″ S, 133°08′53.4″ E; 29 Feb. 2010; M. Schwentner, C. Sieves and B.V. Timms leg.; raised later from sediment; AM P.91704 • 1 ♂, 1 ♀; grassy Ilparpa claypan near Alice Springs; 23°45′17.1″ S, 133°48′00.0″ E; 8 Mar. 2011; M. Schwentner and B.V. Timms leg.; AM P.91731, P.91732. – **South Australia** • 2 ♀♀; borrow pit 90 km S of border; 26°49′22.0″ S, 133°19′44.7″ E; 10 Mar. 2011; M. Schwentner and B.V. Timms leg.; AM P.91735, P.91736 • 4 ♂♂, 1 ♀; clearwater dugout 20 km S of Williams Creek; 29°05′34.5″ S, 136°32′15.1″ E; 12 Mar. 2011; M. Schwentner and B.V. Timms leg.; AM P.91709 to P.91713. – **Western Australia** • 1 ♂; Woomberna Rock on Balladonia Station; 32°17′01.7″ S, 123°33′22.9″ E; 14 Aug. 2009; B.V. Timms leg.; AM P.91704.

Additional material (not examined)

AUSTRALIA – **South Australia** • 1 ♀; vegetated clear water swamp 43 km W of Oodnadatta; 27°20′38.9″ S, 135°08′40.3″ E; 11 Mar. 2011; M. Schwentner and B.V. Timms leg.; AM P.91733.

Type locality

South Australia, dead shrub dam 1 km N of William Creek, 28°54′14.0″ S, 136°19′35.4″ E.

Description

Males

Carapace (Fig. 44a, c–d). Length 4.1–6.7 mm (HT: 5.6 mm, mean: 5.5 mm), height 2.4–3.9 mm (HT: 3.4 mm, mean: 3.3 mm). Coloration ranging from reddish-orange to light orange or light whitish yellow (most specimens with light coloration), outer margin lighter. 14–36 (HT: 32, mean: 28) growth lines, 11–25 (HT: 22, mean: 19) widely spaced and 2–15 (HT: 10, mean: 8) crowded.

Carapace shape. Dorsal margin straight, distinct dorso-posterior corner. Posterior margin broadly rounded, suboval, equicurvate (b/H 0.48–0.55, HT: 0.57, mean: 0.52). Ventral margin nearly straight in middle section. Umbo position anterior to submedian (Cr/L 0.23–0.29, HT: 0.26; mean: 0.26).

Carapace ornamentation (Fig. 44e–h). Larval valve and directly following growth bands finely punctate (may appear granular; punctae best seen under SEM). Within following growth bands, dorsal parts punctate, with shallow and strongly anastomosing lirae forming ventrally within growth band (the onset and extent of lirae differs markedly between individuals; in some individuals lirae appear to reach across

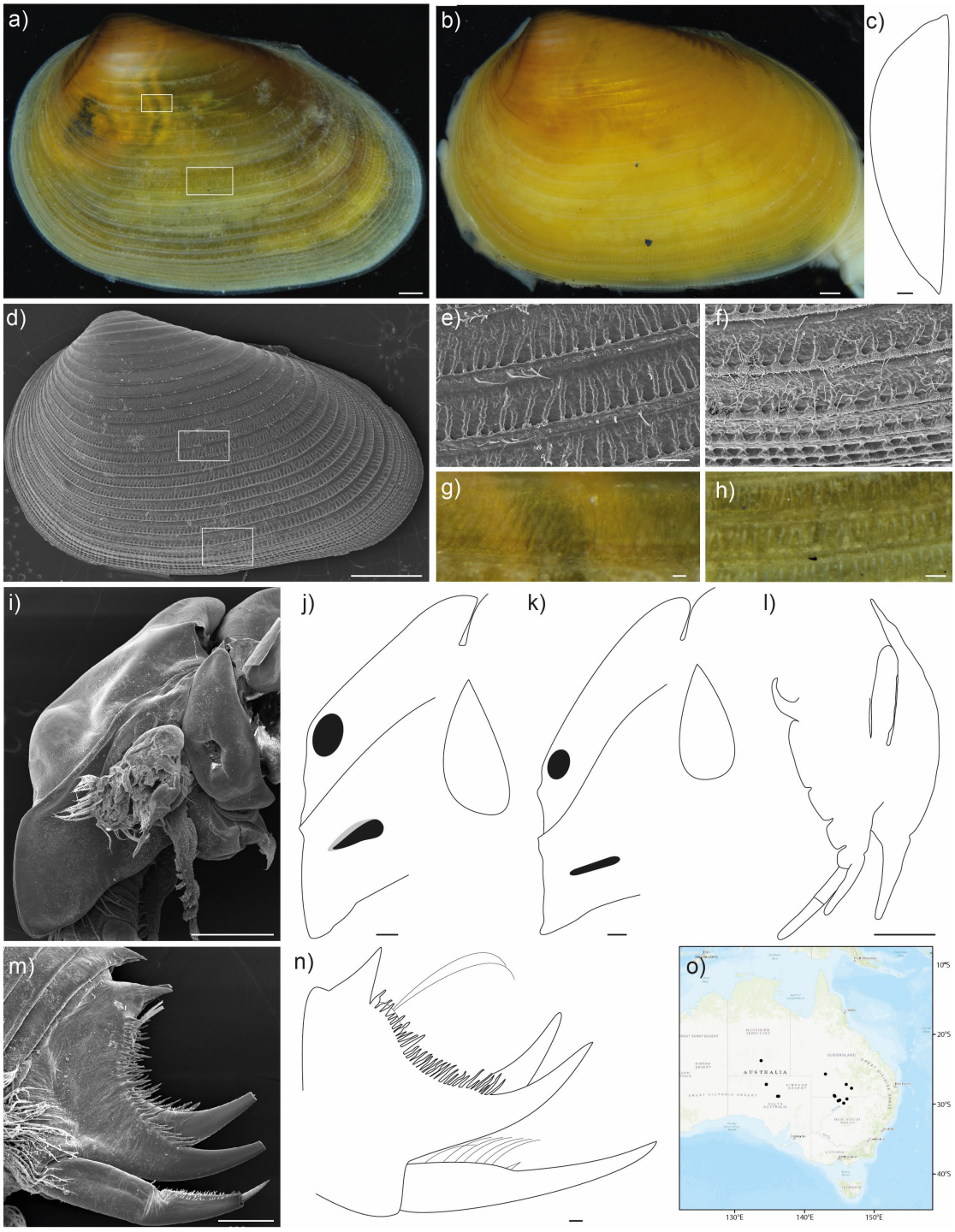

Fig. 44. *Ozestheria selmae* sp. nov. **a–d**. Carapace. **a**. Male, holotype (P.91717). **b**. Female, paratype (P.91714). **c**. Male, holotype, dorsal view (right valve only; P.91717). **d**. Male, paratype (P.91716), SEM. **e–f**. Carapace ornamentation of male paratype (P.91716; positions marked in d by rectangles). **e**. Mid-carapace. **f**. Ventral carapace. **g–h**. Carapace ornamentation of male, holotype (AM P91717; positions marked in a by rectangles). **g**. Mid-dorsal carapace. **h**. Mid-carapace. **i–k**. Head (antennae not shown). **i**. Male, paratype (P.91716), SEM. **j**. Male, holotype (AM P:91717). **k**. Female, paratype (P.91714). **l**. Male, third right thoracopod (holotype; P.91717). **m–n**. Telson. **m**. Male, paratype (P.91716), SEM. **n**. Male, holotype (AM P:91717). **o**. Distribution map (produced in ArcMap 10.7; see caption Fig. 7 for sources). Scale bars: a–d = 1 mm; e–h = 0.1 mm; i–l = 0.5 mm; m–n = 0.2 mm.

full growth bands also dorsally on carapace). Lirae becoming more pronounced in progressing ontogenetic stages and posteriorly. From mid-dorsal carapace, lirae pronounced and less strongly anastomosing (especially posteriorly on carapace). Crowded growth bands often too closely set for ornamentation, otherwise well defined, parallel lirae forming forming deep pits. Concentric ridges slightly raised, with nodules at the upper margin in moniliform row in later ontogenetic stages. Setae mostly filiform (rarely spiniform); preferentially preserved on ventral and posterior parts of the carapace, if any preserved. Setal pores in single row along all growth lines.

Head (Fig. 44i–j). Condyle long, distally acute; occipital notch narrow. Condyle with weakly developed or absent anterobasal hump (HT: absent). Margin between condyle and ocular tubercle straight to weakly concave. Ocular tubercle weakly developed, forming obtuse angle with rostrum, which can be nearly straight or close to rectangular (ranging from ~100–170°). In some individuals, rostrum dorsally protruding from head. Anterior margin of rostrum weakly convex or straight, in some individuals dorsally with a slight concave notch. Ventral margin of rostrum with or without slight notch close to apex, posteriorly weakly concave; apex rounded or slightly pointed (~60–90°). Naupliar eye subtriangular. Antenna I long with 10–15 lobes (HT: 11, mean: 13), reaching to antenna II flagellomeres VI–VIII (HT: VIII, mean: VII). Antenna II with 10–14 flagellomeres (HT: 12, mean: 12).

Thorax. 21–22 (HT: 22, mean: 22) segments, 20–22 (HT: 21, mean: 21) thoracopod-bearing and none to one posterior limbless segment not reaching dorsal margin. Last ~13 thoracopod-bearing segments with spine and/or setae bearing dorsal extensions. Dorsal extensions increasing in size posteriorly over successive segments; segments with several short spines, in posterior segments central spine stouter.

Thoracopod III (only P.91717; Fig. 44l). Endite I short and curved dorsally. Endites II–V broad, decreasing in size. Endite V palp two-segmented, basal segment extending further than endopod. Exopod ventral extension subequal in extension to endopod, dorsal extension wide, narrowing distally, overreaching epipod. Epipod long, cylindric.

Telson (Fig. 44m–n). 15–34 spines (HT: 34; mean: 24). First (anterior) spine greatly enlarged. Following spines subequal in length, thin, elongate, aciculate (anterior ¼ of spines slightly broader and slightly conical), posterior spines increasing in size, very densely spaced; 1 (rarely 2) slightly larger spines interspersed (about mid-length of telson). Dorsal margin strongly concavely curved; in some individuals anteriorly convex and posteriorly concavely curved (reverse s-shaped). Right terminal claw more strongly curved than left.

Furca (Fig. 44m–n). Proximally with dorsomedial longitudinal row of 2–8 (HT: 7, mean: 6) setae, row ending distally in a single conical spine. Distal part ½–⅔ of furcal length, with numerous small denticles.

Females

Overall appearance as in males. Carapace (Fig. 44b) length 3.7–7.0 mm (mean: 4.9 mm), height 2.2–4.4 mm (mean: 3.0 mm); 19–33 growth lines, 16–25 widely spaced and 2–17 crowded; Cr/L 0.24–0.27 and b/H 0.50–0.58. Nauplius eye subtriangular to suboval. Rostrum protruding dorsally in some individuals, anterior margin slightly concave and undulating; apex pointed, nearly rectangular angle, tip drawn out; ventral margin slightly concave, lacking anterior notch; overall rostrum shape trapezoidal (Fig. 44k). Antenna I with 8–13 small lobes, lobes smaller than in males, often poorly separated from each other; reaching to antenna II flagellomeres III–VI. Antenna II with 9–12 flagellomeres. Telson with 18–37 dorsal spines; left and right terminal claws equally curved. Furca with 2–5 setae, distal part ½–¾ of furcal length.

Distribution (Fig. 44o)

Ozestheria selmae sp. nov. is widely distributed in eastern and central Australia. It occurs in northern New South Wales, southern Queensland as well as Southern Northern Territory and northern and central South Australia. It occurs mostly in clear, freshwater habitats, but has also been collected in turbid claypans and hyposaline habitats.

Remarks

Ozestheria selmae sp. nov. is part of a group of five very closely related species; see remarks on *O. typica* comb. nov. for details. *Ozestheria selmae* (Fig. 6) occupies a large and central area in the morphospace of the long-condyled species of *Ozestheria*. *Ozestheria selmae* is generally distinct from *O. frederikeae* sp. nov., *O. sivesae* sp. nov., *O. mariae*, *O. gemina* sp. nov., *O. ngamurru* sp. nov. and *O. carnegiensis* sp. nov., and overlaps with all other long-condyled species.

Ozestheria setifera sp. nov.
urn:lsid:zoobank.org:act:D9452DA6-013B-46C2-9FCF-96D868320BF0
Fig. 45

Ozestheria sp. K – Schwentner *et al*. 2015a: figs 2, 6; 2020: figs 1–2. — Hethke *et al*. 2023: fig. 10.

Diagnosis

Ozestheria setifera sp. nov. is characterized by a long condyle and a narrow occipital notch; a widely rounded ventral carapace margin; carapace ornamentation within all non-crowded growth bands dorsally smooth and ventrally with irregular short lirae, smooth area can be very narrow and usually decreases in size ventrally on carapace; carapace setae mid-long and thick, usually very dense on most growth lines; male rostrum with strongly convex anterior margin, apex rounded with rectangular angle, ventral margin straight (except anterior notch); female rostrum anterior margin weakly convex, apex rectangular and weakly rounded, ventral margin straight or weakly convex; 10–16 (male) or 10–16 (female) antenna I lobes reaching to antenna II flagellomeres IV–VIII (male) or II–V (female); 10–14 (male) or 9–14 (female) antenna II flagellomeres; 18–21 complete thorax segments; 18–31 telsonic spines, anterior two-thirds conical with two or three larger spines interspersed, posterior spines aciculate and slightly increasing in size; 2–8 furcal setae.

Differential diagnosis

Ozestheria setifera sp. nov. can be easily differentiated from most other Australian species of *Ozestheria* by the dense setation of the carapace (in most other species the majority of setae are broken off) and the characteristic carapace ornamentation with the smooth band dorsally within growth bands. *Ozestheria echidna* sp. nov. also has such dense carapace setation, but here setae are even longer and carapace ornamentation features only very short, faint lirae and only mid-dorsally on the carapace (ventrally on carapace growth bands completely smooth), the hump at the base of the condyle is usually absent and the telson has a larger number of setae (28–44 vs 18–31). *Ozestheria jiangi* sp. nov. and *O. echidna* also have smooth bands in their carapace ornamentation, but lack the dense setation and differ in the shape of the male and female rostrum. In *O. jiangi* the smooth section within growth bands is more extensive dorsally on the carapace, where the whole growth band can be smooth (in *O. setifera* lirae are always present ventrally within growth bands).

Etymology

The species name derives from the Latin words '*seta*' ('bristle') and '*ferre*' ('to bear'), referring to the dense and stout setation on the carapace.

Type material

Holotype

AUSTRALIA – **New South Wales** • ♂; Bloodwood Station, Marsilea Pan, 29°32′13.2″ S, 144.52′26.3″ E; 19 Feb. 2010; M. Schwentner, C. Sieves and B.V. Timms leg.; GenBank no: KJ705808 (COI); AM P.91580.

Paratypes

AUSTRALIA – **New South Wales** • 13 ♂♂, 13 ♀♀; same data as for holotype; GenBank nos: KJ705791 to KJ705794, KJ705809 to KJ705824, KJ705826 to KJ705831 (COI); AM P.91563 to P.91566, P.91581 to P.91596, P.91598 to P.91603 • 1 ♂; same data as for holotype; GenBank no: KJ705824 (COI); NHMW-ZOO-CR-28483 • 6 ♂♂, 3 ♀♀; same data as for holotype; 30 Mar. 2009; M. Schwentner and B.V. Timms leg.; GenBank nos: KJ705783 to KJ705787, KJ705832 to KJ705834, KJ705836 (COI); AM P.91555 to P.91559, P.91604 to P.91606, P.91608.

Other material examined

AUSTRALIA – **New South Wales** • 5 ♂♂; Muella Station, Muella Vegetated Pool 1; 29°31′10.3″ S, 144°56′21.8″ E; 31 Mar. 2009; M. Schwentner and B.V. Timms leg.; AM P.91550 to P.91554 • 1 ♂, 1 ♀; Muella Station, Muella Vegetated Pool 2; 29°31′00.3″ S, 144°56′22.7″ E; 31 Mar. 2009; M. Schwentner and B.V. Timms leg.; AM P.91560, P.91561 • 1 ♂, 1 ♀; Muella Station, Muella Vegetated Pool 2; 29°31′00.3″ S, 144°56′22.7″ E; 19 Jan. 2010; M. Schwentner and B.V. Timms leg.; AM P.82539, P.82540 • 1 ♀; Muella Station, Muella Vegetated Pool 3; 29°30′12.0″ S, 144°55′37.4″ E; 31 Mar. 2009; M. Schwentner and B.V. Timms leg.; AM P.91562 • 1 ♂, 1 ♀; claypan-like W of Engonia; 29°18′32.8″ S, 145°44′06.9″ E; 21 Jan. 2010; M. Schwentner and B.V. Timms leg.; AM P.91610, P.91611. – **Queensland** • 3 ♂♂, 1 ♀; coolibah swamp W of road; 28°50′51.9″ S, 143°53′54.4″ E; 26 Feb. 2011; M. Schwentner, S. Richter and B.V. Timms leg.; AM P.91574 to P.91577 • 1 ♂; beefwood grassy swamp; 28°50′34.5″ S, 143°53′47.3″ E; 26 Feb. 2011; M. Schwentner, S. Richter and B.V. Timms leg.; AM P.91609 • 1 ♂, 4 ♀♀; swamp near Thargomindah Station; 28°03′12.5″ S, 143°47′11.5″ E; 26 Feb. 2011; M. Schwentner, S. Richter and B.V. Timms leg.; AM P.91569 to P.91573 • 2 ♀♀; horse paddock claypan on Springfield Station; 25°49′29.6″ S, 143°04′07.9″ E; 1 Mar. 2011; M. Schwentner and B.V. Timms leg.; AM P.91567, P.91568.

Additional material (not examined)

AUSTRALIA – **New South Wales** • 2 juvs; Bloodwood Station, dead ram pan; 29°31′45.4″ S, 144°52′05.4″ E; 21 Feb. 2011; M. Schwentner, S. Richter and B.V. Timms leg.; AM P.91578, P.91579.

Type locality

New South Wales, Bloodwood Station, Marsilea Pan, 29°32′13.2″ S, 144.52′26.3″ E.

Description

Males

Carapace (Fig. 45a, c–d). Length 3.6–5.2 mm (HT: 4.9 mm, mean: 4.4 mm), height 2.1–3.1 (HT: 2.9 mm, mean: 2.6 mm). Coloration yellow-orange, becoming lighter towards outer margin. 15–28 (HT: 20, mean: 20) growth lines, 11–20 (HT: 17, mean: 16) widely spaced and 0–12 (HT: 3, mean: 4) crowded.

Carapace shape. Dorsal margin straight, rounded dorso-posterior corner. Posterior margin broadly rounded, supracurvate to equicurvate (0.38–0.48, HT: 0.46, mean: 0.44). Ventral margin widely curved, central section nearly straight. Umbo position anterior to submedian (Cr/L 0.21–0.28, HT: 0.24, mean: 0.25).

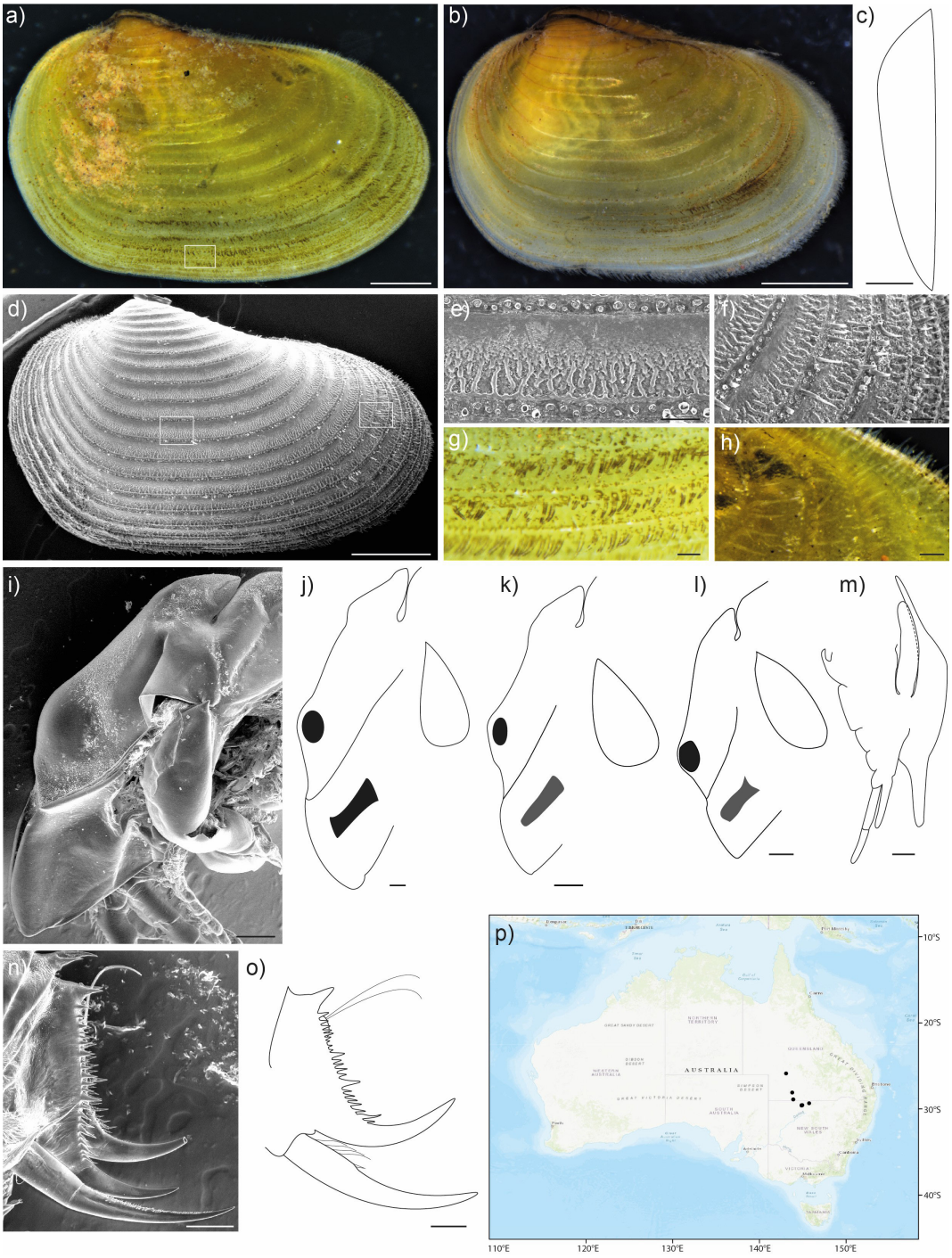

Fig. 45. *Ozestheria setifera* sp. nov. **a–d**. Carapace. **a**. Male, holotype (P.91580). **b**. Female, paratype (P.91588). **c**. Male, holotype, dorsal view (only left valve shown; P.91580). **d**. Male, paratype (P.91581), SEM. **e–f**. Carapace ornamentation of male paratype (P.91581; positions marked in d by rectangle; most setae broken off during SEM preparation), SEM. **e**. Mid-carapace. **f**. Posterior carapace. **g–h**. Setation on carapace. **g**. Male, holotype, ventral carapace (P.91580; position marked in a by rectangle). **h**. Male, paratype, posterior on carapace (P.91581). **i–l**. Head (antennae not shown). **i**. Male, paratype (P.91581), SEM. **j**. Male, holotype (P.91580). **k**. Male, paratype (P.91592). **l**. Female, paratype (P.91588). **m**. Male, holotype, third right thoracopod (P.91580). **n–o**. Telson. **n**. Male (AM P:91581, SEM). **o**. Male, holotype (P.91580). **p**. Distribution map (produced in ArcMap 10.7; see caption Fig. 7 for sources). Scale bars: a–d = 1 mm; e–h = 0.1 mm; i–o = 0.2 mm.

Carapace ornamentation (Fig. 45e–h). Larval valve smooth or granulate, under SEM finely reticulated, transitioning to punctate on the following growth bands. In the dorsal and median part of the carapace, dorsalmost part of each growth band smooth, transitioning into ornamentation with short, intermittent, curved, anastomosing lirae (nodular under SEM); most individual lirae do not reach across ornamented region. In some individuals smooth section very narrow. In ventral growth bands the smooth area is reduced and nodular lirae dominate. Lirae stronger and slightly more regular in the posterior region of the carapace. Crowded growth bands with inconspicuous nodular ornamentation. Concentric ridges raised. Setae very dense, thick and mid-long, usually preserved along most growth lines. Setal pores in 2–3 rows on concentric ridges along all growth lines.

Head (Fig. 45i–k). Condyle long, distally acute; occipital notch narrow. Condyle with anterobasal hump. Margin between condyle and ocular tubercle strongly concave. Ocular tubercle weakly or well developed, forming obtuse angle with rostrum (varying between ~110°–170°). Anterior margin of rostrum strongly convex. Apex rounded, ~90°. Ventral margin of rostrum with anterior notch in most specimens, otherwise straight. Naupliar eye elongate, sub-rectangular to sub-triangular. Antenna I long with 10–16 lobes (HT: 12; mean: 13), reaching to antenna II flagellomeres IV–VIII (HT: VII; mean: VII). Antenna II with 10–14 flagellomeres (HT: 12; mean: 12).

Thorax. 19–21 (HT: 21; mean: 20) segments, 19–21 (HT: 20; mean: 19) thoracopod-bearing and none to one (HT: one) posterior limbless segment not reaching dorsal margin. Last ~14 thoracopod-bearing segments with spine bearing dorsal extensions. Dorsal extensions increasing in size posteriorly over successive segments (until ~7th last segment). First segments with long setae, central setae turning into stout spines in posterior segments.

Thoracopod III (only P.91580; Fig. 45m). Endite I short and curved dorsally. Endites II–V broad, decreasing in size. Endite V palp two-segmented, basal segment longer than endopod. Exopod ventral extension subequal in extension to endopod, dorsal extension wide, narrowing distally, overreaching epipod. Epipod long, cylindric.

Telson (Fig. 45n–o). 18–26 spines (HT: 23, mean 22). First (anterior) spine enlarged. Spines on anterior two-thirds of telson of varying size, mostly conical. Two or three slightly larger and stouter spines interspersed. Spines on posterior third of telson thinner, subequal in size. Dorsal margin nearly straight, slightly convex in center. Right terminal claw more strongly curved than left.

Furca (Fig. 45n–o). Proximally with dorsomedial longitudinal row of 2–8 (HT: 4, mean: 5) setae, row ending distally in a single conical spine. Distal part ⅔ of furcal length, with numerous small denticles.

Females

Overall appearance as in males. Carapace (Fig. 45b) length 3.6–5.4 mm (mean: 4.5 mm), height 2.2–3.5 mm (mean: 2.8 mm); 16–28 (mean: 21) growth lines, 13–20 (mean: 17) widely spaced, and 1–9 (mean: 4) crowded; dorso-posterior corner rounded or distinct angle; Cr/L 0.21–0.27 (mean: 0.24) and b/H 0.38–0.48 (mean: 0.44). Margin between condyle and ocular tubercle weakly to strongly concave (Fig. 45l). Angle between ocular tubercle and rostrum obtuse, usually close to 180°, rarely ~110°. Anterior margin of rostrum weakly convex; apex rectangular, not or only weakly rounded, not drawn out; ventral margin straight, rarely weakly convex, lacking anterior notch; overall rostrum shape trapezoidal. Antenna I with 10–16 small lobes (mean: 12), lobes smaller than in males; reaching to antenna II flagellomeres II–V (mean: IV). Antenna II with 9–14 flagellomeres (mean: 11). 19–21 (mean: 20) segments, of these 18–20 (mean: 19) thoracopod-bearing and none to one posterior limb-less segment not reaching dorsal margin. Telson with 20–31 (mean: 25) dorsal spines; right terminal claws stronger curved (as in males). Furca with 2–7 setae (mean: 4); distal part ⅔–¾ of furcal length.

Distribution (Fig. 45p)

The species is not very common. It occurs predominately in vegetated, grassy swamps in northern New South Wales and southern Queensland, in the catchments of the Paroo River and the central Cooper Creek.

Remarks

The carapace shape of *Ozestheria setifera* sp. nov. (Fig. 6) is distinct from that of many other species and overlaps partly with those of *O. minor* comb. nov., *O. timmsi* sp. nov., *O. sivesae* sp. nov., *O. gemina* sp. nov., *O. marthae* sp. nov., *O. selmae* sp. nov., *O. cancellata* comb. nov., *O. weeksi* sp. nov., *O. quinlanae* sp. nov., *O. pilbarensis* sp. nov. and fully with *O. fuersichi* sp. nov. and *O. barcaldinensis* sp. nov.

Ozestheria sivesae sp. nov.
urn:lsid:zoobank.org:act:E86EC450-37BD-41D3-B398-2AC8A2F38177
Fig. 46

Ozestheria sp. I – Schwentner *et al*. 2015a: figs 2, 6; 2020: figs 1–2.

Diagnosis

Ozestheria sivesae sp. nov. is characterized by a long condyle and a narrow occipital notch; a broadly rounded ventral carapace margin; carapace ornamentation punctate dorsally on carapace, from mid-dorsal carapace smooth band dorsally within growth bands followed by punctae and shallow lirae (smooth bands become more pronounced in following growth bands); male rostrum with straight anterior margin, apex rounded with acute angle (close to rectangular), ventral margin concave to nearly straight; female rostrum anterior margin weakly concave, apex weakly drawn out (not into acutely pointed tip) with acute angle (nearly rectangular), ventral margin weakly convex to straight; 12–16 (male) or 11–14 (female) antenna I lobes reaching to antenna II flagellomeres V–VI (male) or IV–V (female); 12–14 (male) or 10–13 (female) antenna II flagellomeres; 19–21 complete thorax segments; 19–27 telsonic spines of varying size, larger and smaller spines almost alternating, anterior spines conical, posterior spines thinner, elongate, aciculate; 8–12 furcal setae.

Differential diagnosis

Ozestheria sivesae sp. nov. can be easily differentiated from most other Australian species of *Ozestheria* by the characteristic carapace ornamentation with the smooth band dorsally within growth bands. Three other species have (partially) smooth growth bands: *Ozestheria jiangi* sp. nov., *Ozestheria setifera* sp. nov. and *Ozestheria echidna* sp. nov. Neither *O. jiangi* nor *O. echidna* have punctae ventrally of the smooth carapace ornamentation. *Ozestheria setifera* has nodular, more irregular lirae. Furthermore, *O. setifera* and *O. echidna* have dense, conspicuous setation along all growth bands (setae mostly broken off in *O. sivesae*). In *O. setifera* setal pores on concentric ridges are arranged in 2–3 rows. In *O. echidna* only short lirae are present and these only mid-dorsally on the carapace (ventrally on carapace growth bands completely smooth) and in *O. jiangi* dorsal growth bands are largely smooth (only short ventral lirae, which become longer in later growth bands, from about mid-dorsal carapace). *Ozestheria sivesae* differs from these and most other species also in the telsonic spination with the very variably sized spines.

Etymology

The species is named in honor of Claire Sives, who has worked on the ecology of the large branchiopod fauna on and around Bloodwood Station, New South Wales, and who took part in collecting some of the specimens studied here, including the species named after her.

Type material

Holotype

AUSTRALIA – **New South Wales** • ♂; Bloodwood Station, Freshwater Lake, 29°29′14.7″ S, 144°49′59.0″ E; 19 Feb. 2010, M. Schwentner, C. Sieves and B.V. Timms leg.; GenBank no: KJ705775 (COI); AM P.91547.

Paratypes

AUSTRALIA – **New South Wales** • 2 ♀♀; same data as for holotype; GenBank nos: KJ705776, KJ705777 (COI); AM P.91548, P.91549 • 1 ♂; same data as for holotype; GenBank no: KJ705774; NHMW-ZOO-CR-28482.

Additional material (not examined)

AUSTRALIA – **Queensland** • 1 juv.; Rockwell Station, Coolibah swamp; 28°54′03.2″ S, 144°59′22.6″ E; 1 Apr. 2009; M. Schwentner and B.V. Timms leg.; AM P. 91545.

Type locality

New South Wales, Bloodwood Station, Freshwater Lake, 29°29′14.7″ S, 144°49′59.0″ E.

Description

Males

Carapace (Fig. 46a, c–d). Length 3.9–4.0 mm (HT: 4.0 mm), height 2.4–2.5 mm (HT: 2.5 mm). Coloration lightly yellowish-brown. 20–22 (HT: 22) growth lines, 16–20 evenly spaced, and 0–6 crowded.

Carapace shape. Dorsal margin straight, rounded dorso-posterior corner. Posterior margin broadly rounded, suboval, equicurvate (b/H 0.47–0.48, HT: 0.47). Ventral margin broadly rounded. Umbo position anterior (Cr/L 0.23–0.24, HT: 0.23).

Carapace ornamentation (Fig. 46e–h). Larval valve and following growth bands finely reticulate to punctate. From about mid-dorsal carapace, unordered, shallow and short lirae appearing between punctae ventrally within growth bands, dorsal part of growth bands smooth; the dorsally smooth band becomes more pronounced in subsequent growth bands. Crowded growth bands too closely set to see ornamentation. Concentric ridges slightly raised, broad, with dorsal row of minute nodules in moniliform row ventrally on the carapace (visible under SEM). Setae filiform, preferentially preserved along the outer margin of the carapace. Setal pores in single row along all growth lines.

Head (Fig. 46i). Condyle long, distally acute; occipital notch narrow. Condyle with anterobasal hump. Margin between condyle and ocular tubercle straight or weakly concave. Ocular tubercle weakly developed, forming widely obtuse angle with rostrum (close to 180°). Anterior margin of rostrum straight. Ventral margin of rostrum concave to nearly straight; apex extending well ventrally, broadly rounded, acute (close to 90°). Naupliar eye elongated, sub-rectangular. Antenna I with 12–16 (HT: 16) lobes, reaching to antenna II flagellomeres V–VI (HT: VI). Antenna II with 12–14 flagellomeres (HT: 14).

Thorax. 20–21 (HT: 21) segments, 19–20 (HT: 20) thoracopod-bearing and one posterior limbless segment not reaching dorsal margin. Last thirteen thoracopod-bearing segments with dorsal extensions bearing spines. Dorsal extensions increasing in size posteriorly over successive segments, well developed in last nine segments. Spines thin and elongated, central spines stronger and broader in posterior segments. The holotype (P.91547) with a single spine situated between the last clearly demarcated segment and the telson on the left side of the body (this appears to be a deformation, maybe due to a not properly developed segment; not present in the other individuals).

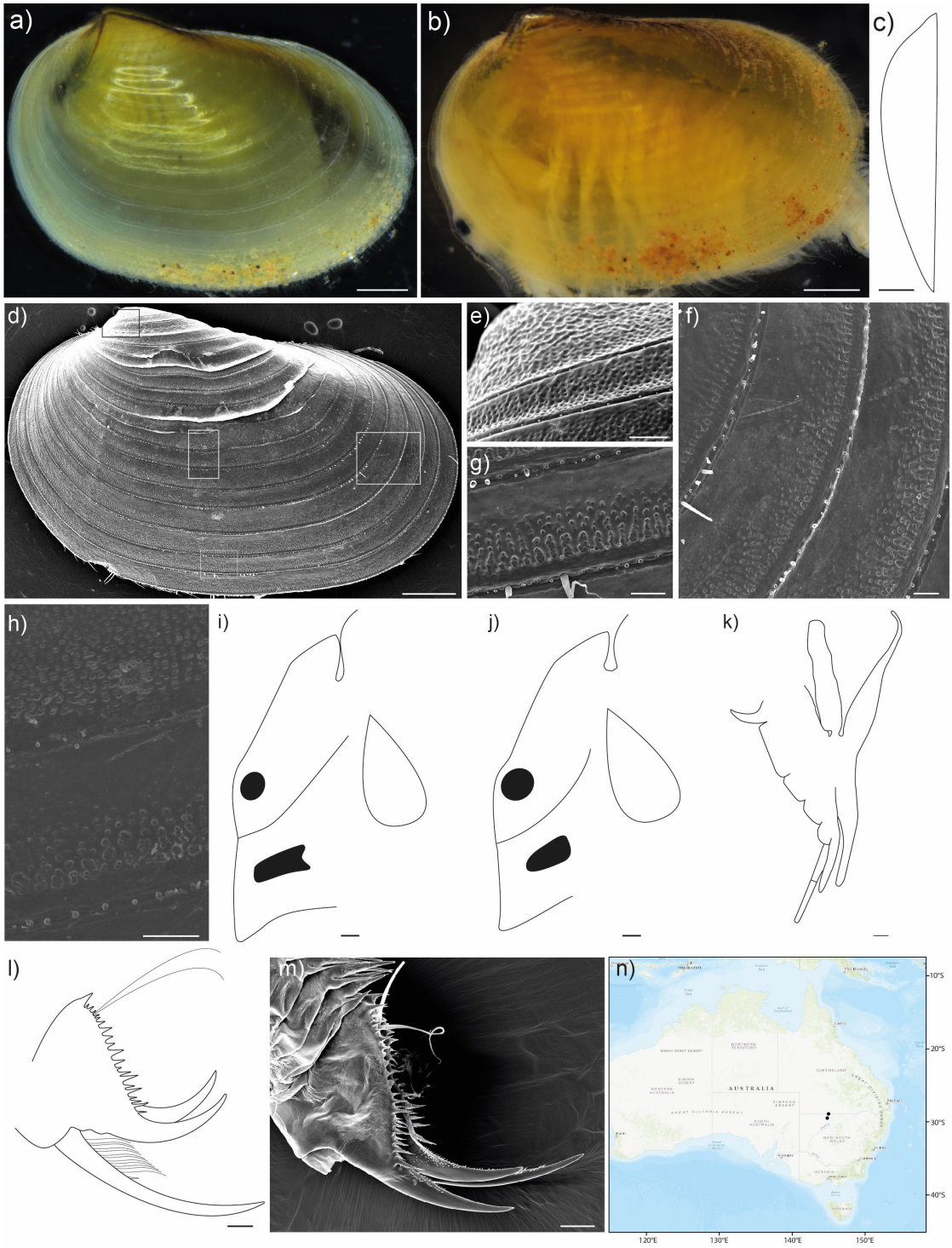

Fig. 46. *Ozestheria sivesae* sp. nov. **a–d**. Carapace. **a**. Male, holotype (P.91547). **b**. Female, paratype (NHMW-ZOO-CR-28482). **c**. Male, holotype, dorsal view (left valve only; P.91547). **d**. Male, paratype (P. 91548), SEM. **e–h**. Carapace ornamentation of male paratype (P.91548, positions marked in d by rectangles), SEM. **e**. Larval valve. **f**. Posterior carapace. **g**. Ventral carapace. **h**. Mid-carapace. **i–j**. Heads, antennae not shown. **i**. Male, holotype (P.91547). **j**. Female, paratype (P.9456). **k**. Male, holotype third right thoracopod (P.91547). **l–m**. Telson. **l**. Male, holotype (AM P:91547). **m**. Male, paratype (P.91548), SEM. **n**. Distribution map (produced in ArcMap 10.7; see caption Fig. 7 for sources). Scale bars: a–d = 0.5 mm; e–h = 0.05 mm; i–m = 0.1 mm.

Thoracopod III (only P.91547; Fig. 46k). Endite I short and curved dorsally. Endites II–V broad, decreasing in size. Endite V palp two-segmented, basal segment shorter than endopod. Exopod ventral extension shorter in extension to endopod, dorsal extension wide, narrowing distally, overreaching epipod. Epipod long, cylindric.

Telson (Fig. 46l–m). 21–27 spines (HT: 21). First (anterior) spine enlarged. Spines of varying size, smaller and slightly enlarged spines more-or-less alternating; anterior spines conical, posterior spines thinner, elongate, aciculate. Dorsal margin nearly straight. Right terminal claw more strongly curved than left.

Furca (Fig. 46l–m). Proximally with dorsomedial longitudinal row of 12 setae, row ending distally in a single conical spine. Distal part ⅔ of furca length, with numerous small denticles.

Females

Overall appearance as in males. Carapace (Fig. 46b) length 3.6–3.9 mm, height 2.2–2.5 mm; 17–18 growth lines, all of these widely spaced, Cr/L 0.25 and b/H 0.46–0.49. Anterior margin of rostrum weakly concave; apex with acute angle (close to 90°), weakly drawn out; ventral margin weakly convex to straight; overall rostrum shape trapezoidal (Fig. 46j). Naupliar eye elongated, sub-rectangular to sub-triangular. Antenna I with 11–14 small lobes, lobes smaller than in males; reaching to antenna II flagellomeres IV–V. Antenna II with 10–13 flagellomeres. 21 segments, 20–21 thoracopod-bearing and none to one posterior limbless segment not reaching dorsal margin. Telson with 19–21 dorsal spines; left and right terminal claws equally curved. Furca with 8 setae.

Distribution (Fig. 46n)

Currently known only from two localities in the catchment of the Paroo River in eastern Australia at the border between New South Wales and Queensland.

Remarks

Because only few specimens were available, the morphological variability of the species is not well characterized. The carapace shape of *Ozestheria sivesae* sp. nov. (Fig. 6) is distinct from that of most other species and overlaps fully with those of *O. cancellata* comb. nov., *O. weeksi* sp. nov., *O. pilbarensis* sp. nov. and partly with *O. timmsi* sp. nov., *O. setifera* sp. nov., *O. gemina* sp. nov., *O. marthae* sp. nov., and *O. selmae* sp. nov. (marginally).

Ozestheria timmsi sp. nov.

urn:lsid:zoobank.org:act:F9FC30F8-FA27-44BB-9E09-4DB92E842F6E

Fig. 47

Ozestheria sp. H1 – Schwentner *et al*. 2015a: figs 2, 6.
Ozestheria sp. H – Schwentner *et al*. 2020: figs 1–2.

Diagnosis

Ozestheria timmsi sp. nov. is characterized by an elongate, but strongly rounded condyle and a narrow occipital notch; carapace ornamentation dominated by large, pit-like punctae, in later growth bands inconspicuous lirae forming between punctae (lirae mainly posteriorly and ventrally on carapace); male rostrum with strongly convex anterior margin, apex rounded, nearly rectangular (~90–100°), ventral margin convexly curved or straight; female rostrum with weakly convex (nearly straight) anterior margin, apex rectangular and usually rounded, ventral margin slightly convex or s-shaped; 11–14 (male) or 12–14 (female) antenna I lobes reaching to antenna II flagellomeres VII–X (male) or III–VI (female); 16–18 (male) or 15–22 (female) antenna II flagellomeres; 23–24 complete thorax segments;

17–31 telsonic spines, spines small with 3–4 larger spines interspersed, anteriorly broad, conical and posteriorly thin and aciculate; 6–10 furcal setae.

Differential diagnosis

Ozestheria timmsi sp. nov. can be differentiated from all other species of *Ozestheria* by the combination of the carapace ornamentation (dominated by pit-like punctae), the carapace shape, size and coloration (generally dark) as well as the rostrum shape and telson spination. Species with similar carapace ornamentation are *O. frederikeae* sp. nov. and *O. carnegiensis* sp. nov., which both have shorter carapace lengths (reaching only up to 7 mm) and fewer complete thorax segments (≤21 vs ≥23). Furthermore, *O. carnegiensis* has fewer antenna flagellomeres (≤14 vs ≥15) and fewer telsonic spines (11–20 vs 17–31). Female *O. frederikeae* have an undulating anterior rostrum margin and fewer antenna flagellomeres (14–17 vs 15–22).

Etymology

The species is named in honor of Brian V. Timms. Brian has worked extensively on the ecology and taxonomy of Australia's large branchiopods and his work has transformed our understanding of their diversity. He also collected the vast majority of the material studied herein; without his relentless efforts and dedication this study would not have been possible.

Type material

Holotype

AUSTRALIA – **Queensland** • ♂; Lake Louisa; 19°53′46.7″ S, 144°15′57.4″ E; 7 Apr. 2009; M. Schwentner and B.V. Timms leg.; GenBank no: KJ705772 (COI); AM P.91544.

Paratype

AUSTRALIA – **Queensland** • 1 ♀; same data as for holotype; GenBank no: KJ705761 (COI); AM P.91533 • 3 ♂♂, 7 ♀♀; same data as for holotype; 12 Apr. 2018; NHMW-ZOO-CR-26637.

Other material examined

AUSTRALIA – **Queensland** • 2 ♂♂, 2 ♀♀; Pelican Lake; 19°53′46.7″ S, 144°15′57.4″ E; 24 Jun. 2020; B.V. Timms leg.; NHMW-ZOO-CR-26638, NHMW-ZOO-CR-26639 • 1 ♂; Salt Bore Lake; 19°51′22.3″ S, 144°16′08.5″ E; 6 Apr. 2009; M. Schwentner and B.V. Timms leg.; AM P.91532 • 4 ♀♀; Salt Bore Lake; 19°51′22.3″ S, 144°16′08.5″ E; 24 Jun. 2020; B.V. Timms leg.; NHMW-ZOO-CR-26640, NHMW-ZOO-CR-26641.

Type locality

Queensland. Lake Louisa, 19°53′46.7″ S, 144°15′57.4″ E.

Description

Males

Carapace (Fig. 47a, c–e). Length 8.3–9.6 mm (HT: 9.6 mm), height 5.1–5.8 mm (HT: 5.8 mm). Coloration light to dark reddish-brown or nearly black, outer margin lighter. 36 –50 (HT: 50) growth lines, of these 28–35 widely spaced (HT: 35) and 4–15 (HT: 15) crowded.

Carapace shape. Dorsal margin straight, dorso-posterior corner rounded. Posterior margin widely oval, equicurvate (b/H 0.47–0.50, HT: 0.48). Ventral margin rounded, strongly and uniformly curved. Umbo position anterior to submedian (Cr/L 0.22–0.27, HT: 0.26).

Carapace ornamentation (Fig. 47f–i). All growth bands densely punctate (larval valve and first few growth bands appear to be smooth in several individuals, but that is probably due to abrasion), punctae large and pit-like or net-like. From about mid-carapace, inconspicuous lirae forming between punctae ventrally on growth bands, lirae stronger defined ventrally and posteriorly on the carapace. Crowded

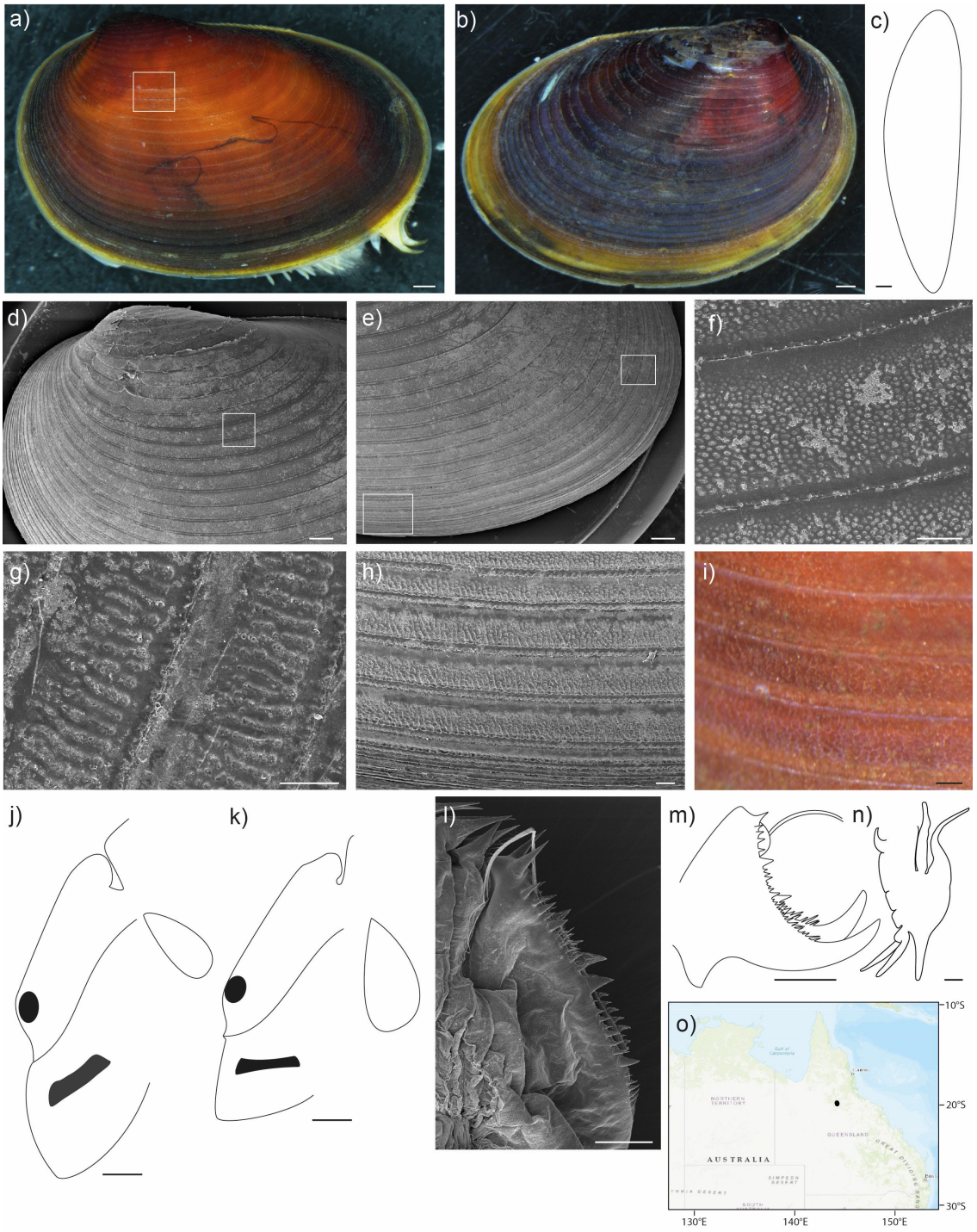

Fig. 47. *Ozestheria timmsi* sp. nov. **a–e**. Carapace. **a**. Male, holotype (P.91544). **b**. Female, paratype (P.91533). **c**. Male, holotype, dorsal view (only left valve shown; P.91544). **d**. Male, antero-dorsal part of carapace (P.91532), SEM. **e**. Male, postero-ventral part of carapace (P.91532), SEM. **f–h**. Carapace ornamentation of male (P.91532; positions marked in d, e by rectangles), SEM. **f**. Mid-carapace. **g**. Posterior carapace. **h**. Ventral carapace. **i**. Mid-dorsal carapace ornamentation of male, holotype (P.91544; position marked in a by rectangle). **j–k**. Head (antennae not shown). **j**. Male, holotype (AM P:91544). **k**. Female, paratype (P.91533). **l–m**. Telson. **l**. Male (P.91532; posteriorly damaged), SEM. **m**. Male, holotype (P.91544). **n**. Male, holotype third right thoracopod (P.91544). **o**. Distribution map (produced in ArcMap 10.7; see caption Fig. 7 for sources). Scale bars: a–e, j–k, m–n = 0.5 mm; f–i = 0.1 mm; l = 0.2 mm.

growth bands with less conspicuous punctae, space between punctae slightly raised, lirae-like (especially posteriorly). Concentric ridges slightly raised and smooth. Setae filiform, preserved usually only on outer growth lines (under SEM all growth lines with single row of setal pores).

Head (Fig. 47j). Condyle long, distally rounded; occipital notch narrow. Condyle with weakly developed anterobasal hump. Margin between condyle and ocular tubercle straight. Ocular tubercle weakly developed, forming obtuse to straight angle (~100–180°) angle with rostrum. Anterior margin of rostrum strongly convex. Ventral margin of rostrum convexly curved or straight, no anterior notch; apex rounded, nearly rectangular (~90–100°). Naupliar eye elongated, subrectangular to subtriangular with rounded edges. Antenna I long with 11–14 lobes (HT: 11), reaching to antenna II flagellomeres VII–IX (HT: VIII). Antenna II with 16–18 flagellomeres (HT: 18).

Thorax. 24–25 (HT: 25) segments, 23–24 (HT: 23) thoracopod-bearing and 1–2 (HT: one) posterior limbless segment not reaching dorsal margin. Dorsal armature increasing in size posteriorly over successive segments, central spines long and thin, laterally row of smaller spines. In posteriormost segments central spines stouter and shorter.

Thoracopod III (only P.91533; Fig. 47n). Endite I short and curved dorsally. Endites II–V broad, decreasing in size. Endite V palp one-segmented. Exopod ventral extension subequal in extension to endopod, dorsal extension wide, narrowing distally, overreaching epipod. Epipod long, cylindric.

Telson (Fig. 47l–m). 17–29 spines (HT: 29). First (anterior) spine enlarged. Spines subequal in length, small and thin. Anterior spines conical, posterior spines becoming thinner and more drawn out (aciculate) and more densely spaced. 3–4 larger spines (~2 × in size) interspersed, one about half-length of telson. Dorsal margin straight to slightly concave. Right terminal claw more strongly curved than left.

Furca (Fig. 47l–m). Proximally with dorsomedial longitudinal row of 8–10 (HT: damaged) setae, row ending distally in a single conical spine. Distal part ⅔ of furcal length, with numerous small denticles.

Females

Overall appearance as in males. Carapace (Fig. 47b) length 7.9–11.5 mm (mean: 8.7 mm), height 5.0–7.6 mm (mean: 5.5 mm); 36–45 (41) growth lines, 23–25 (mean: 29) widely spaced and 5–20 (mean: 13) crowded; Cr/L 0.21–0.26 (mean: 0.24) and b/H 0.46–0.53 (mean: 0.50). Anterior margin of rostrum only weakly convex (nearly straight), apex more rectangular than in males but usually rounded. Ventral margin slightly convex or s-shaped. Angle between eye bulge and rostrum widely obtuse, nearly straight (Fig. 47k). Antenna I short with 12–14 (mean: 13) small, well-defined lobes, lobes smaller than in males; reaching to antenna II flagellomeres III–VI (mean: IV). Antenna II with 15–22 flagellomeres (mean: 18). 24–25 (mean: 25) segments, 23–24 (mean: 24) thoracopod-bearing and one to two posterior limbless segments not reaching dorsal margin. Telson with 24–31 (mean: 27) dorsal spines; up to 3–5 larger spines interspersed. Furca with 6–10 setae.

Distribution (Fig. 47o)

Ozestheria timmsi sp. nov. is known only from three localities in northern Queensland. It is the only species of *Ozestheria* recorded so close to the tropical climate zone.

Remarks

The carapace shape of *Ozestheria timmsi* sp. nov. (Fig. 6) is distinct from that of most other species and overlaps with those of *O. frederikeae* sp. nov. (only marginally), *O. sivesae* sp. nov., *O. setifera* sp. nov., *O. mariae*, *O. gemina* sp. nov., *O. jonnae* sp. nov. (only marginally), *O. marthae* sp. nov., *O. weeksi* sp. nov., *O. cancellata* comb. nov., *O. quinlanae* sp. nov., *O. pilbarensis* sp. nov.

Ozestheria typica (Spencer & Hall, 1896) comb. nov.
Figs 48–49

Estheria packardi var. *typica* Spencer & Hall, 1896: 237, fig. 21.

Caenestheriella packardi var. *typica* – Daday 1914: 120.
Cyzicus packardi var. *typica* – Brtek 1997: 48.
Ozestheria packardi (in part) – Richter & Timms 2005: 347. — Rogers 2020: 24.
Ozestheria sp. Q5 – Schwentner *et al*. 2015a: figs 2, 6; 2020: figs 1–2. — Hethke *et al*. 2023: fig. 11.

Diagnosis

Ozestheria typica comb. nov. is characterized by a long condyle and a narrow occipital notch; carapace ornamentation dorsally on carapace punctate (may appear granular), in following growth bands anastomosing lirae forming ventrally within growth band, lirae become longer, less anastomosing and more pronounced with progressing growth bands; male rostrum with weakly convex anterior margin, apex weakly rounded with ~70–90° angle, ventral margin posteriorly weakly convex (rarely straight) with slight notch close to apex; female rostrum anterior margin short, slightly convex to straight, apex rectangular and drawn out into small and acute tip, ventral margin straight to strongly convex; 10–14 (male) or 8–14 (female) antenna I lobes reaching to antenna II flagellomeres V–X (male) or II–V (female); 8–13 (male) or 8–12 (female) antenna II flagellomeres; 19–20 complete thorax segments; 18–32 large telsonic spines, anterior spines small and conical, posterior spines thinner, drawn out, aciculate and increasing in size posteriorly, one larger cone-shape and one larger aciculate spine interspersed (rarely up to three larger spines each interspersed); 1–14 furcal setae.

Differential diagnosis

Ozestheria typica comb. nov. can be differentiated from many other species of *Ozestheria* by the narrow occipital notch and long condyle in combination with the carapace ornamentation (dominated by punctate ornamentation dorsally on carapace, transitioning to distinct, subparallel lirae during ontogeny), except from *O. cancellata* comb. nov., *O. minor* comb. nov., *O. fuersichi* sp. nov., *O. jonnae* sp. nov., *O. marthae* sp. nov., *O. selmae* sp. nov., *O. radiata* sp. nov., *O. bourkensis* sp. nov., *O. rincewindi* sp. nov., *O. barcaldinensis* sp. nov., *O. ngamurru* sp. nov., *O. beleriandensis* sp. nov., *O. quinlanae* sp. nov., *O. glabra* sp. nov., *O. pilbarensis* sp. nov. and *O. weeksi* sp. nov., and differentiating these species can be difficult. *Ozestheria typica* differs from *O. cancellata*, *O. fuersichi*, *O. jonnae*, *O. marthae*, *O. rincewindi*, *O. barcaldinensis*, *O. ngamurru*, *O. quinlanae*, *O. glabra*, *O. pilbarensis* and *O. weeksi* in having at least the posterior half of the telsonic spines long, elongate and aciculate (in the other species fewer telsonic spines are long and aciculate and more spines shorter and conical) and by the shape of the female rostrum (straight anterior margin and apex drawn out into a minutely pointed tip). In *O. minor* the line between condyle and ocular tubercle is straight and the female antennae I and II have more lobes and flagellomeres. *Ozestheria bourkensis* generally has fewer telsonic spines and the angle between the ocular tubercle and rostrum is nearly rectangular in males (vs obtuse in *O. typica*). *Ozestheria selmae* has a larger carapace (length 3.7–7.0 vs 2.8–5.5; while having similar numbers of growth lines), more complete thorax segments and the apex of the female rostrum is not as minutely pointed. *Ozestheria beleriandensis* has a more rounded ventral carapace margin and a slightly longer carapace. *Ozestheria radiata* has a larger carapace and the apex of the male rostrum is more strongly rounded.

Type material

Syntypes

AUSTRALIA – **Northern Territory or South Australia** • 3 ♂♂, 4 ♀♀, 1 spec.; Charlotte Waters Central Australia; Horn Expedition leg.; the material was given to the collections of MV by O.A. Sayce 25 Jul. 1911, the syntypes probably dried out in the past and are in rather poor condition, the soft bodies are greatly distorted and the corresponding features could be inferred only in a few instances; MV J54046.

Other material examined

AUSTRALIA – **New South Wales** • 2 ♀♀; E of Lake Lauradale, 29°51′22″ S, 145°38′49″ E; 29 Mar. 2009; M. Schwentner and B.V. Timms leg.; AM P.91679, P.91678 • 1 ♂; E of Lake Lauradale; 29°51′22″ S, 145°38′49″ E; 18 Jan. 2010; M. Schwentner and B.V. Timms leg.; AM P.91753 • 4 ♂♂; Muella Station, Lower Lake Eliza; 29°25′28.9″ S, 145°03′41.8″ E; 20 Jan. 2010; M. Schwentner and B.V. Timms leg.; AM P.91754 to P.91757 • 1 ♂, 6 ♀♀; N of Wyandra; 27°11′03.2″ S, 145°59′41.2″ E; 17 Feb. 2010; M. Schwentner, C. Sieves and B.V. Timms leg.; AM P.91747 to P.91750, P.91695 to P.91697. – **Northern Territory** • 3 ♂♂, 1 ♀; Ilpara claypans near Alice Springs; 23°45′15.8″ S, 133°47′52.7″ E; 27 Jan. 2010; M. Schwentner and B.V. Timms leg.; AM P.91681 to P.91684. – **Queensland** • 2 ♂♂, 1 ♀; grassy turbid swamp; 27°41′52.4″ S, 146°45′44.7″ E; 18 Feb. 2010; M. Schwentner, C. Sieves and B.V. Timms leg.; AM P.91751, P91752, P.91758 • 1 ♀; Currawinya National Park, well-vegetated claypan; 28°47′19.4″ S, 144°17′43.3″ E; 24 Feb. 2011; M. Schwentner, S. Richter and B.V. Timms leg.; AM P.91742 • 1 ♂, 2 ♀♀; Currawinya National Park, *Triops* claypan; 28°47′14.9″ S, 144°17′49.1″ E; 24 Feb. 2011; M. Schwentner, S. Richter and B.V. Timms leg.; AM P.91743 to P.91745 • 1 ♂; Currawinya National Park, claypan halfway on northern fence of Bilby enclosure; 28°52′12.8″ S, 144°21′52.1″ E; 25 Feb. 2011; M. Schwentner, S. Richter and B.V. Timms leg.; AM P.91741 • 2 ♂♂, 1 ♀; Gidgee claypan 9 km from Tenham Station; 25°41′02.4″ S, 143°00′59.4″ E; 28 Feb. 2011; M. Schwentner and B.V. Timms leg.; AM P.91737 to P.91739 • 1 ♂; same data as for preceding; NHMW-ZOO-CR-28492. – **South Australia** • 1 ♂, 3 ♀♀; old small dugout 105 km E of Marla; 27°10′00.2″ S, 134°33′07.2″ E; 11 Mar. 2011; M. Schwentner and B.V. Timms leg.; AM P.91723 to P.91725, P.91766 • 4 ♂♂, 1 ♀; daisy claypan 106 km E of Marla; 27°10′02.2″ S, 134°33′30.7″ E; 11 Mar. 2011; M. Schwentner and B.V. Timms leg.; AM P.91727 to P.91730 • 3 ♂♂, 1 ♀; daisy claypan 106 km E of Marla; 27°10′02.2″ S, 134°33′30.7″ E; 11 Mar. 2011; M. Schwentner and B.V. Timms leg.; AM P.91719 to P.91722 • 1 ♀; dead shrub dam 1 km N of William Creek; 28°54′14.0″ S, 136°19′35.4″ E; 12 Mar. 2011; M. Schwentner and B.V. Timms leg.; AM P.91718. – **Western Australia** • 1 ♀; roadside scrape, 12 km W of Paynes Find; 29°17′07″ S, 117°34′01″ E; 20 Aug. 2011; B.V. Timms leg.; AM P.91708.

Additional material (not examined)

AUSTRALIA – **New South Wales** • 5 juvs; 25 km E of Engonia; 29°15′29.7″ S, 146°05′37.4″ E; 21 Jan. 2010; M. Schwentner and B.V. Timms leg.; AM P.91759 to P.91763 • 3 juvs; Bloodwood Station, turbid *Marsilea* swamp S of Junction Pool; 29°31′33.3″ S, 144°50′23.6″ E; 23 Feb. 2011; M. Schwentner, S. Richter and B.V. Timms leg.; AM P.91746, P.91764, P.91765.

Type locality

Spencer & Hall (1896) did not specify a type locality but generally stated where they collected *O. packardi* and its newly described varieties as "Common in water-holes along the Finke and its tributaries, also in the Macumba and Stevenson Rivers". The label of the syntype collection states "Charlotte Waters Central Australia".

Description

Males

Carapace (Fig. 48a–d, f). Length 3.3–4.6 mm (ST: 3.3–3.7 mm, mean: 3.8 mm), height 2.0–2.6 (ST: 1.9–2.3 mm, mean: 2.3 mm). Coloration orange to reddish-brown or light brownish, coloration lighter ventrally on carapace; outer margin whitish. 14–48 (ST: 14–16, mean: 25) growth lines, 11–19 (ST: 11–12, mean: 15) widely spaced and 3–30 (ST: 3–5, mean: 11) crowded.

Carapace shape. Dorsal margin straight, rounded or distinct dorso-posterior corner. Posterior margin broadly rounded, suboval, equicurvate to infracurvate (b/H 0.46–0.57, ST: 0.46, mean: 0.51) with greatest extension at or below midline. Ventral margin nearly straight. Umbo position submedian (Cr/L 0.26–0.35, ST: 0.26–0.27, mean: 0.29).

Carapace ornamentation (Fig. 48g–k). Larval valve and directly following growth bands finely punctate (may appear granular). Within following growth bands, dorsal parts punctate, with shallow and strongly anastomosing lirae forming ventrally within growth band (the onset and extent of lirae differs markedly between individuals; in some individuals lirae appear to reach across full growth bands also dorsally on carapace). Lirae becoming more pronounced in progressing ontogenetic stages and posteriorly. From mid-dorsal carapace, lirae pronounced and less strongly anastomosing (especially posteriorly on carapace). Crowded growth bands often too closely set for ornamentation, otherwise well defined, parallel lirae. Concentric ridges shallow. Setae mostly filiform (rarely spiniform); preferentially

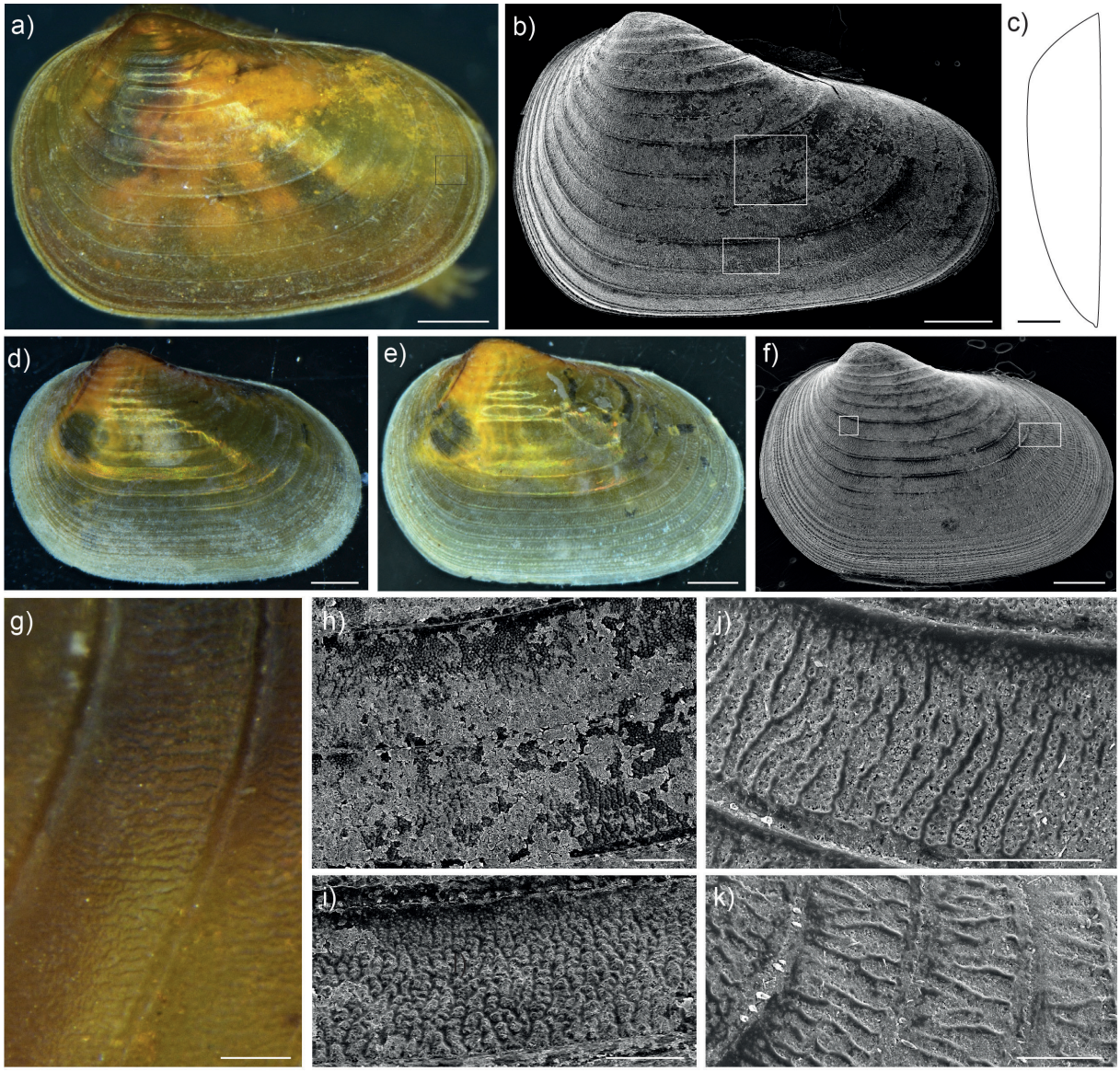

Fig. 48. *Ozestheria typica* comb. nov. (Spencer & Hall, 1896). **a–f**. Carapace. **a**. Male, syntype (MV J54046). **b**. Male, syntype (MV J54046), SEM. **c**. Dorsal view (male, P.91738). **d**. Male (P.91738). **e**. Female (P.91737). **f**. Male (P.91739), SEM. **g–i**. Carapace ornamentation of male syntype (MV J54046; positions marked in a, b by rectangles). **g**. Posterior carapace. **h**. Mid-carapace, SEM. **i**. Ventral carapace, SEM. **j–k**. Carapace ornamentation of male (P.91739; positions marked in f by rectangles), SEM. **j**. Mid-carapace. **k**. Posterior carapace. Scale bars: a–f = 0.5 mm; g–k = 0.1 mm.

preserved on ventral and posterior parts of the carapace if any preserved. Setal pores in single row along all growth lines.

Head (Fig. 49a–c). Condyle long, distally acute; occipital notch narrow. Condyle with anterobasal hump. Margin between condyle and ocular tubercle slightly to strongly concave. Ocular tubercle well developed, forming obtuse angle with rostrum, which can be nearly straight or close to rectangular (ranging from ~100–170°). Rostrum dorsally protruding from head. Anterior margin of rostrum weakly convex. Ventral margin of rostrum with slight notch close to apex, posteriorly weakly convex, rarely straight; apex weakly rounded with ~70–90° angle (due to following notch, the overall angle ~60–70°). Rostrum shape subtrapezoidal. Naupliar eye usually relatively short and stout, triangular, anterior vertex sometimes widened and rounded. Antenna I long with 10–14 lobes (mean: 12), reaching to antenna II flagellomeres V–X (mean: VIII). Antenna II with 8–13 flagellomeres (mean: 11).

Thorax. 19–21 (mean: 20) segments, 19–20 (mean: 19) thoracopod-bearing and none to one posterior limbless segment not reaching dorsal margin. Last ~13 thoracopod-bearing segments with spine and/or setae bearing dorsal extensions. Dorsal extensions increasing in size posteriorly over successive segments (until ~10th last segment). Most segments with 5–7 spines or setae, posterior segments with three or one stout spine.

Thoracopod III (only P.91738; Fig. 49f). Endite I short and curved dorsally. Endites II–V broad, decreasing in size. Endite V palp two-segmented, basal segment subequal in length to endopod. Exopod ventral extension shorter in extension to endopod, dorsal extension wide, narrowing distally, overreaching epipod. Epipod long, cylindric.

Telson (Fig. 49h–i). 18–30 spines (ST: 18–20; mean: 25). First (anterior) spine greatly enlarged. Following spines subequal in length, anterior ~½ of spines small and conical, posterior spines thinner, drawn out, aciculate and increasing in size posteriorly. Usually, one larger conical and one larger aciculate spine interspersed, rarely up to three larger spines each interspersed. Dorsal margin either straight or anteriorly convex (~⅕–⅓ of length) and posteriorly concavely curved. Right terminal claw more strongly curved than left.

Furca (Fig. 49h–i). Proximally with dorsomedial longitudinal row of 1–14 (mean: 6) setae, row ending distally in a single conical spine. Distal part ½–⅔ of furcal length, weakly to strongly curved, with numerous small denticles.

Females

Overall appearance as in males. Carapace (Fig. 48e) length 2.8–5.5 mm (ST: 2.8–3.8 mm; mean: 4.2 mm), height 1.8–3.3 mm (ST: 1.8–2.2 mm; mean: 2.6 mm); 16–40 (ST: 16–17, mean: 28) growth lines, 12–28 (ST: 12–13, mean: 17) widely spaced and 0–32 (mean: 11) crowded; Cr/L 0.25–0.30 (mean: 0.28) and b/H 0.48–0.57 (mean 0.53). Rostrum clearly protruding dorsally, anterior margin short, slightly convex to straight; apex pointed, drawn out into small, acute tip, overall rectangular; ventral margin straight to strongly convex, lacking anterior notch; overall rostrum shape trapezoidal (Fig. 49d–e). Antenna I with 8–14 small lobes (mean: 10), lobes smaller than in males, but usually clearly demarcated from each other; reaching to antenna II flagellomeres II–V (mean: IV). Antenna II with 8–12 flagellomeres (mean: 11). 19–21 (mean: 20) segments, 19–20 (mean: 19) thoracopod-bearing and none to one posterior limbless segment not reaching dorsal margin. Telson with 20–32 (ST: 27, mean: 26) dorsal spines; difference in curvature of left and right terminal claws less pronounced than in males (Fig. 49g). Furca with 2–6 setae (mean: 5).

Distribution (Fig. 49j)

Ozestheria typica comb. nov. is one of the most widely distributed Australian spinicaudatan species. It has been recorded in eastern Australia (especially in the northern Murray-Darling Basin in northern New South Wales and southern Queensland), central Australia (northern South Australia and southern Northern Territory, e.g., close to Alice Springs) as well as Western Australia (close to Paynes Find). It occurs predominately in turbid claypans, dugouts or swamps.

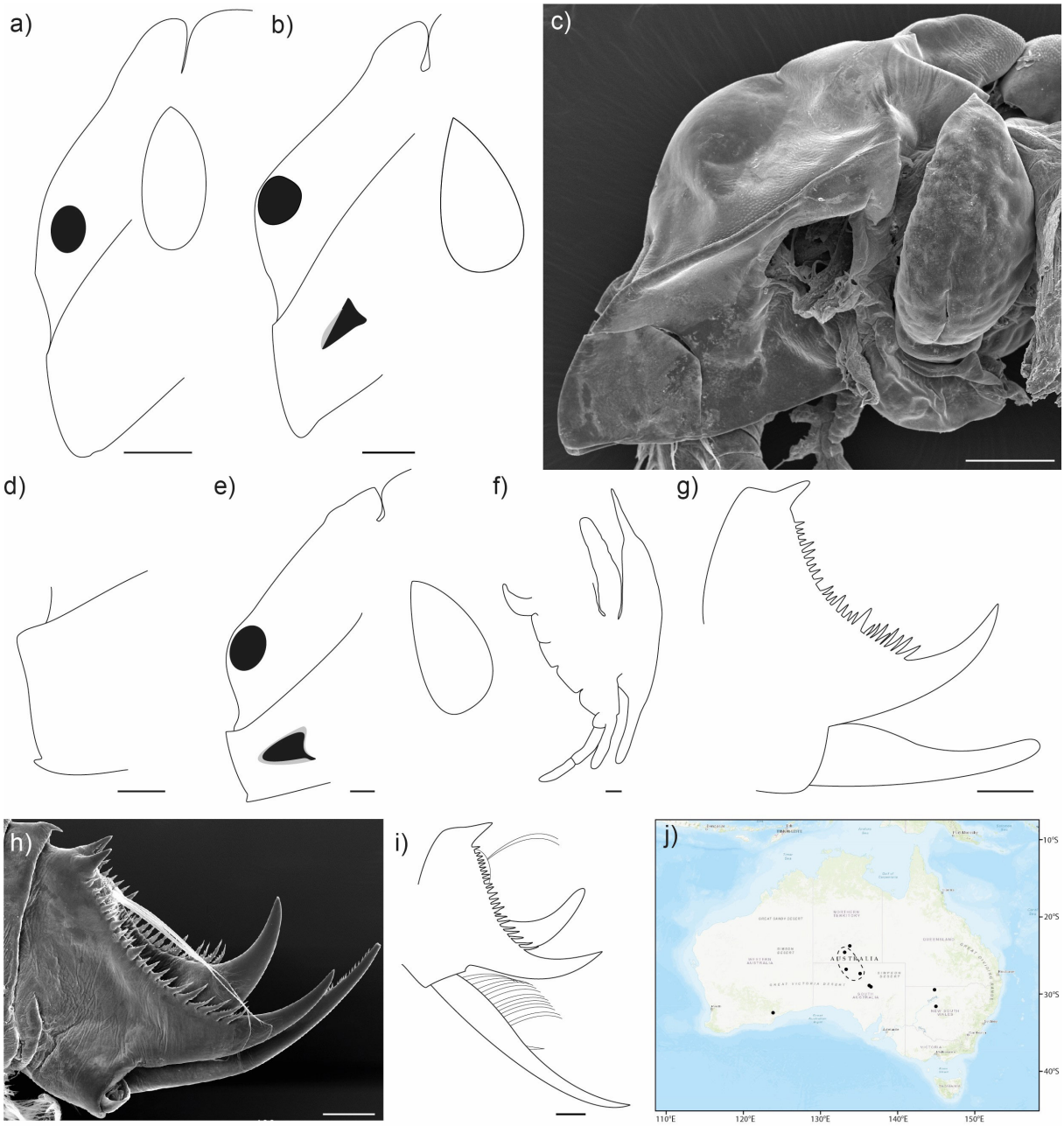

Fig. 49. *Ozestheria typica* comb. nov. (Spencer & Hall, 1896). **a–e**. Head (antennae not shown). **a**. Male, syntype (MV J54046). **b**. Male (P.91738). **c**. Male (P.91739), SEM. **d**. Rostrum female syntype (MV J54046). **e**. Female (P.91737). **f**. Third left thoracopod (male, P.91738). **g–i**. Telson. **g**. Female, syntype (MV J54046, furcal setae not shown as animal was dried out). **h**. Male (P.91739), SEM. **i**. Male (P.91738). **j**. Distribution map (type locality indicated by dotted line; produced in ArcMap 10.7; see caption Fig. 7 for sources). Scale bars: a–c = 0.2 mm; d–i = 0.1 mm.

Remarks

Ozestheria typica comb. nov. was originally described as one of three varieties of *O. packardi* by Spencer & Hall (1896). Previous workers (e.g., Richter & Timms 2005; Rogers 2020) have synonymized these varieties with *O. packardi*. However, the large cryptic species diversity within *O. packardi*, which was revealed by molecular genetic analyses (Schwentner *et al*. 2015a), strongly suggested that *O. typica* and the other varieties represent valid species. A comparison between the syntypes and the genetically delimited species strongly suggests that *O. typica* corresponds to *Ozestheria* sp. Q5 of Schwentner *et al*. (2015a). This correspondence includes in particular details of the carapace ornamentation and shape, the telson spination pattern and the rostrum shapes (especially the minutely pointed female apex) as well as the geographic distribution.

In the geometric morphometric analyses of carapace shape (Fig. 6), *O. typica* comb. nov. is distinct from that of most other species and overlaps partly with those of *O. jiangi* sp. nov., *O. minor* comb. nov., *O. selmae* sp. nov., *O. radiata* sp. nov., *O. bourkensis* sp. nov., *O. ngamurru* sp. nov., *O. beleriandensis* sp. nov., *O. carnegiensis* sp. nov. and *O. echidna* sp. nov. In the classification of type specimens, the mean shape of the syntypes of *O. typica* (Supp. file 2_4.6) was most similar to *O*. sp. Q5 (44.5% probability, 0.26 typicality), followed by the closely related species *O*. sp. Q3 (*O. selmae*; 25.2% probability, 0.27 typicality) and *O*. sp. Q4 (*O. radiata*; 20.1% probability, 0.30 typicality).

The syntypes of *O. typica* were neither explicitly marked as types nor as *O. typica*. Based on the labels and notes associated with these specimens, they were identified as *Caenestherialla packardi* (= *O. packardi*) by Sayce (1911) and Timms (2008). However, the collection details of these specimens correspond to the material from the Horn Expedition, which was collected and studied by Spencer & Hall. In combination with the morphological congruence, it is highly likely that these are the original type specimens of *O. typica*.

Schwentner *et al*. (2015a) reported five very closely related species (termed *Ozestheria* sp. Q1–Q5), which are probably reproductively separated. While one of these represents *O. typica* comb. nov. (= *O*. sp. Q5), three others are formally described as new species herein: *O. weeksi* sp. nov. (= *O*. sp. Q2), *O. selmae* sp. nov. (= *O*. sp. Q3) and *O. radiata* sp. nov. (= *O*. sp. Q4). Of *O.* sp. Q1, only three individuals were available, of which two are probably not fully mature. As this does not allow a proper assessment of the species' morphological variability and its differentiation from the other closely related species, we decided to not formally name and describe *O.* sp. Q1 herein.

Ozestheria weeksi sp. nov.
urn:lsid:zoobank.org:act:2787CF24-8E98-45FC-A8C2-E0ECFD67DBDE
Fig. 50

Ozestheria sp. Q2 – Schwentner *et al*. 2015a: figs 2, 6.

Diagnosis

Ozestheria weeksi sp. nov. is characterized by a long condyle and a narrow occipital notch; carapace ornamentation dorsally on carapace punctate (may appear granular), in following growth bands intensely anastomosing lirae forming ventrally within growth band, lirae become longer, less anastomosing and more pronounced with progressing growth bands; male rostrum with weakly convex anterior margin, apex rounded with nearly rectangular angle, ventral margin anteriorly convex, then straight or weakly concave; female rostrum with concave and dorsally strongly protruding (globose) anterior margin, apex rectangular and drawn out into acute tip, ventral margin convex; 10–13 (male) or 9–12 (female) antenna I lobes reaching to antenna II flagellomeres IV–VII (male) or II–III (female); 10–12 (male) or 10–11 (female) antenna II flagellomeres; 19–20 complete thorax segments; 17–29 telsonic spines, anterior spines short and conical with usually two larger spines interspersed, posterior spines increasing in size and aciculate; 5–12 furcal setae.

Differential diagnosis

Ozestheria weeksi sp. nov. can be differentiated from many other species of *Ozestheria* by the narrow occipital notch and long condyle in combination with the carapace ornamentation (dominated by punctate ornamentation dorsally on carapace, transitioning to distinct, subparallel lirae during ontogeny), except from *O. cancellata* comb. nov., *O. minor* comb. nov., *O. typica* comb. nov., *O. fuersichi* sp. nov., *O. marthae* sp. nov., *O. selmae* sp. nov., *O. radiata* sp. nov., *O. bourkensis* sp. nov., *O. jonnae* sp. nov., *O. rincewindi* sp. nov., *O. barcaldinensis* sp. nov., *O. ngamurru* sp. nov., *O. beleriandensis* sp. nov., *O. quinlanae* sp. nov., *O. glabra* sp. nov. and *O. pilbarensis* sp. nov., and differentiating these species can be difficult. *Ozestheria weeksi* differs by having fewer antenna II flagellomeres than most other of the abovementioned species and by the shape of the female rostrum with the dorsally strongly protruding (globose) anterior margin. The latter is also present in *O. marthae*, *O. selmae* and *O. bourkensis*, but less strongly pronounced.

Etymology

The species is named after US zoologist Stephen C. Weeks, honoring his contributions to clam shrimp biology. The described specimens were reared and documented in Stephen's lab.

Type material

Holotype

AUSTRALIA – **Western Australia** • ♂; Cullimbin Reserve, Shire of Dowerin via Stout Rd, Pool 5; 30°50.972′ S, 117°14.751′ E; 7 Mar. 2007; A. Calabrese leg.; cultivated from sediment 2022 by M. Hethke and S. Weeks; GenBank no: PQ427022(COI); NHMW-ZOO-CR-28187.

Paratypes

AUSTRALIA – **Western Australia** • 9 ♂♂, 11 ♀♀; same data as for holotype; GenBank nos: PQ427019–PQ427021, PQ427023–PQ427029, PQ427032–PQ427037, PQ427039 (COI); NHMW-ZOO-CR-28176 to NHMW-ZOO-CR-28186, NHMW-ZOO-CR-28188 to NHMW-ZOO-CR-28196.

Other material examined

AUSTRALIA – **Western Australia** • 4 ♂♂; Woomberna Rock on Balladonia Station; 32°17′01.7″ S, 123°33′22.9″ E; 14 Aug. 2009; B.V. Timms leg.; AM P.91698, P.91699, P.91703, P.91705 • 1 ♂, 1 ♀; claypan at King Rocks Rd, 33 km NE of Hyden; 32°19′37.9″ S, 119°6′8.17″ E; 14 Oct. 2008; C. Francis leg.; WAM C77989, C80225 • 1 ♂; claypan at King Rocks Rd, 33 km NE of Hyden; 32°19′37.9″ S, 119°6′8.17″ E; 14 Oct. 2008; C. Francis leg.; NHMW-ZOO-CR-29000.

Type locality

Western Australia, Cullimbin Reserve, Shire of Dowerin via Stout Rd, Pool 5, 30°50.972′ S, 117°14.751′ E.

Description

Males

Carapace (Fig. 50a, c–d). Length 4.9–6.0 mm (HT: 5.5 mm, mean: 5.4 mm), height 2.8–3.4 (HT: 3.2 mm, mean: 3.1 mm). Coloration white-yellowish to yellow-orange, crowded growth bands lighter. 17–40 (HT: 20, mean: 24) growth lines, 14–24 (HT: 16, mean: 17) widely spaced and 3–22 (HT: 4, mean: 7) crowded.

Carapace shape. Dorsal margin straight, distinct dorso-posterior corner. Posterior margin broadly rounded, suboval, supracurvate to equicurvate (b/H 0.44–0.50, HT: 0.44, mean: 0.47). Ventral margin nearly straight to slightly rounded. Umbo position submedian (Cr/L 0.20–0.27, HT: 0.25, mean: 0.25).

Carapace ornamentation (Fig. 50e–g). Larval valve and growth bands in dorsal parts of carapace punctate or granular (punctate under SEM). In successive growth bands, poorly defined, irregular

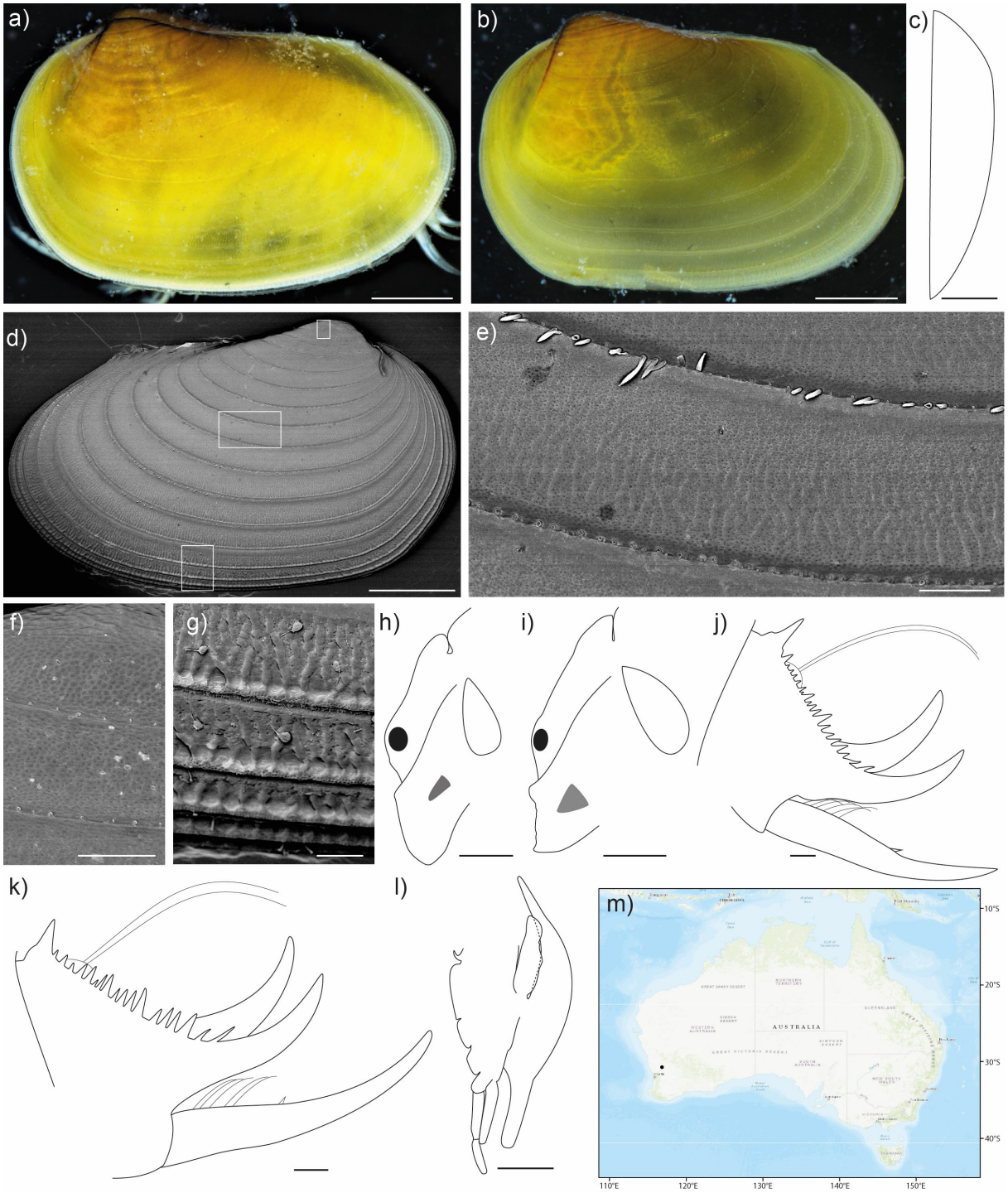

Fig. 50. *Ozestheria weeksi* sp. nov. **a–d**. Carapace. **a**. Male, holotype (NHMW-ZOO-CR-28187). **b**. Female, paratype (NHMW-ZOO-CR-28192). **c**. Dorsal view, male, holotype (right valve only; NHMW-ZOO-CR-28187). **d**. Male, paratype (NHMW-ZOO-CR-28199), SEM. **e–g**. Carapace ornamentation (male, paratype, NHMW-ZOO-CR-28199; positions marked in d by rectangles), SEM. **e**. Mid-carapace. **f**. Dorsal carapace. **g**. Ventral carapace. **h–i**. Head (antennae not shown). **h**. Male, holotype (NHMW-ZOO-CR-28187). **i**. Female, paratype (NHMW-ZOO-CR-28192). **j–k**. Telson. **j**. Male, holotype (NHMW-ZOO-CR-28187). **k**. Female, paratype (NHMW-ZOO-CR-28192). **l**. Male, third left thoracopod (holotype, NHMW-ZOO-CR-28187). **m**. Distribution map (produced in ArcMap 10.7; see caption Fig. 7 for sources). Scale bars: a–d = 1 mm; e–g, j–k = 0.1 mm; h–i, l = 0.5 mm.

lirae forming ventrally between punctae; lirae increase in length in following growth bands. Lirae become longer in following growth bands, extending across whole growth bands. Lirae subparallel, anastomosing and intermittent; usually more pronounced and less anastomosing ventrally within growth bands. Crowded growth bands with short, parallel, pronounced lirae in some individuals. Concentric ridges raised and punctate. Setae spiniform, usually only few on carapace; setae of the outer most 2–3 growth bands often dense and longer. Setal pores in single row along all growth lines.

Head (Fig. 50h). Condyle long, distally acute; occipital notch narrow. Condyle with weakly developed or without anterobasal hump (HT: present). Margin between condyle and ocular tubercle straight to weakly concave. Ocular tubercle well developed, forming nearly rectangular to nearly straight (~100°–180°) angle with rostrum. Anterior margin of rostrum weakly convex. Apex rounded, nearly rectangular. Ventral margin of rostrum anteriorly convex, then straight or weakly concave. Naupliar eye subtriangular. Antenna I long with 9–14 lobes (HT: 11; mean: 12), reaching to antenna II flagellomeres IV–VII (HT: VII; mean: VI). Antenna II with 10–12 flagellomeres (HT: 11; mean: 11).

Thorax. 20–21 (HT: 21; mean: 21) segments, 19–20 (HT: 20; mean: 20) thoracopod-bearing and one (HT: one) posterior limbless segment not reaching dorsal margin. The majority of thoracopod-bearing segments with numerous spines and setae on dorsal extensions.

Thoracopod III (only NHMW-CR-28187; Fig. 50l). Endite I short and curved dorsally. Endites II–V broad, decreasing in size. Endite V palp two-segmented, basal segment slightly shorter than endopod. Exopod ventral extension subequal in extension to endopod, dorsal extension wide, narrowing distally, overreaching epipod. Epipod long, cylindrical.

Telson (Fig. 50j). 15–29 spines (HT: 20; mean: 21). First (anterior) spine enlarged. Spines on anterior ½ to ¾ of telson short, conical, subequal in length; following spines thinner, elongate, aciculate, in some individuals increasing in size posteriorly. Two larger spines interspersed (usually among conical spines or at transition to aciculate spines). Dorsal margin straight or weakly concave. Right terminal claw more strongly curved than left.

Furca (Fig. 50j). Proximally with dorsomedial longitudinal row of 6–12 (HT: 6, mean: 7) setae, row ending distally in a single conical spine. Distal part ⅓–⅔ of furcal length, with numerous small denticles.

Females

Overall appearance as in males. Carapace (Fig. 50b) length 5.0–5.8 mm (mean: 5.3 mm), height 2.8–3.4 mm (mean: 3.1 mm); 17–34 (mean: 19) growth lines, 12–19 (mean: 16) widely spaced and 1–15 (mean: 3) crowded; Cr/L 0.23–0.27 and b/H 0.46–0.50. Ocular tubercle weakly developed. Anterior margin of rostrum concave, dorsally strongly protruding, globose; apex drawn out into acute tip, with rectangular angle; ventral margin convex (Fig. 50i). Antenna I with 9–12 small lobes (mean: 11), lobes smaller than in males; reaching to antenna II flagellomeres II–III (mean: III). Antenna II with 10–11 flagellomeres (mean: 11). Telson with 17–27 (mean: 21) dorsal spines; left and right terminal claws equally curved or right slightly stronger curved (Fig. 50k). Furca with 5–7 setae (mean: 6).

Distribution (Fig. 50m)

Ozestheria weeksi sp. nov. is known only from a single locality in southwestern Western Australia

Remarks

Ozestheria weeksi sp. nov. is part of a group of five very closely related species; see remarks on *O. typica* comb. nov. for details. The carapace shape of *Ozestheria weeksi* (Fig. 6) is distinct from that of many other species and overlaps partly with those of *O. jiangi* sp. nov., *O. minor* comb. nov., *O. fuersichi*

sp. nov., *O. timmsi* sp. nov., *O. sivesae* sp. nov., *O. setifera* sp. nov., *O. mariae*, *O. gemina* sp. nov., *O. jonnae* sp. nov., *O. marthae* sp. nov., *O. selmae* sp. nov., *O. cancellata* comb. nov., *O. barcaldinensis* sp. nov., *O. quinlanae* sp. nov., *O. echidna* sp. nov., and *O. pilbarensis* sp. nov.

Discussion

Species diversity

A key question in integrative taxonomic approaches, which include elements of DNA barcoding, is whether genetically divergent clades or lineages represent taxonomically distinct species. For the majority of species studied herein this was already discussed in detail (Schwentner *et al*. 2015a), also regarding differences based on the employed species concept. The congruence between mitochondrial (COI) and nuclear markers (including ITS-2) observed by Schwentner *et al*. (2015a) strongly suggested that the main genetic lineages delimited by COI are reproductively isolated from each other and represent distinct species under the majority of species concepts. True reproductive isolation, as required for the Biological Species Concept sensu Mayr (1942), was convincingly shown for all species with sympatric distributions (for allopatric species pairs reproduction cannot be ruled out once they come into contact again), representing about half of all herein described species. Also, the newly studied Western Australian species exhibited comparable mitonuclear congruence between COI, 16S and ITS-2, strongly suggesting that those are equally well-distinguished species. This is further supported by the morphological differences observed among species.

Molecular-based species delimitation was challenging only in a few instances, where several species are genetically very closely related. This was especially the case for species assigned to the complex of closely related species previously referred to as *Ozestheria* sp. Q (Q1–Q5; now *O*. sp. Q1, *O. weeksi* sp. nov., *O. selmae* sp. nov., *O. radiata* sp. nov. and *O. typica* comb. nov.). Here, the lowest interspecific genetic distances were observed (≥3% in COI). But also these species could be distinguished based on morphological characteristics and in most instances on nuclear ITS-2.

Our study greatly increases the number of species of *Ozestheria* in Australia. Previously, only 10 species were formally recognized (Richter & Timms 2005; Rogers 2020). We have now raised this number to 38 species, with another two putative species (*O*. sp. N2 and *O*. sp. Q1; see also Schwentner *et al*. 2015a) – of which we had insufficient material available for formal taxonomic descriptions – awaiting description. This makes *Ozestheria* the most species-rich spinicaudatan genus in Australia and one of the most species-rich spinicaudatan genera worldwide.

Since the late 2000s, the number of formally recognized Australian spinicaudatan species has been continuously and extensively increased (Timms 2009a, 2009c, 2015, 2016a, 2016b, 2018; Timms & Richter 2009; Schwentner *et al*. 2012a; Timms & Schwentner 2012, 2017, 2020; Tippelt & Schwentner 2018). While only 23 spinicaudatan species had been recognized in 2005 (Timms & Richter 2005), 97 spinicaudatan species are recognized for Australia today (Rogers 2020). Of these, ~40% belong to *Ozestheria*. Australia harbors nearly half of the globally known spinicaudatan diversity of ~220 species (Rogers 2020 recognized 195 spinicaudatan species worldwide) making it the global hotspot for spinicaudatan and overall large branchiopod diversity.

Within Australia, the central Paroo River catchment in eastern Australia (see also Timms *et al*. 2021) and central Western Australia appear to hold the greatest *Ozestheria* species diversities. It is noteworthy that the majority of species recorded from Western Australia has not been recorded anywhere else, a notable exception being *O. typica* comb. nov. Conversely, the majority of species recorded from central Australia occurs in eastern Australia as well, suggesting a stronger faunal exchange between central and eastern Australia than central and western Australia. Similar distribution patterns have also been recorded for other spinicaudatans (Schwentner *et al*. 2012b, 2014).

Because morphological species identification can be challenging, molecular genetic techniques (DNA barcoding or integrative taxonomy) will be an important tool to aid species identifications. Especially for future taxonomic studies on Australian species of *Ozestheria*, we strongly suggest including genetic data to ascertain that any newly described species is indeed distinct.

Intraspecific variability and interspecific variation – extent and implications

The taxonomy of Spinicaudata is complicated by their intraspecific variability and morphological overlap between species (e.g., Straskraba 1966; Schwentner *et al*. 2012a, 2014; Rogers & Padhye 2015; Tippelt & Schwentner 2018; Hethke *et al*. 2023). A better understanding of the extent and causes of intraspecific variability and its overlap with interspecific variation will be important for future taxonomic studies.

Virtually all morphological characters studied herein exhibit variability and, in many cases, this overlapped with character states in other species. This was particularly the case for numeric characters such as carapace length, the number of carapace growth bands, antenna I or II segments, the number of thorax segments, the number of telsonic spines and the number of furcal setae. None of these characters by themselves can be used to identify any of the Australian species of *Ozestheria*. They may be helpful in some instances to "point" to certain species or may be useful in conjunction with other characters. For example, *O. lutraria* is characterized by having very few and small telsonic spines (usually 14 or fewer). However, the studied individuals included a single adult specimen that featured 20 telsonic spines; plus, there are other species yielding similarly low numbers of spines.

Less variable morphological characters were the shape and ornamentation of the carapace, the shape of the male and female rostrum and the arrangement of telsonic spines. As a single taxonomic character, carapace ornamentation is probably the least variable and most informative character. However, although the ornamentation pattern itself varied little among individuals within a species, the ornamentation's intensity differed strongly. In many species the ornamentation pattern changes during ontogeny and along single growth bands (from anterior to posterior), most strongly between early and later widely spaced growth bands as well as between widely spaced and crowded growth bands, and growth bands of secondary growth phases. While this change can be observed in all individuals of the respective species, the timing (i.e., the specific growth band) and pace of change differed markedly among individuals. To fully assess ornamentation patterns, it is often necessary to study the carapace from different directions or angles and under different light regimes. The ornamentation is often not well visible on all parts of the carapace, either due to damage, dirt, or differences in intensity. Usually, ornamental features are more strongly pronounced posteriorly on the carapace. Ornamentation patterns can be species specific (e.g., *O. berneyi*, *O. christiani* sp. nov., *O. echidna* sp. nov., *O. fuersichi* sp. nov., *O. jiangi* sp. nov., *O. pellucida*, *O. rufa*, *O. sarsii*, *O. setifera* sp. nov., *O. sivesae* sp. nov.; see also Hethke *et al*. 2023), but as many ornamentation patterns are shared by several species (ornamental differences between species are visible but subtle), also this character alone is often not sufficient to identify a specimen to species level.

The potential causes of the intraspecific variability are manyfold, including age/maturity, genetics, environmental factors (such as temperature, salinity, turbidity or presence/absence of predators or other species), and sexual dimorphism (e.g., Astrop *et al*. 2012; Brown *et al*. 2014; Huang and Chou 2015, 2017; Hethke *et al*. 2021; Sun & Cheng 2022). Our data is not suited to disentangle the contribution of each of the various causes to the observed variability, but it allows some general observations.

An obvious cause of intraspecific variability within spinicaudatan species is the age and/or level of maturity of the individuals. Assessing the influence of age and/or maturity is hampered by several factors. Spinicaudata molt and grow throughout their life, and it is likely that growth rates depend to a

certain degree on environmental factors. Thus, a larger individual is not necessarily older. Furthermore, it is not always clear if or when an individual reached maturity. The only unambiguous sign of maturity is the presence of eggs in females. Early growth is commonly rapid and decelerates after reproductive maturity is reached. Thus, another morphological feature often used to infer maturity is the noticeable discontinuity in the growth pattern of the carapace when the growth bands become narrower and change from widely spaced to crowded. It is assumed that this indicates slower growth of mature individuals. In general, this feature appears to be quite reliable as most females of *Ozestheria* with crowded growth bands carry eggs. However, in a few instances also females without crowded growth bands carried eggs, leading to a discrepancy between maturity determined by the presence of eggs and by the presence of crowding (see also Hethke *et al*. 2023: table 1). In some individuals and species, the transition between widely spaced and narrow growth bands is not clear-cut, with growth bands becoming slightly thinner over many growth bands. Some individuals featured one or multiple secondary growth phases (e.g., in *O. glabra* sp. nov.), where widely spaced growth bands followed several narrow (crowded) growth bands. Changes in environmental conditions (e.g., after rainfalls) most likely triggered such secondary growth phases. Whether maturity was already reached during the first phase of crowded growth bands or whether growth was halted due to a shortage of resources or similar environmental stressors is an open question. Interestingly, the growth band ornamentation of the secondary growth phase does not confer to the ornamentation of the primary growth phase's widely spaced growth bands but resembles the ornamentation of the crowded growth bands.

Measures like carapace length, height or the number of growth bands (especially of crowded growth bands) are obviously influenced by the individuals' age and will continue to increase after the individual reaches maturity. Whether characters such as the number of thorax segments, number of antennal lobes or number of telsonic spines change after maturity is reached in species of *Ozestheria* is unknown. For *Eocyzicus* no such increase was observed (Tippelt & Schwentner 2018); thus, the variability observed in those characters may have other causes.

Despite not including juveniles in the species descriptions, we still studied some juveniles (of about a quarter of all species). These showed some consistent morphological differences to adults. Most juveniles featured a rostral spine, a feature never observed in adult *Ozestheria*. This spine is probably present in juveniles of all species of *Ozestheria* and is lost some time before reaching maturity. Also, the shape of the head and the rostrum differed from that of the adults. Similar differences have been documented before (Sars 1896). The most intriguing example was *O. lutraria*, whose juveniles had previously been assigned to a separate species (*O. dictyon*). Apart from differences that are to be expected (smaller carapace size, fewer thorax segments, presence of rostral spine), juveniles also yielded more and larger telsonic spines, spines dorsally on the last thorax segments (which are bare in adults) and the distal portion of the furca was larger relative to the furca's total length. To our knowledge, comparable ontogenetic differences have not yet been reported for any spinicaudatan species. Especially the reduction in the number and size of furcal spines and the loss of thoracal spines is surprising; it is usually assumed that countable characters increase in number with age.

For the majority of habitats, we lack detailed ecological data. Therefore, it is not possible to assess how ecological factors influenced morphological features. At least the carapace coloration appears to be related to ecological factors. While several species exhibit a variety of colorations and color intensities (including dark reddish colored and nearly translucent individuals), individuals collected from the same habitat usually exhibit very similar colorations.

Sexual dimorphism also plays a role in intraspecific variability. Apart from the male claspers, the characters showing the strongest sexual dimorphism are the shape of the rostrum, the length of antenna I (shorter in females; though it should be noted that the number of antenna I lobes hardly differed) and the

curvature of the terminal claw of the telson (in males the right was more strongly curved, in females more or less equally curved). For carapace shape, Hethke *et al*. (2023) detected minor differences between sexes in species of *Ozestheria*; these differences appeared to be lower than observed in species of other spinicaudatan genera such as *Eulimnadia* (Astrop *et al*. 2012). This was also exemplified by the fact that species identification based solely on the carapace shape of *Ozestheria* was improved if males and females were pooled and jointly analyzed (Hethke *et al*. 2023). Sexual dimorphism in ornamental features has not been examined here. Some dimorphism was observed in clam shrimp species investigated by Sun & Cheng (2022), but the basic ornamentation pattern was species specific, corroborated by our data, where the overall ornamentation pattern in a species remained stable across males and females, despite overall variations in, e.g., the timing of the onset of lirae on the carapace.

For reliable morphological species identifications of Australian species of *Ozestheria*, the morphological characters of carapace ornamentation, carapace shape, rostrum shape and telson spination patterns are probably the most important and reliable. Morphological species identification will always require studying multiple characters as no single character can be used to identify and discriminate all species. It is also advisable to study multiple specimens per species from each population to better assess the variability of certain morphological characters (e.g., carapace ornamentation), and to include sexual dimorphism (e.g., shape of rostrum). It should be noted that co-occurrences of several species of *Ozestheria* within single habitats are common, but usually these do not include closely related and thus morphologically highly similar species. The geographic distribution can be very informative for species identification, as many morphologically similar species are geographically separated.

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Such extensive taxonomic works require not only direct access to hundreds of individuals of potentially ‘new’ species but also to historic material and valuable type specimens. Access can be problematic already during normal times, but with the majority of this study being conducted during the COVID pandemic, further restrictions on travel, shipment etc. had been imposed. But thanks to the tremendous support and trust of all contacted curatorial staff at various museums, all relevant material (including all known type material and material suspected to represent types) was provided to us as loans, for which we are very grateful. Our thanks go to Stephen Keable, Helen Stoddart, Claire Rowe and Shane Ahyong (Australian Museum), Joanne Taylor and Melanie Mackenzie (Museums Victoria), Andrew Hosie and Ana Hara (Western Australian Museum), Andrea Crowther (South Australian Museum), Miranda Lowe and Lauren Hughes (Natural History Museum, London), Åse Ingvild Wilhelmsen (Natural History Museum, University of Oslo), Karstein Hårsaker (NTNU University Museum), and Robert Bergensen (Tromsø University Museum) for their help in the search for lost type material and all the loans, and Kirsty Quinlan (Department of Biodiversity, Conservation and Attractions) for providing the new Western Australian material. Dorian Moro (TMPAC) suggested the species names matuwa and ngamurru. Peter C. Dworschak helped with the correct Latinization of species names and Theresa Kutzner and Matthias Alberti with the outlining of carapaces. We thank D. Christopher Rogers for his very helpful comments on an earlier version of the manuscript. MH was financially supported by the grant DFG HE 7531/1-1.

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Supplementary file 1. Markdown file for the morphometric analysis of short-condyled species based on Fourier shape analysis, including classifications of type specimens of known species to the various species delimited herein. https://doi.org/10.5852/ejt.2025.992.2905.13157

Supplementary file 2. Markdown file for the morphometric analysis of long-condyled species based on Fourier shape analysis, including classifications of type specimens of known species to the various species delimited herein. https://doi.org/10.5852/ejt.2025.992.2905.13159

Supplementary file 3. Detailed information on all studied individuals. For each individual, the respective museum registration number, the previous and current species identification, the type status, collection details, GenBank accession numbers as well as morphological characteristics (various carapace measurements, see Fig. 1, as well as ornamental details) are provided. All specimens studied by Schwentner *et al*. (2015a) are included, as well as those which were not studied morphologically. https://doi.org/10.5852/ejt.2025.992.2905.13161

Supplementary file 4. Uncorrected COI *p*-distances among all pairs of Australian species of *Ozestheria*. Intraspecific distances are provided along the diagonal. https://doi.org/10.5852/ejt.2025.992.2905.13163

Supplementary file 5. Fourier shape coefficients of the 248 studied outlines of short-condyled individuals. https://doi.org/10.5852/ejt.2025.992.2905.13165

Supplementary file 6. Fourier shape coefficients of the 497 studied outlines of long-condyled individuals. https://doi.org/10.5852/ejt.2025.992.2905.13167