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## *Moorea zealandica*, new genus and species from New Zealand with a discussion of its phylogenetic relationships (Coleoptera: Staphylinidae: Aleocharinae)

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**Abstract** *Moorea zealandica*, new genus and species, is described and illustrations of diagnostic features are presented. Based on, seta v absent on mentum, contiguous mesocoxal cavities, and galea with several setae only on mesal surface and apex with setae, *Moorea zealandica* is hypothesised to be a member of the tribe Liparocephalini. A cladistic analysis of the Liparocephalini based on 50 adult characters suggests that the genus *Moorea* belongs to the Liparocephalini.

**Keywords** *Moorea zealandica*; intertidal; Liparocephalini; Staphylinidae; Coleoptera; New Zealand; phylogenetic relationships

### INTRODUCTION

The Aleocharinae in New Zealand includes 11 tribes and 59 genera, and the fauna is characterised by a high ratio of endemism at the genus level. Twenty-three aleocharine genera endemic to New Zealand and/or its associated subantarctic islands, and a number of species are waiting to be described (Klimaszewski et al. 1996).

Although there is a great diversity of aleocharines in terrestrial habitats, some groups are found in sea-shore habitats (Moore & Legner 1976; Ahn & Ashe 1995; 1996a,b; Ahn 1996, 1997; Hammond 2000). Six out of 59 genera, (*Baeostethus* Broun, *Leptusa* [subgenus *Halmaeus* Kiesenwetter] Kraatz, *Arena*

Fauvel, *Halobrecta* Thomson, *Dasydera* Cameron, *Gyronotus* Cameron), are confined to the seashores in New Zealand (Hammond 2000).

This paper describes a new genus and species from specimens found under fine gravels in the intertidal region in Breaker Bay, Wellington, New Zealand, and presents a revised cladistic analysis of the liparocephaline genera.

### *Moorea* new genus

**DIAGNOSTIC COMBINATION:** Among aleocharine genera with 4–4–5 tarsal formula, members of *Moorea* (Fig. 1) are recognised by the combination of: labrum with more than 30 setae (Fig. 2), mandible with two internal teeth (Fig. 4), galea with several setae only on mesal surface and apex with setae (Fig. 5), two medial setae one behind the other present on prementum, ligula entire and very long, longer than half of labial palpus (Fig. 6), mentum (Fig. 7) without v setae, mesocoxal cavities contiguous, tibiae with numerous pores (Fig. 8), hind wings absent, female tergite VIII distinctly emarginated posteriorly (Fig. 11), more or less diamond-shaped apical lobe



**Fig. 1** *Moorea zealandica*.  
Habitus.

of paramere (Fig. 14), spermatheca (Fig. 15) long and twisted posteriorly, and their occurrence in the intertidal zone.

**DESCRIPTION:** Small sized, length 3.3–3.4 mm. Body shape narrow, flattened, and parallel-sided. Body dark brown or brown. Body sculpture not distinct (Fig. 1).

**Head.** Slightly deflexed, depressed, as long as wide. Eyes with microsetae between facets, small sized. Neck absent. Infraorbital carina developed on lateral base of head. Microsetae short, almost uniformly distributed. Temple long, about 0.6 times length of head. Antenna 11-articled, all antennomeres elongate, slightly incrassate toward antennomere 10.

**Mouthparts.** Labrum (Fig. 2) transverse and sinuate anteriorly, 22 + 22 setae present, sensillae present. Epipharynx as in Fig. 3. Mandibles (Fig. 4) symmetrical, two internal teeth present, protheca well-developed, membranous with fibrils. Maxilla (Fig. 5) with galea and lacinia elongate; galea narrower and shorter than lacinia with several setae only on mesal surface and apex with setae, lacinia more or less acute, internal surface with comb of a single row of 7–8 well separated spines, followed more proximally by a patch of setae, and a distinct row of numerous setae on dorsal surface; maxillary palpus 4-articled. Labium (Fig. 6) with palpi 2-articled, palpomere 1 partially separated, elongate; ligula entire and very long, longer than half of palpus; a pair of medial setae, one behind the other, twin pores, median pores, basal pores, setal pores, real pores present and pseudopores absent medially and laterally. Prementum with a pair of comb-like hypoglossae. Mentum (Fig. 7) trapezoidal, seta v absent, several setae and pores present.

**Thorax.** Pronotum about 1.1 times as wide as long, very slightly narrowed behind middle, narrowest at base and widest near anterior one-third, sides rounded, basal line round and apical line slightly prolonged anteriorly; short microsetae uniformly distributed. Pubescence pattern with setae directed anteriorly in anterior half of median strip and posteriorly in posterior half of median strip, and directed laterally in other regions. Hypomera large, entirely visible in lateral aspect. Mesocoxal cavities contiguous; mesosternal process acute. Legs with tarsal formula 4-4-5; each tibia with numerous sensory pores (Fig. 8); each tarsus with a long empodial seta.

**Elytra.** About 1.1 times as long as pronotum; outer apical angles sinuate, longer laterally than medially; microsetae numerous, uniformly distributed. Hind wings absent.

**Abdomen.** Parallel-sided, flattened. Tergites III–V moderately transversely impressed at base, anterior margin V-shaped.

**Secondary sexual characteristics.** Male tergite VIII (Fig. 9) slightly emarginated posteriorly, female tergite VIII (Fig. 11) distinctly emarginated posteriorly; male sternite VIII (Fig. 10) rounded posteriorly, female sternite VIII (Fig. 12) prolonged very slightly.

**Aedeagus.** Median lobe as in Fig. 13. Parameres with apical lobe more or less diamond shaped (Fig. 14). Spermatheca. Long and twisted posteriorly, basal bulb round (Fig. 15).

**TYPE SPECIES:** *Moorea zealandica*, here designated.

**DISTRIBUTION:** New Zealand.

**ETYMOLOGY:** Named after Dr I. Moore, in honour of his research on intertidal staphylinids.

**BIOLOGY AND ECOLOGY:** Adults have been found in deep, fine seashore gravel near the low tide level. They have been collected at two sites, one in the south of the North Island, and one in the south of the South Island. At both sites the gravel had an average grain size of about 3 mm and was at least 0.5 m deep. The gravel contained very little organic matter, but a few Collembola and mites were present. Adults have been collected in May, July, November, and January, and from this it is inferred that adults are present all year round. One specimen collected in early November appears to be slightly teneral.

If the beetles are immersed in water, they float to the surface straight away and sit there with most of their bodies above the surface film of the water. In this position, they are very quickly blown across the surface of the water by air currents.

**REMARKS:** I compared the morphology of *Moorea* to several other intertidal aleocharine genera including Liparocephalini, Phytosini, Homalotini, Diglottini, Athetini, and Myllaenini. My comparative examination reveals that *Moorea* and Liparocephalini share the following synapomorphies: seta v absent on mentum, contiguous mesocoxal cavities, and galea with setae only on mesal surface and apex with setae. Therefore, *Moorea* can be placed in the tribe Liparocephalini, and this hypothesis is tested by cladistic analysis, (see phylogenetic analysis section).

There are also substantial differences between *Moorea* and other liparocephaline genera, especially *Baeostethus* Broun, which also occurs in New Zealand. Differences among *Moorea*, *Halorhadinus* Sawada and *Baeostethus* are presented in Table 1. The genus *Halorhadinus* is a possible sister group of *Moorea* (see phylogenetic analysis section).

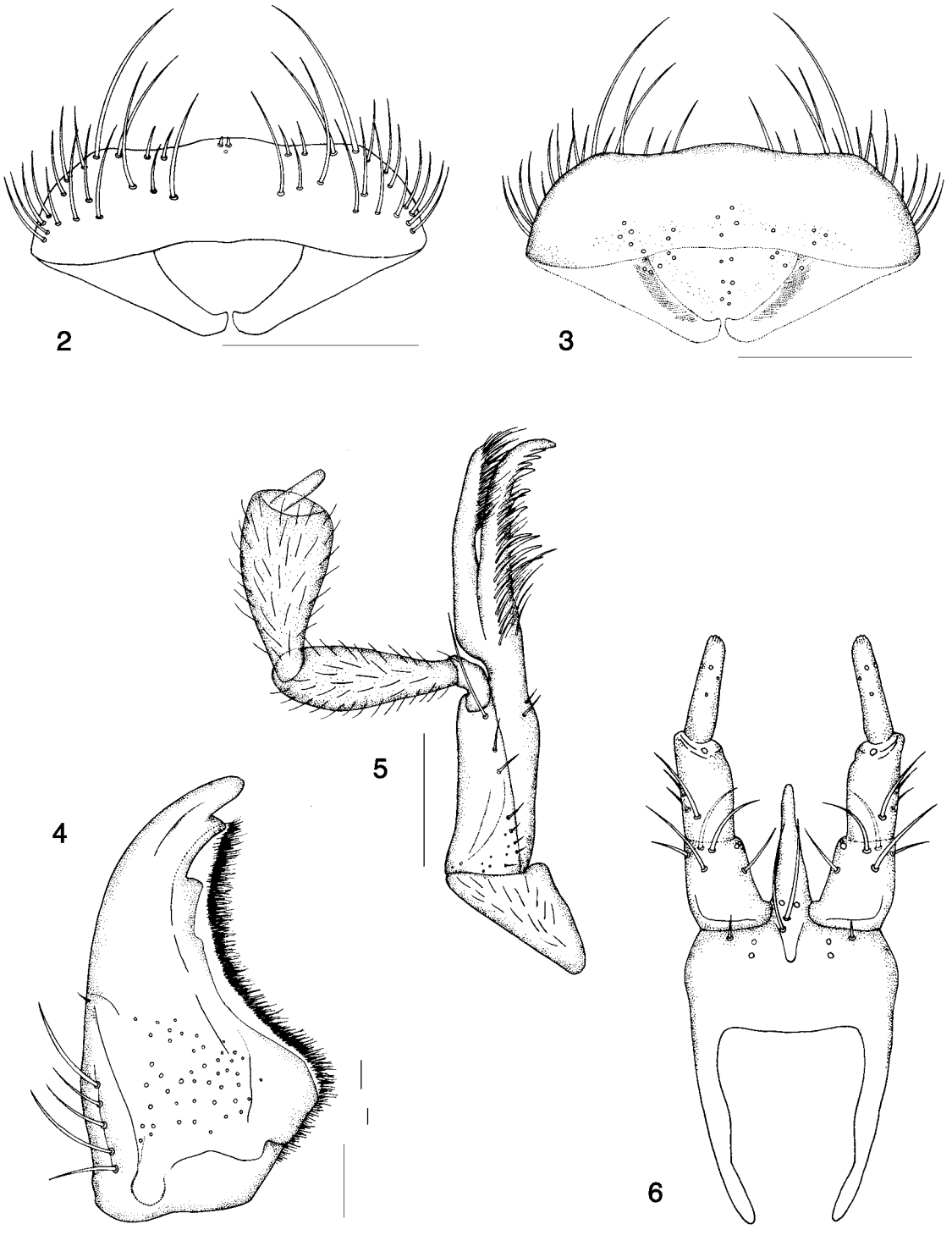


Fig. 2-6 *Moorea zealandica*. 2, labrum, dorsal aspect; 3, epipharynx, ventral aspect; 4, left mandible, dorsal aspect; 5, maxilla, ventral aspect; 6, labium, ventral aspect. Scale, 0.1 mm.

***Moorea zealandica* new species**

Length 3.3–3.4 mm, dull, brown or dark brown. Head round, about as long as wide. All antennomeres elongate, length to width ratio decreased from articles 4 to 10. Tarsomere 4 of front and middle legs about as long as tarsomeres 1–3 combined; one long empodial setae present. Abdomen parallel-sided, flattened. Tergites III–V moderately transversely impressed at base, anterior margin V-shaped. Male tergite VIII (Fig. 9) slightly emarginated posteriorly, female tergite VIII (Fig. 11) distinctly emarginated posteriorly. Median lobe as in Fig. 13. Paramere as in Fig. 14. Spermatheca as in Fig. 15.

TYPE SERIES: Holotype, labelled as follows: 'New Zealand: WN Point Dorset, Breaker Bay, 20-Jan-97, in fine intertidal gravel, Holotype, *Moorea zealandica* Ahn, Desig. K.-J. Ahn'. Holotype is deposited in the New Zealand Arthropod Collection (NZAC).

Paratypes, 17, same data as type; 5 (1 on slide), Breaker Bay, Wellington, 21-7-1991; 4, 20-May-95; 7, Katiki Point, Moeraki, 1-Nov-03. Paratypes are deposited in the NZAC, Chungnam National University Insect Collection and John Nunn's private collection (Dunedin).

DISTRIBUTION: New Zealand.

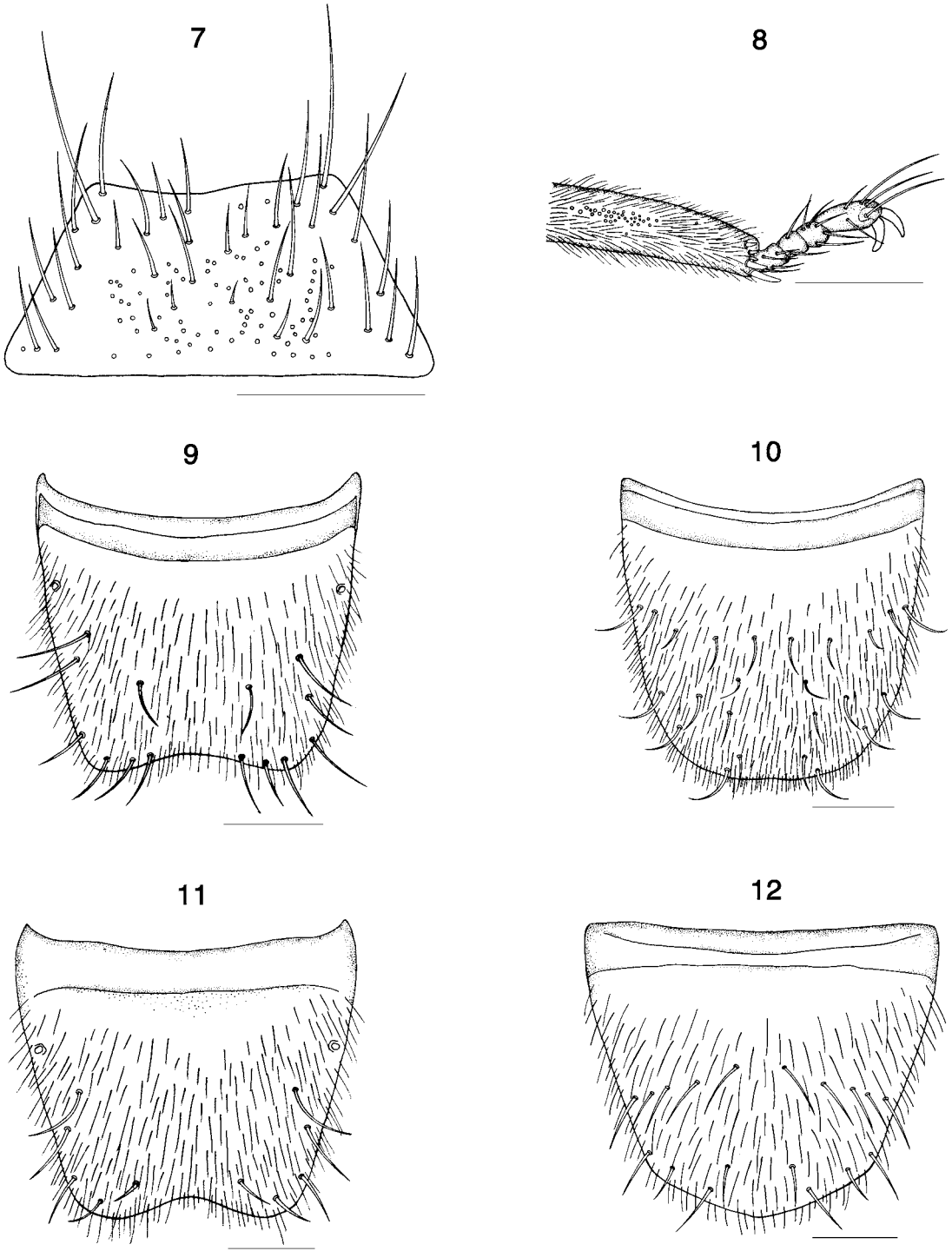
ETYMOLOGY: Named after the type locality.

**PHYLOGENETIC RELATIONSHIPS OF THE GENUS *MOOREA***

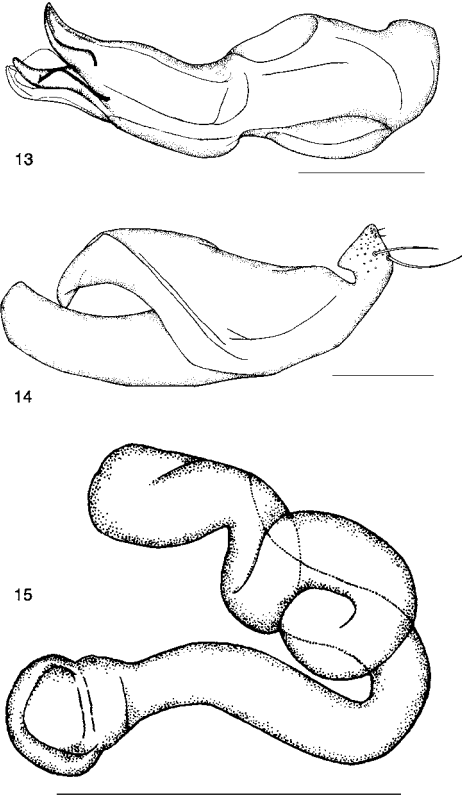
Ahn & Ashe (1996a) proposed that the Liparoccephalini form a monophyletic group based on synapomorphies (seta v absent on mentum, one medial seta present on prementum, contiguous mesocoxal cavities, and galea with several setae only on mesal

**Table 1** Comparison of *Moorea*, *Halorhadinus*, and *Baeostethus*.

Characters	<i>Moorea</i>	<i>Halorhadinus</i>	<i>Baeostethus</i>
Antennomeres	all elongate	all elongate	not all elongate
Setae between facets	present	present	absent
Mentum shape	almost trapezoidal	anterior margin deeply sinuate and antero-lateral parts triangular	almost trapezoidal
Labrum: number of setae	fewer than 30	between 31 and 50	between 31 and 50
Mandibles: serration of teeth between apex and median tooth	one large tooth present	irregular teeth present or absent	about 5 large teeth present
Mandibles	symmetrical	asymmetrical	symmetrical
Maxilla: distribution of setae on galea	several setae only on mesal surface and apex with setae	several setae only on mesal surface and apex with setae	many setae on mesal surface and apex with many setae
Maxilla: shapes of galea and lacinia	galea narrower and shorter than lacinia	galea narrower and shorter than lacinia	galea not narrower and shorter than lacinia
Labium: ligula	entire and very long	entire and very long	entire and short
Pronotal length to elytra length ratio	less than 1.0	less than 1.0	more than 1.3
Metasternum	almost same as mesocoxal width	longer than mesocoxal width	shorter than half of mesocoxal width
Elytra	longer than wide	longer than wide	wider than long
Hind wings	absent	present	absent
Legs: shape of tarsal setae	not spatulate	not spatulate	spatulate
Abdominal tergites III–VI	anterior margin deeply and broadly V-shaped	anterior margin deeply and broadly V-shaped	anterior margin straight
Abdominal tergites	impressed basally	impressed basally	not impressed
Body pubescence	shorter setae not densely distributed	shorter setae not densely distributed	relatively long setae densely distributed



**Fig. 7–12** *Moorea zealandica*. 7, mentum, ventral aspect; 8, front tibia and tarsus, lateral aspect; 9, male tergite VIII, dorsal aspect; 10, male sternite VIII, ventral aspect; 11, female tergite VIII, dorsal aspect; 12, female sternite VIII, ventral aspect. Scale, 0.1 mm.



**Fig. 13–15** *Moorea zealandica*. 13, median lobe, lateral aspect; 14, paramere, lateral aspect; 15, spermatheca, dorsal aspect. Scale, 0.1 mm.

surface and apex with setae). My hypothesis that the genus described here and the liparocephalines form a monophyletic group, provides the opportunity to reanalyse the phylogenetic relationships among these genera. This phylogenetic analysis is intended to hypothesise a tribal placement of *Moorea* among Aleocharinae, rather than to represent the relationships of the liparocephaline species and to supplement those of Ahn & Ashe (1996a), Ahn (2001), and Leschen et al. (2002).

I repeated the cladistic analyses of Ahn (2001) and Leschen et al. (2002), consisting of 50 adult characters, to which I add the data for *Moorea zealandica* to the data matrix as follows: 1101101000 4120000110 0020011000 1111010010 0100010000 (see Tables 1 and 2, Ahn 2001). I revised mandible teeth characters (character number 10, see Ahn 2001)

for *Baeostethus chiltoni* Broun as character state 2, *Halorhadinus aequalis* Sawada as character state 3, and *H. inaequalis* Sawada as character state 0. The genera *Phytosus* Curtis, *Heterota* Mulsant & Rey and *Leptusa* Kraatz are used as outgroups.

The ingroup composed of 25 species of the following genera (*Diaulota* Casey, *Liparocephalus* Mäklin, *Baeostethus* Broun, *Paramblopusa* Ahn & Ashe, *Amblopusa* Casey, *Halorhadinus* Sawada, *Moorea*, *Salinamexus* Moore & Legner). Phylogenetic analyses were performed using NONA 2.0 (Goloboff 1998), run within WinClada (Beta) 0.99 (Nixon 1999). Tree search options of HOLD 10000, HOLD/100, MULT\*1000 were used. Multistate characters were treated as unordered.

The analysis resulted in a single most parsimonious tree (length = 127, CI = 0.58, RI = 0.83, RC = 0.48). The reconstructed phylogeny of the liparocephaline genera is not substantially different from that of Ahn & Ashe (1996a), Ahn (2001), and Leschen et al. (2002) with the following pattern of generic relationships (outgroup (*Salinamexus* ((*Halorhadinus*, *Moorea*) (*Amblopusa* (*Paramblopusa* (*Diaulota* (*Liparocephalus*, *Baeostethus*))))))). But members of *Diaulota* did not form monophyly. Monophyly of the liparocephaline lineage including the genus *Moorea* is supported by three synapomorphies (seta *v* absent on mentum, galea with several setae only on mesal surface and apex with setae; mesocoxal cavities contiguous). This provides strong support for the hypothesis that *Moorea zealandica* is a member of the liparocephaline lineage.

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