

Plate 1 on p. 68

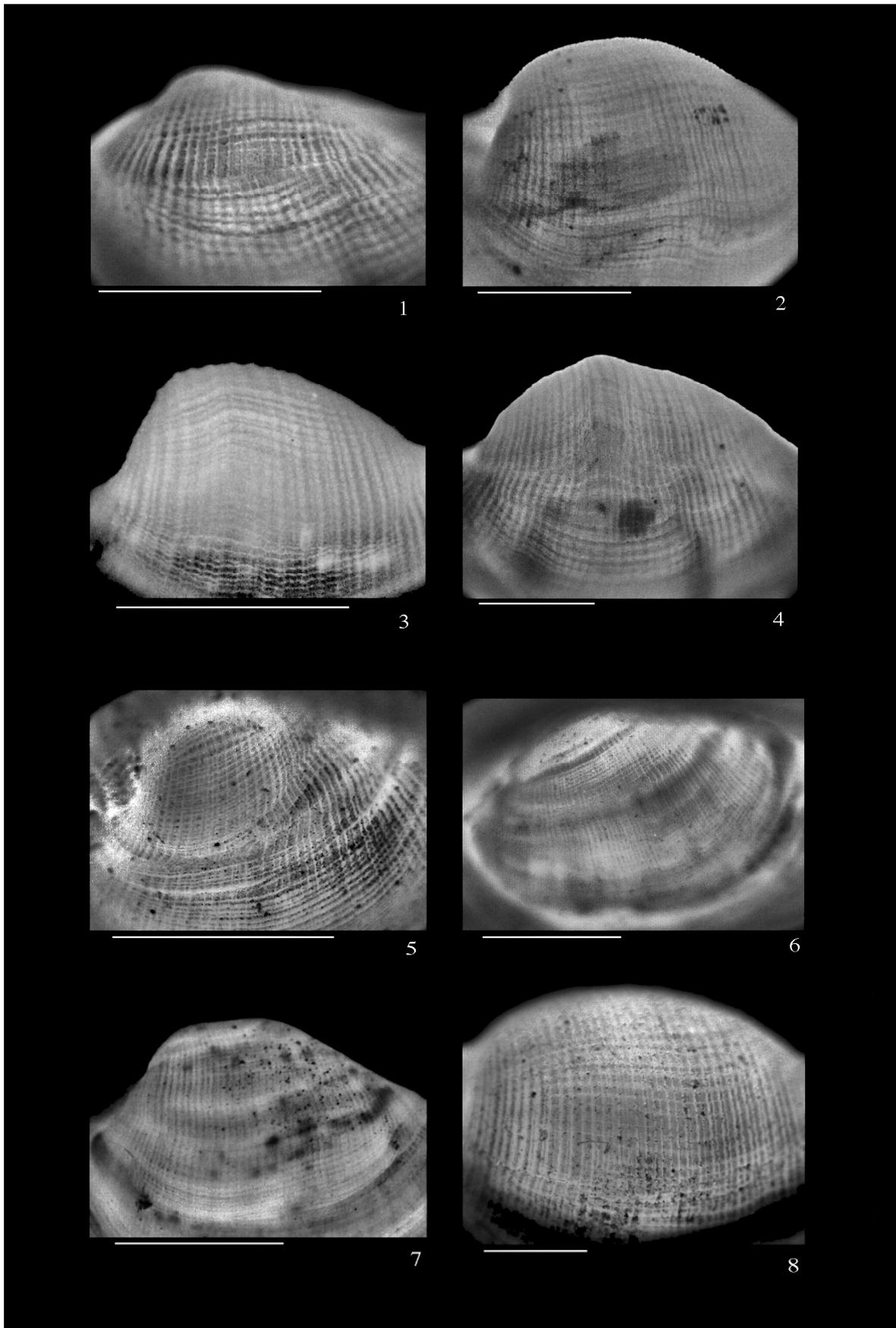
- Fig. 1:** *Pedicularia morrisoni*, n. sp. Holotype, 9.7 mm
Fig. 2: *Pedicularia morrisoni*, n. sp. Paratype 2, 5.1 mm
Fig. 3: *Pedicularia morrisoni*, n. sp. Paratype 1, 10.5 mm
Fig. 4: *Pedicularia elegantissima*, 5.6 mm, Cabilao, Bohol, Philippines
Fig. 5: *Pedicularia pacifica*, New Caledonia, 5.8 mm
Fig. 6: *Pedicularia vanderlandi*, Halmahera, Indonesia, 8.0 mm
Fig. 7: *Pedicularia californica*, California, USA, 10.2 mm

Plate 2 on p. 69

Photographs of the sculpture of early whorls. Left column: juvenile or male shells, right: adult females.
Scale: approximately 1 mm.

- Figs. 1-2:** *Pedicularia elegantissima*, Cabilao, Bohol, Philippines, on *Stylaster* sp. at 30 m.
Figs. 3-4: *Pedicularia pacifica*, S. New Caledonia, dredged with *Stylaster* species, off 450 m.
Figs. 5-6: *Pedicularia morrisoni*. n. sp., Lord Howe Island, at 30 meters on *Stylaster brunneus*.
Fig. 7: *Pedicularia vanderlandi*, S. Halmahera, Indonesia, at 5 meters on *Distichopora* species.
Fig. 8: *Pedicularia californica*, Santa Barbara, USA, at 25 meters on *Stylaster californicus*.

Plate 2



Explanations p. 70

Plate 1



Explanations p. 70

In the female of *P. splendida*, egg capsules are clustered in the marsupium formed by the shell and the mantle cavity. In *P. morrisoni*, n. sp. the egg cluster is embedded in the body of the animal, above the posterior half of the foot. Anatomical details of this structure could not be examined in the preserved animals available for study. Related observations in other species of the genus are lacking.

P. morrisoni, n. sp. lives in association with *Stylaster brunneus*, a solid coral with rather thick colonies. These resemble *Stylaster californicus* (VERRILL, 1866) in the thickness of their branches. The host of *P. californica*., *P. elegantissima*, and *P. pacifica* live on a variety of delicate species of *Stylaster* spp. and *Errina* spp., whereas, *P. vanderlandi* is found only on colonies of *Distichopora* spp., in moderately shallow water (GOUD & HOEKSEMA, 2001).

Incidentally, the bright purple to orange color of the shells of *P. morrisoni* n. sp. does not correspond to the greenish-brown color of their host. The same was also observed by the authors of *P. vanderlandi* for that species. As in Ovulidae, for the genus *Pedicularia*, alimentary homochromy does not always apply as a cause for the coloration of the shell (see also LORENZ & FEHSE, 2009).

The host coral *Stylaster brunneus* is only known from a few places: New Caledonia, Norfolk Island, and the Norfolk Ridge, New Zealand. It is found in less than 10 meters of water, down to approximately 300 meters (CAIRNS, 1991). The isolation of Lord Howe Island in combination with the rather unusual host are factors that may have led to the formation of such a conchologically extreme species. This new Australian endemic constitutes an interesting addition to the fascinating, yet not well understood, genus *Pedicularia*.

Acknowledgements

Many thanks to WILMA BLOM, Auckland Museum, New Zealand, NEVILLE COLEMAN †, TASMAN DOUGLASS, Lord Howe Island, DIRK FEHSE, Berlin, Germany, KLAUS GROH, Hackenheim, Germany, Dr. MICHAEL A. MONT, Owings Mills, USA, HUGH MORRISON, Perth, Western Australia, ANDREIA SALVADOR (National History Museum, United Kingdom) for providing images of the *P.*

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Figure 5: Male shells of *Pedicularia*. Left: *P. pacifica* (3.3 mm), middle: *P. californica* (6.6 mm), right: *P. californica*, adult female. The labrum of the male shell is still well visible inside the aperture (arrow). Scale: 1 mm.

Pediculariids are found wherever their hosts occur, from a few meters down to over 1,000 meters. All species have irregular outlines of their adult shells as a consequence of fitting themselves to a fixed position on their stylasterine host. The type of host coral is one important aspect that separates between species of *Pedicularia*. The fine sculpture of the shells, the appearance of male shells, and the maximum shell's dimensions are additional characteristics in the Pediculariid taxonomy (GOUD & HOEKSEMA, 2001).

The shells of *P. morrisoni*, n. sp. are considerably larger and more solid than those of their western Pacific relatives, namely *P. elegantissima* DESHAYES, 1863, *Pedicularia pacifica* PEASE, 1865, and *P. vanderlandi* GOUD & HOEKSEMA, 2001. These three widespread species rarely exceed a length of 7 mm, and are always thin-walled.

The dorsal sculpture of the early whorls of *P. morrisoni*, n. sp. is fine, dense, and cancellate (Plate 2, Figs. 5-6). It changes quite abruptly to more distant, transverse striae below the transition from the coiled (male) part of the shell to the girdle (female, see Text-Figure 1). The sculpture of *P. vanderlandi* is comparably fine, but predominantly transverse (Plate 2, Fig. 7). In *P. elegantissima*, and especially *P. pacifica*, the sculpture is coarser in comparison, and does not change its density during growth. The dorsum of *P. pacifica* has alternating ribs (see Plate 2, Figs. 3-4). In *P. californica*, the dorsal sculpture is fine, somewhat cancellate, but does not change its density during growth as that of *P. morrisoni*, n. sp.

The male phases of the three Pacific congeners and *P. californica* all have a denticulate columellar plate and a thickened, denticulate labrum. The three western Pacific species are only about half the length of the males of *P. morrisoni*, n. sp.: 2-3.5 mm compared to 5 mm. The males of *P. californica* can reach 7 mm in length.

Adult females of *P. californica* (NEWCOMB, 1864) from the western coast of America attain lengths up to 15 mm. It is the largest living *Pedicularia*. The shells are quite solid and calloused interiorly. The shell's outline is more regular than in other species of the genus. Males have a ribbed columellar shield and a denticulate labrum (See Text-Figure 5). The male of *P. morrisoni*, n. sp. does not show a similar development of labral dentition, and the columellar shield is only slightly developed (Plate 1, Fig. 2).

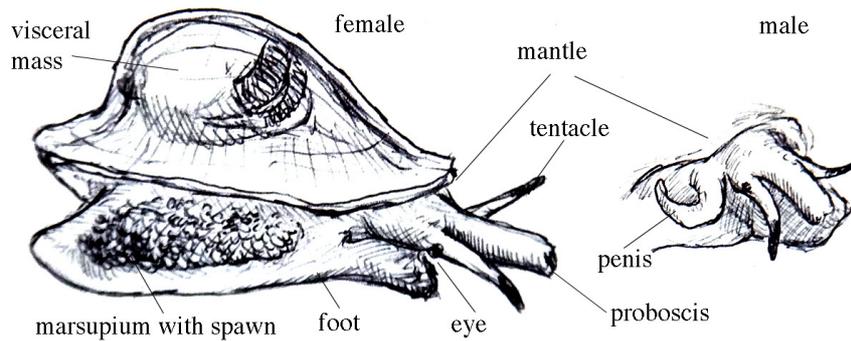
In their description of *Pedicularia vanderlandi* GOUD & HOEKSEMA, 2001, the authors gave a comprehensive revision of the genus. Based on observations of the shells of that species, they arrived at the conclusion that the animals of *Pedicularia* have separate sexes. Recently, the spectacular *Pedicularia splendida* LORENZ, 2009, from the deep sea of the Atlantic, was described. In this case, female stages have remnants of a penis, which implies that this species of *Pedicularia* is a protandric hemaphrodite.

Paratype 4 is obviously transitional on account of a shell with labral thickening that begins to form a girdle (See Text-Figure 4). In the preserved animal of this specimen, a small lump on the right side of the head was observed, which could be remnants of the penis. That feature was still present, though less recognizable, in the adult females of *P. morrisoni*, n. sp.

In adult females of most specimens of any *Pedicularia*, a growth line separates the coiling part of the shell from the area where the formation of the girdle starts. Inside the shell, that area bears a calloused ridge, which may still show the dentition of the male labrum (for instance in the specimen of *P. californica* in Text-Figure 5 on the right). It is possible that the genus *Pedicularia* comprises both; species with separate sexes and hemaphrodites (see also BOUCHET & WARÉN, 1993).

sexes have a moderately large, oval foot. There is a prominent proboscis which appears to be retracted in most of the preserved animals. That of paratype 1 is quite long and narrow. The tentacles in the preserved animals are broad, short, pointed, and with a conspicuous black eye at their base. In the female animal of the holotype, a large cluster of egg capsules is visible though a thin membrane in the posterior half of the body, directly above the foot. Egg capsules were not found in the cavity between the mantle and the shell.

In the male stage, the large penis is situated on the right side of the head. In the female phase, a small lump is visible in that area and may represent a vestigial remnant of the penis. This structure is more developed in the animal of paratype 4, whose shell is also transitional. The color of the preserved animal is white, and the tips of the tentacles darker orange in some paratypes. Text-Figure 4 shows reconstructions of the external animal features derived from the preserved material.



Text-Figure 4: Reconstructions of the living animals of *Pedicularia morrisoni*, n. sp. Explanations in text.

Habitat and distribution

The type material of *Pedicularia morrisoni*, n. sp. was collected on a colony of "Green Lace Coral," *Stylaster brunneus* BOSCHMA, 1970, attached to an overhang at 30 meters south of North Rock, Admiralty Group, Lord Howe Island, offshore New South Wales, Australia, (31°21.345'S 150°04.328'E), in January 1997. The new species has so far only been reported once before, also from Lord Howe Island (COLEMAN, 2002). The identification of the brown *Stylaster* from that place as *Stylaster brunneus* is done according to CAIRNS (1991). The type locality of that species is New Caledonia, in reef environment (H. ZIBROWIUS, pers. comm. 2012).

Etymology

Named in honor of my friend HUGH MORRISON, of Perth, Western Australia. HUGH is a well-known conchologist and diver, whose spirited attitude has produced many new species of Mollusca, from many places all over the world.

Discussion

The family Pediculariinae is considered a sister group to the Ovulidae. There is an extensive fossil record, but only a few living genera. The number of known living species is rapidly rising in recent years, due to intensified research in deeper waters. The genus *Pedicularia* consists of about ten species, with wide distributions across the Indo-Pacific, the Atlantic, and the western coast of America. All of them live in close association with one or more types of stylasterine corals, from the tropics to the cold waters of Atlantic seamounts. Pediculariids are often referred to as "parasites," and the coral is traditionally addressed as the "host." However, the only discernible interaction between the coral and the mollusc is that depressions form on the hydroid colonies in places where the Pediculariid attached itself. As the Pediculariids do not feed on the polyps of the coral, but on the mucus they secrete, their biocoenosis is better described as commensalism (see also LILTVED, 1989, LORENZ & FEHSE, 2009).

The attachment of the shell to the coral is not permanent, as even animals with strongly modified shells are still able to move about.

Abbreviations

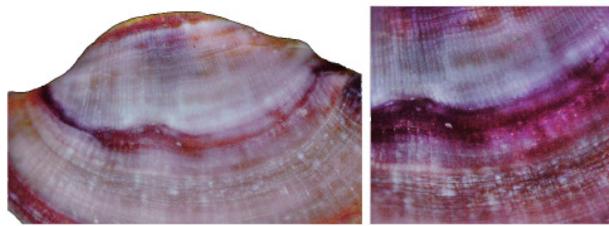
FL	Collection of FELIX LORENZ, Buseck, Germany
MAM	Collection of Dr. MICHAEL A. MONT, Owings Mills, Maryland, USA
MNHN	Museum National d'Histoire Naturelle, Paris, France
WAM	Western Australian Museum, Perth, Australia

Description

As the shell's characteristics change considerably during the life cycle of the animal, the following description is, therefore, based on all available specimens.

The female holotype and the female paratypes are large for the genus, with solid walls, and a calloused edge framing the marsupial girdle that encircles the shell. The early whorls of the male phase are finely cancellate, with regular, stronger transverse and finer, longitudinal striae, causing a dull appearance. There are several growth-lines on the early post-nuclear whorls.

The transition to the female phase is marked by a darker line below which the interstices between the transverse striae become twice as wide, while the longitudinal striae remain dense (See Text-Figures 2 and 3). This is also the point below which the shell no longer forms enrolled whorls, but forms an irregular, collar-shaped girdle. Dorsally, on the columellar side, the coarser striae of the girdle also cover a part of the earlier whorls and the protoconch, and appear more glossy than the rest of the shell's outside. There are two or more irregular depressions or grooves dorsally, above and on the girdle (well visible in paratype 2, Plate 1, Fig. 2).



Text-Figure 2: Details of the sculpture of *Pedicularia morrisoni*, n. sp. The purple band marks the transition from the male to female growth stage. Note that the striae are markedly coarser below the band. Scale: 1 mm.

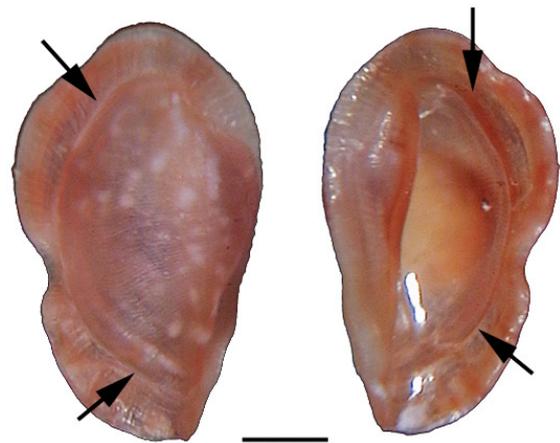
Inside, the shell shows a solid layer of glossy callus. There is a straight, smooth callus-ridge bordering the columella. In older females, this

structure is visible far inside the shell. There is no indication of teeth along the labral or the columellar part of the girdle. The female paratypes vary considerably in their outline as they adapt to the irregular surface of the stylasterine coral.

In the male phase, the smooth columellar ridge is already well-developed. A columellar shield is not found, but coarse striae extend across the base, onto the angular, outer margin and beyond towards one-third of the dorsum (Plate 1, Fig. 2, bottom middle and right). The labral margin is slightly thickened in the male shell, but there are no discernible denticles. The labrum remains visible as a ridge inside the aperture as the shell continues to grow (See Text-Figure 3).

The protoconch is completely hidden inside the shell in the females. Only in the male paratype 2 are there two whorls of it partly exposed. These show a cancellated sculpture, but not enough of it is visible to measure and characterize the protoconch in more detail.

The shell's ground color varies from a rich-orange to a saturate-purple. The earlier whorls are slightly paler purple to grey, and the growth lines are darker, causing concentric circles on dorsal view. There are darker zones running down from the transition of the male whorls to the edge of the girdle dorsally. The interior of the shell shows various shades of orange, brown, to rich purple.



Text-Figure 3: *Pedicularia morrisoni*, n. sp. Paratype 4. This specimen is a transitional stage between male and female. Note the internal ridge as reminiscent of the labrum of the male stage, and the transition from male to female growth stage (arrows). Scale: 1 mm.

The preserved animals allow only a limited characterization of their external features: both

A New Species of *Pedicularia* from Lord Howe Island (Gastropoda: Pediculariidae)

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With 5 Text-Figs and 2 Plates with 15 Figs

Keywords

Gastropoda, *Pedicularia morrisoni*, new species, Lord Howe Island, Australia, endemic, protandric hemaphrodite, *Stylaster brunneus*.

Abstract

The protandric hemaphrodite *Pedicularia morrisoni* n. sp. is described from Lord Howe Island, NSW, Australia. It lives as commensal on *Stylaster brunneus* and differs from its congeners by larger shell, and finer, cancellate dorsal sculpture, which abruptly decreases in density during the transition from male to female.

Zusammenfassung

Der protandrische Zwitter *Pedicularia morrisoni* n. sp. wird von der Lord Howe Insel, NSW, Australien, beschrieben. Die Art lebt kommensalisch auf *Stylaster brunneus* und unterscheidet sich von ihren Verwandten durch ein größeres Gehäuse sowie feinere, gefensterte Dorsalskulptur, deren Dichte während der Übergangsphase vom männlichen zum weiblichen Geschlecht abrupt abnimmt.

Introduction

Lord Howe Island lies isolated in the Tasman Sea, approximately 600 kilometers east of Sydney, New South Wales, Australia. It is of volcanic origin and estimated to be approximately 7 million years old. Situated in a subtropical environment, the island is a unique place in which organisms from cold water regularly meet with species from warmer conditions. Many endemic molluscs have developed in the shallow surrounding areas, and there is a great diversity of endemic flora and fauna on its approximately 15 square kilometers of land mass (RECHER & CLARK 1974, MCDUGALL et al. 1981).

In his book on the sealife of Lord Howe Island, NEVILLE COLEMAN (†2012) illustrated and briefly described a new species of *Pedicularia* living on the hydrozoan *Stylaster brunneus* BOSCHMA, 1970 (COLMAN, 2001: 37). Although he reported the species as "common to area," no specimens were ever available for study. Only recently, HUGH MORRISON of Perth discovered a small glass tube

with this spectacular Pediculariid in a shell collection. It is described in the following.

Pedicularia morrisoni n. sp.

Material and methods

Six live-collected specimens (maximum lengths are given):

Holotype (female) 9.7 mm, collection WAM # S80380

Paratype 1 (female) 10.5 mm, collection FL

Paratype 2 (male) 5.1 mm, collection FL

Paratype 3 (female) 7.0 mm, coll. MNHN #25672

Paratype 4 (transitional) 5.4 mm, collection WAM # S80381

Paratype 5 (female) 8.0 mm, collection MAM

According to the collection label, all specimens were taken with a colony of their stylasterine host in January of 1997. A fragment of the host coral accompanied the sample (Text-Fig. 1). The shells, with their animals inside, had been stored in ethanol.



Text-Figure 1: A fragment from a colony of *Stylaster brunneus* BOSCHMA, 1970 with the holotype of *Pedicularia morrisoni*, n. sp. Scale: 4 mm.

The animals were rinsed in distilled water for two hours, and removed from the shells to examine their external features. Radulae have not been extracted and remain available for further study.

Conchylia

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