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Description of *Nassarius berniceae* (Mollusca: Gastropoda: Nassariidae): a new species of shallow water whelk endemic to the Kermadec Islands

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Abstract

Nassarius berniceae is described as a new species based on material collected during the 2011 Kermadec Biodiscovery Expedition. It is endemic to the Kermadec Islands and one of only two species of shallow water (less than 50 m in depth) nassariid whelks occurring at these remote southwestern Pacific islands. Its affinities appear to lie with *N. albomaculatus* Rehder, 1980, a Polynesian endemic species, rather than with *N. gaudiosus* (Hinds, 1844), which is the name used for it in previous works on the Kermadec Islands molluscs, but that name relates to a different, widespread Indo-Pacific species.

Keywords

Mollusca; Gastropoda; Nassariidae; *Nassarius*; new species; Kermadec Islands; biogeography.

INTRODUCTION

During the 2011 Kermadec Biodiscovery Expedition, two species of scavenging whelks were caught in baited traps. One of these was *Nassarius spiratus* (A. Adams, 1852) and the other was the species called *N. gaudiosus* (Hinds, 1844) in previous works on marine molluscs from those islands (Cernohorsky 1984; Brook & Marshall 1998). Some specimens of this latter species were sent to the senior author for determination and were immediately recognised by him as a new species. They are formally described here (as *Nassarius berniceae*) and compared with similar nassariid species from the Indo-Pacific Ocean, particularly the true *N. gaudiosus*. *Nassarius berniceae* is the first and, as far as is possible to tell at present, the only species of nassariid endemic to the Kermadec Islands.

The family Nassariidae (popularly known as dogwhelks, mudwhelks or mudsnails) are buccinoidean gastropods specialised for scavenging carrion or, less frequently, for carnivory (e.g. Loch 1977) or, remarkably, even for herbivory in one species (e.g. Giannotti & McGlathery 2001). Besides general buccinoidean characters, nassariids have the following set of unique characters (summarised from Boss (1982) and from Cernohorsky (1984)). There is a large foot

that is somewhat narrowed and pointed behind with a pair of postero-dorsal metapodial tentacles (or rarely a single tentacle). The mantle edge forms a long, highly extensible and flexible siphon anteriorly. The proboscis is very long and pleurembolic, and has a distal buccal cavity. The operculum is triangular, its apex is subcentral and the edges are serrated. The radula is multidenticulate and stenoglossan, with a formula of 1.1.1; the central tooth being large, concave anteriorly and multicusped, and dimorphic in some species; the lateral teeth possess two unusual rather prong-like pointed cusps, the outer one the longer. An accessory plate of unknown homology and function is often present inside the lateral tooth on each side but it is lacking in some species. The family dates to the Paleocene where *Desorinassa* evolved from a buccinid ancestor (Cernohorsky 1984). Today the family is worldwide, with the majority of species (several hundred) occurring in the tropical Indo-Pacific Ocean.

Many species of nassariids have planktotrophic larvae (as deduced from the multiwhorled protoconchs) and the Indo-Pacific species have traditionally been interpreted as possessing enormous ranges (e.g. Cernohorsky 1984), but recent studies are showing some of them are actually complexes of morphologically similar species, each with a far smaller geographic range (Cernohorsky 1992; Kool & Dekker 2006; 2007).

This work is dedicated to the malacologist Walter O. Cernohorsky (30 June 1927 – 23 September 2014).

The genus *Nassarius* contains species with moderately large shells with determinate growth; with convex whorls that are sculptured with axial ribs and occasionally spiral threads and nodules at the suture; the columella is calloused and moderately or (occasionally) greatly expanded laterally; the outer lip is denticulate, either marginally or internally; the inner margin of the aperture is strongly plicate; and the siphonal and (generally also) anal canals are prominent. The operculum is usually serrated marginally. The central tooth of the radula is multicuspid; the lateral teeth consist of two prong-like cusps; and an accessory lateral plate is present.

As part of a regional monograph, Cernohorsky (1981) documented the Recent and Tertiary nassariid fauna of mainland New Zealand (i.e. excluding the Kermadec Islands) and included three Recent species – *Nassarius aoteanus* Finlay, 1926, *N. ephamillus* (Watson, 1882) and *N. spiratus* (A. Adams, 1852). The former species is endemic, *N. ephamillus* occurs in water deeper than 150 m, and the latter species only occurs at the far north of the North Island. Another species, *N. burchardi* (Dunker in Philippi, 1849), originally endemic to temperate southern Australia, has recently become established in harbours in the northern North Island (Townsend *et al.* 2010), probably as the result of shipping, but it is too soon to decide if it will become naturalised or not. The Recent nassariid fauna of the Kermadec Islands has been documented by Cernohorsky (1978a; 1984) and Brook & Marshall (1998) and listed by Spencer *et al.* (2012). It includes four species – *Nassarius spiratus*, *N. gaudiosus* (Hinds, 1844), *N. nodifer* (Powys, 1835) and *N. himeroessa* (Melvill & Standen, 1903). The former two species live in water shallower than 50 m, whilst the latter two species live in water deeper than 100 m. The 2011 Kermadec Biodiscovery Expedition collected live individuals of the two shallow water species (Keable & Reid 2015: 300; A. Reid pers. comm.).

Material and Methods

The majority of individuals of the new nassariid species were caught in traps for invertebrates baited with frozen pilchards that were set overnight. Fifteen specimens were taken by hand and two were taken by airlift on SCUBA. Shells, opercula and penes were examined with a SZH stereo dissecting microscope and drawings were made with a camera lucida attached to this microscope. Opercula were photographed with a Dino-lite digital microscope. Radulae (five in total) were photographed with a scanning electron microscope (i.e. a Zeiss Evo LS15 using a Robinson Backscatter Detector at AM, or a Jeol JSM-5610LV scanning electron microscope at CDU).

Institutional Abbreviations

AM Australian Museum, Sydney, Australia.
 AIM Tamaki Paenga Hira, Auckland Museum, Auckland, New Zealand.
 CDU Charles Darwin University, Darwin, Australia.
 NTM Museum and Art Gallery of the Northern Territory, Darwin, Australia.
 TMAG Tasmanian Museum and Art Gallery, Hobart, Australia.

SYSTEMATICS

Genus *Nassarius* Duméril, 1806. Type species, by subsequent monotypy (of Forriep 1806), *Buccinum arcularia* Linnaeus, 1758. Recent, Indo-Pacific Ocean. Genus masculine.

Nassarius berniceae n. sp. (Figs 1–4, 9–13)

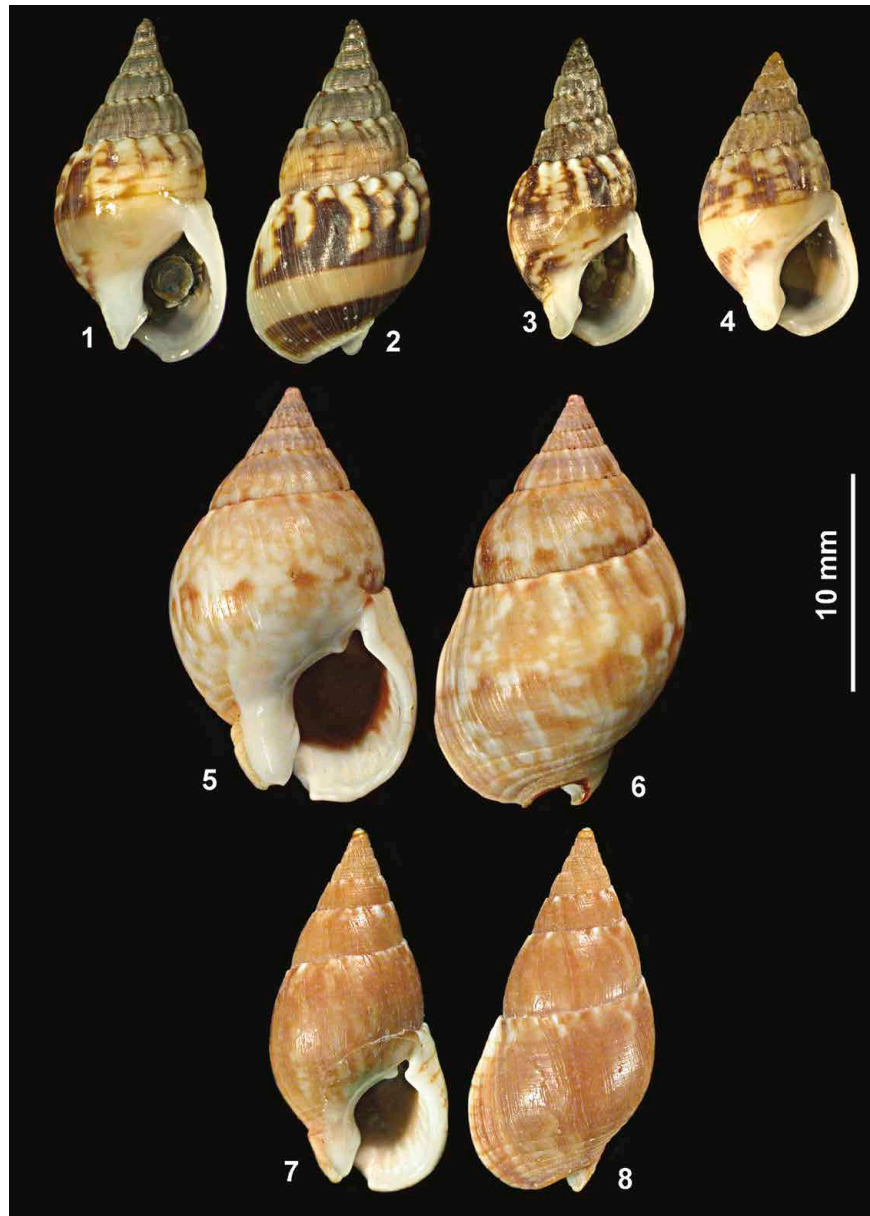
Material examined

Holotype – (Figs 1, 2), AIM MA73396, 20 m, Boat Cove, Raoul Island, Kermadec Islands, 15–16 May 2011 (29.2799°S, 177.8962°W), Kermadec Biodiscovery Expedition station K-2011-33. Shell length 15.8 mm, shell width 8.0 mm, height of aperture 6.2 mm.

Paratypes – (Figs 3, 4), AM C.471149, 10 specimens (2 on scanning electron microscope stub number 5873), 50 m, Boat Cove, Raoul Island, Kermadec Islands, 15–16 May 2011 (29.2872°S, 177.8990°W); AIM MA73397, 10 specimens, 50 m, Boat Cove, Raoul Island, Kermadec Islands, 15–16 May 2011 (29.2872°S, 177.8990°W), Kermadec Biodiscovery Expedition station K-2011-35; NTM P.48813, 7 specimens, same data as holotype.

Additional (Non-Type) material (Historical) – AM C.36670, 8 specimens, Raoul Island, Kermadec Islands, coll. T. Iredale and R. Bell, ca. 1908–1910; AM unregistered, 3 specimens, Raoul Island, Kermadec Islands, coll. W. R. B. Oliver, ca. 1908–1910; AIM AK28109, 3 specimens, Sunday Island, Kermadec Islands, coll. R. S. Bell, no date; AIM AK94611, 5 specimens, Oneraki Beach, Raoul Island, Kermadec Islands, coll. M. S. Morley & G. Stace, May 1995 (29.25°S, 177.913°W); AIM AK98278, 11 specimens, Sunday Island, Kermadec Islands, coll. C. A. Fleming, ca. 1960; AIM AK116249, 3 specimens, Kermadec Islands, no collector or date.

Additional (Non-Type) material (2011 Kermadec Biodiscovery Expedition) – AM C.471148, 2 specimens (both on scanning electron microscope stub number 5861), 12–20 m, western side of L'Esperance Rock, Kermadec Islands, 26 May 2011 (31.3542°S, 178.8267°W), Kermadec Biodiscovery Expedition station K-2011-99-6; AM C.475970, 14 specimens, 50 m, Boat Cove, Raoul Island, Kermadec Islands, 15–16 May 2011 (29.2872°S, 177.8990°W), Kermadec Biodiscovery Expedition station K-2011-35; AM C.475971, 2 specimens, 21 m, Macauley Island, Kermadec Islands, 21 May 2011 (30.2278°S, 178.4389°W), Kermadec Biodiscovery Expedition station K-2011-70-3; AM C.475972, 1 specimen, 10 m, western side of North Chanter Islands, Herald Islands, Kermadec Islands, 16 May 2011 (29.2517°S, 177.8558°W), Kermadec Biodiscovery Expedition station K-2011-42-6; AM C.475973, 1 specimen, 12–20 m, western side of L'Esperance Rock, Kermadec Islands, 26 May 2011 (31.3542°S, 178.8267°W), Kermadec Biodiscovery Expedition station K-2011-99-6; AIM MA30361, 10 specimens, 50 m, Boat Cove, Raoul Island, Kermadec Islands, 15–16 May 2011 (29.2872°S, 177.8990°W), Kermadec Biodiscovery Expedition station K-2011-35;



Figures 1 and 2. *Nassarius berniceae* n. sp. Holotype AIM MA73396. Shell length 15.8 mm.

Figure 3. *Nassarius berniceae* n. sp. Paratype AM C.471149 Specimen 3. Shell length 14.4 mm.

Figure 4. *Nassarius berniceae* n. sp. Paratype AM C.471149 Specimen 4. Shell length 13.3 mm.

Figures 5 and 6. *Nassarius gaudiosus* AM C.13805 Lord Howe Island, c. 1903. Shell length 19.4 mm.

Figures 7 and 8. *Nassarius reeveanus* AM C.74829 Siassi Island, Papua New Guinea, October 1966. Shell length 17.0 mm.

AIM MA30362, 3 specimens, 10 m, western side of North Chanter Islands, Herald Islands, Kermadec Islands, 16 May 2011 (29.2517°S, 177.8558°W), Kermadec Biodiscovery Expedition station K-2011-42-5; AIM MA30363, 7 specimens, same data as holotype; AIM MA30364, 1 specimen, 20 m, Boat Cove, Raoul Island, Kermadec Islands, 15–16 May 2011 (29.2781°S, 177.8946°W), Kermadec Biodiscovery Expedition station K-2011-34; AIM MA30365, 8 specimens, 12–20 m, western side of L'Esperance Rock, Kermadec Islands, 26 May 2011 (31.3542°S, 178.8267°W), Kermadec Biodiscovery Expedition station K-2011-99-6.

DESCRIPTION

Shell (Figs 1–4) up to 15 mm in length, elongate-ovate, light in weight, relatively thin-shelled for genus. Spire relatively high for genus – spire height ca. 1.3 times aperture length; straight-sided. Protoconch of 3.5–4, shining, smooth (actually microscopically pitted; see Fig. 11), evenly convex whorls; final whorl strongly carinate. Teleoconch of 4.25–4.5 whorls; upper whorls and penultimate whorl evenly convex; body whorl straight-sided adapically; whorls evenly rounded (never concave) anterior to suture; suture moderately indented.

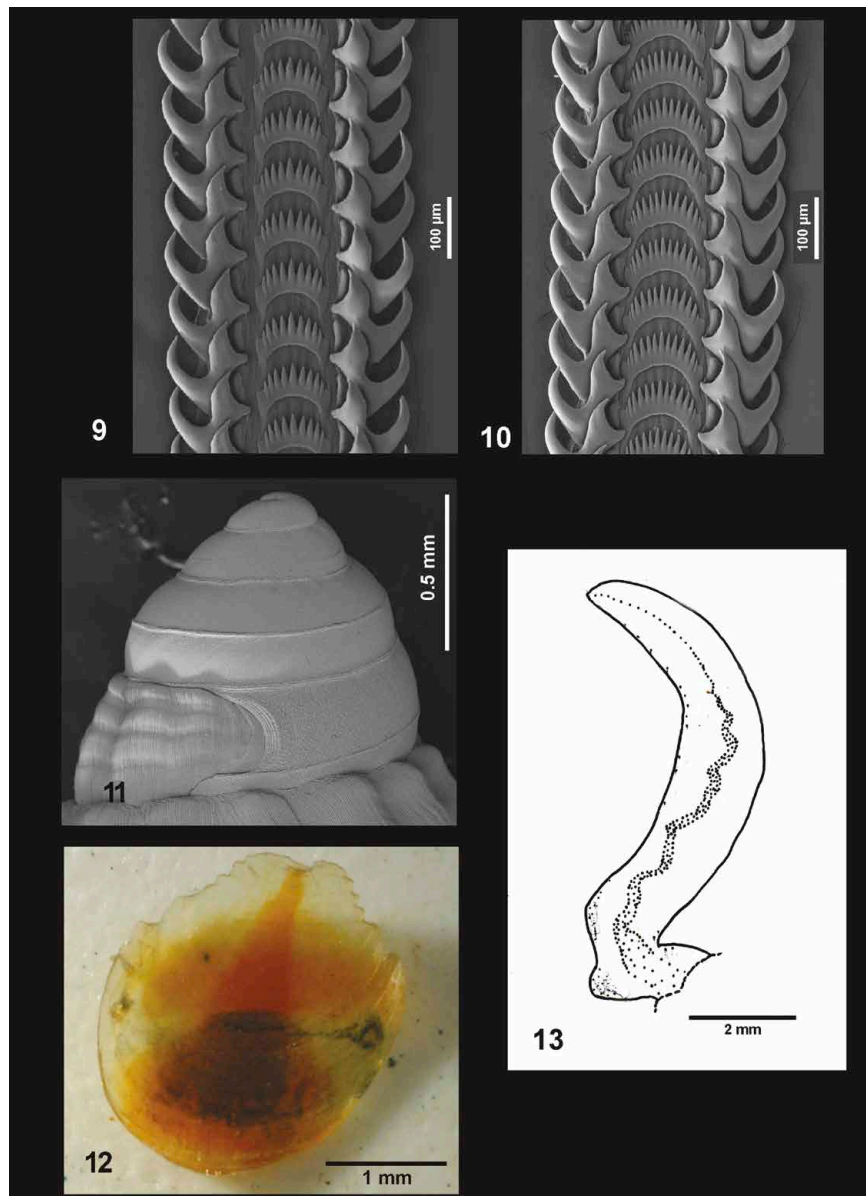


Figure 9. *Nassarius berniceae* n. sp. Radula (male) Paratype AM C.471149 specimen 1.

Figure 10. *Nassarius berniceae* n. sp. Radula (female) Paratype AM C.471149 specimen 2.

Figure 11. *Nassarius berniceae* n. sp. Protoconch AM C.471148.

Figure 12. *Nassarius berniceae* n. sp. Operculum NTM P.48813.

Figure 13. *Nassarius berniceae* n. sp. Penis, *in situ*, detail, dorsal view NTM P.48813.

Axial sculpture consisting of 17–22 broad (i.e. wider than interspaces), gently curved ribs of equal strength on spire whorls and persisting at least to penultimate whorl; ribs greatly reduced on body whorl, becoming almost obsolete; fine, crowded axial threads present on all whorls giving satiny appearance externally. Body whorl smooth abapically, with short, rather weak riblets on adapical third to quarter. Spiral sculpture consisting of 4–5 broad (i.e. twice width of intervening grooves), flat-topped, overriding spiral cords on upper teleoconch whorls, becoming obsolete on latter whorls. Abapical section (base) of body whorl completely smooth, or with only very weak (visible only under

magnification), widely spaced, shallow spiral grooves. Siphonal fasciole smooth, delimited from base of body whorl by narrow, sharp, raised keel. Outer lip of adult shell thickened by strong varix. Aperture quite wide, semicircular, broadest centrally; siphonal canal moderately deep. Outer lip thickened internally, with 12–14 short, low denticles in fully mature specimens; abaxial denticle longest and strongest; no (or only very weak) abaxial tubercle delimiting anal canal. Columella evenly curved, deeply convex, appearing smooth apart from single basal fold. Columella callus prominent anteriorly but only glazed above parietal wall, adhering to columella throughout its length.

Colour of protoconch uniform, dark chocolate-purple. Teleoconch rather constant in colouration: upper whorls uniformly grey-brown with pale subsutural zone; penultimate whorl brown with pale maculations and prominent, broad, white subsutural zone with chestnut brown maculations on every second or third nodule; body whorl fawn to creamish white, with 2 prominent, broad, sharp-edged, chestnut-brown spiral bands – lower band immediately above siphonal fasciole narrower, most often uninterrupted but in occasional specimens interrupted with white maculations or streaks; and broader upper band extending over centre and shoulder of shell, always interrupted by irregular white spots that are evenly tessellated in occasional specimens. All of outer lip, base of columella and columella callus porcelain-white. Interior of outer lip (i.e. throat of shell) semi-transparent, permitting external pattern to be discerned. Siphonal fasciole white. Crest of fasciolar ridge with fine brown line in some individuals.

Head-foot of animal cream with numerous black speckles present on (all of) front edge of foot, dorsal metapodium, siphonal canal and tentacles, but speckles definitely not coalescing into bands on tentacles. Eyes conspicuous, black. Mantle margin unpigmented. Exterior of mantle lightly dusted with black in vicinity of gill and hypobranchial gland. Penis (Fig. 13) relatively large, elongate, dorso-ventrally flattened, straight-sided, gradually tapering to pointed tip, uniformly cream in colour.

Operculum (Fig. 12) roughly triangular, apex subcentral, anterior-facing margin (when foot is extended) circular, posterior-facing margins (when foot is extended) strongly serrated (in all specimens examined), golden brown with dark apricot flush centrally and strong dark apricot streak extending from central area to apex.

Radula (Figs 9, 10) multidentulate and stenoglossan (i.e. 3 teeth per row), consisting of 51, 44 and 43 rows of teeth in 3 individuals counted. Central tooth large, narrow, strongly arched, with numerous long, sharp-pointed, even denticles on front edge; number of denticles gender-dependent, with consistently more denticles in females (15) than males (11–12). Lateral teeth with 2 sharp-pointed cusps, outer cusp longer and narrower than inner cusp. Triangular accessory plate interposed between central and lateral teeth, partially overlapping base of central tooth.

ETYMOLOGY

This species is dedicated to Bernice Beechey, wife of the junior author, in recognition of her long support of malacology.

REMARKS

The distinctive characters of *Nassarius berniceae* are its straight-sided spire consisting of evenly convex whorls, great reduction of axial ribs on the body whorl, absence of an abaxial tubercle on the outer lip, absence of a parietal tubercle (resulting in no delimitation of

an anal canal at the top of the aperture whatsoever), dark chocolate-purple protoconch, broad brown spiral bands on the body whorl and vivid apricot pattern on its operculum. Its spire varies in height (Figs 3, 4) and the white maculations on the upper band can be large or small and separated or confluent.

In addition to the type locality of Raoul Island, specimens of *Nassarius berniceae* were taken at North Chanter Islands, Macauley Island and l'Esperence Rock during the 2011 Kermadec Biodiscovery Expedition. Depths ranged from 10–50 m. Thirty-three shells collected intertidally at the Kermadec Islands already existed in AM and AIM (see Material examined above); these specimens were collected on earlier expeditions to the Kermadec Islands – from just over a century ago to 1995.

Cernohorsky (1972; 1978a; 1978b; 1981; 1984; 1994) consistently employed subgeneric names to divide up the enormous genus that is *Nassarius*. However, these names certainly require reassessment under modern phylogenetic criteria to test their monophyly. *Telasco* H. & A. Adams, 1853 is one such controversial subgenus because, as Cernohorsky (1981: 113) himself admitted, it is “intermediate in shell characters” between two other subgenera, *Niotha* H. & A. Adams, 1853 and *Zeuxis* H. & A. Adams, 1853, and the present new species clearly demonstrates the problem with such arbitrary allocation to subgenera. Characters of *Telasco* possessed by *Nassarius berniceae* are its moderately small shell, combination of axial ribs and spiral cords on early teleoconch whorls, suppression of (both axial and spiral) sculpture on the body whorl, basally expanded columella callus, denticles inside the outer lip and accessory radular plate. However, its columella is smooth (versus denticulate in *Telasco*) and its aperture is moderately wide as in *Zeuxis* (versus moderately narrow in *Telasco*). In view of this uncertainty, we have decided not to allocate *Nassarius berniceae* to any subgenus.

The following comparisons are made with Indo-Pacific species of *Nassarius* presently classified in the subgenera *Telasco*, *Niotha* and *Zeuxis* that have a reasonably close morphological similarity to *N. berniceae*.

Nassarius gaudiosus (Figs 5, 6), the name by which this species was known in previous works on Kermadec Islands molluscs and under which it was represented in museum collections, is larger (to 22 mm shell length), squatter, thicker-shelled, with a concave spire, inflated and axially ribbed penultimate whorl which is concave anterior to the suture, smaller and narrower pink protoconch, relatively narrower aperture, narrower axial ribs, deeply incised spiral striae on the base of the body whorl, striae present on the columella fasciole, paler colouration overall without brown bands on the body whorl, a brown spot at the apex of the siphonal canal dorsally, much stronger and longer denticles inside the outer lip that qualify as true lirae, a prominent anal canal produced by the strong denticle at the top of the outer lip and the parietal tubercle, the anteriorly facing margin of the operculum (when the foot is extended) being almost straight (versus semicircular in *N. berniceae*, reflecting

the different shape of the shell's aperture), and a single orange-red streak running the length of the operculum. There are no authentic records of true *N. gaudiosus* from the Kermadec Islands.

Some individuals of the polymorphic *Nassarius reeveanus* (Dunker, 1847) (Figs 7, 8) recall *N. berniceae* in being brown-banded, but *N. reeveanus* is larger (to 26 mm shell length), thicker-shelled, with flat-sided to weakly convex whorls resulting in a regularly conical spire, much smaller, narrower and taller cream protoconch with a weaker carina. The first 2–3 teleoconch whorls have more numerous (8–10) and crisper spiral threads, much narrower axial ribs that become obsolete on the mid-spire whorls, crenulate suture, more persistent spiral striae (in some individuals the striae can be seen even on the body whorl, especially on the back of the outer lip), that are deeply incised on the base of the body whorl, striae present on the columella fasciole, paler colouration overall with a more intricate pattern, much stronger and longer denticles inside the outer lip that qualify as true lirae, a prominent anal canal produced by the strong denticle at the top of the outer lip and the parietal tubercle, and a uniformly brown operculum.

Nassarius limnaeiformis (Dunker, 1847) is larger (to 23 mm shell length), very solid and tumid with a large and long body whorl, the siphonal fasciole is slanted towards the aperture, the columella is denticulate along its entire length, the colour pattern is thickly marbled with the maculations separated by brown spiral lines, and many individuals have a narrow central spiral band on the body whorl consisting of dark brown and white spots.

Nassarius shackelfordi (Melville & Standen, 1896) is similar-sized (to 14 mm shell length), glossy, almost completely smooth with only a few, obsolete spiral grooves on the top of the spire whorls and at the base, the columella is plicate only at the base and the background is white ornamented with zig-zag axial lines and dark brown blotches at the suture.

The sympatric *Nassarius nodifer* is much larger (to 35 mm shell length) and more solid. The early teleoconch whorls possess a weakly indented, presutural groove which gives rise to a row of nodules on the mid-teleoconch whorls. These nodules, however, become obsolete on the latter teleoconch whorls and are absent on the body whorl. The base of the body whorl has 4–5 strong, corrugated, spiral cords and the shell is cream to fawn, usually ornamented with a narrow, nebulous, white band and broader brown bands on the body whorl.

The sympatric *Nassarius himeroessa* is much smaller (to 7 mm shell length), elongate-ovate, sculptured with numerous fine, slender axial riblets, and is uniformly white in colour.

Nassarius comptus (A. Adams, 1852) is larger (to 28 mm shell length), shiny-shelled, white to fawn in colour, ornamented with orange-brown axial streaks and occasionally 2–3 nebulous, interrupted, white bands on the body whorl, and in some individuals brown spots at the suture.

Nassarius algidus (Reeve 1853) is larger (to 25 mm shell length), shiny-shelled, has a paucispiral protoconch of only 1.75–2 whorls, nodulose suture, is white in

colour, ornamented with reddish brown axial streaks which are interrupted by a single white band on the spire whorls and 2 such bands on the body whorl, forming 3 rows of quadrate white spots.

The sympatric *Nassarius spiratus* is larger (to 25 mm shell length), the suture of the last 3 whorls is tabulate, the aperture is smooth and without denticles, the colour is cream, ornamented with irregular, short, reddish brown lines and arrow-shaped markings and short axial streaks at the suture, the first 1–2 teleoconch whorls are flushed with violet or pale purple.

Nassarius albomaculatus Rehder, 1980 is similar in size (to 17 mm shell length) and shape to *N. berniceae*. It has microscopic, crowded axial striae on the shell, there is no columella callus shield, and the colour is brown with large, irregular, white maculations and a distinctive narrow subsutural band of dark reddish brown and white spots.

This last species is, in our opinion, most closely related to *N. berniceae* because both share numerous morphological characters. Whilst some are negative gain characters (Mikkelsen 1998), several of these are synapomorphies and so are phylogenetically significant. Both species: (a) attain a similar adult size; (b) have a similar shell shape; (c) have a similar number of protoconch whorls; (d) lack an anal canal (i.e. there is neither a denticle on the adapical section of the outer lip nor a corresponding parietal tubercle that together form an anal canal); (e) have the columella shield represented adapically merely by a glaze on the parietal wall; (f) lack axial ribs on the body whorl; (g) possess numerous fine, crowded axial threads; (h) lack spiral striae on both the base of the body whorl and the columella fasciole; (i) have only short denticles within the outer lip; and (j) share a pattern of large white maculations on a dark background on the body whorl. *Nassarius albomaculatus* is endemic to Polynesia. It was described from Easter Island (= Isla de Pascua) (Rehder 1980) some 6,500 km due east of the Kermadec Islands. It was subsequently found at Rapa Island, Austral Islands (Cernohorsky 1984; Tröndle & Boutet 2009), even further to the west. All these islands lie at almost the same latitude (30° S) in the southern Pacific Ocean and receive dispersive stages via the eastward-flowing current forming the southern leg of the circum-Pacific oceanic gyre that flows most strongly at this latitude (Willan & Perkins 2011). The Kermadec and Easter Islands already have some documented faunal connections; for example, the shallow water pomacentrid fish *Chrysiptera rapanui* (Greenfield & Hensley, 1970) occurs only at these islands (Allen 1991). So similar biogeographic patterns should now be searched for amongst other marine organisms between these far-flung islands.

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REFERENCES

- Allen, G.R. 1991. *Damselfishes of the World*. Mergus Publishers, Melle, Germany. 271 pp.
- Boss, K.J. 1982. Mollusca. Pp. 1092–1166, in: Parker, S.P. (ed.) *Synopsis and Classification of Living Organisms. Volume 2*. McGraw-Hill Book Company, New York.
- Brook, F.J. and B.A. Marshall 1998. Appendix: Checklist of benthic coastal marine chitons, bivalves, gastropods and cephalopods of the northern Kermadec Islands. Pp. 210–233, in: Brook, F.J. (ed.) *The coastal molluscan fauna of the northern Kermadec Islands, southwest Pacific Ocean*. *Journal of the Royal Society of New Zealand* 28: 185–233.
- Cernohorsky, W.O. 1972. *Marine shells of the Pacific. Volume 2*. Pacific Publications, Sydney. 411 pp.
- Cernohorsky, W.O. 1978a. New records of neogastropod Mollusca from the Kermadec Islands. *Records of the Auckland Institute and Museum* 15: 55–65.
- Cernohorsky, W.O. 1978b. *Tropical Pacific marine shells*. Pacific Publications. Sydney. 352 pp.
- Cernohorsky, W.O. 1981. Revision of the Australian and New Zealand Tertiary and Recent species of the family Nassariidae (Mollusca: Gastropoda). *Records of the Auckland Institute and Museum* 18: 137–192.
- Cernohorsky, W.O. 1984. Systematics of the family Nassariidae (Mollusca: Gastropoda). *Bulletin of the Auckland Institute and Museum* 14: i–iv + 1–356.
- Cernohorsky, W.O. 1994. Description of new species of Nassariidae (Mollusca, Neogastropoda) from the Pacific Ocean. *Bulletin du Muséum National d'Histoire Naturelle, Paris, série 4, section A* 14: 69–74.
- Giannotti, A.L. and K.J. McGlathery 2001. Consumption of *Ulva lactuca* (Chlorophyta) by the omnivorous mud snail *Ilyanassa obsoleta* (Say). *Journal of Phycology* 37: 209–215.
- Keable, S. and A.M. Reid 2015. Marine invertebrates collected during the Kermadec Biodiscovery Expedition 2011. *Bulletin of the Auckland Museum* 20: 263–310. <http://www.aucklandmuseum.com/research/pub/bulletin/20/11>.
- Kool, H.H. and H. Dekker 2006. Review of the *Nassarius pauper* (Gould, 1850) complex (Gastropoda: Nassariidae). Part 1, with the description of four new species from the Indo-West-Pacific. *Visaya* 1(6): 54–75.
- Kool, H.H. and H. Dekker 2007. Review of the *Nassarius pauper* (Gould, 1850) complex (Gastropoda: Nassariidae). Part 2, the Western Indian Ocean species, with the description of two new species and introducing a nomen novum. *Visaya* 2(2): 62–69.
- Loch, I. 1977. Predatory nassariids. *Australian Shell News* 20: 3.
- Mikklesen, P.M. 1998. Review of shell reduction and loss in traditional and phylogenetic molluscan systematics, with experimental manipulation of a negative gain character. *American Malacological Bulletin* 14: 201–218.
- Rehder, H.A. 1980. The marine mollusks of Easter Island (Isla de Pascua) and Sala y Gómez. *Smithsonian Contributions to Zoology* 289: 1–167.
- Spencer, H.G., R.C. Willan, B.A. Marshall and T.J. Murray 2012. *Checklist of the Recent Mollusca recorded from the New Zealand Exclusive Economic Zone*. Internet publication. <http://www.molluscs.otago.ac.nz/> [31 May 2012].
- Townsend, M., B.A. Marshall and B.L. Greenfield 2010. First records of the Australian dog whelk, *Nassarius (Plicarcularia) burchardi* (Dunker in Philippi 1849) (Mollusca: Gastropoda) from New Zealand. *New Zealand Journal of Marine and Freshwater Research* 44: 343–348.
- Tröndle, J. and M. Boutet 2009. Inventory of marine molluscs of French Polynesia. *Atoll Research Bulletin* 570: 1–87.
- Willan, R.C. and A. Perkins 2011. “Tropical” marine species newly recorded from northern mainland New Zealand: one damselfish and three sea slugs. Pp. 79–86, Figs 3–12. in: Kuric, A., M. Coutts and M. Radjainia (eds) *Behind the Bubble Curtain: Auckland University Underwater Club 50th Anniversary Book*. Auckland University Underwater Club. Auckland, New Zealand. 96 pp.

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