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New records of Rissoidae for the Hellenic Seas with the description of *Rissoa electrae* n. sp.
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Ô, MER NUL NE CONNAÎT TES RICHESSES INTIMES
TANT VOUS ÊTES JALOUX DE GARDER VOS SECRETS

Charles Baudelaire, "L'Homme et la Mer"
Les Fleurs du Mal, 1857

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Variability and geographical distribution of *Darioconus lohri* (Kilburn, 1972)

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The taxon *Conus lohri* Kilburn 1972 was published in *Annals of the Natal Museum* 21 (2): p. 428, figs 8a & 14b – d, indicating as a synonym *Conus consors* (*non* Sowerby), Tomlin, 1931: 441.

The original description is as follows:

Rather narrowly conical, sides of body whorl almost straight; spire low and obtusely rounded, except for the rather depressed, mucronate apex; spire whorls gently convex. Greatest width of shell just below shoulder. Young specimens show traces of microscopic spiral striae on the spire and over most of the body whorl, but in the adult there are no longer visible, save for very faint indications of striae on the base of the body whorl; growth lines rather distinct, particularly on the shoulder slope. Base slightly twisted, forming a fasciolar swelling towards the base of the labium. Aperture becoming steadily wider towards

Radula (terminology after Nybbaken, 1970): Shaft of each tooth very slender and markedly curved, but rather flexible; canal closed. Base without a lateral spur, but the shaft shows a small basally-directed cusp just above the very slight indication of a waist, followed by a double row of small serrations, which extend as far as the distal opening of the median duct. Tip with a single barb and a low blade, which has a barb-like ending. Although proportionally much longer and more slender, there is a very marked resemblance to the radula of *Conus virgo* Linn., as figured by Peile (1939: text-fig. 12), except that the latter shows a basal spur to be present, and the row of serrations to be single. However in an example of *virgo* examined Bazaruto Island the spur is in fact absent and the serrations show a tendency towards splitting into two series, just as in *lohri*. Kohn (1959: 316) reported that *C. virgo* was vermivorous. Unfortunately the stomach of the holotype of *lohri* only contained an amorphous pink mass, which could not be identified.

Shell dimensions: 40.2 x 23.4 mm (holotype); 63 x 35.5 mm, 56.9 x 31.3 mm, 44.4 x 24.4 mm (paratypes).

Comparative remarks: Although there is nothing striking about the present species, it displays a combination of characters which clearly set it apart from its congeners. It has been officially recorded as *Conus consors* Sowerby, 1833, which it does resemble in some respects, but from which *lohri* differs in its blunter shoulder, more obtuse spire, mucronate apex, and smooth, convex shoulder slope, this area being markedly concave and distinctly striate in *consors*. *Conus ochroleucus* Gmelin, 1791, also approaches *lohri* to some extent in general form, apertural characters and basic colour pattern, but differs in the presence of conspicuous basal grooves, and in its narrower proportions, more conical spire and striate shoulder slope. The only other species with which comparison is warranted is *Conus virgo* Linn., 1758, which possesses a radula of very similar basic structure; however, the two differ widely in shell shape, coloration and sculpture.

Distribution: Hibberdene on the Natal south coast to Baía dos Cocos in Moçambique. Type locality: Baía dos Cocos, between Inhambane and Jangamo Beach (about 24°S.), Moçambique. In addition to the type material, specimens from Clansthal and Hibberdene have been examined. The holotype was found on the inner side of an exposed reef, in 2–3 m of water on a flat rocky ledge covered in algal turf. It was collected by Mr. M. Lohr of Alberton, in whose honour it is named.

Type material: All type material is deposited in the Natal Museum. It is composed as follows:

Holotype (F8701; T1634, radula slide 100); Baía dos Cocos, living; ♀; leg. M. Lohr, December, 1971.

Paratype 1 (3309; T1637); Scottburgh; live-taken; H. C. Burnup coll., don. 25/IV/1921, leg. H. Mullens

Paratype 2 (5094; T1636); Umkomaas, dead; W. Falcon coll.

Paratype 3 (5092; T1635); Scottburgh, dead; Falcon coll.



Darioconus lohri (Kilburn, 1972)

Live taken, Machangulo Peninsula, Mozambique

the base, except where interrupted by the above-mentioned swelling. Anal sinus rather deep, forming a slightly L-shaped curve. Limits of protoconch not clear, probably 3 whorls; teleoconch whorls at least 7.

Ground colour brownish-orange, fading to orange-buff, body whorl often with two broad zones of darker transverse hair-lines, one zone occupying the base, the other lying around the middle; shoulder slope with a series of rather irregular but predominantly arrowhead-shaped chestnut marks; aperture light violaceous, fading to flesh-colour.

Periostracum thin, close, rather smooth and opaque, colour dull brown. Operculum reduced, unguiculate, margins not serrated; apex broken off in only available example (holotype), but length of remainder 5.2 mm (length of aperture 36.3 mm).



Darioconus lohri (Kilburn, 1972)
Live animal from Machangulo Peninsula, Mozambique

Apart from the fact that the species was clearly uncommon to rare when first collected, a particularly curious aspect of this description is the choice of species with which the new one was compared, mainly in view of the lack of comparison with the one that actually appears to be the closest ones, *Darioconus pennaceus* Born, 1778. In his 2001 work, Filmer states "Nomenclatural status, an available name. Taxonomic status, a synonym (colour form) of *C. pennaceus* Born, 1778."



Holotype of *C. lohri* (after Filmer)

Jerry G. Walls, in his *Cone Shells – A Synopsis of the Living Conidae* (1978), considers *C. lohri* a valid species (albeit a possible synonym of *C. martensi* E. A. Smith, 1884), even though its treatment is in some respects a bit surprising:

Comparison: This species is so non-descript that it is difficult to compare it with anything. However, the color of the body whorl is closely matched by some specimens of *Conus hyaena*, a species which sometimes shows similar brownish triangular spots on the shoulder as does *C. lohri*. However, *C. hyaena* is a much rougher cone with distinct (though irregular) body and spire sculpture, so the two are quite distinct. I can think of no other close relatives. *C. consors* is much more tapered in shape and has distinct nodules on the early whorls plus strong spiral sculpture on the other whorls.

Variation: This species still seems to be known mostly by the type series, so little is known of the amount of variation to be expected. It would seem that larger specimens become duller in color with the already faint bands becoming even fainter. The

sides of the body whorl may be more concave in larger specimens than in smaller ones.

Distribution: So far known only from shallow reefs of the northern Natal coast, South Africa, and the southern Mozambique coast. Perhaps not uncommon but so plain that it is ignored by collectors.

Synonymy: *C. martensi* was based on a single 24 mm specimen from the central Indian Ocean. In shape and the plain color it is very close to *C. lohri*; however, the description mentions the spire as being three-grooved, which would probably correspond to having two spiral ridges. In the *C. lohri* so far known (none less than 40 mm in length) the spiral sculpture is very weak or completely absent, although this could be a function of growth or erosion. Certainly it seems unusual for two species of plain yellowish or orange cones with weak sculpture and similar shape to be described from the southern and central Indian Ocean. Until juveniles of *C. lohri* are known, nothing further can be said.

Notes: The type series are not attractive cones, having heavy axial growth marks and eroded spires as well as damaged lips. Perhaps fresher specimens in good condition would be more attractive because of the bright orange or yellowish color, but the species has apparently not yet entered the market. It is, as mentioned earlier, possibly not rare, just ignored. I find it hard to believe the range is limited to the localities of the type series. As was often the case in the author's work, some of his statements are not adequately substantiated, and appear to be the result of some kind of faith. An example of this is the observation "it seems unusual for two species of plain yellowish or orange cones with weak sculpture and similar shape to be described from the southern and central Indian Ocean", which totally eschews any justification.

Seventeen years later, Dieter Röckel, Werner Korn and Alan Kohn published the first (and only) volume of their *Manual of Living Conidae* (1995), and in this well-known work, popularly referred to as "RKK", *C. lohri* is considered as a synonym of *C. pennaceus*.

When describing the latter, the following remarks referring to *C. lohri* are included:

"Periostracum greyish to brownish yellow, thin, translucent, and smooth; rather brown, thicker, less smooth, and opaque in form *lohri*. [...]"

In form *lohri*, animal white [as opposed to "dorsum of foot white, mottled with brown", in typical *C. pennaceus*] [...]. The colour photograph identified as *C. lohri* in Liltved and Millard (1989) seems to show an animal of the *C. planorbis/C. ferrugineus* complex. [...]

Form *lohri* with very similar radular teeth; serration of a double row of denticles terminating in a cusp (Kilburn, 1972). [...]

Habitat and Habits: [...] Form *lohri* reported from 30 m and deeper in Natal (Liltved & Millard, 1989); in S. Mozambique, this form in 2-20 m of water, on rocky ledges with algal turf (Kilburn, 1972; Ramalho, pers. comm., 1989). [...]

Specimens from Natal and S. Mozambique as far north as Inhambane were described as *C. lohri* (Pl. 63, Figs. 20-22) but cannot be separated from *C. pennaceus* from Bazaruto Is. and Massinga by shell morphology and sculpture, not do they differ from *C. pennaceus* in body colouration or structure of radular teeth. The report of a multispiral larval shell in *C. lohri* (Kilburn, 1972) appears doubtful. The ground colour is orangish brown to brown or greyish blue to greyish violet, and sometimes all these colours merge on the same shell. The last whorl often has a

broad darker spiral band on each side of centre and occasionally remnants of a brown to blackish brown pattern similar to that of form *bazarutensis*. The aperture is pale blue to pale violet, edged with a violet collabral band. The low spire has a sigmoid outline and a reddish violet to purple apex. The differences between *C. lohri* and *C. pennaceus* in colour, structure and translucency of the periostracum do not allow separation at the species level."

More recently (2018), in *A Taxonomic Iconography of Living Conidae* (vol. 2), Éric Monnier, Loïc Limpalaër, Alain Robin and Christophe Roux consider *Darioconus lohri* (Kilburn, 1972) as a valid species, separating it from *D. pennaceus* (Born, 1778); at the same time, the populations usually identified as *D. pennaceus bazarutensis* (Fernandes & Monteiro, 1988), one from Bazaruto Island, the other from mainland Mozambique (Inhambane Province) are separated, the former being treated as a valid species, *D. bazarutensis* (Fernandes & Monteiro, 1988), and the latter merged with *D. lohri*. The authors state the following: "This species has been described from specimens devoid of any pattern and originating from Southern Mozambique. Their ground colour varies from grey to deep pink or bright orange. Some have a few black streaks on the last whorl. Such shells are found together with more typical *D. pennaceus* shells and intergrades in southern Mozambique. Shells living along the southern continental coast of Mozambique cluster together in DNA phylogenies and are genetically distinct from the nearby *D. bazarutensis* (Pereira *et al.*, 2010). They are quite variable in colouration with a background varying from yellowish to grey through pink or orange. The pattern is dark reddish brown. Intergrades with typical *D. lohri* show a dissolving pattern."

These comments can be slightly confusing, since they simultaneously appear to separate *D. lohri* from both *D. pennaceus* and *D. bazarutensis* (Fernandes & Monteiro, 1988), but also to mention the existence of intergrades between *D. lohri* and *D. pennaceus*, while *D. bazarutensis* is genetically distinct, hence a valid separate species. This means that further enlightenment is needed on the relationship between these taxa. In their 2010 paper "Conus pennaceus: a phylogenetic analysis of the Mozambican molluscan complex" (*African Journal of Marine Science* 32(3)), Pereira *et al* in fact state that there is "a close genetic relationship between *C. lohri* and *C. pennaceus bazarutensis*"; the authors also suggest a number of different hypotheses to help explain the origin and dispersion of the species in the *pennaceus* group.

One possibly minor characteristic, which appears to differ between *D. lohri* and *D. p. bazarutensis* is the decoration of the spire. In *D. lohri*, the spire whorls are usually almost patternless, but present a number of arrow shaped dark brown markings along the suture (even in specimens whose body whorl is totally devoid of pattern); in *D. p. bazarutensis*, the pattern on the body whorl (even if quite sparse) usually extends to cover the whole spire, and does not form the characteristic arrow shaped markings along the suture.

Anyway, some facts can be established beyond any doubt, using the most recent data available:

D. lohri is found from Praia da Barra (23° 47' S), Inhambane Province, Southern Mozambique, to the southern coast of Kwazulu Natal (31° 04' S), South Africa, a range that extends for about 900 km along the eastern African coast. It is a rare species and recent collecting expeditions have shown that the population known from the Inhambane Province, usually of an orangish colour, which used to be the most numerous, appears to be close to extinction.

The orangish to pink Inhambane specimens are usually found

in shallow water, at low tide in depths of 2-8 m. In the Maputo Province, off Inhaca Island, on the other hand, orangish specimens were found in much deeper water, about 30 m, but they are very rare.

To the south of Inhaca Island, it is found along the coast, like at Inhambane, but slightly deeper, between 10 and 14 m. The coloration of these specimens begins to vary from grey to olive green, sometimes beige.

The species has not been found on the northern coast of the Natal Province, but it reappears further south, between Durban and Port Edward, always between 30 and 40 m deep. The specimens from this area are orangish or reddish, very rarely lemon yellow. Two forms occur in the area, the one that is present along the entire range of the species and a more elongated one that was named *D. natalaurantia* Veldsman, 2013. Its habitat is always in crevices in rocky slabs, or on rocks and blocs of dead coral.

In the description of *D. natalaurantia* (*Malacologia* III/2013, August, n. 80, p. 8-11), Stephan G. Veldsman states the following: "After 5 years of research on *Darioconus lohri* (Kilburn, 1972) [...] it became apparent that there are significant differences between the Mozambique shells and the KwaZulu-Natal shells, with a biogeographical gap between them. This has led to the description of a new species: *D. natalaurantia* nov. sp. The author agrees with Tenorio and Monteiro (2008) that *D. lohri* must be recognized as a full valid species and not a subspecies of *D. pennaceus* (Born, 1778). [...]"

The Holotype of *D. lohri* [...] was described from Baía dos Cocos [...], just south of Inhambane, Mozambique (Kilburn, 1972). After careful in-depth research of this species, it became apparent that the shells from southern KwaZulu-Natal, South Africa, are significantly different. The three Paratypes of *D. lohri* are in fact the new species and are used as the Holotype and two of the Paratypes for *D. natalaurantia* nov. sp. [...]"

Type locality and distribution: Type locality of the Holotype of *d. natalaurantia* nov. sp. is off the coast of Scottburgh (30° 17' S & 30° 35' E), KwaZulu-Natal, South Africa [...]. The distribution is southern KwaZulu-Natal, reported from Hibberdene, Pennington, Park Rynie, Scottburgh and Umkomaas. Shells were dived at depths ranging from 10-45 m and dredged at depths of 100 m.

Discussion: *D. natalaurantia* is closely related to *D. lohri* [...] from Mozambique. *D. natalaurantia* is on average a longer, more slender shell than *D. lohri*. The shoulder of *D. natalaurantia* is rounder and more convex than the broader, slightly concave edge of the shoulder of *D. lohri*. The body whorl side of *D. lohri* is straighter and more angular in relation to the shoulder than that of *D. natalaurantia*. There are also clear differences between the protoconch structure of the two species [...].

Some of the specimens in the Natal Museum, South Africa were dredged off Kosi river mouth at a depth of 45 m by the R. V. Meiring Naudé and dived at depths of 4-10 m off the coast of Kosi Bay. These specimens compare with *D. lohri* (D. Herbert, pers. comm. 2013).

There is a clear biogeographical gap (northern KwaZulu-Natal – between Durban and Kosi Bay) that separates the two species. This biogeographical gap is also evident in the *Callipara* (*Similiyria*) *queketti* (E. A. Smith, 1901), group of Volutes from south-eastern Africa, clearly separating the subgenus into several distinct species (Veldsman 2012). The genus *Marginella* shows the same trend, where most of the southern KwaZulu-Natal species do not occur at Kosi Bay and Mozambique.

As explained in the discussion, the main difference between *D. lohri* and *D. natalaurantia* lies in the general profile of the

shell, which is markedly more elongated in the latter (see pl. 4). However, some specimens found in South Africa present wider shells, as can be seen from this specimen collected at Park Rynie, South Africa, at a depth of 35 to 38 m."

In view of the morphological aspects listed above and also of the geographical distribution of the different populations considered, we would suggest that *D. lohri* is a valid species, with *D. natalaurantia* referring to its southernmost population (eventually with subspecific status). The question of merging the mainland populations heretofore labelled as *D. pennaceus bazarutensis*, with *D. lohri* is still open to some discussion, although its specimens can usually be easily separated from the true *D. bazarutensis* from Bazaruto Island, especially by anyone used to handling samples from both locations.



D. natalaurantia

Park Rynie, S. Kwazulu-Natal, South Africa

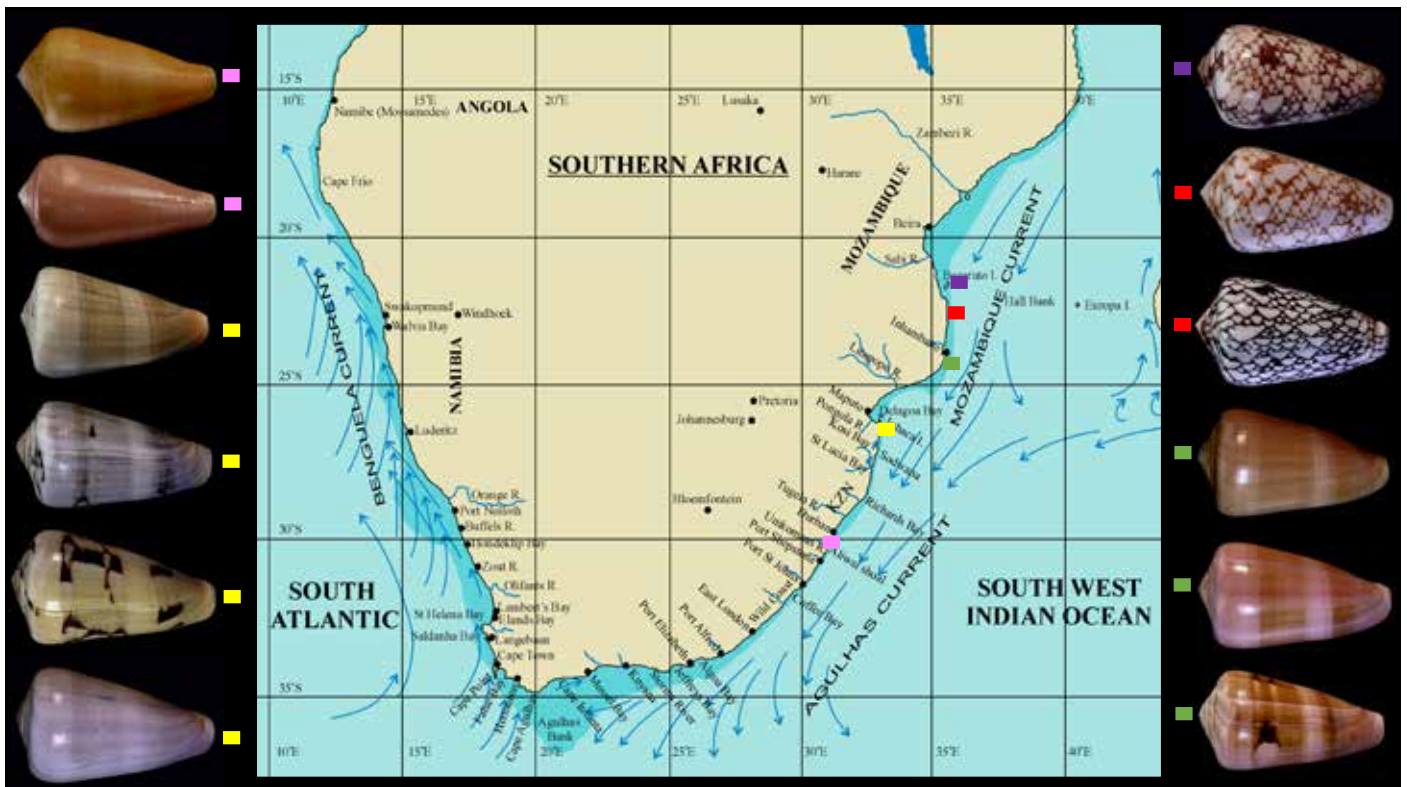




PLATE 1 - Inhambane Province

1-3, Correntes Cape, Inhambane Province

4-7, Ligogo, Inhambane Province



1



2



3



4



5



6



7



8





9



10



11



12



13.



PLATE 2 – Machangulo Peninsula

1-11, Machangulo Peninsula, open sea
12-13, Ponta Abril, Machangulo Peninsula



PLATE 3 – *D. natalaurantia*

Park Rynie, S. Kwazulu-Natal,
S. Africa (35-38 m)



PLATE 4 – *D. bazarutensis* (Bazaruto Is.)

PLATE 5 – *D. bazarutensis* (Inhambane)

Murrungulo, Inhambane Province



1



2



3



4



5



6



New records of Rissoidae (Mollusca: Gastropoda) for the Hellenic Seas with the description of *Rissoa electrae* n. sp.

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Keywords

Alvania, *Rissoa*, *Setia*, Greece, *Rissoa electrae* n. sp.,

Abstract

Among 18 recorded Rissoidae species belonging to 3 genera, 13 are new for the Hellenic Seas, while *Rissoa electrae* n. sp. is described from East Thermaikos Gulf (North Aegean Sea) based on twelve specimens found in two locations at depths of 0.2 m and 5.0 m. The new species is compared with similar species of the genus (*R. lilacina* Récluz, 1843, *R. similis* Scacchi, 1836, *R. splendida* Eichwald, 1830 and *R. violacea* Desmarest, 1814), from which it differs in many characters, including teleoconch micro and macro sculpture and animal colour. The laborious, diverse and very careful efforts for the collection of minute gastropod specimens are emphasized.

Résumé

Parmi les 18 espèces connues de Rissoidae, appartenant à 3 genres, 13 sont nouvelles pour les mers Helléniques, alors que *Rissoa electrae* n. sp. est décrite de l'Est du Golfe de Thermaikos (Nord de la mer Egée) sur la base de 12 spécimens trouvés en deux endroits à des profondeurs de 0.2 m et 5.0 m. La nouvelle espèce est comparée à des espèces semblables du même genre (*R. lilacina* Récluz, 1843, *R. similis* Scacchi, 1836, *R. splendida* Eichwald, 1830 et *R. violacea* Desmarest, 1814), desquelles elle diffère en de nombreux points, dont la teleoconque, les micro et macro sculptures et la couleur de l'animal. Les efforts laborieux, nombreux et très soigneux pour la collecte de minuscules spécimens de gastéropodes sont soulignés.

Introduction

Studies in the last decades have greatly increased the knowledge of Mediterranean species of the Rissoidae family with most species well illustrated (Verduin, 1976; 1983; 1984; 1985; 1986; 1988; Giannuzzi-Savelli *et al.*, 2002; Segers *et al.*, 2009; Cossignani & Ardevini, 2011; Gofas *et al.*, 2011; Scap-errotta *et al.*, 2012; 2013; 2014; 2015), while the Rissoidae of Azores, Canary Islands, Cape Verde Islands, Madeira and West Africa have been also studied (Moolenbeek & Rolán, 1988; Moolenbeek & Hoenselaar, 1989; Gofas, 1990; Moolenbeek

& Hoenselaar, 1998; Hoenselaar & Goud, 1998; Gofas, 1999) so that new species can be more easily identified. At the same time, the relevant malacofauna of Greece seems to be among bycatch and out of interest material. As our aim is the contribution to the research for the Hellenic molluscan biodiversity, the current study is focused on Rissoidae species with the description of a new one.

Methods

The sampling and handling of the specimens were conducted according to Manousis & Galinou-Mitsoudi (2014) from October 2008 to October 2018 in certain locations of Greece. In addition, we have applied: a. Soft brushing on holothurians, sea urchins and sponges either *in situ* or on live material brought temporarily to the surface in several localities and from various habitats, b. Sampling vertical substrates (e.g. poles, embankments) by means of a metal pole scraper connected to a 120 µm mesh nylon net, c. Keeping until examined and sorting out benthic material in cool sea water until photography of live specimens took place. Cooling of biological material in the sea water was achieved by means of a gel freeze ice pack under the examination vessel. The protoconch whorls were counted according to Verduin (1976), the protoconch's visible height was measured parallel to its axis, from the tip to the intersection of the larval scar and the teleoconch suture, while for the shell's slenderness (h/w) the outer lip of the aperture was included in the shell's width. The species recognition was based on systematic guides and atlases, faunistic and review articles and studies on the Mollusca fauna in the Hellenic seas. Information from specific web sites was also taken into account. More specifically, for the species nomenclature update, besides the Marine Biodiversity and Ecosystem Functioning EU Network of Excellence (MarBEF) (<http://www.marbef.org>.) and the World Register of Marine Species (WoRMS) (<http://www.marinespecies.org>.), the Taxonomic on-line Database on European Marine Mollusca (CLEMAM) (http://www.somali.asso.fr/clemam/biota_xis.php.) was also used. In addition, the Hellenic Network on Aquatic Invasive Species (ELNAIS) (<https://services.ath.hcmr.gr>.) and the Marine Mediterranean Invasive Alien Species database (MAMIAS) (<http://www.mamias>).

org. were used for the alien species status in the Hellenic and Mediterranean Seas. All previous referred web sites were accessed by April 2019. Records were compared with the checklist of Koukouras (2010). The specimens are deposited in the premises of the International University of Greece and those of Dr. T. Manousis, C. Kontadakis and G. Mbazios. Scientists are welcome to have access to the biological material for inspection by appointment.

Results

The records

In total, 18 species of the Rissoidae family were identified belonging to the genera *Alvania*, *Rissoa* and *Setia* with 6, 8 and 4 species respectively. 13 species are referred for the first time for the Hellenic fauna raising its documented Rissoidae gastropod biodiversity from 67 to 80 (19.4% increase). One of them is described as new species. All 1st and 2nd documented records from the Hellenic Seas are listed in Table 1 with collection data. A brief description of certain findings is given below whenever additional information is supportive to their identification. They are all presented in Figures 1 to 4.

Abbreviations: **BB** - Biogenic Bottom, **CEA** - Central and East Atlantic Ocean, **CEMS** - Central and East Mediterranean Sea, **CMS** - Central Mediterranean Sea, **Co** - Common, **CTM** - Collection Thanasis Manousis, **EMS** - East Mediterranean Sea, **EMS1** - First record for the East Mediterranean Sea, **G1/G2** - First or Second record for Greece, **Ktl** - Known from type locality, **MB** - Mixed Bottom, **MS** - Mediterranean Sea, **MS1** - First record for the Mediterranean Sea, **n. sp.** - new species, **Ra** - Rare, **Un** - Uncommon, **WCMS** - West and Central Mediterranean Sea, **WMS** - West Mediterranean Sea, **ZB** - *Zostera* bed.

Rissoa janusi (Nordsieck, 1972) (Fig. 2a).

One shell (1.50 mm long, 0.80 mm wide). Shell translucent, moderate convex whorls and conspicuous suture. Protoconch glossy, blunt, paucispiral, opaque white with brown its nucleus. Sculptural ornamentation of prosocline growth marks and pitted spiral lines, most prominent on the body whorl. Aperture ovate. Colour ornamentation of two rows of elongated chestnut-brown spots on the whorls and three on the body whorl. Species referred as endemic for the Madeira and Selvagens Archipelago and the Canary Islands (Segers *et al.*, 2009).

Rissoa electrae Manousis n. sp. (Fig. 3a-l).

Systematics:

Superfamily **Rissooidea** Gray, 1847
Family **Rissoidae** Gray, 1847
Genus ***Rissoa*** Desmarest, 1814

Type Species: *Rissoa ventricosa* Desmarest, 1814 (type by subsequent designation)

Description: Shell rather small for the genus (Holotype, Fig. 3a-f), height (length) 2.75 - 4.20 mm (Holotype, 3.30 mm), diameter (DN-1) 1.35 - 2.20 mm (Holotype, 1.70 mm), height of aperture (M) 0.95 - 1.66 mm (Holotype, 1.25 mm), solid, translucent-opaque, elongate-conical. 5.5-6.5 onion-shaped and moderately convex whorls (Holotype, 6 whorls), with a shallow and slightly canalculated suture. Protoconch (Fig. 3b) obtuse, paucispiral, 0.75 - 0.80 whorls (Holotype, 0.75 whorls), nucleus diameter (d) 40-45 µm (Holotype, 42 µm), diameter of first half

whorl (D₀) 90 - 95 µm (Holotype, 94 µm), maximum diameter of protoconch (D) 110 - 120 µm (Holotype, 113 µm). Protoconch with dense microgranules. protoconch/teleoconch transition sharp, prosocline. First 3-4 teleoconch whorls' microsculpture (Fig. 3c) of dense growth lines, subsequent whorl with 10-11 inconspicuous axial ribs attenuating by the suture, body whorl only with prosocline and dense growthlines reaching the aperture. Spiral sculpture of dense pitted lines more prominent on the body whorl (Fig. 3c). Aperture (Fig. 3d) small, ovate-rounded, one third of shell height, internally smooth, labial rib present on outer lip, lip prosocline turning sharp by its end. Umbilical chink absent, inner lip with a notch at its limit with the parietal callous. Shell color of fresh specimens purple-brown on the protoconch and the first 3-4 teleoconch whorls, turning off white on the body whorl, and purple-brown peristomium. Color pattern of chestnut-brown elongated spots arranged in four to five spiral rows on the body whorl. Periostracum and operculum straw-yellow. Animal (Fig. 3e, f) head-foot background colour translucent white with snow-white speckles extending to long cephalic tentacles.

Type Material: Holotype (Fig. 3a-f) 3.30x1.70 mm, CTM, Greece, East Thermaikos Gulf, Cape, Epanomi, *Zostera* bed, - 0.20 m, 40°23'N - 22°53'E; Paratypes 1-3 (Fig. 3g-i, respectively), CTM, Greece, East Thermaikos Gulf, 5 m Palioura, Epanomi, mixed bottom, 40°25'N - 22°52'E; Paratypes 4-6 (Fig. 3j-l, respectively), CTM, Greece, East Thermaikos Gulf, Cape, Epanomi, - 0.20 m, *Zostera* bed, 40°23'N - 22°53'E.

Type Localities: Palioura, Epanomi and Cape, Epanomi, 0.2/5 m in East Thermaikos Gulf (NWAegean Sea), *Zostera* bed and mixed bottom, respectively.

Distribution: Known only from the type localities.

Habitat: The specimens were collected live and as shells from bottom material in two different and distant, by approximately 2.5 kms, localities.

Etymology: This species is named after Dr. Manousis daughter Electra.

Remarks: *Rissoa electrae* n. sp. has been compared with all congenates encountered in this work as well as non Mediterranean species. In particular, it was compared with *R. lilacina* Récluz, 1843 (Fig. 2f), *R. similis* Scacchi, 1836 (Fig. 4a), *R. splendida* Eichwald, 1830 (Fig. 4b) and *R. violacea* Desmarest, 1814 (Fig. 4c). More specifically, it differs from: *R. lilacina* and *R. violacea* in its smaller - nearly by half - size, its fewer and more inflated whorls, its prosocline axial ribs that are absent from the body whorl, its more dense spiral sculpture and the presense of spiral rows of spots, while the color of the animals of *R. lilacina* and *R. violacea* are orange-yellow with purple-black tinges (http://www.idscaro.net/sci/04_med/class/fam3/species/rissoa_violacea1.htm; https://commons.wikimedia.org/wiki/File:Rissoa_lilacina_RSCN4404_-_copie.jpg); *R. splendida* in its smaller size and slender contour, its more inflated whorls, the presence of axial ribs only on the penultimate teleoconch whorl and in its characteristic colour of the teleoconch whorls but the body whorl which is cream-white. Unlike *R. electrae* n. sp., the animals of *R. similis* and *R. splendida* bear brown stripes. In conclusion, *Rissoa electrae* n. sp. inhabits the same environment as all other Mediterranean *Rissoa* species and can be easily distinguished from its sympatric congenates.

Discussion

The current improvement for the studied family with 13 new species for the Hellenic Seas (all being minute in size and collected from a variety of both substrates and depth range 0-400 m), 10 of which are new for the East Mediterranean Sea and 3 of them being new for the Mediterranean Sea including *Rissoa electrae* n.sp., is attributed to: a. The collaboration of more researchers, b. The few and, in some cases, old studies on the gastropod fauna of the area, c. The lack of search in various environments as far as the different depths and the types of substrates is concerned, d. The collection tactics related to the type of habitats, to all possible and available material and substrate sources (e.g. discarded material from the fishing boats, trawled material, dissection of sponges, brushing of ship wrecks), to the collection equipment, to the detailed sorting of minute in size organisms and to the repeated search efforts and e. More study areas with variable substrates and clean marine environment that promise a rich biodiversity.

The finding of the new species only in E Thermaikos Gulf in mixed with or without *Zostera* beds is attributed to the laborious, diverse and very careful efforts for the collection of minute gastropod specimens.

The almost simultaneous findings of many species from different areas of Greece indicates that they are wider distributed in the Hellenic Seas and the Eastern Mediterranean Sea, and that independent searches from the same type of substrates and direct sampling might bring to light more species that could otherwise be lost during the collecting procedure and handling. The work continues on other molluscan families and expands in more areas of the Hellenic Seas.

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Family	Species	Figure	Shells	Live	Depth m	Bottom	Area	Global coordinates	Rarity	Origin	Record	Literature
Rissoidae	Alvania aartseni Verduin, 1986	1a		2	1,5	ZB	Cape, Epanomi	40°23'N – 22°53'E	Un	MS	G1	Giannuzzi-Savelli et al., 2002
	Alvania bozcaadensis Tisselli & Giunchi, 2013	1b	10	5	20	MB	Nea Michaniona	40°26'N – 22°49'E	Un	EMS	G2	Repetto et al., 2005 Tisselli & Giunchi, 2013
					10	MB	Aggelohori	40°27'N – 22°47'E				
					30	MB	Paralia, Epanomi	40°23'N – 22°52'E				
	Alvania disparilis Monterosato, 1890	1c	7		80	BB	Skyros Island	38°50'N - 24°30'E	Co	CMS	G1, EMS1	Giannuzzi-Savelli et al., 2002
	Alvania elisae Margelli, 2001	1d	3		120	BB	Paxoi Island	39°10'N – 20°08'E	Ra	CEMS	G1	Repetto et al., 2005 Margelli, 2001
	Alvania josefoi Oliver & Templado, 2009	2a	1		60	MB	C Thermaikos Gulf	40°08'N – 23°07'E	Un	WMS	G1, EMS1	Oliver & Templado, 2009
	Alvania nestaresi Oliverio & Amati, 1990	2b	6		80	BB	Skyros Island	38°50'N - 24°30'E	Un	WMS	G1, EMS1	Repetto et al., 2005
	Rissoa gemmula P. Fischer in de Folin, 1869	2c	4		5	MB	Nea Michaniona	40°27'N – 22°51'E	Ra	EMS	G2	Giannuzzi-Savelli et al., 2002
					5	MB	Palioura, Epanomi	40°25'N – 22°52'E				Repetto et al., 2005
	Rissoa italiensis Verduin, 1985	2d	1	1	5	MB	Cape, Epanomi	40°23'N – 22°53'E	Un	CMS	G1, EMS1	Giannuzzi-Savelli et al., 2002
												Repetto et al., 2005
	Rissoa janusi (Nordsieck, 1972), description in text	2e	1		20	MB	Paralia, Epanomi	40°24'N – 22°52'E	Un	CEA	G1, MS1	Segers et al., 2009
	Rissoa lilacina Récluz, 1843	2f	4		5	MB	Palioura, Epanomi	40°25'N - 22°52'E	Un	MS	G1	Repetto et al., 2005
												Gofas et al., 2011
												Scaperrotta et al., 2015
	Rissoa electrae Manousis n. sp., description in text	3a-l	8	6	5	MB	Palioura, Epanomi	40°25'N – 22°52'E	-	Ktl	G1, MS1	
					0,2	ZB	Cape, Epanomi	40°23'N - 22°53'E				
	Rissoa similis Scacchi, 1836, image for comparison	4a										
	Rissoa splendida Eichwald, 1830, image for comparison	4b										

	Rissoa violacea Desmarest, 1814, image for comparison	4c														
	Setia bruggeni (Verduin, 1984)	4d	1		0,2	ZB	Cape, Epanomi	40°23'N - 22°53'E	Un	WMS	G1, EMS1				Giannuzzi-Savelli et al., 2002	
															Repetto et al., 2005	
	Setia fusca (Philippi, 1841)	4e	8	7	40	MB	Paralia, Epanomi	40°23'N – 22°51'E	Un	WCMS	G1, EMS1				Giannuzzi-Savelli et al., 2002	
															Repetto et al., 2005	
	Setia scillae (Aradas & Benoit, 1876)	4f	1		0,2	ZB	Cape, Epanomi	40°23'N - 22°53'E	Ra	WMS	G1, EMS1				Giannuzzi-Savelli et al., 2002	
															Repetto et al., 2005	
	Setia slikorum (Verduin, 1984)	4g	3		60	MB	Pyrgadikia, Chalkidiki	40°18'N - 23°45'E	Un	WMS	G1, EMS1				Giannuzzi-Savelli et al., 2002	
					120	MB	Paxoi Island	39o10'N – 20o08'E							Repetto et al., 2005	
					80	MB	Anafi Island	36o20'N – 25o47'E								

Table 1: The recorded species of the study. In the Literature column, helpful references for each species identification are included. Dush (-) indicates lack of information. Abbreviations above.

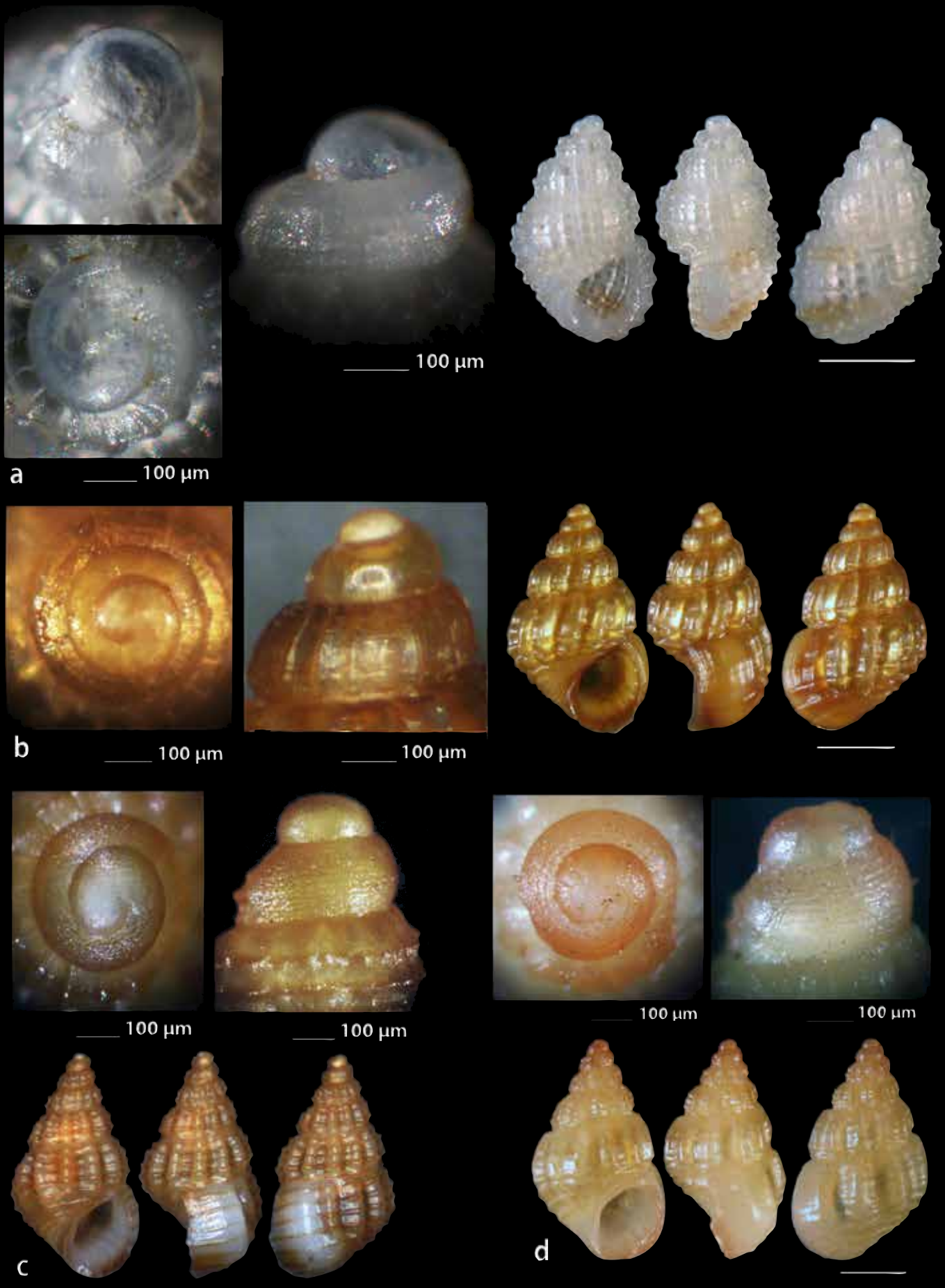


Figure 1: a. *Alvania aartseni* Verduin, 1986, b. *Alvania bozcaadensis* Tisselli & Giunchi, 2013, c. *Alvania disparilis* Monterosato, 1890, d. *Alvania elisae* Margelli, 2001. Barr = 1 mm, unless otherwise indicated.

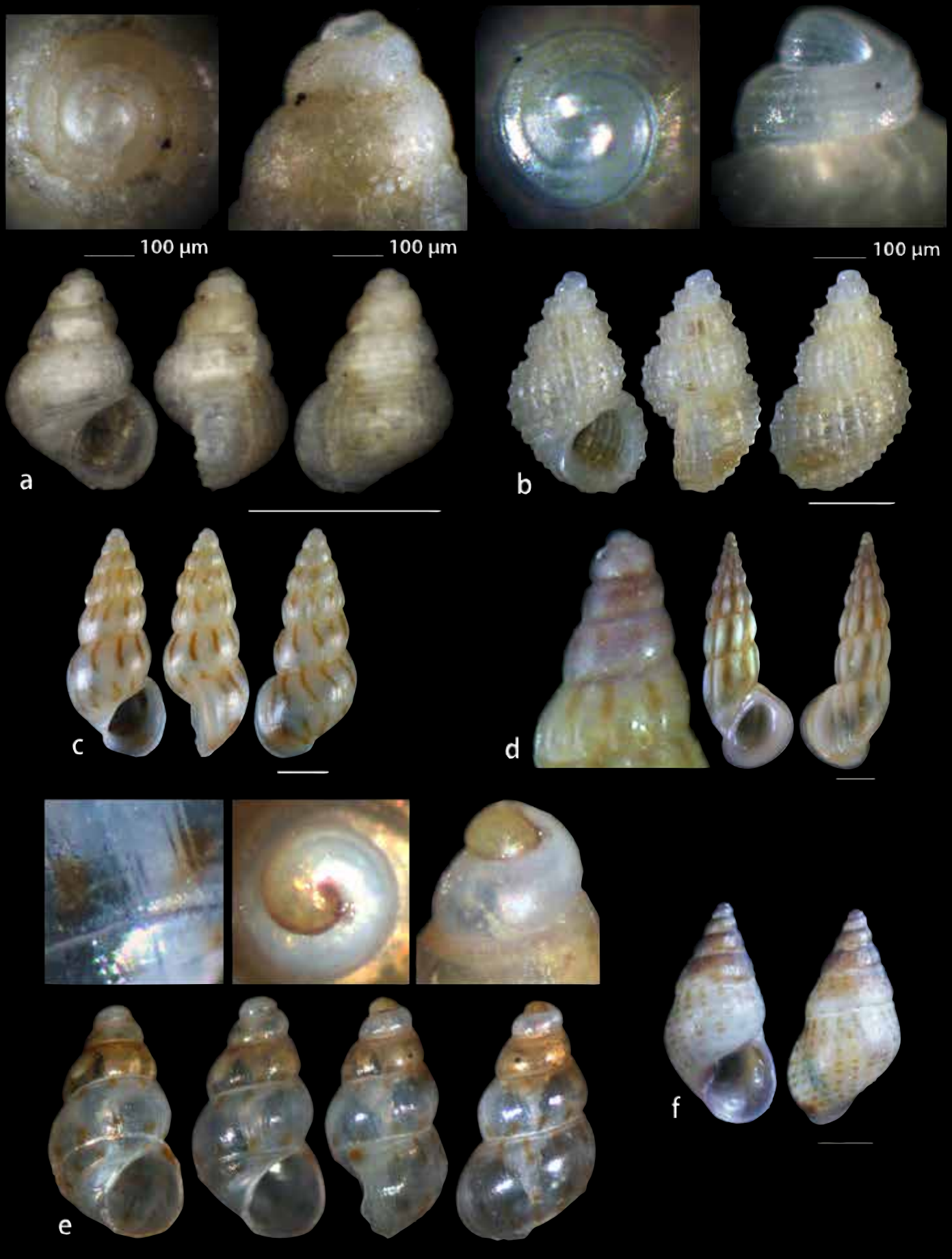


Figure 2: a. *Alvania josefoi* Oliver & Templado, 2009, b. *Alvania nestaresi* Oliverio & Amati, 1990, c. *Rissoa gemmula* P. Fischer in de Folin, 1869, d. *Rissoa italiensis* Verduin, 1985, e. *Rissoa janusi* (Nordsieck, 1972), f. *Rissoa lilacina* Récluz, 1843. Barr = 1 mm, unless otherwise indicated.

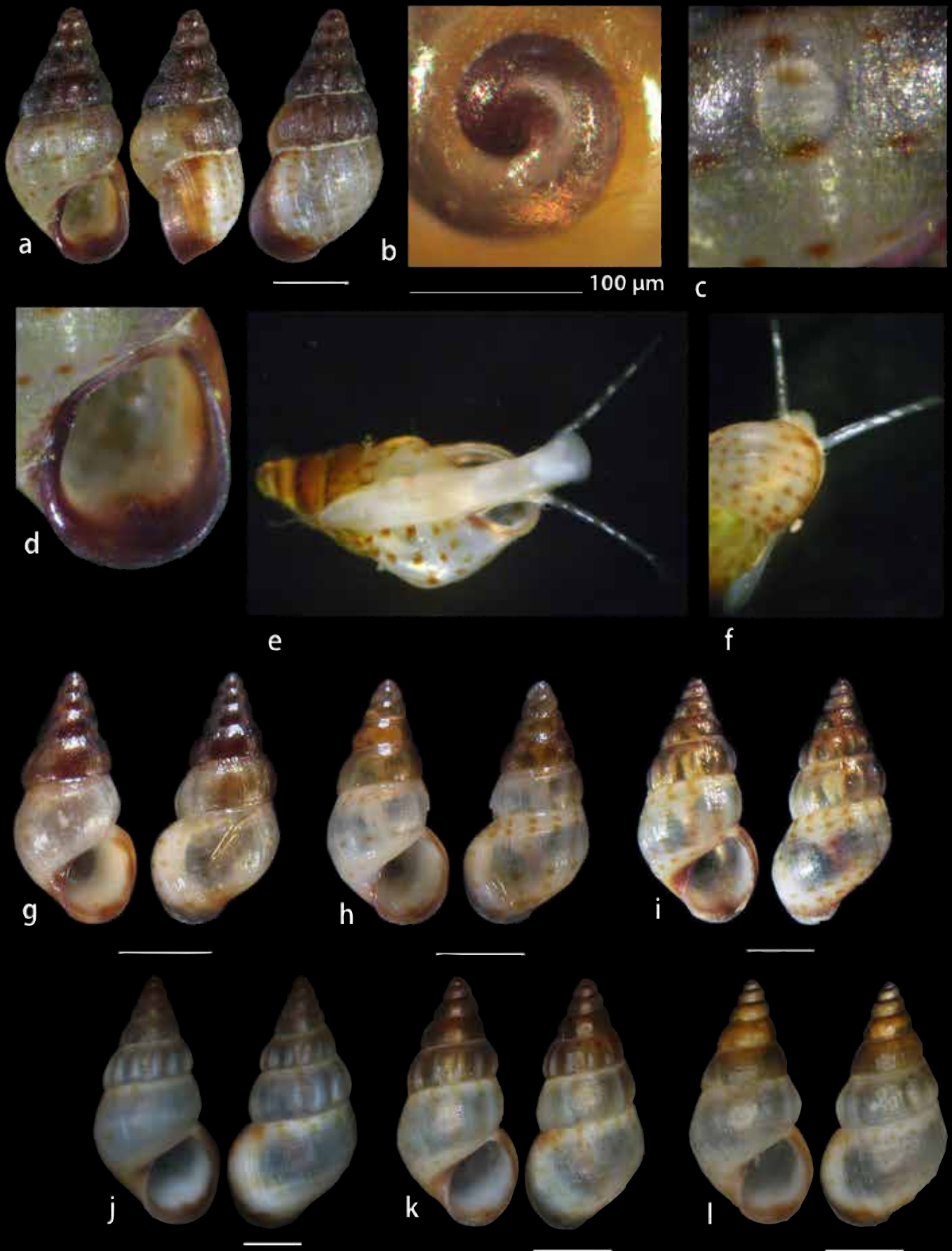


Figure 3: a-l. *Rissoa electrae* Manousis n. sp.. a-d. holotype – MNHN-IM-2000-34745, b. protoconch, c. spiral sculpture, d. aperture, e and f. live individual, g-i. paratypes 1-3, respectively, j-l. paratypes 4-6, respectively. Barr = 1 mm, unless otherwise indicated.



Figure 4: a. *Rissoa similis* Scacchi, 1836, b. *Rissoa splendida* Eichwald, 1830, c. *Rissoa violacea* Desmarest, 1814, d. *Setia bruggeni* (Verduin, 1984), e. *Setia fusca* (Philippi, 1841), f. *Setia scillae* (Aradas & Benoit, 1876), g. *Setia slikorum* (Verduin, 1984). Barr = 1 mm, unless otherwise indicated.

Prédation par des Naticidae sur l'Île Rodrigues

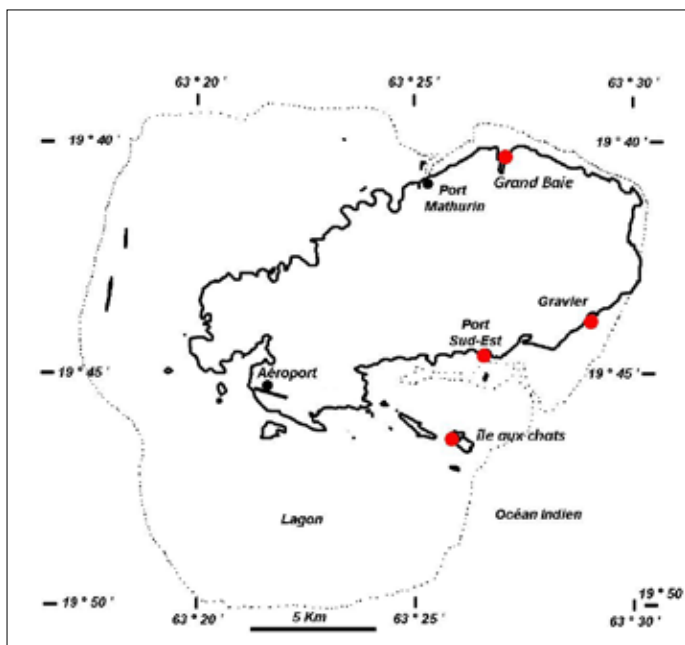
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Introduction

Les représentants des Naticidae sont habituellement décrits comme des prédateurs, principalement de bivalves, vivant dans les sédiments sableux ou sablo-vaseux, de la zone intertidale jusqu'à des milliers de mètres de profondeur. Cet article montre les nombreuses proies possibles de ces gastéropodes sur l'Île Rodrigues. Il montre aussi que certaines Natices peuvent chasser sur des zones partiellement rocheuses et tuer des proies qui vivent non pas dans le sable mais sur les rochers. Ce comportement est a priori peu habituel pour les membres de la famille des Naticidae. Ces observations ont été faites sur l'Île Rodrigues en Février 2019.

Zones d'observation et de recueil des données

Certaines zones côtières ont été parcourues, en particulier la zone intertidale, à la recherche de Naticidae vivantes ou de coquilles mortes présentant des perforations. Ces zones sont reportées sur la carte ci-dessous.



Grand Baie : Embouchure de rivière avec mangrove qui débouche sur une grande plage sablo-vaseuse largement découverte à marée basse.

Gravier :

Alternance de parties sableuses et de zones de rochers basaltiques.

Port Sud Est : Plage sablo-vaseuse largement découverte à marée basse.

Île aux chats : Plage de sable.

Comment vérifier que les perforations ont été faites par des Naticidae ?

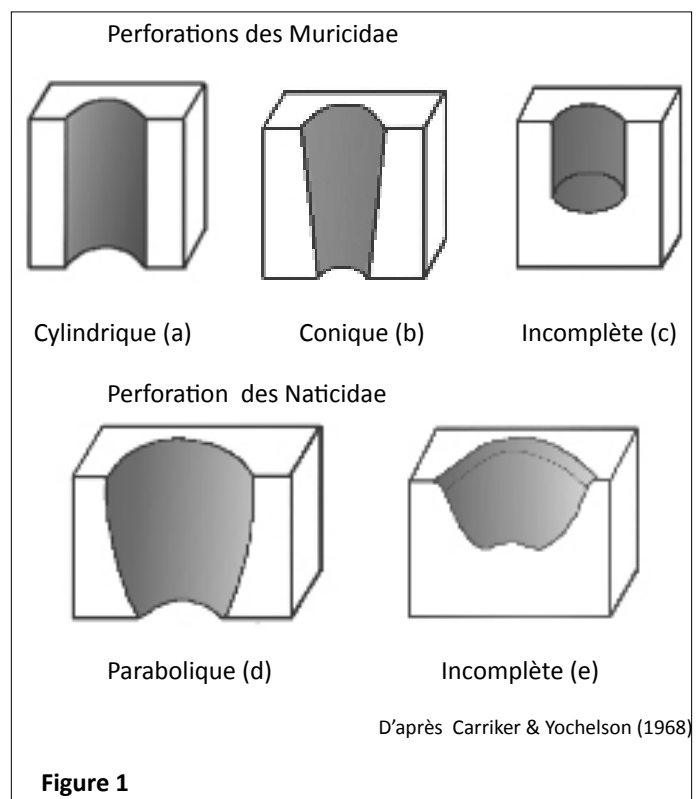
Dans la mesure où il est difficile de prendre sur le fait une Naticie en train de percer une coquille, et comme d'autres prédateurs peuvent forer les coquilles de leurs proies, il faut dans un premier temps s'assurer que les perforations sont bien le résultat de la prédation par des Naticidae.

Carriker & Yochelson (1968) ont comparé les perforations réalisées par les gastéropodes perceurs. Ils en distinguent schématiquement trois types. Les perforations peuvent être cylindriques, coniques ou paraboliques (voir figure 1).

Les perforations incomplètes peuvent se présenter sous forme

cylindrique à fond plat ou bien parabolique, à bord fraisé et fond présentant une bosse centrale. Les perforations cylindriques et coniques dans les coquilles épaisses sont attribuées par les auteurs à l'activité des Muricidae (figures 1 a, b, c) de même que des perforations légèrement paraboliques dans les coquilles très fines. Les Muricidae chassent en surface, de préférence des proies présentes sur les fonds rocheux. Les perforations incomplètes présentent un fond plat ou légèrement concave.

Les Naticidae circulent sous la surface ou bien à la surface des sédiments sableux à sablo-vaseux et chassent préférentiellement les proies enfouies dans le sédiment. La conformation particulière de leur système de perforation crée une perforation typique de section parabolique (figures 1 d, e), avec une marge externe d'aspect souvent fraisé. Les perforations incomplètes montrent une bosse centrale caractéristique.



D'après Carriker & Yochelson (1968)

Figure 1

Une consultation des travaux plus récents conforte en grande partie ces résultats. Kowalewski (2004), Morton (2005), Morton et Al. (2007), Lützen et Al. (2012) confirment que les perforations faites par les Muricidae sont de forme cylindrique, avec des bords réguliers et souvent des traces d'attaque chimique, sans traces de cassures faites par la radula.

En ce qui concerne les Naticidae, (Morton 2008), Chiba & Sato (2012), Kong et Al. (2017), confirment l'observation de perforations de section parabolique montrant souvent des traces de la radula, la partie intérieure pouvant présenter des cassures irrégulières causées par l'action mécanique de celle-ci. Le bord extérieur porte parfois des traces d'usure ou d'action des sécrétions de l'organe accessoire de perçage, situé en arrière de la bouche et qui est utilisé pour affaiblir chimiquement la structure de la coquille de la proie. Le forage consiste (comme chez les Muricidae dont les sécrétions contiennent de l'acide) en l'alternance de phases mécaniques (action de la radula) et de phases chimiques (dépôt de sécrétions qui attaquent la co-

quille). On peut donc dire que les perforations de section parabolique, avec éventuellement un bord interne et ou externe montrant des traces d'usure ou de cassure par la radula sont bien faites par des Naticidae.

Pour un individu de *Notocochlis gualtieriana* (Récluz, 1844) récolté vivant sur les plages de Gravier, la dissection de la tête sous loupe binoculaire a permis d'extraire la radula qui a ensuite été nettoyée sous microscope. Après coloration à l'éosine, celle-ci a été montée entre lame et lamelle dans de la résine Eukkit®. La figure 2 montre l'observation de cette radula au microscope optique.

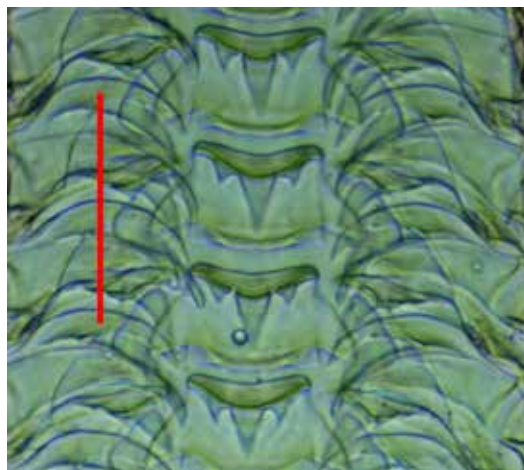


Figure 2. Radula de *Notocochlis gualtieriana* (Récluz, 1844) observée au microscope optique. Barre d'échelle 100 µm

Les Naticidae présentes (figure 3)

Espèces / Species	Hauteur Min / Max (mm)	spécimens Gravier	spécimens Port Sud Est	spécimens Ile aux chats	spécimens Grand Baie
<i>Mammilla melanostoma</i> (Gmelin, 1791)	9,2 – 32,8	29	1	0	3
<i>Notocochlis gualtieriana</i> (Récluz, 1844)	5,8 – 17,1	13	1	1	1
<i>Notocochlis cernica</i> (Jousseau, 1874)	9,2 – 11,7	4	0	0	0
<i>Polinices parvulus</i> Bozzetti, 2010	9,2	0	1	0	0



Polinices parvulus Bozzetti, 2010. Port Sud Est. 9,2 mm



Mammilla melanostoma (Gmelin, 1791). Gravier. 22,2 mm



Notocochlis cernica (Jousseau, 1874). Gravier. 9,2 mm



Notocochlis gualtieriana (Récluz, 1844). Gravier. 13,7 mm

Figure 4.



Les proies de Naticidae de l'île Rodrigues

Les récoltes sur les différentes plages indiquées ont permis de retrouver, en proportions très variables, les espèces représentées sur la figure 4 et listées dans le tableau qui suit.

Si pour certaines on retrouve bien un milieu de vie conforme à ce qu'on pouvait attendre (sable et vase) on constate que d'autres sont des espèces vivant sous ou sur les rochers de la zone intertidale, ce qui est beaucoup moins typique et qui implique soit que les Natices s'aventurent dans les zones rocheuses, soit que toutes ces proies s'en éloignent pour aller dans le sable, ce qui semble peu probable.

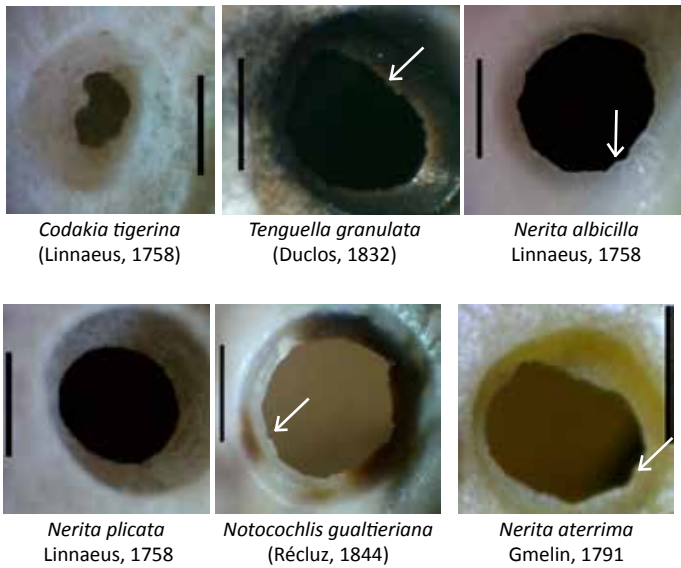
Les proies de Naticidae et leur milieu de vie.

(Voir tableau ci-dessous)

Les perforations trouvées sur ces coquilles ont été observées à la loupe binoculaire (figure 5) pour rechercher des traces typiques de l'action de radula puis certaines ont été disquées (miniperceuse avec disque à tronçonner) en coupe transversale médiane de manière à observer la section de coupe (figure 6).

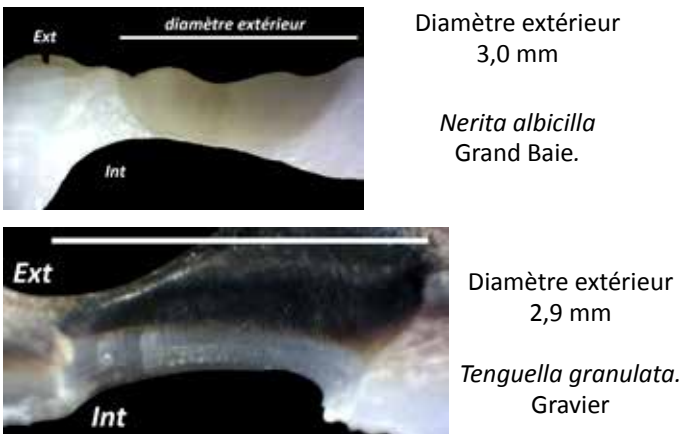
Espèce / Species	Milieu de vie	Spécimens perforés	Localisation	Figure 4
<i>Clypeomorus batillariaeformis</i> Habe & Kosuge, 1966	Plages rocheuses de la zone intertidale	2	Gravier	a
<i>Rhinoclavis aspera</i> (Linnaeus, 1758)	Dans le sable	2	Gravier Ile aux chats	b
<i>Peristernia hiliaris</i> Melvill, 1891	Dans les lagons, sous les pierres	2	Gravier	c
<i>Notocochlis gualtieriana</i> (Récluz, 1844)	Plage sablo-vaseuses de la zone intertidale	7	Gravier	n
<i>Nerita aterrima</i> Gmelin, 1791	Sur les rochers de la zone intertidale	5	Gravier	d
<i>Nerita plicata</i> Linnaeus, 1758	Partie supérieure de la zone intertidale, sur les rochers émergés à marée basse	2	Gravier	e
<i>Nerita albicilla</i> Linnaeus, 1758	Rochers et mares de partie moyenne de la zone intertidale	15	Gravier Grand Baie	f
<i>Tenguella granulata</i> (Duclos, 1832)	Zone intertidale rocheuse ou récifale	2	Gravier	h
<i>Drupa ricinus</i> (Linnaeus, 1758)	Zone intertidale rocheuse ou récifale	1	Gravier	i
<i>Aplustrum amplustre</i> (Linné, 1758)	Sous les pierres, eau peu profonde	1	Gravier	j
<i>Planaxis sulcatus</i> (Born, 1778)	Dans le lagon, sous les pierres	2	Port Sud Est	k
<i>Otopleura auriscati</i> (Holten, 1802)	Dans le sable des lagons	1	Port Sud Est	l
<i>Pyramidella sulcata</i> (A. Adams, 1854)	Dans le sable des lagons	6	Ports Sud Est	g
Eulimidae sp	Espèces le plus souvent parasites de divers animaux	6	Gravier	m
<i>Codakia tigerina</i> (Linnaeus, 1758)	Dans le sable	1	Gravier	o
<i>Gafrarium pectinatum</i> (Linnaeus, 1758)	Dans le sable	5	Gravier Port Sud Est	p

Figure 5. Perforations de quelques proies observées à la loupe binoculaire



On note bien (flèches blanches) sur la partie interne des perforations les cassures irrégulières, trace de l'action de la radula.
Barre d'échelle : 1 mm

Figure 6. Coupes de perforations de proies observées à la loupe binoculaire



On note le profil parabolique des perforations.

Prédation d'espèces des rochers.

Les perforations des *Nerita*, *Tenguellia* et *Drupa* sont assez étonnantes puisque leurs représentants sont typiquement des habitants des zones rocheuses intertidales. Au moins un autre cas de ce type a été observé puisque Hugues (1985) a montré que *Natica unifasciata* Lamarck, 1822 peut chasser des *Nerita scabricosta* Lamarck, 1822, espèce habituellement rencontrée émergée, sur les rochers en zone intertidale, et que cette espèce de Naticidae peut rester longtemps émergée (jusqu'à une heure).

Ici aussi nous avons la preuve que des Naticidae ont bien attaqué et consommé des Nérites, notamment *Nerita albicilla* Linnaeus, 1758 en assez grand nombre sur les plages rocheuses de Gravier. On retrouve surtout cette espèce perforée (15 individus) alors qu'il n'a été trouvé que deux spécimens de *Nerita plicata* Linnaeus, 1758, espèce qui vit dans la partie la plus supérieure de la zone intertidale. Quoi qu'il en soit cela suppose ici un comportement assez différent de celui pratiqué habituellement. Dans la zone de Gravier (Figure 7) qui montre une alternance de plage sableuses et de zones de rochers basaltiques de tailles diverses, les *Nerita* ne se rencontrent vivantes que sur les rochers basaltiques.

Figure 7. Plages de la région de la zone de Gravier



Même si aucune action de chasse n'a pas pu être directement observée, un individu de l'espèce *N. gualtieriana* a été filmé et photographié, sur une plage de Gravier, à marée basse, rampant émergé sur des rochers basaltiques puis s'immergeant et traversant rapidement les zones de sable grossier pour rejoindre un nouveau rocher (voir Figure 8). Cette observation suggère bien que cette espèce est capable de chasser émergée, et pas seulement dans le sable mais aussi sur des rochers. Savazzi E. & Reymont R. A. (1989) avaient d'ailleurs déjà montré que l'espèce chassait à marée basse, émergée jusqu'à une demi-heure sur le sable. On peut donc confirmer cette aptitude à la recherche de proies hors de l'eau et ajouter au répertoire des comportements de l'espèce la chasse directement sur les rochers (pas seulement sur les plages sableuses) à la recherche notamment des Nérites, et accessoirement de Muricidae.

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L'individu rampe à fleur d'eau, sur un rocher basaltique



Immergé dans environ 2-3 cm d'eau, il rampe en direction d'un autre rocher.



Il rampe sur le sable grossier, émergé.



A flanc de rocher, l'animal rampe sous l'eau et s'enfonce vers le fond d'une flaque.

Figure 8. Photographies d'un individu de *N. gualtieriana* observé (durée de l'observation environ 10 minutes) lors de son déplacement sur les rochers et les zones sableuses.

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