THE NON-MARINE MOLLUSCS OF BONAIRE (MOLLUSCA)

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During the Bonaire Estafette Expeditie the non-marine malacofauna was investigated. The investigation mainly focused on molluscs in natural habitats, but attention was also given to garden centers and botanical gardens as well-known locations for exotic species. In total 31 (sub-) species of land snails and slugs and six species of freshwater snails were found. No freshwater bivalves were encountered. Twenty of these taxa were not reported from the island before. Based on these results an identification card of the land and freshwater molluscs of Bonaire was produced.

INTRODUCTION

From October 2022 tot March 2023, Naturalis Biodiversity Center (Leiden, the Netherlands) and the National Parks Foundation Bonaire (STINAPA) organised the Bonaire Estafette Expeditie (BEE) (Kalkman et al. 2025), to map the invertebrates on the island. In the period 21 January to 5 February 2023 the focus was on the land and freshwater molluscs (fig. 1). Marine molluscs were not included.

ISLAND DESCRIPTION

Bonaire is located in the Caribbean Sea, at a distance of about 87 km from Venezuela and 40 km from Curaçao. Bonaire has a surface of 288 km² (Rijksoverheid 2024). Klein Bonaire is a small island located 830 m from the main island and has a surface of 7 km². Bonaire has a rapidly growing population of 24,090 inhabitants (as of 1 January, 2023), Klein Bonaire has no permanent inhabitants (CBS 2024).

The islands have a relatively dry tropical climate and a quite constant temperature. The average maximum daytime temperature is 30-32 °C, the average minimum temperature during the nights is 24-27 °C. The average rainfall is 500 mm per year. The amount of precipitation varies from year to year between 300 and 1000 mm. The winter of 2022-2023 was very wet. The islands have a fairly high relative humidity (the average annual humidity is 76 %) (Klimaatinfo.nl 2023).

The geology of Bonaire was described by Rutten (1932) and Van den Koppel (2011). De Freytas et al. (2005) constructed a detailed vegetation and landscape map and a soil map. The soil of Bonaire consists partly of volcanic rock, probably formed by submarine volcanoes. This volcanic rock is recognisable by its reddish-brown colour. Sediments dating from the Cretaceous period (approximately 90-100 million years ago) have been deposited over it. The northwestern tip of the island is the most elevated part and belongs to the Washington Slagbaai National Park (WSNP), which is managed by STINAPA Bonaire. The highest mountain on the island, Brandaris, is 241 m high and is located in the middle of the WSNP. This mountain is formed by the described sequence of rocks. The WSNP is accessible by two car routes in the National Park:

Figure 1. The snail team on Bonaire in front of Kas Sientífiko (research station). Photo Jan Wieringa.

a long car route (34 km) and a short car route (24 km) and walking trails.

In addition, there are large parts of Bonaire where the soil consists of white-coloured limestone. These are old reefs of corals and red algae that were formed in the Miocene (about 5 million years ago). The growth of these reefs continued until about 110,000 years ago, when sea levels were about 15 m higher than today. Erosion and karst phenomena have created holes and crevices and formed caves. On the highest part of this reef plateau, situated between the villages Rincon and Kralendijk, the Bonaire Caves & Karst Nature Reserve is established in 2019, as part of a larger plan for the conservation of Bonaire's cave systems.

Over half of the island surface is covered with dry tropical forest, partly strongly degraded (Debrot et al. 2018). The southern part of the island is the lowest. A large part is taken up by salt lakes and salt pans where sea salt is extracted. In Lac Baai there are areas covered with mangrove forests and seagrass and seaweed fields. Off the west coast lies the island of Klein Bonaire, which consists of an old reef and is therefore rich in limestone. The vegetation is low and sparse, but the aim is to return forests and that is why trees have recently been planted. There are salt and brackish water lakes along the coast along the southwest side and there are also some natural freshwater wells. There is a beach on the south side and two walking trails. Bonaire and Klein Bonaire are surrounded by coral reefs, since 1979 protected in the Bonaire Marine National Park. The availability of the various habitats is shown in table 1.

Table 1. Habitats on the islands of Bonaire and Klein Bonaire in 2017, based on Debrot et al. (2018).

Habitat	Area in hectares
Dry tropical forest	16,108
Strongly degraded dry tropical forest	3,154
Caves	3
Beaches	305
Mangrove forest	365
Salt pans and salt lakes	3,814
Seagrass and seaweeds fields	870
Buildings and agriculture	4,163

PREVIOUS RESEARCH

The first non-marine mollusc that was described from Bonaire was *Tudora aurantia* by Wood (1828), followed by *Microceramus bonairensis* and *Neosubulina harterti* by Smith (1898). Bland (1861) and Vernhout (1914) were the first authors to make a list of the molluscs known from Bonaire and other Dutch Caribbean islands. They worked on the basis of collection material and literature, but they had never visited the islands themselves. Bland (1861) mentioned one species from Bonaire (Buen Ayre), Vernhout (1914) six species. Their work mainly illustrates how little was known of the molluscs of Bonaire at the beginning of the 20th century.

That changed a decade later. In 1922, Herbert Burrington Baker made an extensive three-month collecting trip to Aruba, Bonaire and Curaçao (ABC islands) to collect molluscs, reptiles, amphibians and ants. For the molluscs, the results were presented in Baker (1924b). He described four species and subspecies from Bonaire as new to science, all endemic to Bonaire and the satellite island Klein Bonaire. In total, he reported 16 taxa from Bonaire, of which 12 also from Klein Bonaire. He also described the radulae of the endemic species (Baker 1924b).

Pieter Wagenaar Hummelinck did extensive fieldwork on the ABC islands. He obtained his doctorate with a thesis entitled 'Studies on the fauna of Curaçao, Aruba, Bonaire and the Venezuelan Islands', focussing on non-marine molluscs, mammals and reptiles (Wagenaar Hummelinck 1940b). Wagenaar Hummelinck lumped several taxa recognised by Baker as separate (sub-)species (1924b). He reported 17 non-marine molluscs from Bonaire, eight of which also from Klein Bonaire. Of these, seven taxa from Bonaire and

two from Klein Bonaire were not mentioned by Baker (1924b). After his thesis he did a large amount of fieldwork in the Caribbean, including Bonaire. Most of his results on molluscs were not published, but a list of field stations is available (Wagenaar Hummelinck 1981) and much of the material he collected is stored in the collection of Naturalis Biodiversity Center (RMNH) in Leiden (the Netherlands).
Hovestadt (1987) published a checklist of terrestrial molluscs of the ABC islands, in which 19 species from Bonaire are reported.

Hovestadt & Van Leeuwen (2017) published an overview of the land mollusc fauna of the ABC islands. Their overview was based on their own fieldwork, material collected by some other persons and literature. They reported 18 (sub)species of terrestrial molluscs that definitely occurred on Bonaire and four as doubtful or erroneous. It was the first publication containing colour pictures of the terrestrial molluscs of Bonaire. Freshwater molluscs were not included in their publication. Table 2 shows an overview of the number of taxa reported by each author.

MATERIAL AND METHODS

The aim of our fieldwork was to map which species of molluscs occur on the island, in which biotopes they live and how they are distributed across the island. The most important methods we used to collect data about terrestrial molluscs was visual inspection and collecting soil samples of 0.5 to 1 litres per location. In the field station, the soil samples were sieved into fractions, after which the molluscs were picked out with the help of a microscope. To gather data of insects, the expedition members installed pitfall traps on several places on the island. Some molluscs that were captured in these traps are also included in our study. In total, we visited 303 snail-watching sites (fig. 2). A complete list of field stations is included in Appendix 1.

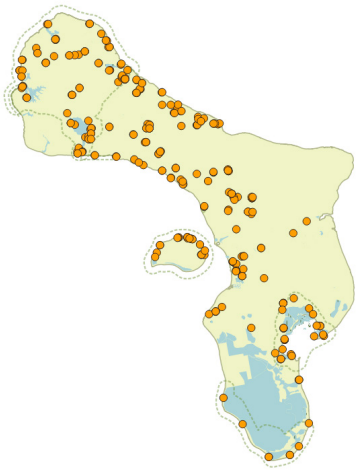

Figure 2. Map of surveyed locations.

Table 2. Number of taxa for Bonaire per publication.

	Bonaire	Klein Bonaire
Terrestrial molluscs		
Bland 1861	1	
Vernhout 1914	6	
Baker 1924	13	10
Wagenaar Hummelinck 1940	15	7
Hovestadt & Van Leeuwen 2017	18	11
Bonaire expedition 2022-2023	31	5
Freshwater molluscs		
Baker 1924	2	1
Wagenaar Hummelinck 1940	2	1
Bonaire expedition 2022-2023	6	2

For the inventory of freshwater molluscs we visited almost all known freshwater locations on Bonaire, such as freshwater ponds along the Kaya Gavilan, a pond northeast of Rincon, Dam Grandi, Pos Gurubu, Pos Fontein, ponds near the water purification at Lagun, ponds (springs or water wells) in the WSNP, beautiful ditches covered with water plants in the area around the football stadium and a water reservoir in an outcrop near Belnem. To collect freshwater molluscs we used a sieve with a mesh size of 1 mm. We have not investigated private water wells and tanks near homes.

Part of the molluscs collected are stored dry in the collection of Naturalis Biodiversity Center (RMNH) and the private collections of Sylvia van Leeuwen and Tello Neckheim. For future DNA studies a small number of specimens of nearly all species were collected alive and stored on alcohol in the collection of Naturalis.

Field observations and photos of the mollusc species made during fieldwork are uploaded in Observation.org. These include photos from shells and from living specimens. The photos contribute to the development of the image recognition in the app 'ObsIdentify' for the islands. In addition, photos of shells were made with a Zeiss Discovery V20 stereomicroscope and an Axio Vision MRC5 photo camera from Naturalis, a Bresser Advanced ICD 10x-160x zoom stereo microscope with a Nikon D90 by Hannco Bakker and with an Olympus Tough by Tello Neckheim.

In addition to knowledge about invertebrates, the expedition should also produce educational material to make that knowledge available to a broader audience. In October 2023, we published an identification card of land and freshwater molluscs of Bonaire for educational activities (Naturalis & STINAPA 2023). In the future we also intend to make a field guide for the non-marine molluscs of the ABC islands.

The records on which this paper is based are available in a dataset on GBIF (doi.org/10.15468/ymu2rn).

RESULTS

In table 3 we present a list of the non-marine molluscs reported from Bonaire. The species treatments are divided in several sections.
Other names Synonyms, other genus species combinations and misspellings which are used for the species in the identification literature, predominantly Baker (1924a, 1924b), Wagenaar Hummelinck (1940b), Venmans (1963), Haas (1960, 1962), Hovestadt & Van Leeuwen (2017), Simone (2006), Pointier et al. (2005) and Pointier (2008, 2015). Vernacular names in English, Papiamentu and Dutch, derived from iNaturalist,org, Hovestadt & Van Leeuwen (2017), Coomans (1963, 1970), Dourson & Caldwell (2018), Rowson et al. (2021) and Naturalis & STINAPA (2023).
Description Description of the species, limited to the most important identification characters, especially compared with other species occurring on Bonaire and Klein Bonaire. Photos of the shell and if available also photos of living animals, in situ or in vitro.
Status The status of the species on Bonaire and Klein Bonaire is given: endemic, indigenous or exotic (introduced by humans) and range of the species worldwide, according to GBIF.org. The type locality of every species is mentioned, based on the original descriptions. For exotic species we try to clarify how the species is likely to have been introduced on Bonaire.
Habitat and distribution Description of the localities and habitats on Bonaire. For each species we include a distribution map of the localities during the BEE in 2022-2023.
Remarks Any other relevant details on e.g., reproduction, risk for humans (e.g. damage to agriculture, pathogens) and taxonomy.

Table 3. Checklist of the non-marine molluscs reported from Bonaire. The scientific names are mainly according to Molluscabase or WORMS. The species are further described and explained in the next section. An X indicates that alive specimens were found during the BEE, x means that only empty shells were found during the BEE, L means that the species was not observed during the BEE but reported by others in the literature.

	Status	Bonaire	Klein Bonaire
Terrestrial molluscs			
Helicinidae			
Lucidella lirata (L. Pfeiffer, 1847)		x	-
Stoastomops walkeri Baker, 1924	Endemic	X	L
Annulariidae			
Bonairea maculata (Baker, 1924)	Endemic	X	L
Tudora aurantia aurantia (Wood, 1828)	Endemic	X	-
Tudora aurantia wassauensis Baker, 1924	Endemic	X	X
Veronicellidae			
Veronicellidae spec.	Exotic, new	X	-
Succineidae			
Succinea gyrata Gibbons, 1879	Endemic	X	X
Succinea concordialis A. Gould, 1848	Exotic, new	X	-
Pupillidae			
Pupoides nitidulus (L. Pfeiffer, 1839)		X	L
Gastrocoptidae			
Gastrocopta curacoana Pilsbry, 1924		X	X
Gastrocopta octonaria Pilsbry, 1924		X	X
Gastrocopta servilis riisei (L. Pfeiffer, 1852)		X	-
Bulimulidae			
Mesembrinus elongatus (Röding, 1798)		X	-
Cerionidae			
Cerion uva bonairensis Baker, 1924	Endemic	X	X
Urocoptidae			
Brachypodella gibbonsi Baker, 1924	Endemic	X	L
Microceramus bonairensis bonairensis (E.A. Smith, 1898)	Endemic	X	X
Achatinidae			
Lissachatina fulica (Bowdich, 1822)	Exotic, new	X	-
Allopeas gracile (Hutton, 1834)	Exotic	X	-
Allopeas micra (d'Orbigny, 1835)		X	-
Neosubulina harterti E.A. Smith, 1898	Endemic	X	L
Paropeas achatinaceum (L. Pfeiffer, 1846)	Exotic, new	X	-
Subulina octona (Brugiere, 1789)	Exotic, new	X	-
Ferussaciidae			
Karolus consobrinus (d'Orbigny, 1841)		X	-
Streptaxidae			
Gulella bicolor (Hutton, 1834)	Exotic, new	X	-
Streptartemon glaber (L. Pfeiffer, 1850)	Exotic, new	x	-
Zachrysiidae			
Zachrysia provisoria (L. Pfeiffer, 1858)	Exotic, new	X	-
Polygyridae			
Polygyra cereolus (Megerle von Mühlfeldt, 1816)	Exotic, new	x	-
Praticolella griseola (L. Pfeiffer, 1841)	Exotic, new	x	-
Sagdidae			
Setidiscus crinitus (Fulton, 1917)	New	x	-
Pristilomatidae			
Hawaiia minuscula (A. Binney, 1841)	Exotic?, new	x	-
Valloniidae			
Pupisoma dioscoricola (C. B. Adams, 1845)	New	x	-
Freshwater molluscs			
Thiaridae			
Melanoides tuberculata (O.F. Müller, 1774)	Exotic, new	X	X
Cochliopidae			
Pyrgophorus parvulus (Guilding, 1828)		X	X
Planorbidae			
Biomphalaria glabrata (Say, 1818)	New	X	X
Biomphalaria cf. *kuhniana* (Clessin, 1883)		x	-
Planorbella duryi (Wetherby, 1879)	Exotic, new	X	-
Physidae			
Physella acuta (Draparnaud, 1805)	Exotic, new	X	-

Helicinidae

Lucidella lirata (L. Pfeiffer, 1847)

Other names *Helicina lirata* L. Pfeiffer, 1847. English: Fringed Lucidella (Dourson & Caldwell 2018).
Description Shell diameter 4 mm, height 2-3 mm. Dome-shape or heliciform, lip reflected. Aperture oval with an operculum, 4 whorls, imperforate, without colour bands. Fresh shells brown, dead shells become whitish. No dorsal small tooth. Recognisable by the sculpture of clear spiral ridges and the closed umbilicus. Habitus: figure 3.
Status Indigenous American species, distributed in Mexico, Central America and the north coast of South America, including several islands near to the coast. Type locality: Yucatan (Mexico).
Habitat and distribution Rare species. We only found some empty shells washed ashore at the northwestern side of lake Goto and on a dry calcareous hill at Fontein (fig. 4). It is also collected by Wagenaar Hummelinck in Fontein, Lagoen, Playa Mangel, Playa Palu Calbas, Lac, on a limestone cliff at Karpat and in 'Goto, Lagoen, near bron Riscado' (Hovestadt & Van Leeuwen, 2017). In Curaçao it lives in a humus rich forest soil on the upper parts of Christoffel Mountain and Seru Gratia (pers. obs. Sylvia van Leeuwen).
Remarks Dourson & Caldwell (2018) show a photo of this species from Belize on which a basal tooth is clearly visible. One shell from Aruba (collection Neckheim) has a small basal tooth, fully adult shells from Curaçao (collection van Leeuwen) show a small basal tooth. In the specimens from Bonaire no tooth is visible. It is unknown to us if this is an important character of this species.

Figure 4. Distribution of *Lucidella lirata* on Bonaire.

Figure 3. *Lucidella lirata*, 3.6 mm. East of Rincon near Tera Barra, 26.I.2023, RMNH.MOL.452378. Photos Hannco Bakker.

Stoastomops walkeri Baker, 1924

Description Shell diameter 2.4 mm, height 2.2 mm. Shell depressed turbinate, alive reddish to purple, 4.5 whorls, markedly convex. Pronounced irregular growth wrinkles. Spiral sculpture of numerous, fine threadlike riblets, more obscure on the base of the shell. Umbilicus narrow. Aperture subbasal, reniform. Peristome simple, sharp, incomplete; columellar wall with whitish callus that ends abruptly in a distinct emargination just above the basal corner. Operculum small. Body whitish to light grey, the head slightly darker than the foot. Black eyes visible at the basis of the tentacles. Males are probably smaller than females

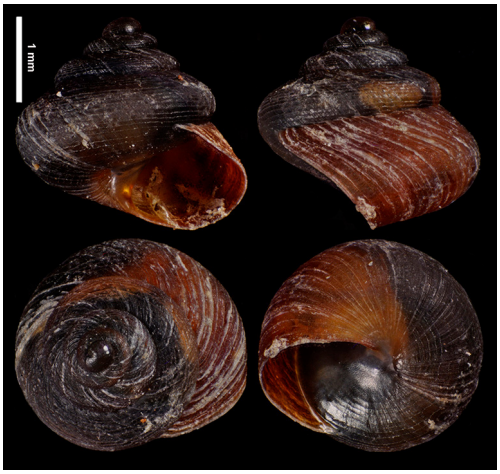

Figure 5. *Stoastomops walkeri,* 2.5 mm. Cave and Karst Reserve, 29.1.2023, RMNH.MOL.452469. Photos Hannco Bakker.

Figure 6-7. *Stoastomops walkeri*, on limestone. Their shells are often, but not always, encrusted with limescale. Cave & Karst Nature Reserve, 29.1.2023. Photos Sylvia van Leeuwen.

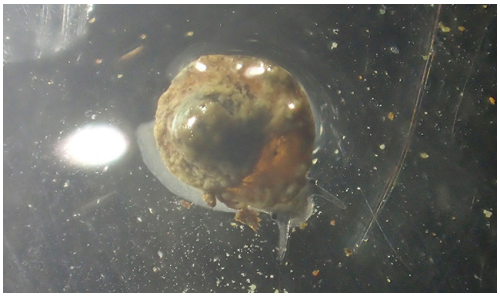

Figure 8. *Stoastomops walkeri,* in vitro. Along lake Goto, 24.1.2023. Photo Sylvia van Leeuwen.

Figure 9. Distribution of *Stoastomops walkeri* on Bonaire.

(Baker 1924b). Habitus: figures 5-8.
Status Endemic species which most probably occurs on Bonaire only. Type locality: Bonaire, valley on western slope of Montagne.
Habitat and distribution In limestone areas only. Lives in shaded places on and under limestones and rocks and in crevices in these stones, often on the place where the rock borders the soil. On Bonaire we found it in the Cave and Karst Reserve, along the Wayaka trail, near Pos Fontijn, Gruta di Lourdes, near the steep limestone cliffs along Kaminda Sabana Piedra Krus and under limestone rocks south of Boka Onima (fig. 9). We did not find the species on Klein Bonaire, but it was found there in 1996 (Hovestadt & Van Leeuwen 2017).

Figure 10. *Bonairea maculata*, 8 mm. Cave and Karst Reserve, 29.I.2023, RMNH.MOL.452462. Photos Hannco Bakker.

Remarks A similar looking *Stoastomops* species was recently found on Curaçao. It is not clear yet if this is *Stoastomops walkeri* or a different *Stoastomops* species (Van Leeuwen & Hovestadt 2022).

Annulariidae

Bonairea maculata (Baker, 1924)

Other names *Tudora maculata* (in: Baker 1924a), *Tudora maculata* 'Bland' H. Burrington Baker, 1924 (in: Baker 1924b). *Tudora maculata* H.B. Baker, 1924 (in: Wagenaar Hummelinck 1940b), Papiamentu: Kokolishi baka pintá (painted cow).
Description Shell diameter 4.5 mm, height 8 mm. Shell beige with a regular pattern of brown spots in spiral bands. Sculpture of very fine axial ribs. In adult animals the last whorl becomes detached from the previous whorls. Mostly the top is eroded. These snails have a calcareous operculum that is very remarkably white. Habitus: figures 10-12.
Status Endemic species, occurs on Bonaire and Klein Bonaire only. Type locality: Bonaire, base of east facing escarpment, about 0.5 km south of Kibrá di Montagne.

Figure 11-12. *Bonairea maculata*, on limestone. Cave and Karst Reserve, 29.I.2023, 11. adult, 12. juveniles. Photos Sylvia van Leeuwen.

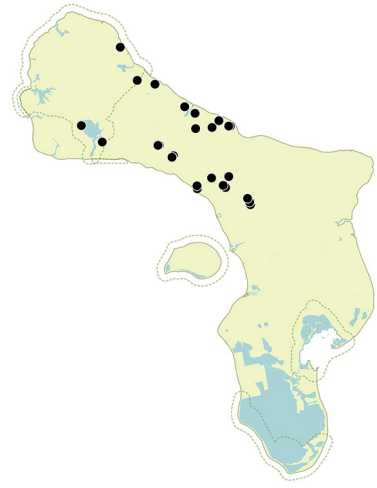

Figure 13. Distribution of *Bonairea maculata* on Bonaire.

Habitat and distribution In limestone areas only. Lives on and under limestone rocks and in crevices in these stones and on steep limestone cliffs of the fossil coral terraces, especially on north and east facing cliffs and shadowed places (fig. 13). We did not find this species on Klein Bonaire

but it is reported from that island by Wagenaar Hummelinck (1940b).
Remarks Not only the species but also the genus is endemic for Bonaire.

Tudora aurantia aurantia (Wood, 1828)

Other names *Tudora aurantiaca* Wood (in: Smith 1898), *Tudora aurantia* (Wood, 1828) (in: Wagenaar Hummelinck 1940b). Papiamentu: Kokolishi kabritu, Cocolishi di cabritu (goat shell). On Curaçao Cocolishi di cabritu is used for *Tudora megacheilos*, a similar looking species (Coomans 1970).
Description Shell females diameter 10 mm, height 19 mm; shell males diameter 8 mm, height 15 mm. Sculpture of very fine to obscure fine spirals and axials growth cords. Especially on the last body whorl of adult shells the sculpture fades out. In mature shells the early whorls have been shed and the top is eroded. The shell colour is variable, from white to yellowish to orange to dark blue, with or without colour bands and stripes. The oval operculum has a horny basis on the inside and a smaller calcareous plate on the outside. The body is greyish with often a yellow to orange glow on the head. The snout is dark grey, the tentacles are light yellow to orange. Black eyes on the basis of the two upper tentacles. Habitus: figure 14.
Status Endemic species / subspecies which occurs on Bonaire only. Type locality: Bonaire, without further details.
Habitat and distribution Very abundant species, living on and under rocks, in crevices of fossil coral terrace and on cacti, trees and plants. On limestone soils it is most abundant, but the species also occurs in lower numbers on non-limestone soils. Distributed on the southern and eastern part of Bonaire, roughly south of the line Porto Spaño and Great Hause Carpata and in the botanical garden near the entrance of WSNP (probably introduced there unintentionally by humans with plants) (fig. 15). It does not occur on Klein Bonaire.
Remarks Snails with remarkable sexual dimorphism: males are much smaller than females (fig. 16).

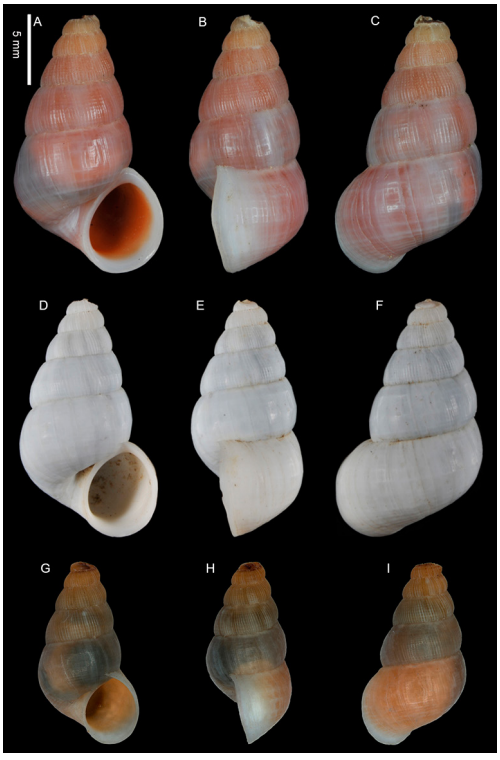

Figure 14. *Tudora aurantia aurantia*, along Kaminda Sorobon, 26.1 and 30.1.2023, A-C. 18.5 mm, D-F. 17.1 mm, G-I. 13.0 mm. Photos Sylvia van Leeuwen.


Figure 15. Distribution of *Tudora aurantia aurantia* on Bonaire.

Figure 16 *Tudora aurantia,* in pairs. The males are much smaller than the females. Tera Barra, 23.x.2022. Photo Theo Peeters.

The taxonomy of *Tudora aurantia* is not fully clear. Sometimes both subspecies were found together at the same locality. Baker (1924b) divided it into two subspecies, based on the differences between the shells. Initially Wagenaar Hummelinck (1940a) followed Baker in this respect, but in his thesis (Wagenaar Hummelinck 1940b) he rejected the division into two subspecies. Because of the clear differences in shell sculpture and the different distribution of the two subspecies, we follow Baker (1924b) and Van Leeuwen & Hovestadt (2017) and continue to use the subspecies to express the biological diversity of the snails of Bonaire. We hope that the analyses of DNA will shed more light on this subject in the future.

Tudora aurantia wassauensis Baker, 1924

Other names *Tudora aurantia* (Wood, 1828) (in: Wagenaar Hummelinck 1940b). Papiamentu: Kokolishi kabritu, Cocolishi di cabritu (goat shell). On Curaçao Cocolishi di cabritu is used for *Tudora megacheilos,* a similar looking species (Coomans 1970).
Description Shell females diameter 10 mm, height 19 mm; shell males diameter 8 mm, height 15 mm. The species is similar to *Tudora aurantia aurantia*, but the shell is more clearly, heavier sculptured and the growth lines are higher and wider spaced. The difference between the subspecies is easiest visible on the last whorl of the adult shell. On shells of *Tudora aurantia wassauensis* the sculpture of growth lines is much more clearly visible. Habitus: figures 17-22.
Status Endemic subspecies, occurs on Bonaire and Klein Bonaire only. Type locality: Bonaire, Seru Wassau, just west of the entrance to the Goto Lake.
Habitat and distribution Very abundant species, habitat the same as *Tudora aurantia aurantia*. Distributed on the northern and western part of Bonaire, above the line Porto Spaño and Great Hause Carpata and on Klein Bonaire (fig. 23).
Remarks See *Tudora aurantia aurantia.*

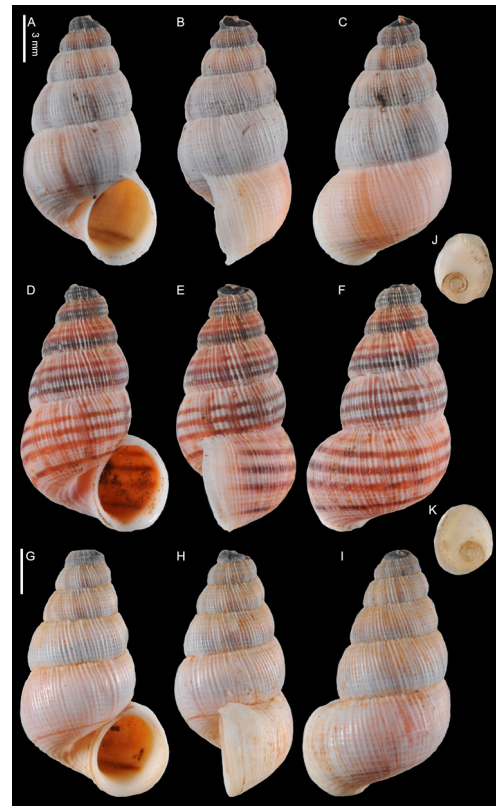

Figure 17. *Tudora aurantia wassauensis*, females, WSNP, 4.II.2023, A-C. blue variety, 16.1 mm, D-F. striated variety, 16.0 mm, G-I. pink variety, 16.6 mm, J. operculum inner side, 4.8 mm, K. operculum outside, 4.8 mm. Photos Sylvia van Leeuwen.

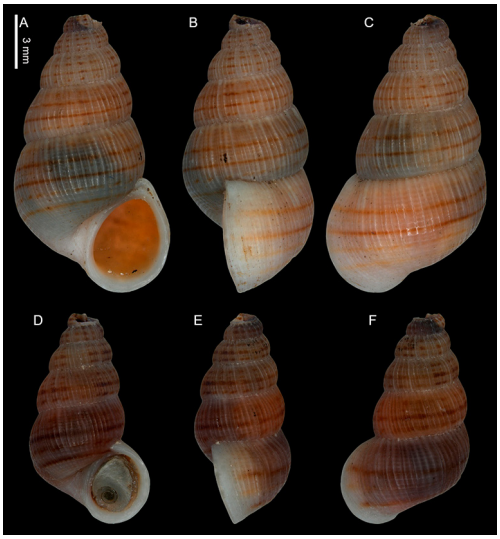

Figure 18. *Tudora aurantia wassauensis*, Klein Bonaire, 25.1.2023, A-C. female, 15.5 mm, D-F. male, 12 mm. Photos Sylvia van Leeuwen.

Figure 19-20. *Tudora aurantia wassauensis,* 19. on calcareous rock, along Kaminda Sabana Piedra Krus, 26.1.2023, 20. on fossil coral plateau. WSNP, Slagbaai, 23.1.2023. Photos Hannco Bakker & Sylvia van Leeuwen.

Figure 21-22. *Tudora aurantia wassauensis,* crawling animal with orange tentacles and dark snout. WSNP near entrance, 23.1.2023. Photos Hannco Bakker & Sylvia van Leeuwen.

Figure 23. Distribution of *Tudora aurantia wassauensis* on Bonaire.

Veronicellidae

Veronicellidae spec.

Other names Veronicellidae indet., English: Leatherleaf slug, Papiamentu: Kokolishi Pegadó ('sticky snail').
Description Size up to 28 mm long. The slugs can be light or dark brown with darker irregular spots. Generally, there is a lighter line over the middle of the body. At rest the head can be covered entirely by the mantle and the body is rather flat. When crawling two upper tentacles are visible. The slugs move very slow and are very sticky and slimy. Habitus: figure 24.
Status Exotic, introduced by humans on Bonaire. The species is most likely imported with potted plants or pot soil. Several species of Veronicellidae are known from other Caribbean islands. Sometimes native, but more often introduced via potted plants.
Habitat and distribution We found several specimens in a garden center in Kralendijk and probably can also be found in private gardens or other cultivated areas (fig. 25). It does not occur on Klein Bonaire.

Figure 24. Veronicellidae, length about 28 mm. Garden center Green Label, 30.1.2023. Photos Sylvia van Leeuwen (A-B), Tello Neckheim (C).


Figure 25. Distribution of Veronicellidae species on Bonaire.

Remarks Slugs of this genus are difficult to identify because of the variability of colours and the lack of visual characters. These species show breeding care, the slug protecting its eggs by curling around them. They can become a pest for garden plants. We are not sure if all slugs observed by us belong to the same species.

Succineidae

Succinea gyrata Gibbons, 1879

Other names Papiamentu: Kokolishi Lechi (milk shell).
Description Shell diameter 4.5 mm, height: 12 mm. Shell often smaller. Last whorl is much larger than previous whorls. The empty fragile shell is somewhat similar to the empty shell of *Succinea concordialis* but the shell of *S. gyrata* is slightly longer and more slender than the shell of *S. concordialis.* Empty shells are straw coloured, brown or orange-brown. The most obvious difference between *S. gyrata* and *S. concordialis* is the colour of the body: beige to orange-brown with some dark speckles and stripes in *S. gyrata* and black with yellow white dots in *S. concordialis*. Gibbons (1879) described the species based on

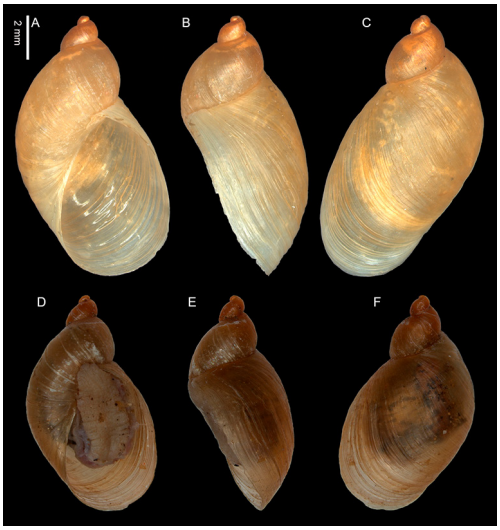

Figure 26. *Succinea gyrata*, Dos Pos, 24.1.2023, A-C. 12 mm, Lac, 26.1.2023, D-F. 9.9 mm. Photos Sylvia van Leeuwen.

the shell characters only, the full anatomy of this animal has never been described, but Baker (1924b) described and figured the radula and the jaw of this species. Habitus: figures 26-27.
Status Endemic species, occurs on Bonaire, Klein Bonaire and Curaçao only. Type locality: St. Ann, Curaçao.
Habitat and distribution Lives on moist places like wells, shores of lakes and dams and near temporary rain puddles on fossil coral terraces and near caves. In the extremely wet season of 2022-2023 the species was more abundant than in

Figure 27. *Succinea gyrata*. Kralendijk in a garden, 22.1.2023. Photo Tello Neckheim.

Figure 28. Distribution of *Succinea gyrata* on Bonaire.

dry years. We found the species on many places, like Salina Matijs, Salina Slagbaai, Put Bronswinkel, near rooien (small temporary rivers) in WSNP, along Lake Goto, at Pos Fontein, near Gruta di Lourdes, in the Cave & Karst Nature Reserve, in Kralendijk and Rincon, etc. We also found it in similar habitats on Klein Bonaire (fig. 28).
Remarks Shells of the genus *Succinea* are difficult to identify to species level and therefore other characters like the colour of the body, anatomical research or DNA analysis are important. Succineidae usually have a short life cycle, adult live animals can only be found during the wet season. In the dry season, only juveniles and empty shells can be found (pers. obs. Sylvia van Leeuwen, Baker 1924b).

Succinea concordialis A. Gould, 1848

Other names English: Spotted Ambersnail, Papiamentu: Kokolishi Sarna ('scabies shell'), Dutch: Gevlekte barnsteenslak ('spotted ambersnail').
Description Shell diameter 7 mm, height 11 mm, often smaller. The fragile shell looks much like *Succinea gyrata* but the whorls are a little more convex. The last whorl is relatively wider than in *S. gyrata*. The most obvious difference is the

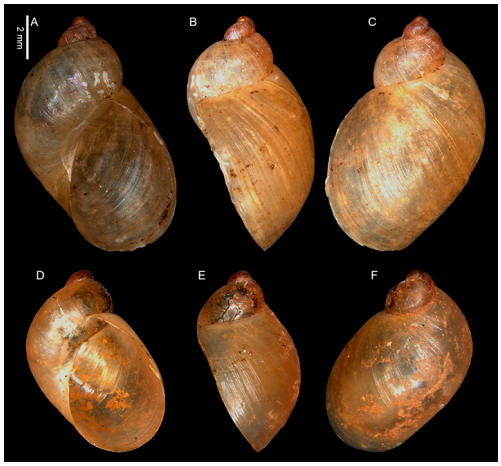

Figure 29. *Succinea concordialis*, Garden center Green Label, 30.1.2023, A-C. adult 10.9 x 6.8 mm, D-F. juvenile 8.5 x 5.5 mm. Photos Sylvia van Leeuwen.

Figure 31. Distribution of *Succinea concordialis* on Bonaire.

colour of the body of the animal: black with yellow white dots. Empty shells straw coloured, brown or orange brown. Top of the shell ruddy. Habitus: figures 29-30.
Status Exotic species, originating from the USA (mainly the southern part and Florida) and Mexico. The species is introduced by humans on Bonaire via potted plants and/or pot soil. Type locality: near Lake Concordia in Texas (USA).
Habitat and distribution It is the first time this species is reported from the ABC islands. We found it alive in two garden centers in Kralendijk (fig. 31). It does not occur on Klein Bonaire.
Remarks The systematics of Caribbean Succineidae is still unclear, not much anatomical research nor DNA analyses have been done. These methods could give more insight in the division of species within the genus.

Figure 30. *Succinea concordialis,* adult and juveniles. Garden center Green Label, 30.1.2023. Photo Tello Neckheim.

Pupillidae

Pupoides nitidulus (L. Pfeiffer, 1839)

Other names *Pupoides marginatus* (Say, 1821) (in: Wagenaar Hummelinck 1940b, Hovestadt 1987). *Pupoides marginatus nitidulus* Pfeiffer (in: Pilsbry 1924), *Pupoides* (*Pupoides*) *marginatus nitidulus* (Pfeiffer) (in: Haas 1960). *Pupoides albilabris* (C.B. Adams, 1841) (in: Hovestadt & Van Leeuwen 2017, Naturalis & STINAPA 2023, Van Leeuwen et al. 2023). English: White-lip Dagger.
Description Shell diameter 1.9 mm, height 4.1 mm,

Figure 32. *Pupoides nitidulus*, 3.8 mm. Cave and Karst Reserve, 29.1.2023, RMNH.MOL.452467. Photos Hannco Bakker.

Figure 33. *Pupoides nitidulus*, on a calcareous rock, hill southeast of Lake Goto, 24.1.2023. Photo Sylvia van Leeuwen.

Figure 34. Distribution of *Pupoides nitidulus* on Bonaire.

but a bit variable in size. Elongated with 6 whorls, slowly tapering to the obtuse apex. Colour pale horn or dusky to cinnamon or darker. Somewhat glossy and smooth. Sutures deeply impressed. The aperture is suboval with a strong whitish lip in adult shells. Easy to distinguish from *Gastrocopta* species by the larger size (about twice as big) and the lack of teeth in the aperture. In juveniles, the top (first whorl) is much wider than the top of *Gastrocopa* species. Habitus: figures 32-33.
Status Indigenous species distributed in the United States, Mexico and several Caribbean islands. Type locality: Cuba, without further details. Type locality of *Pupoides albilabris*: Crown Point, New York (USA). Type locality of *Pupoides marginatus*: Upper Missouri (USA).
Habitat and distribution Widely distributed on Bonaire, mainly on calcareous parts of the island but in lower numbers also at places with volcanic soil. Up and under rocks and stones on fossil coral terrace and forest, in gardens, on shaded walls and buildings (fig. 34). Baker (1924b) reported this species from Klein Bonaire and there seems to be sufficient habitat for this species. However we did not find this species there and neither did Wagenaar Hummelinck (1940b).
Remarks In Baker (1924b) the species is included as '*Pupoides* spec.?' This species has a wide distribution in the America's and can be somewhat different in size but it is steady in shape and colour.

Gastrocoptidae

The species within this genus are difficult to identify and in the past mistakes have been made. For Bonaire we assume that there are three species, but potentially four. For identification we mainly used the work of Pilsbry (1916-1918, 1924), Nekola

& Cools (2010) and Nekola et al. (2012). A study regarding the limits in morphology is required in combination with molecular and anatomical work to further investigate the diversity of *Gastrocopta* species on the Caribbean islands. All species are very small and can best be found under calcareous stones and in leaf litter samples (fig. 35).

Gastrocopta curacoana Pilsbry, 1924

Other names *Pupa longurio* (Crosse, 1872) (in: Smith 1898, Baker 1924b), *Gastrocopta* (*Gastrocopta*) *curacoana* Pilsbry (in: Haas 1960).
Description Shell diameter 0.75-0.95 mm, height 1.5-2.4 mm. The shell is slender, elongated, subcylindric, slowly tapering to the obtuse summit; shell cinnamon-brown, paler to the apex, weakly striated obliquely (Pilsbry 1924). The angulo-parietal lamella is strongly bifid, the left part often larger than the right part. Lower palatal fold is long and above this a shorter palatal fold. These are often visible through the outside of the shell. Distinguished by its small size, cylindrical and slender form. In comparison with *G. octonaria* it lacks the slightly shouldered penultimate whorl. This variable species is related to *G. barbadensis* but is certainly distinct by the decidedly longer lower-palatal fold, its inner half curved downward, by various small differences in the lamellae and by the long, slender shape and strongly convex whorls, the last one more compressed laterally (Pilsbry 1924). Habitus: figure 36.
Status Indigenous species, distributed on the ABC islands, the Venezuelan mainland and the islands Blanquilla and Tortuga. Type locality: Fort Nassau, Curaçao.
Habitat and distribution In calcareous areas only. We found the species on Bonaire in the WSNP near Slagbaai, along Lake Goto, the Cave and Karst Reserve, Seru Largu, Kaminda Turistico, on a rock wall behind Gruta di Lourdes, along Kaminda Turistico (south of Rincon), and east of Rincon near Pos Fontijn, Boca Onima and on a rocky wall along the coast. On Klein Bonaire we found it along the Kos de Vito trail (fig. 37).

Figure 36. *Gastrocopta curacoana,* 1.5 mm. Rock wall behind Gruta di Lourdes, 31.1.2023, RMNH.MOL.513737. Photos Hannco Bakker.

Figure 35. *Gastrocopta* spec., under a calcareous rock, hill southeast of Lake Goto, 24.1.2023. Photo Sylvia van Leeuwen.

Figure 37. Distribution of *Gastrocopta curacoana* on Bonaire.

Gastrocopta octonaria Pilsbry, 1924

Other names *Gastrocopta* (*Gastrocopta*) *octonaria* Pilsbry (in: Haas 1960).
Description Shell diameter 0.95 mm, height 2.3 mm. Elongated, slender, cylindrical shape, but more elongated in comparison with *G. curacoana*. The 5.5 penultimate whorls are slightly shouldered, the whorls less rounded than in *G. servilis riisei*. The whorls are strongly convex. The angulo-parietal lamella is strongly bifid; in a basal view, the parietal shows no spur on the columellar side. A tubercular, rather deeply placed infraparietal lamella is present. The columellar lamella is strongly developed; below its inner end there is a strong subcollumellar tubercle, somewhat united with the columellar. The palatal folds are similar to those of *G. curacoana* in shape and position, but they are generally white; the lower-palatal is long, the inner half curved (Pilsbry 1924). Habitus: figure 38.
Status Caribbean species, distributed in La Guajira Peninsula (Colombia), the ABC islands, Isla Orchila and Islas Los Hermanos (Venezuela) and Barbuda Island. Type locality: Fort Nassau, Curaçao.
Habitat and distribution This is the most common *Gastrocopta* species on Bonaire. We found it in the Cave and Karst Reserve, near Lake Goto, near Seru Largu, behind Guto di Lourdes, east of Rincon near Pos Fontijn and on a rocky wall near the coast, and in WSNP at Slagbaai, Jawapas and near a small dried-up stream with many deciduous trees. We also found it on Klein Bonaire (fig. 39).

Figure 38. *Gastrocopta octonaria*, 1.9 mm. Rock wall behind Gruta di Lourdes, 31.1.2023, RMNH.MOL.452435. Photos Hannco Bakker.


Figure 39. Distribution of *Gastrocopta octonaria* on Bonaire.

Gastrocopta servilis riisei (L. Pfeiffer, 1852)

Other names *Pupa riisei* L. Pfeiffer, 1852 (unaccepted [original combination] in: WORMS), *Gastrocopta* (*Gastrocopta*) *servilis riisei* (Pfeiffer) (in: Haas 1960). English: Wandering Snaggletooth Snail, Wandering Snag. This is the vernacular for *Gastrocopta servilis*, there are no other vernaculars for this subspecies.
Description Shell diameter 0.9 mm, height 2.1 mm. Elongated, tapering to a somewhat acute apex. Pale chestnut or horn-coloured. The shell differs from *G. servilis servilis* (Gould, 1843) by the oblong, less conic shape. The teeth are smaller, the parietal lamella is lower and a basal fold is absent. The upper palatal plica is small or often wanting. Rather rounded whorls, broader than the previous two species and larger, therefore rather easy to separate from the other two species on Bonaire. Habitus: figure 40.
Status Indigenous subspecies, widely distributed on several Caribbean islands: Jamaica, St. Croix, St. Martin, Barbuda, Antigua, Tobago, ABC islands (Hovestadt & Van Leeuwen 2017). Also reported from Puerto Rico and Florida (USA),

Figure 40. *Gastrocopta servilis riisei,* 2.1 mm. Rock wall behind Gruta di Lourdes, 31.1.2023, RMNH.MOL.452478. Photos Hannco Bakker.

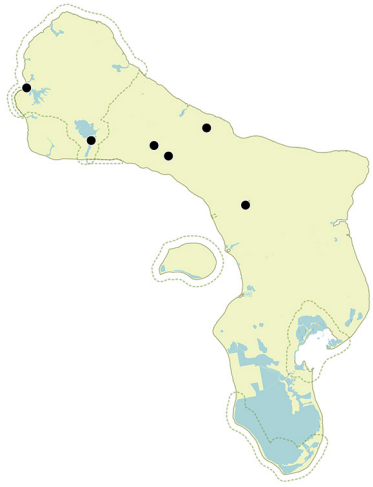

Figure 41. Distribution of *Gastrocopta servilis riisei* on Bonaire.

Costa Rica and Venezuela (GBIF.org). Type locality: Saint Thomas, Virgin Islands (USA).
Habitat and distribution We found it in calcareous areas only. Although the three *Gastrocopta* species can occur together in the same place, this species seems to prefer slightly more moist places than the other two *Gastrocopta* species. On Bonaire we found it along the east coast of Lake Goto, in WSNP at Slagbaai, near Pos Fontein, between Santa Barbara Crowns and Seru Largu along a small wall for the water flow, near a cave in the Cave and Karst Reserve, and on a rock wall behind Gruta di Lourdes (fig. 41). The species has never been reported from Klein Bonaire and we have not found it there either.

Bulimulidae

Mesembrinus elongatus (Röding, 1789)

Other names *Bulimus elongatus* Bolt (in: Bland 1861). *Bulimulus elongatus* (Bolten) (in: Smith 1898). *Drymaeus virgulatus* (Férussac) (in: Baker 1924b). *Drymaeus virgulatus* (Férussac, 1821) (in: Wagenaar Hummelinck 1940b, Hovestadt 1987). *Drymaeus elongatus* (Röding, 1798) (in: Hovestadt & Van Leeuwen 2017, Naturalis & STINAPA 2023, Van Leeuwen et al. 2023). Papiamentu: Chubatu, Kokolishi Chubatu ('flute', 'flute shell'), after the way the shell is used.
Description Shell diameter 11-13 mm, height 27-29 mm. Higher than wide. The relatively large shell has a smooth and rather shiny surface. The colour is very variable, sometimes totally whitish, greyish-white or yellowish but often with all kinds of light to dark brown markings parallel to the whorls. Sometimes the brown markings become stripes. Often the colour of the top is purplish. The inside of the aperture can be brown. The end of the aperture is sharp in young shells. This species can easily be distinguished from juvenile *Lissachatina fulica* because adult *Mesembrinus elongatus* is half as wide at the same shell height. Habitus: figures 42-44.
Status Caribbean species, known from the ABC islands and several islands of the Lesser Antillean arc: Anegada, Anguilla, Barbuda, Isla Mona, Puerto Rico, Vieques, Saint Thomas, Saint Johns, Tortola, Saint-Barthélemy, Saint Croix, Sint Eustatius and St. Martin (Hovestadt & Van Leeuwen 2017, Van Buurt 2016). Type locality: not mentioned by Röding. The type locality of the synonymised *Drymaeus virgulatus* is Puerto Rico.
Habitat and distribution We found the species distributed over the northern half of Bonaire: in the WSNP (e.g. Seru Grandi, near a little rooi and near Boca Kokolishi), Seru Wasao, around Lake Goto, in the Cave and Karst Reserve, along the Wayaka trail, in the surroundings of Rincon (Gruta di Lourdes, Fontijn, viewpoint Altamira Unjo), in Tera Barra, near Pos Gurubu and Seru Largu (fig. 45). These places have in common that

there is a well-developed and undisturbed natural vegetation with large trees, often but not always on a calcareous soil. *Mesembrinus elongatus* lives on the stems of trees, bushes and cacti and sometimes on the leaves of it. According to Van Buurt (2016) the species is clearly dependent on a fairly limited selection of local plants. The species can withstand salt spray, but not too much. The species is vulnerable to air pollution (Van Buurt 2016).

Large groups are found in the shade on Wayaká tree *Guaiacum officinale* and the Surun *Crateva tapia* (fig. 46). Van Buurt (2016) suggests that these are probably breeding aggregations.

The species has never been reported from Klein Bonaire and we have not found it there either.

Remarks Breure (2023) argued that the species name should be *Drymaeus virgulatus*, while Bank (2023) replied to that paper that *Drymaeus elongatus* should be the valid name because *Helix elongata* Röding is a nomen protectum, and the name

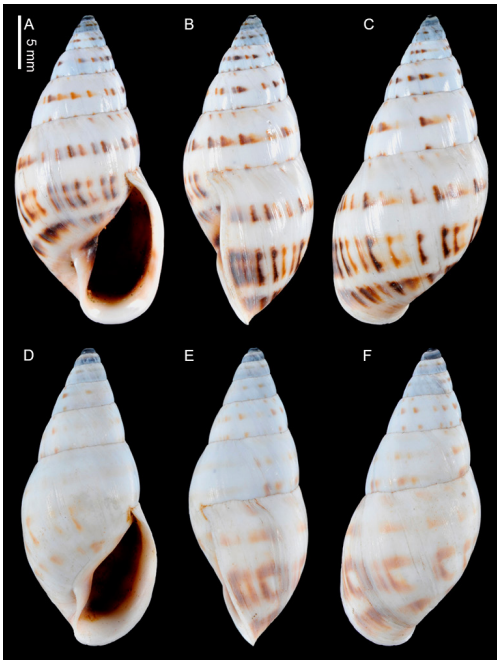

Figure 42. *Mesembrinus elongatus*, Wayaka trail, 3.II.2023, A-C. dark specimen, 29.1 mm, D-F. light specimen, 28 mm. Photos Sylvia van Leeuwen.

Figure 43-44. *Mesembrinus elongatus*, 43. adults, Cave and Karst Reserve, 29.I.2023, 44. juvenile, Tera Barra, 1.II.2023. Photos Hannco Bakker & Sylvia van Leeuwen.

Figure 45. Distribution of *Mesembrinus elongatus* on Bonaire.

Figure 46. A group of *Mesembrinus elongatus* on a large Wayaká tree *Guaiacum officinale*, possibly a breeding population. Wayakatrail, 3.II.2023. Photo Sylvia van Leeuwen.

Drymaeus virgulatus introduced by Férussac in 1821 is a junior synonym. The recent change of the genus from *Drymaeus* to *Mesembrinus* is based on a molecular study of the Orthalicoidea by Salvador et al. (2023). This snail is the biggest indigenous terrestrial snail species of Bonaire and the most colourful.

Cerionidae

Cerion uva bonairensis Baker, 1924

Other names *Cerion uva bonairensis* form *kralendijki* Baker, 1924 (in: Baker 1924b). *Cerion uva* Linnaeus, 1728 (in: Wagenaar Hummelinck 1940b). Papiamentu: Kokolishi karne, Cocolishi carné ('sheep shell'), maybe because of the white colour of the shell (Coomans 1970). Cocolishi di kalakóena and Kokolishi di kalkoena ('turkey-shell'), due to the fact that it was given to turkeys as (calcareous) food (Hovestadt 1987). Dutch: Gebakerd kindje ('swaddled baby'), Bijenkorfje ('beehive'), and Kinderwiegje ('baby crib'), referring to the shell shape (Hovestadt 1987).
Description Shell diameter 8-10 mm, height 24 mm. Cilinder-shaped. The colour of the shell is ivory-white without colour bands or other markings. Generally 8 to 10 whorls. The axial ribs are strong and blunt. Habitus: figures 47-51. Sometimes much higher shells have been found, up to 33.4 mm with 12 whorls (fig. 50). But also smaller shells are found in one population.
Status Endemic subspecies on Bonaire and Klein Bonaire only, with Bonaire, Porta Spaño as the type locality (Baker 1924b, Harasewych 2014). The species *Cerion uva* Linnaeus, 1758 occurs on Curaçao, Aruba and Bonaire and Klein Bonaire only (Harasewych 2014, Hovestadt & Van Leeuwen 2017).
Habitat and distribution The species is widely distributed and locally abundant on both islands (fig. 52). They are found along the shore and inland and are most numerous on the limestone terraces along the coasts and on inland limestone areas like the calcareous hill southeast of Lake Goto and the Cave & Karst Reserve. They also occur on volcanic non-limestone soils, although they are less numerous there.

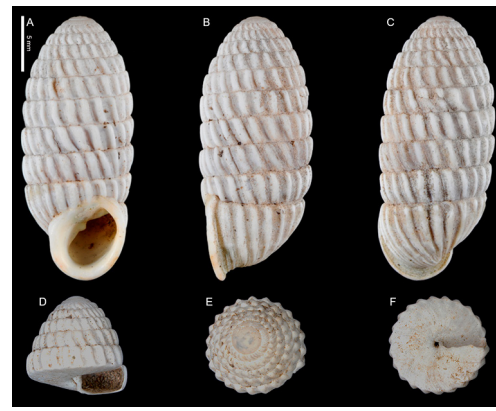

Figure 47. *Cerion uva bonairensis*, Gruta di Lourdes, 4.II.2023, A-C. adult 24.0 mm, D-F. juvenile, 9.1 mm. Photos Sylvia van Leeuwen.

Figure 48. *Cerion uva bonairensis* can locally occur very abundant. WSNP near Slagbaai, 23.I.2023. Photo Sylvia van Leeuwen.

Figure 51. Juveniles of *Cerion uva bonairensis* under a calcareous rock. Cave and Karst Reserve, 29.I.2023. Photo Sylvia van Leeuwen.

Remarks *Cerion uva* (Linnaeus, 1758) was the first terrestrial species from the ABC islands that was ever described in a binomial way. Following the settlement of Curaçao by the Dutch West India Company in 1634, shells of *C. uva* were even well

Figure 49-50. *Cerion uva bonairensis,* 49. on a tree. Tera Barra, I.II.2023, 50. some specimens develop shells that are much higher than normal. This specimen has 12 whorls and is 33,4 mm high. Fontein, 26.I.2023. Photos Sylvia van Leeuwen & Tello Neckheim.

known to pre-Linnaean authors (Harasewych 2014).
In the 20th century there was a lot of discussion about the taxonomy of this species, based on several studies of the shell morphology. Baker (1924b) observed variation in shell size and sculpture within this species and described and recognised eight subspecies and forms of *Cerion uva*. From Bonaire he described the subspecies *C. uva bonairensis* and *C. uva bonairensis* forma *kralendijki* for the specimens with much smaller shells. Initially Wagenaar Hummelinck (1940a) followed this view, but in his thesis (Wagenaar Hummelinck 1940b) he stated that the morphological differences within *C. uva* were not enough to justify a subdivision. Therefore, he regarded *C. uva bonairensis* and *C. uva* forma *kralendijki* (as well as all other subspecies from Curaçao and Aruba described by Baker) as synonyms of *C. uva*. De Vries (1974) agreed with the opinion of Wagenaar Hummelinck (1940b), while Gould (1969 and 1984) supported a division into four subspecies, including *C. uva bonairensis* from Bonaire and Klein Bonaire. Harasewych (2014) has conducted an extensive DNA analysis of the various named subspecies and forms of *C. uva*. His analysis showed that all *C. uva* populations belong to one single species that can be divided into four subspecies. Populations from Bonaire were characterised by distinct haplotypes that require a minimum of seven mutational steps to connect to the nearest Curaçao population for the COI gene and a minimum of five mutational steps for the 16S gene. He concluded that *C. uva bonairensis* had to be recognised as a different subspecies. The differentiation between *C. uva bonairensis* and *C. uva bonairensis* forma *kralendijki* by Baker (1924b) was not supported by his genetic analysis.

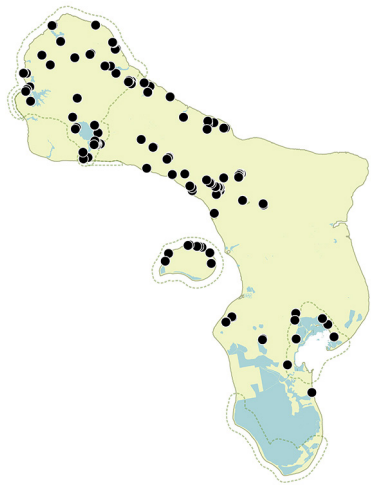

Figure 52. Distribution of *Cerion uva bonairensis* on Bonaire.

Urocoptidae

Brachypodella gibbonsi Baker, 1924

Other names *Brachypodella raveni* (Crosse, 1872) (in: Wagenaar Hummelinck 1940).
Description Shell diameter 2.4 mm, height 6-7 mm. Strong elongated. The up to 10 whorls are strongly ribbed. Often the top of adult shells is eroded. In adult shells the last whorl is not attached to the penultimate whorl. The aperture is roundish and has a sharp and reflected lip. Juvenile shells lack the characteristic aperture and are not decollated. Habitus: figures 53-54.
Status Endemic species of Bonaire and Klein Bonaire only. Type locality: Bonaire, base of western escarpment of Montagne.
Habitat and distribution Occurs in limestone areas only. Prefers calcareous rocky places, especially under stones in crevices and on steep limestone rock walls, sometimes openly on the rocks. On shady moist places (fig. 55). Baker (1924b) and Wagenaar Hummelinck (collection RMNH) also found the species on Klein Bonaire, but we did not find it there.
Remarks While Baker (1924b) recognised different species of *Brachypodella* from Bonaire, Curaçao and Aruba, Wagenaar Hummelinck (1940b) had the opinion that they were all the same species. For this reason Wagenaar Hummelinck (1940b) considered *Brachypodella gibbonsi* Baker, 1924 as a synonym of *Brachypodella raveni* (Crosse, 1872).

Figure 53. *Brachypodella gibbonsi,* 7.2 mm. Cave and Karst Reserve, 31.I.2023, RMNH.MOL.452437. Photos Hannco Bakker.

Hovestadt & Van Leeuwen (2017) agreed with Baker because the Bonaire specimens have deeper sutures and higher and heavier growth riblets than specimens of *Brachypodella raveni* on Curaçao. We follow the opinion of Baker (1924b) and Hovestadt & Van Leeuwen (2017) and hope that genetic analysis can bring more clarity in the taxonomy of the genus *Brachypodella* in the future.

Figure 54. *Brachypodella gibbonsi,* on fossil coral rock. Wayakatrail, 3.II.2023. Photo Sylvia van Leeuwen.

Figure 55. Distribution of *Brachypodella gibbonsi* on Bonaire.

Microceramus bonairensis bonairensis (E.A. Smith, 1898)

Other names *Pineria Bonairensis* (in: Smith 1898). *Microceramus bonairensis* (E.A. Smith, 1898) (in: Wagenaar Hummelinck 1940b).
Description Shell diameter 3 mm, height 8 mm. The shell shape is cylindrical, the penultimate whorl is slightly the broadest. Shell light brown to beige, frequently marked with contrasting lighter and darker streaks and patches. Aperture roundish, but broader than high. Shell thin with a sculpture of transverse growth lines. Adult shells have about 10 whorls. Lip reflected in adult snails. Juvenile shells have a very thin lip without reflection. Habitus: figures 56-58.
Status Endemic subspecies from Bonaire and Klein Bonaire. Type locality: Bonaire.
Habitat and distribution Occurs in limestone areas only (fig. 59). Prefers calcareous rocky places, especially on and under stones in crevices, on steep limestone cliffs and on coral plateaus shaded by trees and shrubs. Generally hidden, sometimes openly on the rocks. We found fresh empty shells

Figure 56. *Microceramus bonairensis bonairensis,* 6.8 mm. Cave and Karst Reserve, 29.1.2023, RMNH.MOL.452404. Photos Hannco Bakker.

Figure 57-58. *Microceramus bonairensis bonairensis*, on fossil coral rock, Cave and Karst Reserve, 29.1.2023, 57. adult, 58. juvenile. Photos Sylvia van Leeuwen.

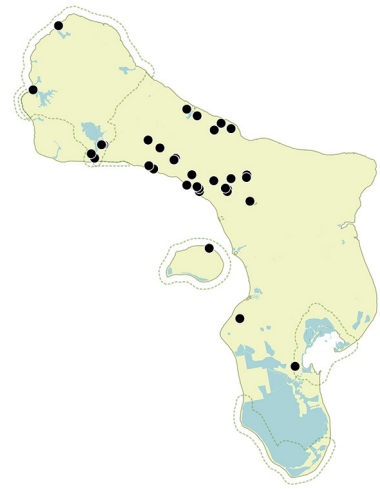

Figure 59. Distribution of *Microceramus bonairensis bonairensis* on Bonaire.

in two places on Klein Bonaire, so it is likely that the species still lives there.

Remarks Wagenaar Hummelinck (1940b, 1994) did not recognise the various subspecies of *Microceramus bonairensis* as described by Baker (1924b) for Aruba, Bonaire and Curaçao and used *Microceramus bonairensis* for the molluscs on all these islands. Hovestadt & Van Leeuwen (2017) agreed with Baker because specimens from each of these islands are sufficiently different. They write that specimens from Bonaire are characterised by its ovate-lanceolate shape, with very prominent growth riblets. We follow the opinion of Baker (1924b) and Hovestadt & Van Leeuwen (2017) and hope that genetic analysis can bring more clearness in the taxonomy in the future.

Achatinidae

Lissachatina fulica (Bowdich, 1822)

Other names *Achatina fulica* Bowdich, 1822. *Achatina fulica* (Férussac, 1821) (in: Van Benthem Jutting 1951). *Lissachatina fulica* (Férussac, 1821) (in: Hovestadt & Van Leeuwen 2017). English: Giant African snail, African Giant Snail, Giant

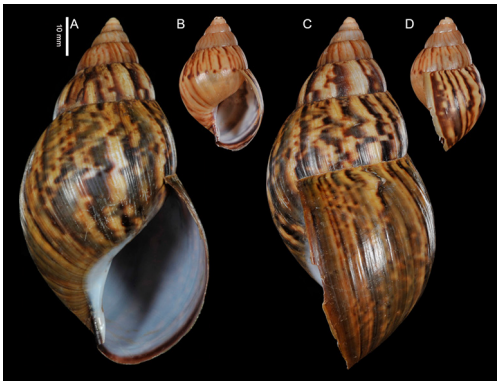

Figure 60. *Lissachatina fulica*, Kaya Piedra Preciosa, 27.1.2023, A and C. 91.6 mm, B and D. juvenile, 35.5 mm. Photos Sylvia van Leeuwen.

Figure 61. A heap of *Lissachatina fulica* found in Kralendijk in the neighbourhood Republiek, 27.1.2023. Photo Sylvia van Leeuwen.

African Land Snail, Giant East African Snail. Papiamentu: Kokolishi Maron ('golden brown shell'). Dutch: Afrikaanse reuzenslak ('African giant snail'), Grote agaatslak ('Big agate snail'), Reuzenagaatslak ('Giant agate snail').

Description Shell diameter 40 mm, height up to 92 mm. Shell very large and clearly higher than wide. This is the largest land snail occurring on Bonaire. The species can become even larger than the maximum size of 92 mm we observed during the expedition. The shell with 7 whorls has variable light and dark brown irregular stripes or bands on a rather white surface. Juveniles can easily be distinguished from the indigenous *Mesembrinus elongatus* because they are nearly twice as wide at the same shell height. Habitus: figures 60-61.

Status Exotic species, introduced by humans in most tropical regions. Type locality: no locality given, probably Mauritius. On Bonaire most likely imported with pot plants or pot soil, because the first observations are from a private garden. Another option is that the animals were imported as pets and then released or escaped.

Habitat and distribution This is the first time the species is reported from Bonaire. The first observation on Bonaire was in 2022 in a garden in Bona Bista (information Johan van Blerk). In 2023 we found it very abundant in gardens in the neighbourhood La Republiek around Kaya Piedra Preciosa. It was also observed in a garden in Rincon around Kaya Kiwi in low numbers (information from a resident). In January 2023 the distribution was limited to some gardens and human settlements only (fig. 62). However, this species is able to spread rapidly and is also able to enter natural areas (for example Kabouterbos on Curaçao, pers. obs. Sylvia van Leeuwen). This species does not occur on Klein Bonaire.

Remarks The anatomy of *Lissachatina fulica* is described by Van Benthem Jutting (1951). On other Caribbean islands *Lissachatina fulica* has

Figure 62. Distribution of *Lissachatina fulica* on Bonaire.

shown to be an invasive species that can increase and spread rapidly, as happened for example on Sint Maarten, Curaçao and Sint Eustatius. *Lissachatina fulica* is considered as one of the 100 most harmful invasive species in the world, mainly because of the feeding damage they cause to garden plants and agricultural crops and because of their risk to human health (CABI 2018). The snail is a potential host of a roundworm, the nematode *Angiostrongylus cantonensis* (Chen, 1935) or rat lungworm, which can cause meningoencephalitis and eosinophilic meningitis in humans, diseases that can lead to blindness and death (Smith 2005). The snail may also be a potential host of the nematode *Angiostrongylus costaricensis* Morera & Céspedes, 1971 which causes abdominal angiostrongylosis, a zoonotic disease that occurs from the southern United States to northern Argentina (Thiengo et al. 2007, Fontanilla 2010). And third, the snail can carry the bacterium *Aeromonas hydrophila* (Chester) Stanier, 1943, that has caused a variety of bacterial infections (bacterioses) in humans, including osteomyelitis, septic arthritis, tonsillitis and meningitis (USDA 1982, cited by Smith 2005). The transmission of nematodes and bacteria from snails to humans does not only occur through eating raw or undercooked snails. Even snail slime (mucus) on unwashed hands, on unwashed lettuce and snail-contaminated drinking water can be sources of the bacteria and nematodes. It is therefore not wise to touch snails and plants on which the snails have crawled with bare hands or to eat them uncooked. CABI (2018) contains extended background information about the species, the risks, policy guidelines and numerous literature references.

Allopeas gracile (Hutton, 1834)

Other names *Lamellaxis gracilis* (Hutton, 1834) (in: Wagenaar Hummelinck 1940b, Hovestadt 1987). *Lamellaxis* (*Allopeas*) *gracilis* (Hutton) (in: Haas 1962). English: Graceful Awlsnail, Traveling Tramp.

Description Shell diameter 3 mm, height up to 10 mm. The shell is slender and fragile. Fresh shells have very fine growth lines that give a mat gloss. Growth lines are clearer near the suture. The aperture is high oval and the outer lip of the aperture (peristome) is sharp. Characteristic is the shallow retraction of the outer lip at the suture. Shells white, a bit transparent, with a cream to yellowish thin periostracum. Old shells can become white and opaque. The body is yellow. Habitus: figure 63.

Status Exotic species that is widely distributed in tropical areas all around the world, including many Caribbean islands (GBIF.org). Also in greenhouses in Europe. Type locality: Mirzapur (India) (Delannoye et al. 2015).

Habitat and distribution We found this species very sparsely in anthropogenic areas (garden center, Kralendijk, Rincon, greenhouse Tera Barra) and near Fontijn (fig. 64). Probably it is more widespread in private gardens. It lives normally in the litter layer but also in greenhouses and other anthropogenic areas. *Allopeas gracile* has never been reported from Klein Bonaire and we did not

Figure 63. *Allopeas gracile*, juvenile 5.0 mm. Parking area near Sorobon Beach, 30.I.2023, RMNH.MOL.452460. Photos Hannco Bakker.

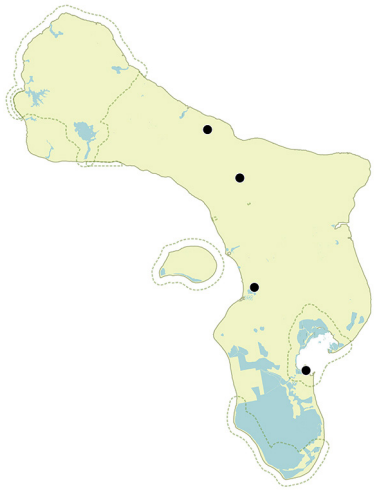

Figure 64. Distribution of *Allopeas gracile* on Bonaire.

find it there either. Hovestadt & Van Leeuwen (2017) erroneously wrote that Haas (1962) reported it from Klein Bonaire, but in fact he reported it from Klein Curaçao.
Remarks *Allopeas gracile* seems to be a rare species on Bonaire, although it can be abundant on other Caribbean islands.

Allopeas micra (d'Orbigny, 1835)

Other names *Opeas micra* (D'Orbigny) (in: Pilsbry 1906-1907, Baker 1924b). *Lamellaxis micra* (Orbigny, 1835) (in: Wagenaar Hummelinck 1940b). *Lamellaxis (Allopeas) micron* (Orbigny) (in: Haas 1962). *Lamellaxis micrus* (Orbigny, 1835) (in: Hovestadt 1987). *Leptopeas micra micra* (d'Orbigny, 1835) (in: Espinosa & Robinson 2021). English: Tiny Awlsnail.
Description Shell diameter 2.3-3 mm, height up to 8 mm. Shell is usually smaller. Translucent white. Looks like *Allopeas gracile* but it is smaller and has a blunter top. Therefore, it looks less slender. Characteristic is the shell sculpture with clearly visible fine regular growth lines, not close together. The outer lip of the aperture (peristome) is sharp. Old shells can become white and opaque. The body is greyish-cream to white. Habitus: figures 65-66.

Status Indigenous species that is widely distributed in tropical and subtropical areas of mainly the Caribbean and South America. Type locality: Santa Cruz (Bolivia). It is also imported in many other parts of the world (Haas 1962). It is reported from Florida (USA), Mexico, Central and South America and many islands in the Caribbean and the Indo-Pacific up to New Guinea (GBIF.org).
Habitat and distribution Found in anthropogenic areas as well as natural places in the litter layer. Only in the northwestern part of Bonaire: in a garden in Rincon, at the northwest side of Lake Goto and on calcareous hill southeast of Lake Goto (fig. 67). This species has never been reported from Klein Bonaire and we did not find it there either.

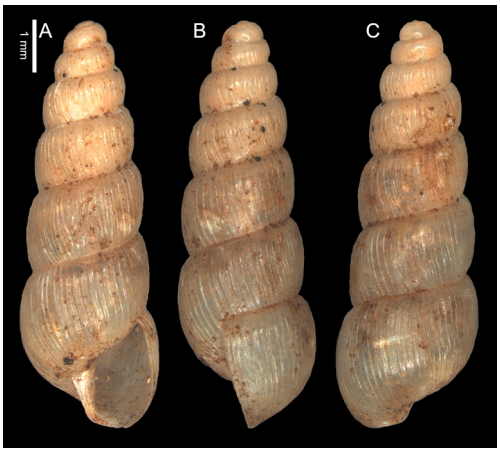

Figure 65. *Allopeas micra*, 7.8 mm. Calcareous hill southeast of Lake Goto, 24.I.2023. Photos Sylvia van Leeuwen.

Figure 66. *Allopeas micra*, juvenile. Private garden in Rincon, 29.I.2023. Photo Sylvia van Leeuwen.

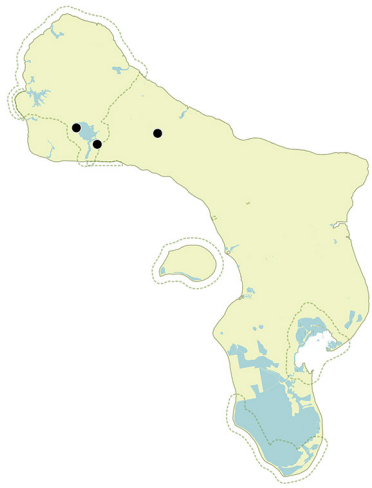

Figure 67. Distribution of *Allopeas micra* on Bonaire.

Neosubulina harterti E.A. Smith, 1898

Other names *Leptinaria harterti* (E.A. Smith) (in: Pilsbry 1906-1907, fig. 17). *Leptinaria* (*Neosubulina*) *harterti* (E.A. Smith) (in: Haas 1962). *Neosubulina gloynii* (Gibbons, 1879) (in: Wagenaar Hummelinck 1940b). *Leptinaria gloynii* (Gibbons, 1879) (in: Hovestadt 1987).
Description Shell diameter 2-2.5 mm, height 13 mm, but often smaller. Shape cylindrical and slender, with 7-9 whorls. In the middle of the shell the shape is more cylindrical. The surface of the shell is mat glossy and quite translucent, white to horn coloured. Old shells become opaque. The body is whitish, the eye is visible as a dark to black dot. Characteristic is the very long spiral parietal lamella in adult shells, which is clearly visible on the outer lip in the aperture. Sometimes the lamella is shining through the shell and even visible from the outside. In juveniles this lamella is lacking. Other species from the subfamily Subulininae on Bonaire do not have such lamella and therefore adults are easy to distinguish from *Allopeas* and *Subulina* species. Habitus: figures 68-71.
Status Endemic species, only occurring on Bonaire and Klein Bonaire. Type locality: Bonaire, probably near Kralendijk (Baker 1924b). Haas (1962) reported this species from Klein Bonaire.

Habitat and distribution Widespread in several habitats, but more common in calcareous areas. It prefers to live in crevices of calcareous rocks filled with detritus and under calcareous rocks situated on a litter layer. We found the species along Lake Goto, on several places in the WSNP, in the surroundings of Rincon, in the Cave and Karst Reserve, Fontijn, Seru Largu, Wayaka trail and on a cliff near Boca Onima (fig. 72). Wagenaar Hummelinck found it on Klein Bonaire in 1949 (Haas 1962) but we did not find this species there.
Remarks Baker (1924b) recognised three endemic species of *Neosubulina* from Aruba, Curaçao and Bonaire respectively. Wagenaar Hummelinck (1940b) considered the species from Bonaire and Aruba to be identical with *Neosubulina gloynii* from Curaçao. Hovestadt & Van Leeuwen (2017) agreed with Baker: the shells of *N. harterti* taper more regularly from the last whorl to the apex than in *N. gloynii* and it reaches less whorls (up to 9 whorls in *N. harterti* and up to 12 whorls in *N. gloynii).* Until genetic analysis brings more clarity in the taxonomy, we follow the opinion of Baker (1924b), Haas (1962) and Hovestadt & Van Leeuwen (2017).

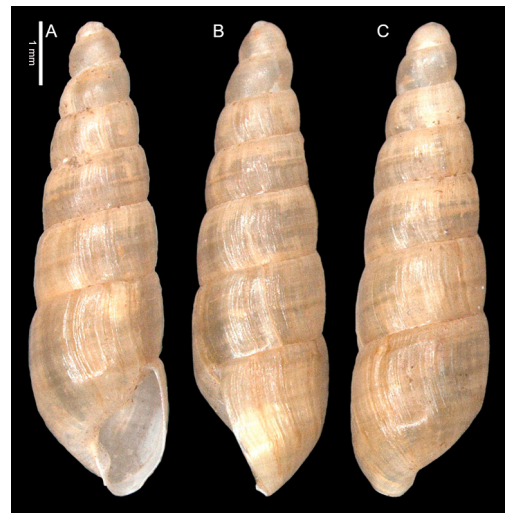

Figure 68. *Neosubulina harterti*, 7,5 mm. Wayakatrail. Photos Sylvia van Leeuwen.

Figure 69-70. *Neosubulina harterti*, in vitro. Near Pos Fontein, 26.1.2023. Photos Tello Neckheim & Hannco Bakker.

Figure 71. *Neosubulina harterti,* juveniles under a fossil coral rock. Cave & Karst Nature Reserve, 29.1.2023. Photo Sylvia van Leeuwen.

Paropeas achatinaceum (L. Pfeiffer, 1846)

Other names *Allopeas javanicum* (Reeve, 1849), also placed in *Prosopeas* or *Lamellaxis* (Horsák et al. 2020). English: Indonesian Awlsnail.
Description Shell diameter 2.5-3 mm, height 10-12 mm. May grow larger, as Pfeiffer (1846)

Figure 72. Distribution of *Neosubulina harterti* on Bonaire.

mentions 4.5 x 13 mm in his original description of the species and Horsák et al. (2020) mention 5 x 15 mm. The last whorl occupies about one third of the shell height. The shell looks like *Allopeas gracile* but it is bigger and the shell is less glossy because of the stronger growlines. Horsák et al. (2020) also write that *P. achatinaceum* differs from *A. gracile* in having a less lanceolate, that is, more turreted, shell shape with a notably higher body whorl. The sculpture of the apex is described and pictured by Naggs (1994), but only visible with a light microscope at 30 x magnification. The colour of the shell is greyish to brown and not as bright as in *A. gracile*. The aperture is oval shaped and the outer lip (peristome) is sharp, not reflected. The body is yellow, the colour of the body being visible through the shell. The eyes are visible as dark spots on the top of the tentacles. The anatomy is described by Naggs (1994). Habitus: figures 73-74.
Status Exotic species. Distributed worldwide in tropical and subtropical areas, mainly in the Indo-Pacific but also on some Caribbean islands and Florida (USA) (GBIF.org). It was established in the Hawaiian Islands prior to 1904 and first detected in Florida in 2001, where it probably arrived on plant material imported from tropical regions (Horsák et al. 2020). Type locality: Java (Indonesia).

Figure 73. *Paropeas achatinaceum*, 10.4 mm. Near garden center Always Green, 1.11.2023. Photos Sylvia van Leeuwen.

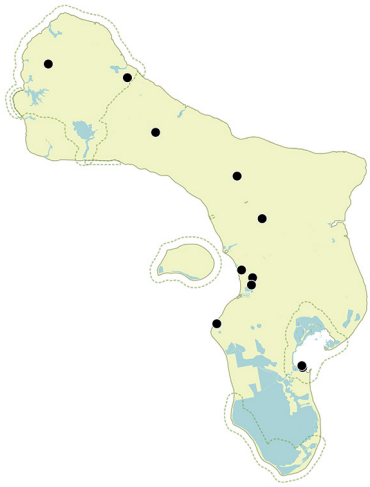

Figure 75. Distribution of *Paropeas achatinaceum* on Bonaire.

Figure 74. *Paropeas achatinaceum*. Tera Barra, in greenery, 1.11.2023. Photo Tello Neckheim.

Habitat and distribution This is the first time the species is reported from the Dutch ABC islands. Mainly found in anthropogenic areas like gardens in Kralendijk, Rincon, Belnem, Bona Vista, Tera Barra and Sorobon Beach, garden centers and around a parking place. It was also found in WSNP near Put Bronswinkel (fig. 75). We did not find it on Klein Bonaire. Due to its wide distribution, we assume that the introduction of this species to Bonaire was not very recent.
Remarks It is unclear if this species is a relatively recent introduction to Bonaire or that it was overlooked due to its similarity to *Allopeas gracile*. If it is a recent introduction the two species might compete for available habitat.

Subulina octona (Bruguière, 1789)

Other names English: Miniature Awlsnail, Glossy Subulina, Wandering Awlsnail, Subulina Snail.
Description Shell diameter 3-5 mm, height 15-18 mm. Cylinder-shaped, shell with 8-9 whorls. Surface glossy and translucent. Transverse striae are faint. Characteristic is the columellar side of the aperture which is S-shaped. The peristome is sharp. The shell is whitish to brown grey, old shells can become white and opaque. The body is yellow and the colour of the body is visible through the shell. Habitus: figures 76-77.
Status Exotic species, distributed worldwide in tropical and subtropical areas, including many

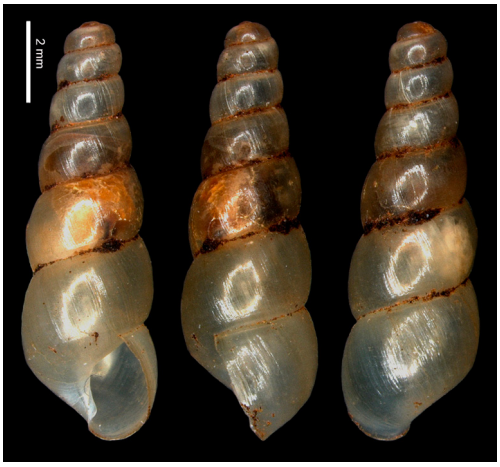

Figure 76. *Subulina octona,* 10.4 mm. Garden center Green Label, 30.1.2023. Photos Sylvia van Leeuwen.

Figure 77. *Subulina octona*. Garden center Green Label, 30.1.2023. Photo Tello Neckheim.

Figure 78. Distribution of *Subulina octona* on Bonaire.

Caribbean islands. Also in greenhouses in Europe (GBIF.org). The geographical origin of this species is unknown, probably South America (Thompson 2011, GBIF.org). Type locality: Guadeloupe (France).
Habitat and distribution This is the first time this species has been reported from Bonaire. It was only found in anthropogenic areas like a plant shop and near a garden (fig. 78). It is likely that it has been introduced by humans recently, because it still has a limited distribution on the island and Van Leeuwen & Hovestadt (2017) wrote that no observations were reported from Bonaire. The species has never been reported from Klein Bonaire and we did not find it there either.
Remarks We do not know why this species is rare on Bonaire while it can be very common and abundant on other Caribbean islands.

Ferussaciidae

Karolus consobrinus (d'Orbigny, 1841)

Other names *Caecilioides consobrina* (d'Orbigny, 1845) (in: Pilsbry 1909-1910, Wagenaar Hummelinck 1940b). *Cecilioides consobrina* (d'Orbigny, 1845) (in: Hovestadt 1987). English: Common Teardrop, Antillean Awlsnail. French: Aiquillette des Antilles.
Description Shell diameter 0.7 mm, height 2.0 mm. The tiny shell is translucent white and has a blunt top. Old shells become opaque. Shell surface is smooth and shiny when fresh. The body is white and light cream, the colour of the body is visible through the translucent shell. This species has no eyes. Habitus: figure 79.
Status Indigenous species, distributed in Mexico, Central America, Venezuela, French Guiana and many Caribbean islands like Trinidad and Tobago, Guadeloupe, Jamaica, Virgin Islands (Saint John, Guana Island), Cuba, Haiti, Martinique, Saint Martin and the ABC islands. Also reported from Argentina and Paraguay (GBIF.org). Type locality: Cuba.
Habitat and distribution This tiny species lives

Figure 79. *Karolus consobrinus*, 2.0 mm. Caves and Karst Reserve, 27.I.2023, RMNH.MOL.452489. Photos Hannco Bakker.

underground in the soil and deep in crevices in the limestone soil. This explains the absence of eyes and shell colour. It may be a common species but it is difficult to find due to the habitat where it lives. They are mostly found in wash-up after rains or stormy weather. Live animals can sometimes be found in leaf litter when it is taken in deeper layers. The distribution on Bonaire seems to be limited to the northwestern part of the island, where we found it at several localities: in the surroundings of Rincon, Fontijn, the Cave and Karst Reserve and Lake Goto (fig. 80). The species has never been reported from Klein Bonaire and we did not find it there either.

Figure 80. Distribution of *Karolus consobrinus* on Bonaire.

Remarks It can be confused with the European species *Cecilioides acicula*, which sometimes is found in the America's and the Caribbean (e.g. Bermuda, Mexico). But *C. acicula* becomes a little higher and has a sharp pointed top, allowing easy separation from *Karolus consobrinus*. The obtuse, broadly rounded apex is one of the distinguishing characters used by Schileyko (1998) to separate the genus *Karolus* from the genus *Cecilioides.*

Streptaxidae

Gulella bicolor (T. Hutton, 1834)

Other names *Ennea bicolor* Hutton, 1834 (in: Wagenaar Hummelinck 1940b), *Gulella* (*Huttonella*) *bicolor* (Hutton, 1834) (in: Venmans 1963), *Huttonella bicolor* (Hutton, 1834) (in: Hovestadt & Van Leeuwen 2017, Naturalis & STINAPA 2023, Van Leeuwen et al. 2023). English: Two-tone Gulella, Toothed Gulella, Carrot Snail.
Description Shell diameter 1.8 mm, height 7 mm. The empty shell is white and has 6-7 whorls. The adult shell has three teeth or lamellas in the aperture and the outer lip (peristome) is reflected. The palatal teeth are bigger than the basal tooth. The fresh shell is glossy and transparent white. Old shells can become opaque. The whorls have fine growth lines. The body is dark orange and this is visible through the shell. Venmans (1963) gives information about the radula and anatomy of this species. Habitus: figures 81-82.
Status Exotic species, distributed worldwide in tropical and subtropical areas (GBIF.org). Also found in European greenhouses like the Hortus

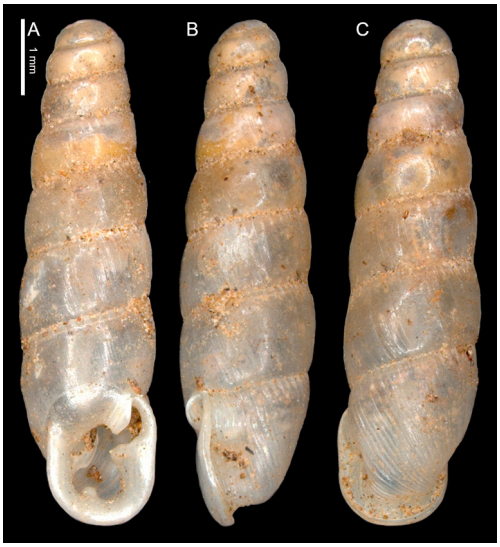

Figure 81. *Gulella bicolor*, 6.8 mm. Kralendijk, garden DCNA, 27.1.2023. Photos Sylvia van Leeuwen.

Figure 82. *Gulella bicolor,* live specimen. Garden center Green Label, 30.1.2023. Photo Tello Neckheim.

Figure 83. Distribution of *Gulella bicolor* on Bonaire.

Botanicus in Leiden (the Netherlands) (pers. obs. Tello Neckheim & Hannco Bakker) and in Bratislava, Slovak Republic (Flasar & Kroupova 1976). Type locality: Mirzapur (India). The species probably originated in East Africa, and if so, it was introduced in India (Gerlach & Van Bruggen 1999).

Habitat and distribution This is the first time the species is reported from Bonaire. We found it in a garden center where it lives under pots and in a natural area under calcareous rocks near Gruta di Lourdes (fig. 83). It is a litter-dwelling species, nocturnal and carnivorous. Feeds on small worms and snails. The species was never reported from Klein Bonaire and we did not find it there either.

Streptartemon glaber (L. Pfeiffer, 1850)

Other names *Streptaxis glaber* Pfeiffer, 1849 (in: Wagenaar Hummelinck 1940b, Hovestadt 1987), *Streptaxis* (*Streptartemon*) *glaber* Pfeiffer 1849 (in: Venmans 1963).

Description Shell diameter 6 mm, height 6 mm. The shell has a bigger and rather crooked last whorl. Juvenile shells are 'normally' coiled and develop in their adult form the crooked last whorl. The adult shell has a small umbilicus, juvenile

shells have a bigger umbilicus. Fresh shells are beige without colour bands or markings and rather shiny. Older shells often become opaque white. The body is white with orange upper parts of the body and orange tentacles. This colour pattern is variable, and is maybe dependent on age. Venmans (1963) summarises the information about the anatomy of the species. Habitus: figure 84.
Status Exotic species, introduced by humans on Bonaire. The species is widely distributed in the Caribbean and South America (Colombia, Venezuela, Suriname, Guyana and Brazil). From the Caribbean it is known from Guadeloupe, Trinidad and Tobago, Dominica, Martinique, Saint Thomas (Virgin Islands), Barbados, Saba (Van Leeuwen et al. 2015), St. Martin and Saint Lucia (GBIF.org), but might also have been introduced there. Type locality: Guyana.
Habitat and distribution Wim Klein found one fresh empty shell only, on a beach along Kaminda Sorobon where garden waste had been dumped (fig. 85). This is not the normal habitat for this species. We were not able to trace the place on Bonaire where the species lives or has lived. This is the first and only record from Bonaire known so far. We suspect that the species on Bonaire comes from a garden and that it was introduced by humans through ornamental plants. In the future it has to become clear whether the species has a sustainable population on the island. It does not occur on Klein Bonaire.
Remarks Snails from this genus are carnivorous. It is not known if introduction of these snails can be a threat to other snails or animals.

Figure 84. *Streptartemon glaber* 6 mm. Kaminda Sorobon, 30.x.2022. Leg. Wim Klein. Photo Sylvia van Leeuwen.

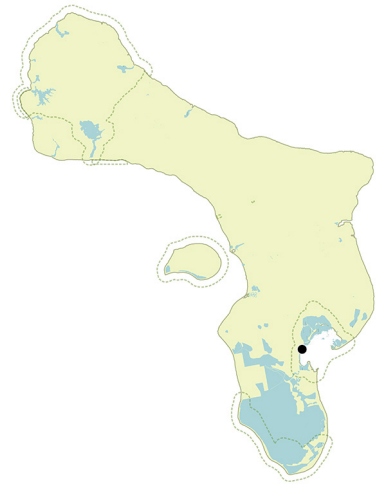
Figure 85. Distribution of *Streptartemon glaber* on Bonaire.

Zachrysiidae

Zachrysia provisoria (L. Pfeiffer, 1858)

Other names *Zachrysia (Chrysias) provisoria* (L. Pfeiffer, 1858) (in: Espinosa & Robinson 2021). English: Cuban Brown Snail, Cuban Garden Snail. Papiamentu: Kokolishi Blanku ('white shell'). Dutch: Cubaanse tuinslak ('Cuban garden snail').
Description Shell diameter 27 mm, height 19 mm. This is a relatively large species. Fresh shells are light brown. When the empty shell is older it becomes more opaque and it can even become white. In live specimens some pigmentation of the body shines through the shell. The growth lines create a fine, regularly striated sculpture. The lip in adults is strong, smooth, a little reflected and white. The body is beige brown with a regular pattern of large tubercles that are paler. Tentacles long when the snail is undisturbed in full action. Habitus: figures 86-88.

Status Exotic species, introduced on Bonaire by humans, most likely with potted plants or pot soil. The species originates from Cuba but became widely distributed in the Greater and Lesser Caribbean arc from Cuba to Trinidad and Tobago and from Cuba to Florida. The species has also been introduced on the Dutch Caribbean islands Curaçao, St. Martin and Saba (Van Leeuwen et al. 2015). Type locality: Cuba.

Habitat and distribution This is the first record from Bonaire. We found this species only in a garden center at Kralendijk but probably the species is also found in private gardens (fig. 89). We did not observe it on Klein Bonaire. *Zachrysia provisoria* is a generalist, feeding during the night on many different plants (CABI 2018).

Remarks On Cuba more *Zachrysia* species occur, but only *Z. provisoria* has become a vagrant. Under dry conditions snails burrow into the soil, emerging with the onset of rainy weather to complete their development and/or mate and deposit eggs for a new generation. When it burrows into soil, it often escapes detection in potted plants. *Zachrysia provisoria* is known mostly as a pest of ornamental plants. It can also be a host of rat lungworm (*Angiostrongylus cantonensis*), which can infect humans (CABI 2018). See the remarks at *Lissachatina fulica* for more details.

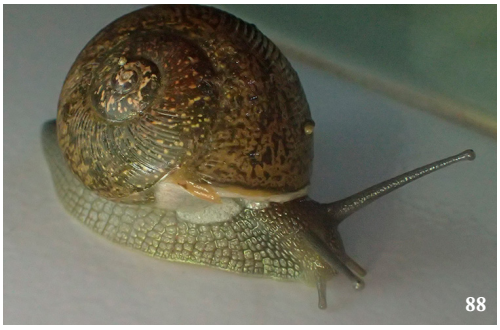

Figure 87-88. *Zachrysia provisoria*. Garden center Green Label, 30.1.2023. Photos Tello Neckheim & Sylvia van Leeuwen.

Figure 86. *Zachrysia provisoria*, 27.2 mm wide x 19.4 mm high. Garden center Green Label, 30.1.2023. B shows a slightly tilted shell so that the surface sculpture is more clearly visible. Photos Sylvia van Leeuwen.

Figure 89. Distribution of *Zachrysia provisoria* on Bonaire.

Polygyridae

Polygyra cereolus (Megerle von Mühlfeld, 1818)

Other names *Helix cereolus* Mühlfeld (in: Bland 1861). *Polygyra cereolus* (Megerle von Mühlfeld, 1816) (in: Hovestadt & Van Leeuwen 2017). English: Southern Flatcoil. Papiamentu: Kokolishi Ishi (named after the geological Ishi formation on Bonaire).
Description Shell diameter 8 mm, height 4 mm. The shell is flatly coiled or just slightly elevated and has rather strong regular ribs. The ribs on the upper side are stronger than on the underside. Fresh shells are brown. In the aperture there is a strong palatal tooth. The tooth and the reflected lip are white. Inside the shells, deep within the last whorl (not visible via the aperture), there is a well-developed parietal lamella. This lamella distinguishes *P. cereolus* from other *Polygyra* species (Pilsbry 1940, Charles 2014, Charles & Lenoble 2020). The umbilicus is widening rapidly and earlier whorls are clearly visible. The shell can be variable in size and the shape varies from flat to low conical, while the top of the last whorl can be more strongly or weakly curved or keeled. Habitus: figure 90.
Status Exotic species, introduced on Bonaire by humans, most likely with potted plants or pot soil. The species is endemic to Florida and has been introduced to several Caribbean islands (Hovestadt & Van Leeuwen 2017, Hovestadt & Neckheim 2020) and several Arabic countries (GBIF.org). It is also known from the other Dutch Caribbean islands St. Martin and Curaçao (Neckheim & Hovestadt 2016, Hovestadt & Van Leeuwen 2017). Type locality: Florida (USA).

Figure 90. *Polygyra cereolus*, 8.8 mm. Garden center Green Label, 30.1.2023. Photos Sylvia van Leeuwen.

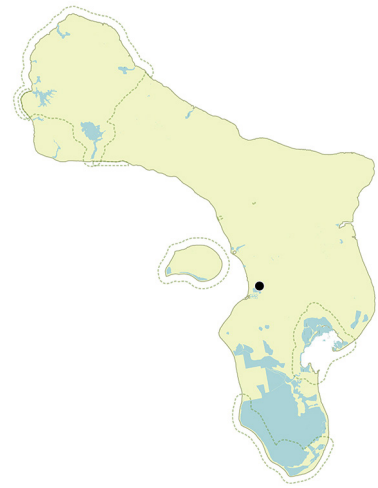
Figure 91. Distribution of *Polygyra cereolus* on Bonaire.

Habitat and distribution This is the first time the species is reported from Bonaire. We only found empty shells of this species in a garden center in Kralendijk (fig. 91), but it can probably be found in more places, for example in private gardens. In the future it will become clear whether the species has a sustainable population on the island. We did not observe it on Klein Bonaire.
Remarks Originally the species lives in mangrove bush and it is resistant to salt spray. However, it can adjust easily in anthropogenic places, because it also survives without problems in gardens and on golf courses. *Polygyra cereolus* is quite similar to *P. plana* (Charles, 2014) that occurs for instance on Bermuda and the Bahamas (GBIF.org). Both *Polygyra* species are variable in shape and size but *P. cereolus* has stronger and clearer ribs and is mostly smaller and with a less depressed shape than *P. plana*. Also the parietal lamella lacks in *P. plana.*

Praticolella griseola (L. Pfeiffer, 1841)

Other names English: Vagrant Scrubsnail, Central American Scrubsnail. Papiamentu: Kokolishi Pintá ('painted shell').
Description Shell diameter: 12 mm, height:

10 mm. The shell is heliciform and it has about 5 whorls. The colour is ivory-white to grey with a small brown band above the periphery of the whorls. The umbilicus is narrow. The adult shell has a deflected lip that slightly covers the umbilicus. Habitus: figure 92.

Status Exotic species, introduced on Bonaire by humans via plants. The distribution of *P. griseola* includes Mexico, Central America and Cuba. It has been introduced on some Lesser Caribbean islands (iNaturalist.org, GBIF.org). Type locality: Veracruz (Mexico).

Habitat and distribution We observed only one empty damaged shell of this species, in a garden center in Kralendijk (fig. 93). This is the first record from the ABC islands. Most likely this species will be found in private gardens on the island. In the future it will become clear whether the species has a sustainable population on the island. We did not observe it on Klein Bonaire.

Remarks The species seems to be a vagrant on the Lesser Caribbean islands. One empty shell was found in St. Martin in 1991 (Neckheim 2021). Two shells are found on Martinique, where it was collected in a deposition zone of rubble and waste plants (Delannoye et al. 2015) In 1946 some shells were found in Hispaniola (Clench 1946).

Figure 93. Distribution of *Praticolella griseola* on Bonaire.

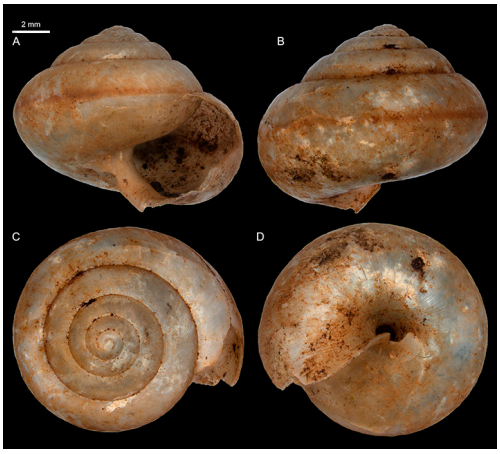

Figure 92. *Praticolella griseola*, 12.4 wide x 10.1 mm high. Garden center Green Label, 30.1.2023. Photos Sylvia van Leeuwen.

Sagdidae

Setidiscus crinitus (Fulton, 1917)

Other names *Thysanophora crinita* (Fulton, 1917) (in: Hovestadt & Van Leeuwen 2017 (but not mentioned for Bonaire), Naturalis & STINAPA 2023, Van Leeuwen et al. 2023). *Trichodiscina crinita* Fulton, 1917 (in: Baker 1924b).

Description Shell diameter 2 mm, height 1.1 mm. On Aruba the shell diameter is up to 4 mm (Baker 1924b). Shell depressed heliciform, brown.

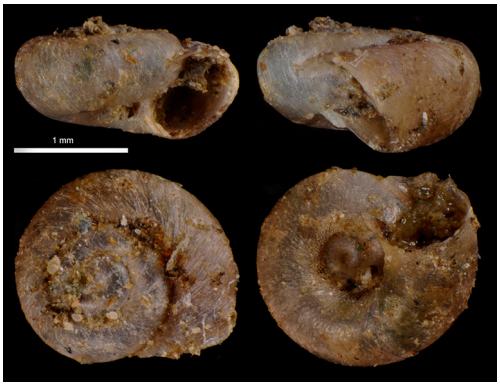

Figure 94. *Setidiscus crinitus*, 2.0 mm. Northwest side of Lake Goto, 24.1.2023, RMNH.MOL.452450. Photos Hanno Bakker.

Fresh juvenile shells are covered with fine hairs. The umbilicus is ⅓ of the diameter. The whorls have irregular small growth ribs. The aperture bends back at the palatal side. Habitus: figure 94.
Status Indigenous species, known from Aruba, Curaçao, Bonaire and Colombia (GBIF.org). Type locality: Cartago (Colombia). On the ABC islands it is a rare species. There is a big distance between Colombia and the ABC islands. The species is either introduced from Colombia or we are dealing with a hidden endemic on the ABC islands.
Habitat and distribution This is the first time the species is reported from Bonaire. Empty shells were found washed ashore at lake Goto and along Kaminda Sorobon and at Put Bronswinkel (fig. 95). The species has never been reported from Klein Bonaire and we did not observe it there either.

Pristilomatidae

Hawaiia minuscula (A. Binney, 1841)

Other names English: Minute Gem Snail.
Description Shell diameter 1.7 mm, height 1.0 mm. This very small species has four convex whorls with deep sutures and the shell is somewhat shiny. The shell is whitish translucent and

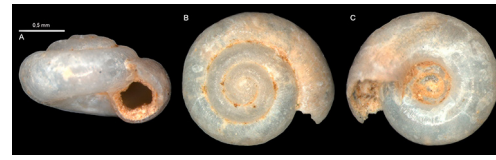

Figure 96. *Hawaiia minuscula* 1.7 x 1.0 mm. Northwest side of Lake Goto, 24.1.2023. Photos Sylvia van Leeuwen.

is depressed heliciform. The umbilicus is wide. Habitus: figure 96.
Status Probably an exotic species. Found in the USA, Mexico, Central America, many Caribbean islands, East Asia and eastern Australia. It is also reported from South America and from greenhouses in Europe (introduced by humans). It is originally described from Ohio and Vermont (USA).
Habitat and distribution This is the first time the species is reported from the ABC islands. We found one empty shell only, washed ashore at the northwest side of Lake Goto (fig. 97). We do not know if it has a stable population somewhere near Lake Goto, or if it was a one-time introduction. The species has never been reported from Klein Bonaire and we did not observe it there either.

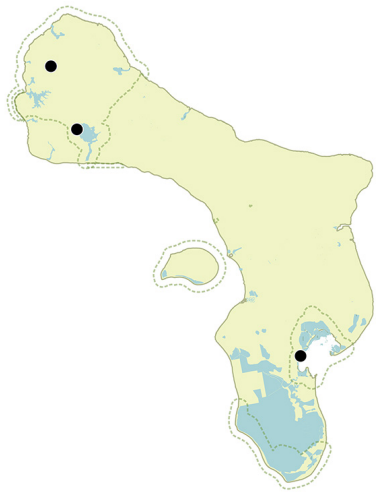
Figure 95. Distribution of *Setidiscus crinitus* on Bonaire.


Figure 97. Distribution of *Hawaiia minuscula* on Bonaire.

Valloniidae

Pupisoma dioscoricola (C. B. Adams, 1845)

Other names *Pupisoma* (*Ptychopatula*) *dioscoricola* (C.B. Adams) (in: Haas 1960). English: Yam Babybody Snail.
Description Shell diameter 1.5-1.85 mm, height 1.3-1.9 mm. The very tiny shell is brown and roundish in shape with three convex whorls. The aperture is round and the lip is sharp and fragile. The apex is blunt. The body whorl has a sculpture of fine unequal growth lines crossed by fine incised spiral striae, sometimes with additional low riblets; upper whorls irregularly granulated; corneous; shining; subtranslucent. *Pupisoma dioscoricola* can easily be distinguished from the other American *Pupisoma* species by its distinct spiral striae and its larger first whorls (Hausdorf 2007). Habitus: figure 98.
Status This species is distributed worldwide in tropical and subtropical regions. It has also been found in botanical gardens in Europe, where it is likely to be introduced by humans. According to Hausdorf (2007) *Pupisoma dioscoricola* originated probably in the Old World. However, given its wide distribution in the Americas, he concludes that it is unlikely that *P. dioscoricola* has been introduced into the New World only by humans (Hausdorf 2007). Following Hausdorf we consider it to be an indigenous species in the Caribbean.

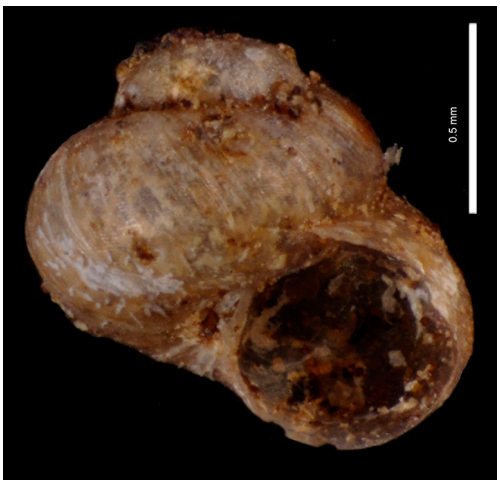

Figure 98. *Pupisoma dioscoricola*, 1.2 mm. Cave and Karst Reserve, 29.1.2023, RMNH.MOL.452411. Photo Hannco Bakker.

Figure 99. Distribution of *Pupisoma dioscoricola* on Bonaire.

Habitat and distribution This is the first time the species is reported from the ABC islands. It lives in lowland forests where it can be found in the litter layer. We found one empty shell only, but because of the minute size it is easily overlooked. The forested coral plateau in the Cave and Karst Reserve where the shell was found offers a suitable habitat for this species (fig. 99). The species has never been reported from Klein Bonaire and we did not observe it there either.
Remarks Hausdorf (2007) did not separate *P. dioscoricola* and *P. minus*. We think those are separate species. *Pupisoma dioscoricola* has growth lines on the whorls, is bigger than *P. minus* and the shell of the latter has an almost smooth surface. *Pupisoma minus* Pilsbry, 1920, is now called *P. macneilli* (G.H. Clapp, 1918).

FRESHWATER SPECIES

Thiaridae

Melanoides tuberculata (O.F. Müller, 1774)

Other names *Melania* (*Melanoides*) *tuberculata* (O.F. Müller, 1774). English: Red Rimmed Melania. Dutch: Slanke knobbelhoren ('slender cusp horn').

Description Shell diameter 9 mm, height 26 mm. Elsewhere it can reach a larger size, up to 35 mm height or more. Shell cylinder-shaped. The colour of the shell varies from light to dark brown, with or without darker stripes or spots. Old empty shells are cream to nearly white. Juvenile shells are often, but not always, lighter brown, with dark brown axial stripes. The shell is opaque and has up to 14 whorls. The shell sculpture consists of alternating spiral grooves and ribs. On the early whorls these are crossed by wavy axial ribs, with bumps in between, giving juveniles a reticulated appearance. On later whorls these axial ribs often fade out or disappear completely. The shell is firm but the shell or the top of living specimens is sometimes eroded. The aperture is narrow oval-shaped and the lip is sharp. The living snail has a dark operculum. Habitus: figures 100-101.

Status Exotic species. Type-locality: Coromandel, India. The species is distributed all over the subtropical and tropical world. It is also for sale as aquarium snail. It eats the algae and detritus in the tanks and it is sometimes found as an escape in the surrounding waters.

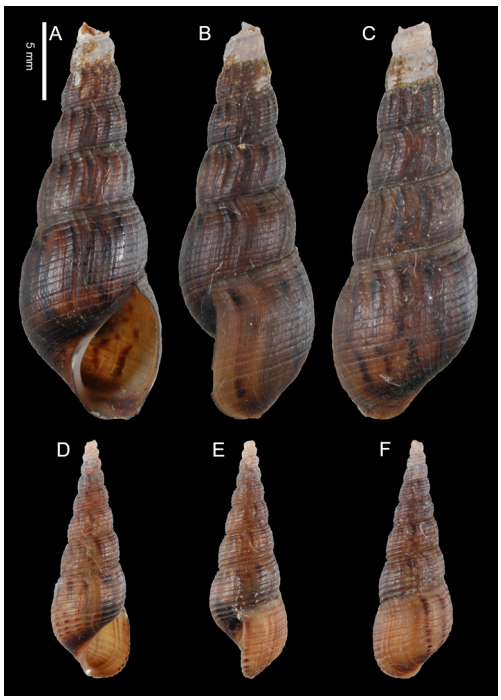

Figure 100. *Melanoides tuberculata*, A-C. adult, 25.8 mm. Kralendijk, ditch along Kaya Hulanda, 27.1.2023, D-F. subadult, 16 mm. Klein Bonaire, 25.1.2023. Photos Sylvia van Leeuwen.

Figure 101. *Melanoides tuberculata*. Kralendijk, ditch along Kaya International, 1.11.2023. Photo Hannco Bakker.

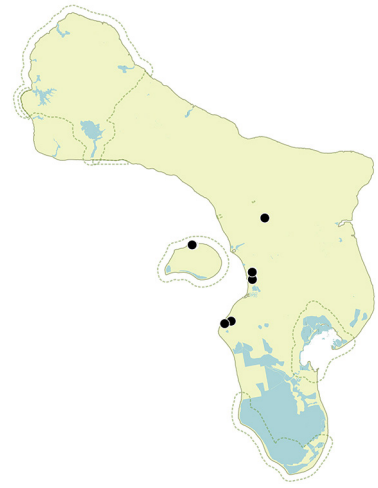

Figure 102. Distribution of *Melanoides tuberculata* on Bonaire.

Habitat and distribution This is the first time the species is reported from Bonaire and Klein Bonaire. This freshwater species can survive in rather polluted and saline waters. On Bonaire we found it in fresh water ditches and ponds with abundant vegetation near the sports stadium and some other places in Kralendijk and Belnem. We also found it on Klein Bonaire in two shallow lakes with fresh or a little brackish water and a small water body or well (fig. 102). The species is also able to survive in small ponds and very shallow water.
Remarks It is known that *Biomphalaria glabrata* disappears when *Melanoides tuberculata* appears (Pointier 2008). See more at *Biomphalaria glabrata*. Probably this species (as juvenile) is eaten by birds, fish and crustaceans.

Figure 103. *Pyrgophorus parvulus*, 4.0 mm. Klein Bonaire, small fresh well in the north, 25.I.2025, RMNH. MOL.452454. Photos Hannco Bakker.

Cochliopidae

Pyrgophorus parvulus (Guilding, 1828)

Other names *Potamopyrgus parvulus* (Guilding, 1828) (in: Baker 1924b, Wagenaar Hummelinck 1940b). *Lyrodus parvulus* (Guilding, 1828) (in: Hovestadt 1987). English: a Crownsnail.
Description Shell diameter 2.5 mm, height 4 mm. The shell is conical shaped with smooth rounded whorls and clear sutures. On early whorls, the shell often has a small spiral wire or keel on about a quarter of the whorl. Sometimes the spiral wire or keel also continues on later whorls. The colour of the shell can be brown to grey when cleaned. Sometimes the shell is covered with dirt. The operculum is corneous and paucispiral. Habitus: figure 103.
Status Indigenous Caribbean species. The species was also reported from Bonaire and Klein Bonaire by Baker (1924b) and Wagenaar Hummelinck (1940b). Type locality: Windward Islands, British West Indies. This species is found on almost every Caribbean island and can be very common.
Habitat and distribution This species lives mainly in fresh water but can also be found in somewhat brackish water. On Bonaire we found this species in Kralendijk in fresh water ditches and ponds with abundant vegetation around the stadium and Kaya International in Kralendijk and washed ashore at the northwest side of Lake Goto. On Klein Bonaire this species was found abundant in shallow lakes with fresh or light brackish water and in a small natural water reservoir (fig. 104). On some Lesser Antillean islands the species can be common in springs of mangrove swamps

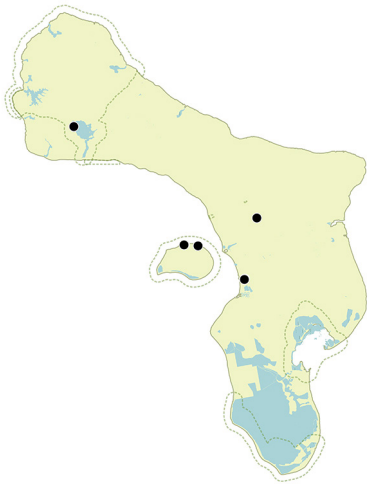
Figure 104. Distribution of *Pyrgophorus parvulus* on Bonaire.

(Pointier 2008), but we did not observe it in the mangrove areas of Bonaire.
Remarks This species can have a form where the periphery of the whorls have conical spines on the keel, but we did not observe this form on Bonaire or Klein Bonaire.

Planorbidae

Biomphalaria glabrata (Say, 1818)

Other names *Planorbis glabratus* Say, 1818 (in: Pointier 2008). English: Bloodfluke Planorb.
Description Shell diameter 15-20 mm, height 4-8 mm. Adult shells are very variable in size and shape. Shell brown and matt glossy. Sculpture of fine growth lines. The shape and convexity of the whorls are the same at the top and bottom of the shell. The spire is big and round. The aperture is flat at the bottom and more rounded at the top. The apex is sunken as we assume that this species is left coiled. Habitus: figure 105.
Status Indigenous species. The species has a large distribution area in the neotropics from Haiti in the north to Parana State (Brazil) in the south. It is found in the Greater Antilles, lesser Antilles and the mainland of South America like Brazil and Venezuela and introduced in Africa (Pointier 2008). The type locality mentioned by Say is South Carolina (USA) but this turned out to be incorrect because his shells were from Guadeloupe (Pointier 2008).
Habitat and distribution On Bonaire we found this species in Kralendijk in fresh water ditches and ponds with abundant vegetation around the stadium and Kaya International in Kralendijk.

Figure 105. *Biomphalaria glabrata*, 15.6 mm. Kralendijk, ditch along Kaya International, 1.11.2023. Photos Sylvia van Leeuwen.

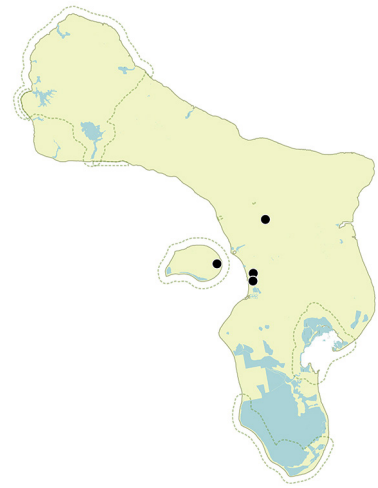
Figure 106. Distribution of *Biomphalaria glabrata* on Bonaire.

On Klein Bonaire we found it on the east side of the island (fig. 106).
Remarks Because the shell is variable in size and shape, many names have been given to this species (Pointier 2008). *Biomphalaria glabrata* is the host of a worm, the parasitic trematod *Schistosoma manzoni*. People become infected when free swimming larval forms of the parasite, cercariae released by freshwater snails, penetrate the skin during contact with infested water. This also includes drinking unboiled water from a natural water source. In humans they cause the disease intestinal schistosomiasis, formerly named bilharzia. Intestinal schistosomiasis can result in abdominal pain, diarrhea and blood in the stool. Liver enlargement is common in advanced cases and is frequently associated with an accumulation of fluid in the peritoneal cavity and hypertension of the abdominal blood vessels (RIVM 2024, World Health Organisation 2024). We do not know if the snails from Bonaire are infected by this parasite. *Biomphalaria glabrata* was affected by the use of molluscicides for controlling schistosomiasis transmission and the introduction of exotic species (Pointier 2008). Therefore this species is becoming rare in the Caribbean. It is observed that when *Melanoides tuberculata*

appears *B. glabrata* is declining (Pointier 2008). This might also occur on Bonaire, but we found both species living together in several places.

Biomphalaria cf. *kuhniana* (Clessin, 1883)

Other names *Planorbis kuhnerianus* Dunker, 1883 (in: Pointier 2015). French: Planorbe de Clessin.
Description Shell diameter 6-8.5 mm, height 2-3 mm. The apex is sunken. The adult shell is slightly variable in size and shape. The colour is grey to white. The shell is opaque. The last whorls go down at the end, the lip is sharp. The umbilicus is almost ⅓ of the diameter. Habitus: figure 107.
Status Caribbean species which lives in the Greater and Lesser Antilles in all kinds of waters. It also occurs in Venezuela and Colombia (Pointier 2008, 2015).
Habitat and distribution We only found empty shells washed ashore at the northwest side of Lake Goto (fig. 108). We could not trace where this species lives on Bonaire. Wagenaar Hummelinck found some small shells at Pos Boca Grandi in 1973 (fig. 109). We did not find this species on Klein Bonaire.
Remarks We did not find live specimens, which are needed for more certainty about the identity. The identification was confirmed by Jean-Pierre Pointier. Baker (1924b) and Wagenaar Hummelinck (1940b) may have reported the same species under different names. Baker (1924b) reported *Biomphalaria pallida* (C. B. Adams, 1846) from Bonaire (as *Planorbis pallidus* C.B. Adams). This species looks more or less similar to *Biomphalara* cf. *kuhniana* and *B. glabrata*, is mainly known from Jamaica and has also been reported from Cuba and the Dominican Republic (Pointier et al. 2005, Vázquez Perera et al. 2010). We did not see Baker's material, it is stored in the Smithsonian Institute in Philadelphia. Wagenaar Hummelinck (1940b) considered *Biomphalaria pallida* as a subspecies of *Planorbis circumlineatus* Shuttleworth, 1854. He reported that species from seven locations on Bonaire. In 1973 he collected another sample

Figure 107. *Biomphalaria* cf. *kuhniana*, A-C. 6.6 mm, D-F. 6.7 mm. Northwest side of Lake Goto, 24.1.2023. Photos Sylvia van Leeuwen.

that was also identified as *Planorbis circumlineatus.* These specimens were also available to us (fig. 109). The current valid name of that species is *Antillorbis aeruginosus* (Morelet, 1851), which is known from Mexico, Central America, Greater Antilles, Virgin Islands and Venezuela (Pointier 2008, GBIF.org). The shells of *A. aeruginosus* look similar to the shells of *B.* cf. *kuhniana*, but they are much smaller (3-5 mm) and have a sculpture of fine spiral striae (Pointier 2008). This does not fit with the material of Bonaire (fig. 109) and we think the name reported by Wagenaar Hummelinck were misidentified shells of *B.* cf. *kuhniana*. *Biomphalaria kuhniana* is not known to serve as


Figure 108. Distribution of *Biomphalaria* cf. *kuhniana* on Bonaire.

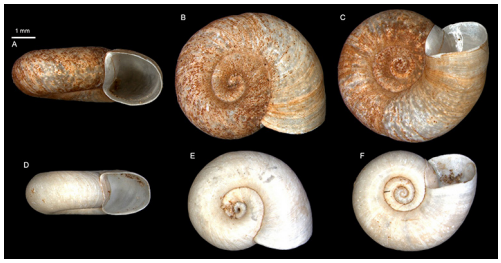

Figure 109. *Biomphalaria* cf. *kuhniana*, initially identified as *Planorbis circumlineatus,* Pos Boca Grandi, WH379k, 15.VIII.1973. Pieter Wagenaar Hummelinck, col. Tello Neckheim, A-C. 6.5 mm, D-F. 5.4 mm. Photos Sylvia van Leeuwen.

the intermediate host of trematodes parasitic to humans or domestic animals. However, little research has focused on the possibility that this snail is a host to helminths other than *Schistosoma manzoni* (Reeves et al. 2008).

Planorbella duryi (Wetherby, 1879)

Other names *Helisoma duryi* (Wetherby, 1879) (in: Pointier et al. 2005, Pointier 2008). English: Seminole Ram's-horn, American Ram's Horn Snail, Florida's Ram's-horn, Miniature Ramshorn Snail.
Description Shell diameter up to 20 mm, height 6-9 mm, on Bonaire mainly smaller. The shell is brown and has a rather smooth surface. Three to four whorls but often less. Variable in size. The apex is sunken, becoming even a small hole. The last whorl has a keel at the underside of the whorl. Sometimes the aperture can be very much higher than the underside of the previous whorl. This species is left coiled. The shells of *Biomphalaria glabrata* and *B. kuhniana* are much flatter

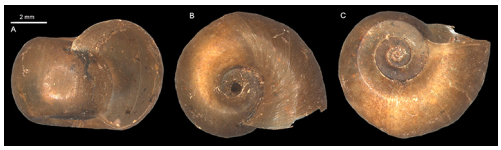

Figure 110. *Planorbella duryi*, 8.6 mm. Tera Barra, 1.II.2023. Photos Sylvia van Leeuwen.

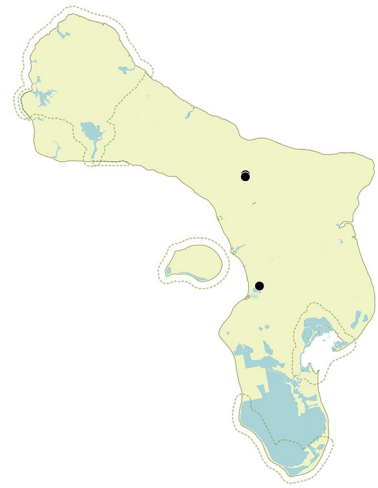

Figure 111. Distribution of *Planorbella duryi* on Bonaire.

than the shell of *P. duryi,* which makes the last species easy to recognise. Habitus: figure 110.
Status Exotic species. Type locality: Florida (USA). Also in Mexico, Costa Rica, several Caribbean islands like Cuba, Jamaica, Bahama's, St. Martin (French part), Guadeloupe, Antigua and Barbuda, Bermuda, Trinidad and Tobago, Martinique, Saint Vincent and Brazil. *Planorbella duryi* can live in small tanks. Because it is a popular aquarium snail it has spread all over the world, also in Europe and Africa (GBIF.org).
Habitat and distribution This is the first time the species is reported from Bonaire. We found it alive in a small tank in a plant shop in Kralendijk and in a tank on Tera Barra (fig. 111). Perhaps it can also be found in tanks and small pools in gardens. We did not find this species on Klein Bonaire.
Remarks The shell can grow rarely high coiled and then it looks like a different species.

Physidae

Physella acuta (Draparnaud, 1805)

Other names *Physa acuta* Draparnaud, 1805 (in: Pointier et al. 2005), *Physa cubensis* L. Pfeiffer,

Figure 113. Distribution of *Physella acuta* on Bonaire.

1839 (in: Wagenaar Hummelinck 1940b, Reeves et al. 2008). English: Acute Bladder Snail. Dutch: Puntige blaashoren ('pointed bladder horn').
Description Shell diameter up to 5 mm, height 7 mm, on Bonaire generally smaller. The shell is brown to grey and sometimes covered with algae. The fresh shell is a little translucent and left coiled. The apex is pointed. When alive small light spots are visible, which is the pigmentation of the mantle. Habitus: figure 112.

Figure 112. *Physella acuta*, 4.1 mm. Kralendijk, ditch near the stadium, 27.1.2023, RMNH.MOL.452458. Photos Hannco Bakker.

Status Exotic species. The type locality is in France but it is originally an American species. This is probably the most introduced freshwater species in the world.
Habitat and distribution This is the first time the species is reported from Bonaire. It can live in fresh water and brackish water ponds. It can even survive in temporary dried out water bodies. It is found in ditches and water bodies with abundant aquatic vegetation around the stadium, near Fontijn and in tanks in Tera Barra, Kralendijk and Rincon (fig. 113). We did not find this species on Klein Bonaire.
Remarks Many names have been given to this species in the past because it has a wide distribution range, but ultimately it appears to be one species.

CONCLUSIONS AND DISCUSSION

During the expedition we recovered all 18 terrestrial (sub-)species reported by Hovestadt & Van Leeuwen (2017), including three species that were reported in literature but not seen by them. This makes clear that these species are still part of the malacofauna of Bonaire. We did not find the four species of land snails that they reported as 'doubtful': *Helicina dysoni* L. Pfeiffer, 1849, *Cistulops raveni raveni* (Crosse, 1872), *Neosubulina gloynii* (Gibbons, 1879) and *Oleacina solidula* (L. Pfeiffer, 1840). This confirms the suspicion of Hovestadt & Van Leeuwen (2017) that these species do not or no longer belong to the malacofauna of the island.

In addition to the previously reported species, 13 species of land snails were found new for Bonaire. We have not yet been able to fully name the slugs that belong to the family Veronicellidae. Counting them as one species, the species list of Bonaire Estafette Expeditie contains 31 (sub)species of land molluscs.

Prior to the recent fieldwork freshwater molluscs on Bonaire were poorly studied (table 2). During the expedition we found six species of freshwater

snails, raising the number of species known from Bonaire from two to six. Remarkably we did not find any freshwater bivalves.

From Klein Bonaire 11 (sub-) species of terrestrial mollusks and one freshwater species were known. We found six terrestrial and three freshwater species. Five terrestrial species reported from Klein Bonaire in the past were not found by us. The fieldwork we did on Klein Bonaire was too limited to conclude that these species disappeared from the island. For example, we did not do fieldwork on the central part of the island, which has a slightly higher elevation and therefore might be more species rich. Also on Bonaire itself some areas received limited attention, in particular Bolivia, Santa Catarina / Lamunchi and Bacuna, where we expect to be good habitat for terrestrial molluscs because of its calcareous soil. The expedition and our fieldwork was not focussed on the mangrove areas, where very specific species of molluscs can be expected that are specially adapted to this valuable habitat with varying water levels and salinities. We hope it will be possible to fill these gaps in the future.

All in all, Bonaire's malacofauna turned out to be more species-rich than previously known. Of particular interest and relevance are the endemic taxa: eight (sub-)species occur on Bonaire only, and one species is restricted to Bonaire and Curaçao.

Most species reported for the first time are exotic species that reached the island through human intervention, mainly via imported garden plants and garden centers. Examples include the African giant snail *Lissachatina fulica*, Cuban garden snail *Zachrysia provisoria*, *Succinea concordialis, Subulina octona*, *Paropeas achatinaceum* and slugs of the Veronicellidae family. These species were only found in the built-up environment (garden centers, gardens, in a greenhouse, around a parking place) on Bonaire. The one record of *Streptartemon glaber* pertains to a fresh empty shell found by Wim Klein on a beach in the mangrove area where garden waste had been dumped. It is suspected that this non-indigenous species lives somewhere else on the island and was transported with garden waste. The increased movement of people and goods to and from Bonaire also increases the chance that exotic species will hitch a ride. Because of the limited distribution of these species on Bonaire, we suppose that they have established themselves there quite recently. It should be noted that we have examined only a few private gardens. More intensive fieldwork in private gardens might lead to a different picture.

Two newly found species are land snails that also occur on other Caribbean islands and may have settled on Bonaire naturally: *Setidiscus crinitus* and *Pupisoma dioscoricola*. Five of the species of land snails which were found new to Bonaire it is also the first record for the ABC islands: *Succinea concordialis*, *Paropeas achatinaceum*, *Praticolella griseola*, *Hawaiia minuscula* and *Pupisoma dioscoricola.*

Most newly established species will lead an inconspicuous life on Bonaire without causing harm to nature, agriculture or public health. This is not the case for the Giant African snail *Lissachatina fulica*. This species poses a risk to public health and can cause a lot of damage to agriculture and ornamental plants. In 2023, this species still had a very limited distribution across the island. If action is taken quickly, a control campaign can still be successful.

Our research also provides insight into the distribution of the species across the island and areas that are particularly important to molluscs. The abundance of terrestrial molluscs varies with the type of soil and the vegetation. The parts with limestone are much richer in terrestrial molluscs (number of species and number of individuals) than the parts with a surface of volcanic rock. Most endemic land snails are limited to the calcareous areas, where they prefer places that offer protection from the sun and from predators. Rich habitats are limestone plateaus covered with natu-

ral forest, steep north facing walls of limestone and limestone plateaus with open structures like holes and crevices. Snails are mainly found hidden under stones and in the many cracks and holes in the limestone. The two large endemics, *Cerion uva bonairensis* and *Tudora aurantia* do live here too, but they can also be found in the open air, on rocks, plants and trees where they are exposed to the sun. Most important areas for endemic land snails are the Bonaire Cave and Karst Reserve and the calcareous area around Lake Goto. Also the northeast facing steep walls of the limestone platforms are hotspots for these land snails.

The ditches in the vicinity of the stadium were the richest places for freshwater molluscs. The ditches contain very clear water, during our research, with a good variety of aquatic plants.

Especially the endemic (sub-) species are an important element of the specific biodiversity of Bonaire. Due to the large number of endemic taxa, we believe that terrestrial molluscs deserve special attention in the nature management and in governmental nature protection policy. Our concern is that the most important areas where these endemic species live are outside the protected national parks. With a quickly growing population on Bonaire, the loss of habitat due to spatial development is a serious risk. In the Bonaire Cave and Karst Reserve, only the caves are protected, while the molluscs live on the karst plateau in between the caves. Also Seru Largu, Kibra di Montaña (which is the type locality of three endemic species) and the steep limestone walls at the northeast side of the limestone terraces on Bonaire are outside the national parks.

Another serious threat to land snails on Bonaire is the recent discovery of the New Guinean land flatworm *Platydemus manokwari* on Bonaire. Being an efficient predator it can do serious harm to land snail populations (De Waart et al. 2025). At this moment we do not know how the flatworm species will establish and distribute across the island and which Bonairean snail species are on its diet. In Florida the same flatworm turned out to be a serious threat to tree snails (Lopez et al. 2022, pers. obs. Johan van Blerk & Steve Rosenthal). These tree snails are most similar in size and behaviour to *Mesembrinus elongatus* and *Cerion uva bonairensis* on Bonaire, but the flatworm also preys on much smaller species like *Zonitoides arboreus* and Clausiliidae (Kaneda et al 1990).

Although our results give much more insight in the malacofauna of Bonaire and Klein Bonaire, there are still many taxonomical questions to be resolved. Especially with regard to the endemic taxa, the taxonomy is not always clear yet (see the species descriptions). In the future, molecular analysis might help to clear these questions.

The land snails of Bonaire and their special features are still relatively unknown to the general public. To contribute to awareness of this, we organised an excursion with the junior rangers of STINAPA during the expedition and we made a provisional identification card for this aim (Van Leeuwen 2023). After the expedition we created a new bilingual (Dutch and Papiamentu) identification card depicting all species of land and freshwater molluscs of Bonaire (Naturalis & STINAPA 2023). The identification card is used by STINAPA for educational activities.

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SAMENVATTING

De non-mariene mollusken van Bonaire (Mollusca)
Tijdens de Bonaire Estafette Expeditie werd de molluskenfauna van land en zoetwater onderzocht. Het onderzoek richtte zich vooral op weekdieren in natuurlijke habitats, maar er werd ook bijzondere aandacht besteed aan tuincentra en botanische tuinen als bekende locaties voor exotische soorten. In totaal zijn er 31 (onder)soorten landslakken en zes soorten zoetwaterslakken aangetroffen. Er zijn geen zoetwatertweekleppigen aangetroffen. Twintig van deze taxa waren niet eerder van Bonaire gerapporteerd. Doordat een groot aantal locaties bemonsterd is, kon ook voor het eerst inzicht gegeven worden in de ruimtelijke verspreiding van soorten. Op basis van deze resultaten is een identificatiekaart gemaakt waarop alle soorten land- en zoetwaterweekdieren van Bonaire zijn afgebeeld.

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Appendix 1. Station list.

Field nr.	Date	Location, description	Lat Long
20230122.BON.01	22.I.2023	N Rincon, along the Kaya G.R.E. Herrera, Dam Grandi, small path between two pools, handcatch	12.263050 -68.335909
20230122.BON.02	22.I.2023	N Rincon, along the road Kaya G.R.E. Herrera, Dam Grandi, next to a small pool, handcatch	12.260702 -68.338778
20230122.BON.03	22.I.2023	WSNP, near entrance, Kas Sientífiko next to Agave plants and high woody plants, leaflitter sample	12.269258 -68.346124
20230122.BON.04	22.I.2023	Rincon, small patch of human disturbed land with many introduced flowering plant species, observations	12.240352 -68.330072
20230122.BON.05	22.I.2023	Rincon, Kaya Oleander, village, observations	12.240683 -68.331252
20230122.BON.07	22.I.2023	WSNP, near entrance, Kas Sientífiko, observations	12.269258 -68.346124
20230123.BON.08	23.I.2023	WSNP, Salina Matijs, brackish water body, observations	12.275211 -68.355917
20230123.BON.09	23.I.2023	WSNP, W Salina Matijs, rocky side with high vegetation along the road, handcatch	12.279772 -68.363376
20230123.BON.10	23.I.2023	WSNP, W Salina Matijs, S Seru Grandi, old seep, dried up, leaflitter sample	12.287274 -68.372513
20230123.BON.11	23.I.2023	WSNP, W Salina Matijs, old well, observations	12.285180 -68.376494
20230123.BON.12	23.I.2023	WSNP, near a running water body, brackish to salt water, leaflitter sample	12.284714 -68.382708
20230123.BON.13	23.I.2023	WSNP, small water body, observations	12.284169 -68.392737
20230123.BON.14	23.I.2023	WSNP, near and around Put Bronswinkel, observations	12.280023 -68.398185
20230123.BON.15	23.I.2023	WSNP, Boca Slagbaai, near the beach, rocky area with salt-resistent flora, leaflitter sample	12.264997 -68.413304
20230124.BON.16	24.I.2023	along Kaminda Goto, small clear flat areas near Lake Goto, observations	12.237251 -68.368793
20230124.BON.17	24.I.2023	along Kaminda Goto, E Lake Goto, small clear flat areas near Lake Goto, handcatch	12.234622 -68.368462
20230124.BON.18	24.I.2023	along Kaminda Goto, E Lake Goto, W steep calcareous hill with large Agave, handcatch	12.232195 -68.372203
20230124.BON.19	24.I.2023	road E BOPEC refinery to Seru Wasao, in cattle grid, under cattle grid, washed up material, handcatch	12.221880 -68.377296
20230124.BON.20	24.I.2023	Seru Wasao, trail upwards next to the BOPEC tanks, observations	12.223069 -68.377336
20230124.BON.21	24.I.2023	Seru Wasao, between BOPEC terminals and southern part of Lake Goto, trail upwards next to the BOPEC tanks, leaflitter sample	12.225402 -68.376489
20230124.BON.22	24.I.2023	coastal area E Lake Goto, leaflitter sample	12.220619 -68.366025
20230124.BON.23	24.I.2023	SE Lake Goto, limestone hill, highest point E Lake Goto, handcatch	12.230866 -68.369354
20230125.BON.25	25.I.2023	Klein Bonaire, along NE coast,washed ashore specimens from a larger area (approx 500 m +), handcatch	12.168170 -68.305077
20230125.BON.26	25.I.2023	Klein Bonaire N, small fresh water body / well, observations	12.167125 -68.302679
20230125.BON.27	25.I.2023	Klein Bonaire E, old deserted house and surrounding, handcatch	12.156897 -68.296056
20230125.BON.28	25.I.2023	Klein Bonaire N, plateau of fossilized coral with medium vegetation, leaflitter sample	12.166862 -68.301821
20230126.BON.29	26.I.2023	along path to Fontein, dry road, low in lime, observations	12.243945 -68.296784
20230126.BON.30	26.I.2023	along path to Fontein, dry road, low in lime, observations	12.242299 -68.296296
20230126.BON.31	26.I.2023	E Rincon, near Pos Fontein, rocky trail with pilar cacti, rockwall next to the road, leaflitter sample	12.240242 -68.298576
20230126.BON.32	26.I.2023	E Rincon, Pos Fontein, wells with dirty water, observations	12.239996 -68.298903
20230126.BON.33	26.I.2023	E Rincon, near Pos Fontein, dried up stream next to Pos Fontein wells, leaflitter sample	12.239996 -68.298903
20230126.BON.34	26.I.2023	along Kaminda Sabana Piedra Krus, rocky wall next to the road, leaflitter sample	12.240979 -68.287953
20230126.BON.35	26.I.2023	E Rincon near Tera Barra, rocky wall, steep, rich in limestone, leaflitter sample	12.209590 -68.287959
20230126.BON.36	26.I.2023	along the shore W Kaminda Sabana Piedra Krus, stony coral plateau with saltwater spray from the ocean, observations	12.240542 -68.284942
20230126.BON.37	26.I.2023	along the shore W Kaminda Sabana Piedra Krus, stony coral plateau with salt water spray from the ocean, leaflitter sample	12.241067 -68.283957
20230126.BON.38	26.I.2023	E Rincon near the coast, rocky wall, small shallow caves, leaflitter sample	12.248914 -68.309435
20230127.BON.39	27.I.2023	Pos Gurubu, small fresh water bodies, observations	12.193136 -68.262766
20230127.BON.40	27.I.2023	Seru Largu, around monument on highest point, observations	12.193874 -68.272029
20230127.BON.41	27.I.2023	N Santa Barbara, along road e Seru Largu, leaflitter sample	12.196934 -68.277717
20230127.BON.42	27.I.2023	between Santa Barbara Crowns and Seru Largu, steep wall sw of Seru Largu, leaflitter sample	12.193698 -68.274700
20230127.BON.43	27.I.2023	between Santa Barbara Crowns and Seru Largu, leaflitter corner along a smal wall for the water flow, leaflitter sample	12.192096 -68.274182
20230127.BON.44	27.I.2023	Kralendijk, small water body next to the stadium, with abundant fresh water vegetation, handcatch	12.150734 -68.273287
20230127.BON.45	27.I.2023	Kaminda Lagun, about 1 km W Lagun, brackish water body, next to the Waste Center, observations	12.178307 -68.226684
20230127.BON.46	27.I.2023	Kaminda Lagun, about 2 km WSW Lagun, brackish / fresh water body, dirty water, only algae, observations	12.170666 -68.235504
20230127.BON.47	27.I.2023	between Kaminda Onima and Boca Onima, steep rocks, handcatch	12.250723 -68.311731
20230127.BON.48	27.I.2023	NE Rincon, lake N Kaminda Onima, not reachable by a normal path, possible more brackish, observations	12.247931 -68.313971
20230127.BON.49	27.I.2023	E Rincon, at the end of Kaya Seru Di Pariba St., steep rocks, west side, leaflitter sample	12.239426 -68.309060
20230128.BON.50	28.I.2023	WSNP, Seru Grandi, rocky slopes, observations	12.290105 -68.356258
20230128.BON.51	28.I.2023	WSNP, long route, Seru Grandi, rocky slopes, observations	12.294208 -68.358236
20230128.BON.52	28.I.2023	WSNP, Boca Kokolishi, beach, handcatch	12.305056 -68.369279
20230128.BON.54	28.I.2023	WSNP, Pos Mangel, but only full with a small waterplants, no snails, observations	12.294783 -68.391768
20230128.BON.55	28.I.2023	WSNP, Playa Funchi, beach and salina, observations	12.281864 -68.413805

Field nr.	Date	Location, description	Lat Long
20230128.BON.56	28.I.2023	WSNP, next to the road, observations	12.275030 -68.415523
20230128.BON.57	28.I.2023	WSNP, beach, observations	12.271163 -68.414118
20230128.BON.58	28.I.2023	WSNP, beach, handcatch	12.264635 -68.413526
20230128.BON.59	28.I.2023	WSNP, next to the road, observations	12.257531 -68.410652
20230128.BON.60	28.I.2023	WSNP, next to the road, observations	12.259394 -68.380865
20230128.BON.61	28.I.2023	WSNP, small dried up stream with many deciduous trees, leaflitter sample	12.263837 -68.375995
20230129.BON.62	29.I.2023	Rincon, garden around empty house next to restaurant Kos Bon So, garden plants, observations	12.237869 -68.330042
20230129.BON.63	29.I.2023	S Rincon, Cave and Karst Reserve, trail to cave with many fossillized coral stones, leaflitter sample	12.222544 -68.323140
20230129.BON.64	29.I.2023	S Rincon, Cave and Karst Reserve, first cave along the road from Rincon, leaflitter sample	12.221580 -68.324032
20230129.BON.65	29.I.2023	NW Santa Barbara Crowns, Cave and Karst Reserve, 2nd cave along the road from Rincon (with large tree growing in the cave), leaflitter sample	12.212458 -68.312752
20230129.BON.66	29.I.2023	NW Santa Barbara Crowns, Cave and Karst Reserve, 3rd cave structure on the road from Rincon, just small open slits, leaflitter sample	12.203799 -68.308180
20230129.BON.67	29.I.2023	Queen's Highway, 1000 steps beach, pebble beach with a bit of sand, washed ashore, handcatch	12.210788 -68.321692
20230130.BON.69	30.I.2023	mangrove area near water mill/ pos, along Kaminda Lac/ Kaminda Sorobon, a random water well, observations	12.125734 -68.242134
20230130.BON.70	30.I.2023	Lac, mangrove area, along Kaminda Sorobon, mangrove, handcatch	12.109878 -68.241851
20230130.BON.71	30.I.2023	Lac, mangrove area along Kaminda Sorobon, mangrove, handcatch	12.102263 -68.241175
20230130.BON.72	30.I.2023	Lac, mangrove area along Kaminda Sorobon, mangrove, handcatch	12.089955 -68.243600
20230130.BON.73	30.I.2023	tourist area, Sorobon Beach Resort, tourist parking lot, handcatch	12.091922 -68.236522
20230130.BON.74	30.I.2023	E coast EEG Boulevard, beach S saltpans, leaflitter sample	12.076603 -68.231652
20230130.BON.75	30.I.2023	along S coast eeg Boulevard, near the lighthouse, beach S saltpans, handcatch	12.028338 -68.237727
20230130.BON.76	30.I.2023	EEG Boulevard, near yellow slave houses, beach SW saltpans, handcatch	12.027048 -68.251601
20230130.BON.77	30.I.2023	Kralendijk, Kaya Industria Pariba, garden center Green Label for exotic plants, handcatch	12.143104 -68.269058
20230131.BON.79	31.I.2023	S Rincon, rock wall behind Gruta di Lourdes, leaflitter sample	12.229089 -68.332316
20230131.BON.80	31.I.2023	Bulevar Gob. N. Debrot, newly built area, observations	12.187624 -68.294047
20230131.BON.81	31.I.2023	NW Santa Barbara Crowns, cave hidden behind some containers, leaflitter sample	12.202033 -68.307787
20230131.BON.82	31.I.2023	along Queen's Highway near Webers Joy, rock walls along the coast, observations	12.206255 -68.315873
20230131.BON.83	31.I.2023	near Queen's Highway, hiking trail along rock walls, observations	12.214329 -68.334033
20230131.BON.84	31.I.2023	near corner Kaminda Karpata - Queen's Highway, abandoned plantation, observations	12.219891 -68.351927
20230131.BON.85	31.I.2023	Rincon, viewpoint Altamira Unjo, top view over Rincon, rocky area, observations	12.234036 -68.340655
20230131.BON.86	31.I.2023	Rincon, Cadushy Distillery, built area, observations	12.237992 -68.332098
20230131.BON.87	31.I.2023	Bario Mamparia Kutu, residential area, new build area, observations	12.141775 -68.254683
20230201.BON.88	1.II.2023	Tera Barra, native garden, in the greenhouse, handcatch	12.210464 -68.278230
20230202.BON.94	2.II.2023	unpaved road along the windmills n Rincon, rocky coast, salt splashes, handcatch	12.261007 -68.321915
20230201.BON.89	1.II.2023	Kralendijk, Villa Carina Apartments, Kaya Gemini, small caves with fresh water, observations	12.120386 -68.286558
20230201.BON.90	1.II.2023	Kralendijk, along Kaya International, small fresh water body with several fresh water plants species, handcatch	12.146633 -68.272827
20230202.BON.92	2.II.2023	N Rincon, water body between the entrance of WSNP and Playa Grandi, water likely more towards brackish, observations	12.268873 -68.338486
20230202.BON.93	2.II.2023	E the entrance of WSNP, along the coast, rocky area, handcatch	12.267023 -68.334921
20230202.BON.95	2.II.2023	Boka Onima, small beach with a valley behind it, NE Rincon, leaflitter sample	12.253130 -68.311241
20230202.BON.96	2.II.2023	Kaminda Lagun e Antriol, water body, likely more towards brackish, observations	12.161152 -68.256639
20230204.BON.98	4.II.2023	S Rincon, rock wall behind Gruta di Lourdes, observations	12.229089 -68.332316
20230124.BON.99	24.I.2023	along NW border Lake Goto, washed up on beach, leaflitter sample	12.241286 -68.381732
20230201.BON.100	1.II.2023	Belnem, corner Kaya Uranus and Kaya Gemini, karst plateau with cave and trees, handcatch	12.120480 -68.286500
20230124.BON.101	24.I.2023	Lake Goto, Kaminda Goto, handcatch	12.231 -68.370
20230127.BON.102	27.I.2023	Seru Largu, handcatch	12.196000 -68.276000
20230123.BON.103	23.I.2023	WSNP, Put Bronswinkel, handcatch	12.280023 -68.398185
BON001	22.I.2023	Kralendijk, in garden opposit Hotel Central, Kaya L.D. Gerhards	12.152444 -68.275362
	22.I.2023	Pos Gurubu, on man made dam	12.1932 -68.2626
	22.I.2023	Kaya Piedra Pretu, along path, dry	12.2629 -68.3365
BON002	23.I.2023	WSNP, Kas Sientífiko, in garden	12.269896 -68.346231
BON003	23.I.2023	WSNP, in dry rooi along unpaved road	12.287274 -68.372513
BON004	23.I.2023	WSNP, in dry rooi along unpaved road	12.284900 -68.379101
BON005	23.I.2023	WSNP, Put Bronswinkel, litter and molm along path to source	12.280023 -68.398185
BON006	23.I.2023	WSNP, Slagbaai, near houses and beach, under limestone rocks.	12.264852 -68.413195
BON007	24.I.2023	Dos Pos along Kaya Para Mira, in dry bassin under watermill	12.238854 -68.356384
BON008	24.I.2023	Lake Goto, Kaya Para Mira, low in lime	12.238 -68.368
BON009	24.I.2023	Lake Goto, along Kaminda Goto, low in lime	12.233 -68.370
BON010	24.I.2023	Lake Goto	12.223 -68.374
BON011	24.I.2023	Lake Goto, Kaminda Goto, calcarous soil, under Aloe	12.231 -68.370
BON012	24.I.2023	along NW border Lake Goto, washed up on beach, leaflitter sample	12.241286 -68.381732
BON012	24.I.2023	Lake Goto, drift on beach, small island	12.2403 -68.3791
BON072	24.I.2023	residential area Rebubliek, Kaya Piedra Presioso/Kaya Sardonis, near parking place	12.185724 -68.278109
BON013	25.I.2023	Klein Bonaire, Kos di vito trail	12.1673 -68.3038
BON014	25.I.2023	Klein Bonaire, Kos di vito trail	12.1673 -68.3037

Field nr.	Date	Location, description	Lat Long
BON015	25.I.2023	Klein Bonaire, Kos di vito trail, in small original waterreservoir	12.1671 -68.3027
BON016	25.I.2023	Klein Bonaire, Kos di vito trail	12.1668 -68.3018
BON017	25.I.2023	Klein Bonaire, Kos di vito trail	12.1595 -68.2936
BON018	25.I.2023	Klein Bonaire, Kos di vito trail, along stone wall	12.1567 -68.2939
BON019	25.I.2023	Klein Bonaire, Kos di vito trail	12.1568 -68.2959
BON020	25.I.2023	Klein Bonaire, Kos di vito trail, at small ruine	12.1569 -68.2958
BON021	25.I.2023	Klein Bonaire, Kos di vito trail	12.1634 -68.2968
BON022	26.I.2023	along path to Fontein	12.2453 -68.2981
BON023	26.I.2023	along path to Fontein	12.2439 -68.2980
BON024	26.I.2023	along path to Fontein	12.2425 -68.2962
BON025	26.I.2023	Fontein, along path with Cacti, under limestone rocks	12.240242 -68.298576
BON026	26.I.2023	E Rincon, along path to Fontein, under limestone rock	12.2401 -68.2986
BON027	26.I.2023	along Kaminda Sabana Piedra Krus, under limstone rocks along the road	12.241 -68.287
BON028	26.I.2023	Fontein, Kaminda Tras di Montana, limestone rocks	12.210 -68.288
BON029	26.I.2023	along Kaminda Sabana Piedra Krus, under limestone rocks	12.240979 -68.287953
BON030	26.I.2023	N Boka Onima, under limestone rocks	12.253 -68.316
BON031	26.I.2023	S Boka Onima, under limestone rocks	12.249 -68.309
BON032	27.I.2023	Kralendijk, fresh water pond around stadium, with *Tilapia* and *Najas marina*	12.151 -68.273
BON033	27.I.2023	Seru Largu, limestone rocks along the road	12.196000 -68.276000
BON034	27.I.2023	Seru Largu, limestone rocks along the road under Acacia	12.196 -68.276
BON035	27.I.2023	residential area Bona Bista, behind houses, garbage belt	12.183 -68.263
BON036	28.I.2023	WSNP, Seru Grandi.	12.290 -68.357
BON037	28.I.2023	WSNP, long route, Seru Grandi	12.294 -68.358
BON038	28.I.2023	WSNP, long route, Seru Grandi	12.2943 -68.3587
BON039	28.I.2023	WSNP, Boka Kokolishi	12.3050 -68.3695
BON040	28.I.2023	WSNP, Salina Bartol	12.2953 -68.3916
BON041	28.I.2023	WSNP, Salina Bartol	12.3048 -68.3966
BON042	28.I.2023	WSNP, Shishiribana	12.2863 -68.4037
BON043	28.I.2023	WSNP, Playa Funchi	12.2818 -68.4135
BON044	28.I.2023	WSNP, N Salina Wayaka	12.2751 -68.4154
BON045	28.I.2023	WSNP, Slagbaai, plus small sample at pebble beach	12.2638 -68.4140
BON046	28.I.2023	WSNP, Salina Slagbaai	12.2577 -68.4109
BON047	28.I.2023	WSNP, Jawa pas, under trees	12.2594 -68.3811
BON048	29.I.2023	Rincon, in garden along Kaya Apelsina	12.238 -68.330
BON048	29.I.2023	Rincon, in garden and on walls along Kaya Apelsina	12.238 -68.330
BON049	29.I.2023	Rincon, along unpaved road near small road to cave	12.2232 -68.3226
BON050	29.I.2023	Rincon, Cave and Karst Reserve, along path to first cave	12.223 -68.323
BON051	29.I.2023	Rincon, Cave and Karst Reserve, near first cave along the road from Rincon	12.2216 -68.3241
BON052	29.I.2023	Rincon, Cave and Karst Reserve, near 2nd cave	12.2124 -68.3128
	29.I.2023	Rincon, Cave and Karst Reserve	12.223 -68.323
BON053	29.I.2023	Rincon, Cave and Karst Reserve, along unpaved path, under stones	12.2051 -68.3095
BON054	30.I.2023	Lac, Kaminda Sorobon, mangrove, calcareous area	12.126 -68.242
BON055	30.I.2023	Lac, Kaminda Sorobon, mangrove, calcareous area	12.1095 -68.2419
BON056	30.I.2023	t-intersection of Kaminda Sorobon - Kaya Ir. R. Statius van Eps	12.089842 -68.243760
BON057	30.I.2023	parking place Jibe City, Kaminda Sorobon	12.093 -68.237
BON058	30.I.2023	Solar Salt Works, eeg Boulevard	12.0765 -68.2319
BON059	30.I.2023	Kralendijk, Kaya Industria Pariba, garden center Green Label, in greenery	12.143104 -68.269058
BON060	31.I.2023	S Rincon, under rocks near Gruta di Lourdes	12.229 -68.333
BON061	31.I.2023	Santa Barbara Crowns, Bulevar Gob. N. Debrot, under limestone rocks	12.188 -68.294
BON062	31.I.2023	Kralendijk, Bulevar Gob. N. Debrot, 3rd cave behind house under construction	12.202 -68.308
BON063	31.I.2023	Kaminda Turistico, limestone area	12.206 -68.316
BON064	31.I.2023	Kaminda Turistico, limestone area along nature trail	12.218 -68.340
BON065	31.I.2023	Rincon, viewpoint Altamira Unjo, limestone area	12.2339 -68.3405
BON066	1.II.2023	Tera Barra	12.210720 -68.278216
BON066	1.II.2023	Tera Barra, in greenery	12.210720 -68.278216
BON067	1.II.2023	Kralendijk, Villa Carina Apartments, Kaya Gemini, small cave with fresh water	12.120286 -68.286520
BON068	1.II.2023	Kralendijk, along Kaya International, fresh water pond	12.146363 -68.273125
BON069	2.II.2023	Rincon, Kaminda Onima, Lake Onima, near kunuku ruin	12.2477 -68.3136
BON070	3.II.2023	Rincon, Cadushy Distillery, in bucket with *Eichhornia crassipes*	12.237992 -68.332098
BON071	3.II.2023	Kaminda Turistico, nature trail along limestone rocks	12.216 -68.337
SVL-LOC. 1	22.I.2023	Kralendijk, near Hotel Central, Kaya L.D. Gerhards, observations, no molluscs collected	12.152300 -68.275400
SVL-LOC. 2	22.I.2023	Pos Gurubu, two small lakes separated by a dam near the pumping station, E Kaminda Gurubu, handcatch	12.193100 -68.262600
SVL-LOC. 3	22.I.2023	Dam Grandi, handcatch	12.260600 -68.338400
SVL-LOC. 4	22.I.2023	along unpaved road with shrubs, e Dam Grandi, handcatch	12.263300 -68.336300
SVL-LOC. 5	22.I.2023	WSNP, near entrance, garden around Kas Sientífiko, handcatch	12.269400 -68.346000
SVL-LOC. 6	22.I.2023	Rincon, flowery fallow field along Kaya Trinitaria, handcatch	12.240100 -68.329900
SVL-LOC. 1	23.I.2023	garden near entrance of WSNP, handcatch	12.270100 -68.346000

Field nr.	Date	Location, description	Lat Long
SVL-LOC. 3	23.I.2023	WSNP, Salina Matijs, salinity 15 promille, handcatch + dip-net	12.275056 -68.356552
SVL-LOC. 4	23.I.2023	WSNP, Cactus forest just past Salina Matijs, handcatch	12.279774 -68.363533
SVL-LOC. 5	23.I.2023	WSNP, little rooi along short route, S Seru Grandi, leaflitter sample	12.287274 -68.372513
SVL-LOC. 6	23.I.2023	WSNP, little rooi with running water, salinity 10 promille, handcatch + dip-net	12.284714 -68.382708
SVL-LOC. 7	23.I.2023	WSNP, around Put Bronswinkel, handcatch + dip-net	12.280023 -68.398185
SVL-LOC. 8	23.I.2023	WSNP, Slagbaai, limestone rocks N bay, handcatch	12.264997 -68.413304
SVL-LOC. 1	24.I.2023	Dos Pos along Kaya Para Mira, in concrete tank around pumping station, small leaflitter sample + handcatch + dip-net	12.238854 -68.356384
SVL-LOC. 2	24.I.2023	along NW border Lake Goto (1st counting point bird monitoring), washed up on beach, large leaflitter sample	12.241286 -68.381737
SVL-LOC. 3	24.I.2023	along N border Lake Goto (2nd counting point bird monitoring), leaflitter sample	12.247643 -68.384047
SVL-LOC. 4	24.I.2023	NE side Lake Goto (3rd counting point bird monitoring), small leaflitter sample	12.242760 -68.370193
SVL-LOC. 5	24.I.2023	NE Lake Goto, along Kaminda Goto, small leaflitter sample	12.238066 -68.368256
SVL-LOC. 6	24.I.2023	Lake Goto, along Kaminda Goto just north of the division of the road to a calcareous hill, leaflitter sample	12.222677 -68.374336
SVL-LOC. 6A	24.I.2023	along Kaminda Goto, little open area along the lake [= 20230124.BON.17], handcatch	12.234622 -68.368462
SVL-LOC. 7	24.I.2023	coral plateau S Lake Goto, near the outlet into the sea, leaflitter sample	12.222672 -68.374352
SVL-LOC. 8	24.I.2023	road E BOPEC Terminals to Seru Wasao, in cattle grid, mollusks likely to be washed away from Seru Wasao, handcatch	12.221830 -68.377258
SVL-LOC. 9	24.I.2023	little beach along Kaminda Karpata, about 100 m E outlet of Lake Goto, washed ashore, in shoreline, handcatch	12.220654 -68.365912
SVL-LOC. 10	24.I.2023	limestone forested hill SE Lake Goto, leaflitter sample	12.231070 -68.368464
SVL-LOC. 1	25.I.2023	Klein Bonaire, E first lake with many green algae, nearly fresh/ little brackish water, 5 cm deep water on coral plateau, at the start of the read walkingtrail , handcatch + dip-net	12.167922 -68.310684
SVL-LOC. 2	25.I.2023	Klein Bonaire, W forst lake, fresh rain water, partly covered by green algae, up to 10 cm deep water on coral plateau, near the start of the red walking trail, handcatch + dip-net	12.167900 -68.311200
SVL-LOC. 3	25.I.2023	Klein Bonaire, second lake along the red walking trail, fresh rain water, partly covered by green algae, handcatch + dip-net	12.167700 -68.311600
SVL-LOC. 4	25.I.2023	Klein Bonaire, splash pool on coral plateau along the coast, filled with sea water, handcatch	12.163000 -68.323100
SVL-LOC. 5	25.I.2023	Klein Bonaire, dry coral plateau approx 100 m from the shore with low vegetation of salt marsh plants, little humus, leaflitter sample	12.158200 -68.325200
SVL-LOC. 6	25.I.2023	Klein Bonaire, large salt lake at west point of Klein Bonaire near the lighthouse, observations + dip-net, no molluscs	12.155400 -68.326300
SVL-LOC. 7	25.I.2023	Klein Bonaire, coral plateau with many low shrubs and loose stones, aprox 100 m inland from No Name Beach (docking place watertaxi), leaflitter sample	12.167400 -68.305000
SVL-LOC. 8	25.I.2023	coral plateau W coast Klein Bonaire, mainly between Kas di Karantina and the lighthouse, washed ashore, handcatch	12.163000 -68.323100
SVL-20230125.BON25	25.I.2023	Klein Bonaire, No Name Beach (docking place of the watertaxi), washed ashore within a radius of 500 m, handcatch	12.168170 -68.305077
SVL-LOC. 9	25.I.2023	Kralendijk, wall with vegetation of high grasses opposite Hotel Central, Kaya L.D. Gerharts 20, handcatch	12.152600 -68.275200
SVL-LOC. 1	26.I.2023	Pos Gurubu, leaflitter sample around 1st and 2nd lake, with vegetation of stoneworts, leaflitter sample + dip-net. No water molluscs found	12.193177 -68.262634
SVL-LOC. 2	26.I.2023	Pos Gurubu more upstream, along the road through forest with cactus and mimosa trees, leaflitter sample	12.193900 -68.262900
SVL-LOC. 3	26.I.2023	Pos Gurubu, third lake off the road, with vegetation of stoneworts, handcatch + dip-net	12.193800 -68.262200
SVL-LOC. 4	26.I.2023	Lac, fairly barren plain with here and there cactus and mimosa bushes, plain has recently been flooded (Lac 1), leaflitter sample	12.128900 -68.235200
SVL-LOC. 5	26.I.2023	Kaminda Lac, coral plateau, approx 5-10 cm higher than most recent flooding level, calcareous rocks with many fossil shells in it, leaflitter sample	12.122400 -68.225100
Single specimen	26.I.2023	Kaminda Lac, lake with mangrove just before Mangrove Info & Kajak Centre, washed ashore, handcatch without location number	12.1187 -68.2225
SVL-LOC. 6	26.I.2023	Kaminda Lac, washed ashore along the ocean coast between large rocks and plastic litter, handcatch	12.104700 -68.215400
SVL-LOC. 7	26.I.2023	Lac, Pariba di Cai, at the end of Kaminda Lac, near fishermans village and large heaps of *Aliger gigas* shells, in edge of mangrove forest under dead leaves, handcatch	12.104500 -68.221800
SVL-LOC. 8	26.I.2023	Lac, Puitu, mangrove forest and field of samphire along Kaminda Lac, before the curve in the road to the end, between and on plants and aerial roots of mangrove, handcatch	12.105600 -68.215900
SVL-LOC. 9A	26.I.2023	brackish water lake between mangrove trees, along Kaminda Lac SW road, handcatch + dip-net	12.111100 -68.217800
SVL-LOC. 9B	26.I.2023	plain along Kaminda Lac NE side of the road, handcatch	12.111100 -68.217800
SVL-LOC. 9C	26.I.2023	shelldump (remainder of consumption) along Kaminda Lac, handcatch	12.111100 -68.217800
SVL-LOC. 1	27.I.2023	Kralendijk, Kaya Hulanda, ditch with many aquatic plants opposite Magero Laundry, W the stadium, handcatch + dip-net	12.184440 -68.265278
SVL-LOC. 2	27.I.2023	Seru Largu, forested calcarious hill, leaflitter sample	12.196000 -68.276000
SVL-LOC. 3	27.I.2023	rooi near Kaya Korona and Kaya Cariben, observations + dip-net, no molluscs	12.173176 -68.272952
SVL-LOC. 4	27.I.2023	Kralendijk, Nikiboko, garden around DCNA office, Kaya Nikiboko south 56, handcatch	12.147657 -68.268347
SVL-LOC. 5A	27.I.2023	residential area Bona Bista, rooi near the entrance of the residential area, handcatch + dip-net	12.184444 -68.265278

Field nr.	Date	Location, description	Lat Long
SVL-LOC. 5B	27.I.2023	residential area Bona Bista, along garden wall in a fallow field at the east side of the residential area, handcatch	12.184300 -68.262255
SVL-LOC. 6	27.I.2023	residential area Republiek, Kaya Piedra Preciosa at square near the corner of Kaya Zircon and Kaya Gamet, handcatch	12.184951 -68.278340
SVL-LOC. 7	27.I.2023	Kaminda Sabana Piedra Krus, steep northcliff of limestone rocks, leaflitter sample	12.244310 -68.294245
SVL-LOC. 1	28.I.2023	WSNP, long route, limestone cliff and low stone wall near Seru Grandi, handcatch	12.290105 -68.356258
SVL-LOC. 2	28.I.2023	WSNP, long route, Seru Grandi, leaflitter sample	12.294208 -68.358236
SVL-LOC. 3	28.I.2023	WSNP, long route, Water Well, 2 dried out wells, observations, no water molluscs	12.298610 -68.361670
SVL-LOC. 4	28.I.2023	WSNP, long route, Boca Kokolishi, handcatch	12.305056 -68.369279
SVL-LOC. 5	28.I.2023	WSNP, Pos Mangel, fresh water with lots of duckweed and along trail to Pos Mangel, observations, no water molluscs	12.294783 -68.391768
SVL-LOC. 6	28.I.2023	WSNP, long route, Salina Bartol, near calcarous rock, leaflitter sample + dip-net, no watermolluscs found	12.304720 -68.397220
SVL-LOC. 7	28.I.2023	WSNP, long route, road along W coast, low in lime soil, observations, no land molluscs found	12.289440 -68.404440
SVL-LOC. 8	28.I.2023	WSNP, long route, road along W coast, low in lime soil, observations, no live molluscs (empty shells of Cerion and Tudora only, not collected)	12.286110 -68.403610
SVL-LOC. 9	28.I.2023	WSNP, long route, Playa Funchi, pebble beach, observations, no marine molluscs washed ashore	12.281864 -68.413805
SVL-LOC. 10	28.I.2023	WSNP, road along W coast, leaflitter sample	12.275030 -68.413523
SVL-LOC. 11	28.I.2023	WSNP, Playa Wayaka I, sea basin with rocks shielded by a reef, and small stream of seepage water, handcatch	12.271163 -68.414118
SVL-LOC. 12	28.I.2023	WSNP, Slagbaai, washed ashore along the beach and along the coastal area, handcatch	12.264635 -68.413526
SVL-LOC. 13	28.I.2023	WSNP, wet part along the road S Slagbaai, handcatch	12.257531 -68.410652
SVL-LOC. 14	28.I.2023	WSNP, dry area along the road SE Slagbaai, handcatch	12.259394 -68.380865
SVL-LOC. 15	28.I.2023	WSNP, along the road near dried out rooi with a lot of white flowering trees, handcatch	12.263837 -68.375995
SVL-LOC. 0	29.I.2023	Rincon, garden around empty house next to restaurant Kos Bon So, handcatch	12.237869 -68.330042
SVL-LOC. 1	29.I.2023	Cave and Cast Reserve, karst plateau, highest part of the plateau with many deciduous trees, leaflitter sample	12.222544 -68.323140
SVL-LOC. 2	29.I.2023	S Rincon, Cave and Karst Reserve, karst plateau with trees near first cave along the road from Rincon, leaflitter sample	12.221580 -68.324032
SVL-LOC. 3	29.I.2023	NW Santa Barbara Crowns, Cave and Cast Reserve, karst plateau with trees near 2nd cave along the road from Rincon (with large tree growing in the cave), leaflitter sample	12.212458 -68.312752
SVL-LOC. 4	29.I.2023	Cave and Cast Reserve, karst plateau with trees near third cave (pit), leaflitter sample	12.203799 -68.308180
SVL-LOC. 5	29.I.2023	Queen's Highway, 1000 steps beach, pebble beach with a bit of sand, washed ashore, handcatch	12.210788 -68.321692
SVL-LOC. 1	30.I.2023	mangrove area near water mill/ pos, along Kaminda Lac/Kaminda Sorobon, handcatch	12.125734 -68.242134
SVL-LOC. 1	30.I.2023	mangrove area near water mill/ pos, along Kaminda Lac/Kaminda Sorobon, shell dump, handcatch	12.125734 -68.242134
SVL-LOC. 2	30.I.2023	mangrove area, at the border of the mangroves along Kaminda Sorobon, handcatch	12.109878 -68.241851
SVL-LOC. 3	30.I.2023	Lac, mangrove area along Kaminda Sorobon, little beach with a lot of household and garden waste dumped, and between dead leaves of the mangrove trees, leaflitter sample	12.102263 -68.241175
SVL-LOC. 4	30.I.2023	Lac, mangrove area along Kaminda Sorobon, bare area along lake with many daed roots and stones, handcatch	12.089955 -68.243600
SVL-LOC. 5	30.I.2023	Sorobon, garden of Hotel Sorobon Beach Resort and surroundings, handcatch	12.091922 -68.236522
SVL-LOC. 6	30.I.2023	along E coast EEG Boulevard, rocky coast with wash-up of dead wood and plastic waste, handcatch	12.076603 -68.231652
SVL-LOC. 7	30.I.2023	along E coast EEG Boulevard, along the road and on the rocks, handcatch	12.048710 -68.225248
SVL-LOC. 8	30.I.2023	along E coast EEG Boulevard, along the road and on the rocks, handcatch	12.033900 -68.231800
SVL-LOC. 9	30.I.2023	along S coast EEG Boulevard near the lighthouse, along the road and on the rocks, observations	12.028338 -68.237727
SVL-LOC. 10	30.I.2023	along W coast EEG Boulevard near the yellow slave houses, handcatch	12.027048 -68.251601
SVL-LOC. 11	30.I.2023	along W coast EEG Boulevard, in the verge of the road near the Kitesurf beach, handcatch	12.048100 -68.268800
SVL-LOC. 12	30.I.2023	along W coast EEG Boulevard, dunes along the salt pans in the verge of the road, handcatch	12.065000 -68.281400
SVL-LOC. 13	30.I.2023	Kralendijk, Kaya Industria Pariba, garden center Green Label, nursery and plants imported from Florida en Dominican Republic, handcatch	12.143104 -68.269058
SVL-LOC. 1	31.I.2023	mangrove, Lac/ Boca di Pos, kayak tour with snorkeling through mangrove canal, coördinates very roughly estimated, snorkeling	12.111330 -68.220130
SVL-LOC. 2	31.I.2023	border of mangrove area with Manzanilla-trees, handcatch	12.121500 -68.242700
SVL-LOC. 3	31.I.2023	Lac, mangrove area along Kaminda Sorobon, little beach with a lot of household and garden waste dumped, and between dead leaves under large mangrove trees, handcatch	12.102263 -68.241175
SVL-LOC. 4	31.I.2023	Lac, Sargasso-beach with picknick table along Kaminda Sorobon, calcareous rocks along Lac, handcatch	12.096172 -68.242537
SVL-LOC. 5	31.I.2023	E Kaya R. Statius van Eps, karst plateau with gourd trees and low shrubs (N saltpans), small leaflitter sample	12.093700 -68.247400
SVL-LOC. 6	31.I.2023	halfway through Kaya R. Statius van Eps, karst plateau with gourd trees and low shrubs (N saltpans), small leaflitter sample	12.109900 -68.263100
SVL-LOC. 7	31.I.2023	W Kaya R. Statius van Eps, near fault line in karst plateau with little cliff, overgrown with gourd trees and spiny shrubs, small leaflitter sample	12.123300 -68.282400
SVL-LOC. 8	31.I.2023	W Kaya Gavilan, small first lake with stonewort, observations + dip-net, no molluscs	12.155733 -68.269348
SVL-LOC. 9	31.I.2023	E Kaya Gavilan, W second large lake with stonewort and piping, observations + dip-net, no molluscs	12.155919 -68.268280

Field nr.	Date	Location, description	Lat Long
SVL-LOC. 10	31.I.2023	E Kaya Gavilan, e of second large lake with stonewort and piping, observations + dip-net, no molluscs	12.155900 -68.267900
SVL-LOC. 11	31.I.2023	Kralendijk, along Kaya International, ditch with Najas marina E road just before Kaya Gresia, handcatch + dip-net	12.146714 -68.273129
SVL-LOC. 1	1.II.2023	Tera Barra, handcatch	12.210497 -68.277942
SVL-LOC. 2	1.II.2023	Kaya Pos di Watapama - corner EEG Boulevard, along outside walls of garden center Always Green, handcatch	12.118703 -68.290848
SVL-LOC. 3	1.II.2023	Belnem, corner Kaya Uranus and Kaya Gemini, karst plateau, near small cave with fresh water, vegetation with trees, leaflitter sample	12.120480 -68.286500
SVL-LOC. 4	1.II.2023	along Kaya International, fresh water ditch with Najas Marina, handcatch + dip-net	12.146200 -68.273200
SVL-LOC. 1	2.II.2023	unpaved road along the windmills N Rincon (Kaminda Brudernan di Brakapoti?), in and near small lake, handcatch + dip-net, no water molluscs found	12.269100 -68.338600
SVL-LOC. 2	2.II.2023	unpaved road along the windmills N Rincon (Kaminda Brudernan di Brakapoti?), near steep northwards facing calcareous cliff, leaflitter sample	12.266900 -68.334900
SVL-LOC. 3	2.II.2023	unpaved road along the windmills N Rincon (Kaminda Brudernan di Brakapoti?), kast plateau with salt water splashes, and sea water pools, handcatch	12.261100 -68.321700
SVL-LOC. 4	2.II.2023	Boka Onima, cove in coastline with small beach NE Rincon, handcatch	12.253000 -68.321700
SVL-LOC. 5	2.II.2023	Kaya Papa Cornes, along unpaved road from sewage treatment plant to the bird ponds, and at the eastern bird pond, observations, no water molluscs and no land molluscs	12.161100 -68.256600
SVL-LOC. 1	3.II.2023	Wayakatrail near Santa Barbara Crowns, karst area with many indigenous trees and shrubs, leaflitter sample	12.204100 -68.291500
SVL-LOC. 2	3.II.2023	Wayakatrail near Santa Barbara Crowns, karst area with many indigenous trees and shrubs, leaflitter sample	12.208700 -68.298900
SVL-LOC. 1	4.II.2023	S Rincon, rock wall behind Gruta di Lourdes [= Loc 20230204.BON.98], handcatch	12.229089 -68.332316
SVL-LOC. 3	4.II.2023	WSNP, along Washikemba trail, along trail over limestone plateau to the shore near the entrance of the national park, leaflitter sample	12.275280 -68.344440
SVL-LOC. 4	5.II.2023	WSNP, Kashikunda trail, near the top of Seru Kashikunda, vulcanic rock, close to the entrance of the National Park, observations, no land molluscs	12.267642 -68.350493
SVL-LOC. 5	5.II.2023	WSNP, in the verge of the road with high shrubs near the start of the Kashikunda trail, close to the entrance of the National Park, land molluscs handcatch	12.270278 -68.348056
BON.2022-2023.31	4-19.I.2023	WSNP, Lagadishi Trail, Pot trap A	12.2711 -68.3483
BON.2022-2023.32	4-19.I.2023	WSNP, Playa Chikitu, mangrove area, Pot trap B	12.2788 -68.3488
BON.2022-2023.33	4-19.I.2023	WSNP, Playa Chikitu small dunes, Pot trap C	12.2794 -68.3485
BON.2022-2023.34	4-19.I.2023	WSNP, Pos Mangel, Pot trap D	12.2950 -68.3919
BON.2022-2023.35	4-19.I.2023	WSNP, Put Bronswinkel, Pot trap E	12.2718 -68.3480
BON.2022-2023.36	4-19.I.2023	WSNP, Kas Sientífiko, Pot trap F	12.2695 -68.3464
BON.2022-2023.37	6-19.I.2023	Tera Barra, dam, Pot trap G	12.2114 -68.2784
BON.2022-2023.38	6-19.I.2023	Tera Barra, Caracara, Pot trap H	12.2115 -68.2784
BON.2022-2023.39	6-19.I.2023	Tera Barra, pond, Pot trap I	12.2115 -68.2785
BON.2022-2023.40	6-19.I.2023	Tera Barra, compost heap, Pot trap J	12.2108 -68.2784
BON.2022-2023.41	6-19.I.2023	Dam Grandi, Pot trap K	12.2607 -68.3386
BON.2022-2023.42	7-19.I.2023	WSNP, Kas Sientífiko, Pot trap L	12.2695 -68.3464
BON.2022-2023.43	7-19.I.2023	WSNP, Pos Mangel, Pot trap M	12.2950 -68.3919
PK002	31.X.2022	Rincon, WSNP, Kas Sientífiko	12.26950 -68.34606
PK006	31.X.2022	Rincon, WSNP, Put Bronswinkel	12.27988 -68.39815
PK018	30.X.2022	Kralendijk, Kaminda Sorobon, little beach along Kaminda Sorobon	12.10274 -68.24127
PK024	1.XI.2022	Rincon, Kaminda Turistiko, Karpata	12.21973 -68.35180