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A SURVEY OF MOLLUSKS COLLECTED IN ARUBA

David P. Berschauer[1] and Leo G. Ros[2]

25461 Barents Street, Laguna Hills, California[1], shellcollection@hotmail.com, and
Moko 36 B, Noord, Aruba[2], leoros@live.com

Aruba is part of the Kingdom of the Netherlands in what was previously referred to in the literature as the Netherland Antilles. Aruba is self-governing with a "status aparte" within the Dutch Kingdom, with justice and defense being the responsibility of the Dutch government. The island nation is located in the Caribbean approximately 27 kilometers north of the coast of Venezuela. Aruba is approximately 32 kilometers long and 11 kilometers wide and is located at the southern end of the Leeward Antilles island arc of the Lesser Antilles (Figure 1). Aruba is generally flat with some rolling hills, a dry climate, and an arid grass and cactus-dominated landscape. The western and southern coasts of Aruba consist primarily of protected white sandy beaches, whereas the windward shores along the northern and eastern coasts are battered by fierce ocean currents. The marine fauna of Aruba is somewhat distinct from its neighboring Grenadine Subprovince islands Curaçao and Bonaire (together sometimes referred to as the ABC islands) because of its proximity to the coast of Venezuela and the shallow waters surrounding the island (Petuch, 2013). By way of comparison, the waters off the coasts of Curaçao and Bonaire extend to 1000 m deep whereas the waters between Aruba and Venezuela do not exceed a depth of 135 m.

The last comprehensive listing of mollusks found in Aruba was published in 1988 by K.M. de Jong and H.E. Coomans. That treatise, while excellent for its time, left out a number of endemic species (including the famous *Tenorioconus curassaviensis* (Hwass, 1792) (Figure 2), and only dealt with marine gastropods, essentially lumping the fauna of the three islands together.

The Jong & Coomans treatise was built on a prior regional work of H.E. Coomans from 1958, however, the 1988 treatise, while printed in book form, was sorely lacking in photographs of the shells of the 723 species presented therein. From a conchologists point of view, a book detailing the

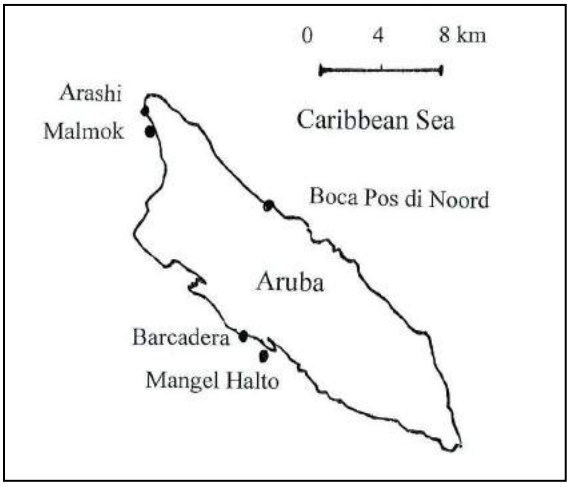

Figure 1. The island of Aruba, just north of Venezuela.

Figure 2. *Tenorioconus curassaviensis* (Hwass, 1792) collected at Malmok, Aruba

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molluscan fauna of the ABC islands complete with good color pictures was sorely needed as the few books on the Caribbean fauna covered area much farther north, and there is no comprehensive book covering the marine Mollusca of the Southern Caribbean, although Warmke & Abbott (1961) and Michael Humphrey (1975) did provide fairly good coverage of the molluscan fauna of Puerto Rico, the Bahamas and the Florida Keys. A much more recent book by Colin Redfern (2001) covers the sea shells of the Bahamas in incredible depth and contains numerous excellent black and white photographs. These works still leave the conchologist who visits the island of Aruba at a distinct disadvantage in identifying the myriad of beautiful shells to be found there, hence the reason for the present work.

The co-author Leo G. Ros is a Dutch citizen and resident of Aruba for over twenty years. Mr. Ros has been collecting and studying shells since his youth in the Netherlands, and has extensively collected shells by diving and snorkeling throughout Aruba on a regular basis for decades. During the senior author's recent visit to Aruba in July 2013, Leo G. Ros and another shell collector friend, Jordy Wendriks, showed him some of their favorite collecting locations and acted as local shell guides. An amazing number of species of marine mollusks were collected in five days by these shell collectors in four locations (Arashi, Malmok, Barcadera, and Mangel Halto) on the western or leeward coast of Aruba. (Figure 3). Additional marine mollusks were found along the drift line on shore at one site located near Boca Pos di Noord on the eastern or windward side of the island. Two land snails were found in separate habitats on the island.

Access to beaches on the leeward side of the island of Aruba is fairly easy as the main road follows the coast line, there is readily available parking, and the beach can be reached either directly or by following well marked sandy trails. The leeward beaches of Arashi and Malmok are similar in that they are readily accessible from the main road, and each has a small white sand beach with rocks and boulders along parts of the shoreline. Both beaches face the open ocean on the leeward side of the island, and are not protected by an offshore barrier island or sandbar. The wave action is minimal and the waters are calm and easy to enter from shore. The sea bottom consists of stretches of white sand with turtle grass beds and rocky ledges with live coral in places. Dead coral boulders lie strewn across the bottom and provide substrate and hiding places for marine organisms. These areas are accessible by either snorkeling or diving to depths of 3 to 10 meters *Eustrombus gigas* (Linnaeus, 1758), *Lobatus gallus*

Figure 3. The authors David P. Berschauer and Leo G. Ros following a dive just north of Malmok.

Figure 4. The beach at Mangel Halto

(Linnaeus, 1758), *Cassis madagascariensis* Lamarck, 1822, and *C. flammea* Linnaeus, 1758, are visible on or just under the sand in the shoal grass beds. Octopus middens can be found in the sandy patches, often surrounded by bivalve shells in excellent condition. Almost all other marine mollusks are hidden under ledges on the coral reefs or under dead, broken coral boulders lying on the sand. Turning over these coral boulders one can see colorful polychaete worms, brittle stars, sea urchins and the occasional sea cucumber.

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Barcadera is just north of Mangel Halto and is somewhat difficult to reach. There is a large sandpile (or mountain) of dredge spoils just slightly inland which is a result of government projects to deepen the harbor at Oranjestad for cruise ships. These dredge spoils can be fruitful for collecting shells as long as one is protected from the harsh sunlight and stays well hydrated. The beach can be accessed by means of a meandering sandy trail through sparse dry brush. On the stems of these plants one can find *Cerion arubanum* H.B. Baker, 1924. Following the trail to the water's edge you walk past mangrove trees and come to a small sandbar which is approximately 15 meters long. The area between the sandbar and the mangrove trees is a protected shallow swampy environment no more than two meters deep, with the bottom covered in shoal grass and decaying mangrove leaves. The other side of this sandbar leads to deeper water with a silty and sandy bottom in an area protected by a thin sandy barrier island. On the mangrove swamp side of the sandbar one can find numerous live *Melongena melongena* (Linnaeus, 1758) and *Bulla solida* (Gmelin, 1791) in the sandbar or near the shoal grass, and *Neritina virginea* (Linnaeus, 1758) which are abundant and can be found adjacent to and on the mangrove roots.

A new cone species *Perplexiconus wendrosi* Tenorio & Afonso, 2013, is endemic to Aruba and to this particular sandbar (Berschauer, Ros & Wendriks, 2013). *Strombus pugilis* (Linnaeus, 1758) can be found in the shoal grass bed. There is a species of jellyfish (similar to a *Nausithoe* species) which is abundant in this area. and inhabits the shallow waters between the sand bar and the mangroves and leaves a moderate burning sensation on the skin followed by a reddish mark and numbness (known as an "Aruban tattoo").

The beach at Mangel Halto (Figure 4) is protected by a low rocky barrier island and sandbar which barely extends above the surface and allows waves to cross during parts of the tidal cycle. There is a coral reef near this rocky barrier and numerous points of access to the white sandy beaches are visited by locals and tourists alike. This is a somewhat protected area which is relatively shallow, 2 to 5 meters deep, and the seascape consists of broad expanses of flat white sand, shoal grass beds, and white sand ridges. Closer to the rocky barrier there are fields of boulders, both rock and dead coral, which provide substrate and hiding places for marine organisms. Colorful fish can be found near the reef among the coral and the rocks. Olive shells and the famed *Voluta musica* Linnaaeus, 1758, can be found in the sand as well as the occasional *Charonia variegata* (Lamarck, 1816). Tours are occasionally conducted for snorkelers in this area.

The beaches on the windward side of the island are almost all virtually inaccessible except by boat, however, there are a few locations which can be reached by off-road vehicles (or carefully by automobile). The beach near Boca Pos de Noord is one such beach and can be reached by means of a dirt road leading off from the landmark Alto Vista Chapel (Figure 5).

Figure 5.. Alto Vista Chapel, Aruba.

Strong waves pound the shoreline at Boca Pos di Noord (Figure 6) which consists of a white sandy beach flanked by dark brown to black volcanic boulders. Clinging to these boulders are several species of chitons and nerites, as well as *Tectarius muricatus* (Linnaeus, 1758) and *Cittarium pica* (Linnaeus, 1758). Most large shells cast up on the shore tend to be broken, however, many of the smaller species are tossed up on the tideline with flotsam and jetsam intact, including many small columbellids.

Figure 6. The beach at Boco Pos di Noord

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Below is a systematic listing of the species of mollusks found by the authors on Aruba during their one week survey, as well as approximately a dozen other species found in Aruba by Leo G. Ros over the years which are in his private collection. Each of the 189 species listed below was either personally collected by the co-authors together, or by Leo G. Ros individually‡. A selection of some of the species found can be seen in Figures 7, 8 and 9.

Identification of species was performed based upon visual inspection of shells in hand compared to published photographs by Marcus and Jose Coltro on www.femorale.com, as well as photos on www.gastropods.com, and on the Natural History Museum of Rotterdam website http://www.nmr-pics.nl/. Comparison has been made to the faunal listing for Aruba at Malacolog verson 4.1.1 at http://www.malacolog.org/ and it has been determined that the authors' survey has 168 new species to add to the list reflected on Malacolog.

List of Mollusks of Aruba found by the authors in July 2013

Polyplacophora

Chitonidae:
- *Acanthopleura granulata* (Gmelin, 1791)
- *Chiton marmoratus* Gmelin, 1791
- *Chiton squamosus* Linnaeus, 1764

Ischnochitonidae:
- *Ischnochiton pectinatus* (Sowerby, 1840)
- *Ischnochiton papillosus* (C.B. Adams, 1845)
- *Ischnochiton striolatus* (Gray, 1828)

Gastropoda

Neritidae:
- *Nerita peloronta* Linnaeus, 1758
- *Nerita tessellata* Gmelin, 1791
- *Nerita versicolor* Linnaeus, 1758
- *Neritina virginea* (Linnaeus, 1758)

Fissurellidae:
- *Diodora cayenensis* (Lamarck, 1822)
- *Fissurella angusta* (Gmelin, 1791)
- *Fissurella barbadensis* Gmelin, 1791
- *Hemitoma emarginata* (Blainville, 1825)
- *Hemitoma octoradiata* (Gmelin, 1791)

Trochidae:
- *Cittarium pica* (Linnaeus, 1758)
- *Tegula excavata* Lamarck, 1822
- *Tegula fasciata* (Born, 1778)

Turbinidae:
- *Astralium phoebium* Röding, 1798
- *Astraea tecta* (Lightfoot, 1786)

Calliostomatidae:
- *Calliostoma bullisi* Clench & Turner, 1960
- *Calliostoma purpureum* Quinn, 1992

Cerithiidae:
- *Cerithium atratum* Born, 1778
- *Cerithium litteratum* (Born, 1778)
- *Cerithium lutosum* Menke, 1828

Batillariidae:
- *Batillaria minima* (Gmelin, 1791)

Littorinidae:
- *Littorina ziczac* (Gmelin, 1791)
- *Tectarius muricatus* (Linnaeus, 1758)

Strombidae:
- *Aliger costatus* (Gmelin, 1791)
- *Eustrombus gigas* (Linnaeus, 1758)
- *Lobatus gallus* (Linnaeus, 1758)
- *Lobatus raninus* (Gmelin, 1791)
- *Strombus pugilis* (Linnaeus, 1758)

Hipponicidae:
- *Malluvium benthophilum* (Dall, 1889)

Calyptraeidae:
- *Crucibulum auritula* (Gmelin, 1791)

Cypraeidae:
- *Erosaria acicularis* (Gmelin, 1791)
- *Luria cinerea* (Gmelin, 1791)
- *Macrocypraea zebra* (Linnaeus, 1758)‡

Ovulidae:
- *Cyphoma gibbosum* (Linnaeus, 1758)
- *Phenacovolva piragua* (Dall, 1889)

Triviidae:
- *Cleotrivia antillarum* (Schilder, 1922)
- *Erato maugeriae* (Gray, 1833)
- *Niveria suffusa* (Gray, 1832)
- *Pusula pediculus* (Linnaeus, 1758)

Naticidae:
- *Natica* sp. (smooth brown)
- *Natica canrena* (Linnaeus, 1758)
- *Natica canrena verae* Rehder, 1947
- *Natica guesti* Harasewych & Jensen, 1984
- *Polinices lacteus* (Guilding, 1834)
- *Sinum perspectivum* (Say, 1831)
- *Stigmaulax cancellatus* (Hermann, 1781)

Tonnidae:
- *Tonna pennata* (Mörch, 1853)

Cassidae:
- *Cassis flammea* Linnaeus, 1758
- *Cassis madagascariensis* Lamarck, 1822
- *Cassis tuberosa* Linnaeus, 1758
- *Cypraecassis testiculus* (Linnaeus, 1758)
- *Semicassis granulatum* (Born, 1778)
- *Semicassis granulatum cicatricosum* (Meuschen, 1878)

Ranellidae:
- *Charonia variegata* (Lamarck, 1816)
- *Cymatium caribbaeum* Clench & Turner, 1957
- *Cymatium femorale* (Linnaeus, 1758)‡
- *Cymatium labiosum* (Wood, 1828)
- *Cymatium martinianum* Orbigny, 1845
- *Cymatium muricinum* Röding, 1798
- *Cymatium nicobaricum* Röding, 1798

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Personidae:
Distorsio mcgintyi Emerson & Puffer, 1953‡
Bursidae:
Bursa cubaniana (Orbigny, 1842)
Bursa ranelloides tenuisculpta (Dautzenberg & Fischer, 1906)
Bursa thomae Orbigny, 1842
Ficidae:
Ficus carolae Clench, 1945
Epitoniidae:
Epitonium angulatum (Say, 1830)
Epitonium nautlae (Mörch, 1874)‡
Eulimidae:
Niso aeglees Busk, 1885‡
Buccinidae:
Cantharus multangulus (Philippi, 1848)
Cantharus tinctus (Conrad, 1846)
Engina turbinella Kiener, 1845
Engoniophos unicinctus (Say, 1825)
Pisania pusio (Linnaeus, 1758)
Columbellidae:
Anachis cf. *lafresnayi* (Fischer & Bernardi, 1857)
Columbella mercatoria (Linnaeus, 1758)
Conella ovulata (C.B. Adams, 1850)
Conella ovuloides (C.B. Adams, 1850)
Nitidella nitida (Lamarck, 1822)
Nitidella ocellata Gmelin, 1791
Rhombinella laevigata (Linnaeus, 1758)
Nassariidae:
Nassarius albus (Say, 1826)
Melongenidae:
Melongena melongena (Linnaeus, 1758)
Fasciolariidae:
Fasciolaria tulipa hollisteri Weisbord, 1962‡
Fusinus ansatus caboblanquensis Weisbord, 1962‡
Fusinus helenae Bartsch, 1839‡
Latirus infundibulum (Gmelin, 1791)
Leucozonia nassa (Gmelin, 1791)
Leucozonia ocellata Gmelin, 1791
Muricidae:
Chicoreus mergus (Vokes, 1974)
Dermomurex cf. *glicksteini* Petuch, 1987
Dermomurex pauperculus (C.B. Adams, 1850)
Muricopsis caribbaea (Bartsch & Rehder, 1939)
Muricopsis cf. *muricoides* (A. Adams, 1845)
Murexiella hilli Petuch, 1987‡
Phyllonotus margaritensis (Abbott, 1958)
Purpura patula (Linnaeus, 1758)
Thais deltoidea Lamarck, 1822
Vokesimurex chrysostoma (Gray, 1834)‡
Coralliophilidae:
Coralliophila caribaea Abbott, 1958
Turbinellidae:
Vasum capitellum (Linnaeus, 1758)
Volutidae:
Voluta musica Linnaeus, 1758
Harpidae:
Morum lamarckii (Deshayes, 1844)‡
Morum lindae Petuch, 1987
Marginellidae:
Prunum marginatum (Born, 1778)
Volvarina avena (Kiener, 1834)
Volvarina heterozona (Jousseaume, 1857)
Cystiscidae:
Persicula catenata (Montagu, 1803)
Persicula calculus (Redfield, 1870)
Mitridae:
Mitra barbadensis striatula (Schröter, 1804)
Mitra nodulosa (Gmelin, 1791)
Volutomitridae:
Conomitra caribbeana Weisbord, 1929
Costellariidae:
Vexillum puella (Reeve, 1845)
Vexillum pulchellum (Reeve, 1844)
Olividae:
Eburna balteata (Sowerby, 1825)
Jaspidella jaspidea (Gmelin, 1791)
Americoliva fulgurator (Röding, 1798)
Americoliva reclusa Marratt, 1871
Oliva cf. *bewleyi* Marrat, 1871
Oliva cf. *reticularis* Lamarck, 1811
Oliva sargenti Petuch, 1988
Olivellidae:
Olivella bullula (Reeve, 1850)
Olivella floralia (Duclos, 1853)
Olivella nivea chiriquiensis Olsson, 1956
Olivella pulchra (Marrat, 1871)
Pseudomelatomidae:
Crassispira fuscescens (Reeve, 1843)
Crassispira pellisphocae (Reeve, 1845)
Pilsbryspira albocincta (C.B. Adams, 1845)
Terebridae:
Hastula hastula (Gmelin, 1791)
Conidae:
Arubaconus hieroglyphus (Duclos, 1833)
Chelyconus ermineus (Born, 1778)
Dauciconus daucus (Hwass, 1792)
Gladioconus mus (Hwass, 1792)
Lindaconus spurius arubensis Usticke, 1968
Stephanoconus regius (Gmelin, 1791)
Tenorioconus aurantius (Hwass, 1792)
Tenorioconus curassaviensis (Hwass, 1792)
Conilithidae:
Kohniconus centurio Born, 1778‡
Perplexiconus puncticulatus columba (Vink, 1990)
Perplexiconus wendrosi Tenorio & Afonso, 2013
Architectonicidae:
Architectonica nobilis Röding, 1798
Heliacus cylindricus (Gmelin, 1791)
Heliacus perrieri (Rochebrune, 1881)

Haminoeidae:
Atys caribaeus (Orbigny, 1841)
Bullidae:
Bulla solida Gmelin, 1791
Bulla striata occidentalis A. Adams, 1850
Micromelo undatus (Bruguière, 1792)
Ellobiidae:
Melampus coffea (Linnaeus, 1758)

Pulmonata
Annulariidae:
Tudora fossor Baker, 1924
Cerionidae:
Cerion arubanum H.B. Baker, 1924
Subulinidae:
Nesubulina gloynii (Gibbons, 1879)

Bivalvia
Thraciidae:
Thracia corbuloidea Blainville, 1827
Cardiidae:
Americardia guppyi Thiele, 1910
Americardia media (Linnaeus, 1758)
cf. *A. columba* Heilprin, 1886
Laevicardium laevigatum (Linnaeus, 1758)
Papyridea lata (Born, 1778)
Acrosterigma magnum (Linnaeus, 1758)
Chamidae:
Chama macerophylla (Gmelin, 1791)
Lucinidae:
Codakia orbiculata (Montagu, 1808)
Lucina cf. *pectinata* (Gmelin, 1791)
Tellinidae:
Arcopagia fausta Pulteney, 1799
Tellina listeri Röding, 1898
Tellina radiata (Linnaeus, 1758)
Veneridae:
Chione paphia (Linnaeus, 1767)
Chioneryx pygmaea Lamarck, 1818
Globivenus rigida (Dillwyn, 1817)
Pitar albidus (Gmelin, 1791)
Arcidae:
Acar domingensis (Lamarck, 1819)
Arca zebra (Swainson, 1833)
Barbatia cancellaria (Lamarck, 1819)
Barbatia candida (Helbling, 1779)
Glycymerididae:
Glycymeris decussata (Linnaeus, 1758)
Plicatulidae:
Plicatula gibbosa Lamarck, 1801
Pectinidae:
Aequipecten acanthodes (Dall, 1925)
Caribachlamys ornata (Lamarck, 1819)
Euvola ziczac (Linnaeus, 1758)
Nodipecten nodosus (Linnaeus, 1758)
Spondylidae:
Spondylus americanus Hermann, 1781[‡]
Spondulys ictericus Reeve, 1856
Limidae:
Acesta colombiana H.E. Vokes, 1970
cf. *A. milts* (Lamarck, 1818)
Lima caribaea Orbigny, 1842
Isognomonidae:
Isognomon bicolor (C.B. Adams, 1845)
Pinnidae:
Atrina seminuda (Orbigny, 1846)
Pteriidae:
Pinctada imbricata Röding, 1798

Scaphopoda
Gadilinidae:
Episiphon didymum (Watson, 1879)

The Festivus is currently soliciting professional articles on malacology and conchology, as well as articles of general interest to shell collectors and conchologists.

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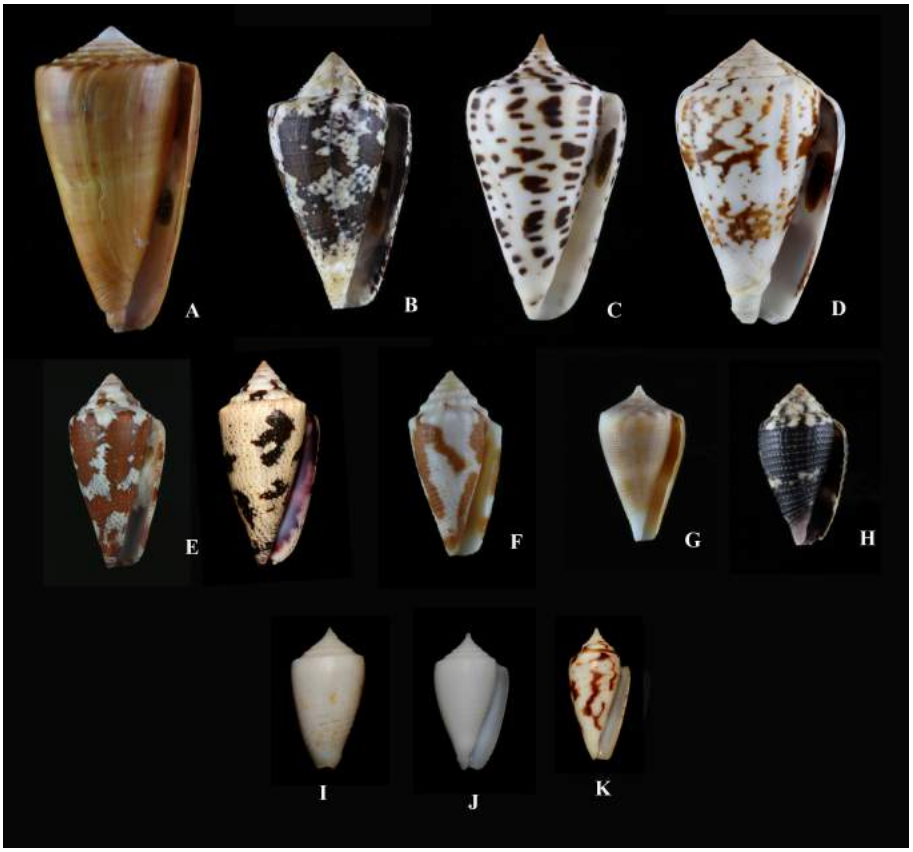

Figure 7. Conidae and Conilithidae of Aruba: **A.** *Dauciconus daucus*, **B.** *Stephanoconus regius*, **C.** *Lindaconus spurius arubensis*, **D.** *Chelyconus ermineus*, **E.** *Tenorioconus curassaviensis*, **F.** *Tenorioconus aurantius*, **G.** *Gladioconus mus*, **H.** *Arubaconus hieroglyphus*, **I.** *Perplexiconus puncticulatus*, **J.** *Perplexiconus puncticulatus columba*, **K.** *Perplexiconus wendrosi*

Figure 8. **1**. *Cassis tuberosa*; **2**, *Cassis madagascariensis*; **3**. *Charonia variegata*; **4**. *Voluta musica*; **5**. *Voluta musica* form *thiarella*. (artistic credit for plate: Martin Schuler)

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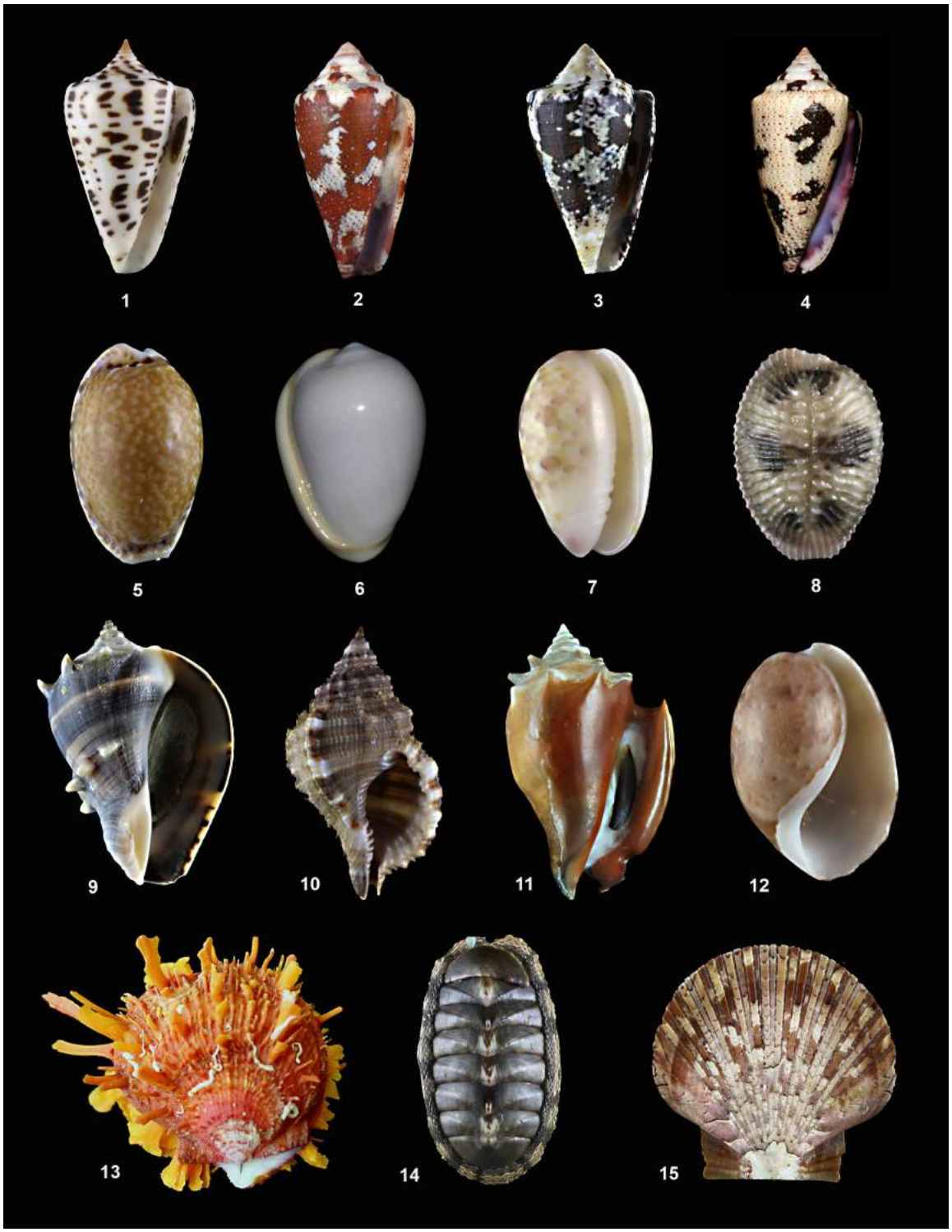

Figure 9. **1**. *Lindaconus spurius arubensis*; **2**. *Tenorioconus curassaviensis*; **3**. *Stephanoconus regius* **4**. *Tenorioconus curassaviensis*; **5**. *Erosaria acicularis*; **6**. *Prunum labiatum*; **7**. *Persicula calculus*; **8**. *Pusula pediculus*; **9**. *Melongena melongena*; **10**. *Cymatium muricinum*; **11**. *Strombus pugilis*; **12**. *Bulla solida*; **13**. *Spondylus americanus*; **14**. *Ischnochiton striolatus*; **15**. *Euvola ziczac.* (artistic credit for plate: Martin Schuler)