

Cowry shells of Andrew Bay in Rakhine coastal region of Myanmar

Abstract

A total of 21 species of cowry shells belonging to genus *Cypraea* Linnaeus 1758 of family Cypraeidae falling under the order Mesogastropoda collected from field observation in 2014, were identified, using liquid-preserved materials and living specimens in the field, based on the external characters of shell structures. The specimens comprised *Cypraea tigris* Linnaeus, 1758, *C. miliaris* Gmelin, 1791, *C. mauritiana* Linnaeus, 1758, *C. thersites* Gaskoin, 1849, *C. arabica* Linnaeus, 1758, *C. scurra* Gmelin, 1791, *C. eglantina* Duclos, 1833, *C. talpa* Linnaeus, 1758, *C. argus* Linnaeus, 1758, *C. erosa* Linnaeus, 1758, *C. labrolineata* Gaskoin, 1849, *C. caputserpentis* Linnaeus, 1758, *C. nucleus* Linnaeus, 1758, *C. isabella* Linnaeus, 1758, *C. cicerula* Linnaeus, 1758, *C. globulus* Linnaeus, 1758, *C. lynx* Linnaeus, 1758, *C. asellus* Linnaeus, 1758, *C. saulae* Gaskoin, 1843, *C. teres* Gmelin, 1791 and *C. reevei* Gray, 1832. The distribution, habitats and distinct ecological notes of cowry shells in intertidal and subtidal zone of Andrew Bay and adjacent coastal areas were studied in brief.

Keywords: Andrew Bay, cowry shells, cypraeidae, gastropod, Rakhine Coastal Region

Volume 8 Issue 4 - 2019

Naung Naung Oo

Department of Marine Science, Mawlamyine University, Myanmar

Correspondence: Naung Naung Oo, Assistant Lecturer, Department of Marine Science, Mawlamyine University, Myanmar, Email naungnaungoomarine@gmail.com

Received: July 06, 2019 | **Published:** August 12, 2019

Introduction

The literature of the molluscs is vast in other countries but in Myanmar only few books are available for reference work. Consequently, it is found that there have been relatively very few works that deal with Myanmar molluscs in the past. The earliest work on Myanmar molluscs is that of Mason.¹⁻³ Mason's books covered almost all branches of science that could be investigated at that time. As far as molluscs were concerned he was able to divide into 4 classes, 2 subclasses, 7 orders, 84 families, 15 subfamilies and 710 species. However, Mason had collected his fauna not only from the Taninthayi Coastal Region but also from the Rakhine Coastal Region in the north. The next appreciable earlier publication on Myanmar molluscs appeared by Mann.⁴ It was fairly up to date literature on shells available for serious students of molluscs of the world. In this way there were entire lack of modern literatures on Myanmar molluscs and information gained from these literatures were very scarce and inadequate. Soe Thu⁵⁻⁷ had recorded the diversity of seashells from Ngapali, Maungmagan and various localities of Myanmar coastal waters.

Consequently, Kyaw Myint⁸ had published a checklist comprising of 153 species of marine gastropods. The list includes 42 families which however is not yet a complete checklist for Myanmar. Maung Win et al.⁹ had also reported the morphology and taxonomy of some marine molluscs found in the coastal waters of Myanmar. Moreover, Phyu Phyu Khin Win¹⁰ had studied the taxonomy of some molluscs trawled offshore in Myanmar waters. Subsequently, Naung Naung Oo¹¹ reported the distribution of marine gastropods in Mon coastal water of Myanmar. Moreover, a systematic account on some gastropods and pelecypods in various localities of Myanmar had been carried out by Aye Thant Zin et al.,¹² Thaw Zin Naing Tun et al.,¹³ Phoo Thet Su Win,¹⁴ Su Pyae Tun¹⁵ and Aung Ko Latt.¹⁶

The Cypraeidae are tropical gastropods with the majority of species found in the Indo-Pacific region; only 25 species are present in the Western Central Pacific.¹⁷ There are *Cypraea annulus* Linnaeus, 1758; *C. arabica* Linnaeus, 1758; *C. argus* Linnaeus, 1758; *C. bouteti* Burgess and Arnette, 1981; *C. caputserpentis* Linnaeus, 1758; *C. carneola* Linnaeus, 1758; *C. caurica* Linnaeus, 1758; *C. depressa* Gray, 1824; *C. eglantina* Duclos, 1833; *C. erosa* Linnaeus, 1758; *C. isabella* Linnaeus, 1758; *C. leviathan* (Schilder and Schilder, 1937); *C. lynx* Linnaeus, 1758; *C. maculifera* Schilder, 1932; *C. mappa* Linnaeus, 1758; *C. mauritiana* Linnaeus, 1758; *C. moneta* Linnaeus, 1758; *C. obvelata* Lamarck, 1810; *C. onyx* Linnaeus, 1758; *C. schildererum* Iredale, 1939; *C. scurra* Gmelin, 1791; *C. talpa* Linnaeus, 1758; *C. tigris* Linnaeus, 1758; *C. ventriculus* Lamarck, 1810 and *C. vitellus* Linnaeus, 1758.

In Myanmar, there were 31 species of *Cypraea*, namely *C. tigris* Linnaeus, 1758; *C. miliaris* Gmelin, 1791; *C. turdus* Lamarck, 1810; *C. mauritiana* Linnaeus, 1758; *C. thersites* Gaskoin, 1849; *C. arabica* Linnaeus, 1758; *C. scurra* Gmelin, 1791; *C. eglantina* Duclos, 1833; *C. talpa* Linnaeus, 1758; *C. argus* Linnaeus, 1758; *C. vanelli* Linnaeus, 1758; *C. carneola* Linnaeus, 1758; *C. vitellus* Linnaeus, 1758; *C. annulus* Linnaeus, 1758; *C. moneta* Linnaeus, 1758; *C. erosa* Linnaeus, 1758; *C. labrolineata* Gaskoin, 1849; *C. caputserpentis* Linnaeus, 1758; *C. nucleus* Linnaeus, 1758; *C. erroneus* Linnaeus, 1758; *C. caurica* Linnaeus, 1758; *C. clandestina* Linnaeus, 1758; *C. cribaria* Linnaeus, 1758; *C. isabella* Linnaeus, 1758; *C. cicerula* Linnaeus, 1758; *C. globulus* Linnaeus, 1758; *C. lynx* Linnaeus, 1758; *C. asellus* Linnaeus, 1758; *C. saulae* Gaskoin, 1843; *C. teres* Gmelin, 1791 and *C. reevei* Gray, 1832 had been reported by Soe Thu.⁷ Likewise, 2 species of *Cypraea*, namely *C. eglantina* Duclos, 1833 and *C. peasei* (G. B. Sowerby III, 1870) had been reported by Naung Naung Oo¹¹ based on morphological and some ecological features collected from various coastal areas of Mon State.

The objective of this study is to determine the distribution, habitats and distinct ecological notes of cowry shells in intertidal and subtidal zone of Andrew Bay and adjacent coastal areas.

Materials and methods

Some cowry shells were collected in the forms of drift and live specimens living in intertidal and shallow subtidal areas such as Geik Taw, Pearl Is., Thanban Gyaing, Abae Chaung, Thanbaya Gyaing, Mayoe Bay, Kathit Is., Thabyu Gyaing, Ponenyat Gyaing, Kwinwina Gyaing, Kyauk pone gyi hmaw and Maung shwe lay Gyaing around the Andrew Bay, Rakhine State (Figure 1) during the field trip in 2014.

All collections were preserved in 10 % formalin in seawater. The epifauna were removed by soaking the shells in a solution of caustic soda and then cleaned, washed, dried, and ready for storage, they are lightly rubbed with a small amount of oil applied with a brush to make them fresh-looking in a slight luster to the surface, and aid in presenting the delicate colouring for further study.

All voucher specimens were deposited at the Museum of the Department of Marine Science, Mawlamyine University (MLM.MS). Zoogeographical distribution of each species was prepared with the data from the literature available. Ecological notes and associated species of these molluscs were also recorded in the field.



Figure 1 Map showing the collection sites of Andrew Bay in Rakhine Coastal Region.

Results and discussion

The cowry shells, locally called ‘Kywe-poke’ were conducted from 12 collection sites at Andrew Bay and its vicinity in Rakhine Coastal Region. In this study, a total of 21 species of cowry shells were observed from different habitats at intertidal and shallow subtidal

levels, to a depth of about 45m. This systematic account follows the identifying set out by Burgess,¹⁸ Lorenz and Hubert,¹⁹ WoRMS²⁰ and Abbott²¹ in detailed (Table 1) (Figure 2).

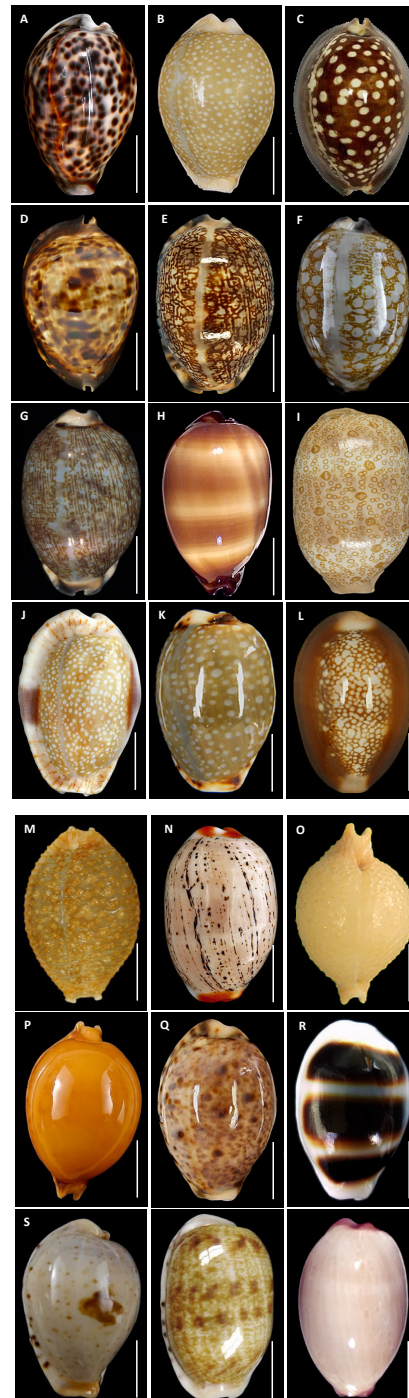


Figure 2 Cowry shells: (A) *Cypraea tigris* Linnaeus, 1758. (B) *C. miliaris* Gmelin, 1791. (C) *C. mauritiana* Linnaeus 1758. (D) *C. thersites* Gaskoin, 1849. (E) *C. arabica* Linnaeus, 1758. (F) *C. scurra* Gmelin, 1791. (G) *C. eglantina* Duclou, 1833. (H) *C. talpa* Linnaeus, 1758. (I) *C. argus* Linnaeus, 1758. (J) *C. erosa* Linnaeus, 1758. (K) *C. labrolineata* Gaskoin, 1849. (L) *C. caputserpentis* Linnaeus, 1758. (M) *C. nucleus* Linnaeus, 1758. (N) *C. isabella* Linnaeus, 1758. (O) *C. cicerula* Linnaeus, 1758. (P) *C. globulus* Linnaeus, 1758. (Q) *C. lynx* Linnaeus, 1758. (R) *C. asellus* Linnaeus, 1758. (S) *C. saulae* Gaskoin, 1843. (T) *C. teres* Gmelin, 1791. (U) *C. reevei* Gray, 1832. Scale bars=10cm.

Table 1 Systematic of cowry shells in the study area

Phylum: Mollusca Linnaeus, 1758	
Class: Gastropoda Cuvier, 1795	
Order: Mesogastropoda Thiele, 1929	
Family: Cypraeidae Rafinesque, 1815	
Genus: <i>Cypraea</i> Linnaeus, 1758	
Species	Common Name
<i>C. tigris</i> Linnaeus, 1758	Tiger cowry
<i>C. miliaris</i> Gmelin, 1791	Military cowry/ Millet cowry
<i>C. mauritiana</i> Linnaeus, 1758	Mauritius cowry/ Mourning cowry
<i>C. thersites</i> Gaskoin, 1849	Black cowry
<i>C. arabica</i> Linnaeus, 1758	Arabian cowry
<i>C. scurra</i> Gmelin, 1791	Mouse cowry/ Jester cowry
<i>C. eglantina</i> Duclos, 1833	Elongate cowry
<i>C. talpa</i> Linnaeus, 1758	Mole cowry/ Chocolate-banded cowry
<i>C. argus</i> Linnaeus, 1758	Eyed cowry
<i>C. erosa</i> Linnaeus, 1758	Gnawed cowry/ Eroded cowry
<i>C. labrolineata</i> Gaskoin, 1849	Lined margin cowry
<i>C. caputserpentis</i> Linnaeus, 1758	Serpent's head cowry/ Snake head cowry
<i>C. nucleus</i> Linnaeus, 1758	Nut cowry/ Nuclear cowry
<i>C. isabella</i> Linnaeus, 1758	Isabell's cowry/ Fawn-coloured cowry
<i>C. cicerula</i> Linnaeus, 1758	Chick-pea cowry
<i>C. globulus</i> Linnaeus, 1758	Globular cowry
<i>C. lynx</i> Linnaeus, 1758	Lynx cowry
<i>C. asellus</i> Linnaeus, 1758	Shallow cowry
<i>C. saulae</i> Gaskoin, 1843	Saul's cowry
<i>C. teres</i> Gmelin, 1791	Tapering cowry
<i>C. reevei</i> Gray, 1832	Reeve's cowry

Characteristics of cowry shells

Cowry shells are of elongated oval form with the spire mostly or wholly enclosed in the body whorl, and with a long narrow aperture and a canal at both ends. One or both lips are ornamented with a series of ridges at right angled to the aperture. In life the shell is concealed by overthrown mantle lobes and lacks periostracum and hence presents a smooth, polished surface due to deposition of an enamel, hence the name porcelain shells often applied to cypraeidae. As the shell is concealed from view, it is rather mysterious that it is usually strongly coloured, often having app atern of brown spots on a lighter background.

The numerous species of *Cypraea* are found mainly in the Indo-Pacific region.¹⁷ The young *Cypraea* differs much from the adult and attains the adult aspect by the in rolling of the lips and enclosure of the spire. The mantle lobes thrown over the shell are often tuberculate or papillate and may be coloured.

Characteristics of family Cypraeidae Rafinesque, 1815

The shell is small to large, ventricose, usually thick, roundly inflated, generally smooth and polished covering with the shining enamel callus, ovate to cylindric ovate. The spire is concealed by the callus presenting only the large body whorl in adult, but the shell is this with a prominent spire with a wide aperture in young stages. Thus, the young shell may be mistaken for different species.

The ventral side of the shell is rather flat. The aperture is long and narrow with a short canal at each end and crenulations on the calloused parietal wall and the inflected outer margin are distinctly formed. There is no operculum. The animal covers the shell by the mantles which meet at the middle of the back.

Characteristics of genus Cypraea Linnaeus, 1758

Shells large, medium, or small; white or decorated with spots, dots, circles, and rings on stringes; shape oval, elongate oval, or rhomboidal; colour various. Spire concealed under body whorl. Aperture long and narrow, channeled at both ends. Both lips with teeth. No operculum.

Key characteristics of Cypraea species in the study area

- a. *Cypraea tigris* Linnaeus, 1758: Numerous black dots on white surface, sides with white spots, base also white (Figure 2A).
- b. *C. miliaris* Gmelin, 1791: Shell thin, white spots numerous, on olive gray, no gands on back, sides with reddish brown (Figure 2B).
- c. *C. mauritiana* Linnaeus, 1758: Shell jump-backed, stocky, pink brown spots on deep mahogany, sides deep brown or nearly black, strong dark brown teeth with white in between, base dark brown (Figure 2C).
- d. *C. thersites* Gaskoin, 1849: Rich brown mottings almost black, strong teeth on white base (Figure 2D).
- e. *C. arabica* Linnaeus, 1758: Irregular markings on gray-blue surface, base pale flesh-brown (Figure 2E).
- f. *C. scurra* Gmelin, 1791: Bluish brown surface covered with a network of brown, brown between lip-teeth (Figure 2F).
- g. *C. eglantina* Duclos, 1833: Light greenish brown surface interrupted with uneven dark brown dashes, base whitish (Figure 2G).
- h. *C. talpa* Linnaeus, 1758: Surface chocolate brown, traversed by alternate bands of light brown and white, sides also dark brown (Figure 2H).
- i. *C. argus* Linnaeus, 1758: Shell pale, scattered with a number of brown rings, aperture fairly wide, lip-teeth brown, base light flesh-brown with two dark brown blotches at the middle (Figure 2I).
- j. *C. erosa* Linnaeus, 1758: Somewhat hexagonal in shape, surface speckled with minute white dots, lip-teeth on outer lip extends over base, a large brown blotch on each shell margin (Figure 2J).

- k. *C. labrolineata* Gaskoin, 1849:** Surface yellowish brown with a number of white spots of varying sizes, shell thin, teeth not strong (Figure 2K).
- l. *C. caputserpentis* Linnaeus, 1758:** Surface with many small white spots surrounded by deep reddish brown colour, base with fading shades of brown (Figure 2L).
- m. *C. nucleus* Linnaeus, 1758:** Surface with numerous small knobs and a middle line crease, colour grayish and sides yellowish brown, base sparsely covered by crossing ribs (Figure 2M).
- n. *C. isabella* Linnaeus, 1758:** Surface fawn colour, both ends dark red with two distinct white bands encircling the body. The base is white on one side and coloured the same as its upper portion (Figure 2N).
- o. *C. cicercula* Linnaeus, 1758:** It has a plump form. Surface light yellow with a small groove at the posterior end, lip-teeth with very prominent ridges (Figure 2O).
- p. *C. globulus* Linnaeus, 1758:** Shell globose, surface light egg-yolk coloured, but numerous brown dots scattered all over, ridges on lip-teeth less prominent (Figure 2P).
- q. *C. lynx* Linnaeus, 1758:** Shell oval, a sprinkling of dark dots all over the surface, basically grayish blue but with an orange brown dorsal line, white base ornamented by orange red in between the long teeth (Fig. 2 Q).
- r. *C. asellus* Linnaeus, 1758:** Surface with three chocolate dark brown bands and two narrow white bands on creamy white coloured surface, both ends hardly rostrated (Figure 2R).
- s. *C. saulae* Gaskoin, 1843:** Fawn colour with a distinct brown patch on its back, sides with few brown small spots, sides dotted with brown (Figure 2S).
- t. *C. teres* Gmelin, 1791:** Surface light brownish-gray, shaded with brown mottlings, white patches also present, aperture wide, sides with black dots (Figure 2T).
- u. *C. reevei* Gray, 1832:** Size medium, surface pinkish brown, lightly banded, single dark dot at pinkish tip (Figure 2U).

Cowry shells were generally associated with coral reefs (Table 2). Feed most actively at night, browsing on encrusting algae and sponges or tiny animals that grow on rock and coral. Juvenile shell strikingly different from the adults: thin and resembling an olive shell in shape, with a pointed spire, a wide aperture and a sharp, untoothed outerlip.¹⁷

Table 2 Habitats and ecological notes of cowry shells in the study area

Species	Habitats and ecological notes
<i>Cypraea tigris</i> Linnaeus, 1758	Abundant on reef areas, on sand among rocks or corals, in tidal pools or on branched corals, often nearby seaweeds. Active during the day. Intertidal and sublittoral zones to a depth of about 30 m.
<i>C. miliaris</i> Gmelin, 1791	Occurs beneath stones and dead corals on mud flats and reefs.
<i>C. mauritiana</i> Linnaeus, 1758	Under stones and in crevices of coral reefs and rocky headlands exposed to strong wave action. Mostly active at night. Littoral and sublittoral zones, mainly in low tide and shallow subtidal levels.
<i>C. thersites</i> Gaskoin, 1849	Near the lower subtidal level associated with coral reefs and coarse sand flat.
<i>C. arabica</i> Linnaeus, 1758	Under slabs and stones and in caverns of the outer edge of coral reefs. In well-aerated waters, from low in the intertidal zone to shallow sublittoral depths.
<i>C. scurra</i> Gmelin, 1791	Often deeply buried in dead coral rubble within reefs, or under coral heads over the reef edge. Lower intertidal zone and shallow sublittoral water to a depth of about 10m.
<i>C. eglantina</i> Duclos, 1833	Under slabs and stones, in coral reef and rocky habitats. Shallow subtidal waters.
<i>C. talpa</i> Linnaeus, 1758	In coral reefs, under slabs or in large coral heads, either on the external slope or in protected areas of the reef. Intertidal and sublittoral zones to a depth of about 10 m.
<i>C. argus</i> Linnaeus, 1758	Under stones, rocks and coral slabs, or in crevices, in coral reef areas. Intertidal and sublittoral zones, from low tide levels to a depth of about 10 m.
<i>C. erosa</i> Linnaeus, 1758	Abundant either in quiet or moderately high-energy environments. Usually occurring under stones and coral slabs or on the underside of rocks, sometimes also on algal crests of reefs or in muddy conditions. Intertidal and subtidal zones, in shallow waters.
<i>C. labrolineata</i> Gaskoin, 1849	In coral reef areas, under coral slabs of lagoons, in gullies or on algal crests. Active during both day and night. Intertidal and sublittoral zones to a depth of about 30m.
<i>C. caputserpentis</i> Linnaeus, 1758	Abundant in coral reefs and rock platforms exposed to wave action. Mainly active at night, crawling out of crevices and boulders, but can also be found in the open during the day. Intertidal and shallow subtidal waters. Coral reef areas, under stones and slabs of the reef table, on the algal crest or in gullies of the outer slope among rubble. Often hidden under soft corals or sponges. Intertidal and sublittoral zones to a depth of about 30m.
<i>C. nucleus</i> Linnaeus, 1758	Coral reef and rock environments. Common in littoral and shallow subtidal zones, but also occurring sublittorally to a depth of about 35m.
<i>C. isabella</i> Linnaeus, 1758	Under boulders and slabs or in crevices, often in small groups, in coral reef and rocky environments. Sublittoral, from shallow water to a depth of about 35m.
<i>C. cicercula</i> Linnaeus, 1758	In rather rough waters of reef areas, under slabs and stones or in hollow corals near the wave swept edge. Active at night on algal crests and rock platforms. Intertidal and shallow subtidal zones.
<i>C. globulus</i> Linnaeus, 1758	In coral reef and rocky habitats, mostly under coral slabs and stones, or half exposed in crevices. Often found in small groups. Intertidal and sublittoral zones, to a depth of about 20m.
<i>C. lynx</i> Linnaeus, 1758	In reefs under coral slabs and rocks, or in muddy areas. Often found exposed during the day on rocks or among the roots in mangrove swamps. Intertidal and sublittoral waters to a depth of about 30m.
<i>C. asellus</i> Linnaeus, 1758	Under stones, inside holes of small corals or among vegetation within the protecting reef. Intertidal and sublittoral zones to a depth of about 10m.
<i>C. saulae</i> Gaskoin, 1843	Abundant in various environments, especially in shallow tide pools, among sea weeds, and under stones, coral remains or empty bivalve shells. Frequently occurring in the open, from high in the intertidal zone to shallow subtidal depths.
<i>C. teres</i> Gmelin, 1791	
<i>C. reevei</i> Gray, 1832	In coral reefs, under slabs and rocks, or in gullies and holes of the algal crests.

Then, the shell cannot increase in size but is thickened by deposition of material over the whole surface, producing the glossy aspect and the distinctive adult colour pattern. Though cowries have been traditionally used as food by native fishermen in many parts of the area, they are nowadays mainly collected for their highly prized shell, for collection purposes or for the shell craft industry.¹⁷⁻¹⁹

Cypraeidae, the largest prosobranch family with 21 species were zonal distributed from intertidal to subtidal water in Andrew Bay and adjacent coastal areas (Table 3). Most members of the family occurs around Geik Taw, Pearl Is., Thanban Gyaing, Abae Chaung, Thanbayer Gyaing, Mayoe Bay, Kathit Is., Thabyu Gyaing, Ponenyat Gyaing, Kwinwine Gyaing, Kyauk pone gyi hmaw and Maung shwe lay Gyaing.

Table 3 Zonal distribution of cowry shells in the study area

Species	High Tide	Mid Tide	Low Tide	Subtidal
<i>Cypraea tigris</i> Linnaeus, 1758				
<i>C. miliaris</i> Gmelin, 1791				
<i>C. mauritiana</i> Linnaeus, 1758				
<i>C. thersites</i> Gaskoin, 1849				
<i>C. arabica</i> Linnaeus, 1758				
<i>C. scurra</i> Gmelin, 1791				
<i>C. eglantina</i> Duclos, 1833				
<i>C. talpa</i> Linnaeus, 1758				
<i>C. argus</i> Linnaeus, 1758				
<i>C. erosa</i> Linnaeus, 1758				
<i>C. labrolineata</i> Gaskoin, 1849				
<i>C. caputserpentis</i> Linnaeus, 1758				
<i>C. nucleus</i> Linnaeus, 1758				
<i>C. isabella</i> Linnaeus, 1758				
<i>C. cicerula</i> Linnaeus, 1758				
<i>C. globulus</i> Linnaeus, 1758				
<i>C. lynx</i> Linnaeus, 1758				
<i>C. asellus</i> Linnaeus, 1758				
<i>C. saulae</i> Gaskoin, 1843				
<i>C. teres</i> Gmelin, 1791				
<i>C. reevei</i> Gray, 1832				

As in the case of family Cypraeidae, many species are occurring very rarely. Thus, *Cypraea thersites*, *C. globulus*, *C. lynx*, *C. asellus* and *C. reevei* are collected singly from their localities. The other rare species, collected more than one but less than five in number include *C. labrolineata*, *C. nucleus*, *C. isabella*, *C. cicerula* and *C. saulae*. The common forms are *C. tigris*, *C. mauritiana*, *C. arabica* and *C. eglantina*. Very abundant species occurring with high frequencies are *C. caputserpentis*. The family also contains many species which are indeterminable.

Myanmar also utilized gastropod shells for preparing indigenous medicine. Species used for this purpose include many species of *Cypraea*. Of all the shells prized and treasured by man, the cowries must surely hold pride of place. The best known and one of the largest and handsomest is the tiger cowry, *Cypraea tigris* which is not striped like the tiger, as one would imagine from its name, but richly spotted like the leopard.⁵⁻⁷ In study areas, the tiger cowry has been made into salt cellars, ring stands, snuff boxes, ink holders and mounted as soup

spoon or ladels. For personal adornment, shells have surely been more widely used than any other product of nature. The convenient little money cowry, apart from its many uses as currency and ornament has long been a favourite counter in playing games of chance.

Conclusion

In the present study, a total of 21 species of cowry shells were collected at Andrew Bay and adjacent coastal areas. The identification is done on the basic of external morphological characters. Shells are fairly sturdy, ovate or oblong, spire short and concealed under body whorl in the adult. Surface is highly polished, smooth and usually vividly patterned, with a low groove on midline of the dorsal side. Periostracum absent. Ventral side of the shells are more or less flattened to calloused. Aperture is long and narrow, extending almost the full length of shell, shortly channeled at both ends. Both lips with raised transverse ridges or teeth, the outer one thickened and incurved; inner lip with a shallow longitudinal furrow situated towards front end. No operculum. Mantle very large, with 2 lobes expanding in life over the shell and meeting along the dorsal groove. Mantle lobes often brightly coloured and with numerous small, finger-like or branched sensory outgrowths. Most of the shells are associated with coral reef and rock platforms. Frequently collected throughout the Andrew Bay areas, mainly for its shell which is used in local food and handicrafts. This study supports for conservation and better management of cowry shell species in Myanmar water.

Acknowledgements

I am indebted to Dr Aung Myat Kyaw Sein, Rector of Mawlamyine University and Dr Mie Mie Sein and Dr San San Aye, Pro-Rectors of Mawlamyine University, for their encouragement and supports in preparing this work. I am very grateful to Dr San Tha Tun, Professor and Head of the Department of Marine Science, Mawlamyine University, for his valuable suggestions and constructive criticisms on this study. I would like to express my sincere thanks to colleagues of Andrew Bay Observation Group, Department of Marine Science, Mawlamyine University, for their kindly help me in many ways during field trips. Many thanks go to Daw Lwin Lwin, Retired Lecturer of the Department of Marine Science, Mawlamyine University, for her assistance in preparations of the manuscript. I would like to thank my beloved parents, U Win Maung and Daw Than Than Aye, for their physical, moral and financial supports throughout this study.

Funding

None.

Conflicts of interest

The author declares that there are no conflicts of interest.

References

1. Mason RF. *The natural productions of Burma or Notes on the fauna, flora and minerals of the Tenasserim provinces and the Burma Empire*. American Mission Press: Moulmein. 1850. 211 p.
2. Mason RF. *Tenasserim or Notes on the fauna, flora, minerals and nations of British Burma and Pegu: with systematic catalogues of the known minerals, plants, mammals, fishes, molluscs, sea-nettles, corals, sea urchins, worms, insects, crabs, reptiles and birds: with vernacular names*. American Mission Press: Moulmein. 1852. 550 p.
3. Mason RF. *Burma, its people and production*. Notes on the fauna, flora and minerals of Tenasserim, Pegu and Burma. Volume 1: Geology, Mineralogy and Zoology. Stephen Austin and Sons Company Ltd, Hertford. 1882. 220 p.

4. Mann JGD. *Fauna of Mergui Archipelago*. Marine Zoology: Volume (1), Part (1). Taylor and Francis, London. 1888. 80 p.
5. Soe Thu. *Sea shells of Ngapali*. University Education Journal. 1970. 5(1):317–368.
6. Soe Thu. *Sea shells of Maungmagan*. University Education Journal. 1971. 6(2):397–432.
7. Soe Thu. *Taxonomy and distribution of Burmese marine gastropods*. Unpublished MSc Thesis. Department of Zoology, Art and Science University, Rangoon, Burma. 1980. 530 p.
8. Kyaw Myint. Check list of Molluscs of the Mergui Archipelago and the Moscos Islands. *University Education Journal*. 1971. 6(2):37–48.
9. Maung Win, Tin Aung, Aung Myint, et al. *Studies on the some molluscs from Burma waters*. Unpublished Term Paper. Department of Marine Biology, Moulmein Degree College, Moulmein, Burma. 1975. 66 p.
10. Phyu Phyu Khin Win. *Taxonomic studies on some molluscs trawled offshore in Myanmar waters*. Unpublished MSc Thesis. Department of Zoology, University of Yangon, Yangon, Myanmar. 1990. 307 p.
11. Naung Naung Oo. *Study on the marine gastropods from Mon coastal areas*. Unpublished MRes Thesis. Department of Marine Science, Mawlamyine University, Mawlamyine, Myanmar. 2012. 360 p.
12. Thant Zin A, Lai Khaing L, Cho Lwin C. *Preliminary survey of gastropods and Pelecypods around the Sin–Ma village, Pathein Township*. Unpublished Term Paper. Department of Zoology, Pathein University, Pathein, Myanmar. 2007. 33 p.
13. Thaw Zin Naing T, Myint Kyaw A, Wai Aung P, et al. *Preliminary Survey of Gastropods and Pelecypods around Kanpani Village, Longlone Township, Taninthayi Region*. Unpublished Term Paper. Department of Marine Science, Mawlamyine University, Mawlamyine, Myanmar. 2012. 48 p.
14. Phoo Thet Su Win. *Study on the marine gastropods and pelecypods from Setse and Kyaikkhami coastal areas*. Unpublished MSc Thesis. Department of Marine Science, Mawlamyine University, Mawlamyine Myanmar. 2012. 165 p.
15. Su Pyae Tun. *The composition and distribution of benthic mollusks along southern Taninthayi Coastal Region*. Unpublished MSc Thesis. Department of Marine Science, Mawlamyine University, Mawlamyine, Myanmar. 2016. 52 p.
16. Aung Ko Latt. *Study on the gastropods and pelecypods of Kawdut coastal area, Ye Township in Mon State*. Unpublished MRes Thesis. Department of Marine Science, Mawlamyine University, Mawlamyine, Myanmar. 2017. 105 p.
17. Poutiers JM. Gastropods. In: Carpenter K. E, Niem VH. Editors. *FAO Species Identification Guide for Fishery Purposes*. The Living Marine Resources of the Western Central Pacific. Volume 1. Seaweeds, Corals, Bivalves and Gastropods. Food and Agriculture Organization, Rome: 1998. p. 363–649 .
18. Burgess CM. *Cowries of the world*. Capt Town, Verhoef. 1985. 289 p.
19. Lorenz FJr and Hubert A. *A guide to worldwide cowries*. Wiesbaden, Hemmen. 1993. 571 p.
20. WoRMS. *World Register of Marine Species*. 2019.
21. Abbott RT. *Seashells of Southeast Asia*. Graham Brash, Singapore, 1991. 145 p.