

Turban shells of Andrew Bay in Rakhine coastal region of Myanmar

Abstract

Turban shells on intertidal and subtidal areas in Andrew Bay are composed of 12 species belonging to genus *Turbo* Linnaeus 1758 of family Turbinidae falling under the order Archaeogastropoda 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 *Turbo argyrostomus* Linnaeus, 1758, *T. articulatus* Reeve, 1848, *T. bruneus* (Röding, 1798), *T. chrysostomus* Linnaeus, 1758, *T. cidaris* Gmelin, 1791, *T. cinereus* Born, 1778, *T. crassus* Wood, 1828, *T. fluctuosus* Wood, 1828, *T. imperialis* Gmelin, 1791, *T. intercostalis* Menke, 1846, *T. petholatus* Linnaeus, 1758 and *T. radiatus* Gmelin, 1791. The distribution of turban shells in intertidal and subtidal zone of Andrew Bay was studied in brief. Moreover, the habitats and utilization of turban shells found along the Andrew Bay were also described.

Keywords: Andrew bay, distribution, habitats, rakhine coastal region, turban shells, utilization

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Introduction

The Turbinidae are tropical gastropods with the majority of species found in the Indo-Pacific region; only ten species are present in the Western Central Pacific.¹ There are 2 genera, *Astraliu* and *Turbo* and 10 species, namely *A. calcar* (Linnaeus, 1758); *T. argyrostomus* Linnaeus, 1758; *T. bruneus* (Röding, 1798); *T. chrysostomus* Linnaeus, 1758; *T. cinereus* Born, 1778; *T. coronatus* Gmelin, 1791; *T. crassus* Wood, 1828; *T. marmoratus* Linnaeus, 1758; *T. petholatus* Linnaeus, 1758 and *T. setosus* Gmelin, 1791 in the family Turbinidae. In this region, the turban shells, *Turbo* Linnaeus, 1758 is probably the most important genus of this family. Many authors have reported significant variations in spatial and temporal distribution and abundance of some species within this family.^{2,3} These species normally present in large numbers, particularly within the shallow near-shore rocky substrate and coral reef ecosystem.⁴⁻⁹

In Myanmar, there were currently very few studies dealing with the biology and ecology of these species except taxonomic work of Soe Thu 10. There are 9 species of *Turbo*, namely *T. petholatus* reevei Phillippi, 1844; *T. argyrostomus* Linnaeus, 1758; *T. chrysostomus* Linnaeus, 1758; *T. cornutus* Lightfoot, 1786; *T. excellens* Sowerby, 1855; *T. marmoratus* Linnaeus, 1758; *T. cinereus* Born, 1778; *T. porphyrites* Gmelin, 1791 and *T. intercostallium* Menke, 1829 (*T. intercostalis* Menke, 1846) had been reported from the three Coastal Regions of Myanmar.¹⁰ Likewise, 2 species of *Turbo*, namely *T. argyrostomus* Linnaeus, 1758 and *T. cinereus* Born, 1778 had been reported by Naung Naung Oo¹¹ based on morphological and some ecological features collected from various coastal areas of Mon State.

Much information such as their distribution pattern, habitat preferences and habitat range were still remained unknown. The objective of the current study was to determine the spatial variations in abundance of turban shells population in their natural habitat. This information is very important for conservation and for better management of this species.

Materials and methods

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

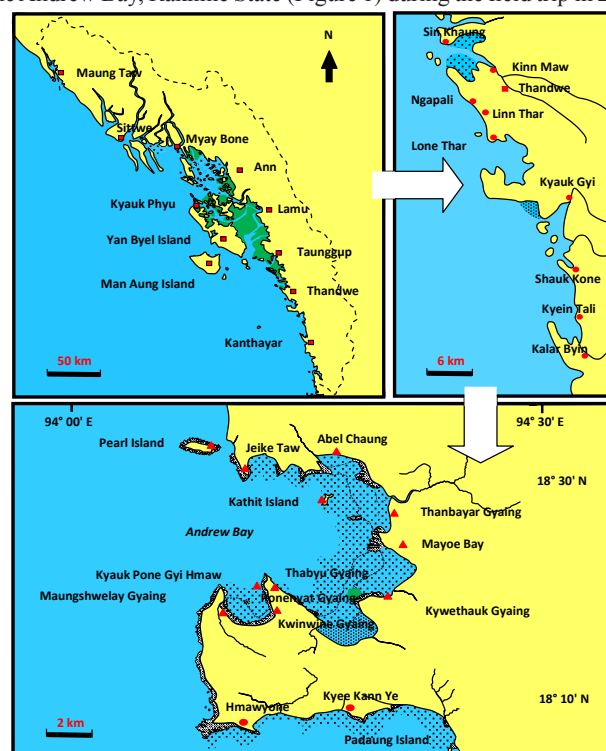


Figure 1 Map showing the collection sites of Andrew Bay in Rakhine Coastal Region.

All collections were preserved in 10% formalin in seawater. The epifaunas 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.

Results and discussion

The spatial variations in abundance of turban shells surveys conducted from 12 collection sites at Andrew Bay and its vicinity

Table 1 Systematic of turban shells in Andrew Bay, Rakhine Coastal Region

| Phylum: Mollusca Linnaeus, 1758 | | |
|--|----------------------|--------------------|
| Class: Gastropoda Cuvier, 1795 | | |
| Order: Archaeogastropoda Thiele, 1925 | | |
| Family: Turbinidae Rafinesque, 1815 | | |
| Genus: <i>Turbo</i> Linnaeus, 1758 | | |
| Species | Common Name | Local Name |
| <i>T. argyrostomus</i> Linnaeus, 1758 | Silver mouth turban | Ngwe-nar-jay |
| <i>T. articulatus</i> Reeve, 1848 | Articulated turban | Jay/ Kha-yu-tha-di |
| <i>T. bruneus</i> (Röding, 1798) | Brown Pacific turban | Jay/ Kha-yu-tha-di |
| <i>T. chrysostomus</i> Linnaeus, 1758 | Gold mouth turban | Shwe-nar-jay |
| <i>T. cidaris</i> Gmelin, 1791 | Crown turban | Jay-chaw |
| <i>T. cinereus</i> Born, 1778 | Smooth moon turban | Jay-chaw |
| <i>T. crassus</i> Wood, 1828 | Crass turban | Kyauk-sein-jay |
| <i>T. fluctuosus</i> Wood, 1828 | Wavy turban | Jay/ Kha-yu-tha-di |
| <i>T. imperialis</i> Gmelin, 1791 | Green turban | Kyauk-sein-jay |
| <i>T. intercostalis</i> Menke, 1846 | Ribbed turban | Jay/ Kha-yu-tha-di |
| <i>T. petholatus</i> Linnaeus, 1758 | Tapestry turban | Kyaung-myat-lone |
| <i>T. radiatus</i> Gmelin, 1791 | Rayed dwarf-turbun | Jay-sue |

Turban shells mainly living in shallow waters of warm temperate and tropical seas, especially on rocky and coral reef habitats. The local distribution and habitat of each turban species are shown in Table 2 and 3. These are herbivorous animals, feeding on small epibenthic algae and vegetable detritus. Turbans (especially the larger species) are commonly collected in the Indo-West Pacific, both for their edible flesh and nacreous shell. They are locally valued for food and some are sought for mother-of-pearl or for carving ornaments. Green turban, *Turbo marmoratus* Linnaeus, 1758 with massive shells possessing shiny iridescent pearl layers, used in the manufacture of buttons, lamp-shades and other fancy articles, support fisheries of importance in Myanmar.^{20,21}

Collected locally for food and shell craft on the Indochinese peninsula. In seaside villages of Japan, children put the operculum in vinegar because it makes a circular movement as it gradually dissolves.¹ Turban shell support an important recreational fishery along the Andrew Bay that provides income for small businesses such as bait and tackle shops, restaurants, hotels, boat rental shops, marinas, and many others. The shells are found on the submerged rocky or

in Rakhine Coastal Region. In this study, a total of 12 species of turban shells were observed from different habitats at intertidal and shallow sublittoral zones, to a depth of about 20m or more. This systematic account follows the identifying set out by Poutiers et.al in detailed^{11,3,12-19} (Table 1)(Figure 2).

Shells are thick, often heavy, turbinate to conical (occasionally flattened) in shape. Outer sculpture is very variable, often spiral to nodular. Periostracum well developed to absent. Aperture is variously rounded, without a siphonal canal, nacreous inside. Inner lip is smooth. Umbilicus present, at least at juvenile stages. Operculum is strongly calcified externally, its inner layer corneous, usually showing spiral coiling with a subterminal or central nucleus. Head with a short, mid-ventrally split snout, and a pair of long tentacles, the eyes on stalks at their outer bases. Foot is large and ovate, sometimes anteriorly truncate, with a fleshy ridge on either side bearing tentaculate processes.

coral reefs at moderate depths. In recent years, heavy commercial exploitations have locally depleted populations. Efforts are expected in the future to produce juveniles in hatcheries and introduce turbans in areas in which they have become extinct or areas currently poor in fisheries resources.

The distribution of turban shells presented by the data from the 12 collection sites of intertidal to subtidal rock and reef areas in Andrew Bay is that abundance is moderate. This is particularly true when it is considered that the 12 sites were spread over a wide area in a region known for high biodiversity. In the present study, Kyauk pone gyi hmaw site had higher abundance than other 11 collection sites. A total of 12 species of turban shells were recorded with their habitats of which 10 species in Kyauk pone gyi hmaw; 8 species in Kathit Island, Poneyat Gyaing and Kwinwine Gyaing; 7 species in Pearl Island and Maung shwe lay Gyaing; 6 species in Geik Taw and Thabyu Gyaing; 5 species in Abae Chaung and Thanbayer Gyaing; and 4 species in Thanban Gyaing and Mayoe Bay, respectively (Table 2).

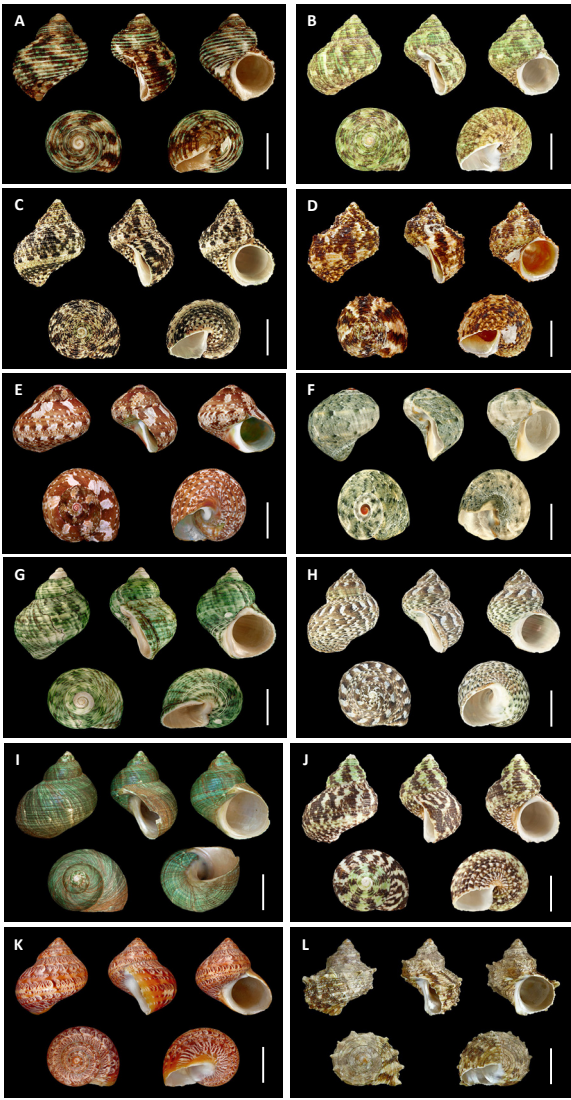


Figure 2 Turban shells: (A) *Turbo argyrostomus* Linnaeus, 1758. (B) *T. articulatus* Reeve, 1848. (C) *T. bruneus* (Röding, 1798). (D) *T. chrysostomus* Linnaeus, 1758. (E) *T. cidaris* Gmelin, 1791. (F) *T. cinereus* Born, 1778. (G) *T. crassus* Wood, 1828. (H) *T. fluctuosus* Wood, 1828. Scale bars=120mm. Turban shells: (I) *Turbo imperialis* Gmelin, 1791, (J) *T. intercostalis* Menke, 1846, (K) *T. petholatus* Linnaeus, 1758, (L) *T. radiatus* Gmelin, 1791. Scale bars=120mm.

Table 2 Distribution of turban shells in Andrew Bay, Rakhine Coastal Region

| Sampling site | Recorded species | | | | | | | | | | | |
|-----------------------|------------------------|-----------------------|-------------------|------------------------|-------------------|--------------------|-------------------|----------------------|----------------------|-------------------------|----------------------|--------------------|
| | <i>T. argyrostomus</i> | <i>T. articulatus</i> | <i>T. bruneus</i> | <i>T. chrysostomus</i> | <i>T. cidaris</i> | <i>T. cinereus</i> | <i>T. crassus</i> | <i>T. fluctuosus</i> | <i>T. imperialis</i> | <i>T. intercostalis</i> | <i>T. petholatus</i> | <i>T. radiatus</i> |
| Geik Taw | | | | | | | | | | | | |
| Pearl I. | | | | | | | | | | | | |
| Thanban Gyaing | | | | | | | | | | | | |
| Abae Chaung | | | | | | | | | | | | |
| Thanbayar Gyaing | | | | | | | | | | | | |
| Mayoe Bay | | | | | | | | | | | | |
| Kathit I. | | | | | | | | | | | | |
| Thabyu Gyaing | | | | | | | | | | | | |
| Ponenyat Gyaing | | | | | | | | | | | | |
| Kwinwine Gyaing | | | | | | | | | | | | |
| Kyauk pone gyi hmaw | | | | | | | | | | | | |
| Maung shwe lay Gyaing | | | | | | | | | | | | |

Table 3 Habitat of turban shells in Andrew Bay, Rakhine Coastal Region

| Species | Habitat |
|-------------------------|---|
| <i>T. argyrostomus</i> | Coral reef areas, in moderately exposed habitats and in lagoons of atolls. |
| <i>T. articulatus</i> | 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>T. bruneus</i> | Rocky shores and coral reefs, in shallow subtidal waters to a depth of about 20m. |
| <i>T. chrysostomus</i> | In coral reef areas. Intertidal and shallow sublittoral zones, to a depth of about 20m. |
| <i>T. cidaris</i> | In exposed areas of coral reefs. Sublittoral zone, in shallow water. |
| <i>T. cinereus</i> | Common among rocks or gravel. |
| <i>T. crassus</i> | Near reefs, in shallow subtidal water, mainly at depths of 1 to 5m. |
| <i>T. fluctuosus</i> | On reef substrate under corals and blocks. Shallow subtidal water to a depth of about 20m. |
| <i>T. imperialis</i> | In subtidal, coral reef areas open to a constant flow of clean oceanic water. Juveniles mainly living on reefs crests, at depths of 1 to 5m; adults also occurring deeper on slopes, to about 20 m or more. |
| <i>T. intercostalis</i> | On rocky shores and coral reefs. Intertidal and shallow subtidal waters. |
| <i>T. petholatus</i> | Shallow coral reefs and rocky shores, in relatively protected habitats. Sublittoral, to depths of about 40m. |
| <i>T. radiatus</i> | Among rocks and gravel, or in crevices. Intertidal. |

Conclusion

Many aspects of the shell morphology in turban shells are associated with physical stabilization in diverse ecological settings. Shells are moderately large, solid and heavy, turbanate in shape with length usually greater than width. Spire is well developed, pointed, whorls strongly convex and with angular shoulders. Outer sculptures are variable, with rounded, unequal spiral cords and many fine scaly axial threads, most developed on the interstices of cords. Operculum is nearly circular in outline, with a sub central nucleus and a convex, smooth external surface. Outside of shell is variable in colour and pattern. The distribution of turban shells in Andrew Bay moderately disperses along the shallow coral reefs and rocky shores. Local people frequently collected by Turbinidae in the area, mainly for food. The operculum is well known in shell jewellery under the name “cat’s eye”.

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Conflicts of interest

The author declares that there are no conflicts of interest in relation to this article.

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