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Research Article

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Notes on the Family Cassidae (Mollusca: Gastropoda) of Myanmar

Naung Naung Oo[1]*

[1]*Department of Marine Science, Pathein University, 10014, Pathein, Ayeyarwady Region, Myanmar*

INFORMATION

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Contact
*Naung Naung Oo
naungnaungoomarine@gmail.com

ABSTRACT

A total of 11 taxa belonging to 5 genera of the family Cassidae under the order Mesogastropoda were collected from three coastal regions of Myanmar from 2012 to 2024. *The specimens of helmet and bonnet shells comprised 1 species of Cassis, namely, Cassis cornuta*; 1 species of *Cypraecassis*, namely, *Cypraecassis rufa*; 2 species of *Casmaria*, namely, *Casmaria erinaceus*, *C. ponderosa*; 6 species of *Phalium*, namely, *Phalium areola*, *P. bandatum, P. decussatum, P. fimbria, P. glaucum, P. muangmani; and 1 species of Semicassis, namely, Semicassis bisulcata, respectively.* Among these, the species of *Phalium* were more noticeably dominant than other species from the study areas. Moreover, the distribution ranges and ecological habitats of all species along the Myanmar coastal regions were described.

1. Introduction

Family Cassidae, commonly known as helmet or bonnet shells, is a taxonomic group of medium to large sea snails. They are primarily found in subtropical and tropical waters, and their shells often exhibit distinct growth marks. Some larger species within this family can be quite significant in size (Poutiers, 1998).

Helmet shells are typically found in warm, shallow waters of subtropical and tropical regions worldwide. They inhabit various underwater environments, including sandy and muddy substrates on the ocean floor. Some species are also found in coral reef ecosystems. Their distribution often includes both the Atlantic and Pacific Oceans, as well as the Indian Ocean (Abbott, 1968).

Bonnet shells are typically found in intertidal and subtidal zones on sandy substrates, primarily in tropical and subtropical regions of the Western Atlantic Ocean. They are often located half-buried in sand flats, which are essential habitats for them (Verbinnen et al. 2016).

The ecological status of Cassidae species, or helmet snails, indicates they play crucial roles in their habitats, particularly in marine ecosystems such as reefs and sandy beaches. For example, *Cassis tuberosa* is an important predator that helps control populations of sea urchins and sand dollars, contributing to the balance of these ecosystems.

However, habitat degradation and overfishing can impact their populations, as some species may be at risk or included in conservation lists (Kreipl 1997).

In Myanmar, the main threats to Cassidae populations include:

- Overfishing: Some species are targeted for their shells, which are used in jewelry and decorative items, leading to population declines.
- Habitat loss: Coastal development, pollution, and degradation of marine habitats such as coral reefs and seagrass beds adversely affect their living conditions.
- Climate change: Rising ocean temperatures and

acidification can impact predator-prey dynamics and the health of ecosystems where Cassidae species thrive.
- Invasive species: Non-native species can alter the ecological balance and compete for resources, impacting the habitat and food supply for helmet snails.
- Pollution: Chemical pollutants and plastic debris can affect the health and reproductive success of these snails.

Conservation efforts and sustainable fishing practices are essential to mitigate these threats and protect Cassidae populations. The objective of this study is to know the species status of helmet and bonnet shells in Myanmar coastal regions.

2. Materials and Methods

The living and drift specimens of helmet and bonnet shells were recorded from intertidal and shallow subtidal waters to a depth of about 2 to 75 m in sheltered areas, on bottoms of coarse coral sand and algae near coral reef areas in three coastal regions of Myanmar from 2012 to 2024 (Fig. 1).

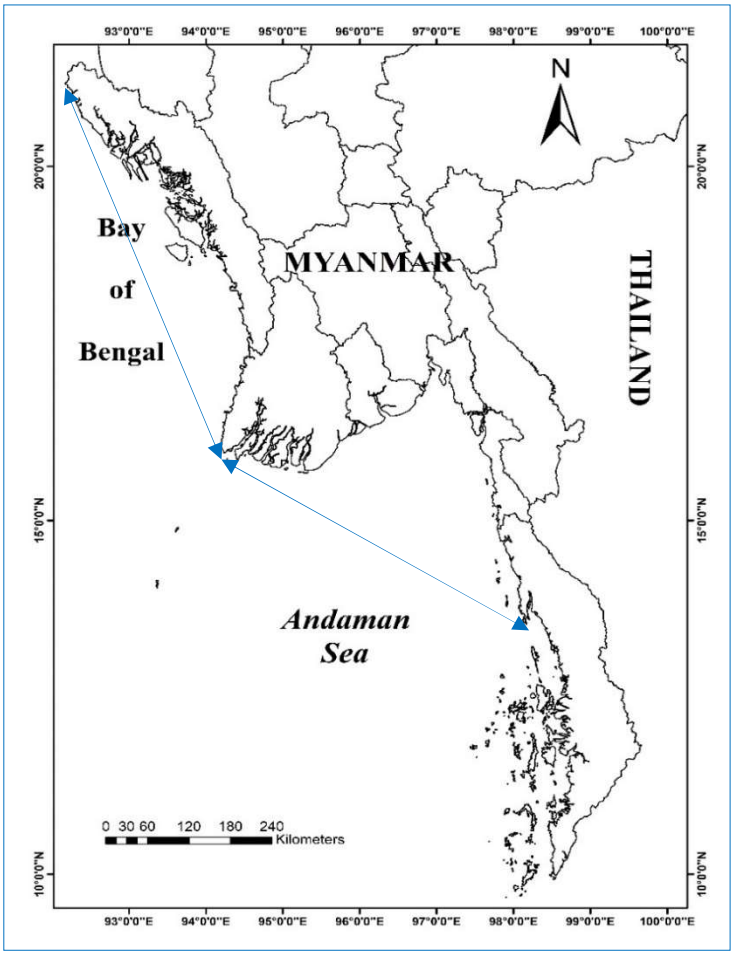

Fig. 1. Collection areas (black arrow line) of helmet and bonnet shells in some coastal areas of Myanmar

2.1. Rakhine Coastal Region

Sittway Point (20° 06′ N, 92° 53′ E), Kyauk Phyu (19° 25′ N, 93° 31′ E), Kyauk Layaine Gyaing (19° 50′ N, 93° 25′ E), Sing aung (18° 32′ N, 94° 14′ E), Mazin (18° 27′ N, 94° 17′ E), Ngapali (18° 26′ N, 94° 18′ E), Shwewar Gyaing (18° 24′ N, 94° 19′ E), Lonetha Gyaing (18° 21′ N, 94° 20′ E), Kyauk Phone Gyi Maw (18° 18′ N, 94° 20′ E), Maung Shwe Lay Gyaing (18° 18′ N, 94° 19′ E), Kywe Thauk Gyaing (18° 17′ N, 94° 22′ E), Kwinwaing Gyaing (18° 17′ N, 94° 20′ E), Hmaw Chay Gyaing (18° 13′ N, 94° 25′ E), Gyaing Kauk Gyaing (17° 47′ N, 94° 28′ E), Hlyaw Gaung Taung Gyaing (17° 45′ N, 94° 30′ E), Yay Myet Taung Gyaing (17° 42′ N, 94° 31′ E), Maw Shwe Gyaing (17° 41′ N, 94° 32′ E), Chan Pyin Gyaing (17° 38′ N, 94° 33′ E), Yahaing kutoe (Gwa Aw) (17° 38′ N, 94° 34′ E), Makyeengu Gyaing (Gwa Aw) (17° 35′ N, 94° 33′ E), Shweya Gyaing (17° 35′ N, 94° 33′ E), Baw Di Gyaing (17° 29′ N, 94° 33′ E), Jade Lett Gyaing (17° 17′ N, 94° 30′ E), Tapin Maw (17° 16′ N, 94° 29′ E), Phoe Htaung Gyaing (17° 10′ N, 94° 29′ E), Wet Thay Gyaing (17° 08′ N, 94° 27′ E), Kyauk Nagar (17° 04′ N, 94° 27′ E), Shwe Thaung Yan (Ma Gyi) (17° 04′ N, 94° 27′ E), Boung Kyun I. (17° 04′ N, 94° 26′ E), Inn Din Gyi (17° 03′ N, 94° 26′ E), Thae Phyu Kyun (17° 01′ N, 94° 18′ E), Chaung Tha (16° 57′ N, 94° 25′ E), Ngwe Saung (16° 52′ N, 94° 22′ E), Thathanar Dauk (16° 36′ N, 94° 19′ E), Ngayoke Kaung Aw (16° 32′ N, 94° 17′ E), Ohn Kyun I. (16° 23′ N, 94° 13′ E), Cape Negrais (16° 02′ N, 94° 11′ E), Ngwe Taung Pagoda (16° 01′ N, 94° 12′ E), Zea Gyaing (16° 01′ N, 94° 12′ E), Mawtin Point (15° 57′ N, 94° 14′ E).

2.2. Ayeyawady Delta and Gulf of Martaban Coastal Region

Letkokkon (16° 19′ N, 96° 08′ E), Kyauk Chaung (15° 59′ N, 94° 16′ E), Kha Mauk Hmaw (15° 59′ N, 94° 16′ E), Kyar Kan (15° 59′ N, 94° 13′ E), Haing Gyi I. (15° 58′ N, 94°18′ E).

2.3. Taninthayi Coastal Region

Ahlyat (16° 37′ N, 97° 27′ E), Kyaikkhami (16° 05′ N, 97° 34′ E), Setse (15° 57′ N, 97° 36′ E), Kalegauk I. (15° 32′ N, 97° 39′ E), Sitaw (15° 11′ N, 97° 48′ E), Ka Byar Wa (15° 04′ N, 97° 48′ E), Maungmagan (14° 07′ N, 98° 05′ E), Thabawseik (Mwe Taung) (14° 06′ N, 98° 05′ E), Kanpani (14° 03′ N, 98° 04′ E), San Hlann (13° 54′ N, 98° 04′ E), South Moscos I. (13° 51′ N, 97° 55′ E), Nyaw Pyin Aw (13° 38′ N, 98° 08′ E), Wa Maw (13° 37′ N, 98° 08′ E), Myin Kwar Aw (13° 33′ N, 98° 08′ E). The collections of mollusca fauna of the family Tonnidae or tun shells were made from the sandy or muddy bottom and seagrass beds of Myanmar coastal areas, using a shovel, and handpicking. All the specimens were preserved in 10% formaldehyde seawater. The epifaunas and periostracum (non-calcareous covering that protects the outside of many shells) were removed by soaking the shells in a solution of caustic soda. After all the shells are cleaned, washed, dried, and ready for storage, they are lightly rubbed with a small amount of olive oil applied with a tuft of cotton to make them fresh-looking in a slight luster to the surface, and aid in presenting the delicate colouring.

And then, the precise locality and date, collector name, habitat, classification system of shell, accession number, and catalogue number are recorded on the label slip for each shell. Voucher specimens were deposited at the Museum of the Department of Marine Science, Pathein University (PMS). This study has followed the classification system used by Poutiers (1998) and WoRMS (2024).

3. Results

Family Cassidae, commonly known as helmet shells and bonnet shells, consists of large, sturdy sea snails that are a significant part of the marine ecosystem (Table. 1). Below is an explanation of their characteristics, habitat, and utilization.

3.1. Characteristics

Shell structure: Cassidae shells are heavy, thick, and robust, with a distinctive shape. They have a broad, helmet-like appearance, often adorned with strong spiral ridges and knobs, giving them a somewhat armored look.

3.1.1. Aperture and Lip

The shell's aperture is large and elongated, with the outer lip often thickened and sometimes folded inward. The columella (the central part of the shell's spiral) often has strong ridges.

3.1.2. Coloration

The shells are typically white, cream, or brownish, with some species showing intricate patterns of spots or stripes.

3.1.4. Body

The animals have large, muscular feet and a retractable proboscis, which they use to feed. Their radula (a toothed, ribbon-like structure) is specialized for drilling into their prey.

3.2. Habitat

Marine environment: Cassidae snails are generally found in warm, tropical, and subtropical seas, living in sandy, soft-bottomed habitats near coral reefs or rocky areas. Some species are also found in temperate waters.

3.2.1. Geographic Range

They are widely distributed, particularly in the Indo-Pacific region, including the coasts of Africa, Australia, and Southeast Asia. They also occur in parts of the Mediterranean Sea and the western Atlantic, including the Caribbean.

3.2.2. Feeding Behavior

Cassids are carnivorous, preying mainly on echinoderms such as sea urchins. Some species are known to burrow in the sand during the day and emerge at night to hunt.

3.3. Utilization

Shell trade: Cassidae shells are highly prized by collectors due to their impressive size and intricate designs. They are often sold as decorative objects and are a common item in the shell trade.

Table 1. Identification and distribution of helmet and bonnet shells in Myanmar

Identification					
Phylum: Mollusca (Cuvier, 1795)					
Class: Gastropoda (Cuvier, 1795)					
Order: Mesogastropoda (Thiele, 1929)					
Family: Cassidae (Latreille, 1825)					
No	**Genus and species**	**Common name**	**Distribution**		
			R	**A**	**T**
I	*Cassis* (Scopoli, 1777)				
1	*C. cornuta* (Linnaeus, 1758)	Horned helmet	+	-	+
II	*Cypraecassis* (Stutchbury, 1837)				
2	*C. rufa* (Linnaeus, 1758)	Bull-mouth/red helmet	+	-	+
III	*Casmaria* (Adams and Adams, 1853)				
3	*C. erinaceus* (Linnaeus, 1758)	Vibex bonnet	+	-	+
4	*C. ponderosa* (Gmelin, 1791)	Heavy bonnet	+	-	+
IV	*Phalium* (Link, 1807)				
5	*P. areola* (Linnaeus, 1758)	Checkerboard bonnet	+	+	+
6	*P. bandatum* (Perry, 1811)	Banded bonnet	+	-	+
7	*P. decussatum* (Linnaeus, 1758)	Decussate bonnet	+	+	+
8	*P. fimbria* (Gmelin, 1791)	Fimbriate bonnet	+	-	+
9	*P. glaucum* (Linnaeus, 1758)	Grey bonnet	+	-	+
10	*P. muangmani* (Massilia and Musetti, 1995)	Siam bonnet	+	-	+
V	*Semicassis* (Mörch, 1852)				
11	*S. bisulcata* (Schubert and Wagner, 1829)	Japanese bonnet	+	+	+

Symbols: *R = Rakhine Coastal Region, A = Ayeyarwady Delta and Gulf of Martaban Coastal Region, T = Taninthayi Coastal Region, + = Present, - = Absent.*

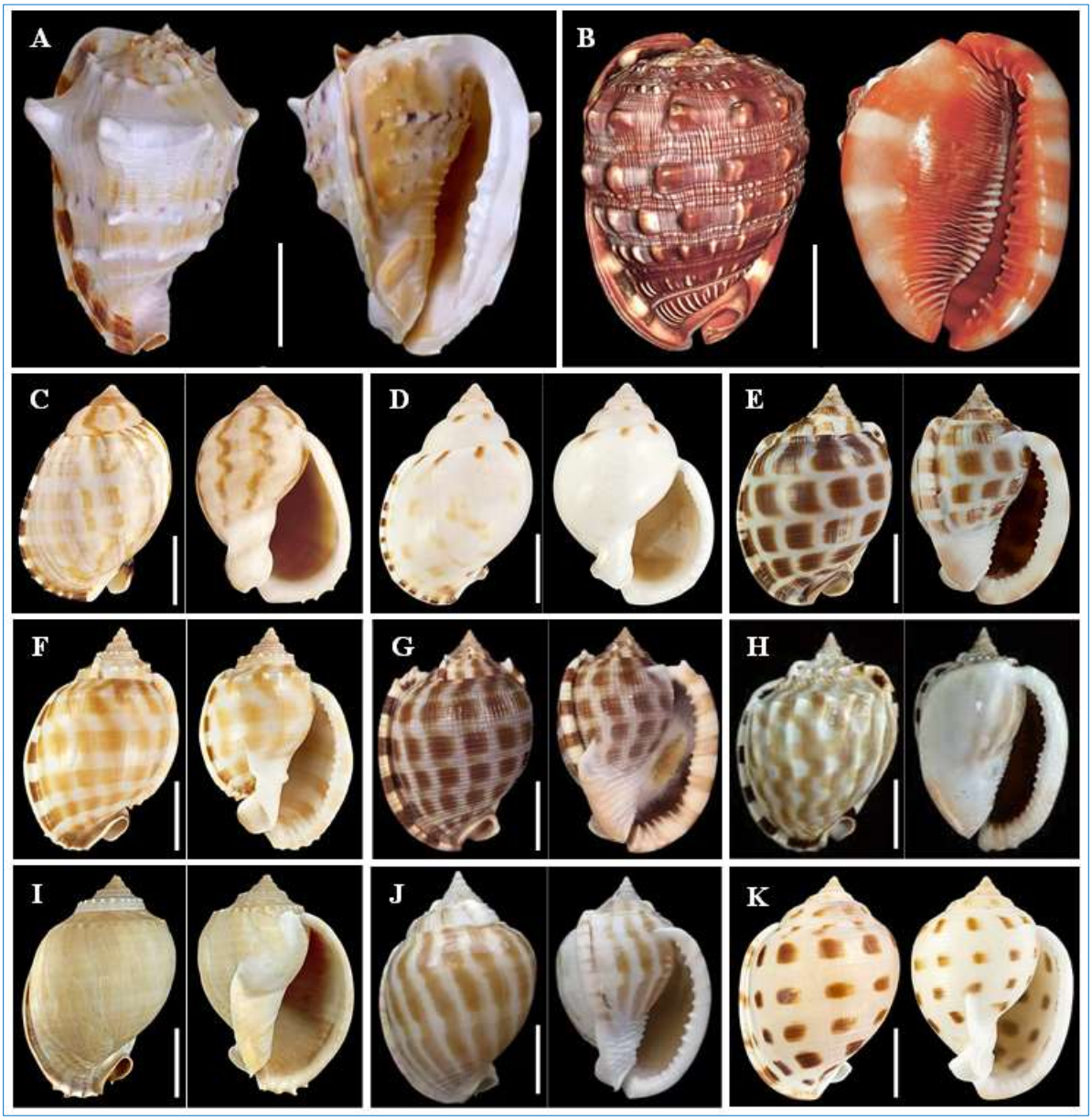

Fig. 2. Helmet and bonnet shells of Myanmar Coastal Water (A-K): (A) *Cassis cornuta* (Linnaeus, 1758); (B) *Cypraecassis rufa* (Linnaeus, 1758); (C) *Casmaria erinaceus* (Linnaeus, 1758); (D) *C. ponderosa* (Gmelin, 1791); (E) *Phalium areola* (Linnaeus, 1758); (F) *P. bandatum* (Perry, 1811); (G) *P. decussatum* (Linnaeus, 1758); (H) *P. fimbria* (Gmelin, 1791); (I) *P. glaucum* (Linnaeus, 1758); (J) *P. muangmani* (Massilia and Musetti, 1995); (K) *Semicassis bisulcata* (Schubert and Wagner, 1829)

3.3.1. Ornamental Use

The beauty and strength of these shells make them popular in jewelry and art. Helmet shells are sometimes polished and used in fine crafts or as display pieces.

3.3.2. Cultural and Historical Uses

In ancient times, some helmet shells were used as vessels or even as currency in trade. They are also used in some cultures for traditional purposes or as musical instruments, similar to conch shells.

3.3.3. Scientific Study

Cassidae are of interest to malacologists for their evolutionary adaptations, particularly their specialized feeding mechanisms for preying on hard-shelled echinoderms.

In addition to their economic value in the shell trade, Cassidae play an ecological role as predators, helping to control sea urchin populations, which in turn benefits coral reefs by preventing overgrazing of algae. In this paper, all taxonomic criteria, naming systems and systematic classifications were followed by WoRMS (2024) in the MolluscaBase edition.

3.4. Genus Cassis (Scopoli, 1777)

Synonyms: *Cassidea* (Bruguière, 1789); *Cassis (Cassidea)* (Bruguière, 1789); *C.* (*Cassis*) (Scopoli, 1777); *C.* (*Galeodocassis*) (Sacco, 1890); *C.* (*Hypocassis*) (Iredale, 1927); *C.* (*Mangkalia*) (Beets, 1941); *C.* (*Morionella*) (Dall, 1909); *Cassisoma* (Rovereto, 1899); *C.* (*Galeodocassis*) (Sacco, 1890); *Goniogalea* (Mörch, 1857); *Hypocassis* (Iredale, 1927); *Nannocassis* (Iredale, 1927).

Cassis is a genus of marine gastropod molluscs, first described by Scopoli (1777). The type species of this genus is *Cassis cornuta*, originally classified as *Buccinum cornutum* by Linnaeus in 1758. This genus includes various species known for their distinct shells. *Cassis* species are characterized by several notable features.

Shell structure: The shells are typically large, robust, and often globular or ovate. They may have distinctive ridges or nodules, which can vary between species.

Coloration: The shells can exhibit a variety of colors and patterns, often featuring brown, white, or orange hues with intricate patterns that can serve as camouflage.

Aperture: The opening (aperture) of the shell is usually wide and elongated. Many species have a beautiful, smooth inner surface.

Spire: The spire of the shell is usually low, with the whorls being relatively flat.

Operculum: Like many gastropods, *Cassis* species have an operculum that covers the shell opening when the animal retracts inside.

Habitat: They are primarily found in warm, shallow marine environments, often associated with sandy or muddy substrates.

Feeding: Many *Cassis* species are carnivorous and feed on other marine organisms, including invertebrates like mollusks and crustaceans.

Ecological role: They play an essential role in the marine ecosystem as both predators and prey.
These characteristics can vary significantly among the different species within the genus *Cassis*.

3.4.1. Cassis cornuta (Linnaeus, 1758) (Fig. 2A)
Synonyms: *Buccinum cornutum* Linnaeus, 1758; *Cassis* (*Cassis*) *cornuta* (Linnaeus, 1758); *C. caputequinum* Röding, 1798; *C. hamata* Röding, 1798; *C. labiata* Dillwyn, 1817.

World distribution: The world distribution of *Cassis cornuta* (Linnaeus, 1758) is in the Indian Ocean (Found along Aldabra, Madagascar, the Mascarene Basin, and Mauritius), the Red Sea, the Pacific Ocean (Found along Melanesia and Micronesia), and off the southern African coast (Found off the southern African coast from northern KwaZulu-Natal and Mozambique).

3.5. Genus Cypraecassis (Stutchbury, 1837)

Synonyms: *Cypraecassis* (*Cypraecassis*) (Stutchbury, 1837); *C.* (*Levenia*) (Gray, 1847); *C.* (Cossmann, 1903); *Levenia* (Gray, 1847). *Cypraecassis* is a genus of medium-sized to large sea snails, belonging to the family Cassidae. It was proposed by Stutchbury in 1837 as a separate genus for certain species previously classified under Brugière's genus *Cassis*. The range of these molluscs extends from the Miocene period to the present. *Cypraecassis* snails are characterized by several distinct features.

Shell shape: The shells are typically robust and have a distinctive oval to conical shape. The anterior end tends to be broader while the posterior end tapers.

Shell sculpture: The surface of the shell often displays prominent ridges, knobs, or spiral grooves which can vary among species.

Operculum: *Cypraecassis* species usually possess a calcareous operculum, which serves as a protective cover for the soft body when the snail retracts into its shell.

Aperture: The aperture (opening) of the shell is elongated and can vary in width, typically being narrower toward the posterior end.

Coloration: The color and pattern of the shells can vary widely, often featuring intricate designs and coloration that helps with camouflage.

Size: Members of this genus can range in size from medium to large, with some species reaching considerable lengths.

Habitat: *Cypraecassis* species are generally found in warm marine environments, often in sandy or muddy substrates.

These characteristics help distinguish *Cypraecassis* from other genera within the family Cassidae and contribute to their identity as a unique group of marine gastropods.

3.5.1. Cypraecassis rufa (Linnaeus, 1758) (Fig. 2B)
Synonyms: *Buccinum pennatum* (Gmelin, 1791); *B. pullum* (Born, 1778); *B. rufum* (Linnaeus, 1758); *B. ventricosum* (Gmelin, 1791); *Cassis labiata* (Perry, 1811); *C. rufa* (Linnaeus, 1958); *C. rufescens* (Röding, 1798); *C. tuberosa* (Röding, 1798); *Cypraecassis (Cypraecassis) rufa* (Linnaeus, 1758).

World distribution: Indo-Pacific: from East Africa, including Madagascar, Sri Lanka, and the tropical islands of the Indian Ocean, through Indonesia and Melanesia, to eastern Polynesia; north to Taiwan Province of China and southern Japan, and south to northern Queensland and the Fiji Islands.

3.6. Genus Casmaria (Adams and Adams, 1853)

Synonyms: *Cassis* (*Casmaria*) (Adams and Adams, 1853); *Phalium* (*Casmaria*) (Adams and Adams, 1853); *Semicassis* (*Casmaria*) (Adams and Adams, 1853).

Casmaria, established by Adams and Adams (1853), is a genus within the family Cassidae. This genus is widely distributed throughout the tropical Indo-Pacific region. *Casmaria* species differ from other gastropods in several key ways.

Shell shape and structure: *Casmaria* species typically have large, smooth, and thin shells with a distinctive wide, inflated profile. This contrasts with many other gastropods that may have coiled, ribbed, or sculpted shells.

Coloration and patterning: The shells of *Casmaria* often feature attractive color patterns, including axial lines and spiral

bands with varying colors and blotches. This level of decorative patterning can be less pronounced in other gastropod families.

Habitat preference: *Casmaria* species are primarily marine and tend to inhabit sandy or muddy substrates in coastal waters. Many other gastropods can be found in a wider range of habitats, including freshwater and terrestrial environments.

Feeding behavior: *Casmaria* species typically feed on algae and detritus, which can differ from other gastropods that may have more specialized diets, such as herbivorous or carnivorous feeding strategies.

Size: *Casmaria* species are generally larger than many other gastropods, which can vary significantly in size within different families.

Behavior: They often exhibit unique behaviors in locomotion and feeding compared to other gastropods, particularly those adapted to different ecological niches.

Overall, while *Casmaria* species share general characteristics with other gastropods, their distinctive shell morphology, coloration, habitat preference, and feeding strategies set them apart within the class.

3.6.1. Casmaria erinaceus (Linnaeus, 1758) (Fig. 2C)
Synonyms: *Buccinum erinaceus* (Linnaeus, 1758); *B. meles* (Dillwyn, 1817); *B. vibex* (Linnaeus, 1758); *Casmaria erinaceus erinaceus* (Linnaeus, 1758); *C. vibexmexicana* (Stearns, 1894); *Cassis (Casmaria) vibexmexicana* (Stearns, 1894); *C. denticulata* (Röding, 1798); *C. glabra* (Röding, 1798); *C. vibex* (Linnaeus, 1758); *C. vibexmexicana* (Stearns, 1894); *Phalium edentulum* (Link, 1807); *P. erinaceum* (Linnaeus, 1758); *P. erinaceum vibex* (Linnaeus, 1758); *P. vibex* (Linnaeus, 1758).

World distribution: This species occurs in the Red Sea, in the Indian Ocean along Aldabra, Madagascar, the Mascarene Basin, and Mauritius; and in the Pacific Ocean along Melanesia, Micronesia, and the Philippines.
3.6.2 C. ponderosa (Gmelin, 1791) (Fig. 2D)

Synonyms: *Buccinum biarmatum* (Dillwyn, 1817); *B. nodulosum* (Gmelin, 1791); *B. pantherina* (Dillwyn, 1817); *B. ponderosum* (Gmelin, 1791); *Casmaria ponderosa ponderosa* (Gmelin, 1791); *C. ponderosa var. bicolor* (Dautzenberg, 1926); *Cassis tenuilabris* (Menke, 1828); *C. torquata* (Reeve, 1848); *Phalium ponderosum* (Gmelin, 1791); *P. quadratum* (Link, 1807); *P. torquatum* (Reeve, 1848).

World distribution: This species occurs in the Red Sea, in the Indian Ocean along the Mascarene Basin, in the Pacific Ocean off Hawaii, and in Australia, Papua New Guinea, Solomon Islands, New Caledonia, Fiji, and Vanuatu.

3.7. Genus Phalium (Link, 1807)

Synonyms: *Bezoardica* (Schumacher, 1817); *Bezoardicella* (Habe, 1961); *Cassis (Bezoardica)* (Schumacher, 1817); *C. (Phalium)* (Link, 1807); *Phalium (Phalium)* (Link, 1807).

Genus *Phalium* (Link, 1807) consists of large sea snails commonly known as bonnet shells. They belong to the subfamily Phaliinae within the family Cassidae. *Phalium* species are marine gastropod molluscs that exhibit various shell coloration and markings, with some species closely resembling each other, such as *Phalium pseudobandatum* and *P. bandatum*. *Phalium* shells, belonging to the genus *Phalium*, exhibit several distinctive characteristics.

Shape and size: The shells are generally large and robust, often with a rounded or slightly conical shape. They can vary significantly in size depending on the species.

Spiral ridges: The outer surface of *Phalium* shells typically feature prominent spiral ridges or cords, which give the shell a textured appearance.

Coloration: *Phalium* shells display a wide range of colors and patterns, including shades of brown, gray, and white, often with intricate markings or bands.

Whorls: The shells usually consist of several whorls. The last whorl is typically the largest, contributing to the overall bulk of the shell.

Aperture: The aperture (opening) of the shell is usually elongated and can be relatively large compared to the overall shell size.

Umbilicus: Some species may feature a distinct umbilicus (a deep spiral depression on the shell's base), while others may not have a noticeable one.

Interior: The interior of the shell is often smooth and reflects the color of the outer surface, sometimes featuring a shiny appearance.

These characteristics make *Phalium* shells easily recognizable and distinguishable from other genera within the family Cassidae.

3.7.1. Phalium areola (Linnaeus, 1758) (Fig. 2E)
Synonyms: *Buccinum areola* (Linnaeus, 1758); *Cassis alea* (Röding, 1798); *C. areola* (Linnaeus, 1758); *C. glaucoids* (Martin, 1879); *Phalium agnitum* (Iredale, 1927); *P. areola var. kuesteri* (Bayer, 1935); *P. clathratum* (Link, 1807); *P. extinctum* (Link, 1807); *P. sulcatum* (Link, 1807); *Semicassis* (*Semicassis*) *vavakuana* (Ladd, 1934); *S. vavakuana* (Ladd, 1934).

World distribution: This species occurs in the Indian Ocean along Madagascar, the Mascarene Basin, Tanzania, and off the southern African coast from KwaZulu-Natal and Mozambique. It can also be found in Melanesia and along Samoa.

3.7.2. P. bandatum (Perry, 1811) (Fig. 2F)
Synonyms: *Cassidea bandata* (Perry, 1811); *Cassis coronulata* (Sowerby, 1825); *C. muricata* (Menke, 1828); *Phalium pseudobandatum* (Tan et al., 2013).

World distribution: This marine species occurs along the coasts of the Indo-West Pacific, from Japan and the Philippines, south through Indonesia to the northern half of Australia.

3.7.3. P. decussatum (Linnaeus, 1758) (Fig. 2G)
Synonyms: *Buccinum decussatum* (Linnaeus, 1758); *Cassis cancellata* (Röding, 1798); *C. flammeolum* (Röding, 1798).

World distribution: This species occurs in the Western Central Pacific: Philippines.

3.7.4. P. fimbria (Gmelin, 1791) (Fig. 2H)
Synonyms: *Buccinum fimbria* (Gmelin, 1791); *Cassis plicaria* (Lamarck, 1822); *C. plicata* (Deshayes, 1844).

World distribution: Unknown.

3.7.5. P. glaucum (Linnaeus, 1758) (Fig. 2I)
Synonyms: *Bezoardica vulgaris* (Schumacher, 1817); *B. glaucum* (Linnaeus, 1758); *Cassidea strigata* (Shirley, 1911); *Cassis bezoar* (Gray, 1839); *C. glauca* (Linnaeus, 1758).

World distribution: Widespread in the Indo-West Pacific, from East Africa, including Madagascar, to Melanesia; north to Japan, and south to northern Queensland.

*3.7.6 P. muangmani (*Massilia and Musetti, 1995) *(*Fig. 2J)
Synonyms: None.

World distribution: This species occurs in western Thailand and eastern Australia.

3.8. Genus Semicassis (Mörch, 1852)

Synonyms: *Cassidea (Semicassis)* (Mörch, 1852); *Cassis (Semicassis)* (Mörch, 1852); *Faurotis* (Jousseaume, 1888); *Phalium (Kahua)* (Marwick, 1928); *P. (Semicassis)* (Mörch, 1852); *P. (Tylocassis)* (Woodring, 1928); *P. (Xenogalea)* (Iredale, 1927); *Semicassis (Kahua)* (Marwick, 1928); *S. (Semicassis)* (Mörch, 1852); *S. (Tylocassis)* (Woodring, 1928); *S. (Xenophalium)* (Iredale, 1927); *Tylocassis* (Woodring, 1928); *Xenogalea* (Iredale, 1927); *Xenophalium* (Iredale, 1927); *X. (Mauicassis)* (Fleming, 1943); *X. (Xenogalea)* (Iredale, 1927).

Genus *Semicassis*, established by Mörch (1852), belongs to the family Cassidae within the class Gastropoda. Members of this genus are marine snails known for their distinctive shells and are typically found in various ocean habitats. Some species of *Semicassis* include notable examples like *Semicassis bisulcata*, and recent research has identified new species within this genus, expanding our understanding of its diversity.

The genus *Semicassis* includes various species of marine gastropods that exhibit several common characteristics:

Shell shape: *Semicassis* species typically have a distinctive, ear-shaped shell that is robust and often features a series of spines or ridges.

Size: The size of the shells can vary but generally ranges from small to medium-sized, with some species having shells that can reach several centimeters in length.

Coloration: The coloration of the shells is often variable, exhibiting hues of brown, cream, or even more vibrant patterns, which can provide camouflage against predators.

Aperture: The aperture (opening) of the shell is often oval or elongated, allowing for the soft body of the gastropod to extend when it is active.

Suture: The spiral suture where the whorls meet can be distinct in some species, contributing to their identification.

Operculum: Like many gastropods, they have an operculum, a hard plate that can close off the shell's opening when the animal retracts into it for protection.

Habitat: *Semicassis* species are primarily found in marine environments, often inhabiting sandy or rocky substrates in shallow coastal waters.

These characteristics help differentiate *Semicassis* from other genera within the family Cassidae, to which they belong. Each species may have specific differences in size, color, and spination that further help in identification.

3.8.1. Semicassis bisulcata (Schubert and Wagner, 1829) (Fig. 2K)
Synonyms: *Buccinum tesselatum* (Wood, 1825); *Cassis bisulcata* (Schubert and Wagner, 1829); *C. booleyi* (Sowerby III, 1900); *C. herklotsi* (Martin, 1879); *C. japonica* (Reeve, 1848); *C. japonica var. minor* (Küster, 1857); *C. nucleus* (Küster, 1857); *C. pfeifferi* (Hidalgo, 1917); *C. pila* (Reeve, 1848); *Phalium* (*Semicassis*) *bisulcatum* (Schubert and Wagner, 1829); *P.* (*Semicassis*) *bisulcatum bisulcatum* (Schubert and Wagner, 1829); *P.* (*Semicassis*) *pila* (Reeve, 1848); *P. bisulcatum* (Schubert and Wagner, 1829); *P. bisulcatum booleyi* (Sowerby III, 1900); *P. pila* (Reeve, 1848); *Semicassis* (*Semicassis*) *bisulcata* (Schubert and Wagner, 1829); *S. bisulcata booleyi* (Sowerby III, 1900); *S. bisulcata f. japonica* (Reeve, 1848); *S. bisulcata persimilis* (Kira, 1955); *S. japonica* (Reeve, 1848); *S. persimilis* (Kira, 1959); *S. pila* (Reeve, 1848); *Xenogalea nashi* (Iredale, 1931).

World distribution: Widespread in the Indo-West Pacific, through the northern Indian Ocean and southeastern Asia. Ranging from East Africa, including Madagascar, Sri Lanka, and the tropical islands of the Indian Ocean.

The shell length of helmet shells varies, with some species like the king helmet shell *Cassis tuberosa* (Linnaeus, 1758) measuring up to 12 inches (approximately 30 cm) (Abbott 1968). Bonnet shells generally have a smaller size, measuring between 1.5 to 5 inches (3 to 13 cm) in maximum dimension. The shell length of helmet and bonnet shells in Myanmar coastal areas is shown in Table 2.

Helmet shells are typically found in warm, tropical, and subtropical marine environments. They inhabit sandy or muddy substrates in shallow waters, often at depths ranging from intertidal zones to around 100 meters (328 feet). Some species are known to reside in coral reefs and seagrass beds. Bonnet shells are usually found in shallow coastal waters, often in sandy or muddy substrates. They prefer areas with abundant marine vegetation and can be spotted in intertidal zones as well as sublittoral zones. They tend to inhabit depths that vary but generally remain within the continental shelf. Both types of shells are adapted to their environments and play roles in their respective ecosystems.

Table 2. Shell length of helmet and bonnet shells in Myanmar

	Species	Length (cm)
1	*Cassis cornuta* (Linnaeus, 1758)	22–35
2	*Cypraecassis rufa* (Linnaeus, 1758)	15–18
3	*Casmaria erinaceus* (Linnaeus, 1758)	4–7
4	*C. ponderosa* (Gmelin, 1791)	3–10
5	*Phalium areola* (Linnaeus, 1758)	3.5–13
6	*P. bandatum* (Perry, 1811)	9–11
7	*P. decussatum* (Linnaeus, 1758)	4–6
8	*P. fimbria* (Gmelin, 1791)	4–8
9	*P. glaucum* (Linnaeus, 1758)	9–12
10	*P. muangmani* (Massilia and Musetti, 1995)	6–13
11	*Semicassis bisulcata* (Schubert and Wagner, 1829)	5–7

4. Discussion

The shell of the family Cassidae is thick and solid, with a large body whorl and a rather small, conical spire. Sculpture variable and axial varices are sometimes present. Apertures elongate, with a short siphonal canal, recurved dorsally. Outer lips thickened. Inner lip with a shield-like callus. The operculum is quite small, and corneous.

Helmet and bonnet shells hold significant cultural importance in coastal communities for various reasons in coastal areas of Myanmar.

Cuisine: Shellfish are a fundamental part of the diet in many coastal cultures. They are often featured in traditional dishes and recipes that are passed down through generations. Festivals and communal gatherings may revolve around shellfish harvesting and preparation.

Economic Resource: Shellfish harvesting is often a vital economic activity for coastal communities. It supports local economies through fishing industries, tourism, and trade, and provides livelihoods for many families.

Traditional Practices: Many coastal communities have traditional practices related to shellfish harvesting, including specific techniques and tools that have been refined over generations. These practices often encompass sustainable harvesting methods that reflect a deep understanding of marine ecosystems.

Cultural Identity: Shellfish contribute to regional identities, with certain species being culturally significant to specific communities. Practices and recipes related to shellfish can foster a sense of belonging and heritage.

Art and Craft: Shells are used in various forms of art and craft, including jewelry, decorations, and ceremonial items. They often play a role in rituals and celebrations, symbolizing a connection to the sea and natural resources.

Environmental and Spiritual Beliefs: In some cultures, shellfish are seen as gifts from the sea, with spiritual significance tied to marine life. They may be involved in storytelling, folklore, or religious practices.

Ecological Awareness: Shellfish reliance can raise awareness of marine conservation issues. Coastal communities are often vested in protecting marine environments due to their direct connection to shellfish resources.

Overall, shellfish are integral to the identity, economy, and traditions of coastal communities, illustrating the deep relationship between these populations and their marine environment.

The conservation challenges for marine species in Myanmar include.

Overfishing: Unsustainable fishing practices and overexploitation of marine resources threaten various species, including commercially important fish and invertebrates.

Habitat Destruction: Coastal development, mangrove deforestation, and pollution from agricultural runoff and urban areas degrade critical habitats for marine life.

Pollution: Plastics and other pollutants enter the marine environment, adversely affecting the health of marine species and ecosystems.

Climate Change: Rising sea temperatures, ocean acidification, and rising sea levels threaten marine biodiversity and the livelihoods of communities dependent on marine resources.

Limited Regulation and Enforcement: Insufficient regulatory frameworks and enforcement mechanisms hinder the effective management of marine resources and habitats.

Lack of Research and Data: A scarcity of scientific research and data on marine species and ecosystems limits the ability to develop informed conservation strategies.

Conflict Over Resource Use: Competition among local communities, commercial fisheries, and development interests can lead to conflicts over the sustainable use of marine resources.

Addressing these challenges requires an integrated approach that includes community engagement, improved regulatory frameworks, and enhanced research and monitoring efforts.

5. Conclusion

The status of helmet and bonnet seashells in Myanmar is not specifically detailed in the available sources. However, the snippets indicate a broader context of marine biodiversity in Myanmar, including studies on various shell species in coastal regions. For precise information on the conservation status or population trends of helmet and bonnet seashells, further research or local studies would be necessary. Conservation efforts in these areas focus on protecting biodiversity and managing resources sustainably.

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References

Abbott, R.T., 1968. The helmet shells of the world (Cassidae). Part 1. Indo-Pac. Moll., 2 (9), 1-201.

Adams, H., Adams, A., 1853. The genera of Recent Mollusca; arranged according to their organization. London, van Voorst. Vol. 1: xl + 484 pp.; vol. 2: 661 pp.; vol. 3: 138 pls. [Published in parts: Vol. 1: i-xl (1858), 1-256 (1853), 257-484 (1854). Vol. 2: 1-92 (1854), 93-284 (1855), 285-412 (1856), 413-540 (1857), 541-661 (1858). Vol. 3: pl. 1-32 (1853), 33-72 (1954), 73-96 (1855), 97-112 (1856), 113-128 (1857), 129-138 (1858)].

Bayer, H., 1935. Descriptions d'espèces nouvelles. Journal de Conchyliologie 15 (1), 64-68, pls 2, 5, 6.

Beets, C., 1941. Eine jungmiocäne Mollusken-Fauna von der Halbinsel Mangkalihat, Ost-Borneo. Verhandelingen van het Geologisch-Mijnbouwkundig Genootschap voor Nederland en Koloniën, Geologische Serie. 13 (1), 1-219; plates 1-9.

Born, I.V., 1778. Index rerum naturalium Musei Cæsarei Vindobonensis. Pars I.ma. Testacea. Verzeichniß der natürlichen Seltenheiten des k. k. Naturalien Cabinets zu Wien. Erster Theil. Schalthiere 1-40.

Bruguière, J.G., 1789. Encyclopédie méthodique ou par ordre de matières. Histoire naturelle des vers, volume 1. Paris: Pancoucke. i-xviii, 1-344.

Born, I.V., 1778. Index rerum naturalium Musei Cæsarei Vindobonensis. Pars I.ma. Testacea. Verzeichniß der natürlichen Seltenheiten des k. k. Naturalien Cabinets zu Wien. Erster Theil. Schalthiere. 1-40.

Bruguière, J.G., 1789. Encyclopédie méthodique ou par ordre de matières. Histoire naturelle des vers. Volume 1. Paris: Pancoucke. i-xviii, 1-344.

Cossmann, T.A., 1903. Notes on shells, with descriptions of new genera and species. Journal of the Academy of Natural Sciences Philadelphia, Second Series 1 (4), 210-214.

Cuvier, G., 1795. Second Mémoire sur l'organisation et les rapports des animaux à sang blanc, dans lequel on traite de la structure des Mollusques et de leur division en ordre, lu à la société d'Histoire Naturelle de Paris, le 11 prairial an troisième. Magazin Encyclopédique, ou Journal des Sciences, des Lettres et des Arts, 1795 [1. année] 2, 433-449.

Dall, W.H., 1909. Preliminary descriptions of new species of mollusks, from the northwest coast of America. Proceedings of Californian Academy of Sciences 7, 1-6.

Dautzenberg, P., 1926. Contribution à l'étude de la faune de Madagascar: Mollusca marina testacea. Faune des colonies françaises. [Contribution to the study of the fauna of Madagascar: Mollusca marina testacea. Fauna of the French colonies.]. Société d'Editions Géographiques, Maritimes et Coloniales 3 (4), 321-636.

Deshayes, G.P., 1844. Histoire naturelle des animaux sans vertèbres, présentant les caractères généraux et particuliers de ces animaux, leur distribution, leurs classes, leurs familles, leurs genres, et la citation des principales espèces qui s'y rapportent, par J. B. P. A. de Lamarck. Deuxième édition, Tome dixième. Histoire des Mollusques. J. B. Baillière: Paris, 638 pp.

Dillwyn, L.W., 1817. A descriptive catalogue of Recent shells, arranged according to the Linnean method; with particular attention to synonym. John and Arthur Arch, London, 1: 1-580.

Fleming, C.A., 1943. Tertiary Mollusca from Dannevirke Subdivision. Transactions of the Royal Society of New Zealand. 73: 193-208.

Gmelin, J.F., 1791. Vermes. In: Gmelin J.F. (Ed.) Caroli a Linnaei Systema Naturae per Regna Tria Naturae, Ed. 13. Tome 1(6). G.E. Beer, Lipsiae [Leipzig]. pp. 3021-3910. Systema Naturae. Linneaeus (ed.). Ed. 13, 1: pars. 6.

Gray, J.E., 1847. A list of the genera of recent Mollusca, their synonyma and types. Proceedings of the Zoological Society of London 15, 129-219.

Gray, J.E., Sowerby, G.B.I., 1839. Molluscous animals and their shells. Pp. 103-155, pls 33-34 [pp. 103-142 by J. E. Gray, 143-155 by G. B. Sowerby I]. In: The zoology of Capt. Beechey's voyage, compiled from the collections on notes made by Captain Beechey, the officers and naturalist of the expedition during a voyage to the Pacific and Behring's straits in his Majesty's ship Blossom, under the command of Captain F. W. Beechey in the years 1825, 26, 27 and 28. London pp. XII + 186 + 44 pl.

Habe, T., 1961. Coloured illustrations of the shells of Japan (II). Hoikusha, Osaka. xii + 183 + 42 pp., 66 pls. xii + 183 + 42 pp., 66 pl.

Hidalgo, B.N.E., 1917. Descriptions of the helmet shells: Cassis pfeifferi. The Journal of Malacology 3 (4), 12-16.

Iredale, T., 1927. A review of Australian helmet shells (family Cassididae- phylum Mollusca). Records of the Australian Museum 15 (5), 321-354.

Iredale, T., 1931. Description of three new species of marine shells from Australia. Proceedings of the Zoological Society of London 12, 616-617.

Jousseaume, F., 1888. Description des mollusques recueillis par M. le Dr. Faurot dans la Mer Rouge et le Golfe d'Aden. Mémoires de la Société Zoologique de France 1, 165-223.

Kira, T., 1955. Coloured illustrations of the shells of Japan. (1st ed., first printing), Hoikusha, Japan, 220 pp.

Kira, T., 1959. Coloured illustrations of the shells of Japan. (2nd ed., first printing), Hoikusha, Japan, 239 pp.

Kreipl, K., 1997. Recent Cassidae. Christa Hemmen, Wiesbaden, 151 pp.

Küster, H.C., 1857. Die gattungen Cassis, Cassidaria, Oniscia, Dolium, Eburna und Harpa. Bearbeitet von Dr. H. C. Küster. Systematisches Conchylien-Cabinet von Martini und Chemnitz. Fortgesetzt von Hofrath Dr. H. G. v. Schubert und professor Dr. J. A. Wagner. Neu herausgegeben und ver vollständigt von Dr. H. C. Küster nach desseb Tode fortgesetzt von Dr. W. Kobelt und H. C. Weinkauff. Vol. 3, part1, section 2. Bauer & Raspe, Nürnberg. 1-104, pls. 36-79.

Ladd, H.S., 1934. Geology of Viti Levu, Fiji. Bulletin of the Bernice P. Bishop Museum 119, 1-263.

Lamarck, J.B., 1822. Histoire naturelle des animaux sans vertèbres. Tome sixième, 2me partie. Paris: published by the author, 232 pp.

Latreille, G., 1825. Catalogus conchylorum quae reliquit I.M.N. Suenson, & c. Hafniae: Chr. F. Graebei. 52 pp.

Link, D.H.F., 1807. Beschreibung der Naturalien-Sammlung der Universität zu Rostock. Adlers Erben. 1, pp. 1-50 [1806]; 2, pp. 51-100 [1807]; 3, pp. 101-165 [1807]; 4, pp. 1-30 [1807]; 5, pp. 1-38 [1808]; 6, pp. 1-38 [1808].

Linnaeus, C., 1758. Systema Naturae per regna tria naturae, secundum classes, ordines, genera, species, cum characteribus, differentiis, synonymis, locis. Vol. 1. Laurentius Salvius: Holmiae, 824 pp.

Martin, K., 1879. Die Tertiärschichten auf Java, nach den Entdeckungen von Fr. Junghuhn. Leiden: Brill. [Paleontologischer Theil, 1–126 (1879); 127–164, i–vi (plate captions) (1880); Allgemeiner Theil, 1–51 (1880); Anhang, 1–6

(1880); Title page and Vorwort, i–ix, [xi] (1880); pls. 1–28 and map (1880?)].

Marwick, J., 1928. The Tertiary Mollusca of the Chatham Islands, including a generic review of the New Zealand Pectinidae. Transactions of the New Zealand Institute. 58: 431-506.

Menke, K.T., 1828. Synopsis methodica molluscorum generum omnium et specierum earum, quae in Museo Menkeano adservantur; cum synonymia critica et novarum specierum diagnosibus. XII + 91 pp. [late in 1828]. Pyrmonti.

Mörch, O.A.L., 1852. Catalogus conchyliorum quae reliquit D. Alphonso d'Aguirra & Gadea Comes de Yoldi, Regis Daniae Cubiculariorum Princeps, Ordinis Dannebrogici in Prima Classe & Ordinis Caroli Tertii Eques. Fasc. 1, Cephalophora, 170 pp.

Mörch, O.A.L., 1857. Catalogus conchylorum quae reliquit I.M.N. Suenson, & c. Hafniae: Chr. F. Graebei, 52 pp. Perry, G. 1811. Conchology, or the natural history of shells: containing a new arrangement of the genera and species, illustrated by coloured engravings executed from the natural specimens, and including the latest discoveries. W. Miller, London, 4 pp. + 61 pls.

Poutiers, J.M., 1998. Gastropods. In: Carpenter, K. E. and Niem, V. H. (Eds), 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, pp. 363-649.

Raybaudi, M.L. Prati, M.A., 1995. Phalium muangmani, n. sp. A new species of Cassidae from Thailand. World Shells 12, 14-17.

Reeve, L.A., 1848. Monograph of the genus Cassis. In: Conchologia Iconica, or, illustrations of the shells of molluscous animals, vol. 5, pls 1-12 and unpaginated text. L. Reeve & Co., London. [stated dates: pls 1-6, August 1848; pls 7-12, September 1848].

Röding, P.F., 1798. Museum Boltenianum sive Catalogus cimeliorum e tribus regnis naturæ quæ olim collegerat Joa. Fried Bolten, M. D. p. d. per XL. annos proto physicus Hamburgensis. Pars secunda continens Conchylia sive Testacea univalvia, bivalvia & multivalvia. Trapp, Hamburg, viii + 199 pp.

Rovereto, G., 1899. Prime ricerche sinonimiche sui generi dei Gasteropodi. Atti della Società Ligustica di Scienze Naturale e Geografiche, Genova 10, 101-110.

Sacco, F., 1890. I molluschi dei terreni terziarii del Piemonte e della Liguria. Parte 7 (Harpidae e Cassididae). Bollettino dei Musei di Zoologia ed Anatomia Comparata della Reale Universita di Torino 5 (82), 1-20.

Schubert and Wagner, J.A., 1829. Neues Systematisches Conchylien- Cabinet Angefangen von Martini und Chemnitz. Vol. 12. Bauer & Raspe, Nürnberg, xii + 196 pp., pls. 214-237.

Schumacher, C.F., 1817. Essai d'un nouveau système des habitations des vers testacés. Schultz, Copenghagen. iv + 288 pp., 22 pls.

Scopoli, G.A., 1777. Introductio ad historiam naturalem, sistens genera lapidum, plantarum et animalium hactenus detecta, caracteribus essentialibus donata, in tribus divisa, subinde ad leges naturae. Pragae. Wolfgang Gerle. Pp i-x + 1-506.

Shirley, K.C., 1911. Cassidae. An amazing family of seashells. Harxheim: ConchBooks. 251 pp.

Sowerby, G.B.I., 1825. The genera of recent and fossil shells, for the use of students, in conchology and geology. Published in 42 parts. Vol. 1, pls 1-126 [1821-1825]; vol. 2, pls 127-262 + text (unpaginated) [1825-1834]. London: G. B. Sowerby.

Sowerby, G.B.III., 1900. Descriptions of two new species of shells: Murex marcoensis and Cassis booleyi. The Journal of Malacology 7 (7), 162-163.

Stearns, T., 1894. I molluschi dei terreni terziarii del Piemonte e della Liguria. Parte 7 (Cassididae). Bollettino dei Musei di Zoologia ed Anatomia Comparata della Reale Universita di Torino 5 (82), 1-20.

Stutchbury S., 1837. On Cypraecassis, a proposed new genus of univalve shells, for the reception of certain species of Brugière's genus Cassis. The Magazine of Natural History and Journal of Zoology, Botany, Mineralogy and Meteorology, New Ser. 1, 214-217.

Stutchbury, S., 1837. On Cypraecassis, a proposed new genus of univalve shells, for the reception of certain species of Brugière's genus Cassis. The Magazine of Natural History and Journal of Zoology, Botany, Mineralogy and Meteorology. new ser., 1: 214-217.

Tan, S.K., Ng, H.E., Nguang, L.H.S., 2013. A new species of Phalium Link, 1807 (Gastropoda: Tonnoidea: Cassidae) from the Sunda Shelf. The Raffles Bulletin of Zoology 61 (2), 507-514.

Thiele, J., 1929. Handbuch der systematischen Weichtierkunde. Jena, Gustav Fischer, 1154 pp. Vol. 1 part 1: 1-376.

Verbinnen, G., Segers, L., Swinnen, F., Kreipl, K., Monsecour, D., 2016. Cassidae. An amazing family of seashells. Harxheim: ConchBooks. 251 pp.

Wood, W., 1825. Supplement to the Index Testaceologicus; or A catalogue of shells, British and foreign. Richard Taylor, London. iv [+1] + 59 pp., plates 1-8.

Woodring, W.P., 1928. Miocene mollusks from Bowden, Jamaica. 2. Gastropods and discussion of results. Carnegie Institution of Washington Publication. 385: vii + 564 pp., 40 pls.

WoRMS, 2024. Available Source: http://www.marinespecies.org., 2024.