International Journal of Earth Sciences Knowledge and Applications
journal homepage: http://www.ijeska.com/index.php/ijeska

Research Article

https://doi.org/10.5281/zenodo.15342573

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

Naung Naung Oo[1]*

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

Article history
Received 15 December 2024
Revised 26 January 2025
Accepted 26 January 2025

Contact
*Naung Naung Oo
naungnaungoomarine@gmail.com

How cite
Oo, N.N., 2025. Notes on the Family Harpidae (Mollusca: Gastropoda) of Myanmar. International Journal of Earth Sciences Knowledge and Applications 7 (1), 91-97.
https://doi.org/10.5281/zenodo.15342573.

Abstract
A total of 6 species of harp shells *Harpa amouretta*; *H. articularis*; *H. davidis*; *H. harpa*; *H. major* and *Morum ninomiyai* were collected from low tide level to deep shelf zone. The highest spatial distribution was recorded in the Rakhine Coastal Region (40 sites) followed by the Taninthayi Coastal Region (14 sites) and the Ayeyarwady Delta and Gulf of Martaban Coastal Region (5 sites) in Myanmar Coastal Water from 2012 to 2024. The two harp shell genera *Harpa* and *Morum* were commonly distributed in subtidal sandy substrates to depths of about 250 m. The ecological notes of the harp shell were presented with their geographical range.

Keywords
Critical role, harp shells, impact, Myanmar Coastal Water, sandy habitat

1. Introduction

Harp shells are spatially distributed primarily in the Indian and Pacific Oceans, from the Red Sea to South Africa. They inhabit benthic environments and are found in tropical climates (Poutiers, 1998). They are active marine gastropods that graze on the sandy bottom of the shallow intertidal to deep shelf zone in Myanmar Coastal Water.

Harpidae typically inhabit sandy or muddy substrates in shallow coastal waters, often at depths ranging from 10 to 100 meters. They are usually found in tropical and subtropical marine environments, frequently associated with coral reefs, seagrass beds, and other habitats where they can find food and shelter. Harp shells are known to bury themselves in the substrate, which helps protect them from predators and allows them to feed on detritus and small organisms in the sediment.

Harp shells play a significant role in their ecosystems as benthic organisms are found typically in tropical environments. They are scavengers and predators, using their strong feet to cling to prey and their specialized feeding structure, the radula, to scrape soft tissues from other mollusks, thus contributing to the nutrient cycle (Hughes and Emerson, 1987). Additionally, they help maintain ecological balance by regulating the population of their prey species. It's important to note that their role can be affected by environmental factors such as temperature and salinity changes, potentially influenced by anthropogenic impact. This study aims to know the critical role of harp shells in marine environments of Myanmar Coastal Water.

2. Materials and Methods

Harp shells were collected from 59 sampling sites of sandy substrate using a shovel and handpicking from shallow intertidal to deeper shelf areas along the three coastal regions of Myanmar (Fig. 1).

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).

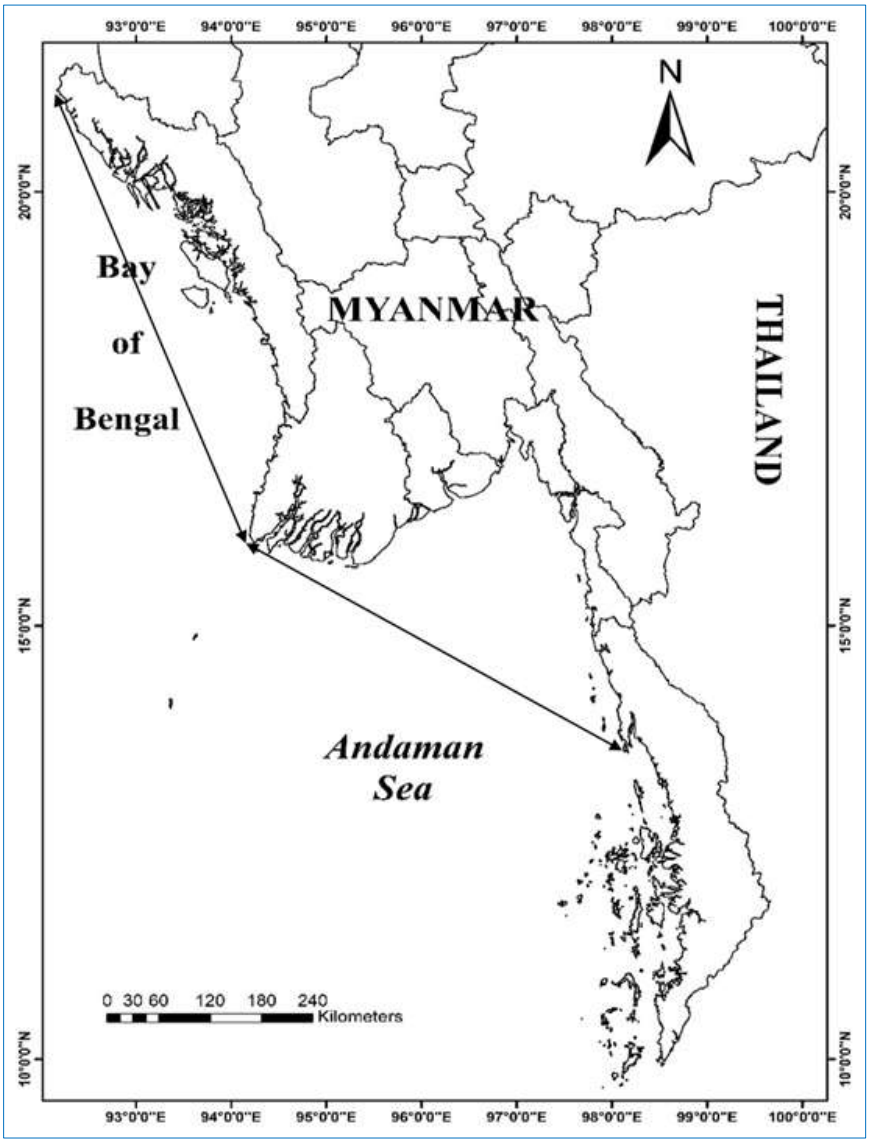

Fig. 1. Collection areas (black arrow line) of harp shells in some coastal areas of Myanmar

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).

All of the specimens were preserved in 10% formaldehyde seawater. The epifaunas and periostracum were removed by soaking the shells in a caustic soda solution. 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).

The identification work of harp shells was followed by Rehder (1973), Poutiers (1998) and WoRMS (2024). The ecological notes of the harp shells were recorded in situ.

Table 1. Identification and distribution of tun shells in some coastal areas of Myanmar

Phylum: Mollusca (Cuvier, 1795)					
Class: Gastropoda (Cuvier, 1795)					
Order: Neogastropoda (Wenz, 1938)					
Family: Harpidae (Bronn, 1849)					
No	**Species**	**Common name**	**Distribution**		
			R	**A**	**T**
I	*Harpa* (Röding, 1798)				
1	*H. amouretta* (Röding, 1798)	Lesser harp	+	-	+
2	*H. articularis* (Lamarck, 1822)	Articulate harp	+	+	+
3	*H. davidis* (Röding, 1798)	Madras harp or David harp	+	+	+
4	*H. harpa* (Linnaeus, 1758)	True harp	+	+	+
5	*H. major* (Röding, 1798)	Major harp	+	-	+
II	*Morum* (Röding, 1798)				
6	*M. ninomiyai* (Emerson, 1986)	Japanese harp	+	-	+

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

3. Results

Family Harpidae, commonly known as harp shells, is a small family of distinctive marine gastropods known for their beautifully ribbed and colorful shells (Table. 1, Fig. 2). Below is an explanation of their characteristics, habitat, and utilization in Myanmar.

3.1. Characteristics

Shell structure: Harpidae shells are recognized for their elongated, oval shape with strong, evenly spaced vertical ribs that resemble the strings of a harp, hence their common name. The shell is glossy and smooth between the ribs.

Aperture and lip: The aperture is long and narrow, extending along the shell's entire length. The outer lip is smooth, notched, and often slightly flared.

Coloration: Harp shells are often brightly colored with various patterns, including bands, zigzags, and spots. The color palette may include shades of brown, yellow, orange, white, and even purple, contributing to their ornamental appeal.

Body: The animals have large feet, which they use for digging into sandy substrates. Their soft body can retract fully into the shell when needed, protecting them from predators.

3.2. Habitat

Marine Environment: Harpidae are typically found in tropical and subtropical marine environments, particularly in shallow waters with sandy bottoms. They are usually associated with sandy lagoons or near coral reefs.

Geographic range: They are widely distributed in the Indo-Pacific region, especially around the coasts of Africa, Southeast Asia, and the Pacific Islands. Some species can also be found in parts of the Caribbean and the Atlantic Ocean.

Behavior: Harp shells are carnivorous and mainly feed on other invertebrates, such as small crustaceans and worms. They are nocturnal hunters, actively searching for prey at night by using their large feet to move through the sand.

3.3. Utilization

Shell collection and trade: Harp shells are highly sought after by shell collectors due to their ornate appearance and vibrant coloration. They are often sold as decorative objects, featured in collections, and used in various crafts.

Ornamental use: The intricate design of the shells makes them popular for use in jewelry and artwork. They are polished and sometimes mounted in frames or used in jewelry settings to create unique decorative pieces.

Cultural significance: In some coastal cultures, harp shells have been used in traditional rituals, and their beauty has led to their inclusion in local art forms. However, their cultural role is generally less significant than their aesthetic and economic value.

Scientific study: Harpidae are interesting to malacologists due to their unique morphological adaptations, especially their ribbed shells and hunting behavior. They provide valuable insight into mollusc evolution and ecology.

Though they are not commercially harvested for food, harp shells play an important role in marine ecosystems as predators that help control populations of smaller invertebrates. Their contribution to marine biodiversity, combined with their aesthetic appeal, makes them ecologically and economically valuable.

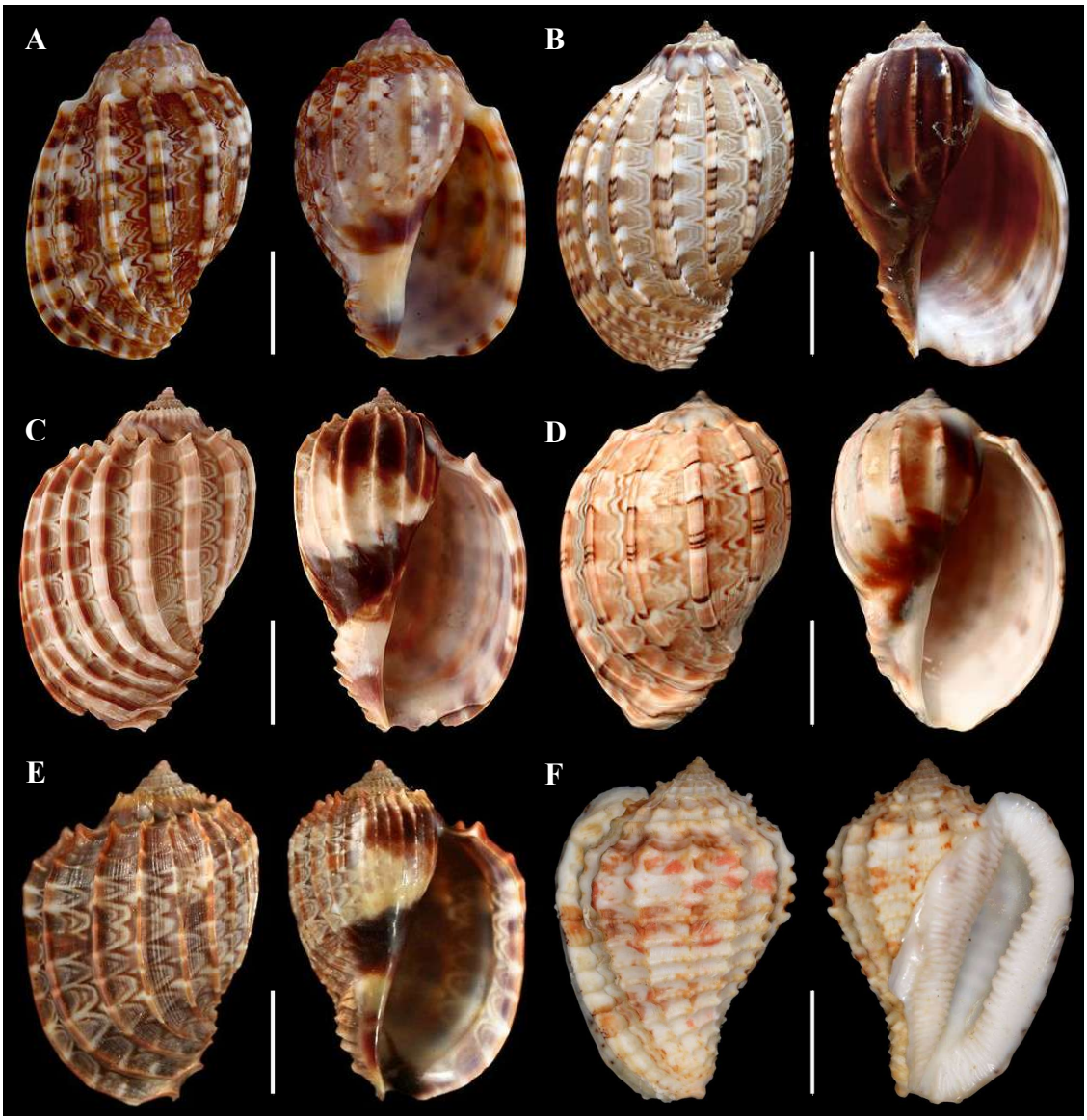

Fig. 2. Harp shells of Myanmar Coastal Water (A-F): (A) *Harpa amouretta* (Röding, 1798); (B) *H. articularis* (Lamarck, 1822); (C) *H. davidis* (Röding, 1798); (D) *H. harpa* (Linnaeus, 1758); (E) *H. major* (Röding, 1798); (F) *Morum ninomiyai* (Emerson, 1986)

3.4. Molluscs Play Several Critical Roles in Their Ecosystems

Nutrient cycling: Molluscs, such as snails, clams, and oysters, help recycle nutrients by breaking down organic matter. Their feeding activities contribute to the decomposition process and nutrient availability in the ecosystem.

Food source: Molluscs are an important food source for a variety of predators, including fish, birds, and mammals. They form a crucial link in the local food web.

Habitat formation: Bivalves, like oysters and clams, can form reefs or beds that provide habitat and shelter for other marine organisms. These structures enhance biodiversity and protect shorelines.

Water filtration: Many bivalves, such as clams and mussels, are filter feeders that improve water quality by filtering out particulates and pollutants, thereby contributing to the clarity and health of aquatic systems.

Bioturbation: Some molluscs, especially burrowing species, contribute to the mixing of sediments in marine and freshwater environments, influencing sediment structure and nutrient distribution.

Indicator species: Molluscs are often used as bioindicators of environmental health. Changes in their populations can indicate shifts in ecosystem conditions, such as pollution levels and habitat quality.

Cultural and economic importance: Molluscs have significant economic value as sources of food (e.g., clams, squids, and snails) and are also important for recreational activities and tourism.

Overall, molluscs are integral to their ecosystems, influencing food webs, habitat structure, and ecosystem services (Walls, 1977; Walls,1980).

3.5. Harp Shells are Notable for Several Distinctive Characteristics

Shape and structure: Harp shells have a unique, elongated,

and typically semi-glossy shell that resembles a harp, featuring an intricate pattern of ridges and grooves. The shell is spiraled and can be quite colorful, often exhibiting shades of white, orange, and brown.

Size: The size of harp shells can vary significantly among species, but they generally range from a few centimeters to over 10 cm in length.

Shell features: Apical angle: Harp shells usually have a high spire and a narrow aperture, with the aperture being typically elongated.

Teeth and ornamentation: The shells are often adorned with various types of spiral cords and distinct teeth along the aperture margin.

Colouration: Many species feature vibrant and diverse coloration patterns which can serve as camouflage against predators in their natural environment.

Habitat: They are typically found in tropical and subtropical marine environments, often inhabiting sandy or gravelly substrates where they can be burrowed.

Feeding behavior: Harp shells are carnivorous, preying on small marine invertebrates like crabs and shrimp. They use a radula (a unique feeding organ) to scrape food from surfaces.

Reproduction: Most harp shells are dioecious, meaning they have distinct male and female individuals. They usually engage in external fertilization, with females laying eggs in the water which hatch into larval forms.

These characteristics make harp shells unique and interesting to both researchers and collectors in Myanmar.

3.6. Environmental Changes can Significantly Impact Harp Shells in Various Ways

Temperature fluctuations: Rising ocean temperatures due to climate change can affect metabolism, reproduction, and distribution of harp shells. Warmer waters may also lead to increased vulnerability to diseases.

Ocean acidification: Increased carbon dioxide levels result in lower pH levels in ocean waters, which can impair the ability of harp shells and other molluscs to form their calcium carbonate shells. This could lead to thinner shells or even shell dissolution over time.

Habitat loss: Coastal development, pollution, and habitat destruction can reduce the availability of suitable habitats for harp shells. As benthic organisms, they rely on stable substrates for feeding and reproduction.

Salinity changes: Variability in salinity due to freshwater input from melting ice caps or altered rainfall patterns can affect the physiology and distribution of harp shells. These organisms typically thrive in stable conditions.

Overfishing and predation pressures: Changes in fish populations due to overfishing can alter predator-prey dynamics, potentially leading to an increase in the populations of species that harp shells feed on, affecting their availability of food sources.

Pollution: Contaminants from agricultural runoff, coastal industries, and plastic pollution can degrade the health of marine ecosystems, making harp shells more susceptible to disease and reducing their reproductive success.

Through these mechanisms, environmental changes can threaten the overall population dynamics and ecological roles of harp shells in their habitats. Addressing these changes is vital for their conservation and the health of the ecosystems they inhabit in Myanmar Coastal Water.

4. Discussion

Myanmar has various seashell resources, particularly in areas like Rakhine, Ayeyarwady, and Taninthayi coastal regions, where harp shells from the genus *Harpa* and *Morum* have been noted. Additionally, the country has a long fishing tradition that plays a significant role in the livelihood of coastal populations, indicating that seashells and marine resources contribute to local food security and income.

Seashell fishing plays a significant role in the economy of Myanmar. Here are key contributions:

Employment: The shell-fishing industry provides livelihoods for millions of people along the coast and in inland regions. It is an essential source of income for many households.

Food security: Shell is a major source of protein for the population, contributing to food security and nutritional needs, especially in rural coastal communities.

Export earnings: Myanmar exports various shellfish and seafood products, including clams, oysters, and scallops, which contribute to foreign exchange earnings. The seafood export sector has been growing, with key markets in Europe, the United States, and Asia.

Economic growth: The fishing sector is an integral part of the agricultural sector, which is a significant part of Myanmar's economy, contributing to GDP and overall economic development.

Cultural significance: Shell-fishing is deeply embedded in the culture and traditions of many coastal communities, supporting local customs and practices.

Aquaculture Development: The rise of aquaculture in recent years has further enhanced production capacity, providing additional economic opportunities and helping meet domestic and international demand.

Overall, seashell fishing is vital for the economic stability and development of Myanmar, influencing livelihoods, food systems, and trade.

Seashell conservation in Myanmar is part of a broader marine conservation effort. The Myanmar government has committed to protecting 10% of its marine areas, aligning its

objectives with international conventions. This commitment includes the conservation of marine ecosystems, which encompasses the habitats of various shellfish species. Ongoing research and recommendations focus on understanding marine systems and enhancing conservation strategies.

However, challenges remain in implementing these protections effectively, and further research is necessary to ensure sustainable management of marine resources. Local communities in Myanmar can play a vital role in marine conservation efforts through various means:

Community engagement: Involving local communities in decision-making processes related to marine resource management ensures that their knowledge and needs are respected and incorporated.

Education and awareness: Programs that educate communities about the importance of marine ecosystems, sustainable practices, and the impact of overfishing and pollution can foster a conservation mindset.

Sustainable practices: Encouraging sustainable fishing techniques and responsible tourism can help reduce environmental impact. Local fishers can adopt practices that protect marine biodiversity.

Monitoring and reporting: Communities can participate in monitoring local marine conditions and collecting data on fish populations, pollution levels, and habitat changes, which can inform conservation strategies.

Restoration projects: Participating in or leading restoration projects, such as coral reef restoration or mangrove planting, helps rebuild damaged ecosystems and enhances local biodiversity.

Establishing Marine Protected Areas (MPAs): Communities can advocate for and help manage MPAs, ensuring that certain areas are protected from over-exploitation and degradation.

Collaboration with NGOs and Government: Partnering with non-governmental organizations and government bodies can enhance capacity for conservation efforts and provide resources for training and implementation of best practices.

Alternative livelihoods: Developing alternative economic opportunities, such as ecotourism or sustainable aquaculture, can reduce pressure on marine resources and promote conservation.

By actively participating in these efforts, local communities not only help preserve marine ecosystems but also benefit from healthier environments and sustainable livelihoods.

Harp shells in Myanmar, particularly in coastal communities, have several uses that reflect their ecological and economic significance:

Food source: In some regions, harp shells are harvested for consumption. Local communities may gather these shells as part of their diet, often preparing them in traditional dishes.

Cultural practices: Harp shells may also hold cultural significance. They can be used in traditional ceremonies, jewelry, or crafts, contributing to local artisan economies.

Shell collecting: The shells can be collected for decorative purposes or as souvenirs, adding to the local tourism experience.

Fishing practices: Local fishermen may use identified habitats of harp shells to gauge ecological health, as the presence of such species can indicate water quality and environmental conditions.

Sustainable practices: Some communities practice sustainable harvesting methods to ensure the ongoing availability of harp shells, balancing economic needs with ecological preservation.

These uses underline the importance of harp shells in both local diets and economies, highlighting the need for conservation and sustainable practices to ensure their availability for future generations.

5. Conclusion

Harp shell ecology in Myanmar is influenced by the country's rich biodiversity and various ecosystems, shaped by its environmental factors. While specific studies on harp shells in Myanmar may be limited, understanding their ecological role involves examining how they interact with other species and their contributions to the ecosystem. Protecting these shells and their habitats is crucial for maintaining ecological balance. In summary, harp shells play vital roles in marine ecosystems, influencing food webs, contributing to habitat complexity, and serving as indicators of environmental health. Their preservation is important not only for biodiversity but also for the ecological integrity of marine environments.

Acknowledgements

I would like to express my gratitude to Dr. Than Tun, Rector of Pathein University; Dr. Khine Le Win and Dr. Moe Moe Aye, Pro-Rectors of Pathein University, for their permission to undertake this research work. I would like to express my sincere thanks to Dr Soe Pa Pa Kyaw, Professor and Head of the Department of Marine Science at Pathein University, for her advice and needful assistance. My final thanks go to local people from my study areas, for their assistance in the sample collections and Daw Lwin Lwin who has put in back-breaking hours studying seashells but more importantly, has kept me focused.

References

Bronn, H.G., 1849. Index Palaeontologicus oder Übersicht der bis Jetzt Bekannten Fossilen Organismen, bearbeitet unter Mitwirkung der Herren Prof. H. R. Göppert and Herm. v. Meyer, bearbeitet von Dr. H. G. Bronn. A. Nomenclator Palaeontologicus, in Alphabetischer Ordnung [two halves, each in a separate volume]. Schweizerbart. Stuttgart. Erste Hälfte.

1848: A–M [i–lxxxiv + p. 1–775, reprinted without change in 1849; Zweite Hälfte. N–Z [p. 776–1381, 1848, reprinted without change in 1849. 1849: B. Enumerator Palaeontologicus: Systematische Zusammenstellung und Geologische Entwickelungs-Gesetze der Organischen Reiche, p. 1-1106.

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.

Emerson, W.K., 1986. A new species of the gastropod genus *Morum* from the eastern Pacific Ocean. Journal de Conchyliologie 107 (1), 53-57.

Hughes, R.N., Emerson, W.K., 1987. Anatomical and taxonomic characteristics of *Harpa* and *Morum* (Neogastropoda: Harpaidae). Veliger, 29 (4), 349-358.

Lamarck, J.B., 1822. Histoire naturelle des animaux sans vertèbres. Tome septième. Paris: published by the author, 711 pp.

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.

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.

Rehder, H.A., 1973. The family Harpidae of the world. Indo-Pac. Moll, 3 (16), 207-274.

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.

Walls, J.G., 1977. Another viewpoint on the living harps. The Pariah, 4, 1-4.

Walls, J.G., 1980. *Conchs, tibias, and harps*. T. F. H., Reigate, 191.

Wenz, W., 1938. Gastropoda. In: Schindewolf, O.H. (Ed). Teil 1: Allgemeiner Teil und Prosobranchia. xii + 1639 pp. Handbuch der Paläozoologie, Band 6. Bornträger, Berlin. Lief. pp. 1-240.

WoRMS, 2024. An authoritative classification and catalogue of marine names. World Register of Marine Species (WoRMS). Available Source: http://www.marinespecies.org.