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Distribution and Habitat of Tun Shells in Some Coastal Areas of Myanmar

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INFORMATION

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ABSTRACT

A total of 9 species of genus *Tonna* belonging to the family Tonnidae were collected from 2012 to 2024 in some coastal areas of Myanmar. The specimens of tun shells were identified and recorded as *Tonna allium, T. canaliculata, T. dolium, T. galea, T. lischkeana, T. melanostoma, T. perdix, T. sulcosa, and T. tessellata*, using liquid-preserved materials and living specimens in the field, based on the external characteristics of shell structures. Among these species, *T. allium, T. dolium, T. lischkeana*, and *T. tessellata* were found in all study areas of Myanmar. Moreover, distribution ranges and habitats of all species in marine environments were described.

1. Introduction

The family Tonnidae commonly known as tun shells is a family of medium to large-sized sea snails and marine gastropod molluscs. Shell is thin, and globose, with a short spire and a very inflated, large body whorl. Sculpture only spiral, of relatively flat ribs or cords. No axial varices. Periostracum is a thin smooth sheet. The aperture is broad. Anterior siphonal canal short, a U-shaped notch. The outer lip is generally thin, sometimes reflected and denticulate, in adults only. Inner lip with a more or less developed, glazed callosity, usually covering the umbilicus. Columella is sometimes twisted. Operculum is absent in the adult. Head with a relatively short but extremely extensible snout. Cephalic tentacles are elongated, usually bearing eyes on bulges of their outer bases. The foot is very large and wide, moderately flat. The fleshy siphon is long (Beu 1981).

The shells are usually pale, often light brown or cream-colored, sometimes with darker spiral bands or blotches. The animals have a soft, muscular body that can retract into the shell for protection. They possess a long proboscis and a pair of tentacles.

Tonnidae species are primarily found in tropical and subtropical waters. They are generally associated with sandy or muddy substrates, often found in shallow waters but also deeper regions. They are distributed in the Indo-Pacific region, including the coasts of Southeast Asia, East Africa, and Australia. Some species also inhabit the Caribbean and the Mediterranean Sea. These snails are carnivorous and feed on other invertebrates such as echinoderms, including sea urchins and sea cucumbers. They use their proboscis to capture prey (Okutani et al., 1988).

The large and attractive shells of Tonnidae are often collected by shell collectors and sold commercially as decorative items or souvenirs. The shells are used in jewelry-making and craftwork due to their appealing appearance and size. These shells have also interested malacologists in taxonomic and ecological studies.

In some coastal communities, tun shells may have cultural or symbolic significance, and they are used in traditional rituals or as musical instruments when blown like a conch. Though not commonly used for food, their ecological role as predators contributes to the balance of marine ecosystems (Qi and Ma 1984). This study aims to know the habitat and distribution of tun shells in some coastal areas of Myanmar.

2. Materials and Methods

Tun shells were collected from the northern Rakhine Coastal Region down to Dawei Point in the north Taninthayi Coastal Region of Myanmar from 2012 to 2024 (Fig. 1).

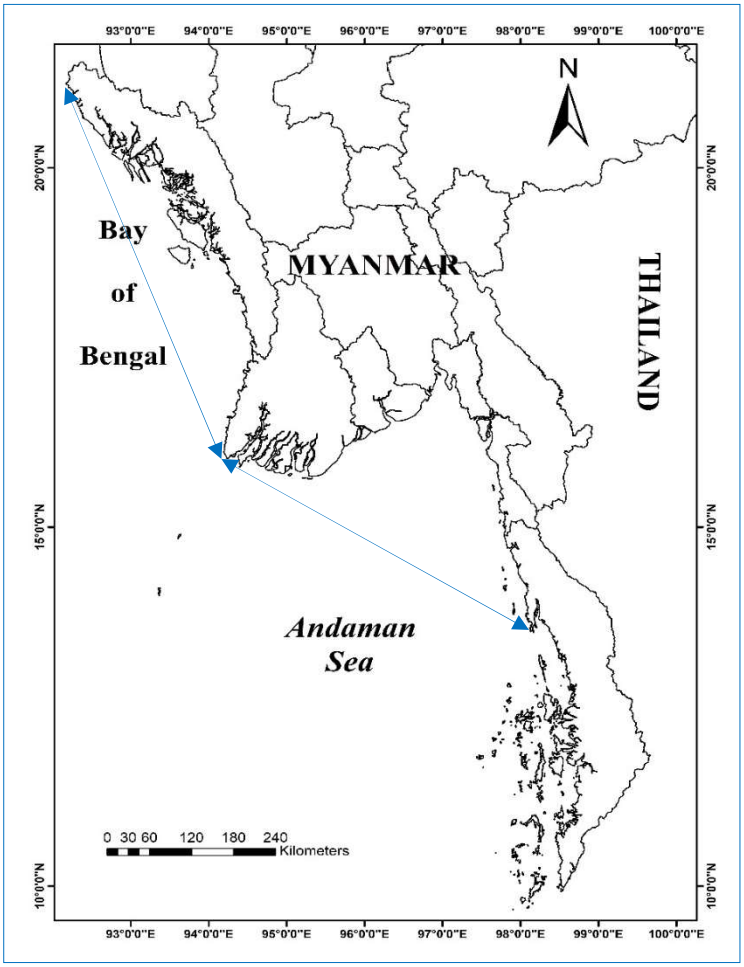

Fig. 1. Collection areas (black arrow line) of tun shells in some coastal areas of Myanmar

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 and Discussion

3.1. Tonnidae Species in Myanmar

Totally 9 species of genus *Tonna* were recorded on sandflats at depths from 10 to 150 m. A few species are only known from deeper waters, and a few mainly inhabit shallow water of Myanmar.

Tonna species were found in tropical and warm temperate, mainly living on sandy bottoms, often where seagrasses abound. They can quickly bury themselves completely in the sand, except for the tip of the fleshy siphon. Feeds mainly on holothurians, which are first paralyzed by a salivary secretion containing sulphuric acid, and then swallowed whole (Vos, 2013). Sexes separate, and fertilization is internal. Eggs lay in masses of broad, gelatinous ribbons. The free-swimming, planktonic stage is very long, lasting 3 to 8 months. Occasionally collected for food in the Indo-West Pacific. Shells are often used as decorative items (Poutiers, 1998). In Myanmar, a total of 9 species of tun shells were recorded with their local and size distribution (Tables 1-2).

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

Phylum: Mollusca (Cuvier, 1795)					
Class: Gastropoda (Cuvier, 1795)					
Order: Mesogastropoda (Thiele, 1929)					
Family: Tonnidae (Suter, 1825; Suter, 1913)					
Genus: *Tonna* (Brünnich, 1771)					
No	**Species**	**Common name**	**Distribution**		
			R	**A**	**T**
1	*T. allium* (Dillwyn, 1817)	Costate Tun	+	+	+
2	*T. canaliculata* (Linnaeus, 1758)	Channeled Tun	+	-	+
3	*T. dolium* (Linnaeus, 1758)	Spotted Tun	+	+	+
4	*T. galea* (Linnaeus, 1758)	Giant Tun	+	-	+
5	*T. lischkeana* (Küster, 1857)	Lischke's Tun	+	+	+
6	*T. melanostoma* (Jay, 1839)	Perfect lip Tun	-	-	+
7	*T. perdix* (Linnaeus, 1758)	Pacific partridge Tun	+	-	+
8	*T. sulcosa* (Born, 1778)	Banded Tun	+	-	+
9	*T. tessellata* (Lamarck, 1816)	Mosaic Tun	+	+	+

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

Table 2. Size distribution of tun shells in some coastal areas of Myanmar

No	Species	Shell size
1	*Tonna allium* (Dillwyn, 1817)	Maximum shell length 10 cm, commonly 7 cm
2	*T. canaliculata* (Linnaeus, 1758)	Maximum shell length 14.5 cm, commonly 11 cm
3	*T. dolium* (Linnaeus, 1758)	Maximum shell length 15 cm, commonly 13 cm
4	*T. galea* (Linnaeus, 1758)	Maximum shell length 23 cm, commonly 18 cm
5	*T. lischkeana* (Küster, 1857)	Maximum shell length 21.4 cm, commonly 9.2 cm
6	*T. melanostoma* (Jay, 1839)	Maximum shell length 30 cm, commonly 22 cm
7	*T. perdix* (Linnaeus, 1758)	Maximum shell length 20 cm, commonly 13 cm
8	*T. sulcosa* (Born, 1778)	Maximum shell length 13 cm, commonly 10 cm
9	*T. tessellata* (Lamarck, 1816)	Maximum shell length 10 cm, commonly 7 cm

3.1.1. Tonna allium (Dillwyn, 1817) (Fig. 2A)

Synonyms: *Buccinum allium* (Dillwyn, 1817); *Dolium costatum* (Menke, 1828); *Tonna hardyi* (Bozzetti and Ferrario, 2005).

Distribution and Habitat: Lives on sandy bottoms in the sublittoral zone at depths of 10 to 50 m. Incidentally, it is collected in shrimp trawl nets. It occasionally appears in the markets of northern Myanmar. It is widespread in the Indo-West Pacific, from East Africa to Melanesia, north to Japan, and south to New South Wales.

3.1.2. T. canaliculata (Linnaeus, 1758) (Fig. 2B)

Synonyms: *Bulla canaliculata* (Linnaeus, 1758); *Buccinum olearium* "Linnaeus" (Bruguière, 1789); *Tonna cepa* (Röding,

1798); *T. planicostata* (Dodge, 1956).

Distribution and Habitat: This species is found on fine sandy bottoms. Intertidal and sublittoral, from low tide levels to a depth of about 30 m. No precise data is available on fisheries in the area of East Africa, but the species is currently sold in the markets of Rakhine and Ayeyarwady in Myanmar. Widespread in the Indo-West Pacific, from East Africa to Melanesia; north to Japan, and south to southern Queensland.

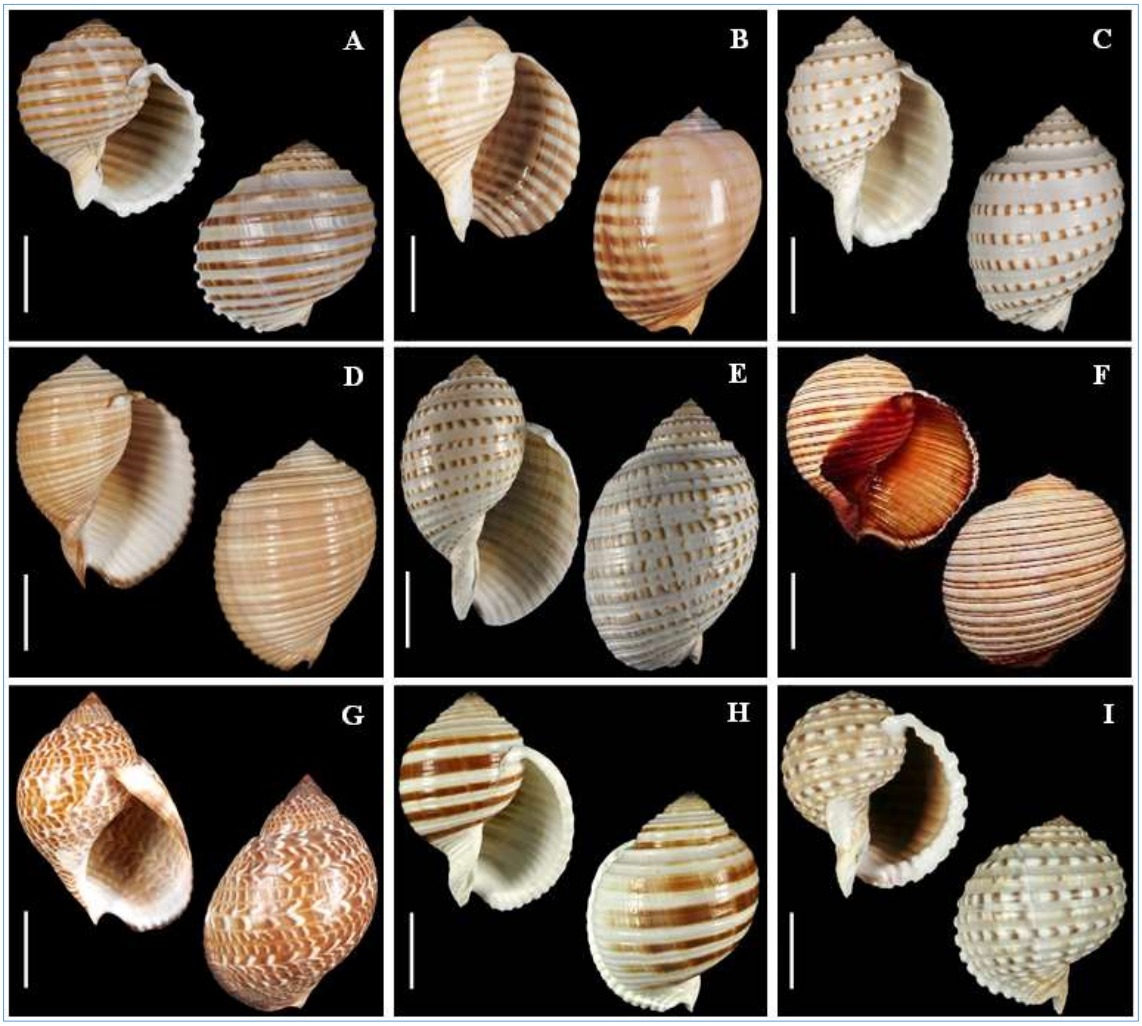

Fig. 2. Tun shells of Myanmar Coastal Water (A-I): (A) *Tonna allium* (Dillwyn, 1817); (B) *T. canaliculata* (Linnaeus, 1758); (C) *T. dolium* (Linnaeus, 1758); (D) *T. galea* (Linnaeus, 1758); (E) *T. lischkeana* (Küster, 1857); (F) *T. melanostoma* (Jay, 1839); (G) *T. perdix* (Linnaeus, 1758); (H) *T. sulcosa* (Born, 1778); (I) *T. tessellata* (Lamarck, 1816). Scale bars = 5 cm.

3.1.3. T. dolium (Linnaeus, 1758) (Fig. 2C)

Synonyms: *Buccinum dolium* (Linnaeus, 1758); *Dolium maculatum* (Lamarck, 1822).

Distribution and Habitat: This species is found on fine sand and mud bottoms. Sublittoral. Common at depths of about 10 m and more. In Hawaii, found on the outer edge of fringing reefs, at depths of more than 30 m. Incidental bycatch in fishing nets. Widespread in the Indo-West Pacific, from East Africa, including the Gulf of Oman, to the islands of the Central Pacific; north to Japan and Hawaii, and south to southern Melanesia and New Zealand; might also occur in northern Australia.

3.1.4. T. galea (Linnaeus, 1758) (Fig. 2D)

Synonyms: *Buccinum galea* (Linnaeus, 1758); *Dolium antillarum* (Mörch, 1877); *D. epidermatum* (de Gregorio, 1884); *D. fasciatum* (Pallary, 1900); *D. majus* (Pallary, 1900); *D. spirintrorsum* (de Gregorio, 1884); *D. tardinum* (de Gregorio, 1884); *D. tenebrosum* (Hanley, 1859); *D. tenue* (Menke, 1830).

Distribution and Habitat: This species is found on sandy to muddy bottoms. Sublittoral and shelf zones, from depths of about 10 to 100 m. Incidental bycatch of shrimp trawlers. Western Pacific and the eastern part of the Indian Ocean, from the Andaman Sea to Papua New Guinea; north to Japan, and south to Indonesia.

3.1.5. T. lischkeana (Küster, 1857) (Fig. 2E)

Synonyms: *Buccinum dolium* "Linnaeus" (Bruguière, 1789); *Dolium lischkeanum* (Küster, 1857); *D. marginatum* (Philippi,

1845); *D. reevei* (Hanley, 1860).

Distribution and Habitat: Typically inhabits sandy or rocky substrates in shallow marine environments, often associated with coral reefs. It prefers areas where it can find food, such as detritus and other organic material. Lischke's Tonna can be found in the tropical and subtropical waters of the Indo-Pacific region. It has been recorded in various locations, including Hawaii, The Philippines, French Polynesia, and various islands in the Pacific Ocean.

3.1.6. T. melanostoma (Jay, 1839) (Fig. 2F)
Synonym: *Dolium melanostomum* (Jay, 1839).

Distribution and Habitat: A large sea snail in the family Tonnidae, is typically found in marine environments, specifically in the Australian Exclusive Economic Zone, including areas around Norfolk Island. Its distribution includes regions in the Indo-Pacific. It inhabits deeper water regions and is commonly associated with sandy and rocky substrates where it can burrow.

3.1.7. T. perdix (Linnaeus, 1758) (Fig. 2G)
Synonyms: *Buccinum perdix* (Linnaeus, 1758); *Perdix reticulatus* (Montfort, 1810); *Dolium rufum* (Blainville, 1829); *D. plumatum* (Green, 1830); *Tonna perdix* fma *paucimaculata* (Bozzetti, 2010).

Distribution and Habitat: It is found on sandy bottoms. Sublittoral zone, to a depth of about 20 m. Most common in shallow waters, at 5 to 10 m. Caught in trawl nets or fish traps. Sometimes found in local markets of the northern Philippines. Widespread in the Indo-West Pacific, from East Africa, including Madagascar and the Red Sea, to eastern Polynesia; north to Japan and Hawaii, and south to southern Queensland.

3.1.8. T. sulcosa (Born, 1778) (Fig. 2H)
Synonyms: *Buccinum sulcosum* (Born, 1778); *Dolium fasciatum* "Martini" (Bruguière, 1789); *D. varicosum* (Preston, 1910); *Tonna fasciata* (Bruguière, 1789).

Distribution and Habitat: This species is found on fine sand and mud bottoms. Sublittoral zone, at depths of 10 to 70 m. Collected in shrimp trawls. Occasionally marketed in the northern Philippines. Central Indian Ocean and the tropical West Pacific, from Sri Lanka to Melanesia; north to Japan and south to northern Queensland.

3.1.9. T. tessellata (Lamarck, 1816) (Fig. 2I)
Synonyms: *Dolium tessellatum* (Lamarck, 1816); *D. fimbriatum* G. B. Sowerby I, 1825; *D. minjac* Deshayes, 1844; *D. fimbriatum* var. *parvulum* Tapparone-Canefri, 1878.

Distribution and Habitat: This species is found on sandy bottoms. Sublittoral, to a depth of about 40 m. Occasionally collected in fishing nets. The central part of the Indian Ocean and the tropical West Pacific, from Sri Lanka to Papua New Guinea; north to the Philippines, and south to Queensland.

3.2. Adaptations of Tonnidae

Tonnidae, like many marine gastropods, have developed several adaptations that allow them to thrive in their sandy and often dynamic environments (Table. 3). In this study, some key adaptations of tun shells are presented according to distribution and habitats.

3.2.1. Burrowing Behavior
Tonnids are semi-infaunal, meaning they spend a significant amount of time buried in the substrate. This behavior protects them from predators and helps them maintain moisture and avoid harsh environmental conditions.

3.2.2. Shell Structure
Their shells are often thick and may have a robust structure, which serves as protection against predation and physical disturbances from waves or currents. The shape of their shells can also help them better integrate into the sandy environment, reducing detection by predators.

3.2.3. Feeding Adaptations
Tonnidae are carnivorous and adapted to feed on other invertebrates. They possess a specialized radula (a toothed tongue-like structure) used for rasping and scraping their prey, typically found in the sediment.

3.2.4. Sensory Adaptations
These gastropods have developed sensory organs that help them detect changes in their environment, including the presence of predators or the availability of food, allowing for more effective foraging and escape behavior.

3.2.5. Reproductive Strategies
Some species in this family exhibit different reproductive strategies, such as larvae that are pelagic (living in the water column) for a period, allowing for dispersal to new habitats, which is essential in dynamic marine environments.

3.2.6. Physiological Adaptations
They may have physiological mechanisms to cope with varying salinities, temperatures, and oxygen levels in their habitats, allowing them to inhabit various coastal environments.

These adaptations make Tonnidae well-suited to life in their specific marine ecosystems, enhancing their survival and reproductive success.

4. Conclusion

1. Sexes in Tonnidae are separate and there is no obvious sexual dimorphism in shell characteristics.
2. Fertilization is internal, and the egg mass a gelatinous ribbon can contain up to 660000 eggs.
3. The larvae are planktotrophic, and the pelagic stage can last as long as one year.
4. Tun shells can be distinguished according to four distinct characteristics: the general shape of the last whorl, spiral sculpture, lip finalization after a growth phase, and shape of the twisted canal.
5. The shells of Tonnidae are thin but strong and lack opercula. They are inflated, thick-set, and globular, with a spire that is much shorter than the body whorl. The aperture of the shell usually occupies two-thirds of its length.

6. Tonnidae are vicious, nocturnal hunters, solely feeding on Holothuria. During the day, they hide in the sand or gravel and come out at night to hunt for food.
7. Tonnidae often reside in shallow coastal waters, typically buried in sand or mud, making them somewhat elusive to observers.
8. Overall, their distribution is broad, but they are most abundant in warm, shallow marine environments.

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