



Biodiversity Of Gastropods In Ayiramthengu Mangrove Ecosystem, Kollam, Kerala, India

Gayathry Gireesh, Sooraj Babu Suresh, Sunitha Vasudevan Sulochana,

Suja Nagampoozhi

Department of Zoology, St Aloysius College, Edathua, Alappuzha, Kerala -689573

ABSTRACT

Mangrove ecosystems are highly productive and serve as vital habitats for a wide range of faunal communities, including gastropods, which play important ecological roles. This study investigates the diversity, distribution and ecological significance of gastropods in the Ayiramthengu Mangrove Ecosystem, located in Kollam District, Kerala, India. Field surveys were conducted from October 2024 to March 2025 to document gastropod species across various microhabitats, including pneumatophores, muddy substrates, and mangrove trunks. Specimens were identified based on their morphological characteristics. Preliminary findings reveal a diverse assemblage of gastropod taxa, predominantly from the families Muricidae, Bursidae, Cerithioidea, and Babyloniidae. Notable species such as *Telescopium telescopium*, *Babylonia spirata*, *Babylonia zeylanica*, *Bufo naria echinata*, *Tibia curta*, and *Neritina pulligera* exhibit unique adaptations to the dynamic conditions of the mangrove environment. This study contributes valuable baseline data on the gastropod diversity of the Ayiramthengu Mangrove Ecosystem and underscores the urgent need for conservation efforts to protect this ecologically important and unique biodiverse ecosystem.

Key Words : Ayiramthengu, biodiversity, gastropods, mangrove ecosystem

Introduction

Mangroves are a group of trees and shrubs that occupy in the coastal intertidal zone. The trees grow in areas with low-oxygen soil, where slow-moving waters allow fine sediments to accumulate. The root system of mangroves hold huge amount of soft sediments and in some areas where dense mangrove forest become established, they are responsible for creating entire islands. Mangrove are the only 'blue carbon' forests of the ocean and also known as the coastal wood land, oceanic rainforest or tidal forests (Kathiresan, 2018). In mangrove ecosystem, gastropod and crab diversity is high compared to fishes, shrimps and insects. Gastropods, commonly known as slugs and snails belong to a large taxonomic class of invertebrates with in the Phylum Mollusca.

Kathiresan (2018), studied the conservation and management strategies of mangroves in India and recommended future directions for their restoration. Study of lipids and amino-acid composition of marine gastropod, *Tibia curta* collected from the Southwest coast of India was studied by Ragi et al. (2015). They reported that the marine gastropods are valuable sources of pharmaceutical compounds and nutritious food. Salim et al. (2017) carried out a case study on gastropod loading, utilization, and trade in Kollam district, Kerala, India. Their study reported that although mollusc production in India was comparatively insignificant in earlier times, it has increased due to the global demand for both edible and ornamental gastropods, as well as their role in generating additional income as bycatch. Shakthikulangara and Neendakara in Kerala rank among the major gastropod landing centers on the west coast of India. The study

highlighted the potential of the gastropod fishery in Kerala and also the lack of a shell craft industry in the state. The study also highlighted the declining availability of gastropods, attributed to their excessive exploitation.

Gastropod diversity along the intertidal coast of Kollam District, Kerala, India was reported by Adhithyasankar et al. (2020). In this study, they observed different varieties of gastropods, their variations in relation to spatio-temporal parameters, the ecological and economic significance of gastropods, and also their potential for biomonitoring. Sreeraj and Nisha (2022) conducted a study on the mangrove-associated shellfish diversity of the Ayiramthengu Mangrove Forest in Kerala, India. The study suggested that gastropods and crabs are abundant in the area, while the diversity of prawns and shrimps was comparatively low. Laxmilatha (2022) reviewed that marine molluscs are important components of the marine ecosystem, contributing significantly to biodiversity from coastal regions to the abyssal depths of the ocean. The diversity and habitat characteristics of malacofauna (gastropods and bivalves) in the intertidal areas of the Azheekal coast in Kerala, India were studied by Dhanyaraj et al. (2024). They examined a total of 3,602 organisms among which, 36 species of gastropods were recorded.

The study of gastropods holds significance across multiple fields, including medicine, ornamental trade, food industry, and environmental monitoring. Considering the medicinal importance, certain gastropods produce bioactive compounds with antimicrobial, analgesic, and potential neuroprotective properties. Ornamental gastropods, such as colorful marine and freshwater snails, are popular in aquariums, contributing to biodiversity awareness and trade. Edible gastropods, like Escargots and Abalones, provide nutritional benefits and support fisheries and aquaculture industries. Additionally, gastropods play a crucial role in biomonitoring, as their sensitivity to pollutants helps assess environmental health. Their shells can accumulate heavy metals and toxins, serving as indicators of ecosystem. This interdisciplinary relevance makes the study of gastropods essential for sustainable development and scientific advancement. The present study provides an information on the gastropods diversity in Ayiramthengu Mangrove Ecosystem, Kollam District, Kerala, India and also contributes to increasing public awareness on the ecological and economic importance of gastropods within the mangrove forest ecosystem.

Methodology

Study Site

The study site is Ayiramthengu Mangrove Ecosystem in Kollam (9.126°N 76.479°E), (Fig.1) which is a habitat for a number of organisms, both marine and terrestrial. The mangroves are nursery for a wide varieties of fish, other fauna like birds and otters. The Ayiramthengu Mangrove Ecosystem is about 25 acre spread. There are 9 different types of mangroves in Ayiramthengu. The place also acts as the breeding centre for different types of fishes. Kollam is a coastal hamlet whose economy primarily depends on the fishery sector, which serves as the main source of livelihood for the fishing communities. Ayiramthengu mangrove is a part of Kayamkulam estuary which is a narrow stretch of tropical backwaters in the west coast of Peninsular India. Ayiramthengu Mangrove Ecosystem is declared as an 'Environmental Hotspot' after it was ravaged by Tsunami in 2004 and faced the threat of extinction (Praseetha & Rajani, 2015).



Fig. 1 A view of the Ayiramthengu Mangrove Ecosystem

Sample Collection and Analysis

Sampling was carried out for six successive months from October 2024 to March 2025 (Fig.2). The gastropods were collected predominantly by handpicking and using forceps. This protocol was repeated twice a month during morning hours. Dippers or long handed net was used to collect small species from shallow water. The collected samples were kept in polythene bag with 10% buffered formalin. After the preliminary examination the samples were placed in separate jars with formalin. The jars were labeled properly. Digital images were taken for each sample. The preserved fauna was identified to major taxonomic groups up to species level using appropriate taxonomic keys (FAO, 1998 ; Jagadis et al., 2019) and standard taxonomic references along with available expertise.

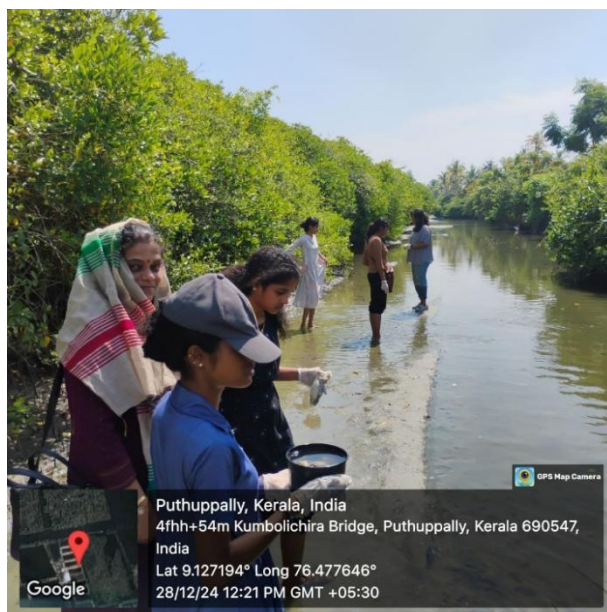


Fig.2 Sample Collection

Results and Discussion

A total of 14 species of gastropods were obtained and identified from the study site. Additionally, a gastropod *Babylonia spirata*, which showed signs of predation with Malacostraca *Dardanus calidus* (hermit crab) was also obtained during the study (Table 1).

The mangroves teemed with the vibrant presence of gastropods such as *Murex carbonnieri* from the Muricidae family, *Bufonaria echinata* of the Bursidae family, *Telescopium telescopium* from the Cerithioidae family, and *Babylonia spirata* of the Babylonidae family, each contributing to the rich biodiversity of this unique ecosystem. Whereas, *Lymnaea accuminata*, *Indothias lacera*, *Neretina pulligera*, *Cassidula nucleus* and *Cerithidae cingulata* were least abundant.

Table 1: Details of gastropods collected from Ayiramthengu Mangrove Ecosystem

Sl No.	Scientific name	Common name	Family
1	<i>Babylonia spirata</i>	Spiral babylon	Babylonidae
2	<i>Babylonia zeylanica</i>	Indian babylon	Babylonidae
3	<i>Bufonaria echinata</i>	Spiny frog shell	Bursidae
4	<i>Cassidula nucleus</i>	Air breathing snail	Ellobiidae
5	<i>Cerithidae cingulata</i>	Girdled horn shell	Potomididae

6	<i>Indothias lacera</i>	Carinate rock shell	Muricidae
7	<i>Lymnaea accuminata</i>	Great pond snail	Lymnaeidae
8	<i>Murex carbonnieri</i>	Carbonnier's murex	Muricidae
9	<i>Neritina pulligera</i>	Dusky nerite	Neritidae
10	<i>Neripteron violaceum</i>	Violet nerite	Neritidae
11	<i>Oxyloma elegans</i>	Slender amber snail	Succineidae
12	<i>Telescopium telescopium</i>	Telescope snail	Potomididae
13	<i>Turritella communis</i>	Common tower snail	Turritellidae
14	<i>Tibia curta</i>	Indian tibia	Strombidae

The systematic classification, characteristics, habitat and the significance of gastropods collected have been comprehensively documented as follows.

1. *Babylonia spirata*

Systematic position

Kingdom : Animalia

Phylum : Mollusca

Class : Gastropoda

Order : Neogastropoda

Family : Babyloniidae

Genus : *Babylonia*

Species : *spirata*

Common name : Spiral Babylon



Fig. 3. *Babylonia spirata*

Characteristics : It is characterized by broad, ovately conical and moderately short shell; spire prominent and pointed; sutural canal conspicuous, wide and deep with angulate keel-like shoulder; body whorl somewhat flattened between the shoulder and above the periphery; aperture about half of shell height; umbilicus varying from wide open to completely closed. Ground colour white; blotches of varying shapes and sizes that are generally arranged in spiral bands, colour ranging from pinkish-orange to dark brown; periostracum thin and brown. Maximum length attained is 4.9cm (Fig.3).

Habitat : Found on mud, fine sand and shell substrates. Also found among seagrass bed and benthic region covering a depth range of 0 - 60m.

Significance : *B. spirata* has rich nutritious composition and good protein profile. Its commonly known as whelks and traditionally exploited for the shell craft industry. The meat is in high demand, making it a valuable export commodity.

2. *B. zeylanica*

Systematic position

Kingdom : Animalia

Phylum : Mollusca

Class : Gastropoda

Order : Neogastropoda

Family : Babyloniidae

Genus : *Babylonia*

Species : *zeylanica*

Common name : Indian Babylon



Fig. 4 *Babylonia zeylanica*

Characteristics : Shell large up to 70 mm in height, fusiform, less solid and with less inflated whorls, body whorl narrower than *B. spirata*, sutures not canaliculated, spire high ending in dark purple apex. Aperture dark, outer lip sharp and smooth, but not flexed at top, columella smooth with heavy broad callus posterior but narrow anterior, a strong parietal ridge almost close to the outer lip, umbilicus broadly open with a row of teeth on the outer margin, fasciole with a ridge on the inner edge, anterior canal broad and deep, posterior canal not distinct, surface smooth, colour white with large brown blotches (Fig.4).

Habitat : Sandy and coastal area

Significance : *B. zeylanica* is rich in nutrients and vitamins. Its meat is a valuable food source. Shells are used in various crafts and trade.

3. *Bufonaria echinata*

Systematic position

Kingdom : Animalia

Phylum : Mollusca

Class : Gastropoda

Order : Littorinimorpha

Family : Bursidae

Genus : *Bufonaria*

Species : *echinata*

Common name : Spiny Frog Shell



Fig. 5. *Bufonaria echinata*

Characteristics : The shell has multiple spines extending outwards. Size varies between 60 to 125mm (Fig.5).

Habitat : Found on muddy and rocky substrates, mangroves and wetland ecosystem.

Significance : *B. echinata* shell is used as biomonitoring tool for heavy metal pollution. Its shells can accumulate heavy metals, providing insights into past and present levels of contamination in the marine environment.

4. *Cassidula nucleus*

Systematic position

Kingdom : Animalia

Phylum : Mollusca

Class : Gastropoda

Order : Ellobiida

Family : Ellobiidae

Genus : *Cassidula*

Species : *nucleus*

Common name : Air Breathing Snail



Fig. 6 *Cassidula nucleus*

Characteristics: A pulmonate gastropod mollusc that prefers to climb mangrove trees, where they feed on growing algae. Length 2-3cm. Shell thick and oval, with wide dark and light brown spiralling bands. Underside pinkish violet around the shell opening (Fig.6).

Habitat : Mud and wood among the mangroves in the upper littoral zone.

Significance : *Cassidula* is a rich source of protein, essential macro nutrients like calcium, sodium etc. It is a key indicator of mangrove ecosystem health and stability. It plays a vital role in nutrient cycling within the soil and can be used as a biomonitoring tool for environmental changes in mangrove areas. Additionally, this snail species exhibits high tolerance to environmental conditions, including pollution, making it a resilient member of the mangrove ecosystem.

5. *Cerithidea cingulata*

Systematic position

Kingdom : Animalia

Phylum : Mollusca

Class : Gastropoda

Order : Caenogastropoda incertae sedis

Family : Potamididae

Genus : *Cerithidea*

Species : *cingulata*

Common name : Girdled Horn Snail



Fig. 7 *Cerithidea cingulata*

Characteristics : Shell small, with 8 to 9 whorls and flat sided, with sutures being slightly impressed. Two channels on upper whorls and four on the body whorl are crossed by axial ribs, giving the shell a beaded appearance. A distinct rib is present on the body whorl of adult shells. Outer lip flared in adults, columella smooth, and the siphonal canal is short. Shell is yellowish, channels darker, and whitish near the outer edge of aperture. Operculum is light brown and horny (Fig.7).

Habitat : Found on mud and sand banks of mangrove streams in upper and mid-intertidal zones.

Significance : *C. cingulata* plays several important roles in its ecosystem, including being a food source for other animals and a potential intermediate host for parasites. It also contributes to nutrient cycling and detritus processing in mangrove habitats. They are an important food source for various animals, including fish, birds, and other invertebrates.

6. *Indothais lacera*

Systematic position

Kingdom : Animalia

Phylum : Mollusca

Class : Gastropoda

Order : Neogastropoda

Family : Muricidae

Genus : *Indothais*

Species : *lacera*

Common name : Carinate Rock Shell



Fig. 8 *Indothais lacera*

Characteristics : The shell is somewhat spiral-shaped, thick-walled, little or hardly shiny, densely covered with fine recessed stripes; these stripes are basically studded with very fine but deeply pierced points and become stronger, almost furrow-like, near the base of the last whorl. The surface is rusty-red, either monochrome or irregularly blotched with reddish spots and flames. The spire is a bit low, pointed; the whorls are sloped upwards, with a sharp, strongly projecting, tooth-shaped sharp ridge, which weakens beyond the last whorl, between which and the upper edge, a second indistinct edge develops; both are studded with strong tooth-like bumps (Fig.8).

Habitat : This species is found in benthic, muddy and rocky areas.

Significance : *I. lacera* is a carnivore, feeding on other marine invertebrates. This can impact the food web and potentially lead to changes in the abundance of prey species. It is collected for food in various part of Indo-West Pacific, notably Indonesia, Indo-China and India.

7. *Lymnaea accuminata*

Systematic position

Kingdom : Animalia

Phylum : Mollusca

Class : Gastropoda

Family : Lymnaeidae

Genus : *Lymnaea*

Species : *acuminata*

Common name : Great Pond Snail



Fig. 9 *Lymnaea accuminata*

Characteristics : Shells are typically conical and brownish, with 3-5 whorls that increase in size. They are characterized by a thin, oval shape, with dimensions ranging from 1.2-2.7cm in length and 1.9-3.5cm in width. The aperture is oval and large, and the shell lacks an operculum (Fig.9).

Habitat : This snail lives in water bodies such as lakes, streams, mangroves and wetlands with thick vegetation. It easily survives in polluted waters.

Significance : *L. accuminata* is a host for many species of trematodes. It is the first intermediate host for *Schistosoma nasale* and *S. spindale*. It is also an intermediate host for the liver flukes *Fasciola gigantica* and *F. hepatica*, which cause the infectious disease fasciolosis in humans and other mammals.

8. *Murex carbonnieri*

Systematic position

Kingdom : Animalia

Phylum : Mollusca

Class : Gastropoda

Order : Neogastropoda

Family : Muricidae

Genus : *Murex*

Species : *carbonnieri*

Common name : Carbonnier's Murex



Fig. 10 *Murex carbonnieri*

Characteristics : Shell very large (up to 125mm in length), with eight subangulate teleoconch whorls. Protoconch of two and one-half to three and one-half convex volutions, terminating at sharp, crescentic varix. Spiral ornamentation on first two teleoconch whorls very weak, masked by axial ornament; third whorl with five weak spiral cords, those at shoulder and periphery somewhat heavier; on fourth whorl three or four secondary threads on subsutural ramp. Tertiary threads intercalated between spiral cords anterior to shoulder on subsequent whorls; body whorl and siphonal canal covered by numerous spiral cords of three orders of magnitude. Axial ornamentation on first two teleoconch whorls of nine angulate ribs, each flattened on subsutural ramp and drawn out into two, almost closed, lamellar spinelets, larger one at shoulder and much smaller one at periphery (Fig.10).

Habitat : Live in the intertidal or shallow subtidal zone, among rocks and corals.

Significance : *Murex* can be used in antiquity to describe spiny sea snails, especially associated with the production of purple dye. This dye was traditionally used in royal robes and various ceremonial or ritual garments, symbolizing prestige and significance. As a predator, *M. carbonnieri* plays a vital role in controlling populations of other marine invertebrates within its habitat.

9. *Neritina pulligera*

Systematic position

Kingdom : Animalia

Phylum : Mollusca

Class : Gastropoda

Order : Cycloneritida

Family : Neritidae

Genus : *Neritina*

Species : *pulligera*

Common name : Dusky Nerite



Fig. 11 *Neritina pulligera*

Characteristics : *N. pulligera* grows upto 40mm length. It has a dark brown to black shell and an orange aperture. The spire is very low (Fig.11).

Habitat : Found in both freshwater and brackish water.

Significance : *N. pulligera* is an algae controller, excellent at cleaning algae from aquarium surface, reducing the need for manual scrubbing. This snail is safe for community tanks. Their striking black helmet-shaped shell adds a unique and subtle visual appeal to aquariums.

10. *Neripteron violaceum*

Systematic position

Kingdom : Animalia

Phylum : Mollusca

Class : Gastropoda

Order : Cycloneritida

Family : Neritidae

Genus : *Neripteron*

Species : *violaceum*

Common name : Violet Nerite



Fig. 12 *Neripteron violaceum*

Characteristics : The shell is small and takes an ovate shape reminiscent of a crepidula. The spine is quite small. The columellar olate is flat and is adorned with 7 -8 small tooth like projections. The central radula has a slightly broader cusp, while the cusps of v- lateral are not particularly large. The aperture is wide and the outer lip is thick with sharp edges. The shell's external surface colour varies, often featuring some thick black or brown bands. The interior of the aperture can be reddish brown to pink, and sometimes white (Fig.12).

Habitat : Mostly found in brackish and freshwater areas.

Significance : It is mainly a part of ornamental pet trade for freshwater aquarium. The snail's attractive appearance and relatively easy care have made it a popular choice for aquarium enthusiasts. It can serve as an indicator of environmental changes, providing valuable information for conservation efforts.

11. *Oxyloma elegans*

Systematic position

Kingdom : Animalia

Phylum : Mollusca

Class : Gastropoda

Order : Stylommatophora

Family : Succineidae

Genus : *Oxyloma*

Species : *elegans*

Common name : Slender Amber Snail



Fig. 13 *Oxyloma elegans*

Characteristics : The shell usually has fewer than 3 whorls. The body whorl is very large and the spire is short. The shell is amber coloured with irregular radial growth lines. The width of the shell is 6–8 mm. The height of the shell is 9–17 mm (Fig.13).

Habitat : *O. elegans* occurs among vegetation in moist habitats such as marshes.

Significance : *O. elegans* can serve as a food source for various animals, particularly predators in their habitat. This species can be used as a bioindicator of environmental quality, helping to assess the health of ecosystems. Shells of *Oxyloma* can be used for ornamental purposes and lime industry.

12. *Telescopium telescopium*

Systematic position

Kingdom : Animalia

Phylum : Mollusca

Class : Gastropoda

Subclass : Caenogastropoda

Family : Potamididae

Genus : *Telescopium*

Species : *telescopium*

Common name : Telescope Snail



Fig. 14 *Telescopium telescopium*

Characteristics : The shell ranges from 8–13cm when fully grown. The shell is thick and heavy relative to the snail itself. The opening of the shell is perpendicular to the shell's longitudinal axis, creating the straight sided cone shape. *T. telescopium* shells are either black or very dark reddish brown. They also have a fold on the columella of their shells, which makes them the only gastropod in the Potamidae family to have so. Despite the obvious colour of the shell they are often covered in barnacles and mud obscuring the natural colour of it (Fig.14).

Habitat : They are concentrated underneath the muddy surface of mangrove foreshores and on mud-flats.

Significance : *T. telescopium* is used as biomonitor of copper, zinc and lead in tropical inter tidal regions. It is considered as traditional food in regions of Southeast Asia and more specifically Singapore. They are also used in the synthesis of medicines used against wheezing. Crushed shell powder is used as an adsorbent to reduce copper ions in synthetic waste water.

13. *Tibia curta*

Systematic position

Kingdom : Animalia

Phylum : Mollusca

Class : Gastropoda

Order : Littorinimorpha

Family : Rostellariidae

Genus : *Tibia*

Species : *curta*

Common name : Indian Tibia



Fig. 15 *Tibia curta*

Characteristics : A heavy shell with a straight-sided spire and an inflated body whorl. A thick columellar callus begins at the lower end of the penultimate whorl and eventually joins the siphonal canal. The aperture narrows above and below. Seen from the rear, the outer lip has a well-defined rim extending to the base of the siphonal canal; its lower half has five or six short, blunt points, below which is a shallow stromboid notch. Pale brown color, with white aperture and columellar callus. The shell is milky brown in colour and have a gloss white interior (Fig.15).

Habitat : Benthic species, mainly found on sandy place offshore.

Significance : Shells can be used in aquarium decoration, crafts, ornaments for ritual worship and in lime industry. *T. curta* contains lipids and amino acids, making it a potential food source. It can help monitor the impact of pollutants in the marine environment.

14. *Turritella communis*

Systematic position

Kingdom : Animalia

Phylum : Mollusca

Class : Gastropoda

Order : Caenogastropoda incertae sedis

Family : Turritellidae

Genus : *Turritella*

Species : *communis*

Common name : Common Tower Shell



Fig. 16 *Turritella communis*

Characteristics : The tall, conical shell is brownish-yellow to white. It is sharply pointed and contains 16-20 enlarged whorls. The spiral ridges are numerous and may have a beaded appearance. The shell grows to a length of 3cm and may become 1 cm wide. The angulate shell aperture is small. The outer lip is crenulate. There is no umbilicus. The concave operculum is small and circular and has numerous pinnate bristles on its edges. The snail shows white markings on the tentacles, siphon and foot. This small foot shows dark spots and streaks (Fig.16).

Habitat : This tower shell can be found in the sub littoral zone to depths up to 200 m, where it is usually found burrowed in gravelly mud. There it remains stationary for long periods. It can be locally abundant on muddy sediment in shallow waters.

Significance : This species is considered as 'Ecosystem engineer' as it constitutes a substratum for numerous epibionts. Its empty shell provides refuge from predation, lowering the levels of physical or physiological stress for the organism living inside.

Occurrence of *B. spirata* with hermit crab *Dardanus calidus*



Fig. 17 *B. spirata* with *D. calidus*

A specimen of *B. spirata* inhabited by a hermit crab, *D. calidus* was recorded at the study site. *D. Calidus*, commonly is a scavenger, feeding on decaying matter from the sea bed. It has been collected from depths greater than 100m, but is more typically found in shallower water. Hermit crabs do not produce their own shell, they use an old shell made by another animal, such as a marine gastropods. They have soft bodies, so they need their shell for protection, and have adapted a hook-shaped tail and strong legs to hang on to the

inside of their shell. Shells provide protection from predators, and retains water to keep their soft body and gills moist. As the crab grows, it must find, examine and test out a new, large shell.

Gastropods are the largest and most diverse class of mollusc and include species that are well studied with in the area of taxonomy, aquaculture, biomineralization, ecology, microbiome, and health. When compared to other ecosystems, mangrove ecosystem has high diversity of fauna ranging from various types of fishes, gastropods, shrimps and crabs. Gastropods are closely associated with mangrove ecosystems, which provide them with habitat, spawning grounds, shelter and a rich food supply that supports their growth. The distribution and density of gastropods are influenced by their habitat, environmental food availability, predation etc.

Dhanyaraj et al. (2024) studied the diversity and distribution characters of malacofauna (gastropods and bivalve) in the intertidal area of Azheekal coast, Kerala. The field study recorded 36 species of gastropods which indicated rich diversity of mollusc along the study site. Similar to the above finding, the present study also reported high diversity of gastropods at Ayiramthengu Mangrove Ecosystem.

The ornamental gastropods are emerging source in the Indian seas. In the present study, the majority of gastropod species obtained were found to possess significant economic value. Species such as *C. nucleus*, *B. spirata*, *B. zeylanica*, *T. telescopium*, *I. lacera*, *C. cingulata*, *M. carbonnieri*, *N. pulligera* and *T. curta* are mainly used for edible purpose and are exported to many countries like Japan, Taiwan, Thailand and China (Anjana, 2007; Khade & Mane, 2012; Ragi et al., 2016; Muhammed et al., 2022).

The availability of plenty of gastropod shells in the present study supports the findings of Ranjana et al. (2019) from Paradeep Mangrove Ecosystem. The shell fish diversity of Ayiramthengu Mangrove Ecosystem studied by Seeraj and Nisha (2022) suggested that there was an abundance of gastropods and crabs in the area and prawns and bivalves were comparatively low. They discussed the edible and ornamental demands of gastropods. Many gastropods collected in the present study have commercial and ornamental importance, which substantiates the study of Salim et al. (2017) on the landing, utilization with emphasis on nutritional value and ornamental importance and trade of gastropods in Kollam, Kerala. The shells of *M. carbonnieri*, *T. curta*, *N. violaceum*, *T. communis*, *B. spirata*, *B. zeylanica* and *C. cingulata* are used to make attractive models, rings, studs, bangles, ash trays, door and window curtain, bath stands, lampshades, keychains, antiquity etc (Anjana & Kripa, 2007; Appukuttan & Ramadoss, 2000; Ragi et al., 2016).

Molluscan shells are important for various commercial purpose such as poultry, medicine, lime production, industrial raw materials, handicraft and interior design. The Ayiramthengu mangrove is remarkably rich in both marine and freshwater biodiversity. Commercially important gastropods, valued for their use in food, shells, and various products, play a vital role in supporting the local economy as well as the marine ecosystem. However, overharvesting may lead to a decline in their populations, threatening the balance of both marine and freshwater biodiversity and jeopardizing the livelihoods of the communities that depend on them.

The diversity of Conidae (Caenogastropoda: Conidae) along the Kerala coast was studied by Ravinesh et al. (2022). However, their findings differ from the gastropod diversity observed in the present study at Ayiramthengu mangrove, where notably low presence of Conidae was observed. In a study on the current status of the molluscan fishery, Laxmilatha (2022) highlighted the ecological significance of marine molluscs in maintaining biodiversity. Species such as *B. echinata*, *T. telescopium*, and *C. cingulata* are commonly used as biomonitoring agents and bioindicators. Due to their high capacity to accumulate heavy metals compared to other aquatic organisms, gastropods are considered effective organisms for environmental monitoring (Yap et al., 2009; Joseph et al., 2016; Bhuban et al., 2018; Nima et al., 2019).

Conclusion

The study of gastropods in the Ayiramthengu Mangrove Ecosystem, located in Kollam District, Kerala, India, has yielded valuable insights into their diversity, ecological roles, and conservation status. The findings highlight the rich biodiversity of gastropods and emphasize their vital role in maintaining ecological balance, contributing to nutrient cycling, and serving as bioindicators of environmental health. This research documented a wide range of gastropod species adapted to both brackish and freshwater conditions. Their presence and distribution were found to be influenced by factors such as salinity, substrate type, and anthropogenic pressures. While some species were observed in abundance, others were present in lower numbers. Visual assessments of the study site during the sampling period revealed significant impacts of habitat degradation and pollution in the area. Conservation efforts, including habitat restoration, are essential to preserve the biodiversity of the Ayiramthengu Mangrove Ecosystem. This study provides a valuable baseline for future conservation initiatives and underscores the importance of protecting mangrove ecosystems to ensure the long-term sustainability of their biodiversity.

Acknowledgement

The authors wish to express their gratitude to the Head of the Department of Zoology, St Aloysius College, Edathua, Alappuzha and The Principal, St Aloysius College, Edathua, Alappuzha. The first and second authors wish to express their gratitude to Ms. Vijayalakshmi, M. for suggesting this topic of study.

References

- Adhithyasankar, S., Fathima, N., & Nithin. R. (2020). Gastropod diversity along the inter-tidal coast of Kollam, Kerala. Post graduate dissertation submitted to the Department of Zoology, T .K .M College of Arts and Science, Kollam. pp 1-68.
- Anjana, M. (2007). Eco- biology and Fisheries of the Whelk, *Babylonia spirata* (Linnaeus, 1758) and *Babylonia zeylanica* (Bruguiere, 1789) along the Kerala coast, India. Ph.D Thesis submitted to Cochin University of Science and Technology. pp : 1- 198.
- Appukuttan, K.K., & Ramadoss, K. (2000). Edible and Ornamental Gastropod Resources in Marine Fisheries Research and Management, (Eds. Pillai, V.N., & Menon, N.G.), Published by ICAR-CMFRI, Kochi. pp: 525-535.
- Bhuban, M.M., Ashimkumar, N., Chiranjeeb, D., Ayan, M., & Nimai, C.S. (2018). Ecological assessment of Hooghly-Bhagirathi river system through the study of diversity of Bivalves and Gastropods in relation to the physio-chemical parameters. International Journal of Current Microbiology and Applied science, 7(7), 2700-2715.
- Dhanyaraj, D., Kiran, P., Radhika, P.R., & Anjana, V.S. (2024). Diversity and habitat characteristics of Malacofauna (Gastropoda and bivalves) in the intertidal areas of Azheekal coast , Kerala , India . Journal of Marine Biological Association of India, 66(2), 59-63.
- FAO, 1998. World Soil Resources Report
- Jagadis, I., Mohamed, K.S., Venkatesan, V., & Kavitha, M. (2019). Picture Book on Marine Gastropods published by ICAR-CMFRI, Kochi.
- Joseph, T.U.R ., & Ramesh, K.B. (2016). Heavy metal risk assessment in Bhavanapadu Creek using three Potamidid snails- *Telescopium telescopium*, *Cerithidea obtusa* and *Cerithidea cingulata*. Journal of Environmental and Analytical Toxicology. 10.4172/ 2161 - 0525. 1000385.
- Kathiresan , K . (2018). Mangrove forest of India , Current Science Association. 114 (5), 976-981.
- Khade, S.N., & Mane, U.H. (2012). Diversity of Bivalves and Gastropods, Molluscs of some localities from Raigad district, Maharashtra, Westcoast of India. Recent Research in Science and Technology 4 (10), 43-48.
- Laxmilatha, P. (2022). Mollusacn Fisheries : Present Status, Manual on Winter School on Recent Development in Taxonomic Techniques of Marine Fishes for Conservation and Sustainable Fisheries Management, Published by ICAR - CMFRI, Kochi. pp 1-690.

Muhammed, F.P., Ode, M.L., & Khoirul, A. (2022). Freshwater Neritidae in Southwest Sulawesi , Indonesia . Aquaculture , Aquarium , Conservation & Legislation, 15 (2), 707 - 715.

Nima, P., Arezoo, B., & Nasrolahzadeh, S. (2019). Shells of *Bufonaria echinata* as biomonitoring materials of heavy metals (Cd, Ni and Pb) pollution in the Persian Gulf: with emphasis on the annual growth sections . Iranian Journal of Fisheries Sciences, 18 (2), 256-271.

Praseetha, T., & Rajani, V. (2015). A preliminary study on ecology of Ayiramthengu mangrove - Kollam Dist., Kerala, India . Innovative Science , Engineering and Technology, 2 (9), 234-239 .

Ragi, A.S., Leena, P.P., & Nair, S.M. (2016). Study of lipids and amino acid composition of Marine Gastropod, *Tibia curta* collected from the southwest coast of India. World Journal of Pharmaceutical Science, 5(3): 1058-1076.

Ranjana, Y., Pratyushkumar, M., Damini, D., Gitanjali, B., Shesdev, P., & Arunendra, M. (2019). Diversity of gastropods and bivalves in the mangrove ecosystem of Paradeep, East coast of India : a comparative study with other Indian mangroves ecosystems. Molluscan Research, 39 (4) , 325-332.

Ravinesh, R., Bijukumar. A., & Preetha, K., (2022). Diversity of conidae (Caenogastropoda : Conoidea) from the Kerala Coast , India . Molluscan Research, 42(1), 73-89.

Salim, S.S., Jagadis, I., Venkatesan, V., Ramees, R.M., & Nashad, M. (2017). Gastropod landing, utilisation and trade in India : A case study from Kollam, India. Journal of the Marine Biological Association of India, 59 (1) , 93-97.

Sreeraj, B., & Nisha, P.T. (2022). Study on mangrove-associated shellfish diversity of Ayiiramthengu Mangrove Forest, Kollam, Kerala. Ecology, Environment and Conservation. 29 : 103-110.

Yap, C.K ., Noorhaidah, A., Azlan, A. , Nor, A.A.A., Ismail, A ., Ismail, A.R., Siraj, S. S., & Tan, S.G. (2009). *Telescopium telescopium* as potential biomonitors of Cu, Zn, and Pb for the tropical intertidal area. Ecotoxicology and Environmental Safety, 72 (2), 496-506.

