coast track

Issues and Challenges in Coastal Management

Mollusca of India

Inside....

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Editorial Note

Mollusca are one of the most diverse groups of animals on the planet, with at least 50,000 living species (and more likely around 200,000) which range in size from 20-meter-long giant squid to microscopic aplacophorans, a millimeter or less in length, that live between sand grains. It includes such familiar organisms as snails, octopuses, squid, clams, scallops, oysters, and chitons.

This group is one of the early formed organisms from Ediacaran period (635 millions year ago - end of the Proterozoic Eon, and the beginning of the Phanerozoic Eon). The molluscs spread out rapidly during the Cambrian explosion. The bivalves and gastropods attained maximum population density during the Ordovician. Aplacophorans, chitons, scaphopods and cephalopods radiated later in the Palaeozoic. Monoplacophorans appear to have experienced a Late Cretaceous bottleneck (Kano et al. 2012), which can be ascribed to their colonization of the deep sea as a refugium, and the series of Cretaceous ocean anoxic events (Jenkyns 1980), which would have limited their distribution episodically. Several aspects of molluscan evolution still need scrutiny.

These creatures are extremely important members of many ecological communities. They are ubiquitous morphologically homogeneous population spread through every possible environment. They are also part of almost every ecosystem in the world. They range in distribution from terrestrial mountain tops to the hot vents and cold seeps of the deep sea. While most are found in marine environment, the gastropods are found in the sea and on its littoral, in brackish-water and fresh water, both rivers and lakes, and on land in surroundings showing every degree of humidity. The lamellibranchs, are mainly marine, with a few fresh-water species. Amphineura, Scaphopoda, and Cephalopoda are wholly marine. These organisms have been important to humans throughout history as a source of food, jewelry, tools and even pets.

This issue of Coast track furnishes the detailed information on mollusca of India, which will be more useful to the Stake holders.

S.SRINIVASALU

MOLLUSCA OF INDIA - THE NEED FOR CONSERVATION

K.VENKATARAMAN

Mollusca, meaning “soft-bodied”, is one of the largest phylums in the animal kingdom. The word mollusc (or mollusk) derives from the Latin word “mollis,” which means “soft.” There are an estimated 200,000 species of mollusk worldwide accounting for nearly a quarter of all marine life. Familiar species of mollusk include snails, squid, octopuses, clams and oysters. According to fossil records, the first mollusks appeared on earth some 600 million years ago. It took another 100 million years before mollusks first appeared in and near freshwater lakes and streams. It is only within the last 100 million years that mollusk has fully evolved to their present states, populating diverse land, freshwater and marine habitats worldwide.

Molluscs have lost much of their historical usage as medicine, tools or religious symbols but their economic value as a source of protein and as ornaments or decorations is possibly greater now than ever before. Ornamental shells are still traded in huge quantities and perhaps even more so today because of the increase of trade via electronic media especially Internet. Throughout the world, gastropod, cephalopods and bivalve shells are bought or collected as 'portable memories' when people are vacationing. Tropical shells, with their attractive colours and hues, various morphologies with intricate spikes and curves, are especially popular souvenirs. The development of international and local tourism in the tropics over the last three decades has increased the demand and trade in souvenirs, with consequent pressures on marine resources.

Mollusks are second largest group of animal after insect, largest of all groups in the marine ecosystem which are highly adaptive and occupy all possible habitats except the aerial. Originated from sea, they spread into freshwater and from there into the land, where they now almost equal to the marine forms in species numbers. The striking feature of the phylum Mollusca is the presence of mantle and radula not found in any other groups. At present molluscs are represented by seven classes of which, five occur in India.

Molluscs have successfully adapted to different ecological conditions. They act as important component of biomass. They are first living creatures to have hard shells and the earlier man was perhaps attracted to these shells for which the association of man and molluscs date back to prehistoric time. They are most part benthonic, but many have pelagic also. Primarily inhabitant of the intertidal and littoral zones of the oceans molluscs descend into a greater depth. A conservative estimate of species by Winckworth is 31,643 marine, 8765 freshwater and 24,503 land molluscs.

Freshwater molluscs play a vital role in the ecosystem, particularly their role in food chain linking up edible fishes, which are major resources of protein for human. Not only the aquatic animals depend on them as food, but also human in many parts of the country, harvests quiet a good amount of their daily food source. As vector, they are transmitter of many diseases in livestock and man and play intermediate

host for many trematods of which Schistosomiasis is reckoned as a potential threat to human population. On the other hand many larval bivalves are parasitic on gill of fishes.

Land molluscs have significant role in terrestrial ecosystems by virtue of their numerical superiority they are large extent regulate the activities of other group of organisms. They play important link in the natural food chain by way of decomposing and degradation of leaf litter. They also serve as a major supplier of calcium to the soil and also food source for various small vertebrates such as frogs, lizard, snakes and bird etc.

Molluscs contribute an important component in the marine biodiversity. Occurs in different habitats, diversity in shell shape, sculpture and colouration they have consumptive and productive uses besides their role in the marine ecosystems. Productive uses are in manufacturing the ornamental and household articles, shell lime industries; poultry feed activities, raw material for cement and rayon industries and potential resources of biomedical compounds.

Molluscs were collected in the beginning out of amateurish love or curiosity of shells. Collections were made at random and preserved for further study. Many distinguished naturalists such as John McClelland, Edward Blyth, W. Blanford, H. Blanford, T.Cantor, Francis Day, H. H. Godwin Austen, T. Hardwicke, B. Hodgson, G. Nevill, H. Nevill, F. Stoliczka, W. M. Sykes, W. Theobald, S. R. Tickell, J. Anderson and H. Wood-Mason significantly contributed in documenting the fauna of Indian subcontinent in early years of eighteen century. Besides, several scientific teams from the Zoological Survey of India (ZSI) surveyed molluscs of India both on the terrestrial and aquatic environment which are part of the National Zoological Collection. However, the history of first molluscan collections in ZSI dates back to 1872. Dr. J. Wood-Mason, an officer of the Indian Museum collected the first molluscan specimens from the Andaman Islands. Perhaps this was due to the series of expeditions carried out during 1865-1886.However, registering the collections would have started in the later part of the expedition. The records present in the Indian Museum shows that Murex trapa, also commonly known as Rare-spined Murex, is the first registered specimen of the then Indian Museum, which was collected by J. Barnett, Esq. Branch Pilot, P.V. Cassandra on 22.08.1884. The incidence of schistosomiasis after the First World War, led to a search for its possible intermediate host in India, which in turn promoted studies on the taxonomy and distribution of freshwater molluscs. The launching of RIMS Investigator in 1881 A. D. formed an important milestone in the study of marine molluscs. Thus studies were initiated on land, marine and freshwater molluscs of India even before the establishment of the Zoological Survey of India.

Importance: Molluscs play important roles in almost every known ecosystem on land and in the sea. Many molluscs are links in food chains, the pathways and the animals that are food for humans and other animals. Nearly 20% of reef fishes feed on molluscs in the coral reef ecosystem. Throughout the world oceans, squids and octopus are the animals on which fishes, whales, dolphins, and sea birds mainly feed. Sustainable use of molluscs in the long run may pave way for the restoration of species balance in nature, especially in the ecologically sensitive, biotically rich, fragile areas like sea grass, mangrove and coral reef ecosystem.

Diversity of Mollusca

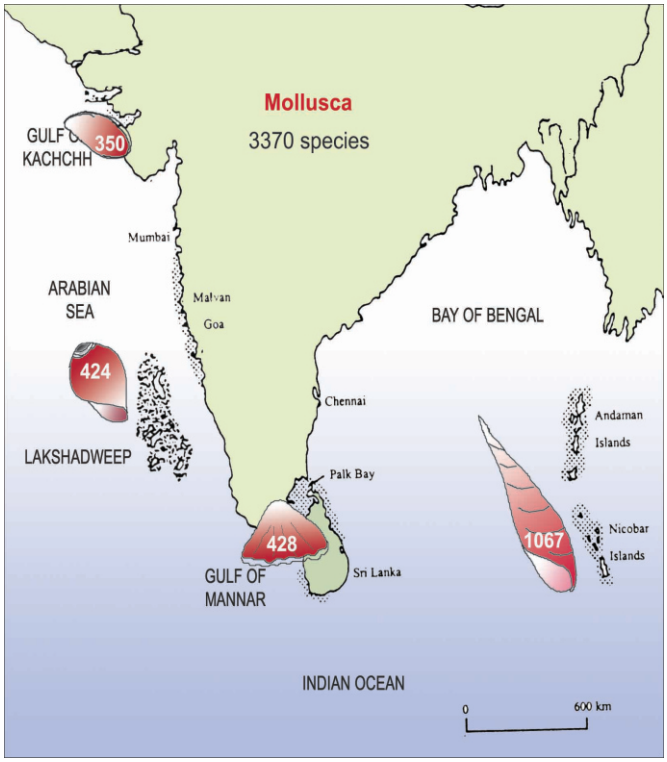
World: Estimation of global diversity of molluscs varies from 80,000 to 1,00,000. According to one estimate there are 62,000 species of gastropods, 9200 species of bivalves, 500 species of polyplaphora, 400 species of cephalopods, 300 species of scaphopods, 130 species of aplacophorans and five species of monoplacophorans.

A more conservative estimate gives the number as 31,663 marine, 8765 freshwater and 24,503 terrestrial species, total 64,931. Family wise estimation reveals a total of 586 families occur in this phylum and 292 families (48.48%), presumably occurs in India and so far, 5155 species are reported.

Diversity of families of mollusca in India

Number of families in different ecosystems				
Class	**Marine**	**Freshwater**	**Terrestrial**	**Total**
Polyplacophora	9	-	-	9
Gastropoda	144	12	34	181
Bivalvia	62	9	-	71
Scaphopoda	3	-	-	3
Cephalopoda	28	-	-	28
Total	**246**	**23**	**34**	**292**

India: The number of species of molluscs recorded from various parts of the world varied from 80,000 to 1,50,000. The history of malacological study in India is immense and interesting. Studies on Indian molluscs were initiated by the Asiatic Society of Bengal (1784) and the Indian Museum, Kolkata (1814). Benson in 1830 was perhaps the first author to publish a scientific paper on Mollusca. Between the years 1830 and 1865 he published a total of about 90 papers dealing with the land and freshwater molluscs of the Indian subcontinent. The beginning of the 20th century is the most productive and significant period in the history of Indian Malacology, with the Zoological Survey of India, Central Marine Fisheries Research Institute and several maritime universities contributing immensely to the knowledge of the molluscan fauna. In India, till today, 5155 species of Mollusca have been recorded from freshwater (22 families, 53 genera 183 species), land (26 families, 140 genera and 1487 species) as well as from marine habitats (242 families 591 genera, 3400+ species) (Subba Rao, 1991, 1998, 2000; ZSI, 2011). From the available data, it is possible to identify certain areas having rich molluscan diversity. Andaman and Nicobar Islands have a rich molluscan 23 diversity, which include over 1000+ species from the marine region (Subba Rao, 2000) Gulf of Mannar and Lakshadweep have 428 and 424 species respectively (Venkataraman, et al., 2004). Eight species of Oysters, two species of mussels, 17 species of clams, six species of pearl oysters, four species of giant clams, one species of window-pane oyster and other gastropods such as Sacred chank, Trochus, Turbo as well as 15 species of cephalopods are exploited from the Indian marine region.



Terrestrial Mollusca: Indian land molluscs consist of 1129 species under 138 genera and 34 families, four orders and three subclasses, which is less than 5% of the total world fauna, although India have 2% of the total global land area with 78% are endemic. This estimate is on a conservative side since much of the eastern as well as western Himalayan regions and central part of India are yet to be inventoried which may reveal several new species and records for India. The dry north western part is just about 100 species with an approximate 50% endemic. Of 1129 species 293 present in north-east, approximately 26% of total Indian species with 80% endemic; north-western part with 100 species with 50% endemic; 300 species from Western Ghat with 70% endemic; a few species from north-west; gangetic plains about 50 species; desert area (Gujarat, Rajasthan and Punjab) with 16 species; The fauna in the northwest includes a few Palaearctic elements. Above 300 species of land molluscs are known from Western Ghats and the peninsular India, the endemic level of which is around 70%. Apart, islands are very important hotspot for land Mollusca and diversity and endemism is high. Andaman and Nicobar Islands with 100 species and about 80% are endemic to India. The Andaman group of islands accommodate 56 species, 34 of which are endemic and the Nicobar group of islands have 51 species with 40 endemic.

Freshwater Mollusca: The diversity of molluscs in freshwater is comparatively poor than the land and marine forms. Against the estimated 8765 global species, 210 species (4.17%) belongs to 59 genera and 29 subgenera under 23 families are reported from Indian subcontinent. A few endemic and monotypic genera from Indian freshwater molluscs are Cremnoconchus (Western Ghats), Mysorella (Monotypic genus from Peninsular Plains), Mainwaringia (Monotypic genus from Gangetic delta and estuaries of Gujarat).

Diversity of freshwater species in India

Class	order	Families	Genera	Species
Gastropoda	Archaeogastropoda	1	4	14
	Mesogastropoda	9	24	118
	Basommatophora	4	9	47
Bivalvia	Acroida	1	1	3
	Unionoida	4	10	67
	Veneroida	4	8	43
Total		**23**	**56**	**292**

Marine Mollusca: The diversity is observed more in the marine molluscs in India especially on east and west coasts as well as the Lakshadweep and Andaman and Nicobar Islands. In India molluscs occurs in diverse habitats such as mangroves, coral reef, rocky coasts, sandy beaches, sea grass beds and also at grater depths in the sea. Globally, the class Polyplacophora is represented by one order, three suborders, nine families and 49 genera; of these, 21 species belonging to 10 genera under five families within two suborders and one order are found in India. There are 652 species of marine bivalves are recorded from the Indian subcontinent, of which 173 genera, 69 families, 11 orders, four subclasses and 88 species are endemic to India. Eighteen species of Scaphopoda have been reported from India under two orders, two families and two genera. The order Dentalida is represented by one family, one genus and 17 species, and there is one species under the order Cadilida. The order Dentalida comprises family Dentalidae with one genus and 17 species, of which four species are endemic to India: three from Andaman and Nicobar Islands and one from the east coast. The order Cadilida consists of the family Cadilidae having only one species under genus Cadulus, from the east coast and Andaman and Nicobar Islands only. The class cephalopoda contains 650 species of nautilus, cuttlefish, squid and octopus. A total of 62 species belonging to 17 genera and 10 families of the class Cephalopoda are reported by various research team workers from the Zoological Survey of India, Kolkata. All the living cephalopods belong to two subclasses - Nautiloidea and the Coleoidea - which occur in the Indian coastal waters.

Molluscan Diversity

(Image source:https://www.researchgate.net/figure/Molluscan-diversity-Anterior-faces-to-the-right-in-all-aspects-Polyplacophora_fig1_287223543)

Molluscs have adjusted themselves to diverse habitats, from the deep sea (3000 m) of Andaman and Nicobar Islands to higher elevation (about 5000 m) in the Himalayas. But the diversity and abundance is more in the rocky inter tidal zone along the coasts and in the coral reef ecosystems of Andaman and Nicobar Islands, Lakshadweep, Gulf of Kachchh and Gulf of Mannar. Sandy coasts support less but typical, mostly burrowing and interstitial forms.

Diversity of marine molluscs of India

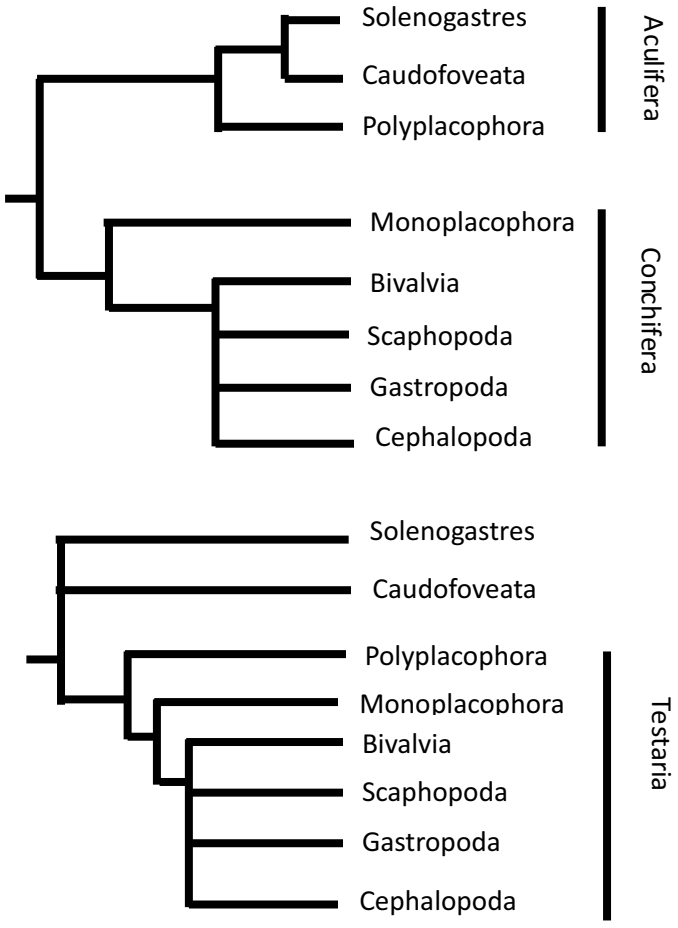
Class	Families	Genera	Species
Polypacophora	9	13	41
Gastropoda	144	311	1820
Bivalvia	62	150	670
Scaphopoda	3	3	20
Cephalopoda	28	85	210
Total	**246**	**562**	**2761**

The molluscs range in size from 24 m long giant squid to microscopic aplacophorans, a millimetre or less in length. Smallest specimens are Cyclostrema (0.75 mm) from marine genus and Gyraulus (4.00 mm) from freshwater and Charonia tritonis (35 cm) collected from Nicobar is the largest among the gastropods. The largest world size recorded of same species 482.60 mm collected from Pacific Ocean. Among the bivalve's smallest Pisidium annadalei (3.00 mm) and Tridcna maxima (1000 mm), collected from Kamorta is largest. The largest clam shell recorded Tridcna gigas (1368.70 mm) weight 230 kg collected from Sumatra. The 24 m length of giant squid (Architeuthis), the highest molluscs is believed to be world largest among invertebrates.

Endemic Mollusca: The number of species present in the northeast India alone is 293 of which approximately 26% of the Indian fauna 80% are endemic. The dry north western part of India is with just about 100 species of which 50% are endemic. The fauna in the northwest includes a few Palaearctic elements. Above 300 species of land mollusc are known from Western Ghats and the peninsular India, the endemic level of which is around 70%. Apart from this, islands are very important hotspot for land molluscs and diversity and endemism is high. The Andaman and Nicobar group of islands have nearly 100 species with a moderately high endemism at 74%. The Andaman groups accommodate 56 species, 34 of which are endemic and the Nicobar groups have 51 species with 40 endemic.

A detailed study on endemism of freshwater molluscs reveals that out of the 206 listed 142 are gastropods and 64 are bivalves, 108 species are endemic from India of which 67 species are gastropods and 41 species are bivalves. Two species are endemic from Andhra Pradesh, one from Punjab, seven species from Assam, three from Manipur, one from Meghalaya, two from Mizoram, 13 from West Bengal, two from Tamil Nadu, six from Maharashtra, three from Andaman and Nicobar Islands, five from Kerala Backwater and three from Jammu and Kashmir are endemic species. Other 61 species are available from different states. According to a report of IUCN, seven species (12%) are assessed as threatened which are Cremnochonchus syhadrensis, C. carrinatus, Arcidopsis footei, Pseudomulleria dalyi are assessed as Endangered and Cremnochonchus conicus, Parreysia khadakvasiensis and Scaphula nagarjunai are assessed as Vulnerable. The majority (88%) are assessed as Least Concern. Endemism among marine Mollusca is not known adequately due to incomplete surveys and difficulty in collecting from deeper waters. Nevertheless, as per the available records, three species of cephalopods, 36 species of bivalves, one each of scaphopoda and polyplacophora, and 25 species of gastropods are considered to be endemic to the east coast of India. One species of gastropod, Sprial Tudicla Tudicla spirilus, which is also included as Scheduled species in the Wildlife (Protection) Act, 1972 of the Government of India is endemic to the Bay of Bengal and east coast of India.

Phylogenetic topologies of mollusca



(Image source: Sigwart and Sutton (2007))

Commercial uses of molluscs in India

Item	Examples of Molluscs	Products
Specimen Shells	Few in trade, expensive; mostly narrow endemics and/or deep water gastropods. Such as *Conus* sp., Volutidae	Collector's items. In trade; private collections.
Ornamental Shells	Mostly large, colourful, relatively cheap, plentiful. Mostly gastropods, some bivalves including giant clams	Whole shells used as "Souvenirs" and decorations. Trade, private collection.
Shell Craft	a) *Strombus gigas, Cassis cornuta*, *Cypraea* sp. b) *Placuna placenta* (Window pane Oyster) c) Small shells such as dove shells, cockles. d) *Turbinella pyrum* (Sacred Chanks)	Cameos, Lampshades, wind chimes, boxes, Handbags, Jewellery, other decorative "souvenirs" Bangles, Jewellery
Mother of Pearl or Commercial Shell	*Trochus niloticus* (Commercial Trochus) *Turbo marmoratus* (Green snail) *Pinctada fucata, P. margaritifera* (black lip pearl shell)	Buttons, inlay work, jewellery, shell craft.
Industrial Shell	Giant clams (Tridacniidae)	Constituents of pottery; glazes, manufacture of floor tiles

Commercial Uses: Marine molluscs are used by human being for a variety of purposes and are also of considerable indirect benefits because of their role in food chains and their contribution to secondary production. Throughout India there is an enormous food fishery, especially for gastropods, bivalves and cephalopods, amounting millions of tonnes annually. India has rich mollusc diversity, which include 242 marine families with 591 genera and 3400 species. Large numbers of species is commercially and medically important and are exploited throughout the country.

Shells of some species have several alternative uses. For example, the entire Giant Clam Shell is used in the ornamental trade while broken shells are used for jewellery. Powder of giant clam shell is used as a constituent of pottery glazes and in the manufacture of floor tiles. Some gastropods and bivalve shells are collected primarily for mother of pearl and are traded as whole shell for ornamental purposes.

Volume of Trade: It is difficult to get clear picture of the volume of the trade in shell for several reasons.

a) Shells are often combined with other goods or marine products (especially corals) in official statics.

b) Trade statics seldom differentiate between species, except for "Commercial" or mother of pearl species, and it is difficult to calculate the relative volume of each species in trade, or the number of individuals involved and

c) International trade statics don't include domestic trade (e.g. through gift shops in the country of origin) so that exports figures cannot necessarily be equated with total exploitation.

Horned Helmet or King Shell

Shell Export: India has a history of shell export to countries far north and east. Countries like Japan, Indonesia, Thailand, Singapore, Taiwan, Mexico, Haiti, Burma are the major shell importers from India. However, the main importer of ornamental shells was and is the United States (including Hawaii) followed by U.K., Japan, Taiwan, Canada and Europe. United Kingdom is one of the largest European importers, followed by Italy and Spain.

The Top shell, Trochus niloticus and Turbo marmoratus are most important molluscs to artisanal fisheries in the tropical and subtropical waters of the eastern Indian and western Pacific Oceans. Both species are collected in the Andaman for export. Fisheries for "commercial" shell exists in many Southeast Asian and in most cases are well documented. Commercial shells are ground, polished and cut into various sizes and used in shell craft industry. Seashell exports from India have risen from 20.0 t in 1969 to 466.0 t in 1979 (Wells, 1981), when the main importing countries were U.S.A., Bahrain, Kuwait. Trochus niloticus is the most important species and annual demand of 6000 t for this species alone was estimated by Bouchet and Bour (1980).

Indian Shell Craft: In India, over 5000 people depend on directly on the shell craft industry for their livelihood and annual exports are in the region. They are over exploited not to meet the demands of international shell trade but also needed in large quantities by the domestic shell craft industry. Sea shells are used in preparation of ornaments and household articles such as table lamp, ashtrays, agarbatti stands, door hangings, Jharbatti, decoration of mirror outside etc. Puri in Odisha is a major centre for collecting, processing and marketing of seashells. The Govt. of Odisha has a Seashell Handicrafts Training Centre in Puri, which trains young boys and girls in the art of shell crafts. The finished products from the artisans are purchased by the Odisha Handicrafts Corporation and Khadi and Village Industries Commission and sent to Calcutta, Mumbai, Madras and Delhi to be exported to foreign countries. The shells are used in jewellery items, curios, wall hangings, door screen and for decorative purposes. Rameswaram in Tamil Nadu is another famous place for shell craft cottage industries which manufacture beautiful curios and several utility articles with molluscan shells. Many families of fishermen are profitably engaged in the collection and trading of shells. There are small shell craft units in Kanyakumari, Chennai, Hyderabad, Puri, Digha, Kolkata, Port Blair and in other parts of India which draw natural, raw shells from the Gulf of Manner, Tuticorin, Nagapattinum, Rameswaram, Andaman and Nicobar Islands. The finished shell products from these units are sold in local market, and transported to inland cities of India and a few exported to U.S.A., Europe, Japan and also countries to Far East.

Garlands, chains, necklaces and other ornamental articles are made out of Pyrene, Oliva, Umbonium, Planaxis, Nasa, Cones, Cowries, Placuna placenta (Window Pane Oyster) etc. House hold articles such as table lamps are made out of shells of Turbo marmoratus (Green Snail), Trochus niloticus (Top shell) Nautilus, Chicoreus ramosus, Lambis lambis (Spider shell), Melo melo (Beggar's Bowl). Chanks, Turban shells, and Top shells are the most popular among shell trader because of their large size and glittering surfaces when polished. The most valuable commercial mother of pearl is obtained from Turbo marmoratus, Trochus niloticus and Pinctada fucata the Indian pearl oyster.

The shells of Giant Clams are used in the manufacture of pottery glazes and floor tiles, but the details of the amounts involved are largely unknown. The molluscan shell forms one of the important raw material for making calcium /calcium carbonate based industries, since 33 to 40 % of the shell is calcium, 90-98 % of which occurs as calcium carbonate. Render (Surat) laboratory of the Gujarat Fisheries Aquatic Science Research Institute prepared tooth powder from edible oyster shells. Shell grift also forms an important ingredient in the preparation of dental cream, talcum powder and in carbide industry. An organized lime burning industry exists in a number of villages on the east and west coasts of India. Huge quantities of shells are collected

along Kerala coast, Karnataka coast (Tadadi port), Tamil Nadu, Andhra Pradesh and Odisha for use in the preparation of slaked lime and poultry feed. Shells play a prominent role in the economy of local fishermen at Kakinada, Andhra Pradesh and at Ashtamudi Lake in Kerala. Among the bivalves Windowpane Oyster Placuna placenta is important and most valuable. Others like granular Arc shell Anadara granosa, Bay clam Meretrix meretrix, Inflated Clam Marcia opima, False Clam Paphia malabarica, Donax shell Donax cuneatus, Button shell Umbonium vestiarium, Cerithid Snail Cerithidea cingulata, Spiral melongena Pugilina cochlidium and Telescope Snail Telescopium telescopium are the major contributors in shell industry.

Shell lime industry is popular in the state of Odisha and it comes mostly from the coastal villages in Baleshwar and Ganjam Districts. In Berhampur town of Odisha, there are eight bhatties (Lime Burning Kilns) in Kamapally area. In lime manufacture, bivalves are preferred over gastropods. In Berhampur, venerids bivalves are mostly used and Cerithidea cingulata is the only gastropods used in lime making (Subba Rao, 2003). Shells are also transported in trucks from Balacheruvu, near Visakhapatnam to meet the demand of lime manufacturers of Odisha. The shells are collected from Talsari, Palur, Ganjam, Gopalpur, Golabanda, Markandi, Ramyapatna and Sonapur in Odisha. There are sub-fossil shell deposits in the neighborhood of Rambha and in Bahuda river bed near Sonepur. At Surala, Sonapur and Pattisonapur, there are extensive bed of edible oyster which is annually leased out by the Department of Fisheries, Government of Odisha for commercial exploitation. The shell trade at the border of Odisha and West Bengal is mainly on one particular species, the Bay clam Meretrix meretrix. Kirtania is a place on the mouth of the Subarnarekha River is the main collecting centre of the shells where collecting activity extends over most of the year, without any restriction. A huge stock of shells piled at Talsari, a border near Digha. Traders purchase shells from the collection centre and transport these in boats to Talsari from where the shells are supplied to various agencies. As per the secondary sources of information, there are more than 1000 persons of all ages thriving on the shell trade from collection to transporting inland to user agencies. These shells are ground and utilized as poultry feed additives.

Why we need to protect Mollusca: Several edible and commercial species fall in to the conservation category, and demonstrates how heavy demand and intensive fishing can have a considerable impact on population as a whole, even though the species themselves are at the risk of extinction. Pugilina (Hemifusus) cochlidium, a Crown Conch is often used as medicinal purpose by the tribal people of West Bengal especially people from Sunderbans. In West Bengal Crassostrea gryphoides Kausturi Jhinuk and Anadara granosa Padma Jhinuk, a huge number of dead and living shells are used as calcium resources in the poultry feed. The Gaint Clams Tridacna spp. is found in Andaman and Nicobar as well as Lakshadweep groups of Islands. Population of the larger species of Giant Clams (Tridacnidae) has declined dramatically in many parts of the Indo-Pacific as a result of over collecting both for shell and meat. The Giant Triton Charonia tritonis, which occurs naturally at low densities seems to have become rare in recent years. For this reason, this species is included in the Schedule I of the Wildlife (Protection) Act, 1972 of India.

There is absolutely no information on the intake of freshwater molluscs by the button industries and several calcium industries in India. Therefore, it is essential to understand the volume of trade and the status of the various species. Many species of “Ornamental” and “Specimen” marine Mollusca have a restricted geographical range and are therefore vulnerable to over collection, particularly if they occur in shallow. Chank Turbinella pyrum is restricted in its distribution, which occur at a depth from 30 m to 45 m in the Gulf of Manner and at lesser depth in the Gulf of Kachchh are fished at regular intervals. Species viz. Trochus niloticus and Turbo marmoratus are two commercially important gastropods. Both the species are distributed in the coral reefs of Andaman and Nicobar Islands and occur up to 20 m depth.

The two rare cones that made history are Glory of the Sea Conus gloriamaris (Chemnitz, 1777) and Glory of India Conus milne-edwardsi (Jousseaume, 1889). The Strombus plicatus sibbaldi is very limited distribution and restricted to Kerala, Gulf of Kachchh and part of Bay of Bengal.

Several species of marine Mollusca in India are well known to be widely used as food, ornaments and decorative items including use in clothing, pharmaceuticals and in the lime industry. For example, the sacred chank Turbinella pyrum, which occur along the coast of Thirunelveli, Sivagangai, Ramnathapuram, Tanjavur, South Arcot and Chingleput, Nagapattinum and Kanyakumari coasts, is threatened by the age-old practice of fishery for its market value. Similarly, the windowpane oyster Placuna placenta is a source of lime, its meat is edible, and the right valve is exported in good quantities to be used for glazing windows. The other species of conservation importance which occur along the east coast of India are gastropods such as gold-banded volute Harpulina arusiaca, trapezium conch Fasciolaria trapezium, cowrie Cypraea limacina, spiral tudicla Tudicla spirillus, Glory of India Conus milnedewardsi and also the king shell Cassis cornuta besides one cephalod, the chambered nautilus Nautilus pompilus. All these are included in the Schedules of Widlife (Protection) Act, 1972 of the Government of India, which prohibits trade, collection or hunting from the wild, keeping them in custody in any form, or marketing of the products and by-products of these shells and imposes punishment or fine or both as per law. The present state of knowledge does not provide any specific information on threatened marine Mollusca from the west coast of India. Many of the species were not recollected after their original discovery or their first collection. Authentic data on the status of various species of molluscs are not available, and there are no documented data on the exploitation of marine molluscs from the west coast. Nevertheless, species like Placuna placenta are heavily exploited along the Maharashtra and Goa coast (Murud-Jinjira, Nauxim Bay), and also from Gujarat (Pouchitra, Raida, Goomara of Gulf of Kachchh). These areas were once abundant with Placuna placenta beds however, because of over-exploitation by shell industries, the population has declined heavily. A similar species, Meretrix casta, is now heavily exploited by the local fisheries along all the west coast of India for its nutritive food value. This species has been found to sell abundantly in local markets of Karwar, Murud, Margao, Daman, Udipi, Malvan, Beypore Cochin, and Vizhingam along the west coast of India, and over-exploitation of undersized clams has been witnessed which may lead to stock depletion and habitat damage and ultimately to extinction of the species. The species Paphia malabarica and Villorita spp are also at stake because of commercial over-exploitation from the sub-fossil sources of lakes such as Kalanadi, Vembanad and Ashtamudi, and stock depletion is an inevitable result. The situation is similar for Gafrarium divericatum a common vanerids used for food along the coast of Maharashtra and popular among those dwelling near to the coast. Besides, species such as the windowpane oyster Placuna placenta, Nautilus pompilius, Sibbald conch Strombus plicatus sibbaldi which are included in the schedules of Wildlife (Protection) Act, 1972 are found along the west coast of India. Turban shell Turbo marmoratus, top shell Trochus niloticus, trumpet shell Charonia tritonis and giant clam Tridacna maxima are among the threatened species of mollusca unique to the ANI, and the turban shell is on the verge of extinction because of over-exploitation (Raghunathan et al., 2010). Out of the 24 species of protected mollusca as per Schedule I and IV of the Wildlife (Protection) Act, 1972 of the Government of India, at least 19 species are found in the Andaman and Nicobar islands, of which seven are in Schedule I of the Act.

Little research has been made on the consequences of selective removal of shells from the ecosystem as a whole. It is suggested that over-collection of the Giant Triton Charonia tritonis, which feeds on large starfish, has contributed to reduction of population explosion of the Crown of Thorns starfish Acanthaster planci in Andaman and Lakshadweep Islands.

Various activities connected with shell collection can alter or degrade habitats of shells where they naturally occur. Common type of disturbance includes trampling and rock removal. Corals are also deliberately or inadvertently broken in order to remove shells. Many fishermen used bottom trawl net to get more fishes and it pushes across sand and rubble areas of the sea where molluscs live, huge amount of molluscs come along the fishes, and they make it dry on the coast of sea and make it poultry feed, known as “trace”, but the practice has evidently declined to some extent, partly because the habitat was altered so drastically that “even fishes were found to have been affected”. The collectors have also been forced to collect from more remote areas because of decline in yield in the vicinity of India.

Conservation: Insufficient information on status of the population (wild stocks) and optimum level of exploitation of marine molluscs in India is known. Determination of the status of many Mollusca is the need of the hour to provide protection and conservation. Data on the life history, abundance, productivity and rates of exploitation from specific localities are essential for every species involved in the shell trade. Recently it is noticed that conservation problems are on the increase and makes it possible to predict which areas and species are most vulnerable. The available literature reveals that depletion of the molluscan population appears to be occurring on a local scale in India. There are several reports of illegal collection of molluscs in West Bengal in areas where collectors concentrate their efforts in order to meet tourist demand. For example, Ancilla ampla, a lustrous Olividae which was once very common on the sandy beach at Digha on the upper east coast of India has now become very scarce due to rampant collection from the beach for use as curios. Poushitra, an area in the Gulf of Kachchh, was once famous for a Placuna placenta bed, but now the population of this species is declining heavily as a result of over-exploitation for calcium and cement. Similarly, the Operculum of Pugilina (Hemifusus) cochlidium, a crown conch, is used for its medicinal value “Sanka Bhasma” by the coastal dwellers of West Bengal, especially fisher folk in Sunderbans.The bivalve Meretrix meretrix is extensively used in the manufacture of poultry feed and lime and is collected by the tonne from the Subarnarekha River in Odisha, East Medinipur and 24 Parganas (South) of West Bengal. Crassostrea gryphoides and Anadara granosa are also used dead or alive as a source of calcium in the poultry industry. The population of the larger species of giant clam (Tridacnidae: Tridacna maxima, Tridacna squamosa) declined dramatically in many parts of the Indo-Pacific, including the Andaman and Nicobar and Lakshadweep islands, as a result of over-exploitation both for shell and for flesh. Species like giant clam attain late reproductive maturity, have a comparatively short larval life span and have poor recruitment to adult population, and this makes them vulnerable to depopulation. The giant triton Charonia tritonis, which occurs naturally at low densities, has become rare through over-collection.

The gastropod sacred chank Turbinella pyrum has a very restricted distribution, occurring at a depth of 30–45{ts}m in the Gulf of Mannar and in the Gulf of Kachchh region. The rights for fishing are leased out by the respective state governments. In the life cycle of the sacred chank, a free swimming veliger stage of development is absent and therefore adults are unable to swim to new territories. Over-exploitation of species such as this will automatically lead to decline in their stocks because of their life history pattern. Ornamental mollusca Trochus niloticus and Turbo marmoratus are the two commercially important gastropods and have distribution only in the Andaman and Nicobar Islands but, because of over fishing, there is substantial depletion in the natural stock. The two rare cones Glory of the Sea Conus gloriamaris and Glory of India Conus milne-edwardsi Jousseaume, 1889 are rare among the marine mollusca because of over-exploitation in the past. At present, relatively few of the widely distributed ornamental species are known to be similarly affected but the future for all these species is not so bright and may verge towards depletion and even to extinction.

Conservation Measures: There are several courses of action that may be taken to control trade in shells, and thus avoid over - exploitation and habitat damage. Conservation problems should not exist if the fisheries are properly managed on an ecologically sound, sustainable yield basis. Government of India should implement species specific management programmes and regulate exports, and importing countries can control imports. The problems would also be lessened if demand for ornamental shells declined. A greater "public" awareness of the conservation issues could help in this respect.

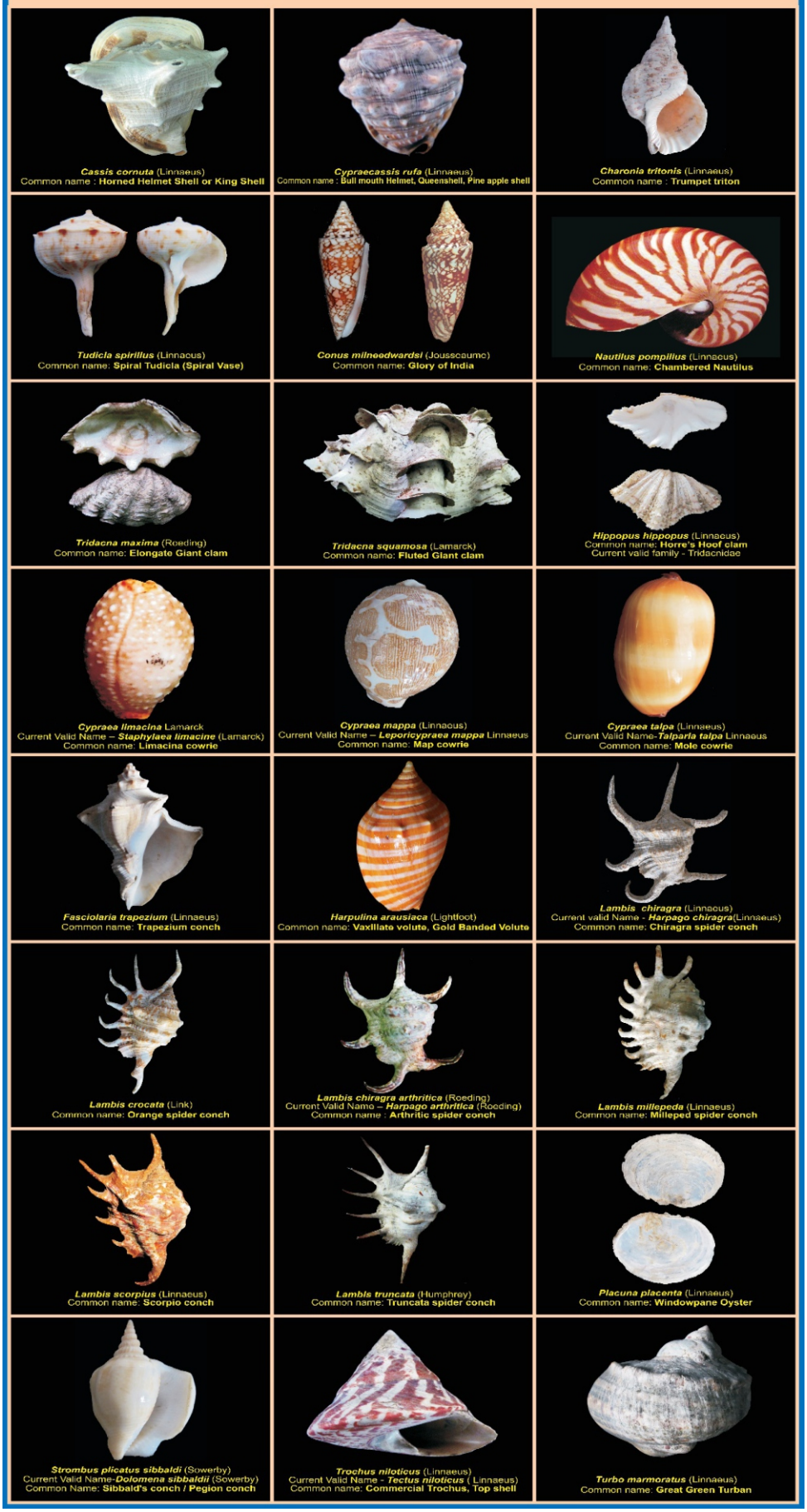
Conservation and management of population of molluscs in the long run may pave way for restoration of species balance in nature, especially in the ecologically sensitive, biotically rich, fragile ecosystems such as coral reef, mangrove and sea grass. There are several rules and regulations formulated by the Government of India to protect conservation of marine biodiversity. However, protection of many commercially important molluscs by the managers is difficult due to economic and political constraints. There are several management actions that can be taken to control trade in shells, and thus avoid over - exploitation and habitat damage. Conservation problems should not exist if the fisheries are properly managed on an ecologically sound, sustainable yield basis. The problems would also be lessened if demand for ornamental shells declined. A greater public awareness of the conservation issues on marine mollusc could help in this respect. Traditional knowledge about the distribution and biology possessed by the shell collectors could be put to use and they should be encouraged to conserve and manage the resources. Measures taken to ensure conservation of species or habitats are more likely to succeed if people who are affected by management decisions are involved in their formulation.

Conservation measures by Government of India: The Ministry of Environment, Forest and climate change promulgated 24 species of marine mollusc under Schedule I (9 species) and IV (15 species) of the Wildlife (Protection) Act, 1972. The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) provides a means of controlling international trade in species considered to be seriously threatened. At present, the only marine molluscs listed are the giant clams (Family Tridacnidae). These are listed in Appendix II, which means that a valid export licence is required from the country of origin before the shells, meat or live animals can be traded between the parties to the convention. This provides a useful means of monitoring trade, particularly as custom and fishery statistics tend to be so poor for molluscs. India have already introduced such legislations are listed in table below

Legislation for protection of mollusca

1	Forest Act	1927
2	Wild life (Protection) Act	1972
3	The Wildlife (Protection) Licensing (Additional Maters for consideration) Rules	1983
4	The Wildlife (Specified Plants-Conditions for Possession by License) Rules	1993
5	The Wildlife (Protection) Rules	1995
6	Chank Fisheries Act (The Indian Fisheries (Tamil Nadu Amendment) Act, 1927 Act 2 of 1929 Keyword(s): Central Act Amendment, Indian Fisheries Act 1897, Prohibition of Fishing Amendment appended: 12 of 1980)	1980
7	Pearl Fisheries Ordinance (The Indian Fisheries Act, 1897 (ACT IV OF 1897) 4th February, 1897)	1897

SCHEDULE MOLLUSCS OF INDIA



The inclusion of Molluscs under Schedule Animals is one such step to protect and conserve several species; nine species are included under Schedule -I and 15 species under Schedule –IV.

Molluscs in the Schedules of the Wildlife Protection Act, 1972

	Schedule-I, Part- IV (B)		Schedule-IV, Part- 19
I	*Cassis cornuta* (King Shell)	I	*Cypraea limacina* (Limacina Cowrie)
II	*Charonia tritonis* (Trumpet Shell)	II	*Cypraea mappa* (Map Cowrie)
III	*Conus milne-edwardsi* (Glory of India)	III	*Cypraea talpa* (Mole Cowrie)
IV	*Cypraecassis rufa* (Queen Shell)	IV	*Fasciolaria trapezium* (Trapezium Conch)
V	*Hippopus hippopus* (Horse's Hoof) CITES Appendix II	V	*Harpulina arausiaca* (Vexillate volute)
VI	*Nautilus pompilius* (Chambered Nautilus)	VI	*Lambis* (*Harpago*) *chiragra chiragra* (Chiragra Spider Conch)
VII	*Tridacna maxima* (Elongated Giant Clam) CITES Appendix II	VII	*Lambis* (*Harpago*) *chiragra arthitica* (Arthritic Spider Conch)
VIII	*Tridacna squamosa* (Fluted Giant Clam) CITES Appendix II	VIII	*Lambis* (*Lambis*) *crocata crocata* (Orange Spider Conch)
IX	*Tudicla spirillus* (Spiral Tudicla)	IX	*Lambis* (*Millepes*) *millepeda* (Milleped Spider Conch)
		X	*Lambis* (*Millepes*) *scorpio scorpio* (Scorpio Conch)
		XI	*Lambis* (*Lambis*) *truncata truncate* (Truncate Spider Conch)
		XII	*Placuna placenta* (Window pane Oyster)
		XIII	*Strombus* (*Dolomena*) *plicatus sibbaldi* (Pegion Conch)
		XIV	*Trochus niloticus* (Top Shell)
		XV	*Turbo marmoratus* (Great green Turban)

Sea ranching of Mollusca: Considerable success has been achieved with several marine molluscan species through aquaculture: larvae and juveniles are reared in hatcheries, and the adults are kept in tanks for production of spawn and ultimately for harvesting. Aquaculture clearly has potential for positive benefits on commercial production of mollusca for food, ornament/curio (pearl and shell based) and also for calcium production as well as ranching for enhancing molluscan diversity, sustainable utilization and conservation.

Improved collecting methods: Collector of the shells should understand the importance of conserving stocks, and using selecting methods which do not damage the habitat. Guidelines or instructions could be produced for both commercial collectors and tourist. The suggested codes of conduct are:

1) Eggs, juveniles and breeding groups should not be taken.

2) Shells with defects should not be taken (these are in any case generally unsalable "specimen" shells).

3)The habitat should be disturbed as little as possible.

4) Living attached corals should not be touched.

5) If stones, loose coral or boulders are moved, they should be returned to their original positions.

Awareness: It is suggested that general awareness can be made through various seminars, symposium, short documentary attractive films, training programmes to make aware to the common people, coastal inhabitants, college students, school children's even to the forest rangers about the conservation of molluscs, role of molluscs in the ecosystems. Power of knowledge exercised by the common people is evidently a great tool for conservation of nature and natural resources.

Conclusion: Despite the Wildlife (Protection) Act, 1972 and Biological Diversity Act, 2002 and the great concern to conserve the marine ecosystems and their biodiversity in India, they are only on the decline. In the circumstances, unless effective conservation measures coupled with long term capacity building and training to the managers and researchers and long term awareness and education on biodiversity conservation at all levels, it would be intricate to save the rich heritage of animal life from irreparable damage and preserve the biological uniqueness of these islands. It is therefore, quite essential to conserve some of the virgin areas free from human interference as viable entities on the long run as biosphere reserves, national parks and sanctuaries for wildlife conservation, genetic diversity and scientific study. Like any resource, especially Mollusca, exploitation by man shall be rational, sustainable and judicious. All destructive activities contributing to the degradation of the natural environment are to be arrested, which are not certainly as easy as the ways of their destruction.

The littoral habitats are also to be protected from adverse effects of potential pollution. Considering the fast depletion of molluscs and the associated biodiversity, the Government of India has established one Biosphere Reserve, besides the earlier established nine National Parks and 96 wildlife sanctuaries comprising an area of 1891.54 sq km in Andaman Nicobar Islands alone, of which in about 350 sq km pertained to the marine ecosystem. In addition, the keen interest evinced by the naturalists to protect our vanishing molluscs, awareness and co - operation of common man, who comes in contact with these animals in day to day life, is very necessary for their conservation. Involvement of local communities in resource management is found important for the successful implementation of our conservation strategies. Further, wide gaps always existed between law and its enforcement, although the legislation often proved better in halting the commercial exploitation of wild resources. Hence, the Wildlife (Protection) Act, 1972 and Biological Diversity Act, 2002 should be strictly enforced, all poaching arrested and deterrent punishment imposed in all cases of violation.

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Livelihood Issues: A journey with the sacred chank

IT is near impossible for humans to be unaffected by an encounter with molluscs. Those of us who retain only a dim memory of high-school taxonomy might not even know that humans have been in the company of molluscs for centuries. The phylum Mollusca is, after all, a very broad category and encompasses over 85,000 species of invertebrates. Of these, jellyfish and cephalopods such as octopuses and squids might be more obscure, but almost everyone has seen a shell, either split open into two identical sets (as in bivalves) or as a twist of colour and calcium around a cavity (as in gastropods).

Molluscs are found in freshwater systems, seas and even oceans, and there is many a molluscan trace encountered in contemporary everyday life that makes it hard to ignore. In India, molluscs are found amidst human communities across social hierarchies, geographies and cultures. An example of a relatively inexpensive decorative shell, although high on its beauty quotient, is the *Melo melo*, a smooth creamy shell commonly known as the "beggar's bowl". On a research trip to the Palk Bay in 2016, this writer met a Hindu mendicant in Pattukottai, in Thanjavur district of Tamil Nadu, who proudly showed her a handsome specimen of this shell. He had bought it for Rs.80 after making a special visit by bus to Kilakarai, over 150 kilometres from Pattukottai.

Kilakarai, in present-day Ramanathapuram district, has been the historical hub of trade in many marine products and bivalve and gastropod shells. Here, and in the temple town of Rameswaram, molluscan presence continues to turn the wheels of its merchants' fortunes.

The meaning of molluscan presence in our lives is multifold. They can be found tied around the necks of cows; hanging from shops, transport vehicles and above thresholds of homes; and braided with ropes and other ritual objects (including aloe vera, coconuts, sacred threads). Usually marine gastropod shells (mostly smaller *Turbinella pyrum*, or the Murex varieties, mostly *Chicoreus ramosus* and cowries), they are intended to dispel evil and are emblematic of multiple gods, goddesses, spirits and their mystical and spiritual powers.

At the higher end of molluscan prestige objects are pearls produced by pearl oysters, rare and unusual shells such as the highly valued *valampuri*, or sinistral, variety of sacred chanks or sacred conch. It is known in Sanskrit as *shankkh*, and in Tamil as *changgu or chankku*. British records refer to this animal as the sacred chank. But there is some confusion whether the common name is merely "the Indian conch or chank" to distinguish it from the sacrosanct *valampuri* variety owned by some temples and monasteries across the world.

How commodities or things embody value and meaning has been at the heart of anthropological enquiry. Is the sacred chank merely an economic commodity, a cultural object, an ecological entity or a whole that is more than the sum of its parts? We know that throughout human history, marine animals such as the one we call *Turbinella pyrum* have shared deep bonds with humans, dictated human fortunes, and wielded tremendous influence on human behaviour or agency.

In the whole world, there was no other place where this chank was present in such abundance as in the seabeds of the Palk Bay and the Gulf of Mannar along the coastal areas of present-day Tamil Nadu and the Northern Province of Ceylon (Sri Lanka).

The fisheries for these animals were aimed at procuring the shell of this animal; the meat was consumed by diver communities. These fisheries supplied chank far and wide, across various parts of the subcontinent for over two millennia, alternating with a fishery for pearls whose fame was worldwide. The fishery was largely state-controlled since colonial times and only recently moved into the hands of licensed fishers. However, over the last few decades chank are not collected in as much abundance as

before. Fishers attribute this to multiple causes, the primary one being fishing by destructive bottom trawling.

The importance of molluscs has not diminished despite significant shifts in cultural modes among people. Today, the Gulf of Mannar is one of the last remaining sites for the sacred chank. The life of the mollusc underwater is a story for another day; equally little is known about the physical and transformative journey of the chank when it encounters a diver. Chank has to be literally hunted down by skilled breath-hold divers who have tricks and skills to find their quarry. Once safely secured in the diver's bag, a series of transformations await the mollusc on land.

Cultural imprint

The life of the chank above water begins with the death of the animal. Cooked, consumed or chilled for a distant food market, it leaves lasting cultural imprints on its consumers. Many other stages of transformation are bestowed on the chank. The animal itself is divided into its parts, with shell, flesh and foot (the operculum, a calcareous lid that covers the opening of the shell when the animal retracts into it) moving along different economic chains.

This photo essay captures some moments of this writer's journey with the chank as it changes shape and is transformed at the hands of humans. We also witnessed the ways in which chanks might be seen as forcing certain skills among those who labour over its transformation, their peculiar instruments and working conditions, and the ways in which the chank might create human fortunes and contribute to the history of places and people.

(SOURCE:https://www.frontline.in/social-issues/general-issues/a-journey-with-the-sacred-chank/article10094830.ece)

The largest shell traders are based in Rameswaram in Ramanathapuram district of Tamil Nadu. The steady depletion of resource and its durability make shell traders store even lower grade chanks until they command a good price in the market. what was considered low grade and useless at one time can today fetch a good price as polishing techniques and processing material make it possible to mask minor flaws such as holes made by shell-boring organisms. The shells are stored in the open a the outer cover disintegrates leaving behind the naked shell.

(Image source: https://www.frontline.in/social-issues/general-issues/a-journey-with-the-sacred-chank/article10094830.ece)

The fisheries and trade for sacred chanks have been practised for over two millennia. Fishers now only need a licence to collect chanks but are free to sell them to anyone. Freedivers collect live chanks from the Palk Bay and Gulf of Mannar and sell them, still covered with organic matter and with the animal inside them, to merchants who sort them on the basis of size and quality. The shells then reach small-scale processors smoothen and polish them before selling them in distinct markets - bangle manufacturers, decorative shell retailers or as a sacred worship.

(Image source: https://www.frontline.in/social-issues/general-issues/a-journey-with-the-sacred-chank/article10094830.ece)

The shells are sourced by middlemen who sell them to larger shell traders such as Kalam Traders and Gandhi Traders in Rameswaram. Here, numerous people are involved in processing work. Shells have to be graded on the basis of weight, shape, smoothness and size. They are also categorised into jaadi and patti varieties, the two main local “types”.

(Image source: https://www.frontline.in/social-issues/general-issues/a-journey-with-the-sacred-chank/article10094830.ece)

The process of polishing involves subjecting the shell to two stages of chemical treatment. First, the shell is placed in a solution of bleaching powder where it loses some of its pigmentation. Next, it is briefly dipped in highly diluted hydrochloric acid. In the larger processing centres, workers are seen wearing gloves and protective boots, but the acrid smell of acid is reminiscent of its corrosive power and offers a strange contrast to the glistening smoothness of the shell. Save for its shape and name, there is little to indicate the chank’s incredible journey from the Palk Bay’s seabed to the mantelpiece of a consumer’s home.

(Image source: https://www.frontline.in/social-issues/general-issues/a-journey-with-the-sacred-chank/article10094830.ece)

The scienticfic name of the mollusc that lives in the chank is Turbinella pyrum. Once it is removed from the water, the animal dies slowly. The animal is edible and is consumed domestically where there are no facilities for its preservation with ice, or traders to sell it. The local preparation in the Palk Bay, of a curry with chank meat, is similar to other curries with chicken or mutton.In some regions, the meat is shaved into chips and sun-dried. This is then deep-fried and served as an accompaniment to other food preparations.

(Image source: https://www.frontline.in/social-issues/general-

The main shell traders in Rameswaram and Kilakarai in the Gulf of Mannar have processing units located on their premises.These units operate small motorised polishing machines that smoothen the naked shell, devoid of its outer covering of organic matter and give it a uniform shape. The rough edges at the mouth of the shell are smoothened so that it can be gripped freely without fear of injury. The people involved in the polishing work have been doing it for most of their lives and often with the same employer. The apex of the shell is cut off to allow air to be blown into it. Blowing the conch is supposed to lend auspiciousness to lend the environs of the devotee.

THE HINDU - 29th March, 2016

Kerala state government steps in to save fishing

The govt. has bowed to the opinion of Fisheries Department officials and followed suggestions from scientists at the Central Marine Fisheries Research Institute.

The State government has stepped in to stop the rampant catch of fish juveniles by notifying the minimum legal size (MLS) for eight fish, four crustacean and two molluscan stocks, implementing which, fisheries industry insiders said, would be a "Herculean task" given the complexities imposed by the wide spectrum of fish species off Kerala coast.

In issuing the order prohibiting the catch of juveniles, the State government has bowed to the opinion of Fisheries Department officials and followed suggestions from scientists at the Central Marine Fisheries Research Institute.

Both traditional fishermen and trawling boat owners had reached a consensus recently on desisting from targeting fish juveniles though the agreement has not been formalized.

The prohibition on catching fish juveniles is for a period of five years, after which the effect of the ban on catching juveniles will be evaluated.

A Fisheries Department official said boats found bringing in fish juveniles could be impounded and operators could be fined up to Rs. 50,000 depending on the weight of the catch.

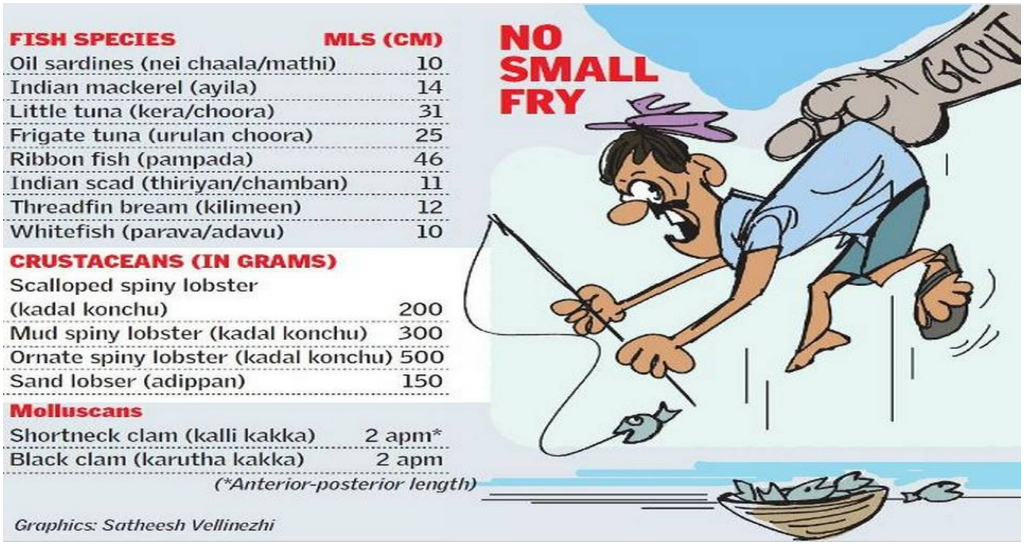
"Both targeted and untargeted catch of juveniles is rampant and it is time for self-regulation," said Charles George, president of Matsya Thozhilali Aikyavedi, who described Monday's Gazette notification prescribing the MLS as a "crucial step" towards resources conservation.

Though the CMFRI suggested MLS for 58 fish species, the government has adopted only 14, surprising fisheries scientists. The fish stocks include oil sardines, mackerel, threadfin breams and four types of sea lobsters.

K.K. Pushkaran of Trawling Boat Owners' Welfare Association welcomed the government order and called it timely.

Mr. George expressed surprise at the exclusion of shrimps and some species of fish from the list which prescribes MLS. He said the government could have consulted stakeholders before taking a decision on the issue. However, he described the government decision as having far reaching consequences in terms of resource conservation. "The order comes at a time when the marine fisheries is going through a crisis," he said.

(SOURCE:https://www.thehindu.com/news/national/kerala/state-steps-in-to-save-fishlings/article7501590.ece)



(Image source: https://www.thehindu.com/news/national/kerala/state-steps-in-to-save-fishlings/article7501590.ece)

DECCAN CHRONICLE - 25th September, 2018

Invasive species pose threat to ecosystem of Anna university

BIO-DIVERSITY SURVEY

Invasive species pose threat to ecosystem of Anna varsity

A.RAGU RAMAN I DC
CHENNAI, SEPT 24

Some of the invasive and exotic pieces like Prosopis juliflora or Velikathan, Parthenium hysterophorus (Railway plant) and Lantana Camara, a perennial shrub, are posing a major threat to the ecosystem of Anna University and soon they may replace much local flora and fauna, finds a biodiversity survey conducted by the university.

"While parthenium weed has a luxuriant growth all over the vacant places at the university, the Prosopis Julifora is actually spreading fast and immediately need to be checked to save the existing flora, fauna ecosystem inside the university," the survey report said.

For the first time, Anna University has prepared a biodiversity register for its sprawling 185-acre Guindy campus recording the flora and fauna population at the varsity's main campus.

It has been prepared during the "Green Skill Development Programme" which is being conducted at the university with the support of the union ministry of environment, forests and climate change.

"We have recorded around 526 species in flora during the biodiversity survey. More than 50 per cent of the trees, grasses, herbs, climbers found in the campus are non-natives," said professor S. Srinivasalu co-ordinator, ENVIS - IOM and director, Institute for Ocean Management, Anna University.

Only less than 50 per cent of the species of trees found on the campus is native trees like palm and tamarind trees.

Some 20 students who were trained in Para-taxonomy conducted the survey recently.

"Among the flora of the campus, nearly 40 per cent of the species found in the campus are herbs. Ten per cent of the non-cultivated plant species that were found were grasses. Shrubs and climbers vary between 10 and 15 per cent, while trees are a mere 5 to 10 per cent," he added.

The present study has revealed that more than half of exotic plant species in Anna University spreading naturally were intentionally introduced and the rest is an unintentional introduction. It is also reported that most of these exotic species that endanger native ecosystems were first introduced for horticultural purposes.

The report also mentions the presence of the medicinal plants inside the College of Engineering, Guindy. "At present, the medicinal plants found in the campus is not utilized. Medicinal plant garden is the need of the hour to conserve some of the important plans for the future generation," it said.

K. Venkatraman, former director, Zoological Survey of India, Kolkata, who supervised the survey of fauna said, "During the night, there is a separate activity of animals happening inside as mongoose bringing their offspring. We also spotted golden jackals, porcupines on the campus."

Anna University is highly influenced by Guindy National Park as many species including jackals and porcupines coming from there. There is also local migration taking place as birds from Pallikaranai marshland is coming for roosting to the campus.

"We have described 120 common plants and 150 common species of animals in the register. Out of which many are alien species. We also registered that 500 trees were fallen during the Vardah cyclone," he added.

The critically endangered Blackbuck once seen in this campus is no more available. The pigeons have outnumbered the crows during the survey.

He further said it is only the preliminary study to find out what are the species available inside the campus and how many of them are alien species and whether there are any endangered species inside the campus. "We need to do further studies," he said.

"Biodiversity register of Anna University" is likely to be circulated among the students and faculty members to make them aware of the existing pieces inside the university.

During the Vardah Cyclone, of 1,000 trees 500 trees were ravaged and 350 trees were uprooted. The non-native trees did not survive the fury of the cyclone while the native trees like palm trees have survived. Citing it, the report also recommended the planting of native species of trees.


Anna university.

NON-NATIVE TREES DID NOT WITHSTAND THE VARDAH CYCLONE'S FURY

The biodiversity survey has revealed that Anna University lost one-third of its green cover because the exotic species (non-native trees) did not withstand cyclone Vardah's fury.

"At Anna University, there are more than 1,500 trees on the Guindy campus of which 500 trees were found ravaged and 350 were uprooted. While the non-native trees were uprooted, the native palm trees withstood the cyclone," the report said.

It also recommended to plant native trees to maintain the local eco-system inside the campus.


Giant African snail

INVASIVE ALIEN ANIMALS IN UNIVERSITY

Giant African Snail: The snail is native to Coastal East Africa and damages native plants and crops. The snail is considered to be one of the largest and most damaging land snails in the world. It is known to eat at least 500 different types of plants. It is a threat to native snails and affects native ecosystems by altering the food chain by providing alternative food sources for predators. It is found throughout the campus and their numbers are staggering.

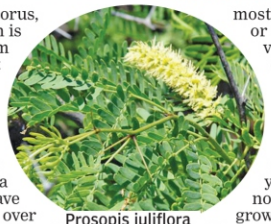
HIGHLIGHTS

- Pigeons outnumber crows at the Anna University campus
- The three most abundant birds on the Campus are the Rock-pigeon, the House Crow and the Common Myna.
- However, the present study reports a very less number of birds in the Campus. Anna University is a highly human-impacted campus. However, the Mammals (including carnivores like the Jackal, Palm Civet and Mongoose) are in good number.
- The accurate number of present population size of these animals is not known. The critically endangered Blackbuck once seen in this campus is no more available.
- Most common butterfly species of the Anna University Campus during the study period include the Crimson Rose, Common Jay, Great Orange Tip, and Common Banded Peacock. Frogs, toads, lizards and snakes also diverse

INVASIVE SPECIES OF FLORA FOUND IN AU

Parthenium hysterophorus, (Railway Plant) which is an exotic species from Tropical America was first reported in India in 1951 from Maharashtra. The weed is an aggressive colonizer of degraded areas such as fallow wastelands, roadsides and overgrazed pastures. In Anna University campus they have a luxuriant growth in all over the vacant places. They found more in the staff quarters of Anna University.

Lantana camara, is a species of flowering plant and one of the ten worst weeds of the world, is a native to tropical and subtropical America. Lantana was brought to India by the British in 1807 as an ornamental shrub for the Calcutta Botanical Garden. In Anna University Campus they are mostly seen as ornamental or found mostly in the vacant land all over the campus.


Prosopis juliflora

Prosopis juliflora, is a shrub was introduced in India in the last century as a species for afforestation of degraded land. But over the years, it has emerged as noxious invader that can grow in various ecosystems. It wipes out plant species in its surroundings.

In Anna University Campus they are more in number. Their luxuriant growth affects most of the other native species. They are fast spreading in the campus and soon they may replace many local flora and fauna. Their unabated growth will be a challenging task for the University.


Parthenium hysterophorus

ENDANGERED SPECIES FOUND ON CAMPUS

Amongst the Indian plants that have been listed as endangered, at least two species occur on the Campus. These are Ashoka tree (Saraca indica) and queen sago (Cycas circinalis). Three species of endangered butterflies Danaid Egg fly, Common Pierrot and Crimson Rose were also found.


Queen sago (Cycas circinalis)

(SOURCE: https://www.deccanchronicle.com/nation/current-affairs/250918/invasive-species-pose-threat-to-ecosystem-of-anna-university.html)

Mollusc-Munching Marine Monster: First Jurassic Ichthyosaur found in India

In a new PLOS ONE study, Guntupalli Prasad and colleagues announce the discovery of what is thought to be the first Jurassic ichthyosaur found in India. The 5.5-meter-long marine reptile likely ate shelled marine animals known as ammonites and other crunchy prey. The authors believe that its unusually complete skeleton may provide insights into ichthyosaur diversity and evolution in the oceans that once covered the Kachchh region of India.

I was initially inspired by Professor Ashok Sahni, the well-known vertebrate paleontologist of India. Since my Ph.D., I have been pursuing research on fossilized vertebrates that colonized India during its northward journey: my most exciting find to date has been the discovery of the first Cretaceous (66-million-year-old) mammals from India. Surprisingly, these mammals appear closely related to similar European and African fossils, even though the Indian subcontinent was an island at this time.

Ichthyosaurs or “fish lizards” resembled modern dolphins and whales and lived between 250 and 90 million years ago. The Earth, initially assembled into a single supercontinent, Pangaea, was at that time breaking up into Laurasia and Gondwanaland. Ichthyosaurs lived in the oceans in a warm and humid climate. Their main marine competitors were plesiosaurs, another group of marine reptiles, and sharks. While the dinosaurs were dominating the land, the pterosaurs, flying reptiles, were the rulers of the air.

Vertebrate fossils are rare from the Kachchh region, and we were expecting only bone fragments from this area. So, to find a near-complete skeleton is surprising as well as exciting. The discovery of this ophthalmosaurid ichthyosaur, which is widely known from Europe, points to the possibility that ichthyosaurs may have moved between Europe, western India, Madagascar and South America - a process known as faunal exchange.

Based on the preserved length of the Kachchh skeleton (3.6 meters), and factoring in its missing front and tail parts, we estimate its total length to be 5.5 meters. We could infer from wear patterns on its teeth that this ichthyosaur was a top-tier predator that fed on hard and abrasive food material, including marine molluscs (ammonoids and belemnites), fish and possibly other marine reptiles.

Initially, we couldn’t find any skull for the Kachchh ichthyosaur, and were forced to conclude that the skull and the jaws had not been preserved. But while making protective plaster jackets ready for transportation of the skeleton, we dug below its front part and were surprised and delighted to come across part of the jaw vertically embedded in the rocks. This was an especially useful discovery because the teeth we found offered insights into the ichthyosaur’s diet.

In the coming years, we plan to carry out extensive field exploration in the Kachchh region to find more ichthyosaur fossils and to search for other marine reptiles. We hope that our find may lead to renewed interest in vertebrate fossil research in this region, which could bring new discoveries to light.

(SOURCE: http://researchnews.plos.org/2017/10/25/mollusc-

(Image Source: http://researchnews.plos.org/2017/10/25/mollusc-munching-marine-monster/)

WORLD ENVIRONMENT DAY - JUNE 5th 2018

India served as the global host of the 2018 World Environment Day, under the theme, 'Beat Plastic Pollution'. The Day raised awareness and urge governments, industry, communities and individuals to come together and explore sustainable alternatives and urgently reduce the production and use of single-use plastic that pollutes oceans, damages marine life and threatens human health.

Our ENVIS Resource partner - Centre for Coastal Zone Management and Coastal Shelter Belt organized a meet up for students on June 5th 2018, at Koodal building, Institute for Ocean Management, Anna university, Chennai. Students representatives from various schools around the zone participated in this programme, the event started with a brief note about the environment day by our ENVIS – Coordinator Dr.S.Srinivasalu, followed by a video presentation and the facilitation talk was given by our special invitee Dr. Kirti Srivastava of National Geophysical Research Institute (NGRI), Hyderabad. Dr.Shankar, Retd. Director, Geological Survey of India gave a talk on “Causes of Plastic Trash in the coast”

The ENVIS team created awareness by issuing posters to the departments and student in and around the university about the plastic pollution and its causes at the coast and marine animals, also declared the Institute for Ocean Management as “PLASTIC FREE ZONE” as an initiative to avoid plastics in the department also planning to establish this to the university as well, by the end of the day all the participants took a promise by printing their hands on the banner that was designed by the team ENVIS in order to avoid plastics in their day to day life saying “THESE HANDS ARE RAISED TO BEAT PLASTIC POLLUTION” assure to reduce the usage of single use plastics.

WORLD ENVIRONMENT DAY - JUNE 5th 2018

WORLD OCEAN DAY - JUNE 8th 2018

Our ENVIS Resource partner - Centre for Coastal Zone Management and Coastal Shelter Belt have organized a coastal clean-up event at Marine beach, Chennai covering two-kilometer distance from IG Office to Vivekanandan house to create awareness to the public on plastic pollution on "World Ocean Day - June 8th 2018" . With the theme "Preventing plastic pollution and encouraging solutions for a healthy ocean". Our ENVIS staff, students and public have participated in the event.

WORLD OCEAN DAY - JUNE 8th 2018

Green Skill Development Programme (GSDP) - 2018

Master training course on Para-Taxonomy including Peoples Bio-diversity Register






Our ENVIS Resource Partner - Centre for Coastal Zone Management and Coastal Shelter Belt has conducted the Green Skill Development Programme (GSDP) course on Para-taxonomy including Peoples Biodiversity Register for master trainers. Our ENVIS Team organized many field visits and theory sessions to the participants for identification of flora and fauna.

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Our ENVIS Team organized field visit to India Seashell Museum, Mahabalipuram, Chennai for the GSDP participants. They gained knowledge about different species of mollusca.

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