Mainstreaming Biodiversity for Sustainable Development

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DIVERSITY OF BIVALVE MOLLUSCS ALONG THE WEST COAST OF INDIA

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Class Bivalvia represents the second largest class among the eight extant classes of the phylum Mollusca. This paper documents the taxonomy and diversity of marine bivalves along the west coast of India, based on surveys conducted in the states of Kerala, southern Tamil Nadu, Karnataka, Goa, Maharashtra and Gujarat. The study documented 200 species of marine bivalves belonging to 3 subclasses, 13 orders, 42 families and 111 genera. Among the recorded bivalves 30 species are newly recorded from India and 26 species are new to West Coast. The species newly recorded from India included *Leiosolenus tripartus* (Mytilidae), *Anadara consociata*(Arcidae), *Tucetona sibogae* (Glycymerididae), *Atrina exusta, Atrina rigida* (Pinnidae), *Pteria howensis* (Pteriidae), *Mimachlamys townsendi* (Pectinidae), *Propeamussium arabicum* (Propeamussiidae), *Hyotissa numisma*, *Hyotissa sinensis* (Gryphaeidae), *Pelecyora ceylonica*, *Pelecyora excisa*, *Protapescor, Globivenustoreuma, Aphrodora sewelli, Venerupis bruguieri* (Veneridae), *Meiocardia cumingi* (Glossidae), *Tellina albinella* (Tellinidae), *Leptomya bracheon* (Semelidae), *Hiatula rosea* (Psammobiidae), *Lepirodes ambiguous* (Galeommatidae), *Lamellolucina oliveri, Myrtea triclotae, Scabrilucina vitrea, Divalinga arabica* (Lucinidae), *Chama croceata* (Chamidae), *Coecellahors fieldii* (Mesodesmatidae), *Nemocardium fulvum, Freneixicardia victor* (Cardidae), *Trapezium oblongum*(Trapezidae). The study recorded 163 bivalvespecies from Kerala, 77 from Gujarat, 70 from Maharashtra, 43 from Goa, 42 from south Tamil Nadu and 30 from Karnataka. 25 species of bivalves were very common and was obtained from all the surveyed states. Family Veneridae with 45 species is the most speciose family. The present study emphasises the richness of bivalve species along the west coast of India and also instigates the need for more comprehensive and thorough studies to realise the true potential of this commercially and ecologically contributing group.

Keywords: Bivalves, diversity, economic and ecological significance.

INTRODUCTION

Class Bivalvia (Acephala, Pelecypoda and Lamellibranchiata) are exclusively aquatic organisms representing the second most speciose class of the diverse phylum Mollusca. This class includes soft, unsegmented, bilaterally symmetrical and laterally compressed molluscs enclosed by calcified valves on the left and right sides connected by hinge, ligament and adductor muscles (Poutiers, 1998; Leal, 2002; Ramakrishna and Dey, 2010). Bivalves

have a long history and rich fossil record dating back to Cambrian era. They have evolved from the Cambrian rostroconchs as small, equivalved shallow water burrowers and deposit feeders. Today, this class comprises of different forms which exhibits variability in colour, shape, form, size, anatomy, habitats and mode of life. The members of this group survive in diverse types of habitats such as mangroves, salt marshes, coral reefs, rocky coasts, sandy beaches, estuaries and sea grass beds ranging from intertidal to hadal depths (Gosling, 2003; Huber, 2010). The global bivalve diversity numbers to 9,620 species included in 101 families and 1380 genera with 8360 marine species, grouped in 4 subclasses and 93 families (Huber, 2015). Of these, 652 species of marine bivalves represented in 173 genera, 69 families and 4 subclasses have been reported from India (Tripathy and Mukhopadhyay, 2015). The highest diversity in global bivalves is in the shallow waters off Indonesia; Indo-Pacific region is the richest province of bivalve diversity and distribution with 3,300 bivalve species recorded (Huber, 2015). India, which falls in this richest province with a coastline of 8,118km and a very wide range of coastal ecosystems such as mangroves, backwaters, salt marshes, estuaries, lagoons, rocky coasts, sandy stretches and coral reefs (Venkataraman and Wafar, 2005) is undoubtedly rich in bivalve resources. As such there is no published report compiling the current information on bivalve diversity of the west coast of India, which is attempted in this paper.

MATERIALS AND METHODS

For the study bivalve specimens were collected from Vizhinjam, Kovalam, Thirumullavaram, Tangassery, Sakthikulangara, Neendakara, Alappuzha, Puthiyappa, Muzhappilangad, Dharmadam and Chombala (Kerala); Kanyakumari, Muttom and Colachel (Tamilnadu); Mangalore, Uduppi, Malpe, Kumta and Karwar (Karnataka); Ratnagiri, New ferry wharf, Versova and Madh island (Maharashtra); Sikka, Narara, Veraval, Okha and Poshitra (Gujarat) regions of the west coast of India. The samples were collected by handpicking, digging, snorkelling, trawling and scuba diving. Cemented species such as oysters were split with a hammer. Burrowing species such as cardiids were digged out. The deep sea bivalves were collected from the bottom trawlers. All the collected specimens were georeferenced using GPS and photographed using digital camera. Shells were preserved dry and the soft body in 5 per cent formaldehyde for taxonomic studies. The collected specimens were identified using the standard keys, relevant taxonomic publications (Gravely, 1941; Satyamurti, 1956; Apte, 1998, 2012; Poutiers, 1998; Leal, 2002; Huber, 2010, 2015) and by seeking help from international experts in each bivalve families.

RESULTS AND DISCUSSION

The present study documented 200 species of marine bivalves represented in 13 orders, 42 families and 111genera. Order Veneroida with 65 species appeared the largest order

followed by Lucinoida, Pteroida, Arcoida, Pectinoida, Mytiloida, Ostereoida, Carditoida, Euheterodonta, Limoida, Nuculanoida, Solemyida and Myoida (Fig.1). The species rich family was identified as Veneridae with 45 species. The families represented by single species were Solemyidae, Nuculanidae, Yoldiidae, Malleidae, Plicatulidae, Placunidae, Propeamussiidae, Cyrenidae, Glossidae, Pholadidae, Mesodesmatidae, Laternulidae, Vesicomyidae and Hiatellidae (Fig.2). The state wise distribution of bivalves revealed 163 species in Kerala, 77 species in Gujarat, 70 species in Maharashtra, 43 species in Goa, 42 species in Tamil Nadu and 30 species in Karnataka (Fig.3).

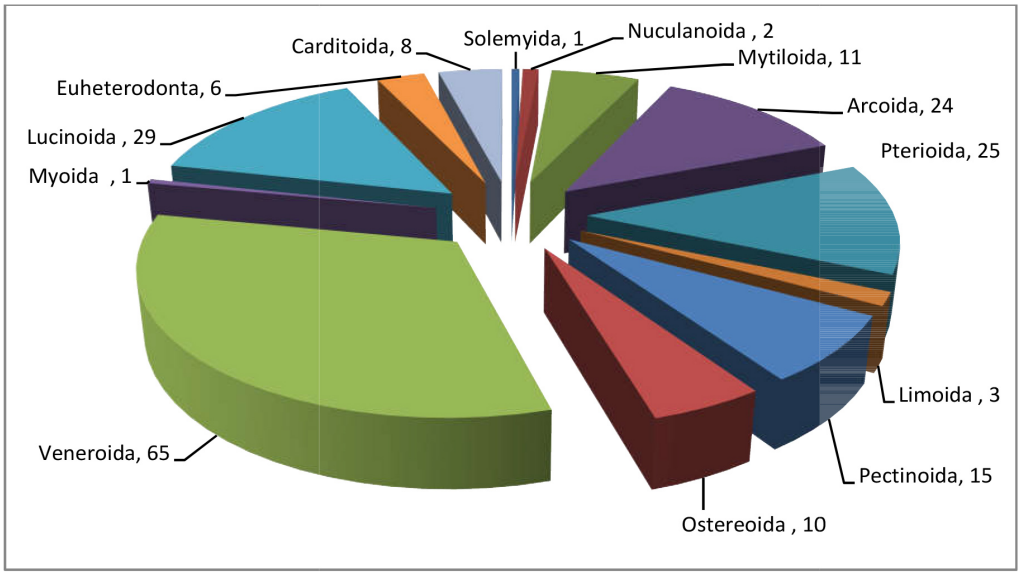

Fig.1. Species diversity in various orders of Bivalvia in the west coast of India

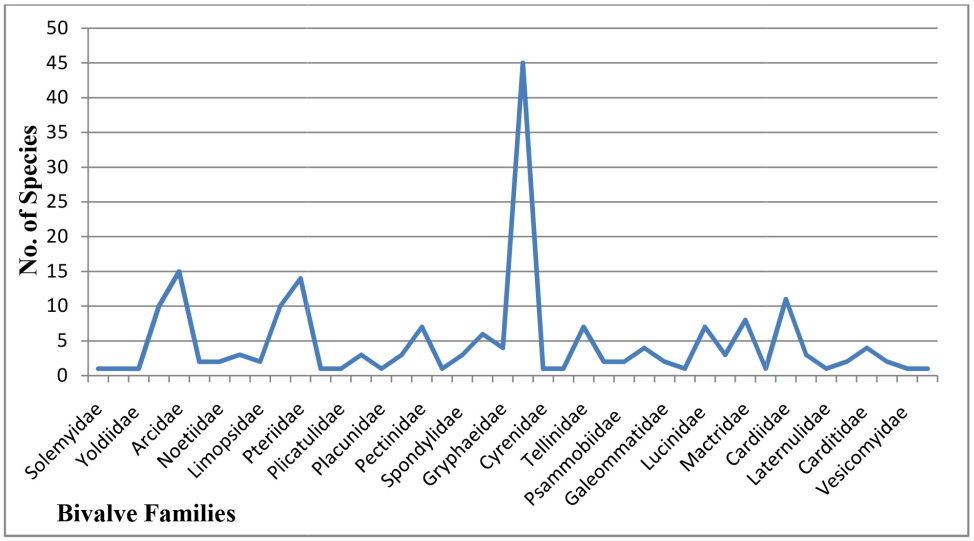

Fig.2. Species diversity in various families of Bivalvia in the west coast of India

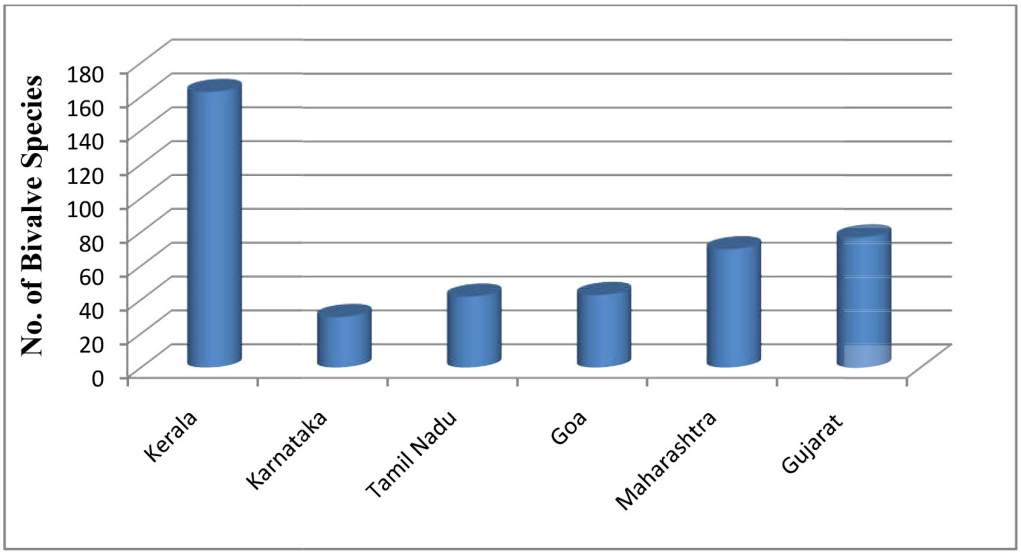

Fig. 3. Diversity of bivalves collected from various states along the west coast of India

Among the recorded bivalves 30 species are newly recorded from India and 26 species are new to West Coast. The species newly recorded from India included *Leiosolenus tripartus* (Mytilidae), *Anadara consociata*(Arcidae), *Tucetona sibogae* (Glycymerididae), *Atrina exusta*, *Atrina rigida* (Pinnidae), *Pteria howensis* (Pteriidae), *Mimachlamys townsendi* (Pectinidae), *Propeamussium arabicum* (Propeamussiidae), *Hyotissa numisma*, *Hyotissa sinensis* (Gryphaeidae), *Pelecyora ceylonica, Pelecyora excisa, Protapes cor, Globivenus toreuma, Aphrodora sewelli, Venerupis bruguieri* (Veneridae), *Meiocardia cumingi* (Glossidae), *Tellina albinella* (Tellinidae), *Leptomya bracheon* (Semelidae), *Hiatula rosea* (Psammobiidae), *Lepirodes ambiguous* (Galeommatidae), *Lamellolucina oliveri, Myrtea triclotae, Scabrilucina vitrea, Divalinga arabica* (Lucinidae), *Chama croceata* (Chamidae), *Coecella horsfieldii* (Mesodesmatidae), *Nemocardium fulvum, Freneixicardia victor* (Cardidae), and *Trapezium oblongum* (Trapezidae).

The most common bivalves, which were present in all the states surveyed were P*erna perna, Perna viridis, Brachidontes pharaonis* (Family: Mytilidae); *Tegillarca granosa, Anadara inaequivalvis, Barbatia amygdalumtostum* (Family: Arcidae); *Cucullaea petita* (Family: Cucullaeidae); *Placuna placenta* (Family: Placunidae); *Anomia achaeus* (Family: Anomidae); *Crassostrea bilineata, Saccostrea cucullata* (Family: Ostreidae); *Gafrarium divaricatum, Gafrarium pectinatum, Meretrix meretrix, Meretrix casta, Callista erycina, Sunetta scripta, Sunetta solanderii, Dosinia tumida, Paratapes textilis* (Family: Veneridae); *Tellina lanceolata* (Family: Tellinidae); *Donax scortum, Donax cuneatus* (Family: Donacidae); *Siliqua radiate* (Family: Pharidae) and *Cardita variegata* (Family: Carditidae). The most commercially exploited bivalve species of India are: *Anadara granosa, Crassostrea bilineata, Donax cuneatus, Gafrarium tumidum, Marcia opima, Meretrix casta,*

Meretrix meretrix, *Paratapes textilis, Perna perna, Perna viridis, Pincatda fucata, Pinctada margaritifera, Placuna placenta, Protapes gallus, Saccostrea cucullata and Sunetta scripta* (Mohammed, 2012). This study documented the presence of all the above mentioned commercially significant bivalves from the west coast of India. Bivalves of the family Arcidae, Cardiidae, Pectinidae, Placunidae and Veneridae are considered to have ornamental value. This study also documented the bivalve Placuna placenta included in Schedulde IV of the Wildlife (Protection) Act of India.

The present study highlights the species richness and diversity of bivalves along the west coast of India. Bivalves, being economically and ecologically significant component of marine biodiversity, have long been used as a cultivable resource, healthy food source, source of lime, pearl, antiviral drugs, decorative shells, models for understanding deep sea diversification, for explaining global, ecological and biogeographical patterns (Anil *et al.,* 2002; Bieler *et al.,* 2014). Besides, they are ecologically important components in terms of biomass, production, and cycling of buried organic material. They act as bioindicators, as scaffold for rocky shore intertidal communities, built a significant link in food chain, contribute to transfer of minerals and organic matter, increase the productivity of mudflats and thus play an important role in the functioning of ecosystems they inhabit (Gosling, 2003; Meyer *et al.,* 2008). Regular taxonomic surveys and diversity analyses of such significant groups prove useful in improved and rational utilisation of resources.

A methodical knowledge on the presence and availability of resources helps further studies in biological and environmental aspects. A proper data collection system on resource availability and utilisation pattern will help in marine resource management by enhancing the underutilised resources and conserving the over utilised categories. In the present scenario of accelerating marine biodiversity loss and where the number of unknown species surpasses the known, taxonomic studies are of great help in accurate identifications, recognising key species and assessing diversity. Furthermore, taxonomic studies support various branches of study such as community ecology, conservation measures, bioprospecting and aquaculture.

REFERENCES

1. Anil, C., Ansari, Z. A., Ingole, B. S., Bichurina, M. A., Sovetova, M. and Boikov, Y. A., Indian marine bivalves: Potential source of antiviral drugs, *Current Science*, 2002, **82,** 1279-1282.
2. Apte, D., *The Book of Indian Shells*. Bombay Natural History Society. Mumbai, 1998, pp. 115.
3. Apte, D., *Field Guide to the Marine Life of India*, Stusa Mudra Private Limited, Mumbai, 2012, 1st ed., pp. 502.
4. Bieler, R., Mikkelsen, P. M., Timothy, M. C., Glover, E. A., González, V. L., Daniel, L. G., Harper, E. M., Healy, J., Kawauchi, G. Y., Sharma, P. P., Staubach, S., Strong, E.

E., Taylor, J. D., Tëmkin, I., Zardus, J. D., Clark, S., Guzmán, A. M., McIntyree, E., Sharp, P. and Giribet, G., Investigating the Bivalve Tree of Life – an exemplar-based approach combining molecular and novel morphological characters. *Invertebrate Systematics*, 2014, **28**, 32–115.

5. Gosling, E., *Bivalve Molluscs: Biology, Ecology and Culture.* Fishing News Books, Garsington Road, Oxford, 2003, pp.456.
6. Gravely, F. H., Shells and other animal remains found on the madras beach. Part-1. Groups other than snails, etc. (mollusc, Gastropoda). *Bulletin of the Madras Government Museum*, 1941, **1**, 1-112.
7. Huber, M., *Compendium of Bivalves*, Conch Books, Hackenheim, 2010, pp. 901.
8. Huber, M., *Compendium of Bivalves 2,* Conch Books, Hackenheim, 2015, pp.907.
9. Leal, J. H., Bivalves. In: *FAO Species Identification Guide for Fishery Purposes, The living Marine Resources of the Western Central Pacific (*ed. Carpenter K. E.), Introduction, Molluscs, Crustaceans, Hagfishes, Sharks, Batoid fishes and Chimaeras. 2002z, Vol.1, pp. 26- 98.
10. Meyer, E., Nilkerd, B., Glover, G. A. and Taylor, J. D., Ecological importance of chemo autotrophic lucinid bivalves in a per- mangrove community in Eastern Thailand. *The Raffles Bulletn of Zoology,* 2008, **18,** 41-55.
11. Mohammed, S. K., Marine molluscan diversity in India- Exploitation and conservation challenges in the 21st century. In *Marine Biodiversity- Status, opportunities and Challenges.* (eds Ramachandran A, Aneykutty Joseph.), 2012, pp. 37-64.
12. Poutiers, J. M., Bivalves (Acephala, Lamellibranchiata, Pelecypoda). In *FAO Species Identification Guide for Fishery Purposes, The living Marine Resources of the Western Central Pacific (* eds Carpenter, K. E., Niem, V. H.), - Seaweeds, Corals, Bivalves and Gastropods, 1998, **Vol.1**, pp.124- 362.
13. Satyamurthi, S. T., The mollusc of Krusadi island II- Scaphopoda, Pelecypoda and Cephalopoda. *Bulletin of the madras government museum*, 1956; **1**(2), 1-202.
14. Tripathy, B. and Mukhopadhyay, A. K., Marine Molluscan Diversity in India. In *Marine Faunal Diversity in India*. Elsevier, 2015, 39-74.
15. Venkataraman, K. and Wafar, M., Coastal and marine biodiversity of India. *Indian Journal of Marine Sciences*, 2005, **34**(1), 57-75.