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COMMERCIAL MARINE MOLLUSCS OF INDIA AND THE NEED FOR THEIR SURVEY

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Marine molluscs have been known to play an important role in the life of the mankind especially of the coastal region, since time immemorial. Shell heaps and thousands of pits filled with shells along the tidal creeks, estuaries and such other places have been known to exist all over the world. Some of these shell-filled pits are, of course, of geological age, dating back to 80 million years while others are man-made and of thousands of years old harbouring the weapons and tools of the early man. These shell-dumps are not only the testimony of the part played by the molluscs in the human life but they form an excellent material for the study of early climatology and also the archaeology and sociology of the then human habitation.

In India, such shell-dumps have been located at several places all along the coast, the huge dump of the kind worthy of mention here is at Vembanad lake in Kerala, where the ancient shells of bivalves *Meretrix*, *Arca* and *Vellorita* support prosperous lime manufacturing industry.

Several attempts have been made in the past to classify the Indian Marine molluscs, the earliest being by Melvill and Abercrombie (1893), Melvill (1893, 1896). Later, Hornell (1916, 1917, 1918, 1921, 1949 and 1951) made a significant contribution to the study of Indian molluscs. Prashad (1932) while giving the taxonomic account of the lamellibranchs of the Siboga expedition, has described several forms from the Indian region. Others who have contributed to our understanding of marine molluscs of India, are Preston (1908, 1914, 1915 and 1916), Annandale and Kemp (1916), Coggin-brown (1923), Annandale (1924), Gravely (1927, 1941) and Crichton (1941). In recent years, several workers have studied the molluscan fauna of some best collection grounds on our coast. Amongst these, works of Patil (1952), Satyamurti (1956), Subramanyam *et al.* (1952), Gidean *et al.* (1957), Menon *et al.* (1961) and Kundu (1965) merit mention.

Intensive study of a single family or a genus as has been done in the case of freshwater molluscs by Prashad (1928), Annandale and Rao (1925) and several others, is not seen in the available literature on Indian marine molluscs. However, attempts of Hornell (1916b, 1917) in giving the account of the varieties and races of the genus *Turbinella* (*Xancus*) and revising the species of *Meretrix* respectively, and by Ghosh

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(1920) on the taxonomic studies on the soft parts of Solenidae are noteworthy. The publication of an excellent memoir "Mitres of Indian waters" by Ray (1956) is another landmark in this direction.

In spite of all these, the molluscan fauna of Indian waters remains a poorly surveyed group. This is especially so in respect of economically important families like Cymatiidae, Muricidae, Strombidae, Cypraeidae, Harpidae *etc.*, amongst Gastropods and Ostreidae, Veneridae, Cardiidae (Cockles), Carditidae (false cockles), Pectinidae, Arcidae *etc.*, amongst Pelecypods.

The commercially important molluscs of Indian coast, fall into four categories: (1) Food molluscs (2) Molluscs yielding pearls, medicines and lime (3) Molluscs used in the manufacture of ornamental and utilityarticles (4) Molluscs which cause damage to our ships and marine structures as foulers and borers. The members of the last category, though not commercially important directly, are perhaps of greater importance than all the earlier categories. The molluscs which contribute to the first category come from all the three major classes of the phylum *i.e.*, Gastropoda, Pelecypoda and Cephalopoda, while the next two categories are formed by Gastropods and Pelecypods and the last one by Pelecypods alone.

Food molluscs.—Among the shellfish utilized for food; oysters, clams, mussels, squids, cuttlefishes and Octopi are the most important. The survey of the edible oysters of India has not been done and our knowledge about the Indian oysters is limited to the excellent works of Awati and Rai (1931), Rai (1932), Rao (1956), and Rao and Nair (1956). I have made some contribution towards the understanding of the systematics, biology and biochemistry of the edible oyster (*Crassostrea gryphoides*) of the west coast of India (Durve, 1961a, & b, 1962, 1964 1965, 1967 and 1974). At present, only two oysters *viz.*, *Crassostrea gryphoides* (Schlotheim) occurring from Saurashtra to Karwar on the west coast and *C. madrasensis* Preston from the Malabar coast and the major part of the east coast of India have been known as the true edible oysters of this country. Despite the detailed work cited above on these two oysters, much is still to be done to assess the density distribution of these oysters, their races and varieties if any, in the numerous estuaries and backwaters of our country. It is reported that the individuals of these oysters living on permanently submerged rocks grow to enormous sizes of 12-14 inches in height. But nothing has been done so far to survey these oysters and assess their fishery potential.

The rock-oyster, *C. cucullata* which is wide-spread on the inter-tidal rocky regions throughout the Indian coast, is a delicacy but little is known about it except for its anatomy (Awati and Rai, 1931). It is likely that there may be more than one species of this oyster. I feel, this oyster has a great fishery potential and much work is needed on its systematics, ecology and biology. The large oysters of the Orissa coast (*Ostrea gryphoides* var. *cuttackensis*) of which much is written by Vredenburg (1904) and Newton and Smith (1911), is further available for the study of its horizontal and vertical distribution along the east coast and the continental shelf. Other possible fishable oysters are *C. discoidea* (Gould) and *Ostrea cristagalli* which are known to occur on the Indian coast but nothing is mentioned about their abundance and the exact localities of occurrence. It is more likely that *C. discoidea*

may prove itself an aberrent environmental variety of some already known species. *Ostrea cristagalli* is likely to be the member of the genus *Lopha* and not *Ostrea*. However, much work is needed in this direction.

A well-planned survey of Ostreidae of the Indian region is essential both from the academic and fishery points of view. This will not only lead to gaining of knowledge about these economic molluscs but may yield some interesting species and genera unrecorded from the Indian region and perhaps even unknown to science.

Clams play a dominant role in the kitchen of coastal people especially during monsoon when the fish is not readily available. They are highly nutritious and delicious. On the west coast, the important edible clams are *Meretrix meretrix* (Linn.) and *Katelysia marmorata*. These form extensive beds on the Kathiawar Saurashtra and Bombay regions. On the southern parts of the west coast, these clams are replaced by *Vellorita cyprinoides* (Gray) and *Meretrix casta* (Chemnitz). On the east coast, the food-clams are *Meretrix casta* (Chemnitz) and *Katelysia opima* (Gmelin) which form extensive beds in the estuaries of south India. The species of Razorclam *Solen* have a wide-spread distribution on the Indian coast. Rao *et al.* (1962) describe eight species of this genus. Members of the family Solenidae are of food-value and contribute to local fishery in several parts of the country.

Besides the above mentioned clams, there are several species of *Gafrarium*, *Donax*, *Arca*, *Cardium*, *Paphia*, *Mactra* etc. which form a good source of food but very little is known about their systematics, ecology and distribution. These resources, thus, still remain largely untapped on commercial basis. In this connection, it may be mentioned that the majority of edible clams belong to the family Veneridae which is practically untouched by Indian workers.

Several Gastropods like *Thais* sp., *Telescopium telescopium*, *Natica* sp. and *Umbonium vestiarum* are also used for food purposes, but nothing is known about their systematics, ecology and distribution.

Mussels form thick carpet of growth on the submerged rocks. Two main species which contribute to mussel fishery are green mussel or *Mytilus viridis* Linne and brown mussel, *Mytilus* sp. The former is a little widely distributed being abundant off Cochin, Malabar, north Kerala and Karwar. It also occurs off Bombay and Ratnagiri but the extent of its abundance is not known. The brown mussel is confined to south of Quilon on Kerala coast to Cape comorin. On the east coast, it is available off Tuticorin. Several small individuals of *Mytilidae* are often seen on the rocky beaches but no literature is available except for stray accounts, on their systematics.

Cuttle fishes, Squids and Octopi are common in the seas around India and are caught in fishing nets in the inshore waters. Early works on the Cephalopods of the Indian waters are by Goodrich (1896), Massy (1916) and Adams (1939). As such, comprehensive treatise on this group is still wanting. Recently, Silas (1968) has given an account of Cephalopods of the west coast of India. Filippova (1968) has added five more species of Cephalopoda to the existing list from the Indian ocean, based on the collections made by the Russian ships participating in the Indian Ocean expedition. In his work (Filippova,

op. cit.) he also gives the abundance of different species in the coastal and open waters around India.

Cephalopods do not form regular fishery around the Indian coast except some parts of east coast especially in Palk bay and Gulf of Mannar where a single species *Sepioteuthis arctipinnis* Gould contributes to the entire fishery (Rao, 1954). *Symplectoleuthis oualaniensis* reported as abundantly available species in the Indian region by Filippova (1968) should be further investigated for its fishery potential.

Molluscs yielding pearls, medicines and lime:—

Almost all bivalves yield pearls, but those obtained from the pearl oysters fetch the highest price. The pearl oyster of India is *Pinctada vulgaris*. Besides, four more species are known to occur in the Indian region. On the west coast, the pearl fishing is restricted only to Jamnagar and northern parts of Halar district of Saurashtra. On the east coast the pearl oyster beds extend from Cape Comorin to Kilakarai in the Gulf of Mannar, with a most productive Central Zone off Tuticorin. Very recently, a sixth species namely *P. sugillata* has been discovered from the Indian waters. The distribution of pearl-oysters of the Indian region has been well reviewed by Rao (1968). Due to the depletion of pearl-oyster beds in the recent years, the pearl fishing is greatly hampered and the proper survey of pearl banks is necessary to ensure the sustained yield of this foreign exchange earner.

Medicinal pearls are mostly obtained from *Placuna*, presently called *Placenta placenta* (Linnaeus) and popularly known as windowpane oyster. These pearls are small, soft and of inferior quality so far as ornamental value is concerned. They are, therefore, used in preparation of medicines, well-known amongst which is the Ayurvedic preparation "Mouktik Bhasma" (मौक्तिक भस्म). Large beds of these windowpane oysters occur on Balarpur area and the Rana Bay in the Gulf of Kutch. They are also found along the Bombay and Goa Coasts, where a sizable fishery exists. Further south, they become sparse. The shells are used as decorative articles and for glazing windows and roofs in China, Far East and Goa. The knowledge about the systematics, distribution, ecology and biology of Anomiidae is scanty, the only notable work being of Hornell (1909) on the anatomy.

All the molluscan shells yield lime after burning in kilns. However, genera like *Meretrix*, *Arca*, *Vellorita*, *Katelysia* and oysters which form extensive beds and the shells of which are readily available in sufficient quantities are generally used for the purpose. Even the dead shells of all the molluscs washed ashore are also collected and burnt to obtain lime. Shell-lime is mainly used in betel leaves. Expensive lime is prepared from the pearls of *Placenta placenta*.

Molluscs used for ornamental and utility articles:—

In this category comes the famous sacred chank *Xancus pyrum* (Linnaeus) earlier known as *Turbinella pyrum*. Besides, species of *Trochus*, *Turbo*, *Lambis*, *Haliotis*, *Harpa*, *Cassis*, *Murex*, *Cyprea* and *Tridacna* —the largest bivalve of the world, have also the importance as curios and decorative articles. Chank beds occur on the west coast in the

Gulf of Kutch near Port Okha and in the Arabian sea off Trivandrum. On the east coast, the most productive beds are chiefly in the Gulf of Mannar near Tuticorin and Kilakarai and in the Palk bay near Devipatnam and Rameshwaram. Large specimens of the rest of the ornamental shells are also found around Rameshwaram, Andaman and Nicobar islands. Hornell (1916b) and Vredenburg (1916) have done commendable work on the sacred chank *Xancus pyrum* (*Turbinella*). However, this work now needs revision. Chank beds also need a careful survey lest they get dangerously depleted due to over fishing. Regarding the work on the family Strombidae, mention may be made of the works of Ray (1956). Abbott (1960, 61, 67). Jung and Abbott (1967) and Subba Rao (1970). However, much of this work is based on collections made from a very wide coverage of the Indo-Pacific region and does not represent a true picture of Indian coast line. The other ornamental molluscs including those mentioned above have not been touched by molluscan workers and it is necessary to give a thought to this problem.

Varieties of large and small shells collected from the sea-shore all along our coast for the preparation of decorative articles like dolls, curios *etc.* belong to different families, genera and species about which no systematic account is available.

Molluscs causing damage to ships and marine structures:—

In this category come the shipworms *Teredo* and *Bankia* along with *Martesia*, *Pholas* etc. Our knowledge about these is mainly due to the workers of wood-preservation schemes of the Forest Research Institute, presently running at several universities in India. Mention may be made here of the works of Palekar and Bal (1957), Nair (1957ab, 1965), Rajagopal (1961) and Subba Rao (1968). In spite of this, the systematic work on this group of molluscs is needed and is evidenced by several new species and records made by these workers.

From the account given above, it will be noticed that the works of Preston (1908, 1914, 1915, 1916), Annandale and Kemp (1916), Annandale (1924), Gravely (1927, 1941), Prashad (1932), Satyamurti (1956), Subramanyam *et al.* (1949, 1951, 1952), Kundu (1965) and several others have given us much needed information about the systematics of Indian molluscs. However, their work touched several groups at a time and as such, especially in the case of recent works, lacks the thoroughness required for the understanding of the taxonomy and distribution of each family. In some cases the illustrations need redrawing to represent the specimens correctly. The material of the recent workers cited above came in most cases from the dead shells found along the shore, with the result, the identifications are, at times, incomplete, obscure and in several cases even doubtful. It is necessary, therefore, to work out this vast phylum of Mollusca familywise and it is needless to state here that priority should be given to such orders and families which are commercially important so that, while filling the lacunae in the taxonomy of the Indian marine molluscs, we will have satisfaction of having contributed indirectly to the welfare of our countrymen.

References

Abott, R. T 1960. The genus *Strombus* in the Indo-Pacific. *Indo-Pacific Mollusca*, **1** (2) : 33-146.

Abott, R. T. 1961. The genus *Lambus* in the Indo-Pacific. *Indo-Pacific Mollusca*, **1**(3): 147-174.

Abott, R. T 1967. *Strombus (Canarium) Wilsoni*, new species from Indo-Pacific *Indo-Pacific Mollusca*, **1**(7): 455-456.

Adams, W. 1939. Cephalopoda in the Indian Museum, Calcutta, *Rec. Indian Mus.*, **41**: 61-110.

Annandale, N. 1924. Fauna of Chilka Lake, Mollusca Gastropoda (Revision) *Mem. Indian Mus.*, **5** (4): 855-873.

Annandale, N. and Kemp, S. 1916. Fauna of Chilka Lake. *Mem. Indian Mus.*, **5** (4): 327–374.

Annandale, N. and Rao, H. S. 1925. Material for the revision of the recent Indian Limnaeidae (Mollusca Pulmonata). *Rec. Indian Mus.*, **27** : 137–189.

Awati, P. R. and Rai, H. S. 1931. *The Indian Zoological Memoir III. Ostrea cucullata* (The Bombay oyster) Ed. K. N. Bahl, Methodist Publication House, Lucknow.

Coggin Brown, J. 1923. On the occurrence of *Ostrea gryphoides* (Schlotheim) in Calcutta. *J. Proc. Asiatic Soc. Beng.*, **19** : 75–80.

Crichton, M. D. 1941. Marine shells of Madras. *J. Bombay nat. Hist. Soc.*, **42** : 323–341.

Durve, V S. and Bal, D. V. 1961. Some observations on the shell-deposits of the oyster *Crassostrea gryphoides* (Schlotheim). *Proc. Indian Acad. Sci.*, **55** : 45–55.

Durve, V. S. and Bal, D. V 1961. Studies on the chemical composition of the oyster, *Crassostrea gryphoides* (Schlotheim). *J. zool. Soc. India*, **13** : 70–77.

Durve, V. S. and Bal, D. V. 1962. Preliminary observations on the growth of the spat of the oyster *Crassostrea gryphoides* (Schlotheim). *J. mar. biol. Ass. India*, **4** (2): 206–213.

Durve, V. S. 1964. On the percentage edibility and the index of condition of the oyster, *Crassostrea gryphoides* (Schlotheim). *J. mar. biol. Ass. India*, **6** (1): 128–134.

Durve, V. S. 1965. On the seasonal gonadal changes and spawnig in the adult oyster *Crassostrea gryphoides* (Schlotheim). *J. mar. biol. Ass. India*, **7** (2): 328–344.

Durve, V S. 1967. On the nomenclature of two Indian backwater oysters. *J. mar. biol. Ass. India*, **9** (1): 173–178.

Durve, V. S. 1974. On the specificity of Madras backwater oyster *Crassostrea madrasensis* Preston and the American oyster, *Crassostrea virginica* Gmelin. *J. Bombay nat. Hist. Soc.* 71(2).

Filippova, J. A. 1968. New data on the Cephalopoda of the Indian Ocean. *Symposium on Mollusca* pt I: 257-264. Marine Biological Association of India.

GHOSH, E. 1920. Taxonomic studies on the soft parts of the Soleniidae. *Rec. Indian Mus.*, **19** : 47–78.

GIDEAN, P. W., MENON, P. K. B., RAO, S. R. V and JOSE, K. V 1957. On the marine fauna of Gulf of Kutch: A preliminary survey. *J. Bombay nat. Hist. Soc.*, **54** : 690–706.

GOODRICH, E. S. 1896. Report on a collection of Cephalopoda from the Calcutta Museum. *Trans. Linn. Soc. London*, **7** : 1–24.

GRAVELY, F. H. 1927. Littoral fauna of Krusadai island Mollusca. *Bull. Madras Govt. Mus.*, (Nat. Hist.), **1** : 1–196.

GRAVELY, F H. 1941. Shells and other animal remains found on the Madras beach I. Groups other than snails etc. (Mollusca. Gastropada) *Bull. Madras Govt. Mus.*, (*N. S.*), *Nat. Hist Soc.*, **5** (1): 62-64.

GRAVELY, F. H. 1942. Shells and other animal remains found on the Madras beach. *Bull. Madras Govt. Mus.* (Nat. Hist.), **5** (2): 1–104.

HORNELL, J. 1909. Report on the anatomy of *Placuna placenta*. The report to the Government of Baroda on the Marine Zoology of Okhamandal in Kattiawar, London, pt. 1: 43–97.

HORNELL, J. 1916. Note on the identification of the edible oyster of Okhamandal. Report on the Marine Zoology of Okhamandal in Kattiawar, Pt. 2.

HORNELL, J. 1916. The Indian varieties and races of the genus *Turbinella*. *Mem. Indian Mus.*, **6** : 109–122.

HORNELL, J. 1917. A revision of the Indian species of *Meretrix*. *Rec. Indian Mus.*, **13** : 154–173.

HORNELL, J. 1918. The edible molluscs of Madras Presidency. *Bull. Madras Fish. Dept.*, **11** : 10–16.

HORNELL, J. 1921. The common molluscs of South India. *Madras Fish. Bull.*, **14** : 97–215.

HORNELL, J. 1949. The study of the Indian molluscs, Pts. 1–III. *J. Bombay nat. Hist. Soc.*, **48** : 303–334, 543–569, 750–774.

HORNELL, J. 1951. *Indian Molluscs*. The Bombay Natural History Society.

JUNG, P. and Abbott, R. T 1967. The genus *Terebellum* (Gastropoda: Strombidae) *Indo-Pacific Mollusca*, **1**(7): 445-454 pts. 318-327.

KUNDU, H. L. 1965. On the marine fauna of Gulf of Kutch, Pt. III, Pelecypoda. *J. Bombay nat. Hist. Soc.*, **62** : 84–103 and 211–236.

MASSY, ANNE L. 1916. The Cephalopoda of the Indian Museum. *Rec. Indian Mus.*, **12** : 185–248.

MELVILL, J. C. 1893. Description of 25 new species of Marine shells from Bombay. *Mem. Proc. Manch. lit. phil. Soc.* Ser., **7** (4): 52–66.

MELVILL, J. C. 1896. Description of new species of minute marine shells from Bombay. *Mem. Proc. Manch. lit. phil. Soc.*, **2** (8): 108–116.

MELVILL, J. C. and ABERCROMBIE, A. 1893. The marine mollusca of Bombay. *Mem. Proc. Manch. lit. phil. Soc.*, Ser., **7** (4): 17–51.

MENON, P. K. B., DATTA GUPTA, A. K. and DAS GUPTA, D. 1961. On the marine fauna of Gulf of Kutch Pt II—Gastropods. *J. Bombay nat. Hist. Soc.*, **58** (2): 475–494.

NAIR, B. N. 1957. The shipworms of south India with a note on the breeding season of *Bankia indica* Nair. *J. Bombay nat. Hist. Soc.*, **54** 344, 357.

NAIR, B. N. 1965. Marine timber boring organisms of the Indian Coast "Report on a collection from the South-east coast of India with notes on distribution in the Indo-Pacific area" *J. Bombay nat. Hist. Soc.*, **62** (1): 120–131.

NAIR, B. N. and GURUMANI, O. N. 1957. Timber boring molluscs of the Indian coast. I Report on a collection from Tondi and Adirampatnam, east coast. *J. Bombay nat. Hist. Soc.*, **54** : 663–673.

NEWTON, R. B. and Smith, E. A. 1912, On the survival of the Mioceric oyster in recent seas. *Rec. geol. Surv. India*, **42** : 1–15.

PALEKAR, V C. and BAL, D. V 1957. Distruction of timber by marine organisms in the Karwar port. *J. Bombay nat. Hist. Soc.*, **54** (4): 962.

PATIL, A. M. 1952. Study of the marine fauna of the Karwar coast and neighbouring islands. Part III. Mollusca (contd.)—Scaphopoda, Pelecypoda and Cephalopoda. *J. Bombay nat. Hist. Soc.*, **51** (1): 29–41.

PRASHAD, B. 1932. The lamellibranchia of the Siboga Expedition. Siboga Expeditie, Pelecypoda, Monograph, **53**C.

PRASHAD, B. 1928. Recent and fossil Viviparidae. *Mem. Indian Mus.*, **8** : 153–251.

PRESTON, H. B. 1908. Descriptions of new species of land, marine and freshwater shells from the Andaman Islands. *Rec. Indian Mus.*, **2** : 209.

PRESTON, H. B. 1914. Mollusca from the Chilka on the east coast of India. *Rec. Indian Mus.*, **10** : 297–310.

PRESTON, H. B. 1915. A further note on Mollusca from Lake Chilka on the east coast of India: Family Solenidae. *Rec. Indian Mus.*, **11** : 304–305.

PRESTON, H. B. 1916. Report on a collection of mollusca from the Cochin and Ennur backwaters. *Rec. Indian Mus.*, **12** : 27–39.

RAI, H. S. 1932. The shell-fisheries of the Bombay Presidecy. *J. Bombay nat. Hist. Soc.*, **35** : 826–847.

RAO, K. V 1954. Biology and fishery of the Palk-Bay Squid, *Sepioteuthis arctipinnis* Gould. *Indian J. Fish.*, **1** : 37–66.

RAO, K. V 1956. Seasonal gonadal changes in the adult backwater oyster, *Ostrea (Crassostrea) madrasensis* Preston from Ennur near Madras. *Proc. Indian Acad. Sci.*, **54** : 332–356.

Rao, K. V 1968. Pearl oysters of the Indian region *Symposium on Mollusca*. Pt III : 1017-1028. Marine Biological Association of India.

RAO, K. V. and NAYAR, K. N. 1956. Rate of growth in spat and yearlings of the Indian backwater oyster, *Ostrea madrasensis* Preston. *Indian J. Fish.*, **3** : 231–260.

Rao, K. V., Narsimhan, K. A. and Algarswami, K. 1962. A preliminary account of the biology and fishery of the razor-shell, *Solen Kempi* Preston, from Ratnagiri in Maharashtra state. *Indian J. Fish.*, **9** (2): 542-599.

RAY, H. C. 1956. Mitres of Indian waters (Mollusca Gastropida : Family Mitridae). *Mem. Indian Mus.*, **14** : 1–72.

SATYAMURTHI, T 1952. The mollusca of Krusadai island. I. Amphineura and Gastropoda. *Bull. Madras Govt. Mus.* (Nat. Hist.), **1** (2), pt. 6.

SATYAMURTHI, T 1956. The mollusca of Krusadai island (in the Gulf of Mannar)—II—Scaphopoda, Pelecypoda and Cephalopoda. *Bull. Madras Govt. Mus.*, N.S.—Nat. Hist., **1** (2): Pt. 7: 1–202.

SILAS, E. G. 1968. Cephalopoda of the west coast of India collected during the cruises of the research vessel *Varuna*. *Symposium on Mollusca*, Pt. I: 277-359. Marine Biological Association of India.

SUBBA RAO, N. V 1968. Report on a collection of wood-boring molluscs from Mahanadi estuary, Orissa, India. *Symposium on Mollusca*, Pt. I: 85-93. Marine Biological Association of India.

SUBBA RAO, N. V 1970. On the collection of Strombidae (Mollusca: Gastropoda) from Bay of Bengal, Arabian sea and Western Indian Ocean, with some new records I. Genus-*Strombus*.

SUBRAHMANYAM, T V., KARANDIKAR, K. R. and MURTI, N. N. 1949. The marine Pelecypoda of Bombay. *J. Univ. Bombay*, **17** (New series), Pt. 5(B): 50–81.

SUBRAHMANYAM, T V., KARANDIKAR, K. R. and MURTI, N. N. 1951. The marine Gastropoda of Bombay. *J. Univ. Bombay*, **20** (1): 21–34.

SUBRAHMANYAM, T V., KARANDIKAR, K. R. and MURTI, N. N. 1952. The marine Gastropoda of Bombay. Pt. 2. *J. Univ. Bombay*, **21** : 26–73.

VREDENBURG, E. 1904. Recent and sub-recent marine bed in Calcutta. *Rec. geol. Surv. India.*, **31**: 174-176.

VREDENBURG, E. 1916. A note on the Geological History of the genus *Turbinella*. *Mem. Indian Mus.*, **6** : 123–126.