

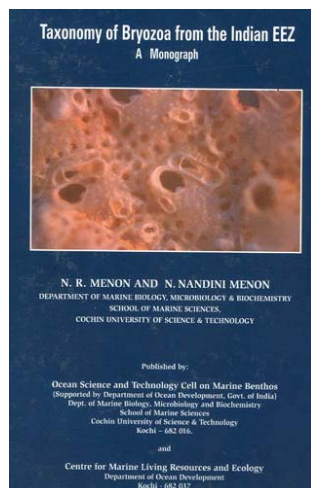
as a common property resource', compiled from the FAO/UN Guidelines, 2004. The section offers some directions to control groundwater over-exploitation by conjunctive use of surface and groundwater, and stresses that land ownership rights and groundwater use rights need to be established through enactment of appropriate laws which can provide guidelines for the protection of groundwater quality.

The book speaks of the multidimensional aspects of groundwater issues from scientific, environmental, social and political perspectives at the local, State, and regional levels. Some articles are mostly reviews that assess previous work done and point to new directions for further research, while others are based on field research. The absence of published references in articles 4, 5, 6, 12 and 14 (although web references are given), does not allow the reader to consult the source material. Barring this, overall a good attempt has been made to present a synoptic insight about the groundwater situation in India.

Nonetheless, the book can be useful to administrators, policy-makers, students, teachers, scientists, researchers, educators and conservationists, who need some general basis to assess the present situation and future guidelines for groundwater management. In fact, this book clearly points out as to how little work has been done so far and much needs to be done for sustainable management of groundwater.

P. S. DATTA

*Nuclear Research Laboratory,
Indian Agricultural Research Institute,
New Delhi 110 012, India
e-mail: psdatta@iari.res.in*



Taxonomy of Bryozoa from the Indian EEZ. A Monograph. N. R. Menon and Nandini Menon. Ocean Science and Technology Cell on Marine Benthos, CUSAT, Kochi 682 016 and Centre for Marine Living Resources and Ecology, Kochi 682 037. 2006. 265 pp. Price: Rs 500.

'For curiosity and beauty, of all the vegetables and animals I have seen, there are none else to match these seaweeds' exclaimed an excited 18th century naturalist on seeing some bryozoans in the field – an experience and view that would be hard to contest by those lucky enough to have encountered these fascinating organisms. In ways more than one, Bryozoa – variously called Polyzoa or Ectoprocta – are highly interesting. To begin with, they pose innumerable problems in their identification. Several of them look like 'weeds or mosses' and have been understandably confused with them by early zoologists who grouped them along with coelenterates as 'zoo-phytes'. In the field, they could be easily mistaken for hydroids, ascidians or even corals. There is a bewildering variety in the texture and formation of bryozoan colonies. They are mostly marine, occurring in all oceans, at all depths and all surfaces, and a few live in freshwater (Phylactolaemata). Bryozoans had a long geological history spanning from Lower Ordovician (500–430 million years ago) to the Recent. It is estimated that the group has about 16,000 extinct and 4000 extant species (a number that actually places them in an intermediate position in the hierarchy of the animal kingdom numerically), but were regarded as a 'minor phylum' for a long time. Bryo-

zoans are among the commonly encountered groups in the intertidal, especially as 'cryptic fauna', and in the fouling assemblages. Some of the fouling species have been reported to be resistant to copper, which is the most commonly used toxicant in paint formulations developed to combat bio-fouling – a multi billion dollar global problem. They are usually found encrusting or attached to firm substrata like rocks and boulders or on shells, corals, polychaete tubes and other animal surfaces. Some bryozoans have extensive calcareous growth forms and 'bryozoan reefs' have even been reported to be significant nourishing areas for commercial fish. They are also a significant component of the 'phytal fauna' at many places and in turn support settlement and growth of a number of epizoans, especially the plantigrade bivalves.

Recent investigations have brought to light the fact that some bryozoan species exhibit pronounced biological activity and produce natural products with great potential for application in biomedical research (e.g. development of anti-cancer drugs). They are also considered a useful biological resource for environmental monitoring and impact assessment, and are being used extensively in cloning and gene mapping by genetic engineers involved with marine organisms.

Despite such scientific, ecological, palaeontological and economic value, bryozoans have long remained poorly investigated in many parts of the tropics. In fact, the 19th century zoologists believed that the tropics were especially unfavourable for their growth – a view that was firmly dispelled by subsequent works, especially the monumental works of Sir Sydney F. Harmer, reporting on the material collected by the Siboga Expedition, in four volumes published during 1915–56. Sydney has reported over 500 species from the Indo-Malayan region alone.

Although interest on Indian Bryozoa dates back to the early works of investigators like Hincks, Annandale, Thornely and Robertson during 1881–1924 (and a few others), the group has remained generally neglected and huge gaps exist in our understanding of their distribution, abundance, ecology, biological relationships, etc. Non-availability of an inventory of accurately identified Indian species of Bryozoa and a comprehensive account of their taxonomy have long remained major gaps and a priority area in

studies pertaining to Indian Bryozoa. The book under review aims to fill that gap.

The book describes 127 species and two varieties of gymnolaematous bryozoans from the Indian EEZ (Exclusive Economic Zone) representing 45 families belonging to three orders. With 113 species and two varieties, by far the most dominant group is the order Cheilostomata, as is mostly the case in faunistic studies in many parts of the world. The families Membraniporidae (17 species and two varieties), Smittinidae and Scrupocellariidae (11 species each) and Schizoporellidae (10 species) are the most represented. At the generic level, Scrupocellaria and *Parasmittina* (with nine species each), and *Bugula* (with seven species) are the best represented. Many of the bryozoans described were from the dredged samples obtained mostly from 5–70 m depths. *Tremogasterina ventri-cosa* and *Euoplozoum cirratum* were from deep waters (330 m and 284 m respectively). A couple of species which were known to occur in deep waters elsewhere were found occurring at much lesser depths (e.g. *Colletosia radiata*). Three species were reported to be occurring at around 140 m depth. Only a few species have been listed by the authors as occurring in the intertidal or subtidal, although many of them were from pearl oyster or coral beds, and from the fouling communities. Some species were found attached to algae and other soft-textured substrata, but majority favour firm and hard surfaces. They were also commonly found encrusting or attached to shells, polychaete tubes, crabs and other animal surfaces as epizooties.

The format adopted in the presentation of the species, i.e. synonymy, description, records from Indian waters, distribution and remarks, is crisp and brings out the salient features of the species. 'Bryozoan taxonomy is a very complicated one' and the study of Bryozoa is burdened with a large and fantastic terminology, much of it dating back to a period when the structure of these organ-

isms was not understood. The authors have fortunately provided a glossary and employed modern terminology, which are welcome features.

A closer look at the monograph, however, brings out some errors, omissions and avoidable mistakes. Mismatches of references, out of place citations and serious omissions (there is, for instance, no mention of the source of the material used for illustrations of the 26 species not recorded by the authors) could be noted. Some species which have already been described as new and named in earlier publications, are mentioned as sp. nov. in this work. More importantly, the book gives the impression that Indian Bryozoa are found concentrated just off the southern coasts of Kerala and Tamil Nadu between approximate latitudes 8°N and 10°N. Only 12 species could be found in the book, reported occurring north of this small strip along the coastal mainland. Some coasts like the Andhra coast, would appear totally devoid of bryozoans and the intertidal too is poorly represented. This simply does not reflect the true picture and the reason for this asymmetry is not difficult to guess.

The book is essentially based on the doctoral work of the N.R.M. (1967) on Bryozoa from the southwest and southeast coasts of India. All the 101 species and two varieties listed in the thesis are included in the book. Results of this work, including taxonomic accounts of many of the species have been published mostly during the years 1967–78. The additional species included in the present work are from the earlier accounts of mainly Thornely and Robertson (1905–24) and two species described by Hincks, even earlier. The references in this monograph run to 19 pages, but just five (including two by the authors) Indian studies from post-1967 figure in the literature cited. A perusal of the literature reveals that two doctoral works on the group and several publications made subsequent to N.R.M.'s thesis have inexplicably not been referred to, resulting in poor representation of Bryozoa from the

areas studied by other investigators. These studies indicate the presence of about 100 species beyond the southwest and southeast coasts, many of them different from the species reported in the book. This is a significant number that cannot be overlooked. In addition, these studies also indicate that luxuriant, band-forming growths of Bryozoa occur along some coasts in the littoral zone.

Taxonomic knowledge of any group in any geographic area is highly dependent on the sampling effort as well as the availability of expertise. It is rightly recognized in the monograph (see preface) 'that a reasonable estimate of bryozoan taxonomists who are currently studying taxonomy of Bryozoa in the Indo-Pacific is less than 10'. Those involved in Indian studies are even lesser. This is reflected in the small number of bryozoologists that figure in the annual newsletters of the International Bryozoological Association (IBA), since its formation in 1966. Not more than two or three names from India figure annually.

In this background, it is imperative that any work aiming to bring out the faunal features of Bryozoa in the Indian region and clarify their taxonomic position wherever necessary, should take into account all the available information, especially when this information is as scanty as is the case with Indian Bryozoa. Had an effort been made and more attention paid in this direction, the Indian coasts would not appear as impoverished of Bryozoa as it would appear in this monograph.

In this sense, and notwithstanding the merits of the book mentioned, this work does not reflect the true picture of bryozoan occurrence in Indian waters, is incomplete and needs an urgent revision.

K. SATYANARAYANA RAO

Flat No. 302,
Dutch House Apartments,
Kirlahpudi Layout,
Visakhapatnam 530 017, India
e-mail: kanuri_rao@yahoo.com