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TRAINING MANUAL
1ST INTERNATIONAL TRAINING WORKSHOP ON
TAXONOMY OF BIVALVE MOLLUSCS

Editors

S. Bijoy Nandan
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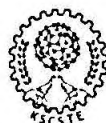
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Glossary

Overview of Bivalve fisheries of India

K. Sunil Mohamed ¹ & Geetha Sasikumar

Introduction

Bivalves are commercially important molluscs belonging to the Class Bivalvia (Lamellibranchia or Pelecypoda), which is the second largest Class under the Phylum Mollusca. They are bilaterally symmetrical, laterally compressed molluscs, with extensive mantle lobes which secrete a single shell composed of two valves. Bivalves are reported to have originated in the euryhaline warm shallow coastal waters prior to their gradual invasion to estuarine, brackish, fresh and all the reaches of marine, ecosystems. Although, none have invaded the land, the bivalves are more successful in marine and a few species are found in freshwater habitats. Nearly 652 species of marine bivalves are reported from India, of which 88 species are endemic to Indian waters.

Habitat

The adult bivalves are benthic or bottom dwelling, with varying levels of evolutionary adaptations to the benthic habitat. This can be generally classified as 1) buried in soft sediments within burrows, 2) cemented or attached by byssal threads to hard substratum and 3) semi-mobile as part of the epibenthos. Thousands of square kilometers of the shallow coastal waters encompassing the estuaries as well as the backwaters are habitats for the bivalves, catering to the regional fishery in India. In estuarine areas, clear zonation in bivalve resources occur in relation to the salinity gradient, with the stenohaline species inhabiting the areas near the bar-mouths.

Exploitation

The commercially important bivalves in India are the clams, mussel and oysters. Clams are exploited from the soft substratum by hand-picking or by using manually operated dredges. In shallow estuaries the clams are located

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by the fishermen by removing the substratum by hand-held tools such as a metallic or wooden pole or by using their feet. The exposed clams are then hand-picked individually and collected in net bags/ canoes. The hand-dredges on the other hand are operated from a canoe for the exploitation of clams from deeper waters. Mussel and oysters are chiseled off hard-substratum by wading or free-diving during low-tide. Mussels are then declumped manually to separate dead shells and epibionts. Oysters are separated from the substratum or from other oyster shells to which they adhere by using chisel or knife.

Species composition

Clams are the most important group among bivalves forming 85.8%, followed by mussels 9.6% and oysters 4.6%. Commercially exploited clams are the *Villorita cyprinoides*, *Paphia malabarica*, *Meretrix casta*, *Sunetta scripta*, *Anadara granosa*, *Meretrix meretrix*, *Marcia opima*, *Cardium sp.*, *Anadara rhombea*, *Geloina bengalensis*, *Gafrarium diverticulum*, *Gafrarium tumidum*. Nearly 93.3% of the contribution to the average annual clam production during 2009-2015 was by three species, namely the *V. cyprinoides*, *P. malabarica*, *M. casta*. The Indian backwater oyster, *Crassostrea madrasensis* is the most important edible oyster exploited (90.1%) followed by the rock oyster, *Saccostrea cucullata* (5.9%) and windowpane oyster *Placuna placuna* (3.6%) along the Indian Coast. Commercial fishery of mussels along the Indian coast is mainly for the green mussels, *Perna viridis*, contributing 83.7% on an average, and the remaining by the brown mussel *Perna indica* which is limited to the fishery along southern tip of Indian peninsula.

Production trends

The average edible bivalve annual production from 2009 to 2015 from the coastal states of Kerala, Karnataka, Andhra Pradesh, Tamil Nadu and Maharashtra, was estimated at 1.03 lakh tonnes. The estimated landings decreased by 47% when compared to the period 1996-2000, which was estimated at 1.52 lakh tonnes. Major share of the bivalve production of the country is from the State of Kerala (85.8%) where, the clams form nearly 89% of bivalve production in the State followed by mussels and edible oysters. Vembanad and Ashtamudi Lakes in Kerala are the two main estuaries, which have well organized clam fishery. The short-neck clam (*P. malabarica*) fishery



in the Ashtamudi Lake in Kerala has received India's first Marine Stewardship Council (MSC) certification in 2014, to encourage sustainable fisheries and also to protect the ecosystem. The Vembanad waters are important for the commercial exploitation of black clam (*V. cyprinoides*). Major green mussel (*P. viridis*) fishing areas are located along the Malabar Coast, of Kerala which are also important for *V. cyprinoides* and *C. madrasensis* fishery. Brown mussel fishery is observed only along the Vizhinjam coast and southern parts of Tamil Nadu.

The share of Karnataka to the average bivalve production was only 6.92% during 2009-2015. Important clam and oyster fishing areas are the Aghanashini, Mulki, Coondapur estuaries. Clams were transported in bulk quantities by road and by rail from estuaries of Kerala and transplanted in Coondapur estuary prior to retailing in local markets of Karnataka and Goa. Green mussel, fishery is also observed along the intertidal and subtidal waters in the coastal region of Karnataka, catering to the domestic markets of Goa and Kerala. Malpe, Nagoor, Kirimanjeshwara and Gangoli are important green mussel fishing areas, where seasonal fishery occurs from December to May.

Ennore, Karapad Bay, Cuddalore and Pondicherry are important bivalve fishing areas along Tamil Nadu. Mussel fishery in Tamil Nadu mainly targets in the domestic markets of north Kerala. In Andhra Pradesh, *Anadara* sp. constitutes the major fishery from Kakinada Bay. Bivalves are fished and utilized from the creeks and estuaries of Sindhudurg and Ratnagiri Districts of Maharashtra. Bivalves are exploited from three major creeks, Shirgoan, Sakhartar and Bhatye creeks in Ratnagiri district. The Indian rock oyster, *Saccostrea cucullata* locally known as 'Kalva' is the major landing. Windowpane oyster, *Placuna placuna* locally known as 'Kachga' is exploited from Kuda creek, a bay along Rajapuri. The local fishermen hand-pick windowpane oyster from specially fabricated fiber rafts during low tide.

Meretrix meretrix, *M. casta*, *A. granosa* and *M. opima* are regularly collected by the fishermen and transported to the different places from Chaumukha (Balasore, Odisha). In Soula (Contai West Bengal) bivalve fishery



for *M. opima*, *M. meretrix*, *A. granosa* and *Donax* sp. *M. meretrix* occurs for industrial purposes.

The Andaman and Nicobar Islands have several bivalve resources among which the black lip pearl oysters (*Pinctada margaritifera*), the Giant clams (*Tridacna maxima*, *T. squamosa*, *T. crocea*, and *Hippopus hippopus*) and the Mabe or winged oyster *Pteria penguin* are fished for the tourism based ornamental shell industry. In the Lakshadweep Island, giant clams are fished by the locals. However, there is no information on the quantities fished and exploitation rate.

Overexploitation and destruction of seed resource

Bivalve fishery is supported by 0-year and 1-year class. The fishing season is usually during the post- and pre-monsoon. The bivalve fishery in Karnataka, Goa and Maharashtra occur during the monsoon season, during the mechanized ban period. Indiscriminate exploitation of seed clams is seen in Kerala and Andhra Pradesh where the clams are utilized in the lime shell industry. In Kakinada Bay, the intensity of blood clam fishery has increased and small-sized clams formed a major part of the total landing. In the mussel fishery of Kerala, destruction of seed mussel has been observed as the fishers discard the seed mussel after they are fished from the natural bed.

Utilization

Clams and mussels are generally marketed as shell-on, whereas oysters are transported to the important domestic markets and sold shell-on and as wet-shucked oyster meat. India has been exporting bivalves, especially clam and mussel meat to other nations. Bivalves fished along the west coast are utilized for human consumption. Some bivalve products like smoked and canned oysters have good market in Indian metro-cities. In Kerala, Tamil Nadu and Andhra Pradesh, part of the clam landings is used as a major ingredient of shrimp feed. The extensive shrimp farms also use dried and boiled clam meat as shrimp feed. Apart from these, the shells of bivalves are used in the manufacture of cement, calcium carbide, sand-lime bricks and lime. The lime shell is used as manure in coffee plantations, as mortar in building construction, in the treatment of effluents, as a pesticide by mixing with copper sulphate and in glass, rayon, polyfibre, paper and sugar industries.



Bivalve shells with attractive sculpture are used by the ornamental shell craft industry.

Management

Bivalves offer one of the important examples of marine resource management along the Indian coast. However, apart from the restriction on the pearl oyster fishery by the Government of Tamil Nadu, and the management measures on the short-neck clam fishery of Ashtamudi Lake, Kerala, there are no regulations for effective utilization and conservation of these sedentary marine resources. One of the major bivalve resources the short-neck clam (*P. malabarica*) is well protected by the following regulations formulated by the Government of Kerala based on recommendations made by Central Marine Fisheries Research Institute (CMFRI): (a) ban on fishing activity during breeding season (September to February), (b) use of gears with 30 mm mesh-sized to avoid exploitation of smaller clam, (c) restrict the grade of export of frozen clams meat to 1,400 nos/kg and above, and (d) initiate semi-culture or relaying of small clams. This co-management model involving the policy makers, fishers and researchers resulted in the short-neck clam (*P. malabarica*) fishery in the Ashtamudi Lake in Kerala receiving India's first Marine Stewardship Council (MSC) certification.

India's first Marine Stewardship Council [MSC] Certified short-necked clam fishery

ICAR-Central Marine Fisheries Research Institute research leads to India's first Marine Stewardship Council [MSC] certified fishery in 2014. Ashtamudi Lake is the second largest estuarine system in Kerala. Clam fishery in the estuary dates back to 1981, supporting the livelihoods of around 3,000 fishers who are involved in collection, cleaning, processing and trading the clams. The growth of Ashtamudi clam fishery was driven by overseas demand in Vietnam, Thailand and Japan in the 1980s and 1990s. By 1991, the catch peaked at 10,000 t, but declined by 50% in 1993 due to overfishing. Based on the participatory research by ICAR-CMFRI, a closed season and mesh size restrictions for nets were introduced, along with a minimum export size and a prohibition on mechanical clam fishing. These measures showed immediate effects, and the clam fishery has sustained landings of around 10,000t annually for the past decade.



The CMFRI's initiatives in studying and managing the short-necked clam (*Paphia malabarica*) fisheries of Ashtamudi Lake since the 1990s helped the WWF, India in identifying this small-scale fishery as an ideal candidate for MSC certification. After three years of relentless hard work, the WWF and CMFRI have together achieved a landmark in Indian fisheries by obtaining MSC certification for the short-necked clam fishery of Ashtamudi Lake, Kerala on November, 2014.

The Marine Stewardship Council (MSC) is a global, non-profit and independent organization working to reverse the decline in global fish stocks through the use of market incentives. The MSC's fishery eco-labelling and certification programme allows consumers to identify and support environmentally responsible fishing practices through purchasing decisions. Consumer support for sustainable fishing in the market place leads to economic benefits for well-managed fisheries and long-term sustainability of fisheries, ensuring secure livelihoods and continuous availability of fish for food.

With its seal of approval on more than 6% of all wild-caught fish, MSC is the world's biggest eco-label for sustainable seafood. If a fishery is successfully certified against the MSC Standard, products from the fishery can be sold with the MSC's unique ecolabel, which identifies seafood as coming from a well-managed fishery. The short-neck clam (*P. malabarica*) fishery in the Ashtamudi Lake in Kerala has received India's first Marine Stewardship Council (MSC) certification which will help boost sustainable fisheries and also protect the ecosystem. It is the first MSC certification in India; it is only the third in Asia (after Vietnam and the Maldives). Up to 1000 fishers rely on this resource. MSC's scoring system puts the fishery in the best practice category on 29 of the 31 indicators, with scoring greater than 80 out of 100. The MSC certification was a joint effort by CMFRI, WWF, Kerala State Fisheries Department and the local fishing community. The certification demonstrates the power of collaboration between partners and the importance of a new council-based management system for clam fishery governance. Benefits of certification include potential for premium prices, access to new markets, preferred supplier status, potential to attract ethical investment in the fishery or funding for local community social and economic infrastructure,





improvements in management of fisheries and public recognition of fishery conservation efforts.

Summary of MSC Principle level scores for the Ashtamudi Estuary Short Necked Clam Fishery:

