# Shellfish Fisheries in India with Special Reference to Maharashtra

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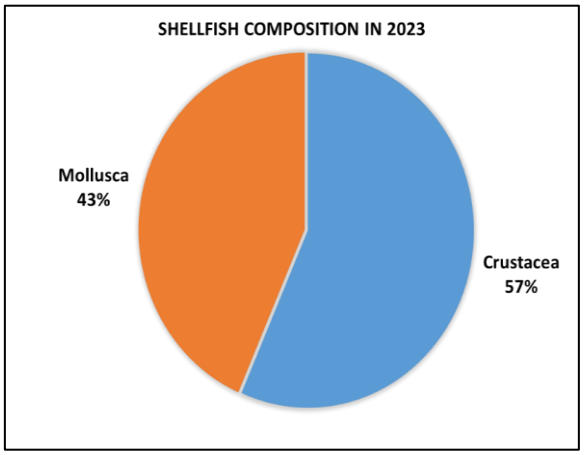
Shellfish, comprising a diverse group of aquatic invertebrates with a protective shell or exoskeleton, encompass molluscs such as oysters, mussels, and clams, as well as crustaceans like shrimp, crabs, and lobsters, providing a valuable source of protein, essential nutrients, and economic revenue. Crustaceans, characterized by segmented bodies covered with armor-like sections of thick or thin shell and jointed appendages, include crabs, shrimps, lobsters, and crayfish. Molluscs are further classified into three types: Bivalves, including clams, oysters, and mussels; Gastropods, comprising abalone, conch, and whelk; and cephalopods, which have a soft pliable body with an internal shell, a beaked head bearing tentacles, and encompass squids, cuttlefish, and octopus.

## Shellfish Fishery 2023

Total Shellfishes landed along Indian coast in 2023 was 7.88 lakh t of this, Crustacean landing was 4.45 lakh t. and molluscan landing was 3.42 lakh t. Crustaceans contribution was 57% and Molluscans 43%.



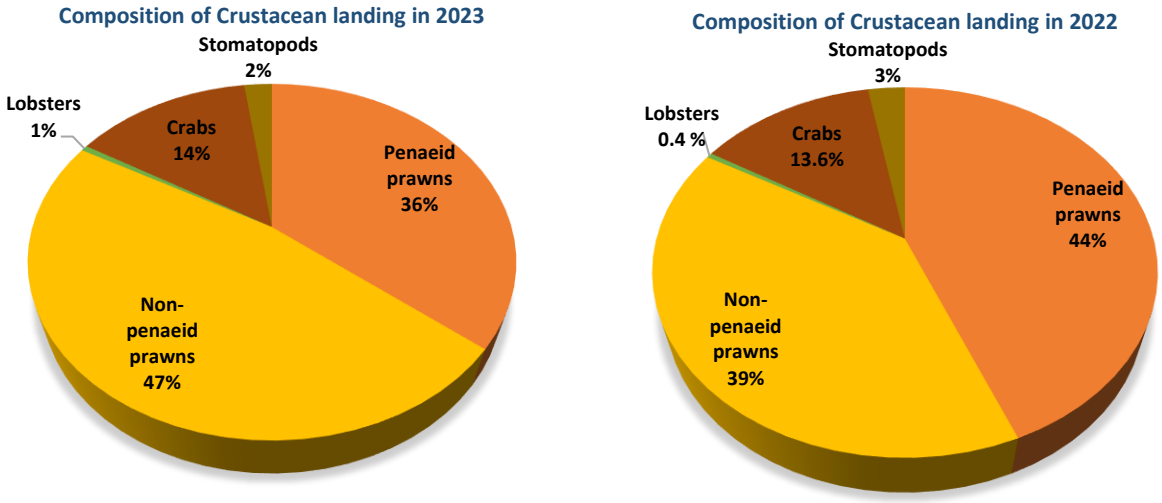

In Maharashtra 47,624 t. Shellfishes were landed in 2023. Crustaceans formed 78% (37,44 t) and molluscan formed 22% (10,280 t).

## Crustaceans

India, as a major producer of marine crustaceans, supports a diverse group of arthropods, characterized by jointed appendages, thriving in a variety of habitats, with the majority being marine and relatively few inhabiting inland waters. The country is home to over 117 species of shrimps, 17 species of lobsters, and approximately 700 species of crabs, predominantly found in marine and estuarine areas, of which around 150 species play a role in commercial catches. Notably, about 80% of crustacean landings come from the west coast, with the remaining 20% from the east coast.

The penaeid shrimps, constituting a significant portion of these crustaceans, serve as the backbone of the seafood export industry, contributing substantially to foreign exchange earnings and serving as a livelihood source for millions of fishermen. It's noteworthy that frozen shrimp alone accounts for approximately 70% of the total export value of the country.

**Crustacean landing in India – 2022 & 2023**




## Marine Prawn landing in India

While the catch of penaeid shrimps in India has exhibited wide fluctuations over the years, it has generally followed an increasing trend. The catch varied from 62,768 t in 1961 to 4.60 lakh t in 2011, and in 2022, it stood at 3.10 lakh t. Throughout this period, the percentage of shrimps in the total catch ranged from 8% to 17%, with an average of 12%. Examining the state-wise contributions, Maharashtra had the highest catch, forming 32% of the total prawn catch in India, followed by Gujarat at 25% and Kerala at 17%. Trawl nets emerged as the principal gear for exploiting penaeid shrimps, with trawlers contributing to about 80% of penaeid landings in India. Smaller varieties of penaeids are captured using dol nets along the northwest coast, while mini trawls operate from Murivalloms along the Kerala coast for penaeid shrimps in nearshore waters (3-8 meters depth). Other gears, including trammel nets along the Vizhinjam - Manakudy region, bottom set gill nets, and disco nets along the east coast, are also utilized in coastal waters to exploit penaeid shrimps. Additionally, stake nets are employed to exploit juvenile shrimps along both the east and west coast.

**Species composition of prawns in India**

The shrimp fishery in India comprises 77 commercially important species, with *Acetes* spp., a non-penaeid prawn, dominating the catch at 33.6%. Among penaeid prawns, the prominent species includes *Parapenaeopsis stylifera* (10.7%), followed by *Metapenaeus dobsoni* (9.6%) and *M. monoceros* (4.8%). In the deep-sea prawn category, *Plesionika* spp., *Heterocarpus* spp., and *Aristeus* spp. are the dominant genera.The deep-sea shrimp landings in various harbors of Kerala represent a diverse array of species from families such as Pandalidae, Aristeidae, Solenoceridae, and Penaeidae, with an annual average estimated landing of 11,315 tons during 2022, caught from depths of 200-500 meters.

Non-penaeid shrimps, constituting about 6% of the total marine fish production, belong to the families Hippolytidae, Palaemmidae, and Pandilidae. The non-penaeid shrimp fishery is primarily supported by species like *Acetes indicus*, *A. johni*, A. *erythraeus, A. japonicus*, and *Nematopalaemon tenuipes* (Spider prawn). Of these, *A. indicus* and *A. johni* sustain commercially important fisheries in marine waters, while others are exploited to a lesser extent in estuarine and near-shore coastal seas in both northeast and northwest regions. *Acetes indicus* is distributed in the northern region of the west coast, especially Mumbai, and throughout the east coast in inshore and brackish waters. *Exhippolysmata ensirostris* is found in inshore waters of Gujarat and Maharashtra and the Godavari estuary in Andhra Pradesh.

**Crabs**

Crabs, members of the suborder Brachyura under the order Decapoda and class Crustacea, are highly sought after in both the domestic and export markets, with certain marine species being particularly popular. Indian waters host about 700 crab species. Dominating the crab fishery in India are key species like *Scylla serrata*, *S. tranquebarica*, *Portunus pelagicus*, *P. sanguinolentus*, *Charybdis feriata*, and *C. lucifera*. Various gears, including seine nets, dip nets, cast nets, lines, hooked iron rods, crab nets, gill nets, and traps, are employed for crab fishing, with trawlers being a major contributor to landings, either as targeted catch or bycatch.

Within the Portunidae family, commercially important marine species like *Portunus sanguinolentus, P. pelagicus, Charybdis feriatus, C. annulata,* and *C. natator* are found. India boasts a robust fishery for marine crabs, with three prominent species, namely C. *feriatus* (Cross crab), *P. sanguinolentus* (Spotted crab), and *P. pelagicus* (Reticulate crab), dominating the fishery of edible crabs in Indian coastal waters.

## Lobsters

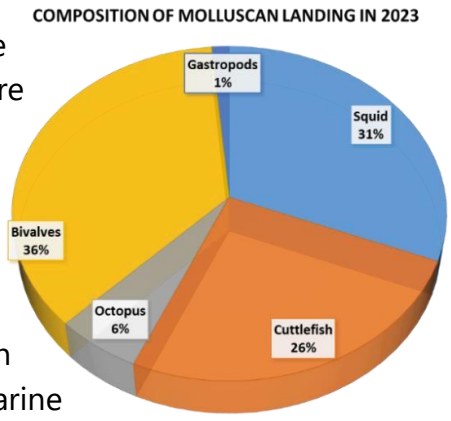
Lobsters, regarded as highly valuable and priced crustaceans and a significant export commodity, are represented by 12 species in Indian coastal waters. Among these, only four species of Spiny Lobsters (*Panulirus homarus, P. ornatus, P. polyphagus, P. versicolor*) and one species of Slipper Lobster (*Thenus unimaculatus*) hold commercial importance. With slow growth rates, most lobsters require more than three years to reach maturation, and they exhibit a prolonged life cycle. In 2022, the total lobster catches in India amounted to 1,607 tons.

India's lobster fauna encompasses 20 species, comprising 14 littoral and 6 deep-sea lobsters. However, commercial significance is attributed to only four littoral species (*Panulirus polyphagus, P. homarus, P. ornatus*, and *P. versicolor*) and one deep-sea species. The northwest coast, particularly, relies on the spiny lobster, *Panulirus polyphagus* (Mud spiny lobster), and the slipper lobster, *Thenus unimaculatus*. The shallow-water *P. homarus* (scalloped spiny lobster), dominant along the southwest coast in the 1-10-meter depth range, is often caught alongside deep-sea prawns by trawlers. Notably, the Andaman Sea reports the presence of *Linupurus somniosus*, a spiny lobster species, and the Gulf of Mannar region revealed a new scyllarid species, *Scyllarus tutiensis*.

## Mollusca

In India, there are 5,070 recorded species of molluscs, with 3,370 species inhabiting marine environments. Certain areas, such as the Andaman and Nicobar Islands, exhibit rich molluscan diversity, boasting over 1,000 species from the marine region. Additionally, the Gulf of Mannar and Lakshadweep house 428 and 424 molluscan species, respectively.

Among molluscs, gastropods stand out as the most successful class, with at least 60,000 living species worldwide. India's marine gastropod resources, comprising a diverse range of species, are regularly exploited for various purposes. Gastropods are primarily distributed in shallow waters, lagoons, and reef areas of coastal seas. India reports 3,370 species of marine molluscs, with gastropods being highly diverse, followed by bivalves, cephalopods, polyplacophores, and scaphopods. Among the seven classes of molluscs found worldwide, five are present in India, with Gastropoda representing 59% of known marine



molluscan families and Scaphopoda being the least represented class. (Reference: Ramakrishna and Dey, 2010; Venkatesan et al., 2019). Species from bivalves, cephalopods and gastropods forms commercial molluscan fishery of India.

**Bivalves**

Bivalves, belonging to the phylum Mollusca, encompass clams, mussels, edible oysters, pearl oysters, and windowpane oysters. Primarily collected for their meat and shells, bivalves were historically sought after for pearl fishing, especially for golden-colored pearls Presently, bivalve resources are largely underexploited along the northwest and northeast coasts, while they face overexploitation along the southeast and southwest coasts.

**Mussels**

The commercial fishery of mussels along the Indian coast is primarily focused on the Green Mussel (*Perna viridis*), accounting for an average contribution of 83.7%. The remaining portion of the fishery is attributed to the Brown Mussel (*Perna indica*), which is confined to the fishery along the southern tip of the Indian peninsula.

**Oysters**

The Indian Backwater Oyster, *Crassostrea madrasensis*, holds significant importance as the most exploited edible oyster along the Indian coast, contributing to 90.1% of the oyster harvest. It is followed by the Rock Oyster, *Saccostrea cucullata*, accounting for 5.9%, and the Windowpane Oyster, contributing 3.6%. Additionally, the Pearl Oyster, *Pinctata fucata*, known for producing natural pearls in the sea, is utilized for the production of cultured pearls.

**Gastropods**

Gastropods are predominantly reported from various regions, including Gujarat, the Gulf of Mannar, the Coramandal coast along the east coast, and the Lakshadweep and Andaman Islands. Among these, the sacred chank holds significant importance, being highly priced and exploited from both the east and west coasts of India, with trawl net fishing being the most popular method.

**Cephalopods**

Cephalopods, which encompass squids, cuttlefishes, and octopuses, belong to the phylum Mollusca. Currently, there are approximately 700 described species of living

cephalopods worldwide. In terms of squids, the order Sepioidea is represented by three families: Sepidae (True cuttlefishes), Sepiadaridae (Bottle tail squid), and Sepiolidae (Bobtail squid). The family Loliginidae includes four genera: Loligo, Doryteruthis, Sepioteuthis, and Loliolus. Interestingly, Cirrate Octopods are entirely absent in Indian waters. Cephalopods are commercially exploited along the entire Indian coast, with the catches of cuttlefish and squid being almost equal proportions.

**Shellfish Aquaculture in India**

Shellfish fisheries play a crucial role in India's coastal communities and economy. Balancing the exploitation of natural resources with sustainable practices is essential for the long-term viability of shellfish fisheries in India. Capture fishery of shellfish resources is a major fishing activity, often leading to overfishing and depletion, which challenges ecosystems and impacts marine environments. Bottom trawl fishery and dredging associated with shellfish fisheries have been found to cause habitat destruction. Climate change and pollution also pose threats to the wild capture fishery of shellfish. Aquaculture of shellfish is practiced globally to sustain and reduce pressure on wild populations. It allows for quality and growth control in captivity, making it a significant industry globally, with shrimp farming reaching technological peaks in India.

**Shrimp Farming in India**

Shrimp culture in India has evolved as a key player in the global aquaculture industry, contributing to economic development while facing challenges to ensure long-term sustainability. India is a leading country in shrimp aquaculture, significantly contributing to global shrimp production. Major shrimp species cultivated in India include the black tiger shrimp (*Penaeus monodon*) and the Indian white prawn (*Penaeus indicus*).

Due to disease problems in indigenous species, the white-leg shrimp (*Litopenaeus vannamei*) gained popularity for its faster growth and disease resistance. Commercial shrimp farming practices are conducted in ponds using traditional, extensive, semi-intensive, and intensive methods with improved management practices. Intensive shrimp farming with circulatory systems is also common.

**Crab Farming in India**

Crab farming, known as crab aquaculture, is an emerging sector in Indian aquaculture. The farming of crabs contributes to both domestic consumption and export markets. The major species cultivated in India is the mud crab (*Scylla serrata*), widely accepted

for its delicious taste and firm texture. Crab farming presents a promising avenue for economic development and diversification within the aquaculture industry.

**Lobster farming in India**

Lobster farming in India was not as widespread as shrimp or crab farming. However, the aquaculture industry can evolve rapidly, and there may have been developments since. Sustainable practices, technological advancements, and government support will play pivotal roles in shaping the industry. Cage farming of lobsters has also been experimented with in India.

**Molluscan Culture in India**

Molluscan culture in India involves the farming of various mollusg species primarily for human consumption. Molluscs, such as oysters, mussels, clams, and scallops, are cultured along the coastal regions of India, taking advantage of brackish water environments and estuarine areas. Various species, including edible oyster (*Crassostrea madrsensis*, *Saccostrea cucullata*), green mussel (*Perna viridis*), brown mussel (*Perna indica*), and clams (*Meretrix* spp., *Anadara granosa*), are cultivated for meat production and, *Pinctada fucata,* for pearl production.

**Mussel Culture**

Marine mussels form one of the most dominant cultivable species all over the world. They give the highest conversion of primary producers (phytoplankton) to human food, and culture of mussels in the column waters can increase the seafood production several fold. In India, the green mussel *Perna viridis*, and the brown mussel, *P. indica* are distributed in the rocky coastal areas where they support a traditional sustenance fishery, but scope for increasing natural production from the existing beds is rather limited.

Marine mussel farming technology using the rope method was developed by scientists of CMFRI in the late 1970s. The technique suited for open sea conditions found few takers and subsequently, in the mid-nineties the technique was modified to suit estuarine habitats with marine conditions. Due to low risks involved in such operations and due to the increasing demand for mussels in northern Kerala, coastal fishers in north and central Kerala readily accepted the technology.

**Edible Oyster Farming**

Oysters occur in shallow waters and form subsistence fisheries in several coastal regions along the Indian coast. Of the six species of oysters, the Indian backwater oyster, *Crassostrea madrasensis* is the dominant species having a wide distribution. Characters like high tolerance to environmental variation and rapid growth have made oysters a candidate species for commercial farming in some parts of India.

**Marine Pearl Culture**

Pearl is one of the oldest of the known gems, produced by the living animal called the pearl oyster. India is well known for the production of natural pearls from time immemorial. India has a wealth of pearl producing oysters: the *Pinctada fucata*, which produces golden pearls, distributed in the Gulf of Mannar, Palk Bay and Gulf of Kutch and the black lip pearl oyster, *P. margaritifera*, which produces the famed black pearls, in the Andaman and Nicobar Islands.

The technology for pearl production, based principally on the Japanese methodology of pearl production, was tried and developed successfully in the Indian pearl oysters by the CMFRI. The technology essentially involves the introduction of an artificial bead along with a secretory mantle tissue into a recipient oyster. The tropical marine environment of India is found conducive to foster the formation of perfectly spherical pearls within a period of 6-8 months.

Molluscan culture in India plays a significant role in providing seafood for domestic consumption and, to some extent, for export. Continued research, sustainable practices, and government support are crucial for the growth and sustainability of the mollusc farming industry in India. For the latest and more specific information, it's recommended to consult recent sources or aquaculture authorities in India.

**Shellfish Fishery in Maharashtra (2022)**

The estimated crustacean landings in Maharashtra during 2022 was 34353 t, showing an increase of 84.4% compared to last year. Penaeid prawns made up 51.5% of the crustacean landings, with non-penaeid prawns coming in second at 45%, followed by crabs (2%), stomatopods ( 1.3%), and lobsters (0.2%). Penaeid prawns were a major contributor (91.7%) to crustacean resources landed by trawlers, and non-penaeid prawns formed a major landing (71.2%) in dol netters.

The estimated cephalopod landing during 2022 was 8517 t. The cephalopod landing showed an increase of 31% from the previous year (2021) and constituted 5% of the

total marine landing in Maharashtra. The trawl net contributes to 66% of cephalopod landings, followed by purse seine (30%). The cephalopod landing was dominated by Indian squid *Uroteuthis (Photololigo) duvaucelii* (82%), followed by pharaoh cuttlefish *Sepia pharaonis* (9.41%) and *Sepiella inermis* (5.24%).

**Shellfish culture taken up under shellfish fisheries Division in Maharashtra**

**Oyster Farming**

Practical dissemination of bivalve farming technologies in the potential maritime locations of Sindhudurg district was undertaken by ICAR-CMFRI. Initially a demo oyster farm was setup in Wadatar, in Sindhudurg District under the UNDP-GEF funded project "Demonstration of bivalve farming at Sindhudurg District in the State of Maharashtra". The training and demonstration for oyster farming was given to the SelfHelp Groups-SHG, "Prasidhi" consisting of 10 members. Five hundred strings containing 7,000 numbers of oysters were harvested. Each string consists of 10-15 live oysters. Live oysters were sold at the rate of Rs. 150-200 per dozen. A total profit of Rs.45,000 was realized. This successful case study can be used as a case manual for group action for bivalve farming technology**.**

The Sindhudurg coast is blessed with a vast network of backwaters and creeks. The numerous estuaries and backwaters along the coast have shown significant mussel and oyster resource. In order to utilise the resources and promote mariculture-based livelihood activities, a study was awarded to Colleges of Fisheries, Ratnagiri for mapping the mussel and oyster culture potentials of Sindhudurg. Based on the study, 38 villages in the 3 coastal talukas viz. Devgad, Malvan and Vengurla were identified, having good oyster fishery resource. Subsequently a pilot project was initiated with

technical support from the Central Marine Fisheries Research Institute (CMFRI) to demonstrate mussel and oyster culture practices in Sindhudurg, taking advantage of the natural spat fall in the identified creeks and locations.

Training on construction of rens by the 'Prasidhi SHG'

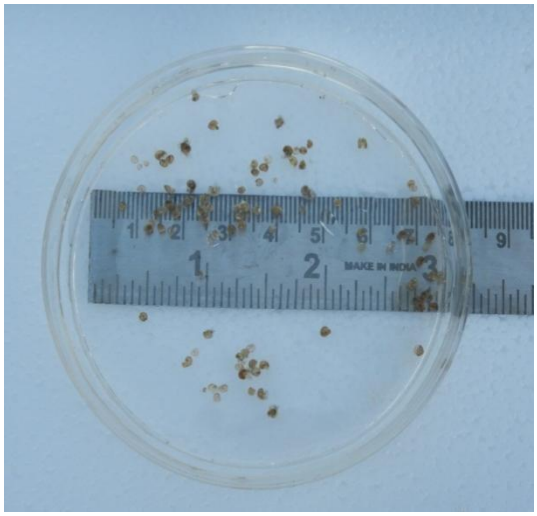
Training on construction of rens by the 'Prerana SHG'

**Training manual prepared by CMFRI for Maharashtra Fishermen**


Sustainable Alternative Livelihood for Coastal Fishing Communities along Palghar District of Maharashtra: Molluscan Mariculture Approach (Ongoing).


Green Mussel Culture and Demonstration at Dahanu, Palghar

Oyster farming with wild collected oyster seed



**Oyster single spat culture (clutch free)**

The nursery reared single oyster spats measuring 0.3 to 0.8 mm were stocked at densities of 500, 1000, 1500 and 2000 densities in hanging trays on rafts.

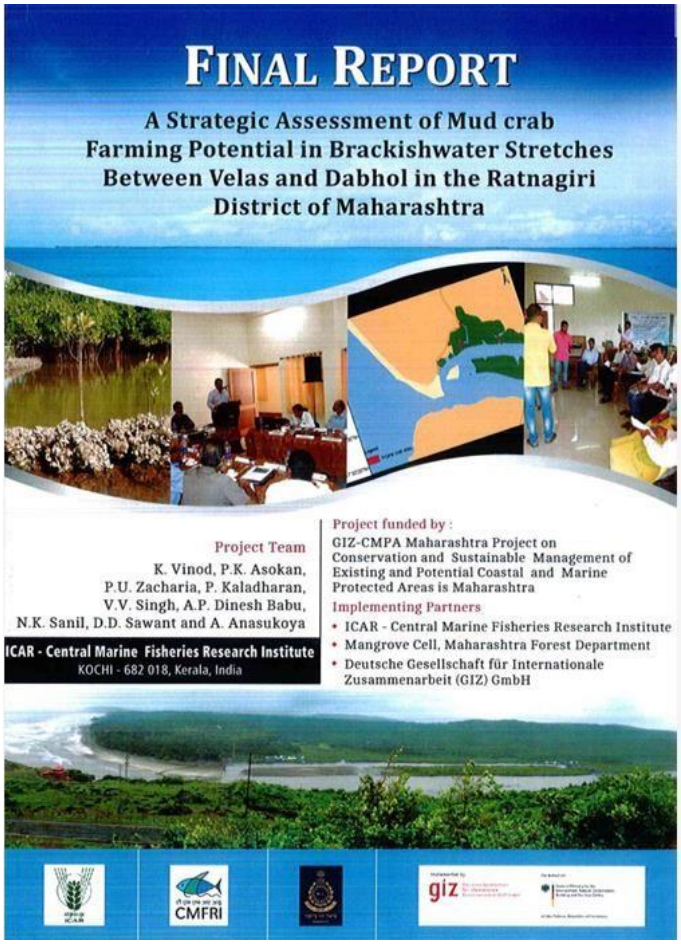
**Demonstration and Training**

The trainings were organized at Asangao and Matgao, Satpati in Palghar district. The participant (oyster handpicker) was told about importance of oyster culture, given hands on raft and ren preparation.

**GIS based Mud crab site selection in Maharashtra by CMFRI leadership (2015-16)**

The Department of Forests, Government of Maharashtra aims to promote mud crab farming in the state of Maharashtra considering the vast natural resources like the estuaries, tidal creeks and mangrove swamps which the state is endowed with and also considering the market potential. This novel approach aims at providing livelihood support to the local communities utilizing the mangrove wetlands, and thereby the local communities also shoulder the responsibility of conservation of mangroves.

In this backdrop, GIZ-CMPA Maharashtra Project on 'Conservation and Sustainable Management of Existing and Potential Coastal and Marine Protected Areas in Maharashtra' supported the programme in which the ICAR-Central Marine Fisheries Research Institute, Mangrove Cell of the Maharashtra Forest Department and Deutsche Gesellschaft fur Internationale Zusammenarbeit (GIZ) GmbH are the implementing partners.




The study was aimed to identify the suitable sites for sustainable mud crab culture in GIS environment.

Detailed field surveys were conducted in brackishwater areas of Anjarle, Kelshi, Aade, Velas and Ansure in the Ratnagiri district of Maharashtra. All stations in the study region had patchy to thick mangrove Based on the topography, water quality, water availability, soil type and accessibility, a total of 10.063 ha have been identified along the brackishwater stretches of Anjarle (1.91 ha), Aade (2.069 ha), Kelshi (1.77 ha), Velas (0.538 ha) and Ansure (3.776 ha) as areas suitable for mud crab farming.