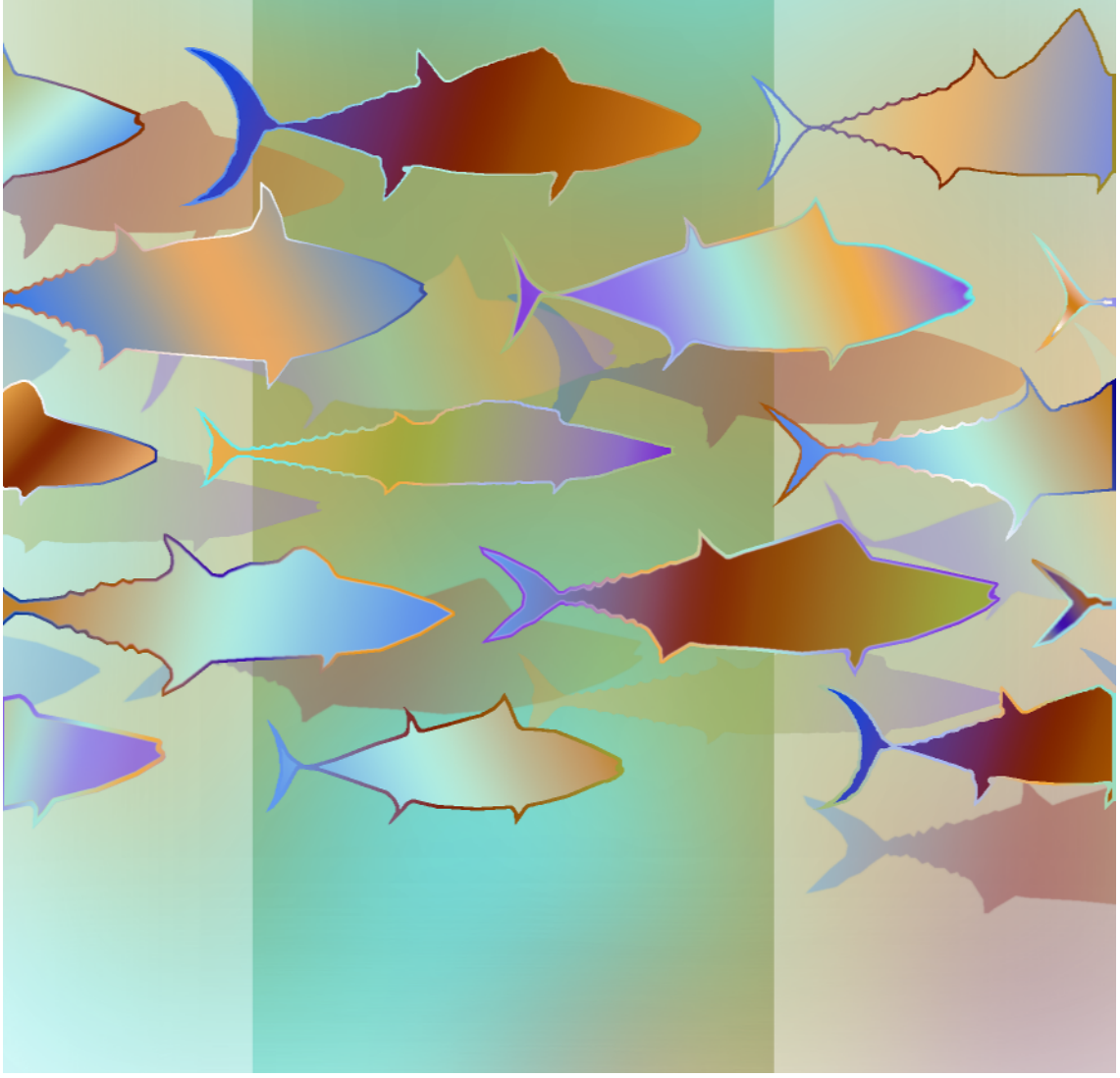
Status of Exploited Marine Fishery Resources of India



STATUS OF EXPLOITED MARINE FISHERY RESOURCES OF INDIA

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27

Marine Bivalves

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1. Introduction

The commercially important bivalves along the Indian coast are clams, mussels, edible oysters and pearl oysters. Except pearl oysters, bivalves have been fished either for their meat or shell since time immemorial. Till 1961, pearl oysters were fished for the golden coloured pearls. When the pearl oyster beds became barren these activities became uneconomic and were not repeated. On the other hand, edible bivalves and ornamental shells became more popular and their fishery improved. During 1995-99, the average quantity of edible bivalve products exported per annum have been estimated as 580 tonnes, worth Rs.26 million and 567 t of oyster shell powder valued at Rs.1.5 million. The status of bivalve fishery ranges from under exploitation in the northwest and northeast coasts to overexploitation in the southern maritime states.

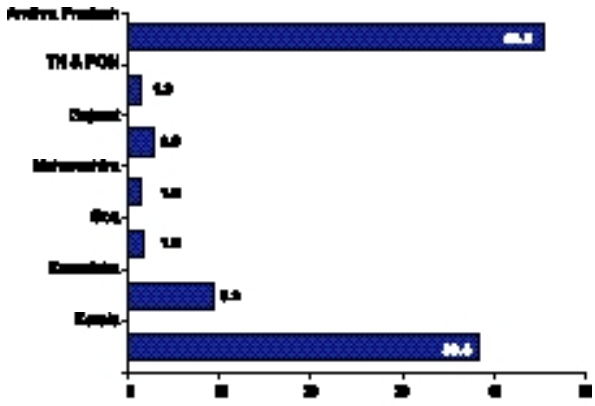

Fig. 1. Production of bivalves - Percentage contribution by different states

2. Production trends

The average annual production of edible bivalves during 1996 to 2000 was estimated as 1.52 lakh tonnes, about 2.5 times more than the average landings during the period prior to 1996. A variety of clams, oysters, mussels and the windowpane oysters are distributed along the Indian coastline where they are fished by the local people (Table 1). Clams and cockles form 73.8%, followed by oysters (12.5%), mussels (7.5%) and windowpane oysters (6.2%). The west coast accounts for 52.3% of the landing where the catch is utilized for both the meat and the shell. Among the maritime states, Andhra Pradesh is the top producer (70,705 t) followed by Kerala (58,763 t). The major bivalve resources and their total landing are given in Table 2. The production levels in other states are meagre (Fig. 1). Information on the bivalve production along the northeastern and southwestern states is scanty.

Table 1. Commercially important bivalves of India

Resource	Common name	Local name
Clams and Cockles		
Villorita cyprinoides	Black clam	Karutta kakka,(Ma), Kala Khube (Ka)
Paphia malabarica, Paphia spp.	Short neck clam, Textile clam	Poovan kakka (Ma), Chippi kallu, Kesha maruvai (Ka), Tisre (Ko)
Meretrix casta, M. meretrix	Yellow clam	Manja kakka (Ma) Matti (Ta), Maruvai, Dadda/ Khude (Ka)
Marcia opima	Baby clam	Njavala kakka (Ma), Vazhukku matti (Ta), Moli (Ka)
Mesodesma glabaratum		Kakkamatti (Ta)
Sunetta scripta	Marine clam	Kadal kakka (Ma)
Donax spp.	Wedge clam	Mural,Vazhi matti (Ta)
Geloina bengalensis	Big black clam	Kandan kakka (Ma)
Anadara granosa	Cockle	Aarippan kakka (Ma)
Placenta placenta	Windowpane oyster	
Tridacna sp, Hippopus hippopus	Giant clam	Kakka (Ma)
Mussel		
Perna viridis	Green mussel	Kallumakkai, Kadukka (Ma),Pachali (Ka), Alichippalu (Te), Kakkai (Mr)
Perna indica	Brown mussel	Kallumakkai, Kadukka (Ma)
Pearl oysters		
Pinctada fucata	Indian pearl oyster	Muthu chippi, (Ma, Ta)
P. margaritifera	Blacklip pearl oyster	Muthu chippi (Ma, Ta)
Edible oysters		
Crassostrea madrasensis	Indian backwater oyster	Kadal muringa (Ma); Ali, Kalungu (Te) Patti (Ta), Muri (Ka)
Saccostrea cucullata	Rock oyster	Kadal muringa (Ma); Ali,Kalungu, Patti (Ta)

Ka – Kannada, Ko – Konkani, Ma- Malayalam, Mr – Marati, Ta- Tamil, Te- Telugu

Table 2. Details of bivalve fishery in the maritime states

State & main landing centers	Commercially important bivalve resources	Average landing (t) (1996-00)	Suggestions for formulating management measures
1	2	3	4
Kerala (Vembanad and Ashtamudi Lakes)	Vc, Pm, Mc, Mo,Cm,Sc,Pv, Pi	58763	Clams and mussels are optimally exploited. Fishing effort for oysters can be increased. As management measures for Vc and Pm which are intensely fished semiculture is recommended
Karnataka (Mulky,Udayavara, Gurupur)	Mc,Vc, Pm, Cm, Sc, Pv	12,750	Clams are optimally fished. Effort can be increased for oysters and mussels. Establishment of Clam fishermen Co-operative societies for marketing is suggested.
Goa (Nauxim Bay, Zuari, Mandovi estuaries)	Mc,Vc, Pm, Cm, Sc, Pv	1,637	Effort can be increased for all resources.
Maharashtra (Ratnagiri)	Pm,Mc, Gb, Cg, Cr, Sc	2,035	Effort can be increased for all resources.
Gujarat (Gulf of Kutch)	Cg, Cr, Sc, Pp, Pf	4,202	Utilization of pearls from windowpane oysters, Repopulating of pearl oyster beds in Gulf of Kutch will be beneficial
Tamil Nadu & Pondicherry	Mc,Mm, m,Cm, Sc, Pv,Pi, Pf	2,098	Resources are fished only for shell, meat can be used instead of being discarded. Establishment of clam fishermen Co-operative societies for marketing is suggested. Repopulating of pearl oyster beds of Gulf of Mannar and Palk Bay will help to revive the pearl industry

Contd. Table 2

1	2	3	4
Andhra Pradesh (Kakinada Bay)	Ag, Gb, Mc, Mm, Pm,Cm, Pv, Pp,	70,705	Resources are fished only for shell, meat can be used instead of being discarded. Establishment of clam fishermen Co-operative societies for marketing is suggested.
Andaman & Nicobar Islands	Tc, Tm, Pmar, Pv, Pm	Na	Intense effort to be made to replenish and conserve the existing stock
Lakshadweep	Tc, Tm	Na	Estimation of standing stock of the endangered bivalve resources. Effort to repopulate the coral reef with giant clams and pearl oysters

Ag- Anadara granosa, Cg-Crassostrea gryphoides, Cm-C.madrasensis, Cr-C.rivularis, Gb-Gelonia bengalensis Mc–Meretrix casta, Mo–Marcia opima, Mm–Meretrix meretrix, Pf–Pinctada fucata, Pi–Perna indica, Pv-P.viridis Pm–Paphia malabarica, Pp–Placenta placenta, Pmar-Pinctada margaritifera, Sc-Saccostrea cucullata, Tc–Tridacna crocea, Tm–T.maxima, Vc–Villorita cyprinoides

3. Exploitation

Fishing methods for bivalves are simple, using non mechanized gear ranging from manual picking to hand operated dredges. Clams are handpicked by men and women usually during low tide. In the shallow estuaries and sandy beaches fishers usually remove the sand by their feet or by wooden or metal plates and pick out the buried clams. Approximately 40 to 50 kg of clams are fished within 3 to 4 hours daily. A scoop net made of semicircular iron frame and a nylon net of 30 mm mesh size is also used for fishing clams. In deeper areas, fishermen go out in pairs, dive in turns and collect clams. In Kerala, as the demand for clams increased the local fishermen started operating hand dredges which has increased the catch per unit effort. In Vembanad Lake, a new fishing method is followed wherein mechanized boats tow several canoes to the fishing site to reduce the effort of the fishermen to reach the site. After fishing, the same boat helps the fishers in the canoes to return to their respective villages. In Kakinada Bay, a special type of craft, Shoe Dhone is used in which the entire family lives during a fishing trip that extends for 3 to 4 consecutive days. Oysters are gathered by separating them from the rocky substratum or dead oysters to which they adhere, using tools that have a flat end like chisel or knife. Mussels are also fished in the same manner but those in the subtidal regions are fished by diving. The fishing season is usually during the post and premonsoon period. In certain estuaries of Goa, the clam fishery is mainly during the monsoon period when there is no marine fishing activity. The length ranges and main fishing seasons of the commercially important bivalves are given in Table 3.

Table 3. Length composition and fishing period of the major bivalve resources of India

Resource	Length composition (mm)	Fishing season	Region
Villorita cyprinoides	10 – 40	Throughout the year	West coast
Paphia malabarica	18 – 52	Feb. – Sept.	West coast
	33 – 86	Apr. – Aug.	East coast
Meretrix casta	12 –34	Throughout the year	West coast
Marcia opima	35-56	Apr. – Aug.	East coast
Anadara granosa	10 – 78	Jan. – April	East coast
Meretrix meretrix	25 – 86	Apr. – Aug.	East coast
Geloina bengalensis	35 - 88	Apr. – Aug.	East coast
Perna viridis	60 – 160	Mar. – May	East coast
	40 – 100	Aug. – May	West coast
Perna indica	40- 120	Sept. – April	West coast
Placenta placenta	30 -160	Apr. – Aug.	East coast
Crassostrea madrasensis	42 - 128	Throughout the year	West coast

Along the west coast, with an estimated landing of 52,537 tonnes of clams, Kerala state accounts for 47% of the total landing of clams and cockles. Vembanad and Ashtamudi lakes in Kerala are the two main estuarine systems which have well organized clam fishery. The former for the black clam Villorita cyprinoides and the latter for the short neck clam Paphia malabarica and their fishery show wide fluctuations based on the export demand. The clam production in Vemband Lake, the largest estuarine system in Kerala, has been estimated as 33,988 t during 2000 which is about 65% of the clam landings in the state. Mussels are the second dominant group, which are fished all along the coast. Oyster fishery is limited to certain estuaries like Dharmadam, Vembanad Lake, Kayamkulam and Ashtamudi Lake.

Clams and oysters are very popular in Karnataka where the fishery is conducted in the major estuaries like Udayavara, Mulky and Gurupur. Recently, the demand for green mussel has increased and about 2,000 tonnes of Perna viridis were landed during 2000. Information on the bivalve fishery and exploitation along the northwestern states is scanty. Nauxim Bay is famous for the fishery of windowpane oyster where about 8,000 to 10,000 oysters are fished per day. In Maharashtra, bivalves are fished and utilized only in certain regions like Ratnagiri coast. Windowpane oysters and edible oysters are the main bivalve resource of Gujarat, but a well-organized fishery is not in vogue. Along the east coast, Tamil Nadu, Pondicherry and Andhra Pradesh have rich bivalve resource but their utilization for human consumption is very negligible. Information on bivalve fishery in the northeastern states like Orissa and West Bengal are not available. 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 are fished for the tourism based ornamental shell industry. Perna viridis and economically important clams like Paphia spp. are used occasionally. In the Lakshadweep Islands, giant clams are also fished by the locals. However, there is no information on the quantity fished and exploitation rate.

Overexploitation and destruction of seed resource

Bivalve fishery is supported by 6 month and one year old specimens, which are usually sexually mature and with high reproductive potential. However, indiscriminate exploitation of seed clams is prevalent in Kerala and Andhra Pradesh. In Vembanad Lake, the black clam and in Ashtamudi Lake, P. malabarica, V.cyprinoides, and M.casta seed clams targeted for shell industry are fished and they form 40 to 50% of the total landing. In Kakinada Bay, the intensity of blood clam fishery has increased and in 1991 small sized clams formed 43.4% 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

Though not regularly, bivalves are exported from India, the main products being frozen, dried, pickled and canned clam and mussel meat, oyster shell powder and other ornamental shells. The export details during 1995-99 are given in Figure 2. Bivalves fished along the west coast are utilized for human consumption. The clams fished from Vembanad Lake in Kerala are marketed through Co-operative societies that cater to the needs and welfare of the clam fishers. Some bivalve products like smoked and canned oysters have good market in Indian metro cities. In Kerala and Andhra Pradesh part of the clam landings are used as a major ingredient of artificially prepared shrimp feed or directly 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 for manuring 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 industries located mainly along the southwest and southeast coasts.

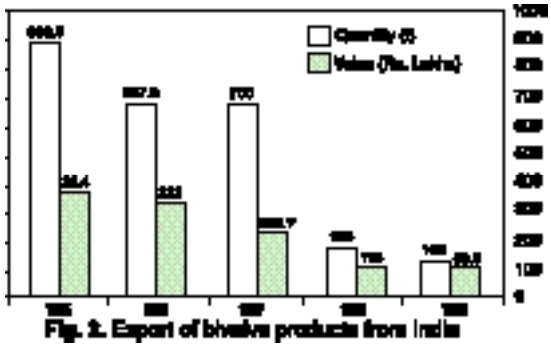

Fig. 2. Export of bivalve products from India

4. Biology

Growth, reproduction and recruitment of bivalves are greatly influenced by the environment and the same species exhibits varied growth rates and spawning periods

in different regions. The biological details of the commercially important bivalves are given in Table 4 .Though the sexes are separate, in certain bivalves like oysters hermaphoditism has been observed. Most bivalves have a wide spawning period with certain peaks. Spat fall, population growth, zonation and species dominance in bivalves are controlled by a combination of different hydrographic parameters like salinity, availability of settlement substrates and current pattern. Typical examples are the disappearance and relocation of Paphia beds along the west coast and the seed settlement of mussels. In central Kerala, the mussel seed settlement during 1997-98 was negligible. In the same beds in the following year there was dense seed settlement which was estimated as 7,954 tonnes extending over a stretch of 561.4 ha. In the pearl oyster beds of Palk Bay, very good settlement was observed in 1998-99 which was followed by high mortality rates.

Table 4. Biology of the commercially important bivalves

Resource	Length at first maturity (mm)	Spawning period	L_{max} mm	Region/ Coast	Length (mm) by I yr	II yr	IIIyr
Villorita cyprinoides	20 - 25	May-June Nov.	52	West	30	41	–
Paphia malabarica	20	Sept. - Feb.	55	West	43.1	–	–
Meretrix casta	11-17	Throughout the year	55	West	42.6	–	–
Meretrix meretrix	21-26	May –June Feb.-Sep.	91	East	47.0	61.5	–
Marcia opima	11-20	Dec. May - Aug.	53.8	East West	30.0 22.0	43.5 31.0	– 43.0
Anadara granosa	20-24	Throughout the year	73.4	East	41.1	55.3	66.3
Perna viridis	15.5-28	Dec.- Jan. Jul.-Nov.		East West	91.5 96.0	117.0 117.0	129.0 129.0
Crassostrea madrasensis	12-14(M) 24-26(F)	Nov- Feb July-Sep. Feb.- Apr.	128	West East	70-80 86	90-110 112	120-130 –

5. Stock assessment

Short term surveys have been conducted in the estuaries and coastal regions of maritime states to study the standing stock of bivalve resource. Using the standing stock estimates by CMFRI, the potential yield of bivalves has been estimated (Table 5). The present status shows that the clam and oyster resources are under-utilized in Gujarat and Maharashtra and effort to utilize these resources should be enhanced (Fig. 3). However bivalves have varied reproductive potential hence these resource estimates have to be revalidated frequently. In other states like Kerala, Karnataka

and Andhra Pradesh these resources are optimally or overexploited and in some regions they require conservation.

Table 5. Standing stock and potential yield estimates of bivalves in tonnes

Resource	Est.standing stock	Av. Annual Before 1995	Landing 1996-2000	Potential Yield Estimate
CLAMS AND COCKLES				
Maharashtra	4000	770	1200	3000
Goa	1200	500	887	2000
Karnataka	8027	6592	8000	6823
Kerala	65000	32927	52537	55250
Tamil Nadu & Pondicherry	5770	950	1150	4905
Andhra Pradesh	58000	4000	49000	49300
TOTAL	141997	45739	112774	121278
OYSTERS				
Gujarat	1500	0	2	1050
Maharashtra	335	0	55	235
Karnataka	450	0	190	315
Kerala	4200	50	1200	2940
Tamil Nadu & Pondicherry	19032	400	853	13322
Andhra Pradesh	23000	0	16500	16100
TOTAL	48517	450	18800	33962
MUSSEL				
Maharashtra	1800	560	780	1260
Goa	1120	200	650	784
Karnataka	9800	37	4560	6860
Kerala	17473	3400	5026	12231
Tamil Nadu	350	0	95	245
Andhra Pradesh	1000	0	205	700
TOTAL	31543	4197	11316	22080
WINDOWPANE OYSTERS				
Gujarat	5000	4200	4200	3500
Goa	120	100	100	84
Andhra Pradesh	12420	5000	5000	8694
TOTAL	17540	9300	9300	12278
GRAND TOTAL	239597	59686	152190	189598

6. Management

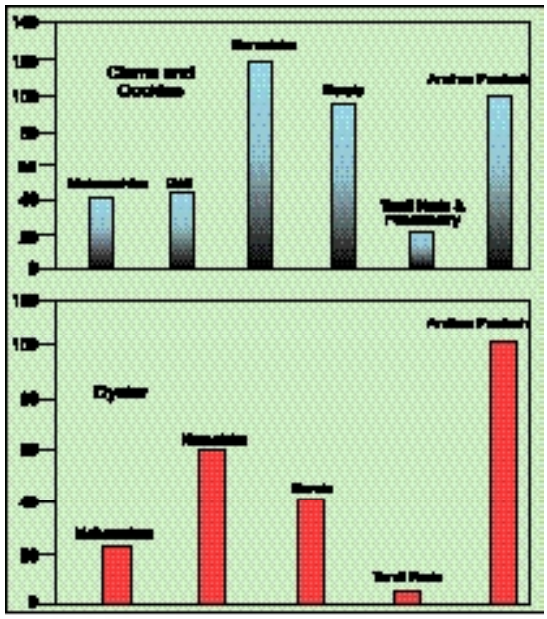

Fig. 1. Present exploitation as % of Potential yield in the maritime states

Bivalves are perhaps the least managed resource along the Indian coast. In most maritime states the effort for fishing bivalves can be enhanced. 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 in 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 is well protected by the following regulations formulated by the Government of Kerala based on recommendations made by CMFRI such as (a) ban on fishing activity during breeding season from September to February, (b) use of gears with 30 mm mesh size to avoid exploitation of under sized clams, (c) restriction on the grade of export of frozen clams meat to 1400 Nos./kg and above, and (d) semi-culture or relaying of small clams by the fishers. Here the fishers are aware of the advantages derived by practicing the management measures and they willingly stock seed clams obtained during fishing for further growth. The result is a well-balanced fishery that forms the livelihood of more than 5,000 families. Similarly, the sea ranching of pearl oyster spat in the pearl beds have helped to repopulate the stock to a certain extent. However, more effective measures are required to attain a productive level.

One of the major drawbacks in management of the bivalve fishery is that there is no mechanism for proper collection of data on the fishery landings. Building up of a proper database on the resource availability and their utilization pattern is essential. Based on the available information, the following management measures are suggested under three heads, viz. resource utilization, resource conservation and marketing. The suggestions for each maritime state for effective utilization of bivalve resource are given in Table 2.

Resource utilization

In areas where the bivalve resources are under-utilized, effort can be made to popularize the resource and increase the fishing effort. Similarly huge quantities of

clams and oysters are fished and only the shell is used after discarding the meat. In such regions the feasibility of using the bivalve meat either for domestic market or in shrimp hatcheries or farms has to be explored. Contrary to such under-utilizations, in some regions especially in Kerala, the resource is overexploited which calls for conservation of the resource. In such situations, relaying or semiculture of clam is suggested. Selected areas with breeding stock of clams may be demarked and fishery restricted for ensuring proper recruitment . Demarcation of the areas for exploitation of sub-fossil has to be made. Destruction of live oyster or clam beds should be avoided.

Proper marketing system has to be developed. Co-operative societies which look into the welfare of fishers and marketing of bivalves set up in collaboration with the state government as in Vembanad Lake in Kerala should be encouraged in other states also.

7. Suggested reading

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