CMFRI

Winter School on

Towards Ecosystem Based Management of Marine Fisheries – Building Mass Balance Trophic and Simulation Models

INFORMATION ONLY

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Technical Notes

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MOLLUSCAN RESOURCES OF INDIA

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India is endowed with rich and diverse bio-resources and the molluscs are not an exception. Molluscs are a heterogenous group of animals both in shape and diversity and are represented by amphineura, gastropods, bivalves, cephalopods and scaphopods. Most of the molluscs inhabit the marine environment and very few dwells in the terrestrial and freshwater habitats. About 8,000-10,000 species of molluscs were recorded from the world over and a total of 3,271 species are reported from India (Subba Rao, 1991). They are represented in 220 families and 591 genera and the spectrum comprises 190 gastropods, 1,100 bivalves, 210 cephalopods, 41 polyplacophores and 20 scaphopods.

Molluscs were exploited for edible, industrial and ornamental purposes and the history of exploitation way back to the time immemorial. 28 species of bivalves, 65 species of gastropods (both the edible and ornamental) and 14 species of cephalopods are exploited at present in India. Various groups and the exploitation status are given in detail below.

CEPHALOPODS

Altogether eighty species of cephalopods are known and only a dozen species contribute to the fishery. Cephalopods comprise the squids, cuttle fishes and octopus and are exclusively marine. They have emerged as valuable resources in recent times due to their high demand in the export market.

Cephalopods make up only a small proportion (nearly 3%) of the world capture fisheries landings, but there have been substantial increases during the last three decades. According to the FAO, the total world landing of cephalopods was 1.6 million tonnes in 1982 and 3.4 million tonnes in the year 2001. The world production of the cephalopods is presented in Figure 1.

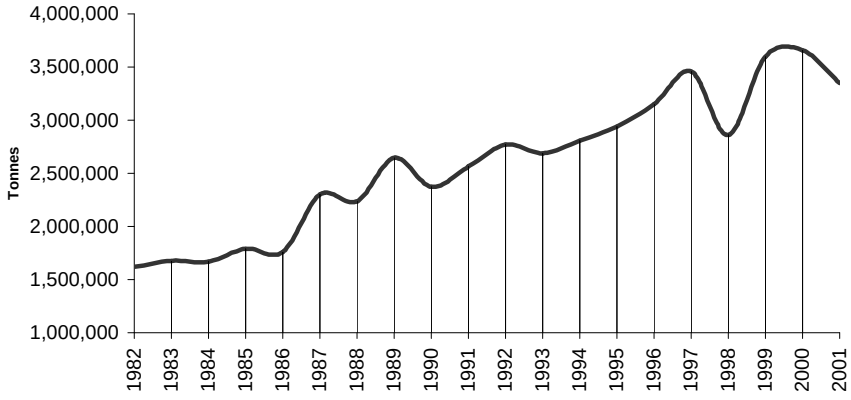

Fig. 1. Global Cephalopod Production (Source FAO)

The production of cephalopods increased from a mere 94 t in 1961 to 1, 11,534 t in 2000 along the Indian coast. However, the increase in production was not consistent and showed the following four phases during the four decades; (i) sharp increase from 94 t in 1961 to 10,786 t in 1976; (ii) marginal increase from 10,786 t in 1976 to 20,407 t in 1984; (iii) again sharp increase from 20,407 t in 1984 to 1, 16,753 t in 1995; and (iv) stagnation at around 1,10,000 t during 1996-2000. By, 2003, the total cephalopod landing is increased up to 1, 27,000t. Concurrent with this growth in production, the contribution by the cephalopods to all India marine fish production rose from 0.1% in 1972 to 4% in 1992.
Cephalopds are landed in all the maritime states in India and the production increased during 1961-1995. Kerala ranked first accounting for 37.70% of the total cephalopod landings followed by Maharashtra (28.98%), Tamilnadu (13.8%) and Gujarat (13.65%) during 1992. Region-wise analysis shows that there is an increase in the production from 83 t to 1,00,246 t along the west coast (1995) where as the increase was from 11t to 16,507 along the east coast. A break up in the production trends of different regions is presented in Table 1.

Table 1. Region-wise contribution (%) of cephalopods along Indian coast

Period	NE	SE	SW	NW	East coast	West coast
1961-1970	I	32	54	13	33	67
1971-1980	0	19	42	38	20	80
1981-1990	0	IS	39	45	16	84
1991-2000	0	13	41	45	14	86

Squids and cuttle fishes are the major groups contributing 52 and 48 % respectively to the cephalopod fishery. *Octopus* are landed in negligible quantities viz. 16t/year. *Loligo duvaceli*, *Sepia pharaonis* and *Sepia aculata* are the three main species contributing 42, 22 and 20% respectively to the cephalopod landing of the country.

The Indian squid, *Loligo duvaceli* is landed in all along the coast and Kerala accounts for 38% of this species, followed by Gujarat (22%) and Maharashtra (20%). Other squids with commercial importance but with restricted distribution are *Loligo uyi*, *Loliolus investigatris* and *Sepioteuthis lessoniana*. They contribute about6% of the total cephalopod landings. Bulk of the catch (87%) is landed by the trawlers which operates within 50m depth. The average catch per trawl unit per day was highest (96.9 kg) in Maharashtra and lowest (0.4 kg) in Orissa.

The all India production of cephalopods in India is estimated at 1,27,000 t during 2003. The production, estimates, percentage in all fish catch and percentage of squids, cuttle fishes and octopus are given in Table 2.

Table.2. Cephalopod production estimates, catch rate and group percentage from key centres during 2003

Landing Centre	Catch (t)	C/U (kg)	% in Trawl	Squids (%)	Cuttlefishes (%)	Octopus (%)
Mumbai	3860	176	6	58	39	3
Mangalore	7138	191	17	54	42	4
Malpe	4122	167	15	49	47	4

Calicut Puthiyappa	601	44	7	45	43	12
Cochin Cochin Munambam Vypeen Neendakara Sakthikulangara	1196 1821 898 4973 6894	136 94 44 128 165	16 16 7 23 23	21	62	17
Tuticorin Trawl net Hooks & lines	541 162	26 14	4	33 46	67 54	0 0
Mandapam Rameswaram Pamban	502 906 229	14 16 8	4 4 2	25 23 27	58 60 59	17 17 14
Chennai	2118	45	8	39	59	2
Kakinada	394	11	2	18	82	0
Visakhapatnam	820		2	9	91	0
Vizhinjam H&L (mech) H&L (Non-mech) Boat - Seine	301 2 226	6 1 9		38 35 100	62 64 0	0 1 0
All India	127000					

POTENTIAL YIELD OF CEPHALOPODS

Various resources survey and estimations are available on the cephalopod resources of Indian Exclusive Economic Zone, continental shelf, neritc and oceanic sector. A brief summary is presented in Table 3.

Table 3. Estimated potential yield of cephalopods

Author	**Year**	**Estimated Potential yield**	**Sector/zone**
George et.,al	1977	1,80,000 t	EEZ
Chikuni	1983	50,000-1,00,000t	Bay of Bengal
Chikuni	1983	1,00,000-1,50,000 t	Eastern Arabian Sea
Silas	1985	50,000	Oceanic sector
Silas	1985	25,000-50,000 t	Neritic sector
Sudarashan	1990	20,600 t	50-300 m depth
Philip and Somavanshi	1991	49,100 t	Cuttlefish alone form the continental shelf
CMFRI	2002	92,604 t	

The cephalopod production has reached at an all time high of 1,27,000 t in 2003. This is higher than the potential estimated indicated by the above said authors. This higher

production is attributed to various factors such as increased fishing efforts, and extension of trawl fishing beyond the 50m depth zone. And more over the above said authors have not taken into consideration of the availability of the cephalopod resources in the columnar, oceanic and pelagic zones (Narasimham, *et al*., 1993).

BIVALVES

The commercially important bivalves along the Indian coast are the clams, mussels edible oysters and pearl oysters. The bivalves were exploited for shell, meat, industrial purposes and for the pearl. The edible bivalves and ornamental shell became more popular and the average quantity of bivalve products exported per annum was 580 t during 1995-1999. The average annual production of bivalves during 1996-2000 was estimated as 1.52 lakhs tonnes. Clams and cockles form 73.8%, followed by oysters (12.5%), mussels (7.5%) and windowpane oysters (6.2%). The state-wise production of bivalves is given in Table 4.

Table 4. Details of bivalve fishery in the maritime states

State & main landing centers	**Commercially Important bivalv resources**	**Average landing (t) (1996-00)**
Kerala *(Vembanad and Ashtamudi Lakes)*	Vc, Pm, Mc, Mo, Cm, Sc, Pv, Pi	58763
Karnataka *Mulky, Udayavara*	Mc, Vc. Pm, Cm, Sc, Pv	12,750
Goa *(Nauxim Bay, Zuari, Mandovi* estuaries)	Mc,Vc, Pm,Cm, Sc, Pv	1,637.
Maharashtra *(Ratnagiri)*	Pm, Mc, Gb, Cg, Cr, Sc	2,035
Gujarat *(Gulf of Kutch)*	Cg, Cr, Sc, Pp, Pf	4,202
Tamil Nadu & Pondicherry	Mc, Mm, Cm, Sc, Pv, Pf, Pi,	2,098
Andhra Pradesh (Kakinada Bay)	Ag, Gb, Mc, Mm, Pm, Cm, Pv, Pp	70,705
Andaman & Nicobar Islands	Tc, Tm, Pmar, Pv,Pm	Na
Lakshadweep	Tc, Tm	Na

Ag-Anadara granosa, Cg-Crassostrea gryphoides, Cm-C.madrasensis, Cr-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.

PERAL OYSTER

The Indian seas harbour six species of pearl oysters and among these, *Pinctada fucata and Pinctada margaritifera* are the two commercially important species. *Pinctada fucata* was

dominant in the Gulf of Mannar and Gulf of Kutch and was contributing substantially for the pearl fisheries till early 60s. The latter is distributed in Andaman and Nicobar islands.

In the Gulf of Mannar, between Kanyakumari and Rameswaram there are about 65 pearl banks known as *Paars.* The *paars* are located at a distance 12-20 km away from the coast, at 12-25m depth. During 1663-1961, 38 pearl fisheries were conducted. The pearl fishery was conducted in India 1900, 1908, 1926 to 1928 and 1955 to 1961. The details of the 1956-1961 series of pearl fisheries in the Gulf of Mannar are given in Table 5.

Table 5. Details of pearl fishery during 1956-1961 in Gulf of Mannar

Year	No. oyster fished	Gross revenue
1955	3508967	146, 000
1956	2129058	45454
1957	1175214	168807
1958	21476514	474067
1859	16428298	874000
1960	16175839	215267
1961	15360928	288860

Due to several reasons there have been considerable decline in the fishery of pearl oysters. Shifting of the sand by bottom currents, colonization by the *Modiolus* on the pearl beds, over-fishing, over-crowding, diseases and predation by the gastropods, octopus, crabs and starfish are some of the explanations advanced for the decline of the resources.

In the Gulf of Kutch, there are about 42 important pearl oyster beds known as *Khaddas* in the inter tidal zone at distance ranging from 1 to 5 km from the coast. The total area is about 24,000ha from Sachana in the east and Ajad in the west. From 1950 to 1967, the average number of oyster fished per season was about 17,000 and the last fishery was held in 1966-67 yielded about 30,000 oysters. The highest value of pearls realized from the fishery was Rs. 61693 during 1943-44. Since 1968, there has been no improvement in the pearl fishery.

The CMFRI has developed the hatchery technology in 1981 for the spat production. To enhance the natural production, sea ranching was done in the Gulf of Mannar. During 1985-1990, a total of 1,025 300 spat of *P. fucata* has been sea ranched in 17 occasions. The average size of the spat ranged from 1.5 to 5.7mm.

WINDOWPANE OYSTER

Among the commercially exploited bivalves in India, the Windowpane oyster (*Placenta placenta*) occupies a prime position next to the clams in production. It occurs soft muddy bottom in shallow bays, estuaries and backwaters. It is reported to occur in Gulf of Kutch, Nauxim Bay (Goa) and Kakinada Bay. The oysters are handpicked at low tide without any diving aids.

In the Gulf of Kutch, Pindara bay is an important production center. The annual yield is 60 million oysters (Pota and Paterl, 1988). The standing stock at Goomara, Poshetra and Raida have been estimated at 9, 1.2 and 0.1 million windowpane oysters respectively (Varghese, 1976). The natural pearls from the oysters are collected and used in the

indigenous pharmaceutical preparations. The shell accounts for 85% of whole weight and is used for lime based industries.

The Nauxim bay in Goa supports a minor fishery yielding 8,000-10,000 oysters/day throughout the year except the monsoon season (Achuthankutty *et al*., 1976). The annual production is estimated at 100t. The oyster meat is consumed locally and the pearls are not used.

Narasimham (1987) studied the windowpane fishery in Kakinda Bay. It occurs 40 km^2 area and the population density is low at 2-15 oyster/km^2. The annual production is 5,000t. The oysters are fished here for the shell only and the meat and pearls are discarded. The standing stock has been estimated at 12420 t in 1983.

In Tuticorin Bay, the windowpane fishery is done mainly for the extraction of the pearl. But in Vellapatti village, the exploitation is solely for the shells. During 2000, 150 tonnes of windowpane oysters were exploited and during 2001, about 60 tonnes of oysters were fished. The live windowpane oysters were purchased at the rate of 1.90/Kg from the fishers and Rs. 2.00/Kg to traders.

EDIBLE OYSTERS

Out of the seven species of edible oysters reported from India, *Crassostrea madrasensis*, *C. rivularis*, *C. gryphoides* and *Saccostrea cucculata* are commercially important. *C. rivularis* occurs along the Gujarat and Maharashtra coast. *C. gryphoides* is distributed along the north Karnataka, Goa, Maharashtra and Gujarat coast and is regularly exploited from several creeks and backwaters in Maharashtra. *S. cucculata* is found on the rocky substratum in marine environment in shallow coastal and intertidal areas throughout the mainland coast of India and also in the Andamans and Lakshadweep islands. At Worli and Bandra near Bombay 8.75 ha beds of this species have an estimated standing stock of 335.2t of oysters (Sundaram, 1988).

C. madrasensis is the mainstay of oyster fisheries of India. Dense populations are found and exploited along the east coast of India and exploited along the coast of Kerala, Karnataka and Maharashtra. It inhabits backwaters, creeks, bays and lagoons from the interridal region to 17m depth. Meat forms 5-10% of the total shell weight.

The studies conducted by CMFRI revealed that 11 water bodies in Andhra Pradesh the standing stock of oystes was about 1450 t in Tamil Nadu, 21 water bodies about 23,000t in Kerala in 13 water bodies at about 4,000t. The current annual production of oysters is about 2,000t.

MUSSELS

Along the Indian coast two species of mussels viz. the green mussel, *Perna viridis* and the brown mussel, *Perna indica* are commercially important. The former is found in small beds at several places along the east coast and extensively along the Kerala coast from Kollam to Kasaragod. It is also found in Karnataka, Goa, Maharashtra and the Gulf of Kutch along the west coast and also in Andamans. *Perna viridis* occurs from the intertidal zone to a depth of 15m. *P.indica* has restricted distribution and is found in the south west

coast from Varkkala north Quilon to Kanyakumari and from there to Thiruchendur along the south-east coast.

Kerala state is aptly called as the "Mussel fishery zone of India" since extensive beds of both mussel species occur in the state. They account for the bulk of mussel production in the country. Kuriakose *et al*. (1988) described the mussel fishery in the state. In the major green mussel landing centers in Calicut-Canannore area about 325 full time and 336 part time divers and 340 canoes were deployed. The green mussel production from this area has been estimated at 3043, 3074 and 2579 t during 1981-82, 1982-3 and 1983-84 respectively. The catch per unit effort varied from 44.3 to 60.4 kg/canoe. The standing stock of the mussel has been estimated at 15887 t in 555 ha of mussel beds. The density varies from 2.25 to 4.5 kg/m^2. In the Majali-Bhatkal are of Karnataka during 1982-83, a total of 36.5 t green mussel were landed. The standing stock from 5 ha mussel bed in this area has been estimated at 206t. Appukkuttan et al. (2001) estimated an extent of 50675 m2 of mussel bed with 178t of biomass in Karnataka. In Kerala, the estimated extent of mussel bed was 5665300 m2 with 7954t mussel biomass.

Apukkuttan *et al.* (1988) described the brown mussel fishery based on the study conducted during 1982-84. The important fishing centers of *P. indica* are located between Kovalam and Muttom in the southern part of south-west coast of India. The annual production is estimated at 500t and the standing stock was estimated at 1586t. The population density of the mussel is 5-8kg/m^2.

CLAMS

Among the exploited bivalve molluscan resources of India calms are widely distributed and abundant. They form subsistence fisheries all along the Indian coast and fished by men, women and children from the inter tidal region to about 4m depth. They are hand picked.

The commercially exploited clams are *Villorita cyprinoides, Meretrix meretrix, M. casta, Paphia malabarica, Katelysia opima* and *Anadara granosa*. In the Andaman and Nicobar giant clams, *Tridacna maxima, T. squamos, T. crocea* and *Hippopus hippopus* occur. The former two species have been reported from Lakshadweep also. The state-wise production of the clams is given Table 6.

Table 6 . The state-wise production of the clams (source Narasimham, 1991)

State	Annual production (t)	%	Dominate species
Gujarat	NA	NA	NA
Maharashtra	1103	2.4	Mm, Ko
Goa	887	2.0	Vc, Mc
Karnataka	6592	14.5	Mc, Pm
Kerala	32927	72.5	Vc, Mc, Pm
Tamilnadu	1087	2.4	Mc
Andhra Pradesh	2816	6.2	Ag, Mm
Orissa	NA	NA	NA
West Bengal	NA	NA	NA
Total	**45412**		

Ag-Anadara granosa, Mc-Meretrix casta, Mm-Meretrix meretrix, Ko- Katelysia opima, Pm-Paphia malabarica, Vc-Villorita cyprinoides.

Kerala state stands far ahead of all maritime states in clam production with a catch of 32927 t which accounts for 72.5% of the estimated 45,412 t clam landings. The Ashtamudi and Vembanad lakes are the important production centers in Kerala. Karnataka ranks the second with 6592 t forming 14.5% of the clam production.

The extent of clam bed in Ashtamudi lake was estimated at 1200.78ha and it is dominated by *Paphia malabarica*, *Villorita cyprinoides* and *Meretrix casta*. About 61255 t of clam was estimated as the standing stock of Ashtamudi lake. The estimated biomass of *V. cyprinoides* is 36945t, *P. malabarica* 22672t and *M. casta* is 1638t (Appukuttan *et al.*, 2002).

A few studies were conducted for the estimation of the standing stock of clams. In Karnataka, Rao and Rao (1985) estimated the standing stock of clams in 11 estuaries at 5345t. During 1984, the standing stock was estimated at 8027 t in 8 estuaries (Rao et al, 1989). In the Karnataka estuaries, Joseph and Joseph (1988) estimated the Y_{max} of *M. casta* in Nethravathi –Gurapur at 661 t, in Mulky at 2581t, Udyavara at 1592t and in Coondapur at 8110t.

In the Kakinada bay during March-May 1983, the standing stock of blood clam (*A. granosa*) has been estimated at 6895t and that of *M. meretrix* at 1082t.

The consumption of the clams generally limited to coastal communities. Export of frozen clam meat began in 1981 and in 1991, 1231.8 t valued Rs. 37.4 million was exported to 18 countries. Also 3t of dehydrated clam meat valued Rs. 8.72 million was exported in 1991.

EXPLOITATION OF SHELL DEPOSITS

The sub fossil deposits, also called lime shell are exploited for industrial purposes. The annual production from Karnataka estuaries is 62,000t, Vembanad lake in Kerala 148,000t, Pulicat lake in Tamilnadu 57,000t, Vaigai estuary in Tamilnadu 5500t and from other sources 5500t with a total of 278,000t. The estimated reserve of lime shell in Karnataka estuaries is 2135700t, suggesting vast scope to step up production.

Standing stock of Bivalves

Surveys were conducted in estuaries and coastal region of maritime states to study the standing stock of bivalve resources. The estimates by CMFRI are presented in Table 7.

Table 7. 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**

GASTROPODS

The shell of the sacred chank, *Xanchus pyrum* (Linnaeus) is extensively used in the bangle industry in West Bengal and exploited from time immemorial. The major resource occur in the Gulf of Mannar along the Ramanathapuram-Tuticorin coast. They are incidentally caught in bottom trawling along Tanjavur-Chingelpet coast, and in hook and lines along Vizhinjam coast. The average annual production in numbers shows that the catch from the Tuticorin coast as 877000, Ramanathapuram 300 000, Tanjavur-Chingelpet coast 40,000, Quilon-Vizhinjam coast 22,000, Gulf of Kutch 12,000 and Andaman and Nicobar Islands 5000. The overall production comes to 1,256,000 numbers. Devaraj and Ravichandran (1988) estimated the annual stock in the Gulf of Mannar at 2 million chanks and in the intertidal zone of the Gulf of Kutch at 25,000 chanks.

During 2003, about 116 tonnes of sacred chank were landed along the southeast coast mainly at Rameswaram, Mandapam, Keelakarai and Tuticorin. *Babylonia* sp., *Conus* sp. *Bursa* sp. and *Murex* sp were landed from Kakinada Bay and Thangaithittu (Pondicherry) and the annual landing came up to 893t.s

TOP SHELL AND TURBAN SHELL

The top shell, *Trochus niloticus*, and turban shell, *Turbo marmoratus* occur in Andaman and Nicobar island groups. These ornamental molluscs and the shells fetch lucrative price. The annual production ranges from 400 to 600t for top shell and 100 to 150 t for turban shell (Appukkuttan, 1977).

WHELK

The species *Babylonia* is widely distributed in the Indo-Pacific region. In India, this species is well represented on the Indian Peninsula at places such as Gulf of Mannar, Poompuhar, Nagapattinam, Madras and the waters around Andaman and Nicobar islands. *Babylonia* are commonly known as 'Whelk,' 'Spiral Babylon' and 'Puravumuttai chank' (Dove egg shell) in local parlance and 'Baigae' in trade. The total quantity of whelk trade during 1993-94 was 300 tonnes and it increased to 500-600 tonnes during 1995-96. *Babylonia* is a much sought after species and it fetch a good foreign exchange. It has been important food species in Indo-pacific region.

Annual landing of whelk during 2001 was 295 tonnes. It increased to 442t in 2002, whereas a decrease is observed in 2003 as 327t

ORNAMENTAL MOLLUSCS

Several ornamental gastropods and bivalves with trade value are distributed in the Gulf of Mannar, Palk Bay, Gulf of Kutch, Andaman and Nicobar islands and Lakshadweep. The important shells are *Xancus pyrum*, *Chicoreus* sp. *Babylonia*, *Cyprea, Conus, Cassis, Cymatium, Cymbium, Drupa, Fistularia, Hemifusus, Lambis, Mures, Natica, Nerita, Oliva, Pyrene, Strombus, Tonna, Tibia, Dentalium* sp. *Umbonium, etc*. They are regularly collected, cleaned and marketed and form the basic material for the shell craft articles. The annual production is estimated at 600 t in 1989, a total of 7.2 t ornamental shells valued at Rs. 0.464 million were exported (Alagaswami and Meiyappan, 1989).

Among edible gastropods whelks in the family Buccinidae is an important by-catch of shrimp trawlers along southern coasts and the fishery along off Kollam is supported by 2 species, *Babylonia spirata* and *Babylonia zeylanica* and have high demand in the international market. Similarly chanks *Xancus pyrum, Chicoreus ramosus, Cerethidae* spp. and *Hemifusus* spp. are other gastropods being exploited along the east and west coasts commercially. All others are landed as by-catches of the trawlers and used in the shell trade. Majority of the gastropods collected (approximately 70 species) are used in the ornamental shell trade. The rare gastropods collected include, *Conus milne-edwardsii* (endangered), *C. bengalensis, C. miles, C. striatus* and *C. geographus* from the family Conidae; *Strombus listeri* and *S. plicatus sibbaldi* (both endangered) from the genus strombus and *Lambis crocea, L. truncate and L. scropius* (three endangered) from the genus *Lambis* of the family strombidae, *Cypracassis rufa, Charonis tritonis, Trochus niloticus* and *Turbo marmmoratus* (all endangered). The species of *Tridacna* from Andaman and Nicobar islands are endangered.

Estimated *Xancus pyrum* landings were 4.2 lakh numbers caught by 52 divers during 2003-04. In addition to this there was 2 lakh numbers of elephant chank *Chicoreus ramosus* caught during this year. The landings of the ornamental shells in different states during 2003-04 are given in Table 8.

Table : 8

Resource	Karnataka	Kerala	Tamil Nadu	Andhra Pradesh	Total
Xancus pyrum	---	---	469.9	---	469.9
Hemifusus sp.	---	---	5.0	0.97	5.97
Cerethedea sp.	---	---	---	1133.3	1133.3
Telescopia sp.	---	---	---	134.5	134.5
Thais sp.	---	---	---	34.0	34
Chicoreus ramosus	---	---	172.5	---	172.5
Total Gastropods			**647.4**	**1302.77**	**1950.17**

CONCLUSION

Though cephalopod exploitation has crossed estimated potential yield, there is no sign of depletion of the stock so far. The bivalves and gastropod resources also are increasing year by year and exploitation in new areas are taken up in recent years. It is felt that closer monitoring of the stocks of mollusks and detailed studies on the population dynamics and systematic surveys of potential areas for assessment of stock are much essential for management of the much priced molluscan resources of India.