

Marine Fisheries Research and Management

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14 An appraisal on the marine fishing craft and gear of the Indian coast

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ABSTRACT

The use of fishing methods varying from simple traps to large trawlers and from hand lines to sophisticated purse seines is a typical feature of marine fisheries in India. The regional and seasonal variation is so vast that the developmental agencies and administrative machinery are often handicapped in deciding priorities on modernizing the traditional tools. A document as attempted here, would form a piece of vital information for the R & D agencies. The traditional gear operated in different regions of the Indian coast are classified based on the mode of operation and an exhaustive listing along with local names is attempted. Besides, contributions to the marine fish production separately by traditional and modern craft are briefly noted.

Introduction

The increase of marine fish production of India from an annual average of 0.5 million tonnes in the early fifties to 1.6 million tonnes towards the end of eighties was gradual but conspicuous. Recent estimates show an average annual production of 2.2 million tonnes during the first half of nineties. Fabrication of different traditional gear by synthetic fibres like nylon and high density polypropylene, improvement in craft design and construction of mechanised boats coupled with the powering of traditional craft for mobility and diversified fishing operation are important developments in the marine fisheries sector responsible for enhanced fish production. Widespread operation of purse-seiners along Kerala, Karnataka and Goa coasts especially from the eighties had a profound influence on the marine fish production.

The small-scale fisheries sector comprising the traditional craft and gear has a significant role in Indian fisheries. Along the Indian coast there are about one million active fishermen employing the indigenous craft and gear following traditional methods of fishing (Anon, 1977).

Construction of the small mechanised boats fit for commercial trawling was made by the erstwhile Indo-Norwegian Project in 1957. Later, the growth of mechanisation was gradual resulting addition of mechanised boats of different specifications apart from the motorisation of country craft. Based on the use of power, the mechanised craft are of two types, namely, those for propulsion and fishing (trawlers, purse-seiners etc.) and the rest using power only for propulsion (pablo type drift gill netters and powered country craft). Fishing operations by both these types of craft contribute to about 85-90 percent of the total marine fish production in India. The impact of mechanisation is much pronounced in all maritime states of west coast where mechanized boats shared nearly 90% of the total marine fish catches while the pace of mechanisation along the east coast has been slow.

The traditional fishing craft are highly adapted to the fishing techniques and marine conditions of a specific region. These craft whether plankbuilt, dug-out or catamaran are gradually changed over to mechanized ones by fitting outboard engines for propulsion. Mechanisation had a deleterious impact on some existing traditional gear. Drastic reduction in the operation of rampant, some other shore seines, few type of boat seines and some gill nets in certain regions along the Indian coast are striking examples in this connection. At the same time, most of other traditional gear still find a place in marine fishing operations and are being operated by both traditional and powered country craft. A marked diversity exist in the craft and gear of both east and west coasts due to topographical features and meteorological conditions which influence the distribution pattern and seasonal abundance of fishes.

Craft and gear employed in marine fishing in certain regions of the Indian coasts have been documented earlier by Chidambaram (1965), Rao (1963), Anon (1982), CMFRI (1981), Mahapatra (1986) and Trumilu et.al. (1991, 1994). The present study is an attempt to present a concise information by listing the various types of craft and gear employed in different maritime states of India along with a brief note on the contribution made by the gear of both traditional and mechanised sectors in the respective states.

Material and methods

CMFRI has been collecting regular statistics on the marine fish landings of India from fifties with special reference to information on different types of craft and gear and its specifications. Their details were also collected during periodic census conducted by the Institute. The present study broadly makes use of the data so collected.

The multitude of traditional gear operated along each maritime state are classified under five major divisions based on their mode of operation viz., seine nets, gill nets, encircling nets, bag nets, hooks & lines and traps. Sub-divisions under each category wherever applicable has been given. The names of various traditional craft and gear are indicated by the prevailing local names in the respective states. Regional difference in the local name of few gear within the state noticed are also indicated. The mesh sizes of different type of nets wherever available are shown against each. The information gathered on the subject are detailed as follows:

West Bengal

The important traditional gear of West Bengal include shore seines, gill nets, encircling nets, fixed bag nets, hook & lines etc. Besides, the scoop nets and traps are also in limited operation.

Between the two types of traditional craft viz. plankbuilt boats and dug-out canoes, the former dominates with 98% and majority of them are distributed in 24 Parganas district. Fishing craft in West Bengal have evolved over the years from riverine boats to more sea-worthy versions (BOBP, 1990). Clinker boats called *Patia* or *Pankhia* without deck are used for operating shore seine and drift nets, whereas carved built boats called *Salte* with deck made of bamboo splits are used in the operation of bag nets (Dan, 1985).

The contribution of trawlers to the mechanised catch of West Bengal is very low. Most of the mechanised boats are plankbuilt country craft called *Chot* with deck made of wooden planks with engine varying between 7.5 - 120 Hp employing bag nets and drift/gill nets, the latter contributing 60% of the mechanised catch. Due to better infrastructure facilities at places like Diamond Harbour, Namkhana and Kakdweep, large number of mechanised boats are in 24 Parganas district. The introduction of master-hooks for hook & line shark fishery employing mechanised craft with the inboard engine of 72 - 120 Hp has been recently reported at Kakdweep (Barman, 1994). The following Table presents the craft and gear of west Bengal.

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Table 1 Traditional and mechanised craft and gear of West Bengal

Type of gear/craft	Local names	Mesh size in mm
1. Seine Nets		
Shore seine	* Sarini jal/Ber jal/ Ghanal jal/Charbel jal	0.5 - 10
2. Gill Nets		
a) Drift gill nets	* Bhasani jal	100 - 140
	* Chandi jal	35-50,90-100
b) Fixed gill nets	Bharang jal	15 - 20
3. Bag Nets/ Stake net	* Behundi jal	30-40
	Bhuri jal	
	Bhasa behundi	80 - 120
	* Kachal	
	Ktel jal/Mal jal	
	Panchkati khul jal	
	Panchkati ber jal	
	Lohi jal	10 - 15
4. Encircling net	* Jungal jal	
5. Hooks & lines	* Don/Kanta	
6. Mechanised trawl nets		
	Craft	
1. Plankbuilt boats	Bachari/Choi/Dingy/Patin/	
2. Mechanised trawlers	Poukhata/Salti	
3. Mechanised gill netters		
4. Mechanised liners		

*Commonly used gear

Orissa

South Orissa coast has narrow continental shelf and open sandy beaches whereas north Orissa is characterised by extended continental shelf, intertidal flats and extensive river deltas. The distribution of marine craft and gear in Orissa is consistent with the diversity of marine ecology from south to north of the state.

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Information on the craft and gear of Orissa was available earlier in CMFRI (1981), BOBP (1984), Mahapatra (1986) and Scariah *et. al* (1987). In number, hooks & line and gill nets predominated followed by shore seine, boat seine and fixed bag nets. A miniature purse seine type net locally called *Jungal* is widely used along Orissa coast. Gill nets are found to be in four specification viz. small meshed (20-40 mm), medium meshed (50-60 mm), large meshed (100 mm) and very large meshed (150-200 mm).

According to the technodemographic census of 1983 conducted by Orissa Fisheries Department (BOBP, 1984), Puri and Ganjam coastal districts account about 60% of the total fishing craft of the state comprising mainly catamaran and plankbuilt boats of which the former predominates (64%) and the plankbuilt boats are of different specifications. The catamarans use nylon bottom and surface drift net of 55-62 mm mesh size. Small meshed cotton drift nets of 20-40 mm mesh size are also employed occasionally for sardines and anchovies.

Among the mechanised boats nearly 70% are trawlers and the rest gill netters. Trials conducted to introduce high opening bottom trawl were successful which resulted in the use of four different types of high opening bottom trawls for fish and prawns (BOBP, 1984). Outboard engine fitted country craft are of recent development and are available in most of the major centres along Orissa coast. Table 2 enlists the craft and gear of Orissa.

Table 2 Traditional and mechanised craft and gear of Orissa

Type of gear/craft	Local names	Mesh size in mm
1. Seine nets		
a) Shore seine	* <i>Sarini jal/Bara jal/Pedda jal/Bada jalo</i>	10 - 20
b) Boat seine	* <i>Irragali/Iraga Jalo</i>	8
2. Gill Nets		
a) Drift nets	* <i>Behandi jalo</i>	70
	* <i>Bhasni jalo</i>	33
	* <i>Chandi jalo</i>	70 - 90
	<i>Ildhi jalo</i>	85 - 110
	* <i>Juga wala</i>	60 - 70
	* <i>Kattala</i>	12-25&25-40

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	<i>Kilu vala</i>	40 - 60
	<i>Nakunda jalo</i>	200
	<i>Phasi jalo</i>	100
b) Bottom set	* <i>Disco vala</i>	
gill net	<i>Palasana vala</i>	
	<i>Pandu vala</i>	
3. Encircling Nets	<i>Gheri jalo</i>	200
	* <i>Jungal jalo</i>	62
	<i>Khia badio jalo</i>	122
	* <i>Sabado jalo</i>	50
4. Wall Nets	* <i>Malo jalo/Bedha jalo</i>	45
5. Lift Net	* <i>Marala</i>	20
6. Hooks & Lines	* <i>Burdu</i>	
	* <i>Jamu thadu</i>	
	* <i>Kanta</i>	
	* <i>Sorrah thadu</i>	
7. Mechanised Trawl Net		10-15, 15-20 & 20-25
	<i>Craft</i>	
1. Catamarans	<i>Theppa</i>	
2. Plankbuilt boats	<i>Choat/Danga/Dhinghy/Nava/Pandhva/Patia/Sabado/Salti</i>	
3. Mechanised trawlers		
4. Mechanised gill netters		

* Commonly used gear

Andhra Pradesh

From early fifties to mid seventies the traditional sector of Andhra Pradesh contributed a sizable share of 96% in marine fish catches which was reduced to 74% during 1977-84. Subsequent estimates indicates that mechanised and traditional sector have equal share in the marine fish production of the state.

Among the traditional gear of Andhra Pradesh, gill nets account for 55% of the

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total fish landings followed by boat seines (20%), shore seine (20%) and others (5%). Boat seines, shore seines and hooks & lines units predominated along Srikakulam and Vizhianagaram districts. Monofilament bottomset gillnets locally termed *naramu* which replaced the multifilament *nylon vala* and *jaga vala* have proven more efficient recently along northern Andhra coast. A new type of net called *mora vala* has been introduced recently along Srikakulam district (Chandrakumar, 1991).

Catamaran, plankbuilt boats and *masula* boats are employed in the traditional sector of which the former locally called *Theppa* comprise 62%. In some areas along Andhra coast the *theppa* is in two halves which can be fastened together and tied to form a catamaran before operation. The plankbuilt boats, locally called *nava* and *masula* boats are used exclusively for shore seine operations. The ordinary *nava* boats are in the length range 5-10 m while bigger boats of 9-12 m length are termed *Kakinada navas*.

Mechanisation of fishing craft commenced in 1954-55 when the state government in collaboration with FAO introduced the first mechanised boat with size 9-11 m. Later three types of trawlers viz. *Royya* (OAL 8 m), *Sorrah* (10 m) and *Sona* (OAL 16 m) were added. The mesh size of trawl nets employed by these vessels ranged between 15 to 25 mm. For fish trawls the cod-end mesh size varied 25 to 30 mm. At Visakhapatnam, the OAL of trawlers is 9.6-11.1 m and the length of trawl net 37-46 m with a cod-end mesh size of 15 mm. Bigger trawlers of OAL 22-25 m are also operating along Andhra coast conducting voyage fishing. Outboard engine fitted craft have appeared in most of the centres along coastal Andhra Pradesh. The craft and gear of Andhra Pradesh are given in Table 3.

Table 3 Traditional and mechanised craft and gear of Andhra Pradesh

Type of gear/craft	Local names	Mesh size in mm
1. Seine Nets		
a) Shore seines	<i>Konti vala</i>	15-20
	* <i>Pedda vala/Chinna alivi vala/Chinna ayila vala</i>	10-15
	* <i>Pedda alivi vala/Pedda ayila vala</i>	15-20
b) Boat seines	* <i>Iraga vala</i>	0.8-15

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2. Gill Nets

a) Drift gill nets	<i>Chengula vala</i>	
	<i>Chiraga vala</i>	
	<i>Megala vala</i>	
	<i>Nadipi vala</i>	
	<i>Pethu vala</i>	
	<i>Thega vala</i>	
b) Bottom set gill net	* <i>Appa vala/Royya napu vala/Chapala napu vala/Disco vala</i>	135-160 (outer) 20-35 (inner)
	* <i>Chanduvala vala</i>	
	* <i>Chinna napu vala</i>	70-80
	<i>Konemu vala/Koona vala/Silk vala</i>	100-120
	* <i>Nara vala/Silk vala</i>	40-60
	<i>Panda vala</i>	130-150
	<i>Pedda napu vala</i>	
	* <i>Nylon vala</i>	120-150
	* <i>Sorra vala/Soralu vala/Teki vala</i>	350-400
c) Other gill nets	<i>Engulla vala</i>	
	<i>Jaga vala</i>	
	<i>Kasula vala</i>	
	<i>Kadaru vala</i>	
	* <i>Kilola vala/Kavvalu vala</i>	
	* <i>Merapa vala</i>	40-50
	* <i>Naram vala/Naranapu vala</i>	30-75
	<i>Poravala vala</i>	
	<i>Rangu vala</i>	
	<i>Ruleretu vala</i>	
	* <i>Tangochi vala</i>	
	<i>Thega vala/Megala vala</i>	

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	<i>Telu vala</i>	20
	<i>Tuva vala</i>	50-55
	<i>Vaddi vala/Katla vala</i>	
3. Bag Nets	<i>Ettudu vala</i>	10
	<i>Kadapu vala</i>	
	<i>*Mapu vala/Needa vala</i>	10-20,15-25,20-30
4. Fixed Bag Nets	<i>Gidasa vala</i>	
	<i>Thoka vala</i>	
5. Lift Net	<i>Mora vala</i>	
6. Hooks & Lines*		
a) Hand lines	<i>Galalu</i>	
b) Long lines	<i>Galapu thradu/Jamu thradu/ Konemu thradu/Sorrah thradu/*</i>	
7. Mechanised Trawl Nets		
a) Shrimp trawl		15-20
b) Fish trawl		25-30
8. Mechanised Drift Gill Nets		70-130
	Craft	
1. Catamarans	<i>Theppa</i>	
2. Plankbuilt boats	<i>Kakinada navas</i>	
3. Masula boats	<i>Kuttupadava/</i>	
4. Fibreglass boats	<i>Padava/Pedda padava</i>	
5. Mechanised trawlers	<i>Pablo/Dan boats/Royya/Sorra/ Sona/</i>	

* Commonly used gear

Tamil Nadu

The distribution and the local names of some of the craft and gear vary in different geographical regions of Tamilnadu coast viz., the Coromandal, the Palk Bay and the Gulf of Mannar.

Majority of gear operated along the coastal Tamil Nadu are gill nets concentrated more along Palk Bay and the Gulf of Mannar coasts. Hooks & lines, boat

seines and shore seines are next in importance. Flying-fish fishery using encircling net *Kola valai* is common in Tanjavoor and South Arcot districts. Traps are employed in shallow coastal water fisheries along Pudukottai, Ramanathapuram and Kanyakumari districts.

In a few coastal villages along northern coast of Tuticorin a special type of fishing is carried out in shallow coastal waters without employing craft. Fishermen carry the net and swim for a distance of 200 m beyond the surf area and release the nets which are of different mesh sizes, locally called as *Nachu valai*, *Vatu valai* and *Sippi valai* (Gurusamy et. al, 1989). Table 4 indicates various types of traditional and mechanised craft and gear of Tamil Nadu.

The seasonal shark fishery of the western coast of Kanyakumari district locally called *matu* is very popular. The hand jigging for cephalopods is successfully carried out in few centres along the Palk Bay and the Gulf of Mannar regions.

A specially fabricated conical bagnet type gear with a mesh size of 15-20 mm fixed to an iron ring having a diameter of 60-75 cm is operated very recently in few places along the shallow coastal areas of Chennai and Cuddalore districts and also along Pondicherry coast mainly to exploit the gastropod *Babylonia spirata*.

Catamarans, plankbuilt boats and dugout canoes are the main traditional craft of which the catamarans constitute about 73% (but not common along coastal Pudupetta and Ramanathapuram districts) followed by plankbuilt boats(22%) and dugout canoes (5%). The specifications of different types of traditional and mechanised craft and gear of Tamil Nadu have been described by Tirumilu et. al (1991, 1994).

The history of fishing boat mechanisation in Tamil Nadu dates back to 1954-55 when designing of a suitable mechanised fishing craft was undertaken in collaboration with FAO. Since then gradual progress has been achieved in the mechanised sector thereby increasing the number of trawlers. The trawl fishery later paved the way for pair trawling in Mandapam and Tuticorin waters. Outboard engine fitted country craft first introduced along Kanyakumari district in 1981 has become much popular later and spread to other areas also in large numbers.

Table 4. Traditional and mechanised craft and gear of Tamil Nadu

Type of gear/craft	Local names	Mesh size in mm
1. Seine Nets		
a) Shore seine	* <i>Peria valai/Thallu valai/ Karamadi valai/Kara valai/ Kattu valai/Iluppu valai/ Marukku valai/Ola valai Vidu valai/Kolache valai</i>	0.65-15 10-20
b) Boat seine	* <i>Thuri valai/Chennakunni valai/Vella valai/Eru valai/Madi valai/Thallu valai/Iluppu valai/ Thattu madi</i>	10-15 20-25
2. Gill Nets		
a) Drift gill nets	* <i>Vala valai/Vali valai/ Methappu valai/ Pokku valai * Pannu valai</i>	35-40 30-50, 65 25-35
b) Set gill nets		
i) Mid-water set gill net	<i>Edathanni valai Kurukkukatti valai</i>	60 30-40
ii) Bottom set gill net	<i>Adi valai/Kallukatti valai/Thattu valai Kala valai Nandu valai * Singiral valai/Singi valai/Pantha valai * Tirukka valai * Katta valai/Paru valai * Motha valai</i>	30-40 40 40-50 50-100 80-100 75-150 150

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	<i>Kallu valai</i>	30-40
	* <i>Mari valai/Disco valai/</i> <i>Selanga valai/FAO net/</i>	
	<i>Trammel net</i>	20-35 & 135
c) Other gill nets	<i>Kacha valai</i>	
	<i>Kannika valai</i>	55
	<i>Kalinga valai</i>	65
	<i>Kavala valai/Chooda</i> <i>valai/Challa valai</i>	20-25
	<i>Kot valai</i>	30
	<i>Kumla valai</i>	55
	<i>Kuzhi valai</i>	30-40
	<i>Maya valai</i>	40-50
	<i>Murai valai</i>	25-35
	<i>Nachu valai</i>	45-50
	<i>Nakku valai</i>	
	<i>Nedunka valai/Pachai valai</i>	
	* <i>Netholi valai</i>	
	<i>Oozhi valai</i>	25
	<i>Podi valai</i>	50-70
	<i>Rai valai</i>	
	<i>Sengani valai</i>	45
	<i>Sippi valai</i>	25
	* <i>Thangoosi valai/</i>	
	* <i>Thatta kavala valai</i>	
	* <i>Narambu valai</i>	20-30
	<i>Theraga valai</i>	10
	* <i>Valacha valai</i>	
	<i>Vavval valai</i>	30
	<i>Velamin valai</i>	
3. Bag Nets	* <i>Mada valai/Eda valai/</i> <i>Kambi valai</i>	20-35

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4.	Encircling Nets/ Scoop Nets	* Kola valai	10-20
5.	Ring Net	Nandu katcha	15-20
6.	Fixed Bagnet/ Stake Net	Kattuvalai/Oonnu valai Kalamkatti valai	
7.	Hooks & Lines		
	a) Hand lines	Kaithoondil/Karai thoondil	
	b) Trolling lines	Ayiramkal thoondil/ Thoorathundil/Melathoondil	
	c) Long lines	Odu kayiru	
	d) Hand jigging	Nangoora thundil Disco thundil	
8.	Traps	Koodu	
9.	Mechanised Trawl Nets		
	a) Fish trawl net		20-30
	b) Shrimp trawl net		150
	c) Pair trawl net		
10.	Mechanised Drift Gill Nets		70-130
		Craft	
	1. Dugout canoes	Kanna/Kattuvallam/Odum/ Thony/Vallam	
	2. Plankbuilt boats	Masula boat/Padagu/Thony/ Thoothududi vallam/Vathai	
	3. Catamarans	Kattumaram	
	4. Mechanised trawlers (OAL 9.5-16.5, 10.5-15.5, 10.5-16.0)		
	5. Mechanised gill netters (OAL 7-9, 8.5-10.5)		

*Commonly used gear

Pondicherry

The Union Territory of Pondicherry with a coastal length of 45 km exhibits close similarity in traditional craft and gear to the adjoining Tamil Nadu state, though the types of gear employed are much restricted. Among the traditional gear, gill nets predominates in number followed by hooks & line and encircling bag net especially *Eda valai*. The operations of shore seines and boat seines are considerably reduced in recent years but more efficient gill nets like *Pannu valai* and *Mani valai* have made their appearance.

Contributing to 95% catamaran is the main artisanal craft. Both fish and shrimp trawlers in OAL range 9.5-16.5 m are operated along the coast in addition to the mechanised drift gill netters. Powered country craft are available in most of the centres. The craft and gear employed in Pondicherry are given in Table 5.

Table 5 Traditional and mechanised craft and gear of Pondicherry

Type of gear/craft	Local names	Mesh size in mm
1. Seine Nets		
a) Shore seine	* <i>Periya valai/Kara valai</i>	065-15, 10-12
b) Boat seine	* <i>Thuri valai</i>	20-25
2. Gill Nets		
a) Drift gill net	* <i>Pannu valai</i>	25-35
	* <i>Vala valai</i>	30-50
	* <i>Pokku valai</i>	65
b) Bottom set gill nets	* <i>Mani valai/Disco valai/ Selanga valai</i>	20-35& 135
	<i>Paru valai</i>	75-150
c) Other gill nets	* <i>Kavala valai</i>	20-25
	<i>Netholi valai</i>	
	<i>Thattakavala valai</i>	30
3. Bag Nets	* <i>Eda valai/Mada valai</i>	20-35
4. Encircling Nets	* <i>Kola valai</i>	10-15
5. Fixed Bag Nets	<i>Kattu valai</i>	10-20

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6.	Ring Net	<i>Nandu katcha</i>	15-20
7.	Hooks & Lines*		
	a) Hand lines	<i>Kai thoondil</i>	
	b) Trolling lines	<i>Thra thoondil</i>	
8.	Mechanised Trawl Nets		
	a) Fish trawl net		20-30
	b) Shrimp trawl net		10-15
9.	Mechanised Gill Nets		70-130
		Craft	
	1. Dugout canoes	<i>Odum/Thony/Vallam</i>	
	2. Plankbuilt boats	<i>Padagu/Thony/Vathai</i>	
	3. Catamarans	<i>Maram</i>	
	4. Mechanised trawlers (OAL 9.5-16.5 m)		
	5. Mechanised gill netters (OAL 7-9 m)		

* Commonly used gear

Kerala

Marine fishery employing traditional gear like boat seines, shore seines and gill nets are age old tradition of the state. Mechanisation made its appearance in the late fifties by the erstwhile INP in Quilon area. By mid-sixties individual entrepreneurs entered the scene paving the way for a fast development of trawling operations along the coastal waters. Commercial purse-seining appeared during the late seventies and the process of large scale motorisation of country craft began in the early eighties (Jacob *et.al* 1987).

With the advent of mechanisation, the development of diversified fishing methods in the artisanal sector gained momentum. One of the important gear operated by traditional craft along Kerala coast was the boat seine, *Thangu vala* of various dimensions and the gill nets. Later a new version of boat seine called *ring seine* has been fabricated and introduced, the details of which have been already published (Sivadas and Balasubramaniabm, 1989).

Mini-trawl is a recent innovation in certain areas of Kerala coast. Along Cochin-

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Alleppey coast the practice is to cut the traditional fishing canoe into two and convert each of the parts into a mini-trawl boat driven by outboard motor. The mini-trawl with a length of 15 m and a mesh size of 10-15 mm resemble a typical trawl net. The commercial purse-seining started by the end of 1979 with base at Cochin gradually increased in numbers; but in the present situation there is a steep fall in the number of unit operations.

Hand jigging for cephalopods is carried out exclusively along Vizhinjam areas for which special types of hooks are being used (Joel and Ebenzer, 1987).

Of the various traditional fishing craft, catamarans are prevalent only along Quilon-Trivandrum coasts. Plankbuilt boats are concentrated more in the southern districts viz. Trivandrum, Quilon and Alleppey while dugout canoes are higher in number from Trichur district to Cannanore district.

Most of the trawlers and gill netters operated along the coast are in the OAL 9-13.8 m and 7.62-9.14 m respectively. With the advent of motorisation, apart from the dugout canoes motorised flatbottomed plankbuilt boats are also used for drift gill-netting. The various traditional and mechanised craft and gear of the state are listed in Table 6.

Table 6 Traditional and mechanised craft and gear of Kerala

Type of gear/craft	Local names	Mesh size in mm
1. Seine Nets		
a) Shore seines	*Chavittu vala/Kamba vala/ Karamadi/Noona vala	8-10
b) Boat seines	Arakolli vala Ayilakolli vala *Chooda vala/Disco vala/ Deppa vala/Ring vala/ Kudukku vala/Thangu vala/ Kolli vala Koru vala Mathikolli vala Patthu vala	18-20 10-12 12-20 18-20

	<i>Pattom kolli vala</i>	
	<i>*Thattu madi</i>	
	<i>Vadakkan vala/Vatta vala</i>	20
	<i>Mandu vala</i>	14
	<i>Rani vala</i>	18
	<i>*Vettukili vala</i>	20
2. Gill Nets		
a) Drift gill net	<i>*Echa vala</i>	60-100
	<i>Nool vala</i>	
	<i>*Ozukku vala</i>	100-110
	<i>Parava vala</i>	
	<i>*Pattu vala</i>	
	<i>*Peru vala</i>	
b) Bottom set gill net	<i>*Chitta Konchu vala</i>	140
	<i>Pathu vala</i>	
	<i>*Ral vala</i>	
	<i>Thathu vala</i>	
	<i>Thorachi vala</i>	
	<i>*Thirandi vala</i>	260
c) Other gill nets	<i>Ayila Chala vala</i>	55
	<i>*Ayila vala</i>	50-55
	<i>Avooli vala</i>	100
	<i>*Chala vala</i>	35-40
	<i>*Disco vala</i>	55-140
	<i>*Edakattu vala</i>	35-40
	<i>*Kangoose vala</i>	40-50
	<i>Kantha vala</i>	33
	<i>*Loop vala</i>	30-35
	<i>Mathi Chala vala</i>	35
	<i>Malan vala</i>	28-30
	<i>Manthal vala</i>	28-30

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	<i>Nandu vala</i>	40-50
	<i>*Netholi vala</i>	5-8
	<i>Odam vala</i>	
	<i>Pachu vala</i>	25
	<i>Uruku vala</i>	
	<i>Vala vala</i>	
	<i>Veloori vala</i>	20
	<i>Vameen vala</i>	36-40
3. Scoop Nets	<i>*Katchal vala</i>	36-40
4. Hooks & Lines*		
a) Hand line	<i>Choonda</i>	
b) Long line	<i>Veppu</i>	
c) Troll line	<i>Ottakar</i>	
d) Hand jigging	<i>Vidukayiru/Nangoora choonda/ Disco nangoora choonda</i>	
5. Mini-Trawl nets (Length of net 15-20 m)	<i>*Bodum vala/Disco vala/ Double net/Neetu vala/ Pothan vala</i>	10-15& 15-25
6. Mechanised Trawl Nets*		
7. Mechanised Drift Gill Nets* (Length of net 800-1000 m)		70-130
8. Mechanised Purse Seine Nets* 13, 20-33 (Length of net 600 m)		8-10, 12-
	Craft	
1. Catamarans	<i>Chalathadi/Thadi</i>	<i>Motorised</i>
2. Dugout canoes	<i>Cheruvanchi/Murtvallam/ Odam/Ottathadi/Thoni/ Vallam/Vanchi</i>	-do-
3. Plankbuilt boat	<i>Cheruvallam/Kochuvallam/ Kattuvallam/Thanguvallam</i>	-do-

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4. Mechanised trawler

(OAL 9-13.8 m)

5. Drift gill netter

(OAL 7.62-9.14 m)

6. Purse seiner

(OAL 11.5-15.0 m)

*Commonly used gear

Karnataka

The predominant traditional gear of Karnataka are gill nets, shore seines, hooks & lines and fixed bag nets in the order of abundance and are concentrated more along Uttar Kannada district. A miniature purse seine type net, *Matabala* or *Pattabala* introduced along the coast in 1984, though acclaimed much popularity has become almost non-functional later along with shore seine *Rampant* and the gill net *Chalabala*. However, the drift gill net *Odubala* have assumed greater importance because of its economic viability (Muthiah, 1982).

Traditional fishing craft of the state comprise dugout canoes, plankbuilt boats and catamarans most of which have been motorised. Table 7 gives the craft and gear of Karnataka.

Table 7 Traditional and mechanised craft and gear of Karnataka

Type of gear/craft	Local names	Mesh size in mm
1. Seine Net		
a) Shore seines	<i>Kairapant</i>	10-15
	* <i>Rampant</i>	
	* <i>Yendt</i>	10-15
b) Boat seines	<i>Chitta bale</i>	
	<i>Ghot bale</i>	
	* <i>Mata bale</i>	15-20
	* <i>Rani bale</i>	14-18.
		16-20, 18-22
2. Drag Net	<i>Goru bale</i>	

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3.	Gill Nets		
	a) Drift gill nets	*Beeni bale	45-55
		*Beedu bale	65-135
		Bolinger bale	
		Gidibide bale	
		Maribale/Marji bale	110-115
		*Odu bale	65-135
	b) Bottom set	*Disco gill net	60
	gill nets	Thorake bale	150-200
	c) Other gill nets	*Chala bale	
		Ida bale	
		Jeppu bale/	
		*Kantha bale	50-55
		Kantly bale	30-35, 45-50
		Manangu bale	
		Pathi bale	20-25, 25-30, 35-50
		Patta bale/	
		*Disco bale	60-80
4.	Mini Trawl net	*Disco bala	10-15, 15-25
5.	Fixed Bag Net/ Stake Net	Bokshi bale Thorki bale	
6.	Hooks & Lines*	Beppu Gala	
7.	Mechanised Trawl Net		
	a) Shrimp trawl		20-28
	b) Fish trawl		20-40
	c) Bull trawl		25
	(Length of above trawl nets 40 m)		
8.	Mechanised Drift Gill Net		70-130
	(Length of net 800 m)		
9.	Mechanised Purse Seine		8-10, 12-13, 20-33

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(Length of net 600 m)

	Craft
1. Catamaran	
2. Dugout canoes	<i>Dhoni/Marji/Oda/Pathi</i>
3. Plankbuilt boats	<i>Padavu</i>
4. Outrigger canoes	<i>Pani/Ulandidhoni</i>
5. Mechanised trawlers	
(OAL 11.5-15.0 m)	
7. Mechanised gill netter with IB	
(OAL 7.62-9.14 m)	

*Commonly used gear

Goa

Goa with a coastline of 153 km has made tremendous achievement in marine fisheries through the last three decades. In the fisheries development of the west coast, Goa has played a prominent role by introducing new fishing methods. Thus, *rampani* was first introduced in Goa in the nineteenth century and of late the advent of commercial purse seining was also first effected in Goa (Kurup *et.al* 1987).

Rampani, *Yendi*, gill nets and hooks & lines constituted the important traditional gear of the state. The stake nets and boat seines which were prominent one decade ago have gradually receded from the coast while the operations of shore seines are much restricted especially after the advent of new type of gill nets among which the drift gill net, *Maag* has attained much prominence followed by other gill nets of varying mesh sizes operated by both the mechanised and motorised country craft.

The plankbuilt boats are the main fishing craft followed by dugout canoes. In the mechanised sector, trawlers, drift gill netters and purse seiners are actively operated along the coast. By 1992 nearly 96% of the total landings of the state was accounted by the mechanised fisheries sector resulting almost total disappearance of the traditional way of fishing from the Goa coast. The common craft and gear of Goa are given below.

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Table 8 Traditional and mechanised craft and gear of Goa

Type of gear/craft	Local names	Mesh size in mm
1. Seine Nets		
a) Shore seine	* <i>Rampani/Yendi</i>	
b) Boat seine	<i>Kattala</i>	
2. Gill Nets		
a) Drift gill net	* <i>Maag</i>	65-135
b) Bottomset gillnets	<i>Disco</i>	20-30 & 135
c) Other gill nets		25, 30-60, 90 & 80-140
3. Drag Net		
4. Fixed Bag Net		
5. Hooks & Lines*		
6. Mechanised Trawl Net*		10-20, 20-25
7. Mechanised Gill Nets* 70-130		
8. Mechanised Purse Seine*		8-10, 20-30
	Craft	
1. Plankbuilt boat	<i>Odi</i>	with OB engine
2. Dugout canoes	<i>Odi</i>	for gill netting
3. Outrigger canoes	<i>Ullandi odi</i>	
4. Mechanised trawler		
5. Purse seiner (OAL 11.5-15.0)		

*Commonly used gear

Maharashtra

The share of mechanised sector to the total marine fish catch of the state is more than 90% brought about mainly by the addition of trawlers and gill netters and recently by purse seiners apart from motorised country craft employing minitrawls and different types of gill nets. Important craft and gear employed along the coast are listed in Table 9.

Among the traditional gear of Maharashtra, gill nets mostly surface drift nets

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of varying mesh sizes are predominant followed by bag nets and hooks & lines. The shore seine, *rampanti* are limited to a few numbers along Sindudurg district and are slowly receding from fishing activities. Along the coastal region of Maharashtra, the use of bag net locally called *dol* is very important. A type of dol net, *Kolim bokshi* is commonly used along Satpathi coast for the fishery of Mysids or opposum shrimp locally known as *Kolim*. A mosquito-net type gear, *machardani* is exclusively employed for the fishery of *Acetes* along Thane creek zone at 3-5 m depth.

Recent report suggested that among the traditional craft, dugout canoes predominated (68%) followed by plankbuilt boats, most of which have been motorised (Anon, 1982).

Most of the mechanised boats are used as dol netters followed by gill netters, trawlers and long liners. The dol netters are of different size ranges viz. 7.5-9 m, 9.3-12 m and over 12 m. The size of the mechanised shrimp trawlers are in the OAL 12-14 m and 18-22 m with trawl net having a mesh size of 20-25 mm and all are doing voyage fishing for 4-5 days. The purse seiners introduced in late eighties off Ratnagiri and Bombay coasts are of 11.5-13.0 m length, operating the purse-seine nets having a length of 500-600 m with a mesh size of 2 cm.

Table 9 Traditional and mechanised craft and gear of Maharashtra

Type of gear/craft	Local names	Mesh size in mm
1. Seine Nets		
a) Shore seine	<i>Rampanti</i>	15-30
2. Gill Nets		
a) Drift gill nets	<i>*Bhangada jal</i>	120
	<i>*Nahi/Wavri jal</i>	150
b) Bottom set gill net	<i>*Budi jal</i>	90
	<i>*Saranga jal</i>	80-150
	<i>*Shevandi jal</i>	35-45
	<i>*Tyani/Kandli jal</i>	50
	<i>*Vagal jal</i>	300
	<i>*Waghra jal/Pasa jal</i>	70-150
c) Other gill nets	<i>Bhulji jal</i>	10-25

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	<i>*Dalda jal</i>	60-80, 70-150, 100-125
	<i>Dharan</i>	12-20
	<i>*Disco jal</i>	30-60
	<i>*Garfel</i>	115
	<i>Pakha jal</i>	20-25
	<i>*Pasa jal</i>	70-140
	<i>Phere jal</i>	10-20
	<i>Thobdi jal</i>	
	<i>*Vouri jal/Pakte</i>	
	<i>*Warri jal</i>	12-20
	<i>*Tarti jal</i>	60-80
	<i>Kandalt jal</i>	40
	<i>Fag jal</i>	30-40
3. Bag Nets	<i>*Dol net/Gholwa</i>	10-15, 15-25
4. Mini Trawl net	<i>*Disco jal 15-25</i>	
	<i>*Bokhsi/Kolm bokshi</i>	8-10
5. Drag Nets	<i>Mudy jal</i>	5-10
	<i>*Machardant</i>	5-10
	<i>Vedi</i>	15-20
6. Hooks & Lines*	<i>Carkadi/Hath jal/Khanda/</i>	
	<i>* Vawool/Waval</i>	
7. Traps	<i>Shevandi gada (Lobster traps)</i>	
	<i>Chimbori gadi (Crab traps)</i>	
8. Mechanised Trawl Net		
9. Mechanised Gill Net		
10. Mechanised Purse-Seine Net		
	Craft	
1. Dugout canoes	<i>Dupaka/Dupki/Pagar with OB engine</i>	
	<i>Sanar/Wanam Hodi</i>	
2. Outrigger canoes	<i>Hodi/Rampan Hodi/</i>	
	<i>Seedachi Hodi</i>	

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3.	Plankbuilt boats	<i>Hodi/Machwa/Salpat/Toni</i>	-do-
4.	Mechanised trawlers (OAL 12-14 m, 18-22 m)		
5.	Mechanised pablo gillnetter		
6.	Mechanised purse seiners (OAL 11.5-15.0 m)		

*Commonly used gear

Gujarat

The coastal Gujarat is unique in not having the seine nets like shore seines or boat seines among the traditional gear. The fixed bag nets and gill nets form the main artisanal gear apart from the widely employed hooks & lines. Fishing by using traps is exclusively found in Baruch district.(Table 10).

Nearly 85% of the traditional craft are plankbuilt boats and the rest dugout canoes. Among the mechanised boats trawlers and gill netters predominate. The mechanised trawlers operating from Porbandar base are in the OAL range 11-14 m employing 50 m trawl.

Two types of craft, FRP boats (with outboard engine) and plankbuilt boats (with inboard engine) are used in gill net fishing. The motorised dugout canoes along Junagad district which operate gill nets are in the length range of 5.5-8.5 m.

Table 10 Traditional and mechanised craft and gear of Gujarat

Type of gear/craft	Local names	Mesh size in mm
1. Gill Net		
a) Drift gill nets	<i>Dhakkal</i>	140-160
	<i>Dhangla jal</i>	150
	<i>Katri</i>	100-150
	* <i>Khandart jal</i>	65-85
	* <i>Nahjal/Warri jal</i>	120
	<i>Pantu jal</i>	100
	* <i>Rachh</i>	100-150
	* <i>Sharand jal</i>	
	* <i>Tarti jal</i>	60-80
	<i>Waghra jal/Pasa jal</i>	70-150

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b) Bottom set	<i>Budi jal</i>	90
gill net	* <i>Halava jal</i>	140-150
	<i>Gonda jal</i>	
	* <i>Jada jal</i>	170-215
	* <i>Tagli</i>	140-280
	* <i>Tiyani/Kandali jal</i>	50
	* <i>Vagul jal</i>	300
	* <i>Jina jal</i>	80-85
c) Other gill nets	<i>Boijal</i>	50-70
	* <i>Eksara jal</i>	65-140
	* <i>Pakha jal</i>	20-25
	<i>Patta jal</i>	
	* <i>Thobdi jal</i>	160
	* <i>Chokla jal</i>	55-60
2. Scoop Net	<i>Aachu</i>	
3. Fixed Bag Net	* <i>Dol/Golva</i>	8-10,10-12
4. Hooks & Lines*	<i>Wagha</i>	
a) Bottom set	<i>Khanda</i>	
long line		
5. Traps		
6. Mechanised Trawl Nets*		
a) Shrimp trawl		8-15
b) Fish trawl		15-25
	Craft	
1. Dugout canoes	<i>Alodi/Dupaka/Dupki/ Pagar/Sanar/Wananhodi</i>	
2. Plankbuilt boats	<i>Galpat/Hodi/Machwa/Tori</i>	
3. FRP canoes with OBE		
4. Mechanised trawlers (OAL 11-14 m)		

* Commonly used gear

Conclusion

The different climatic and geographical factors of the Indian coast have presented varied types of marine fishing craft and gear. In this process a number of traditional gear have been modified in recent years while few others are found to be not economically viable due to meagre returns.

The seine nets are old traditional gear operated in shallow coastal waters along the Indian coast excepting Gujarat. Due to the recent advent of purse seines along west coast and mechanised trawling in shallow waters along east coast, the operations of boat seines and shore seines have been considerably reduced and in state like Karnataka the gear have even become non-functional. Reduction of mesh size of shore seine below 10 mm as has been reported recently in few centres along Andhra coast may adversely affect the post-larval and juvenile stages of various fish species.

It has been noticed that the shore seines in general and the boat seines of Andhra Pradesh, Tamilnadu and Pondicherry in particular are the only traditional gear made of cotton twines. Recent report indicates that in some centres along East Godavari district of Andhra Pradesh, the shore seine has been fabricated with transparent nylon twines which facilitates easy operation and handing (Rao, 1987).

Of the total traditional fishing gear in India, nearly 40% comprise gill nets. Gill nets are passive gear with mesh opening of suitable size. The fish desired can be caught by gilling them. The hanging co-efficient i.e., the relation of the length of the rope and the length of netting hung to it has a high influence on the efficiency of gill nets because the factor influences the shape of the mesh in water (Brandt, 1972). The net will be stationary when set on the bottom or they are drifting independantly in connection with a vessel. Among the numerous types of gill nets, the sardine gill nets has retained its efficiency for more than five decades as has been indicated by its continous and extensive operations along the coast. This gear account for nearly 90% of sardine catch along the east coast. Luther (1994) has detailed the operations of sardine gill nets of different mesh sizes ranging from 15 mm to 38 mm.

The trammel net or the three-walled gill net, popularly known as disco net has got wide acceptance as an efficient gear along the Indian coast in recent years. This net designed for setting at the bottom is fabricated in such a way that it has a fine net of smaller mesh hung loosely between vertical walls of coarser net of much larger meshes. Nearly 70% of the total prawn catches by traditional gear in Tamil Nadu is

caught by Trammel nets (Pillai, *et.al.* 1994).

The hooks and lines are dominant gear next to gill nets in all maritime states exploiting large pelagic, column and demersal fishes and are much predominant in the number of units in Tamil Nadu followed by Orissa and Andhra Pradesh. This gear underwent only minor changes with regard to size of hooks, number of hooks in a line, bait organism and resource availability (Menon *et. al* 1991). Hand lines, troll lines and long lines are the different methods of hooks & lines fishery apart from the pole and line fishing employed in Lakshadweep. The hand jigging for cephalopods, using different hooks are widely operated in certain centres, the details on the fishery status of which is available (Ninan, 1991).

Fixed bag nets or stake nets though operated in all maritime states, the predominance is more along Maharashtra and known by the name *dol* supports the economy of a large fishermen community. These bag nets with length of 15-20 m kept stretched by current are usually set in rows side by side between stakes. The encircling bag net, *Eda valai* of Tamil Nadu coast acclaimed as an efficient gear to tap the pelagic species account nearly 90% of the oil sardine catch of the state.

Trap fishing is practiced in a few maritime states especially in Gujarat, Tamil Nadu and Kerala. Nair (1991) has detailed the technological aspect of trap fishery in India.

The introduction of mini trawls, a typical dragger type gear, with a length of 15-18 m and a mesh size of 10-15 mm operated by powered country craft is a recent innovation along Kerala, Karnataka and Maharashtra coasts. Drag nets, scoop nets, wall nets and entangling nets are also employed though in restricted numbers along some maritime states of India.

Increase in number of trawls reduced return per gear forcing the operator to reduce the code-end mesh size in order to maintain the catch level. Due to heavy competition and intensive trawling the reduction in the mesh size is very high. The reduction in the mesh size and increase in the number of trawl have led to many problems affecting the fish stocks. Symptoms of economic over fishing and size over fishing have been noticed during eighties in most of the species exploited in Indian waters. The presence of trawls and their operation in the inshore waters sharing the resources with indigenous sector posed socio-economic problems mainly affecting the indigenous sector (Alagaraja, 1994).

Due to scarcity and high price of wood materials, construction of fishing craft especially for traditional ones like plankbuilt boats and dugout canoes poses a serious problem. The ferrocement boats made of steel and mortar as a substitute could not succeed due to various disadvantages. Later FRP boats made of a composite material of fibreglass and a polyester resin has gained wide acceptability as they are of light weight and having longevity and strength. FRP boats of various specifications have already been appeared in most areas though in limited number. Introduction of beach landing craft capable of operating from surf beaches are reported in some centres along Orissa, Andhra Pradesh and Tamilnadu coasts (BOBP, 1993).

Realising the need for improvements in the existing designs of craft and gear, it has been recommended that improvement be effected keeping operational efficiency and cost in view, to the existing craft types and gear using local material, expertise and skills with the full involvement of all concerned including the fishermen. Besides the conventional timber used at present, suitable alternative material for the construction of traditional fishing craft may be identified, tested and made available (CMFRI 1979). Recent studies suggested that standardisation and popularisation of polypropylene, polyamide monofilament yarn etc. should be made on long term basis in collaboration with manufacturers and voluntary organisation in different agroclimatic conditions and new series of low energy fuel efficient and operationally economical vessel designs are also to be developed (*Proc. National Workshop on Low Energy Fishing, 1991, CIFT, Cochin*).

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