CHAPTER V

DISCUSSION
CHAPTER V

DISCUSSION

Potentially, the Inland Fish resources of the country are of very high order and among the richest in the world. The inland fish production in India has enhanced from a level of 0.22 million metric tones in 1950-51 to 3.2 million metric tonnes in 2002-2003. Today, India is the second largest freshwater fish producing country in the world.

In Karnataka, there are twenty-four inland fish producing districts. The state is one of the richest among the Indain states having inland water spread area of about 5.20 lakh hectares having a resource potential of about 2.64 lakh metric tonnes of fish production per annum. The inland fish production from Karnataka during 2002-2003 is 86262.61 metric tones (Anon, 2004).

The level of inland capture fishery is far from optimum mainly because of inadequacies of the existing
fishing gears, fishing methods and fishing crafts. This would require a thorough study of the existing fishing gears, methods and crafts in vogue, of which little is known at present and hence the present study.

Regarding Marine Fisheries of Karnataka the state has 300 Km. of coastline and 27,000 square kilometers of continental shelf area, rich in pelagic fish resources. Out of the Indian exclusive economic zone (EEZ) of 2.02 million square kilometers the Karnataka has a share of 87,000 square kilometers. The marine fisheries resource potential of the state is estimated at 4.25 lakh metric tones of which, 2.25 lakh metric tonnes from inshore zone up to a depth of 70 meter and remaining 2.0 lakh metric tonnes from the offshore/deep sea zone. During 2002-2003 the total marine fish production from Karnataka coast was 1.80 lakh metric tones (Anon, 2004).

From the study on marine fishing gear and crafts of Karnataka it was observed that purse seining; trawling,
drift gill-netting and line fishing are the commercial fishing methods of Karnataka. At present, there are 2669 trawling boats, 349 purse seines, 4260 gill netters, 139 other mechanized boats and 18966 non-mechanized boats operating in the state.

RIVERINE FISHING GEARS AND CRAFTS OF KARNATAKA

From the study of Riverine fishing gear and crafts of Karnataka, it is evident that the gill nets, cast nets, long lines, shore seines and drag nets are the major fishing gears employed for harvesting riverine fish resources of Karnataka.

Alivi net and Maya jal are the two riverine shore seines operated in Tungabhadra and Krishna rivers during summer. As the mesh size in alivi net is 20 mm, the catch is dominated by small sized catfishes and weed fishes whereas big sized carps and catfishes are caught in large meshed Maya jal. The Maya jal operated in Krishna
River resembles in design and construction of "Maha Jal" described by Faruqui and Sahani (1943) and Saxena (1966), which were operated in Ganga and Jamuna rivers.

The alivi net is mostly operated in shallow riverine waters with coracle or without coracle. The alivi net lacks bag whereas maya jal possess a bag at its central portion. The uses of seine nets without a bag was observed by Joseph and Narayanan (1965) while studying fishing gear and methods of Brahmaputra River and are of the opinion that absence of bag is to suit the ecological and topographical needs of a particular river system.

Among gill nets, sub-surface set gill nets locally known as "Rangoon nets", bottom set gill nets as "Bidubale" and gilling cum drag net, known as "Seesada bale" are the types observed. Footrope is absent in Rangoon nets where as the footrope is weighted with lead sinkers. Lack of footrope in Rangoon nets is to facilitate entangling of big fishes. Saxena (1966) reported the use...
of similar type of gill nets in Ganga and Jamuna rivers. Seesada bale is operated as drag net during morning and as set gill net during evening in the deeper waters of riverine stretches. In seesada bale, fishes are caught by gilling or by entangling. Joseph and Narayanan (1965) also reported such nets operated in Brahmaputra River and is locally called as “Lungi Jal”.

Cast nets with strings, cast nets with pockets and cast nets without strings and pockets were observed during the present study. The cast nets with strings and cast nets with pockets having varying mesh sizes are commonly operated in most of the riverine fisheries for harvesting Catfishes and Weed fishes. Cast nets without strings and without pockets are being operated in Kabini and Cauvery Rivers by migrated fishermen from Mattur to catch big sized fishes.

The cast net ‘Catamara Jal’ observed by Joseph and Narayan (1965) in Brahmaputra River in which pursing is
involved during operation is not observed in the riverine fisheries of Karnataka. The cast net with pockets operated in Krishna River System resembles to a great extent with the cast net ‘Bhawar Jal’ operated in the Ganga and Jamuna Rivers both in its design and construction (Saxena, 1966).

The introduction of other gears for riverine fishing of Karnataka mainly depends on the availability of fishes during particular seasons. Based on the movement of fishes against and along the flow of Hemavathy Riverine waters during monsoon, aerial raft fishing is practiced in Kikkeri Hobli of K. R. Pet taluk, Mandya district of Karnataka. Hence, possibilities of extending such fishing techniques have to be explored due to the introduction of irrigation facilities recently in some Southern districts of Karnataka.

Long line fishing gear is operated when the operation of other nets are difficult due to heavy flow in
riverine waters during Rainy season. Line fishing methods are to be encouraged to harvest Catfishes and other air breathing fish resources available in the reverine waters of Karnataka since these resources are not exploited to the optimum extent.

The unique method of fishing is fishing with Scare lines, which is exclusively practiced to harvest Cobitids, which are in demand. Suitability of introduction of such fishing methods is to be explored. Kulnawa fishing service which is practiced in River Ganga for harvesting Minnows is to be tried in riverine waters of Karnataka for its introduction (Banerji et.al., 1979).

The Scoop net locally known as 'Prawn net' is operated throughout the year in weed infested shallow margins of the rivers to capture Juveniles of Catfishes, Weed fishes and Prawns.
The trap locally known as 'Kukke bale' is being operated during January and June to exploit Murrels. The behavior of Murrels, which invariably enters and stays on in weed-infested areas, is utilized for the successful operation of this trap.

With reference to the construction of riverine fishing gears, it was observed that the use of nylon webbing in most of the fishing gears except in some places, where cotton webbing is still being used for the fabrication of cast nets.

For construction of traps for harvesting Murrels, Palmyra fibres are still being utilized. The reason is quick sinking of the fibre after wetting and availability at low coasts. Studies are needed to find suitable materials for the construction of traps.
Coracles are the main fishing crafts employed in riverine fisheries. Possibilities of introduction of wooden crafts are to be employed since wooden crafts are safe to the fishermen during fishing and fishermen can increase their fishing effort further thereby increasing the fish production from the riverine waters of Karnataka.

**FISHING GEARS AND CRAFTS EMPLOYED IN RESERVOIR FISHERIES OF KARNATAKA**

Reservoirs are among the important inland fisheries resources of India. Karnataka possesses 74 reservoirs with a water-spread area of 2.27 lakh hectares. At present, Alivi nets, gill nets, lines and dragged gears are being operated in almost all the reservoirs of Karnataka. Among gill nets, sub surface gill nets locally known as Rangoon nets or catla nets are being operated during night for harvesting Indian major carps. These nets lack footrope. From the present study, it was found that the length of Rangoon nets operated in most of the reservoirs varied from 50 meters as observed at Malaprabha Reservoir up to 800 meters at Tungabhadra Reservoir.
The depth of the net was 1.5 meter at Narayanpur Reservoir to 6.0 meters at Vanivilas Sagar.

The Rangoon nets operated in different reservoirs of Karnataka except Narayanpur Reservoir and Kabini Reservoirs were lacking footrope and sinkers. The absence of foot rope in Rangoon gill nets makes the net get rolled up due to wind and wave actions in the reservoirs. Hence, it is better if the Rangoon nets operated in reservoirs of Karnataka are provided with footrope and sinkers to increase the efficiency of the gear.

The hung depth of the Rangoon nets operated in reservoirs of Karnataka in reservoirs of Karnataka varied from 1.5 to 6.0 meters. George et. al., (1984) are of the opinion that for catla nets the hung depth of 5.0 meters is essential to increase the efficiency of nets.
The main webbings of the Rangoon nets operated in reservoirs of Karnataka are made up of polyamide twine 23tex x 1 x 3 and 23 tex x 3 x 3. George et. al., (1984) after conducting experiments in reservoirs of Karnataka recommended PA 23tex x 2 x 3 twine as the most suitable twine size for the efficient exploitation of *Catla catla*, *L. calbasu* and *L. bata* and other fishes.

There is no selvedge in Rangoon gill nets of Karnataka and hence there is need to introduce selvedge into the webbings of Rangoon nets to increase the durability of their webbing and to reduce the cost of fishing in the reservoirs.

The present study, revealed that the gear requires modifications in respect of rigging, design and other parameters like mesh size and twine size in order to increase its catching efficiency. Bidubale is an indigenous bottom set gill net operated in most of the reservoirs of Karnataka to harvest catfishes, major carps, minor carps,
weeds fishes and other fishes available in the reservoirs. The length of the net varies from 30-35 meters in Harangi reservoir to 200 meters in Tungabhadra reservoir. The depth of the net ranges from 0.5 meters at Tungabhadra reservoir to 2.0 meters at Kabini and Nugu reservoirs. The mesh size was 25-40 mm at Harangi reservoir up to 60 mm at Narayanapur reservoir and up to 100 mm at Tungabhadra reservoir. George et. al., (1984) recommended a hung depth of 3.0 meters for nets catching *Labeo calbasu, L.bata* and other fishes and mesh size of 70-80 mm and twine size of 23 tex x1 x 3 for efficient exploitation of uneconomical fishes from the reservoirs.

Hence, further detailed studies are needed to determine the required length and depth of bidubale, the mesh size requirement for harvesting different species and size groups in the reservoirs of Karnataka.
It was observed that the fishes caught in the gill nets from the reservoirs of Karnataka were entangled and also gilled in the net. Von Brandt (1964) felt that larger fishes are usually caught by entangling rather than gilling. The studies conducted by Sulochanan et al., (1966) in Hirakud reservoir have also revealed that 77 per cent of the fish caught were entangled and the rest were gilled. Hence, possibilities of introducing vertical line gill net, trammel gill net and framed gill nets for fishing in the reservoirs of Karnataka are to be explored as these nets are found to catch more fish compared to simple gill nets.

Alivi net is a shore seine operated in a few reservoirs of Karnataka for the exploitation of weed fishes, catfishes, minor carps and other fishes. The introduction of Alivi nets for fish exploitation in other reservoirs of Karnataka is to be encouraged based on the topography of each reservoir since the continued operation of gill nets and long lines widely in reservoirs avoided the capture of certain species of fishes and size groups due to their selective nature of fishing. This resulted in either under
exploitation or proliferation of certain fishes in many reservoirs. Hence, studies on catch and catch composition of alivi nets at present employed in some reservoirs of Karnataka are to be undertaken.

Among the line fishing methods long line is the gear operated in the reservoirs of Karnataka for the exploitation of catfishes, murrels and other miscellaneous fishes. The length of the long line varied from 100 meters in most of the reservoirs to 600 meters at Tungabhadra reservoir and the hook number from 8 to 12. The baits commonly used are earthworms, minor carps and frogs. Optic and olfactory stimuli are the primary factors responsible for the luring effect of this gear.

Tree stumps, boulders and other obstacles were observed in certain areas of the reservoirs, where gill net operation is not possible. Hence, long lines are recommended for fishing in such zones. Presently, the fishermen using hook No.8 to 12 for long lines with
earthworms and weed fishes as baits. The studies carried out by George et. al, (1984) established that Kirby bent hooks of size 20 are the most suitable hooks for catching predator fishes like *Silondia silondia*, *Mystus aor*, *M. seenghala* and other fishes. Hence, detailed studies on long lining are needed for the optimum exploitation of fish resources available in the reservoirs of Karnataka.

Cast nets are the most primitive types of gears used in most of the reservoirs of Karnataka. According to von Brandt (1984) cast nets have originated in India. During the present study, it was observed that cast nets with strings and cast nets with pockets were being operated in the riverine zones of the reservoirs. All cast nets are constructed based on the same design but the mesh sizes were different.

The possibilities of introducing trawling, light fishing, electrical fishing and use of fish aggregating
devices for the exploitation of available fish resources from the reservoirs of Karnataka are to be explored.

Comprehensive knowledge on the species wise occurrence and variations in their abundance with reference to season is an essential pre-requisite for proper exploitation of reservoir fisheries. Studies conducted similar to that of Devaraj et. al., (1987) on Hemavathy reservoir have to be initiated for all the major reservoirs of Karnataka to harvest untapped fish resources of reservoirs of Karnataka.

FISHING GEARS AND CRAFTS EMPLOYED IN TANK FISHERIES OF KARNATAKA

It has been inferred from the above study that the tank fishing gear of Karnataka comprise seine nets, cast nets, gill nets, dragnets, traps and other miscellaneous gears. It was observed that due to selective nature of fish catching by gill nets and long lines, some fish species and size groups are not exploited to the optimum extent from
the canal fed and rain fed perennial tanks of Karnataka. Hence, Encouragement for operations of seine nets are needed to increase the fish catch from tank resources of Karnataka.

The presence of impressive numbers of major and minor tanks in Karnataka along with their rich fish resources provide an ample opportunity for fishery scientist to experiment with improved gears and capturing methods. Carnivorous fishes such as catfishes and murrels are to be exploited by developing a parallel "feed fisheries" as baits to be readily utilized in traps and in line fishing methods. To this extent, suitable survey and stock build up of feed fishes can be undertaken.

For gill net fishing, synthetic fibres of different colors like blue, grey and green are to be attempted against the water column so as to access the efficiencies of colors to attract better catches on similar lines as

From the study on fishing gear and crafts employed in tank fisheries of Karnataka, it was observed that the following measures are needed to increase the catches from the capture fisheries. They are:

1. Improvement of existing fishing methods in partially exploited tanks by,
   a) Use of coracles, rafts and wooden boats be encouraged in all the major tank in Karnataka which are rain fed and canal fed for exploitation of fish wealth.
   b) Studies are needed on improving the efficiencies of gill nets, traps and other fishing gears employed in tank fisheries of Karnataka.
   c) Follow up of information on migratory or invading fish from tank to tank during
rains and also when water is released from canals.

**ESTUARINE FISHING GEAR AND CRAFTS OF KARNATAKA**

The brackish water environment represents a unified ecosystem of high fertility, supporting a rich natural fishery which is of considerable significance in the rural economy of the developing countries.

A large number of estuaries are found along the Karnataka coast, of which Netravati-Gurupur, Gangolli, Sharavati and Kali estuary are important from the fisheries point of view. Fishing in estuaries is carried out throughout the year and the peak season is June to August, which falls during the monsoon period in the region. Diversified fishing methods using gears such as shore seines, gill nets, cast nets, hook and lines and mini-trawls are employed for the capture of estuarine fishes such as

367
Sillago sihama, Gerres spp., Mugil spp., catfishes, prawns and other miscellaneous fishes.

Among the estuarine fishing gears, gill nets are prominent for the capture of Indian sand whiting Sillago sihama, which is abundant in the estuaries of Karnataka. The traditional gill nets “Kane bale” and “Pare bale” are the two important gill nets operated in all the estuaries of Karnataka. Kane bale with its mesh size of 35 mm is specially used for catching Indian sand whiting which is locally called as kane. The pare bale with a higher mesh size of about 50 mm is operated especially for Mugil spp. and Gerres spp. Based on the catch data collected on the monofilament and multifilament gill nets operated in estuaries of Karnataka, it was found that monofilament gill nets were found to be better than multifilament gill nets in catching number of species and in quantity-wise. However, detailed observations for a longer period are needed.
Among the lines, hand lines and long lines are the most popular fishing gears employed to harvest *Sillago sihama* in the estuaries of Karnataka.

“Sigadi rampani” a shore seine, mini-trawl and “Goru bale” are the main fishing gears employed in the estuaries of Karnataka to exploit the prawns, mullets and other estuarine fishes during the monsoon months.

Among falling gears, cover pots and cast nets with different mesh sizes are the gears employed for fishing in estuaries of Karnataka. The cover pot is operated for catching single fish during night in estuaries using light whereas “Thool bale” and “Thar bale” are the cast nets with pockets operated in estuaries. In Thool bale *Mugil* spp., were found to be more whereas in Thar bale *Sillago sihama* were found to be more.
"BoIbu bale" a stake net is operated in estuaries of Karnataka for *Sillago sihama* and *Gerres* spp. The capture technique essentially includes scaring the fishes using line of palm leaves. Along east coast of India, similar type of stake nets is also in practice in estuaries (Radhakrishnan, 1957).

The clam resources of the estuaries of Karnataka are not fully exploited so far. At present, the bivalves are either hand picked or removed with chisels. It may be pointed out that molluscan resources are harvested using modern devices such as rakes and dredges in Europe and in East Asia (Brandt, 1968). While it is recommended to increase the fishing efficiency to harvest bivalves resources of Karnataka it is also mandatory to initiate management and conservation measures to protect the stock of bivalves for sustainable production. The regulatory measures recommended by Appu Kuttan *et al.* (2002) for management and conservation measures for clam resources of Cochin areas are:

1. Ban on fishing for juveniles.
2. Ban on fishing during peak spawning season (October to January).

3. Mariculture practices such as transplantation/relaying /semi culture of clam seeds for increasing production. Sea ranching programmes to reduce fishing pressure on the juvenile stock.

The same regulatory measures may be implemented for the bivalves exploitation in the estuaries of Karnataka.

MARINE FISHING GEARS AND CRAFTS OF KARNATAKA

Out of 27 districts of Karnataka, only three districts namely Dakshina Kannada, Udupi and Uttara Kannada are having marine resources. The total coastal length of Karnataka is 293 kilometer out of which 42 km in Dakshina Kannada, 98 km in Udupi district and 160 km in Uttara Kannada district. The state has rich continental shelf of 27,000 square kilometers with an Exclusive Economic Zone (EEZ) of 87,000 square kilometers having
a resource potential of 4.25 lakh metric tones of fish production per annum.

In the past, marine fishermen confined themselves to the operation of one and the same type of gear without any recourse to the change for more productivity and economic returns. For example, seine nets were operated for shoaling fishes like Oil-sardines and mackerels, drift gillnets for exploiting Seerfishes, tunas, elasmobranchs and other fishes. Long lines for harvesting sharks, tunas and catfishes by traditional crafts fitted with sails. The fishing was confined up to a depth of 40 fathoms till past few years.

At present, commercial fishing methods namely Trawling, Purse-seining, Gill netting and Long lining by motorized boats are capable of exploiting available fish resources from deeper waters and also able to tap new fish and prawns resources in deeper waters of the coast which was hitherto unexploited.
For exploitation of new marine fishery resources from the waters of Karnataka, modern fishing gears like purse seine, trawl, gill net and long lines with variations in design and construction were introduced and being employed at present in marine fishing. Since, fishing is extended into offshore and deep sea the size of mechanized boats is also increased.

Hence, the present study is initiated to study the design and constructional details of the existing fishing gear and crafts and to document the changes taken place from the earlier one's in the coast of Karnataka.

I. SURROUNDING GEARS

Purse seine, the most important commercial surrounding gear was introduced along the Karnataka coast during 1975-1976. It is one of the efficient gears employed in catching shoaling fishes. It is well known that Karnataka coast is abundant in pelagic fisheries wealth.
Along the coast 50-52 feet O.A.L. mechanized fishing boats fitted with 106-110 BHP engines are employed for operating the purse seines up to a depth of 100 meters successfully. The nets of size up to 900 meters and depth 60 meters are operated for the fishery. The purse seines operated along this coast are single-boat purse seines.

The purse seines are made out of knotted polyamide webbing. Generally, soft twines are being used in the construction of the net. For greater sinking speed and better durability mixed yarns can be used (Titaka, 1971).

At present, there are three different purse seines being operated in the coasts of Karnataka. Purse seines with 12 mm mesh size in its bunt part are operated for catching oil-sardines, mackerels, anchovies, prawns and other small size fishes. Whereas purse seines with 20 mm mesh size in its bunt part, locally called as “Koti bale” are
operated for catching big size fishes like seer fishes, tunas, catfishes, elasmobranchs, ribbon fishes and other fishes. The net is operated successfully during September to October months to catch above big sized fishes available in the Karnataka coast.

The mini-purse seine locally known as “Rani bale” is a two boat purse seine operated by two plank-built boats of O.A.L. 40-45 feet during monsoon months for harvesting shoaling pelagic fishes. Along the coast of Ghana, a similar type of purse seine called “Canoe purse seine” is being operated by two dug-out canoes (Dykhuizen and Sci., 1972).

II. DRAGGED GEARS

The introduction of bottom trawling and purse seining proves to be of great significance among the recent developments in modern fishing techniques in Karnataka. Between the two, bottom trawling is the most prominent type of fishing technique widely prevalent along the
Karnataka coast contributing about 97925 tonnes of marine prawns and fish resources valued Rs. 19442.01 lakhs during 2002-2003 (Anon, 2003). At present, there are about 2669 trawling boats operating along the Karnataka coast, the O.A.L. ranging from 30 to 52 feet.

Presently, there are about 4735 trawl nets of various sizes being operated along the Karnataka coast (Anon, 2003). The number of trawl nets operation is concentrated in Malpe and Mangalore fishing centres. According to the construction, the trawl nets are classified as four-seam and two-seam trawl nets. Four-seam trawl nets with flat rectangular otter boards are being operated in the inshore and off-shore waters of Karnataka for harvesting prawns and fishes by mechanized boats of O.A.L. 30-45 feet, whereas two-seam trawl nets popularly known as High-opening bottom trawls (HOBT) are operated to catch bottom and off-bottom fishes in addition to shrimps available in off-shore and deeper waters of the coast.
At present high opening bottom trawls are operated in deeper waters of the coast by mechanized boats of size up to 52 feet O.A.L. and carry out the fishing up to 7-10 days continuously employing Ashok Leyland turbo engines which are found to be fuel efficient and fast engines.

The otter boards are the principal accessory in a trawl for keeping the mouth of the trawl open horizontally during trawling. The vertical opening of the trawl mouth is obtained by floats and sinkers attached to the net. Among the type of otter boards, flat rectangular and Vee shaped otter boards are popularly employed for trawling in Karnataka coast. It is a well known fact that demersal fishes such as prawns, crabs, flat fishes and sciaenids are of the habit of either burrowing into the bottom or remaining just on the sea bed. Because of bottom burrowing nature of prawns and some fishes many workers have recommended the use of four-seam trawl nets with flat rectangular otter boards in inshore and offshore waters of the coast, Mohan Krishna (1985) and
Ashok (1989). But the work carried out by Sahu (1997) on the efficiency of Vee shaped otter boards over conventional flat rectangular boards for demersal trawling it was found that average catch rate of shrimps, crabs, flat fishes and sciaenids for Vee boards remained higher than that of flat rectangular boards in depths ranging from 10 to 35 m. The reason is Vee boards kept the high opening bottom trawl nets in bottom contact during trawling and hence better catch of above fishes. The better bottom contact by HOBT nets by the use of Vee shaped otter boards has been explained by the adherence of mud to the otter board and to the lower panel of the net.

Proper rigging of the trawl net to the foot rope and head rope and attachments of trawl doors with suitable lengths of sweep lines and bridle lengths are important for smooth operation of trawl net and also for obtaining maximum efficiency of the net in catching fish resources. The investigation carried out by Jaya Naik (2002) has confirmed that the maximum catch was obtained in the
HOBT with 25-30m sweep line and 18-21 m bridle lengths.

At present, most of the trawling operations are being carried out in offshore and deep sea for harvesting prawns and fish resources. The studies carried out by Radhika and Madhusoodan Kurup (2004) indicated about slow growth rate of deep sea prawns when compared to their counterparts inhabiting in the coastal waters. Hence, there is need to initiate various measures for the sustainable exploitation and management of deep sea prawns available in Karnataka as suggested by the above scientists.

III. FALLING GEARS

Cast nets form an important category among falling gears. These are the most primitive type of gears used all along the Karnataka coast. According to Brandt (1972), cast nets have originated in India.
During the present study, two cast nets namely Thagadale and Kooribale were found to be operated for fish capture along the Karnataka coast. They are stringed cast nets and hence the fishes are collected in the pockets formed by drawing the string lines. There are 5912 cast nets being operated in Uttara Kannada district, 1292 cast nets in Udupi district and 1745 cast nets in Dakshina Kannada district during the year 2002-03 (Anon, 2003).

Cast nets are operated along this coast either from shore or from a boat depending upon the availability of fishes. At present, cast nets are being operated only in inshore waters of Karnataka, while Brandt (1972) reported its operation up to a depth of 150 meters in Black sea by Turkish fishermen. It is seen that cast nets operated in groups to harvest shoaling fishes. Sakurai (1972) has reported the cast nets operation during night in Thailand for catching squids using lamps. Hence, possibilities of capture of squids by this method in Karnataka coast is also worth considering.
IV. GILL NETS

Gill netting is of a low capital fishing technique and a multispecies fishery. Different types of gillnets are operated along the Karnataka coast for catching fishes like sardines, mackerels, *Kowal coval*, seer fishes, elasmobranchs and other miscellaneous fishes.

The important gillnets operated for mackerels are Kantabale and Pattabale. Kantabale is a set gillnet whereas Patta bale is an encircling gillnet operated by two dug-out canoes. Kantabale of Karnataka coast and “Bangadajal” of Maharashtra coast are similar type of gillnets both in design and operational details (Narayana Rao, 1970). “Pattabale” of Karnataka coast and “Ayilachalavala” of Kerala coast are similar in design and operation and are exclusively employed for harvesting mackerels (Narayana Rao, 1970).

Pattirle bale and Thirandi bale are operated along the Karnataka coast for the exploitation of sharks and...
rays. The mesh size of Pattirle bale is 260 mm, while in Thirandi bale it is 350 mm, though both nets are operated to catch the same fishes in the inshore waters of this coast. However, the seasons of their operation are different as Pattirle bale is operated during March to July and Thirandi bale during September to May.

Odubale is a drift gillnet operated by plank-built boats fitted with out-board engines and mechanized boats in the inshore and Off-shore waters of Karnataka to harvest columnar fishes like seer fishes, pomfret, elasmobranches, tunas, catfishes and other fishes. At present, there are 4260 gill netters and 5400 numbers of gillnets being operated in Karnataka coast. The drift gillnet fishery by Odubale in Karnataka coast is playing a significant role in the economy of small scale fisheries sector. As the gear targets high value Seerfish and sharks, the economics of its operation show good profit to the operators owing to the growing consumer demand. According to Muthaiah and Uma Bhat (2003) there is further scope to increase the yield of Seerfishes from the
distant waters by further shifting the fishing operations into deeper waters from where the multi-day trawl fishing, multi-day drift gillnet fishing could be attempted. The peak period of abundance of Seerfish in the region is September-December which happens to be the lean season for single-day trawl units, hence, these units can profitably operate drift gillnet operations during this period. Some units can operate trawling during day time and shift to drift gillnet fishing during night to enhance fish yield and economic returns.

“Kandaibale” is a surface drift gillnet operated during September in the shallow regions of the sea along the Karnataka coast for harvesting Strongylurus spp. Along the Gujarat coast, a drift gillnet called “Tanadi” is operated for Strongylurus spp. and Hemirampus spp.. “Tanadi” differs from “Kandaibale” in length and mesh size (Anon, 1964).
The use of gillnets does give the advantage that fish stocks can be exploited more selectively. It may be mentioned that when gillnets are lost in the sea, fishes continue to get gilled and perish. Therefore, it is better to use natural fibres for attaching floats as they deteriorate faster, so that the net would sink.

There have been attempts elsewhere to use luring lamps with gillnets (Blinov, 1958). It has been observed that drift gillnets catch more fish, both in number and weight by using underwater lights attached in series to the net (Biswas and Mohanty, 1971). Attempts on these lines may be made for Odubale units during operation along this coast to enhance the gillnet catches.

V. LINE FISHING

Along the coast of Karnataka, long line fishing is popularly called as “Bepu fishing”. In the inshore waters of Karnataka long line measuring a length of 300 meters with 150 hooks of size number 10 are operated during
day time for sharks and catfishes. The fishermen hailing from Tamilnadu are operating long lines of 1000 meters length with 500 hooks to catch elasmobranches, tunas in deeper waters of the coast.

Line fishing is being carried out in Karnataka coast in dug-out canoes in inshore waters and by mechanized boats in deeper waters. No light is utilized during long line fishing along Karnataka coast. In the waters of Vizhijam, Kerala coast light fishing is being carried out with hooks and lines using kerosene lamps, gas lamps during October to May for catching mainly big-eye scad *Selar crumenopthalmus* which is in Kerala locally known as Kannanpura or Peringapara. The other fishes caught by this method are mackerels, perches, carangids and squids (Bhaskaran Achari et al. 1997). The line fishing with the help of lights can be tried along the Karnataka coast to study the catch and catch composition.
At present, deep-sea line fishing is being carried out up to a depth of 500 meters in the Karnataka coast with high opening bottom trawl nets for catching deep-sea prawns and fishes on multi-day trawling. Since, the growth rate of deep sea prawns and fishes is less when compared to the prawns and fishes of coastal waters, in order to reduce trawling pressure in deep sea, the trawl boats can employ long lines fishing when there is less catch of demersal fishes for harvesting other fish resources such as seerfishes, Polynaemids, sharks, tuna, rockcods and other fishes. The above type of alternative fishing by trawl boats is being carried out in Satpati waters of Maharastra by the Tamilnadu fishermen successfully (Dineshbabu et. al., 1999).

At present 1496.28 metric tones of sharks and 680.70 metric tones of rays and skates are being caught during 1999-2000 from the Karnataka coast by different gears. But there is potential of 2704 metric tones of sharks and 5700 metric tones of tunas available for exploitation from the waters of Karnataka coast (Anon,
2003). At present at Janjira-Murud region of Maharastra, a successful line fishing for sharks *Carcharhinus* spp. is being carried out by migrated fishermen of Kanyakumari in 60-95 bhp boats. The gear consists of 400-500 hooks of size number 2 and operated up to a depth range of 100-150 meters on multiday fishing for 5-6 days (Ramesh Rao, 1998). In order to exploit the Chondricthyans (Sharks, rays, sawfish and chimera) resources of Karnataka coast, the local fishermen can be trained in shark long line fishing or arrangements may be made to harvest the above resources by migrated fishermen from the Karnataka coast. According to William. White and Dhamad Fahhi (2004) the fishing gears employed for harvesting dasyatid and Rhyncobatid rays are gillnets, long lines for Carcharhinid shark and deep water longlining for squabid sharks in artisanal elasmobranch fisheries in south-eastern Indonesia. Hence, similar methods of fishing may be tried along the Karnataka coast.
At present, the Indo-pacific sail-fish *Istiophorus platypterus* are often caught as by-catch of tuna long line, by surface drift nets, by trolling, by harpooning and by set netting by the fishermen of Indian ocean. In India, sail fishes are caught by the drift net in the coastal waters whereas from the oceanic waters, they are taken as by-catch of the tuna fishery exclusively by long line gears.

Hence, there is an urgent need to study fish and fisheries of sail-fish in order to develop commercial fishing practices to harvest these migratory fishes.

Long lines with revolving hooks are used along Gujarat coast for preventing any damage to the mainline due to struggling prey. In Karnataka the long lines are operated without revolving hooks. Hence, it is desirable to modify the gear by incorporating swivels/revolving hooks, which may result in better efficiency and durability of the gear.