CHAPTER 2

Fishing Technology and Fishermen's Perception of their Marine Environment

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The following chapter describes the different types of fishing gear and craft that are presently used by artisanal fishermen and attempts to explain how they are adapted to the ecological conditions prevailing in different parts of Orissa.

The social and economic factors related to fishing technology such as distribution of income and ownership patterns will be discussed, and sharing systems described, in Chapter 4.

Furthermore, the ways in which the increased demand for fish in India as well as abroad, the transition of the basically subsistence-oriented traditional fishing economy into a market-oriented economy, and the availability of new materials for manufacture of fishing craft and gear have affected artisanal fishing technology, will be examined. Finally the chapter discusses the present distribution of artisanal fishing craft and gear in Orissa and summarizes the present stage of development.

2.1 Marine Environment

The moderate climate of Orissa consists of three seasons: summer from March to May, rainy season from June to September, sometimes prolonged to November, and a winter season 'from December to February,

There are two monsoons, the active south-west monsoon during June-September and the weak north-east monsoon in November. The south-west monsoon contributes 90% of the annual rainfall and the north-east monsoon 10%, which averages about 148 cm.

Orissa's coastal area is cyclone-prone and is worst affected by cyclones and floods during the south-west monsoon. Cyclones may also occur in May and in the inter-monsoonal period.

As elsewhere in the Bay of Bengal along the east coast of India, two major currents prevail throughout the year : a north-easterly current flows during the period January to July and a south-westerly current flows during the period August to December.[1]

The continental shelf upto 200m depth covers an area of 2500 km^2 which is 4.5% of the total area of the Tndian continental shelf. In the northern part of Orissa, the continental shelf extends upto 120 km: in the southern part, upto 40 km.

While the southern coastline has sandy beaches and open surf-beaten shores, the northern coastline is characterized by rivers and estuaries and an extended tidal area.

The demersal fisheries potential (exploitable fish stock) in the continental shelf of Orissa has been estimated at 100,000 to 120,000 tonnes of fish by the Tndian Institute of Foreign Trade. Out of the total, 30,000 tonnes are expected within the 10 fathoms zone, another 30,000 tonnes between 10 and 40 fathoms and the balance 60,000 tonnes between 40 and 100 fathoms. The pelagic resources which are the economically more important ones for artisanal marine fisheries are not yet quantified, neither are the deeper areas of the continental shelf.2

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1. A description of the major oceanographic and geological features of the Bay of Bengalis given by Fairbridge (1966) p. 110

2. The current knowledge of fisheries resource% in the shelf area of the Bay of Bengal is summarized by Raja (1982)

The differences in the ecological and oceanographical conditions between the north and the south are related to the occurrence of different species of fish forming the economically most important artisanal fisheries in both parts of Orissa. While the major artisanal fisheries in the south are for sardines, anchovies, mackerels, seer fishes and prawns, the major fisheries in the north are for hilsa and pomfret.

Other abundant but economically less important species in both north and south are catfishes, elasmobranchs, sciaenids, polynemids and ribbon fishes.

2.2. Fishing Gear and Methods

Fishing gear and methods used in different areas in Orissa reflect the environmental conditions.

In the extended shallow shelf areas off Balasore coast, encircling nets and inshore seines are operated. The river mouths and estuaries of Cuttack and Balasore districts are used for the operation of set bagnets while tidal wall nets are operated in the extended tidal areas off Balasore coast. Typical fishing methods of Puri and Ganjam districts with their surf-beaten open shores and steep slope of the continental shelf are the operation of beach seines, lift nets, and boat seines. Gillnets and lines which are used all along the coastline of Orissa have different specifications in the north and the south of Orissa too, according to differences in economic conditions and abundance of fish species.

2.2.1 Gillnets

A fishing method practised all along the coastline of Orissa by the artisanal fisherfolk is the operation of gillnets. A gillnet is a wall net the lower end of which is weighted by sinkers while the upper end is raised by floats. Gillnets are set in a direction transverse to that of migrating fish. They are considered a passive fishing gear. While swimming forward, fish get caught in the meshes, sometimes at the beginning of the dorsal or behind the gills and opercles, so that the fish can swim neither forward nor backward. Larger fish, while struggling to free themselves, become entangled in the net, which is why gilling is very often combined with

entangling. To gill or entangle fish, the meshes must have the appropriate size as well as the correct shape. The visibility of the net also plays an important role. The entangling capacity of the net can be increased by hanging the net very slack, extending the length of the float line and/or reducing the amount of weight on the ground line. Gillnets are used in principle in two ways: drifting on the surface, connected with a rope to a fishing boat or set, e.g. anchored on the sea bottom.

In the artisanal marine fisheries of Orissa, gillnets are used exclusively as driftnets. They are operated either on the surface or, in South Orissa, close to the sea bottom to catch prawns.

To modify the gilling or entangling capacity in order to adopt the net to exploit the abundance of different fish species throughout the year, artisanal fishermen just change the number of sinkers. In artisanal fisheries gillnets are fabricated in small pieces which are later joined together to form an operational unit.

Even though gillnets are common everywhere along the coast, there are distinct differences between North and South Orissa with regard to length, depth, mesh size and other details of design and construction of gillnets, which are related to differences in operational conditions such as the type of fishing craft used, currents as well as with regard to the abundance of different species of fish. In the following section, the major types of gillnets now used by artisanal fishermen are described with regard to season, area, time and mode of operation, main species caught, sharing system and basic technical dimensions such as length, depth, mesh size and material used for netting, floats and ropes.

The gillnets common in North Orissa are 'Nakuda Jalo'[1] or 'Sanla Jalo', used to catch large species of fish like threadfins and croakers, 'Phasi Jalo' and 'Ilishi Jalo', mainly used to catch hilsa, 'Behendi Jalo', used to catch prawns and small fish, and 'Bhasani Jalo' for very small fish. All these nets are used as surface drift nets. In South Orissa the major gillnets used by artisanal fisherfolk

1. 'Jalo' is the Oriya word for net,

are a bottom driftnet called 'Jagavala'[1], which is used to catch prawns, a surface drift net called 'Kilumala', which is used to catch prawns and pelagic fish such as mackerel, and another surface driftnet used to catch anchovies and sardines, which is called 'Katlala' or 'Kavalavala'.

2.2.1.1 **Gillnets used by Artisanal Fishermen in North Orissa**

-Nakuda Jalo and Sanla Jalo

Nakuda Jalo and Sanla Jalo are large mesh driftnets which are operated by artisanal fishermen in South Balasore and in Cuttack district. Even though there are some differences between the two nets in their design[2], the basic operational pattern is similar. The following is a description of Nakuda Jalo which is used off the southern coast of Balasore.

The Nakuda net is operated during spring and early summer, when small mangrove shrubs, growing along the coast, are in bloom and attract large species of fish such as threadfin, saw fish and large croaker[3]. Nakuda Jalo has a mesh size of 210 mm. One piece of net has a length of 80 meshes and a depth of 465 meshes. 150 net pieces are usually operated in a unit. Nowadays the netting is made from nylon and the floats from polyethylene. However, some nets are still made from hemp with wooden floats. Since Nakuda Jalo is used as an entangling net, it has no sinkers. It is fixed with a rope to a boat and together with it drifts through shallow water areas close to the coast, covering the entire depth of the water.

Ten crew members are required to operate the net. They work either for a fixed wage or on share basis. In the latter case the net pieces are contributed by the crew members and the proceeds from the sale of the catch are equally divided into 11 shares.

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1. 'Vala' is the Telugu word for net.
2. The design of Nakuda Jalo is shown in annexure 2.3
3. In Cattack district the net Is operated throughout the year off river mouths;

One share goes to the boat, and one share to every 11 pieces of net'. Sometimes net owners do nor participate in the operation of the net themselves but delegate a labourer whom they pay a fixed daily wage.

-Phasi Jalo and Ilishi Jalo

Both nets are almost identical, except for length and depth, because of difftrent depth ranges in their respective areas of operation. Phasi Jalo has a stretched mesh size of 100-110 mm and its netting is made from polyethylene. One piece of net has a depth of 100-150 meshes and a length of 500 meshes. 30 pieces of net are joined together to form an operational unit.

Ilishi Jalo has a mesh size of 85-110 mm, the net pieces being longer (970 meshes) and less deep (70 meshes) compared to Phasi Jalo. 18 to 20 net pieces form a fleet or operational unit. The netting of Ilishi Jalo is made from polyethylene or nylon.

In Phasi Jalo as well as in Ilishi Jalo polypropylene is used for float line and sinker line. Floats are made from polyethylene, while sinkers are made from cement.[2]

The main species caught by Phasi Jalo and Ilishi Jalo is hilsa, which is economically the most important variety in North Orissa, besides white and black pomfret, croakers, perches, seer fish, horse mackerels, cat fish and silver bar fish.

Phasi Jalo and Ilishi Jalo are operated throughout the year except in rough weather during the south-west monsoon. Peak

1. The system that if a crew member does not contribute a piece of net, he does not get a crew member's share but is paid a fixed daily wage, which is comparatively unfavourable, is common among Oriya and Bengali fisherfolk and applies also to all other nets used in North Orissa. It indicates that the economic stratification and possibly also the social stratification among owners of artisanal fishing craft and gear and non-owners are more distinct in North Orissa than among the Telugu fisherfolk of South Orissa who do not know a wage labour system but have separate shares for cuntribution of gear and labour by crew members.

2. The detsigns of Phasi Jalo and Ilishi Jalo are shown in annexure 2.1 and 2 2

periods of operation are July/August for hilsa and from October to February for the other fish species. Both nets are surface driftnets usually operated from one boat from the evening until the next morning. Occasionally the nets are operated during day time when shoals of fish are spotted. The operational area extends up to 20 km off shore if the weather is favourable.

Four crew members are required to operate the net. Phasi Jalo and Ilishi Jalo are operated either on a wage labour basis in case the crew members do not contribute net pieces or on the basis of a sharing system under which different shares of the sales proceeds accrue to a boat, net pieces and crew labour. The most common rule is that the sales proceeds of the catch are divided into 5 shares, out of which one share is for the boat and one share for every 5 pieces of net.

-Behendi Jalo

Behendi Jalo has a mesh size of 53 to 70 mm. A piece of net has a length of 400 meshes and depth of 140 to 150 meshes. The netting, as well as the float and sinker line, are made of polyethylene. Polyethylene is used for floats too, while sinkers are made of cement. 40 to 45 pieces of net are operated in one unit.

The net is used mainly to catch prawns but is also used for small hilsa, mackerel, jewfsh and similar varieties.

The fishing season extends from September to February reaching **its** peak from October to December during the prawn season. The net is set from early morning till noon. Behendi Jalo is operated in inshore waters within 5 km distance from the coast. One boat and a crew of four are required for the operation of the net.

As in the case of Phasi Jalo and Ilishi Jalo the crew members are paid a fixed daily wage if they do not contribute any net pieces. If they do, a sharing system prevails. The sales

proceeds are equally divided into 5 shares, out of which one share accrues to the boat and one share to approximately every 11 pieces of net.

-Bhasani Jalo

Of all gillnets used by artisanal marine fishermen in North Orissa, Bhasani Jalo is the one with the smallest mesh size (33 mm). One piece has a length of 2060 meshes and a depth of 100 meshes. Six to eight pieces are operated together in a unit.

The netting material is nylon. The floats are made of wood and the sinkers of clay. Polyethylene is used for the float and the sinker line[1].

The net is mainly used from January to June to catch sardines, anchovies, small catfish, small ribbon fishes, small perches and jewfish and other small fishes belonging to various species.

The operational area extends up to 10 km offshore. The net is set in the early morning hours and hauled at noon. Three or four crew members are engaged in operating the ner.

As in the case of the other nets mentioned above, the Bhasani net is operated either on share basis or on wage-labour basis. In the first case, the sales proceeds are equally divided into 5 shares one share accrues to the boat and one share to every 2 net pieces.

2.2.1.2. Gillnets used by Artisanal Fisherfolk in South Orissa

·Jagavala

Jagavala is the only gillnet in Orissa's artisanal fisheries that is used not as a surface driftnet but as a bottom driftnet, operated by fishermen off the Puri and Ganjam coast.

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1. Annexure 24 shows the design of a Bhasani Jalo.

It is primarily operated to catch prawns, even though pomfret, ribbon fish, croakers and other fish too are caught.

An interesting aspect of its operation is that the net is not anchored on the sea bottom as is the usual operational pattern, but just lowered towards the ground by adding additional weights to the sinker line and then drifts over the ground tied to a Kattumaram, locally called teppa.

The net is operated from March to August up to 10 km off the coast with a large Kattumaram. It is usually set in the early morning hours and hauled around noon

3 crew members are engaged in handling the net. One piece of net is 1500 to 2160 meshes long and 120 to 130 meshes deep. 10 to 12 nets are joined to form a unit. The mesh size ranges from 60 to 70 mm[1].

The sales proceeds are distributed on a sharing system. Out of 5 shares, one share goes to boat and net while 3 shares are equally divided among the labourers.

-Kilumala

Kilumala is a surface driftnet[2], which is used to catch species similar to those caught with Jagavala e.g. prawns, small ribbon fish, pomfrets, small croakers and jewfish. The net is operated throughout the year except in rough weather during the south-west monsoon in June/July. It is operated closer to the shore than Jagavala, at a distance not exceeding 6 km.

Its mesh size of 40 mm to 60 mm is slightly smaller than the mesh size of Jagavala, and its depth is less than half (55 meshes) the depth of Jagavala. The length of one piece of Kilumala is 2400 meshes. 4 pieces are operated from a small Kattumaram and 12 pieces from a large Kattumaram.

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1. The design of a Jagavala net is shown in annexure 2.11
2. The design of a Kalumala is shown in annexure 2.12

A crew of 2 fishermen is required to operate 4 pieces and double the number is needed to operate 12 pieces. For netting, float and sinker line, floats and sinkers, the same materials are used as in the case of Jagavala.

The sharing system is also the same as described for Jagavala, if 12 pieces are operated.

In the case of an operational unit consisting of 4 pieces, the sales proceeds are equally divided into 8 shares, out of which 5 shares accrue to the two crew members and 3 shares to boat and net.

-Kavalavala o r Katlala

Kavalavala or Katlala is the only gillnet used by artisanal fishermen in Orissa that is still made of cotton. Fermented rice water is used for preservation of the yam. The net has wooden floats and lead sinkers. Kavalavala is operated with a small Kattumaram by a crew of 2 fishermen. It catches mainly white bait, anchovies and sardines.

Depending on area. month and species available, the mesh size of Kavalavala ranges from 12 mm for small anchovies to 40 mm for large sardines. Length and depth range from 4180 meshes length and 600 meshes depth for a net of larger mesh size to 6845 meshes length and 700 depth meshes for a net of smaller mesh size[1]. Only one piece of net is usually operated. The operational period lasts from October to February. Nets of smaller mesh size are operated up to 3 km off shore, while nets of larger mesh size are operated up to a distance of 5 km from the shore. During peak season, however, when shoals of fish come very close to the shore, the net is often operated within less than 2 km from the shore.

The fishing goes on from the early morning hours till noon. The reason why cotton is used instead of nylon or polyethylene is explained by the fishermen as follows. When fishing is very active,

1. **The designs of a Kavalavala for sardines and a Kavalavala for anchovies are shown in annexure 2.13 and 2.14**

the net is set several times during the day and after each haul the Kattumaram returns to the shore to dispose of the catch. While sailing back the fish is kept in the net.

On reaching the shore those fish that are not properly gilled or just entangled are shaken off the net while the others are removed one by one. In the context of this method of handling, cotton causes less damage to the fish than artificial yarn would, according to the fishermen. The catch is divided into 3 equal shares out of which 2 shares accrue to the two crew members and one to boat and net.

2.2.1.3 Conclusions

The gillnets used by artisanal fishermen in North Orissa as well as in South Orissa show a wide variety of mesh sizes and designs and indicate that the operation of this type of fishing gear has been adopted in quite a sophisticated and complex way to accord with the various environmental, economic and operational factors.

It is astonishing, for example, how quickly artisanal fishermen responded to the increased demand for prawns by introducing large numbers of Kilumala and Jagavala nets. The abundance of prawns, mackerels, sardines and anchovies in South Orissa is clearly reflected in the use of gillnets of small and medium mesh sizes. In North Orissa most of the gillnets are of medium and large mesh sizes and catch hilsa, pomfret. jewfish, croakers, perches and larger species of fish, which are in abundance and in great demand, particularly in Calcutta.

Regarding the material and fibres from which accessories such as floats, sinkers, head rope, foot rope and netting are fabricated, synthetic fibres such as nylon, polyethylene and polypropylene have almost completely replaced natural fibres and materials such as cotton, hemp, wood and clay. The replacement of natural by synthetic fibres has taken place almost indigenously without much outside assistance from government agencies and

other institutions, It has increased the efficiency of the traditional gillnets to a very large extent, due to the fact that synthetic fibres are less visible than natural ones. apart from other advantages such as easier handling, hardly any need for preservation, longer life span and less weight.

All in all gillnets operated by artisanal fishermen in Orissa are well adapted to the environmental conditions such as abundance of resources as well as to the consumer demand and preferences. Furthermore, modern materials such as synthetic fibres and metals used for fabrication of yarn, ropes, floats and sinkers have been widely incorporated in the artisanal gillnet fishery.

2.2.2. Encircling Nets, Boat Seines and Beach Seines.

Some species of fish li ke hilsa, sardines and mackerels, during certain seasons of the year, gather in large shoals close to the surface of the sea and move towards the shore. While entering shallow water or penetrating into beaches or estuaries these shoals become accessible to artisanal fisheries.

Once fish shoals are in shallow water they can bc easily surrounded with nets reaching from the top of the water to the bottom. These nets are called encircling nets. With no way left to escape, the fish are frightened by striking the water with oars, sticks and other means and thereby driven into the net. Fish are harvested from the enclosed area with the help of scoop nets or seine nets. In the artisanal marine fisheries of Orissa encircling nets are operated in the extended shallow waters off the coast of Balasore and North Cuttack districts. Khia Badia Jalo, Sarini Jalo and Gheri Jalo are operated off river mouths or very close to the shore while Jangal Jalo and Sabado Jalo are operated further out in the sea. Compared to the other fishing methods employed by artisanal fisherfolk, the operation of encircling gillnets is quite a ‘large-scale’ one, considering the number of fishermen involved, the duration of the operation as well as the amount of capital required.

In deeper waters, however, like those off the coast of South Orissa, where nets cannot reach the ground, the method described above cannot be, employed, since the fish have the chance to escape into the depths. Here fishing gear which surrounds the fish shoal from below as well as horizontally is required. For this purpose a shovel-shaped gear which surrounds the fish shoal completely would be suitable. A variety of such gear has been developed in East and South Asia (Brandt 1972, p. 167), which are shaped like a dust pan. They are called lampara-like nets. The principle of their working is that, after surrounding a fish shoal, the open front side of the net shovel is closed by lifting the anterior edge of the net. An example is the 'Kolli net' which is used on the Malabar Coast of India.

Lampara-like nets, however, are of comparatively large size and weight and require a fishing craft which has a higher carrying capacity than the Kattumaram presently used in South Orissa, not to speak of the problem of carrying the catch back to the beach.

For this and other reasons, in South Orissa beach seines and boat seines are used, instead of encircling nets, to catch shoaling fish close to the shore.

Boat seines have long wings on both sides, as well as long hauling lines, which are attached to the wings. They have a strong centre to collect the fish caught, sometimes with a net bag attached. They are operated by two Kattumarams.

Beach seines consist of a bag to which two wings are attached. They are laid out in a semicircle facing the shore and then pulled towards it.

In the following section, five types of encircling nets used in North Orissa are described as well as a boat seine employed by artisanal fishermen in South Orissa.

2.2.1. Encircling Nets of North Orissa

-Jangal Jalo

The Jangal Jalo net is operated off North Balasore coast usually within 10-15 metres depth. It is operated from August unti the end of February. The main species caught are hilsa, croakers threadfin, catfish, perches and perch-like fishes such as grouper and snappers.

35 fishermen in 5 boats participate in the fishing operatior Each fisherman contributes 5 pieces of nets, so that 175 pieces c net are operated in a unit. The 2 biggest boats out of the 5 boat carry the gear to the fishing area. On locating a **shoal** of fish the net **is** deployed around the area by the two bigger boats. **The** three smaller boats remain within the encircled area and the fishermen beat the water with empty tins and oars to drive **the** fish into the net. While the smaller fish are gilled the bigger one are trapped in the pouches above the sinker line, which touches the sea floor.[1]

One piece of net has the following dimensions :[2]

It has a mesh size of 62 mm, a length of 360 meshes and depth of 330 meshes. Its netting, head and footropes are made polyethylene. Wooden floats and clay sinkers are used.

The fishing unit usually stays out at sea for days at stretch, while one boat carries the **catch to the** shore and returns with supplies. In some cases the catch is collected at sea by fhs merchants.

Regarding the sharing system, the sales proceeds are equally divided into 41 shares, after deducting common open tional expenses. The two bigger boats get 1.5 shares each while one share **accrues** to each of the three smaller boats. Or share goes to every 5 pieces of net, which are contributed bt each of the crew members.

1. In some cases fixed tapering nets are used to harvest the fish encircled b Jangal Jalo.
2. The basic design of a Jangal Jalo is shown in annexure 2.5

-Subado Jalo

Sabado Jalo is another encircling net which is operated by stisanal fishermen off Balasore coast and also off North Cuttack coast.[1] Compared to Jangal Jalo it is operated closer to the last, sometimes even at the mouth of a river. Seven fishing coats and 36 crew members are engaged in the operation of a Sabado Jalo. The net catches species similar to those caught by Jangal Jalo.

The two largest fishing boats carry the gear to the fishing sound, joined by the other five boats. On locating a shoal of fish the two larger boats share the net between themselves and circle the area. The other boats remain in the circle and their few beat the water with empty tins and oars to scare the fish to the net.

Unlike the operation of the 'Jangal Jalo' net, the sinker he is pulled after encircling the shoal and forms a pouch or rse so that the fish is trapped. The fish is sometimes kept alive the net for days and harvested little by little with scoop nets seine nets to avoid bulk landings.

Au operational unit of 'Sabado Jalo' consists of 2 pieces of net. One piece has a mesh size of 50 mm, a length 410 meshes and a depth of 975 meshes. The netting is made cotton; the float line of polyethylene; and the sinker line of use. Wooden floats and stone sinkers are used.

The net is operated from August to February. The sharing system works as follows : one share goes to each of the boats and one share to every 7 pieces of net which are contributed by each of the 36 crew members.

Sarini Jalo

Another encircling gillnet which is operated close to the ore or at the mouth of a river is Sarini Jalo. With 25 mm it is a smaller mesh size than Jangal Jalo and Sabado Jalo.

The design of Sabado Jalo is shown in annexure 2.6

Sarini Jalo is operated throughout the year except in rough weather during the south-west monsoon. Jewfish, threadfins, perches, hilsa and mullet are the main species caught by this gear.

Sarini Jalo is operated by 20-30 fishermen from 2 or 3 boats. 90 pieces of net are joined together to form one operational unit. One piece of net has a length of 766 meshes and a depth of 460 meshes. The netting material is cotton. The float and ground line are made of hemp. Wooden floats are used.' On reaching the fishing ground and locating a shoal of fish, the boats deploy the net in a circle and the fish are driven into the net by beating the water with oars and empty tins. The proceeds from the sale of the catch are equally divided into 33 sharer, out of which one share goes to each boat (in case 3 boats are operated), and one share to every 3 pieces of net.

--Gheri Jalo

Gheri Jalo is an encircling net of considerably less depth and a larger mesh size than the three nets described above. It can be operated only in shallow waters very close to the shore Artisanal fishermen in North Cuttack district use it in inshore waters off the Hansua river mouth. The main species caught are croakers and threadfins. The fishing season for Gheri Jalo extend: from October to March.

Fishing usually continues for seven or eight days at a stretch starting 3 or 4 days before full or new moon and continuing unti 3 or 4 days after. The catch is brought back to the market in a separate boat. The nst is operated by two boats as describele earlier for Jangal Jalo and Sabado Jalo: or one rope is kept on the shore while a boat deploys the net in a semicircle and returns the other end of the net to the shore. A crew of seven in the case of one boat or 14 in the case of two boats is required for the operation.

Gheri Jalo consists of seven pieces. One piece is 1000 meshes in length, 35 meshes in depth and has a mesh size of 200 mm. The

1. Annexure 2.10 shows the design of Sarini Jalo.

netting is made of nylon, the floatline of polyethylene while the sinkerline is made of jute. Polyethylene floats are used and sinkers are made of stone.[1]

The proceeds from selling the catch are divided into 8 equal shares if one boat is operated, out of which one share goes to the boat and one share to each piece of net, which is contributed by each of the seven crew members.

-Khia Badia Jalo

Another large mesh encircling gillnet, which is operated in shallow waters off the coast of North Cuttack district, particularly off Hansua river and Hukito Bay is called Khia Badia **Jalo.**

It has a smaller mesh size (122 mm) than Gheri Jalo and catches, besides hilsa, threadfins and croakers as well as clupeids.

One piece of net has a length of 200 meshes and a depth of 60 meshes. The netting is made of nylon, polyethylene is used for float and sinker line as well as for floats, while stones are used as sinkers.[2]

The fishing season for Khia Badia Jalo extends from October to March. The net is operated either by one boat from the shore or by two boats as an encircling net. 96 pieces are operated in a fleet.

The operation of the net is similar to the one already described for Gheri Jalo. 7 crew members are engaged if one boat is used, 14 crew members are involved if two boats are employed. In the latter case the sales proceeds are divided into 16 *equal* shares out of which one share accrues to each of the two boats and one share to every 6 pieces of net.

2.2.2.2 Boat and Beach Seine of South Orissa

In olden days boat seines were the most common gear used with Kattumarams. They were operated throughout the year to catch

1. Annexure 1.6 shows the design of Gheri Jalo.
2. Annexure 2.7 shows the design of Khia Badia Jalo.

various species. Their operation, however, depended very much on favourable winds and currents. Later on, with the introduction of gillnets, which did not depend so much on winds and currents and which were more selective and specialized, and with the competition of trawlers, the number of boat seines was considerably reduced. Nowadays boat seines have almost become a secondary gear, operated only when other gear cannot be used profitably.

-Irragali (Irgali)

Irragali is a boat seine which is operated off the coast of Ganjam, Puri and South Cuttack districts from February to August. The catch consists mainly of jewfish, ribbon fish, sardines, mackerels, silver bellies, small threadfins and shrimps.

The net is operated by two Kattumarams from early morning until noon within 5 kms from the shore.

Irragali is made of cotton. Tt consists of two wings and a bag. The wings are approximately 25 metres long, while the bag has a length of 11 metres and a depth of 2.7 metres. The mesh size in the wings is 120 mm, 60 mm in the mouth of the belly, and 20 mm in the cod end. For float and sinker line cotton is used. Floats are made of wood and sinkers of stone.[1]

The preservative is made by boiling and extracting the bark of a plant called *Acacia fistula.* Another preservation made of powdered tamarind seeds is also used.

The net is operated in the following way. Two Kattumarams sail to the fishing ground, one carrying the net. On reaching the fishing ground both come together to stretch out the net. In order to do this, the two Kattumarams move almost directly away from each other, laying out the net and 60 m of coir rope on each side. When the net is fully released the Kattumarams turn at right-angles and move on a parallel course, usually with the current. As they move closer to each other and haul the lines and wings.. together, the fish are concentrated and directed into the bag.

1. Annexures 2.15 and 2.16 show the design of an Irragali.

The returns from fishing are shared by dividing the sale proceeds into equal shares and allotting one share to each Kattumaram, one share to the net and one share to each fisherman.

-Bada Jalo

Along the wide beaches of Gnnjam and Puri districts, beach seines, locally called Rada Jalo, are operated to catch shoaling fish which enter the beach area during certain seasons.

Beach seines are operated from October to April, whenever shoals of fish come close to the shore and weather conditions are favourable. The catch consists mainly of anchovies, sardines and silver bellies.

The beach seine has a detachable bag portion and 2 wings. To each wing a towing warp is attached.

The net is operated as follows. Tt is loaded on a barboat which takes the net out to sea. One towing warp is left on the shore. The shore side wing of the net is laid out, and after the bag of the net is released, the boat moves in a semi circle and, laying out the other wing, brings the second towing warp back to the shore. The two towing warps are then pulled in by 10 or 12 persons on each side, moving closer together as the net comes nearer the shore. TWO or three fishermen remain in the water to guide the net onto the beach. Before reaching the shore the bag portion is detached from the net. 30 to 35 people, including the boat crew, are engaged in the operation.

The beach seine consists of different sections, which are made of different materials and have different mesh sizes and different dimensions. For the belly portion of the bag as well as its cod end, cotton and hemp are used. The belly portion has a length of approximately 12m. The wings of Bada Jalo consist of three parts. The first part near the belly portion of the net is made of cotton. For the middle portion coir is used, while the outer part near the rope is made of hemp. The lengths of the three parts arc 32m, 55m and 137m respectively. The towing warps which are made of hemp and coir have a length of 22.5 metres.

The shore side towing warp consists of 30 ropes. The sea side warp consists of 50 ropes. Two hemp and one coir rope, in some nets one hemp and one coir rope, are joined in series.[1]

The mesh size near the wings is 62 to 75 mm, while the mesh size near the cod end is 20-25mm. The cod end itself has a mesh size of 8 mm.

The sales proceeds are shared in the following way : 2/3 of the sales proceeds accrues to the owner/owners of net and boat and l/3 to the labourers which is distributed according lo the type and amount of work each labourer contributes : if the catch is small the share of the labourers increases, and vice versa.

2.2.2.3 Conclusions

Various types of encircling nets and seine nets are used by artisanal fisherfolk in Orissa to catch pelagic species of fish which appeer in shoals during certain seasons of the year in shallow waters close to the shore, For Balasore district and North Cuttack district with their extended shallow continental shelf areas, 5 varieties of encircling nets have been described, they differ in mesh, size, depth, length and other details, to suit local conditions, such as abundance of species, availability of estuaries, etc.

In South Orissa, with its open surf-beaten beaches and the comparatively steep slope of its continental shelf, boat seine and beach seine are operated. They are more appropriate than encircling nets considering the type of sea coast and the type of fishing craft available e.g. Kattumarams and bar-boats.

While synthetic fibres are used for the fabrication of Jangal Jalo, Khia Badia Jalo and Gheri Jalo, the other two encircling nets as well as boat seine and beach seine are still made of natural fi bres.

There might be at least two reasons why the replacement of natural fibres by synthetic fibrcs has been slower than in the

1. Annexure 2.18 shows the design of Bada Jalo.

case of gillnets. Since encircling nets are active and not passive fishing gear[1], the advantage of synthetic twines in being less visible than natural twines does not count as in the case of gillnets.

Secondly, encircling nets and seines are quantitatively and economically less important than gi llnets and sometimes even considered old-fashioned and outdated. Therefore, the process of replacement of natural by synthetic fibres, particularly its encouragement by financiers such as fish merchants and middlemen has been a slower and more selective one.

2.2.3 Tidal Wallnets

In the ebb and flow areas along the Balasore coast, tidal wall nets are operated. The method of catching fish with permanent and semi-permanent barriers that prevent fish from escaping during ebb tide has been practised since pre-historic times." In the beginning, small pools or pits were dug in areas which were known to be flooded during high tide. Later, stone or mud walls were constructed which were then replaced by fences made of bamboo, hrushwood and mats. Nowadays nets are used which are more easy to handle. During high tide fish pass over these nets and are caught during low tide when they try to follow the water flow. Along the coast of Balasore district a type of tidal wall net is used which is locally called Malo Jalo. In some areas it is also called Bheda Jalo.

--- Malo Jalo

Malo Jalo is a tidal wall net which is fixed to bamboo sticks at intervals of 2.8 m to 4.4 m. The net is set during low tide on the flat, gradual beatches of central Balasore district, where the distance between the high tide line and the low water line ranges from 2 to 4 km. The gear is operated continuously for 7 or 8 days during new moon and full moon, when the tidal differences are maximum.

1. In accordance with BRANDT (1972, p. 180) active gear is defined as gear which the fish takes involuntarily while passive gear is taken voluntarily.
2. See BRANDT 1972, p. 85 f.

Fish which pass over the net at high tide are trapped in the meshes during low tide and collected with the help of scoop nets.

The netting of Malo Jalo is made of polyethylene. The depth of the net is 67 meshes except for the middle portion where the fish are collected, and which is 140 meshes deep. The mesh size ranges between 40 and 50 mm. Head and ground line are made of polyethylene.

10 fishermen are required to operate the net. They are usually employed on a fixed wage basis by the person who has taken the area of operation on lease from the revenue department and also owns the net. At present tidal wall nets are operated on a Large scale, wherever the area is suitable.1

2.2.4 Liftnets

Liftnets belong to a category of gear which are dipped into the water and with expertise lifted up again, once the fish to be caught have gathered over them.

There are various types of liftnets such as portable hand liftnets, stationary liftnets and liftnets operated by boats.

Along the sea coast off South Orissa, liftnets operated by four Kattumarams have been a common gear in the past and are still operated, even though on a smaller scale.

Liftnets are mainly operated to catch fish shoals while they are moving along the coast. In Orissa liftnets are usually used with lures to attract fish to swim over the net.

—Marala

The type of liftnet which is used off the coast of South Orissa is locally called 'Marala'.[2]

Each of its four wings is approximately 26 m long. The mesh sizes in wings, belly and cod end are 120 mm, 50 mm and

1. A design of a tidal wall net is shown in annexure 2.9.
2. The design of a Marala is shown is annexure 2.17.

30 mm respectively. To the edges of the wings, 60 m long coir rope warps are attached, which are used to dip and lift the net. Stones are used as sinkers. Sometimes, two Irragalis are joined together to make a Marala.

Nowadays the net is mainly used from February to April to catch anchovies, sardines, mackerels, silver bellies, shrimps and jew fish.

The net is worked by four Kattumarams which drop the net to the sea bottom and lift it up again, when fish swim over it. 8 to 12 crew members are engaged in the operation of a Marala net.

Out of the sales proceeds 50% goes to the owners of the boats and nets while the other 50% is equally divided among the labourers.

2.2.5 Handlines and Longlines

Three types of handlines/longlines are used by artisanal fishermen in the coastal waters of Orissa. All of them are operated in the South. In North Orissa longlines are used only in estuaries and, therefore, not described here.

Out of the three types of lines, one is a spinning line called 'Kata', operated from the beach, another a handline called 'Burdu', used from a Kattumaram which at the same time operates a gillnet and the third one is a surface longline called 'Suti', operated from a Kattumaram. All three lines are used only occasionally and when compared to other fishing gear are not very important.

-Kata

Kata is operated by a single fisherman from the shore near the surf line or from the mouth of an estuary, usually in the early morning or in the evening. The main species caught are threadfins and perches. The gear consists of two 50 m long nylon lines of one mm diameter each. A piece of wood is fixed to the line, which has a lead piece of 30 gm attached to it and is wrapped

in a white cloth so that it looks like a fish. Two hooks are fixed to the wood and are also wrapped in the cloth. One hook is larger (80 mm stem 35 mm bend x34 mm end with a 20 mm barb), the other smaller (50 mm 20 mm x 16 mm also with barb)[1]. The handline is spun and thrown beyond the breakers and pulled back to the shot-c. During the operation the wood floats on the water with the lead and hooks below it.

--Burdu

Burdu is operated from a kattumaram which at the same time operates a gillnet. The fish caught in the gillnet attract predators, which in turn are caught by the handline.

Burdu consists of two nylon lines with a length of 180 m to 200 m and a diameter of | or 2mm. Flat lead pieces followed by a small stone are used as weights. 2 to 4 barbed hooks are used. Their size is 40 mm stem x 16 mm bend x 16 mm end.[2]

The hooks are baited with small fish or shrimp and lowered into the water close to the bottom. The hooks are then *jerked* at intervals. Dogfish, catfish and perches are mainly caught.

—Suti

Suti is a traditional floating longline which is used only by a few fishermen now-a-days because of the higher efficiency of gillnets. Suti consists of a mainline to which hooks are attached with snoods. The mainline has a maximum length of 750 m and a diameter of2 or 3 mm. It is made of nylon. The snoods are made of nylon, too. Their length ranges between 30 and 60 metres. The hooks are of the size 7 to 10 mm The distance between each hook is about 1 m, SO that approximately 750 hooks are operated. They are baited with shrimps, anchovies and cuttlefish.

Suti is operated throughout the year. It is set in the evening and hauled the next morning. It is used along the southern coastline within 3 km from the shore. A crew of two fishermen is required

1. Annexure 220 shows the design of Kata.
2. Annexure 2.19 thow she design of Burdu.

for its operation. One end of the gear is connected to the kattumaram while the other end is fixed to a buoy. The lines are shot and hauled hy hand.

2.2.6 **Cast Nets**

Hand-operated cast nets are a common gear all along the coastline of Orissa. Originally used for lake, pond. river and estuarine fishing, cast nets hnve been adapted to fishing from the seashore i I less than 3 mstrcs depth. Cast nets are also operated from a boat and within less than 3 metres depth when shoals of fish are located.

Whether operated from a boat or from the shore, cast nets have to be thrown with great skill so that they fall flat upon the surface of the water and quickly sink to the ground. The cast net used along the sea-shore of Orissa is called Khepa Jalo.

-Khepa Jalo

Khepa Jalo is made of nylon and has a conical shape. The loop is connected at its apex with a hauling-in rope. Its circumference is 10 to 20 M and the height of the net is 3 to 5 m. The mesh size ranges from 50 mm to 20 mm. The sinker line is made of polypropylene weighted with 200 or more lead sinkers.

Khepa Jalo is operated thus : while the hauling rope is held, the Khepa Jalo is whirled above and then cast so that its sinker line falls flat on the water forming a circle.

After the sinker line has reached the ground, the hauling rope is slightly lifted so that a bag is formed along the circumference of the net in which fish and prawns which try to escape are trapped. Khcpa Jalo is operated usually during the early morning hours and whenever shoaling fish are located.

2.3 Artisanal Marine Fishing Craft of Orissa

As on the northern coast of Orissa with its wide shelf, gradual slope and extended tidal range, differs from the fishing gear used on the southern coast, so also do the two areas boast

distinct types of fishing craft. The estuaries in the north provide landing facilities and shelter for plank built displacement boats of various types such as Chhoat, Patia, Botali, Salti, Donga, Dinghy and Sabado, which cannot be opereted from the open surf-beaten beaches in the south.[1] There, raft-type kattumarams called teppas are used, which are able to cross heavy surf and land on the beach. Since kattumarams can be easily assembled **and** disassembled it is possible to carry them up to the beach in order to protect them against the breakers and to dry them.

Besides kattumarams, bar-boats, locally called Podhua, are used along the southern coast of Orissa to operate beach seine nets, **All** the craft in Orissa excepting Navas are constructed locally with simple tools. They are driven by sail, oars or paddles and the range of operation is limited to the coastal belt up to a depth of 15 to 20 fathoms.

2.3.1 **Fishing Craft of North Orissa.**[2]

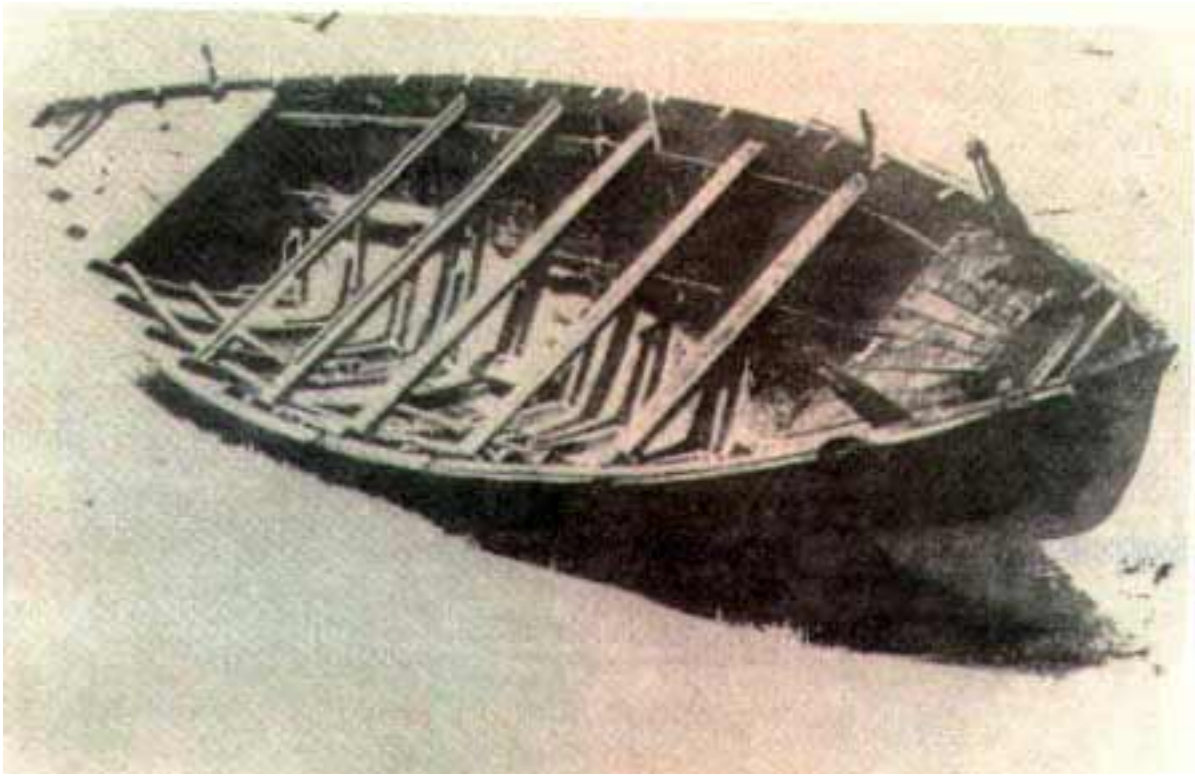
— Chhoat

The Chhoat is the largest traditional fishing boat used by artisanal fishermen in Orissa. It ranges from 10-11 metres in length. A 10.4 m long boat has a width of 2.40 m and a depth of 1.50 m. The wooden mast has a height of 8.6 m and the rectangular sail cloth has the dimensions 6.4m x 6m. The Chhoat is a carvel-built double-ender, the aft being more extended. It is made of salwood (Shorea robusta). Chhoats are comparatively seaworthy and used in the northern part of Balasore district to carry encircling nets to the fishing ground. They are also used to operate driftnets for hilsa. Chhoats fish up to 30 km from the shore if the weather is favourable. Some Chhoats have been mechanized indigenously,

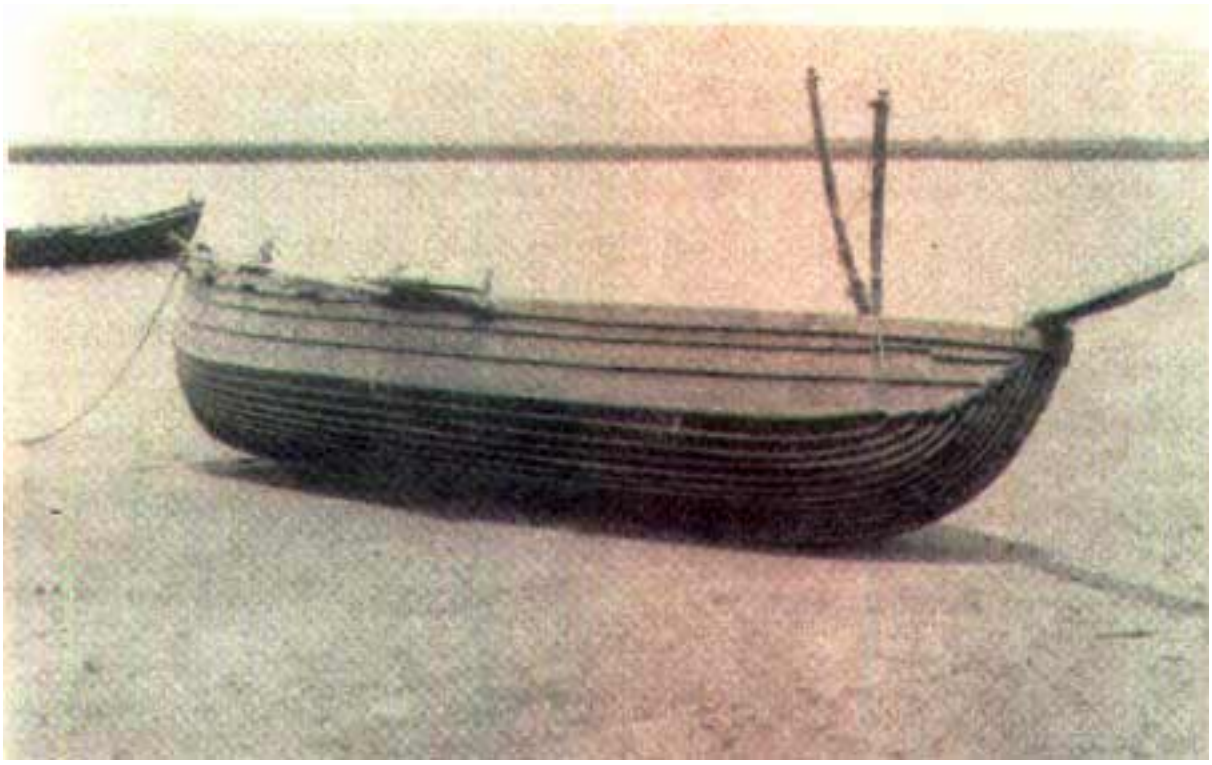
-Patia or Botali

The Patia is a clinker-built boat made of salwood with almost vertical stem and stern.

1. The only exception are framed, plank built boats called Navas, which migrate during the calm season from November to February from Andhra Pradesh to Puri to fish there with large mesh driftnets.
2. The designs of the craft described in this chapter are given in annuxure 3



Chhoat



Patia (Botali)

Danga

Dinghy

The length ranges from 8-5 to 10.5 metres. An 8.95 m long boat is 1-8 m wide and 1-3 m deep.

The wooden mast of Patia has a length of 8 metres and the rectangular sail cloth is 6-4 metres by 6 metres.

Patia is used in encircling gillnet and driftnet fishing. It is quite a seaworthy fishing craft and her area of operation extends up to 30 km off shore.

— *Danga*

The Danga is clinker-built, constructed like Patia. The Danga is made of salwood. Stern and stem are nearly vertical. The maximum beam is forward of midship. The length of a Danga ranges from 7.5 to 9 metres.

A Danga of 8.3 m length has a width of 1.91 m and a depth of 1.26 m. The height of the mast is 7 m. The boat is driven by a rectangular sail measuring 5.5 by 5 metres.

The Danga is similar to Patia and a relatively seaworthy craft. It operates with driftnets up to 20 km from the shore.

Flat bottomed versions of the Danga that are not seaworthy are operated in the estuarine waters of North Cuttack and South Balasore districts.

-Dinghy

The Dinghy is also made of salwood and carvel-built. The Length varies between 6 and 9 metres. A 6.5 metres long boat has a width of 1.63 m and a depth of 0.97 m. Like the three types of traditional boats discussed above, the boat has a full midship section, the double ends close to vertical. The wooden mast has a length of about 4.6 metres and holds a rectangular sail cloth which measures 3.6 by 4.2 metres.

The Dinghy is widely used for all types of fishing up to a distance of 20 km from the shore.[1]

1. Another version of the Dinghy, locally called Bengali Dinghy, is meant for estuarioe and river fishing.

Salti

The Salti has a more oval hull with extended and raised ends. It is made of salwood and carvel-built. The length ranges from 7 lo 10 metres. A 9.8 metres long Salti has a width of 2.1 metres and a depth of 1 metre.

The wooden mast has a height of 5.2 metres while the sail cloth is 4.1 metres at the top, 4 metres at the bottom, 5.1 metres at luff and 2.8 metres at leech.

The Salti is not seaworthy and used in the sea only from October to February when the weather is calm enough for encircling net operations and gillnet fishing. During the rest of the year Salti is used for estuarine fishing.

-Sabado

The Sabado fishing boat is similar to the Salti but larger. Both ends are extended and raised, the aft end more than the fore end. The boat is csrvel-built with an oval hull made of salwood. The length ranges from 9.75 to 13.5 metres. A Sabado boat with a length of 13.4 metres has a width of 2.4 metres and a depth of 0.97 metre. The wooden mast has a height of 5.75 metres and the dimensions of the sail cloth are 4.5 metres at the top, 4.3 metres at the bottom, 5.5 metres at luff and 3 metres at leech.

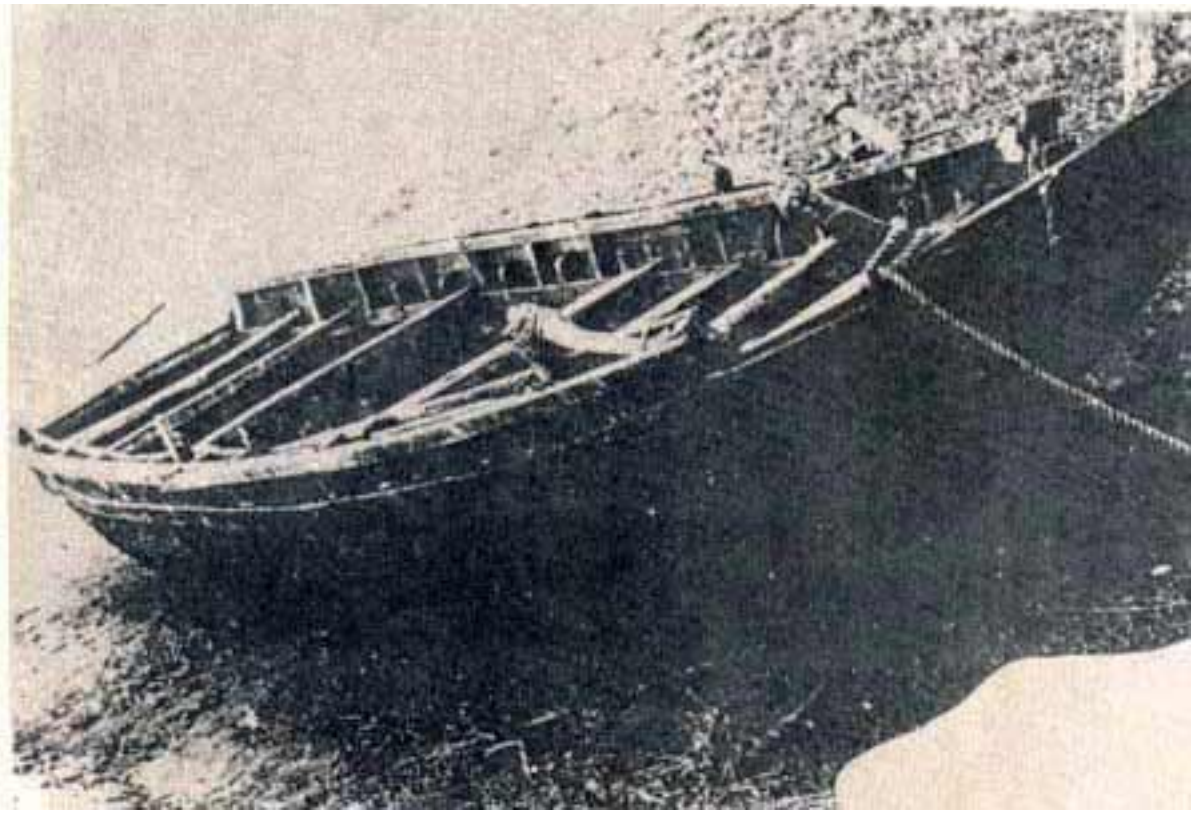
The boat is operated in the sea only in calm weather, mainly from October to February. During this period it is primarily used with encircling nets close to the shore or with shore seines, Gillnets are also operated with Sabado boats.

During the remaining months of the year, the Sabado boat is used for estuarine fishing.

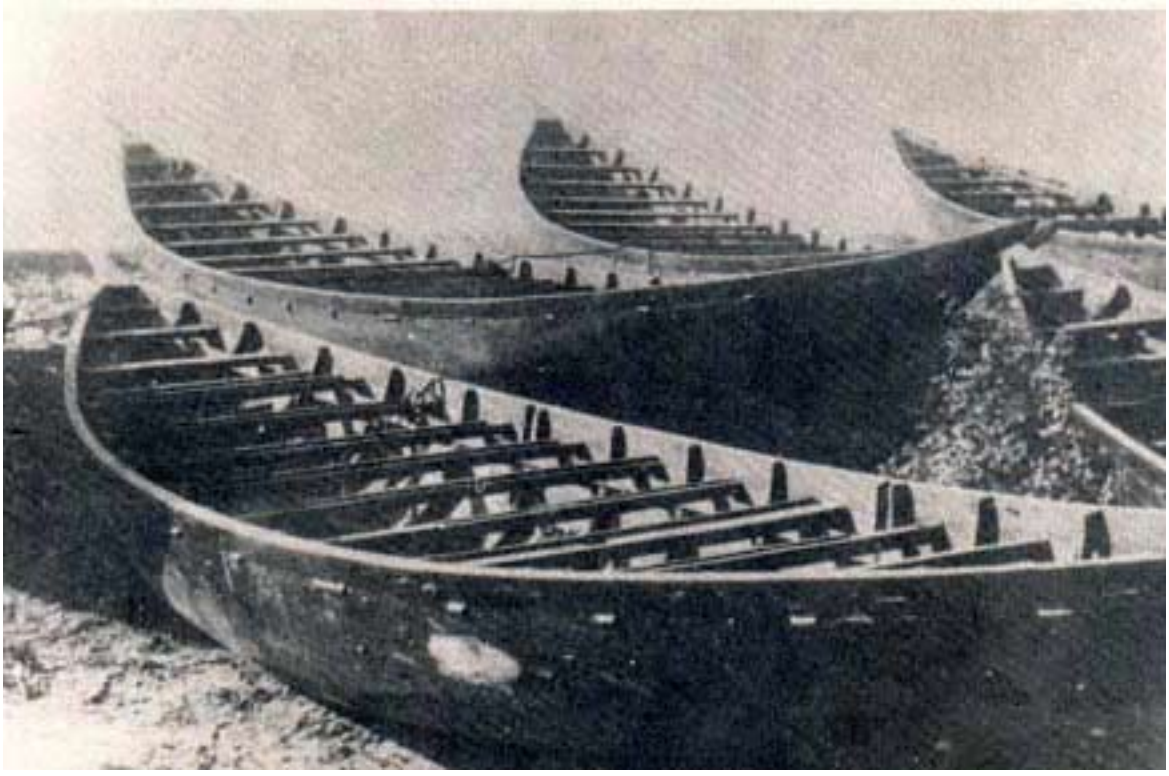
2.3.2. Fishing Craft of South Orissa

– Kattumarams/Teppa

The Kattumarams, common from Paradeep southwards, range from 4.2 to 8.5 metres in length. They are locally known as Teppa. They are made of two, three or four log pieces, which are themselves made of a number of smaller pieces pegged together.



Salti



Sabado

3-log teppa

4-log teppa

Three types of Kattumarams can be distinguished according to the number of log pieces or sections they consist of.

The two-logged Kattumaram is the largest Kattumaram and is handled by about 3 to 4 fishermen, whereas the smaller three-logged or four-logged Kattumarams are operated by only two fishermen. The entire flotation of these crafts is due to the buoyancy of the logs as the wood is light, the main species being Albizzia stipulated and Erithryna india, locally known as Chakunda and Paldhua.

The three-log Kattumaram ranging from 4.2 to 5 metres and the four-log Kattumaram ranging from 4.5 to 5.5 metres are the most common craft that are widely used along the surf-beaten beaches of Puri and Ganjam districts. Fishing is done up to 8 km from shore almost throughout the year, whenever the surf is negotiable, the breaks being mainly during the monsoons.

The three-log and the four-log Kattumarams have a bamboo mast of 4 and 4.5 metres length and triangular sail cloths which measure 4 and 4.5 metres at the luff side and 2.8 and 3 metres at the lower angular side.

The two-log Kattumaram is a bigger craft from 6 to 8.5 metres in length; each half is made of two bigger median logs and smaller peripheral logs. Vertical wash strake and accessory stem pieces give the craft a sharp break point above the general level.

The two-log Kattumaram has a bamboo mast of 8 metres length and a triangular sail which measures 7.5 metres at luff and 6.25 metres at the lower angular side.

---Bar boat

The bar-boat, locally known as Podhua, ranges from 7 to 8.3 metres in length and is made from Mango planks (Mangif era indica). The boat is without frames, stem more vertical than stern, it lifts well, and can withstand the knocking of the surf. The boat is used for beach seining along the southern coastline from October to April.

The Podhua has a mast of 2.5 metres length and is driven by a triangular sail which measures 8.3 metres by 5.6 metres by 4.9 metres.

— Nava

Another traditional fishing boat which however, is used only sensonally and only in one location, i.e. Puri, is the Nava. The Nava is a plank-built boat brought from Andhra Pradesh and is operated from the open beaches from October to February during calm weather. The length varies from 8.5 to 10 metres.

The Nava has a wooden mast with a length of 5.5 metres and is driven by a triangular sail which measures 8 metres by 7 metres by 7 metres. It is the only craft described here that is not made by carpenters in Orissa.

2.4 Development and Distribution of Traditional Fishing Craft and Gear

In olden days, the main fishing gear were shore seines, boat seines, lift nets, hook and lines and tidal barriers. They were operated throughout the year to catch whatever species of fish were available.

With the change from subsistence economy to market economy and with an increased and specified demand at home and abroad for fish and prawns, a process of specialization and diversification of artisanal fishing technology has been initiated.

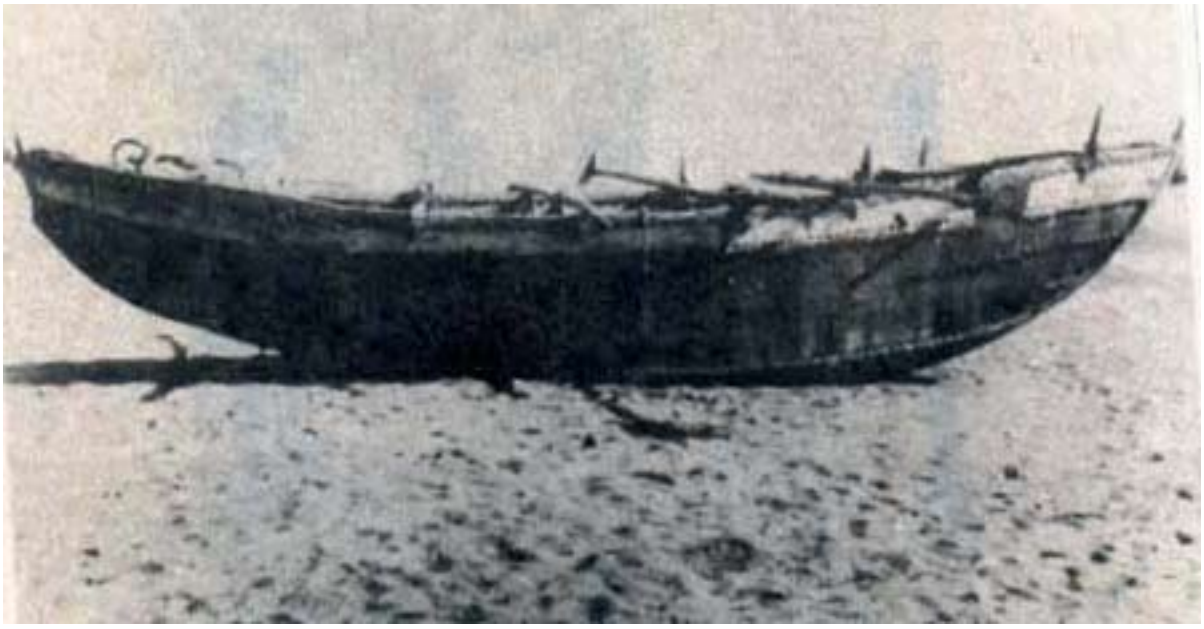
Gillnets of various mesh sizes and designs have been introduced by artisanal fishermen on a large scale all along the coastline of Orissa. They catch different varieties of fish during the different seasons of the year and are very well adapted to the sea conditions prevailing in the various areas along the coast.

Little by little synthetic fibres have almost completely replaced natural fibres in the construction of netting, ropes, floats etc.

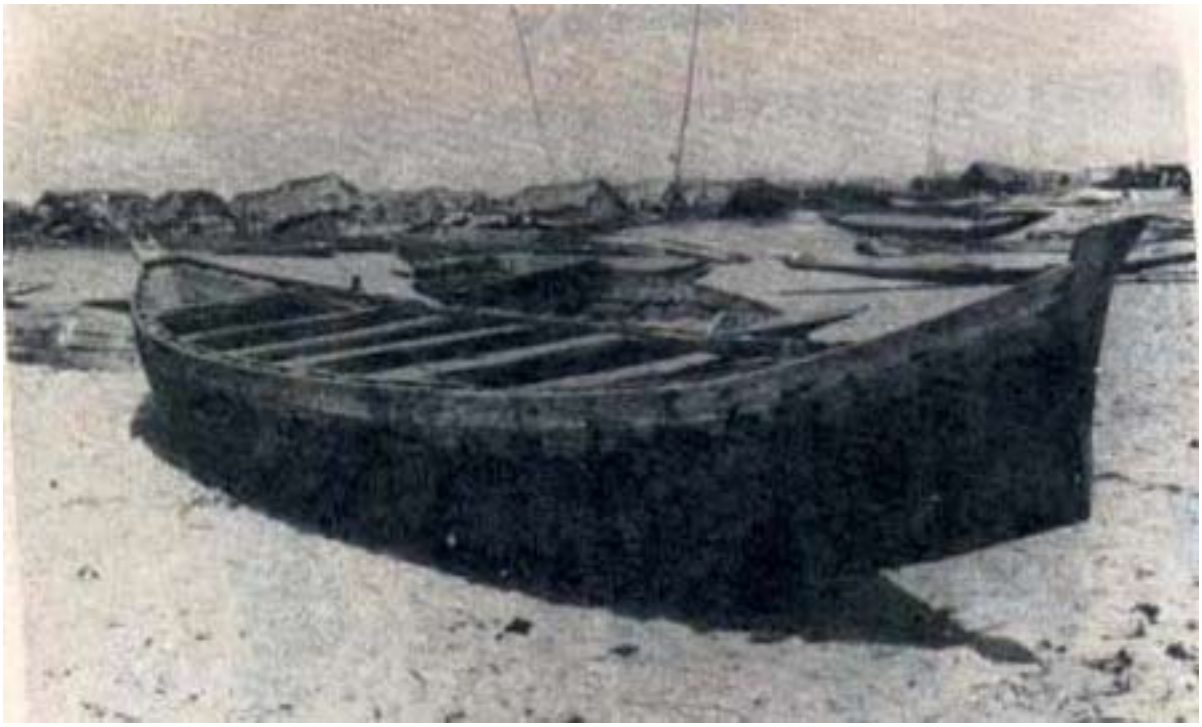
Encircling nets have undergone changes, too. Different nets of different mesh sizes and designs are used in different

2-section teppa

Launching a teppa



Podhua



Nava

areas. Natural fibres have been gradually replaced by synthetic fibres.

The same applies to tidal wall nets, too.

The relevance of such traditional gear as beach seines, boat seines, lift nets and hook and line has been reduced to a large extent even though they are still used. These 'old-fashioned' gear are still made of natural fibres such as cotton, hemp, etc.

To operate the wide variety of fishing gear presently used by artisanal marine fisherfolk, various types of boats have been developed; there arc differences in their size, carrying capacity, seaworthiness and other factors.

The table on page 38 shows the distribution of traditional fishing craft and gear in the four coastal districts of Orissa.

The table illustrates the differences in fishing craft and gear between the southern districts of Ganjam, Puri and South Cuttack and the northern districts of Balasore and North Cuttack, which have been described earlier. Kattumarams, Bar boats and Navas are operated in the south, while in the north are various types of plank-built displacement craft of which the most widely used are Dinghies and Drngas. Regarding gear, small and medium mesh size gillnets for sardines, anchovies, mackerels, prawns, etc., are used in the south, while medium and large size gillnets for hilsa, pomfret, jewfish, perches, threadfins and other larger species are operated in the north.

The table also shows that the typical gear of North Orissa are encircling nets, tidal wall nets and set bag nets, while lift nets and boat seines are used exclusively **in** the south.

While beach seines are operated in South Orissa, shore seines are operated in North Orissa.

Furthermore, it **is** shown, that quantitatively gillnets have become by far the most important fishing gear, followed by tidal wall nets, boat seines, estuarine set bagnets, beac h and shore seines, and encircling gillnets.

	ITEM	DISTRICT				TOTAL
		Ganjam	Pun	Cuttack	Balasore	
Fishing Craft	Kattumaram—Small					3977
	Large			41		296
	Total			23		231
	Bar-boat			93		87
	Nava				87	**1619**
	Salti			62	757	787
	Dinghy/Danga				787	159
	Patia/Botali			5	**154**	83
	Chhoat			16	67	
	Motorised gilinetter					
	Total No. of boats	2959	1288	1140	1852	7239
	Small mesh gillnets (2-4 ems.) Katlala, Kavala, Kokuli, etc. in operational units	2168	294	74		2536
	Medium mesh gillnets (5-6 ems.) Jagawala, Kilumala, Nyallala, Behundi etc. in operational units	2186	1041	466	1159	4852

Fishing Gear	Large mesh gillnets (10 ems.) Phashi, Pedasilkiwala			7	2854	2861
	Very large mesh gillnets (15-20 cms.) Nakuda, Bhekti			63	10	73
	Total No. of drift/bottom gilinets in operational units	4354	1335	610	4023	10322
	Wallnets: Malo, Bedha				*1545*	*1545*
	Set bagnets Behundi, Dhai[1]				705	705
	Beach seine, shore seines Bado, sarini, etc.	235	67	39	291	632
	Encircling gillnets Jangal, Khia badia			35	120	155
	Boatseifles Irgali	580	190	26		796
	Liftnets : Marala	102				102
	Total No. of gear in operational units	5271	1592	710	6684	14257

1. The set bagnetS mentioned in the table have not been described, because they are actually not marine but riverine or estuarine gear. Hook and line and cast nets are not included in the table because they were not covered by the census on which the table is based.

2.5 Fishermens' Perceptions of -their Marine Environment'

Fishermen's perceptions of their environment have been examined with regard to winds, cyclones, tides, currents, fish detection methods, fishing procedures and their relation to sea bottom, currents, winds etc., and concerning the peak periods of main fish species.

The information was gathered from fishermen in two areas along the coast of Orissa. These areas were Avana and Puri. Avana is a small secluded fishing village about 60 kms from Balasore in North Orissa. The majority of active fishermen in Avana have some arable land which provides them with a secondary income. Puri is itself a large town in South Orissa, The artisanal fisherfolk of Puri numbering approximately 10,000 live on or very near the sea shore, with fishing providing their only source of income. During the peak fishing season for prawns from November to January about 6,000 fisherfolk from Andhra Pradesh migrate to Puri, making it one of the biggest landing centres of artisanal marine fisheries in India.

Before discussing the fishermen's perceptions of their marine environment, [1] few points on the coastal features, fishing methods, main economic species and the fishermen themselves.

Avana : The coastal area of Avana is estuarine and has a large shallow continental shelf as a result of deposits from the river Ganges and other small rivers in the area. Because of this continental shelf the effect of the tide is felt greatly and it can be said that the fishing revolves around the tidal flow.

The fishing methods of the area are adapted to the physical structure of the coast. The main fishing gear used are surface gillnets, bottom gillnets, tidal wall nets, and fixed trap nets. Fishing is carried out in conjunction with the tidal flow i.e. the fishermen will set out with an ebbing tide and return with a

1. The terminology used by the fisherfolk to describe their environment does **not** necessarily conform to commonly spoken Telugu or Oriya words, as it is obvious in the case of winds, currents etc. To explain the reasons behind this phenomenon, is left to further linguistic studies.

flowing tide. This generally means that they will stay out over-night and return the next day because they have to travel a long distance.

The main economic catch of the area is Indian shad (Hilsa ilisha) and prawns (Penaeus indicus and Penaeus monodon), but when the fishermen speak about a good catch they are nearly always referring to the hilsa catch.

Regarding responsiveness the fishermen were generally reserved and it was found that the few bits of information they gave did not coincide in many cases. Their information differed mainly with regard to wind. This may have been due to shyness, mistrust, a lack of knowledge or an inability to communicate or a combination of these.

Puri/Pentakhota : Puri has a narrow continental shelf with consequently little tidal flow and a troublesome surf zone. The presence of the surf zone make it necessary for the fishermen to use a fishing craft which can withstand the harsh surf which frequently hammers the boat on the shore when they set out and return from fishing trips. Therefore, they use a strong but crude Kattumaram which consists of two to four logs held together by means of pegs and hemp rope and filled with a rudder, mast and sail.

Fishermen generally leave at an early hour 4-6 am, and return in the afternoon, 2-6 pm. They generally do not stay out fishing overnight, except during the period October-January when the surf is relatively calm and the 'nava' boat can be used. The nava is 9 metres in length.

The main fishing gear used in Puri are bottom set and drift nets and surface gillnets.

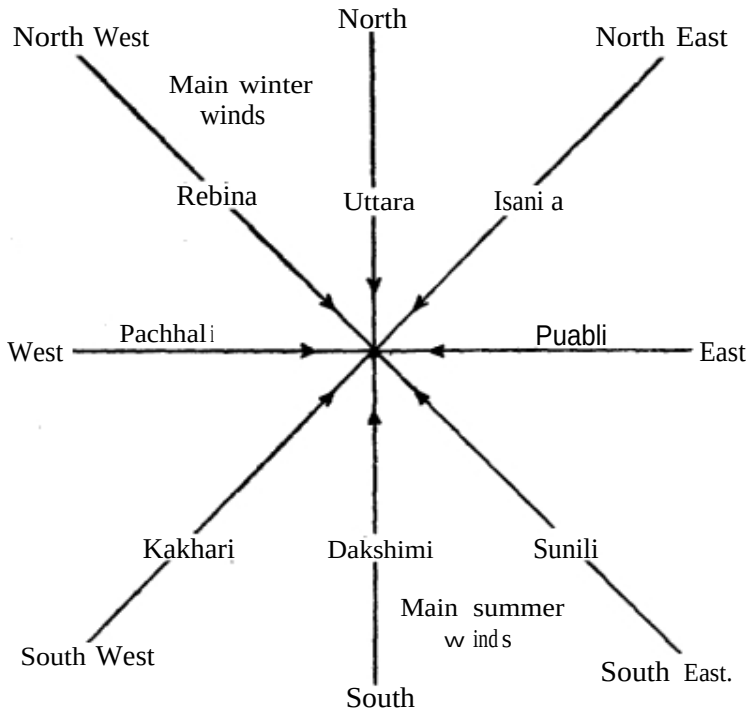
The main economic catch of the area is prawns, tiger and Indian prawns *(Penaeus monodon* and *Penaeus indicus),* and when fishermen speak of a good catch in Puri they are generally referring to the prawn catch.

The fishermen of Pun seemed to be much more responsive to questions than the men of Avana. They volunteered a lot of information and they were also more confident and fluent in delivering their answers.

2.5.1 Perceptions of Oriya Fisherfolk in North Orissa

— ***Winds***

Although the fishermen of Avana, depend very much on the winds, for their livelihood they still gave conflicting accounts of when the winds blew and what their effects were. On the whole the following picture emerged.



During the summer the main winds which blow are the south and south-east winds. When the south wind blows the

fishermen will head out to sea and fish for that day and night, but if the south-east (onshore) wind blows which generally brings high waves, they will return to shore with that wind. When the south-west wind blows during the summer they will not venture out because the wind will carry them too far off shore, and there is no knowing when a favourable wind will blow. As the south-west wind is the predominant summer wind of Tndia, during the summer months fishing is not generally good.

During the winter when fishing is at its best the main winds to blow are the north and north-west winds. The north wind brings calm weather and clear skies, and because of the relatively constant off-shore winds of the Bay of Bengal, upwelling also occurs enriching the whole area. Tf a north-west, west or south-west offshore wind blows during winter, the fishermen will go out fishing because they know that within a day or so the wind will change in their favour, enabling them to return to shore.

When the east onshore wind blows during spring and early summer the fishermen are restricted to fishing close to shore as the wind is unfavourable for travelling out to sea. At this time to get to the fishing grounds the fishermen use paddles and not sail.

-Cyclones

There are two seasons for cyclonic weather, the main one being between winter and summer when the north-east wind blows. During that time little or no fishing can be carried out. The other cyclonic wind is the north-west wind which generally just brings rain and this usually occurs between summer and winter. The fishermen can generally tell a day or two in advance when a cyclone is about to hit their coast. The usual signs which foretell the coming of a cyclone are :

(l) Water spouts may be seen at sea a day or so in advance of of the cyclone

(2) Dark clouds begin to gather either in the north-east or north-west corners of the horizon

(3) The fishing is bad a day or two before a cyclone i.e. no fish to be found

(4) The smell of wet soil reaches their nostrils on the wind before the cyclone occurs

(5) Some fishermen say they know a cyclone is coming from the sound the waves make when they hit the shore.

-Tides

The tides in northern Orissa have a major effect on the fishing pattern of the fishermen. The reason for this is the great tidal range which exists in that area as four kilometres of beach can be exposed during low tide. Each day of the lunar month is given a name signifying the importance of the lunar month and its effect on the tide.

Lunar month

English name	Local name
New Moon	Ama basya
1st lunar day	Pratipada
2nd lunar day	Dwitiya
3rd lunar day	Trutiya
4th lunar day	Chathurthi
5th lunar day	Panchami
6th lunar day	Shasthi
7th lunar day	Saptami
8th lunar day	Ashtami
9th lunar day	Nawami
10th lunar day	Dashami
1 lth lunar day	Ekadashi
12th lunar day	Dwadashi
13th lunar day	Trayodashi
14th lunar day	Chaturdashi
Full Moon	Purni ma

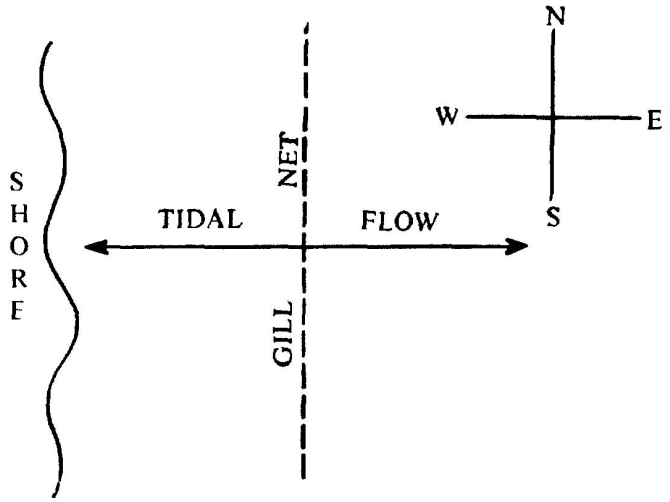
The same names are used again for the lunar days between the full moon and the new moon.

All the fishermen agreed that the best catch was obtained from the 11th lunar day to the 4th lunar day, with the new moon and the full moon nights bringing in the optimum catch. From

the 5th lunar day to the 10th lunar day the catches and the tidal flow were at their lowest.

It used to be an old custom in Avana not to go fishing during the new moon and full moon nights. The custom originated from the fear of boats capsizing in the high waves predominant at this time. This custom died as a result of financial pressures (still in existence) which forced the men to fish in these nights.

When they go fishing the men leave the village during the day, stay fishing overnight and return the next day. The fishermen have found that they obtain the maximum catch if they put their nets out just before the tide turns to go out during the 11th to the 4th lunar day period. The reason for this, according to the fishermen, is that fish swim with the tidal flow close. to shore and return to the sea when the tide begins to recede. The fishermen place their nets parallel to the shore in a north-south direction, at right angles to the tidal flow.



It would be assumed that the best catch would be achieved on the new moon night, when the tidal flow is maximum, but this is not so. According to the perceptions of the fishermen, the fish can see the net on the new moon night, The explanation

might be that as a result of being disturbed by the nets the plankton glows and consequently shows up the position of the gill nets and so the fish avoid the nets. On full moon nights the light from the moon generally overpowers the light from the disturbed phosphorescent plankton, and reduces the visibility of the monofilament nets which are not easily visible in water. This phenomenon exists only when the water is clear i. c. during the winter period. When the fishermen were asked if they noticed any difference in catch between the new and the full moon period, when the water is muddy, March-August, they replied that they were unaware of any.

-Water Currents

The Avana fishermen do not go much by actual currents. They regard tidal flow as a current, and initially it was difficult to get them to distinguish between tidal flow and current. Once the distinction was made they had little to say about currents apart from these two observations :

(1) Fish always swim with the current (including the tidal flow). The reasoning behind this is that when the tide comes over the large expanse of beach it brings the fish with it. As Avana fishermen first used fixed beach wall nets which caught the fish as the tide was receding the fishermen came to the conclusion that fish swim with the current i.e. fish came with the tide and left with the tide. Another fact which supports their theory is that when using a fixed bagnet in the rivers close to the sea, they catch fish only when the tide is receding and the fish swimming with the river are trapped by the bag as they swim towards the sea.

(2) Once they were outside the effect of the tidal flow i.e. 10 km offshore, they found that the current always pulled them south. This does not coincide with the strong clockwise circulation of currents in spring, which would pull them north, but does coincide with the weaker anti-clockwise currents of the fall, They are not experiencing the spring clockwise currents because in the spring they do not go out beyond 5 km due to the predominantly east winds which keep them close to shore.

One conflicting point is that the same fishermen who said that they felt only the anti-clockwise current also said that when the current was heading north-east (clockwise) and accompanied by a north wind, the fishing uas good. The reason might be that as wind and current were flowing in the same direction little or no tangling of nets occurred. Therefore, during the spring the fishermen must, on some days, go out to sea far enough to feel the northerly current.

-Fish Detection Methods

The fish detection methods of the fishermen of Avana are mainly those of sight and smell.

As hilsa is the most economic catch they spoke only about the detection of hilsa.

(1) Tf the water is clear and has a green-blue-black colour it indicates a good catch.

(2) If the surface of the water has a thin pink oily film, there will be much hilsa underneath the surface.

(3) If the surface is oily and the water has a fishy smell, again there will be fish and not only hilsa.

(4) Also there is the sound which the hilsa make as the shoal breaks the surface of the water.

They do not use the unjointed oar for fish detection as the men of Puri do.

-Fishing Procedure with regard to Sea Bottom, Current, Wind, etc.

The fishermen of Avana prefer fishing with surface gillnets

(1) because the main catch is hilsa which is a palagic fish and

(2) because their nets do not get damaged as bottom set and drift nets sometimes do.

They have no specific places of preference of setting their nets but they find that the best place with regard to sea bottom

topography is a flat area, which seems to be a very vague statement, compared to that of the fishermen of Puri.

-Catch of Main Species throughout the Year.

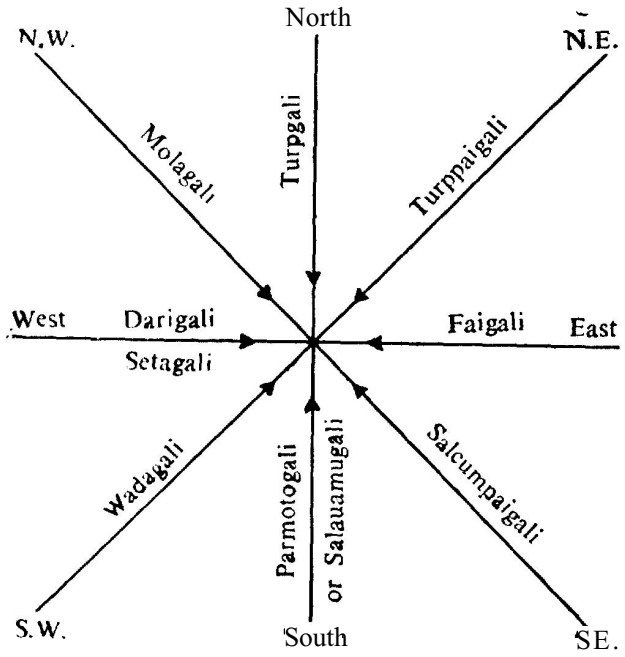
Regarding the peak periods of the main species the fishermen volunteered the following information :

Species' common name	Zoological name	Peak period
Indian Shad	Hilsa ilisha	August-September
Prawns	Penaeus indicus and Penaeus monodon	November-January
Clupeids	Hilsa toli	October-December
Silver Pomfret	Pampus argenteus	March-May
Black Pomfret	Parastromateus niger	October-December
Seer Fish	Scombreoides commerson	October-December
Silver Bar	Chirocentrus dorab	-do-
Bombay Duck	Harpodon ne hereus	-do-
Jew Fish	Othli thes argenteus	January-February
Ribbon Fish	Trichiurus savala	October-December
Indian Salmon	Eleotis **fusca or Eleutheronema** tetradactylus	October-December

2.5.2 Perception of Telugu Fisherfolk in South Orissa

The winds play an important role in the life of the Puri fishermen. They are aware of the winds and the effects which the winds have on the catch.

The predominant winds are shown below.



During the months October-February the main winds which blow are the Darigali and the Faigali. The west wind blows mainly during the night and in the morning, while the east wind blows mainly during the day and in the evening. According to the fishermen the times are approximately12 midnight-12 noon for the Faigali. These winds are the normal sea breezes associated with coastal areas i.e. the alternating land and sea breezes. As opposed to the fishermen of Avana and Puri, these fishermen leave for fishing early in the morning with the west wind.

Darigali carrying them out to sea, and return to shore in the afternoon with the help of the east wind Faigali.

Occasionally during December the Molagali (north-west, wind) will blow between the Darigali (west wind) and the

(cast wind). The Molagali (north-west. wind) occurs only some days, but when it does appear it halts fishing because this strong wind upsets the nets and the boats so that fishing is generally halted for its duration. As with the Molapali (NW): the Turppaigali (NE) usually blows unannounced from November to January. Again fishing is sometimes halted because of strong winds which tend to capsize the boats and damage the nets. Generally in this strong wind (NE) the sails are not opened. If the Turppaigali (NE) blows gently as it sometimes does the fishermen say that it will result in a very good catch of prawns.

During the months October-February when the Darigali (W) and the Faigali (E) blow the fishing is good for both prawn and other species of fish.

During the months March-September the main winds which blow are the Salcumpaigali (SE), the Wadagali (SW) and Parmotogali (S). The Snlcumpaigali (SE) is a cool wind and the Wadagali (SW) is a warm wind. According to the fishermen the Wadagali (SW) makes the fish hide in the mud in order to keep themselves cool. This is their reasoning behind the observation that during the period April-September hand-to-mouth fishing is all they can hope for. Tt is these constant offshore winds that bring about upwelling which replenishes the nutrient stocks of the water. The nearshore l pwelling zone not only has a high yield of nutrients, but also is a high primary production area for phytoplankton and related zooplankton.

This occurs in the north-east part of the Bay of Bengal during the north-east winds and on the west side during the south-west winds. Therefore, organic production is high along these coasts from early to late winter respectively.

These nutrients are slowly depleted so that by spring and early summer organic production is at a low ebb again as upwelling does not occur along the coast during the winter. The low to moderate catch of fish during March-September is a result of low organic production in summer, not because the fish hide to protect themselves from the hot south-west winds. Also the cyclonic weather which prevails from August to September prevents the fishermen

from going to sea, and also decreases the level of salinity in the Bay leading to an environment unfavourable for marine fish.

Regarding the causation of winds the fishermen believe strong winds to be the work of the devil who is out to get their boats. Also, the two goddesses Cbingamaru and Banamaru will stop boats moving in the sea, even though the crew may be paddling with oars (effect of current).

Once a year the fishermen set afloat a model boat filled with cigarettes, biscuits etc. as an offering to these goddesses and hope that they will accept the model boat and leave their own fishing boats in peace.

-Prediction of Rain and Cyclones

Generally the fishermen can tell that rain is coming by looking at the clouds on the horizon. When fishing, if dark clouds are seen on the west side they will immediately stop fishing and head home (westward). If clouds are seen in the east they will continue fishing until **just** before the rains come as the wind which will be blowing towards the west will carry them to the shore.

These fishermen as well as the Avana fishermen hold that the following signs herald the coming of a cyclone :

(1) Water spouts precede cyclones anywhere form 4 hours to 1 day.

(2) Dark clouds in either the north-east or the north-west.

(3) Their nets become infested by jelly-fish one or two days before a cyclone.

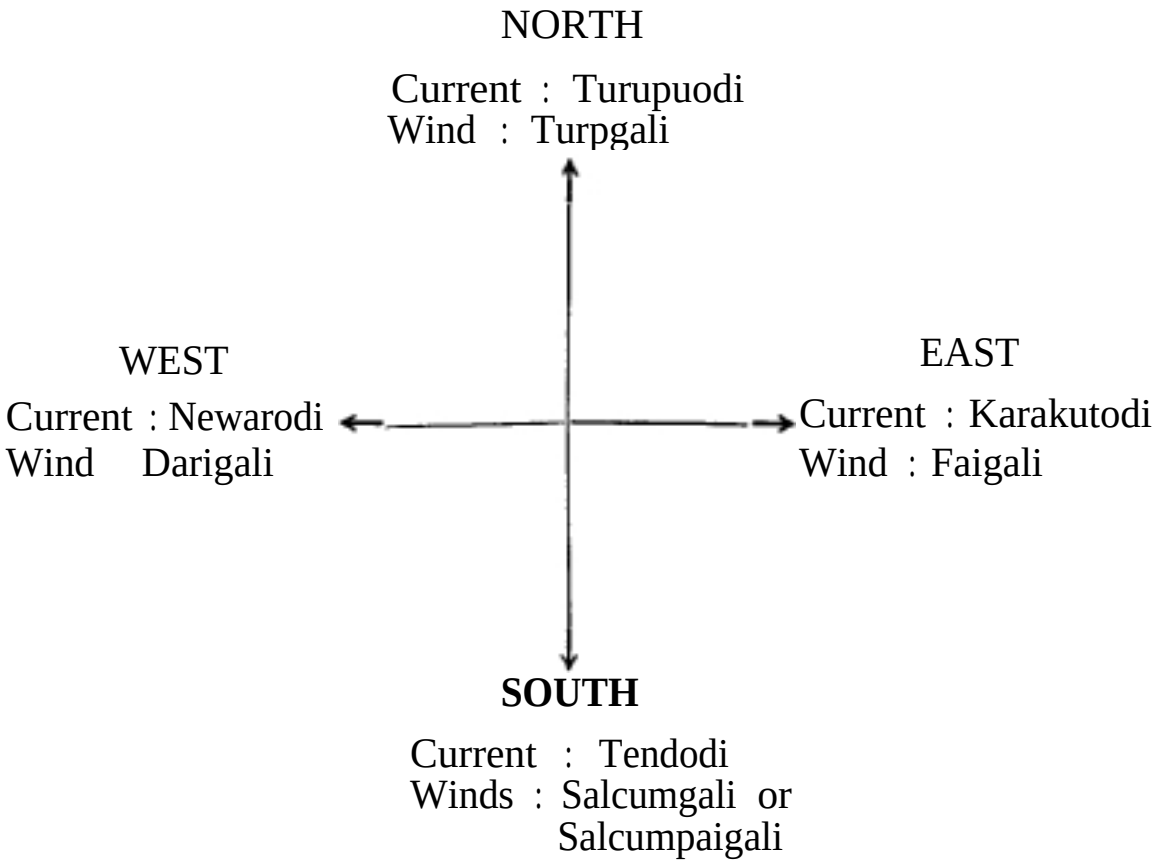
(4) White large clouds on the horizon accompanied by wind from the clouds indicate a heavy storm (not necessarily a cyclone).

(5) A soft wind will blow in a direction opposite to that of the path of the cyclone.

(6) Some fishermen are again able to predict a cyclone from the sound of the waves breaking on the beach, the shape and the size of the waves also act as an indicator. The Puri fishermen say that they can predict any wind from the special noise the waves make before the onset of the wind.

— ***Currents***

The diagram shows the four main currents and their associated winds. The fishermen realize that these are surface currents and are a result of the prevailing winds.



The Turupuodi (north) flows from October to hnuary and is part of the anticlockwise circulation of the surface waters of the Bay of Bengal. Around the month of February the north current begins to slow down, as a result of the winds changing from their northerly directions to the southerly directions. This wind change brings about the surface current change from the Turupuodi (north) to the Tendodi (south) or from an anti-clockwise to a clockwise circulation within the Bay of Bengal.

The fishermen say that the Turupuodi brings a good catch of prawns and other fish. This is true because of the upwelling which occurs in late spring and summer and also because the weather is conducive to fishing and calm. The Tendodi (south) brings a moderate catch and flows from March to September.

The Newaredi (West) and the Karakutodi (east) which the fishermen call currents are presumably the effect of the tidal flow and wind direction, because the fishermen say that they occur throughout the year, but are specially noted during the full moon and new moon periods.

When either of these currents flows the fishermen say that they do not catch fish either close to shore or out at sea.

As opposed to the Avana fishermen, the fishermen of Puri believe that fish swim against the current. Their reasoning stems from a story which tells how fish live in a mud house in the bottom of the sea. The fish are safe while they are in their houses, but when they come out the current drags them away from their home. Therefore, when the fish are caught in the nets they are always swimming against the current in order to return to their homes.

The fishermen do feel the currents which move north-east, north-west, south-east and south-west but they say they are insignificant and have not been given any names.

Fishermen also say that if there is no current they will not be able to catch any fish.

– *Tides*

The effect of the tide has little influence on the fishermen of Puri, the reason being the narrow belt of shallow water which runs along their coast. This narrow continental shelf drops off quickly to deeper water, thus absorbing the tidal flow. The main influence of the tide on the fishermen is that it either helps or hinders them while launching their boats.

Receding tide and low tide are called Padi, while advancing tide and high tide are called Neeri.

Like most coastal people they are also aware of the influence the moon has on the tides i.e. a more forceful tide and new and full moon periods. Apart from the above-mentioned facts the fishermen seem to dismiss the tides as not worth discussion.

-Special Fish Detection Methods

The fishermen of Puri have an ingenious method of detecting the presence of fish and their prize catch, prawns, in the sea.

1. With the aid of a single unjointed wooden oar, the broad end placed in the water and the narrow end held close to the ear, the fishermen can say what type of fish, if any, are present below the water surface. The oar must be kept clear of contact with the boat in order that a clear undisturbed sound can be heard. Each fish gives off its own distinctive sound, except for mackerel and pomfret which according to the fishermen are silent.

Below is an attempt to write what some of the sounds are and what each sound represents :

1. Chit bit, chit bit, chit bit. . . . .

   There are prawns on the sea bottom, but the prawns have dug themselves in so there will be no catch.

2. Sheeeeeeee. . . . . high to medium pitch

   This sound indicates that prawns are on the move and if the net is put out, the catch will be good.

3. Quack, quack....

This sound heralds the presence of fish, such as Megalops (tarpon), Chirocentrus (silver bar) and Techysurus (catfish) but not prawns.

This method is mainly used for the detection of bottom-dwelling fish.

For the detection of pelagic fish the usual methods are employed i.e. sight and sound. Shoals of sardine are seen as dark patches on the sea surface and often they are heard as they break the surface of the water. The fishermen say the sound resembles that of rain falling on the sea surface. No matter when this sound is heard, the fishermen will drop everything and rush to put out their nets once they see the shoal as a black area in the sea.

One of the beliefs of the fishermen concerning the irregular occurrence of pelagic fish is that all pelagic fish live in a big mountain covered with seaweed in the deep ocean. When strong winds blow the fish come to the surface but their home is in the seaweed on the mountain. They associate strong winds with pelagic fish because a strong south-east wind bring with it tarpon, silver-bar, hilsa, spotted spanish mackerel and black pomfret, while a strong north wind brings tiger and white prawns, ribbon fish, silver belly and jew fish.

The birds called Kali Peta (potipetu male, bandava female) are protected by the fishermen because when they appear in a flock of 15-50 sitting on the water surface the fishermen know that they will find fish in that area. The fishermen will again use the oar to listen for the type of fish underneath the birds and if the sound is favourable they will cast their nets.

These birds also indicate to the fishermen when their nets are full bacause they then start diving on the nets to eat the fish snared by the nets

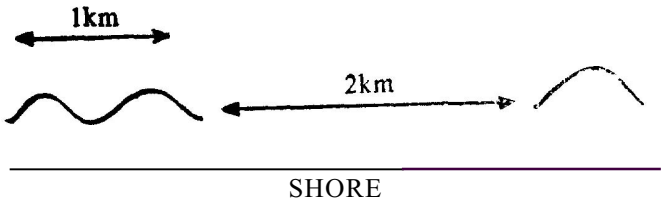
The fishermen were not aware that oil floating on the water surface could be an indicator of the fish.

-Fishing procedures with regard to sea bottom, current, wind etc.

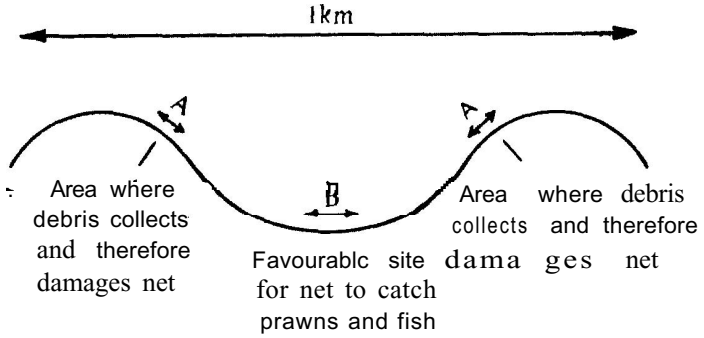
When fishing, the fishermen first have to cross the surf zone, then taking into account the wind and current, they will head for a position which they have fixed from land marks and where they know the fishing is good. Having reached the good fishing area, they will drop a line and sinker to measure the depth of water and to assess the composition of the sea bed.

Composition of sea bed	**Type of catch expected**
Sand	Few prawns and fish and many spiral shelled snails which entangle themselves in the net causing much damage. Not a good area to place net.
Sand and mud	Prawn and other fish, but not many of either.
Mud	Especially good for prawns and other fish.

The most common method of fishing in Puri is that of bottom set and drift gillnet. The fishermen have their favoured fishing sites. There are two just off the cost of Puri approximately 2 km from the shore at a depth of approximately 4-12 fathoms.



The diagram' shows these two arcas approximately 2 km apart, the tops of these mounds are approximately 4 fathoms from the surface while the depression: and sea bed at the base of the mounds measure 8-12 fathoms.



The mounds run parallel to the coast and so do the north and south currents, with the current at its strongest in the valley. The fishermen set their nets at right angles to the current i.e. in an east-west direction. If the current is flowing in an east-west direction it sometimes happens that the fishermen cannot place their nets at right angles to the current as they may lose or damage their nets on the debris areas marked A. The two areas mentioned are not the only areas where fishing is carried out, but they are favoured spots. There are other areas where the sea bed is favourable

for fishing and the fishermen may go to depths of 45-50 fathoms offshore in order to reach them, but the usual depth is 20-30 fathoms.

In Section A of the diagram, where there is a large collection of debris, baited hook and line fishing used to be carried out until June 1984 when the fishermen decided among themselves to ban hook and line fishing. The principle behind this ban was that a baited hook and line generally caught shark and the fishermen believe that when a shark is in the water, especially one that has been injured by the hook, the blood and the presence of the shark frightens all other marine creatures away, Therefore the banning of baited hook and line fishing is an attempt not to attract sharks to the area. This ban resulted from a low catch of prawn during the end of 1953 and beginning of 1981 and the fishermen blame the sharks for this low catch. The fishermen catch shark with a large mesh gillnet only during the months of November-January when they can take out the nava boat which is larger than the log kattumarams. During the rest of the year when the surf is high the kattumarams cannot accommodate the catch from the Large mesh gillnets. This, therefore, explains why they don't catch shark with large mesh gill nets so as to reduce the population of shark in the area. Consequently they have resorted to banning hook and line as the only answer because as they cannot deplete the population they feel at least they should not attract shark to the area with a baited hook. It is not a satisfactory solution, but the only one available to them, and also it is unlikely that sharks arc the sole reason for the low prawn catch of l983.

Surface gillnets are used to catch the pelagic fish. During winter the fishermen like to place their net 2-3 km away from the mouth of the Puri canal (Nuanai) because they find that there they catch such species as grey mullet, mullet, giant perch. big sea bream, giant herring and Indian shad.

Most of the time the fishermen wait until they sight a shoal to put out their nets or else, when the strong south-cast wind blows or the north winds blow they bring with them tarpon, silver-bar, hilsa, spotted Spanish mackerel. pomfret, ribbon fish, silver belly and jewfish.

Surface gillnet fishing is often carried out during the day but the nets are also left out overnight during the months of October-January from the Nava boats.

When fishermen fish at night, they navigate and tell the time by stars. They do not go out of sight of the Puri and Konarak lighthouses which also help them in their navigation. But it must be remembered that the main navigational aids at night for the fishermen are the stars.

-Catch of Main Species throughout the Year

Regarding the peak periods of the main species the fishermen volunteered the following information.

Species common name	Zoological name	Peak Period	Lean Period
Prawns	Penaeus indicus Penaeus monodon	August-Nov.	Dec.-Feb.
Mackerel	Scomberoides Rastrelliger	April-June	July-Sept.
Tarpon	Megalops cyphronoi	March-Sept.	Sept.-Dec.
Pomfret	Pampus argenteus Chilenisus	Oct.-Dec.	Jan.-March
Sardines	Anchoviella commersoni Anchoviella tri	Oct.-Feb.	March-April

The differences in perceptions and knowledge of the marine environment between the Oriya fisherfolk of Avana, North Orissa, and the Telugu fisherfolk of Puri, South Orissa, clearly reflect the ecological differences as well as the different fishing techniques employed. This is shown by the lack of knowledge of the Oriya fisherfolk about sea bottom configurations, currents and detecting methods for bottom-dwelling fish and their elaborate knowledge of tides. Furthermore, there is a difference in the depth of their knowledge between those groups of fisherfolk. Owing to their longer association with sea fishing, the Telugu fisherfolk of South Orissa have more elaborate and realistic perceptions and knowledge of winds, navigation and other aspects of sea fishing.