CHAPTER III

TYPES OF FISHING GEARS AND METHODS

Research Question: *What are the different types of gears and fishing methods commonly used in different seasons in the various beels of Assam and the level of CPGH of each type of gear use?*

TYPES OF GEARS AND FISHING METHODS

INTRODUCTION

Fishing is an ancient occupation. The concept of conservation and long-term sustainability of fresh water living resources dated back to man's history. Fishing is not only a major source of acquiring food for the humanity but also it provides employment, and economic benefits to large sections of the society as a whole. In the face of challenges confronted by capture fishery development the world over, there is a need for better understanding of fish harvesting systems and recognition of their strengths and weakness in terms of objectives of responsible fishing, by all those who are concerned with development, management, utilization and conservation of aquatic resources.

Knowledge concerning the fish and fisheries is quite ancient in India (Hora, 1951). Similarly, as it might seem, the state of Assam in India with its large number of beel fisheries is highly rich in fishery resources. Potentially, the inland fishery resources of the country are of very high order (Joseph, et al., 1965). Extensive areas under floodplain wetlands in the form of mauns, beels, chaurs, jheels available in eastern U.P., north Bihar, WestBengal, Assam, Tripura, Manipur, Arunachal Pradesh and Meghalay together form an area of more than 2,00,000 ha, offering ample scope for culture base-fisheries (Sinha, 1997). These are shallow nutrient rich water bodies formed due to the change in the river course as well as some tectonic activities.

Beel fishery covers an estimated area of 0.12 million hectare, which is about 80% of the total lentic area of the state (Bhagawati, et al., 1987). Fishing in these beels is more common by unconventional methods than by seining, gilling or dragging (Yadav, et al., 1981).

In the present work an attempt has been made to discuss the fishing gear and the fishing methods in the beel fisheries of Assam, based on survey which covers the beel fisheries water area from Dhubri to Sibsagar of Brahmaputra valley and all the three districts of Barak valley.

REVIEW OF LITERATURE

There are relatively a large number of literatures on the conventional fishing gears and their mode of operations employed in different parts of India, such as Sulochanan et al. (1968), George (1971), Dutta (1973), George et al. (1980) and Khan et al. (1980). Similarly, Kulashrestha, (1986), Rama Rao (1989), Pillai (1989), and Khan et al. (1992) reported on traditional fishing gear and methods from different parts of India. In 1993 various works were reported by Kurup et al., Sitarama Rao et al., Khan et al., Mohan Rajan, Kurup, and Changeux on traditional fishing methods, fish trapping devices and fishing effort and catch of fishing gears. Studied on the fishing craft and gears were conducted by Pandey (1994) in Padma river and Mishra (1994) in the riverine fisheries of Bihar.

However, there is a paucity of literature on the gear and methods of operation in the beel fisheries of Assam. The earliest record of conventional fishing gears and their mode of operation in Assam was found from the work of Day (1878). Thereafter, the fishing gears of the inland waters of the state were reported by Dey (1910), Job and Pantulu (1958), Joseph and Narayanan (1965). Works on traditional fishing methods and gears were reported by Yadav et al. (1981) and Bhagawati et al. (1987). Similarly, Sarma et al. (1993), and Goswami et al. (1994) reported on low energy fishing techniques and fishery exploitation system of the state.

MATERIALS AND METHODS

All the relevant data on fishing gear and methods were collected through field survey of 57 numbers of beels (Annexture-II). A large number of fishermen were personally interviewed and description of the gear and methods and other relevant statistics provided by the fishermen were recorded in the relevant section of the questionnaire (Sec I of Annexture-I). The gears and methods of operations were personally investigated where possible. The major statistics on gears and methods were types of gear, seasonal variation of gears, types of indigenous fishing devices, and fish composition.

OBSERVATIONS

A diverse range of fishing gears and methods have been evolved over a long period of time by the fishermen of Assam to capture a wide range of fish species available in the beel fisheries. Fishing gears in Assam vary greatly in their structure, materials used; principles of capture process and methods of operations. Hence, there is a need to classify them for their discussion in a systematic way. Several systems of classifications of fishing gears have been developed based on the principles of capture, design and operational methods. Based on the mechanism in the capture process fishing gears whether primitive and modern can be classified into five categories viz., gilling and tangling (e.g. gill nets), trapping (traps), filtering (e.g. trawls, seines and other net fishing system), hooking and spearing (e.g. hook and line) and dewatering (e.g. fish ditches).

Fishing gears can also be classified as either passive or active. Passive gears are gill nets and entangling nets, hooking and traps, and active gears are trawls or seines. Active fishing systems are generally energy intensive and more productive than passive gears.

Most widely used systems of classification are based on principles of fish capture, historical development and structural differences. Based on this and the principles laid down by the Joint Committee of ICNAF, ICES and FAO (1956), Brandt (1968) grouped the fishing gears and methods into 13 categories viz. fishing without gear, wounding gear, stupefying methods, line fishing, fish traps, traps for jumping fish, bag nets with fixed mouth, dragged gear, seines, surrounding nets, dip or lift nets, falling nets, and gill and tangle nets.

It has been observed that the classification of fishing gears into five categories mentioned at the beginning is grossly inadequate to describe the gears and methods of Assam. Hence the study followed the minute classification suggested by Brandt (1964). It has been seen that there is no gear in Assam as far as the study is concerned, which directly fall under the stupefying methods, traps for jumping fish and bag nets with fixed mouth. Moreover, seines namely *musari jal* and *gully jal*; surrounding nets namely *ber jal, pan jal, chella jal, Katalmara jal, polo jal, juluki* and *jhupri*; and falling nets namely *khewali jal* and *angtha jal* share common characteristics i.e. encircling type nets.

According to the study conducted on the type and methods of fishing gears in the beel fisheries of Assam more than 60 types of fishing gears were identified which were grouped into eight classes as described below.

A. FISHING WITHOUT GEAR

This method is the simplest form of capturing fish and is practized in Bhitopuni and Meda beel of Barak valley. The method involves dewatering of the beel through channels and is carried out during winter season (December-February). After dewatering fish are caught by hand picking or by simple implements such as shovels, picks or knives. The fishermen generally employ other methods of fishing like gilling, trapping, and filtering before resorting to this dewatering method. In general

this method is applied in those beel whose bed surface lies above the outlet channel or there are deeper water zone nearby.

B. IMPALLING GEAR

This method uses sharp implements for catching fish by wounding, grappling and killing. The different types of impalling gear found in beel fisheries of Assam have been described below.

Jongar

The *jongar* or *joar* [Fig. 3.1 (a) and (b)] as were found in 12 beels such as Siligurijan, Deepar, Lakhanabandha, Satiyan, Siyalekhaity, Dighali-patali, Brahmamaijan, Teliadanga, Moridikhow, Batha, Raumari and Gathia beel, where it was used mostly. In another 15 beels it was found as occasionally used gear. It consists of a tapering bundle of ten or more split bamboo spears, shod with sharp conical iron points. It is heavy and hurled with considerable force at the fish, which is pinned to the ground. It is also known as *Pocha* in Nagaon and Sibsagar districts.

Tiara

It was traced in 13 nos. of the beel fisheries where the gear was used mostly. In another 6 beels it was found as occasionally used gear (Table-3.2). It is a light bamboo spear, ending in a detachable fork of three barbed points. The fork is attached to the shaft by a fine string. The points are made of steel wire tied in a bunch with a piece of thinner wire.

Pokora

The *pòkora* (Fig.3.3) is a thin bamboo spear with a single barbed point, which is detachable, and is fastened with the shaft by a fine string. It is generally used for spearing large fish and tortoises also. It was recorded in 16 beels as mostly used

Fig3.1(a). Jongar

Fig3.1(b). Jongar

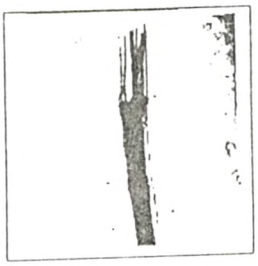

Fig3.1(c). Jongar

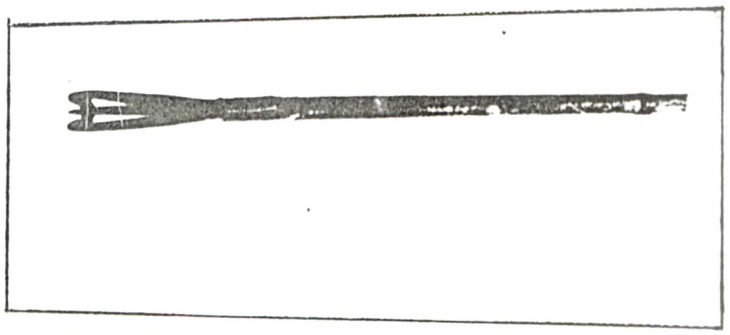

Fig.3.2. Tiara

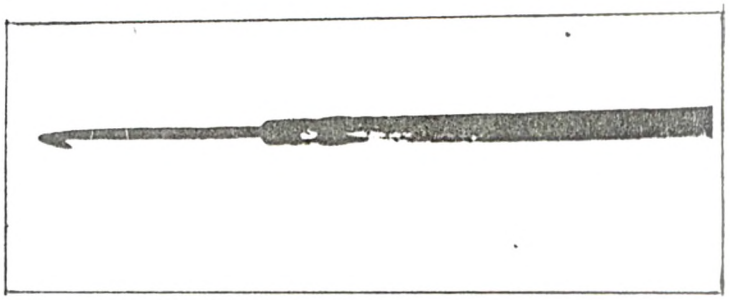

Fig.3.3. Pokora

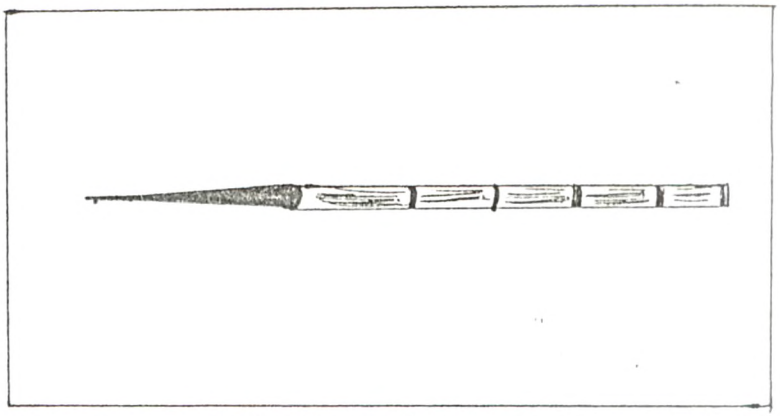

Fig. 3.4 Kol or Kati

impalling gear. Moreover, in another 8 beels the gear was used occasionally (Table-3.3).

Kol or Kati

The design and construction of *kol or kati* (Fig.3.4) is same as *pokora* but is small spear with single point, which are not barbed. It was found in 16 beels as mosly used gear and in 9 beels as occasionally used gear (Table-3.3). It is known as *"shel"* or *"hat-kati"* in Nagaon and *"ek-shalia"* in Kamrup.

C. TRAPS

Traps are fishing devices into which fish or shellfish are enticed by bait or shelter spaces or enclosures where they are guided to enter, because of an obstacle placed in their normal migration path and from which their escape is made difficult by constriction by retarding valves or labyrinths.

Trap fishing is a passive fishing technique of ancient origin. Traditional trap fishing techniques have been evolved all over the state to catch demersal fish. There is extra-ordinary variety in design, fabrication and operation of traps in order to match specific local conditions and behavior of the target fish species. The various types of traps as recorded in various beels of Assam are described below.

Ghani

The *Ghani* (Fig.3.5) is a cylindrical fixed trap slightly flattened at the bottom to enable it to lie stable on the floor of the beel. On one end of the cylinder has a concave surface, going into the cylinder and ending into a narrow orifice. The meshes are 50-70mm square. The trap is used in beels and also in rivers for catching large fishes. It is fixed by being tied to stakes driven in the bed. The *Ghani* has a door at the top of the back through which it is emptied once after 6-8 hours. It was

used mostly in 9 beels as shown in the table-3.3. In another 13 beels this trap was used occasionally.

Chepa

The *Chepa* is a drum shaped shieved bamboo trap (Fig.3.6), tapering at both ends. One opening is closed by a piece of wood while the opening on the other side is half-closed by another piece of wood. There is also an opening at one side of the trap with bamboo stripes extended inward, so that fishes get an easy entry to the trap while the extended gill like bamboo stripes prevent them from escaping. The trap is facing the opening against the current. The diameter of the opening is 20-40 cm and total length varies from 90-150 cm. The catch composition comprises of mainly minor group fishes. The trap is used mainly in April – June. Chepa was recorded in 39 beels of which in 30 beels it was used mostly while in another 9 beel it was used occasionally (Table-3.3).

Dingora

"Dingora" is made of bamboo stripes, rectangular in shape having a mouth at one side with the sieves directed inward, like spines (Fig.3.7). It is set between two guard- walls, made of screens of vertical split bamboo, inclined to each other at an obtuse angle. The length varies from 0.5-1.3m. Generally, the trap catches all kinds of minor group fishes mainly in monsoon (May – July). It was observed in 32 beels where the gear was used mostly. In another 5 beels it was used occasionally.

Derki

The *"Derki"* is a rectangular box like trap, which is very much similar to *"Dingora"* in design details and mode of operation. It has two semicircular trap doors at the bottom of each side. Along the whole length of the middle of one face runs a narrow vertical trap door. The *"derki"* has no spine like inward directed structure as in *"Dingora"*. Instead, the wall of the trap is folded directing inward at the openings (Fig.3.8). The composition consists of mainly minor group fishes. Out of 30 beels in

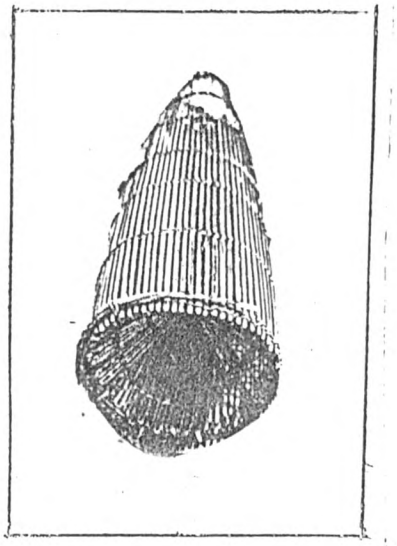

Fig. 3.5 Ghani

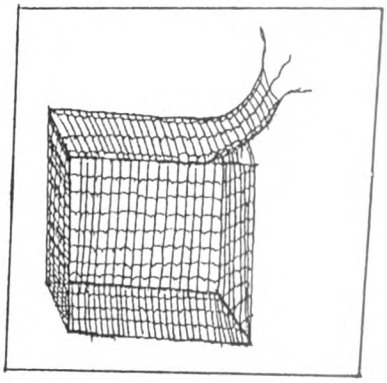

Fig. 3.8. Derki

Fig. 3.6. Chepa

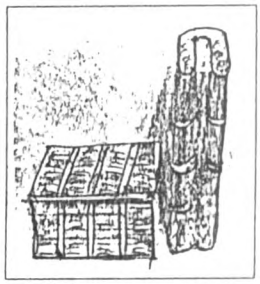

Fig. 3.9 Dalangi

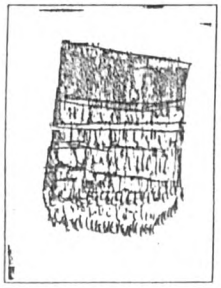

Fig. 3.7. Dingora

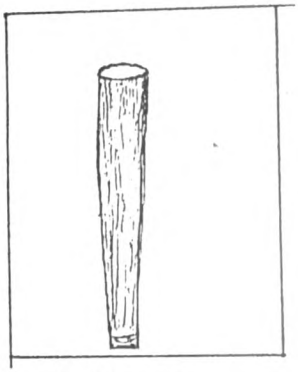

Fig. 3.10 Chunga

24 beels it was used mostly while in another 6 beels the gear was used occasionally as shown in table-3.3.

Dalangi

The "*Dalangi*" of Kamrup and Nagaon district is a large trap of pyramidal shape on a quadrilateral base with four triangular sides (Fig.3.9). One side which is larger than the other side is open. It is set in the beels at the time of strong current (monsoon season), and is fixed with two ropes fastened to the base of the open side and tied to the stakes driven into the bank. The inside of the trap is loosely filled with twigs and leafy branches of trees, in which the fish coming down stream find shelter. Every fourth or fifth day it is cautiously pulled ashore and the twigs are removed, when the fish that lie among them are caught. The larger sized *Dalagi* is also known as *Hukuma.* It was recorded in 34 beels of which in 27 beels the was used mostly (Table-3.3)

Chunga

The *chungas* consist of a single inter node of thick bamboo (Fig.3.10), with anode at one end. A line of *chungas* is placed on the floor of beel, and B aim fish take shelter in these cylindrical holes. After afew days the fishermen drive down, close the open end with the palm of the hand and pull it up to the shore. Sometimes poisonous snakes may get in, therefore, this system of fishing is held to be dangerous. It is known as *"thula"* if small and *"huka"* if large in Sibsagar district. In 21 beels out of a total number of 28 beels chungas were used mostly.

Boldha

The structure of "*boldha*" is similar to that of "*dingora* but smaller in size (Fig.3.11). The breadth is 0.1-0.15m and the lenth is 0.2-0.25m. Bait with snail flesh is kept inside. The catch composition comprises of minor group of fishes. Out of 27 beels in 15 beels it was used mostly while in another 12 beels the gear was used occasionally.

Cherha

It is a funnel shaped fishing trap (Fig.3.12), which is also known as *Shohora* in Kamrup district. The height of the trap measures 77 cm and the width is 10.1 cm (diameter). Funnel shaped fishing basket is made of several strips. A ring of bamboo supports the circular wide mouth. The whole body is woven by a spirally travel bamboo or cane slip. The dried bushes that arrest the exit of catches fill in the body. The trap is set in the shallow water. It was used mostly in 21 beels as shown in table-3.3.

Thorka

It is a funnel shaped trap found in Kamrup district of Assam (Fig.3.13). The height measures 161 cm while the width is 23.5 cm (diameter). The basket is made of single bamboo piece. One third of the split in a regular interval form a circular and wide mouth having a ring around it. At the time of manipulation the mouth of the specimen is placed upwardly against the falling water from the outlet of higher catchments area. The fishes are taken out by inserting hand through mud. As shown in table-3.3 *Thorka* was observed in 13 beels as mostly used traps.

Bamidhara

It is also a funnel shaped trap (Fig.3.14). The height of the trap measures 59 cm and the width is 11 cm. The basket is made of a single bamboo split into a number of strip having a node at the bottom circulate wide mouth. The whole body is woven with bamboo slips. One rope is tightly tied with the mouth. The trap is used for catching eel (bami fish). The trap is used in shallow turbid water. Out of 19 beels in 11 beels thorka was used mostly (Table-3.3)

Khoka

Funnel shaped fishing trap (Fig.3.15) found mostly in Nagaon district of Assam. The height measures 60 cm and width is 10.5 cm (diameter). The basket of the trap is made of bamboo stripes. The body is strengthened with several rings made of

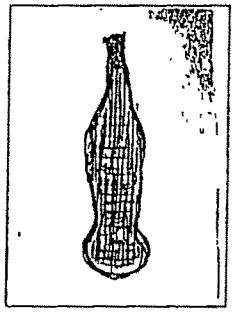

Fig. 3.11. Boldha

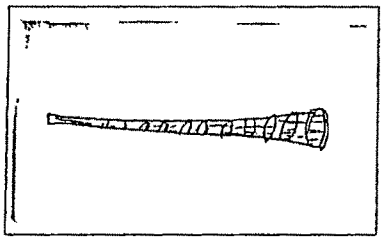

Fig.3.12 (a). Cherha

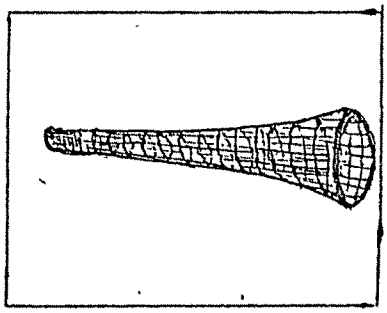

Fig.3.12 (b). Cherha

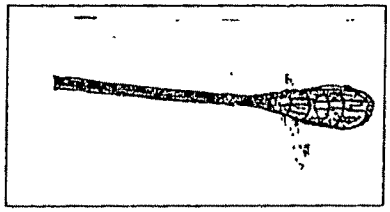

Fig. 3.13. Thorka

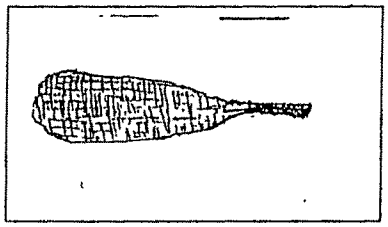

Fig. 3.14. Bamidhora

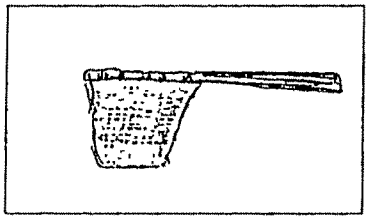

Fig. 3.15. Khoka

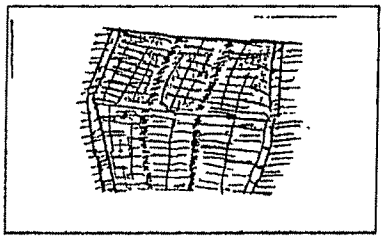

Fig. 3.16. Tuna

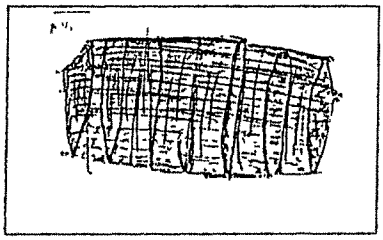

Fig. 3.17. Dori

bamboo slip. It is used in shallow water. It was recorded in 14 nos. of beels of which in only 6 beels it was used mostly.

Tuna

It is an oblong valved fishing trap (Fig.3.16) traced in Dibrugarh district of Assam. The height of the trap measures 65 cm. The basket of the trap is made of cane strips. The basket comprises three parts. Opening, valved mouth and body. Interspaces between the stripes are maintained by using cane rings from the both inside and outside and twined with the cane slips. The funnel shaped valve is formed by fixing the pointed extended cane stripes inward around the mouth. The posterior mouth can be open while taking out the fishes. Otherwise it is kept closed by rapping with rope. The trap is manipulated in shallow water and valves remain opposite to the current. As shown in the table-3.3 this trap was recorded in15 beels of which in 9 beels it was used mostly while in another 6 beels the trap was used occasionally.

Dori

It is a trap, which consists of several (30-50) traps joined together by ropes and is placed in a fixed place by bamboo sticks (Fig.3.17). This trap was recorded in 27 beels of Assam (table-3.3). Each trap of *"khati-dori"* is rectangular in shape with semi-circular trap doors at the bottom of each side through which fishes are trapped inside the trap. The catches are unloaded through another door on the wall of the trap.

Polo jal

The *Polo* is a bell-shaped split bamboo trap (Fig.3.26), with a small opening on the top (15-25cm.) and bottom (60-90cm.in circumference). It is usually 0.6-0.9 m in height and is used in shallow water for catching all kinds of fish. It was observed in 35 beels as mostly used trap while in another 8 beels (Table-3.3) it was used occasionally. The fisherman walks into the water, press down the polo in front of him and then stupping down plunges his hand through the opening at the top and gropes in the mud for the fish that are trapped. Sometimes this trap is used in

combination with *Goroi langi*. Fishes disturbed by operation by polo are lead into the net.

The catch composition comprises mainly of bottom dweller species. Other kinds of fishes are also trapped by polo.

Juluki

The design details of '*Juluki*' are very much similar to the polo with few exceptions (Fig.3.27). In *'Juluki'* the circumference of both the top and bottom openings are almost equal (in mouth 20-30cm, bottom 28-30cm). Rice bran baits are used to lure the fishes, which facilitates easy trapping. *Juluki* was used mostly in 23 beels as shown in the table-3.3.

The catch composition comprises of Channa spp., Anabas spp., H. fossilis, Clarias spp., Puntius spp., Nandus spp., etc.

Jhupri

The design details are similar to polo but in this trap the mesh size is much smaller which can trap fries also. The spaces between the reeds are interwoven with string (Fig.3.28). All types of fishes are trapped with *'Jhupri'*. The trap was mostly used in 28 beel and occasionally used in 10 beels as shown in table-3.3.

D. HOOK AND LINE FISHING

Lines are widely used in both traditional and modern fisheries. The principle of capture is based on the feeding and hunting behavior of target species. Unlike the net fishing methods here the fishes are individually caught and retained by hooks, which are tethered to lines. Though the quantity of landing is less, catch obtained by the line fishing is generally of high quality and commercial value. Environmental impacts of the lines are considered to be the minimal. The line fishing techniques are

highly energy efficient and the investment requirement on gear operations is generally low. Lines are highly species and size specific. Environmental conditions such as depths, water current, rough bottom conditions and thick vegetation in the beel have less effect on operation of lines. Line fishing methods such as long-line fall under the category of passive and static fishing gear while others such as pole and line is active fishing method.

Line fishing is basically composed of a line and a hook. Hooks are made of galvanized or aluminium coated iron, brass or stainless steel. They are manufactured in different shapes and sizes. Different types of hooks and lines fishing as studied in the beel fisheries of Assam are described below.

Rod and Line

It is also known as rod and line and is very common in the beel fisheries of Assam. Fishing rods are made of local bamboo (Fig.3.18). The lines are usually of twisted cotton or hemp thread. The common rods have short lines tied to the top of the rod. The floats are commonly made of "*ulu-grass*, jute stick or "*sola-pith*. The smaller hooks or the local made larger hooks are tied well to the line. The hooks are usually barbed and one to three hooks are used on the same line. Baits are made of earthworm, larvae of wasps and similar other insects. Bottom feeder and predacious fish are caught with the line baits, usually small fish, like "*cheng*", "*lati*", prawns, frogs etc. As the fishes try to eat the baits it is indicated by the floats and pole is pulled out of water with great force and the fish species is caught by the hooks. Pole and line fishing was found very common fishing method in the beels of Assam. It was used mostly in 49 beel and occasionally in 6 beels out of 55 total surveyed beel. It can be categorise in to two types depending on the materials used in the preparation of the pole.

(a) ***Nal barshi*** is commonly found in the beel fisheries of Kamrup district. This type of barshi bears a *nal* instead of bamboo, which is of about 1.5m long and is tied centrally with a nylon rope with a hook, which can float freely at the right angle to

the *nal*. Generally earthworm is used as bait in this barshi. About 100 to 150 nal-barshis are found floating in the beel at a time and are checked three times a day to catch the hooked fishes. The catch composition mainly comprises of Goroi, Cheng, Kaoi, Singara and Singi.

(b) ***Sip-barshi*** is made up of *bijuli* bamboo, which measures about 20 to 24 feet in length. At the tip of the bamboo a nylon rope with a hook is tied with a grasshopper taking as bait. The nylon rope measures about 4 to 4.5 feet in length. This type of barshi is used to capture Singri and *Clarius* sps.

Dhan-barsi

It is a ground line consists of a short stout line, one end of which is tied to a boat, while a number of finer lines, carrying baited hooks baited hooks, are tied at intervals to the last yard or two of the other end. It resembles like an ear of paddy (Fig.3.19) so known as "*Dhan-barsi*". In Nagaon it is known as *"Khuti-barshi"*. In 18 nos. of beels it was used mostly while in 8 beels (Table-3.3) it was used occasionally.

Bamboo hooks

In some beels split bamboo hooks are used by fishermen for fishing (Fig.3.20). It is operated during monsoon (June-September). The hook is made of soft and rigid bamboo barks cut into small pieces of around 10mm. In length and 1mm. in girth which are neatly folded in the middle and the two ends are joined together with earthworm and prawn baits. The hooks are subsequently tied to threads in the middle and set in water. When fish devours the bait, the hook opens sharply keeping in the mouth of the fish tightly open holding it from escaping. Anabas and Nandus sps are the major catch composition. As shown in the table-3.3 it was observed in only 13 beels and in all the cases it was used mostly.

Dan- barshi

It is a multi-hooked barshi comprising of a number of hooks in a single barshi (Fig.3.21). A main nylon rope of the required length is tied with two bamboo posts at the either end of a particular area where chances of catch is more. The main nylon rope on the other hand contains several hooks that are tied with another nylon ropes measuring 1 to 1.5m in length and are spaced at an interval of 3 to 3.5 feet so that the hooks might not entangle each other. This type of barshi is used to capture mainly *sol* fish.

E. ENTANGLIG GEAR

Entangling gears such as gill nets are passive fishing gears. They are vertical walls of netting kept erect in water column by means of floats and sinkers and set perpendicular to the direction of movement of target fish. The simplicity of its design, construction, operation and low investment has made this fishing gear very popular among small-scale fishermen. In the beel fisheries of Assam they are operated in surface layer of water column and are known as drift gill nets that were found in operation in different beels of Assam during study period are described below.

I. LANGIJAL (Gill net)

Langi-jals are renctangular nets (Fig.3.22), which are provided with head and footropes. The foot and head ropes are provided respectively with sinkers and floats. *Langi-jals* are often fabricated coarse, but stronger materials like *sunn* hemp. These nets vary much in size and meshes and operated as bottom set, encircling or dragged gill net depending upon the behavior of the species sought. The net is set by fastening to anchor. Sometimes the net is simply allowed to stretch the float. Fishes are often driven towards the net by beating kerosene tins or by disturbing the water

with bamboo poles. Sometimes the net is tied against the current and allowed to remain over night. Fishes get entangle in the net by their operculum. The *langi* is the largest net used in Sibsagar. The ordinary *langi* of Lakhimpur, Nagaon and Darrang have no floats and are worked in only shallow waters. It was observed in 55 beels of which in 52 nos. of beels the net was used mostly while in only 3 beels it was used occasionally as shown in table-3.3. Langi-jals are of different types that are as follows:

Puthi langi

It is operated in round the year. The design is similar as mentioned above and the mesh size is only 8-10mm. The total length varies from 10-50m. The catch composition comprises of Puntius sp., Heteropneustus spp., Catla spa., Labeo sps., Nandus sps., etc.

Kaoi langi

The design detail is same as mentioned earlier about *langijal* and mesh size is around 17 mm. The major catch composition is Anabas sps., Nadus sps., Heteropneustus sps., and Clarius sps.

Goroi langi

The mesh size is little more (20mm) than *Kaoi langi* and *Puthi langi* but design detail is similar. The net is usually set near weed infested shore area. Fishes are driven into the net with Polo and *Juluki*. To operate the net 3-5 persons are needed for about 1-2 hours. The catch composition comprises of Chana sps., Carp fingerlings and small sizes Wallago spp.

Mola langi

It is a large sized *langi jal* used as encircling gill net and made up of cotton. The mesh size is 12.5 mm. and the height is 0.80m. It is generally used to fish Mola (A.mola) spa.

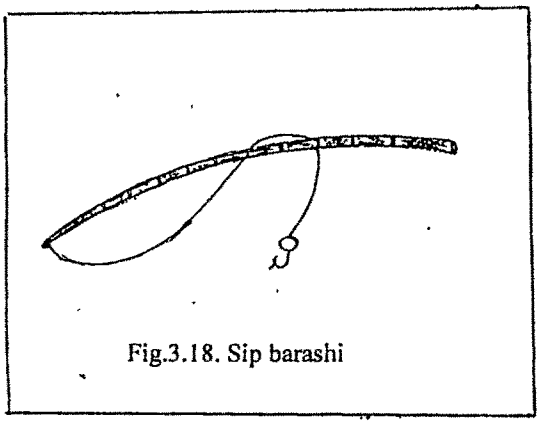

Fig.3.18. Sip barashi

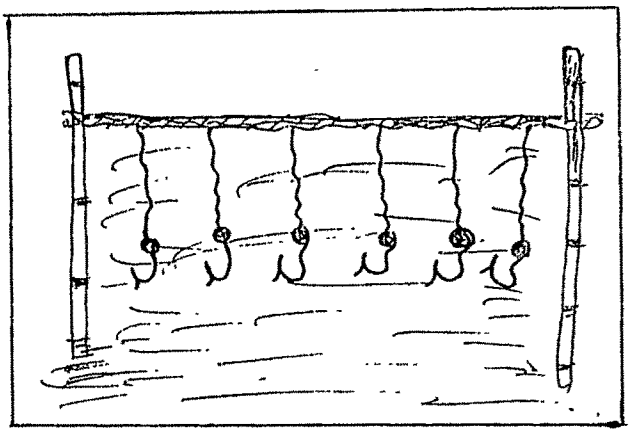

Fig. 3.21 Dan barashi

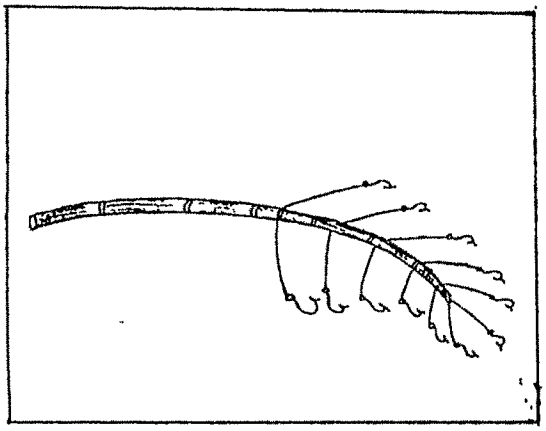

Fig.3.19. Dhan barashi

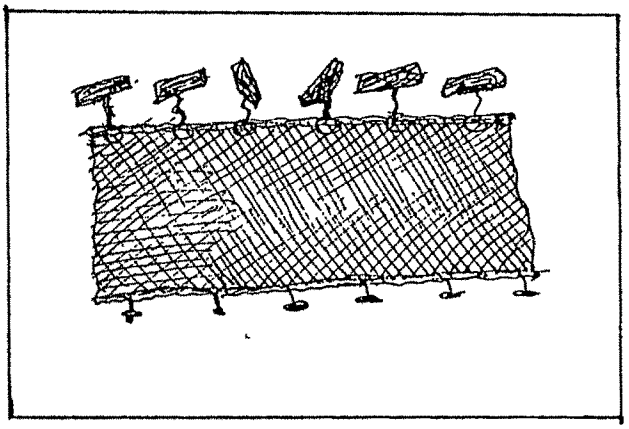

Fig. 3.22 Langijal

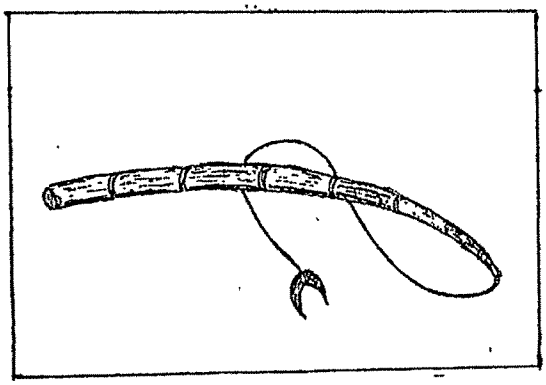

Fig. 3. 20 Bamboo hook

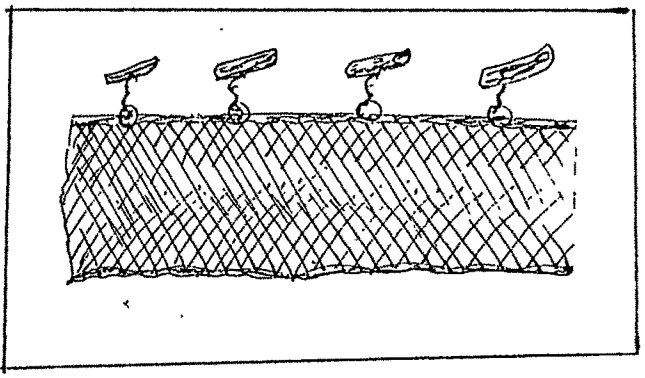

Fig. 3.23 Phansijal

Ari langi

It is also large sized *langijal* but used as dragged gill net. It is made of sunn-hemp (4 ply) 55-60mm meshes. The height of net is about 1.15m. It is used to fish *Ari* fishes (Mystus sp.).

Sittica langi

It is used as bottom set gill net and is made of "*reha*" of 0.6mm diameter. The mesh size is 40.0 mm with 1.28m height of the net. The net is used to capture minor carp sps.

II. PHANSI JAL

Phansijals are a gill net of which the design detail is similar with that of *langijal* with few exceptions (Fig.3.23). It is also a rectangular net provided with head and footropes. Unlike *langi jal,* the footrope is generally devoid of sinkers but is much thicker. *Phansijals* are made of light materials i.e. nylon or cotton.

The method of operation involves several indigenous devices to drive the fish into the net and is operated as surface set or drift net for Hilsa sps., carps and cat fishes. In 51 numbers of beels phansijal was used mostly (Table-3.3) while in only 4 beels the net was used occasionally. Like *langijal* these are also variously named depending upon the fish species sought. These are as follows:

Ilisha phansijal

It is extensively used as surface drift gill net in Sonitpur district. *Ilisha phansijal* is made of nylon with 35.0 - 40.0 mm meshes and modus operandi is mase as mentioned above. It is used mainly to capture Hilsa sps.

Rau phansijal

Rau *phansijal* is extensively used as surface set gill net in Jorhat district. It is made of sunn-hemp (3 ply) with 107.5mm meshes. The other design detail and modus operandi is same as mentioned under the head *phansijal*. As name indicates it is used to capture *Labeo rohita* but other carp sps. of similar size could also be captured.

Karal phansijal

It is made of nylon or cotton with 120-135mm. meshes and 1.30m height. It is used as surface set or drift gill net to capture C.catla and other fish sps. of similar size in Sonitpur district. The structural details and method of operation is described under "*phansijal*".

Ari phansijal

It is mostly used as surface set or drift net in Jorhat district and is made of cotton with 150-165 mm meshes and 2.5 m height. As name indicates it is used to capture *ari* (M. aor) species. The structural details and method of operation is mentioned under *phansijal*.

F. ENCIRCLING GEAR

The task of this net is to encircle a certain area where supposed to be presence, or a detected fish school and capture them by dragging the gear or some time scooped out with other nets. This type of gear is also known as surrounding nets. In operation of certain encircling gear one end of the net is shot from a fixed point, after which the gear is then hauled. The starting point is generally the shore of the beel. It was found to be operated in shallow water and the net sinks from the surface to the bottom. Different types of cast nets are also fall in this category.

Different types of encircling gear as have been recorded during the study are described below.

I. SURROUNDING NETS

Mushari jal

Mushari jal is also known as "*Mohorijal*" in Kamrup district. It is used extensively all through the year except monsoon season. Out of the total 55 surveyed beels musarijal was used mostly in 51 beel and only in 4 beels (Nandini, Solmari, Saitali, and Ganak-dubai-duba beel) it was used occasionally (Table-3.3). Due to heavy vegetation in these four beels fishing with musarijal become complicated. The net is made up of 2-5 pieces of rectangular nylon nets of mesh size 1-1.2mm (Fig.3.24). Each piece of net varies 20-30m in length and 6-8m in breadth, tied together by nylon threads. The upper margin of the net is attached with a stout jute rope that is known as *head rope* like wise the lower margin with another jute rope, the *ground rope* or the *footrope*. The net is also provided with the floats of soft wood or banana shoot and sinker of lead or breaks in the *head rope* and *footrope* respectively. Another long ropes are tied on either side of the net.

The net is taken into the deep portion of the beel, stretched and the bottom rope is allowed to settle. The two nets are dragged towards the shore and brought together. As the central portion of the net comes to the shore, the net is lifted to form an effective bag. Generally 8-14 persons are required depending upon the size of the net for a single operation with the help of 2-3 boats. A single operation needs about 5-7 hours.

The catch composition comprises mainly the surface and column feeders but this net captures almost all types of fishes including Macrobrachium spp.

Berjal

It is a large rectangular seine-net or surrounding net (Fig.3.25) also known as *tana-ber* (Nagaon district). Berjal was found in all the 55 beels of which in 25 beels the net was used mostly and in another 30 beels it was used occasionally (Table-3.3). The net is provided with a head rope that carries floats and a footrope, which may not possess sinkers, but the absence of sinker is compensated by a much thicker footrope. The length and breadth of the net shows considerable variation and are dependent mainly on the area and depth of the strech to be fished. The size of the mesh also varies ranging 25-30mm.

The method of operation is very much similar to that of *mohorijal*. The net is shot in a semi circle with the shore of the beel as base and is hauled up on to the land by gradually pulling in either end. Two boats, each of which carries half the net, do the paying of the net. The boats proceed to an appropriate distance from the shore; turn to both side and row towards the shore, simultaneously realizing the net. The net is then hauled up and the catch is collected at the middle point of the net, which is kept slackened during hauling by manipulating the head and footropes. Operation of *Berjal* requires 10-15 men and 2-4 boats.

The catch composition comprises mainly of *Labeo spp., Cirrihina spp., Mystus spp., Channa spp., Wallago spp., Notopterous spp., Ompak spp., Cyprinous spp., Hilsa spp.*, and *Rita spp*. The berjals are variously known as *pan jal, chella jal, Gullyjal* (with peripheral pockets).

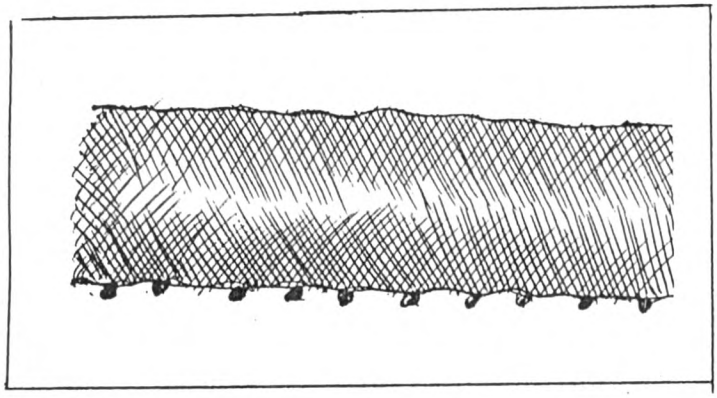

Fig. 3.24 Musarijal

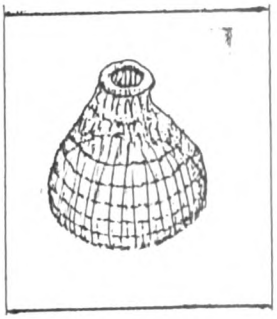

Fig.3. 26(ɓ) Polo

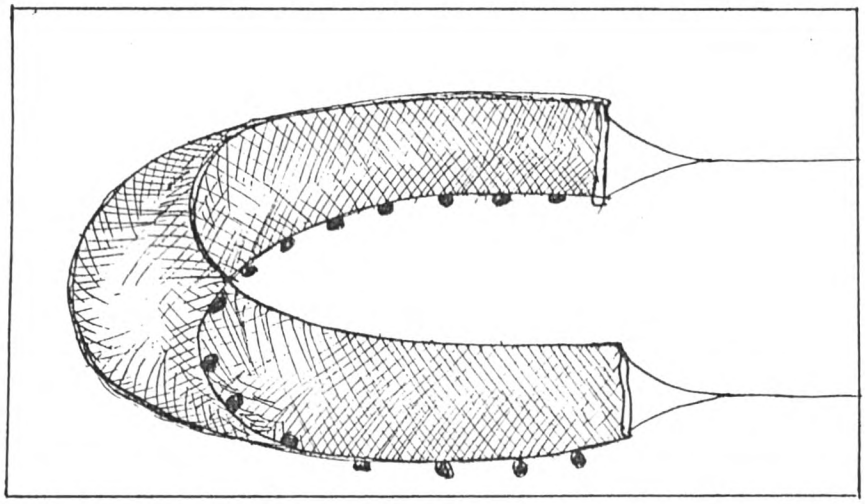

Fig. 3.25 Berjal

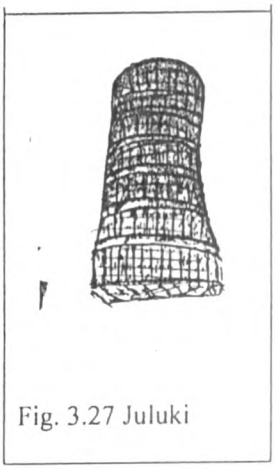

Fig. 3.27 Juluki

Fig. 3. 26(a) Polo

Fig. 3.28 Jhupri

II. CAST NET

Khewali jal

The *khewali jal* is also known as *Jhanki jal* or *Asra jal* and is the most common form of net used all over the state. The net was recorded as mostly used fishing gear in 52 beels (Table-3.3) while in only three beels it was found as occasionally used net. It is a conical cast-net of 8-15 mm mesh and the length of the net is 2-2.5m (Fig.3.29). Some times it is colored dark brown with gate-juice. The circular edge of the bottom of the cone is doubled and sewn into a number of pockets, a foot or two in height. Along the inner edge of the mouth of the pockets run a chain of iron drum-shaped weights. A rope is attached to the apex of the cone. The fisherman stands knee-deep in water, with the end of the rope in his left hand and the net folded on his right arm. By a dexterous sweep of the arms he whirls the net above his head and coats it on the water, on it falls in the form of a perfect circle. The weights pull the net down uniformly in the form of a cone into the water. The net is pulled gently by the rope, when the cone shrinks gradually and the enmeshed fish find their way into the pockets. Generally all types of fishes are caught with this net.

The '*afalia*' and '*ghan jal*'of kamrup, the '*ghan khewali*'of Nagoan and the '*upelia khewali*'of Darrang corresponds to the *Jhanki jal.*

Angtha jal

It is also a cast net of larger size (3 to 4 m in length and 2 to 3 m in circumference). *Angthajal* contains several pockets at the bottom end and are fitted with sinkers made up of iron rings (Fig.3.30). The mode of operation is same as mentioned above but are operated in deeper open zones of the beel. This net was also observed in similar beels as in the case of khewali jal.

G. SCOOPING GEAR

This is very simple and common and has been described as dip or lift nets. This method is to submerge a hanging net, then pull it rapidly out of the water so as to capture any fish which happen to be over it. The smaller net of this type is hand operated but bigger one needs a mechanism on land or on a boat. The netting is supported on a round or rectangular frame.

Different types of scooping gears, which were recorded in the beel fisheries of Assam, are described below.

Dharmajal

Dharmajal is a rectangular dip net (Fig.3.31). This net was observed in 14 beels where it was used mostly. But in maximum cases (34 beels) this net was used occasionally (Table-3.3). It consists of a supporting bamboo pole to which two hollow pieces of bamboo (0.5-2m) are tied crosswise at the apex. Four pieces of tender bamboo shots or split bamboo (5-10) are inserted in the four ends of the pieces of bamboo. The distal ends of the tender bamboo shoots are tied to corners of a square net (9-36 square meter) of about 10 mm mesh size. A rope is tied at the apex of the supporting bamboo pole. One man holds the base of the supporting pole tightly and pulls the rope towards him. This action lifts the net. Sometimes *Dharmajal* is also operated on a framework and the catch composition is similar to that of *jatajal. Dharmajal* is also known as "*Parangi-jal*" in Cachar district.

Dhekijal

Dhekijal of Cachar is also known as *jinti, tariakha, chemchai* and *heka* in Cachar district, *pa* and *bocha-jal* in Sibsagar district, *kharra jal* in Dhubri and Goalpara district and *ghat-jal* in Nagaon and Lakhimpur districts. It was found in all the 55 beels of which in 31 cases the net was used mostly while in another 24 cases it was used occasionally (Table-3.3).

The *Dhekijal* is a large triangular net stretched across two bamboos tied near the thick ends (Fig.3.32). The construction of *dhekijal* is very much similar to that of *jatijal* of Kamrup district with a few exceptions. The net is balanced in front of a bamboo platform raised in the bed of the beel about 6 feet above the level of water. The fisherman standing on the platform releases the cross piece from its fastening to the platform, when the net drops down into the water. After 30-45 minutes the fisherman puts his weight on the crosspiece when the net slowly swings up in the air. The fishes caught slide down to the apex of the frame, where the fisherman gathers them. Almost all kinds of fishes are caught in this net due to its small (7.5-12.5mm) mesh size.

Thela-jal

The commonest form of the *dipnet* is called *Thela-jal.* It is a triangular frame of bamboo, with a short handle at the apex. A triangular piece of 8.0-10.0mm mesh net made of cotton is hung from this frame. The frame is held by the handle and dipped into the water, pushed forward along the bottom and then lifted up with a jerk. A short crosspiece of bamboo is fixed near the apex to keep the angle (30 to 45) between the two bamboo poles constant. This gear is operated in knee-deep water depth. The catch composition comprises of mainly minor and intermediate group of fishes. *Thela-jal* of various kinds is described below.

Pah jal

It is also a *thela jal* found in Nagaon district the structure of the gear is same as mentioned under *thela-jal* (Fig.3.33). But mesh size about 70.0mm and is made of *sunn-hemp* instead of cotton. A man standing at the bow end of the boat while it is drifting operates it. It is said to be a special gear of hilsa and migratory carps. As shown in the table-3.3 this gear was used mostly in 52 beels.

Jakoi

The *'Jakoi'* is a pouch of bamboo matting, which is triangular in shape with a wide mouth (2m circumference). It is made of bamboo sieves oven at intervals of 0.3-

0.7cm. A bamboo rod is fixed across the mouth from the middle of the base of the triangle to the vertex, and is prolonged to a short handle (Fig.3.34). The fisherman plunges it into the bed of shallow water with the mouth facing him and dances on the ground driving the fish at the bottom into the pouch. Then he suddenly lifts it up in slanting position. It is also pushed along the ground. The catch composition comprises of mainly small fishes with surface and column feeders. This gear was recorded in 52 beels and in all the cases it was used mostly as shown in the Table-3.3.

H. TRAWLING GEAR

Trawling gears are also known as drag nets and are used for dragging the beds of beels. They are generally used in shallow water. Dragnets are large and exist in various forms and dimensions. Nets have been divided into two kinds viz. with pockets and without pockets. Drag net without pockets are more prevalent and used through out the year except monsoon season. The sizes of the net vary greatly depending upon the local requirement like water level, Availability of funds and manpower etc. Likewise, mesh size also varies, being larger at the outer extremity and smaller towards the mid region of the net.

Different types of trawlers used in the beel fisheries of Assam have been described below.

Moi jal

Moijal is a small trawl net used for dragging shallow waters (Fig.3.35). It is made of *sunn*-hemp used during September to March. The net is rectangular in shape, 40-50m long and 1.5-2m in breadth. It was used mostly in only 8 beels where as in another 18 beels the net was used occasionally (Table-3.3)

About one third of the lower part of the net is doubled up, and the sides are sewn to the upper part forming a large pocket. A number of small iron drum-shaped weights are attached to the lower half of the mouth of the pocket. The top of the net is attached with a thin bamboo rod, to the extremities of which are tied to the ropes, by which the net is dragged. Two brick weights are fastened with ropes about afoot in length, to the ends of the bamboo, so that when the net is drawn, the bamboo floats a foot above the bed of the water and keeps the mouth of the pocket open. The weights at the lower end of the pocket scrape along the ground and stir up the fish, which run into the pocket. Mesh size at the bottom is 10-12 mm, which gradually increases to 20-23 mm at the upper limit.

The net is taken to the deep portion of the beel and dragged towards the shore. Fishes blocked on the way by the net tend to go downwards and are eventually trapped in bottom bags 6-8 persons are needed to operate the net which requires 1-2 hours for a single operation.

The catch composition of *moijal* recorded was Puntius spp., Gadusia spp., Mystus spp., Xenothedon spp., Clarius spp., Heteropneustus spp., Ompok spp., and Esomes spp.

Horhori jal

The net is used during October –January. It is conical shaped bag like, 8-10 m in length and 6-8m in circumference at the mouth (Fig.3.36). The mouth of the net is distended my two rods near the two ends where the drag-ropes are fastened. The middle of the mouth is kept open by a vertical float of bamboo, attached to the middle of the upper edge. A chain of small drum shaped iron weights is sewn to the lower edge, which keeps the net on the bed of the water. The meshes towards the apex of the purse are smaller than those near the mouth.

The net is operated in pit free beels. It is released in the deep portion of the beel. Subsequently, the mouth opens because of counter-movements of the floats and

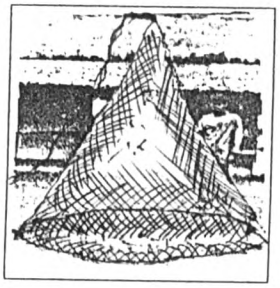

Fig. 3.29. Khewali jal

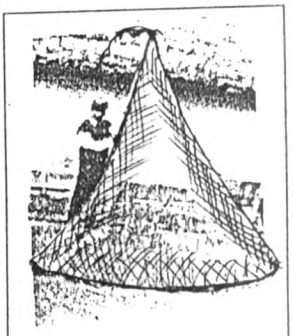

Fig. 3.30 Angtha jal

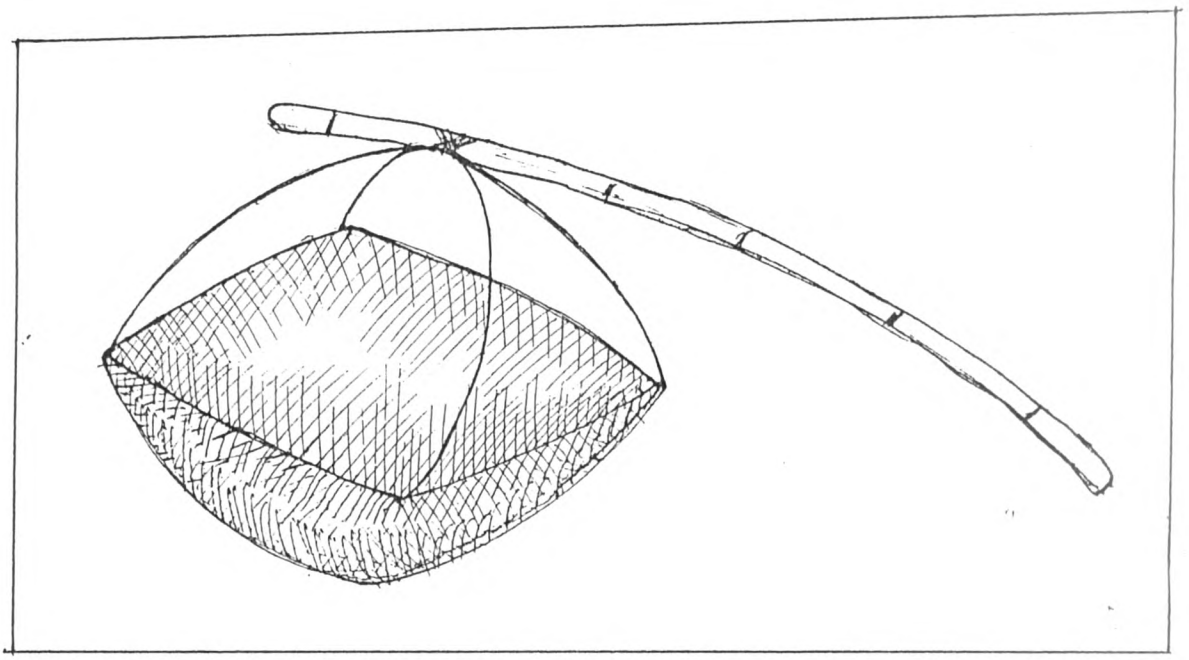

Fig. 3.31 Dharmajal

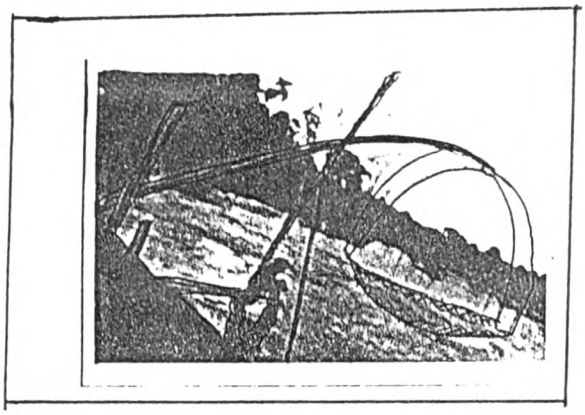

Fig.3.32. Dhenkijal

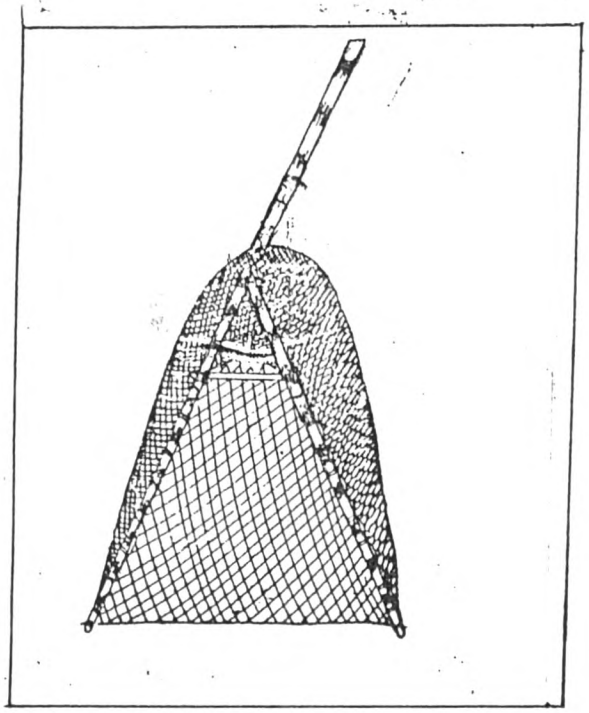

Fig. 3.33 Pahjal

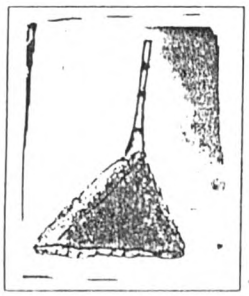

Fig. 3.34. Jakoi

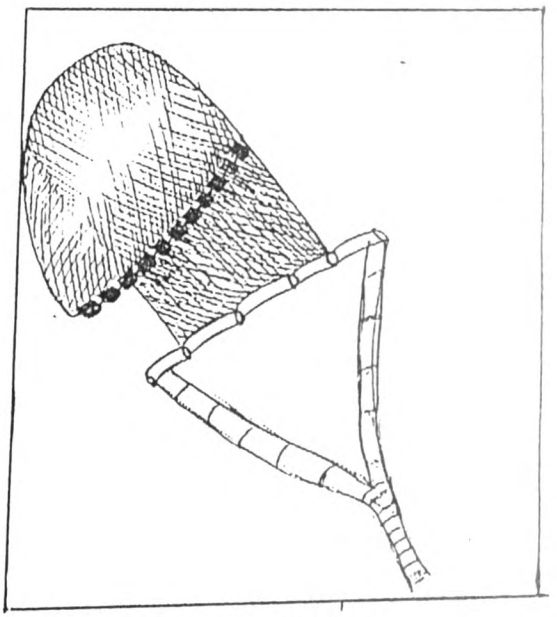

Fig. 3.35 Moijal

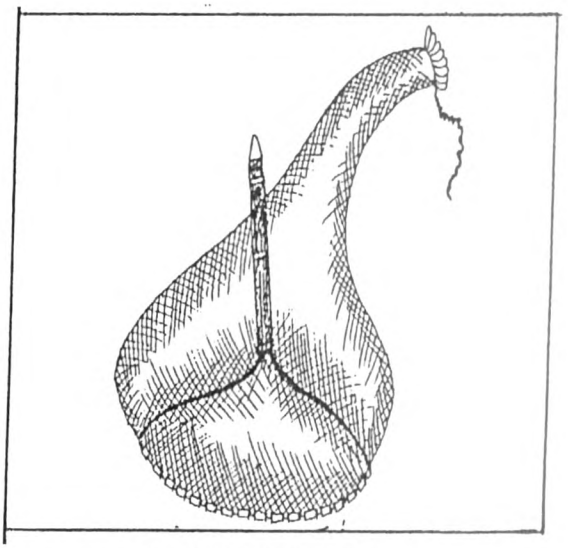

Fig.3.36. Horhorijal

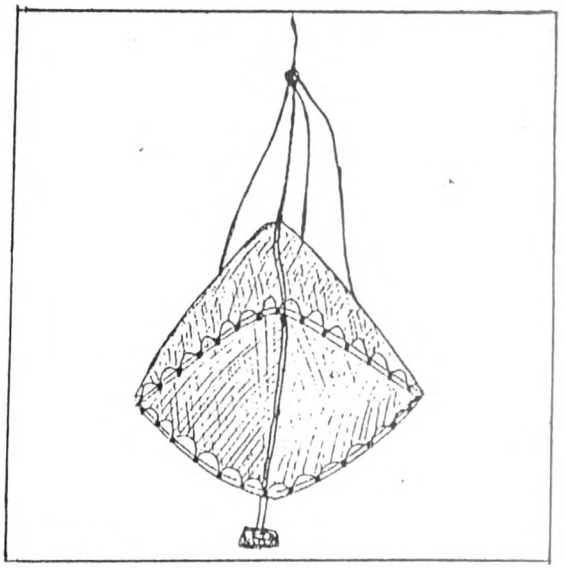

Fig.3.37. Shangla jal

sinkers. 6-8 persons slowly drag the net towards shore and fishes trapped inside are caught. Only in 9 beels this net was used mostly while in another 18 beels it was used occasionally (Table-3.3).

The catch composition consists of Puntius spp., Rasbora spp., Chanda spp., Mystus spp., and Glossogobius spp.

Shangla jal

It is a semicircular purse net extensively used mostly in catching Hilsa in 30 beels of Assam (Table-3.3). The net consists of an elliptical frame my tying two split bamboos on either side, and a bag shaped net attached to it (Fig.3.37). The bag is formed by lashing four right-angled triangular pieces of webbing of identical dimensions. A rope which is attached to the lower to the lower lip of the net, after passing through the upper lip, goes into the right hand of the man standing of the forepart of the boat, which is drifting. This forms the haul rope. A big knot, which limits the opening of the mouth, is made at some distance on the rope. A stone or brick is attached to the middle of the lower arc to keep the net submerged. The upper net of the purse is tied in three points near the mouth to a piece of string, which also goes to the hand of the fisherman. By manipulating the rope the fisherman can regulate the opening of the mouth, and by the movement of the net, communicated through the string, he can feel when a fish enters the net. This net is used at all depths. The arcs of the net are about 4-6m in length and the mesh size of the net measures 35-50mm knot to knot. The material for preparation of the net is *sunn* hemp or cotton. The net is also known *Illish shangla, Karal shangla* in Dhubri district *Kura jal,* and *Jem jal* in Cachar district.

INDIGENIOUS FISHING METHODS

On account of highly diverse nature of the beel habitat, the methods ranging from catching with hands to the operation of large and indigenously designed nets and diverse methods of fish capturing devices are adopted for fishing in the beel fisheries of Assam. The indigenous fishing methods employed are varied and no doubt, the outcome of tradition and possibly the result of long years of trial for perfection have made them most suitable for that particular environment. Assam and other Northeastern states, as such, have no dearth of indigenous fishing methods and many of them are unreported till date.

Therefore, an attempt has been made to focus on certain indigenous methods, which were recorded during the present work that are described hereunder.

Katal Fishing

'Katal fishing' or *'Katalmara'* (Yadav, 1981) is a method, which is extensively used (33 out of 55 total surveyed beels) in the beel fisheries of Assam (Table-3.4). The method was probably brought to this region by the migrating fishermen from Bangladesh and has now come to stay as a profitable method of fishing in beels. It is also known as *'Jeng'* in lower Assam. Though the method is very simple and low investment but requires a long time between installation and harvesting.

'Katals' are lures and the motive is to entice fishes in accumulated mass of bushes (Fig.3.38), weeds and tree branches for a period of 2-3 months, where they form their abode and are finally caught by enclosing the area. The circumference of the inner periphery, which constitutes the main *'Katal'* ranges in between 200-320m. In the inner periphery water hyacinth, bushes and tree branches are dumped together and a circle made by fixing tree stumps around this vegetation mass to avoid scattering. The outer periphery about 4-6m all around denotes the territorial right of

the; *Katal*' and is treated as 'no disturbance area', where no boats are allowed to move.

The installation period of '*Katals*' is post monsoon (September-October) when the beel water starts receding. In suitable places with water depth varying from 1.5-3.0m the '*katals*' are arranged and lie dispersed all over the beel. These are then left as such up to 2-3 months when the beel water recedes and fishing starts. A few days prior to the harvest the *'katals'* are encircled by '*katalmarajal'* and '*Banas*' closely woven bamboo matting. When the actual fishing starts, a group of 20-30 fishermen depending upon the size of the *'katal'* enter the encirclements. The circle is gradually reduced, vegetation set aside and with the help of cast nets, encircling gears, *thella jal* the fishes are caught. The operation is carried out from boat and it lasts for 8-12 hours where by harvesting the complete *'katal'* at a stretch. In certain beels after complete harvesting again the '*katal*' is arranged with the help of same bushes, tree stumps and bamboos, which are then harvested after 1-2 months.

Banas Fishing

This method of fishing is practiced in those beels, which are well connected to river by a channel (Fig. 3.39). The channel plays a pivotal role during monsoon season; when with the water current, adults and juveniles of various species enter the beel for breeding, feeding, temporary migration, etc. With the waning monsoon, the current starts receding towards the river and many species undertake their return journey and this stage '*Banas*' fishing commences. During the present work, this method of fishing was recorded in 11 beels as shown in the table-3.4.

'Banas' are erected on the outlet channel, which connects to the nearby river. For the preparation and erection of '*Banas*' locally available giant variety of bamboo are cut into thin strips and closely woven with coir rope into screens of 2-3m length and 6m width. Besides standing long immersion in water with no change in shape, the screen permits as low an inter space as 0.5-1.0 cm between the stripes. The screens of '*Banas*' are fixed across the channel, bank to bank, with the help of wooden stakes.

The submerged portion of '*Banas*' are further lined inside by gill nets which are folded to trap fishes in their attempt to jump over the '*banas*'. In the center of the channel a 3-5 m wide gap is left. A dip net is installed in this gap. 8-10m behind this placement, another obstruction of *banas* is arranged from bank to bank giving a similar V shape in the center. In this 'V' a gill net is placed which is tied with bamboo sticks in the boarder end of the V, and at the narrow end the net is tied to poles. The enclosure is known as '*Bharal*' or the storehouse. One or two dip nets are placed in between the two bamboos periphery.

The fixing of with the decline of the monsoon and the fixing starts from the middle of August *banas*' starts and lasts till November. The maximum catch is landed by the dip net. Four to five men position themselves at the anterior end of the 'V' and at the intervals lift the gill net with the help of already attached bamboo poles. Fishes attempting to jump the '*banas*' are caught in the pockets of the net lining the submerged portion of '*banas*'.

The catch composition comprises of *G. chapra, E. vacha, L. calbasu* etc. Besides this, fingerlings of Indian Major Carps and Hilsa spp. are also caught in plenty.

Khati Dori Fishing

'*Khati dori*' fishing is recorded in 11 beels all of which belongs to Karimgunj, Cachar and Hailakandi districts of Assam. It is a kind of fishing by traps (Fig. 3.40). The term '*khati*' implies to all pits and ditches round a man's homesteads or fields. The '*Dori*' on the other hand is a trap, the average height of which is 0.75m and width 0.50 m. Dories are made of bamboo sticks and approximate cost of fabrication may range from Rs. 40 to Rs. 70 depending upon the size.

The modus operandi of *khati dori* is very simple. A large number of dories are tied well with a 200-500m long rope, which is fixed at a certain place with bamboo poles. The dories are tied to the main rope at equal distance of about 2 or 3m apart. Fishes are trapped in the dories during their search of food, shelter, or migration. At a time

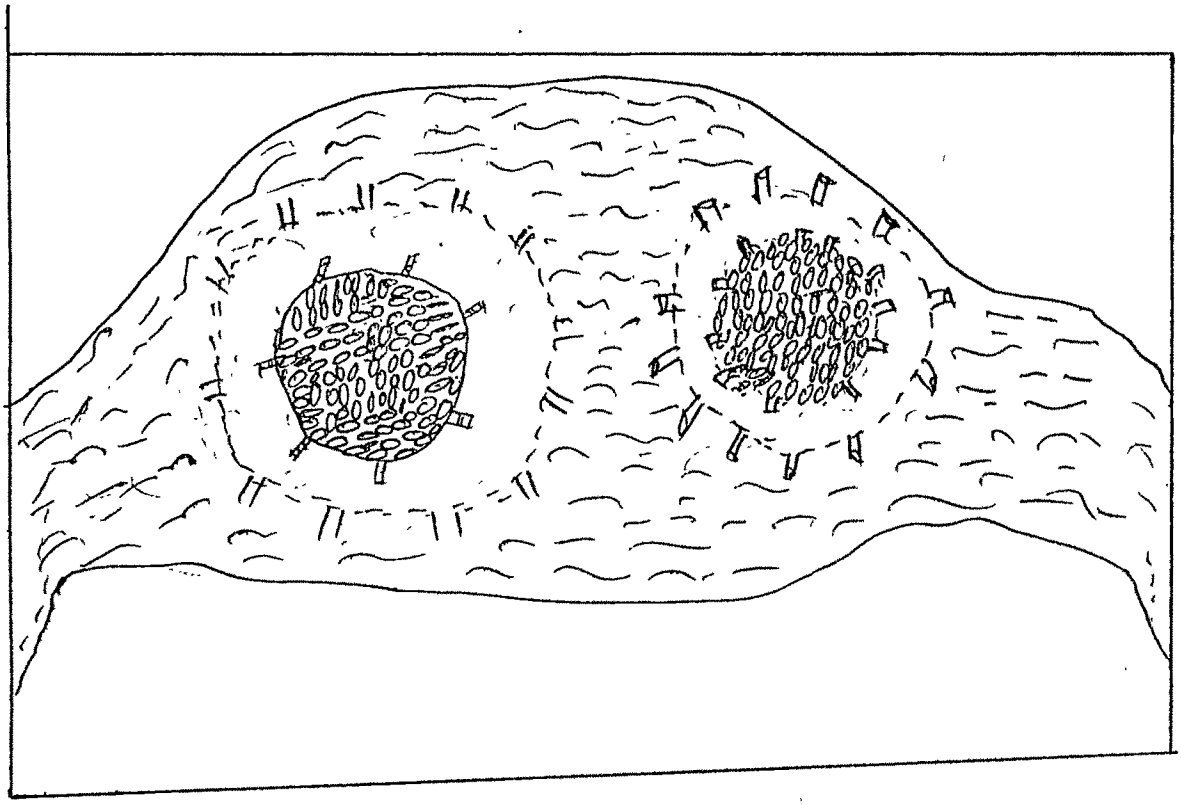

Fig.3.38 Katal Fishing

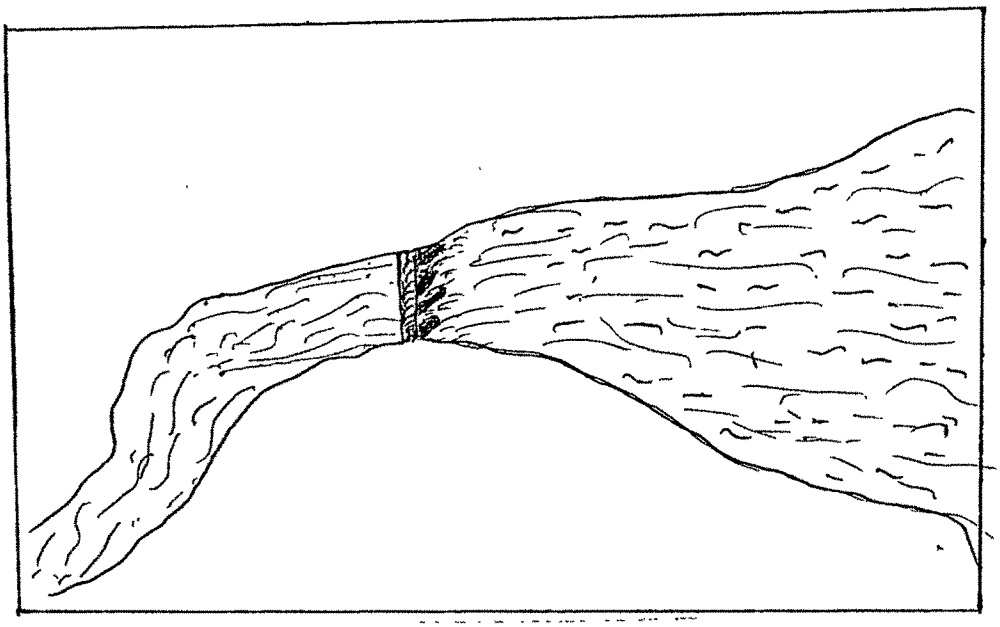

Fig.3.39 Banas Fishing

interval of 1-2 hours, dories are emptied by two to four fishermen with the boats. The catch composition comprises of mainly intermediate groups of fishes. Thus a good income is derived from the sale of fish from the *khati-dori* in the beels of Cachar district.

Tik-Tiki Khedani

This method of fishing was recorded in Nandini-Karmari, and Brahmamaijan beel of Morigaon district, which was probably brought to this region by migrating fishermen from Bangladesh.

The 'modus operandi' of *'tik-tiki khedani'* is very interesting to note (Fig. 3.41). It needs utensils, made of aluminium, and gill nets. At the one end of the beel gill nets (*langijal* and *phansijal*) are set at the surface layer of the water column with the help of bamboo poles stretching the whole width of the beel. On the another end (in case of small beels) or a certain position (in case of larger beel) which is at a considerable distance from the gill net, fishermen move towards the net making noises with the help of their utensils and also making disturbances to beel water with the help of split bamboo. Generally 2-4 boats are needed depending upon the width of the beel and each boat comprises of 2-3 fishermen. The positions of the boats cover the whole width of the beel. Thus the fishermen approach to the nets by making continuous noises and disturbing water. The sounds and disturbance of water compel fishes to migrate towards the safe shelter place but they are entangled to the nets when they attempt to cross the net. After reaching to the nets fishermen lift the net and fishes are landed on the boat. Thus the process is repeated again and again and finally results a good income at the end of the day.

'Tik-tiki khedani' fishing is also practiced during nighttime by applying the same methods. But at night-lights are used at the time of fishing.

Draining Fisheries Dry

It is an extremely common method of destruction of fish practiced in certain beels like Bhitorpuni (Cachar), Tapang (Cachar) and Meda beel (Karimgunj) of Assam, by

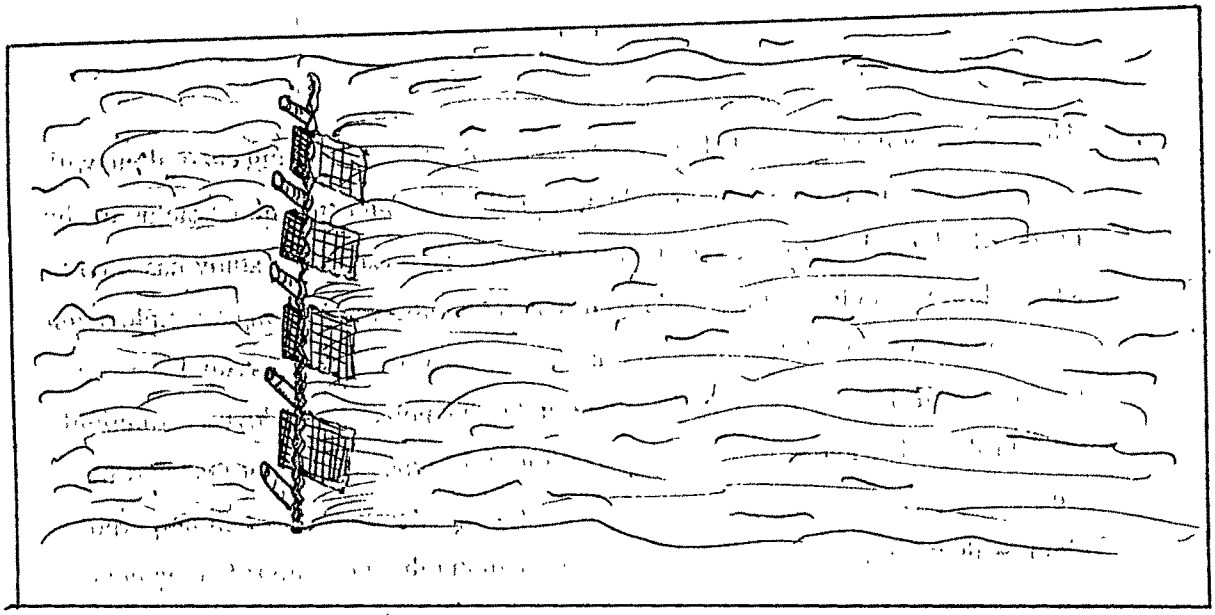

Fig.3.40 Khati-Dori Fishing

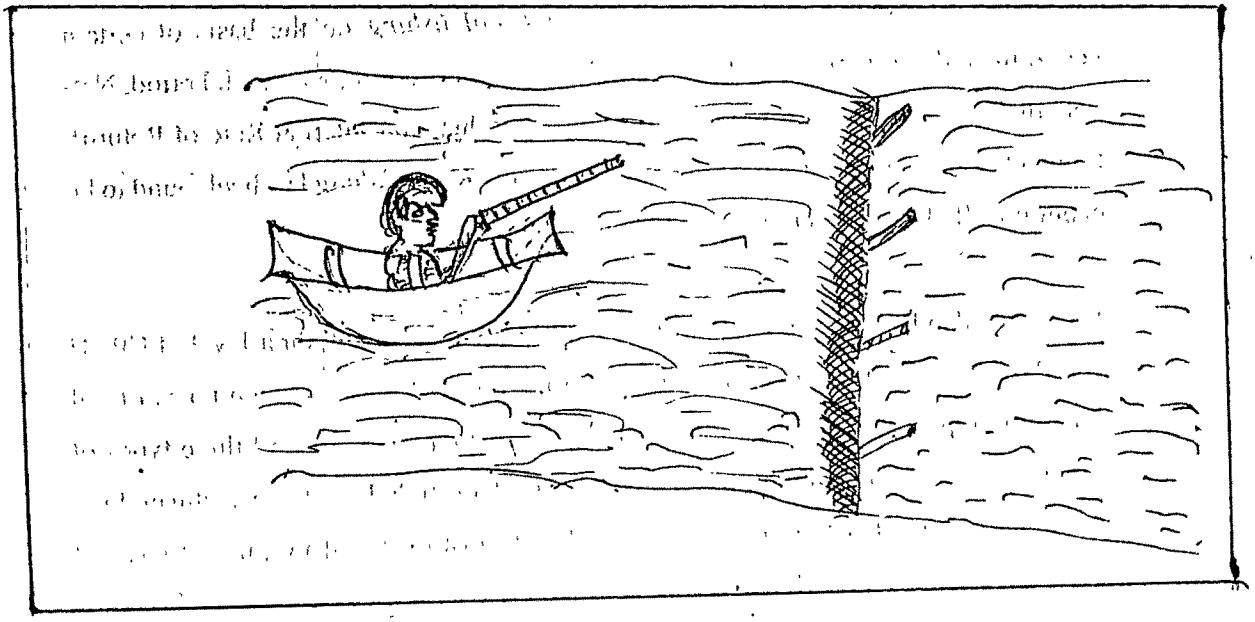

Fig. 3.41 Tik-Tiki Khedani Fishing

draining the fishery completely dry and then catching every fish in it by hand or by some other instruments. This method is seen working in all small fisheries. When they practiced partially dry they had to make a '*Bheta*' or '*Bandh*' with the help of swamps and muds which divides the beel into two halves. The water from one half of the beel is dried first for fishing purposes the other half is dried to fish the beel completely.

Khatia Fishing

'*Khatia*' fishing was recorded in 11 numbers of beels that belongs to Cachar, Karimgunj and Hailakandi districts of Assam, is a similar system to that the draining fisheries dry. In this system certain deeper portions of the beel are separated for a period of three years. In the first year, as soon as the water begins to subside (November), the lessee puts up low embankments wherever necessary all around his plot. In the second year, nothing is done actually and the lessee only watches that no fishing takes place within his enclosures. In monsoon season, the embankments are covered by the floodwater, and the confined fish go out freely.

But when the water begins to go down, they come back to their enclosures, which they consider to a sanctuary, and possibly also tempt other friends in. In the third year, the same process is repeated and many more fishes come in. When the water round the enclosures has gone down sufficiently, a narrow drainage cuts, with a sieve at the mouth, are opened in the embankment and the enclosure drained absolutely dry. All the fishes, which have taken shelter in it are then easily caught. This method of extermination after inducing confidence is said to work very well, and is most lucrative.

SEASONAL VARIATION

Fishing activity follows a seasonal pattern after a partial closing in May; the main effort establishes itself in October and lasts until April. During heavy rain i.e. in monsoon (Jun-Sep) fishing become difficult and this time is known as slack season.

But partial fishing in the beel fisheries also practiced in monsoon season also. Thus the total number of fishing days in the beel fisheries of Assam ranged between 240 and 270 days.

The study on seasonal variation revealed that most of the gears such as *khewali jal, puthilangi, kaoi langi, Ghoka jal, juluki, boldha, jakoi,* hooks and line and fishing spears such as *joar, pocha, jhogra, pokora, dukathi* and tiara were used all through the year. But other gears exhibited seasonal pattern in their use. As shown in the table it was evident that *musari jal, ber jal, horhori jal, moi jal, panti jal, phansi jal, goroi langi* and polo were used mainly in pre and post monsoon (Mar-May and Oct-Nov). Likewise, in monsoon season (Jun-Sep) *jata jal, dharma jal, ghat jal, sepa, darki, dingora,* and hooks and line predominated the fishing. In winter (Dec-Feb) season there was no choice and all types of gears were recorded in use.

The study also revealed that *Bana* and *Serakashi* fishing (indigenous fishing device) practiced in pre and post monsoon season and *Katals* (indigenous fishing device) were harvested in winter season, which were installed in the post monsoon or at the advent of winter.

Table-3.1 Seasonal variations of gears and fishing methods

Season	Month	Types of gears and methods
Pre and Post monsoon	Mar - May and Oct - Nov	Musari jal, ber jal, Moi or Doli jal, Horhori jal, Panti jal, Phansijal, Goroi langi, Polo, Bana fishing, Serakashi fishing.
Monsoon	Jun - Sep	Jata jal, Dharma jal, Ghat jal, Sepa, Darki, Dingora and Iron and Bamboo hooks.
Winter	Dec - Feb	All gears and Katal fishing, Khati-Dori fishing and Tik-tiki khedani.
All through the year	-	Khewali jal, Puthi langi, Kaoi langi, Ghoka jal, Juluki, Jakoi, Boldha, Iron hooks and fishing spears like Joar, Pocha, Jhogra, Pokora, Dukathi, Tiara.

DISCUSSION

The survey of the fishing gears and their methods of operation in various beels (water bodies) of Assam reveals that 36 types of fishing gears are in vogue in commercial use, which belongs to eight categories (Table-3.3). The topography of beel area and behaviour of the fishes play a dominant role on the types of fishing gear used in fishing processes (George, 1971) but no such demarcation have been noticed regarding the distribution of fishing gears in different types of beels of Assam (Table. 3.2). Hutchinson (1957) differentiated 76 types of lakes on the basis of geo-morphological inceptions. While generalizing these lakes types into nine major groups, Wetzel (1975) observed that the lake basins of tectonic origin were occasionally formed in areas of localized subsidence that result from earthquake. Morphologically, the floodplain wetlands of Assam are classified, based on their sizes, into four categories namely - *Purely riverine horseshoe shaped, Tubular elongated, Oval floodplain,* and *Rectangular.*

As shown in the Table-3.2 it is evident that *musarijals* (encircling gear), and *langijals* and *phansijals* (entangling gear) are the most extensively used implements in commercial fishing. *Musarijal* is found in 51 and 52 beels respectively where it is used for commercial purpose. The fishing with this gear is banned during 1st May to July 15th vide Assam Fisheries Rule, 1953 (Phukan, 2001). Another type of encircling net is the *'Ber jal'* or *'Borjal'* the design details of which are same as *'musharijal'* except the mesh size (25-30mm). These gears are generally operated in the deep areas of the main beel and are observed in 25 beels.

The seines used in the beel fisheries of Assam show certain peculiarities when compared with the conventional shore seines of the East Coast. The most important differences of these, is the absence of a bag or bunt at the mid length of the net from end to end, while the other is the presence of peripheral pockets in some of the seines. Hornell (1924) and Naidu (1938) have observed similar features in the seines of the river Ganga, Padma, and Hoogly.

Hornell (1925) has stated that seines with the above characteristics are very primitive. It seems that the uniform width of the net is a feature, which is closely associated with the steep nature of the riverbanks and the relatively even depth of the fishing ground (Joseph, et al., 1965). Hence, it is quite likely that the above features have been developed to suit the peculiar ecological and topographical needs of the beel fishery system of Assam.

'Mah' fishing with *'Ber jal'* shows a close resemblance to the *'Veri'* fishing in Baroda waters described by Pillai, 1957. But considering the method of operation and the method by which fish are brought into relationship with the gear, *'Mah'* fishing resembles gill netting and dragging than the seining.

The gill nets of the set type are the principal fishing gear in the reservoirs in which there are many underwater obstructions (George, 1971). In the beel fisheries of Assam gill nets come next in importance to seines. Of the gill nets *langijal* in 52 beels and *phansijal* in 51 beels are found in the use for commercial purposes. The line of demarcation between seines and certain type of gill nets (*Langijal*) seems to be intermediate as gill nets are some time operated in the fashion of seines. De (1910) has classified *'langijal'* as drag nets while Hornell (1924) has treated it as 'gilling seines'. During the present survey it has been observed that fish are caught in these nets by gilling or enmeshing. *'Langi'* nets are some times used to drag or encircle an area. But such practices are only the means to scare and drive fish into the net. The main distinction between *'Langi'* and *'Phansi'* lies in the method of operation and rigging. The footrope of the 'Langijal' touches the bottom during operation whereas in the latter it does not. The footrope in 'Phansijal' is devoid of sinkers.

De (1910), Hornell (1924), Naidu (1938), and Mitra (1952) have also considered the gill nets among the principal type of fishing nets of the Gangetic system. Similarly, Dutta (1973) considered the gill nets as one of the most important types of commercial gear in Hoogly estuary. Kuriyan (1973) described the gill nets as the

fishing gear in common use in the fresh water reservoir of India. But in contrast to the above facts Khan, et al., 1992 reported that simple gill nets were less effective in comparison with the other entangling nets such as frame nets, vertical line nets and trammel nets.

The present study reveals that '*Khewali jal*' i.e. cast net is used all through the year in the beels of Assam unlike other gears which show a distinct seasonal pattern. This gear is generally found in operation in the shallow depth areas of the beel and can be placed third in order of importance. The remarkable feature of cast net is the presence of peripheral pockets as described by Von Brandt (1968). Moreover, Von Brandt (1964) considered that the cast nets originated in India.

The scooping gears such as *Dharma jal* and *Dhenki jal'* are also used all through the year except stormy weather. *Dhenkijal* resembles with '*Khora jal*' (Joseph, 1965) in shape and operation and are mostly used in flood season. Dharmajal on the other is used all through the year. Hickling (1961) reports similar methods from Indo-China and South India.

Contrivances for trapping fish may be presumed to antedate the invention of nets (Hornell, 1938). In the beel fisheries of Assam different types of fish traps have been found in operation. They are found to have economic and energy related advantages over active search and capture methods (Mohan Rajan, 1993). But the use of perch traps has been criticized because of their low catching power (Stott, 1970). The present survey has shown that there is a marked seasonal variation in the catching power of traps, which to a large extent can be attributed to the behavior of fish. In general, trap is a highly versatile fishing gear whose dexterous operation enables several scattered areas to be worked out simultaneously.

Fishing methods in beels are diverse and some of them are unique. Common gears such as cast nets, gill nets, dip nets, and traps are in vogue. But certain beels offer

ample scope to certain indigenous fishing devices such as '*Katal*' fishing (Yadav, et al., 1981) and *'Banas'* fishing (Yadav et al., 1986).

Among the indigenous fishing devices *Katal* fishing is a unique and assured method of capturing big size fishes. This method has some resemblances with the *'Byana'* fishing of West Bengal (Day, 1877). In lower Assam it is know as 'Jeng' fishing. This special fishing device needs '*Khewali jal'* (cast net), '*Ghurni jal'*, '*Catalmara jal'*, and *'Ber jal'* (encircling gear) and certain other gears such as '*athua jal'* (trawl net) and '*thela jal'* (dip and lift net). The catch composition includes mainly the major carps. This method of fishing in the beels of Assam is very much popular which has been recorded in 33 nos. of beels (60%).

Likewise, *Banas* are fixed barriers, erected across the channel to prevent return of fishes from the beel to the river along with the receding waters. It is considered one of the major fishing methods where the beel has a connection with the river. It was recorded in 11 beels (20%) as shown in table-3.4. *G.chapra, E.vacha,* Adults and juveniles of *H.ilisha* entering the beel along with the floods, tend to return with the receding waters and are chiefly caught. It also acts as an obstruction for the commercially important varieties like *L.rohita, C.catla, C.mrigala, L.gonius,* and feather backs migrating back to the river.

'*Banas'* fishing was introduced in Dhir beel, Dhubri district of Assam, by Bihari fishermen in late sixties and the method met with tremendous success, which led the other beel fishermen adopting this technique (Yadav, 1981). *Banas* fishing has some resemblance to *Roak* fishing of River Yamuna (Wishard, 1976). However, *'banas'* are in vogue in post monsoon months, whereas '*roak*' is operated during pre-monsoon months. Unlike *'roak'* fishing this method does not have much deleterious effect on the fisheries except the wanton killing of juveniles of IMCs and other commercially important species.

Khati-Dori fishing is recorded in 11 nos. of beels (20%) Cachar, Karimgunj and Hailakandi district only and no reports are available regarding this method of fishing or similar to it. From the economic point of view it seems to be cost effective because it needs only one person to operate and a single boat. Moreover, as the traps (Dories) are fixed with bamboo poles and tied with ropes fisherman has to approach to the traps only at the time of hauling which generally occurs at an interval of 4-6 hours. Therefore, this type of fishing device is not time consuming like other methods.

Khatia fishing, which has been recorded in 11 nos of beels (20%) of Cachar and Karimgunj district, is a similar method to that of 'Draining fisheries dry' as described by De (1910). But this method needs three years for fishing purposes, which is not possible for commercial fishermen to spare.

The study on seasonal variation of the use of fishing gears support the statement provided by Changeux, et al., 1993 that fishing activity follows seasonal pattern. The pre-monsoon, post-monsoon and winter are the main fishing season in the beels and all most all gears are used in these seasons. Moreover, in winter katals are harvested which yield a substantial catches of the beels.

CONCLUSION

The study reveals that the beel fisheries of Assam use not less than 37 types of fishing gears (fishing nets, traps, and spears), which belongs to eight categories. Moreover, indigenous fishing devices are also in vogue in the beels. *Katal fishing* is one of the most popular fishing practices in the beel fisheries. The study also reveals that fishing activity allows seasonal pattern and per-monsoon, post-monsoon and winter season are the main fishing season of the beels. *Katal* are also harvested in winter season.

Table- 3.2 Gears Used in Beel Fishereis of Assam

Name of beel	District	Category of the Beel	Types of gears used in the beel.
Kalidanga	Dhubri	Purely Riverine Horse-shoe Shaped	Musarijal, Berjal, Khewalijal, Phansijal, Langijal, Dolijal, and Hooks and line.
Hakama	Dhubri	Purely Riverine Horse-shoe Shaped	Musarijal, Berjal, Khewalijal, Phansijal, Langijal, Dolijal, and Hooks and line.
Nandini	Dhubri	Purely Riverine Horse-shoe Shaped	Berjal, Khewalijal, Phansijal, Langijal, Dolijal, and Hooks and line.
Harinchora	Dhubri	Purely Riverine Horse-shoe Shaped	Musarijal, Berjal, Khewalijal, Phansijal, Langijal, Parangijal, and Hooks and line.
Barundanga	Dhubri	Purely Riverine Horse-shoe Shaped	Musarijal, Berjal, Khewalijal, Phansijal, Langijal, Parangijal, and Hooks and line.
Bhoispuri	Dhubri	Purely Riverine Horse-shoe Shaped	Musarijal, Berjal, Khewalijal, Phansijal, Langijal, Parangijal, and Hooks and line.
Jogra	Dhubri	Purely Riverine Horse-shoe Shaped	Musarijal, Berjal, Khewalijal, Phansijal, Langijal, Parangijal, and Hooks and line.
Chandakhal	Dhubri	Tubular Elongated	Musarijal, Berjal, Khewalijal, Phansijal, Langijal, Parangijal, and Hooks and line.
Sagmara	Barpeta	Purely Riverine Horse-shoe Shaped	Musarijal, Khewalijal, Phansijal, Langijal, Ghatjal, and Hooks and line.
Borbilla	Nalbari	Oval Flood Plain.	Musarijal, Berjal, Khewalijal, Phansijal, Langijal, Parangijal, and Hooks and line.
Botuakamakhya	Nalbari	Purely Riverine	Musarijal, Berjal, Khewalijal, Phansijal, Langijal, Parangijal, and

		Horse-shoe Shaped	Hooks and line.
Siligurijan	Kamrup	Tubular Elongated.	Musarijal, Khewalijal, Phansijal, Langijal, Dolijal, Horhorijal.
Deepar Beel	Kamrup	Oval Flood Plain.	Musarijal, Berjal, Khewalijal, Phansijal, Langijal, Dhenkijal, and Hooks and line.
Solmari	Kamrup	Oval Flood Plain.	Khewalijal, Langijal, and Parangijal.
Batha	Darrang	Purely Riverine Horse-shoe Shaped	Musarijal, Khewalijal, Phansijal, Langijal, Dhenkijal, and Hooks and line.
Roumari	Darrang	Purely Riverine Horse-shoe Shaped	Musarijal, Khewalijal, Phansijal, Langijal, Dhenkijal, and Hooks and line.
Diplinga-mailata	Darrang	Rectangular.	Musarijal, Khewalijal, Phansijal, Langijal, Dhenkijal, and Hooks and line.
Gathia	Darrang	Oval Flood Plain.	Musarijal, Khewalijal, Phansijal, Langijal, and Dhenkijal.
Mori Beel	Morigaon	Purely Riverine Horse-shoe Shaped	Musarijal, Khewalijal, Phansijal, Langijal, Dhenkijal, and Horhorijal.
Bormonoha	Morigaon	Tubulat Elongated.	Musarijal, Khewalijal, Phansijal, Langijal, Dhenkijal, and Horhorijal.
Jaluguti	Morigaon	Oval Flood Plain.	Musarijal, Khewalijal, Phansijal, Langijal, Dolijal, Horhorijal, and Hook and Line.
Kasodhora	Morigaon	Tubular Elongated.	Musarijal, Khewalijal, Phansijal, Langijal, Dolijal, Horhorijal, Parangijal, and Hook and Line.
Kujibalipatti	Morigaon	Oval Flood Plain.	Musarijal, Khewalijal, Phansijal, Langijal, Dolijal, Horhorijal, Parangijal, and Hook and Line.
Deora	Morigaon	Oval Flood Plain.	Musarijal, Khewalijal, Phansijal, Langijal, Dolijal, Horhorijal, Parangijal, and Hook and Line.
Thekera	Morigaon	Oval Flood Plain.	Musarijal, Berjal, Khewalijal, Phansijal, Langijal, Dolijal, Horhorijal, and Hook and Line.
Udori	Morigaon	Tubular Elongated	Musarijal, Khewalijal, Phansijal, Langijal, Ghatjal, Horhorijal, and Hook and Line.

Nandini-Karmari	Morigaon	Purely Riverine Horse-shoe Shaped	Musarijal, Khewalijal, Phansijal, Langijal, Ghatjal, Horhorijal, and Hook and Line.
Lakhanabandha	Nagaon	Purely Riverine Horse-shoe Shaped	Musarijal, Khewalijal, Phansijal, Langijal, and Hook and Line.
Satiyan	Nagaon	Purely Riverine Horse-shoe Shaped	Musarijal, berjal, Khewalijal, Phansijal, Langijal, Ghatjal, and Hook and Line.
Siyalekhaity	Nagaon	Oval Flood Plain.	Musarijal, Khewalijal, Phansijal, Langijal, Dhenkijal, and Hook and Line.
Dighalipatali	Nagaon	Purely Riverine Horse-shoe Shaped	Musarijal, berjal, Khewalijal, Phansijal, Langijal, Ghatjal, and Hook and Line.
Brahmamaijan	Nagaon	Purely Riverine Horse-shoe Shaped	Musarijal, Khewalijal, Phansijal, Langijal, Ghatjal, and Hook and Line.
Pungani	Golaghat	Purely Riverine Horse-shoe Shaped	Mahajal, Barjal, Khewalijal, Phansijal, Langijal, Ghatjal, and Hook and Line.
Ganak-Dubai-Duba	Golaghat	Purely Riverine Horse-shoe Shaped	Barjal, Phansijal, Langijal, Ghatjal, and Hook and Line.
Goroimaro-Bihdia-Jopora	Golaghat	Purely Riverine Horse-shoe Shaped	Musarijal, Khewalijal, Phansijal, Langijal, Ghatjal, and Hook and Line.
Merkolaberia	Golaghat	Purely Riverine Horse-shoe Shaped	Musarijal, Khewalijal, Phansijal, Langijal, Parangijal, and Hook and Line.
Tinsuki-borbeel	Golaghat	Purely Riverine Horse-shoe Shaped	Musarijal, Khewalijal, Phansijal, Langijal, Parangijal, and Hook and Line.
Moridisoi	Golaghat	Purely Riverine Horse-shoe	Musarijal, Khewalijal, Phansijal, Langijal, Dhenkijal, and Hook and Line.

		Shaped	
Botalikhosa	Golaghat	Rectangular.	Musarijal, Berjal, Khewalijal, Phansijal, Langijal, Dhenkijal, and Hook and Line.
Bihdia	Golaghat	Purely Riverine Horse-shoe Shaped	Musarijal, Berjal, Khewalijal, Phansijal, Langijal, Dhenkijal, and Hook and Line.
Teliadanga	Sibsagar	Rectangular.	Musarijal, Berjal, Khewalijal, Phansijal, Langijal, Dhenkijal, and Hook and Line.
Moridikhow	Sibsagar	Purely Riverine Horse-shoe Shaped	Musarijal, Berjal, Khewalijal, Phansijal, Langijal, Dhenkijal, and Hook and Line.
Salchapra	Cachar	Purely Riverine Horse-shoe Shaped	Musarijal, Purjal, Khewalijal, Phansijal, Langijal, and Hook and Line.
Sibnarayanpur Anua	Cachar	Purely Riverine Horse-shoe Shaped	Musarijal, Khewalijal, Phansijal, Langijal, and Hook and Line.
Baskandi	Cachar	Purely Riverine Horse-shoe Shaped	Musarijal, Purjal, Khewalijal, Phansijal, Langijal, Parangijal, and Hook and Line.
Auti-Bauti	Cachar	Oval Flood Plain.	Musarijal, Purjal, Khewalijal, Phansijal, Langijal, and Hook and Line.
Tapang	Cachar	Oval Flood Plain.	Musarijal, Purjal, Khewalijal, Phansijal, Langijal, and Parangijal.
Rani-Megna	Karimgunj	Purely Riverine Horse-shoe Shaped	Mahajal, Khewalijal, Phansijal, Langijal, Dhenkijal, and Hook and Line.
Sagar	Karimgunj	Purely Riverine Horse-shoe Shaped	Mahajal, Khewalijal, Phansijal, Dhenkijal, Parangijal, and Hook and Line.
Gopharchang	Karimgunj	Purely Riverine Horse-shoe Shaped	Mahajal, Khewalijal, Phansijal, Dhenkijal, and Hook and Line.
Angang	Karimgunj	Purely Riverine	Mahajal, Khewalijal, Phansijal, Dhenkijal, and Hook and Line.

		Horse-shoe Shaped	
Sone Beel	Karimgunj	Oval Flood Plain.	Mahajal, Khewalijal, Langijal, Dhenkijal, and Hook and Line.
Rata	Karimgunj	Purely Riverine Horse-shoe Shaped	Mahajal, Khewalijal, Langijal, Dhenkijal, and Hook and Line.
Saitali	Karimgunj	Purely Riverine Horse-shoe Shaped	Langijal, Dhenkijal, and Hook and Line.
Digar-bakri-baiya	Hailakandi	Purely Riverine Horse-shoe Shaped	Musarijal, Purjal, Khewalijal, Phansijal, Langijal, Dhenkijal, and Hook and Line.

Table-3.3. Gears found in different beels of Assam

Category of Gears.	Name of Gears.	Name of Beels Used the Gear Mostly (Nos.).	Name of Beels Used the Gear Occasionally (Nos.).
2. Impaling Gears.	***Jongar***	Siligurijan, Deepar beel, Lakhanabandha, Satiyan, Siyalekhaity, Dighali-patali, Brahmamaijan, Teliadanga, Moridikhow, Batha, Raumari, and Gathia. **Total Nos. 12 (%).**	Kalidanga, Hakama, Nandini, Harinchora, Barundanga, Bhoispuri, Salchapra, Sibnarayanpur, Baskandi, Auti-Bauti, Digar-bakri, Rani-Megna, Sone, Rata, and Satali. **Total Nos. 15 (%).**
	Tiara	Kalidanga, Hakama, Nandini, Harinchora, Salchapra, Sibnarayanpur, Baskandi, Auti-Bauti, Digar-bakri, Rani-Megna, Sone, Rata, and Satali. **Total Nos. 13 (%).**	Brahmamaijan, Teliadanga, Moridikhow, Batha, Raumari, and Gathia. **Total Nos. 6 (%).**
	Pokora	Jaluguti, Deora, Thekera, Nandini-Karmari, Lakhanabandha, Siyalekhaity, Baskandi, Digar -bakri, Sagar, Angang, Saitali, Pungani, Bihdia, Teliadanga, Batha, and gathia. **Total Nos. 16 (%)**	Bormonoha, Kasodhora, Satiyan, Dighali-patali, Tapang, Rani-megna, Botalikhosa, and Raumari. **Total Nos. 8 (%).**
	Kol or Kati	Salchapra, Sibnarayanpur, Baskandi, Auti-Bauti, Tapang, Meda, Digar -bakri, Rani-megna, Sagar, Gopharchang, Angang, Sone, Rata, Saitali, Batha, and gathia. **Total Nos. 16 (%)**	Jaluguti, Deora, Thekera, Nandini-Karmari, Lakhanabandha, Siyalekhaity, Pungani, Bihdia, Teliadanga. **Total Nos. 9 (%).**
3. Traps	***Ghani***	Salchapra, Sibnarayanpur, Baskandi, Auti-Bauti, Digar-bakri, Rani-Megna, Sone, Rata, and Satali. **Total Nos. 9 (%).**	Nandini, Harinchora, Barundanga, Bhoispuri, Pungani, Ganak-Dubai-Duba, Merkolaberia, Moridisoi, Botalikhosa, Batha, Mailata-Diplinga, and Raumari. **Total Nos. 13 (%).**
	Chepa	Nandini, Harinchora, Barundanga, Bhoispuri, Siligurijan, Deepar beel, Jaluguti, Deora, Thekera, Nandini-Karmari, Lakhanabandha, Siyalekhaity, Pungani, Bihdia, Teliadanga. Salchapra, Sibnarayanpur, Baskandi, Auti-Bauti, Tapang, Meda, Digar -bakri, Rani-megna, Sagar,	Hakama, Barundanga, Jogra, Solmari, Mori, Bormonoha, Satiyan, Brahmamaijan and Botalikhosa. **Total nos. 9 (%).**

		Gopharchang, Angang, Batha, Raumari, Mailata-Diplinga and gathia. **Total Nos. 30**	
	Dingora	Kalidanga, Hakama, Barundanga, Bhoispuri, Siligurijan, Deepar beel, Jaluguti, Deora, Thekera, Nandini-Karmari, Lakhanabandha, Siyalekhaity, Pungani, Ganak-dubai-duba, Botalikhosa, Bihdia, Teliadanga. Salchapra, Sibnarayanpur, Baskandi, Auti-Bauti, Tapang, Meda, Digar -bakri, Rani-megna, Sagar, Gopharchang, Angang, Batha, Raumari, Mailata-Diplinga and gathia. **Total Nos. 32**	Nandini, Harinchora, Solmari, Bormonoha, Brahmamaijan. **Total Nos. 5**
	Derki	Harinchora, Barundanga, Bhoispuri, Deepar beel, Jaluguti, Deora, Thekera, Nandini-Karmari, Siyalekhaity, Pungani, Bihdia, Teliadanga. Salchapra, Auti-Bauti, Tapang, Meda, Digar -bakri, Rani-megna, Sagar, Gopharchang, Angang, Batha, Mailata-Diplinga and gathia. **Total Nos. 24**	Nandini, Siligurijan, Lakhanabandha, Sibnarayanpur, Baskandi, Raumari. **Total Nos. 6**
	Dalangi	Hakama, Jogra, Bhoispuri, Siligurijan, Deepar beel, Jaluguti, Deora, Thekera, Lakhanabandha, Siyalekhaity, Pungani, Bihdia, Goroimari-Bihdia-Jopora, Moridisoi, Baskandi, Auti-Bauti, Tapang, Meda, Digar -bakri, Rani-megna, Sagar, Gopharchang, Angang, Batha, Raumari, Mailata-Diplinga and gathia. **Total Nos. 27**	Nandini, Harinchora, Barundanga, Nandini-Karmari, Teliadanga. Salchapra, Sibnarayanpur. **Total Nos. 7**
	Chunga	Nandini, Hakama, Barundanga, Bhoispuri, Jogra, Siligurijan, Deepar beel, Jaluguti, Deora, Thekera, Nandini-Karmari, Lakhanabandha, Siyalekhaity, Merkolaberia,	Harinchora, Solmari, Mori, Kujibalipatti, Dighali-patali, Pungani, Bihdia, Moridikhow, Mailata-Diplinga. **Total Nos. 9**

		Tinsuli-borbil, Teliadanga. Salchapra, Sibnarayanpur, Baskandi, Auti-Bauti, Tapang, Meda, Digar -bakri, Rani-megna, Sagar, Gopharchang, Angang, Batha, Raumari, and gathia. **Total Nos. 31**	
	Boldha	Siligurijan, Deepar beel, Jaluguti, Deora, Thekera, Nandini-Karmari, Lakhanabandha, Siyalekhaity, Pungani, Bihdia, Teliadanga, Batha, Raumari, Mailata-Diplinga and gathia. **Total Nos. 15**	Nandini, Harinchora, Barundanga, Bhoispuri, Salchapra, Sibnarayanpur, Baskandi, Auti-Bauti, Rani-megna, Sagar, Gopharchang, Angang. **Total Nos. 12**
	Cherha	Barundanga, Bhoispuri, Solmari, Jaluguti, Deora, Thekera, Nandini-Karmari, Lakhanabandha, Siyalekhaity, Pungani, Bihdia, Teliadanga. Salchapra, Rani-megna, Sagar, Gopharchang, Angang, Batha, Raumari, Mailata-Diplinga and gathia. **Total Nos. 21**	Nandini, Harinchora, Siligurijan, Deepar beel, Sibnarayanpur, Baskandi, Auti-Bauti. **Total Nos. 7**
	Thorka	Harinchora, Barundanga, Bhoispuri, Siligurijan, Jaluguti, Deora, Thekera, Nandini-Karmari, Lakhanabandha, Pungani, Batha, Mailata-Diplinga and gathia. **Total Nos. 13**	Nandini, Bihdia, Teliadanga, Raumari. **Total Nos. 4**
	Bamidhora	Nandini, Harinchora, Barundanga, Thekera, Nandini-Karmari, Pungani, Bihdia, Teliadanga. Batha, Raumari, and gathia. **Total Nos. 11**	Bhoispuri, Siligurijan, Deepar beel, Jaluguti, Deora, Lakhanabandha, Siyalekhaity, Mailata-Diplinga. **Total Nos. 8**
	Khoka	Barundanga, Bhoispuri, Siligurijan, Thekera, Batha, and gathia. **Total Nos. 6**	Nandini, Harinchora, Deepar beel, Jaluguti, Deora, Raumari, Mailata-Diplinga **Total Nos. 8**
	Tuna	Jogra, chandakhal, Siligurijan, Lakhanabandha, Siyalekhaity, Batha, Raumari, Mailata-Diplinga and gathia. **Total Nos. 9**	Harinchora, Barundanga, Bhoispuri, Pungani, Bihdia, Teliadanga. **Total Nos. 6**
	Dori	Siligurijan, Thekera, Nandini-Kumari, Siyalekhaity, Pungani,	Deepar beel, Jaluguti, Deora, Lakhanabandha, Pungani, Bihdia, Teliadanga, Salchapra,

		Bihdia, Teliadanga. Salchapra, Sibnarayanpur, Baskandi, Auti-Bauti, Rani-megna, Sagar, Raumari, and gathia. **Total Nos. 15**	Sibnarayanpur, Gopharchang, Angang, and Batha. **Total Nos. 12**
4. Hook and Line Fishing	***Pole and Line***	Kalidanga, Hakama, Nandini, Harinchora, Barundanga, Bhoispuri, Jogra, Chandakhal, Sagmara, Borbila, Botua kamakhya, Deepar, Jaluguti, Kasodhora, Kujibalipatti, Deora, Thekera, Udori, Nandini-Karmari, Lakhanabandha, Satiyan, Siyalekhaity, Dighalipatali, Brahmamaijan, Salchapra, Sibnarayanpur, Baskandi, Auti-Bauti, Digar-bakri, Rani-Megna, Sone, Rata, Satali, Pungani, Ganak-Dubai-Duba, Goroimari-Bihdia-Jopora, Merkolaberia, Tinsukiborbil, Moridisoi, Botalikhosa, Bihdia, Teliadanga, Moridikhow, Batha, Mailata-Diplinga, and Raumari. **Total Nos. 49 (%).**	Siligurijan, Solmari, Mori, Bormonoha, Tapang, and Gathia. **Total Nos. 6 (%)**
	Dhan barshi	Kujibalipatti, Deora, Thekera, Udori, Nandini-Karmari, Brahmamaijan. Pungani, Ganak-Dubai-Duba, Tinsukiborbil, Moridisoi, Botalikhosa, Bihdia, Teliadanga, Moridikhow, Batha, Mailata-Diplinga, Raumari, and Gathia. **Total Nos. 18 (%)**	Jaluguti, Kasodhora, Lakhanabandha, Satiyan, Siyalekhaity, Dighalipatali, Goroimari-Bihdia-Jopora, and Merkolaberia. **Total Nos. 8 (%)**
	Bamboo hook	Bormonoha, Jaluguti, Kasodhora, Kujibalipatti, Deora, Thekera, Udori, Nandini-Karmari, Lakhanabandha, Satiyan, Siyalekhaity, Dighalipatali, Brahmamaijan. **Total Nos. 13 (%)**	
	Dan barshi	Sagmara, Borbila, Botua kamakhya, Siligurijan, Deepar, Solmari, Mori, Bormonoha, Jaluguti, Kasodhora, Kujibalipatti, Deora, Thekera, Udori,	Hakama, Nandini, Harinchora, Barundanga, Bhoispuri, Jogra, Salchapra, Sibnarayanpur, Baskandi, Auti-Bauti, Tapang, Digar-bakri, Rani-Megna, Sone, Rata, Satali, Pungani,

		Nandini-Karmari, Lakhanabandha, Satiyan, Siyalekhaity, Dighalipatali, Brahmamaijan, Batha, Mailata-Diplinga, Raumari, and Gathia. **Total Nos. 24 (%).**	Ganak-Dubai-Duba, Goroimari-Bihdia, Jopora, and Merkolaberia. **Total Nos. 21 (%)**
5. Entangling Gear	***Langijal***	Kaiidanga, Hakama, Nandini, Harinchora, Barundanga, Bhoispuri, Jogra, Chandakhal, Sagmara, Borbila, Botua kamakhya, Siligurijan, Deepar, Solmari, Mori, Bormonoha, Jaluguti, Kasodhora, Kujibalipatti, Deora, Thekera, Udori, Nandini-Karmari, Lakhanabandha, Satiyan, Siyalekhaity, Dighalipatali, Brahmamaijan, Salchapra, Sibnarayanpur, Baskandi, Auti-Bauti, Tapang, Digar-bakri, Rani-Megna, Sone, Rata, Satali, Pungani, Ganak-Dubai-Duba, Goroimari-Bihdia, Jopora, Merkolaberia, Tinsukiborbil, Moridisoi, Botalikhosa, Bihdia, Teliadanga, Moridikhow, Batha, Mailata-Diplinga, Raumari, and Gathia. **Total Nos. 52 (%).**	Sagar, Gopharchang, and Angang. **Total Nos. 3 (%)**
	Phansijal	Kalidanga, Hakama, Nandini, Harinchora, Barundanga, Bhoispuri, Jogra, Chandakhal, Sagmara, Borbila, Botua kamakhya, Siligurijan, Deepar, Mori, Bormonoha, Jaluguti, Kasodhora, Kujibalipatti, Deora, Thekera, Udori, Nandini-Karmari, Lakhanabandha, Satiyan, Siyalekhaity, Dighalipatali, Brahmamaijan, Salchapra, Sibnarayanpur, Baskandi, Auti-Bauti, Tapang, Digar-bakri, Rani-Megna, Sagar, Gopharchang, Angang, Pungani, Ganak-Dubai-Duba, Goroimari-Bihdia, Jopora, Merkolaberia, Tinsukiborbil, Moridisoi,	Solmari, Sone, Rata, and Saitali. **Total Nos. 4 (%)**

		Botalikhosa, Bihdia, Teliadanga, Moridikhow, Batha, Mailata-Diplinga, Raumari, and Gathia. **Total Nos. 51 (%).**	
6. Encircling Gear	***Musarijal***	Kalidanga, Hakama, Harinchora, Barundanga, Bhoispuri, Jogra, Chandakhal, Sagmara, Borbila, Botua kamakhya, Siligurijan, Deepar, Mori, Bormonoha, Jaluguti, Kasodhora, Kujibalipatti, Deora, Thekera, Udori, Nandini-Karmari, Lakhanabandha, Satiyan, Siyalekhaity, Dighalipatali, Brahmamaijan, Salchapra, Sibnarayanpur, Baskandi, Auti-Bauti, Tapang, Digar-bakri, Rani-Megna, Sagar, Gopharchang, Angang, Sone, Rata, Pungani, Goroimari-Bihdia, Jopora, Merkolaberia, Tinsukiborbil, Moridisoi, Botalikhosa, Bihdia, Teliadanga, Moridikhow, Batha, Mailata-Diplinga, Raumari, and Gathia. **Total nos. 51 (%).**	Nandini, Solmari, Saitali, and Ganak-Dubai-duba. **Total Nos. 4 (%).**
	Berjal	Kalidanga, Hakama, Nandini, Harinchora, Barundanga, Bhoispuri, Jogra, Chandakhal, Deepar, Thekera, Satiyan, Dighalipatali, Salchapra, Baskandi, Auti-Bauti, Tapang, Digar-bakri, Rani-Megna, Gopharchang, Pungani, Ganak-Dubai-Duba, Botalikhosa, Bihdia, Teliadanga, and Moridikhow. **Total nos. 25 (%)**	Sagmara, Borbila, Botua kamakhya, Siligurijan, Solmari, Mori, Bormonoha, Jaluguti, Kasodhora, Kujibalipatti, Deora, Udori, Nandini-Karmari, Lakhanabandha, Siyalekhaity, Brahmamaijan, Saitali, Sibnarayanpur, Sagar, Angang, Sone, Rata, Goroimari-Bihdia-Jopora, Merkolaberia, Tinsukiborbil, Moridisoi, Batha, Mailata-Diplinga, Raumari, and Gathia. **Total nos. 30 (%)**
	Polo	Hakama, Nandini, Harinchora, Barundanga, Bhoispuri, Jogra, Chandakhal, Sagmara, Borbila, Botua kamakhya, Siligurijan, Deepar, Solmari, Mori, Bormonoha, Jaluguti, Kasodhora, Kujibalipatti, Deora,	Kalidanga, Saitali, Sibnarayanpur, Sagar, Angang, Sone, Rata, Goroimari-Bihdia-Jopora. **Total Nos. 8 (%)**

		Thekera, Udori, Nandini-Karmari, Lakhanabandha, Satiyan, Siyalekhaity, Dighalipatali, Brahmamaijan, Salchapra, Baskandi, Auti-Bauti, Batha, Mailata-Diplinga, Raumari, and Gathia. **Total Nos. 35 (%)**	
	Juluki	Kalidanga, Harinchora, Barundanga, Bhoispuri, Jogra, Botua kamakhya, Siligurijan, Deepar, Solmari, Mori, Bormonoha, Jaluguti, Kasodhora, Kujibalipatti, Lakhanabandha, Satiyan, Siyalekhaity, Dighalipatali, Brahmamaijan, Batha, Mailata-Diplinga, Raumari, and Gathia. **Total Nos. 23 (%)**	Hakama, Nandini, Chandakhal, Sagmara, Borbila, Deora, Thekera, Udori, Nandini-Karmari. **Total Nos. 9 (%)**
	Jhupri	Barundanga, Bhoispuri, Jogra, Chandakhal, Sagmara, Borbila, Bormonoha, Jaluguti, Kasodhora, Kujibalipatti, Deora, Thekera, Udori, Nandini-Karmari, Lakhanabandha, Satiyan, Siyalekhaity, Merkola-beria, Tinsukiborbil, Moridisoi, Botalikhosa, Bihdia, Teliadanga, Moridikhow, Batha, Mailata-Diplinga, Raumari, and Gathia. **Total Nos. 28 (%)**	Hakama, Nandini, Harinchora, Botua-kamakhya, Siligurijan, Deepar, Solmari, Mori, Dighalipatali, Brahmamaijan. **Total Nos. 10 (%)**
	Khewalijal and Angthajal	Kalidanga, Hakama, Nandini, Harinchora, Barundanga, Bhoispuri, Jogra, Chandakhal, Sagmara, Borbila, Botua kamakhya, Siligurijan, Deepar, Solmari, Mori, Bormonoha, Jaluguti, Kasodhora, Kujibalipatti, Deora, Thekera, Udori, Nandini-Karmari, Lakhanabandha, Satiyan, Siyalekhaity, Dighalipatali, Brahmamaijan, Salchapra, Sibnarayanpur, Baskandi, Auti-Bauti, Tapang, Digar-bakri, Rani-Megna, Sagar, Gopharchang, Angang, Sone, Rata, Goroimari-	Pungani, Saitali, and Ganak-Dubai-Duba. **Total Nos. 3 (%).**

		Bihdia-Jopora, Merkola-beria, Tinsukiborbil, Moridisoi, Botalikhosa, Bihdia, Teliadanga, Moridikhow, Batha, Mailata-Diplinga, Raumari, and Gathia. **Total Nos. 52 (%).**	
7. Scooping Gear	***Dharmajal***	Harinchora, Barundanga, Bhoispuri, Jogra, Chandakhal, Solmari, Kasodhora, Kujibalipatti, Deora, Baskandi, Tapang, Sagar, Merkolaberia, and Tinsukiborbil. **Total Nos. 14 (%)**	Kalidanga, Hakama, Nandini, Sagmara, Borbila, Botua kamakhya, Deepar, Mori, Bormonoha, Udori, Nandini-Karmari, Satiyan, Siyalekhaity, Dighalipatali, Brahmamaijan, Digar-bakri, Rani-Megna, Gopharchang, Angang, Sone, Saitali, Pungani, Ganak-Dubai-Duba, Goroimari-Bihdia-Jopora, Moridisoi, Botalikhosa, Bihdia, Teliadanga, Moridikhow, Batha, Mailata-Diplinga, Raumari, and Gathia. **Total nos. 34 (%)**
	Dhenkijal	Sagmara, Borbila, Botua kamakhya, Deepar, Mori, Bormonoha, Udori, Nandini-Karmari, Satiyan, Siyalekhaity, Dighalipatali, Brahmamaijan, Digar-bakri, Rani-Megna, Sagar, Gopharchang, Angang, Sone, Saitali, Pungani, Ganak-Dubai-Duba, Goroimari-Bihdia-Jopora, Moridisoi, Botalikhosa, Bihdia, Teliadanga, Moridikhow, Batha, Mailata-Diplinga, Raumari, and Gathia. **Total Nos. 31 (%).**	Kalidanga, Hakama, Nandini, Harinchora, Barundanga, Bhoispuri, Jogra, Chandakhal, Siligurijan, Solmari, Jaluguti, Kasodhora, Kujibalipatti, Deora, Thekera, Lakhanabandha, Salchapra, Sibnarayanpur, Baskandi, Auti-Bauti, Tapang, Rata, Merkola-beria, and Tinsukiborbil. **Total Nos. 24 (%)**
	Thelajal	Kalidanga, Hakama, Nandini, Harinchora, Barundanga, Bhoispuri, Jogra, Chandakhal, Sagmara, Borbila, Botua kamakhya, Siligurijan, Deepar, Solmari, Mori, Bormonoha, Jaluguti, Kasodhora, Kujibalipatti, Deora, Thekera, Udori, Nandini-Karmari, Lakhanabandha, Satiyan, Siyalekhaity, Dighalipatali, Brahmamaijan, Salchapra,	

		Sibnarayanpur, Baskandi, Auti-Bauti, Tapang, Digar-bakri, Rani-Megna, Sagar, Gopharchang, Angang, Sone, Rata, Goroimari-Bihdia-Jopora, Merkola-beria, Tinsukiborbil, Moridisoi, Botalikhosa, Bihdia, Teliadanga, Moridikhow, Batha, Mailata-Diplinga, Raumari, and Gathia. **Total Nos. 52 (%).**	
	Jakoi	Kalidanga, Hakama, Nandini, Harinchora, Barundanga, Bhoispuri, Jogra, Chandakhal, Sagmara, Borbila, Botua kamakhya, Siligurijan, Deepar, Solmari, Mori, Bormonoha, Jaluguti, Kasodhora, Kujibalipatti, Deora, Thekera, Udori, Nandini-Karmari, Lakhanabandha, Satiyan, Siyalekhaity, Dighalipatali, Brahmamaijan, Salchapra, Sibnarayanpur, Baskandi, Auti-Bauti, Tapang, Digar-bakri, Rani-Megna, Sagar, Gopharchang, Angang, Sone, Rata, Goroimari-Bihdia-Jopora, Merkola-beria, Tinsukiborbil, Moridisoi, Botalikhosa, Bihdia, Teliadanga, Moridikhow, Batha, Mailata-Diplinga, Raumari, and Gathia. **Total Nos. 52 (%).**	
8. Trawling Gear	***Moijal***	Kalidanga, Hakama, Nandini, Siligurijan, Jaluguti, Kasodhora, Kujibalipatti, and Deora. **Total Nos. 8 (%)**	Sagmara, Borbila, Botua kamakhya, Sagar, Gopharchang, Angang, Sone, Saitali, Pungani, Ganak-Dubai-Duba, Goroimari-Bihdia-Jopora, Moridisoi, Botalikhosa, Bihdia, Teliadanga, Moridikhow, Batha, and Mailata-Diplinga. **Total Nos. 18 (%)**
	Horhorijal	Siligurijan, Mori, Bormonoha, Jaluguti, Kasodhora, Kujibalipatti, Deora, Udori and Nandini-Karmari. **Total Nos. 9 (%)**	Sagmara, Borbila, Botua kamakhya, Sagar, Gopharchang, Angang, Sone, Saitali, Pungani, Ganak-Dubai-Duba, Goroimari-Bihdia-Jopora, Moridisoi,

			Botalikhosa, Bihdia, Teliadanga, Moridikhow, Batha, and Mailata-Diplinga. **Total Nos. 18 (%)**
	Shanglajal	Kalidanga, Hakama, Nandini, Harinchora, Barundanga, Bhoispuri, Jogra, Chandakhal, Sagmara, Borbila, Botua kamakhya, Siligurijan, Nandini-Karmari, Brahmamaijan, Salchapra, Sibnarayanpur, Baskandi, Auti-Bauti, Tapang, Digar-bakri, Rani-Megna, Sagar, Gopharchang, Angang, Sone, Moridikhow, Batha, Mailata-Diplinga, Raumari, and Gathia. **Total Nos. 30 (%)**	Borbila, Botua kamakhya, Siligurijan, Rata, Goroimari-Bihdia-Jopora, Merkola-beria, Tinsukiborbil, Moridisoi, Botalikhosa, Bihdia, and Teliadanga. **Total Nos. 12 (%)**

Table- 3.4 Indigenous Fishing Methods in the Beels of Assam

Indigenous Fishing Methods	Name of Beels where practiced.	Total Nos. (%)
Katal Fishing	Hakama, Nandini, KalidangaHarinchora, Bhoispuri, Barundanga, Jogra, Botua-Kamakhya, Sagmara, Siligurujan, Mori, Thekera, Nandini-Karmari, Bormonoha, Satiyan, Dighali-patali, Pungani, Ganak-dubai-duba, Tinsuliborbil, Bihdia, Botalikhosa, Goroimari-Bihdia-Jopora, Moridisoi, Merkolaberia, Teliadanga, Digar-Bekri, Baskandi, Sibnarayanpur, Salchapra, Auti-Bauti, Rata, and Angang.	**33 (60%)**
Banas Fishing	Kalidanga, Hakama, Nandini, Harinchora, Barundanga, Bhoispuri, Moridikhow, Batha, Mailata-Diplinga, Raumari, and Gathia.	**11 (20%)**
Khati-Dori Fishing	Salchapra, Sibnarayanpur, Baskandi, Auti-Bauti, Tapang, Digar-bakri, Rani-Megna, Sagar, Gopharchang, Angang, and Sone.	**11 (20%)**
Tik-Tiki Khedani	Nandini-Karmari, and Brahmamaijan.	**02 (3.64%)**
Khatiya Fishing	Salchapra, Sibnarayanpur, Baskandi, Auti-Bauti, Tapang, Digar-bakri, Rani-Megna, Sagar, Gopharchang, Angang, Sone.	**11 (20%)**
Draining Fisheries Dry	Bhitorpuni, Tapang, and Meda beel.	**03 (5.46%)**