

Design and General Characteristics of Gill Nets of Assam

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Gill nets are one of the predominantly used fishing gears of Assam in the rivers and flood plain wet lands (*beels*). Results of a study on the gill nets of Assam undertaken during 2004-2006 are reported in this paper. Gill nets of different mesh sizes ranging from 20 to 320 mm targeted at different groups of fishes are prevalent in Assam. The technical specifications, salient features and operational aspects of different gill nets are discussed. The nets are classified into groups based on the mode of operation, species of fish caught and materials used for construction. Synthetic materials like polyamide has almost completely replaced the natural fibres in gill nets and polyamide monofilament yarn of 0.16 to 0.20 mm dia are being widely used in the state.

Key words : Gill nets, monofilament, rivers, beels, flood plains, Assam

The rivers Brahmaputra and Barak along with their numerous tributaries and rivulets have been the traditional source of fishing for the people of the state from time immemorial. Similarly the floodplain lakes of Assam popularly known as beels and ponds are the main sources of fish production. Geographically, the state is divided into three distinct regions. The northern plain, known as the Brahmaputra valley, the southern plain of Barak valley and the third region comprising the hills. Various traditional and indigenous fishing gears are used to harvest the fishery resources from different water bodies in Assam. Gill nets are very popular among the fishermen and are widely used in the state due to its ease in construction and operation, efficiency and low energy requirement. It is predominantly used throughout the year in flood plain wet lands (*beels*) and in the lower and middle reaches of the rivers as the flow of water is comparatively less compared to the upper reaches.

General design and operation of different gill nets operated in inland waters in India have been described by Jones (1959a, 1959b), George (1971, 2002), Banerjee & Chakrabarthy (1972). Gill nets operated in rivers of India have been reported by Saxena (1964), Sreekrishna & Shenoy (1987), Dutta (1973), Saxena (1988), Baiju & Hridayanathan (2002) and Remesan & Ramachandran (2005). Gill nets in the water bodies of Assam have been reported by Joseph & Narayanan (1965); Dey & Kar (1989); Sinha (1988); Kar & Dey, (1991 & 1993); Choudhury (1996); Sharma *et al.* (1993); Sharma (2001); Bhattacharya *et al.* (2004) and Kar *et al.* (2007).

Over the years, many changes have taken place in the gill nets with respect to material used, design, net dimension, mesh sizes and mode of operation. Presently synthetic webbings, especially polyamide monofilament yarn of different mesh sizes and twine sizes are widely used to target different species of fishes in Assam. The

salient features of designs and operational aspects of different gill nets are discussed. This study was undertaken to document various designs and technical specifications and methods of operation of gill nets in Assam to serve as a baseline data for further improving the catching efficiency of the gill nets of the state.

Materials and Methods

A study on the gill nets of Assam was undertaken during 2004-2006 in the rivers and tributaries of Brahmaputra, Barak and in major beels and wet lands of the state to document the designs and technical characteristics of gill nets operated in the state. Details of gill nets were collected from Barpeta, Bongaigaon, Dhemaji, Dhubri, Dibrugarh, Goalpara, Hailakandi, Jorhat, Kamrup, Karimganj, Morigaon, North Lakhimpur, Silchar, Sonitpur and Tinsukia districts. The major beels of the state covered were Tamranga beel, Sone beel, Deepor beel, Dheer beel, Dhigali beel, Doloni beel, Monoha beel, Samoguri beel and Sareswar beel. The details of various designs of gill nets, methods of operation, depth of operations, catch and other relevant details were collected following Miyamoto (1962). Representative sample from each category of gill nets were examined and the designs of the nets were prepared following Nedelec (1975).

Results and Discussion

The gill nets are operated either from wooden canoes of size ranging from 7 to 10 m or operated without canoes in shallow waters of the river and beels throughout the year as drift net, set net, fixed net (with bamboo poles) and encircling net. The technical details of representative samples of major types of gill nets operated in Assam are given in Table 1. The nets were broadly classified based on the construction, mesh

size, mode of operation and target species (Fig.1.)

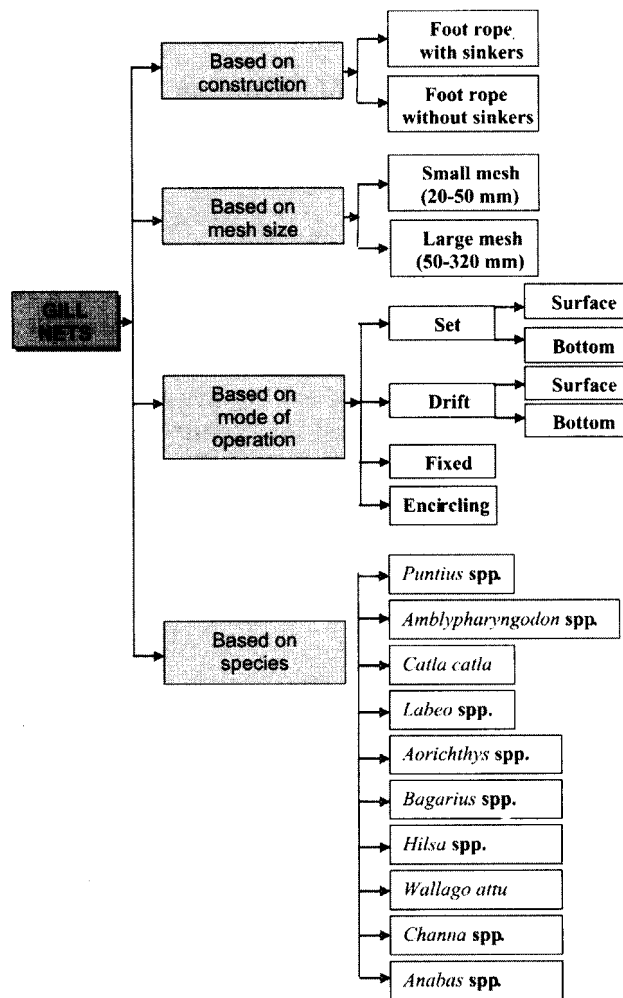


Fig. 1. Classification of gill nets

Gill nets of different mesh sizes ranging from 20 to 320 mm were found to be in operation in the state. The length of each unit of gill net varied from 5 to 60 m and the hung depth ranged from 1.25 to 6 m. The length and depth of the net varied depending upon the area, depth of water body, mode of operation and species. The fleet length of the nets was increased by joining one or more units of gill nets and wide variety of floats were used in the head rope of gill nets. Most of the gill nets use locally available buoyant materials like grass stalk (*Kuh bon, Khagra*), reeds, wood, bamboo and

Table. 1 Technical specification of major types of gill nets operated in Assam

Net	<i>Mola</i>	<i>Puntius spp</i>	<i>Anabas</i>	<i>Channa</i>	<i>Hilsa</i>	<i>Aorichthys aor</i>	<i>Rohu</i>	<i>Wallago attu</i>	<i>Catla</i>	<i>Bagarius</i>
Local name	<i>Moah jaal</i>	<i>Puthi mara jal jaal</i>	<i>Gosai langi</i>	<i>Kawai langi jal jaal</i>	<i>Ilisha marajal jaal</i>	<i>Ari phansi jaal</i>	<i>Rohu phansi jaal</i>	Soyne jal jaal	Katal phansi	<i>Gosaila/ Bagar jal jaal</i>
District	Dibrugarh	Dhubri	Kamrup	Karim-ganj	Sonitpur	Dibrugarh	Dhemaji	Dhubri	Sonitpur	Dhubri
Area of operation	River	Beel, River	River	Sone beel	River	River	River	Beel, River	River	River
Mode of operation	Surface drift	Surface set	Bottom set	Fixed net	Surface drift	Surface drift	Surface set	Bottom set	Bottom drift	Surface drift
Material Specification	PA mono 0.16 mm dia	PA mono 0.16 mm dia	PA multi 210dx2x3	PA mono 0.20 mm dia	PA mono 0.20 mm dia	PA mono 0.20 mm dia	PA mono 0.20 mm dia	PA multi 210dx6x3	PA multi 210dx6x3	PA multi 210dx12x3
Mesh size (mm)	20	35	45	45	70	100	150	180	220	270
Length (No. of mesh)	2600	300	2250	400	900	500	500	300	300	320
Hang. coeff.	0.48	0.50	0.50	0.50	0.50	0.55	0.50	0.48	0.50	0.70
Hung length (m)	25	5.25	50.00	9.00	31.5	27.50	37.50	25.92	33.00	60.48
Depth (No. of mesh)	71	50	100	19.5	100	15	35	5.5	15	10.5
Vert. hang. coeff.	0.88	0.87	0.87	0.87	0.87	0.84	0.87	0.88	0.87	0.71
Hung depth (m)	1.25	1.52	3.90	0.76	6.09	1.25	4.55	0.87	2.86	2.02
Head rope (material) Specification	PE multi 1.0 mm dia	PE multi 1.25 mm dia	PE multi 1.25 mm dia	PA multi double 210x6x3	PA multi double 210dx4x3	PA mono 1.0 mm dia	PA mono 1.5 mm dia	PA multi 210dx6x3	PE multi 4.0 mm dia	PA multi 210dx6x3
Float (material) Size (mm)	Grass stalk 60x5	Grass stalk 45x8	Grass stalk 75x6	Nil	Rubber 50x6x4	Rubber 40x6x3	Grass stalk 45x8	Bamboo 150x25	Wood 80x10	Rubber 45x4x2
Floats (Nos)	70	8	75	Nil	9	9	71	7	9	9
Foot rope Specification	PE multi 1.0 mm dia	PE multi 1.25 mm dia	PE multi 1.25 mm dia	Nil	PA multi 210x4x3 double	Nil	PA multi 210x4x3 double	PA multi 210/6/3	10 mm dia	14 mm dia
Sinker (material) Size (mm)	Lead 60x7x2	Burnt clay 60x7x2	Burnt clay 60x7x2	Stone -	Lead 60x7x2	Lead 60x7x2	Nil	Iron 20x10x5	Nil	Nil
Sinker (Nos)	325	17	45	7	5	250	Nil	16	Nil	Nil

pieces of stem of banana. Plastic, thermocol, tin and rubber floats and pieces of rubber slippers are also commonly used. Use of reeds in inland gill nets by the migratory fishermen of Karnataka has been reported by Remesan & Ramachandran (2005). Empty plastic water bottles are commonly used as

floats as they are cheap and easily available. Disc shaped poly vinyl chloride floats and apple shaped plastic floats were observed in a few gill nets. The floats are either fixed directly to the head rope or a separate floatline is provided to attach the floats to the head rope. Sinkers made from burnt clay

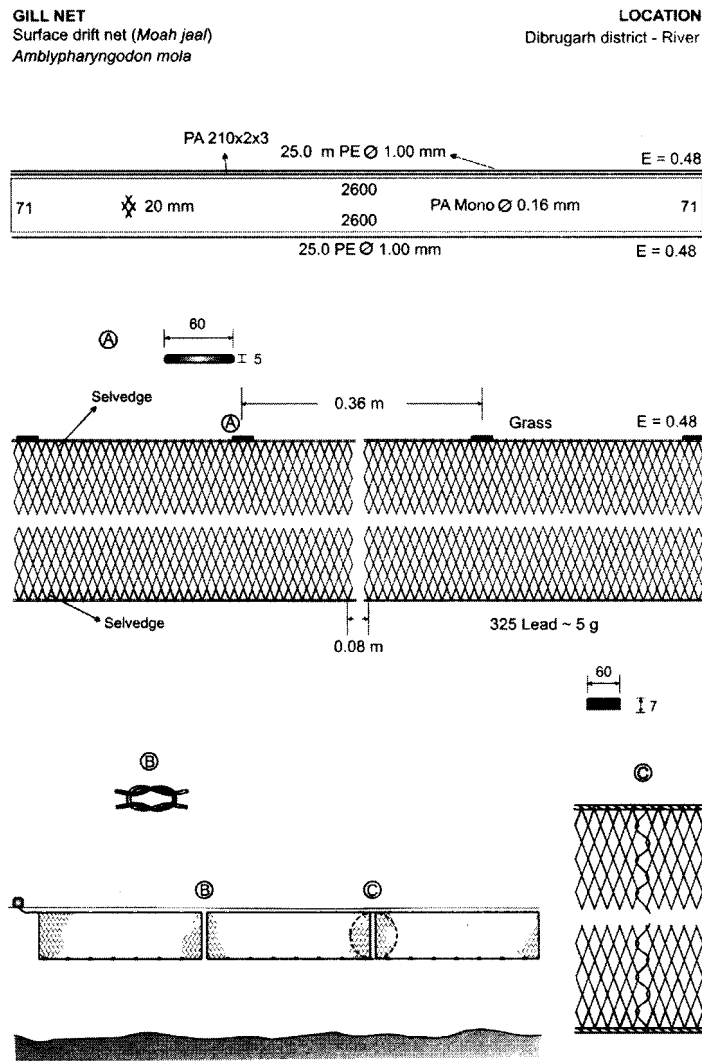


Fig. 2. Design of *Amblypharyngodon mola* gill net from Dibrugarh

and iron are very common. The shape and size of sinkers varied according to the type of net and mode of operation. Use of burnt clay as sinkers by the inland fishermen of Kerala has also been reported by Remesan & Ramachandran (2005). Lead, mud balls, and stone are also used as sinkers in the foot rope. In some gill nets jute is used as foot rope and in such cases sinkers are not used.

Polyamide monofilament yarn of 0.16, 0.20, 0.32, 0.36, 0.50 and 1.0 mm in diameter and polyamide multifilament twines of 210dx2x3, 210dx4x3, 210dx6x3, and 210dx12x3 and tyre cords were used in the fabrication of various gill nets.

The study showed that most of the gill nets were operated as surface drift nets. The operation of nets varied depending upon season and species of fish. Over the years a shift from natural to synthetic materials and in recent years, change over from PA multifilament to polyamide monofilament has been observed. This phenomenon has been observed in inland and marine water bodies in other parts of India also (George, 2002; Thomas & Hridayanathan, 2006; and Remesan & Ramachandran, 2007). Generally, polyamide monofilament is used in the main body of the gill nets. Similar observations were made by Baiju & Hridayanathan (2002)

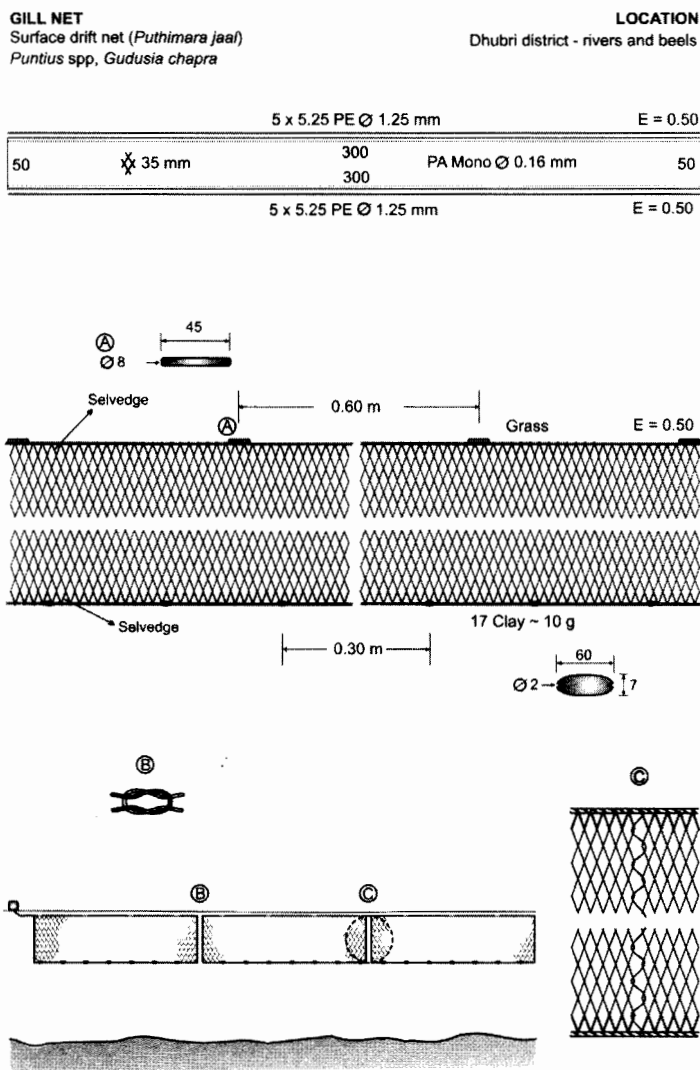


Fig. 3. Design of *Puntius* spp. gill net from Dhubri

in gill nets used in rivers of Kerala. Though synthetic materials like polypropylene and polyethylene are widely used for the head rope and foot rope of gill nets, natural materials like jute and hemp, are still being used in foot rope and they range from 10 to 14 mm in diameter. Polyamide braided and polyethylene braided rope were also used as head and foot rope of gill nets.

Gill nets are predominantly used in the lower reaches of the river as the force of current is less compared to the upper reaches and they are operated both during day and night mostly throughout the year.

Most of the gill nets in the river are operated as surface drift or bottom drift. The float line length is either increased or decreased to adjust the depth of the net in water. One end of the net is attached to the canoe and as the net drifts along the current, the boat also moves along. The fisherman hauls the net after a distance and then returns to his previous position to set the net again. Most of the nets are operated during winter months (September to February); a few during rainy season while some nets are operated round the year in rivers, beels, paddy fields and derelict water bodies.

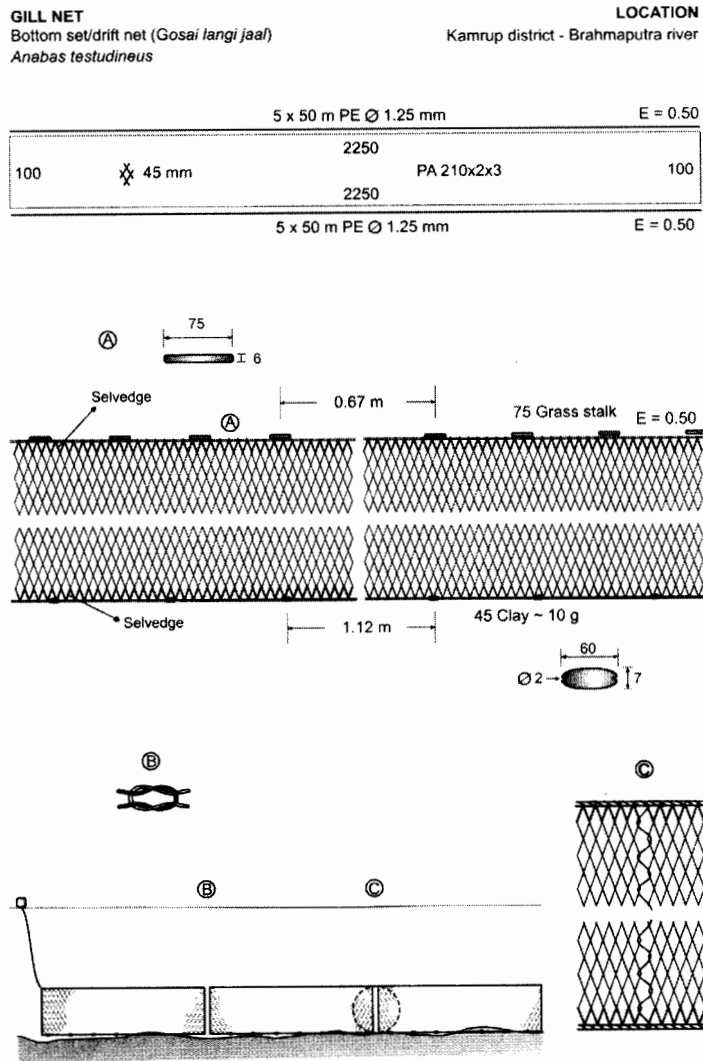


Fig. 4. Design of *Anabas spp.* gill net from Kamrup

Drift gill nets are locally known as *Current jaal*, *Gosaila jaal*, *Fesi jaal*, or *Sessa jaal*. *Puntius spp*, *Mystus spp*, *Anabas testudineus*, *Channa spp*, *Heteropneustes fossilis*, *Bagarius bagarius*, *Chitala chitala*, *Clupisoma garus*, *Eutropiichthys vacha*, *Pangasius pangasius*, *Colisa fasciatus*, *Aorichthys aor*, *Wallago attu*, *Labeo rohita*, *Catla catla* and *Clarias batrachus* are the usual catches in surface drift nets. The same nets are sometimes used as surface drift and bottom drift by adjusting the floats and sinkers in the net depending on the availability of fish.

Gill nets are also operated as set net, where they are either set in the surface or

in the bottom. These nets are locally known as *Patan jaal*, *Bheta phasi*. For surface setting, anchors are used on both ends of the nets and the nets will be operated close to surface. For bottom setting, the nets are rigged with more sinkers so that the foot rope touches the bottom and heavy stones are provided as anchor. Thermocol blocks or empty plastic cans are used as marker floats. Sometimes gill nets are set by tying one end of the net to the bank of the river while the other end remains anchored in the river. The main catches are *Anabas testudineus*, *Clarias batrachus*, *Channa punctatus*, *Mystus spp.*, *Labeo dyocheilus*, *Wallago attu*, *Ctenopharyngodon idella*, *Labeo rohita*, *Cirrhinus*

GILL NET		LOCATION	
Bottom fixed net (Kawai langi jaal)		Karimganj district - Sone beel	
<i>Channa punctatus, Anabas spp, Claruis spp</i>			
3 x 9 m PA 210x6x3 double		E = 0.50	
19.5	45 mm	400	PA Mono Ø 0.2 mm
		400	
		E = 0.50	

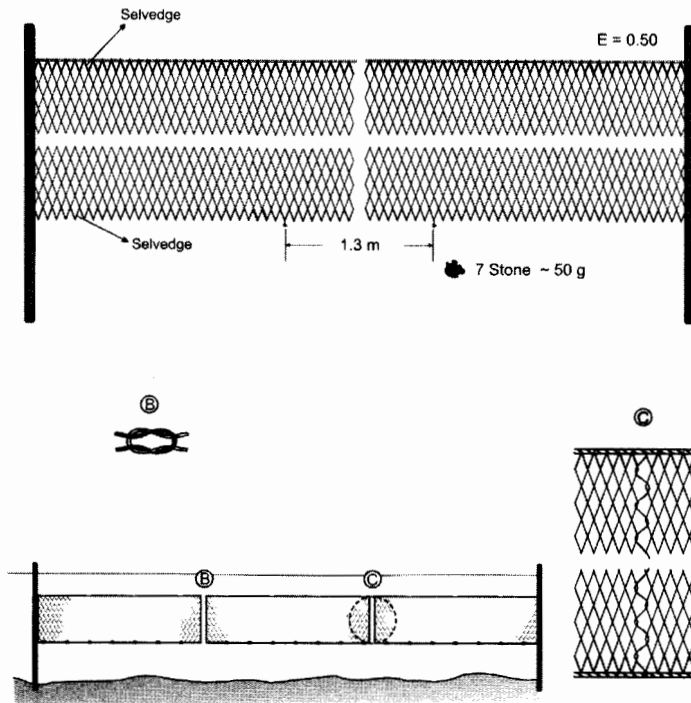


Fig. 5. Design of *Channa spp.* gill net from Karimganj

mrigala, Aorichthys aor, Labeo gonius, Nandus nandus, Cyprinus carpio and Puntius spp.

A few gill nets are fixed to the bottom with the help of bamboo poles and these nets do not have floats and sinkers as they are fixed to two poles at opposite ends. These nets are operated in shallow waters. The length of the net may vary from 22.5 to 270 m and the depth from 1.1 to 8.8 m. The mesh size of the nets starts from as low as 25 mm to a maximum of 108 mm. Polyamide monofilament is used in the main webbing. The nets are provided with either single or

double head rope with no selvedge. The nets are operated round the year in rivers, beels, paddy fields and derelict water bodies. The main catches are *Anabas testudineus, Clarias batrachus, Channa punctatus, Mystus spp., Labeo dyocheilus, Wallago attu, Ctenopharyngodon idella, Labeo rohita, Cirrhinus mrigala, Aorichthys aor* and *Labeo gonius*.

Encircling gill nets are operated mostly in shallow waters. Locally these gears are known as *Goroi langi jaal*. The fishermen scare the fishes by splashing water with hand or sticks and drive the fish towards the net. Then the net is encircled and fishes get

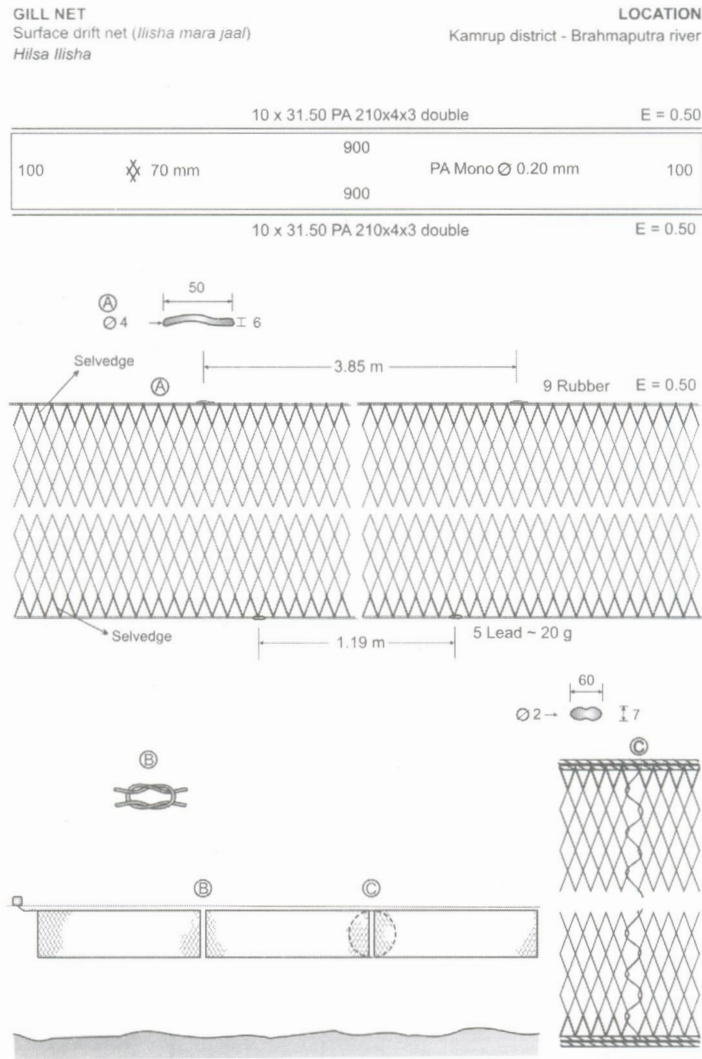


Fig. 6. Design of Hilsa gill net from Kamrup

gilled or entangled in the net. Encircling gears of Sone Lake have been described by Kar & Dey (1993). Gill nets come next in importance to seines. Gill nets are sometimes operated in the fashion of seines. The mesh size in these gill nets ranges from 15 to 20 mm and is mainly operated for *Channa* spp.

The gill nets of Assam have been broadly grouped into two by Jospheh & Narayanan (1965) based on the construction of the net which are locally known as *Langi jaal* and *Phansi jaal*. The *Langi jaal* is provided with sinkers in the foot rope and is operated as bottom set, or used as an

encircling gill net, whereas in *Phansi jaal*, the footrope is devoid of sinkers and is generally operated as surface set or surface drift net. These are also popularly known as *Current jaal*. Generally small mesh sizes (12-50 mm) with loose hanging (hanging coefficient – 0.3 to 0.4) were observed in *Langi jaal* facilitating more of entanglement of fishes in *Phansi jaal*, the mesh sizes are considerably larger (50 to 230 mm) with hanging coefficient of 0.5 to 0.7 facilitating capture by gilling. The local names of these nets vary from place to place and most of the gill nets are also named after the target fish species.

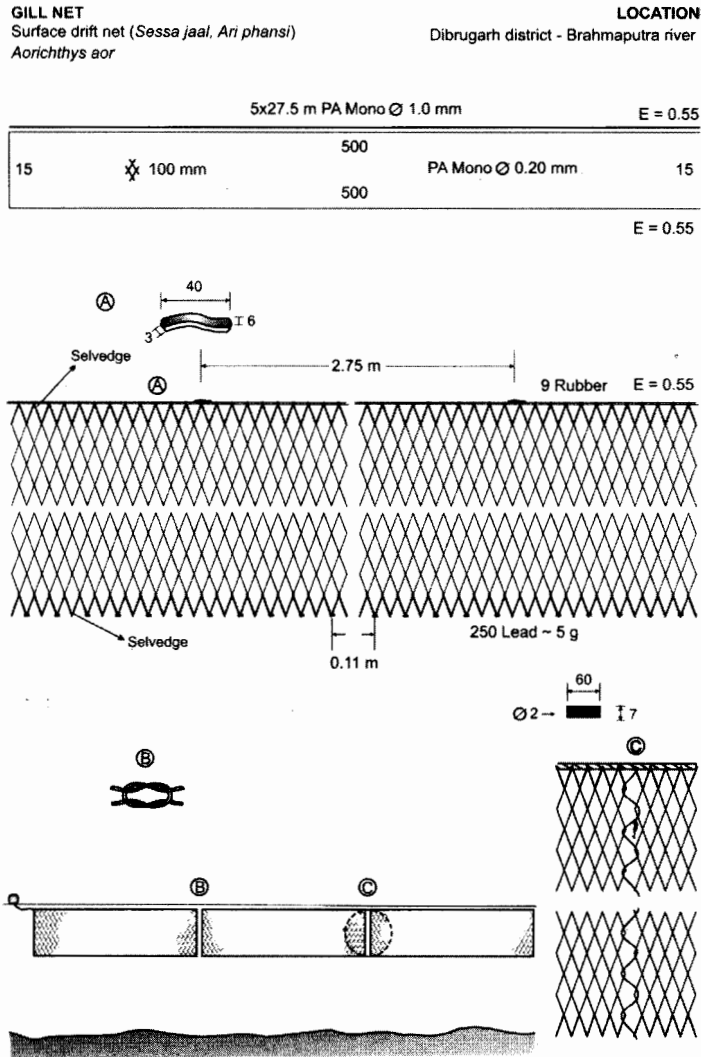


Fig. 7. Design of *Aorichthys aor* gill net from Dibrugarh

The small mesh nets are used for harvesting *Puntius* spp., *Anabas* spp., *Channa* spp., and miscellaneous fishes and the large mesh nets are used for hilsa, rohu, *Wallago* spp., *Bagarius* spp., *Aorichthys* spp. and *Catla catla*. The length of each unit of small mesh gill nets ranges from 5 to 50 m while the large mesh nets have a length ranging from 25 to 60 m.

Gill nets are also named by the target fishes they capture. Gill nets for *Amblypharyngodon mola* are widely used all along the state of Assam. These nets are used as surface drift gill net. The design of a typical *A. mola* gill net operated in Dibrugarh

district is given in Fig. 2. These nets are locally called as *Moah jaal* or *Current jaal*. The mesh size ranged between 20 and 25 mm. These nets also catch miscellaneous fishes. The nets are made up of polyamide monofilament of diameter 0.16 mm and have a hanging coefficient of 0.48 to 0.49. The hung length of one unit is 25.0 m with hung depth of 1.25 m.

Similarly, gill nets for *Puntius* species are used as drift gill nets all along the state. The design of a typical *Puntius* gill net operated in Dhubri district is given in Fig. 3. These nets are popularly known as *Puttimara jaal* and were in vogue in Dibrugarh,

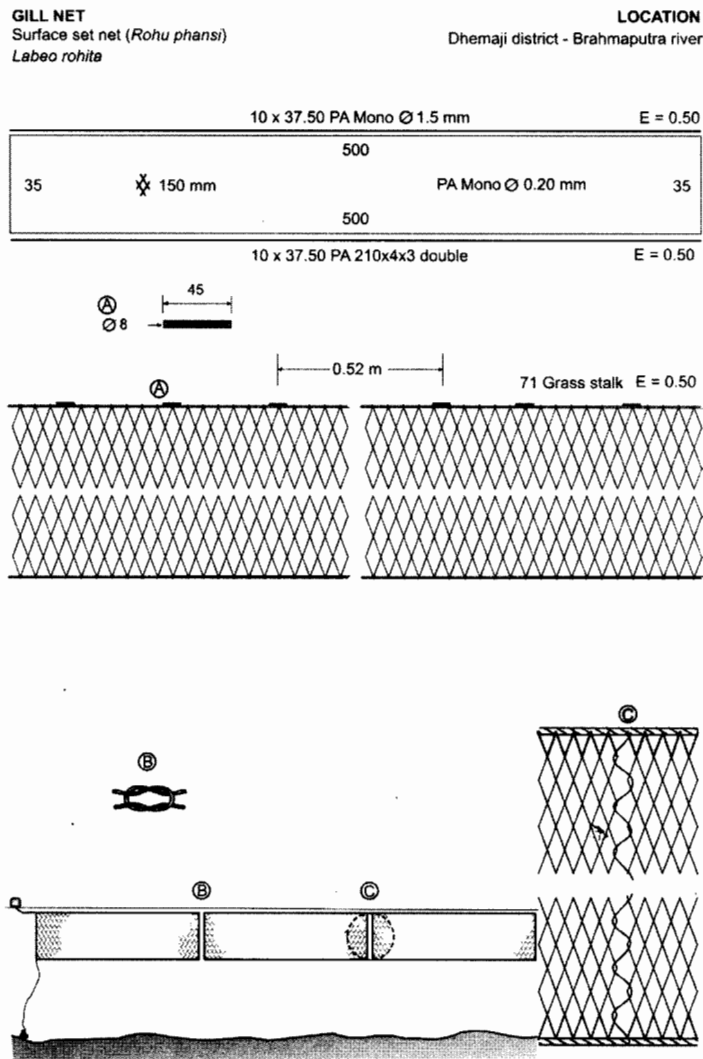


Fig. 8. Design of Rohu gill net from Dhemaji

Hailakandi, Kamrup and Tinsukia districts. The mesh size ranged between 25 and 35 mm. Other species like *Mystus* spp., *Heteropneustes fossilis*, *Amblypharyngodon mola*, *Barilius* spp., *Clupisoma garua* and miscellaneous fishes are also caught in the net. These nets too are made of Polyamide monofilament of diameter 0.16 mm. The hanging coefficient of the net ranged from 0.48 to 0.50. The hung length ranged from 5.25 to 40 m and the hung depth of the net ranged between 0.8 to 1.5 m. Nets operated in the river had larger hung depth.

Gill nets for *Anabas* species, are also known as *Gosai lungi* and are operated as

bottom set. A typical *Gosai lungi* operated at Kamrup district is given in Fig. 4. These nets are made exclusively of Polyamide multifilament 210dx2x3. The mesh size ranged between 35 and 45 mm. The hanging coefficient given is 0.50 and the hung length ranged from 40 to 50 m. The hung depth of the net ranged between 1.0 and 5.0 m and is mostly operated in the rivers and its tributaries. *Anabas* gill nets are locally known as *Kawai langi jaal* in Sone beel, Karimganj district and is operated as fixed net.

Gill nets for *Channa* species are also operated by fixing both the ends of the nets with bamboo poles. The design of the net is

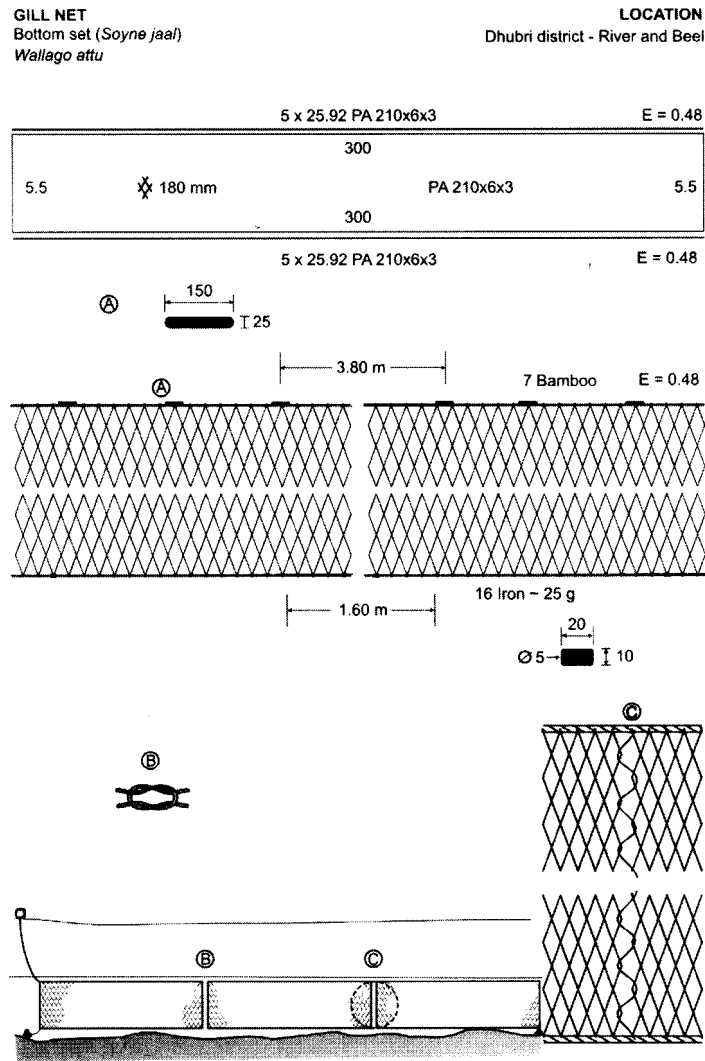


Fig. 9. Design of *Wallago attu* gill net from Dhubri

similar to *Gosai langi*. This is also locally known as *Kawai langi jaal* in Dhubri district and also in Sone beel, Karmiganj district. A typical gill net for *Channa* species operated in Sone beel, Karimganj district is shown in Fig. 5. The material used is PA monofilament and mesh size ranged between 35 and 50 mm. The hanging coefficient given is 0.50 and the hung length ranged from 7 to 10 m. The hung depth of the net ranged between 0.7 to 1.0 m. These nets are sometimes used as encircling gill nets in beels.

Gill nets with large mesh sizes target large size fishes like hilsa, rohu, catla, *Wallago attu*, *Aorichthys. aor*, and *Bagarius*

spp. Hilsa gill nets locally known as *Ilis phansi jaal* or *Ilis mara jaal* are operated as surface drift gill in the middle and lower reaches of river Brahmaputra. These nets are made of polyamide monofilament of 0.16-2.0 mm diameter and usually have mesh sizes ranging from 60 to 80 mm. The length of each unit ranges from 10 to 12 m with hanging coefficient of 0.5 and depth of 1.8 to 2 m. The fishermen increase the length by adding more units. Jones (1959 a) reported that the length of the Hilsa gill net varied from 60 to 300 m according to the area and depth of water body. Hilsa gill nets are operated only in the middle and lower reaches of the river Brahmaputra covering

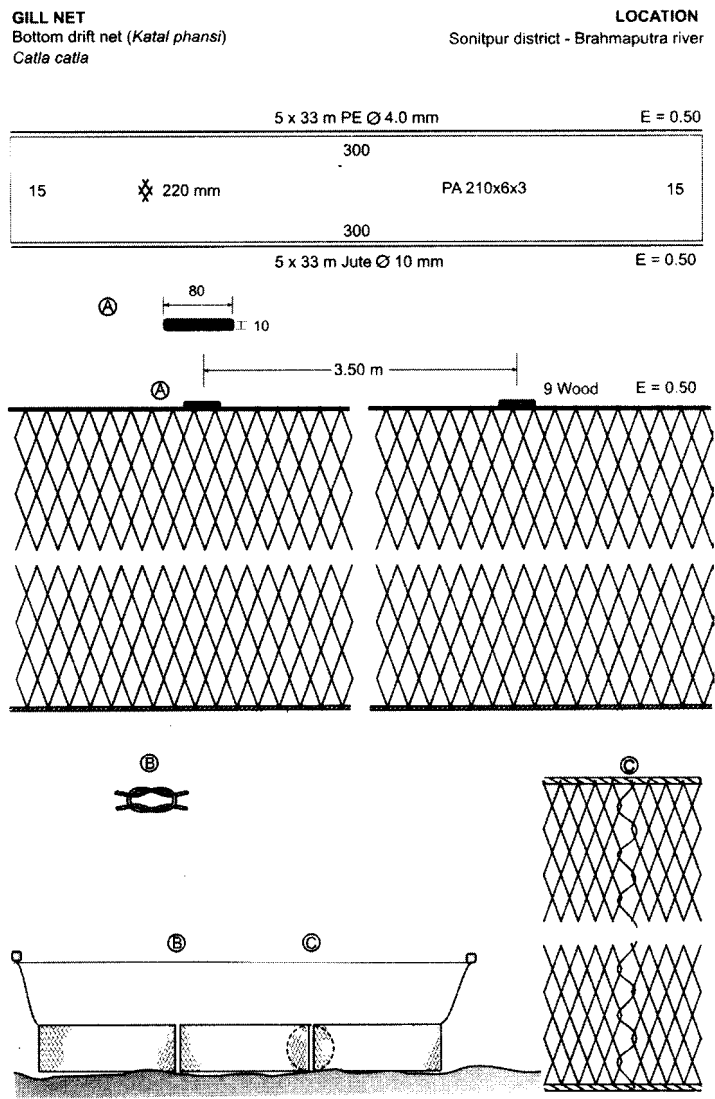


Fig. 10. Design of Catla gill net from Sonitpur

districts from Kamrup to Dhubri. The design of a typical hilsa gill net operated in river Brahmaputra in Kamrup district is shown in Fig. 6.

Gill nets for *Aorichthys aor* locally known as *Ari phansi jaal* use thicker monofilament yarn of 0.32 to 1.0 mm dia. The gill net for *A. oar* operated as surface drift net in Dibrugarh district is shown in Fig. 7. It is also operated as bottom drift net during winter season. These nets were observed in Dibrugarh, Goalpara and Sonitpur district. It is locally known as *Sessa jaal* in Dibrugarh district and *Gosaila jaal* in

Goalpara district. Mesh size ranged from 90 to 120 mm. The hung length of the net varied from 20 to 30 m and hung depth from 1 to 1.5 m only. Hanging coefficient was 0.5.

Rohu gill nets are commonly called as *Rohu Phansi jaal*. The design of Rohu gill net operated as surface set in Dhemaji district is shown in Fig. 8. They are also known by different names in different districts. In Barpeta district these nets are operated as surface drift net in river Beki and are known as *Ahal phansi jaal*. The nets are made of thicker twines 210dx4x3 to 210dx6x3 with mesh size ranging from 80 to 160 mm. The

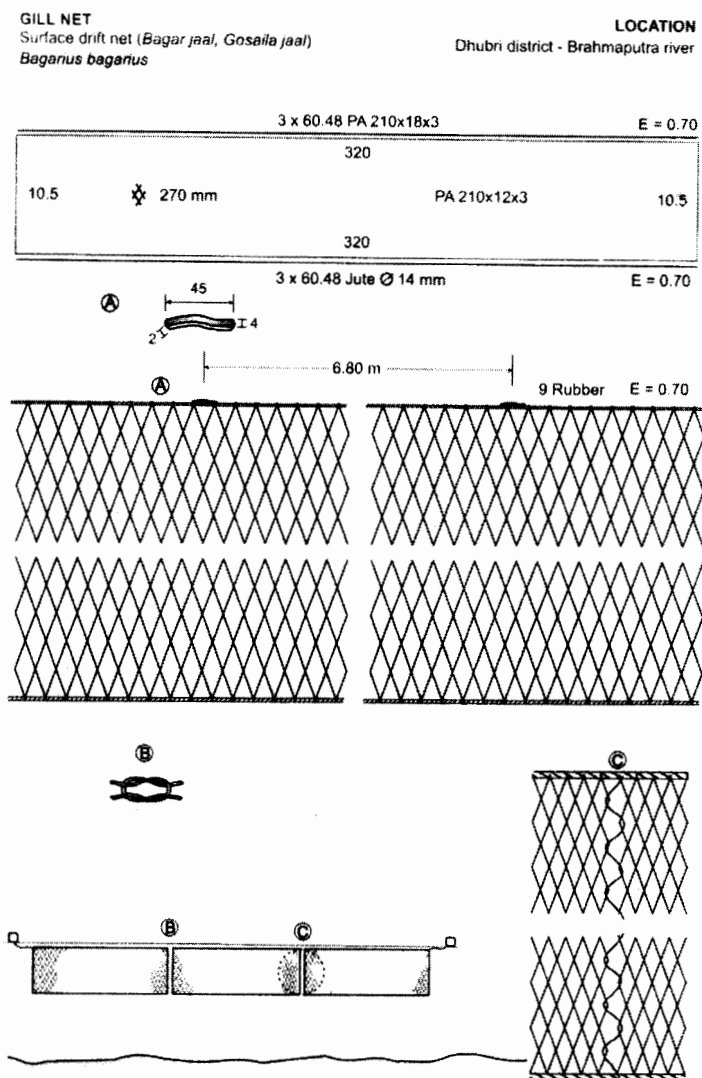


Fig. 11. Design of *B. bagarius* gill net from Dhubri

length of each unit is about 30 m with a hanging coefficient of 0.5. The depth is around 4 m. The nets are operated mainly during August to December. These nets made of tyre cord were observed in north Lakhimpur district and locally known as *Bhasan jaal* and these were sometimes operated as surface set net.

Gill nets for *Wallago attu*, locally known as *Soyne jaal* in Dhubri, are made up of PA multifilament 210dx6x3 and have mesh sizes ranging from 120 to 180 mm. A typical *Wallago attu* gill net operated in Dhubri district is shown in Fig. 9. These nets are

operated as bottom set both in the rivers and beels. It is commonly known as *Current jaal* in Morigaon district and *Fesi jaal* in Dhemaji district. The same net is also locally known as *Dangor Langi* in Kamrup district and operated as bottom set net. Polyamide monofilament of 0.20 to 1.0 mm dia is also used for the main webbing and 210dx4x3 to 210dx6x3 PA multifilament for the head rope.

Catla gill nets are mostly used as bottom drift net. The design of a typical Catla gill net operated in Sonitpur district is given in Fig. 10. These nets are popularly

known as *Catal phansi*. It is also known as *Bhasan jaal* in River Dibru, Tinsukia. The mesh size ranged from 250 to 300 mm. The nets are made up of PA multifilament 210dx6x3. The hanging coefficient of net ranged from 0.48 to 0.60 and the hung length ranged from 30 to 50 m. The hung depth of the net ranged from 3 to 5 m.

Bagarius spp. are also caught by gill nets with large mesh sizes ranging from 250 to 270 mm. The nets are made up of PA multifilament 210dx12x3. A typical *Bagarius* net operated as surface drift in Dhubri is shown in Fig. 11. It is locally known as *Gosaila jaal* or *Bagar jaal*. It is locally known as *Bhasan jaal* at Sonitur district. This net is also operated as bottom drift. The hanging coefficient given was 0.70 with a hung length ranging from 50 to 60 m and hung depth of 2 m.

Natural materials used in gill nets in the 1960s (Joseph & Narayanan, 1964) have been totally replaced by synthetic materials. However in some of the gill nets, natural fibres like jute and hemp are still used as foot ropes. Readily available natural materials like weeds and bamboo are commonly used as floats and clay and stones are used as sinkers. The nets are still being operated by traditional canoes without any mechanical propulsion. There has not been much change in the size of units of gill nets. Most of the gill nets are readily available, rigged with floats and sinkers in the local markets. The mounting and rigging is done haphazardly and in most of the nets, the hanging coefficient varies in the unit itself, indicating improper mounting of net to head rope and foot rope. In most cases the floats and sinkers are arbitrarily or randomly fixed which would affect the catching efficiency of the gill nets. Polyamide monofilament is used in case of small mesh gill nets and the

same observation has been made by Thomas & Hridayanathan (2006) in small mesh marine gill nets of Kerala. Operation of multi mesh gill nets simultaneously in a fleet of net is also common targeting different fishes or different sizes of the same species. Due to use of different mesh sizes during the same period, many juveniles of target species are also caught in the net. Though optimum mesh sizes have been worked out for a few freshwater species, there is a need to carry out selectivity studies for arriving at optimum mesh sizes for other species. Use of optimum mesh sizes in gill nets for the different species of fish is necessary to make the gill nets a more selective and sustainable fishing gear. Majority of the drift gill nets used have low hanging coefficient with pronounced entangling action making the gear less selective.

The gill nets are mainly operated during night and the fishermen bring it to the landing centres in early morning hours. The soaking time of the net is an important factor during summer, as the fish is more vulnerable to spoilage. Ice box to carry ice will have to be provided in the canoes to maintain the freshness and quality of catch.

The rampant use of very thin polyamide monofilament materials, discarded and lost nets in the river or beels could lead to ghost fishing and can also cause environmental and ecological problems. Proper selection of mesh sizes, hanging ratio, and mode and time of operation can make gill net an eco-friendly, low energy and sustainable fishing method.

The authors thank Director, CIFT Cochin - 29 for granting permission to publish the paper and also thank ICAR for funding the Ad hoc project to carry out the study. They also thank Shri P.S. Nobi, Shri. B. Pradhan and Shri P. Pattnayak, Technical

Officers, CIFT for the assistance rendered for the work.

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