STUDY REPORT

OF THE

REGULAR COURSE TRAINEES AND SPECIAL TRAINEE IN COMMERCIAL FISHING TECHNOLOGY 1996

SOUTHEAST ASIAN FISHERIES DEVELOPMENT CENTER
TRAINING DEPARTMENT

TD/RP/39

December 1996

CONTENTS

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LIST OF THE REGIONAL TRAINING COURSE TRAINEES
IN COMMERCIAL FISHING TECHNOLOGY
18 JULY - 17 DECEMBER 1996

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Bottom Trawl Fishing in Bangladesh

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1.0 Introduction

Bangladesh is situated at the Northern end of the Bay of Bengal, between lat. 20 34' N to 26 38' N and 88 01' to 92 04' E. Bangladesh is endowed with vast marine , coastal and inland waters, having great fisheries potential. The Republic has 480 km long coast line on the southern zone and approximately 1,000,000 ha territorial waters extending 19 km up to the sea. The nation's economic zone extends 320 km out in to the sea from the coastline.

The continental shelf of Bangladesh covers an area of 66440 sq. km of which 37000 sq.km is not deeper than 50 m. The bottom material of the water up to 40 m depth are mostly alluvial silt and mud. The sand bottom occurs in deeper waters. The salinity ranges from 12 to 33 ppt in monsoon and 16 to 39 ppt in the dry season

The multi-species coastal fisheries at both artisanal and commercial levels, comprise 120 species of brackishwater estuarinefish with crustaceans accounting for a sizable proportion of the annual biomass harvested.

2.0 Methodology of trawl Fishing

2.1 Gear Used

Trawl is a bag net type of fishing gear which is towed through the water mass to trap the fish coming on its way. Depending on the area of operation, the trawl net is further classified into (a) surface trawl (b0 midwater trawl and (c) bottom trawl

The surface trawl and midwater trawl usually are operated in the deep sea to catch the fast moving pelagic and semi-pelagic fish. While the bottom trawl is operated to catch the comparatively slow-moving fish. Bottom trawl is towed at slow speed of 2 to 3 knots. The top panel of the trawl is provided with

over hang to prevent the fish escape from top o f the net mouth while bottom panel of the surface trawl is provided with the reverse over hang to prevent the fish escape from the bottom of the net mouth. In Bangladesh trawl fishing is done by trawling.

Based on the construction of the gear and method of operation, the bottom trawl is classified as follows:

2.1.1 Bottom Beam Trawl

This is the simplest of trawl net, as a beam is used to spread the netting which held above the sea bed by two metal concrete shoes. The head rope of the net is connected to the beam while the ground rope is fastened loosely between the base of the shoes . A strap having lazy line is attached to the cod end to aid recovery. This trawl is not used in Bangladesh.

2.1.2 Bottom Otter Trawl

This a large bag net wider at one end called the net mouth, from where it tapers to the closed end called cod end where the fish enters through the mouth of the net are caught. The head rope of the net runs around the upper edge of the mouth to which a number of floats are attached. The ground rope is attached around the bottom of the mouth which is made heavy by attaching steel chain when the net is operated on the clear bottom. however, for opening the net on rough bottom the iron, wooden or rubber roller are rigged to the foot rope , to carry out trawling smoothly with out damaging the net. Depending on the target species of the net operation, the vertical opening of the mouth is controlled by adjusting the floats on the head rope and the weight attached to the ground rope. The horizontal spread of the mouth is achieved by the otter boards towed ahead of the net and set at an angle of attack to the towing direction to provide the spreading force. The otter boards are either connected directly to the wings or are separated by a length of rope known as sweep line. The sweep lines are connected to the otter board by a back strop and to the net by bridle arrangement. Bottom trawl shooting as well hauling of the net is from stern side of the vessel. They are called as stern trawlers.

2.1.3 Bottom Pair Trawl

This is a trawl net operated by two vessels, each towing one warp. The horizontal opening of the mouth is adjusted by the outward pull provided by the correct lateral spacing of the two fishing vessels, hence otter boards are not used and warps are directly to the sweep lines or bridles from each wing. usually the length and mouth opening of the pair trawl is very large and it sweeps very large sea bottom area during its operation. This method is not popular in Bangladesh. Very few bottom pair trawlers are in operation in Bangladesh.

3.0 Crafts Used

The majority of the Bangladeshi trawlers are shrimp trawlers with steel body. At present there are 39 shrimp trawlers and 13 fin fish trawlers. Among the shrimp trawlers five are of wooden construction and the rest in steel. Steel body shrimp trawlers, operating by outriggers at a time from two sides with booms and use modern shrimp trawl nets with codend mesh size ranging between 45 to 50 mm. The head rope of the trawl nets used 18 to 32 m. Almost all the vessel are equipped with modern navigation, communication and fish finding equipment. The overall length of the shrimp trawlers varies from 20.5 to 44.5 m Among the fin fish trawlers 3 have steel hull and the rest have wooden hull. The fish trawlers include six public sector trawlers owned by Bangladesh Fisheries Development Corporation (B.F.D.C). Fish trawlers ranges from 17.5 to 28 m in length overall. The engine power varies from 350 to 1200 hp but mostly fall within 550 to 850 hp.

The fish trawlers use mostly high opening bottom trawls . Codend mesh size varied from 60 to 65 mm. The fish trawlers goes out for fishing cruise from 7 to 10 duration with 15 to 25 crew members on board, depending on length of the trawler. Crushed ice is carried in the vessel's fish hold. Fish trawlers usually fish at a depth of 10 20 m. The trawl is shot from the stern of the vessel, after which the otter boards are released depending on the depth of the water. The warp is released three to five times the water depth. After completion of the shooting, the net is dragged for 3 hours at a speed of 2 to 3 knots. The cruise duration of the shrimp trawlers is usually 20 to 25 days. Every shrimp trawler has freezing system on board. Shrimp trawlers usually fish at a depth of 40 to 80 m.

4.0 Catch Composition

The shrimp is the target species in bottom trawling. The shrimp species such as *Penaeus japonicus*, *Metapenaeus monoceros* and *Parapenaeopsis stylifera* contribute to the commercially important shrimp catch. In the shallow water up to a depth of 20 m other important species caught are hilsa, Indian salmon, jewfish, grunter, red snapper, silver pomfret, Chinese pomfret, cat fish, ribbon fish, eel, Bombay duck . The bottom otter trawling contributes the bulk of the marine fish landings in Bangladesh. This fishing method seems to be economically viable in Bangladesh

STUDY REPORT

ON

COASTAL PURSE SEINE OPERATION

By

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Regional Training Course in Commercial Fishing Technology

18 June-17 December 1996

SEAFDEC /TD ,THAILAND

STUDY REPORT
ON
COASTAL PURSE SEINE OPERATION

I Introduction

The purse seine is the one of the most advanced types of fishing gear for surrounding fish schools used for catching pelagic fish species such as Sardine , Anchovy, Mackerel, Hard tail scad, Bonito and Skipjack.

The purse seine consist of pieces of rectangular netting, a cork line or float line with float attached and a foot rope or sinker line with sinker attached .At both ends of the seine, there are side line to which hand rope are fixed. However, the most silient feature of the gear is that it is used to encircle and impound fish schools by closing the bottom either with hooks (in the case no purse line),or purse line with passes through purse rings fixed to the ends of bridles attached to the sinker line at regular intervals, thus preventing the fish escaping downward.The bunt or cod end part of the net is generally located at the end of one of the wings except in the case of two boat-type purse seine where the bunt or cod end is located in the middle .

II Classification of the Purse seine

The purse seine fisheries is generally are classify as follow :

1- One -boat Sardine purse seine fisheries

2- Two-boat Sardine purse seine fisheries

3- One - boat Horse Mackerel purse seine fisheries

4- Two- boat Horse Mackerel purse seine fisheries

5- One - boat Skipjack and Tuna purse seine fisheries

6- Two- boat Skipjack and Tuna purse seine fisheries

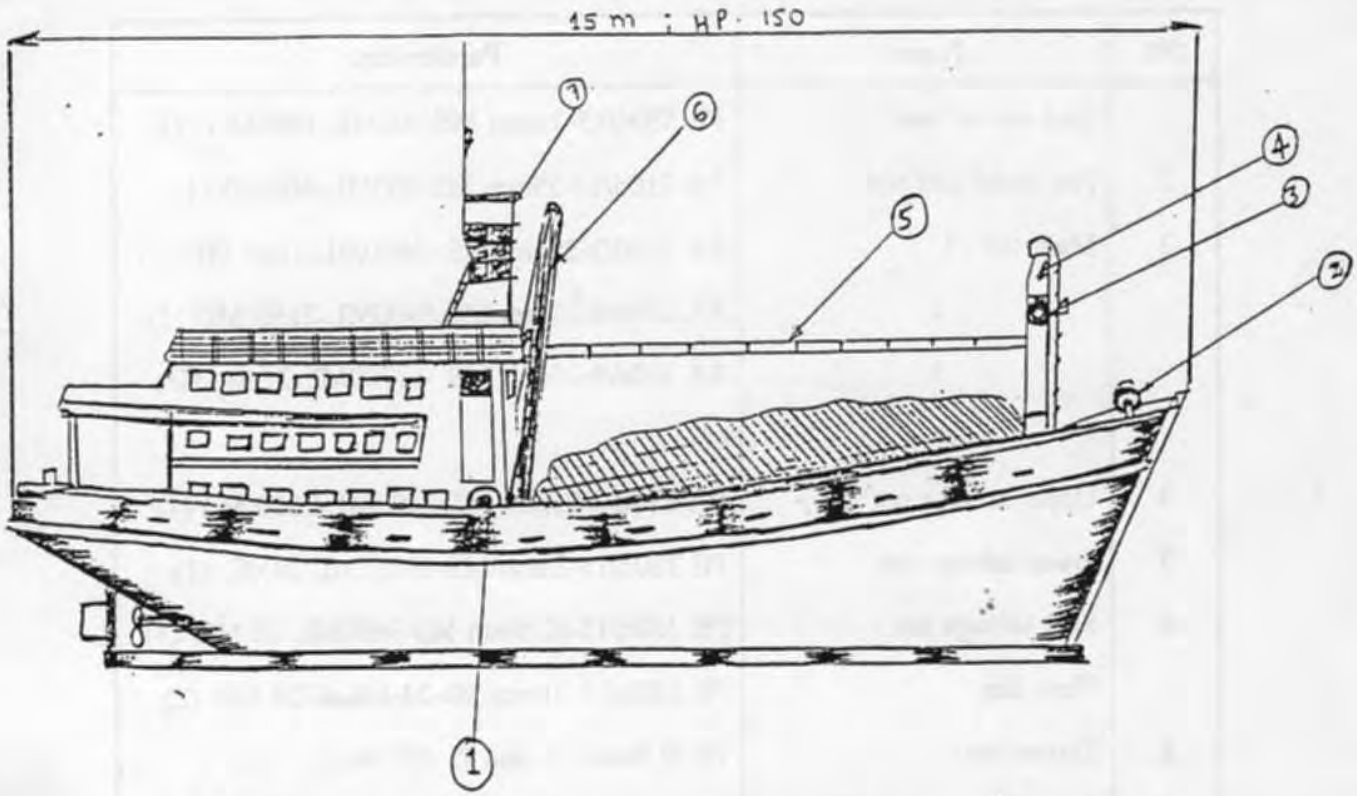
They are also classified from the point of view of fishing operation into the one boat type of purse seine and two boat type .However , they are devided into two groups :

1 **Purse seine without purse line**

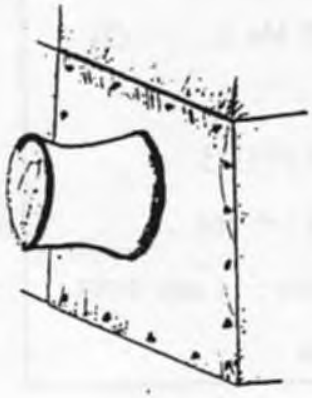
The purse seine without purse line is a surrounding net for catching Anchovy, Sardine ,...etc. It is a small scale fishing gear and generally operated by small boat with a crew of 6-12in shallow area, 2-12 meter in depth near the coast or island. The operation can also be done near the coral reefs or area with rocky bottom .

2 **Purse seine with purse line**

The purse seine with purse line is also a type of surrounding net for catching various pelagic fishes , depending on the mesh size structure of the net and method of fishing . It is a type most commonly found in coastal area .It can be operated by both of small and large boat in coastal and high sea .



1. **Capstan winch :** is used to pull the purse line, anchor line and scoop line when scooping the fish from the bunt, etc. Use the gear wheel of a car connected to the main engine and joined to the capstan on both sides of the wheel house.



2. **Bow Pulley** : Two pulleys on both sides of the bow for the purse line pass to the winch when hauling the purse ring up.

Construction of purse seine

No	Name	Particulars
1	Cod end or bunt	PE 380d/15-25mm MS-900ML-1200MD (1)
2	Net under cod end	PA 210d/12-25mm MS-900ML-960MD (1)
3	Main net : 1	PA 210d/3-25mm MS -3600ML-2160 MD (1)
	2	PA 210d/6-25mm MS-5400ML-2160 MD (1)
	3	PA 210d/6-25mm MS -11700ML-2160 MD
	4	(1)
4	Upper selvage net	PA 210d/3-25mm MS-2400ML-2160 Md (1)
5	lower selvage net	PE 380d/15-30mmMS-19355ML-24MD (1)
6	Side selvage net	PE 380d/15-62.5mm MS-9600ML-18 MD (1)
7	Float line	PE 380d/15-31mm Ms-24-ML-1728 MD (2)
8	Sinker line	PE ∅ 9mm - S and Z :420 Me.L (2)
9	Purse line	PE ∅ 9 mm -S and Z :480 Me.L (2)
10	Side line	PE ∅ 28 mm , Braided rope 530 Me.L (1)
11	Breast line (Bridle)	PE ∅ 9 mm , S and Z 20 Me .L (2)
12	Small float	PE ∅ 9 mm ,0.03 Me.L
13	Big float	PL No. 3 (60 x 200 x 40)÷1315
14	Purse ring	PL No. 5 (90 x 250 x 60) ÷ 264
15	Sinker	SST ∅ 90mm outside , thick : 15 mm ÷193
		Load 0.5 Kg -1 Kg / Piece

Abbreviations :

MS : Mesh size

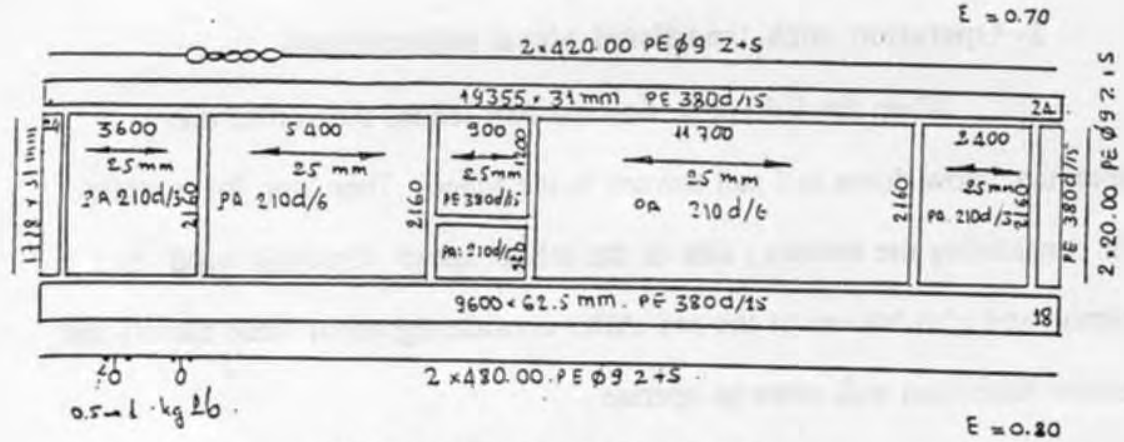
PE : Polyethylene

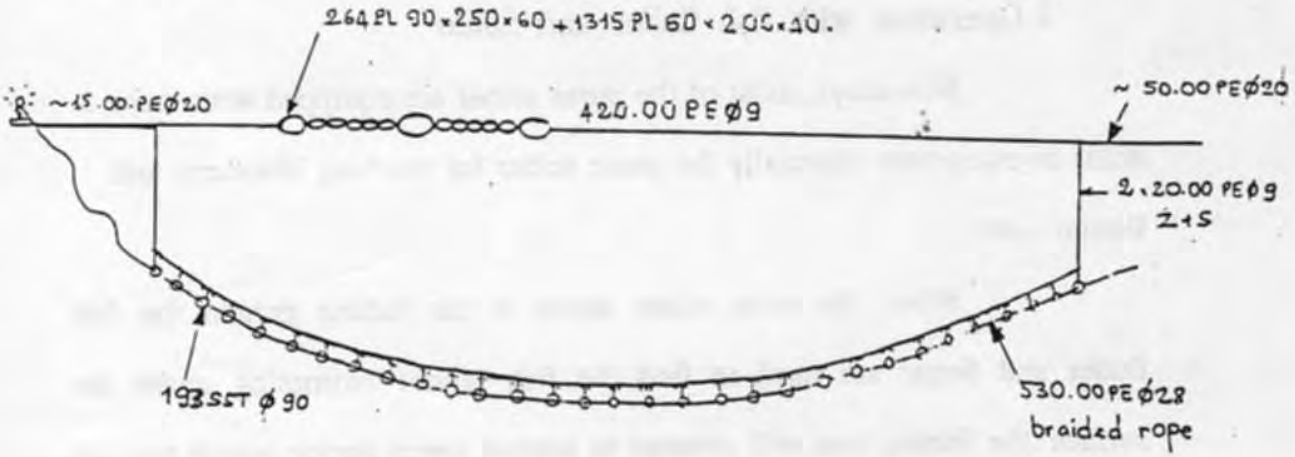
MD : Mesh depth

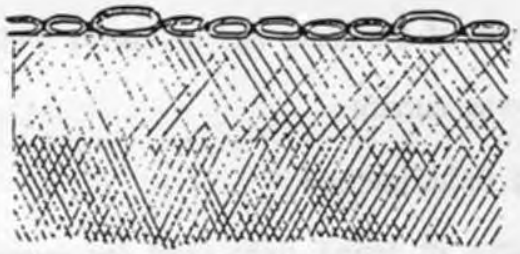
Me.D : Metre depth

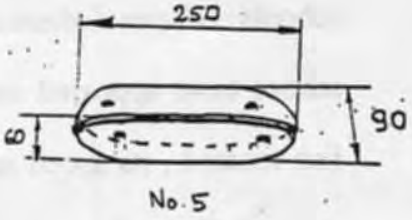
Me.L : Metre length

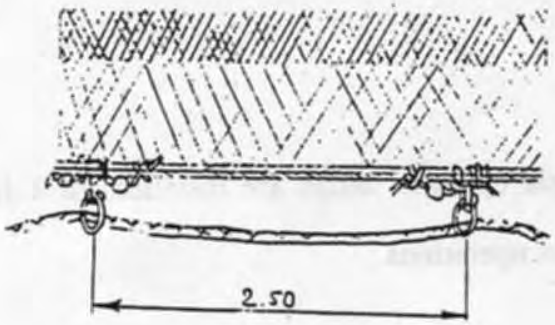
M.L : Mesh length

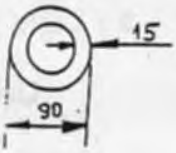

E = 0.70
2×420.00 PEØ9 2+S
19355 × 31 mm PE 380d/15
3600
25 mm
2A 210d/3
2160
5400
25 mm
PA 210d/6
2160
900
25 mm
PE 380d/15
PA 210d/6
11700
25 mm
PA 210d/6
2160
2400
25 mm
PA 210d/3
2160
PE 380d/15
2×20.00 PEØ9 2+S
9600×62.5 mm. PE 380d/15
18
2×480.00 PEØ9 2+S
0.5~1 kg/b
E = 0.80


264 PL 90×250×60 + 1315 PL 60×200×40.
~15.00 PEØ20
420.00 PEØ9
~50.00 PEØ20
2×20.00 PEØ9
2+S
193 SET Ø90
530.00 PEØ28
braided rope




250
90
6
No. 5


2.50


15
90

III Fishing operation

1- Operation with traditional visual observation

When the fisherman find the fish school they order the steerman slow down and sail toward to the school .Then stop for a while for considering the species , size of the school speed direction wind and current and also bottom of the sea .After considering about these factors the master fisherman will order to operate .

2-Operation with fish finder and Sonar

Nowadays, most of the purse seiner are equipped with these 2 items of equipment especially the purse seiner for catching Mackerel and Bonito ...etc.

When the purse seiner arrive at the fishing ground the fish finder and Sonar are used to find the fish school swimming under the surface .the fishing boat will proceed at normal speed during search for fish schools .Master fisherman will order to shot the net when he knows fish school have appeared in the screen of the sonar and he knows well about fish located , its speed and the water current .

3-Operation with luring light method

There are three types of luring light used for purse seine fishing operation .

a / Light raft :

Usually, 3 sets of gas cylinder lamps are installed on 1 light raft . 1- 13 rafts are used for these operations .

b / Light boat :

Usually , ordinary lamp, 500W , 1000W ,or mercury lamp 500 W,1000W ,1500W , are fixed to the light boat and purse seiner for these operations .

c / Underwater light :

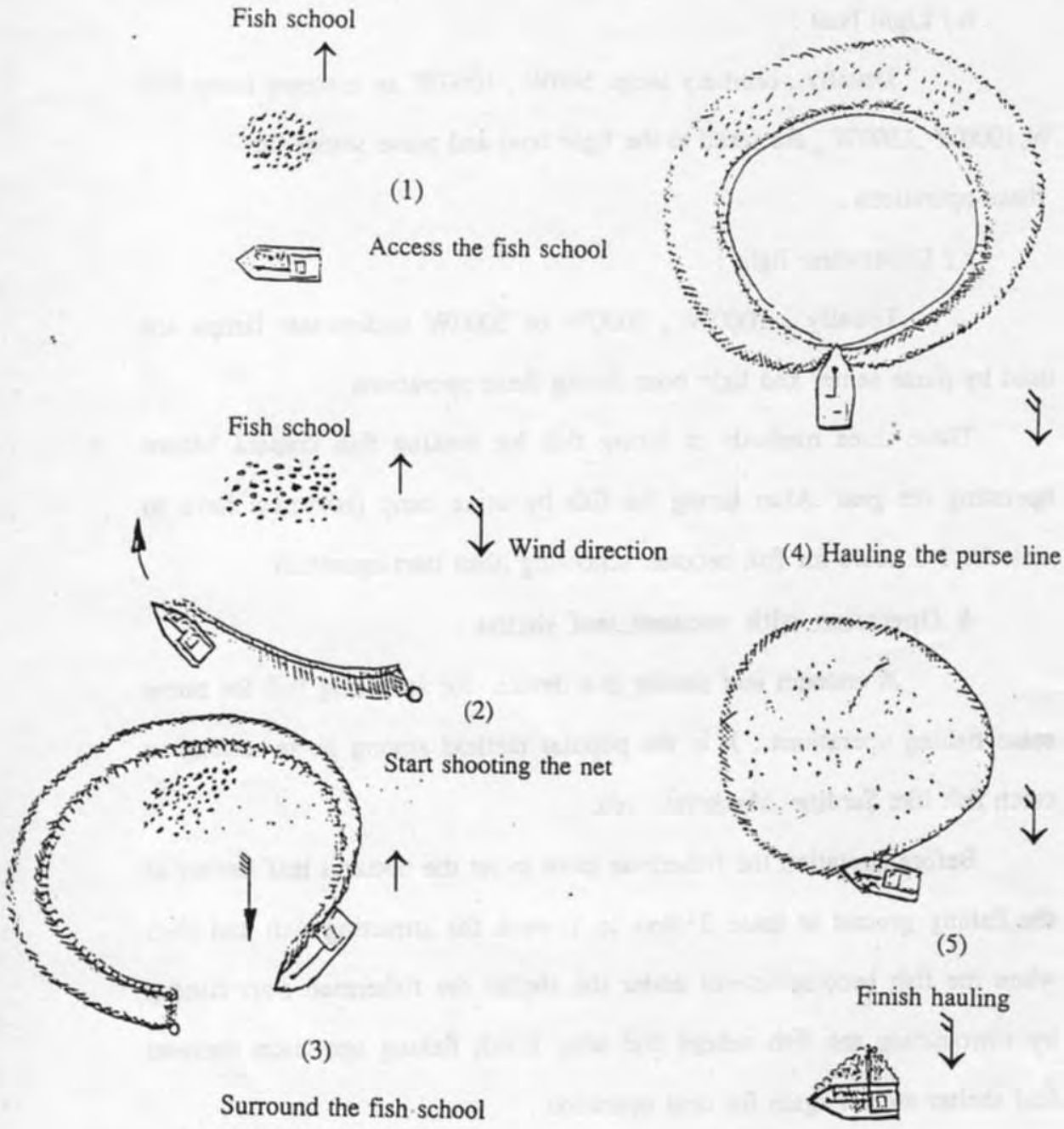
Usually , 1000W , 2000W or 3000W underwater lamps are used by purse seiner and light boat during these operations .

These three methods of luring fish for making fish content before operating the gear .After luring the fish by using lamp fisherman have to wait for 3-5 hours for fish become schooling .then start operation .

4 Operation with coconut leaf shelter

A coconut leaf shelter is a device for attracting fish for purse seine fishing operations . It is the popular method among purse seiners to catch fish like Sardine ,Mackerel, ...etc .

Before operation the fisherman have to set the coconut leaf shelter at the fishing ground at lease 3 days to 1 week for attracting fish and then when the fish become school under the shelter the fisherman start fishing by surrounding the fish school and after finish fishing operation coconut leaf shelter are set again for next operation .

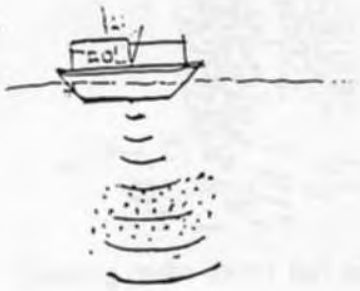


the traditional visual observation of the fishing operation

Checking fish school by

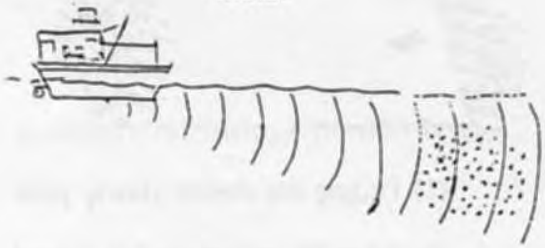
Echo sounder

(1)

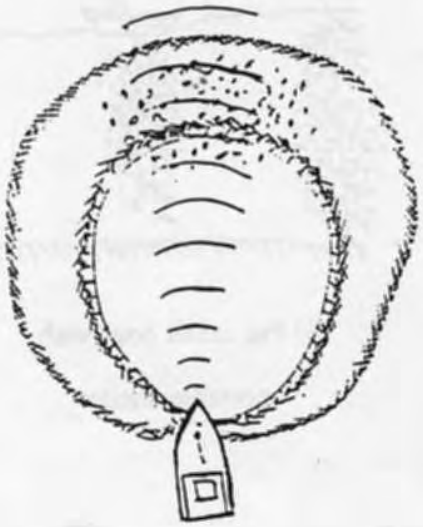


Checking fish school by

Sonar



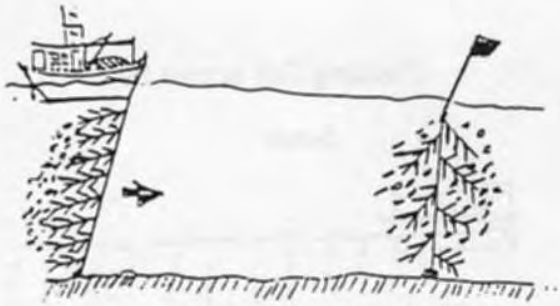
(2) Surrounding fish school



(3) Hauling purse line

(4) Scooping fish into the fish hold

Fishing operation by using fish finder and sonar

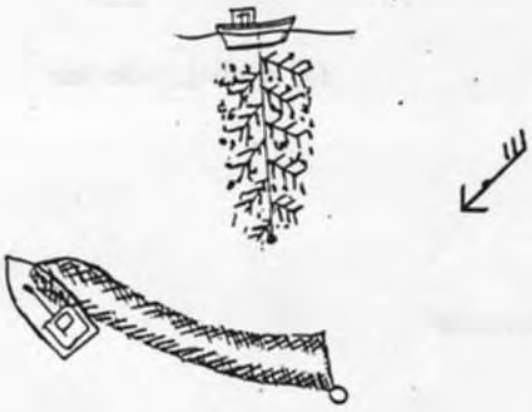


(1) Pulling the shelter slowly pass the other for collecting fish school

(2) Use full speed when passing another shelter for attracting fish.

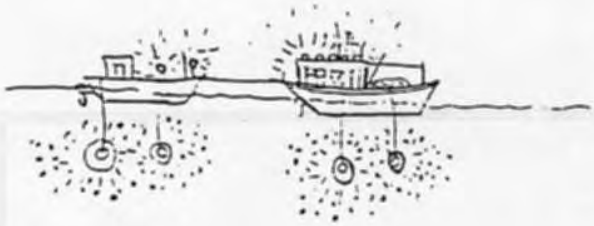
(3) Put small boat with portable shelter

(4) moving fish from the fixed shelter to portable shelter.



(5) Start shooting the net.

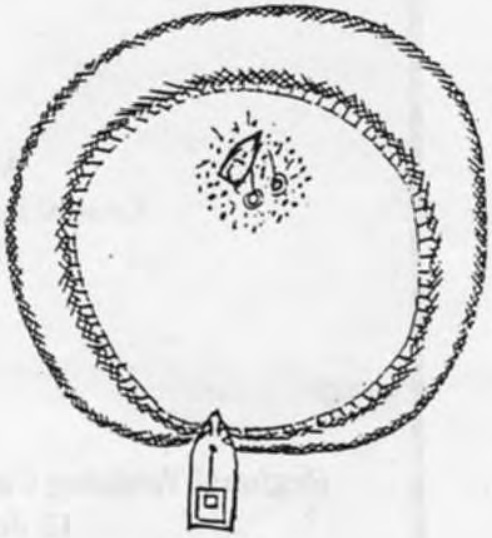
Day time fishing operation by using coconut leaf shelter.



(1) Setting the lamp after sun set.

(2) Turn off all the lamp on boat for making fish content at light boat.

(3) Start surrounding the light boat.



(4) Start hauling purse line .

(5) Collecting fish put into the fish hold .

Night time operation with luring light .

Approaches to Energy Conservation in Fishing

By

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Contents

Tables

Figures

Approaches to Energy Conservation in Fishing

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1.0 Background

1.1 Modern fishing is one of the most energy intensive methods of food production. Energy input for production of rice is one-tenth of the output. The ratio between input and output of energy is close to unity for milk production by grass-fed cows and artisanal coastal fishing. However, distant water fishing is extremely energy intensive consuming 15 to 20 times more energy than it produces.

1.2 Mechanized fishing is dependent on fossil fuels. Fossil fuels are non-renewable and limited. Estimated oil resources in 1995 was 138 billion tonnes. At the current levels of consumption (3.23 billion tonnes a year) this will last only for next 42 years if drastic conservation measures are not taken.

1.3 Moreover, fossil fuels produces increased levels of carbon dioxide in the atmosphere. Increase levels of carbon dioxide in the atmosphere produces what is known as "green house effect". Green house effect lead to global warming, irreversible climatic, oceanographic and sea level changes, which is of serious consequence to the inhabitants of the earth. Use of fossil fuels also produces other pollutants which are detrimental to the environment and human health.

1.4 The dramatic escalation in oil prices during the seventies brought the need for fuel conservation to sharp focus. Spiraling oil prices may severely affect the economic viability of fishing as a means of food production.

1.5 One of the triple challenges facing the fishing industry today, apart from issues of resource conservation and ecological safety, is energy conservation. Many nations have begun serious large scale programmes in energy conservation, in consideration of the implications mentioned above. This paper outlines important approaches to energy conservation in fishing so that unit coast of production of fish and environmental impact of fossil fuel use, could be brought down, apart from an extension in the use of limited oil resources, until viable alternative means are found.

2.0 Fuel Consumption in Fishing Industry

2.1 Annual fuel consumption by fishing industry is roughly 15-21.5 million tonnes. Fuel consumption by industrial sector (14-19 million tonnes) is 9-15 times more than that of small-scale sector (1-2.5 million tonnes), whereas the production per tonne of fuel is lower by a factor of 4 to 5 (Table 1).

Table 1. Fuel consumption and production per unit fuel use in fishing industry

	Large scale sector	Small scale sector
Annual fuel consumption (million tonnes)	14 - 19	1 - 2.5
Fish caught per tonne of fuel consumed (tonnes)	2 - 5	10 - 20

Source: Allsopp 1988

3.0 Methods of Energy Conservation in Fishing

3.1 Fishing Gear & Methods

Choice of fishing gear is one of the main options available for energy conservation in fishing. Large variations in energy use exist among different fishing gears (Table 2). The introduction of man-made netting materials has increased the catching power and fuel efficiency of fishing gears. Same of the energy conserving fishing practices such as large scale purse seining became possible only with the introduction of synthetic netting material.

Table 2 Fuel consumption vs.. fishing methods

Fishing method	Kg of fuel needed to catch one kg of fish
Trawling	0.8
Longlining and Gillnetting	0.15 - 0.25
Purse seining	0.07

Source: Gulbrandson 1986

3.1.1 Fuel consumption vs. fishing methods

Trawling is the most energy intensive fishing activity (1.25 kg of fish /kg fuel). It consumes 3 to 5 times more fuel compared to longlining and gillnetting and over 11 times more fuel compared to purse seining for every kg of fish produced. Purse seining for schooling fish is the most energy-efficient fishing method producing 14.3 kg of fish per kg of fuel. Passive fishing methods such as longlining and gillnetting have intermediate efficiency producing 4 to 6.7 kgof fish per kg of fuel. Thus most potential for energy conservation exists in trawling.

3.1.2 Fuel consumption in trawling

In trawling typically a substantial portion of the time is spent for towing the gear. During the tow, the resistance of the vessel is insignificant compared to the resistance of the gear. The gear resistance therefor has a large effect up on the overall fuel economy. Fuel costs can be around 50 per cent of the total expenses on a fishing trip.

3.1.3 Drag of trawl gear components

The drag of trawl gear components vary considerably from design to design and depending on operational conditions. A typical set of values for Nordic trawl designs are given in Table 3, below:

Table 3 Drag of trawl gear components (percentage on total drag)

		Drag (per cent)
Warp	...	5
Sweeps	...	4
Otter boards	...	20
Floats	...	3
Foot rope	...	10
Netting	...	58

Source: Wileman 1984

3.1.4 Methods of fuel saving in trawl fishing

After extensive model tests and field studies on Nordic trawl designs Wileman (1984) has arrived at several means of reducing drag in trawl system (Table 4). Of these use of double rig system, use of large meshes, use of thinner twine and door angle adjustment are in common fishing practice. Gear that is not matched to the economic towing power of the vessel, wastes energy.

Table 4 Methods of fuel saving in trawl fishing

Approaches to fuel saving	Reduction in total drag
Use of knotless netting in some trawl sections	7 %
Use of thinner twine in upper trawl sections	7 %
Use of large meshes in the upper trawl sections	7 %
Use of cambered otter boards	4 %
Reduction of door angle of attack to 30 to 35 degrees	4 %
Fitting of slot to otter boards	2 %
Use of double rig trawl system for catching fish living close to bottom	25 %

Source: Wileman 1984

3.1.5 Fish Aggregating Devices (FADs)

Use of fish aggregating devices in purse seining and other types of fishing techniques increases the catch per unit effort and decreases the search tine, thus reducing energy use.

3.2 Vessel Technology

Significant improvement in operational savings has been achieved by optimizing vessel and machinery design. The power required to propel a vessel is mainly a function of (I) speed, (ii) length of water line and (iii) displacement, i.e., weight of boat including crew, fishing gear, fish and ice.

3.2.1 Economic vessel speed

Vessel speed is the single most important factor affecting fuel consumption of the vessel (Fig. 1). The concept of economic speed is most important in energy conservation. When reducing speed of a vessel of 8.0 m LWL and displacement of 3.5 tonnes from 7.0 knots to 6.0 knots, the saving in fuel is 2.2 l/h (4.8-2.6) or 46 percent. True fuel consumption, taking into consideration the distance travelled, is 0.26 l/h (0.69 - 0.43) or 37 per cent (Table 5)

Table 5 Fuel Consumption vs. speed and distance covered (vessel LWL: 8.0 m; displacement: 3.5 t)

Speed in kn	Fuel consumption l/h	l/nm
5.0	1.7	0.34
6.0	2.6	0.43
7.0	4.8	0.69

Source: Gulbrandson 1986

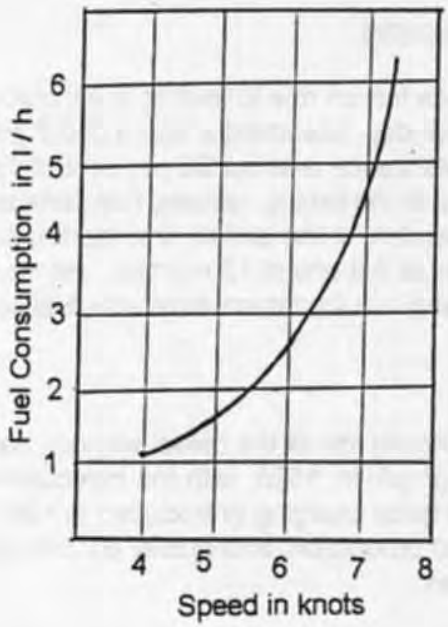

Fig 1. Fuel consumption vs. speed (LWL: 8.0 m; Displacement: 3.5 tonnes) (adapted from Gulbrandson 1986)

3.2.2 Hull Design & Maintenance

Reduction in power requirements can be achieved by (I) increasing length of waterline (LWL) and (ii) reducing displacement wherever possible at the design stage, and taking measures for control of hull fouling.

3.2.2.1 Length of waterline (LWL)

For normal economic speed the ratio between vessel speed (kn) and boat length (ft), V L is close to unity. Increasing length of waterline while keeping other dimensions the same, it is possible to reduce hull resistance and thus increase speed. Although the weight of the vessel is increased in the process the overall effect on hull resistance is beneficial. However increase in construction cost has to be balanced against fuel saving advantages. Trials Norway and Denmark have shown 15 to 25 percent reduction in resistance by modifications with a sharper bow and long waterline on existing vessels. By increasing LWL from 8m (Displacement 3.5 t) to 10 m (Displacement 4.0 t) fuel saving of the vessel can be 23 percent at a service speed of 6.5 kn.

3.2.2.2 Displacement

Reduction in displacement also contribute to lower fuel consumption. Hull built of aluminium, FRP and plywood will be lighter than that of steel, ferrocement and conventional wooden construction. Fuel advantage can be up to 14 percent for a 8 m boat when hull weight is decreased from 2.0 t (displacement 3.5 t) to 1.5 t (displacement 3.0 t) at a service speed of 6.5 knots. Fuel saving advantage has to be balanced against a possible reduction in the sea kindliness of the vessel.

3.2.2.3 Antifouling measures

In tropics, surface friction due to fouling is estimated to increase at the rate of 0.6 to 1.5 per cent per day. Assuming a figure of 0.7 per cent per day as average and that the frictional resistance is about 35 per cent of the total resistance at the normal operating speed of the fishing vessels, fuel consumption due to fouling would increase by 7 per cent at the end of first month, 44 per cent at the end of 6 months and 88 per cent at the end of 12 months. Hence use of antifouling paints and periodic hull cleaning can lead to considerable fuel conservation.

3.2.3 Engines

Specific fuel consumption of the diesel engines has decreased from 175 g/hp/h in 1945 to 135 g/hp/h in 1995, with the introduction of major technical improvements such as turbo charging (introduced in 1965) and new material development, advanced production and quality control systems and computer aided design techniques

3.2.3.1 Type of engines

Two types of engines are used in small fishing boats (I) outboard petrol/and or kerosene engines and (ii) inboard diesel engines. The main disadvantage of two stroke outboard engine is the high fuel consumption (specific fuel consumption : 0.5 - 0.6 l/hp/h) compared to diesel inboards (0.25 l/hp/h).

3.2.3.2 Engine power and operating range

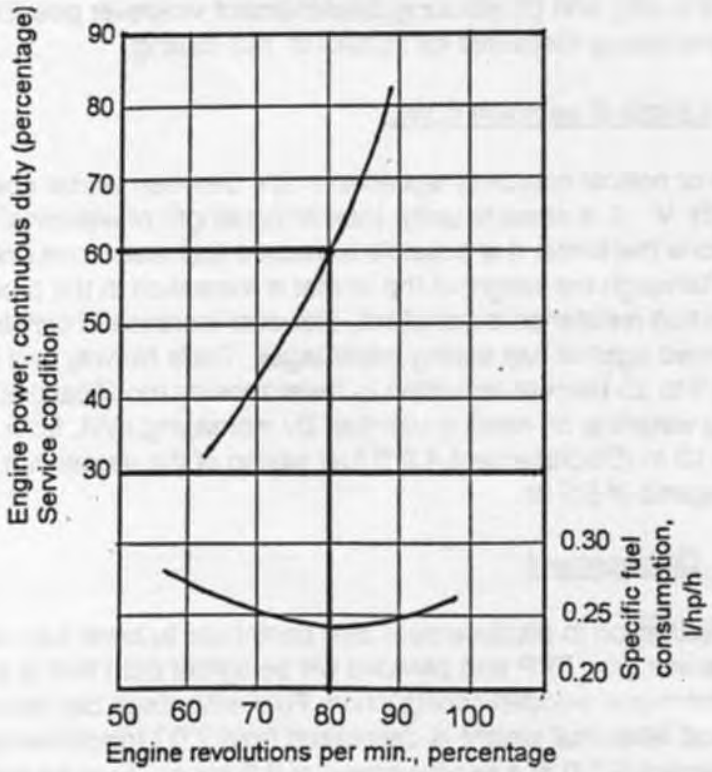

Fig 2. Engine power and operating range (adapted from Gulbrandson 1986)

Modern marine diesel engines will run most economically at service speed of 80 per cent of the maximum engine RPM. The power out put would then be about 60 per cent of the maximum power (Fig. 2). The propeller should be designed to allow engine to operate in the area of lowest specific fuel consumption.

3.2.3.3 Engine maintenance

The loss in efficiency of a badly maintained engine can be as high as 30 per cent. Preventive maintenance including regular cleaning or replacement of injectors, oil changes as recommended by the engine manufacturer are very important steps in conserving fuel and controlling pollution.

3.2.4 Reduction gear, propeller and nozzle

The efficiency by which the propeller converts the engine power to thrust depends mainly on propeller revolutions, provided an optimum propeller diameter and pitch are used. Considerable fuel saving is possible if larger propeller with lower rpm (larger reduction gear ratio) matched to absorb the engine power at the lowest specific consumption RPM, is used. Incorporation of propeller nozzle and improved design of propeller would also cut down fuel consumption rate.

3.2.5 Sail-assisted propulsion

In many countries like India, Sri Lanka and Indonesia there is a long tradition of using sail in small fishing crafts and kattamarans. If the sail is used as the main propulsion wherever it suits the fishing method adopted, it is possible to reduce the size of the engine to what is required for maneouring in the harbours and fishing grounds. In low energy passive fishing methods like gillnetting and longlining it is definitely a practical alternative energy source.

3.3 Adoption of Advanced Technology .

3.3.1 Global Positioning Systems and acoustic fish detection and monitoring techniques

Recent advances in technology have provided fishermen with equipment to reach the potential fishing ground accurately (Global Positioning Systems); detect the presence of fish and monitor the success of capture process acoustically (echosounder, sonar and net sonde), thus saving search time and fishing time and hence energy.

3.3.2 Remote Sensing Techniques

Progress in satellite-based remote sensing techniques which use sea surface temperature and ocean colour to identify areas of potential fish abundance also greatly reduces search time as near-real time information is communicated to the fishermen.

3.3.3 Geographical Information Systems (GIS)

Development of fishery-based Geographical Information Systems could ultimately provide accurate decision support for choice of fishing grounds for specific target species, based on spatial relationship of fish stocks in relation to hydrographic and bathymetric parameters.

3.4 Fleet management

Energy can also be conserved by optimizing fleet management. Multi-day fishing rather that daily fishing; mother ship and catcher boat operations wherever practical are fuel saving practices in fleet operation.

3.5 Conservation and Enhancement of Fishery Resources

Most of the important fish stocks of the world have been subject to relentless fishing pressure leading various stages of growth and economic overfishing. This has resulted in diminishing returns from traditional stocks, reduction in average size and catch per unit effort and thus considerably increasing the fuel cost per unit weight of fish caught. The effort in searching and catching is obviously a function of the abundance of the target species.

Two of the most effective ways of reducing fuel costs are therefore (i) conservation of resources and (ii) enhancement of depleted stocks. Conservation measures may include (i) area closures, (ii) seasonal closures, (iii) quota systems, (iv) mesh regulation, (v) banning of destructive fishing practices (e.g. dynamiting and cyanide fishing), (vi) protection of nursery grounds, (vii) promotion of selective fishing gear and methods, (viii) promotion of eco-friendly and low energy fishing gear and practices and primarily (ix) by controll of total fishing effort through a system of licenses, so that yields remain at sustainable level. Fishery enhancement schemes may include the hatchery production of fingerlings and their release to the natural environment, sea ranching and creation of artificial reefs.

4.0 Conclusions

The need for conserving fossil fuels can not be over stressed, considering its non-renewable nature, limited availability and the effect of its use on environment. Until alternative sources of energy become viable, the existing stocks has to be used with extreme care, with accent on conservation and ecological safety. It is in the long term interests of the fishing industry to take note of the urgency of the situation and translate the means available for conservation into immediate action and for the fishing nations to develop and adhere to a fuel conservation strategy.

5.0 Acknowledgments

The author is grateful to the Chief of Training Department, Training Division Head and Course Coordinator for the excellent facilities and support; to Japanese experts and members of Teaching Faculty of SEAFDEC/TD for sharing their expertise during the class room sessions. The opinions expressed in this paper is not purported to be officially subscribed by the Organization to which the author belongs.

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Conserve Fuel; Lest It be the Last Drop !
Conserve Resources; Lest It be the Last Fish !!
Protect Environment; Lest It be Our Last Breath !!!
Earth is a Spaceship where Nothing is Unlimited
And Everything is Interconnected

STUDY REPORT

ON

REVIEW OF BOTTOM LONG LINE USED BY SMALL SCALE FISHERIES IN INDONESIA

By

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Regional Training Course in Commercial Fishing Technology
18 June - 17 December 1996
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(Arius SP) Shark (Charcharias SP) , Ray (Trygon SP) Thread fin bream (Nemepterus SP),Yellowpik conger (Congresox SP) and the other demersal fishes .

2 / Classification of bottom long line .

Bottom long line can be classified by the baiting method and by the target species . Classification by the baiting method are two type of bottom long line.

- Baited bottom long line

This type of bottom long line , fish can be couch by eating the bait which placed on the hooks .

- Unbaited bottom long line

This type of bottom long line , fish can be couch by tangling on the hooks . In this case the fishes entangling not on the mouth part , but on the other part (body fin etc)

By the target species bottom long line can be classified into

- Red snaper bottom long line
- Shark bottom long line
- Ray bottom long line

2.1 - Red snaper bottom long line

Even the target species not only Red snaper but mostly this kind of fishing gear is called Red snaper bottom long line .This type of bottom long line is common in all area of the country , but the fishing gear and method various according to topography at the sea bed the depth of the

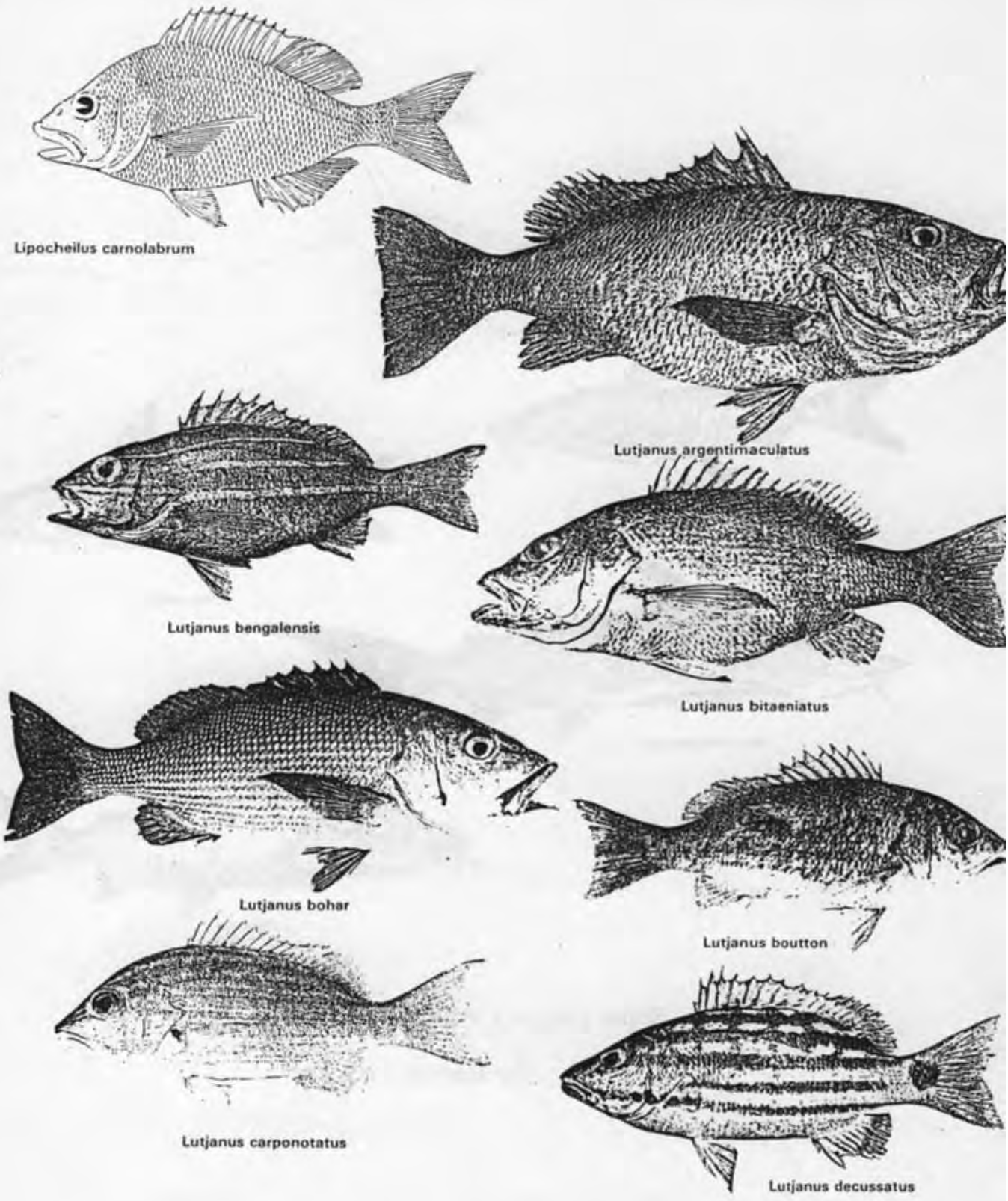


Fig 1 Some kind of snapers (Lutjanus sp) cought by Bottom long line

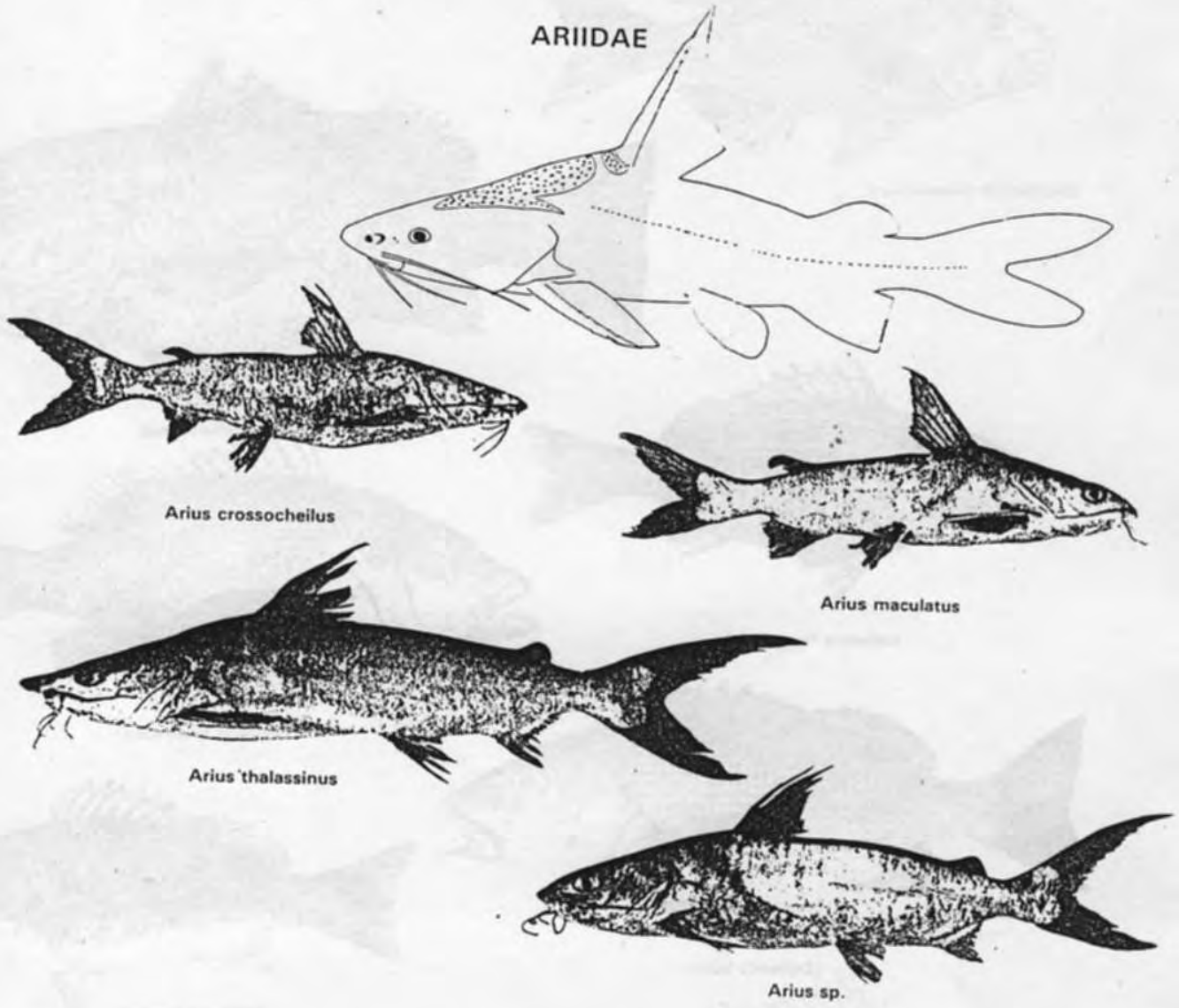
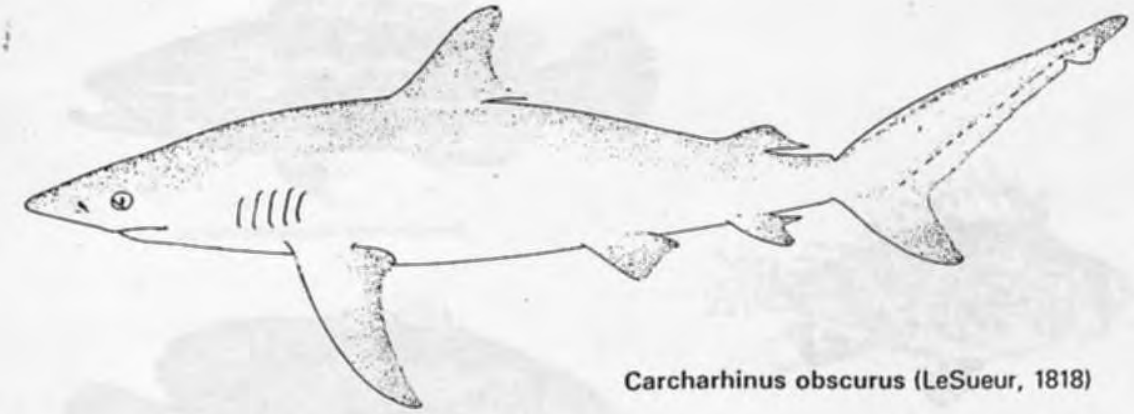
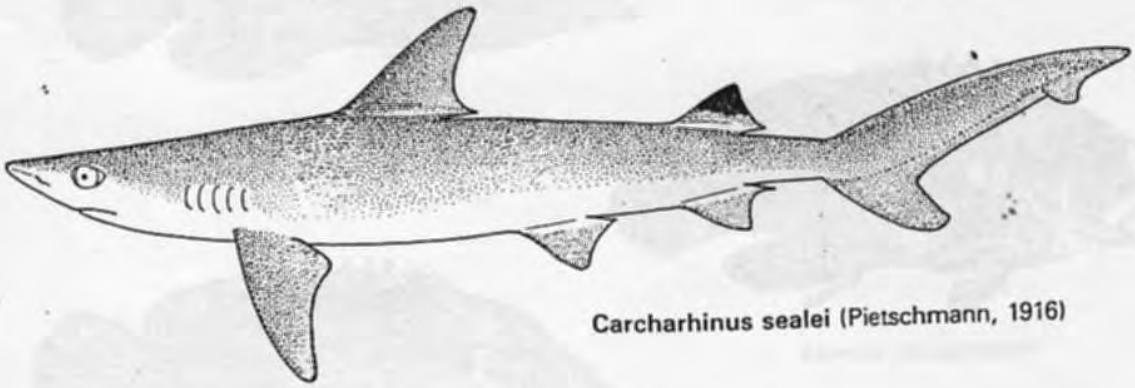


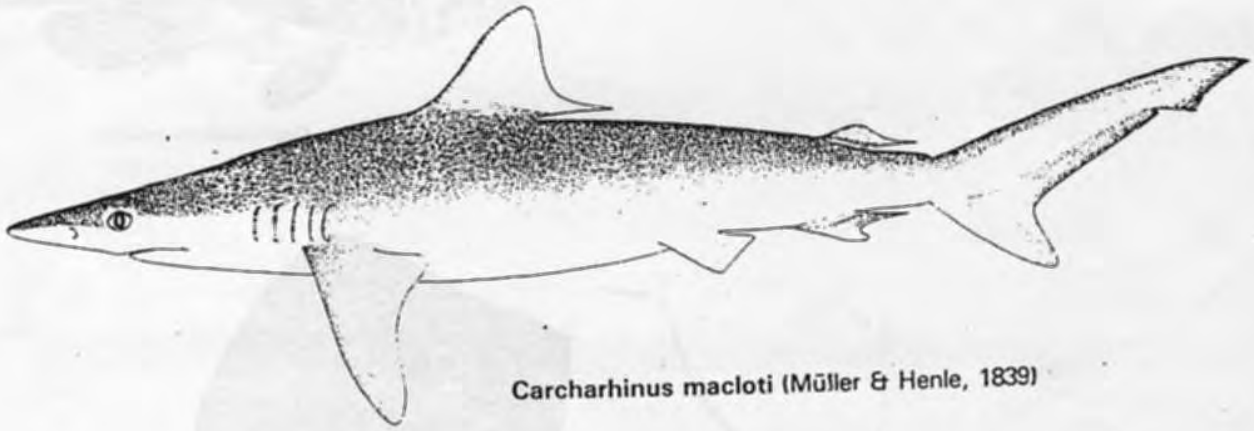
Fig 2 Some kind of Catfishes (Arius sp) cought by Bottom long line



Carcharhinus obscurus (LeSueur, 1818)

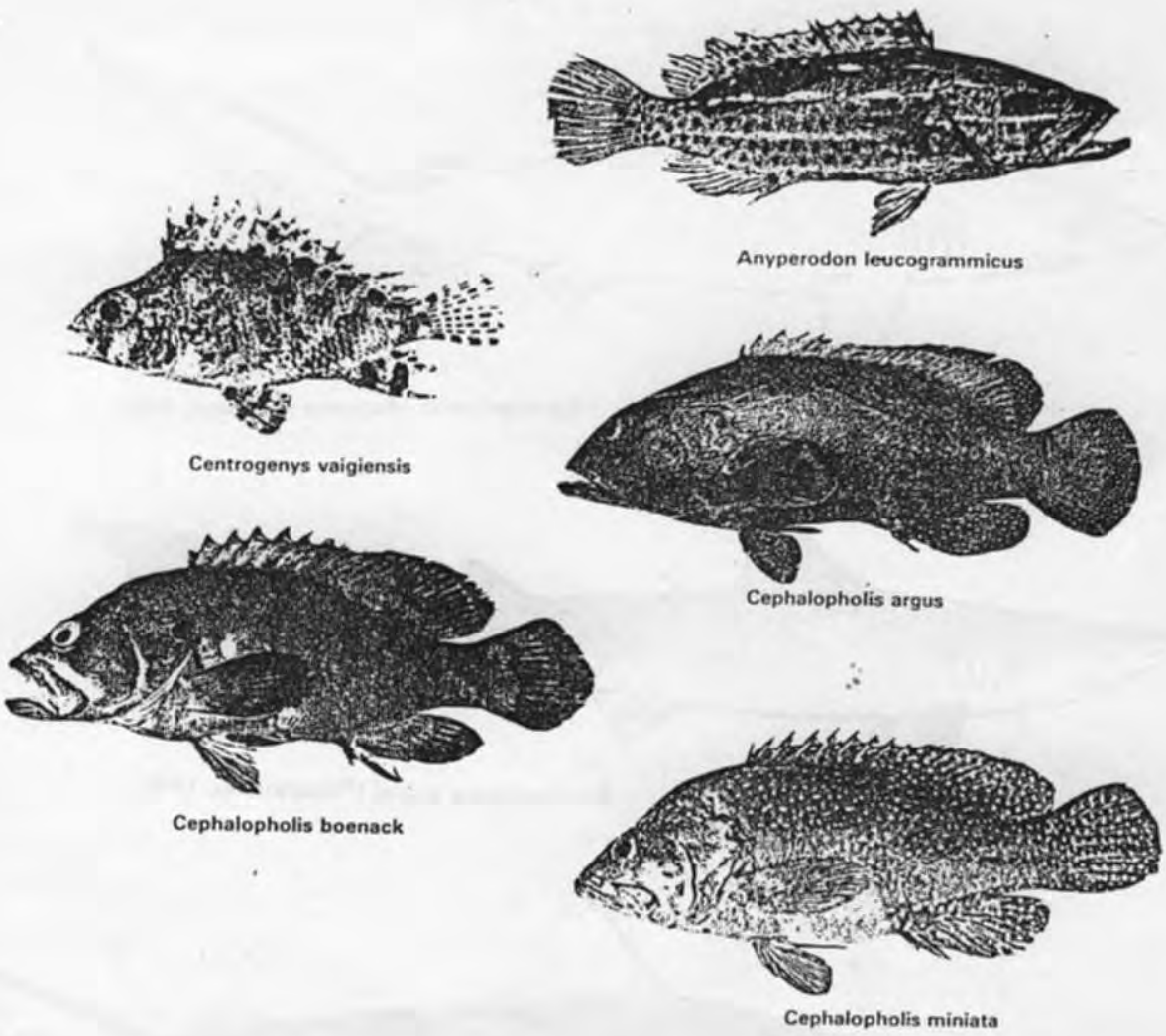


Carcharhinus sealei (Pietschmann, 1916)



Carcharhinus macloti (Müller & Henle, 1839)

Fig 3 Some kind of Sharks (Char carias sp) cought by Bottom long line



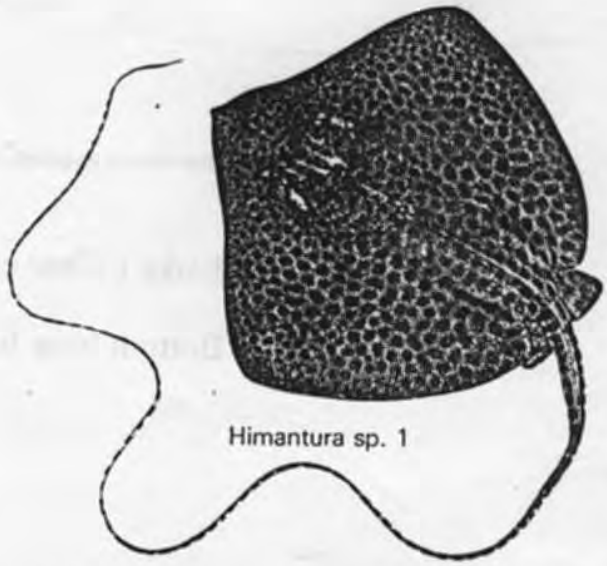


Fig 4 Some kind of Groupers (Spenepecus sp)and Ray (Trygon sp)cought by Bottom long line

CONGRIDAE

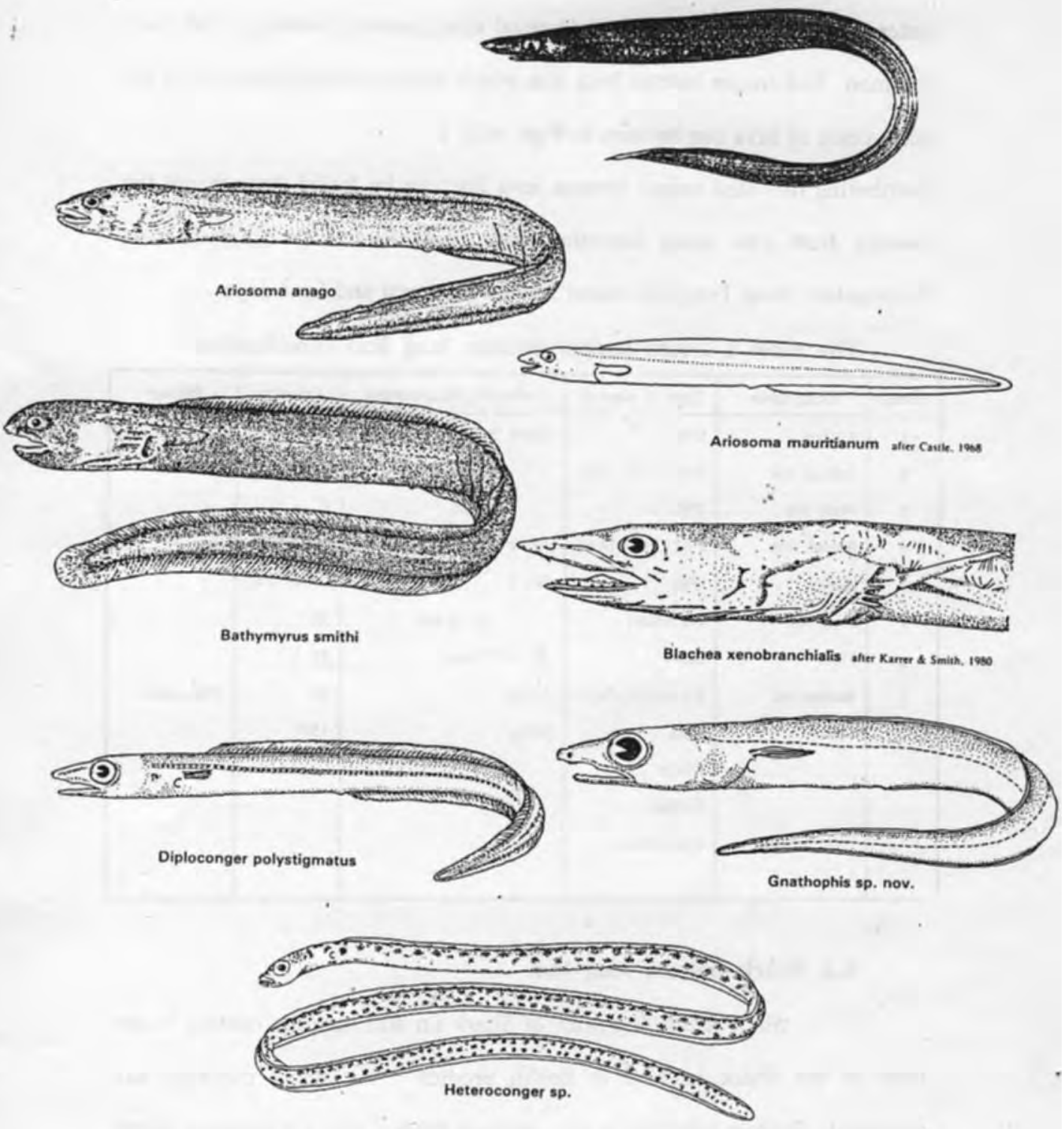


Fig 5 Some kind of Yellow pikes conger(Congersok sp) cought by Bottom long line

water and gear handling method (manual ormechanical hauling) The most common Red snaper bottom long line which were used by fisherman at the north coast of Java can be seen in Fig6 table 1

distributing of - Red snaper bottom long line can be found through out the country from east coast Sumatra North coast Java West to east coast Kalimantan ,Nusa Tenggara island , South Sulawesi and Irian Jaya .

The table 1 : Red snaper bottom long line specification

Serial	Designation	Type of material	Standard / Measurement	Quantity	Remark
a	Anchor	Iron	About 5-7 Kg	2	
b	Anchor line	Polyethylene	4 -5 mm	2	
c	Main line	(PE)	4 mm	1	
d	Branch line	Polyethylene	Ø =1.1 mm , 1.5 m	2000-3000	
e	Hooks	(PE)	No 7	2000-3000	
f	Float line	PA .Mono	5 - 6 mm	30	
g	Float	Steel	Ø = 175 mm	32	
h	Marker rod	Polyethylene	2.5 m	30	With sinker
i	Sinker	(PE)	300 g	150	
		Plastic			
		Bamboo			
		Iron / stone			

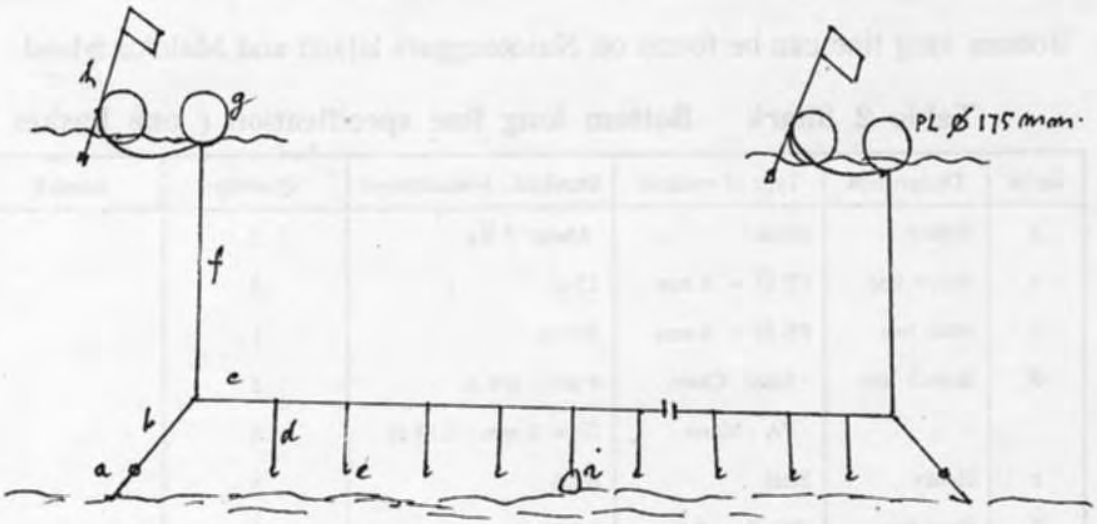
2.2 Shark bottom long line

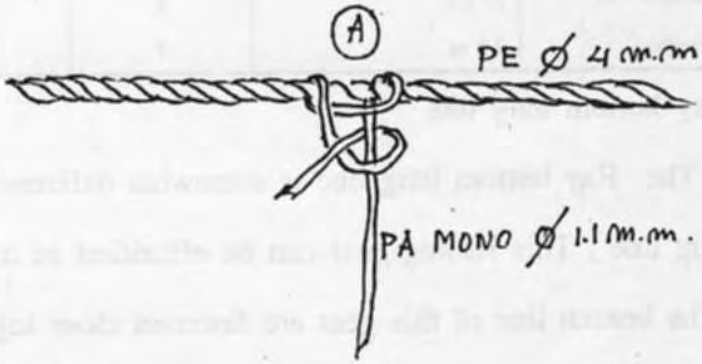
Since increasing price of Shark fin and squaline contain in the liver of the Shark is used in health product , the Shark catching has increased . Bottom long line is the common fishing gear for catching Shark . The difference of Shark bottom long line from an ordinary Bottom long line is the material of the branch line . This fishing gear used metal as a branch line to protect from the Sharp shark teeth . The construction of the

RED SNAPER BOTTOM LONG LINE.

LOCATION: NORTH COAST JAVA.

VESSEL:
LOA : 12 m.
HP : 50 HP





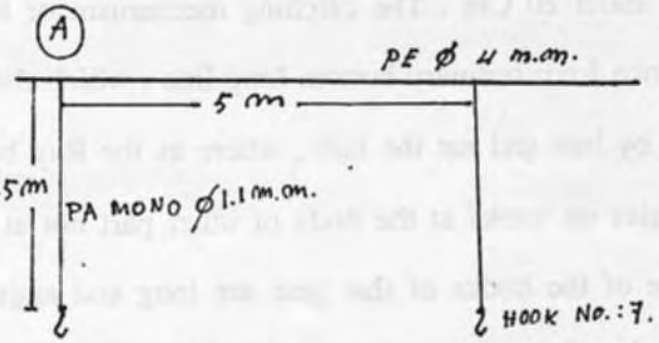


FIG. 6. SNAPER BOTTOM LONG LINE GENERAL CONFIGURATION.

Shark Bottom long line can be seen in Fig 7 table 2 .Distributing of Shark Bottom long line can be found on Nusatenggara island and Maluku island .

Table 2 Shark Bottom long line specification (one basket)

Serial	Designation	Type of material	Standard / Measurement	Quantity	Remark
a	Sinker	Stone	About 5 Kg	2	
b	Sinker line	PE Ø = 8 mm	15 m	2	
c	Main line	PE Ø = 8 mm	100 m	1	
d	Branch line	- Steel . Chain	4 mm - o.8 m	5	
		- PA . Mono	Ø = 2 mm - 0.17 m	5	
e	Hooks	Steel	No 3	5	
f	Float line	PE Ø = 8 mm	1.5 depth	2	
g	Float	Jerrican - PL	25 LT	2	
h	Marker rod	Bamboo	2.5 m	2	

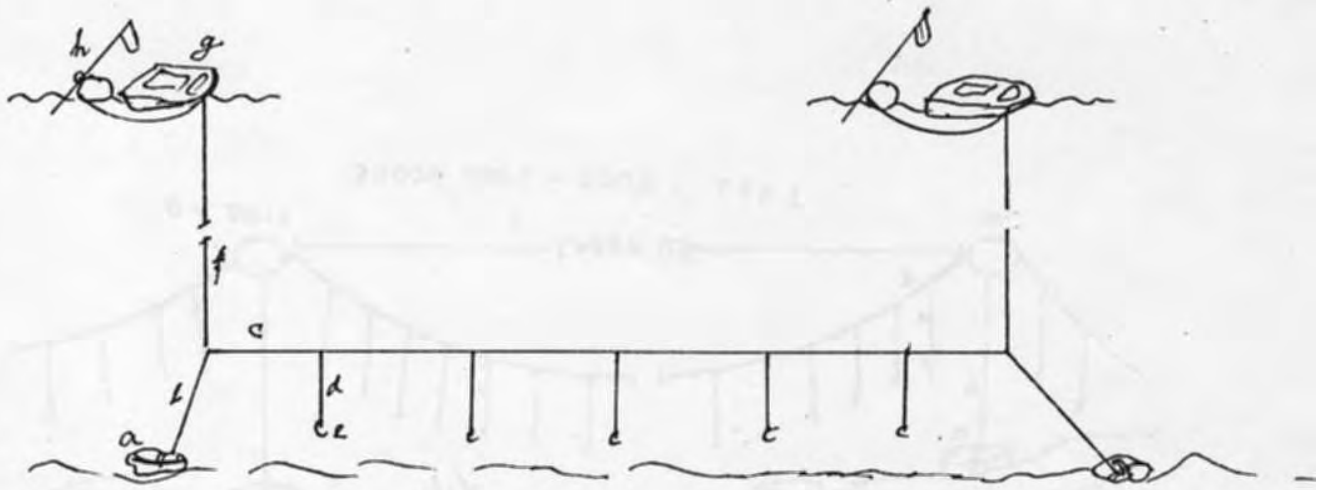
2.3 Ray bottom long line

The Ray bottom long line is somewhat deference from ordinary bottom long line . This fishing gear can be classified as unbaited bottom long line. The branch line of this gear are fastened close together , with interval only about 20 Cm . The catching mechanism of Ray bottom long line is difference from ordinary bottom long line , which the fish to be coutch is attracted by bait and eat the bait , where as the Ray bottom long line the fish entangles on hooks at the body or other part not at the mouth of fish . The shape of the hooks of this gear are long and angular with a very sharp point and without barb on it . The configuration of Ray bottom long line which widely used in Lampung province , Indonesia is shown in Fig 8 table 3 .

SHARK BOTTOM LONG LINE.
SHARK, RAY. -

LOCATION :
NTB. PROVINCE

VESSEL :
LOA : 9 m.
hp : 25 HP.
CREW : 3-5.



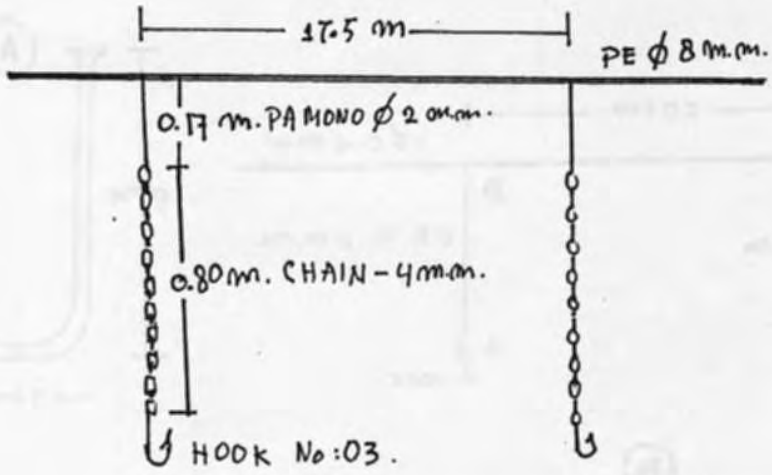


FIG. 7. SHARK BOTTOM LONG LINE GENERAL CONFIGURATION.

RAY BOTTOM LONG LINE
MAIN CATCH: RAY.

LOCATION :
LAMPUNG PROVINCE

VESSEL :
LOA : 9 meter.
hp :
CREW : 2 - 3.

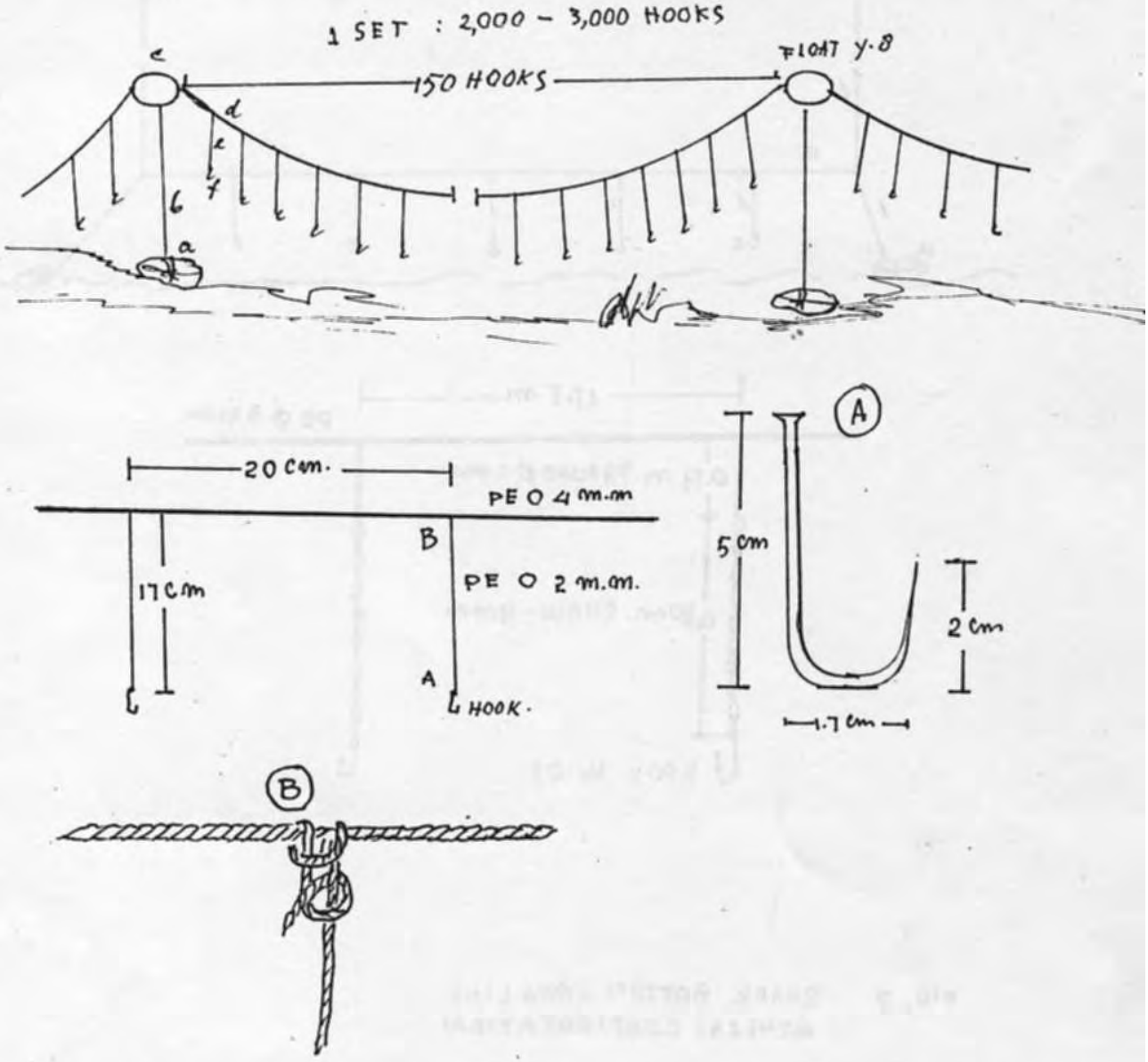


FIG. 8. RAY BOTTOM LONG LINE
GENERAL CONFIGURATION.

Table 3 Ray bottom long line specification

Serial	Designation	Type of material	Standard / Measurement	Quantity	Remark
a	Sinker	Stone	About 2 - 3 Kg	2	
b	Sinker line	PE	∅ = 4 mm , 1m	2	
c	Float	Plastic	Y . 8	2	
d	Main line	PE ∅ = 4 mm	31 m	1	
e	Branch line	PE ∅ = 2 mm	20 Cm	150	
f	Hooks	Steel ∅ = 2 mm	5 Cm ,1.17 - 2 Cm	150	

III DISCUSSION

1/Fishing Gear Construction

The main part of the bottom longline which widely used by small scale fisheries consist of mainline, branchline, hooks, floatline and anchors. Polyethylene ropes (PE) are widely used as mainline. Even this material has low specific gravity, but the price is not so expensive. In order to increase the sinking force, the sinkers are attached.

The thickness of mainline is determined by many factors such as the size of the target species, the size of the boat and the gear handling method (manual or mechanical hauling). As general rule, the breaking strength of the mainline is greater than 10 times of the tonnage of the vessel or the square of the vessel length (in meter), or atleast 10 times the weight of the largest fish one expect to catch.

For example the minimum breaking strength for mainline of bottom longline used by 9 meters, 4 tons vessels must be greater than;

- $10 \times 4 = 40$kg
- $9 \times 9 = 91$kg

But if one expects to catch individual fish weighing 10kg it is necessary to calculate ;

- 10 × 10=100kg

Generally the thickness of the mainline which widely used are about 4mm in diameter for red snappers bottom longline, 8mm in diameter for shark bottom longline and 4-5mm for ray bottom longline.

The branch line should have low visibility in water, high flexibility and good breaking strength.

Red snapper bottom longline mostly use PA monofilament as branchline. The shark bottom longline using metal branch line (steel or monel) and ray bottom longline using Polyethylene or PA monofilament.

The breaking strength of the branch line is determined by the size of the fish and it must be atleast equal to twice the weight of the fish which is expected to catch. The length of branch line is usually less than half the distance between branch line in order to avoid entangling.

The hooks are usually chosen by experience, according to size and behavior of the target species. The hooks for ordinary bottom longline are all mostly the same shape but vary in size. This type of hooks has a long shank and rounded bend and are barbed. The hook for ray bottom longline are long angular without barb.

Float line is mostly made of the same material with the mainline but the thickness is little bit bigger . The length of float line depends on the depth mostly 1.5 times by the depth.

In order to fix the position of the bottom longline at certain fishing grounds, the anchor should be attached. The anchor fastened at both ends

of the line. Steel anchor or stone by the weight of 5-10kg is commonly used.

2;Fishing Operation

Bottom longline can be operated at every times, but mostly the good catch during night time operation. Before operating the bottom longline, the suitable fishing ground have to be decided.

The fishing grounds are usually chosen by the target species. If the target species are red snappers or other rock fish the hard bottom or surrounding rocky waters are the good fishing grounds. But if the target species are yellowpike, conger or ray, the muddy bottom is the good fishing ground.

Shooting the line is mostly done from the staboard side of the boat while the bait is put on the hooks. Bait for ordinary bottom longline are small pelargic fishes such as sardines or mackeral, whose body size are about 12 cm. The fish bait are cut into two pieces. During shooting the line the boat should be operated across the current in order to prevent branch line entangling to the mainline. The sinker steel or stone by the weight of about 300 grams are hung on the mainline at 20-25 branchline intervals. At the interval of 100 branchlines attached floatlines including the mark, to prevent the gear from being lost because entangling to the rocky bottom or other objects, which may cut the main line.

2000- 3000 pieces of hooks are used in one operation.

When shooting of the line has been completed, the boat should drift near the end of the line, and hauling can be done after one hour.

The bottom longline for ray is kept in the bottom for several hours before hauling. Hauling is mostly conducted from the port side of the boat.

Hauling for red snapper longline and shark longline can be done by means of mechanical as hydraulic line haulers, but bottom longline for ray mostly by hand hauling.

The catch from red snapper or ray bottom longline are preserved by ice and sea water, but the catch from shark bottom longline which the main target is shark fin, preserved by drying by the sun heat.

IVCONCLUSION

The bottom long line is a type of fishing gear which widely used in Indonesia throughout the country . This fishing gear are operated on a small scale fisheries in the coastal water . The main target species of this gear mostly various species of economical value and high price such as Red snaper Grouper Sea breams Yellowpik conger Catfish Shark and Ray The bottom long line can be clasified by the baiting method into baited bottom long line and unbaited bottom long line . By the target species bottom long line can be classified into Red snaper bottom long line , shark bottom long line and Ray bottom long line . Polyethylene or PE rope is the most common and widely used as a main line , and Poly Amide (PA) Monofilament is used for branch line .

Ahmed Mushtaque.
Rep of Maldives.

FADs used in Maldives

INTRODUCTION

Traditionally payaw or fish shelters as it is known as FADs (Fish Aggregating Devices) today is a device used to attract and hold schools of both surface and deep sea fish species which is the most significant development in Maldivian fisheries in recent years. It was introduced to Maldives in 1980 and since then it became more and more popular among the fishermen because it has been shown to produce increased and more consistence catches ,reduce search and travel time, thereby conserving fuel and to increase the safety factors of small vessels.

FAD

A FAD is a fish shelter operated by fishermen which is to aggregate or attract fish ,which is anchored ,drifting or transferable, usually made of bamboo, steel ,FRP or other materials, underneath which is a line or lines with sinkers to which are attached coconut leaves, twinges, plasticstrips or nettings.

The idea of FAD came from the floating objects which was observed and known by fishermen that many fishes are attracted or found under floating objects such as blocks of wood and even simply floating slippers in the open sea.

A FAD consist of 4 functional parts which are;

(1) Anchoring Section,

(2)Mooring Section,

(3)Floating or Buoyant section,

(4)Attractant Section.

CONSTRUCTION AND INSTALLATION OF FADs IN MALDIVES

In this section I will try to give some ideas about the construction and installation of FADs which are used in Maldives.

(1)Anchoring Section *(figure 1)*

This is the part of FAD which hold the place or secure to prevent dragging of the FAD. Two rectangular concrete blocks are used as the anchor. Sixteen concrete blocks which can be locked to eachother are used to make the two anchor blocks, each weighing about 1.5 tones and consists of eight blocks.(figure 2) On top of each block there is a handle made out of steel to which the anchorline is attached using a stainless steel ring.(figure 3) The anchor weight is distributed to two pieces to reduce the risk of dragging.

(2)Mooring Section*(figure 4)*

This is the part of FAD which connects the anchoring section and floating section. 130 feet chain of diameter 5/8 inches , which is divided into three pieces, of which the length of one piece is 30 feet and the other two are 50 feet each are required. Nylon and Polypropylene rope of 20 mm diameter are used as the main part. The length of this varies upon to the depth of the sea.

After surveying the depth, ropes are spliced in accordance with the depth. As the specific gravity of nylon is higher than the polypropylene nylon is used for the upper part of the line. The two ends of the rope are eye spliced with a thimble.(figure 5) One end of the 30 feet chain is joined to the mooring point of the float with a stainless steel ring.(figure 6) the other end is shackled to the nylon end with a swivel and a ring.(figure 7) Ends of two pieces of the 50 feet chains will be connected to the two anchor blocks.(figure 3) and the other two ends are joined together with a ring and shackled to the polypropylene end.(figure 8)

Catenary curve mooring is followed because they incorporate a reserve slack line which provides a safeguard against excessive strain coming onto

any part of the mooring during conditions of bad weather or current as well as providing the errors of depth estimation. The catenary curve depends on the sinking and floating properties of nylon and polypropylene.

(3)Floating or Buoyant section

This is the part of the FAD which is responsible to buoy up or to float the mooring line. Fiberglass Reinforced Plastic(FRP) buoys of 5 feet diameter are used as floats in the Maldives.(figure 9) These buoys are molded in semi spherical shape and later joined together. The vacuum inside is filled with Polyurethane foam. The mooring point, the point where the mooring line is connected is made out of 1 inch diameter stainless steel rod and 0.5 inch thick stainless steel plate. Then this is bolted to a steel pate fixed inside the buoy.(figure 10)

(4)Attractant Section

The attractant feature is the principle feature of FAD. This serve as the main attraction for fish where the principle of payaw attraction revolve on disintegration of fronds, alga growth, aggregating and adhesion of phyto and zooplankton, small fishes and larger fish feeding on the small fishes.

In Maldives old nets are used as attractant. The nets are attached to the mooring and is fixed up to 30 feet from the surface.

It is also believed that when the fish attractant used is net, the fish is attracted because of the shadow or big shade made from the net, so as much as big net is used as a fish attractant.

FACTORS TO BE CONSIDERED IN THE SELECTION OF A FAD SITE.

In choosing a FAD site, factors such as the speed of current, exposure to the monsoon, bottom topography, presence of small fishes like anchovies and others which are the food of large migratory fishes particularly tuna and tuna like species and the wind and wave action must be considered.

In Maldives FADs are installed 15-20 miles offshore and the average depth is about 2700 meters.

SOME CAUSES OF FAD LOSS

In Maldives the most common cause of FAD loss is due to fishbite. This is the genetic term used to describe any damage inflicted on mooring line by free swimming marine animals. The other causes include shackle failure, rope splice slipping, rope cut by propeller. But these cases are rarely experienced in Maldives.

DEPLOYMENT METHODS

The two methods of mooring FADs in deep sea are the "Anchor Last" and "Anchor First" methods.

When deploying, first the buoy will be set adrift in the water with its mooring line. When about 50 meters is released the line will be tied to the vessel to prevent further drifting of the buoy. Then the anchors are released and when the anchors are settled in the sea bottom the buoy line will be untied and released. This method is useful when the bottom depth is in question but can be dangerous.

FIGURE 1

ANCHORING SECTION

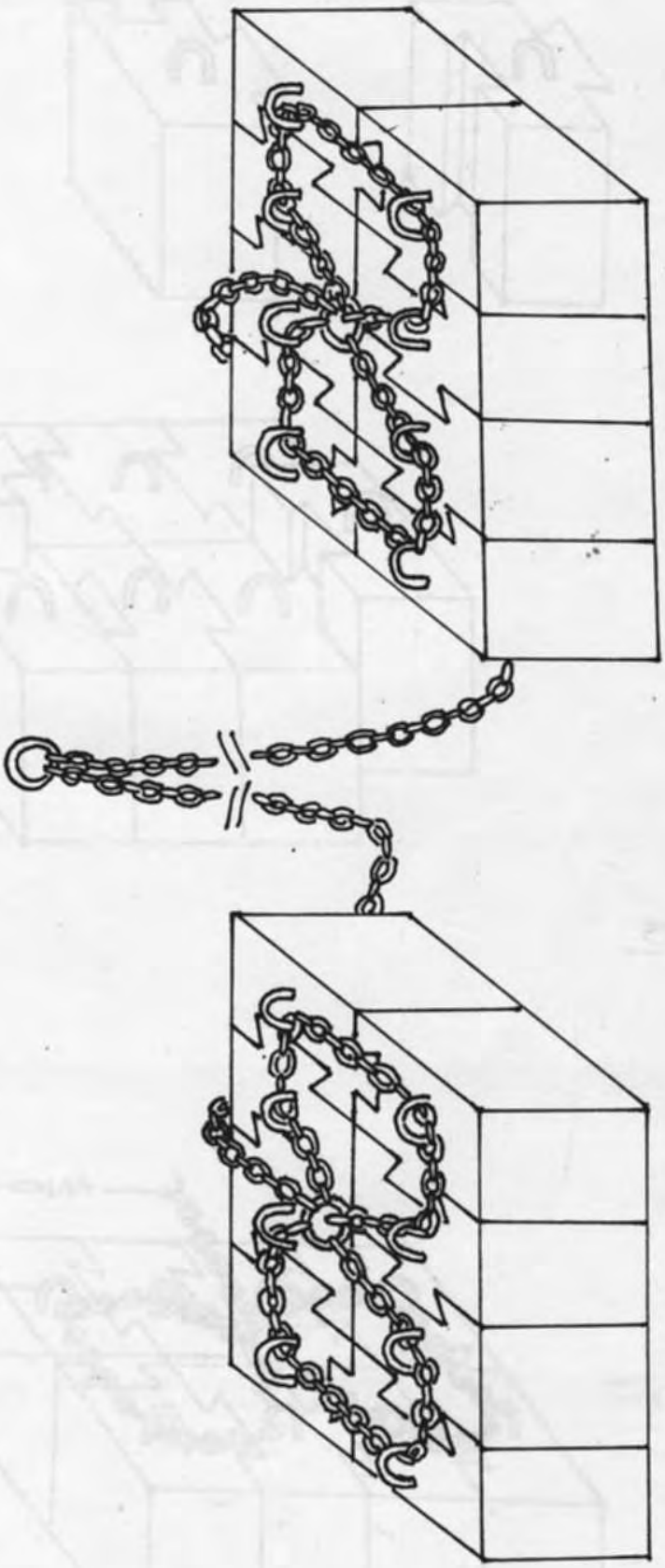


FIGURE 2

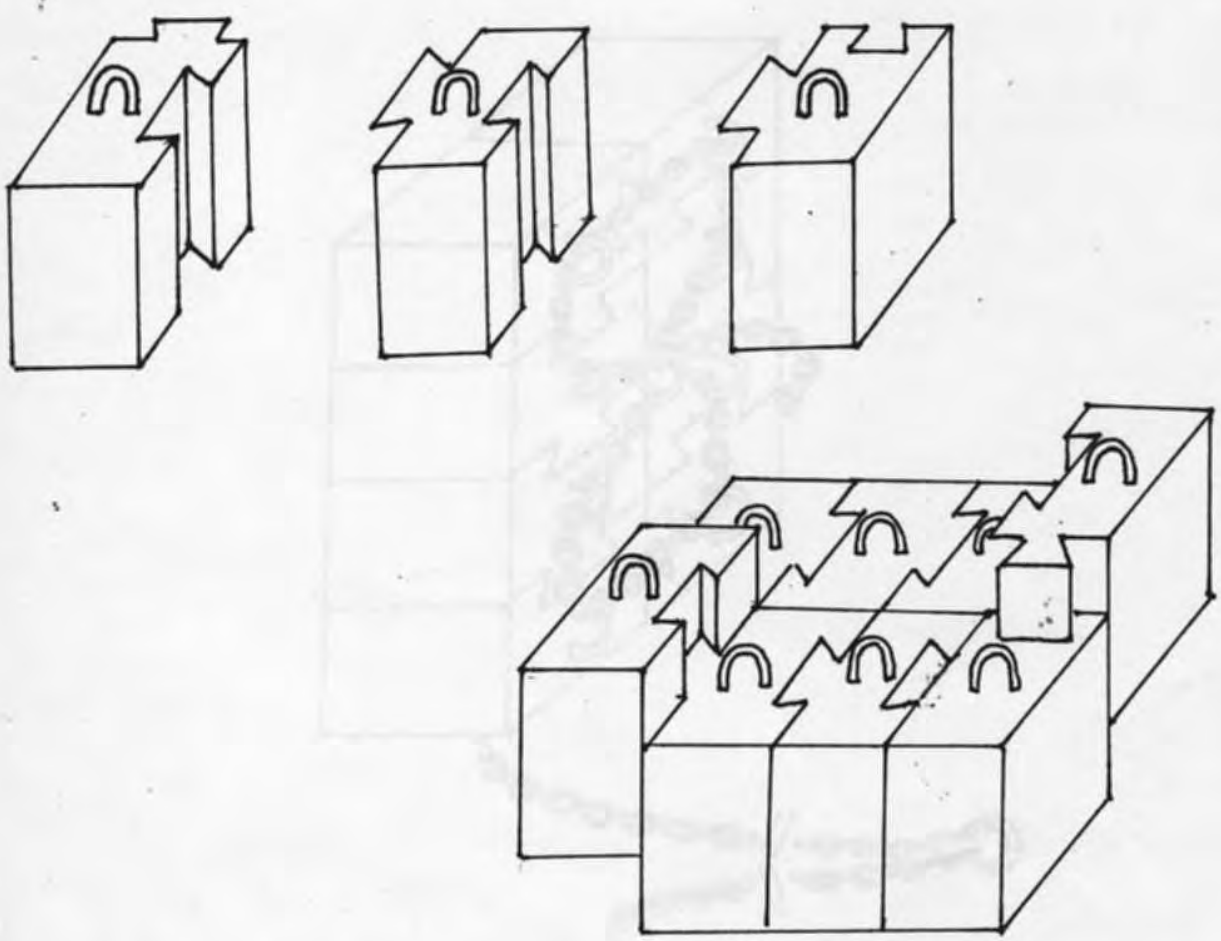


FIGURE 3

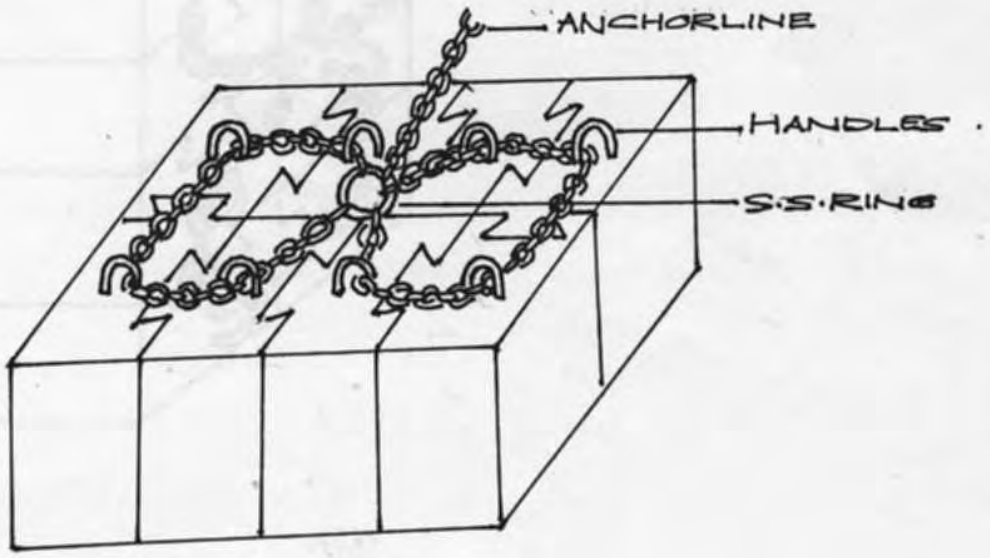


FIGURE 4

MOORING SECTION.

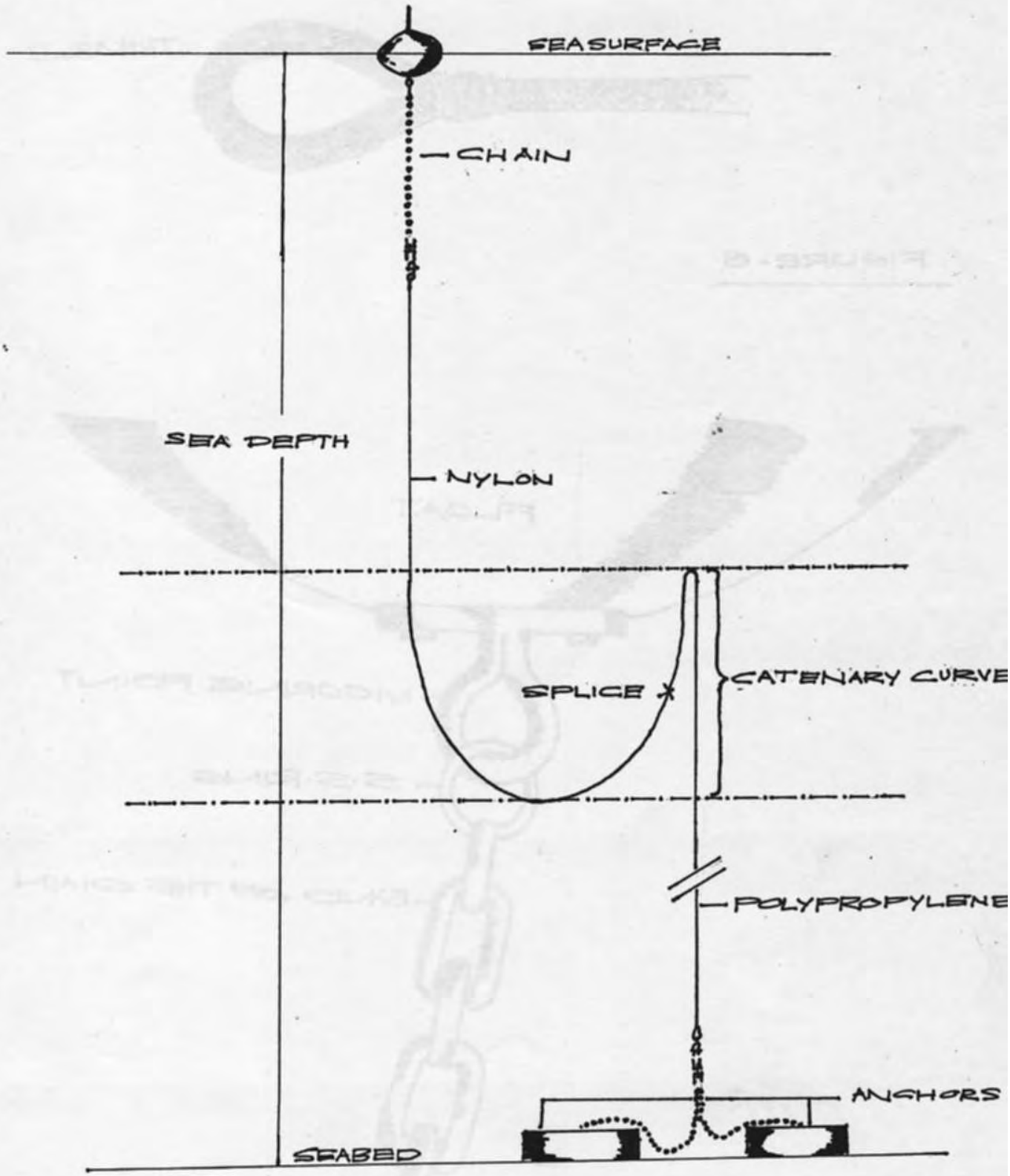


FIGURE-5

FIGURE-6

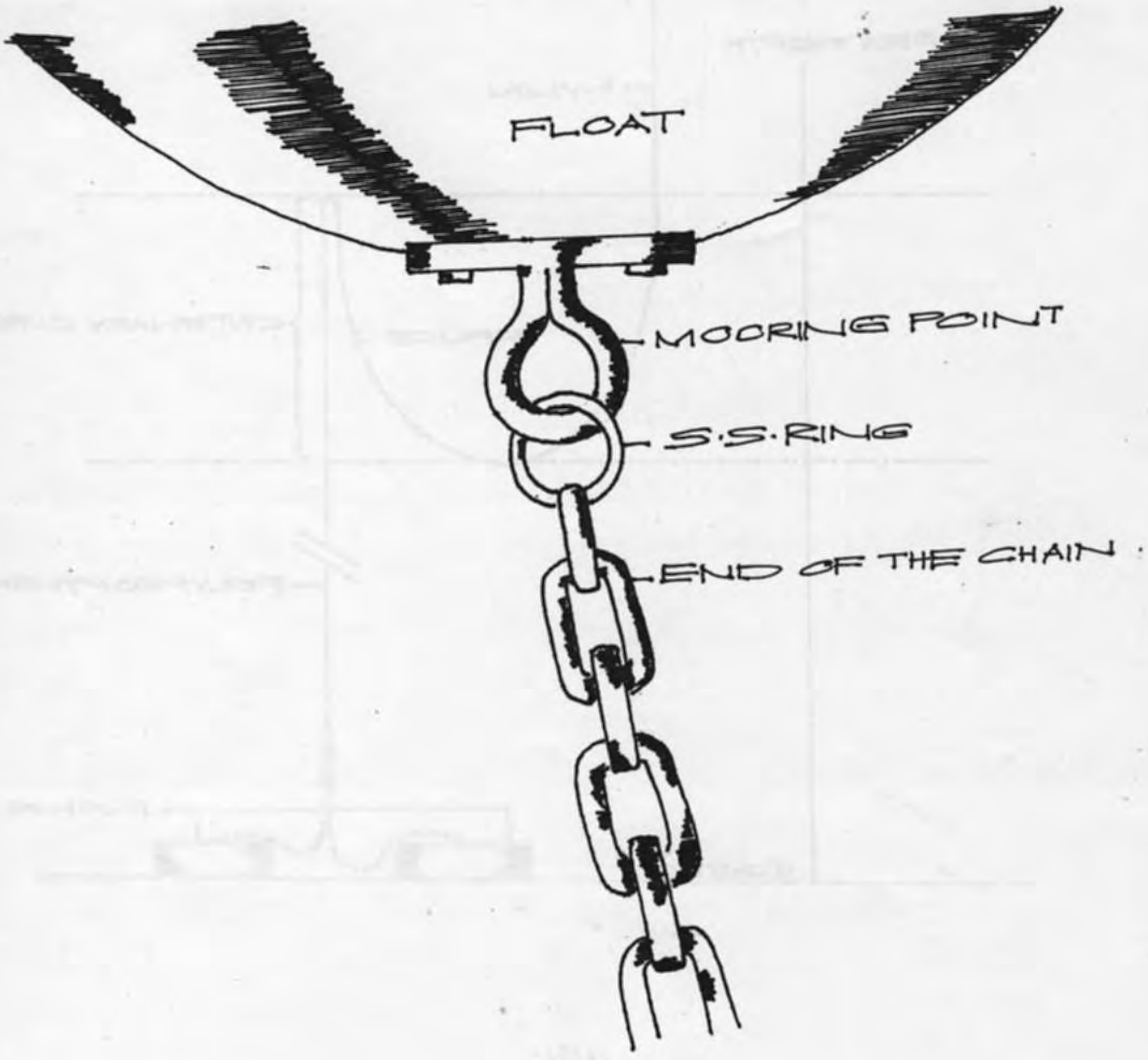


FIGURE 7

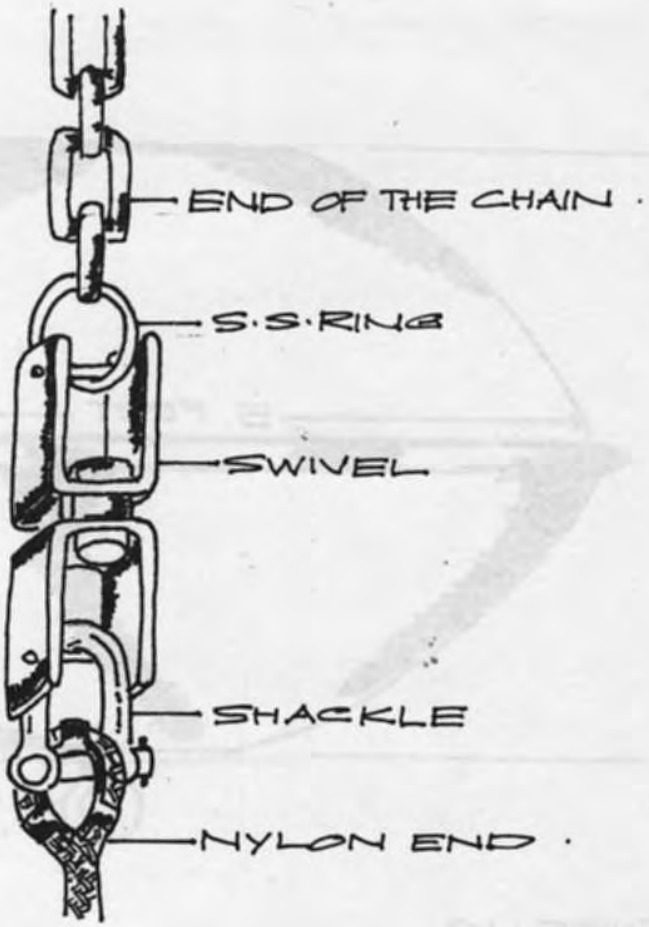


FIGURE.8

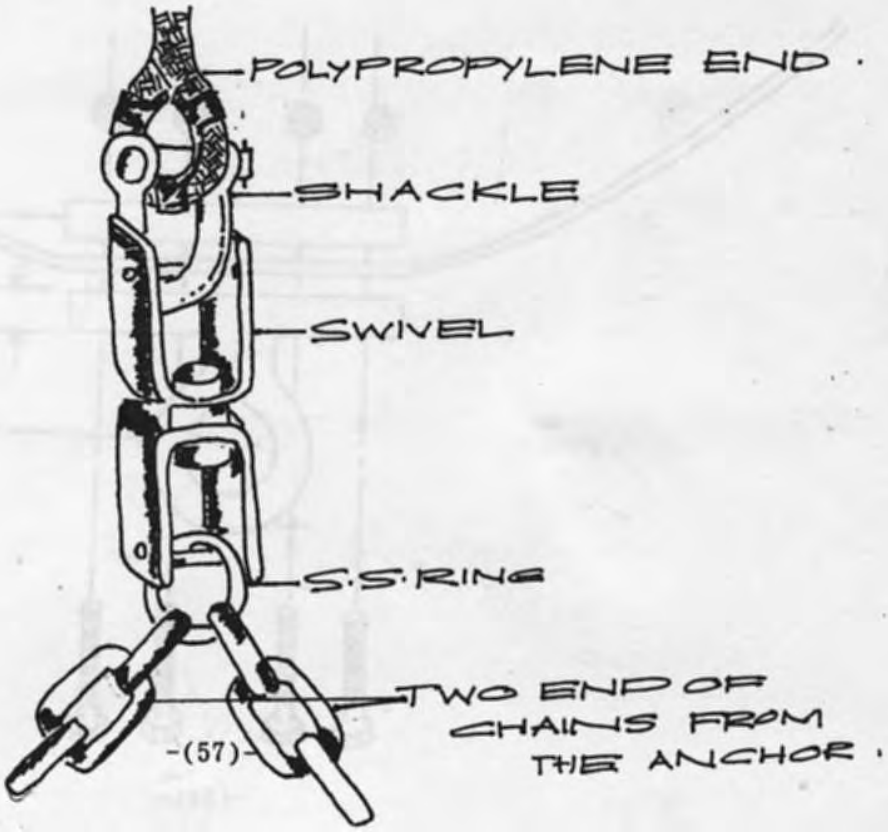


FIGURE · 9

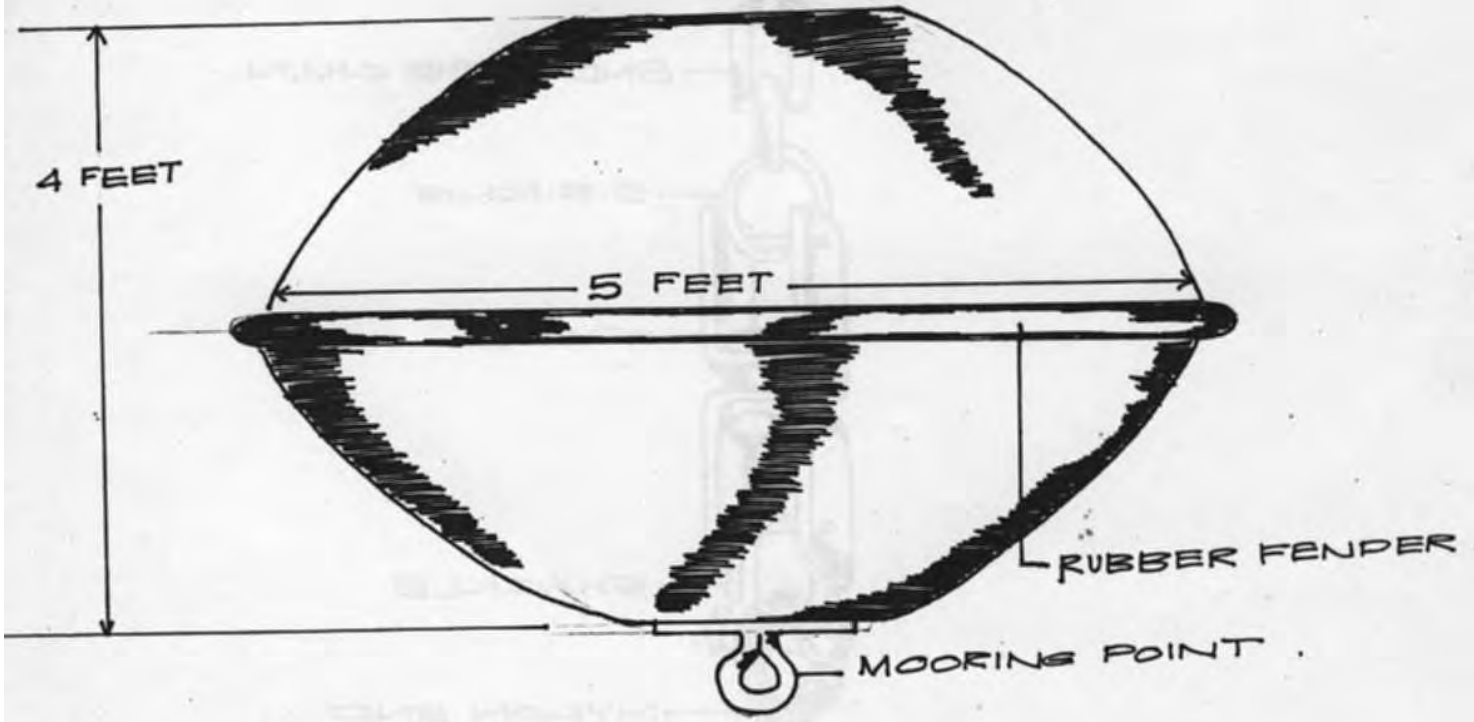
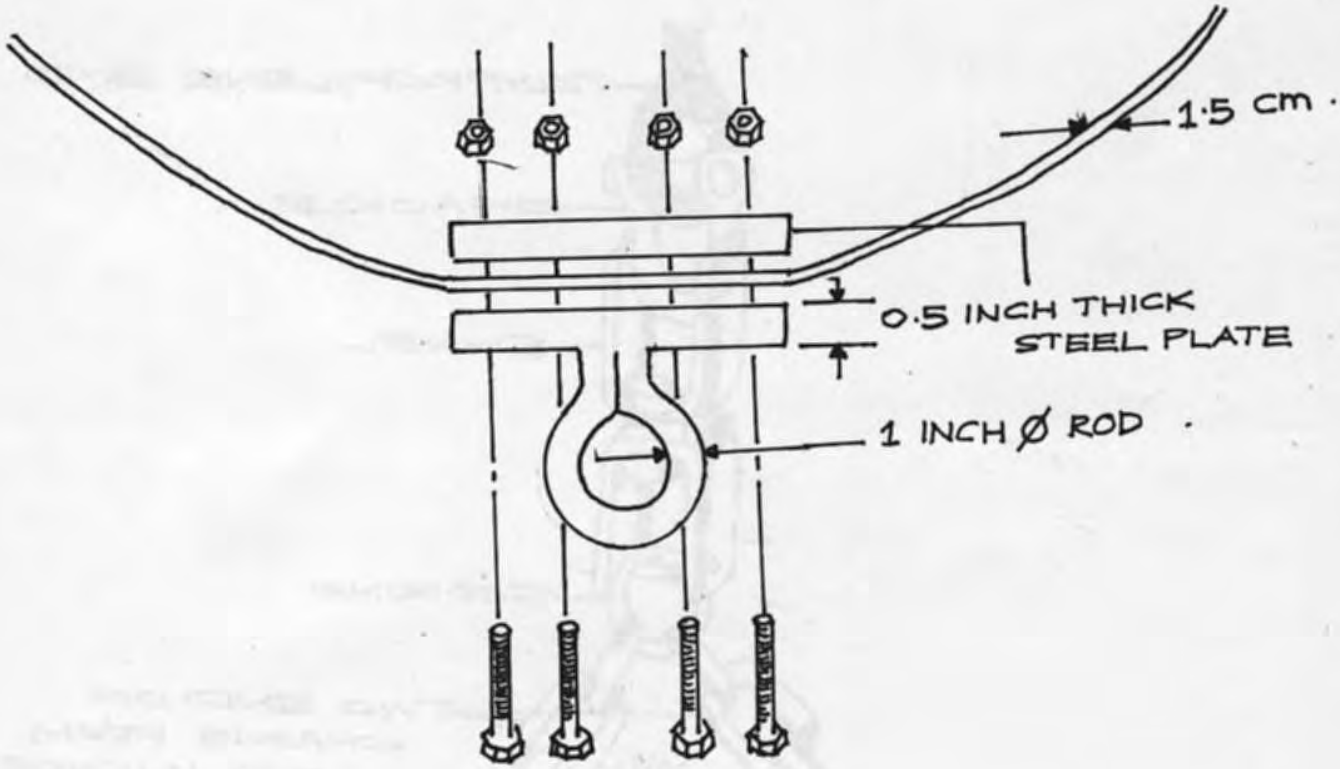


FIGURE · 10



STUDY REPORT

ON

BOTTOM TRAWL

Compiled

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18 June - 17 December 1996

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FOREWORD

This study report has explains the bottom otter trawl fishing including the material and methods. It is contains not only the explanation how the bottom trawl has operated but also the designation of trawler and other equipment essential for trawling operation.

Mostly the information to prepare this study report were source from the experience and knowledge of participant of Regional of Commercial Fishing Technology Course in 1996. Beside that a couple of reference book which has had written and produced by SEAFDEC Training Department, Bangkok, Thailand.

Almost generally procedure and method of trawling which is explain in this report are related to the utilization of trawling in Malaysia . Finally we expected this study report will be helpful for understanding especially for the student who intend to study about trawl fishing technology. and it is might be useful for many people concerned.

Oct 1996

INTRODUCTION

Trawl is one of the most important fishing gear which has been used in Malaysia. The number of gear licensed was 25,856 unit and trawl has contributed 21.96% beside the other gear. In term of fishing gears, trawlers was landed 72.49% (RM 174.06 million). Therefore the trawl fishery has become the most important in the marine resource exploitation.

CLASSIFICATION

In general trawl fishing can be divided into four major group: 1) Bottom Beam Trawl 2) Bottom Otter Trawl 3) Bottom Double Rigging Trawl and 4) Bottom Pair Trawl. Anyhow there were a mid water trawl which is operate in the middle of water and the common target species catched is the pelagic fish. In this report the bottom otter trawl has been choosed as entitle to be explained an discuss including the classification and other equipment of the gear.

FISHING GROUND

Bottom otter trawl can be operated neither in the deep sea nor at the coastal water area. Normally our fishermen absolutely emphasize to the condition of sea bottom as to avoid the net damage. The muddy and sandy sea bottom area are most suitable for operating. The condition of sea bottom can be ensure by using the Echo Sounder or Sonar instrument.

TARGET SPECIES

The species being caught by this gear are mostly the dimersial fishes. In Malaysia the species were graded are as follows:

Grade I

Includes Chinese Promfret (pampus chinensis), Silver Pomfret (pampus argenteus), Black Pomfret (formio niger), Threadfin (polynemus spp.), Spanish Mackerel (scomberomorus spp.),Wolf Hering, Grouper (epinephelus spp.), Mangrove Snapper (lutianus johni).

Grade II

Includes Shad (pellona spp.), Red Snapper (latianus argentinaculatus), Sweeptip (spilotichyryhs picfus), Horse Mackerel (carangoides spp.), Golden Travelly (caramix speciocus)., amberjack (seriolanigrafusciata).

Grade III

Includes Squid (loligo spp.), Cuttlefish (sepia spp), Mud Crab (portunus pelagicus) etc.

TRAWL FISHING VESSEL AND EQUIPMENT.

There are many types of trawlers varying in size from open board powered by outboard engines to factory vessel which can fishes in the most distant water. There are two requirement are common for

trawler, one is used for traction or other word for towing power an another one is used for a winch or mechanical hauling system.

In order for bottom trawl fishing it is utilize commonly of stern trawler. This stern trawler have an advantage af being able to use for towing power. Mostly the stern trawlers construct the bridge (wheel house) at the stern part or the middle part of the vessel. In case when shooting and hauling the captain must keep his eye on the man on deck.

Otherwise the trawlers are commonly provided with equipment such as Radar, Echo Sounder, Net Hauler, Net Drum, Radio Communication and Navigation system.

CLASSIFICATION OF NET AND FISHING OPERATION

In trawl net the main part of the net consist are as follows: triangle square,upper triangle wing, upper side wing, lower side wing, triangle belly,square, upper triangle baiting, side belly, baiting or belly,extensionm and cod end. Nowadays our fishermen have capability to construct the trawl net by guiding the plan. Other equipment are also essential for trawl net are otter board,head rope, sinker, bobbin, buoy, etc.

Trawl net is designed with a large bag shaped wider at one end called the net mouth, from where it tapes to the close end called cod end., where the fish entered through the mouth of the net being caught. The head rope of the net rund around the upper edge of the mouth to

which the number of floats attached. The foot rope or ground rope is attached around the bottom of the mouth which is made heavy by attaching steel chain or lead. However for operating the net on rough bottom the iron, wooden or rubbers roller are rigged to the foot rope or carry out trawling smoothly without damaging the net.

The opening of the mouth of net is controlled by adjusting the floats on the head rope and the weight attached to the foot rope. The horizontal spread of the mouth is achieved by the otter board towed ahead of the net. The otter board are connected directly to the wings,or are separated by a length of wire rope or rope known as sweep line. The sweep line are connected to the otter board by a back strop and to the net by a bridle or dandelion arrangement. Shooting and hauling is from stern side and the material use for constructing the trawl net is polyethylene.

When started for shooting the net is shot from the stern, after that the otter board are released. The towing warp is release four to five times of water depth. Then the net will dragged for 3 to 4 hours at the speed 2 to 3 knots. Then the warp is hauling from the stern using the capstans winch .

DISCUSSION

Although trawl fishing is one of the famous fishing gear recently due to get a lot of caught, it 's has given the negative consequent to the

marine resources, The marine resources was exploited optimally by this kind of gear. At present in Malaysia the trawl license utilities were controlled and limited by the authority. However our fishermen was excited utilize this gear widely despite they have no legal license or in other word permission by the authority. Preservation and conservation of our marine resource suppose to get the support from the public community. The authority under the department of Fisheries has introduced the artificial reef widely in the Malaysia water as effort to conserve the resources. Beside that some island was preserved as the marine park. It's mean that any fishing activities is strictly prohibited along 3 nautical miles surrounding such island. Hopefully in the future all people will support the effort and CO operating with the authority beside running their fishing activity.

CONCLUSION

As we know, trawling is the most important fishing gear and popular especially in Malaysia and Thailand. At present about 72.49% and 85% the total of catch is contributed by trawl in Malaysia and Thailand respectively. Thus showed that 3/4 approximately the total of catch were contributed by trawl in both country.

Even the bottom trawl fishing has become the most important fishing gear to the marine resources exploitation, but sometime we should thinking not only for commercial business but also what was happened to our marine resources as consequent by using this gear.

Otherwise the number of trawler , particularly in Thailand was increased within 2 to 3 year lately. Instead in Malaysia the authority is limiting the number of trawl to be licensed. As to prevent the marine resources by 'over fishing' which was happened in some neighboring countries.

Reference Book:

1. Basic Fishing Gear.Tech.(TD/LN/74)
2. Fishing Gear & Methods In Southeast Asia II Malaysia.
3. Fishing Boats.(TD/LN/ 78)
4. Annual Fisheries Statistic of Malaysia 1994.
5. Term of Trawl (TD/LN/72)

Figure 1 : Shackle and Swiwel.

Figure 2 : Trawl Net Plan

Figure 3 : Trawl operation

Figure 4 : Trawler

Figure 5 : Trawling in gear.

FIG · 1 · SHACKLE AND SWIVEL·

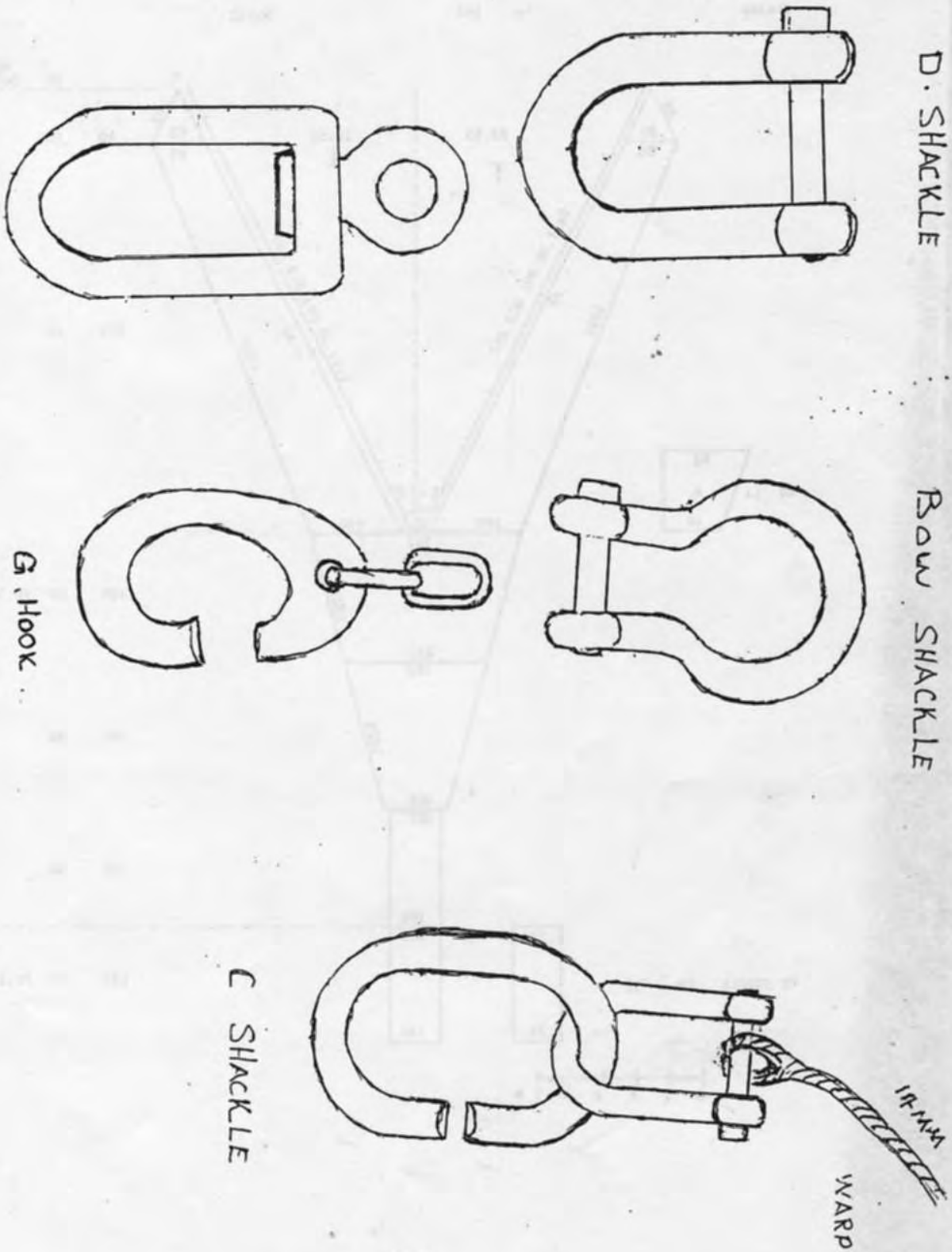
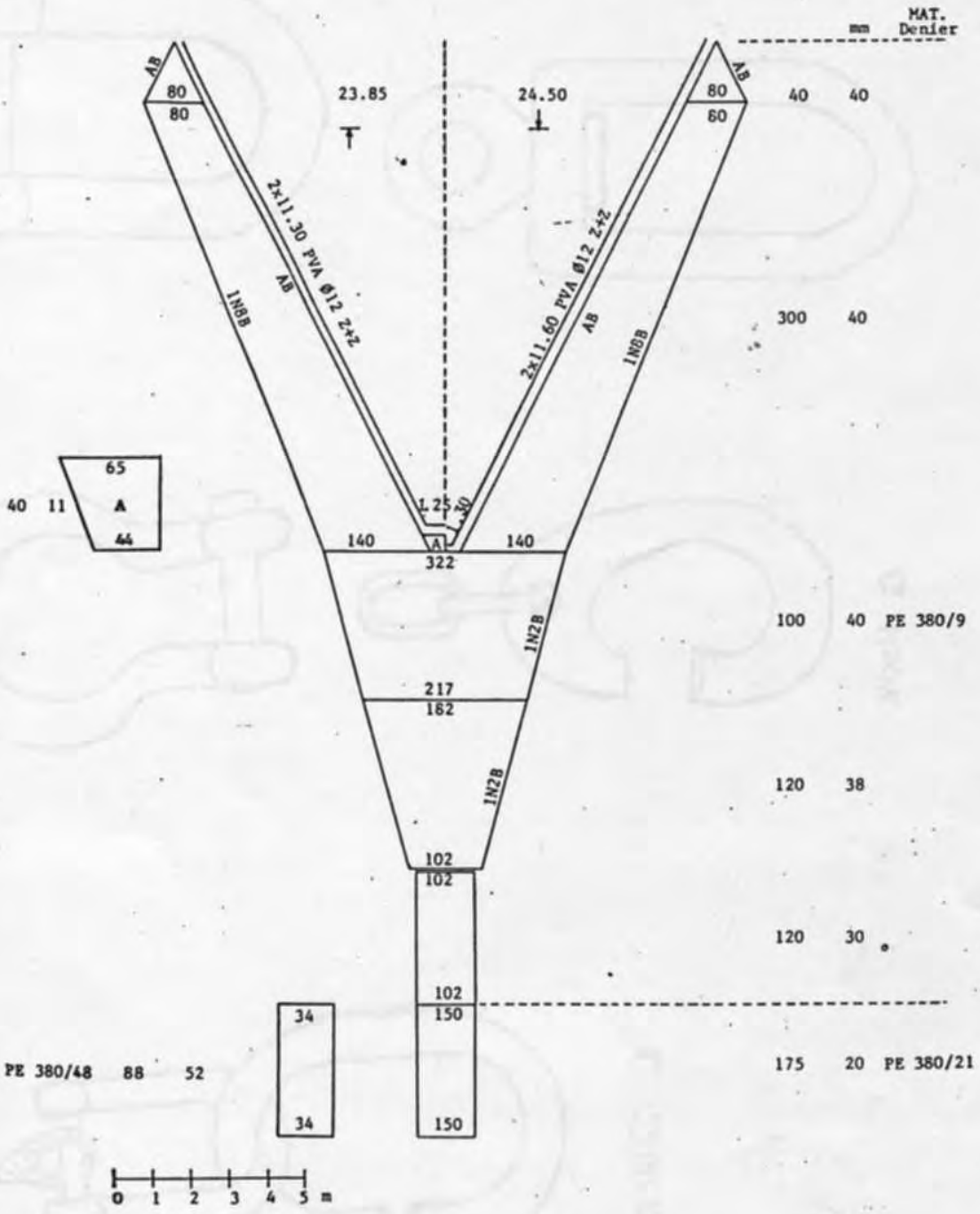


FIG 2: TRAWL NET PLAN.

TRAWL
Bottom, otter
Shrimp

VESSEL
Loa 13 m
hp 140

LOCATION
Kuala Kedah
Kedah



TRAWL

Bottom, otter

Demersal fishes

VESSEL

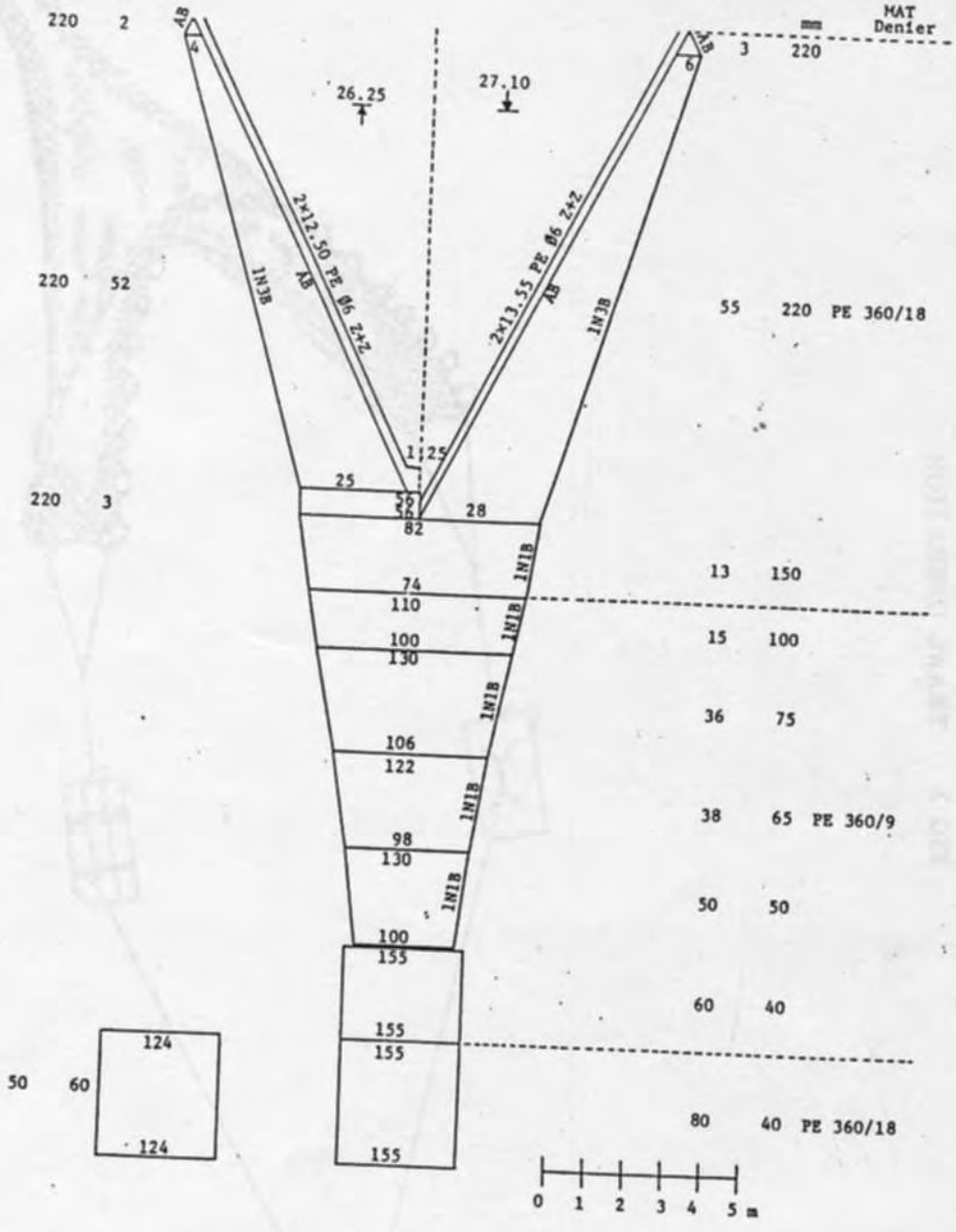
Loa 13 m

hp 37

LOCATION

Kuala Terengganu

Terengganu



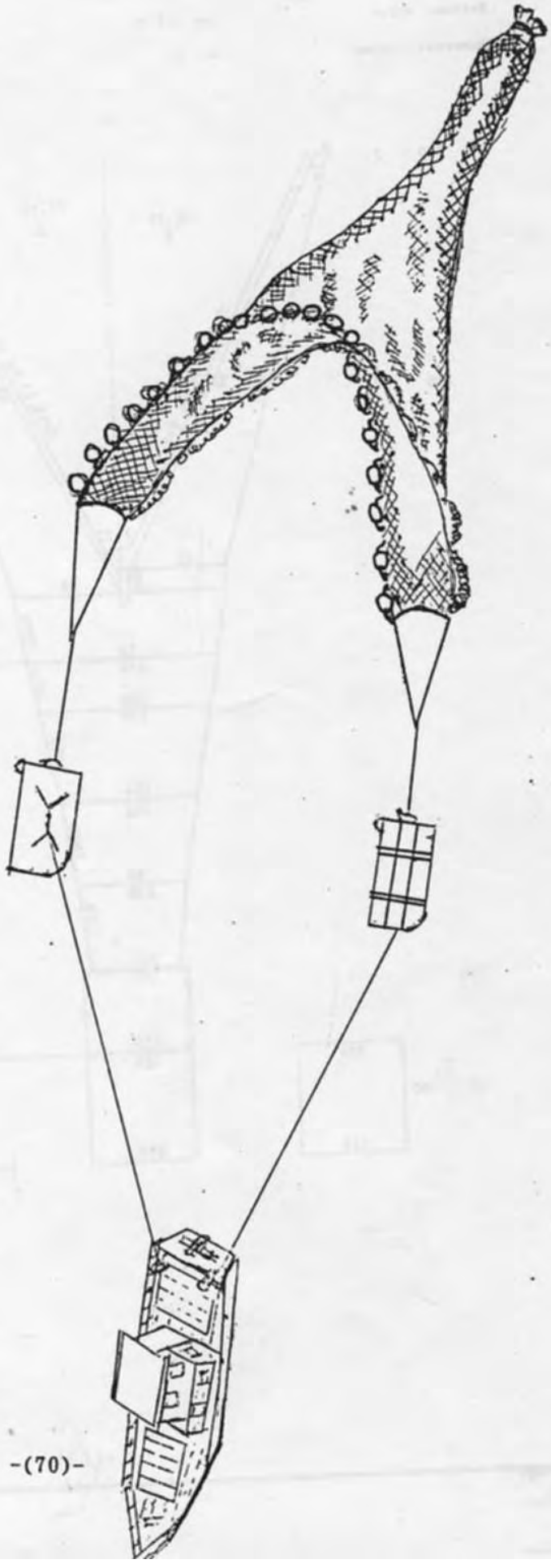
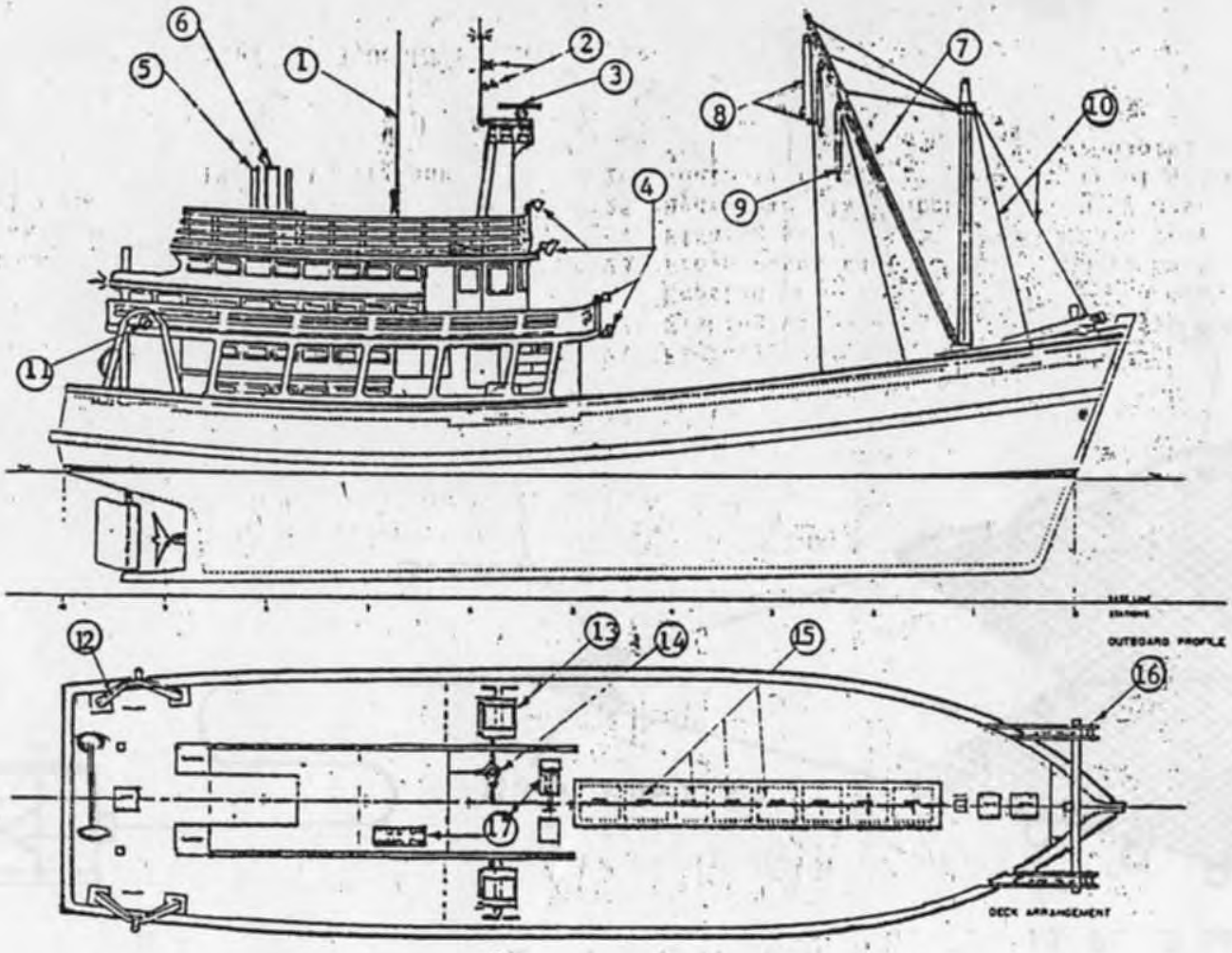


FIG 3 : TRAWL OPERATION

FIG 4 : TRAWLER.



1 Radio communication antenna
2 Fishing light
3 Radar antenna
4 Fore deck projector
5 Generator exhaust pipe
6 Main engine exhaust
7 Gilson
8 Net pulling block
9 Fish tackle
10 Fore stay
11 Towing warp block
12 Gallows
13 Towing warp winch
14 Vehicle rear axles
15 Fish hold
16 Anchor block
17 Generators
18 NET DRUM.

FIG 5 : TRAWL HANDLING GEAR

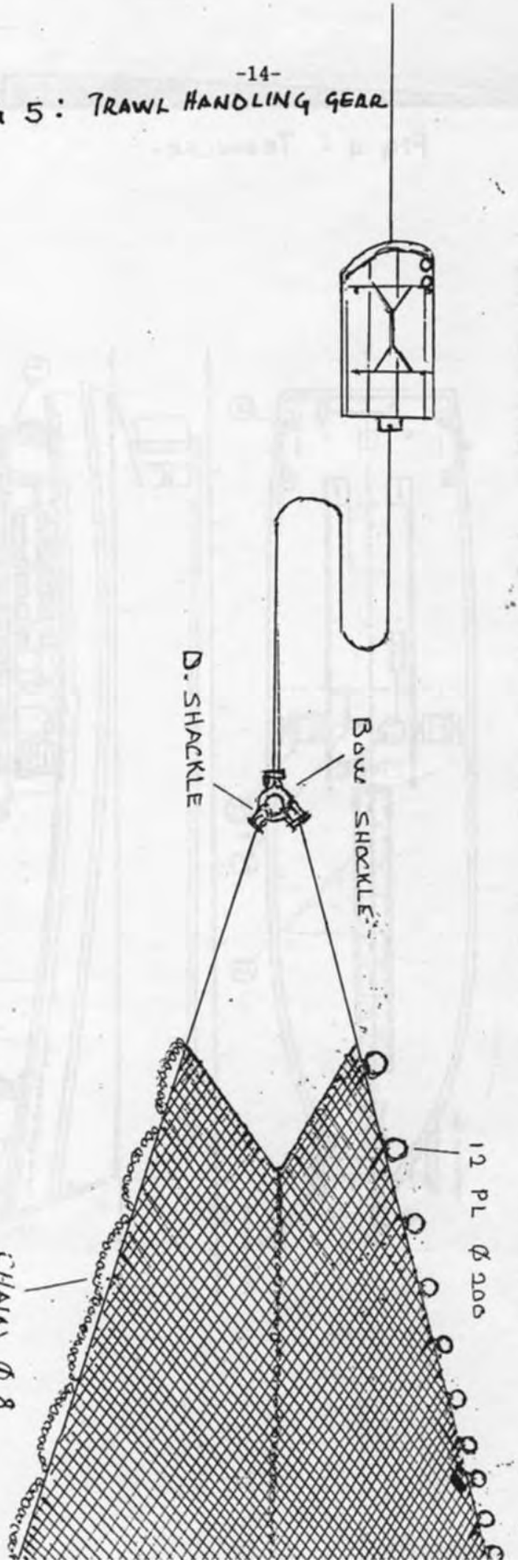
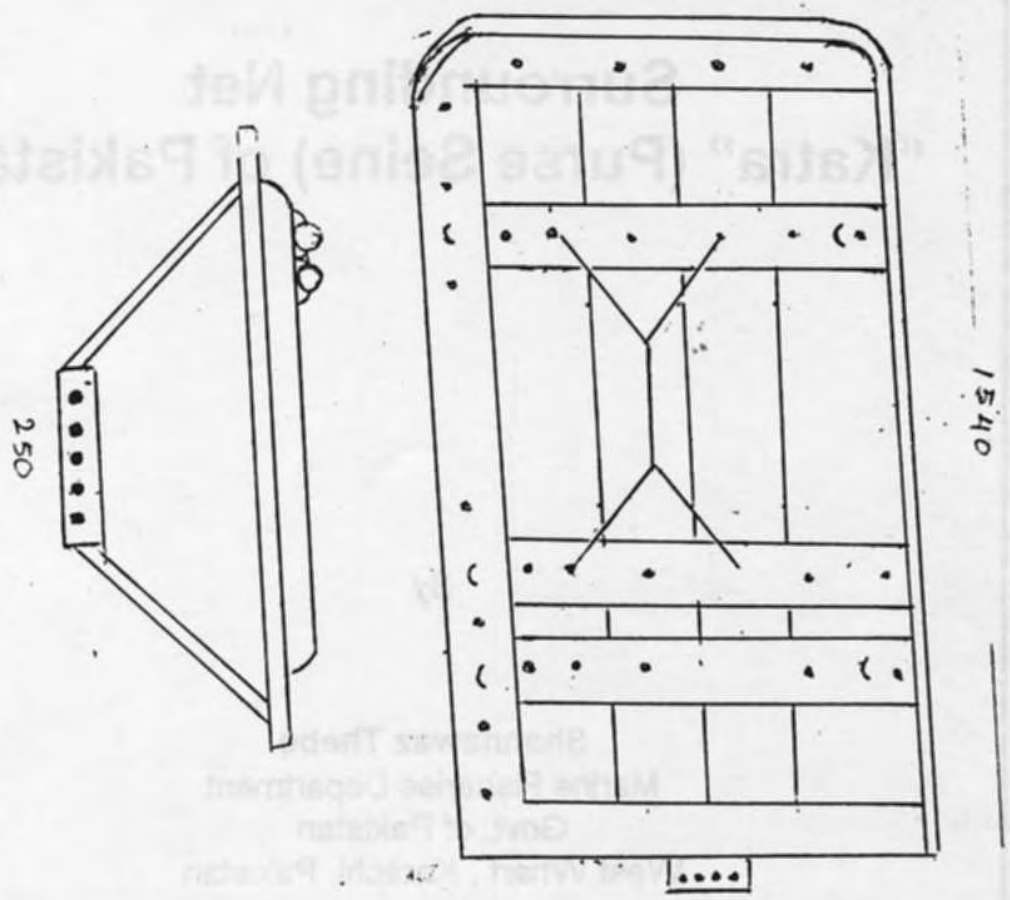


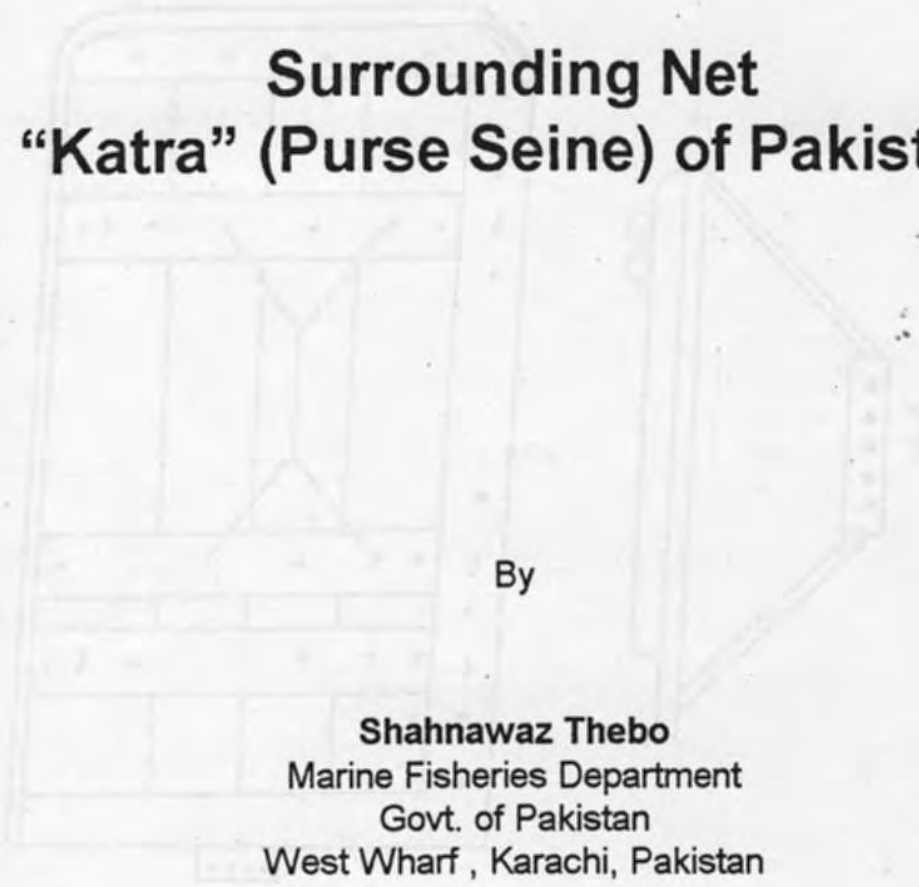
FIG. 6 : OTTER BOARD.



Study Report

on

Surrounding Net "Katra" (Purse Seine) of Pakistan



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Surrounding Net "Katra" (Purse Seine) of Pakistan

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Introduction

The *Katra* has been derived from a local word *Kachi* which means small. Since the net has a small meshes, the fishermen have named the net as *Katra*(Fig. 1). The net was introduced in the country about 25 years back and has expanded rapidly. The net is locally made by the fishermen from nylon webbing. The *Katra* net falls into the category of surrounding nets and is constructed basically as a purse seine net with a bunt at the centre and two lateral wings. But instead of using purse line to enable the net to be closed like a purse seine the *Katra* net is pursed by hauling in at the same time the lead lines of two wings and also the bunt's lead line goes on retrieving and the net is closed. The webbing and the float lines are hauled from the ends and the fish caught concentrate in the bunt from where it is brailed. A helping rope of 80 m is attached to the middle of the net of which the other end is connected to the boat.

Technical details of the *Katra* Net

(a) Length

Floatline	200 m
Leadline	200 m
Bunt	20 m
Wings	2 x 90 m

(b) Depth

Hung depth in the bunt	27 m
Hung depth in the wing ends	10 m

(c) Mesh size (stretched) and twine size

Bunt	12 mm;	210D/6
Wings	15 mm;	210D/4
Selvedge	20 mm;	210D/6

(d) Floats

420 nos. 100 mm dia Plastic

(e) Sinkers

1400 nos. of 70 g Pb.

(f) Total weight of net

280 kg

The float line is made from nylon rope of 14 mm dia. 360 floats are attached in the wing section while in the bunt section which is 20 m in length 60 floats of same dimensions are attached to the float line. The lead line is made out of nylon rope of 14 mm dia and 1400 Pb sinkers. Bottom selvedge in 10 mesh depth is made out of nylon R 835 tex size and mesh size in this portion is 50 mm. The top and side selvedges are of same twine but 3 meshes in number.

Boat Used for the Operation of the *Katra* Net

The net is generally operated from a boat of maximum length of 15 m called *Hora* (Fig 2.) which is propelled by long tail out board motor. Originally teak wood was used as building material but due to its excessive price local "Chilgoza" or imported :Marsawa" timber are being used for the construction. The diesel engine of various models ranging from 16 to 80 hp are used in the *Hora* boat. Most boats carry minimum 2 engines for safety reasons and one *Hora* boat is able to carry up to 30 tonnes of fish. The *Hora* boats used for the *Katra* net has two bulk heads for separation of fish hold in the centre and two small spaces in the bow and stern for storing gear, etc. The bulkhead having draining holes allowing bilge water to drain in to the two lateral sections from where it can be pumped. The *Katra* net is usually stored on the port side of the deck. Bigger *Hora* boats undertake *katra* fishing most of the year while smaller *Hora* boats (10 m) Participate only during peak season from October to November and February to April. The rest of the year they undertake gill netting. *Katra* fishing boats have a large group on board ranging from 20 to 24 fishermen. The bulk of the fish caught by *Katra* net is sardines which is almost used for production of fish meal.

Conclusions

From the economic point of view the present *katra* fishery is quite effective. The boat is simple and relatively cheap to built. The nets are very light, easy to handle on board with the available man power. In socio-economic context this fishery is labour intensive spreading the income over many families.

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1 Khan, Mohammed Yunus (1986) *Fishing techniques in coastal waters of Pakistan* National Seminar on Fisheries Policy /Planning pp. 345-364

2. FAO (1986) (MFDP-PAK/77/033) *Exploration of small pelagics in Pakistran's coastal waters by Katra fishery* , Contribution to National Seminar on Fisheries Policy /Planning

Fig 1. Katra Net

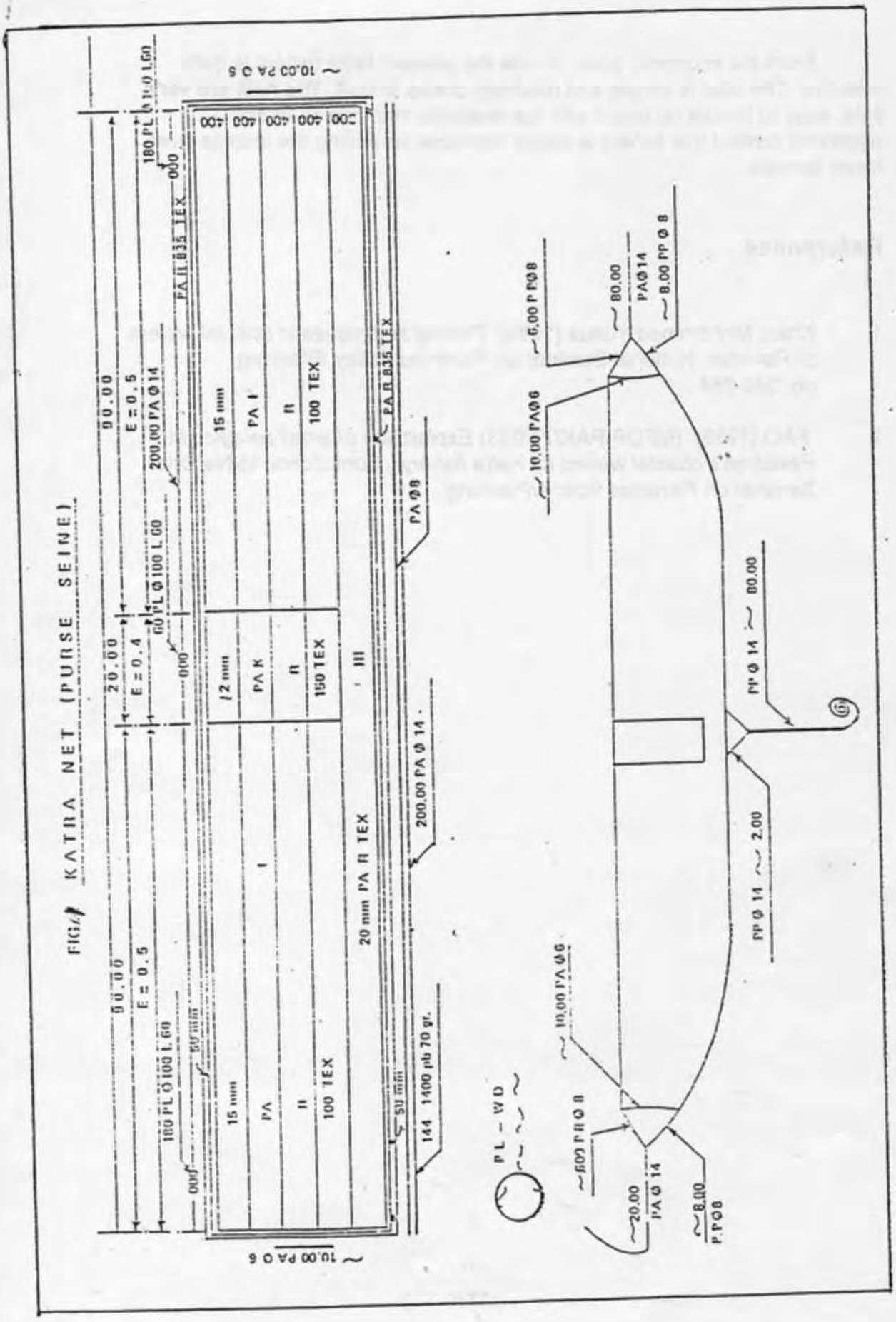

Fig 2. Katra Fishing Boat (Hora) before Motorization

Study Report

on

SARDINE PURSE SEINE OPERATION IN THE PHILIPPINES

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SARDINE PURSE SEINE OPERATION IN THE PHILIPPINES

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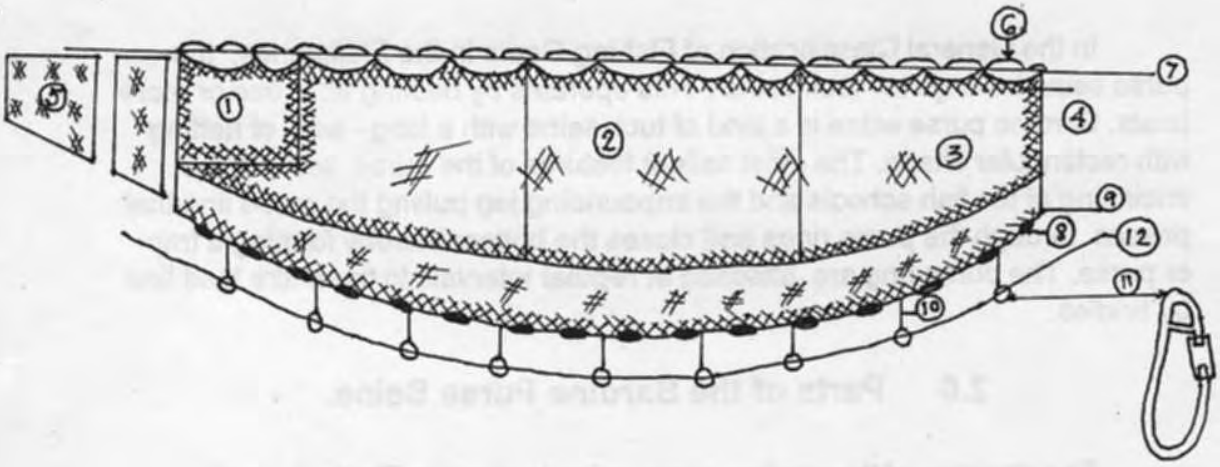
I.0 Introduction

In the General Classification of Fishing Gears in the Philippines, the purse seine belongs to ' tuck seine'. This operates by hauling from one or more boats. Sardine purse seine is a kind of tuck seine with a long - wall of netting with rectangular shape. The most salient features of the purse seine is the encircling of the fish schools and the impounding leg pulling the purse line that passes through the purse rings and closes the bottom thereby forming a trap or purse. The purse ring are attached at regular intervals to the entire lead line by bridles.

2.0 Parts of the Sardine Purse Seine.

The structure of the sardine purse seine is given in Fig.1. the major parts of the gear are described below:

1. Bunt is the portion of the net with smaller mesh size and thicker twine. where the fish are concentrated before brailing. It is located usually on one end of the net.
2. Body planking the bunt on both sides or on one side with the next bigger twine and mesh size.
3. Outer most section of the wing (if choke is not placed) with much bigger twine and mesh compared to the body .
4. Selvedge on top, the bottom and side made of bigger mesh size and twine. The main purpose of this is to support the main netting and protect it from damage during operation.
5. Choke is an optional section of the purse seine which is the outermost with much bigger twine and mesh size. Its function is to protect the net wing end from frequent damage and to facilitate the starting of power block operation of the net .
6. Floats to make the net float in the water.
7. Float line where the floats are attached.
8. Sinkers made of chain or lead.
9. Sinker line of synthetic material where the sinkers are attached.



1. Bunt
2. Body
3. Wing
4. Selvedge
5. Choke
6. Floats
7. Floatline
8. Sinkers
9. Sinker
10. Purse line bridle
11. Snap ring
12. Purse line

Fig. 1 Parts Of Sardine Purse Seine of Philippines

10. Purse bridle rope or chain attached to the lead line where other end is fixed to the snap ring.
11. Snap ring made of stainless steel attached to the lead line by way of bridles. through which the purse line pass through.
12. Purse line which is used to closed the purse ring or bottom. Made of cable.

3.0 Target Species

Target species for this fishing gear are pelagic fishes, although it can catch demersal fishes too especially in shallow areas where the net touches the bottom. The commonly caught species of fish are the following:

1. Round scad
2. Big eyed scad
3. Sardines
4. Herrings
5. Short bodied mackerel
6. Hard tail scad
7. Tuna and tuna like fishes, etc.

4.0 Fishing Season

Fishing season in the Philippines is strictly limited by the Northeast and Southwest monsoons. For bigger purse seiners that have the capability to navigate in all parts of the country, fishing operation is possible during the whole year . Smaller purse seiners, operate throughout the year in well - sheltered bays and coves and during the absence of the prevailing monsoons.

5.0 Fishing Ground

There are hundreds of places where even big purse seiners can operate. The most well - known purse seining grounds are Palawan and Zamboanga waters. Other fishing grounds are the following:

Batangas coast
Ragay Gulf
Samar sea
Dinagat sound,
Waters around Negros and Panay islands
Visayan sea
Lamon Bay
Bicol waters
Davao Gulf
Ilocos coast and
Lingayen Gulf.

6.0 Description of Boat and Equipment

6.1 Boats

Purse Seiner

Purse Seiner may be wooden or steel hulled. Sizes varying from 50 to 180 GT and is equipped with 30 kVA generator. The horse power of marine diesel engine depends on the size of the boat.

Skiff boat

Skiff boat is of steel hull with an open engine house. The deck is provided with bitts and towing pad eye for towing lines coming from the catcher. This should be provided with propeller guard to prevent entangling of the net. Engine power varies from 140 to 210 hp.

Light boat

The light boat is of 30 to 80 GT and is equipped with marine diesel engine of 180 to 260 hp. The main function of this boat is to attract fish using lights. The light boat is equipped with a generator of 30 to 45 kVA capacity. Incandescent lamps of 1000 to 5000 watts and halogen lamps are used .

Sonar boat (scout boat)

The gross tonnage of Sonar boat (Scout boat) varies from 30 to 80 and horse power rages from 180 to 260 hp. This is provided with a scanning sonar, fish finder and generator of 30 to 45 kVA.

Fish Carriers

Fish carriers are used to carry the catch to the landing port. It has gross tonnage of 200 to 300 GT ; horse power of 750 to 1200 hp. The fish hold capacity ranges from 66 to 80 tonnes.

6.2 Equipment

Generally, a purse seiner in the Philippines is equipped with modern equipment in order to operate efficiently and profitably, labor - saving devices and equipment have been introduced like the puretic power block which has eliminated much manpower handling of the net.

Puretic Power Block

The main advantage of operating power block is the elimination of too much manpower in handling the net. It reduces the net wear and tear due to reduced abrasion. It is a great assistance in loading and unloading a very big net from the boat and increase the efficiency of the fishing operation by facilitating the hauling in the net platform ready for another fishing operation. The most common power block used in sardine purse seining is number 31, 42, 45 or above for tuna purse seine.

Purse Winch

This winch is characterized by the pressure of rigger heads at the end of the shaft and cable drum which can be reversed on free wheel by means of separated clutches.

The winch should be little apart to the purse davit to give a greater clearance from the rigger heads. The capacity of winch should be of 5 to 20 tons.

Purse Davit

It is a single or double davits constructed of heavy steel bar. This can be located on the starboard or port side. In this manner, collision during operation is minimized. The best position of purse davit is about the middle of the boat where during operation, the drag on the boat is equal on boat sides.

Fish Finder

This equipment registers the depth of the water and at the same time determines the presence of fish underneath the boat. All vessels of the fleet should have one of this equipment.

Scanning Sonar

This is similar to an ordinary fish finder, the only difference is that it can detect school of fish 360 degrees. The sonar (scout boat) should have this equipment respectively.

Radar

This is also an electronic equipment that gives the position of the boat especially during navigation time. It determine the distance of the boat from any object or land all around the boat up to 72 nautical miles or depending on the range of the radar.

GPs (Global Positioning System)

This is one of the electronic equipment that is used by fishing vessels in determining the exact position of the vessel in any part of the ocean. The data are being fed to the equipment and you can see to the screen or the display unit the speed, latitude and longitude every time.

Radio Communication Equipment

This are excellent sets of equipment of a fishing boat like; receiver, transmitter, hand set, VHF, etc. Through this equipment, you can get the daily weather reports, report daily activities onboard and also the sister ships can give information to other ships as the good fishing ground.

7.0 FISHING OPERATION

There is much technology involve in purse seining and each country adopts its own which is suitable to the area of operation. Generally purse seining operation is conducted with a fleet of vessels including catcher vessel, light boat, sonar boat and carriers. About 10 to 20% of the operation is using a single catcher vessel and work boat. Generally, purse seining in the country before is limited by the phases of the moon, the effective days is 20 to 22 days per month during moon-less nights. However, with the introduction of 360 degrees scanning sonar, fishing is now conducted 30 days in a month including daytime. Sonar or Scout boats are used as accessories in the catcher boat to locate schools of fish.

Today, there are two types of operation by Sardine purse seine. One is for light attraction or luring and the use of 360 degrees scanning sonar.

7.1 Luring light or light attraction

Lighting operation commence at dusk, and the presence of fish schools is determined by fish finder or sonar. If the fish school concentration is sufficient, light boat calls the catcher. Automatically reduces its light one after the other with an interval of at least 3 to 5 minutes duration until two light remain starboard and port side. Before these switch off, the two light in a conical - shaped shade port and starboard will be switch on to keep the fish school roaming in a smaller radius.-The setting of net now commence.

Signals For Setting

The setting of the net starts at the leeward side of the light boat when the wind is quite strong or against the current.

- 3 whistle from masterfisherman - means all hands standby to respective position.
- 3 whistle from assistant masterfisherman - means all hands are ready.
- One prolonged whistle from masterfisherman - means setting the net.
- One prolonged whistle from assistant masterfisherman - means skiff boat and the end of headrope is released.
- One prolonged whistle from assistant masterfisherman - means half of the net paid out.
- One prolonged whistle again - means total net paid out is 3/4 parts.

The catcher boat now will slow down her speed and perform its function through the command of the masterfisherman. Maintain her distance from the light boat until the catcher and skiff boat meet each other. The washing (assistant skiff man) gives the messenger line of purse line and floatline to the catcher. The end of the purse line will pass through the block or pulley of the davit, then connect to the main winch end rope and haul simultaneously. The floatline rope end will be hauled to the bow capstan until the triangle of the net end reach the gunwale. The skiff boat move outside the net and get the victory line from the catcher and perform skiff operation.

Occasionally, the masterfisherman signals the skiff boat to pull the catcher away from the net especially when the purse line is just beneath the boat. After pursing is completed and snap ring are already onboard, power blocking of net begins.

Power blocking, detached snap rings and brailing the catch

Tie the starter line which is pass through the sheave of the power block to the beginning of the net or triangle and engage the power block. Assistant masterfisherman is the leader during power blocking and arranging the net.

Six fisherman arrange the net, two for arranging floats, two for snap rings and one for detaching snap rings respectively. If there is some

entanglement of net to the power block or plenty of gilled fishes, every now and then the assistant masterfisherman whistle to get the attention of the person holding the control of power block to disengaged it.

- One whistle - means stop or disengaged the power block
- Two whistle - means reverse
- One whistle - means engaged the power block.

Masterfisherman orders to the skiff boat to pull away the catcher from the net by means of flashlight or VHF radio. Disengaged the power block when there is not enough bunt floatline remaining in the water. Hauling of net by manpower begin until the catch is ready for brailing.

The carrier boat now alongside to the catcher boat and the brailing, sorting and icing is directly to the carrier. For every dropping of fish into the deck, shower crushed ice to maintain the good quality of fish. Repeat the procedure of brailing until the fish are onboard. Resume the power blocking of the net and arrange ready for another operation.

7.2 Using Sonar

Using sonar which can detect and locate fish schools in a 360 degrees circle around the boat, fish and their abundance are determined by both sonar and catcher boat. The catcher position with the scanning sonar always directed toward the detected fishes. Instruction for setting is from the sonar boat operator. In some cases , the sonar boat puts on light on board if the fish school is stationary. The sonar boat is then encircled by the catcher boat, followed by pursing to close the bottom of the net totally. The Procedure of setting is the same as explained above. The sonar boat moves outside the net and continues searching for other fish school.

Study Report

on

Bagnet in the Philippines

by

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I. INTRODUCTION

The Philippine Bagnet is a box-like gear operated from an outriggered or launch type of boat with the aid of light. Affecting capture of fish by its dipping motion of the net simulates on inverted mosquito net under the boat during operation. The size of the net depends upon the range of the outrigger or the length of the bamboo boom of the boat on which it will be operated. They are equipped with diesel engine and generating set of 10-30 KWA with 6-10 incandesced bulb and halogen bulb. Bamboo boom 3-6 meter long are installed along the sides held in place by stay and shards supported by an auxiliary mast.

II. DESIGN OF THE NET

The traditional way of assembling the five section of the gear weaken strength of the joints. The new structure now requires only three(3) sections including the bottom net. The use more weight and bigger twine number for the netting to make it heavier for them to haul the entire net during operation.

Netting;

1-Main net	PVA 30/6×10mm
2-Flooring or bunt	PVA 30/6×10mm
3-Selvedge	PVA 30/28×35mm

Ropes;

1-Reeving line	(PP)-8mm ∅
2-Head rope	(PE)-12mm ∅
3-Pull rope	(PE)-12mm ∅

Sinker;

1-Lead	(Pb)-4kgs each

III. PARTS OF THE BAGNET

(1) Bunt or flooring

This is the bottom portion of the net where the catch will be concentrated during fishing operation. This includes the two(2) opposite sides B and B1 of the net without separating from the flooring or bunt. The part will form a rectangle when finished on inverted mosquito net.

(2) Selvedge

A piece of netting located at the upper portion of the net(bagnet) where the head rope is fixed by a line. The purpose of this is to protect the main net from tearing on account of the pressure of forces that may act upon the gear in opposite direction or by lifting or pulling force.

(3) Reeving line

This is a soft rope with a low breaking strength which sets as an intermediate rope between the net and the main working rope. The size of the line is 7mm diameter. The length of this is equal to the length of the selvedge.

(4) Headrope

This is a line where the net is hung according to the desired hanging ratio.

(5) Pull rope

This is the part attached to every corner of the net, side net, and mid point used for hauling. The net eight(8) pieces of PA rope 12mm diameter, thirty (30) fathom long.

(6) Lead sinker

This is heavy material attached to one free end of the pull rope connected to the net used to provide an immediate sinking of the net. The number of sinkers used depend on the number of pull rope needed during the fishing operation.

IV. TARGET SPECIES

The most common species caught by bagnet are; anchovies, herrings, sardines, mackerels, slipmouth, round scad, lizard fish and other pelagic fishes.

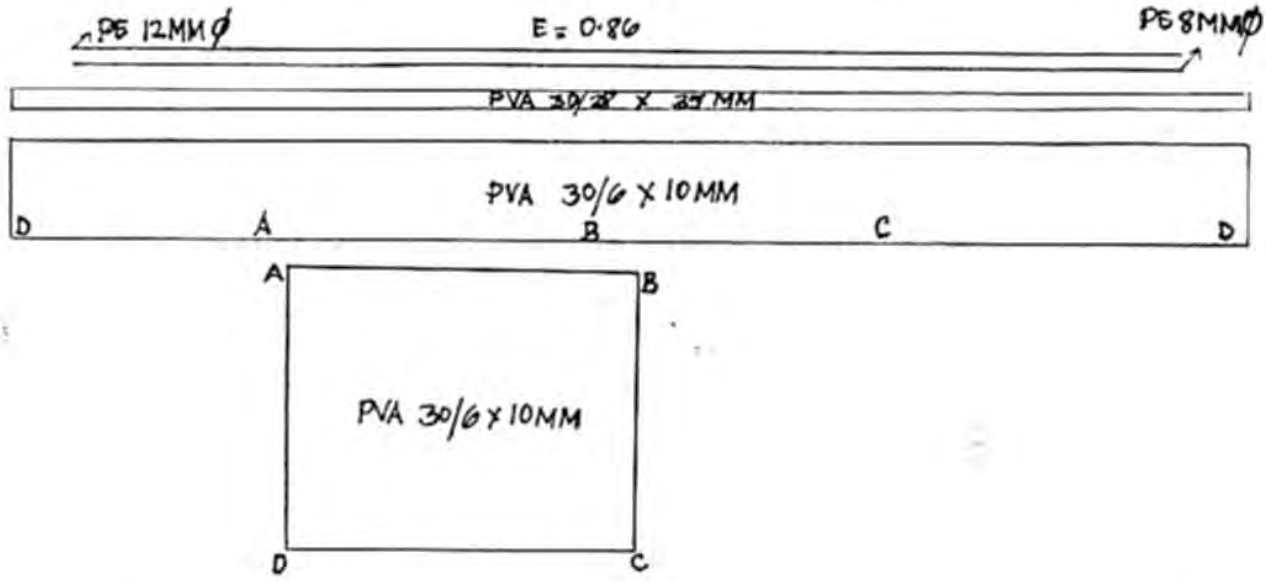
V. FISHING SEASON

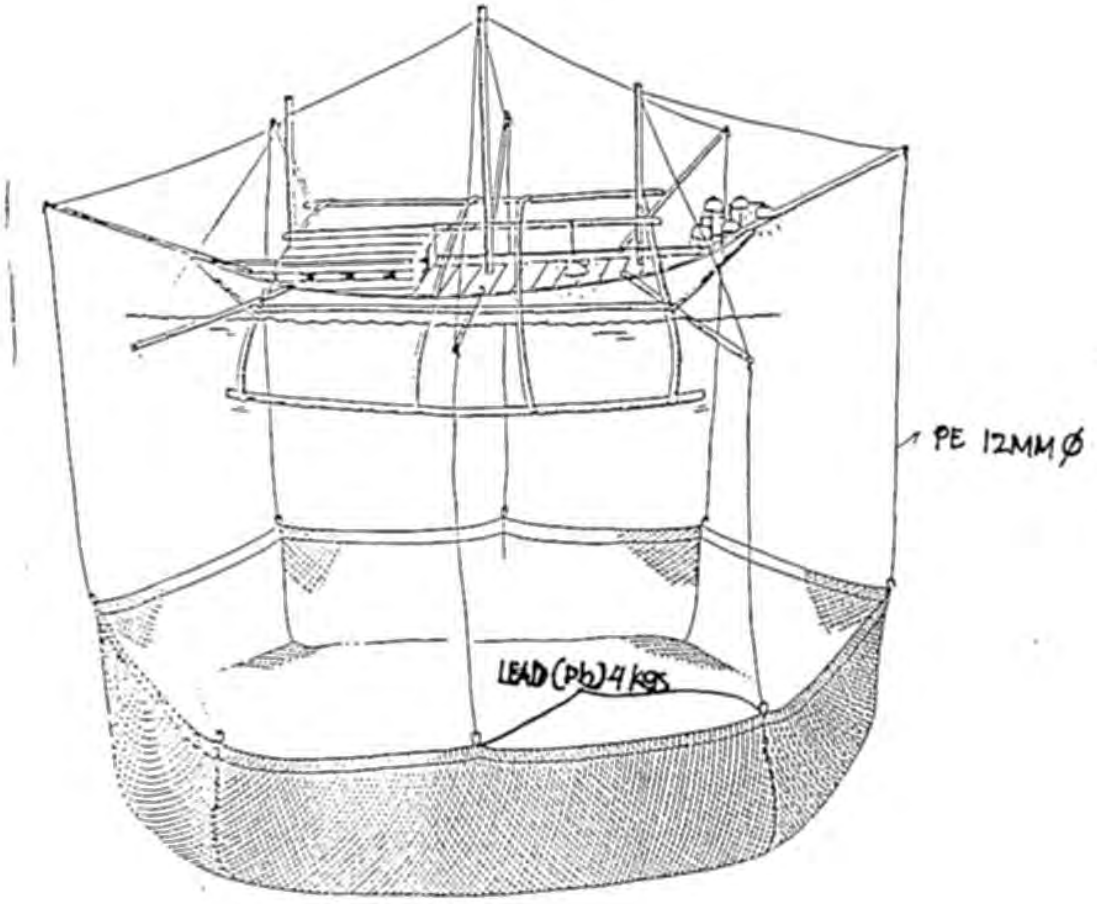
Fishing season is carried out throughout the year in most fishing grounds except those affected by prevailing monsoons.

VI. FISHING GROUND

A good fishing ground for bagnet operation should by sandy, muddy or sandy-muddy some of this fishing grounds are; Moro gulf, East to Sulu, South Sulu sea, Sarangani bay, Batangas bay, Manila bay, Visayan sea, Northern Palawan water, Mindoro area, Turtle Island group, Davao gulf, Ragay gulf, Tayabas bay, Lamon bay and off San Miguel bay.

DIAGRAM OF SPECIFICATION AND OPERATION OF MAGNET





VII. FISHING OPERATION

Bagnet operation in different parts of Philippines is basically the same slight differences in the minor details. The gear is operated in the dark phase of the moon from fifth night after the full moon to the first quarter of each month which may be extended to five(5) night more provided the moon does not shine brightly.

(1) Stock the net on the platform which is located at the portside near the center of the boat with the headrope located at the topmost part of the file.

(2) Attach sinker to one free and of each coiled pull rope.

(3) All necessary materials for the operation such as fuel, lubrication oil, extra fishing accessories, food for crew members, drinking water etc. must be brought onboard the boat.

(4) proceed to selected fishing ground usually the boat leave the homeport in the afternoon to be at the fishing ground before dusk. Upon reaching the fishing ground the boat is then anchored and all lights are put on to attract the school of fish.

SETTING OPERATION

Before setting the net the masterfisherman first determine whether the volume of attracted fish warrant the setting operation practically this could be determined by the presence of bubbles and rippied caused by the constant movement of fishes under water.

(1) Tie each end of the pull rope with sinker to each of the four(4) corner and mid-points of the head rope.

(2) Pass free end of pull rope A1 under outrigger AB and tie at corner A pull rope B1 is likewise tied at B, C1 and D1at D remaining pull ropes on the starboard side are also tied to their respective corner passing it under the boat.

(3) Put off the light alternately for about 3-5 minutes duration leaving the traveling light situated near the bow and the sloop located at mid-ship.

(4)With all the crew members positioned in their respective place the net is payed out from the platform.

(5)Release the weighted net if the bottom of the water is 30 fathom just at the net sink until 15-20 fathom only.

(6) The traveling light is slowly brought close to the slope to bring the attracted fish mid-ship.

(7) After a few minutes traveling light is put off leaving the sloop alone to concentrate the fish in a smaller area.

HAULING OPERATION

After allowing the fish to play to several minutes under the light, the masterfisherman order his crew members to report to their respective place.
(1) At the signal of the masterfisherman all the pull ropes are simultaneously pulled up until the upper portion of the net is brought to the surface. All light at the bow are again put on to attract another school of fish.
(2) The net transferred from the starboard side to the port side by pulling lines HG, EF and DE simultaneously passing under the boat and hanged at the gunwale.
(3) Lines AH at the bow and lines OD at the aft are pulled at the same time while crew at lines ABC move toward the boat.
(4) Lines EFG are then pulled and their respective headrope are stacked at the gunwale on the aft portion of the boat at the same time lines ABC are also pulled towards the platform where their respective headropes are stacked the net form a smaller rectangular position.
(5) The net is properly hauled until the catch is concentrated at the brailing of the net or bunt.
(6) The catch is brailed and placed in boxes or tubs. The same procedure is repeated when there are still abundant fish attracted to the light. In one night operation, setting and hauling operation are done to a maximum of six(6) to a minimum of three(3) depending upon the volume of attracted school of fish.

Study Report

on

Ringnet in the Philippines

By

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1.0 INTRODUCTION

Ring net is one of the most effective type of fishing gear for surrounding fish school used for catching fish species such as round scad, big-eyed scad, mackerel, sardine, bonito, skipjack, tuna and tuna like fishes. It is locally known as kub-kub, likom-likom and pangulong in the different parts of the country. The nets is consist of rectangular nettings, a float line with floats attached and sinker line with sinker attached. At both ends of the gear, there are side lines to which the ropes are fixed. However, the most salient feature of the gear is that is used to encircle and impound the fish school by closing the bottom by purse line which passes through the purse ring fixed to the end of the bridles attached to the sinker line at regular intervals, thus preventing the fish from escaping downward. The bunt of the net is generally located at the center followed by body and wings on both sides. Hauling is done manually by pulling simultaneously on both sides of the net.

Ring net which was originated from " Tuck Seine " and were developed to catch surface dwelling fishes in deeper water. It is also introduced and operated during the dark phases of the moon. Eventually, ring net is became successful in catching pelagic fishes in the region by using light attraction and payao as fish aggregating device. Until today, ring net has been developed rapidly and are still the most productive type of fishing gear.

2.0 FISHING GEAR CONSTRUCTION

2.1 Webbing

2.1.1 Bunt

The bunt is important part of the net where the fish collect in the last step of the fishing operation before being scooped into the fish hold or in the fish boxes. The materials of the webbing used for this part should be strong and thicker than the other parts. Usually in a ring net, the bunt is located at the center. see figure 1.

2.1.2 Net under the bunt

The upper rim of this portion is joined to the bunt while the lower rim is joined to the lower selvedge. The twine size of this part should be the same as that of the body or the wing part and the mesh size is the same or bigger than the other part. Usually the mesh size is vary from 20-30 mm and polyamide 210d/9 - 210d/18 is used. see figure 1.

2.1.3 Body and Wing net

In a ring net, the body and wing nettings is the largest part of the net for surrounding the fish school. There are many sizes of twine used in this part, especially since the part is located near the bunt should be bigger than that of the outside. The size of webbing twines used for this part are 210d/6 - 210d/12 and 25-50 mm mesh size is generally used to catch more fish. see figure 1.

2.2 Selvedge

This part of the net acts like a frame to prevent the bunt, body and the wings being damaged during use. So the larger twine size and stronger webbing twine will be used. There are 3 parts of selvedge:

2.2.1 Top selvedge

The upper rim of the top selvedge is joined to the float line while the lower rim is joined to the bunt, body and the wings. Usually, this ring net used polyethylene webbing twine 400d/9 - 400d/18 for the selvedge. The mesh size used for the selvedge is usually the same as that of the body net or slightly bigger. The length of the top selvedge must be equal to the length of the bunt, body and the wings while the depth should be about 10-30 meshes. see figure 1.

2.2.2 Lower selvedge

The lower rim is joined to the sinker line. The webbing material and size are the same as those of the top selvedge. However, the mesh size of the lower selvedge is the same as that of the body netting, though it can be twice as much or a little more. Similarly, the length of the lower selvedge is equal to the bunt, body and the wings while the depth is 10-35 meshes. see figure 1.

2.2.3 Side selvedge

The side net is joined to the wing net on both sides and attached to the side line. Most ring net are used polyethylene webbing with a twine size and mesh size equal to that of the top and lower selvedge. The number of meshes width used varies from 10-30 meshes. see figure 1.

2.3 ROPES

2.3.1 Float line and reeving line

Two piece of polyethylene rope, 14 mm diameter are used for the float line and reeving line. One rope is inserted into the meshes of the rim of the top selvedge while the other piece has the floats and attached to the other piece of rope. see figure 1.

2.3.2 Sinker line and reeving line

Two pieces of polyethylene rope, 10 mm diameter are used for the sinker line and reeving line. One rope is for the sinker and the other rope is inserted through the meshes of the rim of the lower selvedge. see figure 1.

2.3.3 Side line

A polyethylene rope of the same size as the sinker line rope is used for the side line. One rope is inserted into the meshes of the rim of the side selvedge while the other is attached to the first rope. see figure 1.

2.4 Bridle rope

Polyethylene rope is used for the bridle rope. One end of the bridle rope is tied to the sinker line while the other end is tied to the purse ring. The length of the bridle rope is 1.83 meters. see figure 1.

2.5 Purse line

It is used to close the bottom of the ring net during fishing operation, the purse line will be inserted through the purse ring and pulled on both sides. The purse line must be thick, strong and not twist or curl during used. Usually polyethylene braided rope or polyprophylene 22-40 mm diameter is used for the purse line. see figure 1.

2.6 Extra rope

This rope connects with the float line at the end of the wings. When shooting the net to surround the fish school sometimes the end of the net cannot meet, then the rope will be used.

2.7 Floats

The floats are attached to the float line and reeving line of the net. Usually, the materials used are fiber, rubber, plastic and cylindrical in shape. see figure 1.

2.8 Sinkers

The sinker is used to weight the net for sinking, usually round in shape and made of lead with a hole at the center. They weigh 200 grams each and are attached to the bridle rope over the purse ring or to the sinker line. see figure 1.

2.9 Purse ring

Generally, purse ring must be made of non-rust materials such as brass, stainless steel or iron covered with zinc. The diameter of the inside of the ring is 100-180 mm and the thickness of the material is 10-50 mm. see figure 1.

3.0 FISH CAUGHT

Mostly the fish caught of a ring net fishing gear are pelagic fish species. Both the municipal and commercial ring net engage in fishing. Other fish species caught by ring net are not included in the table. see Table 1.

Table 1. Major species caught of Ring net (in MT)

Species	1994	1993
Round scad	**38,864**	**35,832**
Skipjack	**15,691**	**17,295**
Frigate tuna	**26,600**	**30,115**
Slipmouth	**1,565**	**3,137**
Sardines	**6,250**	**3,136**
Indo-Pacific mackerel	**4,876**	**2,020**
Indian sardines	**39,273**	**36,811**
Indian mackerel	**5,148**	**2,574**
Bigeyed scad	**8,216**	**5,223**
Eastern little tuna	**27,430**	**8,763**

4.0 MAJOR FISHING GROUNDS OF RING NET FISHING GEAR

Bohol Sea
East Sulu Sea
Lamon Bay
Mindanao Waters
Moro Gulf
Palawan Waters
South Sulu Sea
Zambales Coast
Samar Sea
Visayan Sea
West Sulu Sea

5.0 FISHING BOAT

The typical ring net boat is wooden and powered by 80-320 HP diesel engine. An auxiliary engine is installed on the main deck to drive an improvised winch or connect them to main engine. An improvised winch is used during pursing operation and heaving the tom weight. The catcher boat is assisted by skiff boat and by an outriggered pumpboat or light boat, powered by 80 HP diesel engine and 16 HP gasoline engine. The light boat is assigned to select the payao with the most fish aggregation which will be lighted and tended for the operation. The catcher boat is manned by 20-35 fishermen while the skiff boat and light boat has 2-3 fishermen. see Figure 3. The pilot house is located at mid-deck. In some areas, it is located in the forward or bow section. The working deck is for hauling the net and purse rope, fish hold and the improvised winch differ for various deck arrangement. see figure 3.

6.0 FISHING OPERATION

6.1 Luring Method

The boat is anchor in a place where the fish are expected in abundance and commences luring in the late evening. All lamps are turn on the ship. After 4-6 hours of lighting the crew member transfer the light to the light boat and put on its light. The lamps on the mother boat are turned off one by one and the anchor is pulled up. This is done so that the fish will concentrate around the light boat.

Fishermen can then start shooting from a suitable place towards the direction of the current and wind in such a manner as to surround the light boat at pull speed. Shooting is done in such a way that the boat is able to return back to its exact initial position at the end shooting. During shooting and hauling of the gear, the light boat must be kept at the center of a circle of the net drawn by the boat.

After complete encircling, the two end of the float line is pulled on board at the same time the end of the purse line which is connected to the float line is set to the winch. The other end is set to another winch and the purse is then pulled out through the pursing davit until it is on board. While hauling, the boat is kept away from the net to avoid trouble and damaged of the net by using skiff boat.

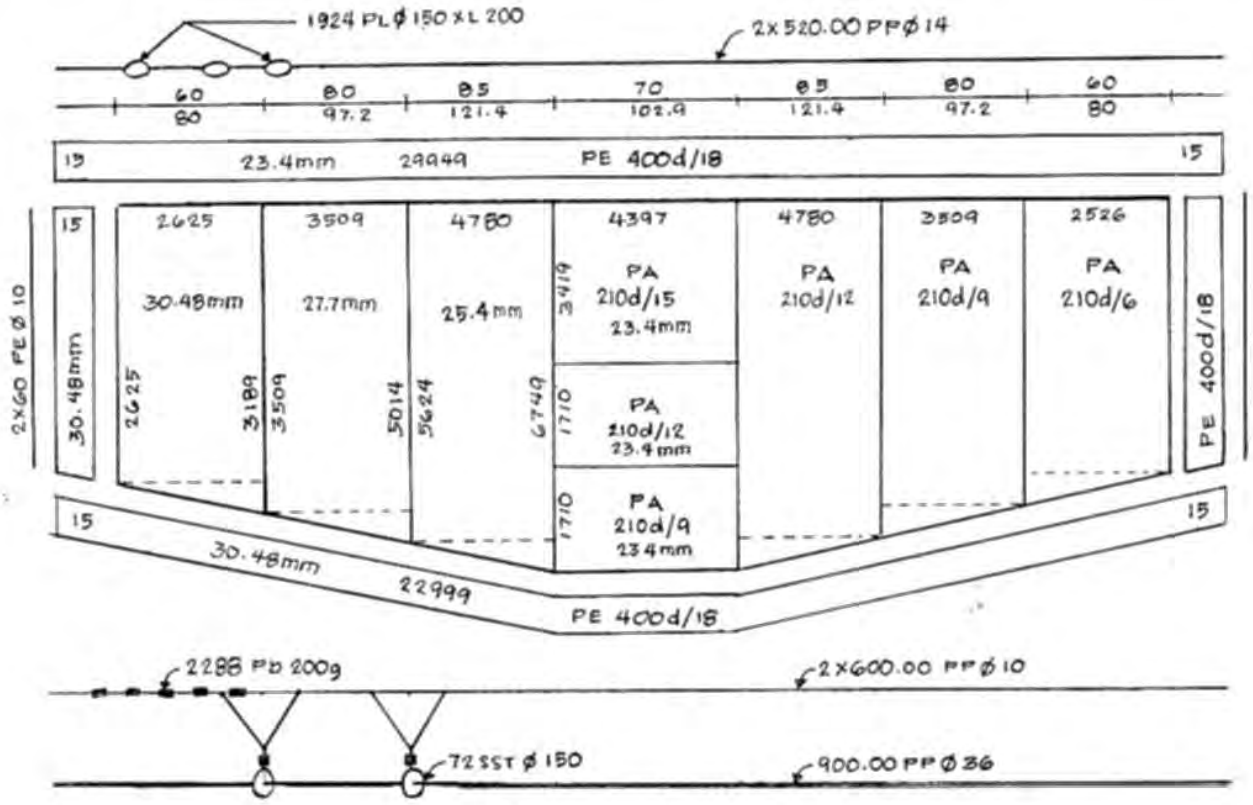
Hauling the net is done manually by pulling simultaneously on both ends. After finished shooting, the net is hauled and put in order into its normal position on the stern side of the boat by a handful fishermen. Both ends of the net is hauled on board until the bunt reaches the side of the boat.

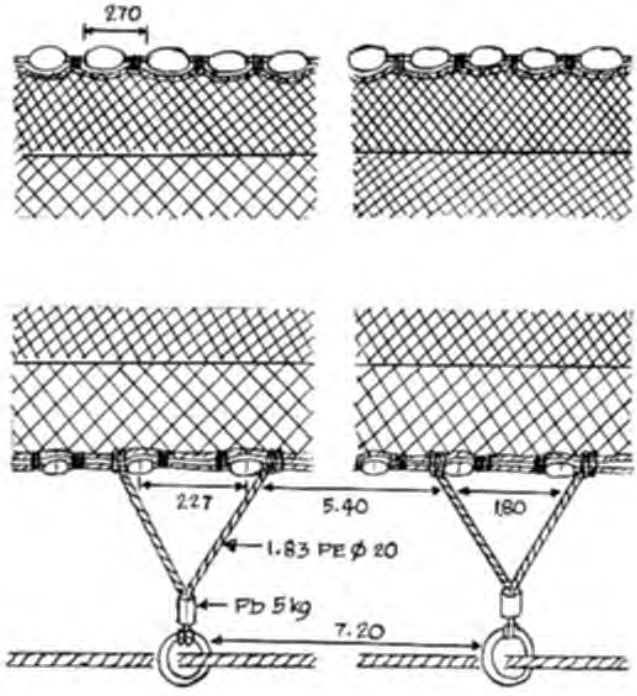
For scooping, the upper part is lifted up above the sea surface to prevent the fish from escaping. The fish are scooped into the boat by scoop net. After scooping the fish, the remaining part of the net from up to the other end is transferred and arranged properly to the stern side of the boat and prepared for the next shooting.

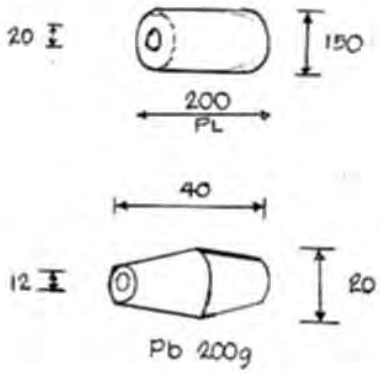
6.2 Payao Operation

Fishing operation utilized mostly in payao where it is lighted at night time. At a determined time (0400- 0500 hr.), the fishermen from the light boat signals the catcher boat to prepare for the setting. The payao attractant or the payao itself is detached and tied to the light boat. After determining the wind and current, the light boat is free from the payao anchor line, the net is set by surrounding the light boat. The purse line is taken on board and hauled using the improvised winch. A 250-400 kilograms tom weight is released with the two rings pursing the purse line to make the lower portion come close together. Pursing will draw all the purse ring above the water and hang them at the davit block. A complete normal pursing operation takes about 20-35 minutes. Both wings are then hauled simultaneously until the bunt is clear of the water. The catch is brailed and poured on deck for sorting or direct to the fish hold for chilling. The net is then stacked on the net platform ready for the next operation. see Figure 4.

FIGURE 1 - RING NET DESIGN AND CONSTRUCTION







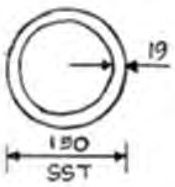
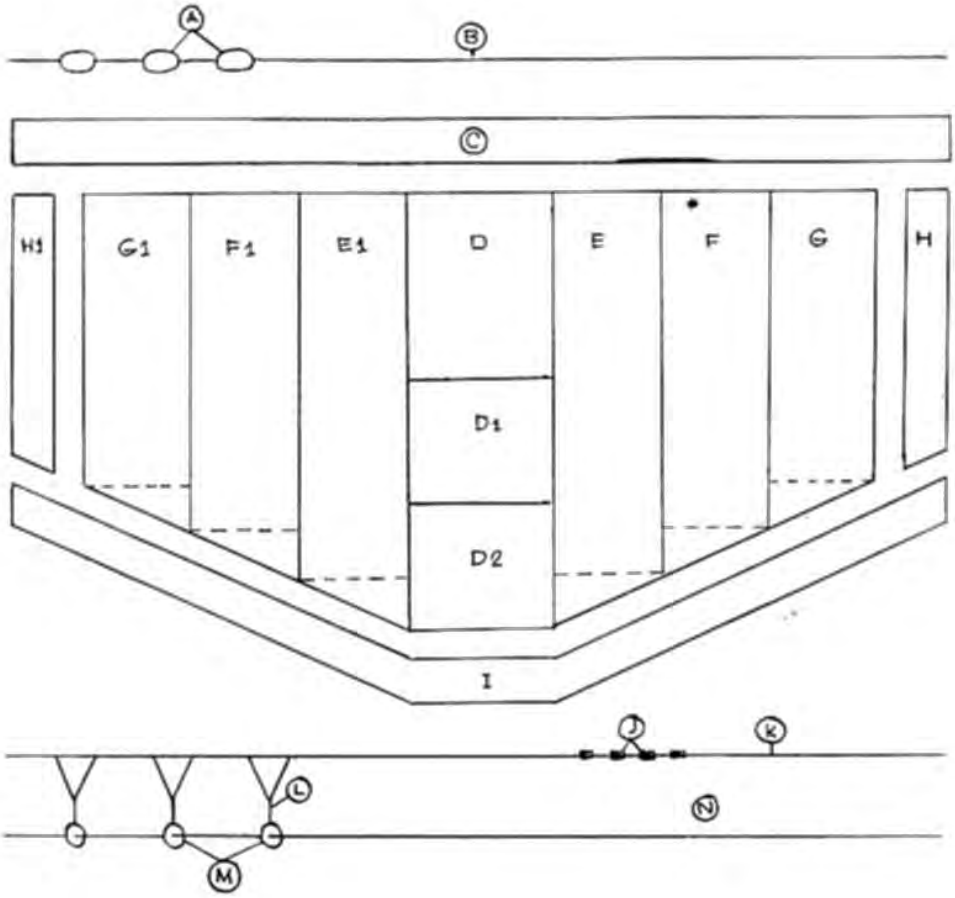


FIGURE 2 - PARTS OF THE NET



A - FLOATS

B - FLOAT LINE AND REEVING LINE

C - TOP SELVEDGE

D, D1 AND D2 - BUNT

E AND E1 - BODY

F, F1 AND G, G1 - WINGS

H AND H1 - SIDE SELVEDGE

I - LOWER SELVEDGE

J - LEAD SINKER

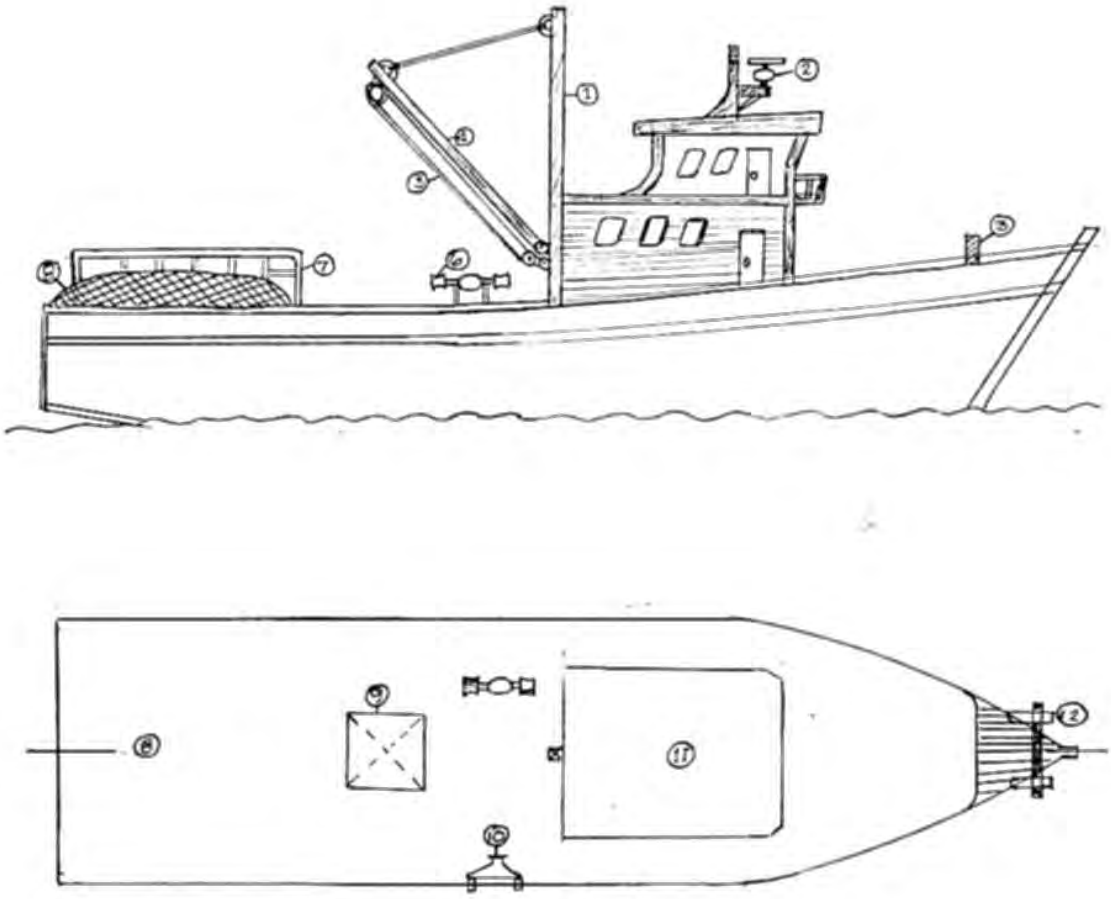
k - SINKER LINE AND REEVING LINE

L - BRIDLE LINE

M - RINGS

N - PURSE LINE

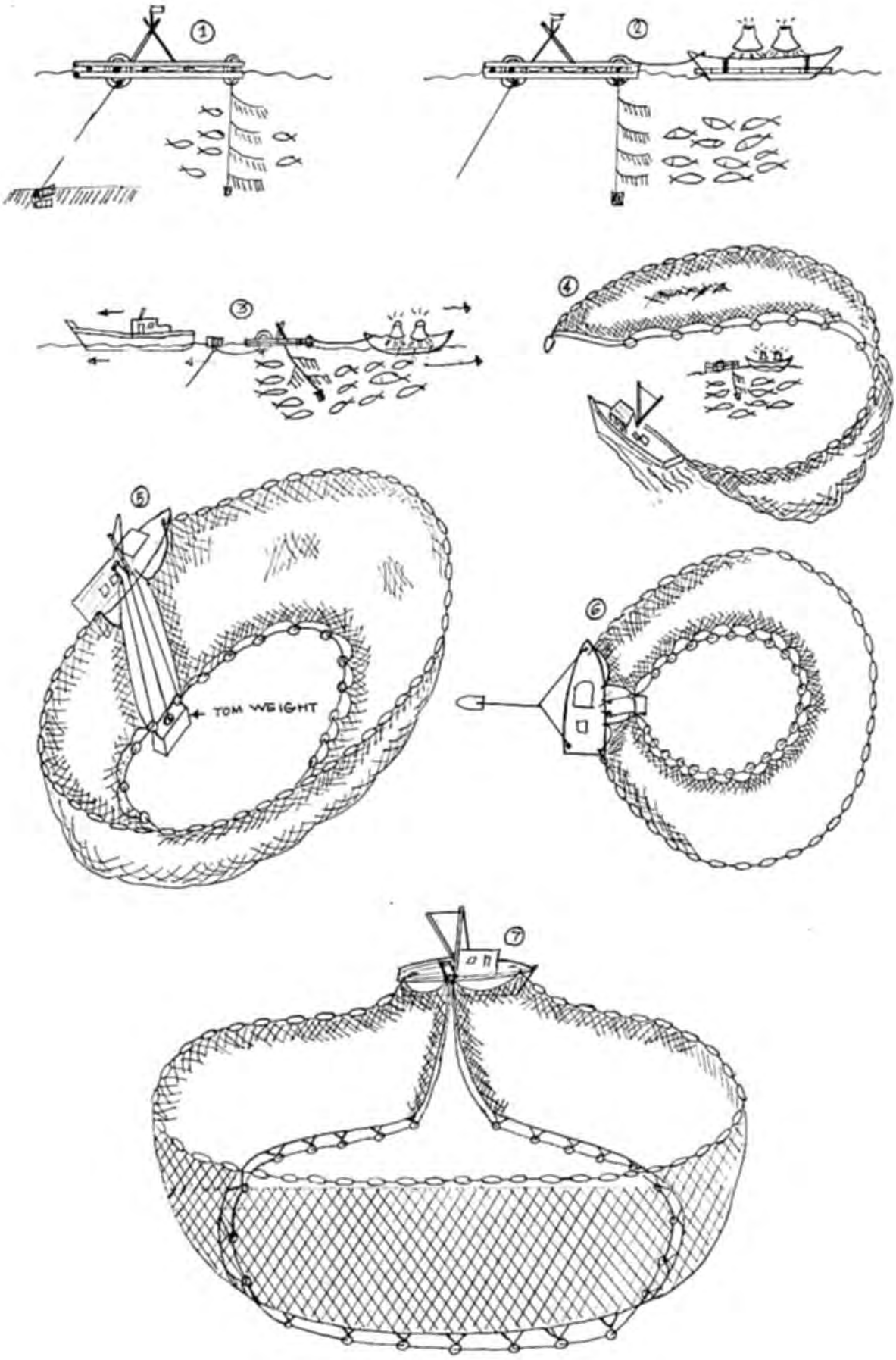
FIGURE 3 - THE RINGNET FISHING BOAT



BOAT ARRANGEMENT

1. MAIN MASS
2. RADAR
3. MOORING BITT
4. BOOM
5. WARP
6. POWER TAKE OFF WINCH
7. FLOAT GUARD
8. NET PLATFORM
9. FISH HOLD
10. DAVIT
11. WHEEL HOUSE
12. ANCHOR CHAIN ROLLER

FIGURE 4- RING NET PAYAO OPERATION



Study Report

on

Drift Gillnet Fishery in Sri Lanka

By

S.V. Ratnapala Fernando
Ministry of Fisheries and Aquatic Resources
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Sri Lanka

Regional Training Course in Commercial Fishing Technology
18 June - 17 December 1996
Training Department
South East Asian Fisheries Development Centre
Phrasamutchedi, Samut Prakan 10290, Thailand

DRIFT GILLNET FISHERY IN SRI LANKA

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INTRODUCTION

Drift gill net is the predominant fishery which is mainly responsible for the capture of large pelagic fishes from the coastal as well as from the offshore areas. Eventhough it has been reported that drift nets made of natural fibbers (cotton and hemp)have been traditionally used in the inshore waters for over a century , the modern gillnet made of synthetic fibber is the most recent gear that has been introduced to the pelagic fishery.
When synthetic netting material(nylon) was introduced in the late 1950s some of the 3 1/2 tone boats began operating drift gill nets for tuna. The success of 11 tone boats of the Ceylon Fisheries Corporation in tuna gillnet fishing acted as a stimulant , resulting in a rapid growth and expansion of this method amongst the coastal 3 1/2 tone fleet in latter years. In the coastal tuna fishery , there was a phenomenal increase in fishing effort by this method , from 5% in 1963, 65% in 1970 and to over 70% in 1980s. The coastal tuna production has increased from 4500 tones in 1963 to 19000 tones in 1970.
The drift gill net fishery is conducted throughout the year, but peak catches are obtained during the monsoon periods. Catches consists of tuna, shark, bill fishes, sail fish, marlin, sword fish, dolphin fish, rainbow runner, and other large pelagic varieties in small quantities.

LARGE MESH DRIFT GILLNET FOR PELAGIC FISHES -Offshore

This gear is generally used by fishermen operating from fishery harbours, onboard the medium sized fishing vessels ranging from 9-15 meters. This gear is widely used in almost all the offshore regions in the country.
The number of units of net used onboard different classes of vessels vary. In general, 15-25 units are used in day boats(figure 1) while in the case of small multiday boats(figure 2) the number of units could be 25-35. Abu Dhabi class of vessels(figure 3) generally carry about 40 units of this gear while the highest number of units which is about 50 is utilized onboard the multiday medium sized vessels.
Each unit of the net consists of 1000 meshes by 80-120 meshes and the webbing ranges from 125mm to 180mm mesh size while the ply is between 21, 24 or 27.
The webbing is hung on to a polypropylene head rope of 10-12mm in diameter. In most cases a bottom rope is not used. Longitudinally grooved plastic floats of 15-18cm length and 4cm central thickness are attached to

the head rope, at intervals of 6-8 meters. Circular cement sinkers of 13-18cm diameter, each weighing 500-700gms are attached to the net at every 12-18 meters. About four G-7 buoys per unit are attached to the headrope with a buoy line of about 2-10 meters in length. Most fishermen use a single large buoy of about 300cm diameter, for every 4-6 pieces of net.
Nets are usually shot just before dusk and the gear is allowed to soak for about 4-5 hours during the monsoon season and for about 6-8 hours during the off season. this gear is usually operated in combination with the shark longline, the shooting of which is done first, followed by the shooting of the drift net. The free end of the drift net is attached to the shark longline which has already been deployed in the water.
It is to be noted, that as a result of the efficiency of this gear, it is getting popularized also among the fishermen who use small GRP boats, specially fishing in coastal areas of the Western and North Western waters using 8-10 units of nets per operation.

SMALL MESH GILLNET FISHERY FOR ANCHOVY-Coastal

According to the elderly fishermen, this gear has in existence for almost a century in Sri Lanka and is locally refered to as the "HALMESSAN DELA". It is operated on both sides of the country during the calm season. During the months from December to April the net is operated in the Southern, South Western, Western areas and in the East and South East from May to November.
The gear is most popular among the small canoe(figure) fishermen in the South and South-West and among the Theppan(figure 3) fishermen in the West and in the East. There are also fishermen in the West, who use small GRP vessels(figure 4) for the operation of this gear.
Webbing used in this net ranges from 10-18mm mesh of 2 ply, a length of 3000 meshes and a height of 500-600 meshes. 2-3mm polypropylene cord is used for the head rope and the foot rope, on to which the webbing is attached by a 9 ply nylon thread. 8-10 mesh are included between 2 staples of about 70 mm. About 10-12 pieces of net are used on board a theppan and up to 25 pieces if the small GRP vessels are used.
1/2 F1 floats are attached on the head rope at every 4 to 8 metre. Ball shaped cement sinkers or round stones, weighing 200-300 grams each,are attached on the bottom rope every 3-4 metres. Fisherman commence their outward journey to the fishing grounds around 5 a.m, and the shooting of the net is done just before dawn. The net is allowed to soak for about 1-2 hours before hauling.
The gear is used as a surface gear, as well as a mid water gear in deeper waters by using a buoy line of about 1 meter. In the latter case buoys are attached to the head rope at every 20-30 meters using a 2-3mm polypropylene rope.

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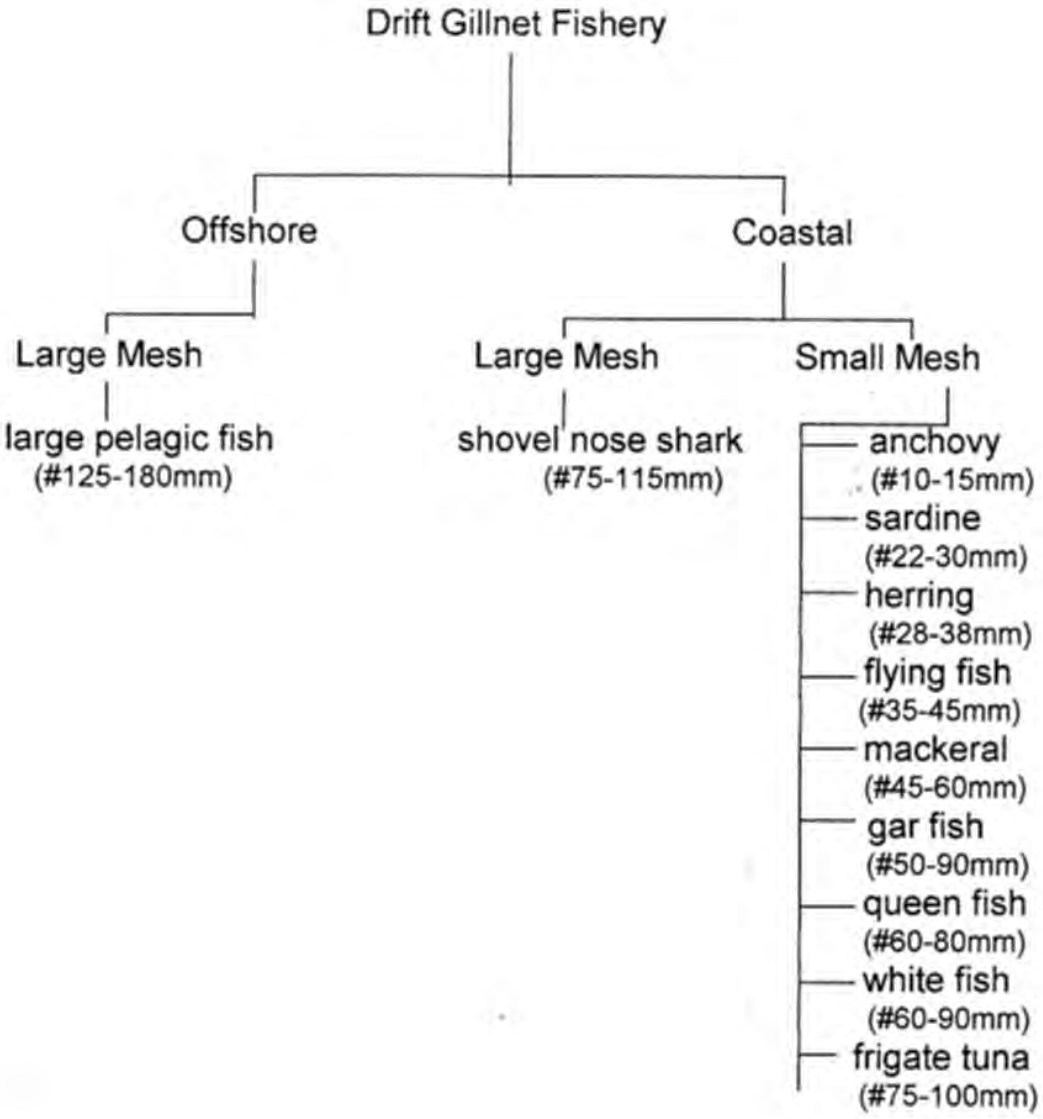
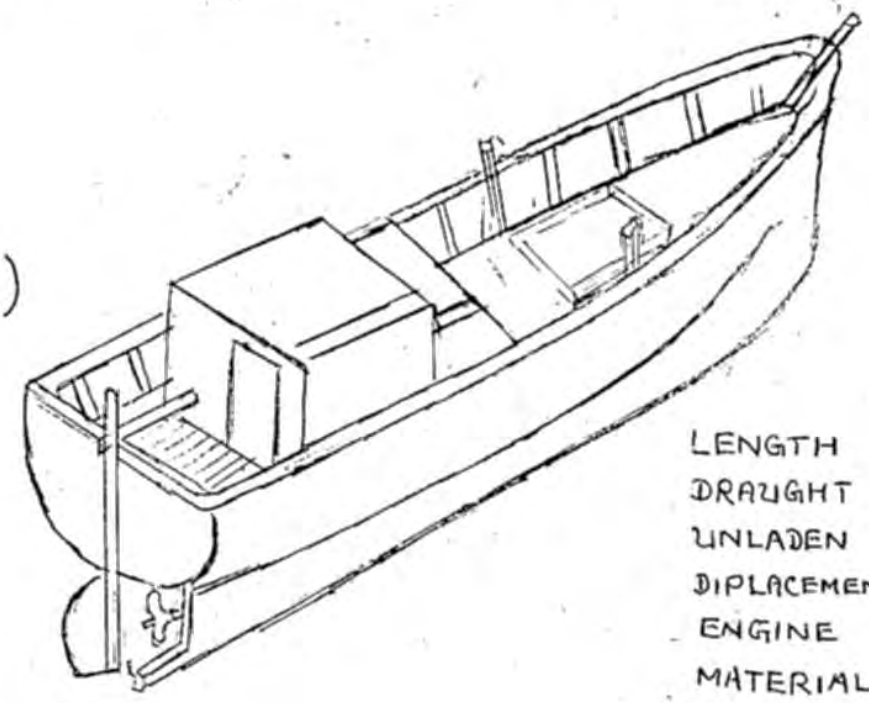
Classification of Drift Gillnet in Offshore and Coastal



3½ TON FISHING VESSEL

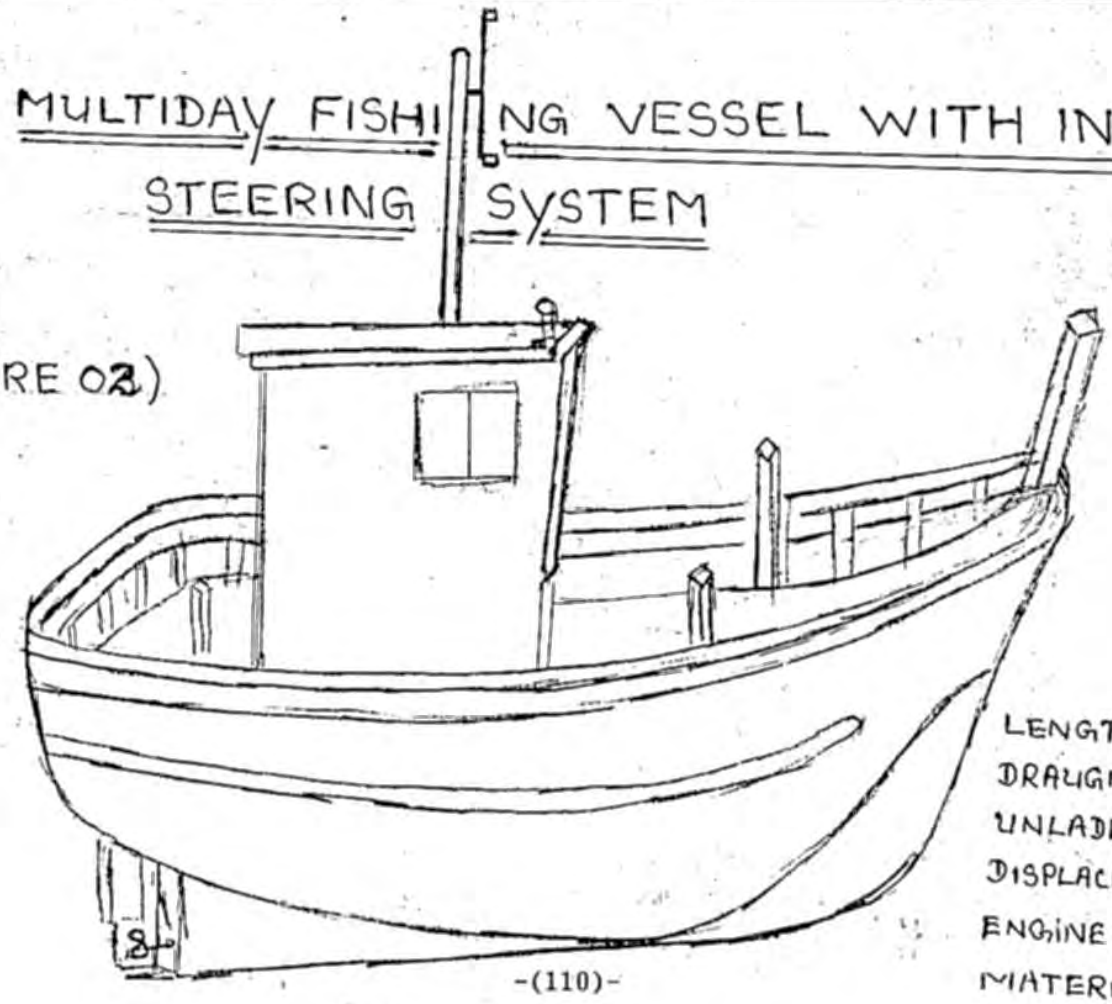
(FIGURE 01)



LENGTH = 8.5 M
DRAUGHT = 0.6 M
UNLADEN DIPLACEMENT } 3½ TON
ENGINE = 24-28 HP
MATERIAL = G.R.P / WOODEN

MULTIDAY FISHING VESSEL WITH INTERNAL STEERING SYSTEM

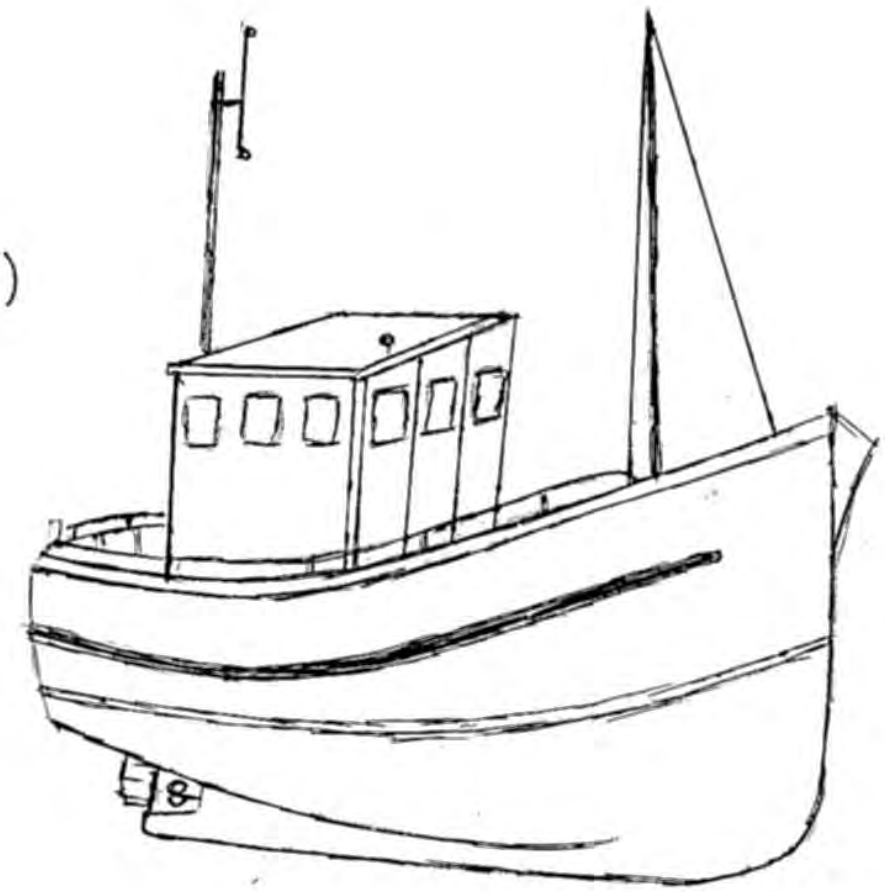
(FIGURE 02)



LENGTH = 10-11 M
DRAUGHT = 0.7 - 0.8 M
UNLADEN DISPLACEMENT } 4-5 TON
ENGINE HP = 36-56
MATERIAL = G.R.P

ABU DHABI TYPE FISHING VESSEL

(FIGURE 03)



LENGTH = 10.7 M

UNLADEN DRAUGHT = 1.4 M

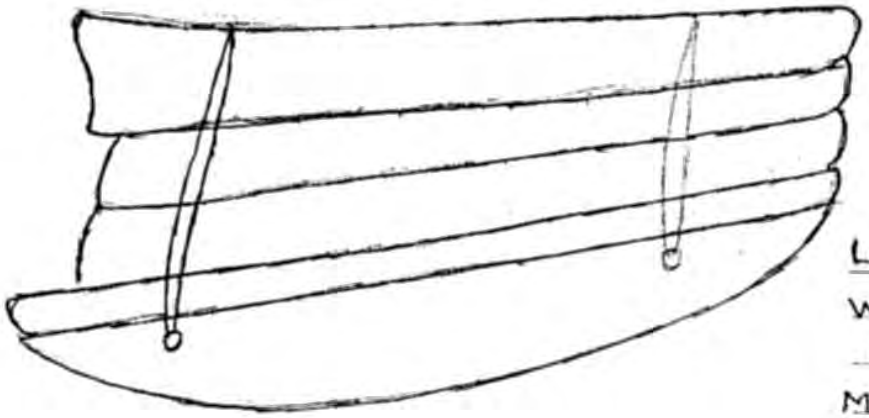
" DISPLACEMENT = 11 TON

ENGINE = 56 HP

MATERIAL = G.R.P

THEPPAN (LOG RAFT)

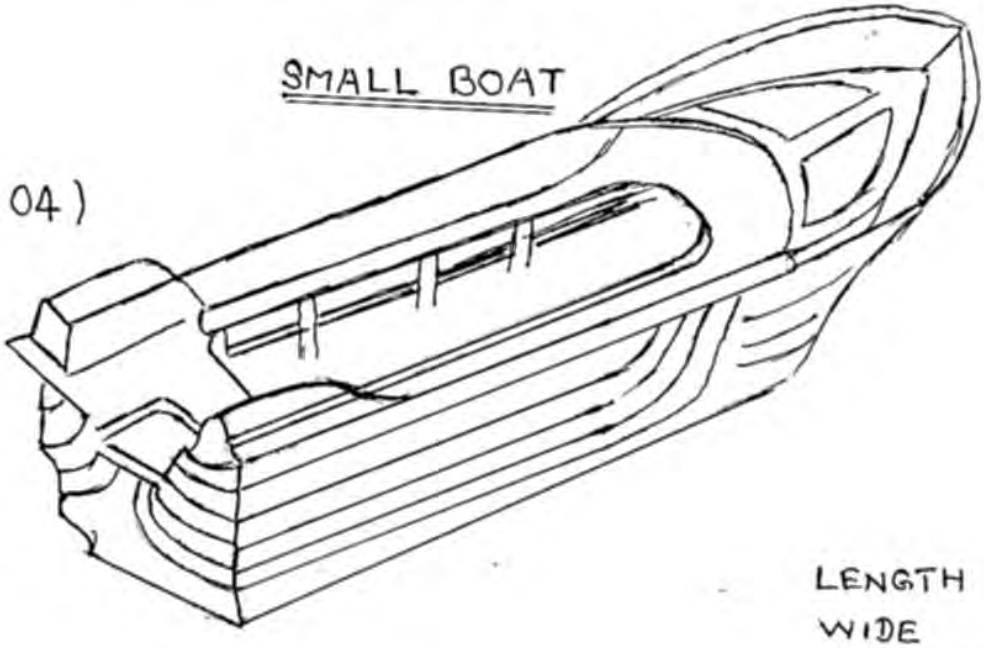
FIGURE 03



LENGTH =4 M
WIDE(ONE SIDE)=1.2M
" (OTHER SIDE) 0.5 M
MATERIAL =WOODEN

SMALL BOAT

FIGURE 04)



LENGTH	= 5.5 - 5.7	M
WIDE	= 1.7	M
DRAUGHT	= 0.3	M
UNLADEN DISPLACEMENT	0.5	TONS
MATERIAL	=G.R.P	

MAIN SPECIES CAUGHT IN LARGE PELAGIC FISHERIES

(PART 01)

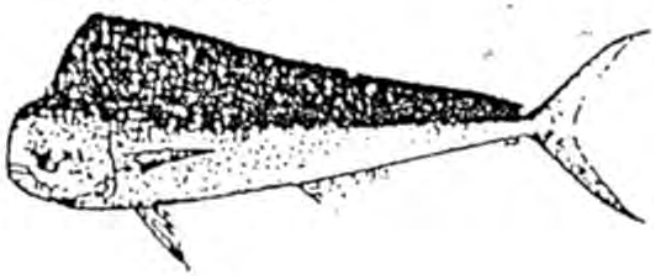
MARLIN

SAILFISH

SWORD FISH

SPANIS MACKEREL

DOLPHIN FISH



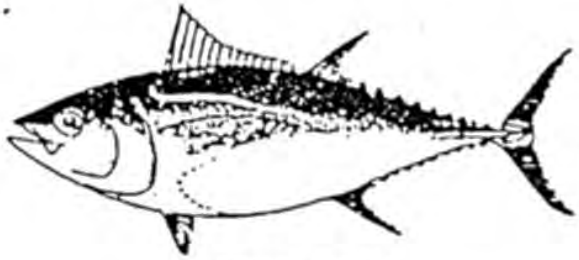
WAHOO

QUEEN FISH

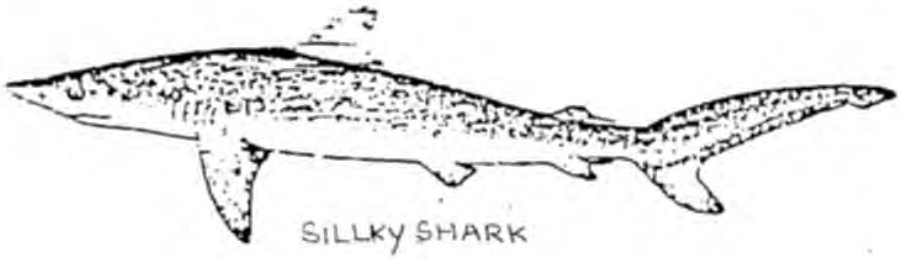
SKIPJACK

YELLOWFIN TUNA

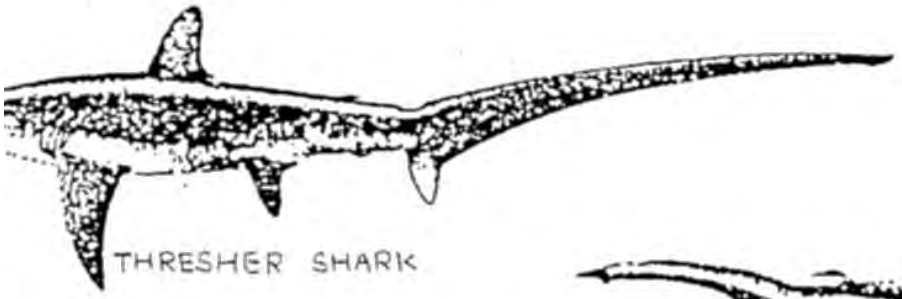
MACKEREL TUNA



BIGEYE TUNA



SILLKY SHARK



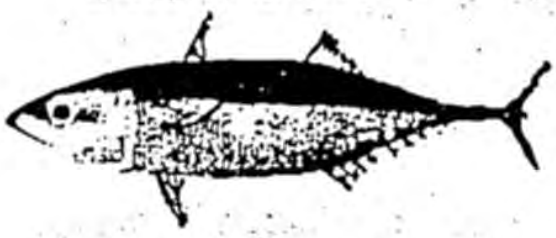
THRESHER SHARK

HAMMERHEAD SHARK

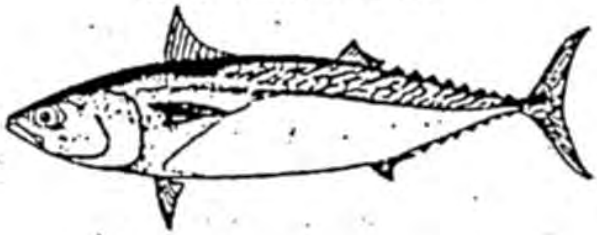
MAIN SPECIES CAUGHT IN SMALL PELAGIC FISHERIES

PART 01

INDIAN MACKEREL



FRIGATE MACKEREL

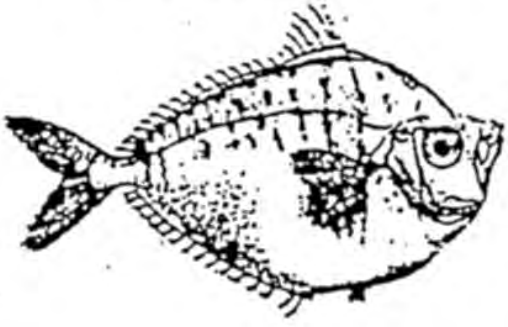


RUSSEL'S SCAD

BIG EYE SCAD

TREVALLY

SILVER BELLY



SARDINE

TRENCHED SARDINE

ANCHOVY

FLYING FISH

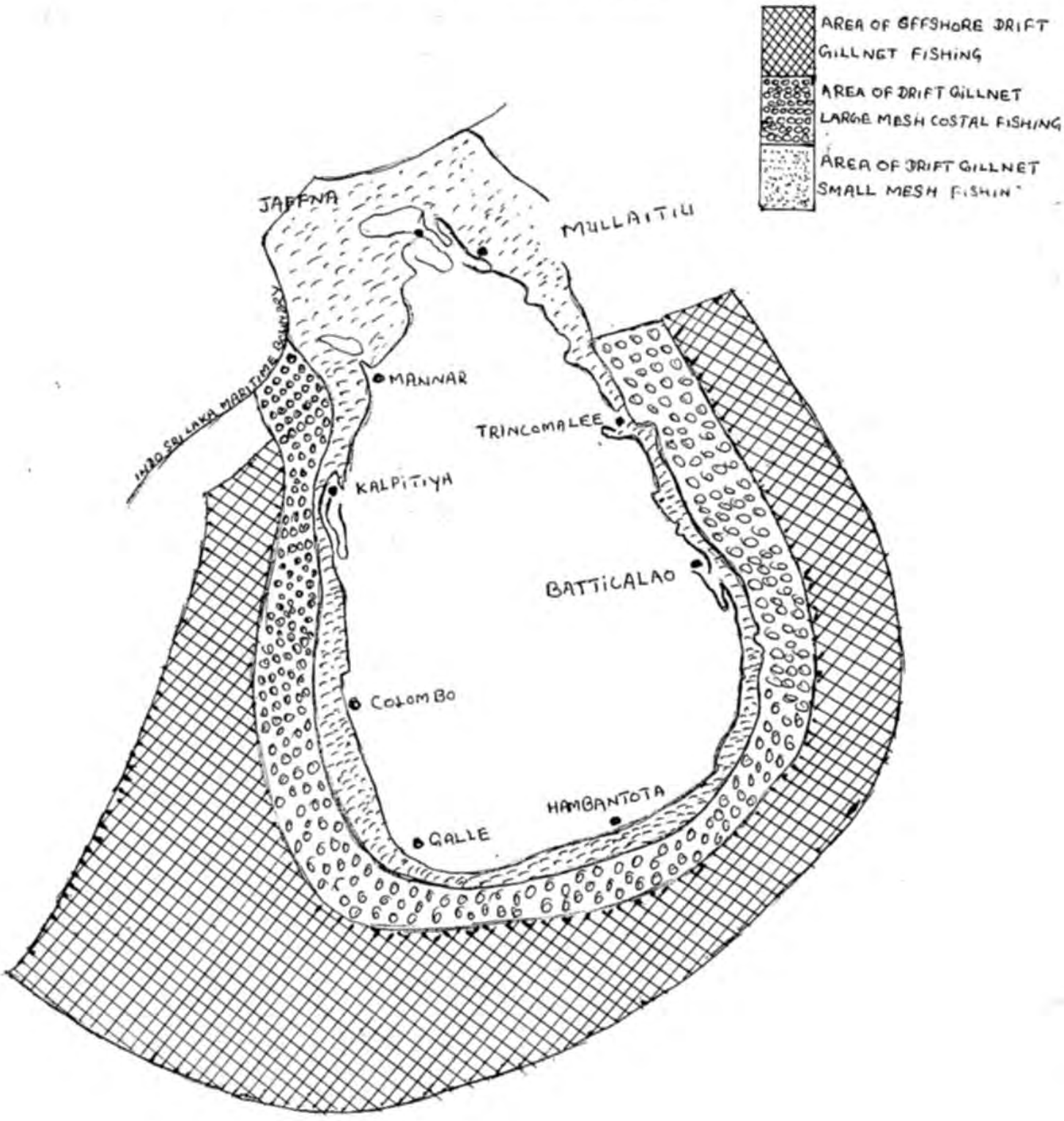
WOLF HERRING

HALF-BEAK

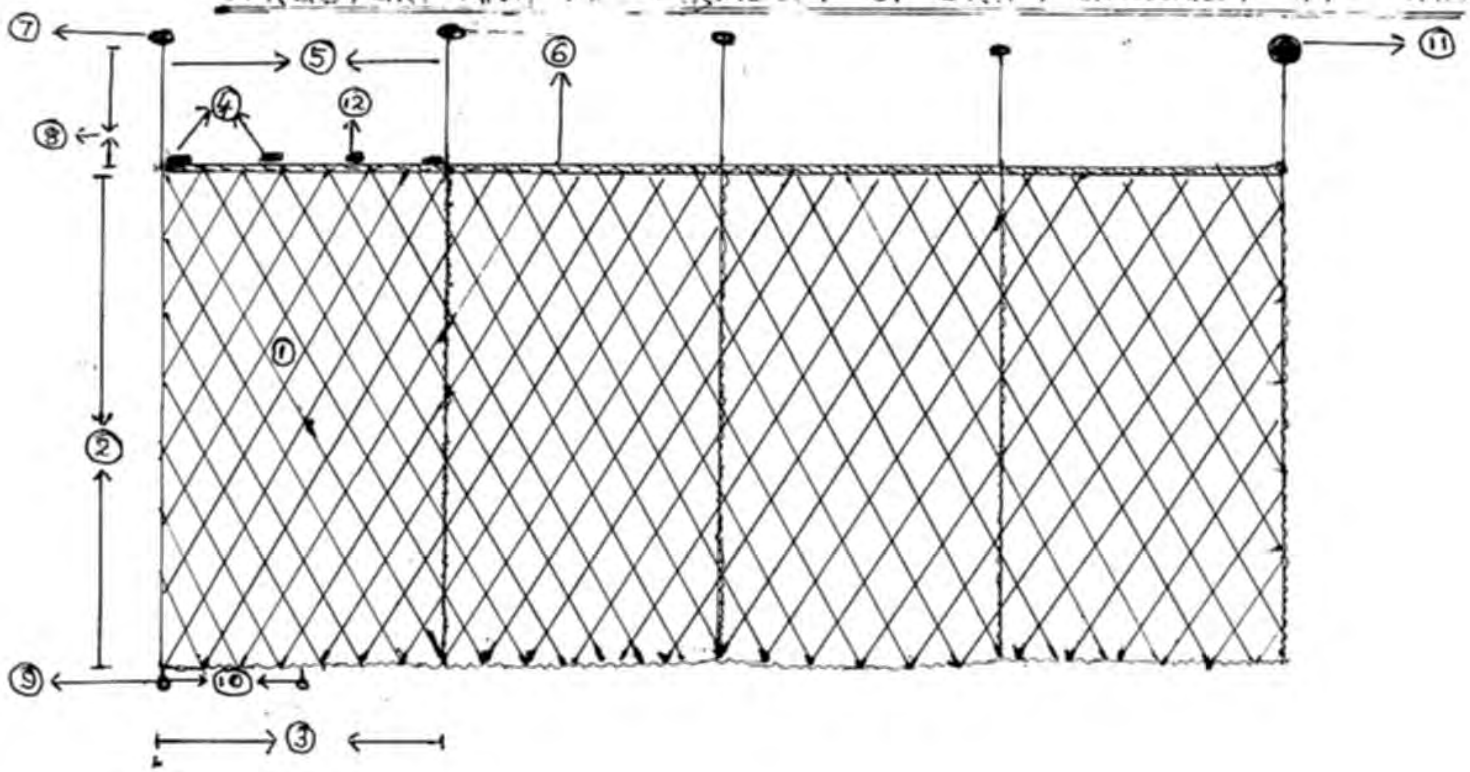
GARFISH

SEA PIKE

AREA OF DRIFT GILLNET LARGE MESH OFF SHORE AND COASTAL



STRUCTURE AND MEASURMENT OF DRIFT GILLNET OFFSHORE



① MESH SIZE 125-180MM

② DEPTH OF NET = 80-120 MESHES

③ LENGTH OF MESHES = 1000 (ONE UNIT NET)

④ DIFFERENCE OF THE LENGTH AMONG F 1 FLOAT IS =6-8 M

⑤ HEAD ROPE 10-12 MM POLYPROPYLENE

⑦ G 7 BUOY

⑤ " " " " " G.7 " IS 14-17 M

⑧ LENGTH OF THE BUOY LINE IS = 2-10 METRE

⑨ SINKER WEIGHT 500 DIAMETRE 18 CM

⑩ DIFFERENCE OF LENGTH AMONG SINKER IS 12-18 M

⑪ PLASTIC BUOY DIAMETRE 300CM

⑫ F 1 FLOAT LENGTH 15 CM

STRUCTURE AND MEASURMENT OF DRIFT GILLNET OFFSHORE

Study Report

on

Drift Tuna Longline of Vietnam

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1.0 Introduction

Longline is known to be an environment friendly fishing gear compared to trawls and high seas drift gillnets. This fishing gear is also known to have greater selectivity compared to other fishing gears such as trawls and purse seines. Longline is useful for fishing widely distributed predatory fishes such as tuna, bill fishes, marlins, sharks, etc. There are about 10 Japanese longliners operating in Vietnam. Yellowfin and Bigeye tuna are the main species caught. A description of the tuna longline in use in Vietnam and its operation is given in this study report.

2.0 Specifications of the Gear

The structure of the tuna longline is given in Fig. 1a, b &c and specification are given in Table 1. The fishing gear is imported from Japan.

Table 1. Specifications of tuna long line used in Vietnam

Item	Specification
Mainline	**PE 12 mm ø; Length: 20,000 m**
Buoy	**Plastic 300 mm ø; 200 nos.**
Buoy line	**PE; 10 mm ø; Length: 25 m**
Branch line	**Nylon Monofilament 3.0, 2.5, 2.0 mm ø; 2000 nos.**
Hook	**Tuna hook No. 38**
Radio buoy	**3 nos.**
Light buoy	**5 nos.**
Marker buoy	**1000 mm ø**

3.0 Fishing Vessel

Tuna longlines are operated Japanese built vessels of 56 m length overall and 8 m width, equipped with line haulers and branch line winders. Usually there are 25 crew members on board and the fishing cruise is for a period of 30 days. The vessel starts with 5000 l of fuel oil and 1200 kg of bait. Bait used is scad imported from Peru or Japan. Salient features of the vessel are given in Fig 2.

4.0 Fishing Ground

Tuna longlines are mainly operated off South Truong Sa Island

5.0 Operation of the Tuna Longline

Shooting operation of tuna longline generally takes place during 05:00 -11:00 hrs. Hauling begins at about 14:00 hr. and extend up to 06:00 hr. during the following day. Shooting and hauling operation are diagramatically represented in Fig 3. The lines are hauled from the head at a low speed of 0.7 kn. per hour .Baits used are sprats imported from either Japan or Peru.

The line are set in two ways:

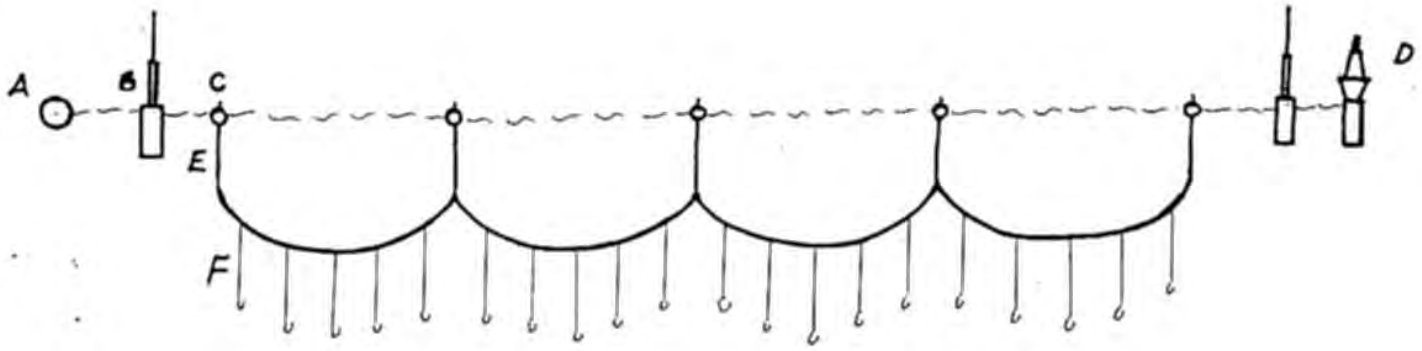
(a) in straight line across the prevailing current (Fig 4a)

(b) in a U-shaped pattern with almost equal lengths of line in the three , limbs (Fig. 4b). In the latter case branch lines are not attached to the corners, so as not to avoid the entanglement with main line while shooting and hauling. This method is more commonly used in Vietnam.

Hooking rate generally varies from 2.5 to 5.0 per cent. The main species caught are Yellowfin and Bigeye tuna (Fig. 5)

6.0 Conclusions

Tuna longline has bright prospects for development in Vietnam. Its wider use is to be advocated due to energy-efficient operation, better selectivity and environmental friendliness.



A : MARKER BUOY
B : RADIO BUOY
C : TUNA LONGLINE BUOY
D : LIGHT BUOY
E : BUOY LINE
F : NYLON MONOFILAMENT

FIG 1a : TUNA LONGLINE

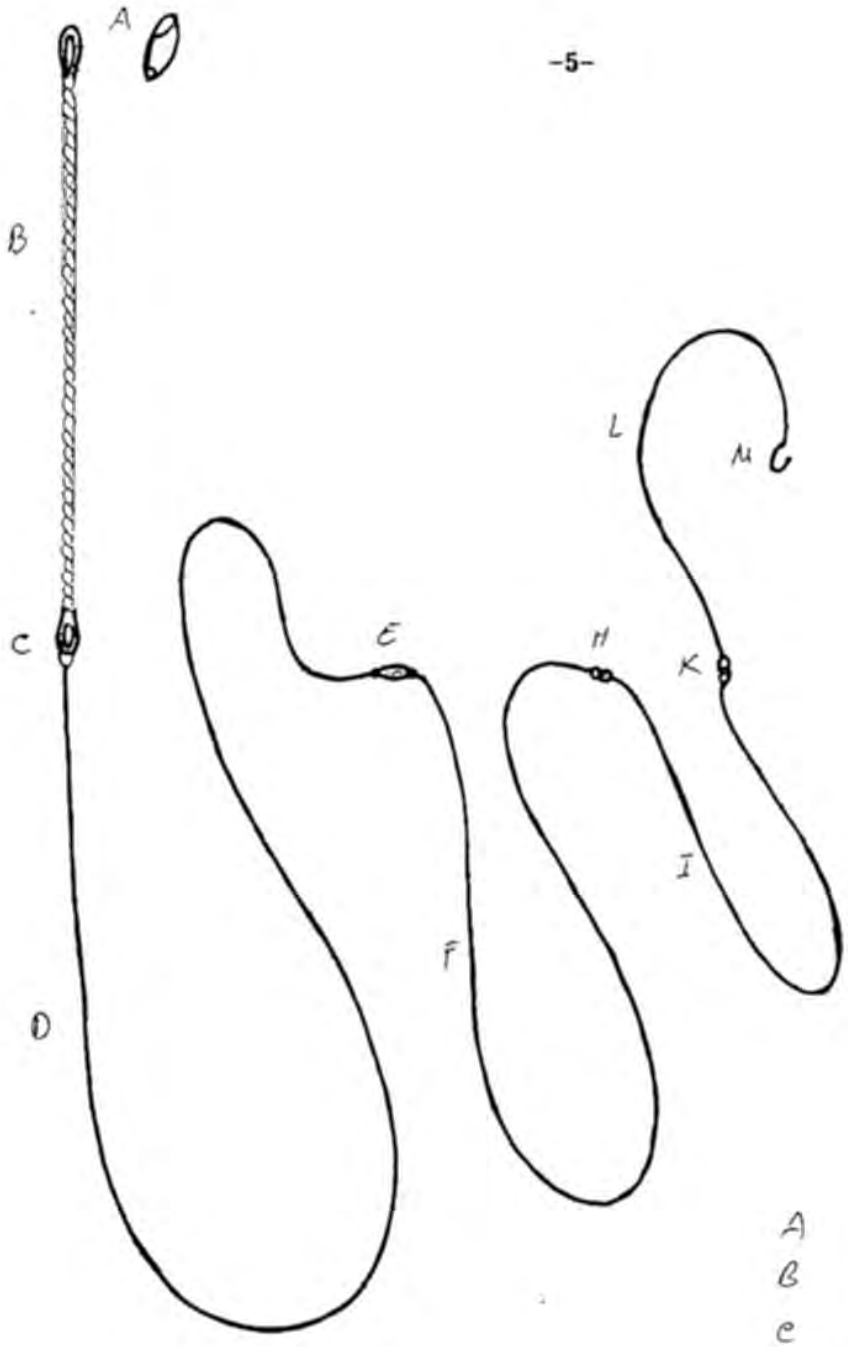


FIG 1b. NYLONMONOFILAMENT

A SNAP N° L-9.
B CREMONA ϕ 3.5 . 1.5 M
C ARMOR SPRING
D NYLON MONOFILAMENT
ϕ 3 - 10 M
E SWIWEL N° 38
F NYLON MONOFILAMENT
ϕ 2.5 - 8 M
H SWIWEL N° 34
I NYLON MONOFILAMENT
ϕ 2 - 4 M
K ARMOR SPRING FOR WIRE LEADER
L WIRE LEADER LENGIHT 2.5 M
M HOOK N° 35

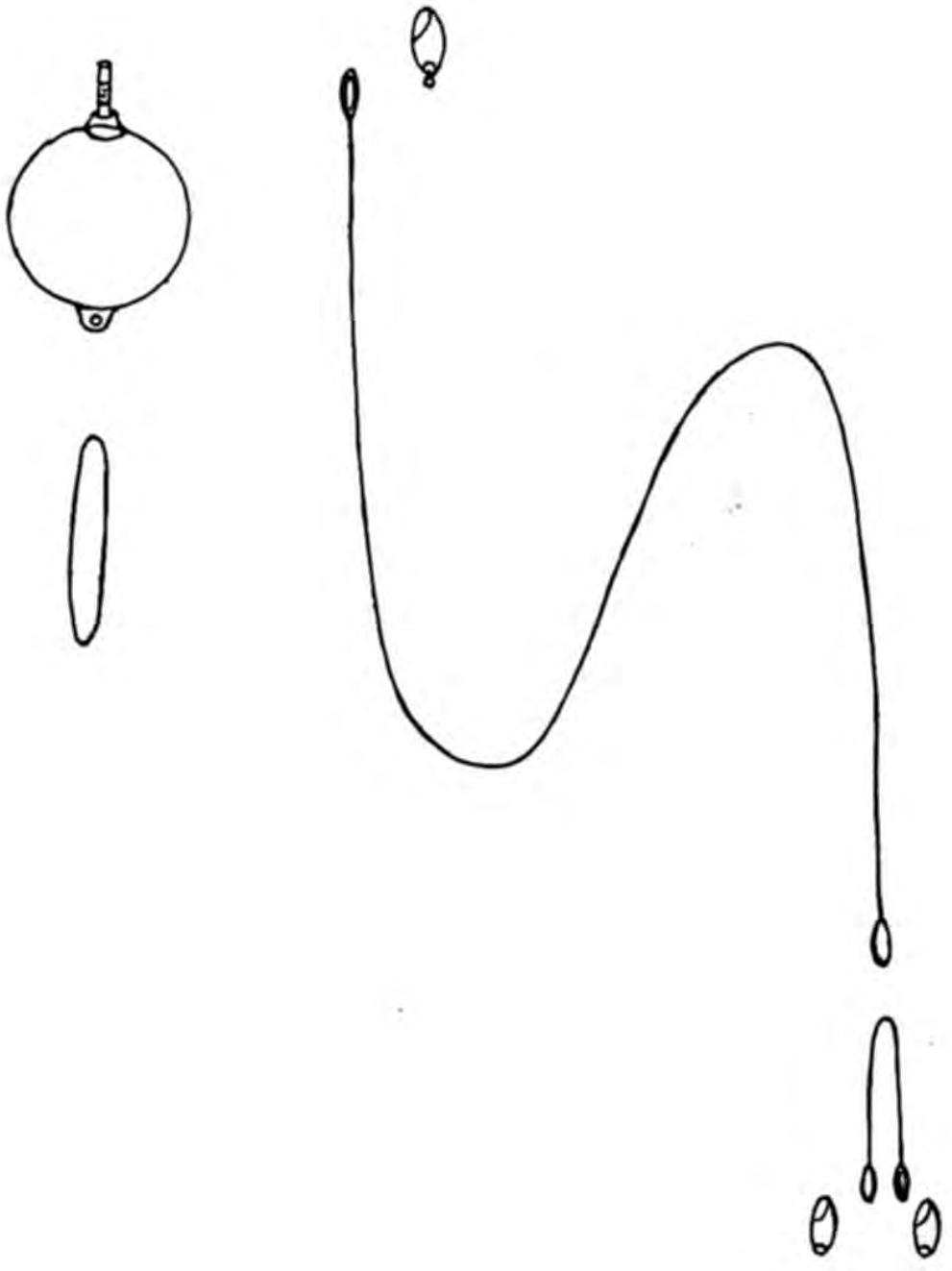
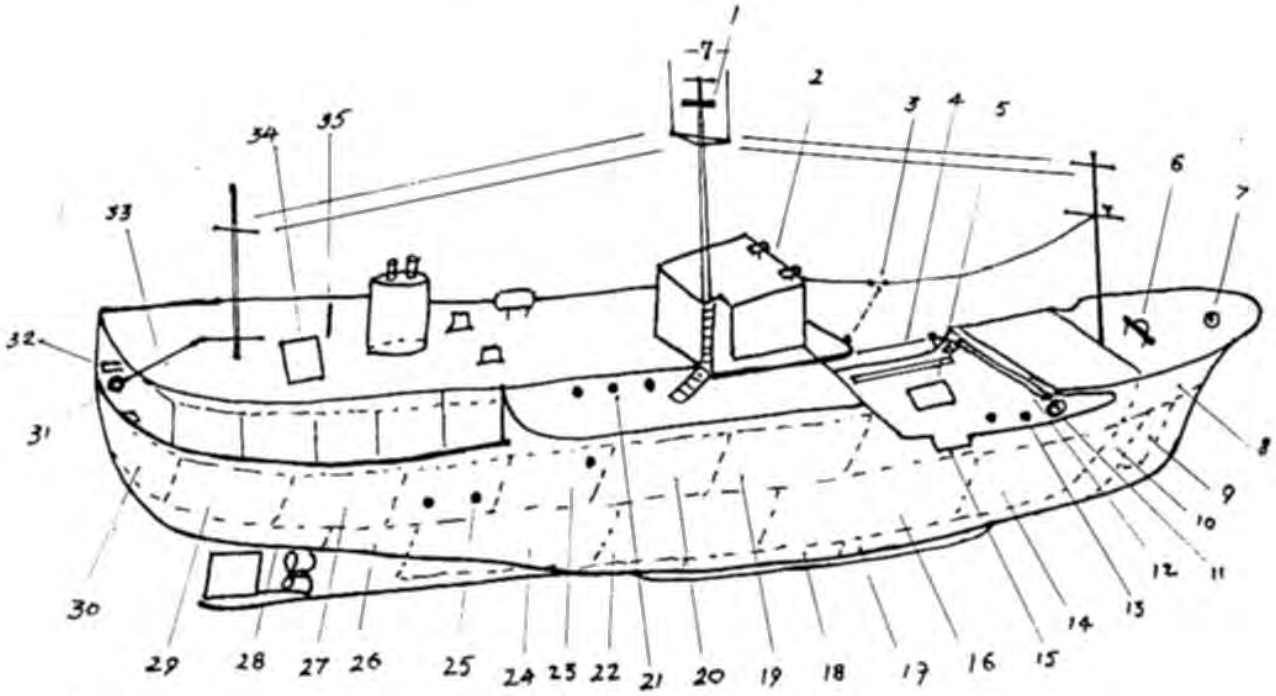
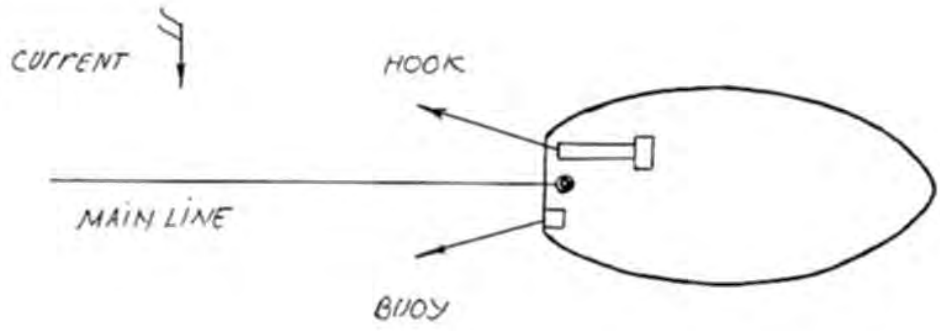


FIG 1c : BUOY AND BUOY LINE

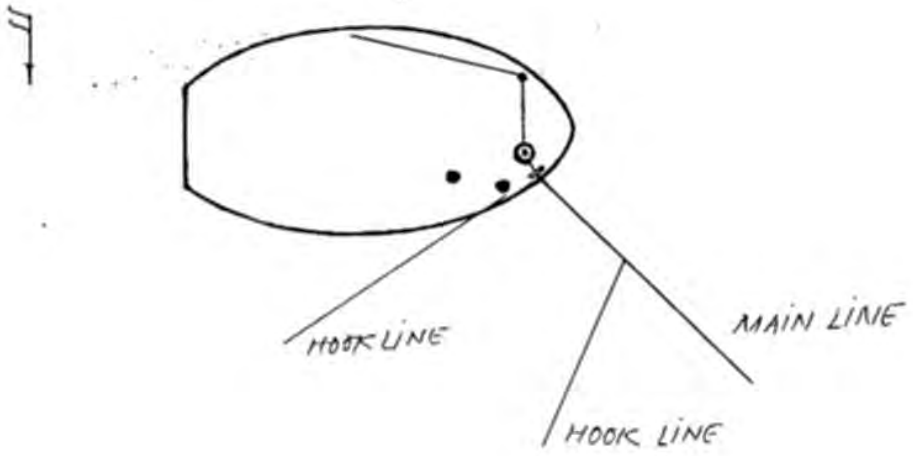


1	RADAR MAST	19	N°1 QUICK FREEZING ROOM
2	WHEEL HOUSE	20	N°2 QUICK FREEZING ROOM
3	CONVEYOR	21	CREW SPACE
4	MAIN LINE GUIDE BLOCK	22	N°3 FISH HOLD
5	FISH HATCH	23	REFRIGERATING MACHINE ROOM
6	WINDLASS	24	ENGINE ROOM
7	ROPE HATCH	25	MESS ROOM
8	STORE	26	FRESH WARTER TANK
9	CHAIN LOCKER	27	PROVISION STORE
10	FUEL OIL TANK	28	FUEL OIL TANK
11	LINE HAULER	29	STORE
12	SLOW CONVEYOR	30	STEERING ENGINE ROOM
13	WIND HOOK LINE	31	LINE EACTING MACHINE
14	N°1 FISH HOLD	32	SLOW CONVEYOR
15	GANGWAY PORT	33	FISHING GEAR STORE
16	N°2 FISH HOLD	34	MAIN LINE HATCH
17	FUEL OIL TANK	35	MAIN LINE GUIDE PIPE
18	FUEL OIL TANK		

FIG 2: TUNA LONGLINE SHIP



SHOOTING



HAULING

FIG:3 HAULING AND SHOOTINH

Study Report

on

Position Fixing Using Landmarks in Coastal Navigation

By

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Regional Training Course in Commercial Fishing Technology
18 June - 17 December 1996
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1.0 Introduction

Accurate position fixing is very important in carrying out any activity in the sea. In fisheries, it is essential to correctly identify the fishing ground, estimate the ETA and reach there by setting the correct course and for safe navigation and fishing by avoiding dangerous areas. Accurate position fixing is also important in preparation of fishery charts. Today, many advance electronic navigation systems such as Global Positioning Systems (GPS) are available. Position fixing by time-honoured conventional methods are still in use as the only method or as a back-up system when other systems fail and for periodically checking the accuracy of the other systems of position fixing. Some of the most widely used methods of position fixing in coastal navigation using landmarks are described in this study report.

2.0 Methods of Position Fixing in Coastal Navigation

Methods of position fixing when only a single landmark is available are described in section 2.1 and methods used when more than one landmarks are available are described in Section 2.2 below:

2.1 Position Fixing Using A Single Landmark

2.1.1 Fix by a distance circle and bearing line

When the bearing and distance of the landmark can be measured at the same time, the ship's position can be fixed as in Fig.1. The intersection P of the distance circle and the bearing line is the ship's position.

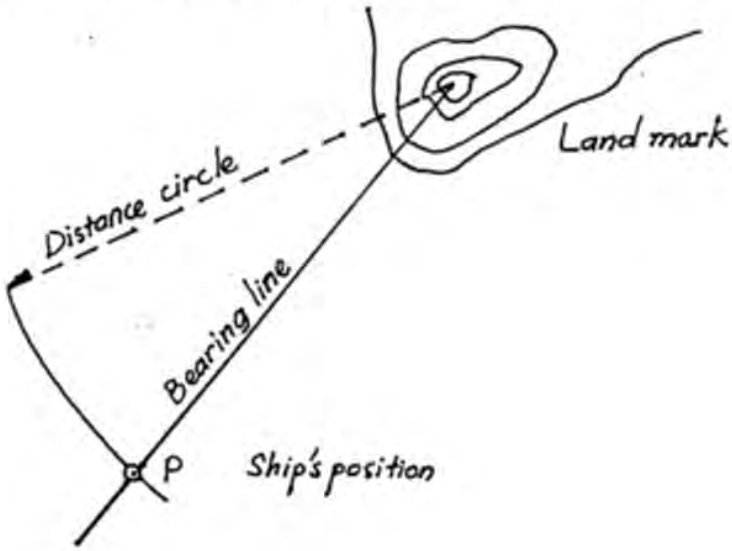

Fig. 1 Fix by a distance circle and bearing line

2.1.2 Fix by doubling the angle on the bow

When the angle α and 2α from the landmark can be measured by compass bowl, the position can be fixed as follows (Fig. 2):

- Measure the first bearing α from ahead at time t1
- Measure second bearing 2α from ahead at time t2
- Draw distance circle which is the distance covered by the ship from t1 to t2, which estimated from ship's speed and time elapsed (t2-t1) or from the log (Chermikeef log, Stangmetier log , Sal log, Doppler speed log, etc.)
- The intersection P of the distance circle and the second bearing line 2α from ahead at time t2 is the ship's position.

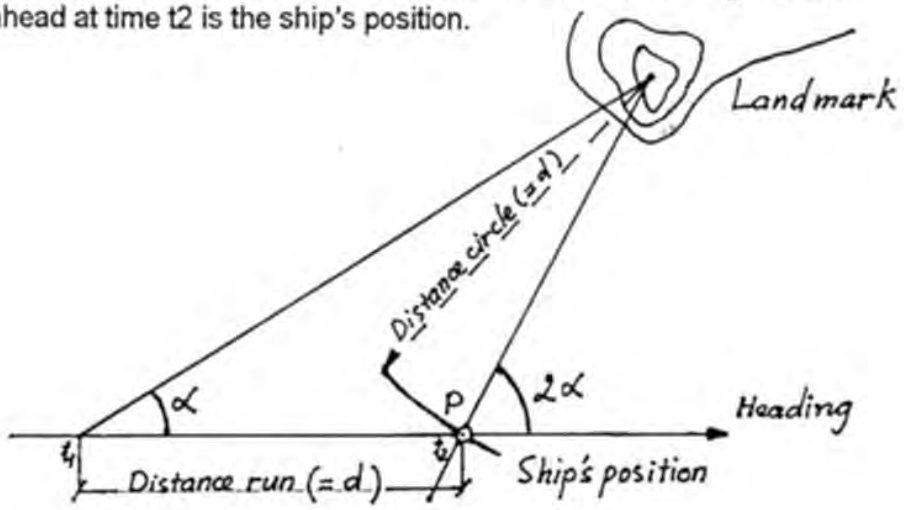

Fig. 2 Fix by doubling the angle on the bow

2.1.3 Fix by doubling the angle on the bow - special situation

First bearing (α) in this case is taken at 45° from ahead at time t1 and the second bearing (2α) at 90° from ahead at time t2. The distance covered between t1 and t2 is equal to the distance from the landmark on bearing 90° from ahead(Fig 3).

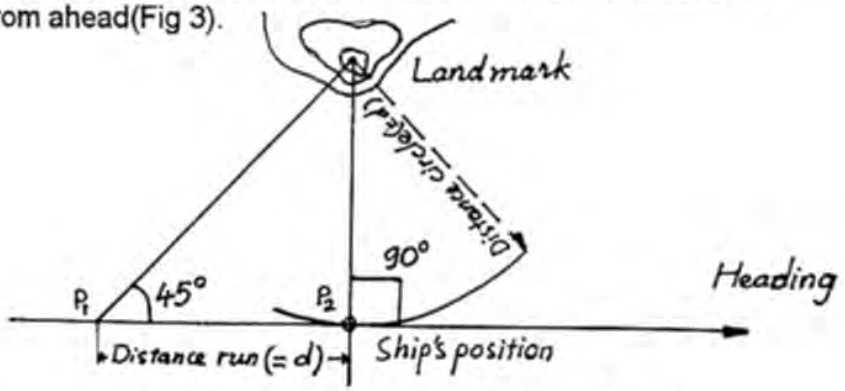

Fig 3 Fix by doubling the angle on the bow - special situation (α=45°, 2α=90°)

2.1.4 Fix by two sequential bearing lines and distance run

In this method position fixing is proceeded as follows(Fig. 4):

- Measure the first bearing at time t1
- Measure second bearing at time t2
- Move the first bearing line following the true course and parallel to itself, the distance of which is the distance from time t1 to time t2
- The parallel line intersects with the second bearing line at point P which gives the ship's position at time t2

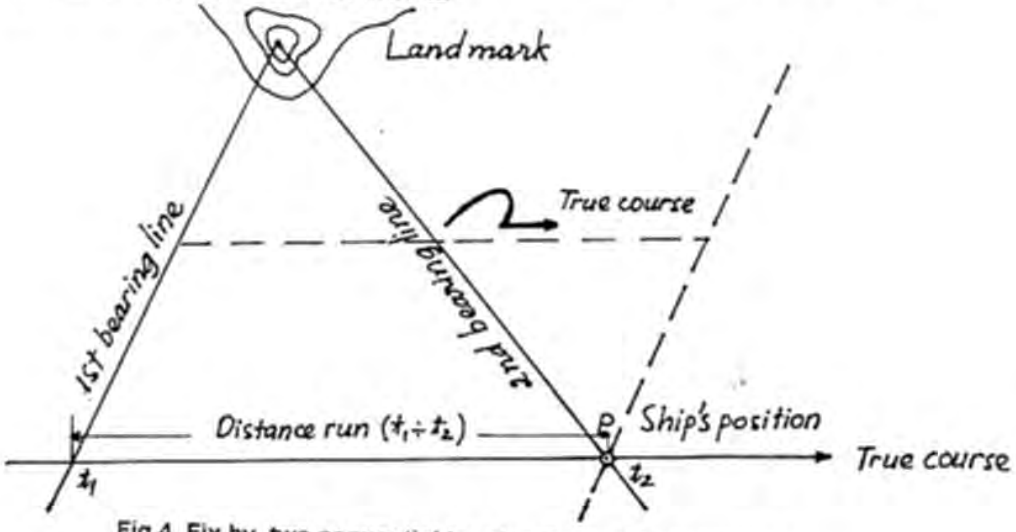

Fig 4. Fix by two sequential bearing lines and distance run

2.1.5 Fix by two sequential distance circles and distance run

In this method position fixing is done as follows (Fig. 5):

- Measure the first distance at time t1
- Measure second distance at time t2
- Move the landmark point following the true course the distance of which is the distance from time t1 to time t2
- The distance circle after movement will intersect with the second distance circle at point P which gives the ship's position at time t2

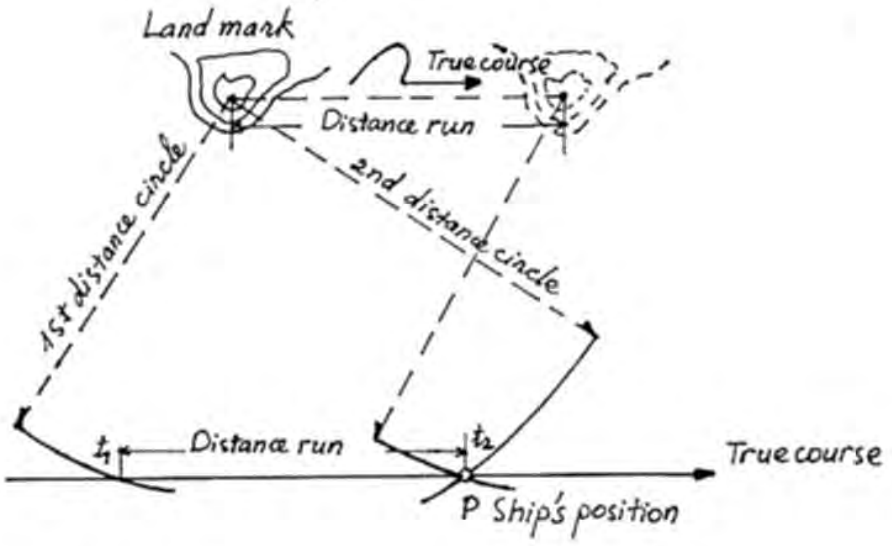

Fig 5. Fix by two sequential distance circles and distance run

2.1.6 Fix by bearing line of a land mark and isobath

An isobath is very useful in estimating the ship's position approximately (Fig. 6)

- Measure the first bearing I from the landmark at time t1, read the water depth immediately by echosounder and check it in the marine chart
- Measure the second bearing from the landmark at time t2 , read the depth of water immediately by the echosounder and check it in the marine chart
- Combine with ship's true course to determine the ship's position at t2

In the example given in Fig 6, the depth of water is 10m and the first bearing line intersects isobath at three points viz., P1, P2 and P3. Depth of water is 10 m again in the second bearing line at time t2 and it intersects the isobath at P4. This information plotted on the marine chart when combined with ship's true course, gives the ship's position P4 at time t2.

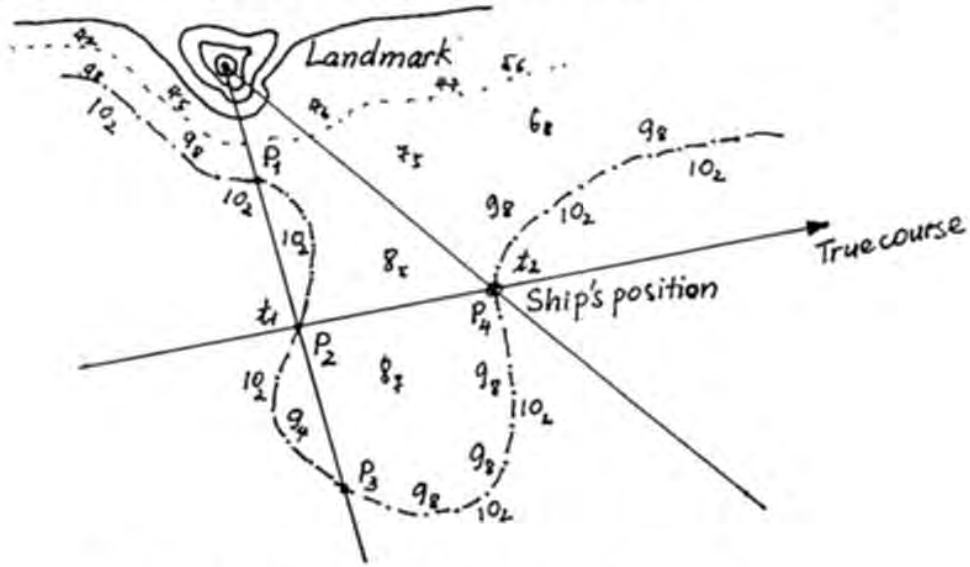

Fig 6 Fix by bearing line of a land mark and isobath

2.2 *Position Fixing Using Two or More Landmarks*

2.2.1 Fix by bearing lines from two landmarks

If the bearings from landmarks A and B are measured simultaneously, the ship's position is given by the intersection of the bearing lines (Fig. 7). In practice usually the bearing of the landmark which changes slowly is measured first and the bearing of the landmark which changes faster is measured afterwards .

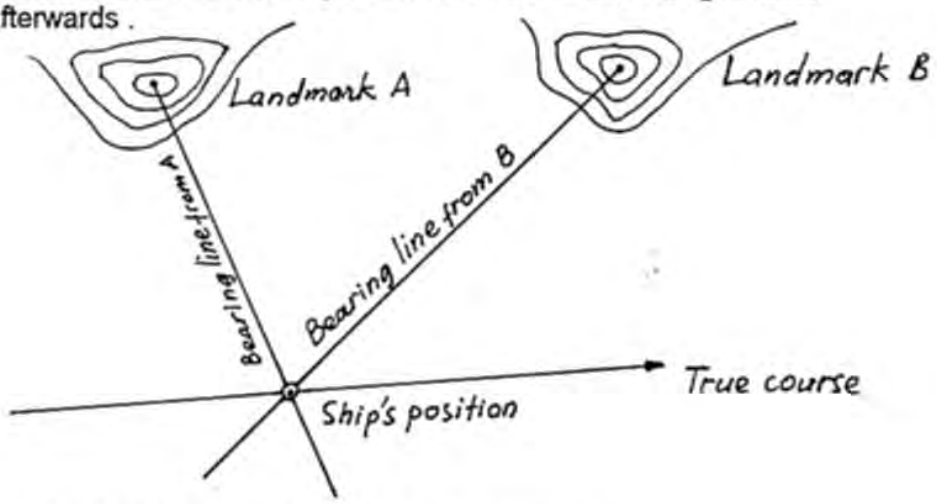

Fig 7 Fix by bearing lines from two landmarks

2.2.2 Fix by distance circles from two landmarks

When the distance from two landmarks A and B can be measured at the same time, ship's position is given by the intersection of the two distance circles from A and B (Fig. 8). In practice usually the distance of the landmark which changes slowly is measured first and the distance of the landmark which changes faster is measured afterwards .

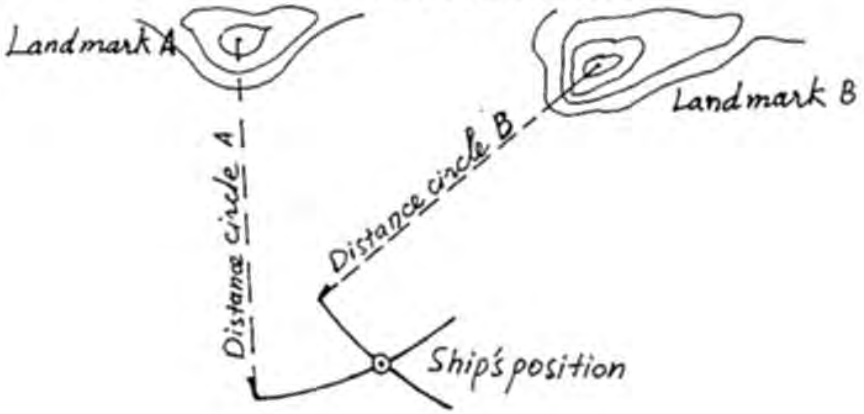

Fig 8 Fix by distance circles from two landmarks

2.2.3 Fix by one distance circle and one bearing line

When one bearing line from landmark A and one distance circle from another landmark B can be measured at the same time , the ship's position is given by the intersection of the bearing line from A and distance circle from B (Fig. 9).

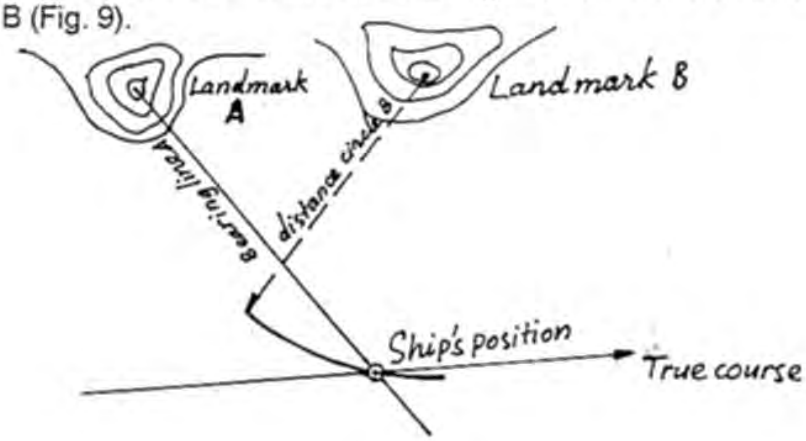

Fig. 9 Fix by one distance circle and one bearing line

2.2.4 Fix by bearing line and the included angle

When there are two landmarks (A and B) one of which can not be seen (B) because of obstruction by ship's superstructure (derrick post, masts, funnel, etc.) the bearing line from the landmark seen (A) can be measured by compass and the included angle between the two targets can be measured by the marine sextant . The bearing line of landmark B is given by Bearing of A + Included angle between A and B. The intersection of the bearing lines from A and B gives the ship's position (Fig 10).

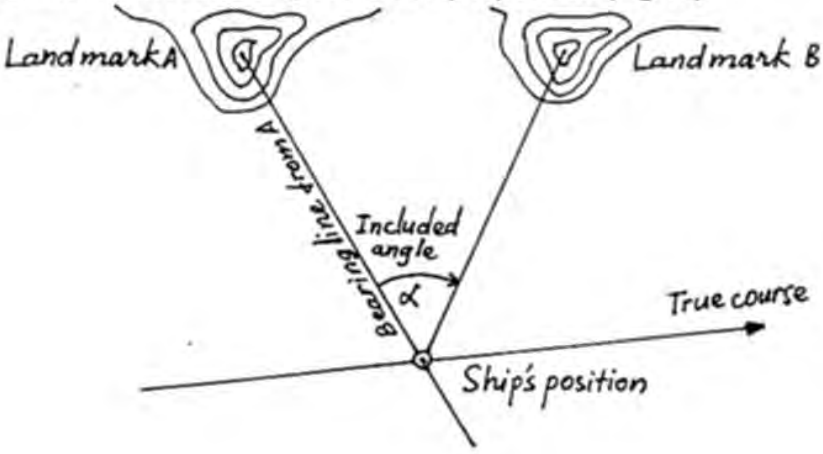

Fig 10 Fix by bearing line and the included angle

2.2.5 Fix by cross bearing from three landmarks

When three bearings can be measured from three landmarks at the same time, the ship's position is given by the intersection of the three bearing lines (Fig. 11). If the bearing lines intersects to make up a triangle, it is known as the triangle of error. In this case, ship's position will be the centre of gravity of the triangle

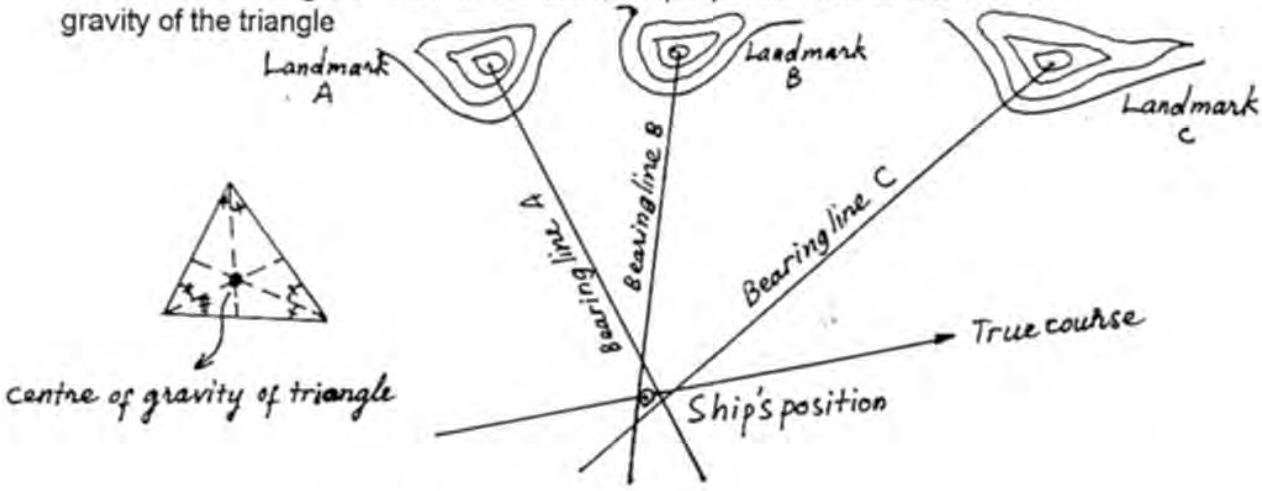

Fig 11 Fix by cross bearing from three landmarks

2.2.6 Fix using marine sextant angle measurements of three landmarks

When there are three landmarks A, B and C, the angle between A and B ($\alpha 1$); and B and C ($\alpha 2$)can be measured using marine sextant. A three-arm protractor can be used to determine the ship's position from the angles $\alpha 1$ and $\alpha 2$ (Fig 12)

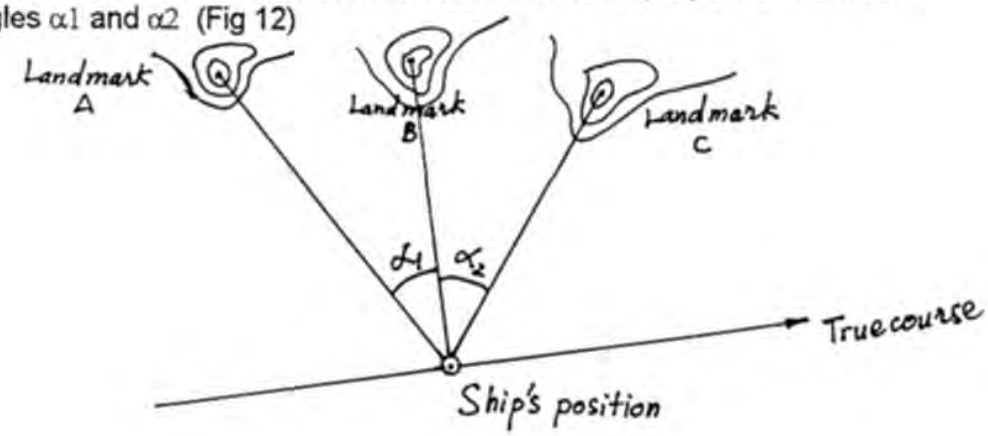

Fig 12 Fix using marine sextant angle measurements of three landmarks

2.2.7 Fix by distance circles from three landmarks

When distance from three landmarks can be measured at the same time, ship's position is given by the intersection of three distance circles . If the intersection of three distance circles at three points make up a triangle, the centre of gravity of the triangle is taken as the ship's position (Fig. 13).

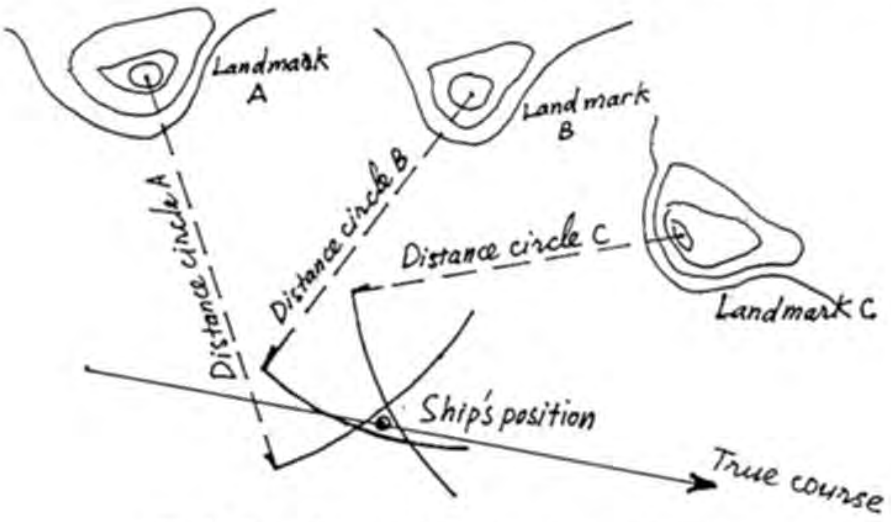

Fig 13 Fix by distance circles from three landmarks

Study Report

on

Global Positioning System for Fishing Boats

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18 June - 17 December 1996
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GPS JLR-6000

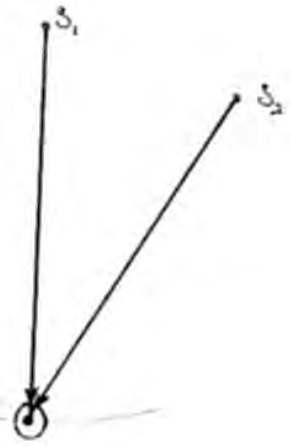
1.0 INTRODUCTION

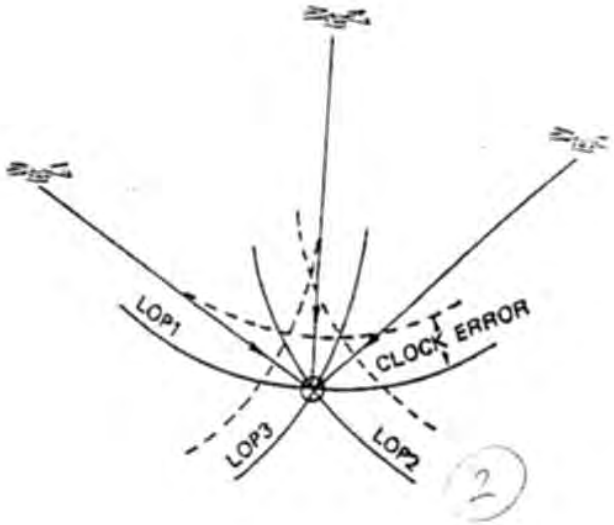
Now-a-days the navigation subject will be more correct and more convenient on over the world with the satellite systems. On the other hand, the price of equipment to communicate to the satellites are not so expensive . Therefore most of the fishing boats which are operating at the off - shore are equipped with the GPS unit .

The signals from the satellite will be received by the navigator or GPS (global positioning system).There are many companies to produce the GPS such as Furuno company , JRC , Koden . In this case, I would like to introduce the JLR - 6000 make by JRC company that we are using on M.V . SEAFDEC .

24 satellites transmit accurately timed signals along with a navigation- message which includes the satellite 's position .

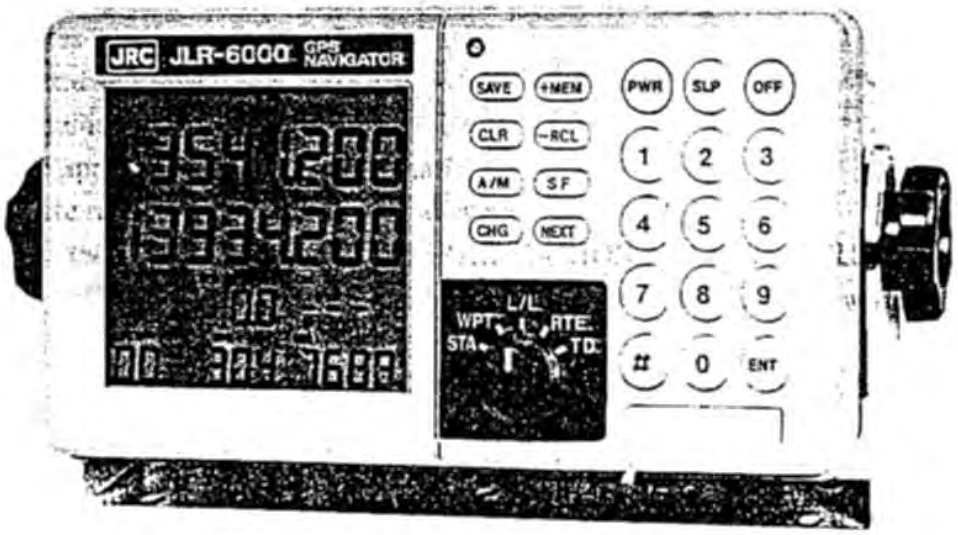
The JLC- 6000 receiver selects the " best satellite" and measures "Time-Of-Arrival " of each satellite signals and to gather with the navigation message data, calculates the range to each tracked satellite If the range to the satellite is known then position of your vessel can be determined by triangulation of the range data . In this case, it would only be necessary to track data from any two satellites to obtain a vessel's Lat/ Longitude . But in actual practice for marine navigation a minimum of three satellites are required - figure 2 .





2.0 GENERAL SPECIFICATION

- Signal frequency: 1575.42+ 1 MHz
- Maximum dynamics: Velocity 300 km/hr (162 knots)
  Acceleration 5 m/sec^2
- Fix update rate: Every 1 sec
- Accuracy: Position: 15 m RMS HDOP <2.5
  Speed : 0.2 knot HDOP<2.5
- Position memories: up to 100
- Save memories: up to 10 (temporary)
- Alarms: 1. Waypoint arrival
  2. Cross-track error
  3. Anchor watch
  4. Boundary
- Signal outputs: NEMA 0180/0182/0183



3.0 OPERATION

Turn the power on - Press PWR
Turn the power off - Press PWR and OFF at the same time

Operating Modes

There are six operating modes in this equipment. We can move the white mark to the mode which we need.

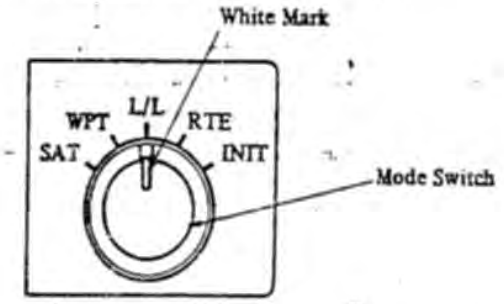


Figure 3.2 The White Mark Indicates the Desired Mode.

Mode	Purpose
L/L	Displays navigation data, features Lat/Long readouts
INIT	Used to enter the initialization and gyro/log data
WPT	Used to enter the waypoints into the memory
RTE	Used to select a waypoint destination or route or to set alarm zone
SAT	Displays satellite data and change satellite selections
SF	Used to set up special operating conditions

3.1 INITIALIZATION OF THE NAVIGATOR

We must initialize the unit if it is just installed or if we don't use for a long time and also if there is a difference of more than 1 degree between the current position and the position indicated in the display.

3.1.1. Initializing using estimated Latitude and Longitude

- Rotate the Mode switch to INIT mode and then enter the estimated position
  e.g. Estimated position 43 29.00 N; 72 30.00 W

Press: [4] [3] [2] [9] [0] [0] [ENT]

[0] [7] [2] [3] [0] [0] [0] [ENT]

3.1.2. Entering the date and time

- If there is difference more than 15 min between the UTC current time and the time indicated on displays, it is necessary to apply correction

Press: digit of year, month and day [ENT]
hour, minute, second [ENT]

Then enter the difference between UTC and local time. We get the local time .
e.g. Press 0[7] [0] [0] [ENT]
The difference time is + 07

3.1.3. Enter the antenna height

To enter the antenna height from the sea level from the top of the antenna

Enter the antenna height (0 to 9999 m) — [ENT]

3.1.4. Averaging data display readout

The data readouts will be displayed every second on the screen and the average for selected time duration could be obtained.

Averaging Lat/Long

Set the function to SF and Press [#2] [1] [ENT]
On the screen:

0	:	Time constant:	Long
1	:	Time constant:	Middle
2	:	Time constant:	Short
3	:	Not averaged; fast acting	

We can select between 0.1.2.3 by pressing the NEXT key

Averaging speed/course

Set the function to SF Press [#] [2] [0] [ENT]
Then select 0.1.2.3 by pressing the NEXT key

3.2 ENTERING THE WAYPONTS (WPT)

After entering, the waypoints are stored in the memory and then they could be recalled whenever necessary. The waypoints are important positions that we need to remember.

3.2.1 Saving Current Position

This equipment has 10 temporary "SAVE" memories to store Lat/Long positions

Set the function to L/L mode
Press SAVE and ENT

If we save over ten, the oldest data is replaced by the newest save entry. When we turn off the unit the memorized data will be erased. the data will be saved if they are transferred in to the waypoint memories

3.2.2 Setting the waypoints with lat/Long

Select WPT function
Press [#] [Number of WPT] [ENT]
The number of WPT could be from 00 to 99
Type in Latitude e.g. 48 14.18 N ENT
Type in Longitue e.g. 74 41.48 W ENT
Using [+MEM] and [-RCL] keys to change N⇄S and E⇄W, as necessary

3.2.3 Entering by bearing and range

Select the WPT function
Press [#] — Number of WPT — [ENT]
Type in bearing in degrees, [ENT]
Type in Range to WPT [ENT]

3.2.4 Waypoint entry by saving position in SAVE MEMORY

10 positions in SAVE MEMORY can be transferred into waypoint memories

Select WPT function
Press [#] — Number of WPT — [ENT]
Press ▼ [SAVE] key until the desired save position is displayed [ENT]

3.2.5 Canceling the waypoints

Select WPT function .
Press [#] — Number of WPT to be canceled— [ENT]
Press [0] [ENT] [0] [ENT]

3.3 NAVIGATION WITH WAYPOINTS .

After we enter the waypoints into memory , now if we want to steer to any waypoint that we can do :

- Set to RTE function .

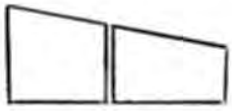
- Press : [#] — Number of waypoint — [ENT]
  (00 to 99)

The display will be show any navigation -information to the WPT .
figure .

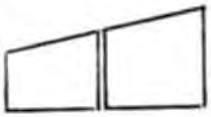
3. 4 The CDI Bargraph (Course Deviation Bargarph)

CDI BARGRAPH

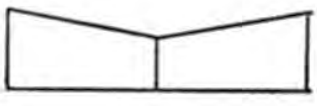
Your vessel on the left of track :



Your vessel on the right of track :

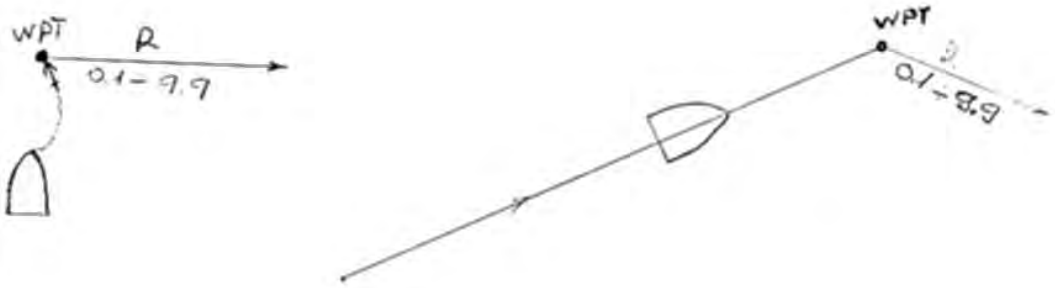


Your vessel on track :



Anchor. Alarm

arrival alarm.



To exchange the bargraph mode , press [SF] [#] [2]
[2] [2] [ENT] - press [NEXT] key for choice 0, 1

0 : 0. 3 NM mode
1 : 0. 1 NM mode

3.5 SETTING ALARMS : ( )

3.5.1 The arrival alarm

If this function was set , when your vessel come into the circle you will hear the alarm.

The range of circle can be set from 0.1 to 9.9 nm

- Select RTE function
- press CGH to get the " page 2 " . If you get ( ) signal

press :(Arrival alarm distance) – [ENT]

- To clear the sound only : Press [CLR]
- To clear Arrival function :
  . Select RTE function at page 2 , press [0] [ENT]

3.5.2 Anchor watch alarm : ( ] [ )

- Select RET function
- Press CHG to get the "page 2 "

If you get ( ] [ ) signal

- Press : [Anchor watch limit] [ENT]

If you get ([ ]) signal

- Press : [- RCL] [Anchor watch limit] [ENT]

Canceling this function is the same as Arrival alarm function . When this function was set , if your vessel has drifted out of the limit (R) the alarm sounds will be appeared .

3.5.3 The OFF-COURSE Alarm

Off - Course - Alarm (XTE) can be set to alarm when you drift a amount (o.o1 to 9.99) NM off - course .

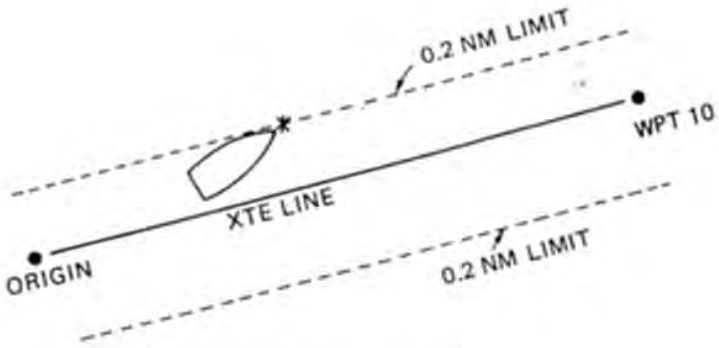


Figure OFF-Course Alarm

- Set the to RTE function , page 2
- Press [ENT] , - if [ ] is displayed , [OFF - COURSE ALARM - DISTANCE] [ENT]

If the vessel strays from the route more than the limit , the XTE alarm will be appear and the audible alarm will sound .
To clear this alarm that is the same as to clear Arrival Alarm .

3.5.4 The Boundary Alarm

This alarm is used when you wish to define a boundary line between two waypoints that you don't wish to cross .

The alarm will sound if you come with -in the setting limit of the defined boundary line .

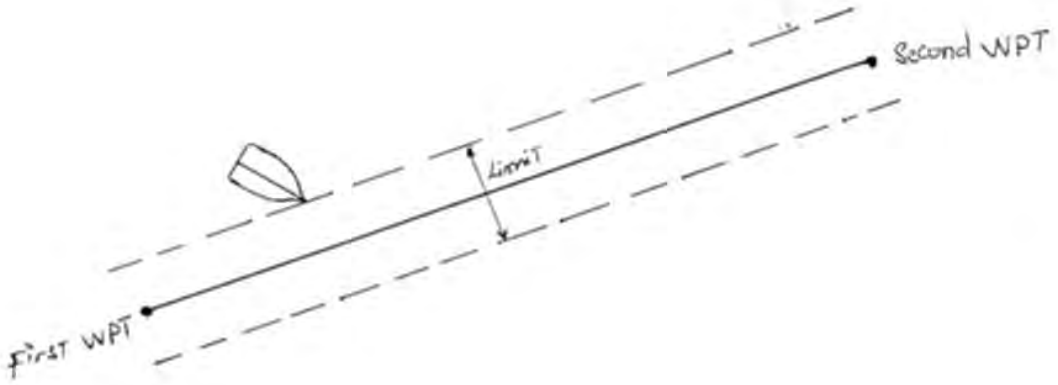
To select the two waypoints you wish to rotate the Mode switch to RTE . Press [#] [first WPT number], [second WPT number] [ENT]

To set the boundary alarm , setting RTE function page 2

- Press : [ENT] (press + MEM if] [is displayed)

[Distance of limit] [ENT]

- To cancell this function is the same as Off-Course-Alarm.



3.6 ORGANIZING ROUTES

3.6.1 Automatic Route Sequence Setting

When waypoints are already stored in the memory , we can copy the waypoints from one WPT location into another WPT location:

- Select WPT function .
- Call up memory location of point to be copied . i.e :

we change the WPT location at number 12 to WPT location at number 22 . Press : [#] [1] . [2] [ENT] [CHG]

Press : [#] [2] [2] [ENT] . Data will be in waypoint memory 12 and also now appear in waypoint # 22 .

After the waypoints are arranged in sequence , we can make a route with following step , below :

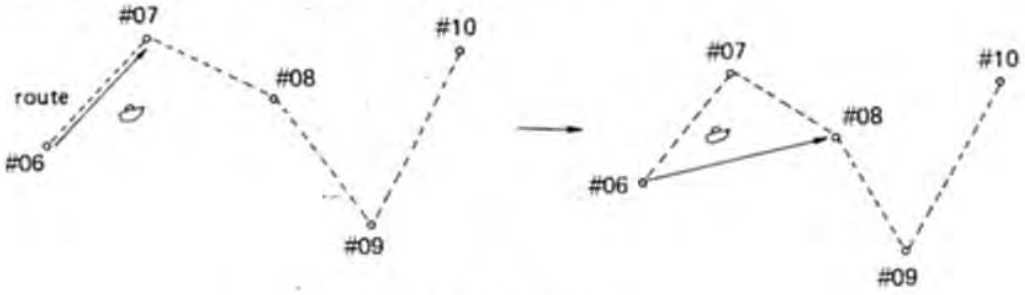
- Select RTE function and press [ENT]
- Press [#] , [number of starting WPT] , [number of the last WPT] [ENT] [A/ M] [ENT]

This will activate the Auto Route mode . As the vessel arrives at each waypoint ,the loran sounds the buzzer for nearly two seconds In a few moments the loran will step to the next waypoint of the route .

3.6.2 By-Passing A Point

Sometime you may elect to eliminate a point in a route . In this case to sequence past a point , press [#] [+MEM]

The bearing and distance will change to next waypoint .



Bypass Waypoint(s)

3.6.3 Cancelling Route Sequence .

At the time that you have completed your intended trip , or if you wish to abandon the Auto Route function ,

- Select the RTE function at page 1
- Press : [ENT] , [—] , [ENT]

3.7 SPECIALIZED OPERATIONS

3.7.1 Selecting Data Output

When you are interfacing this GPS to other electronic equipment , you must choose the data output for that equipment

+ N.M.EA - 0180 or 0182 for Autopilot
+ N.M.EA - 0183 or JRC for Standard Data .

- Press : [SF] [#] [1] [ENT] , press [NEXT]
to choose _ N.M.EA 0180 , 0182 , 0183 , or JRC

3.7.2 Selecting the Unit (NM / KTS , SM / MPH , KM / KPH)

Press : [SF] [#] [0] [5] [ENT] , press [NEXT] To choice :

0 : NM / KTS (nautical miles / knots)
1 : SM / MPH (statute miles / miles per hour)
2 : KM / KPH (kilometer / kilometer per hour)

3.7.3 Selecting Interval Fix Mark Output (for JRC Format)

we can select the interval of fix mark data out for JRC Navigation-Equipments that are interface to this unit .

- Press : [SF] [#] [1] [3] [ENT]

- Press : [NEXT] to choice the time of interval fix mark
0 : 4 seconds , 2 : 8 second ... up to 1 hour .

3.7.4 Master Reset .

Sometime, because of some mistake in using or the electric supplying is not stable , the equipment will show the data out with error, or it can't give the data out . In this case , we use the Master Reset function to clear all entered data inside the memory .

- Press : [SF] [#] [9] [0] [ENT]

After that , if we would be the unit again working with normal condition, we have to enter initial setting data again .

Note :

Before we operate the Master Reset , we must record out the necessary data , unless we will be lost all the data that is necessary for initial setting data after .

4.0 MAINTENANCE

4.1 Adjustment of Receiver

Do not tamper with the control and adjusters in the receiver . The tuning coil for the receiver is strictly adjusted . If you move it, a malfunction error in position fix will result . If adjustment is absolutely necessary for some some reason , the receiver must be adjusted at the factory according to the correct procedure .

4.2 Fuse

The power supply unit uses a 2A quick-blow fuse . The size and type of this fuse is just suitable for protection of the circuit . Do not use a larger amperage fuse or slow-blow fuse .

Type : MF 51NR-2A JRC Code : 5ZFAD00292

4.3 Battery

The data processing unit provided with a built-in lithium battery to protect the RAM for the data processing unit and receiving control unit , crystal clock against power interruption . Do not put the PCB on a conductive surface . If you should do so, the battery would be discharged , and the data in memory would be destroyed . The life of the lithium battery is about three years . However , it is recommended to replace it sooner to assure ▶ normal and undisturbed operation of the receiver

TYPE: CR2032-P5-2 . JRC Code : 5ZBAD00077

4.4 Power supply

The power supply should stabilized. Unstabilized power supply and sudden surges may damage the equipment.

study report

on

Trap Fishing

by

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Tinnasulanonda
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18 June - 17 December 1996
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TRAP FISHING

Introduction

Fishing is broadly classified into net fishing, line fishing and miscellaneous fishing. Trap (or basket or pot) fishing is included in miscellaneous fishing, and is generally operated on small scale. Traps are used to catch Demerol marine animals.

The construction of fishing gear, in example. the shape size and the materials of gear vary from one fishing region to the next and according to target marine animals. In most trapping operations, bait is placed into traps to attract marine animals, but non-baited traps are also used widely. Some species with a positive thigmotaxis tend to gather around absolutely necessary.

The fishing statistical records showed a decline of catch in 1989 and 1993.

Table 1. Annual catches by different kinds of trap.

Kinds of trap	Marine production in Thailand by different kinds of trap (tons)				
	1989	1990	1991	1992	1993
Fish trap	1,724	1,294	1,068	1,182	1,232
Squid trap	5,720	5,510	7,653	6,973	6,993
Crap trap	5,294	5,038	5,449	5,846	5,672

The main species of fish caught by each kind of trap in 1993 were as follows:-

Table 2 Marine production in gulf of Thailand by type of fishing methods and species, 1993

Fishing Methods	Grand total	Sub-total	Other shrimp	Decmoral fish	Barbel eel	Snapper	Grouper	Other food fish	Swimming	Mud-Crab	Cuttle fish
1.Fish Trap	284	283	1	120	33	-	87	163	-	-	-
2.Squid Trap	6,551	6,551	-	-	-	-	-	-	-	-	6,551
3.Crab Trap	3,729	3,729	-	-	-	-	-	-	1,170	2,559	-

Tabel 3 Marine Production in Andaman sea by types of Fishing Method and species, 1993

Fishing Methods	Grand total	Sub-total	Other shrimp	Decmoral fish	Barbel eel	Snapper	Grouper	Other food fish	Swimming	Mud-Crab	Cuttle fish
1. Fish trap	948	948	-	835	-	33	802	113	-	-	-
2. Squid trap	442	442	-	-	-	-	-	-	-	-	442
3.Crab trap	1,930	1,930	-	-	-	-	-	-	147	1,783	-

(source:Depatment of fisheries Ministry of Agricutture and Cooperative No.2/1996)

Characteristics of trap fishing

1. Trap fishing gear has high selectivity for species of marine animals.
2. A marine animal captured in a trap is protected from predators such as sharks which cannot enter into the trap.
3. Captured marine animals can survive several days in a trap therefore the freshness of catch is very good.
4. While the fishing boat is in port because of engine trouble, stormy weather etc., set-trap fishing gear continues fishing at the fishing ground.
5. Operation of trap gear is possible in very deep sea as well as in shallow water.
6. If trap are lost on the sea bottom, they continue the unuseful fishing until the trap gear corrodes and breaks up.

Classification of trap fishing gear

Classification of trap fishing by target marine animals.

1. Fish trap
2. Squid trap
3. Crab trap

Fishing Gear And Methods

1. Fish-Trap

Fish-trap or "pots", as they are sometimes called, of various shapes and sizes are operated in Thai coastal waters. According to their shape, three main groups can be distinguished: semi-cylindrical, rectangular and cylindrical traps. The entrance to a trap is usually either funnel shape or wedge-shape. Small trap are about 55 cm long 27 cm wide and 22 cm in height or diameter. Large trap area about 200 cm long, 100 cm wide and 85 cm high.

Rattan is traditionally the most widely used material for making trap frames. This natural material is not only readily available but is also strong and pliable. This last quality makes it particularly useful for building frames of cylindrical or semi cylindrical traps. Wood is used for frames of rectangular traps. Bamboo is another commonly used material for traps.

Nowadays, polyethylene netting is the main material for comparatively smaller traps, whereas the mesh of larger ones is made of steel wire. Polyethylene nets with rhomboid mesh have mesh-size of about 4.5 - 12.0 cm. The wire netting normally has hexagonal meshes. whose one leg (bar) id about 2.0 - 2.5 cm long.

As many as 120 traps can be shot in the course of one operation. Its traps has its own float and float line, and each is shot separately from the others. Small-sized traps are usually baited and are hauled daily. Large traps, on the other hand, do not contain any bait and are kept on the bottom for several days continuously. Sometimes the float line is made shorter than the water depth so that it does not show on the water surface. In this way the trap is more likely to remain in position until its owner returns to look for it. In such a case fisherman must

know the exact setting position of their traps, by means of the bearings of objects on land.

The traps which have a short float-line and submerged floats are hauled by using a special method. When the boat comes near the place where the trap is set, a fairly long line, about 50 m long and with sinkers attached at both ends, is shot to surround the float-line of the trap. The float of the trap is large enough to be hooked by this surrounding long line, Which is than used to pull the trap to the surface.

2. Squid Trap

In some parts of Thailand the traditional fish traps are now operated for squid and this kind of fishing seems to be spreading. The shape of the traps used for this purpose is semi-cylindrical. The top of the traps is covered with coconut leaf to provide shade. The traps is suspended at one-third of the water depth under the surface. A float with a bamboo pole marking the position is used to suspend the trap in water.

3. Crab Trap

The crab-trap used widely in Thailand has a cylindrical body narrowing into a cone at one end, and with an entrance at the other end. The trap can either have a single entrance, or a two entrance, one of them in the middle of the trap. The shape of entrance is always funnel like. Crab traps are made of split bamboo. The length of the trap is about 75-100 cm, with the maximum diameter of the cylindrical part about 26-28 cm. The diameter of entrance at the narrowest point is about 8-9 cm. The bamboo slat in the frame are spaced so that they leave 2-3 cm wide gaps. A piece of fish or some minced fish is used as bait. A bamboo skewer with bait is placed in the center of the traps through two small loops which

are provided for that purpose. About 20 traps are attached on one set of main line at 5 m intervals. The traps are hauled one or twice a day.

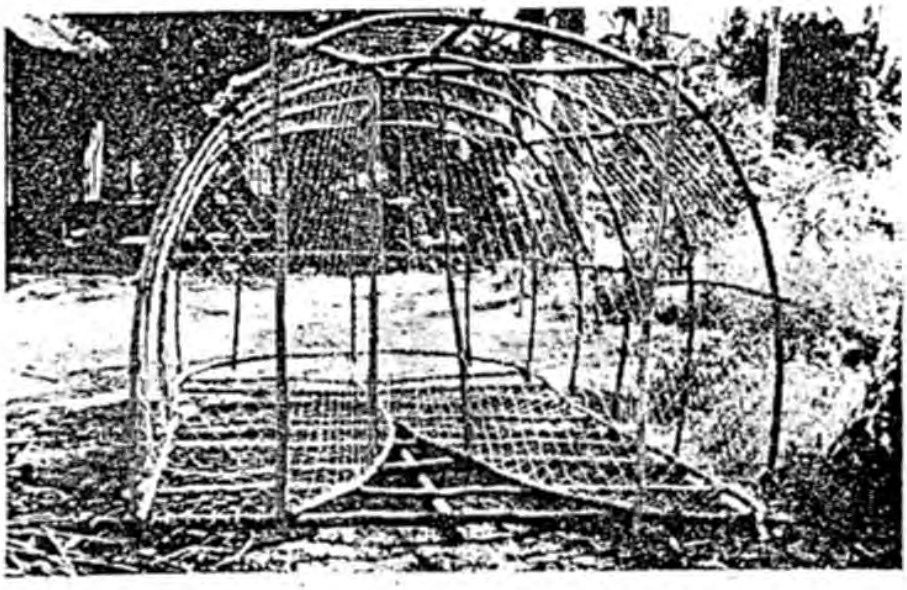
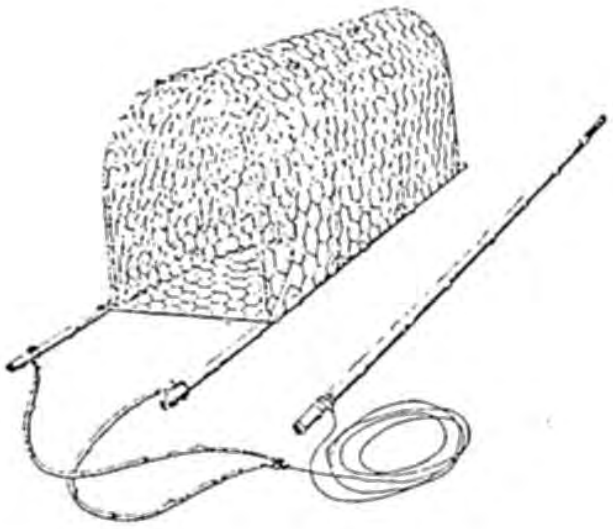


Fig.1 Fish Trap (Giant trap)



(Wire trap)

TRAP	VESSEL	LOCATION
Fish trap	loa 8 m	Ao Makhampom
Grouper, Snapper	hp 6	Rayong

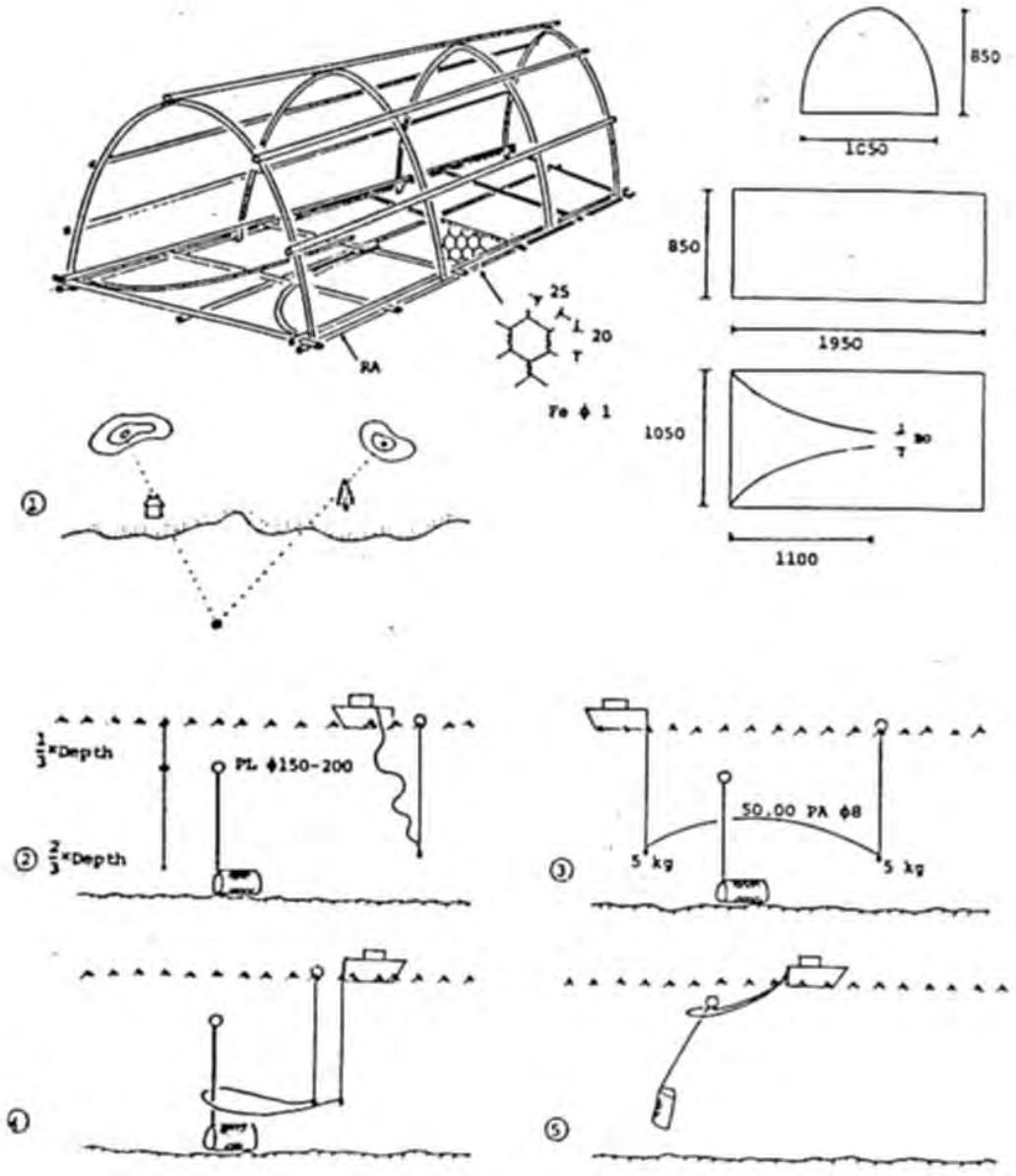


Fig. 2 Fishing Operation

TRAP	VESSEL	LOCATION
Squid trap	16 hp	Khungkraben
Squid		Chantaburi

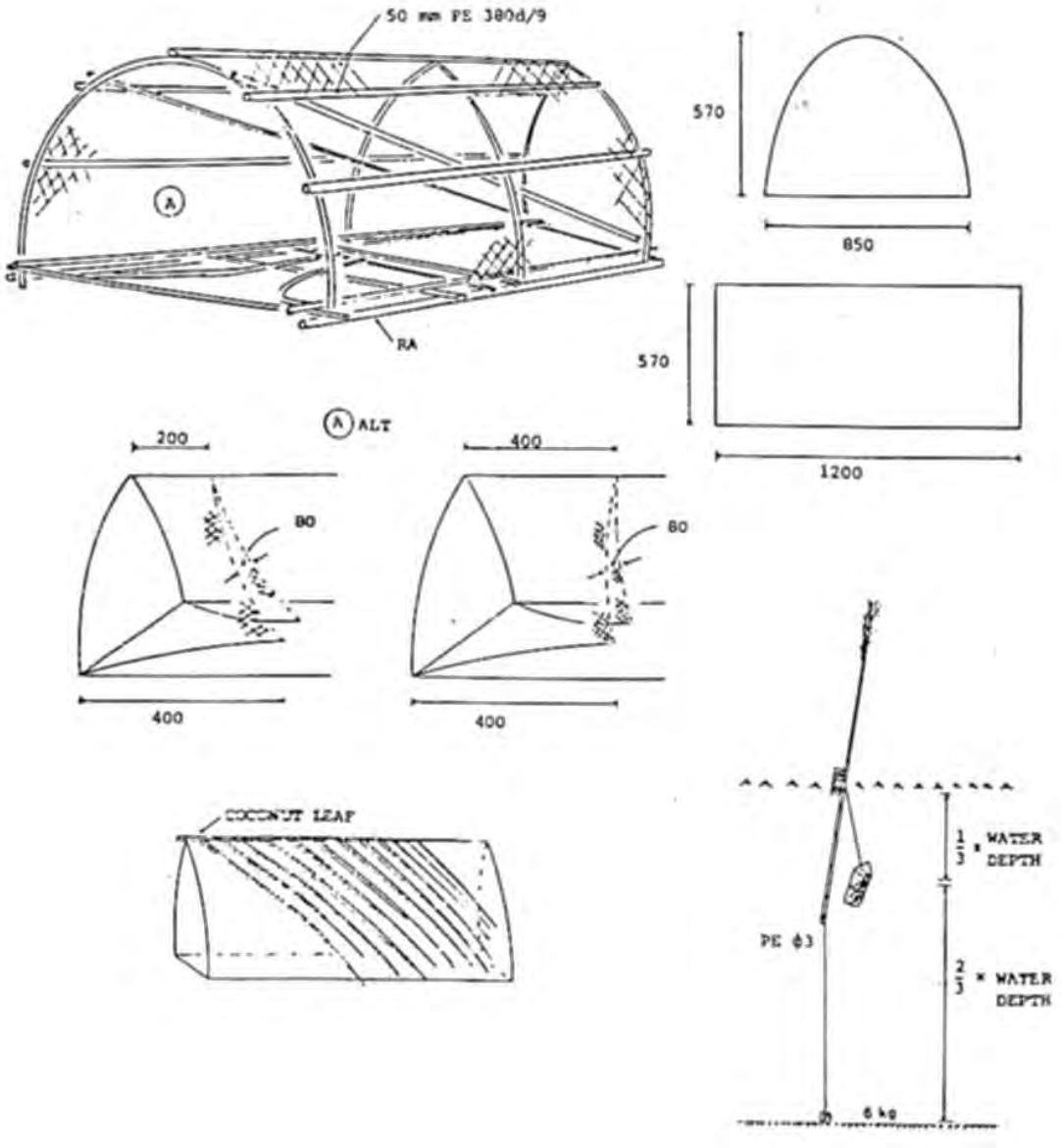


Fig. 3 Fishing Operation

TRAP	VESSEL	LOCATION
Crab trap	Loa 5 m	Hard Amara
Mangrove crab		Samut Prakarn

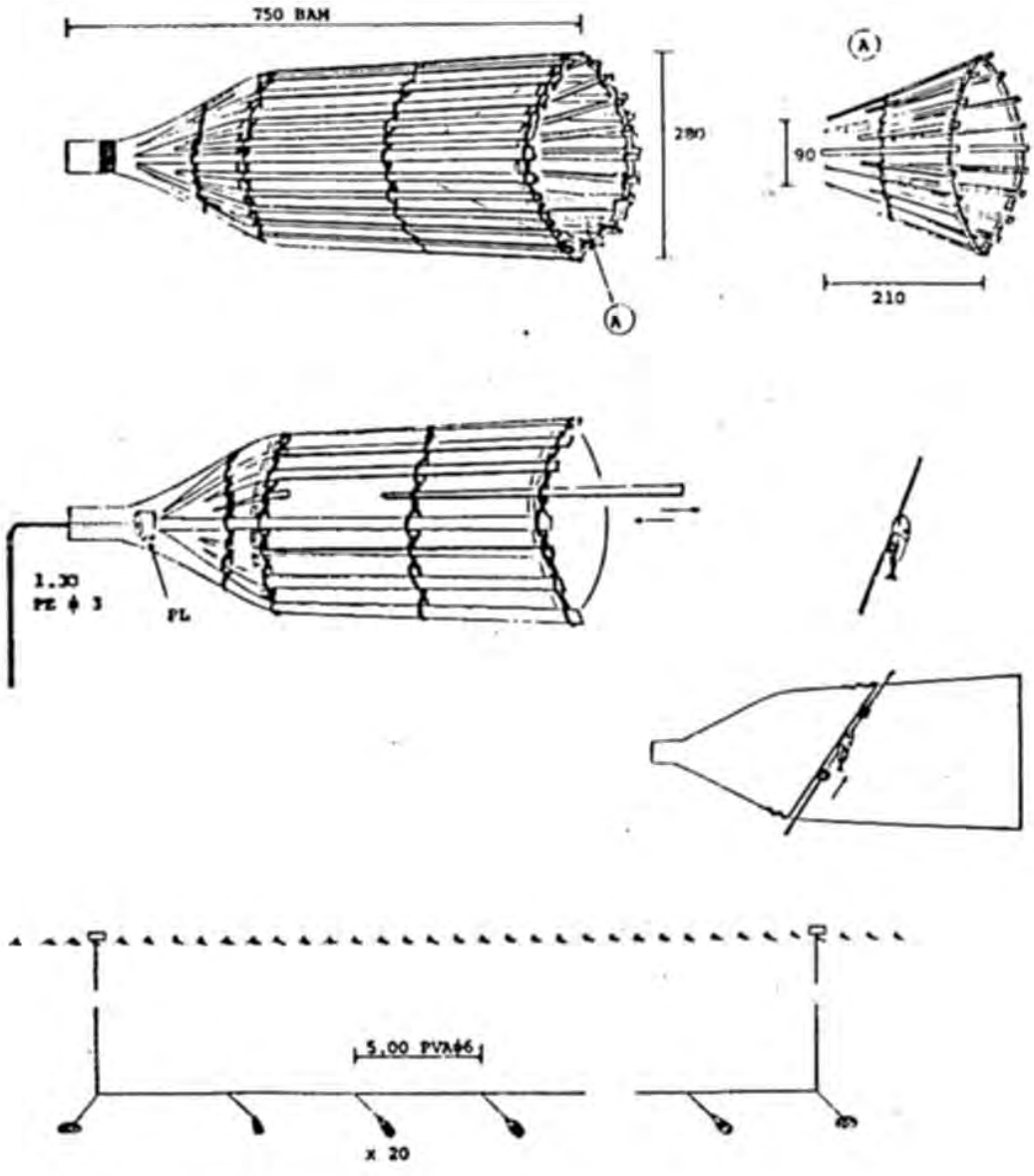


Fig.4 Fishing operation

TRAP	VESSEL	LOCATION
Crab trab	Loa 6 m	Ban Pak Nakhon
Mangrove crab	hp 4 LT	Nakhon Si Thammarat

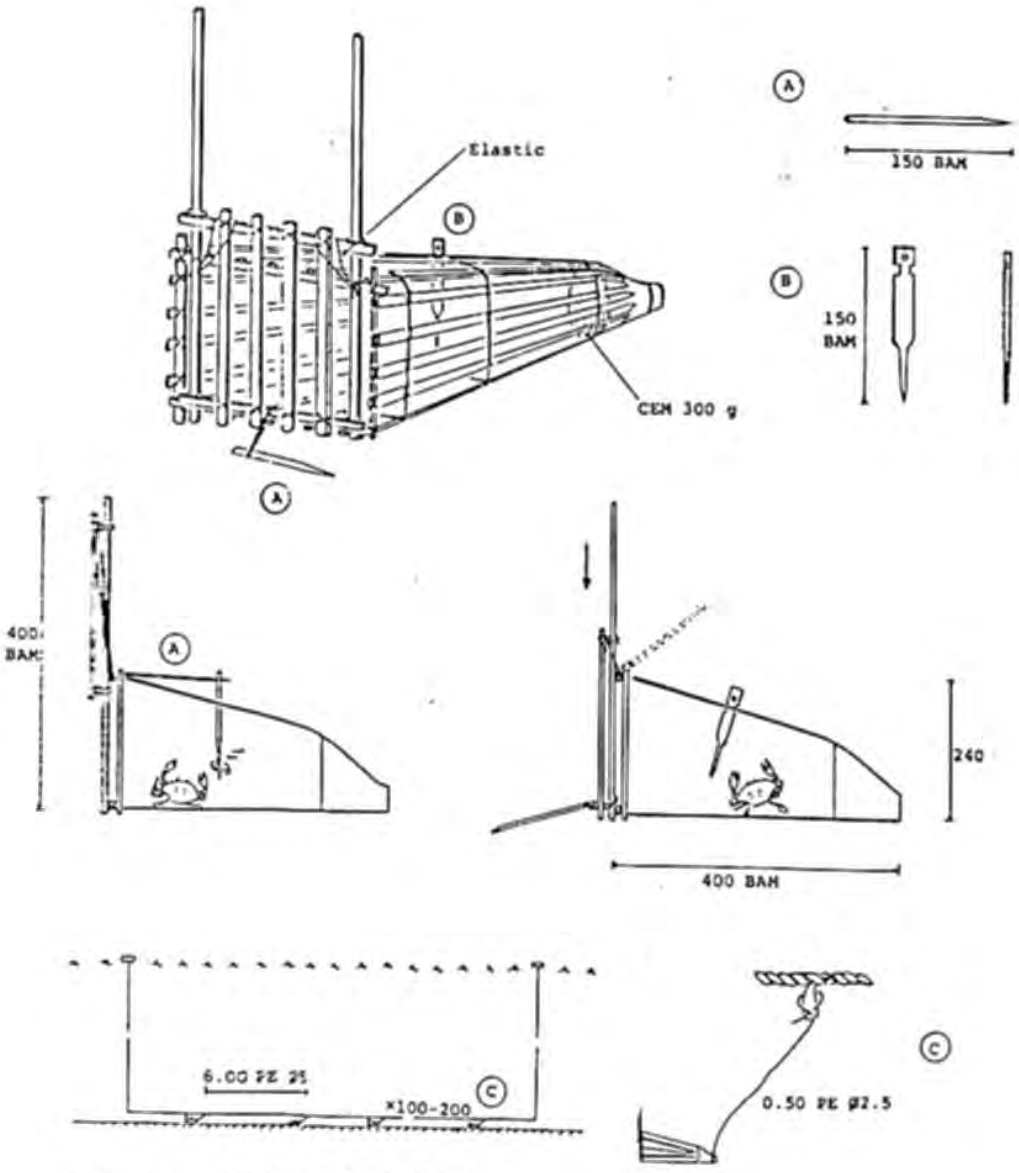
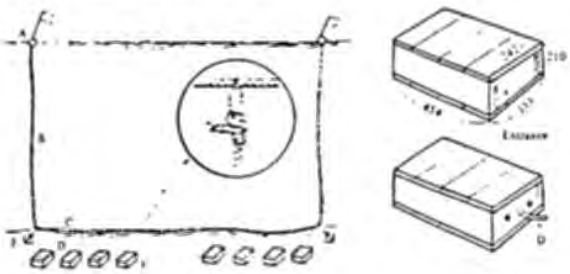


Fig. 5 Fishing Operation

Octopus fishing

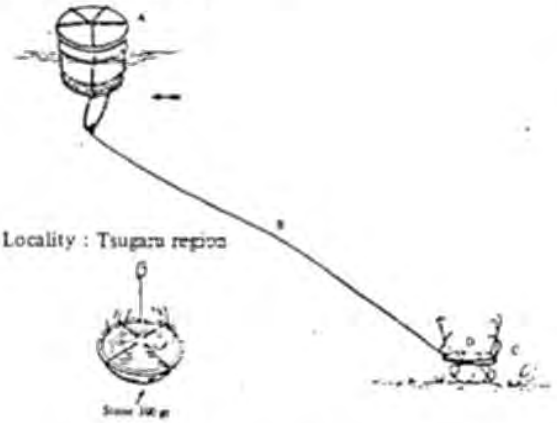
Locality : North of Japan
Gear : Octopus box line
Vessel : 4 ton, 2 crew
Fishing ground:
Depth of water 80~110m
Near shoal place
Octopus caught:
Average weight 16~17 kg
Fishing operation :
Number of nights setting line is 3~20



A	Buoy	
B	Buoy line	P.E. φ5, length is 2 times water depth
C	Main line	P.E. φ6, 700m (1 set)
D	Branch line	P.E. φ10, 3m length, 14m interval, 50 pices (1 set)
E	Anchor	7.5 kg
F	Box	Octopus box (Wood)

———— o ————

Country : Japan
Locality : Various places
Gear : Octopus current pulling line.
Local name are "Taru-nagashi, Isari-biki".
Vessel : 5 ton
20 barrarels operated by one crew
Fishing ground :
Spring (30~45 m depth)
Autumn (45~60 m depth)
Fish species
Octopus 5~7 kg in weight
Max. catch is 500 kg/day



Locality : Tsugaru region

A Barrel : Dia 300~400 mm, made of wood (cedar), drifted by current
B Towing rope Polyester (Tetron) twine φ3.3, Length is adjusted to current strength. When slow current, the length is 3~4.5 meters longer than water depth and faster current, 9~10.5 meters longer.
C "Isari" oak-wood piece, 180 × 100 × 10. Several wires with hook-shaped nails on both ends are fastened with wood base.
Under the base 2.5 kg weight of stone is attached.
D Bait : salted saury pike, flat fish, Alaska pollack, small octopus

Operation : Barrels are drifted in parallel with 0.5~0.7 km intervals. Three points are essential in octopus fishing.

1. Judgment of current in fishing
   Choose the slow current from the land to off shore
2. State of barrel drifting.
   Adjust the towing rope length to get the barrel to sink about 30~40 percent of the total barrel's height. This is the best running speed of "Isari".
3. Haul the rope
   When the octopus sits on the wooden piece, instantly the barrel is picked up and the rope should be pulled softly and keeping constant speed for the base board.

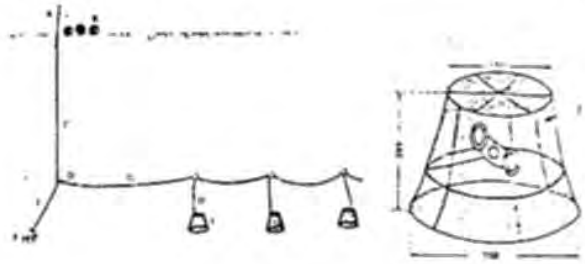
Basket line

Locality : North of Japan
Gear : Prawn basket line
Vessel : 5 ton
Fishing ground :
Depth of water 300~650m
Operation : Set basket 1~2 nights
Bait : Saury pike 3~4 pieces cuts

A	Buoy	Synthetic float φ450
B	Buoy line	P.E. φ11.5, length is 1.4 times the depth of water
C	Anchor rope	P.E. φ11.5, 35m
D	Anchor	10 kg
E	Main line	P.E. φ11.5, 1200~1500m
F	Branch line	P.E. φ9.3, 3.8m length, 12~15m interval
G	Net	Polyester 21 yarns, 17.8 mm
H	Bottom fram	Iron bar
I	Frame	Vinyl pipe
J	Bait hook,	

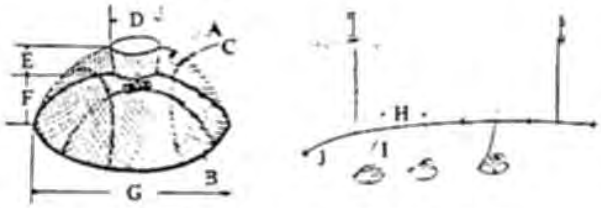
———— o ————

Locality : North of Japan
Gear : Prawn basket line
Vessel : 10~50 ton, crew 4~5
Fishing ground :
200~500 m depth of water. Sandy mud
Equipment: Line hauler
Bait : Alaska pollack



A	Bamboo pole & flag	
B	Buoy	Glass buoy, φ360
C	Buoy line	P.E. φ13.5~15.2, length is 1.5 times depth of water
D	Joint point	
E	Anchor rope	P.E. φ13.5~15.2, 30~40 m
F	Sinker	Natural stone
G	Main line	P.E. φ13.5~15.2, 1,000~1,300 m (1 set)
H	Branch line	P.E. φ11.5, 10 m length, 10 m interval 100~130 pieces (1 set)
I	Basket	
J	Net	P.E. 12 yarns, Mesh size 25~28

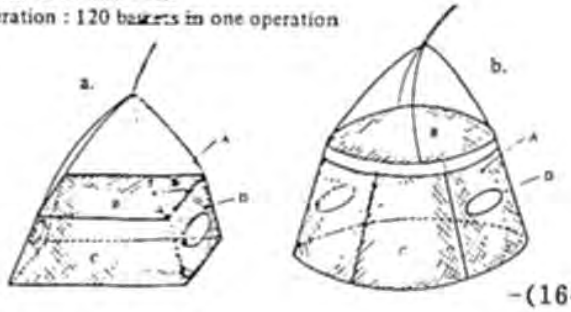
Locality : North of Japan
Gear : Horsehair crab basket line
Vessel : 1.5 ton, 8 ps
Fishing ground :
Depth of water 25~90m
Bottom nature is muddy sand
Bait : Squid, Alaska pollack
Fishing operation :
Number of baskets operated in a day is 400~800.
Size of crab caught :
Big more than 90mm in shell, Medium 80~90mm,
Small less than 80mm



A	Net	Vinylon 30 yarns, Mesh size = 75.8mm, Brown color
B	Base frame	Iron bar,
C	Frame	Polyethylen pipe, Outside φ13, Inside φ9
D	Entrance	Dia 230mm
E	Entrance height	212~242mm
F	Height of basket	242mm
G	Bottom size	Dia 880mm
H	Interval	Between two basket = 18~22m
I	Branch line	P.E. φ5, 2.2~3m
J	Anchor	5.6~7.5 kg (weight)

1 set = 200 baskets = 20m x 2000 = 4000m (length)

Locality : Hokkaido
Gear : Crab basket line
Vessel : Less than 5 ton
Operation : 120 baskets in one operation



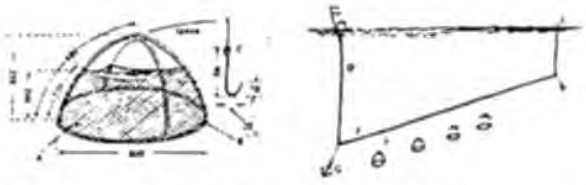
a. Oblong type

A	Net	P.E. 21 yarns. Mesh size = 910 mm
B	Upper oblong	1020 x 1100, Height = 730
C	Lower oblong	1420 x 1100
D	Side hole	Frame is iron bar φ9, size = 230 x 340

b. Round type

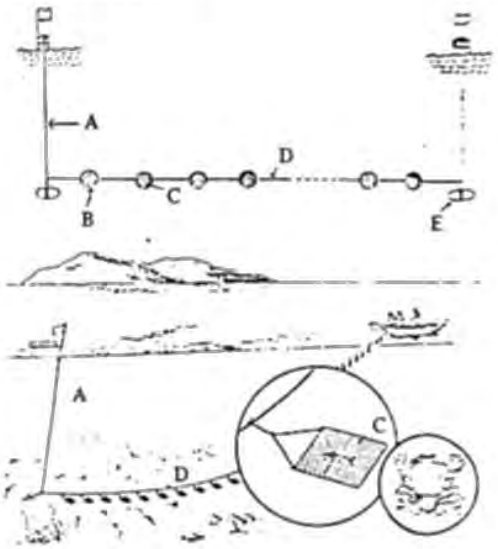
A	Net	same as a.
B	Upper circle	Dia 1040 Height = 750
C	Lower circle	Dia 1240
D	Side hole	230 x 340

Locality : North of Japan
Gear : Shell fish basket line
Vessel : 5~10 ton
Fishing ground :
Depth of water 68~135 m Muddy bottom
Operation :
Set line 3 nights
1 set is 800 baskets
Average catch per day is 600~700 kg.



A	Net	Vinylon 21 yarns, Mesh size = 30.3 mm, Bottom net 54.5 mm
B	Iron frame	Iron bar φ9
C	Bait hook	
D	Buoy line	P.E. φ11.5, length is 1.3 times of water depth
E	Main line	P.E. φ13.0 1 set = 800 baskets
F	Branch line	P.E. φ11.5, 1.5~3.0 m
G	Anchor	7.5 kg

Locality : Taiwan coastal waters
Gear : Squilla basket line
Vessel : 1 ton, 4 ps, 2 crew
Reference : M. Chin



A	Barrel line	P.E. 380d 144 yarn, length 1.6 times water depth
B	Flat basket	Round type or square type 500mm, 40 pcs
C	Net	P.E. 380d 9 yarn, 30mm
D	Main line	P.E. 380d, 144 yarn, 80m interval
E	Sinker	Stone 3~5 kg

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STUDY REPORT

OTTER TRAWL

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COMMERCIAL FISHING TECNOLOGY COURSE

Introduction

Orter trawl is one of the most recently introduced fishing gears in Thailand. It is now the most wide - spread and the most important gear in terms of production and the number of fishing unit.

The first experiments with otter trawl fishing conducted in the early1950 by some private fishing companies were unsuccessful. In 1960 however, the department of fishing intervend and with the technical assistance from the federal republic of germany launched a program designed to promote trawl fishing psrticularly otter trawl which was gaining reputation of being highly effective. After that, the number of otter trawl fishing boats has increased repily, with a corresponching sharp rise in production.

Catch of Marine Fishery by Type Fishing Gear by Fishing Area

1993

Fishing Gear	Total	Gulf of Thailand	Indian Ocean
Otter Trawl	1,604,908	902,558	449,475

****

OTTER TRAWL

The most popular form of trawl fishing in Thailand is by otter trawl, in which otter boards are used for horizontal spreading of the net mouth . Most otter trawl nets consist of two panels, this is called a " two-seam net". The mouth is oval-shaped when viewed from front . Two wings stretch out to increase the swept area and to quide fish in the net path down to the cod-end. There are two types of otter trawl . One for shrimp and the other for fish.

The otter trawl for shrimp is usually operated from small fishing boats, 8-16 m in length and with the low to medium power of the main engine (30 -120 h.p). The netting is 30-60 mm, mesh size, polyethylene 250d/6 or 380d/6-12 for the wings., upper panel the belly, and 20-25 mm mesh size polyethylene 380d/9-15 for the cod end. In most cases the triangular piece of netting at the top wing of both panel is omitted. The size of net depend on the power of the fishing boat, the head rope varies from 11-23 m and the ground rope from 13-14 metres. The difference between them is 1-2 metres. Both are made of polyethylene or polypropylene. The ground rope is weighted with a chain or with lead sinkers. Otter board are rectangular and flat made of wood and iron, 50-100 cm wide and 100-200 long with a bridle chain and a back strap. The sweep line or hand rope are 10-36m long, 14-26mm in diameter, made of polyethylene, polypropylene or a combination rope.

The warps are 14-28mm in diameter also made of polyethylene or polypropylene. A capstan winch is used for hauling warps and lifting the catch in the cod-end onto the fore deck of the fishing boat. The net is pulled by hand at stern. Four to eight fishermen take part in a fishing operation. The shrimp otter trawls are mostly operated from Nakhon Sithammarat to Songkhla province and the catch consist of shrimps and trash- fish.

The fish otter trawl are the largest single fishery in Thailand. Most vessels used in this ease are comparatively big, from 15 to over 30 m in length, with the main engines ranging from 100 to 500 h.p. The fishing expendition take one or two weeks, some times even longer. The two seam type of net is used, 120-180 mm mesh-size polyethylene 700d/12-21 netting for the wings, square, upper panel and belly, and 20-30 mm mesh-size polyethylene 380d/9-15 mm netting for the cod-end. This net differs from the shrimp otter trawl net in that in has a triangular piece of netting at the two wings of both panels. The head rope is 28-40 m, and the ground rope 30-46 mm long. The difference in their lengths is 2-6 metres. Both ropes are made of wire and combination rope. Wooden and rubber rollers, sometimes covered with spherical plastic capsules are attached on the ground rope for weighting and nothing. Otter boards are rectangular and flat, 1-2 m wide, 1.2×2.4 m long, made of wood and iron. They have a fixed bracket and a bridle chain or fixed iron holders, and sometimes 1-5 plastic floats are attach at the front top part of the boards, so as to prevent the sinking

of the boards into the muddy sea bed. Gallows, which are necessary for this type of trawl, are fixed at the stern of the boat. The sweep lines or the hand ropes are 35-80 m long, 22-32 mm thick combination ropes. The warps are 14-18 mm thick wires, coiled on the warp drum winches on both sides of the boat, or in the middle of a stern trawler. Warps are hauled by a warp warp drum winch, the net is pulled by a capstan winch, and passes through a pulley on the crane boom at the fore deck (or stern deck of a trawler). The cod-end is hauled in the same way. Ten to twenty men are needed for a fishing operation. The main catch are bottom fishes and trash fish. The major fishing ports are Samut Prakan, Samut Sakhon, Songkhla and Phuket.

Setting; When the gear is to be prepared, the boat streams along the desired course into wind if desirable. the cod-end is thrown out and the working ropes retied in their correct positions on head line and wings and the net streamed out astern, the sweep lines run out. The otter boards are connected to the warps and unhooked from the gallow, all is ready for setting.

This may be accompolished by releasing the winch brakes simultaneously so allowing the otter boards to drop into the water and spread while "on the run" or alternating the warps may first be eased out until the otter boards are just below the surface and seem to be spreading satisfactorily before the warps are released.

All is now ready to set the otter boards and run out the warps to their required extent.

Hauling; When hauling, the otter boards are hove up to the gallows and left hanging on the warps, being clamped if the ground rope. Then the ground ropes, wings and bellies of the trawl also are hauled up to the stern and the cod-end is pulled to the fore deck for emptying.

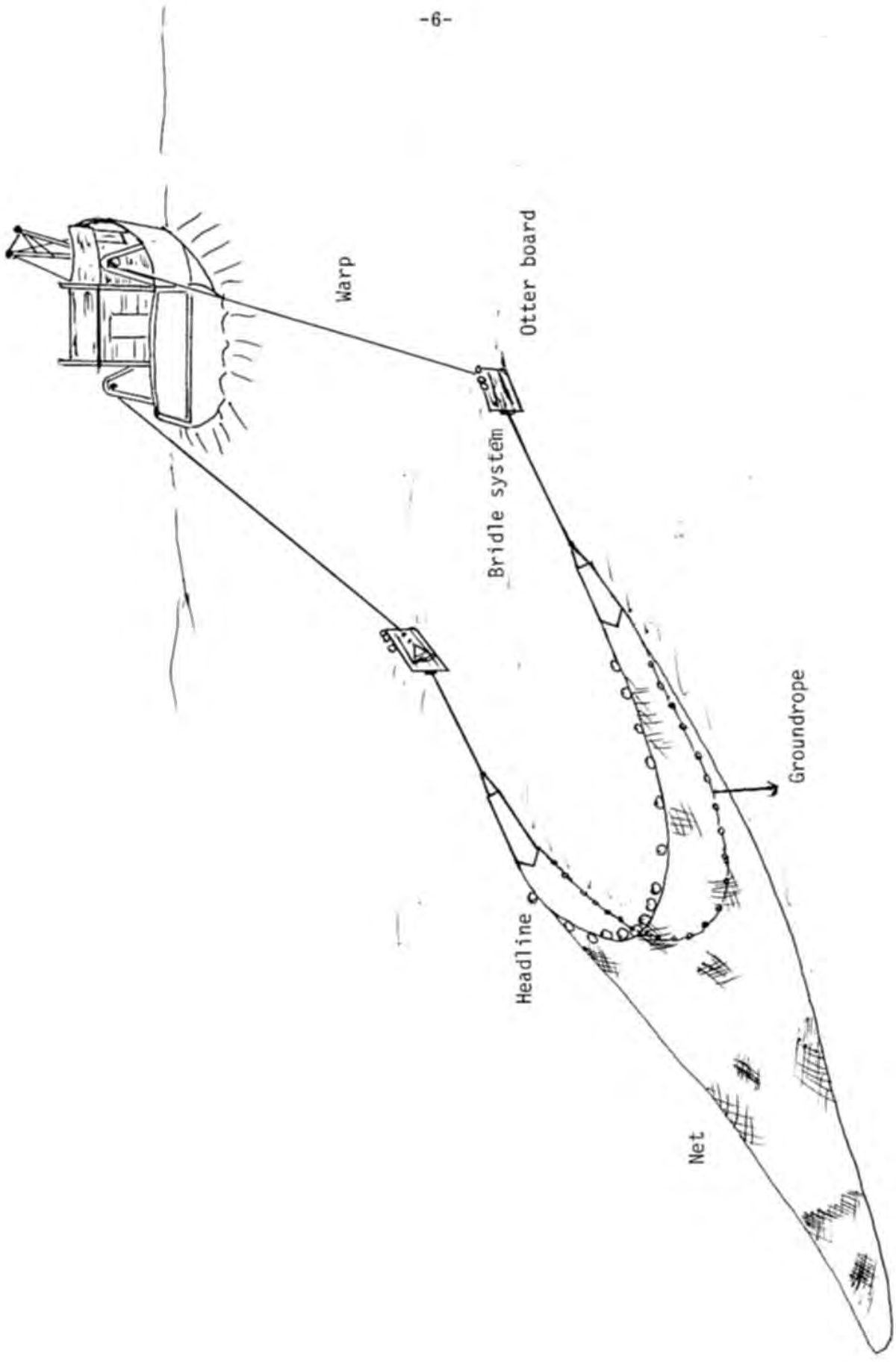
The main species caught by trawl, otter trawl

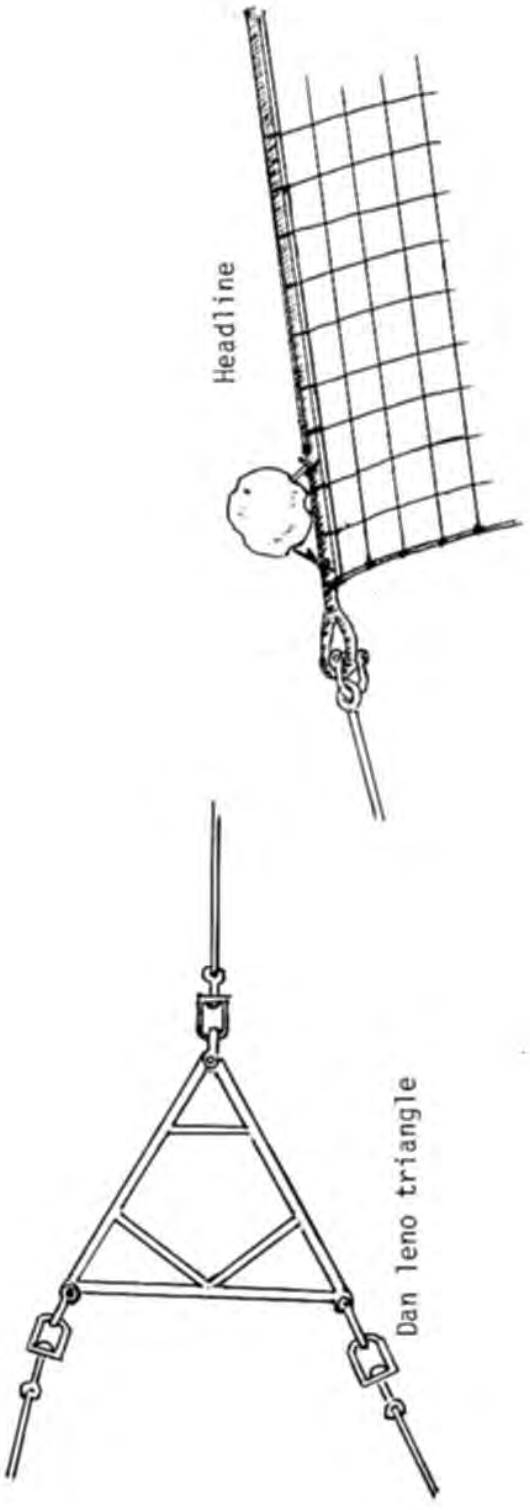
- Trash fish
- Non - penacid prawns
- Squid
- Cuttle fish
- Threadfin bream and others.

Otter board trawl

Table Number of fishing boat registered by size total gross tonnage and by prvince, 1994

Province	No. Of boat	<14m	14-18m	18-25m	>25m
Total	6,482	2,068	2,262	2,067	85
Trat	461	280	146	34	1
Chanthaburi	303	55	142	106	-
Rayong	198	23	83	91	1
Chonburi	275	200	44	13	-
Chachoengsao	69	40	24	5	-
Samut Prakan	595	35	134	419	7
Samutsakhon	448	37	102	269	40
Samut songkhram	314	144	65	87	18
Phetchaburi	295	76	107	111	1
Prachuabkhirikhan	64	53	5	6	-
Chumphon	445	144	269	32	-
Surat thani	141	76	44	21	-
Nakhon sithammarat	781	241	385	155	-
Songkhla	761	303	278	180	-
Pattani	286	123	108	54	1
Narathivat	43	38	4	1	-
Ranong	157	7	80	69	1
Phangnga	1	1	-	-	-
Phuket	110	1	51	56	2
Krabi	10	8	1	1	-
Trang	494	55	138	294	7
Satun	179	126	27	23	3
Bangkok	70	2	25	40	3
Other	-	-	-	-	-


Warp
Otter board
Bridle system
Groundrope
Headline
Net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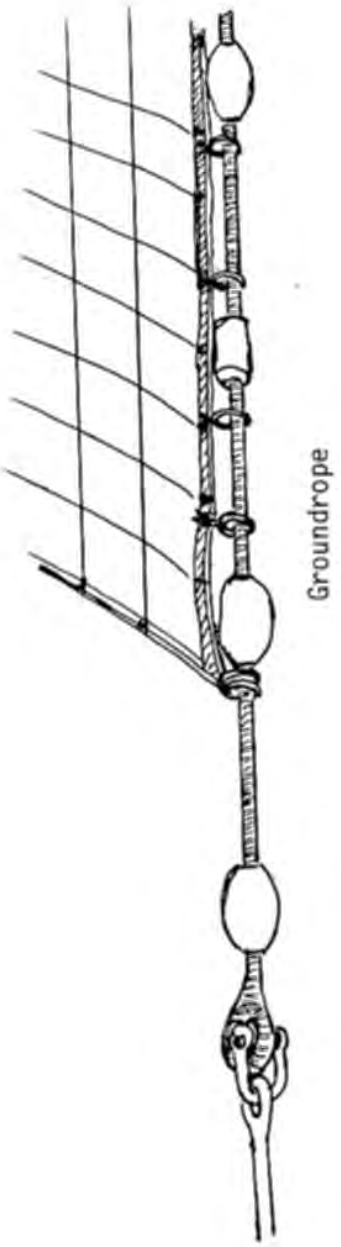
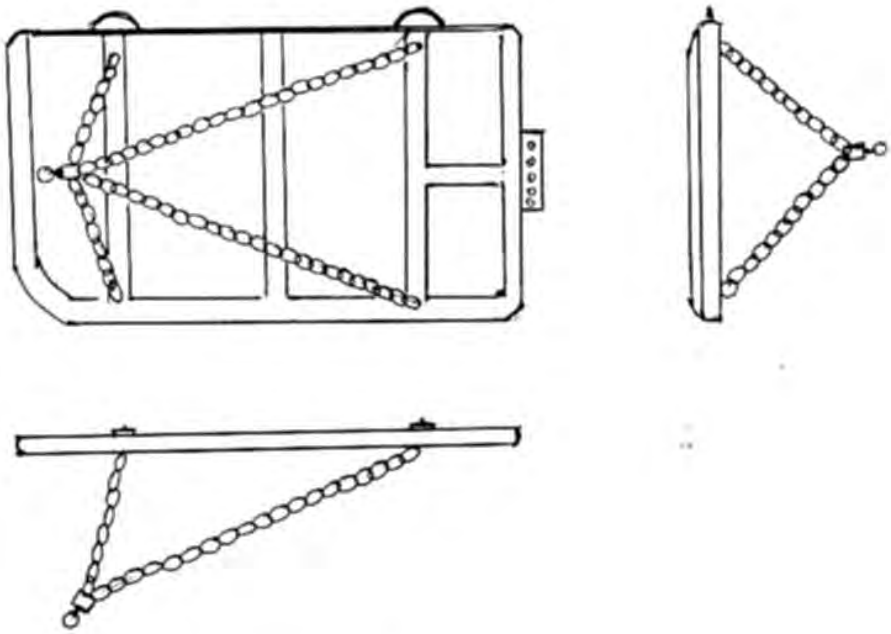
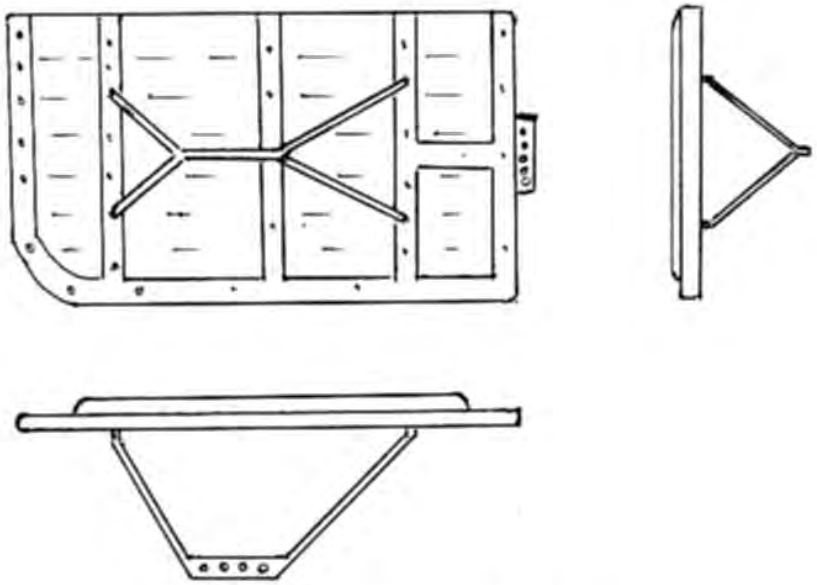
Dan leno triangle


Groundrope

Flat With Chain Brackets



Cambered



Some types of otter boards

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STUDY REPORT

NET MENDING

Mr. Niphon Thongyou

OCEANIC FISHERIES DIVISON

SAMUTPRAKARN

COMMERCIAL FISHING TECNOLOGY COURSE

NET MENDING

By Mr.Niphon Thongyou

(Trainee,Thailand)

INTRODUCTION

Fishing net have been used for thousands of years by those who seek food from the sea or make their living by catching fish.

In the early days suitable knots had to be devised before a net could be made. Its size was determined by the availability of suitable materials and by the time available to make by hand the twine and then braid the net.

The introduction of net making machines about 100 years ago speeded up operation considerably and meant much bigger nets could be manufactured. However, many hours still had to be spent by fishermen washing the natural fibers, preserving them with tar or tannin and mending them to extend their useful life.

When synthetic fibers were introduced in the 1950's, nets of greater strength and longer life became available to fishermen, but despite these advantages modern nets still get damaged and have to be repaired by hand.

ARRANGING THE NET FOR MENDING

Netting is made by machine or hand. It is a series of knots, each knot completing a mesh and each row of knots increasing the length of the piece of net by half a mesh. In Fig.1 it will be seen that each row must be completed before the next can be started, the arrows show the direction in which each successive knot is made.

When mending a piece of net the first step is to arrange the netting so that the knot run in the same direction as when it was constructed so that the rows of knot are in line. Fig.2 shows a piece of netting correctly lines up and Fig.3 shows a piece line up incorrectly, that is , 90 degrees to the netting in Fig.2. If the twine is cut immediately below one of the knot in Fig.2 and the knot untied, a loop will remain, if the twine is cut immediately below a knot in Fig.3 and the knot untied, two loose ends will remain.

The most common way of supporting a piece of net whilst mending are :

1. Have an assistant hold the net by several meshes in the same row, directly above the point at which the net is being mended.
2. Hook a number of meshes in the same row (two feet are more above the hold being mended) over a nail or onto a hook supported at a suitable height.
3. If it is convenient to sit down a number of mesh in the same row can be looped over the toes.
4. Weaving a bar or stick through the meshes, making sure that all mesh are in the same row, and then supporting the bar at both ends. This is one of the best methods.
5. Providing the knot in a prown or fish trawl net run in the right direction the net can be fleeted up to the boom and large areas can be inspected easily for holes and mended.

It is stressed that to mend a net quickly and efficiently the row of knots must be lined up in the right direction and the netting properly supported.

THE KNOT

Knots described are those commonly used in net mending and patching. There are several variations of the starting and finishing knots but only the best know ones are shown. There are also double left and right hand side knots but they are seldom used, because they are slower to execute, and have little advantage over the simple side knots illustrated, and have not been included.

THE STARTING KNOT

Pass the needle up through the mesh until a short tail of twine remain below the knot. Throwing the loop of twine to the left from a double sheet bend and pull tight (Fig.4).

NET MAKING KNOTS

These are also known as half mesh knots. When working from left to right across the net the needle is brought up through the mesh (Fig.5).

The size of the loop formed is measured against the preceding half mesh using the fingers as illustrated (Fig.6). These leaves the thumb and index finger to clamb the twine at the centre point of the half mesh on which the knot is being tied (Fig.7).

A sheet bend is then formed by throwing the loop of twine to the left and passing the needle under the half mesh and over the loop. The knot is then pulled tight by moving the needle to the right (Fig.8).

When working from right to left the needle of passed down through the mesh and the size of the loop is measured against the preceding half mesh using the fingers as illustrated (Fig.9). This time the palm of the hand, not the back of the hand, is towards the net mender. The back of the hand is towards the mender when working from left to right. The twine is clamped in the half mesh by the index finger and thumb and a sheet bend formed in the same manner as before and tightened by moving the needle to the left (Fig.10).

LEFT SIDE KNOT

Lay the twine to the left of the knot in the side mesh with the index finger behind the knot. Measure the length of the bar of the mesh being formed by lining up the two knots above one being made (Fig. 11). Put the twine under the side mesh, then pass it between the twine and the side mesh. Clamp the twine with index finger and thumb just below the knot in the side mesh. Throwing the loop in the twine to the right from an overhand knot around the knot in the side mesh and pull it tightly by moving the needle to the right (Fig. 12).

RIGHT SIDE KNOT

Lay the twine to the right of the knot of the size mesh with the index finger behind the knot. Measure the length of the bar in the same manner as for the left side knot and clamp the twine in the same direction (Fig. 13). Put the twine under the side mesh, then pass it between the twine and the side mesh. Clamp the twine with index finger and thumb just below the knot in the side mesh. Throwing the loop in the twine to the left from an overhand knot around the knot in the side mesh and pull it tightly by moving the needle to the left (Fig. 14).

PICK - UP KNOT

When working from left to right across the net the needle is passed up through the mesh. The length of the bar of the mesh being formed is measured by lining up the knot being formed with the adjacent knot on the left. Clamp the twine with the index finger and thumb. A sheet bend is then formed by throwing the loop of twine to the left and passing the needle under the half mesh being picked up and over the loop. The knot is then pulled tight by moving the needle to the right (Fig.15).

When working from right to left the needle is passed down through the mesh being picked up and the length of the bar of the mesh being formed is measured by lining up the knot being formed with the adjacent knot on the right. The twine is clamped between forefinger and thumb and a sheet bend formed, throwing the loop in the twine to the left and tightening by moving the needle to the left (Fig.16).

FINISHING KNOT

To finish off a mend a double sheet bend is formed in the same manner as the pick up knot and a half hitch is then tied around the bar opposite the large bar formed and pulled tight.

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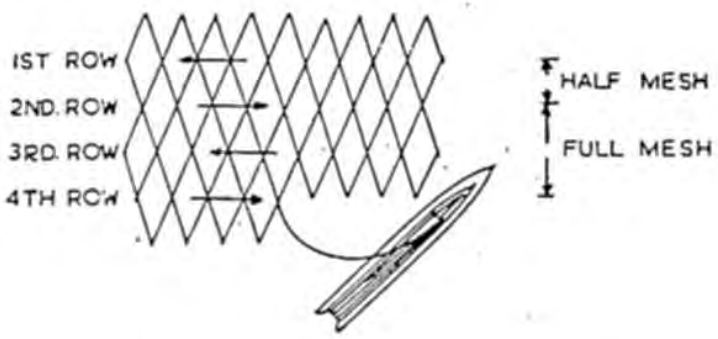


Fig.1 Row and mesh

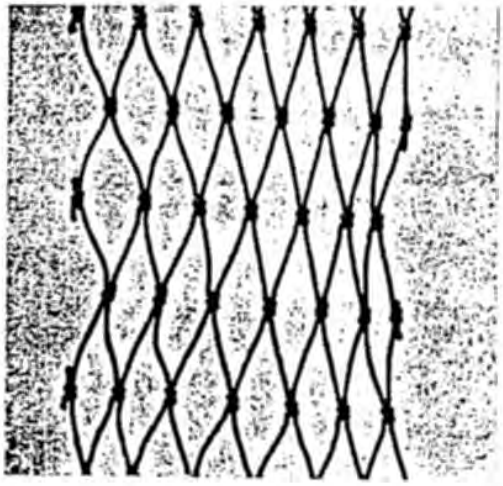


Fig.2 Piece of netting correctly lined up

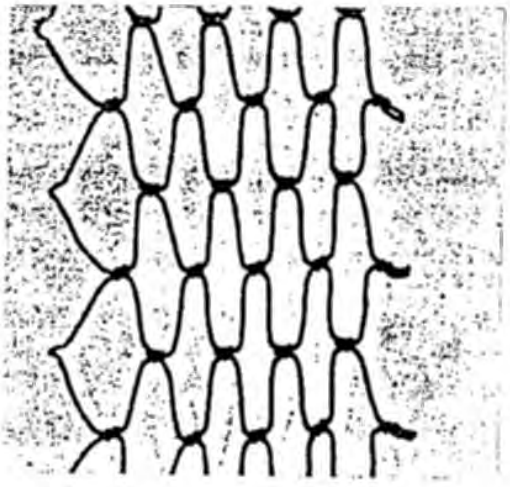


Fig.3 Piece of netting lined up incorrectly

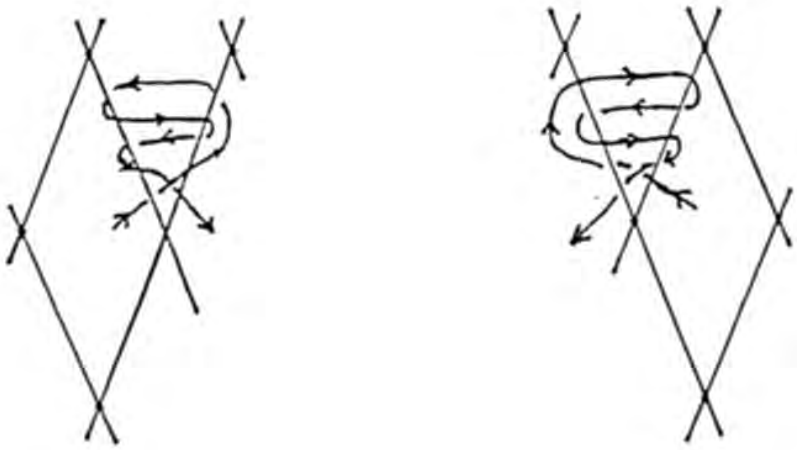


Fig.4 The starting Knot

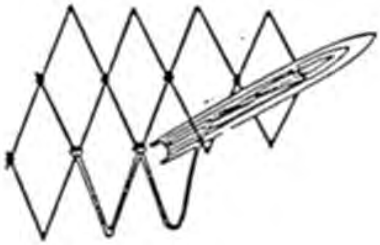


Fig.5 Net making

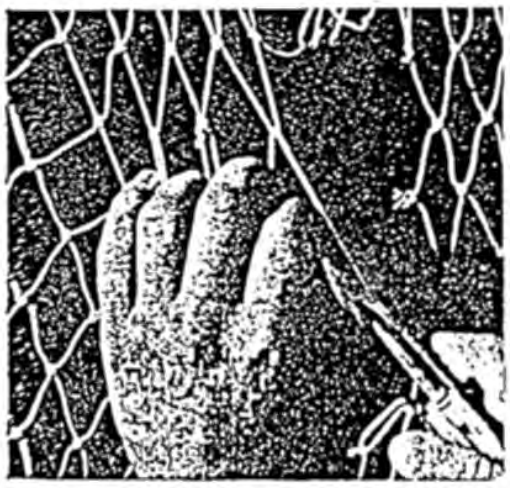


Fig.6 The fingers as illustrated from left to rigth

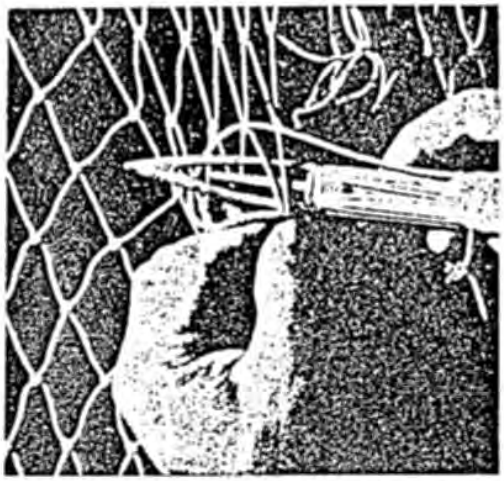


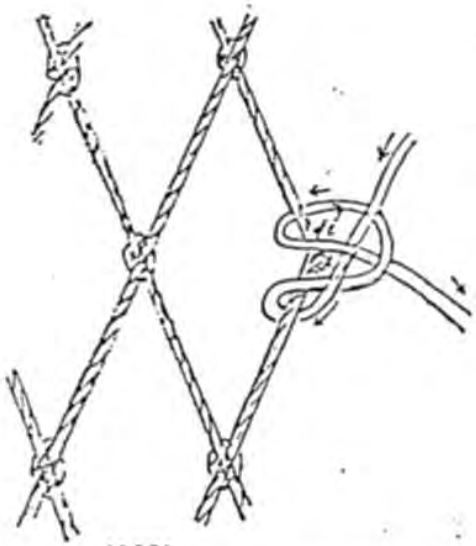
Fig.7 The knot is being tied

Fig.8 Left to right

Fig.9 The fingers as illustrated from rigth to left

Fig.10 Right to left

Fig.11 Measure the legth of the bar



-(183)-

Fig.12 left side knot

Fig.13 Measure the length of the bar in the same manner as for the left side knot.

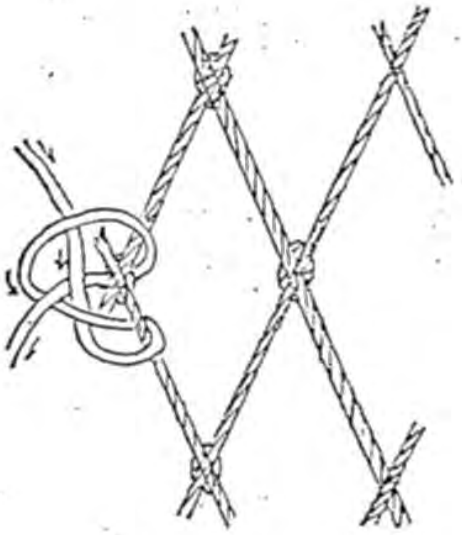
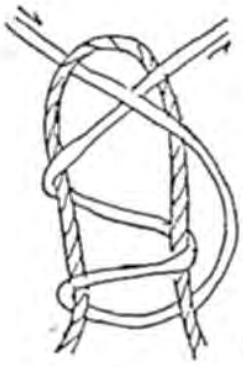


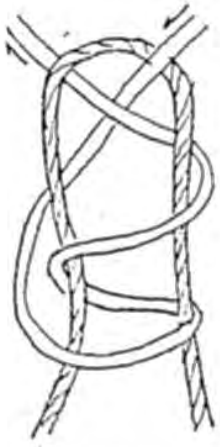
Fig.14 right side knot

Fig.15 Pick-up knots from left to right

Fig.16 Pick-up knots from right to left



(a) Right side



(b) Left side

Fig. 17 Left and right side finishing knot

STUDY REPORT

ON

LIFT NET OPERATION IN THAILAND

BY

MR. SITTHISAK OMAK

DEPARTMENT OF FISHERIES
THAILAND

The Regional Training Course
in
Commercial Fishing Technology
18 June - 17 December 1996.
Southeast Asian Fisheries Development Center

LIFT NET OPERATION IN THAILAND

By

MR. SITTHISAK OMAK

THAILAND

1. INTRODUCTION

The lift net is an extremely adapble fishing method which is practiced world-wide in rivers, lakes, marskes coastal water and even the open sea. The nets range widely in both scale and operation frome small scoop nets operated by one man to large-scale lift met operations in volving the erews of up to eight boats.

A lift net consists of a sheet of netting surrounded by a round, rectangular, square or fan - shaped frame which is submerged, they raised or hauled up ward out of the water to catch the fish above them. Several large sheets of netting may be loosely hung on the frame allowing the net to take on a bag - like appearance when under water. The lift net as in all types of fishing nets, also consists of main net and rope of oyn the tic fibre with float and/or a sinker attacted.

When the net is set, fish are lured into the area either with chum bait or by attraction lamps. The ideal species to be caught in this way are those who gather in large schools and can be attracted by lights or natrual bait. These species in clude sardines, anchovy, mackerd, squid, horse mackerel, Pacific saury etc.

There are no independent statistical records for lift net fishing. The data appcar either as a part of the general small scale fisheries, or else the are inseparable frome recontrds of the squid cost net fishery since most cost net vessels operate both methods. We can, however, roughly classify lift nets into four basic types:

1. Crab liftnet
2. Fish liftnet
3. Stationary liftnet
4. Stick - held dip-net

2. FISHING GEAR AND METHODS

2.1 Crab liftnet

This is one of the oldest fishing gears in Thailand, as well as in other parts of the world. Them materials of which the gear is made may have changed, but the shape and the technique of use have remained the same.

The gear consists of a bamboo or metal frame for the net, and a bamboo pole or a rope with a buoy. The frame is usually round, 40-50 cm in diameter, or square with 45 cm long sides. The height of the frame is 15 cm. Nowadays, the net is polyethylene or nylon, with 70-140 mm meshsize. The fisherman can use this gear in very shallw water, from a rowing-boat or a long-tail boat, or simply walk along the shore. The catch is usually mangrove crab and blue swimming crab. Fishing is done in the day or night-time, all the year round.

2.2 Fish liftnet

This gear is a modification of the crab liftnet. The metal frame is round, 50-80 cm in diameter, and containes a 1 m deep nylon net that looks lide a scoop net, with 25 mm mesh size. A rope is attached to the frame, for lifting the gear to the surface. Before the net is lowered to the bottom, a small piece of fish or crab is hung in the center of the frame as bait. The net is lifted frequently to check if there is

catch, which may be a rabbit fish, marine catfish and sometimes a young grouper. One often sees this gear used by children or occasional fishermen, in fishing ports.

A kind of fish liftnet is used for catching planktonic shrimp. The net in this case is either cotton, nylon or polyethylene minnow or rachel net, mesh size 2 x 2 mm or 6-8 mm. A bamboo handle, 2-3 m long, is commonly used for gear with a square frame, whereas a round frame has a rope attached for lifting. The net is operated so that it is placed at the bottom in very shallow water, and the fisherman waits until he sees a school of planktonic shrimp pass; then he lifts the net. No bait is required.

2.3 Stationary liftnet

This is a comparatively large liftnet, rarely used in Thailand. The type of stationary liftnet found in Songkhla has a leader net or a fence to guide the fish into the main net, which is suspended on a wooden frame in the water 0.5-2 meters deep. An observation platform, 8-10 meters high, is built so that the fisherman can see a passing fish school and operate the net from a good vantage point. The net is made of nylon 210d/6, with 25 mm mesh-size. Fishing can be done by a single person, in the day-time between high and low tide. The catch is mostly mullet. Similar gear can be found in nakhon si thammarat province. The shrimp liftnet consists of two bamboo leaders, funnel-shaped, and a net hung on two poles which are tied like a see-saw on a vertical wooden frame, so that the net can easily be lifted out of the water. The net is polyethylene 250d/6, 15 mm mesh-size, the size of net is 4 x 7 square metres. The net is set so as to face the current.

The mullet net, also found in Nakhon Si Thammarat, is rather larger: 10.7 x 15.3 square metres. It is hung on four stilts. There is a platform at each corner,

from which the net is raised or lowered through a system of pulleys. A leader net is set on wooden stakes between the beech and the liftnet. Five ment are required to operate the net.

2.4 Stick-held dip-net

Derived from the stationary liftnet, the stick-held dip-net is smaller and simpler tooperate. Fishing takes place on board a small-to medium-sized vessel (8-14 m) equipped with electric luring lamps. The gear itself consists of a square or rectangular net, two bamboo poles, sinkers and ropes. The size of gear depends on the size of the fishing vessel. The net is usually black nylon 210d/3-6, 20-30 mm mesh-size, and 0.4-0.5 hanging ratio. Fishing is done on moonless nights. During the operation the boat is allowed to drift with the current; a drift gill-net is used as a parachute anchor. The lift net is operated either by "pulling" or "pushing", depending on how it is hung on the bamboo poles at the start of operation. The main catch are squids and cuttlefishes. Anchovies are caught by the same gear and a similar method, except that the main net must have a smaller mesh-size and it is customary to operate a "pulling type" net.

The number of fishing vessels still engaged exclusively in squid stick-held dip-net fishing has been declining ever since the more effective squid stick-held castnet appeared. This kind of fishing, however, still continues along the eastern seaboard in Chon Buri and Rayong province.

Squid stick-held dip net (Operation)

There are two types of stick-held dip net in Thailand. One is used by rather large boats (15 meters up), and in order to catch squid, the net is pulled toward the boat.

The other types of net, which is used by small boats, (14 meters down) catches squid by being pushed adainst the boat.

These two types of stick-held dip nets are quite similar in construction. They are operated at the fishing grounds of 10-20 meters depth.

Pulling type net

After arriving at the fishing ground, the engine is stopped. Then one set of the mid-water gill net (300-400 meters long and 14 meters deep) is thrown out to the sea as a sea anchor, and the end of the net is joined to the bow side of the boat.

Then all fish luring lamps except one red colour lamp are switched on to attract the squid around the boat. (The boat is equipped with 10 fish luring lamps and 1 red colour lamp.)

The squid are attracted around the boat after some time. The net is set under water, then the ends of three lift lines which are connected to the sinker lines are held by three fishermen.

After checking these preparations, the masterfisherman switches off all lamps at the same time (within 1-2 seconds).

Then one of the four lamps on the starboard side is quickly switched on. All squid attracted around the boat will then shift to the starboard side where the net is.

By reducing the illuminating power of the lamp which had been switched on, the squid are attracted to come up to the sea surface.

Pushing type net

This type of gear is operated at the same fishing ground as the pulling type net. A set of mid-water gill net also serves as a sea anchor.

After arriving at the fishing ground, all fish luring lamps on board are switched on for about 30-60 minutes.

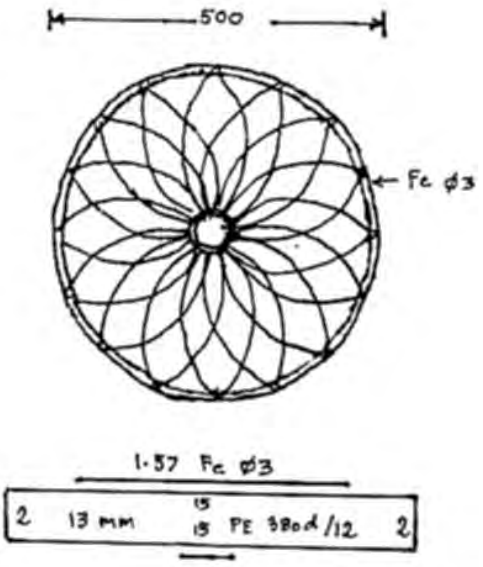
Then after checking that the squid are attracted around the boat, the port side lamps and bow and stern side lamps are switched off. 4 lamps on the starboard side are kept lit. When all squid are attracted to the starboard side by the above procedure the net is set under the water. After that three of the four lamps on the starboard side are switched off. One lamp is left switched on and its illuminating power is reduced slowly.

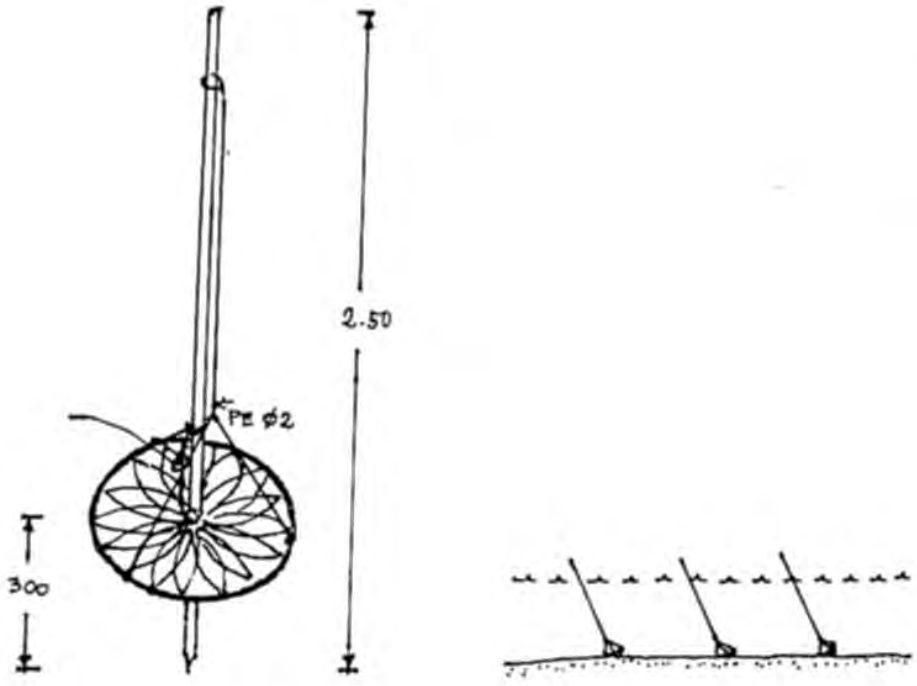
When the squid come up to the surface, the net is pushed quickly by two fishermen.

The operation is repeated about 20 times in one night by 3 fishermen.

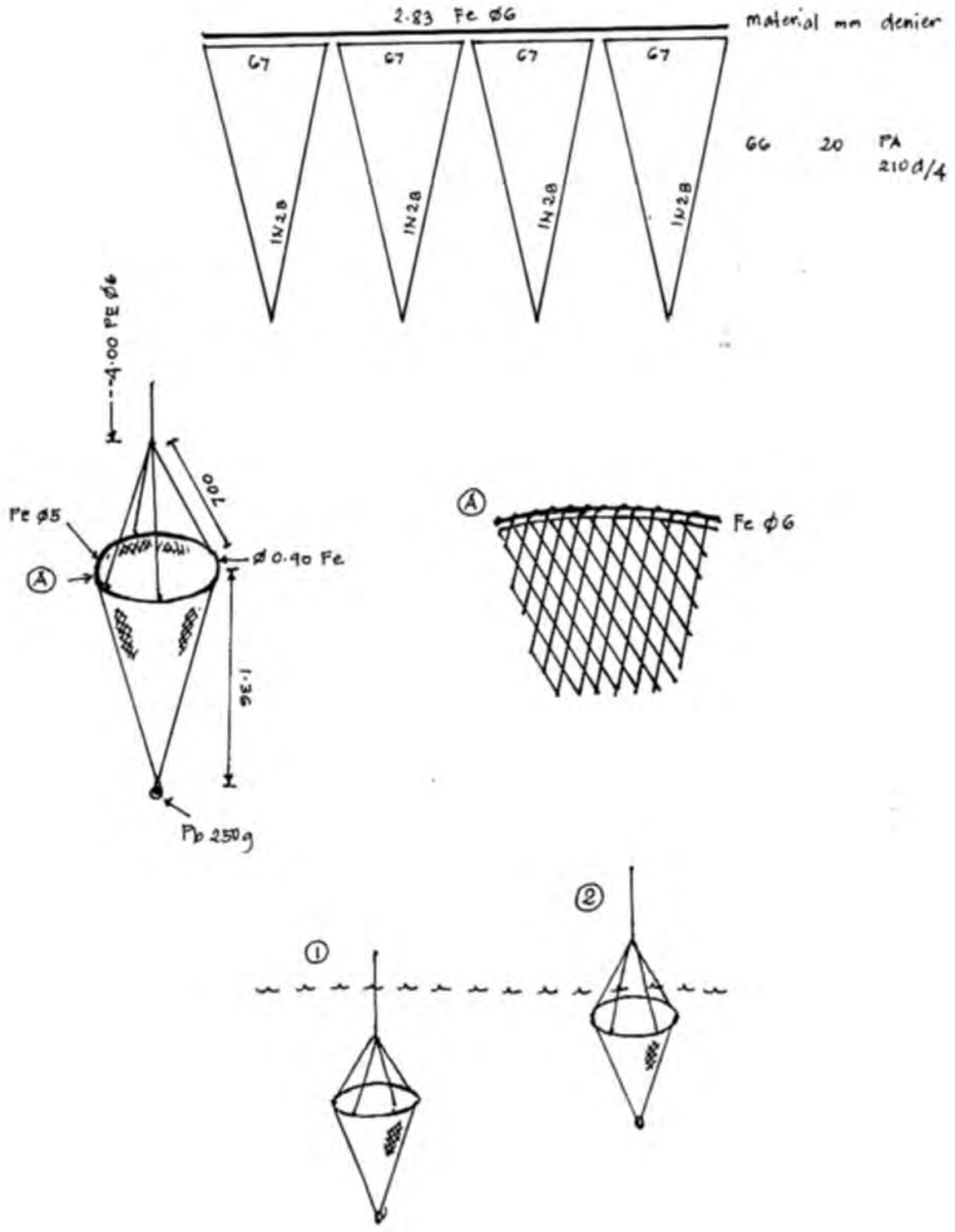
3. FISHING GEAR DESIGN AND CONSTRUCTION

Crab lift net

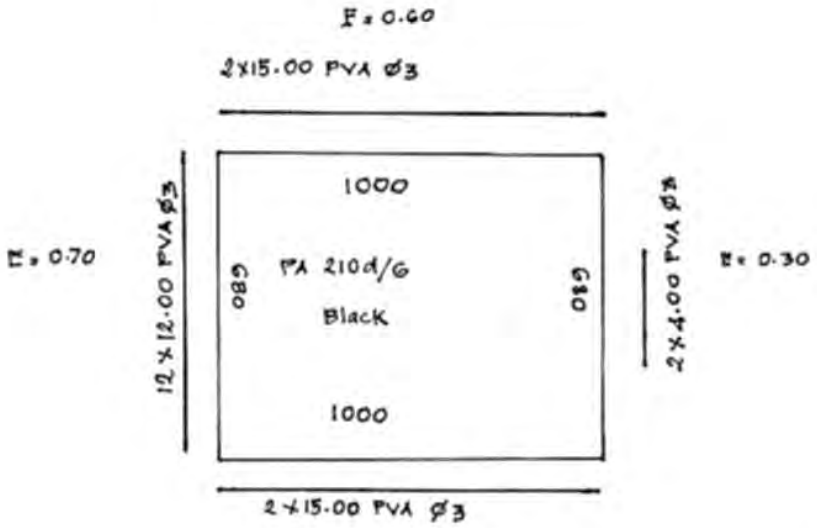


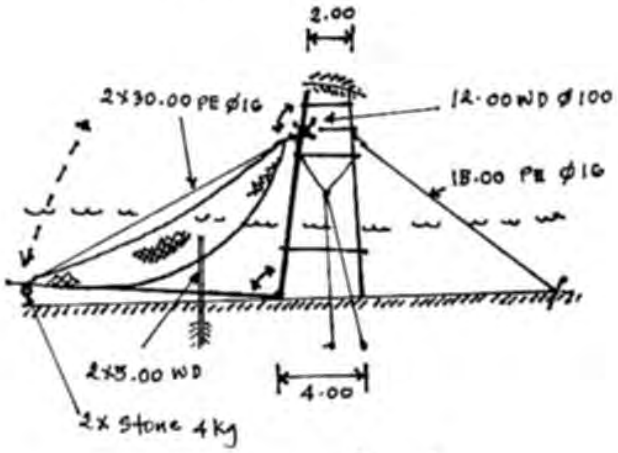


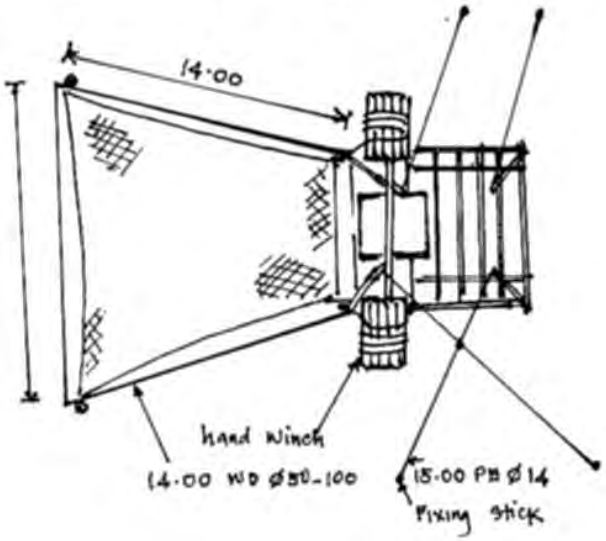
Fish lift net



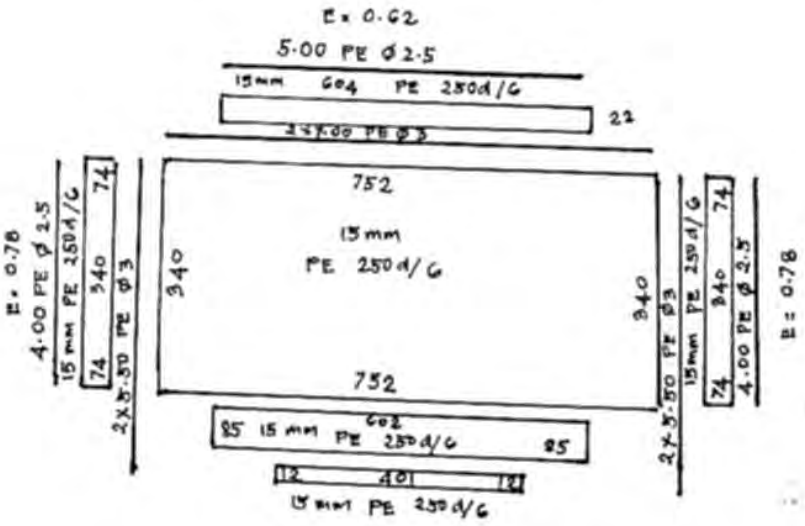
Stationary lift net for mullet

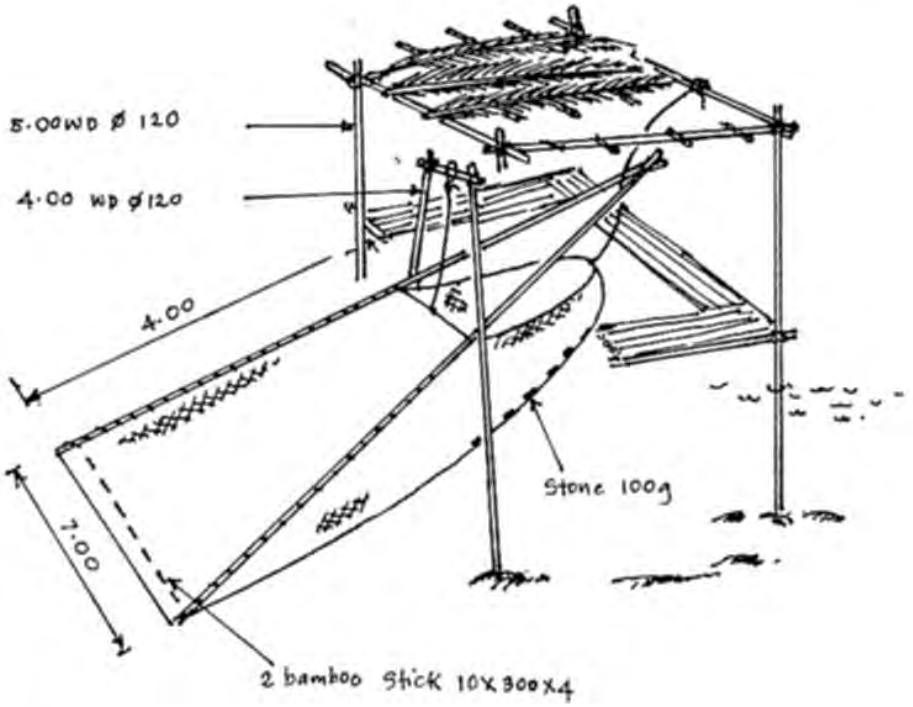


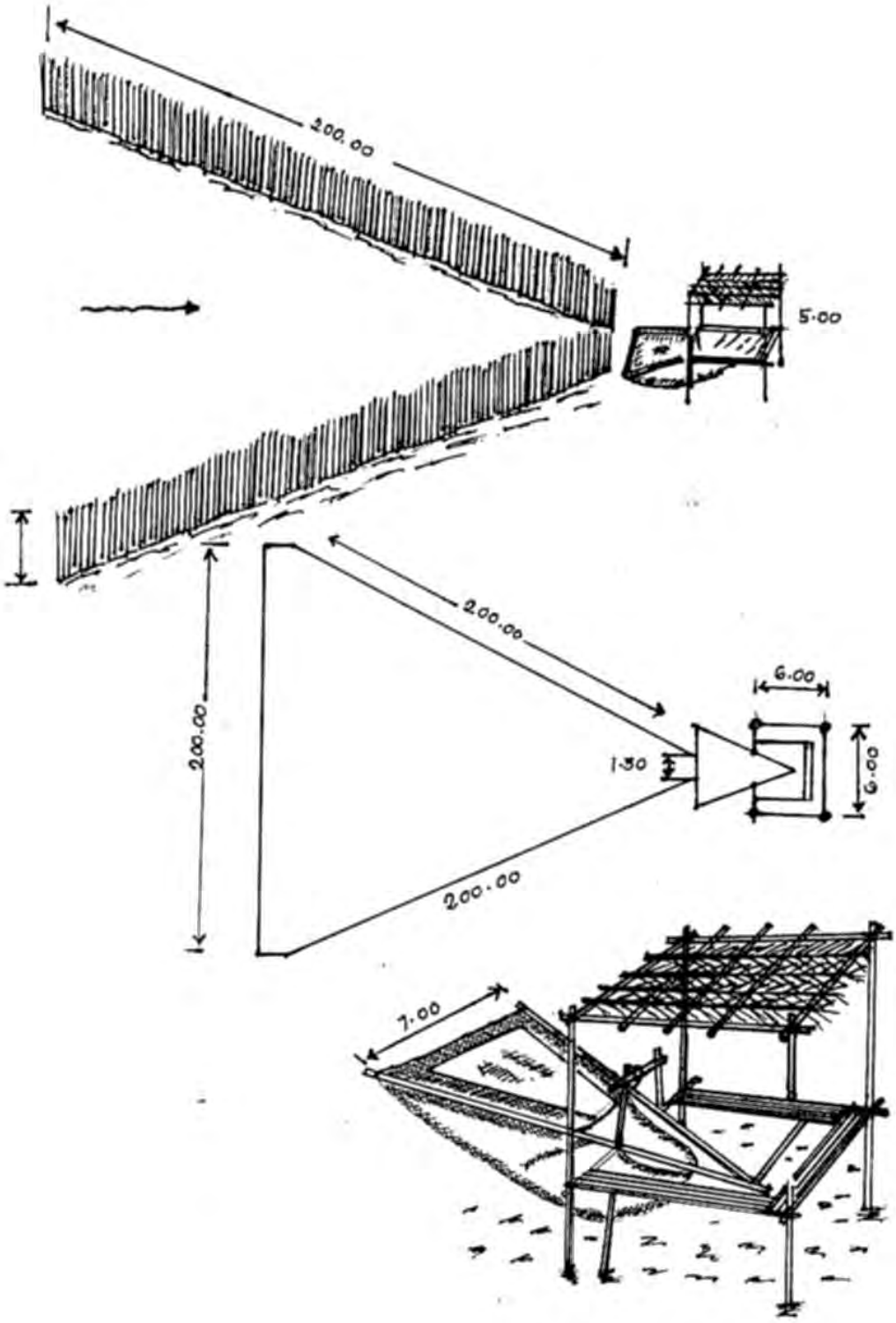




Stationary lift net per shrimp



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DESIGN OF STICK-HELD DIP NET

- Factors to be considered in designing a stick-held dip net

- Behaviour of fish :

Before designing the net, it is necessary to know the behaviour of fish. For example, some fishes such as mackerel pike, anchovy and squid are easily attracted around the boat by the fish lamp illumination. These fishes are caught with the stick-held dip net using fish luring lamp in the night-time.

On the other hand, mackerel and horse mackerel can be attracted around the boat with the aid of bait. The fish are caught with the stick-held dip net using bait in the daytime.

The shape of the net is slightly different for night-time and daytime operation.

- Condition of the fishing boat :

As mentioned previously, many types of fishing boats are used for operation of the stick-held dip net. Therefore, it is necessary to know the condition of the fishing boats, in particular size of the boat, size of the engine, number of fishermen, equipmenes on board etc.

The size of the net should be decided by the condition of the fishing boat.

- Effective length of the boat :

Two bamboo poles are used for the purpose of stretching the net during operation. One bamboo pole projects from the bow side and the other one projects from the stem side.

Therefor, the boat should be long enough to allow fo rthe proper distance between the poles.

About 80 percent of the boat length is usually considered as the effective length of the boat.

- Shape of the net :

The shape of the net can be square, rectangular and trapezoid. The appropriate shape should be chosen by taking into consideration the type of boat and the behaviour of fish.

- Material of the net :

It is very important factor to select the best materials of which the net and ropes are made. The success or failure of the stick-held dip net depends on whether the net can withstand the influence of sea current and wind and keep a proper required shape in water during operation. The net is operated many times in a day or night. This means that the net is taken up on board and thrown out into the sea whenever the operation is done.

Therefore, the material of the net and rope should have the following properties.

1) High breaking strength,

2) High abrasion resistance,

3) High density (specific gravity),

4) Low price.

The materials which satisfy these requirements best are the following synthetic fibers:

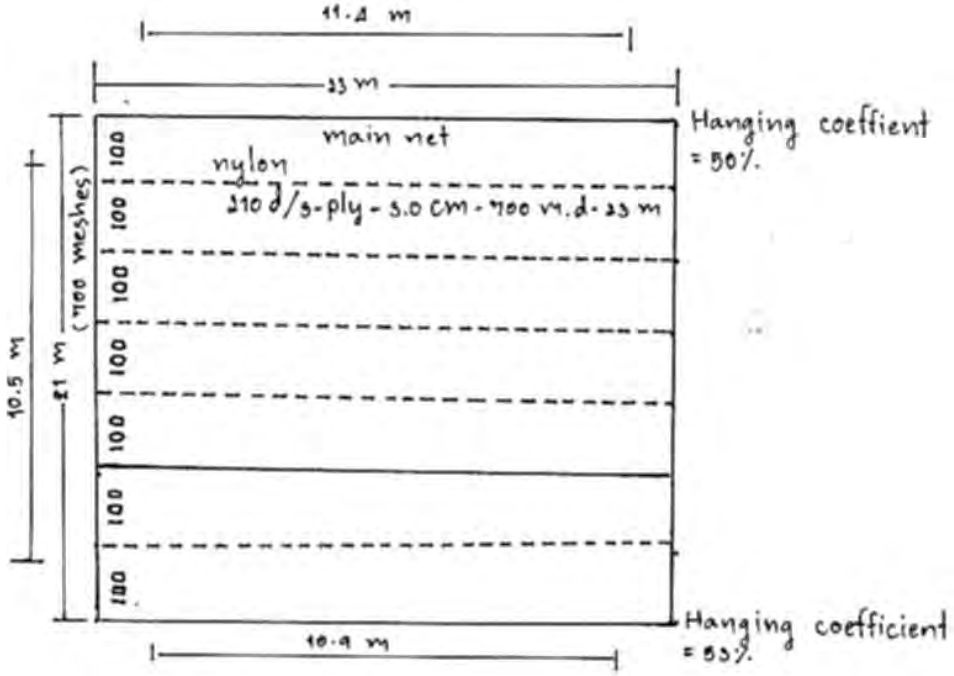
1) Nylon (Polyamide),

2) Vinylon (Polyvinyl alcohol),

3) Saran (Polyvinylidene chloride) and nylon mix twisted fiber,

Size of the netting twine and the rope and accessories should be selected with particular regard to the size of the net and boat and the target fish.

Design diagram of stick-held dip net

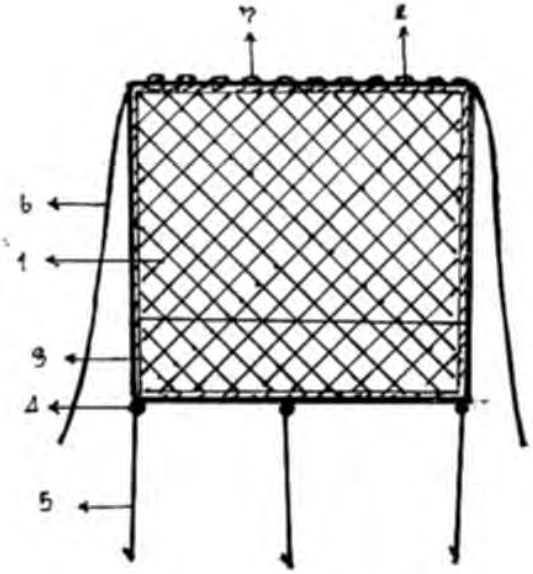


Particulars of stick-held dip net (Pulling type)

1.	Main net	nylon 210^{d}/3-ply-3. 0cm-700cm. d.-32 meters	1 p' ce
2.	Side line	vinylon 4mm dia S & Z twist 2 lines	43.3 m
3.	Lift line	" " Z twist 3 line	30 m each
4.	Line for pull-ing of the net	polyethylene 12mm dia 2 line	40 m each
6.	Sinker	lead 5^{kg}/p' ce	3 p' cs
6.	Float	synthetic rubber, float type 185 x 38 x 27mm	57 p' cs
7.	Bamboo pole	10.5cm (outer dia) 15 meters	2 poles
8.	Block	iron	2 p' cs

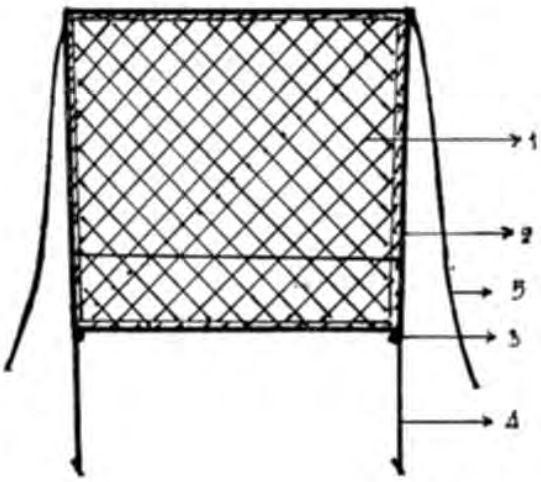
Construction of Stick-held dip net

Pulling type net



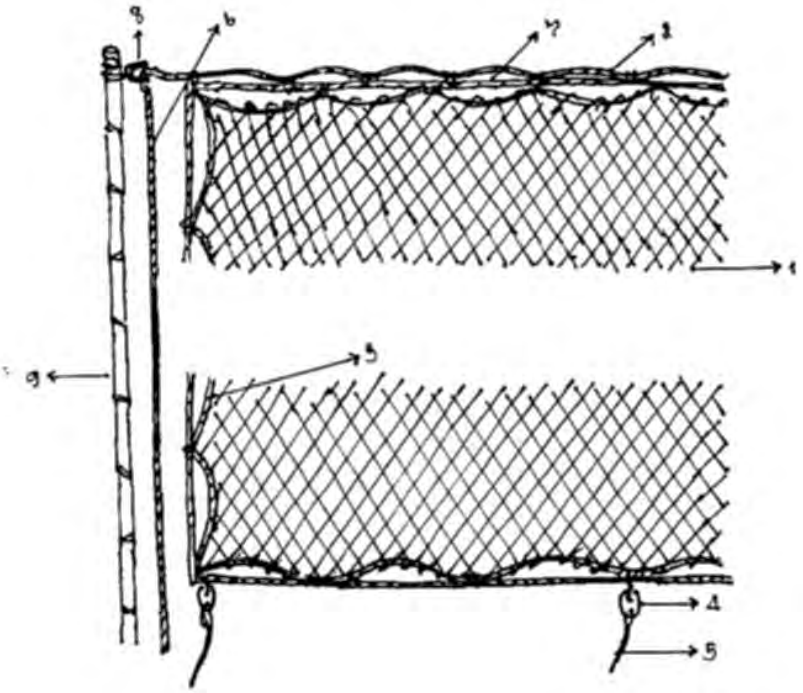
1. Main net
2. Float line
3. Side line
4. Sinker
5. Lift line
6. Line for pulling of the net
7. Float

Pushing type net



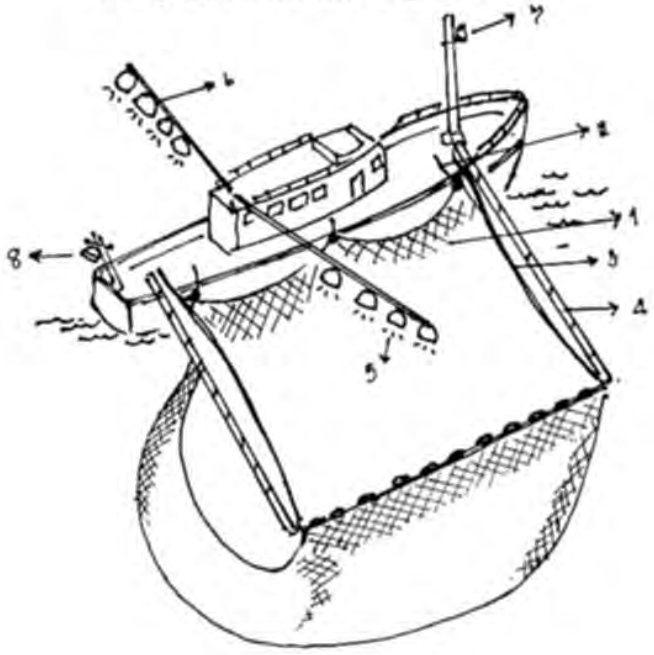
1. Main net
2. Side line
3. Sinker
4. Lift line
5. Line for pushing of the net

Constrction of stick-held dip net



1. Main net
2. Float line
3. Side line
4. Sinker
5. Lift line
6. Line for pulling or Pushing of the net
7. Float
8. Block
9. Bamboo pole

Pulling type stick-held dip net



1. Main net
2. Lift line
3. Line for Pulling of the net
4. Bamboo pole
5. Luring lamp (Starboard side)
6. Luring lamp (Port side)
7. Luring lamp (Bow side)
8. Luring lamp (Stern side)

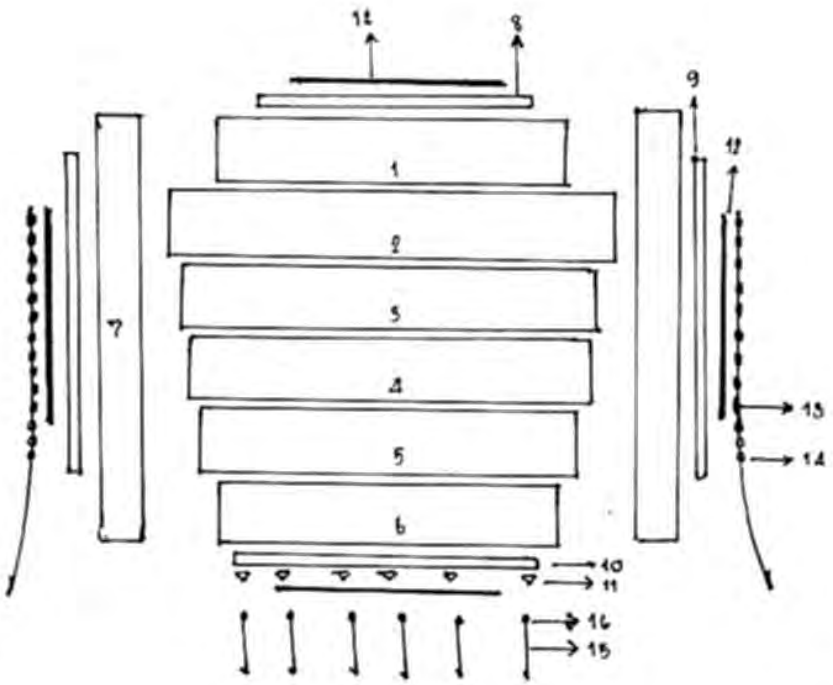


Fig. 1. Detailed of the net

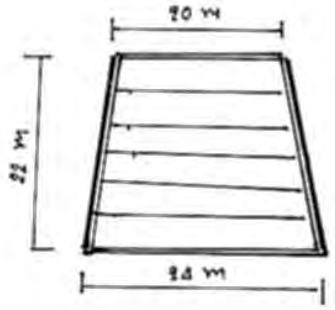


Fig. 2. View pt the completed net

Stick-held dip net

Scale : 10 m : 1.2 cm

Particulars

No.	Name	Twite	Size ot mesh	No. of mesh	Length	No. of sheet
1	End (1)	SN/12	2.2 cm	100	7.5 m	18
2	End (2)	SN/12	2.2 "	"	"	23
3	Main 3rd	SN/9	2.2 "	"	"	22
4	Main 4th	"	"	"	"	21
5	Main 5th	"	"	"	"	20
6	Main 6th	"	"	"	"	19
7	Side net	SN/12	"	"	3.7 m	20 x 2
8	Selvedce	SN/24	3.5 cm	10	30 m	1
9	"	"	"	"	34 m	1 x 2
10	"	"	"	"	31 m	1
11	Triancle	SN/45	5.0 cm	1 ~ 10		6
12	Side line	Vinylon 10m/m dia S & Z				88 m
13	Float	Synthetic 7 x 2½" x 1½"				5 x 2
14	Ring	2" cir. lom/m dia				6 x 2
15	Lift line	Vinylon 12m/m dia 60 m				6 lines
16	Sinker	Lead Big size 20 kg . . . 2 P' cs				
		" " 15 kg . . . 4 "				
		Small size 100 g. . . . 100 "				

SN . . . . . Saran nylon mixed twine.

Squid Stick-Held Dip Net

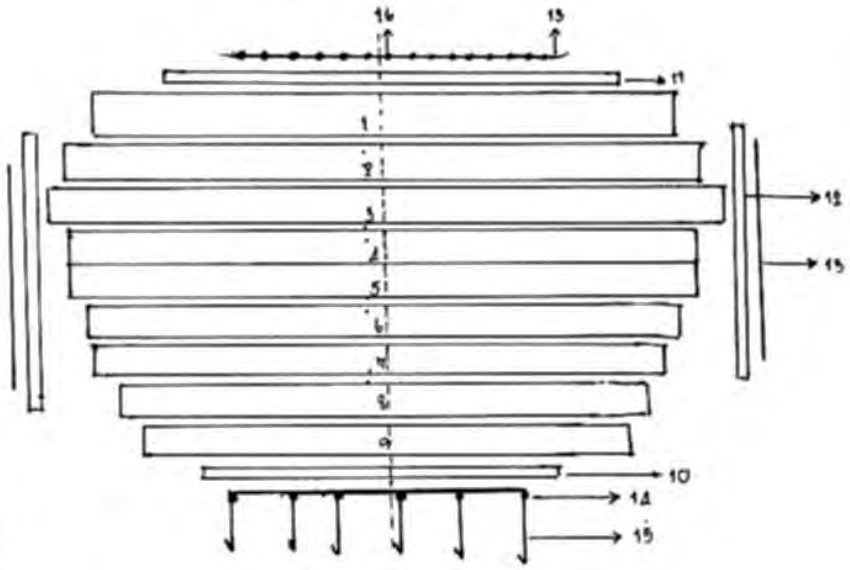


Fig. 1. Detailed of the net

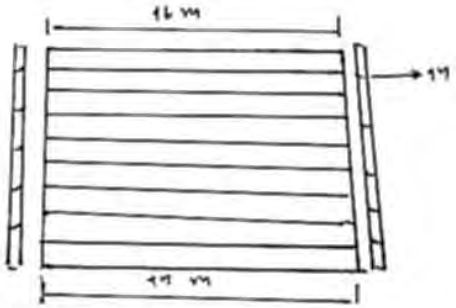


Fig. 2. size of completed net
scale 1 : 180

Particulars

No.	Name	Twite	Size ot mesh	No. of mesh	Length	No. of sheet
1	End (1)	210d/4	2.5 cm	100	35 m	1
2	End (2)	"	"	"	39 m	1
3	Main 3rd	"	"	"	40 m	1
4	Main 4th	"	"	"	39 m	1
5	Main 5th	"	"	"	38 m	1
6	Main 6th	"	"	"	37 m	1
7	Main 7th	"	"	"	36 m	1
8	Main 8th	"	"	"	34 m	1
9	Main 9th	"	"	"	33 m	1
10	Selvedge	210d/6	3 cm	6	25 m	1
11	Selvedge	"	"	"	26 m	1
12	Selvedge	"	"	"	16 m	1
13	Side line	Vinylon 6 mm dia			90 m	1 line
14	Sinkers	Lead 3 Kg x 4 pcs; 4 kg x 2 pcs				
15	Lift line	Vinylon 10 mm dia				6 pcs
16	Floats	7" x 2" dia (round)				90 pcs
17	Pole	Bamboo 10 m				2 pcs

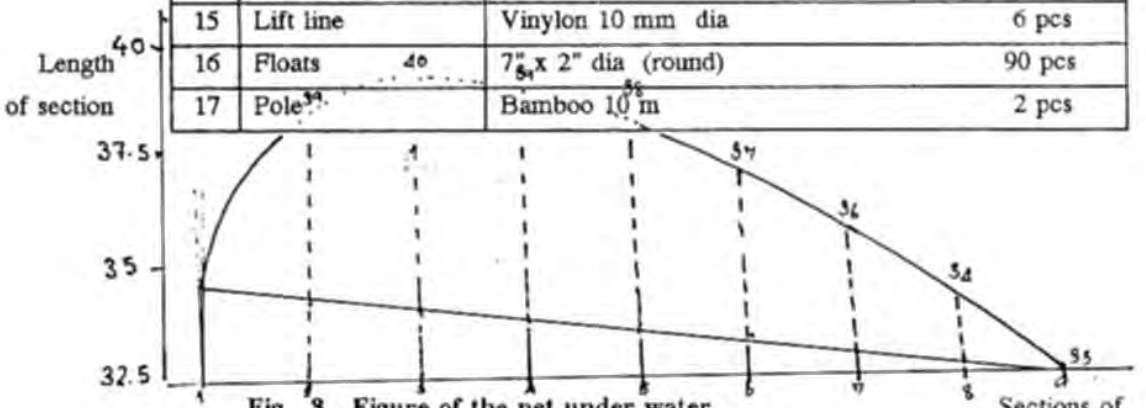


Fig. 3. Figure of the net under water
Scale 1 : 170

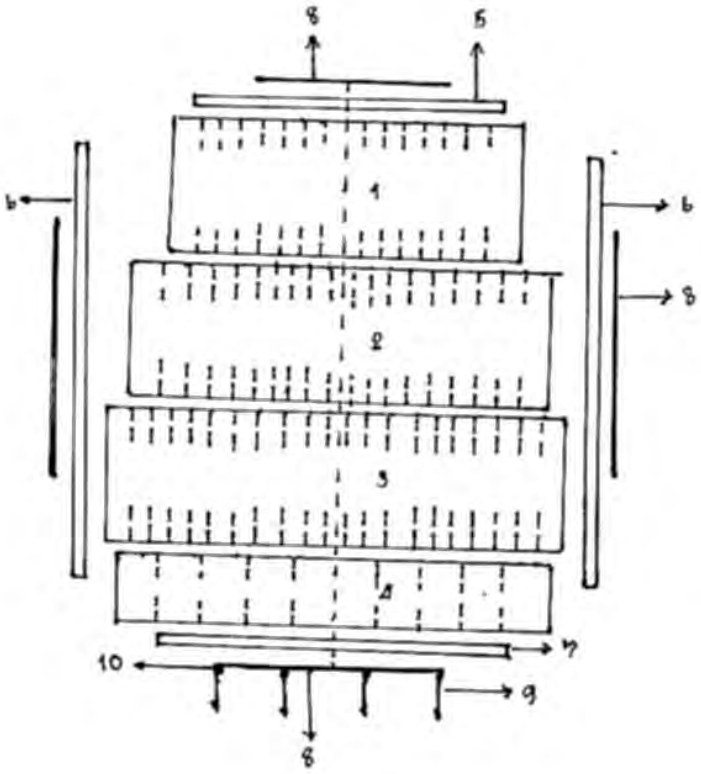


Fig. 1. Detailed of the net

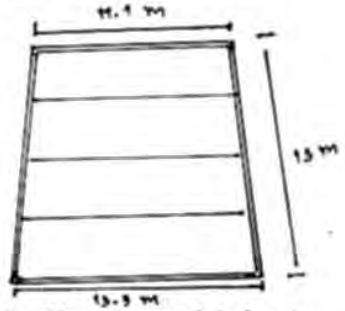


Fig. 2. Size of completed net

Sardine stick-held dip net

Scale : none

Particulars

No.	Name	Twite	Size ot mesh	No. of mesh	Length	No. of sheet
1	End	nylon 210d/4	1.2 cm	100	7.5 m	16
2	Main 1st	210d/4	1.2	100	7.5	19
3	Main 2nd	210d/4	1.2	100	7.5	21
4	Lower brim	210d/6	2.3	100	3.8	10
5	Upper vedge	210d/15	3.0	6	15.0	1
6	Sid vedge	210d/15	3.0	6	19.0	1 x 2
7	Lower vedge	210d/15	3.0	6	19.0	1
8	Sid line	Vinylon 6m/m dia S&Z			50.6 m	
9	Lift line	Vinylon 9m/m dia Z			40m x 4	
10	Sinker	Lead 7.5 Kg/ P' ce			4 P' cs	
11	Pole	Bamboo 6 ~ 7 cm dia			13 m	

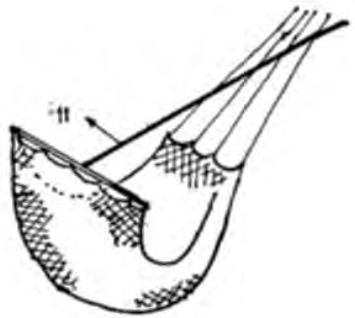
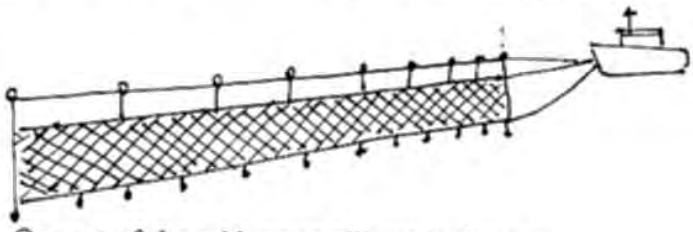


Fig. 3. Schematic view of the net

Operation method of stick-held dip net (Pulling type net)

1.

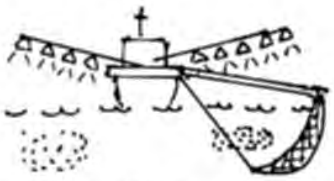


One set of the mid-water gill net is thrown out to the sea as a sea anchor

red colour lamp

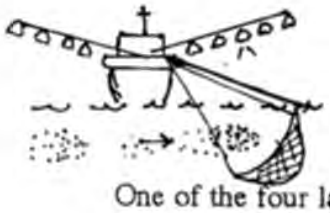
All fish luring lamps except the red colour lamp are switched on to attract the squid around the boat.

3.



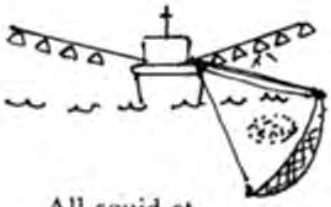
The squid are attracted around the boat after somme time. The net is set under water.

4.



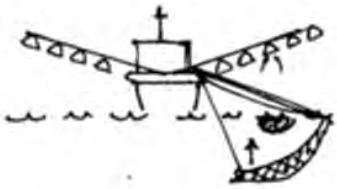
One of the four lamps on the starboard side is switched on.

5.



All squid attracted around the boat will then shift to the starboard side where the net is.

6.

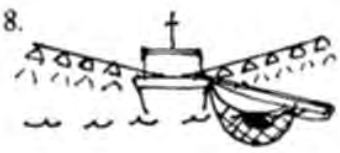


By reducing the illuminating power of the lamp, the squid are attracted to come up to the sea surface.

7.

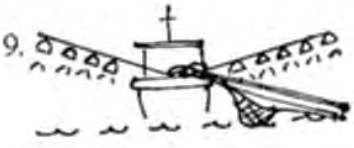
The net is quickly hauled by three fishermen.

8.



The boat is pulled to the boat side.

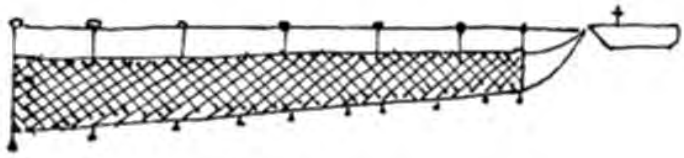
9.



The catch is hauled on board.

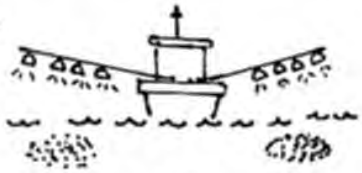
Operation method of stick-held dip net (Pushing type net)

1.



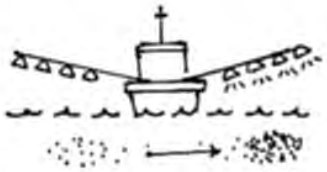
One set of the mid-water gill net is thrown out to the sea as a sea anchor

red colour lamp



All fish luring lamps except the red colour lamp are switched on to attract the squid around the boat.

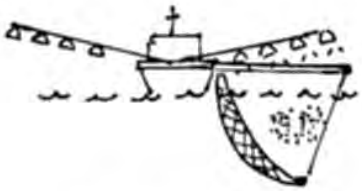
3.



Port side lamps and bow and stern side lamps are switched off.

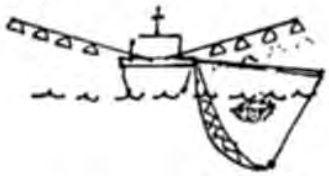
4.

All squid are attracted to the starboard side.



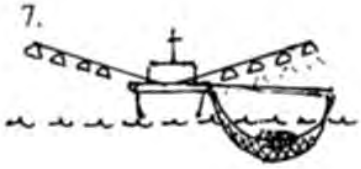
The net is set under the water.

6.



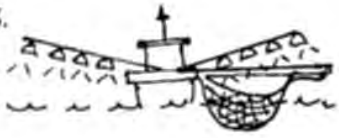
Only one lamp is left switched on and its illuminating power is reduced slowly. The squid com up to the surface.

7.



The net is pushed quickly by two fishermen.

8.



The net is pulled to the boat.
All fish lamps are switched on for next operation.

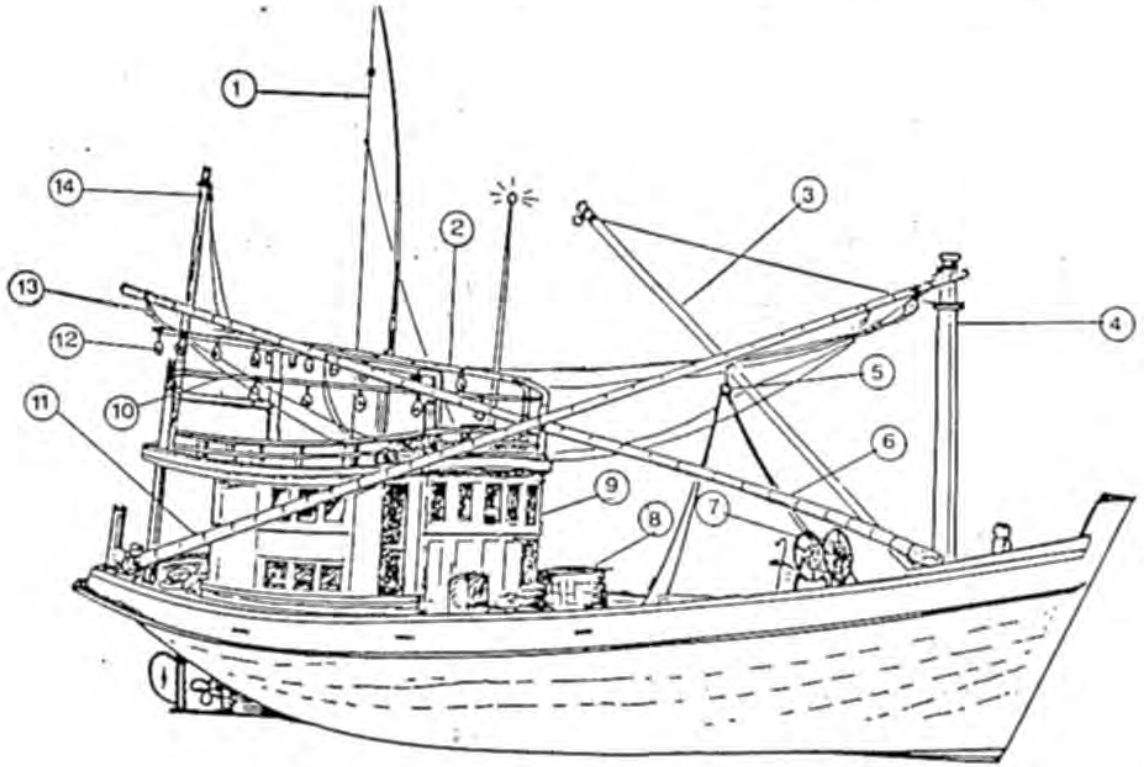
9.

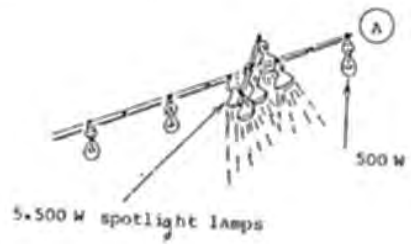
The catch hauled on board.

(4) Fishing boat for stick-held dip net

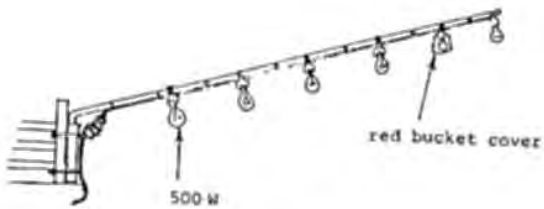
The fishing boat is made of wood. The boat is about 15 meters long and is equipped with engine 40-160HP and a generator of 10kw. power. Normally the boat has a crew of 2-8 fishermen.

1. Radio communication antenna
2. Port side attracting lamps boom
3. Fore derrick
4. Fore mast
5. Purse line block
6. Fore net boom
7. Purse line drum
8. Fresh water tank
9. Wheel house and accommodation
10. Stern attracting lamps boom
11. Stern net boom
12. Attracting lamp 500w
13. Top net-boom block
14. Stern mast





lamp for Anchovy



Lamps for Squid

Study Report

on

Knots and Splices

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1.0 Introduction

Rope is an important part for fishing gear from small one to big one. Rope is also necessary for use in ship and boat, such as tieing with anchor , another boat,etc.. Hence fishermen must have a thorough knowledge on how to tie and splice the rope.

Using the rope depends on the kind of rope and on purpose , how important is purpose, how much convenience and how much strength the user wants. Given below are some of the important knot types and splicing methods commonly used by fishermen I their trade.

2.0 Knots

2.1 Reef Knot

Reef knot is used for joining two ropes together. It is easy to tie and becomes more tight whrn pulled making it difficult it untie.

2.1 Sheet Bend

Sheet bend is used for joining two ropes of different sized together. It is easy to tie, but on pulling can easily untie.

2.3 Double Carrick Bend

This is used joining two ropes of same size together. It is used for work that requires strength. It is not so easy in tieing and untieing.

2.4 Round Turn and Two Half Hitches

This is used for temporary tieing in rush time. It is easy to tie and untie and is mostly used to to tie with boat ring, column or pole. this knot is firm and do not slip.

2.5 Anchor Bent or Fisherman's Bent

This is used for tieing with the anchor or ring that want firm tieing and is usually used for permanent tieing.

2.6 Clove Hitch

Clove hitch is easy and quick . It is used to tie with apole or stake when ship or boat come alongside in the port. Yhis knot is easy to untie when slackened and becomes tight when under strain.

2.7 Stopper Hitch and Roling Hitch

This is used to tie with stake or steel pole. This knot do not slip easily.

2.8 Bowline

This is a most useful way to form a loop in the end of the rope. Though simple in construction it never slips or jams. Even after severe tension has ben applied to , a simple push of the finger will loosen it enough to tie it.

3.0 Splices

The same kind and same size of rope can be joined together by splicing to make an even joint. This is used tom join purse line of purse seine net.

3.1 Short Splice

This is used to join the same size and samr kind of rope . The rope at the joint area will be larger. It is a very strong joint and is used for pulling purpose

3.2 Long Splice

This is used for big ropes of the same size. After completion of joining the joint area will not be bigger than the previous one

3.3 Back Splice

This is used for the end of the braided rope

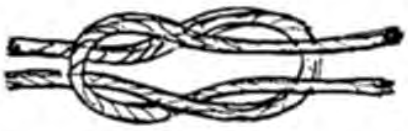
3.4 Eye splice

This is used for making an eye at the end of braided rope and is very strong. This kind of splice can be used for joining two kinds of ropes together by making loops.

4.0 References

John Corner (1989) Net Work Exercise Fishing News Books Ltd., Surrey England 57 p

Prado, J. (1990) Fisherman's Workbook Fishing News Books Ltd., Oxford, 180 p



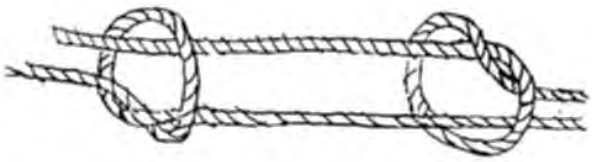
Reef knot

Figure of eight knot

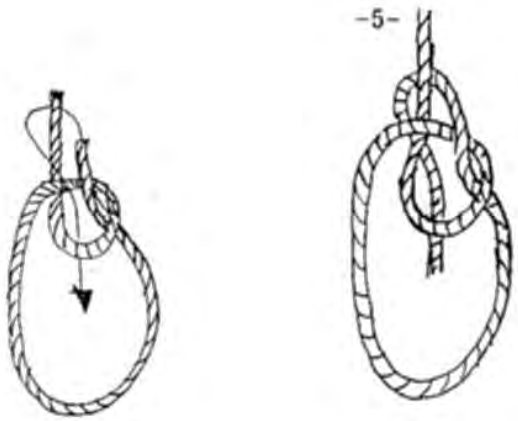
Round turn and
two half hitches

Fisherman's bend

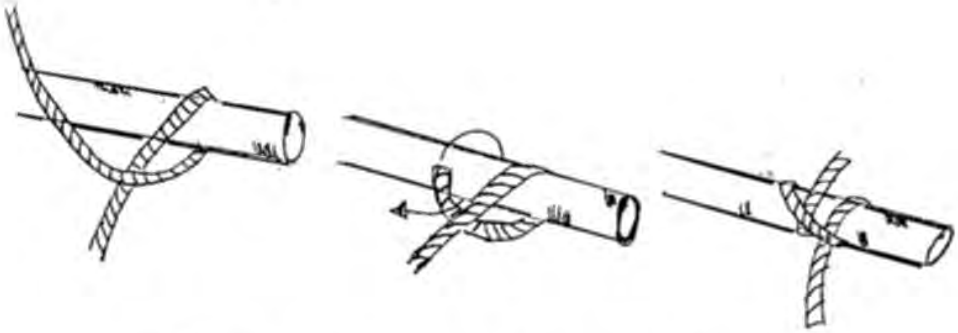
Sheet bend, double sheet bend



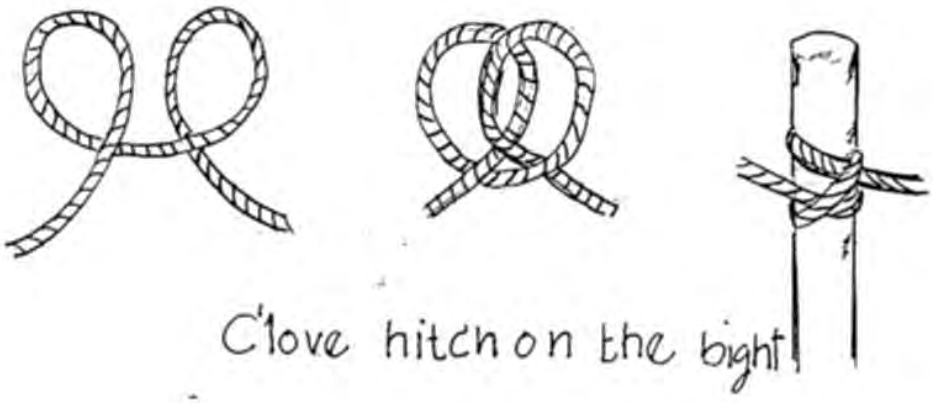
Fisherman's knot



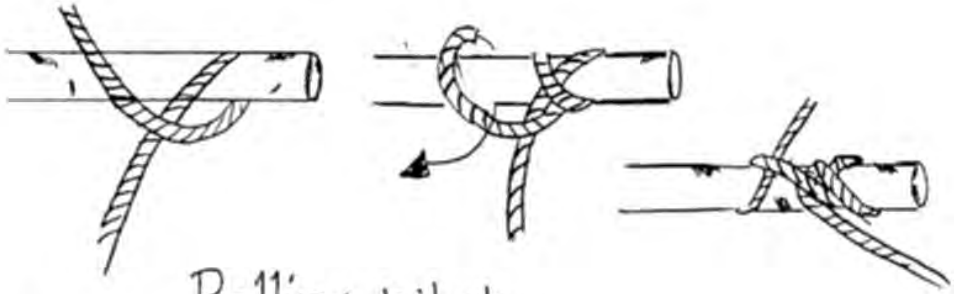
Bowline



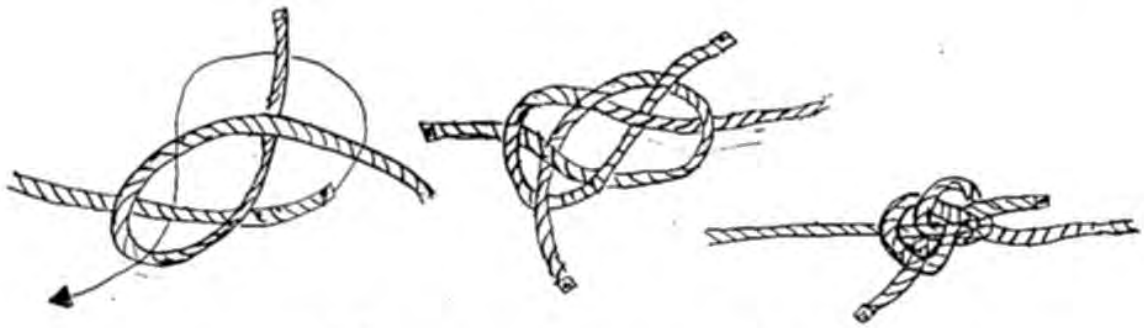
Clove hitch on the end



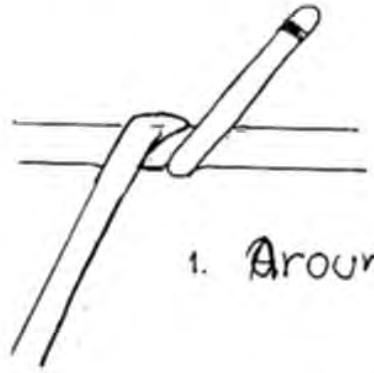
Clove hitch on the bight



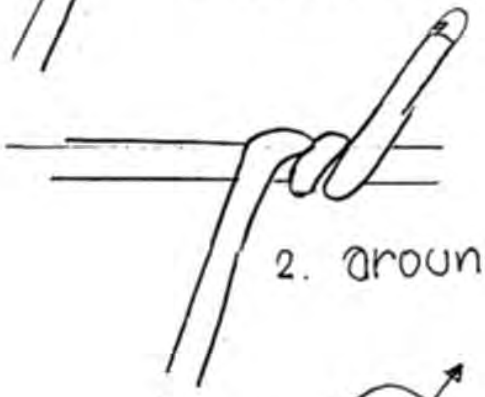
Rolling hitch.



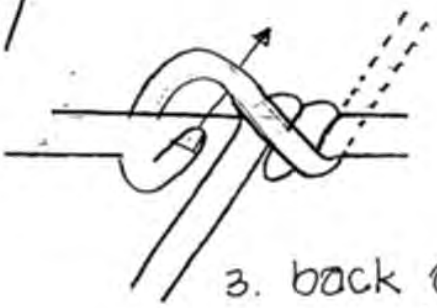
Double Carrick Bend



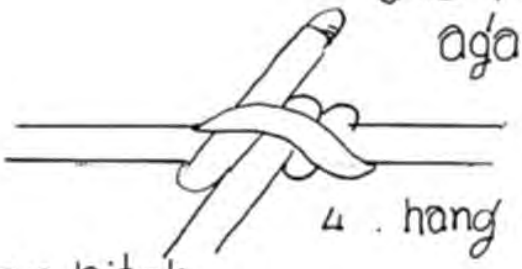
1. Around once



2. around again

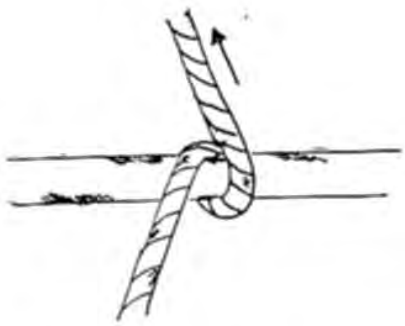


3. back across and round again

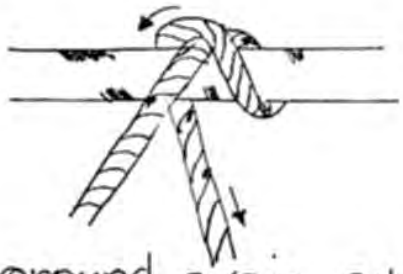


4. hang her off

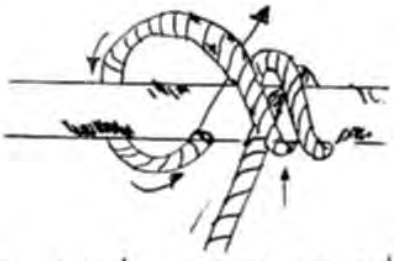
Stopper hitch.



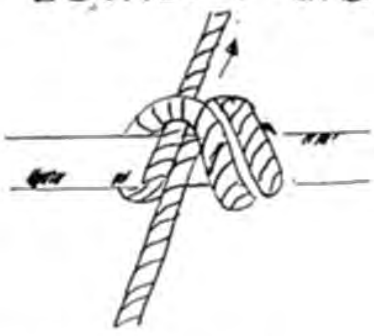
1 around once



2. around again across the other

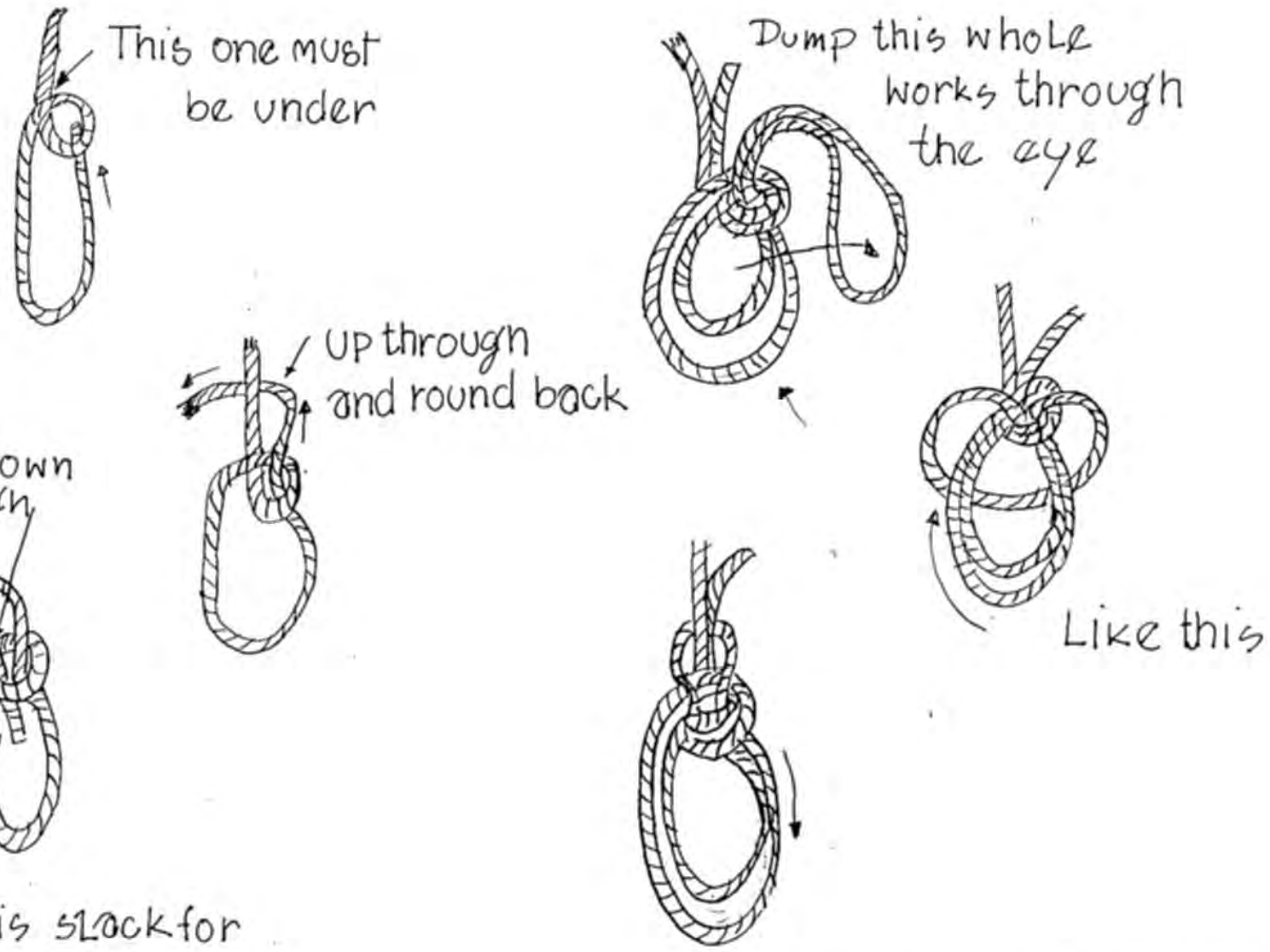


3 up between and round again

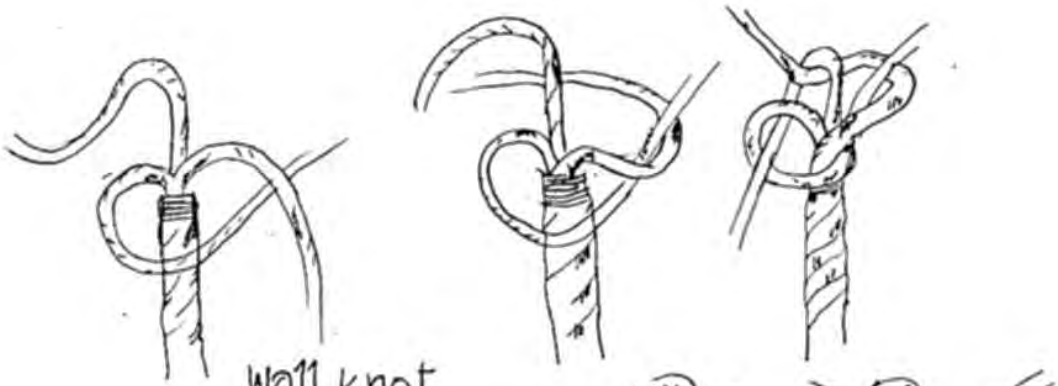


4. hang her off

Rolling hitch.

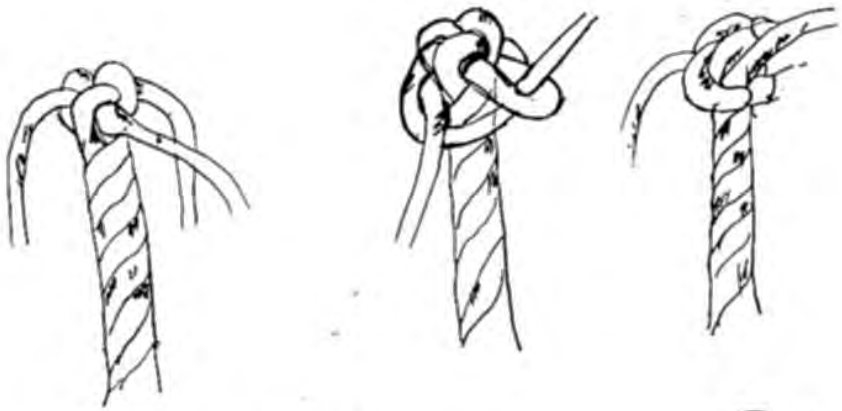


Tying a bowline

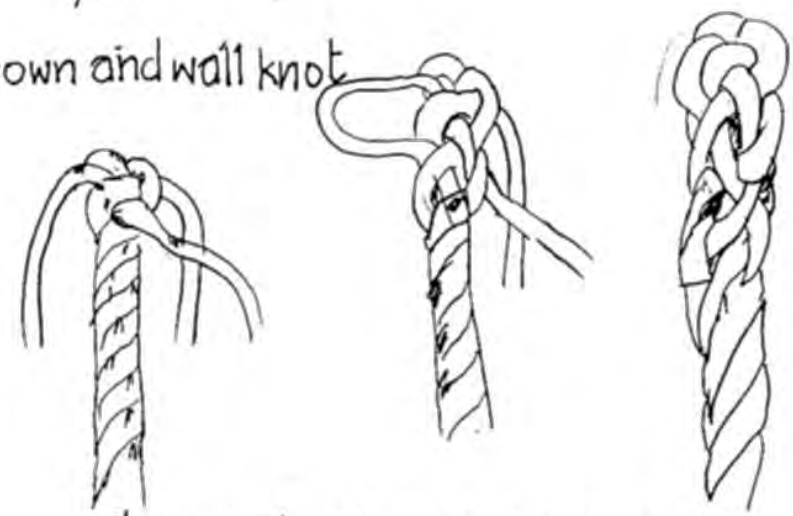


Wall knot

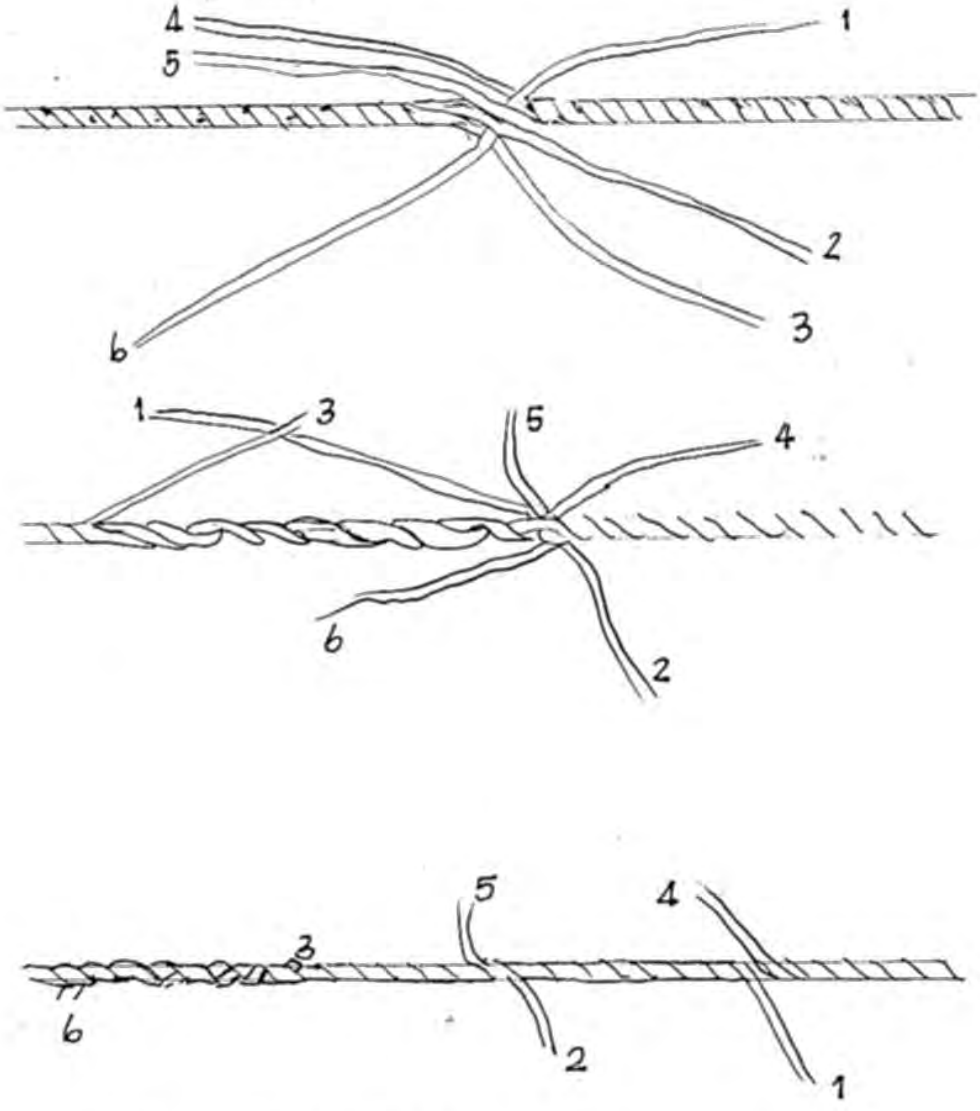
Crown knot



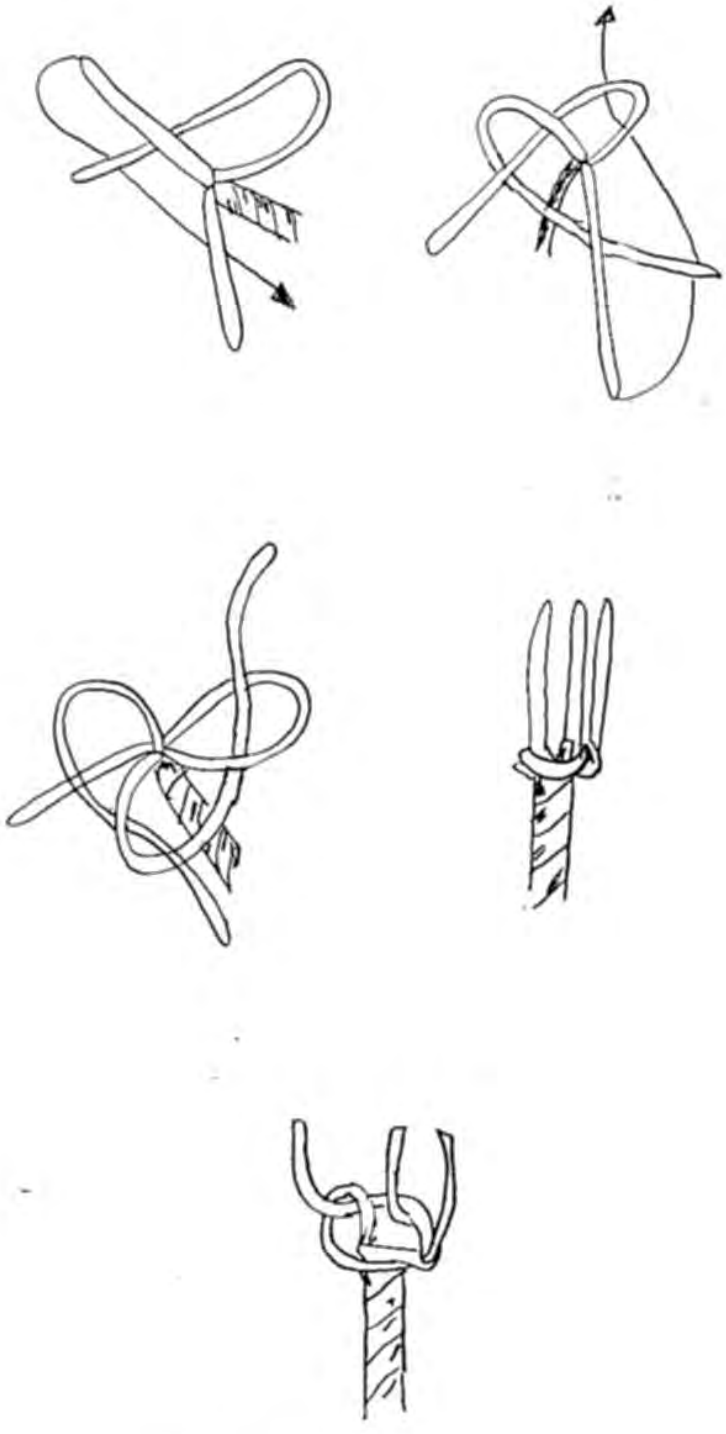
Crown and wall knot



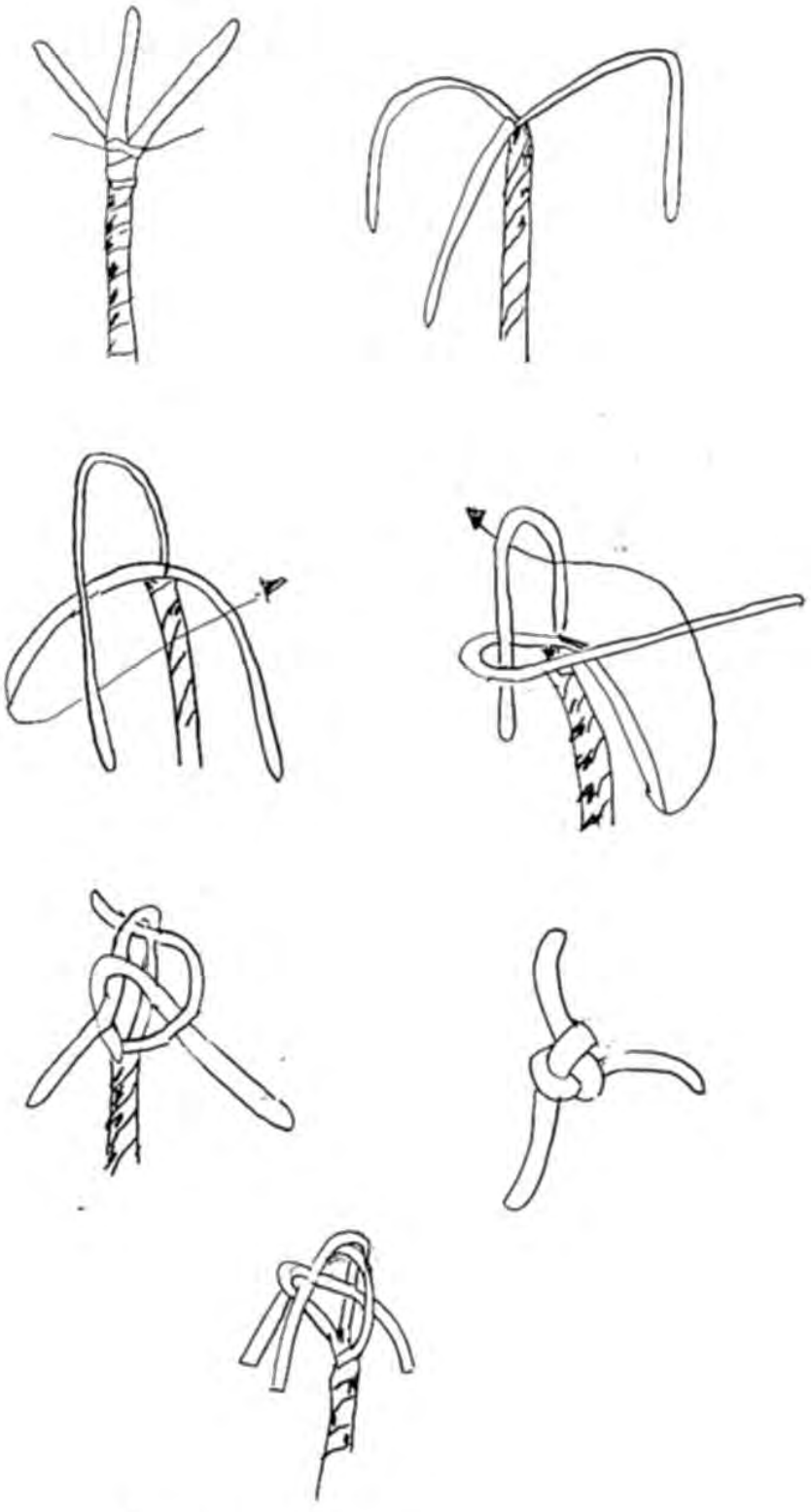
Crown knot and back splice



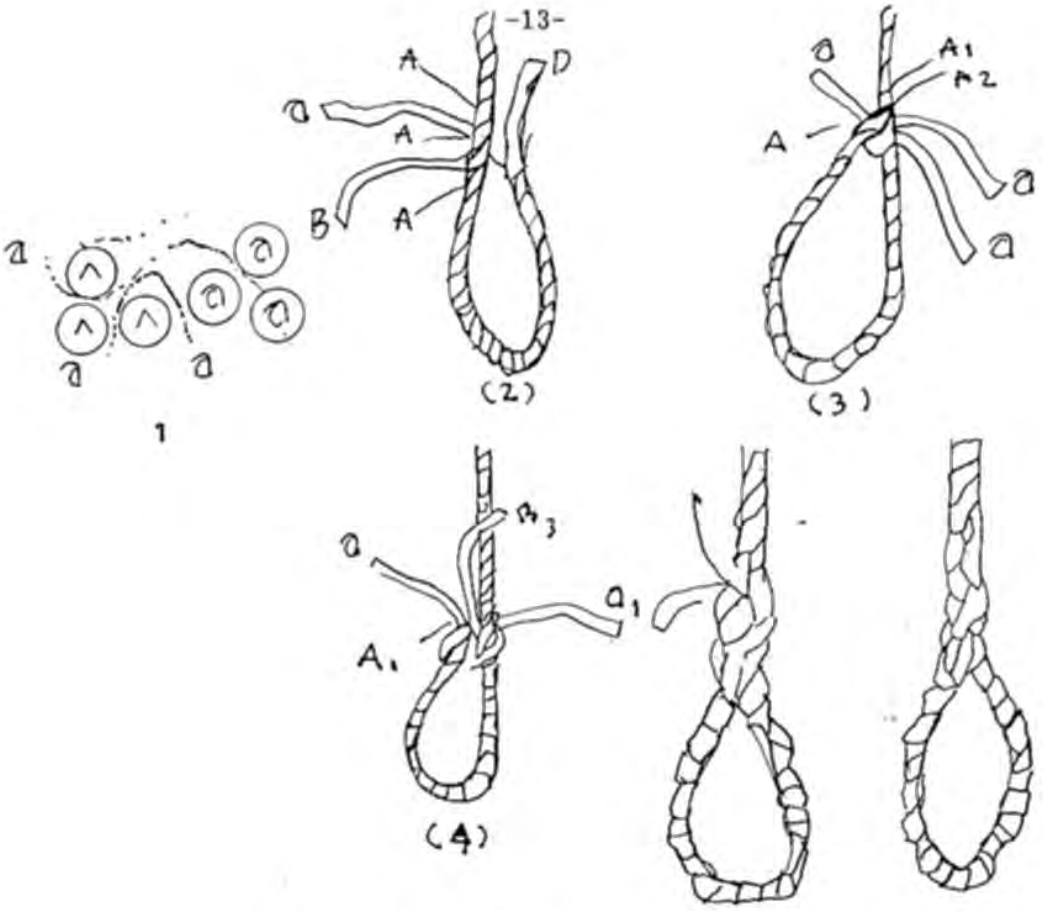
Long splice



Wall Knot



Crown knot



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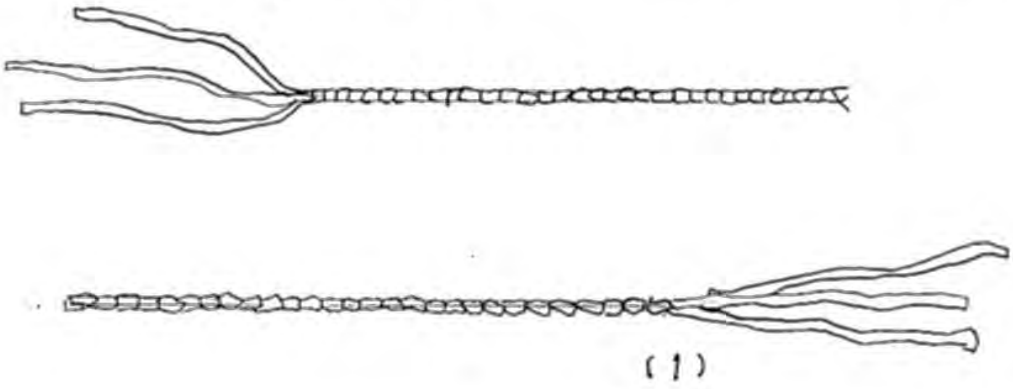
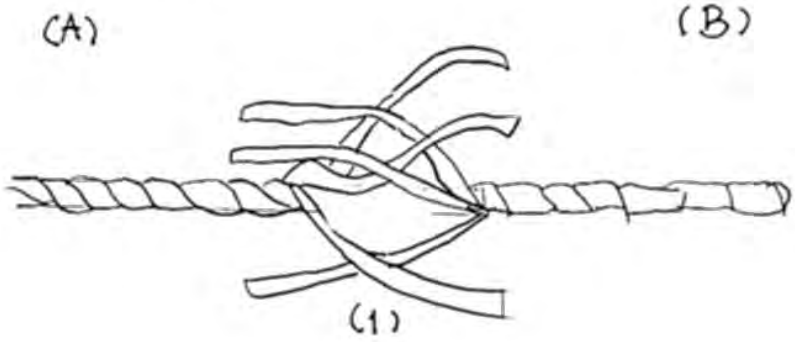
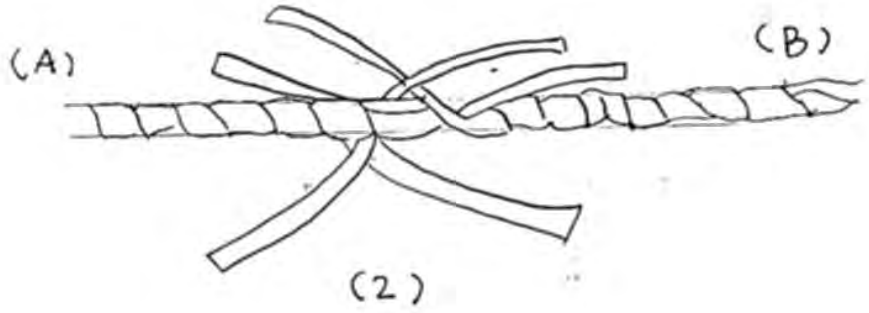
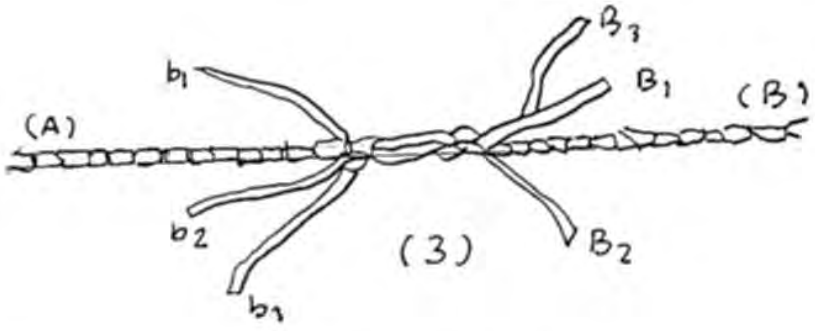
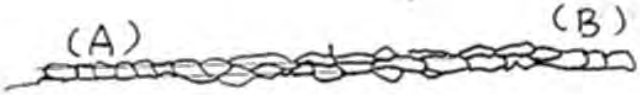


Short splice









Cut splice

STUDY REPORT

INTERPRETATION OF ECHO TRACES

BY

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SPECIAL TRAINEE

REGIONAL TRAINING COURSE ON
COMMERCIAL FISHING TECHNOLOGY
JUNE - DEC 1996

Acknowledgments

First of all I wish to thank SEAFDEC/TD and Training Division to give me a great opportunity to get a lot of knowledge here, Dr. Yuttana Theparoonrat who introduce me to a complicated world of Hydroacoustic equipment and also lent me a lot of good books, Mr. Aussanee Munprasit who transmitted useful experience with skill and patience on M.V.PLATOO and M.V.PLAUNG, Thanks to Mr. Boopendranath who advised and explained about the echo traces, Ship Division for kindful to let me using modern copy machine. And unforgettable, special thanks to special friend who word-processed all of this report.

Contents

Introduction

From old days, fisherman used to utilize their own naked eyes went to look for fish shoals at the sea. Nowadays, the manufacturing industry has rapidly developed, fisherman can also take advantage of the gear of the industry for fish detection. In present-days effective method to detect fish under water depends on using hydroacoustic equipment. Echosounder is one of effective gear. The principal on which echosounder works is that the instruments transmit acoustic pulses of a very high frequency and receive and record the echoes from any objects which these sound signals strike. Generally the biggest echo receive is from sea-bed, but if fish or shoals of fish or even a layer of microorganisms are located in the way of the signal, they also will return as an echo. These echoes are recorded on paper by an electric stylus pen, or watched on color monitor, and also can recorded on video tape if necessary.

The paper display of echosounder is an ordinary type in use audit produces a trace of the sea-bed with darker and tighter shading according to the hard or soft of sea-bed.

The color monitor display also shows the depth of the water. Color will be represented indicator that can tell how hard or soft of the bottom or sea-bed or how much density of fish shoal.

In this report will basic explain about characteristics of echogram or echo trace in interesting topics that important, related to the fisheries and fishing operation.

1. Echo traces from the fish

1.1 Single fish

Early experiment on fish target strength showed the swimbladder in responsible for returning more than 50% of the echo signal, although it form only 5% of fish volume. By average, the swimbladder lies at angle of 4° down to the head to tail direction; for adult fish it is about 0.4 times the body length and about 0.24 times the body width. Fig. 1A, 1B, 1C show diagrammatically the directional pattern for swimbladder, the fish body and combination of two responses.

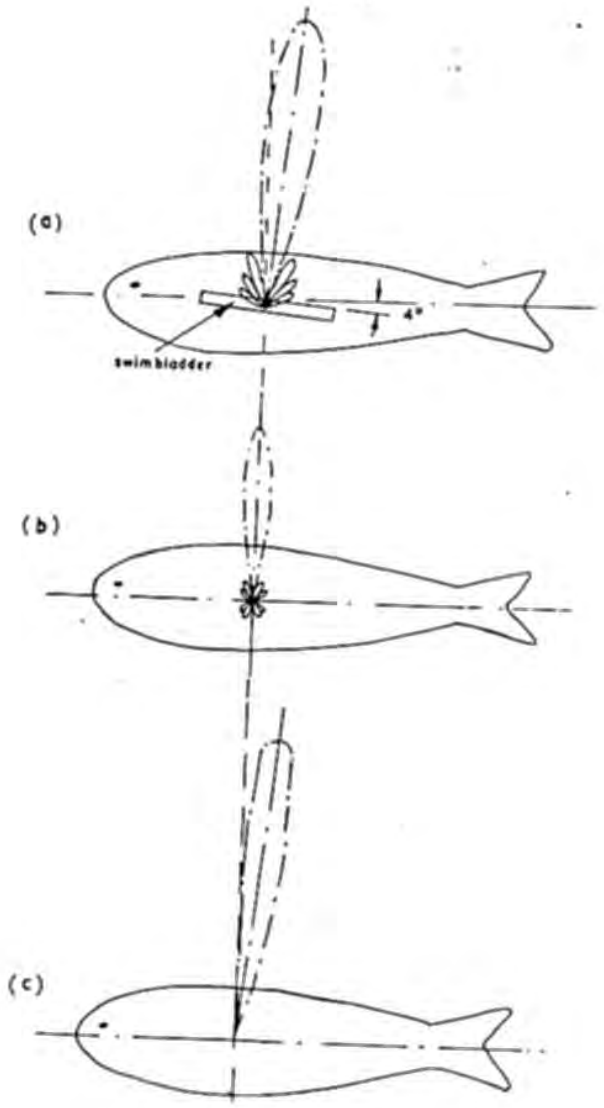


Fig. 1 Diagram of separate responses due to parts of the fish
(a) swimbladder
(b) body without swimbladder
(c) combination of the two responses, (a and b)

According to fish swimbladder vary in size and shape depend on many factors, such as species, age, sex, etc. of fish.

Observation at sea have shown that for equal size (length) of two fish at about the same depth. Coalfish produce a smaller number of echoes as they pass through the echosounder beam than do cod. That's mean echo traces can only estimate size of fish. We can not know exactly size of fish by echo traces.

If fish swimming or ship moving while echosounder transmitting the signal. Echo traces of single fish will be in form of "Hyperbolic" or "Inverted V" or "fingernail". Consider a fish swimming at constant depth on a diameter track across the cone of the sound beam. Its range decreases from its point of entry in to the beam until it reaches the axis of the beam and from there its range increases to the point of exit: Easily explanation shown by diagram in Fig. 2.

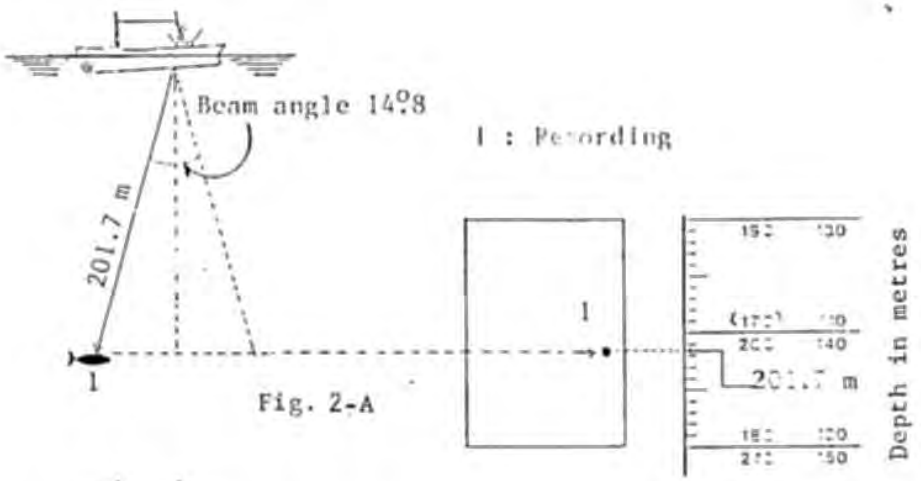


Fig. 2-A

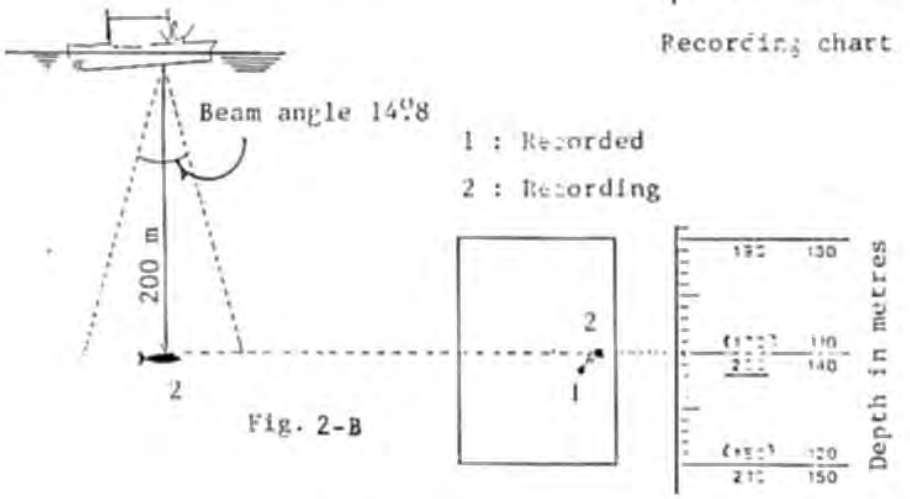


Fig. 2-B

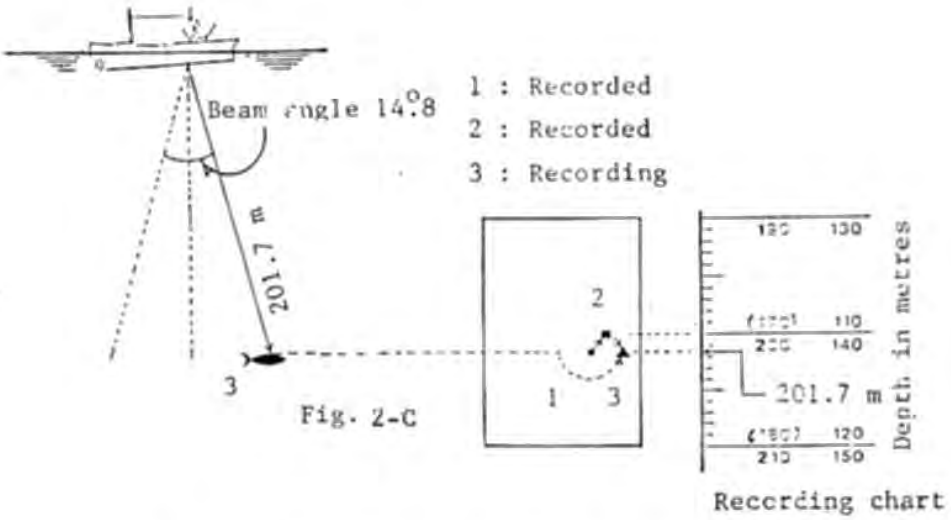


Fig. 2 The cause of "hyperbolic" echo traces from individual fish.

In Fig. 2-A the fish reaches the extreme-left side of the sounding beam the fishfinder's first record trace of tuna is at a depth of 201.7 metres. Next the fish is beneath the fishfinder (Fig. 2-B) and, the recorded depth of the fish is 200 metres, shallower than 201.7 metres as shown in Fig. 2-A. Finally the fish will reach the extreme-right side echo trace at a depth of 201.7 metres.

Therefore, the echo trace will form a "hyperbolic" or "fingernail" trace on the recording chart as shown in Fig. 3.

Fig. 3 Shows traces of individual tuna.

Vertical movement of fish can be observed by echo traces. Diagram in Fig. 4-A shows the typical motion when tuna are migrating vertically towards the sea-bed following the deep scattering layer. This can be seen after sunrise or before dawn.

The diagram in Fig. 4-B shows tuna migrating vertically towards the surface synchronized with the moving of the scattering layer. This pattern can be seen after sunset or at twilight.

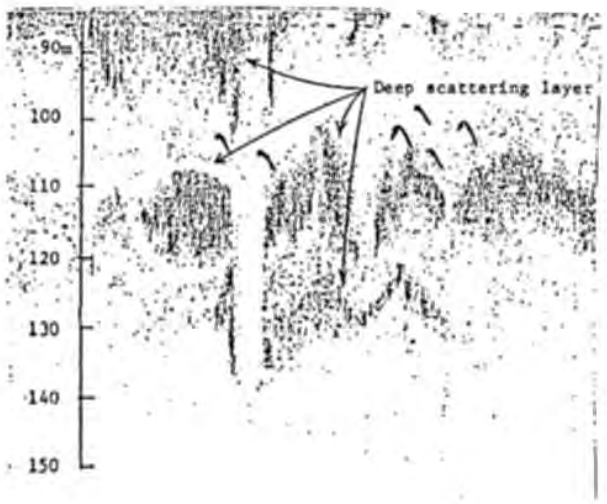


Fig. 4A

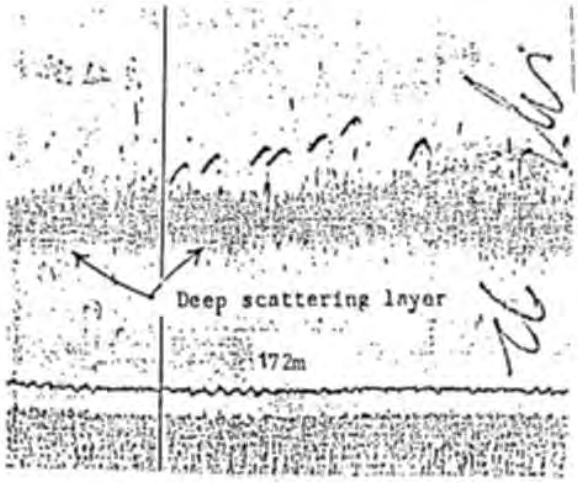


Fig. 4B

Fig. 4A, 4B show vertical migration of tuna, down to the sea-bed in Fig. 4A and upward to surface in Fig. 4B

Vertical movement also can be seen in cuttlefish and squid synchronized with the light. The echogram in Fig. 5A shows shoals of cuttle fish migrating vertically from sea-bed to mid-water after sunset. In Fig. 5B shows the shoal of cuttle squid move vertically from mid-water to sea-bed after sunrise record by 20 KHz fish finder.

Fig. 5A

Fig. 5B

Fig. 5A and 5B show vertical movement of cuttle fish.

Vertically movement of fish echo traces can be explained by the Fig. 6A and 6B.

In Fig. 6A, when fish moving up towards to surface, reflection of echo waves will get shorter and shorter, echo traces that have been recorded will form

In Fig. 6B, fish migrating vertically down, reflection signals will be longer and longer. Echo traces will be like this

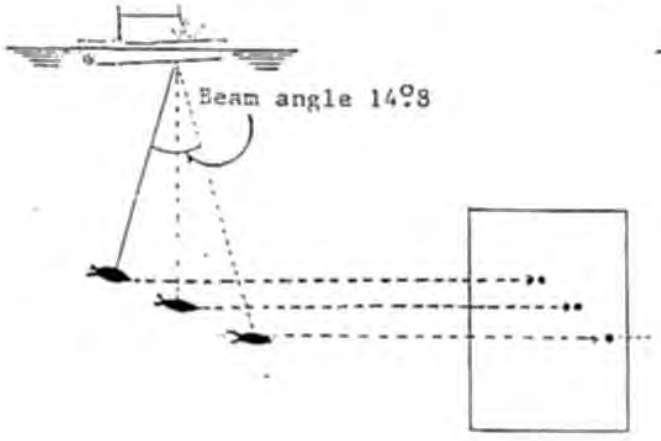


Fig.6A

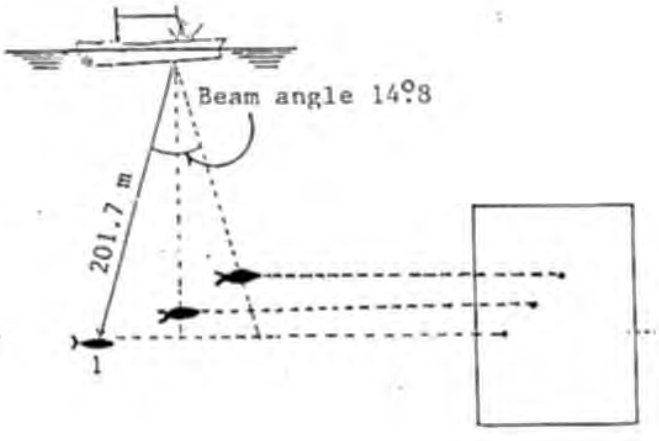


Fig.6B

Shoal echo traces

Fish shoals of different species vary in size seasonally. For example feeding shoals are small and rather active, where as spawning shoals may be large and inactive. Further, the animals live at different depth at different seasons; the arctic cod live at about 50-70 m. in the Vestfjord in northern Norway, where they sprawn, but at 200-300 m. on the edge of continental shelf off Bear Island, where they feed. Two of the major variables governing the shape of fish trace change considerably during a season. It might be expected that the variation within a fish species would be as great as that between species.

The physical extent of a shoal can usually be gauged by measuring the length of trace along the ship's track and to either side. In order to make the assessment of shoal size in terms of its dimension in the horizontal plane, a knowledge of ship's speed is needed. A trace lasting 1 minute at 10 knots is just over 300 m. in length, and 5 knots is only half as much.

Supposing a shoal is 300 m. long by 50 m. wide and is reasonably uniform in depth of 10 m. We can then calculate the volume of 150,000 m^3. This sort of calculation is extremely crude, but given practice and experience it can be useful. But in fact, the most significant is due to the fore/aft beam-width of the sounder and the extent of this effect can be seen in Fig. 7 using the same sample of 300 m. by 50 m. Shoal, we can see from Fig. 7 that if it were assumed to be at a mean depth of 20 m. the length and width would have each been over-estimated by 7 m. for 20° beam angle. But if the mean depth had been 80 m., and the beam angle is the same the over-estimated is 28 m., thus reducing the true volume of the shoal to 59,800 m^3. That's a very big difference.

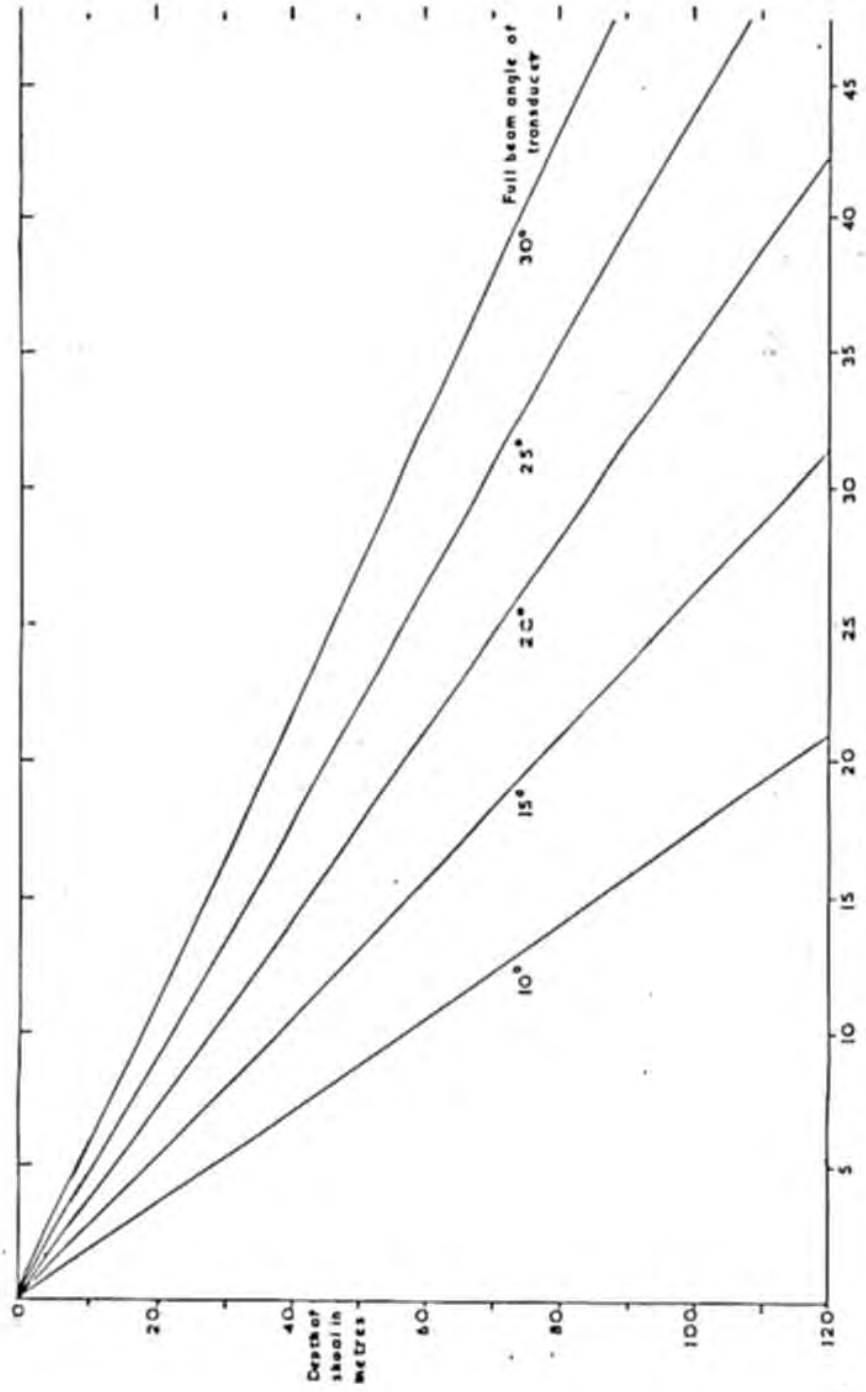
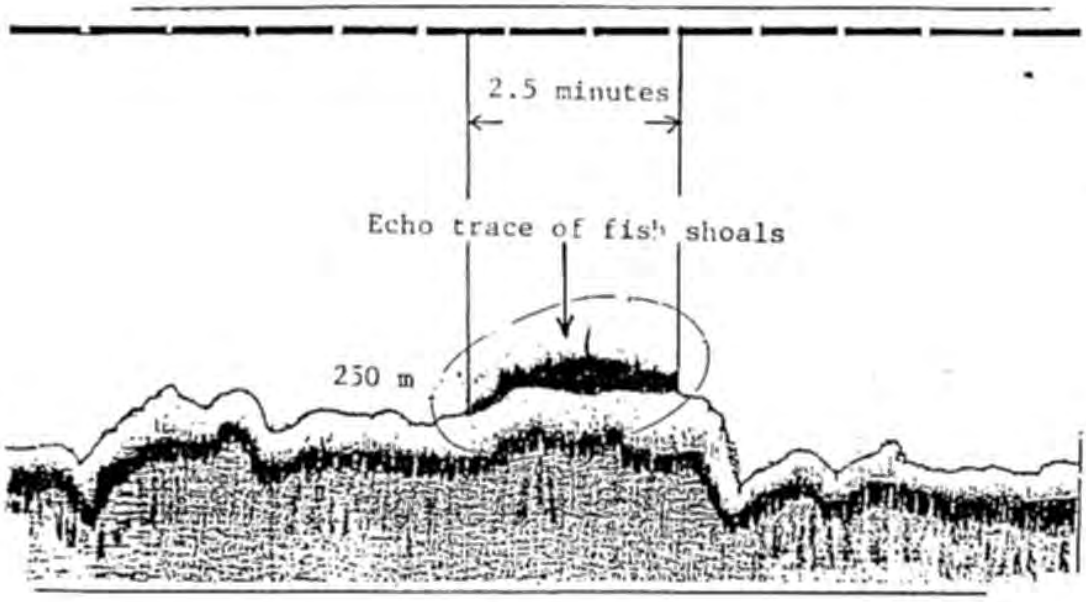


Fig. 7 Showing the extent to which the horizontal dimensions of a shoal may be overestimated for certain beam angles and depths.

The echogram in Fig. 8 shows a trace of fish shoals and its value of elapsed time as 2.5 minute (see the recording in Fig. 8) in a fishing ground off the East African Coast.



The echo traces density also vary by adjusting gain of different echo beam frequency. Fig. 9 show the same fish shoal but detected by different frequency of echosounder.

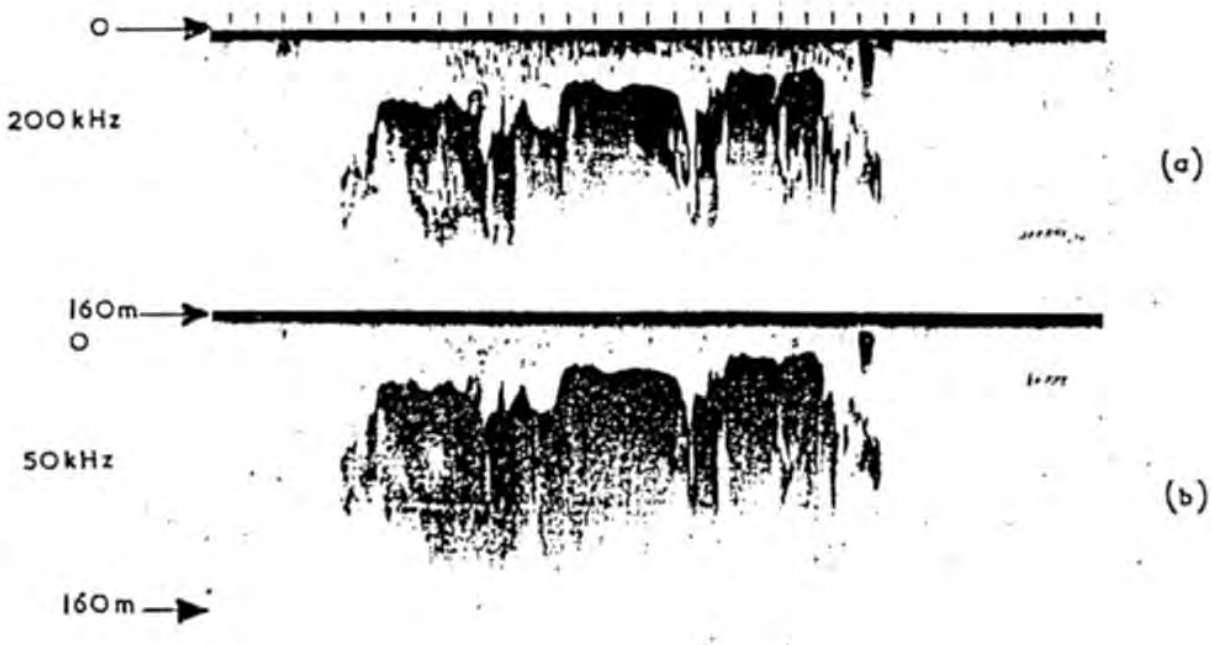


Fig. 9 Top trace 200 KHz ; lower trace 50 KHz . depth 0-160 m. Simultaneous recording of common mackerel shoals. Off the north-east coast of Japan.

Echo traces of sea-bed

The echosounder measures the true depth of the sea nearly correct. Error happens because of shape of the sound beam, like a cone shape. In Fig. 10 shows the cause of the sea-bed's reverberation (R) on recording. Length $\overline{SA}$ and $\overline{SC}$ are long or deeper than the length $\overline{SB}$, the shortest and it is the true depth of the water. So $\overline{SB}$ is recorded upper most on the trace and, $\overline{SA}$ and $\overline{SC}$ are recorded underneath the trace of $\overline{SB}$.

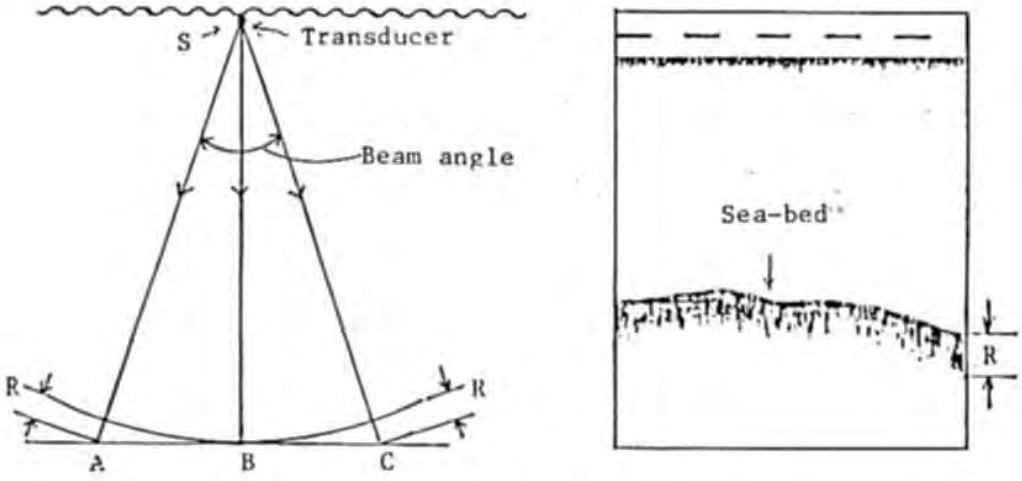


Fig. 10 Cause of sea-bed's reverberation.

Different of Bottom type presented in echogram in different characteristic. If frequency, pulse length and amplifier "GAIN" are stable and constant in value, a soft sea-bed like mud gives a shorter reverberation (tail), a harder one like rock shows a longer reverberation and a hard one like sand indicates a short reverberation recording as shown in Fig. 11A and Fig. 11B.

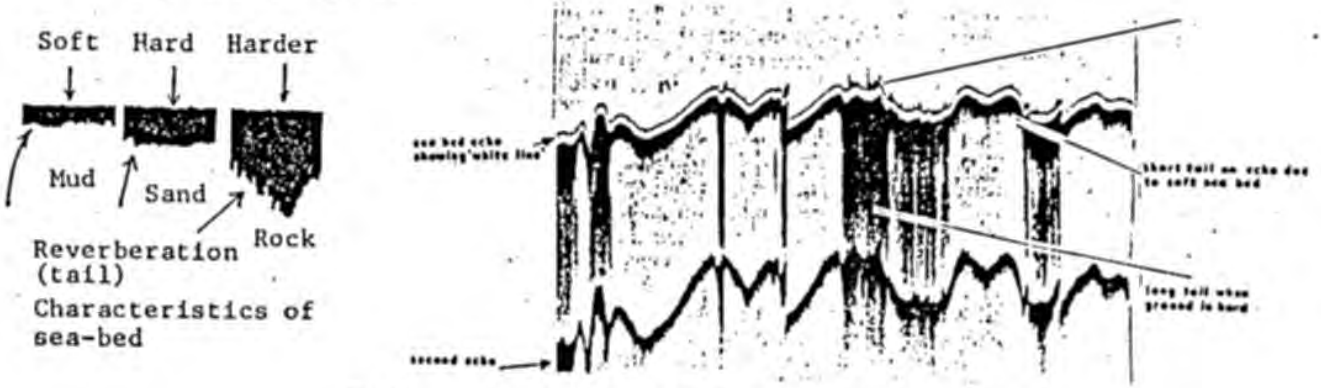


Fig. 11A and 11B Different reverberation from different sea bed

In opposite way, if the sea-bed is the same type but frequency, pulse length and amplifier (GAIN) are varied. Sea-bed echo traces that responding to frequency, pulse length and gain will be shown in difference as Fig. 12.

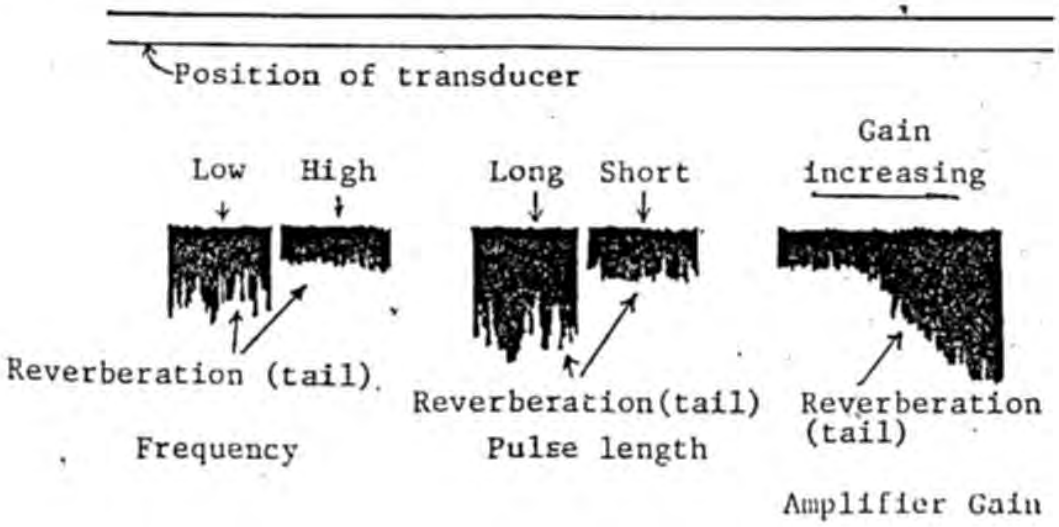


Fig.12 Different reverberation from different frequency

Second echo traces of sea-bed

Second echo traces of sea-bed will be presented when echosounder transmit signal in shallow water. First echo trace, which shows the true depth of water is from the first signal that reflected from the sea-bed. Some of reflecting beam still have enough power to reflect ship's hull bottom and go down to sea-bed then reflect sea-bed again and be received by the receiver. The display will shows second echo traces of sea-bed which has same characteristic and depth is double of first echo trace of sea-bed.

The diagram in Fig. 13 show how the second and third echo traces almost resemble the first echo trace (true sea-bed). In shallow water, the pulses are reflected a number of times between the sea-bed and ship's hull bottom. Recording 1 shows the first echo trace (true depth, 10 metres), Recording 2, first and second echo traces (false sea-bed, apparent depth 20 metres) and Recording 3, second and third traces (false sea-bed, apparent depth 30 metres).

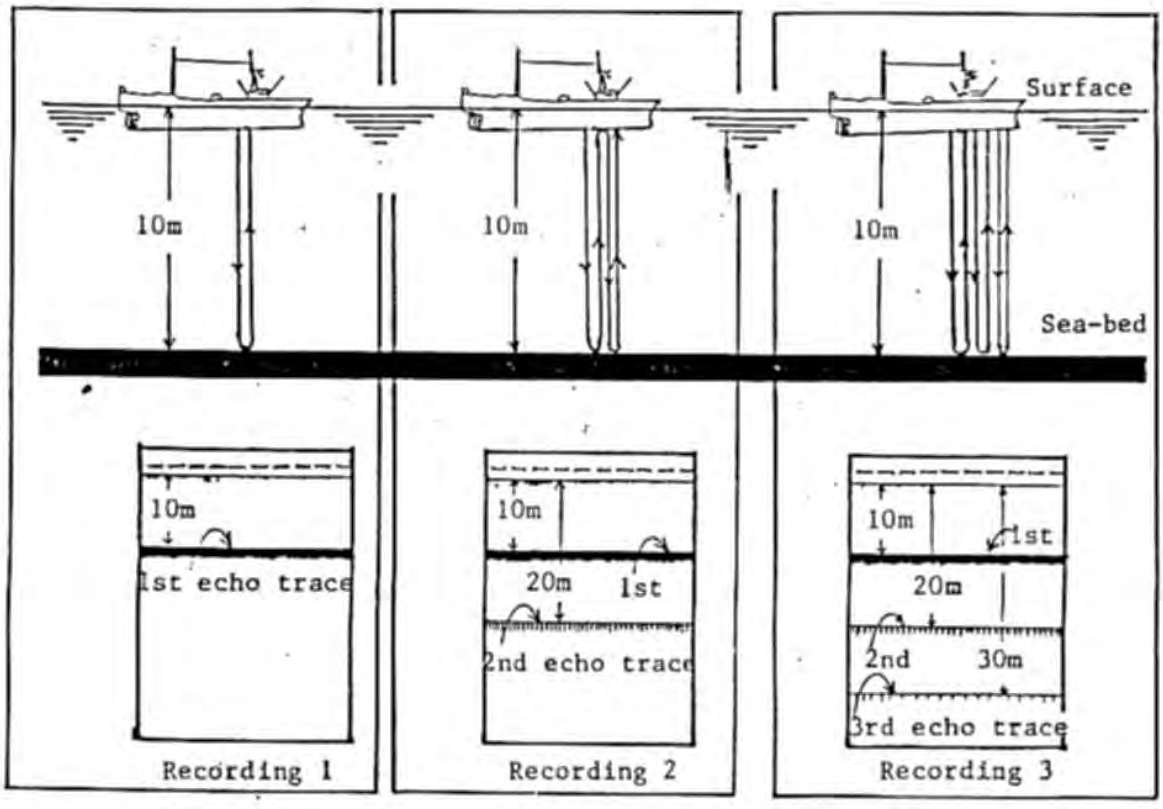


Fig. 13 Typical diagrams of first, second and third echoes

Fig. 14 the second echo traces from a flat sea-bed bears a resemblance to the first echo trace, however, the second echo trace from a sloping sea-bed does not resemble the first echo. Measurement of length A and A'=3.4 cm. B and B'=5.4 cm., that show they resemble each other.

The breadth of the white part in section D underneath the line that represents the surface of the sea-bed looks wider than section E. But measurement of the length of D and E shows the same value; D=E=0.8 cm. So, be careful because recording can influence of the interpretation of echograms.

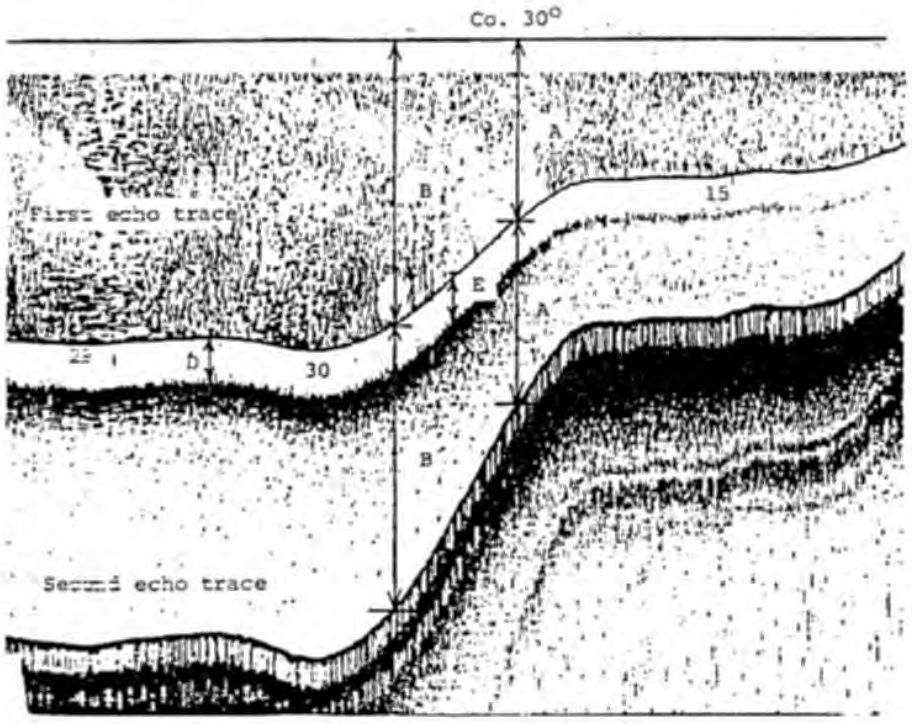
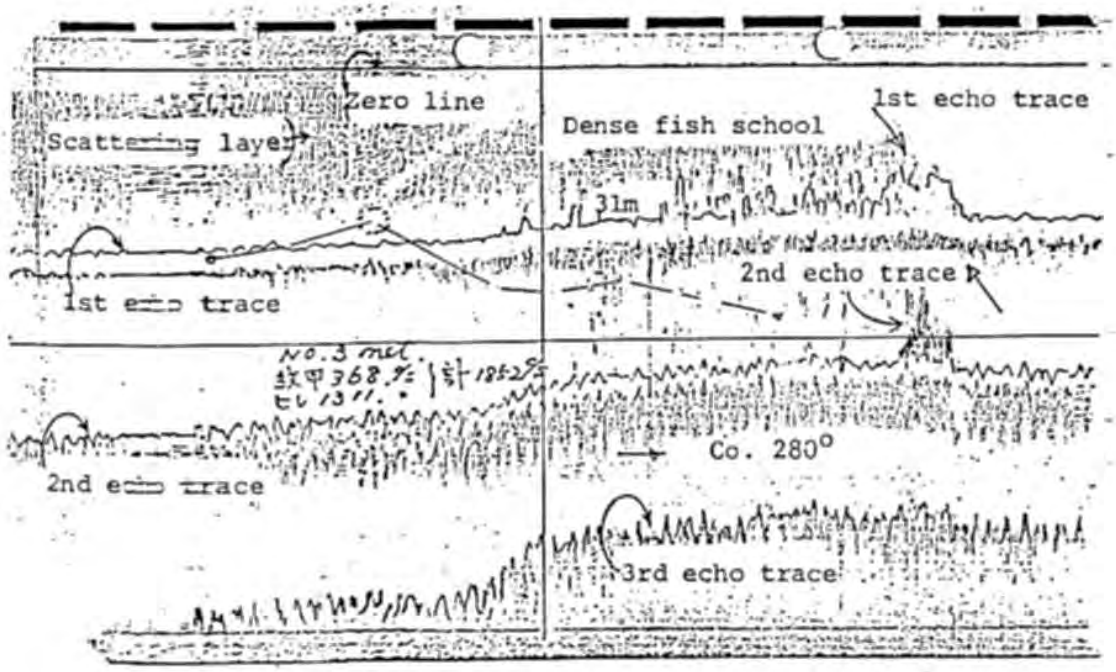


Fig. 14 First and second echo traces of sea-bed

In Fig. 15 shows the first, second and third echo traces of sea-bed and fish shoals recorded by a 50 KHz_2 fishfinder.



In case of fish shoals stay very close to the sea-bed. A paper recorder receiving the same signal can only present them as a small difference in colour tone shading in a dry paper recorder. It is more difficult for eyes to judge differences in tone than to see changes in size.

This problem can be solved by the "WHITE LINE", signals are amplified in normal way to the system. Beyond this there is a preset threshold control which at the lower end of its range corresponds to the weakest signal likely to be received from the sea-bed. All signals smaller than this level pass through the system normally, but anything larger is switched off after a set time. Meanwhile the paper no further signals will produce a white line after the thin black line which forms the sea-bed echo. The line is sufficiently well controlled that slight thickening can normally be attributed to fish signals.

Fig. 16 shows illustrating the change in trace when a white line is switched on and Fig. 17 shoes fish shoals above the white line.

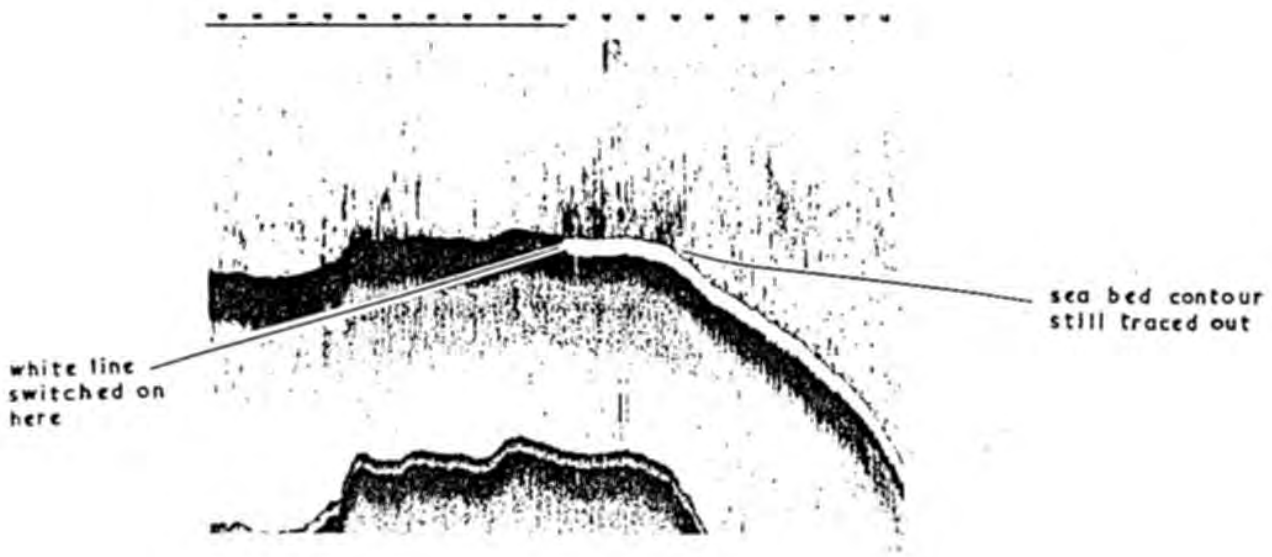

sea bed contour
still traced out
white line
switched on
here

Fig. 16

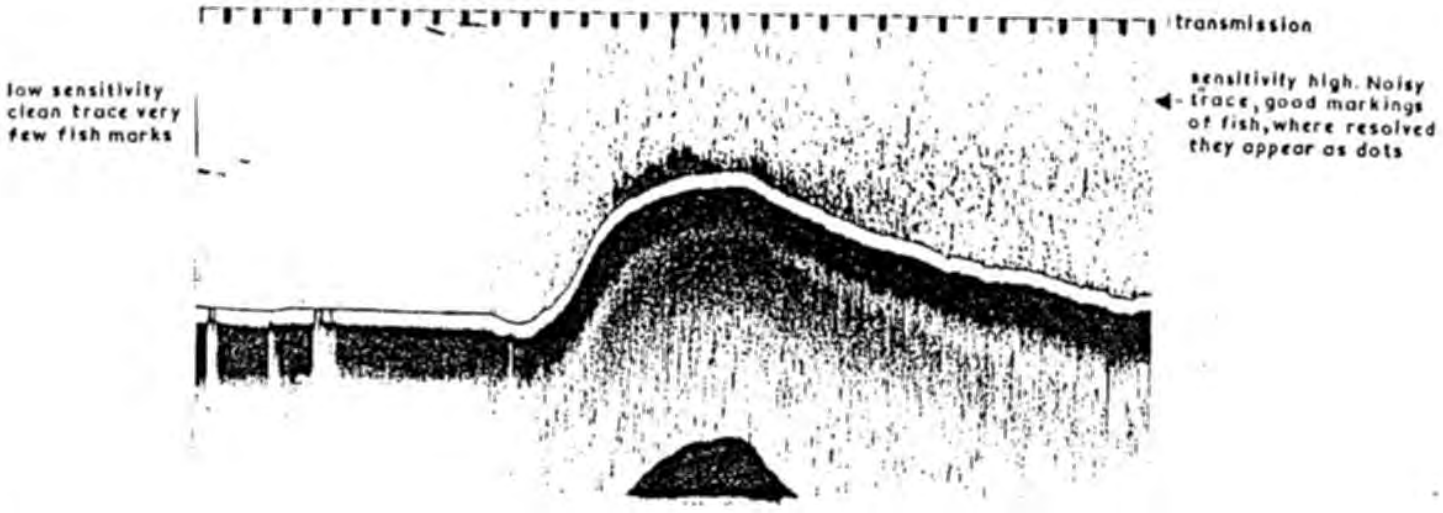

transmission
low sensitivity
clean trace very
few fish marks
sensitivity high. Noisy
trace, good markings
of fish, where resolved
they appear as dots

Fig. 17

The deep scattering layer

The deep seas or oceans always found the difference sea mass that occurred by difference temperature. We called difference temperature layer of sea mass in term of "Thermocline". Another kind of difference sea mass caused by difference of composition, such as oceanic organism, phytoplankton,zooplankton, etc. that condensing in a layer.

Fig. 18 shows a typical diagram of reflection and refraction of sound waves. When supersonic sound waves propagate and cross from one layer to another different layer, reflection and refraction are generated on the layer's surface and the sound wave energy is attenuated. This is the reason why fishfinder recordings traces the scattering layer on the chart.

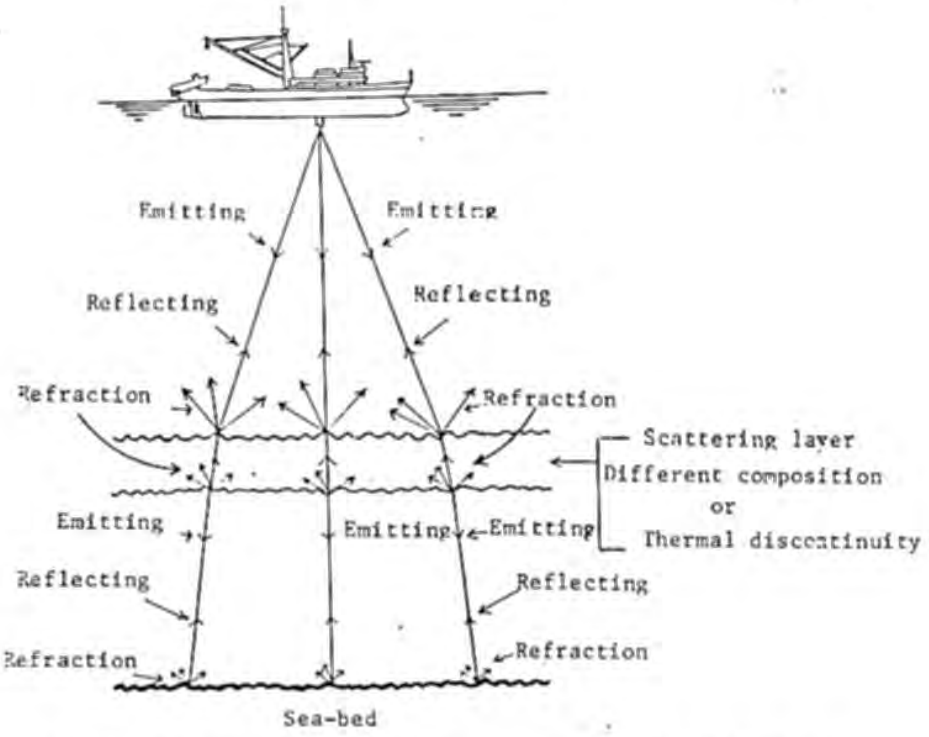


Fig. 18 Relation between sound waves, scattering layer and sea-bed

The scattering layer is important part of information for pelagic fishing. Because pelagic species are largely linked to the deep scattering layer.

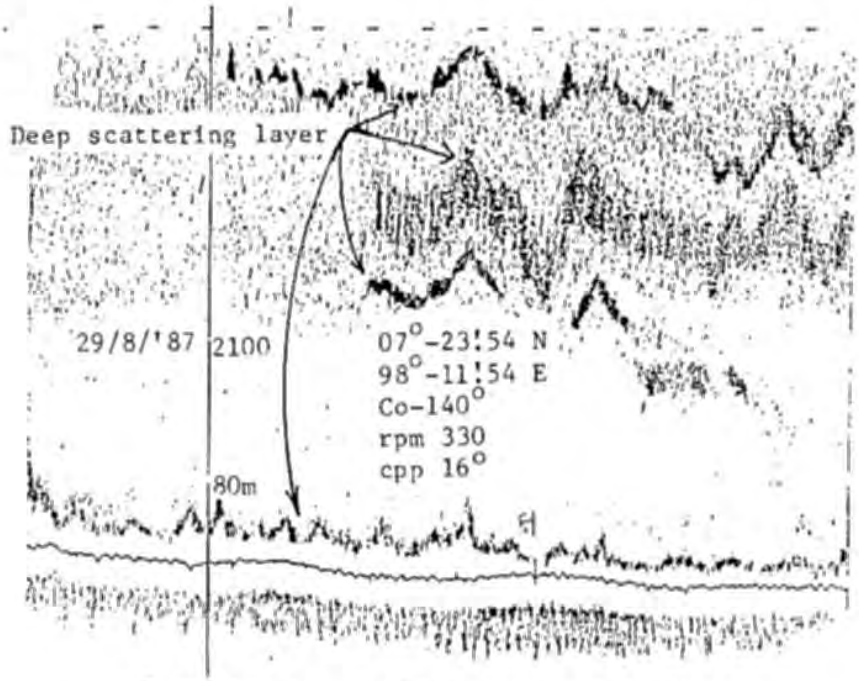


Fig. 19 Echo traces from multi-scattering layer

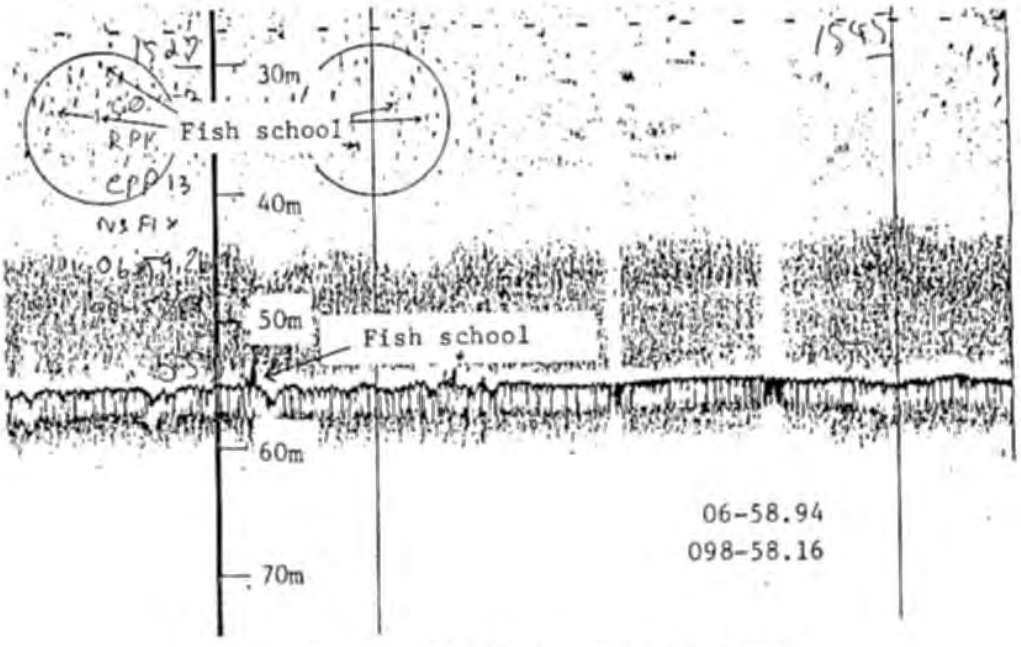


Fig. 20 Echo trace of turbulence and fish shoals

Fig. 20 shows the deep scattering layer like a "curtain" close to the sea-bed. Beneath the layer echo traces from fish shoals are visible but invisible above it. Fish shoals inhabit the area near the layer. Here is good condition for fishing operation.

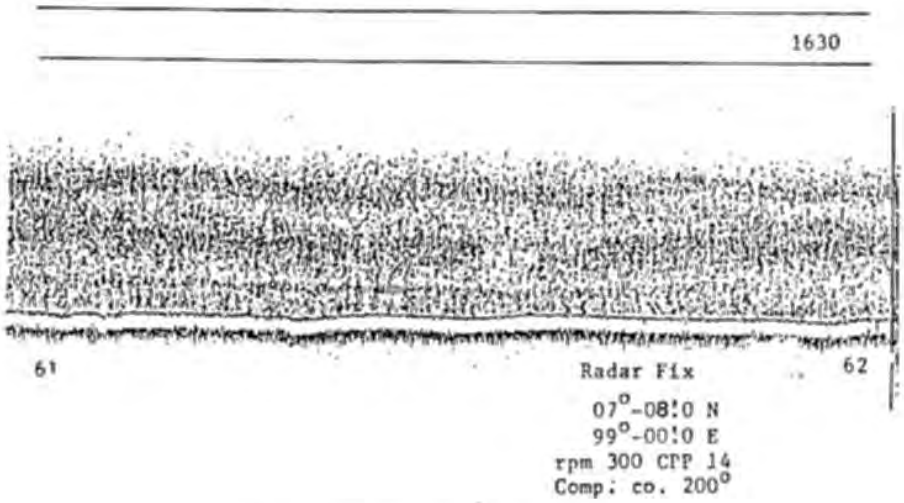


Fig. 21 Echo trace of turbulence

The echogram is Fig. 21 shows water turbulence "hard down" on the sea-bed. This turbulence yields poor catch of demersal species, recorded by a 200 KHz fishfinder on M.V. PAKNAM in Andaman Sea.

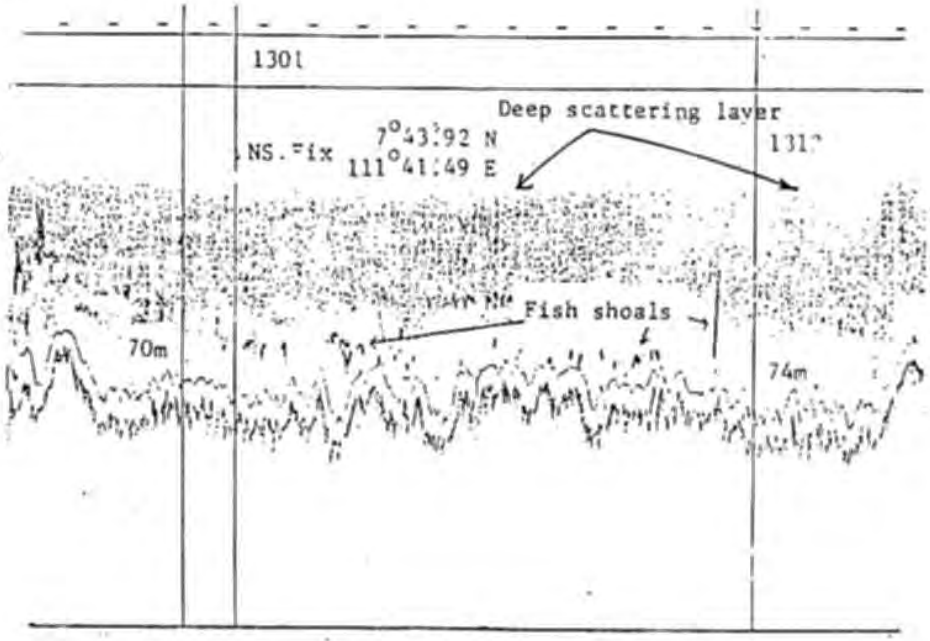


Fig. 22 Echo trace of deep scattering layer (recorded by a 200 KHz)

The recording in Fig. 22 shows water turbulence near the sea-bed and echo traces probably from bonito, recorded individually, in mid-water. Echo traces from demersal species can also be seen at a depth of 55 metres.

The deep scattering layer could effects to amount or composition of catches. Considering of deep scattering layer have to use both knowledge of biology and experience. The layer might brings fisherman poor or good catches depends on type, composition, depth and time that layer had happened. There are many theory interpreting of migration, vertical and horizontal of the layer, relation between fishes etc. More information from scientist and more experience from fisherman still be needed.

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