

Fishing Gear and Methods for Off-Shore Fishing in Sri Lanka

By

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Preface

This paper describes the commercially viable off-shore fishing methods for catching known commercial resources available around Sri Lanka. Also the in-shore fishing methods such as bait fishery which are related and of prime importance for carrying out certain off-shore methods are described.

This paper may serve as a background material for the description of fishing methods and to discussions on their various aspects connected with the operation of those fisheries.

Introduction

Fishing methods to be applied are determined by known commercially exploitable resources within operating range from a base.

As discussed by Dr. Sivasubramaniam on the previous paper the known commercially exploitable resources are of pelagic nature. Deep-sea demersal resources are still unknown and no commercial scale fishery have even been done and should not be without further experimental investigation which would determine the future commercial value of such resource and indicate what vessel, gear technology should be used.

As a result the fishing methods to be discussed are as follows :

- (1) Long lining for large pelagic species such as large Tuna (Yellowfin, Bigeye), Shark, spearfish and others ;
- (2) Driftnetting for small and large Tuna species (Skipjack, Yellowfin and others), shark, spearfish, etc.;
- (3) Pole and line for small deep-sea pelagic species such as Skipjack, Yellowfin, Frigate mackerel, etc.;
- (4) Purse seining (small scale) for small pelagic species suitable as bait fish for pole and line and longline fisheries.

Being intended to provoke open discussion each fishing method is briefly described giving general idea on the gear and the fishing operation, but not giving technical detail which could bring unnecessary confusions.

(1) Longlining

Longlining for large pelagic species is an oceanic fishery for dispersed specimens and rather small school. The method therefore depends for its success in covering large area and the more gear can be put out fishing, the higher catch rate can be expected. The operation of longline requires a detailed knowledge of the hydrographic meteorologic conditions of a region so as to select best fishing areas.

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Species encountered are large in size and as follows :

Yellowfin
Bigeye
Seerfish

Where tuna is present so is shark which is a predator species caught by baited hooks but also feeding and attacking tuna on the hooks. Considering the above, tuna longline fishing requires fast and efficient operations if one is to set out a maximum of units (basket) and haul them within the shortest period. Speed of longlining operation depends not only on the vessel and line hauler, but more on the crew performance as a team reaching very high degree of efficiency. Because of the nature of this fishery, tuna longline fishery requires large number of units of gears. Hence the work is arduous even for a well trained crew and is a rather high capital investment fishery.

Vessels

The type and size of boats engaged in deep-sea or oceanic longlining range from 15–1,000 gross tons hence sophistication and facilities vary accordingly; but as indicated above and for success of longlining, vessels have to be of the deep-sea-going class with required facilities.

Fishing Gear

Each ocean going fishing boat has about 350–400 units (baskets) of long lines constructed as per figure I and of the following specifications :

<i>Name</i>	<i>Material</i>	<i>Size</i>	<i>Length</i> <i>Meters</i>	<i>Quantity</i>
Main line	Kuralon/Vinylon	50 ply × 3	250–300	1
Buoyline	Kuralon/Vinylon	50 ply × 3	20–30	1
Branchline	Kuralon/Vinylon	40 ply × 3	12–20	4–5
Sekiyama	Wire and Kuralon	27/3 × 3	7–8	4–5
Snoodwire	Wire	27/3 × 3	2–3	4–5
Hook	Steel	10 × 12 cm		4–5
Swivel	Brass and lead	6 × 8 cm		4–5
Glass float	Glass	30 × 33 cm	—	1
Bamboo pole	Bamboc	—	4–5	1
Flag	—	1 sq. ft.	—	1
Light buoy*				12
Beacon buoy*				3

P.S.—Light and beacon buoys are numbered for a total of 350–400 baskets and used on board ocean going vessel.

The total length of the line is about 120 KM but owing to the slack given during setting the actual distance from end to end while fishing is only approximately 70 KM.

A complete set of gears can be used for about 300–350 operations and then must be renewed.

As regard to the fishing gear new type of longline used by Korean vessels with more hooks (10—12) per basket, which also upon collected information, fished, deeper resulting in high catch rate within the region.

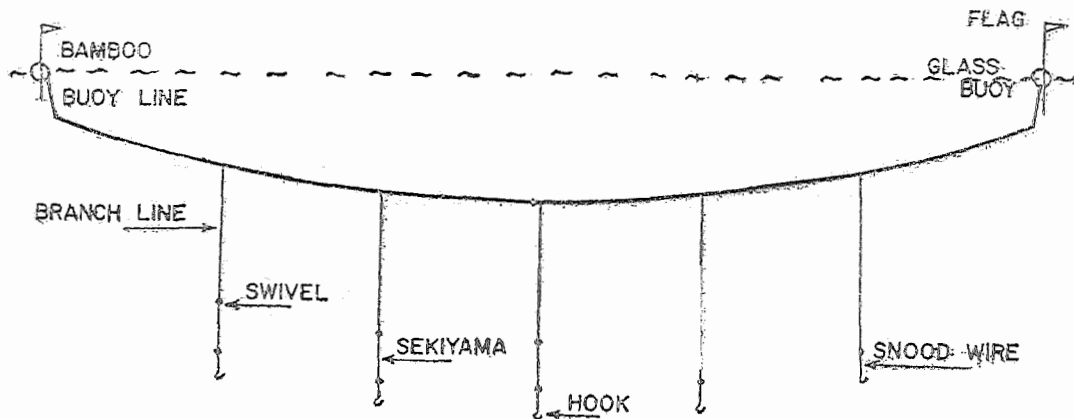


Fig. 1.—Basket of standard Japanese long line.

Bait

Bait is frozen and stored in wooden or cardboard cases each generally contains approximately 100–120 pieces. The most commonly used species by Japanese and Koreans are mackerel pike (Samma) of 100–140 gms each. But other bait fish are also used such as squid, sardine with some success. The pre requisite of longline bait fish are freshness and hard bone reducing drop off from the hook especially, on board vessel using large numbers of baskets

Hauling Devices

Hauling great numbers of baskets requires a good reliable fast hauler and such type of device was developed in Japan to suits their oceanic longline fishery. Various sizes are available to suit different sizes of vessel. Hauling speed varies from models and ranges from 80 to 250 metres per minute ; speed required for such fishing operation.

Fishing Operation

When preferably a good fishing ground is found the baited line is shot before sunrise, the vessel steaming at nearly full speed The setting operation usually lasts 3 to 5 hours for 350–400 baskets. The line is shot with considerable slack to bring the hooks into greater depth. Then the vessel is kept drifting some time or steams back to the end of the line which was laid out first ; then the hauling of the line with help of line hauler begins and this operation may last 10–12 hours depending on catch, weather conditions, etc. A longliner works this daily routine around its selected fishing area but rarely operate for more than 10 days in each area.

(2) Drift Gillnetting

Drift gillnetting for large pelagic species is a passive type of fishery widely used in many countries around the world with various degrees of success and viability. There are small as well as large scale fisheries with relative sophistication. In Sri Lanka this type of fishery has been for decades a traditional

one and is classified as a surface and or close sur-face inshore as well as off-shore fishery. The main species encountered off-shore are skipjack, yellowfin, shark and spearfish, etc. In the earlier days nets were hand made out of cotton or hemp. In the fifties introduction of synthetic netting (PA multifilament) gradually replaced cotton and hemp. Today only nylon (PA multifilament) is used and the up grading of the gear has subsequently improved and made driftnetting a viable fishery.

Fishing Boat

The type of boats and sizes engaged in drift gillnet fishery are many, ranging from indigeneous crafts to most sophisticated medium or even large size fishing vessels, but due to the nature of this fishery the more nets are put out higher catch and relative efficiency of gear will be obtained Hence drift gillnetter must have a relatively high carrying capacity with proper deck space for handling bulky gear. As everybody may know in Sri Lanka boats engaged in this fishery are indigeneous mechanized crafts and mechanized fishing boats 3 to 11 tons class day boats, which are limiting the expansion of this fishery in relation to fishing areas, fishing technique, etc.

Fishing Gear

The number of nets put out fishing is mainly guided by the size of the vessel engaged in this fishing and whether a net hauler is used. A fleet of nets may range from 20 to 30 nets. In Sri Lanka the number of nets used by each boat range from 10 to 50 nets depending on the size of the boat and availability of fishing gear. A drift gillnet consists of a rectangular strip of netting of varying depth and length to suit local fishing conditions with on top a framing line with float to ensure floatation of the gear and fish and at the bottom another framing line with sinkers for netting to spread out vertically in water. Figure 2 gives the design of nets used in Sri Lanka fishery which have the following specifications :

Netting material	PA nylon multifilament
Type of knot	Single or double English knot
Colour	Golden yellow, light grey, green, natural white
Twine size	21 ply (R530tex) 24 ply (R600tex) 27 ply (R680tex) 30 ply (R760tex)
Mesh size	4" (102 mm) 5" (127 mm) 5 ½" (140 mm) 5 ¾" (146 mm) 6" (152 mm) 7" (178 mm)
Length of piece of net	500-1,000 meshes
Depth of netting	50 - 60 - 90 - 100 - 110 - 120 - 130 - 150 meshes
Hanging ratio	0.45 - 0.50 - 0.60
Rope	Vinyon 6 - 10 - 12 mm diam. Polypropylene 6 - 10 - 12 mm diam.
Float	G1 float longitudinally grooved 20 × 4 cm (buoyancy 200 gf each) G7 cylindrical 150-100 cm (buoyancy 1.80 kgf) Glass buoy 30 cm diam.
Ballast	Cement sinkers 0.50 - 0.60 kgf.

When large number of nets are used light and beacon buoys are also used for marking and recovering lost netting.

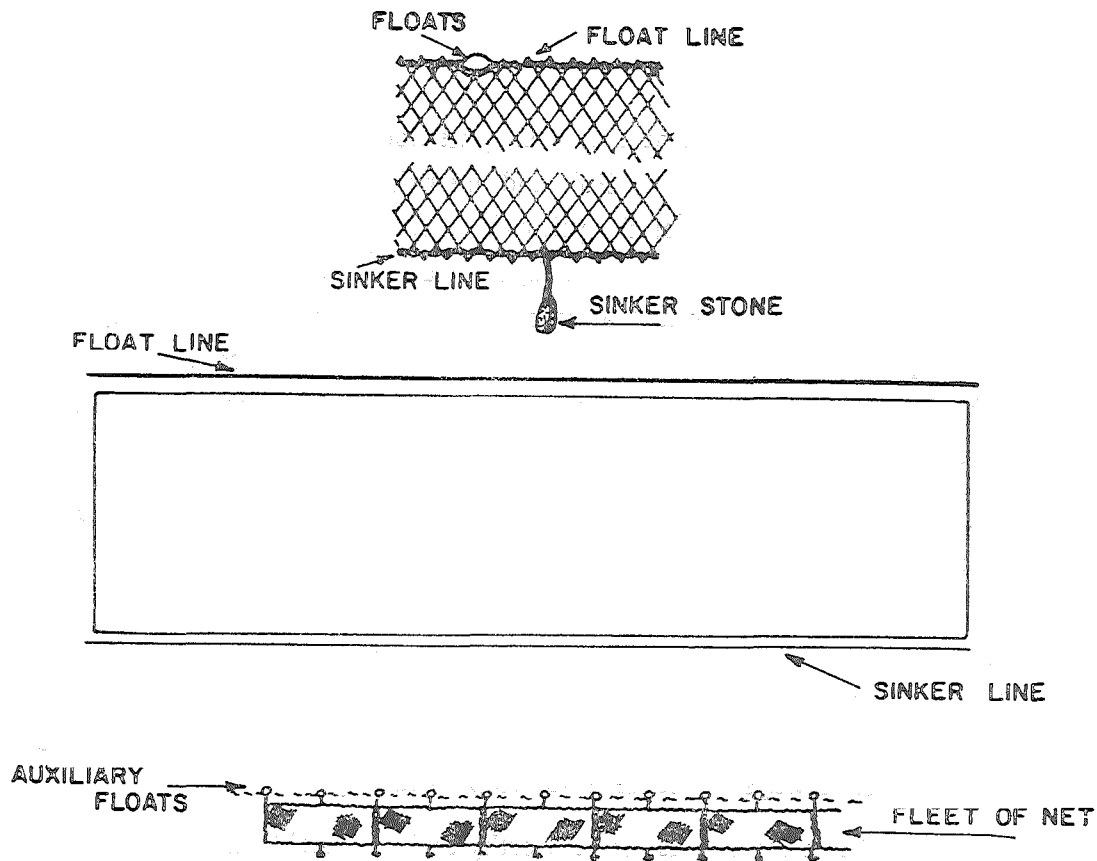


Fig. 2.—Drift nets used in Sri Lanka.

Hauling Device

On the larger vessels for handling great number of nets, net haulers are used in many countries and model differs accordingly, but nevertheless the purpose is always the same which is to assist crew in the handling of the gear particularly when the fleet of nets are large and catches are higher.

In Sri Lanka only now, with the introduction of 38' FRP boats, net hauler have been introduced but a more careful approach is necessary as to select the most suitable hauler for the local fishery.

Fishing Operation

On reaching a good fishing ground, nets are set before or after sunset. Small local crafts use their drift for laying the net. This process is rather long and shooting 20-40 nets may take from 1 to 3 hours depending on the weather conditions. Larger vessels operating great numbers of net shoot them under power. The nets are kept drifting for few hours and the soaking time depends on prevailing fishing conditions but never exceed 10 hours. Then the hauling operation commenced either entirely by hand on board small boat or with the help of a net hauler on board larger ones. As the net comes in, the enmeshed fish is removed and net restacked ready for shooting.

Though the local drift net fishery has been carried out for decades and is a rather seasonally productive fishing method it can be improved in various aspects such as gear, vessel and fishing operation.

(3) Pole and Line

Pole and line is an in-shore, off-shore and oceanic fishing method carried out in most part of the world with variation in sophistication and viability. Pole and line fishing is aimed at small and large pelagic tuna species such as frigate mackerel, Ssijack, yellowfin and bluefin which are forming schools. Due to the fishing technique pole and line is essentially a surface or close surface fishery, the success of this fishery depends on various factors such as resources of suitable oceanic species, availability of live bait, proper technique for catching, appropriate type of vessel to suit local conditions and skilled manpower. This fishery is rather difficult and a costly operation, needing time and experience not only in catching Tuna but in finding, catching, handling suitable live bait.

The existing pole and line fishery in Sri Lanka is a coastal fishery still at a low technical level compared to some other countries but on seasonal basis is a rather successful one.

Vessel

Type of boat, size and general arrangements engaged in pole and line are many and each one, in developed fisheries, seems to serve the purpose of being a good working platform suiting the local conditions. This fact is not always the same in developing fishery.

Basically, a pole and line vessel must be seaworthy and very stable, have enough operational autonomy and matching capacity for fuel, freshwater, ice or freezing hold, bait tank, etc., to suit local fishing conditions, have a rather large crew accommodation, have good bait carrying capacity in one or more hold with good natural sea water circulation or better centrifugal one through proper pump and piping, have good insulated hold for icing or freezing, have a good water sprinkling system through a centrifugal pump with piping laid along one side and the stern board, have a good clear deck space for poling tuna and be equipped for carrying out her own bait fishery so as to be a self-autonomous unit equipped with deep-sea-going navigation and fishing aid.

Fishing Gear

Since the gear for bait fishing will be discussed later, only the pole and line gear is described below.

The basic gear used for catching tuna is very simple and consist of either a bamboo or a fibreglass pole to which a length of monofilament with hook at its end is attached (fig. 3). The poles are of various sizes and lengths to suit fishing conditions ; vessel, weather, species encountered etc., and it ranges from 2 to 5 metres. The lines generally are a monofilament Polyamide which also the sizes vary according to species encountered and length of pole used, but it is always shorter than the pole.

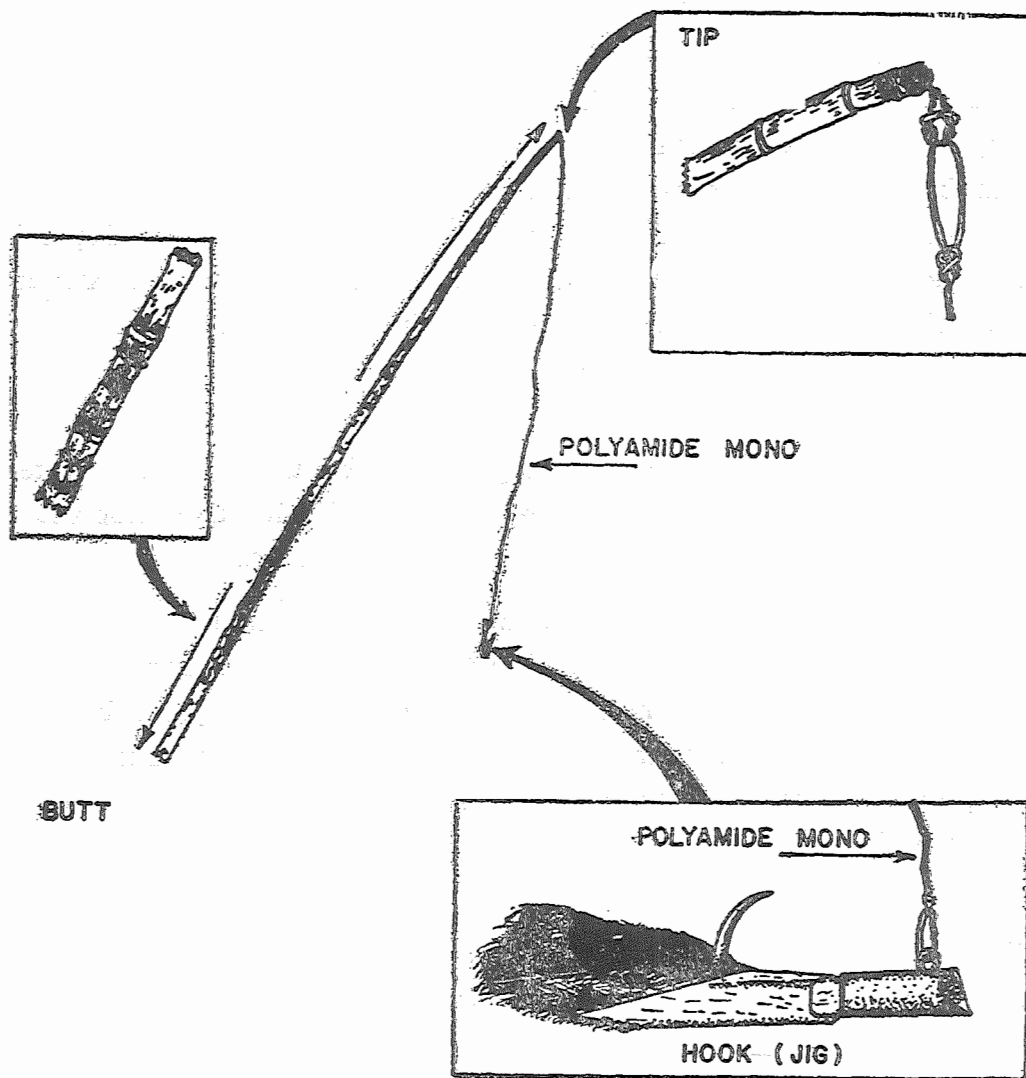


Fig. 3.—Bamboo pole/hook (jig)

Two distinctive types of hooks are used : Bait hooks and practical jigs. The bait hooks are characterized by having barbs and being round and broad. This hook is specially used when biting is very poor and live bait is hooked on. Artificial jigs (Lure) carried a barbeless wide open tuna hooks embedded in lead in a brass tube with an eye affixed to the tube, and with the hook and shank chrome finished. Selected chicken feathers are secured to the shank of the hook, with bat skin or dolphin skin fastened to the intended part of the tube forming a wrapping around the base of the feathers to prevent fraying. For both type of hooks, various sizes are used depending on the species and sizes fished. As auxiliary fishing gear there are :

- Spoon not for chummer ;
- Powerful binocular for spotter ;
- Fishing rod pad ;
- Bait tub for transfer of live bait ;
- Scouting tool for trolling.

Live Bait

The success of pole and line fishing is firstly based on the availability of live bait within operational distance from the tuna fishing ground and with a coinciding seasonal pattern. A good live bait is characterized by its size, it must be as small as possible as to increase the number of fishes, by its hardness, it must be hardy enough to stand handling from catching net into tank and for a long stay in these tanks on board vessel with low mortality rate. By its response to chumming, bait fish must not have tendency to swim away from the bait boat or deep in water. Bait must be attractive to tuna so as to stop school and bring fishes to feeding frenzy resulting in high catch rate.

Fishing Operation

Fishing operations differ with areas as well as the type of vessel but the principle of the techniques is the same, which is first to identify a good fishing ground and by planning, try to stop a school of tuna and hold it as long as possible close round to the vessel to enable angling.

The identification of fishing ground is done by radio communication with others vessels, hydrographic observation (water temperature, etc.) and experience. Then as the vessel reaches the expected fishing area beside continuing the above observation the following must be done : Spotter with binocular must keep a look out for schools of tuna, whale porpoise which are species often associated with the fish, for flocks of seabird, floating logs and change of resource, etc. Other crew members must watch the trolling line with lure, if any used for subsurface school.

(4) Purse Seine

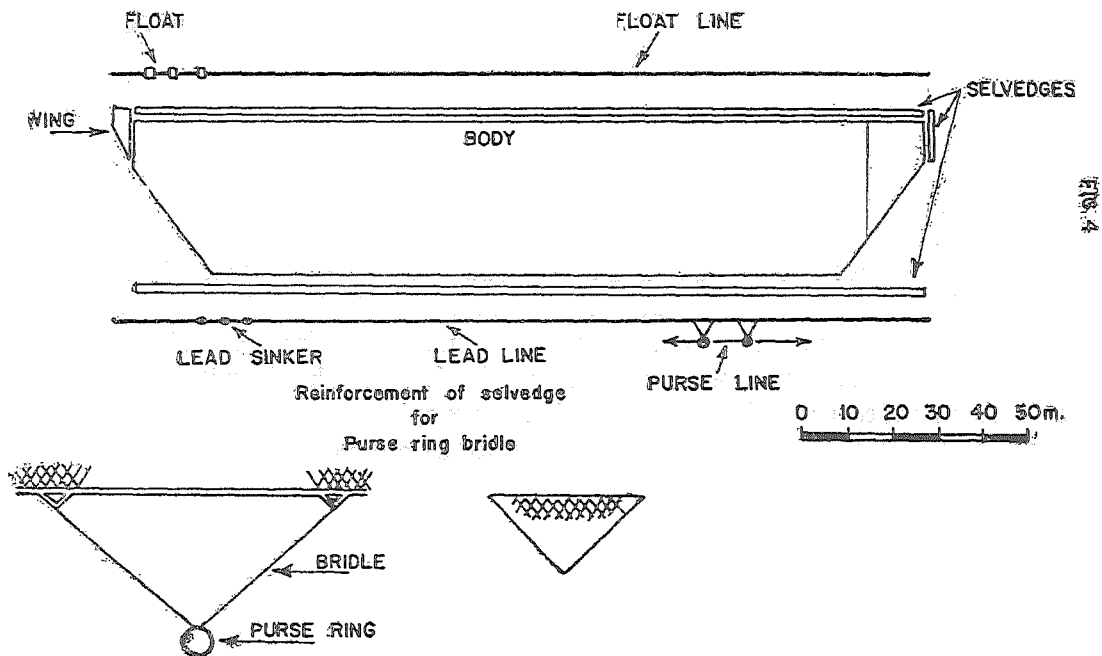


Fig. 4.—Purse seine.

The purse seine (Fig. 4) is made by assembling different parts of the gear having specific mesh, twine size, etc., and referred as follows :—

- (1) Body ;
- (2) Bunt or bag ;
- (3) Selvedge ;
- (4) Wing or breast ;
- (5) The framing lines (float, lead lines) ;
- (6) Purse line.

All these parts are made of synthetic material. The body (main webbing) is the larger part of the gear made of strip of webbing which hang horizontally or vertically and are laced to others. The webbing is made out of the thinner twine, sizes ranging from R 50 tex (2 ply) to R 150 tex (6 ply) and of small mesh, 10–12 mm stretched mesh.

Masterfisherman and helmsman keep watch on the echosounder and/or sonar, if any, once on the fishing ground, the chummer has one very important position, he must be alert at all times and very skilful in luring, holding the school close to the vessel with the minimum wastage of live bait. Before chumming takes place, have some bait crowded into hatches with help of framed net or into special chum tank. Chumming is the scattering of live bait into the sea to attract the tuna to feed on the live bait then slowing or even stopping the school close enough to the vessel to be fished.

As the vessel approaches a school the sprinkler is turned on for it is believed that the spray hitting the surface of the water gives illusion of abundance of small fish on the surface, causing the tuna to go into feeding and biting frenzy.

When near enough the chummer scoops live bait and start throwing live bait in handfuls at regular rate, as far as possible towards the schools to form a thin continuous line. As chumming goes on a careful watch on the chum line must be kept looking for sight of fish, splashes or breaks at the surface, which is an indication that the school has started taking the bait. Chumming is then done more actively until the school is drawn and held close to the vessel for fishing. Simultaneously at the first sign of the school biting the bait, the boat is stopped in position for fishing and fishermen start angling. Angling technique with jigs consist of hauling fish in as fast as possible. When the fish are feeding and biting it strikes the jig the moment it hits the water. With a strike on the jig immediate tension is applied to keep the line taut and the fish hooked. The fish is then pulled out of the water and swung on board. As the fish lands on the deck behind the fisherman tension is released causing the hook to disengage. But a skilled fisherman, when the fish is overhead, must be able to release the tension on the line causing the fish to be unhooked. This action is called flipping but can only be used for small fishes up to 6–7 kgs. As angling commences, the chummer goes on assuring steady chumming just off the jigs, evenly distributed to all the fishing jigs or hooks so that the rate of biting is steady among fish close to most of the fishermen. As biting rate reduces or the school is not held close enough, the vessel may move slowly attempting to reactivate fishing and or fishing is stopped when the rate of biting comes to the point where it no longer justifies expending the bait fish. Then the vessel proceed to search for another school.

Though the local pole and line fishery has been carried out for decades there are great opportunities for technical improvements which would enable local fishermen to express, demonstrate their angling skill obtained through their long experience.

Bait Fishing Method

Various fishing gears are used to catch bait fishes and their use and techniques vary from country to country. Those gears can be classified into two groups. Round hauling and lift hauling. Both being used with or without the help of light attraction. The round hauling group includes beach seine, lampara, half ring net and purse seine. The lift hauling group includes lift net and stick held lift net (Boke Ami). A bait net is characterised by its relatively small size, lightness in construction and netting. Most of the bait net can be manually operated except purse seine.

In Sri Lanka five of those methods have been used : lift net, stick held net, lampara, half ring net and purse seine. The more productive gear was by far the purse seine followed by the half-ring net which shows that the surrounding technique is the most appropriate for this area. Hence purse seine and its fishing operation is chosen for detailed description.

A purse seine is a long wall of webbing hanging down between corks and lead lines with an essential feature which is pursing by pulling a drawn string (purse line) which is threaded through a series of rings along the bottom of the net below the leadline so that the leadline is bunched and hauled up to the surface closing the bottom of the net and impounding the catch before pulling the net aboard.

The bunt (bag) is a cup shaped fullness of the webbing at the first end of the net to serve in impounding the catch in a more confined area for collecting bait fishes. The netting is heavier than the body being exposed to more strength. The twine sizes range from R 100 tex (4 ply) to R 230 tex (9 ply) and is of smaller mesh size than the body 9-10 mm stretched mesh.

Selvages are small strips of netting to reinforce, protect the main body and Bunt along the float and lead line. The float line selvage is made of small mesh so that the head rope will not get entangled in the meshes and to prevent bait fish from entangling or escaping. The lead line selvage is usually of larger mesh to offer less resistance to the water when pulling the lead line.

The wing or breast is the last end of net to be paid out hence the first is to be retrieved and made out of various mesh sizes but usually of large meshes.

Framing line

To keep the upper edge of the net at the surface the webbing is hung from a head rope or float line upon which floats have been strung. To keep the webbing upright, the lower edge is laced to a footrope or lead line weighted with sinkers, usually lead.

The purse line is essential in the operation of a purse seine, it is made out of synthetic fibre preferably of low density and braided. This line is threaded through the series of rings, which are attached along the lead line and by pulling, is bunching the lead line and closing the purse seine before pulling the net aboard.

AUXILIARY EQUIPMENT

Line Puller

Pulling the purse line require a line puller and the power will vary with size of net and vessel. But basically a double horizontal or vertical mechanical capstan is most suitable.

Echo Sounder

For location of bait fishing ground and assessment of aggregation of fish to the light attraction, a small echo sounder fish finder is a most valuable equipment.

Light Fishing

Whenever necessary to attract bait fish, electric lamps are most suitable and 1,500W through surface lamp is sufficient. For this operation the following equipment are required : Electric generator 1.5–2.0 KW, surface lamp (1500 W), row boat 10–12 feet. Battery set 24 volt, 90 amp. surface or submersible lamp for 24 V and of a power of 300–500 W.

Fishing Operation

Consists on surrounding or encircling the school or aggregation of fish attracted with light. This operation resulted in the formation of a rough cylinder. First, the bag end of the net and the purse line are fastened to the buoy and then the seiner moved in a circle paying out the net and finally retrieving the buoy attached to the first set end of the net. Once the encircling is completed the purse line is drawn with the help of a double head gypsy winch (capstan). On completion of the pursing operation, the lead line is bunched on the surface, closing the net and preventing the bait fish from escaping. Then the net is pulled aboard, starting from the last end (breast) so as to drive the fish gradually into the bunt (bag). Then the catch of bait fish is carefully transferred to the bait tanks with the help of scoop net or better special buckets. As shown the purse seine is retrieved the reverse order of setting and by this procedure it is possible to stack the net ready for the next fishing operation.

The local bait fishery for live bait as well as longline can tremendously be improved with the introduction of new techniques, and the use of the half ring net or purse seine, development which should have a great impact on the pole and line and longline fishery.

DISCUSSION

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|-----------------------|--|
| Mr. J. T. de Livera | How far can midwater trawling be used for tuna fishing ? |
| Dr. Sivasubramaniam | Midwater trawling is not employed for tuna fishing as tuna is a fast swimming fish. |
| Mr. T. Ochi | Explained the functions of the UNDP Sri Lanka Fishery Development Project and mentioned the availability of technical staff for any assistance regarding the development of the tuna fishery.

Taiwan, a tropical country like Sri Lanka has developed a tuna fishery and is now a major producer of this fish. Like Taiwan, Sri Lanka too can develop this fishery. |
| Mr. Dawson Silva | Is it possible to use "Bala oruwa" for off-shore tuna fishing ? |
| Mr. K. M. Joseph | It depends on the endurance, sea worthiness, etc., of the craft in question, besides its suitability for tuna fishing. The issue needs a careful evaluation by a Naval Architect. |
| Mr. Ananda Silva | What is the position regarding joint ventures for tuna fishing ? |
| Mr. V. L. C. Pietersz | It is permissible. Each case will be decided on its merits, by the Government. |
| Mr. Bertram Perera | Installation of communication devices, echo sounders, direction finders, warning lights, etc., is very essential for successful off-shore fishing with 38' boats. What steps are being taken by the ADB Fisheries Project to provide these for the buyers of 38' boats ? |

Mr. K. M. Joseph

The 38' class boat is equipped with a powerful radio telephone and the Ministry of Fisheries is taking steps to make available the other requirements soon.

Mr. Omar

There is at present a scarcity of fishing gear in the country. Have any measures been taken up to improve this situation by the Government ?

Mr. V. L. C. Pietersz

Provision is being made for private sector to import gear. When these imports gather momentum it will be possible to obtain fishing gear without a card.

Mr. Bertram Perera

Since Ceylon Fisheries Corporation which handles the radio control room is closed during Poya days and Sundays, ship to shore communication from 38' boat is not possible during these days. Some of the Ceylon Fisheries Corporation communication rooms, located outside Colombo are often closed due to battery failures. To overcome this 38' boat owners should be provided with transceivers.

Mr. V. L. C. Pietersz

Action will be taken to keep open the Ceylon Fisheries Corporation control room regularly. The question of providing shore radio communication sets to buyers on 38' boats will be sympathetically considered.