

THE "DUG-OUT" TRAWL FISHERY OF MANILA BAY

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ONE PLATE AND FIVE TEXT FIGURES

INTRODUCTION

The dug-out trawl fishery is comparatively a new industry developed in Manila Bay during the last three or four years. The fishery consists essentially of a small otter trawl net rigged to a motorized dug-out and operated on shallow, smooth littoral areas to catch shrimps, crabs, slipmouths, soles and whittings. At this writing about 500 units are in active operation in Manila Bay and the gear is now being introduced in other fishing grounds of the Philippines. Conservative estimates place the total investment in this new industry at about half a million pesos worth of fishing craft and equipment. The growing importance of this new fishery has led to a study of the fishing craft and gear, its operation, the fishermen and composition of the commercial catches. The study was conducted in Manila Bay in the environs of Navotas, Rizal, during August and September, 1954.

History and development.—The dug-out trawl is a miniature outfit of the established western type of otter trawl in the United States that has been in commercial use since 1947 in the Philippines. In effect this miniature otter trawl gear reflects a decided improvement over the manually operated age-old push net (*sakag*) used in the catching of tidal-flat inhabiting species of fish, shrimps and crabs. The development of this gear came about after the complete cessation of the operation of another mechanized fishing gear, the *pandilis*,¹ operated in the same motorized dug-out. This short-lived fishery, despite its relative efficiency, was outlawed both by the local and national government because it used explosives as an accessory in the catching of pelagic species. Another contributing factor that has enhanced the development of the mechanized dug-out crafts in Manila Bay is the decline in the catches

¹ *Pandilis* is an enlarged scissors net operated at the bow of a mechanized dug-out purposely used in the catching of anchovies, shrimps and juvenile sardines, herrings and mackerels.

of subsistence fishermen using the age-old scissor nets, operated on wading depths of less than a fathom. The large scissor nets formerly used in the pandilis fishery was first modified into a flat-type otter trawl net and dragged with a single towline over the stern of the same dug-out craft. Later, regular otter trawl nets were constructed to suit the size and power of the dug-out craft being used.

The recent success of the dug-out otter trawl in Manila Bay has stimulated the further mechanization of the other indigenous dug-out fishing crafts. The fishing gear is gaining a wide acceptance especially among the small-scale and subsistence fishermen on account of the relatively low initial capital investment and simplicity of operation.

THE FISHERMEN

A fishing unit is usually manned by one or two fishermen depending upon the size of the dug-out craft. Dug-outs having a length of from ten meters or more each employ two men because of the much larger fishing gear used. However, dug-out craft of relatively smaller size are usually operated each by a single man-crew who usually is the owner of the fishing outfit. When a craft is operated by one other than the owner the catch is usually divided equally between the operator and the owner after deducting the operating expenses. For dug-out craft employing two men the catch is divided into three equal shares. One part goes to the owner of the unit and the remaining two parts are equally divided between the two fishermen.

THE FISHING CRAFT

The fishing craft consists of a dug-out which is hewn out from a solid log of *mayapis*, *Shorea palosapis* (Blanco) Merr. To increase the free-board and enlarged the craft side plankings of palosapis, *Anisoptera thorifera* (Blanco) Merr., boards are nailed along the port and starboard sides of the craft. For proper stability of the craft, it is provided with a pair of bamboo or wooden outriggers on port and starboard sides. Some dug-outs are provided with a single outrigger on the starboard side only. This single outrigger consists of a 5 to 6 meter-bamboo (*Bambusa spinosa*) beam (*batañgan*) and a bamboo float (*palañgoy*) which varies in length from 8 to 10 meters. The fishing craft is propelled by a 2½ to 9 horsepower gasoline engine (usually 6) which is generally installed amidship. However, a few larger craft are provided with a 4-cylinder gasoline

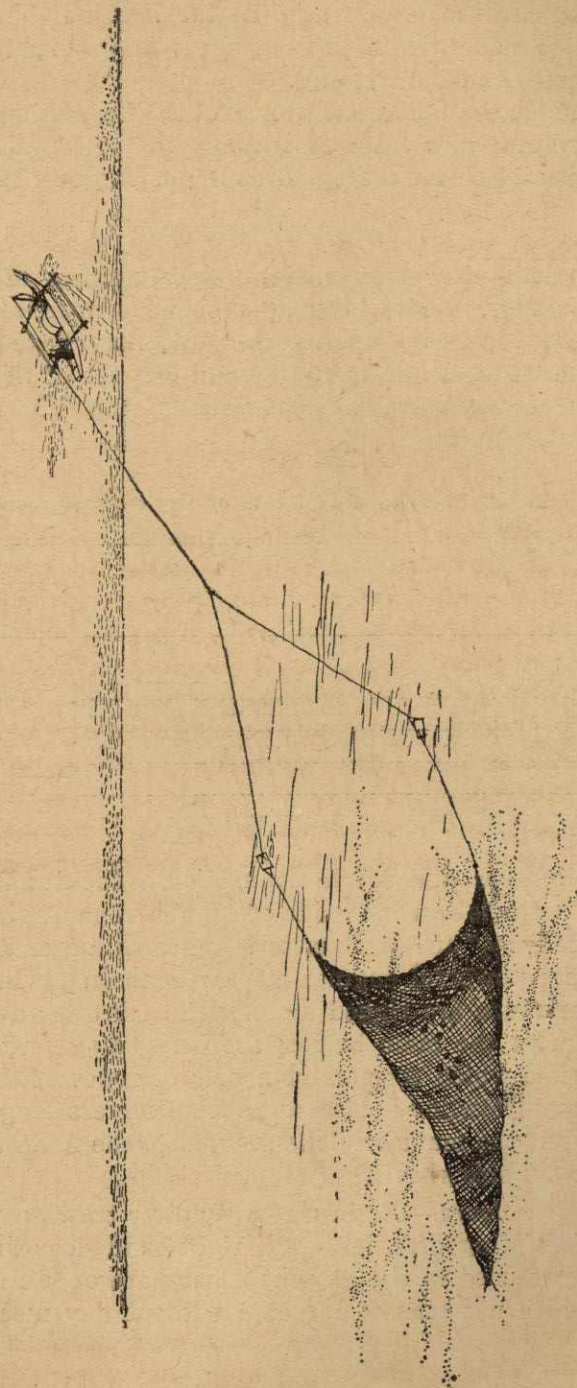


FIG. 1. Dug-out otter trawl in operation (diagrammatic).

engine ("Continental" or Jeep engine). An engine coaming of canvas or flat galvanized iron sheet is provided to serve as protection from the weather.

A complete fishing outfit including the fishing gear, craft and its accessories costs around 800 to 1,200 pesos, depending upon the size of the craft and power of engine (Table 1).

THE FISHING GEAR

A dug-out otter trawl fishing gear consists of three main parts, namely, the towlines and bridle connections, the otter door, and the net proper. An outfit may have one or two sets of otter doors or nets although one set of fishing gear is the most common complement wherein the fisherman himself attends to its upkeep.

TABLE 1.—Estimate of cost of dug-out trawl outfit.

Items	Cost	
	Small dug-out	Large dug-out
	Pesos	Pesos
One inboard gasoline engine (6 to 9 H. P.)	450.00	600.00
One dug-out	250.00	350.00
Two sets of otter trawl nets	90.00	120.00
One pair of otter door	10.00	20.00
Abaca towing ropes	5.00	10.00
Miscellaneous	10.00	10.00
Total	815.00	1,110.00

Trawl warps and bridle connection.—The trawl warp consists of a single towline made of Manila rope of about 15 to 25 meters long, $\frac{1}{2}$ " to $\frac{5}{8}$ " diameter. In some larger dug-out craft with more powerful engines, a pair of main towlines of equal length and size are rigged directly to each otter door. In this arrangement the main bridles are being dispensed with. The main bridle which consists of a pair of ropes of the same size as the main towline measures about 5 meters long each. The fork-end of the main bridle is secured to the main towline with a $\frac{3}{8}$ " or $\frac{1}{2}$ " size swivel.

The otter doors.—As in a regular otter trawl, a pair of otter doors consisting of a left- and right-hand door is used. The otter doors used in the dug-out fishery are of the much lighter types which are simply operated without any mechanical aid.

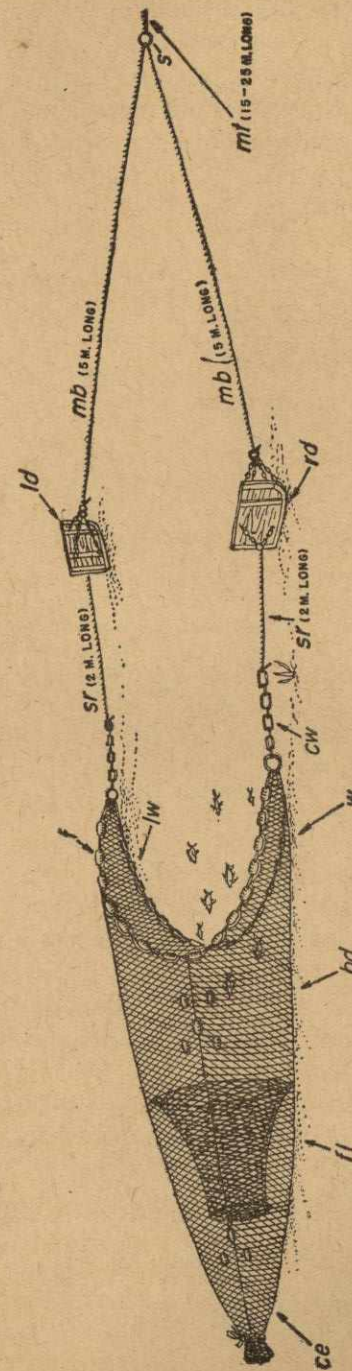


FIG. 2. Sketch of trawl net showing parts and accessory connections (diagrammatic).
ce, Cod end; *fd*, funnel; *bd*, body; *w*, wings; *f*, float; *lw*, lead weight; *cw*, chain weight; *sr*, sweepline; *rd*, right otter door; *ld*, left otter door; *mb*, main bridle; *mt*, main towline; *s*, swivel.

The size and weight of each door vary in accordance with the size and power of the craft (Table 2). These empirical ratios were developed by the local fishermen through trial and error tests. A typical otter door measures about two feet long and one and one-third feet wide, each weighing about 10 kilograms, including the forward bracket, chain bridles and iron plate shoes.

TABLE 2.—Horse power of engine in relation to size of craft, otter door, and length of headrope and footrope.

Horse power of engine	Length of headrope	Length of footrope	Length of dug-out	Otter doors	
				Size	Weight
	Meter	Meter	Meter	Meter	kg.
2½	2-3	2-3	5-7	18"×12"	5-8
6	5-7	5-7	5-12	27"×16"	8-10
9	7-9	7-9	7-12	48"×28"	10-12
Jeep engine	9-12	9-12	12-15	52"×28"	15-20

A typical otter door consists of a pair of light planking of *palosapis* or *tangile* (*Shorea polysperma*), 5/8 inch thick and 6 inches wide and held together by forward and aft wooden braces (4 inches wide by 5/8 inch thick). The door is weighed by a pair of iron plates bolted together along the lower gliding edge of the door. Each door is suspended by a forward and a rear bridle, the former consisting of a triangular iron bracket and the latter of galvanized iron chain. These bridles are held at a "focal center" which lies at a midpoint one-third distant from the forward edge of the door. The forward bridle is held by a No. 24 gauge galvanized iron plate and the latter passes through holes on the door and held on its either side by a cross pin bolt consisting of a 4" nail. A pair of door straps or bridles made of the same size as that of the sweep rope are rigged to eyebolts or aft bridle chains on the nether side of the otter door (fig. 3).

The net proper.—The net consists of a simple, flat-typed funnel-shaped net provided with two short tapering wings. Footropes and headropes are made almost of the same length, although the former should be hanged ten per cent longer than the latter in order to increase catching efficiency. The body is tapered off to form a pair of pointed wings. Fig. 5 shows the cutting plan of a typical five-meter (15 ft.) footrope trawl

net suitable for a 6-H.P. gasoline engine. The specification of this net is as follows:

Part	Mesh size in cm stretched	Length in meters	Thread number	Netting requirement (meters)
Wings	2.5	2	6	25 m × 200 m.d.
Body	2.3	3	6	25 m × 200 m.d.
Bag	1.5	3	6	5 m × 200 m.d.

The body of the net is cut out from a 25-meter stretched seine netting of about 200 meshes deep (m.d.) and five meters long by 200 meshes deep for the bag. The tapered sides of the body and wings are cut "one and one" which is equivalent to a "straight cut on the bar" (*dagaray*). The two cut sections (A and B) are joined along their sides to form the body and wings. For the bag the five-meter netting is folded over to form a cylindrical bag, one end of which is seamed to the tapered end of the body.

To strengthen the net seams of Sections A and B, a mid-dorsal and midventral cotton ribbings (90 thread) are secured along the entire length of the net from the rim of the mouth until the cod-end of the bag. The middorsal ribbing also serves for attachment of floats of the net.

The assembled net is then ready for hanging on the foot- and headropes. The foot- and headropes used are of equal length and size each consisting of a 1/2" or 5/8" diameter cotton or abaca rope. Local net makers hang trawl net by simply apportioning uniformly the netting on a given length of foot- and headropes. As a rule, however, proper hanging of trawl nets should be by one-third basis; that is, hang three meshes on the length of the footrope taken by two stretched meshes. This will give the proper diamond shape of the meshes and produce an even strain on all parts of the net. In hanging trawl nets, it is always proper to start from the center and work toward both ends.

The use of a bottom selvage of at least six coarse meshes lined along the belly portion of the footrope is often advantageous. This selvage protects the belly of the net from wear and tear and keeps off the mud and sand from entering the net.

After hanging the net on the head- and footropes the lead weights and floats are attached. Usually the wooden floats are strung along the entire length of the headrope before the net

is hung on it. From 15 to 30 wooden floats (2" × 4") are used depending upon the size of the net. From 50 to 70 one-ounce lead weights are clamped along the footrope.

A two-inch brass ring is rigged to the tip of each wing for attachment of the sweeprope during actual fishing operation. To avoid the possible escape of the fish toward the mouth of the net a rectangular flapper is hanged diagonally on the forepart of the bag leaving about five-centimeter opening from the floor of the cod-end.

Otter door hook-up.—In the dug-out trawl the dandy-line hook-up is commonly used. This consists of a pair of sweepropes, the after ends of which are connected directly to 2-inch brass rings rigged to each tip of the tapered wing of the net. The forward ends of the same footropes are connected to the doorstraps. The double "Manila hook-up" or "double leg" which consists of a pair of ropes is connected directly to the aft corners of each door from the forward corners of the wings. This arrangement is seldom used and is only adoptable to nets with rectangular wings.

Each sweeprope measures five meters long, $\frac{5}{8}$ " diameter; that of the double leg consists of a pair of $\frac{1}{2}$ " diameter abaca rope measuring about a meter and a half long. In these two kinds of hook-ups mentioned above wing brails or "Dhanlenos" are not used; they apparently add dragging weight to the net in this type of small trawl.

THE FISHING OPERATION

Time of operation.—The dug-out trawl is usually operated between 12:00 o'clock in the evening and 7:00 o'clock in the morning. The catch is handled on board without the benefit of icing. Some boats, however, fish all night and carry from 40 to 50 kilograms of ice. During the calm months they also fish during the day but the catch is usually landed within 6 to 10 hours after leaving port. During operation they apparently seek the sheltered areas of the bay in accordance with the prevailing monsoons.

Fishing grounds.—In Manila Bay the fishing grounds consist of the shallow littoral flats between one and six fathoms deep along the northern and eastern sides of the Bay. The dug-out trawlers fish the areas abandoned by fish corrals. They consistently operate along the muddy and sandy areas where shrimps and crabs are usually taken.

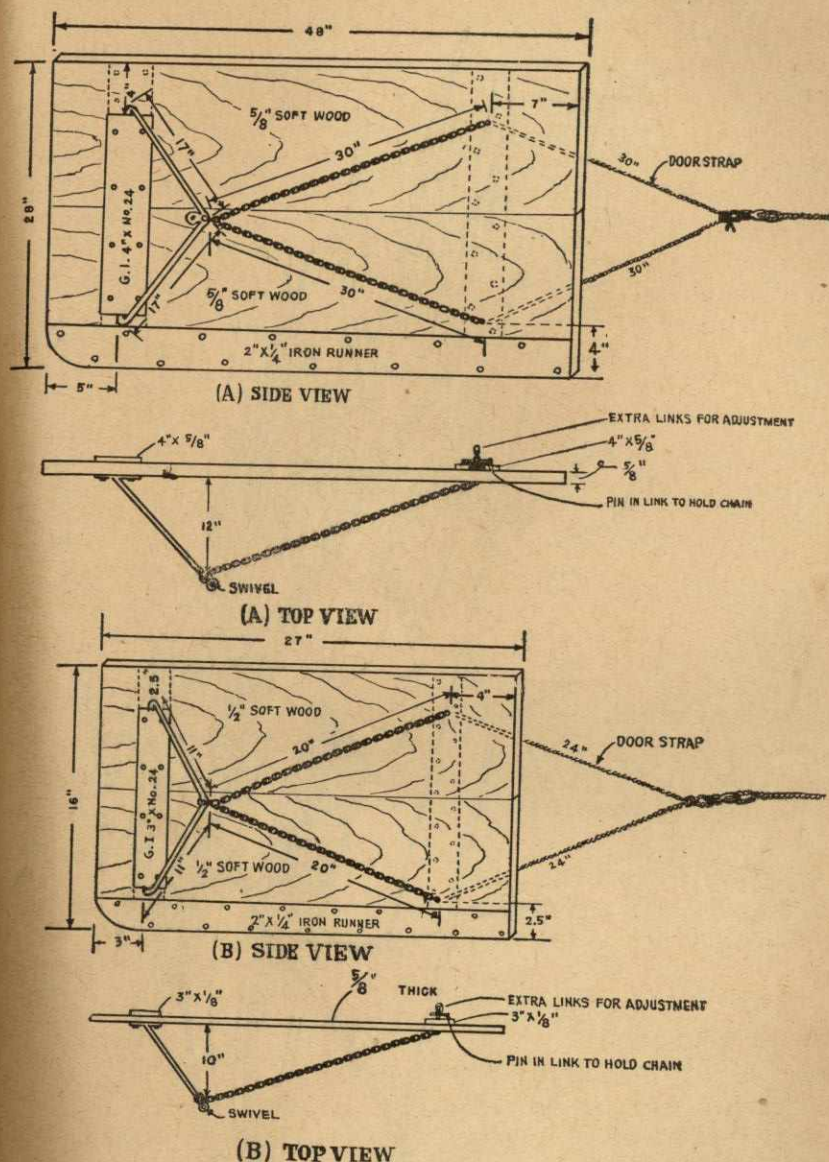


FIG. 3. Diagram of otter door (right hand) suitable for use with a 25-foot (8 meters) net (A) and 20-foot (6 meters) net (B).

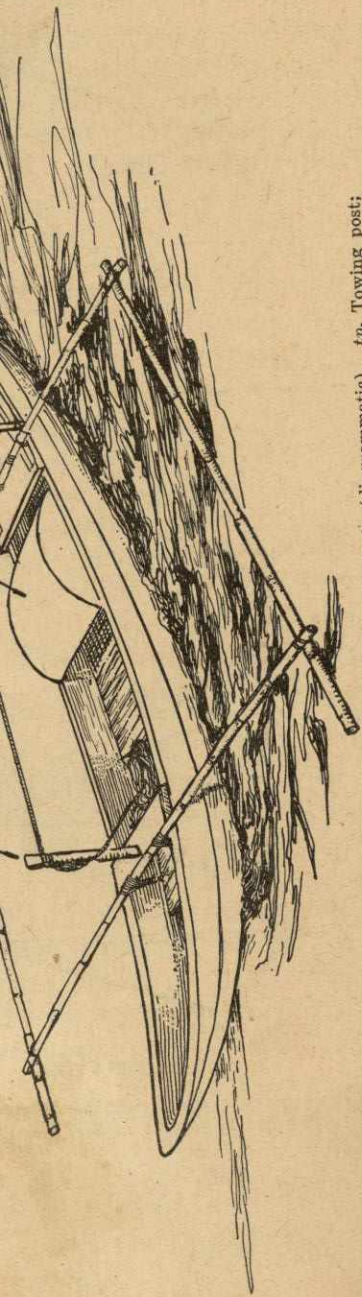


Fig. 4. Dug-out trawl craft in operation showing parts (diagrammatic). *tp*, Towing post; *fo*, bamboo outrigger; *ec*, engine coaming; *f*, fisherman operator; *ml*, main towline; *dr*, door track; *lp*, landing platform.

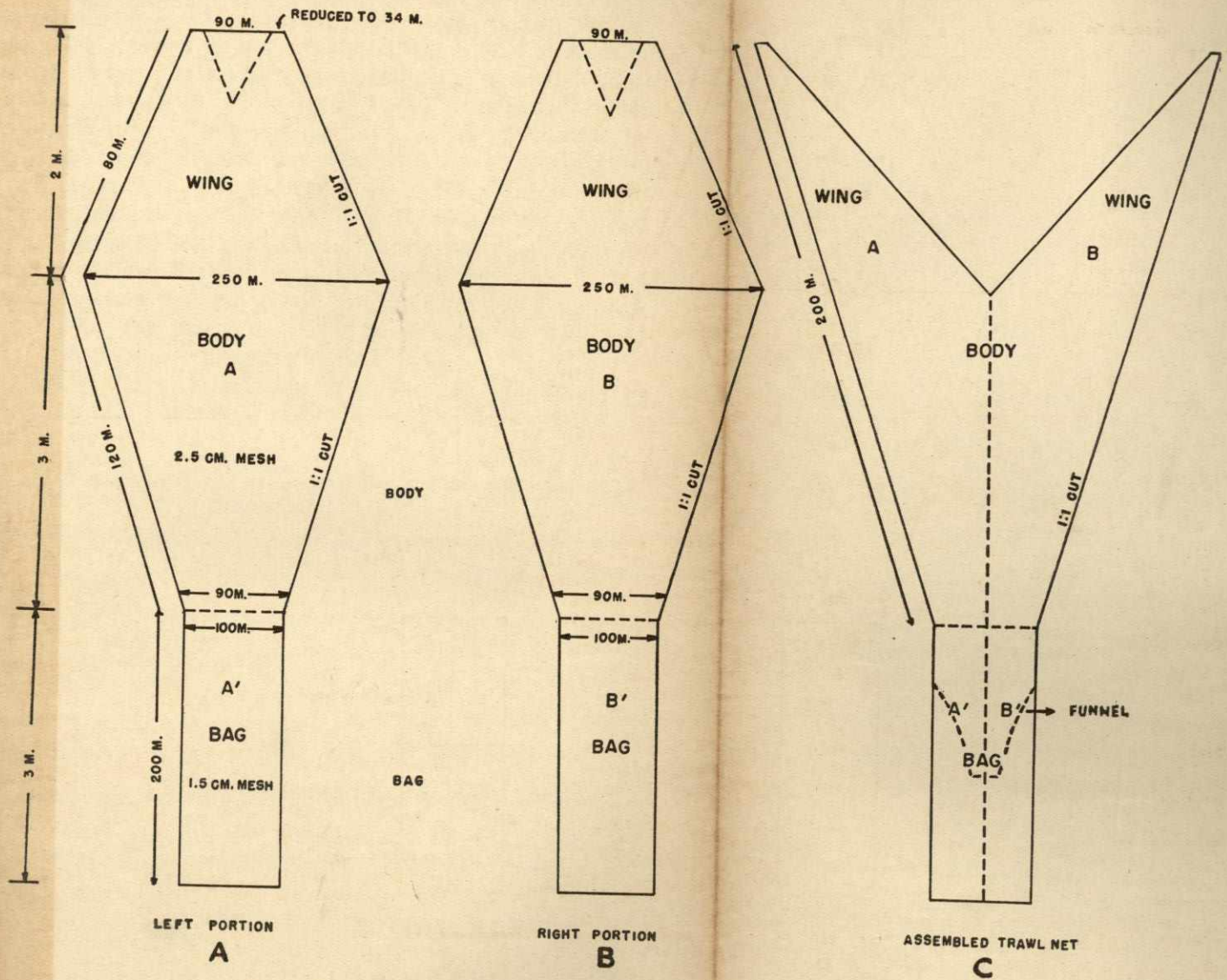


FIG. 5. Cutting diagram of a typical dug-out trawl net suited for a 6-H.P. gasoline engine: A and B, cut section and C assembled section of the trawl net.

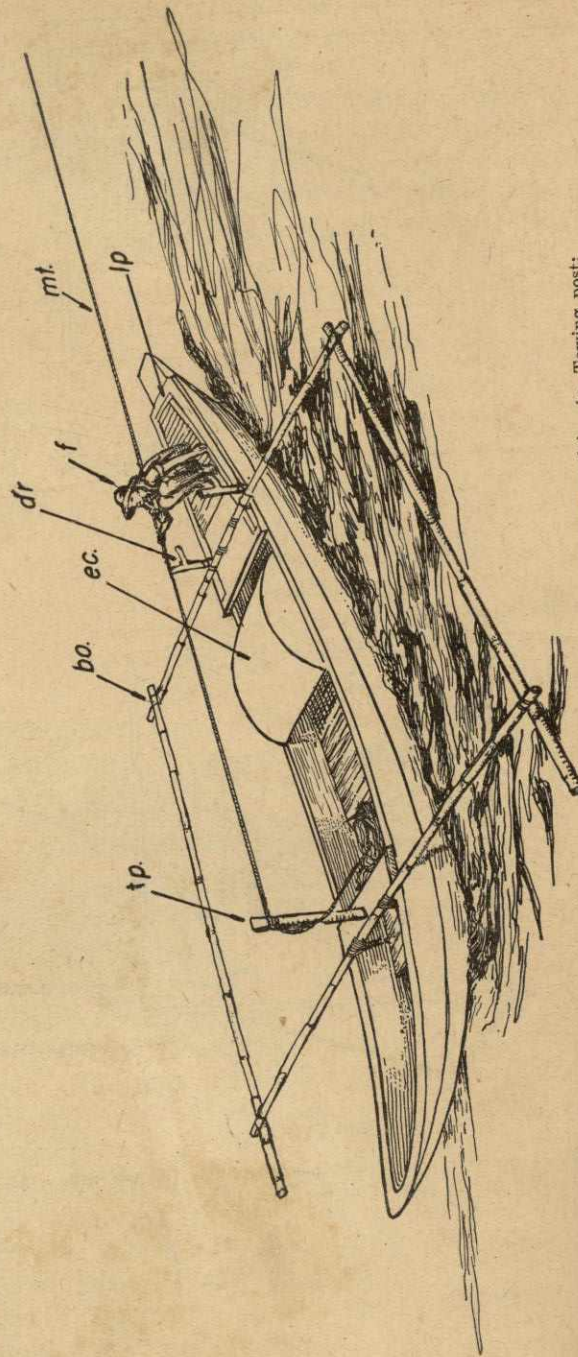


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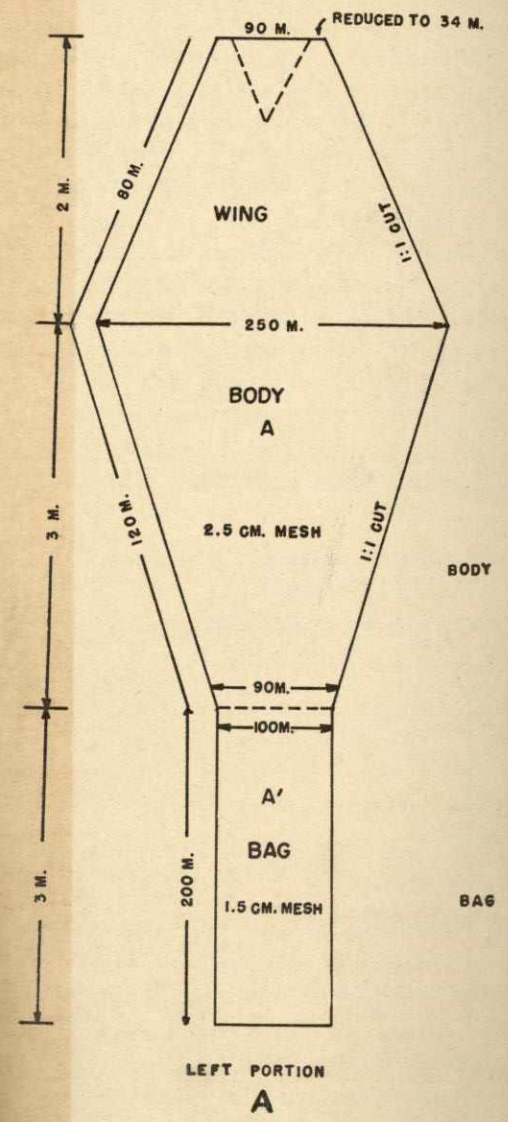


FIG. 5. Cutting diagram of A and B, cut se

the cod-end. The catch is placed in bamboo baskets (*tiklis*). The sorting of the catch is done at the fish landing.

Frequency, speed and duration of drag.—A drag covers from the time when actual towing commences until hauling time. A drag usually lasts from 20 to 30 minutes depending upon the abundance of fish. Normally, from 8 to 10 drags or hauls can be made in a night's fishing from 12:00 o'clock midnight to 7:00 o'clock in the morning. The speed of the drag varies from 1 to 1½ miles per hour. Craft with more powerful engine can drag as fast as 2 miles per hour.

THE CATCH

Species taken.—The species taken by dug-out trawl consist of a wide variety of aquatic animals which usually inhabit the littoral sea bottom. Table 4 shows the species taken with their relative abundance and respective range of sizes.

Rate of catch.—The usual rate of catch per drag of half an hour in Manila Bay during the survey is about 3 kilograms of marketable fish. A night trip may land from 20 to 30 kilograms of assorted marketable fish. The shrimps predominate in the hauls, ranging from 50 to 60 per cent of the entire marketable catch.

Disposal of catch.—Upon arrival at the landing the catch is sorted and placed in standard fish trays, each weighing about 4 kilograms of classified marketable fish. Unlike the catch of the large vessel otter trawlers, the catch is generally not handled through regular fish commission agents. The catch of the dug-out trawlers is sold direct to the wholesale buyers from Manila. Daily gross sales per trawler per day vary from 15 to 30 pesos and the operating expenses run from 5 to 15 pesos depending upon the size and power of the fishing craft.

Tanning of nets.—Trawl nets are usually tanned three or four times a month. However, when the operation is continuous, tanning is done every end of the week. The net is generally tanned by soaking it overnight in a macerated bark of *nige* (*Xylocarpus granatum*) bark or a decoction of *bakawan* (*Rhizophora* sp.) bark. The following day the net is dried in the shade and is ready for use. No blood treatment is employed in tanning dug-out trawl nets.

TABLE 4.—Typical composition of commercial catches of dug-out trawl in Manila Bay.

Species		Size range (total length in cm.)	Percentage
Scientific name	Tagalog name		
<i>Penaeus indicus</i>	Hipong puti.....	8-12	29
<i>Penaeus canaliculatus</i>	Hipong suaje.....	4- 7	35
<i>Neptunus pelagicus</i>	Alimasag.....	3- 8	12
<i>Gerres</i> sp.....	Malakapas.....	5- 8	7
<i>Cynoglossus</i> sp.....	Dapang chinelas.....	4-11	8
<i>Sillago</i> sp.....	Asohos.....	8-14	5
Miscellaneous.....			4
Total.....			100

SUMMARY AND RECOMMENDATIONS

- (1) A comprehensive study of the dug-out trawl fishery of Manila Bay has been undertaken which includes the history and development of the gear, the fishermen, the fishing craft and gear, mode of operation and an analysis of the size and nature of the commercial catches.
- (2) This comparatively new industry has undoubtedly increased the fishing efficiency of a large number of small-scale and to a certain extent some of the subsistence fishermen.
- (3) This mechanized dug-out craft used in the coastal otter trawl fishery is a piece of versatile craft that can be used for innumerable purposes, such as for other kinds of fishing, transporting and light towing in lakes and rivers.
- (4) The engines used in the present dug-out trawls are all of gasoline fed. While the initial cost of the 5 to 9 horse power diesel engine is high, its adoption would be more economical in the long run than the presently used gasoline engine.
- (5) The use of an auxiliary canvas sail will help reduce operating expenses as well as wear and tear of the engines.
- (6) The introduction of the dug-out trawl in other similar fishing grounds will help increase production of fresh fish in the less accessible rural areas of the Philippines.
- (7) The operation of the dug-out trawls will soon be in conflict with other fishing gear such as the shallow fish corrals, gill net, trawl lines and push nets. Studies on this problem are therefore in order.

ILLUSTRATIONS

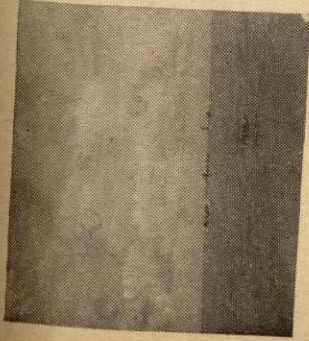
PLATE 1

- FIG. 1. Manila Bay. Note three dug-out trawlers in the background. August, 1954.
2. Dug-out trawler being readied for the fishing trip in Manila Bay. Note a modern trawler anchored in the background.
3. Paying-out the trawl net. Note one man operating the gear.
4. Hauling-in of the trawl net. Note carriers and medium trawlers anchored in the background, Manila Bay.
5. A typical dug-out trawler anchored along Navotas River, Navotas, Rizal.
6. Rear deck view of a typical dug-out trawler. Note the single piston gasoline engine, the tow ropes coiled over a rack and the two otter doors secured on regular wooden racks.
7. Trawl net hung on bamboo poles to dry on board a dug-out trawler.
8. Dug-out trawling fleet anchored in Navotas River, Navotas, Rizal.

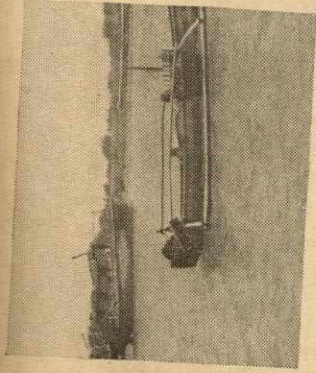
TEXT FIGURES

- FIG. 1. Dug-out otter trawl in operation (diagrammatic).
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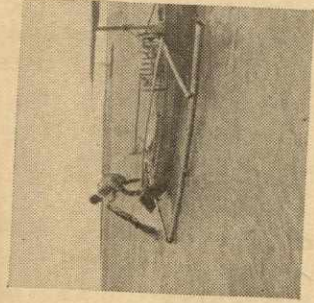
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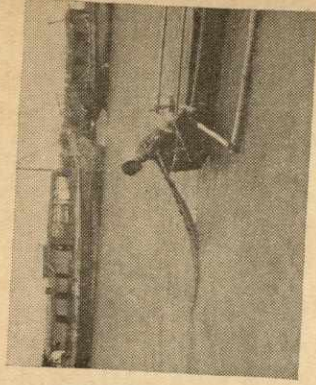
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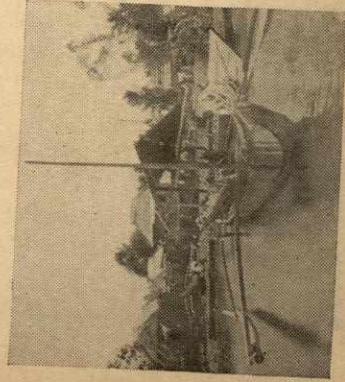
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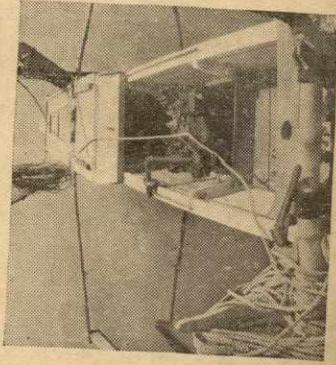
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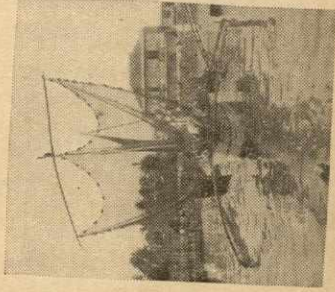
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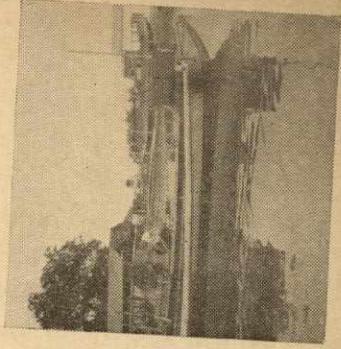
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