THE PHILIPPINE
JOURNAL OF FISHERIES

VOL. 2 JULY–DECEMBER, 1953 No. 2

THE GOBY DREDGE-TRAWL FISHERY OF LAGUNA DE BAY, WITH NOTES ON THE COMPOSITION OF THE COMMERCIAL CATCHES

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FIVE PLATES AND ELEVEN TEXT FIGURES

INTRODUCTION

The goby dredge-trawl fishery is comparatively a new industry, being developed during the postliberation period. At the close of 1950 it became an established industry along Rizal Province side of Laguna de Bay. This industry consists principally of the catching of white goby, *biyang puti* (*Glossogobius giurus*), with the use of an indigenous dredge-trawl gear operated on fishing dugouts. The gear was formerly employed in gathering fresh-water mollusks, which are the basic feed of the commercially raised ducks (*Anas boschas*) around the lake. Conservative estimate in 1950 placed the value of the industry in the neighborhood of 160,000 pesos worth of fishing craft, equipment and accessories. The extensive operation of this new fishing gear has resulted in various conflicts, if not in competition, with the other commercial fishing gear used in Laguna de Bay. As a consequence, two controversial views on the destructive effect of the gear have prevailed. One group claims it is a destructive gear to the demersal fishery; the other claims otherwise. In view of these

conflicting claims, some studies on the gear and its operation, as well as on the composition of the catches, were undertaken to determine its effects on the fishery resources.

Laguna de Bay (text fig. 1) is the largest fresh-water lake in the Philippines with an estimated area of about 930.7 square kilometers,[1] excluding Talim Island. It is a relatively shallow,

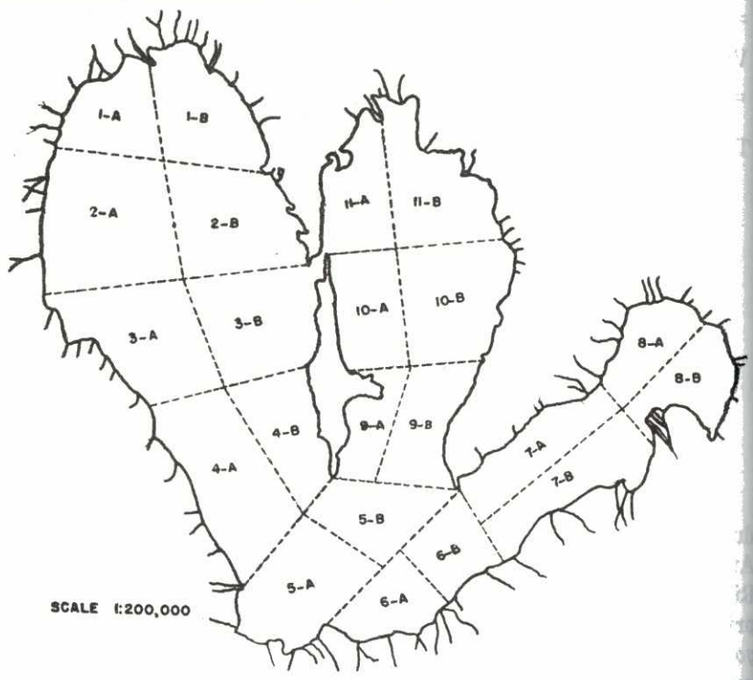

FIG. 1. Map of Laguna de Bay showing divisions of reference areas.

flat and muddy lake with a depth ranging from 3.5 meters in the middle area to 22 meters at a point near Diablo Pass. The average depth of the trawlable area (approximately 850 square kilometers) is about three meters. The nature of the bottom is generally of soft mud with sandy littoral areas near the mouths of inflowing rivers. The areas around the small island and headlands are generally rocky and muddy. These conditions of relative shallowness, muddy smooth bottom and almost perennial turbidity of the water make it ideal for the growth and multiplication of melanid snails and clams as well

[1] Aldaba, Vicente. The dalag fishery of Laguna de Bay. Phil. Jour. Sci. 45 (1931) 41–57.

as for the operation of dragnets, fish-corrals and gillnets in the lake throughout the year.

INTRODUCTION OF THE GOBY DREDGE-TRAWL AND OTHER TRAWLS IN LAGUNA DE BAY

The dredge trawl was evidently evolved from the age-old snail dredge trawl (*kaladkad*) commonly used in the commercial gathering of clams and snails used by the duck industry around Laguna de Bay. As far as it could be ascertained the fishermen of the municipalities of Pasig, Pateros, Taguig, and Binangonan, Rizal Province, were the originators of this goby dredge trawl.

As early as 1943 some experimental tests of the dredge trawl were conducted by Pasig and Pateros fishermen. But during the boom of the duck-raising industry in 1945–1947, the use of the dredge trawl ceased for sometime. However, immediately after the major collapse of the duck industry brought about by the typhoon "Jean" on December 26, 1948, the dredge trawl was revived by fishermen of Laguna de Bay as a means of livelihood. A much improved design, which was developed by the fishermen of Barrio Kalinawan, in the municipality of Binangonan, Rizal Province, came into use.

The original contrivance was a one- or two-dredge-trawl nets towed by a sailing fishing craft. Later in 1949–1950 motorized fishing crafts and motorlaunches towing three to four nets from a fishing craft were used. This motorlaunch-towed fishing craft was initiated by Pasig snail fishermen who fished alternately or wholly for snail and/or fish. With the collapse of the duck-raising industry in 1948–1949, a large number of the fishing craft formerly used in the snail fishery were converted into dredge trawlers purposely for *biya*, hence, the local name "*kalad kad pambiya*".

In 1949 a commercial beam trawl gear (Japanese utase) operated on a 60-foot motorlaunch was tried with success in Laguna de Bay, but many fishermen in the lake objected to its use. It damaged a lot of set lines (*kitang*) and gill-nets (*pante*) besides offering stiff competition with other fishing gear. However, it ceased operation after a few months. A small experimental otter trawl was also used by the Bureau of Fisheries for the purpose of assaying the bottom resources of the lake. The operation of the beam and otter trawl was often beset by constant digging-in of the foot-rope on the very

soft bottom of the lake. To offset this difficulty, flat stone weights and footrope seized with old netting were used.

THE FISHERMEN

Two or three men form the fishermen crew of sailboats and motorized craft. Each fishing craft is generally owned by the "head" fisherman who usually acts both as the pilot and as master fisherman. The crew are usually paid on the share basis of the catch. After deducting the operating expenses, 25 per cent of the net return goes to the vessel and gear, and the remaining 75 per cent is equally divided among the crew. Since this group of fishing vessel is less than three tons gross, a licensed skipper or engineer is not required as in a motorlaunch-towed fishing craft.

In motorlaunch-towed fishing craft, 50 per cent of the net return goes to the towing motorlaunch, 25 per cent to the towed fishing craft and fishing equipment, and 25 per cent to the fishermen. However, if the towing motorlaunch and towed fishing craft are both owned by the same person, the fishermen are paid on the daily basis of from 3 pesos to 4 pesos each. The towed fishing craft is usually manned by three or four fishermen and the towing motorlaunch by two or three men, a licensed skipper and two deckhands.

THE FISHING CRAFT

On the basis of the nature and mode of propulsion, the fishing craft are classified into three categories, namely, sailboat, motorized and motorlaunch-towed craft. Table 1 shows

TABLE 1.—*Number and kind of dredge-trawler units operating in Laguna de Bay (as of August, 1950).*

Kind	Number
Sailboat craft	184
Motorized craft	12
Motorlaunch-towed craft	4
TOTAL	200

that of the 200 operating units reported in August, 1950, 184 were sailboats, 12 motorized and four motorlaunch-towed fishing craft. Motor power used ranged from single, double to four cylinder gasoline engine (8 to 15 horsepower, air- or water-cooled types) which are installed on large dugout craft.

The fishing craft proper consists of the conventional wooden dugout which varies in size and mode of rigging for the different categories. The dugout is shaped out of a log of *mayapis, Shorea palosapis* (Blanco) Merr., and side plankings of *palosapis, Anisoptera thurifera* (Blanco) Merr., are added to increase the free board of the fishing craft.

Sailboat fishing craft (*Plate 1, fig. 1; text fig. 2*).—A typical sailboat fishing craft consists of a dugout measuring from 10 to 12 meters long, 1.0 to 1.3 meters wide and about a meter deep. It is propelled by a pair of lateen sails consisting of a main and a foresail. It has an open deck like the other two types of fishing crafts. The deck flooring consists of preformed bamboo or wooden slats which are made into removable sections.

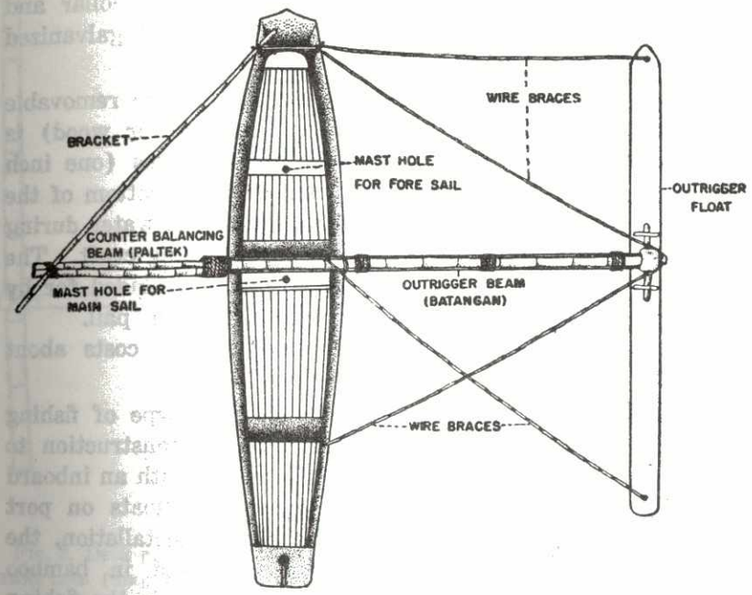

FIG. 2. Deck plan of a typical sailboat fishing craft towing one to two dredge-trawl nets (diagrammatic).

The craft is provided with a single outrigger fixed on the starboard side of the fishing craft. The outrigger consists of a six-meter bamboo (*Bambusa spinosa*) beam (*batangan*) and a wooden float (*palañgoy*). To strengthen it, the beam is braced by a pair of boards (2″ × 6″ × 20′) which are

bolted through the main bamboo beam and seized together by a series of galvanized iron wires or Manila rope seizings. Toward the portside, the beam is extended by a pair of short bamboo beam for counterbalancing purposes (*paltek*). This is supported from the forward bow by a bamboo bracket and mast stays.

The outrigger float is made of a flattened elongate box (6″ × 12″ × 20′) although a number of fishing craft still use the original paired bamboo floats. This box float is completely hollow inside and is constructed from 2-inch tanguile boards. It is thoroughly coated with coal tar to preserve and to keep it watertight. The outrigger float is held in place to the beam by means of a wooden outrigger beam collar and by forward, cross and aft braces made of jointed galvanized iron wire.

At the stern an open socket is provided for the removable rudder tiller. A portable open stove (kerosene or wood) is located aft the fishing craft. Three or four holes (one inch diameter) are drilled along the midcenter of the bottom of the dugout in order to provide entrance of fresh lake water during fishing and for drainage when beaching the fishing craft. The circulation of water in the livewell is crudely provided for by regularly bailing out of the water with a 2-gallon pail.

A complete outfit including two sets of nets costs about 750 pesos.

Motorized fishing craft (*text fig. 3*).—This type of fishing craft is similar in size and general plan of construction to the sailboat, except that the former is provided with an inboard engine and two equal bamboo outriggers and floats on port and starboard sides. Because of the engine installation, the livewell is eliminated and the catch is stored in bamboo baskets. To keep them in fresh condition while in the fishing ground, the fish are stored in alternate layers of either rice straw or banana leaves. Since this type of craft usually operates in the evening, the catches are iced at the landing before shipping them to markets early in the morning.

The engine is installed amidship and is provided with an engine coaming as a protection from the weather. The tiller of the rudder is controlled by an extension lever arm to a wheel immediately behind the engine coaming. To protect the engine against the rain or splash of lake water, the coaming is covered by either canvas or flat galvanized iron sheet.

A complete outfit including two sets of nets costs about 850 pesos.

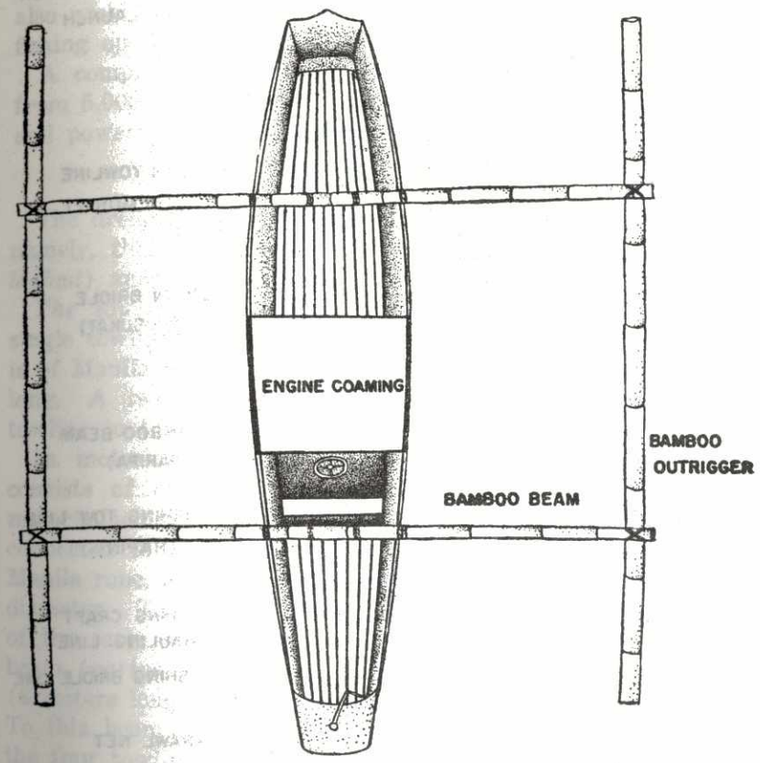

FIG. 3. Deck plan of a motorized fishing craft towing one or two dredge-trawl nets (diagrammatic).

Motorlaunch-towed fishing craft (*text fig. 4*).—The fishing outfit consists of a towing "mother motorlaunch" of about 8 to 15 tons gross, powered with a single diesel engine (70 to 225 horsepower) and one or two towed fishing craft. Ordinarily, one fishing craft towed operates four dredge-trawl nets. The "mother" craft is usually a 30- to 45-foot wooden harbor motorlaunch with a relatively shallow draft of about six feet.

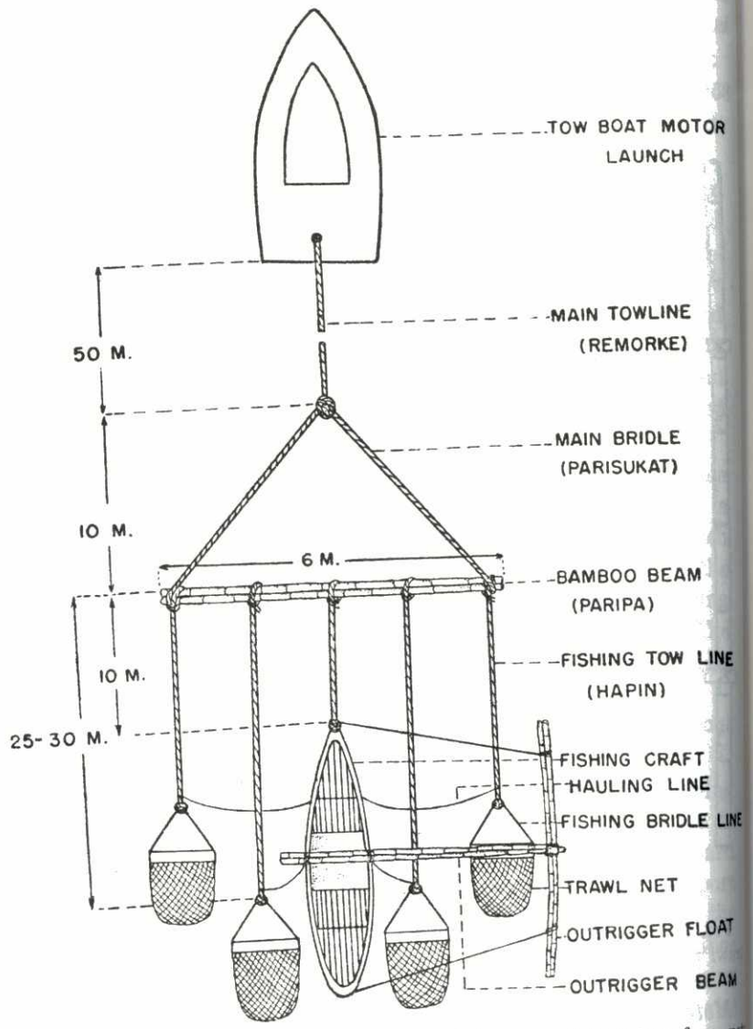

FIG. 4. Motorlaunched-towed fishing craft in operation using four net (diagrammatic).

The fishing craft proper used is generally bigger than th two types just described. It is about 15 meters long, 1 meters wide and about a meter deep. This type of craft ha a spacious livewell. It is provided with a starboard outrigge of paired beam and bamboo float. The deck is open wit bamboo slat floorings. The midsection of the deck which

open fore and aft at the bases of the outrigger beam serves as the hatch to the livewell. This uncovered portion of the deck also serves for the bailing out of water while the bottom intake holes of the vessel are open to provide aeration of the livewell. A rudder and an open hand tiller at the stern are also provided for the proper maneuvering of the craft during fishing operation.

A complete outfit including the mother motorlaunch costs from 5,000 pesos to 8,000 pesos,[2] depending upon the tonnage and power of the mother towing vessel.

THE FISHING GEAR

The dredge-trawl fishing gear consists of three main parts, namely, the towline (*remorke*), the dredge-trawl frame (*kaladkad*) and the net proper (*lambat*).

The towlines.—In sailboat and motorized fishing craft, a single towline (*hapin*) is attached to each individual net. It is of Manila rope, ½ to ⅝ inch diameter and about 30 meters long. A two-meter briddle of the same rope connects the towline to the dredge-trawl frame.

In motorlaunch-towed fishing craft, however, the towline consists of one main line (*remorke*) rigged to the towing motorlaunch and a series of individual fishing towlines (*hapin*) connected to each trawl net. The main towline is made of Manila rope, about 50 meters long and from 1 to 1.5 inches in diameter. This is connected to a 20-meter bridle (*parisukat*) of the same size. The bridle ends are secured to a bamboo beam (*paripa*), consisting of three pieces of a whole bamboo (6 meters long) seized together by G.I. wires or rattan splits. To this beam is secured the fishing craft at the center and the four towlines, each measuring from 25 to 30 meters long and ½ to ⅝ inch in diameter, which are evenly set on the beam. At the junction of each fishing towline and the fishing bridle line, a retrieving line 5 meters long, ½ inch diameter, Manila rope is connected for hauling-in the trawl net.

The dredge-trawl frame (*Plate 4, fig. 1, and text fig. 5*).—In effect the dredge-trawl frame serves as the basic skeletal structure of the gear, like the shrimp pipe trawl, the trawl-heads and sleds of the early original beam trawls used in the early days of trawling in New England and British Columbia (Symonds, 1947). The frame consists of a sledlike device

[2] One peso is equivalent to 50 cents U. S. currency.

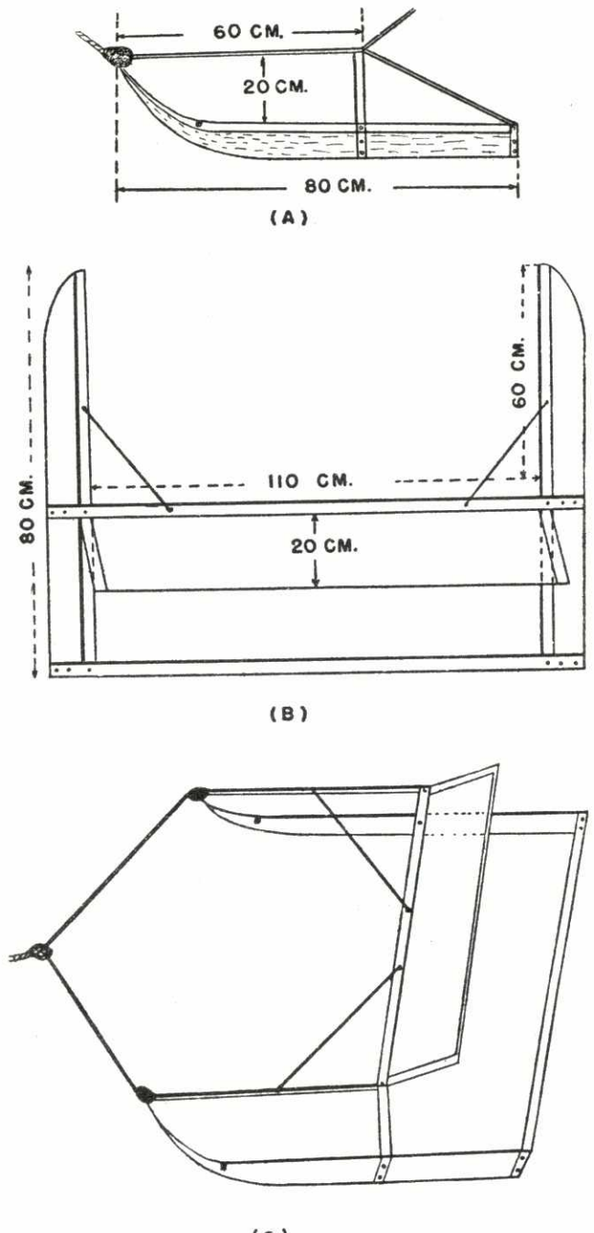

FIG. 5. Dredge-trawl frame: (A) side view, (B) top view, (C) dorso-lateral view.

made from rivetted iron plates (¼" by 1") with two bottom skis or runners. These skis are made either of wood or G.I. iron sheets which prevent the digging-in of the gear on soft mud during operation. To keep the gear from hugging the bottom a horizontal paravane (rectangular wooden board, 20 by 110 centimeters) is rigged in an inclined plane (30° to 45°) on the top of the iron framework. The angle is adjusted by bending upward or downward the iron plate base of the wooden board.

The frontal opening of an average dredge-trawl frame measures 110 centimeters wide and about 20 centimeters in height (text fig. 5*b*). The horizontal length is about 80 centimeters from the tip of the sled-runner to its base. To strengthen the framework two diagonal iron braces, ⅜" diameter, hold the upper framework. The fore-ends of the skis are connected by a fishing bridle, about 2 meters long, ⅝ inch diameter Manila rope (text fig. 5*c*).

The net proper.—Essentially, the net is similar in general features to that used for the snail dredge. The difference lies only in the size and mesh of the net used—the former being much bigger in size, with larger meshes and heavier netting. The dredge-trawl net and frame when wet weighs about ten kilos, convenient enough for two men to haul-in from the water with the fish catch.

A typical net measures from two to three meters long and about one meter in diameter at the mouth. Normally, a flapper is provided to prevent the escape especially of mudfish (*Ophicephalus striatus*) through the mouth of the net. It is made of a 25-centimeter strip of light netting sewed around the inside lining of the throat and nape of the net, about 30 centimeters from the mouth. The net is made of three parts, namely, the wings (*pakpak*), body (*katawan*) and the cod-end (*supot* or *pusod*).

In effect the wings are not actually a part of the main net. They consist of a barricade of netting rigged on the side of the frame of the skis. This is made of a piece of 6-thread cotton netting, 3-centimeter stretch mesh, which is held by a G.I. iron wire fitted to the shape and size of the side of the trawl frame where it is fixed permanently. As in the modern trawl, these wings prevent the escape of the fish toward the sides; thus increasing the efficiency of the gear.

Text fig. 6*a* shows the diagram of a dredge-trawl net. The net is entirely made of a 3-centimeter stretch mesh, No. 6 thread, seine netting. It is cut from a single piece of netting, 190 meshes long by 150 meshes wide. The shaded sections as indicated in the diagram are cut out. Then the bottom is folded over the top and the following sections are joined together: Sections A to B; E to C–C′; and E′ to D–D′. In folding, the top side is extended 10 meshes beyond the mouth (upper flap) which serves as the square as in the regular trawl nets. The final form of the net when assembled is shown in text fig. 6*b*, resembling a rectangular box. The bottom of the boxlike net becomes the cod-end. The rim of the mouth of the net is provided with a 2″-mesh selvage made of No. 9 thread, and of the same size of mesh as the body of the net.

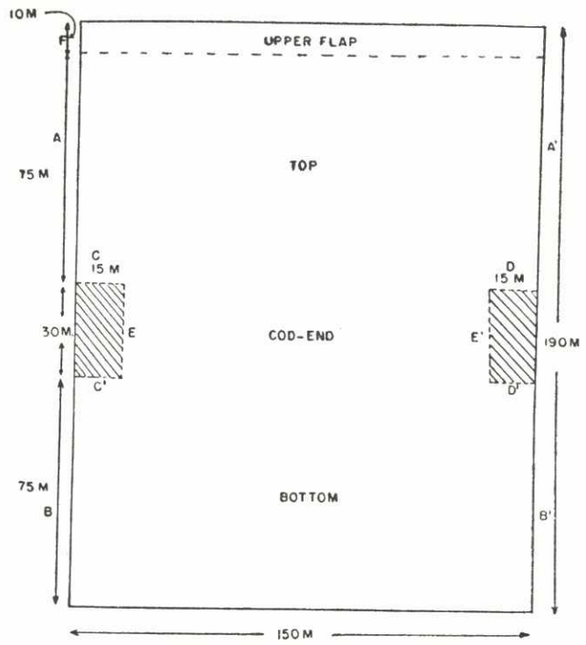

FIG. 6*a*. Cutting diagram of a piece of netting 3-centimeter stretched-measure mesh No. 6 cotton twine 150 x 190 meshes for making a typical fish dredge-trawl net.

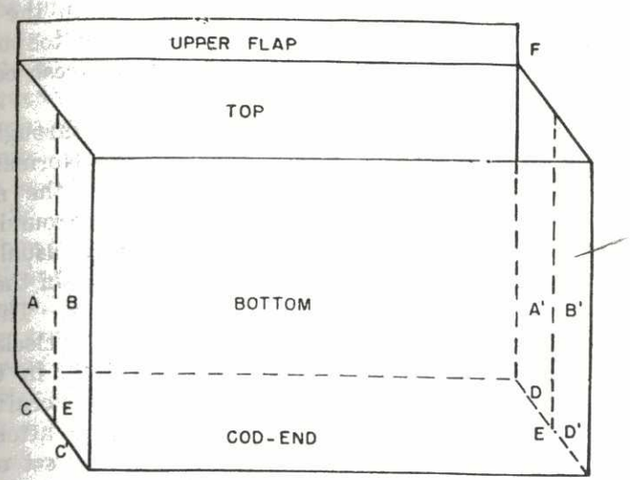

FIG. 6*b*. The dredge-trawl net after joining sections.

The actual cost of materials and labor needed for the construction of a dredge-trawl gear is as follows:

Frame	₱10.00
Net	10.00
Tow rope	6.00
Total	₱26.00

These dredge trawls are generally made by the fishermen themselves in small village shops located in Bangbang, Pasig and Kalinawan (Plate 3, fig. 1) Binangonan, Rizal Province, and in Gulod, Cabuyao, Laguna Province.

FISHING OPERATIONS

The dredge-trawl net, being light and handy, is suitable for use on board dugout fishing craft without the aid of mechanical deck equipment. The size of trawl nets used is almost the same for the three classes of fishing craft employed in the fishery in Laguna de Bay.

Sailboat fishing craft depend upon steady and moderate winds, which usually occur in the afternoons during the southwest monsoon period (June through August). However, during the northeast and easterly monsoon period (September through March) these winds are more or less steady from sunrise to sunset allowing a full-day fishing operation by the sailboat fishing craft.

The motorized fishing craft usually operate in the evening during the northeast monsoon period returning to port early in the morning to dispose off the catch still in fresh condition, thereby avoiding the use of a livewell.

The motorlaunch-towed fishing craft operate throughout the year except during heavy winds or typhoons. Normally, they leave port between 5:00 and 6:00 o'clock in the morning, arriving between 8:00 and 9:00 in the fishing ground. However, those in the homeport, in Pasig, Rizal, usually leave between 2:00 and 3:00 in the morning, arriving in the fishing ground between 5:00 and 6:00 of the same day. They leave the fishing ground between 12:00 and 1:00 o'clock in the afternoon, arriving Pasig at about 3:00 o'clock, in time for the fresh-fish market. Motorlaunch-towed fishing craft usually clear off the fishing ground before 4:00 in the afternoon in order to allow gill net and set line operators to set out their gear. These gears are retrieved at sunrise of the following day before the dredge trawlers start to operate again.

Shooting the net.—In the fishing ground, after securing all the towlines of each individual net and setting the proper course and trawling speed of the fishing craft, the nets are payed out one after the other on the starboard or port-side, depending upon the position of the towline on the securing beam. Each gear is shot overboard with both hands holding the frame and allowing it to hit flat on the water with the mouth of the frame downward. The towline is held taut until the net stretches out in the water and then the entire towline is released. Dragging then commences (Plate 2, figs. 1–3).

Hauling-in.—In sailboat and motor-propelled fishing craft, the craft is hove-to before the hauling-in operation. The sails are slacked off and/or the engines stopped. Then, the towlines are hauled-in by hands. The dredge-trawl frame is lifted out of the water and placed on deck. The cod-end part of the net is "shaked off" in the water to wash out the mud (Plate 5, fig. 1). The catch is then emptied on the bamboo deck (Plate 5, fig. 2), sorted and released while still alive into the livewell. The small-sized biya and kandule are thrown back into the sea. In motor-launch-towed fishing craft, however, the fishing operation involves a continuous process of alternate shooting and hauling of the four nets. The fishing craft is not hove-to or stopped except in case of a snag or fouling of the gear. However, the hauling-in of the nets is done by one or two men alternately pulling the towline. A retrieving line, attached to each net facilitates the hauling of the nets on the side of the fishing craft (text fig. 4).

Frequency, speed and duration of drag.—In sailboat and motor-propelled fishing craft, a normal drag takes from 10 to 15 minutes depending upon the abundance of fish and nature of the sea bottom so that in an eight-hour fishing day from 20 to 30 hauls can be made. In motorlaunch-towed fishing craft however, about five to ten minutes is the duration per normal drag, thereby allowing from 70 to 90 hauls in one day. Evidently, more hauls can be made on motorlaunch-towed fishing craft because of its continuous dragging operation. The speed of dragging ranges from one to two miles per hour, the latter rate having been observed in the motorlaunch-towed fishing craft.

Trawl-warp depth ratio.—The trawl-warp depth ratio varies from 6 to 8 times the depth in sailboat and motor-propelled fishing craft. In motorlaunch-towed fishing craft, the ratio is from 8 to 10 times the depth, the payed out towing line ranging from 25 to 35 meters long.

Species caught.—Table 2 shows the list of common marketable species caught by dredge trawlers in Laguna de Bay from June through September, 1950. Among the species of fish

TABLE 2.—*List of common marketable and nonmarketable species taken by dredge trawler in Laguna de Bay (June to September, 1950).*

English name	Tagalog name	Scientific name
Marketable species:		
White goby	Biyang puti	*Glossogobius giurus.*
Sea catfishes	Kandule	*Arius* spp.
Fresh-water theraponid	Ayuñgin	*Therapon plumbeus.*
Murrel	Dalag	*Ophicepalus striatus.*
Fresh-water catfish	Hito	*Clarias batrachus.*
Mullet	Talilong	*Mugil* spp.
Nonmarketable species:		
Prawns	Hipon	*Palaemon lanceifrons.*
Viviparid snail	Papan	*Vivipara angularis.*
Ampularid snail	Kohol	*Ampularia luzonica.*
Clam	Sulid	*Simpsonella subcrassa.*
Clam	Tulya	*Cyrena manillensis.*

caught were the white goby, *biyang puti* (*Glossogobius giurus*); sea catfish, *kandule* (*Arius* spp.); fresh-water theraponid, *ayuñgin* (*Therapon plumbeus*); murrel, *dalag* (*Ophicephalus striatus*); fresh-water catfish, *hito* (*Clarias batrachus*) and white mullets, *talilong* (*Mugil* spp.). Of the species taken, the white goby usually formed the major bulk of the hauls,

the amount varying in different months. From February through September about 65 to 98 per cent of the hauls consisted of biya; 0.5 to 35 per cent, kandule; and up to 14 per cent of dalag (Tables 3, 4 and 5). The theraponid (ayuñgin) very often formed the major bulk of the trash fish taken in

TABLE 3.—*Analysis by months of catches of sailboat fishing craft in Laguna de Bay towing two nets, Areas 2A, 2B, 4A, and 4B*

Date	Sailboat number	Fishing time	Marketable fish			Total catch	Rate of catch per hour
			Biya	Kandule	Dalag		
1950		*Hrs.*	*Kgs.*	*Kgs.*	*Kgs.*	*Kgs.*	*Kgs.*
July	1	6	19	9.0	----	28.0	4.6
	2	7	10	7.0	----	17.0	2.4
	3	6	12	8.0	----	20.0	3.6
	4	5	12	4.8	----	16.8	3.3
	5	5	17	12.0	----	29.0	5.8
	6	7	16	5.0	----	21.0	3.0
	7	5	24	15.0	----	39.0	7.8
	8	5	11	4.0	----	15.0	3.0
Total	----	46	121	64.8	----	185.8	----
Per cent	----	----	65.1	34.9	----	100.0	----
August 2	9	5	16.0	1.5	----	17.5	3.5
	10	5	18.0	3.0	7	28.0	5.6
	11	5	20.0	3.0	23	46.0	9.2
	12	6	30.0	3.0	----	33.0	5.5
	13	5	16.5	4.0	----	20.5	4.1
	14	4	17.5	5.2	----	22.7	5.6
	15	3	14.2	----	----	14.2	4.7
	16	3	22.0	----	----	22.0	7.3
Total	----	86	154.2	19.7	30	203.9	----
Per cent	----	----	75.6	9.7	14.7	100.0	----

Average catch per hour in kilograms: July 4; August, 5.7.
All months combined: 4.8.

TABLE 4.—*Analysis by month of catches of motorized fishing craft using two nets in Laguna de Bay, Areas 2 and 4 (evening operation).*

Date	Fishing unit	Fishing time	Marketable fish		Total catch	Catch per hr. per unit
			Biya	Kandule		
1950		*Hrs.*	*Kgs.*	*Kgs.*	*Kgs.*	*Kgs.*
September: 13	A	7	8	34	42	6.0
	B	7	6	16	22	3.0
	C	7	6	26	32	4.5
	D	7	7	28	35	5.0
	E	7	3	12	15	2.0
Total	5	35	30	116	146	----
Per cent	----	----	20.6	79.4	100	----

Average catch per hour in kilograms: September, 4.1.

TABLE 5.—*Analysis by months of catches of motorlaunch-towed fishing craft using four nets in Laguna de Bay, Areas 1A, 1B, 2A, and 2B.*[a]

Date	Fishing time	Marketable Catch			Total catch	Rate of catch per hr.
		Biya	Kandule	Ayuñgin		
1950	*Hours*	*Kgs.*	*Kgs.*	*Kgs.*	*Kgs.*	*Kgs.*
February 2	7	99.0	2.5	----	101.5	14.5
3	7	92.0	0.5	----	92.5	13.2
5	7	93.5	----	3	96.5	13.8
6	7	88.0	----	----	88.0	12.5
8	6	81.5	7.0	----	88.5	14.8
9	7	102.0	5.5	----	107.5	15.4
11	7	93.5	----	28	121.5	17.4
13	7	81.0	4.5	----	85.5	12.2
15	7	96.0	----	18	114.0	16.3
16	7	95.5	12.0	----	107.5	15.4
17	7	93.0	----	----	93.0	13.3
Total	76	1,015.0	32.0	49	1,096.0	----
Per cent	----	92.6	2.9	4.5	100.0	----
March 1	7	76.5	5.5	----	82.0	11.7
2	7	109.5	----	----	109.5	15.6
3	7	87.0	----	----	87.0	12.4
4	6	78.0	----	----	78.0	13.0
6	7	108.5	----	----	108.5	15.5
7	7	134.0	----	8	142.0	20.3
8	7	69.0	----	----	69.0	9.9
9	7	101.0	----	----	101.0	14.4
16	6	85.0	----	----	85.0	14.2
18	7	110.5	----	----	110.5	15.8
19	7	82.0	----	----	82.0	11.9
Total	75	1,041.0	5.5	8	1,054.5	----
Per cent	----	98.7	0.5	0.8	100.0	----
April 10	7	95	16.0	----	111	15.9
11	7	97	14.0	----	111	15.9
12	6	74	11.5	----	85.5	14.3
13	7	73	----	----	73	10.4
14	7	93	3.0	----	96	13.7
15	7	92	----	----	92	13.1
16	7	93	----	----	93	13.3
17	7	116	----	----	116	16.6
18	7	88.5	----	----	88.5	12.6
Total	62	821.5	44.5	----	866.0	----
Per cent	----	94.9	5.1	----	100.0	----
May 4	7	73.5	5.0	----	78.5	11.2
5	7	66.5	----	----	66.5	9.5
9	6	76.0	----	----	76.0	12.5
10	6	44.5	13.5	----	58.0	9.7
11	7	69.5	19.5	----	89.0	12.7
12	7	85.0	13.0	----	98.0	14.0
13	7	97.5	1.0	----	98.5	14.1
Total	47	512.5	52.0	----	564.5	----
Per cent	----	90.8	9.2	----	100.0	----
Grand total	260	3,390.0	134.0	57	3,581.0	----
Per cent	----	94.7	37.0	1.6	100.0	----

Average catch per hour in kilograms: February, 14.4; March, 14.06; April, 13.9; May, 12.1. All months combined: 13.62.

[a] Data secured through the courtesy of motorlaunch, *Junior Liner*, a commercial dredge trawler operating in Laguna de Bay during the period.

the haul and the amount was not usually recorded except the few big-sized ones. There was, however, one instance in September, 1950, when the kandule formed 79 per cent of the monthly average haul, exceeding that of biya. The murrel (*Ophicephalus striatus*), fresh-water catfish (*Clarias batrachus*) and mullets (*Mugil* spp.) was also taken as incidental composition of the catch.

There were also included in the haul a number of species of shellfishes which were usually saved by the fishermen for duck feed. These shellfishes consisted of *papan* (*Vivipara angularis*) and *sulib*, *Simpsonella subcrassa* (Table 2). At times the bigger-sized snails were utilized as food by the fishermen. During the period of abundance of these snails in the lake, the fishing efficiency of the goby dredge trawl was very much reduced owing to the clogging of the cod-end of the net. In every haul the catch consisted mostly of shellfishes with a very small percentage of marketable fishes.

It is very interesting to note here that a lone species of aquatic snake, *duhol*, *Chersydrus granulatus* (only known member of the genus from the Philippines) is caught in quantities by the dredge-trawlers in Laguna de Bay. From 4 to 8 snakes, ranging in length from one-half to one meter, are taken per haul during the period of observation. A number of this harmless snake are strung together and at the landing their blood is immediately extracted for tanning dredge-trawl nets and scoop nets (*panalok*) used in the fish corral fishery.

Size of catches.—Tables 3, 4, 5 and 6 show the actual catch record of marketable fishes taken by the three kinds of dredge-trawlers observed from February to September, 1950, in Laguna de Bay.

It will be seen that the total catch of sailboat fishing craft per fishing trip of one day ranged from 14 to 46 kilograms of marketable fish consisting of biya, kandule and dalag. The average catch per hour, using two nets, was 4 kilograms for July and 5.7 for August, 1950, with an overall average of 4.8 kilograms. In motorized fishing craft using two nets, the catch per trip a day was almost within the range of those of the sailboat, being 15 to 42 kilograms, and overall average catch per hour of 4.1 kilograms for September, 1950.

With the motorlaunch *M/S Junior Liner* rigged to one fishing craft and towing four nets, the total catch per fishing day ranged from 58 to 142 kilograms from February through May, 1950, with an hourly average of about 14 kilograms for February, March and April, and 12 kilograms for May (Table 5). With another motorlaunch *M/S Pasigueño* rigged also to one fishing craft and towing four nets the range of catch of marketable fish was from 48 to 93 kilograms per fishing trip of one day with an average catch per hour of 9.5 kilograms for June and July, 1950 (Table 6).

TABLE 6.—*Analysis by months of catches of motorlaunch-towed fishing craft towing 4 nets in Laguna de Bay, Areas 1 and 2* [a]

Date	Fishing time	Marketable catch				Total catch	Rate of catch
		Biya	Kandule	Ayufigin	Dalag		
1950	*Hours*	*Kgs.*	*Kgs.*	*Kgs.*	*Kgs.*	*Kgs.*	*Kgs.*
June							
16	7	51.5	8.0	-------	1.0	60.5	8.6
17	6	46.5	23.5	-------	1.5	71.5	11.9
18	7	49.5	12.5	-------	4.5	66.5	9.5
19	7	54.0	29.0	-------	2.5	85.5	12.2
21	7	36.5	6.0	-------	5.5	48.0	6.9
22	7	42.0	13.0	-------	3.0	58.0	8.3
23	6	41.1	4.5	-------	8.0	53.5	8.9
24	7	46.0	1.5	-------	2.0	49.5	7.1
26	8	48.0	43.0	-------	2.0	93.0	11.6
Total	62	415.0	141.0	-------	30.0	586.0	-------
Per cent	-------	70.8	24.1	-------	5.1	-------	-------
July							
3	7	57.5	34.0	-------	1	92.5	13.2
4	7	46.5	28.0	-------	3	77.5	11.1
5	7	30.0	18.0	-------	-------	48.0	6.9
7	7	25.0	21.0	7.0	-------	53.0	7.6
8	7	56.0	13.5	-------	-------	69.5	9.9
Totals	35	215.0	114.5	7.0	4	340.5	-------
Grand total	97	630.0	255.5	7.0	34	926.5	-------
Per cent	-------	68.0	27.6	0.7	3.7	-------	-------

Average catch per hour in kilograms: June, 9.5; July, 9.7; all months combined, 9.6 kilograms.

[a] Data secured through the courtesy of motorlaunch *Pasigueño*, a commercial dredge trawler operating in Laguna de Bay during the period.

It appears from the foregoing rate of catch of marketable fish that the motorlaunch-towed fishing craft landed from two to four times as much as that of the sailboat and motorized fishing craft. This is attributed to the fact that the former towed twice the number of nets, and in actual fishing operation, at least two or three trawl nets fish continuously while one or two are being hauled-in simultaneously.

Size composition of the catch by species.—Tables 7, 8 and 9 and text figs. 7 to 10 show the size composition of samples taken from the commercial catches of sailboat trawlers by species from June to August, 1950, inclusive. It will be seen that the size (body length) composition of biya taken ranges from 60 to 280 millimeters long with the mode at 124 milli-

TABLE 7.—*Length frequency distribution by month of samples of biya (Glossogobius giurus) taken by sailboat fishing craft in Laguna de Bay.*

Standard length	Biya (*Glossogobius giurus*)	
	June, 1950	July, 1950
mm.		
50— 59	1	
60— 69	1	
70— 79	3	1
80— 89	8	17
90— 99	20	16
100—109	31	92
100—119	71	88
120—129	54	60
130—139	39	50
140—149	36	34
150—159	23	24
160—169	12	25
170—179	14	15
180—189	7	12
190—199	3	8
200—209	10	3
210—219	3	3
220—229	1	1
230—239	4	1
240—249		1
250—259		2
260—269		1
270—279	2	
280—289		
TOTAL	343	504

TABLE 8.—*Length frequency distribution by month of samples of kandule (Arius spp.) taken by sailboat fishing craft in Laguna de Bay.*

Fork length	Kandule (*Arius* spp.)	
	June, 1950	July, 1950
mm.		
41— 45	2	
46— 50	1	
51— 55	12	
56— 60	10	
61— 65	10	
66— 70	1	
71— 75	4	
76— 80	2	
81— 85	2	
86— 90	2	
91— 95	1	
96—100		
101—105		
106—110		4
111—115		4
116—120		6
121—125		10
126—130		19
131—135		9
136—140		14
141—145		12
146—150		2
151—155		5
156—160		5
161—165		2
166—170		0
171—175		0
176—180		2
181—185		4
186—190		1
191—195		2
196—200		
201—205		
Total	47	101

TABLE 9.—*Length frequency distribution by month of samples of ayuñgin (Therapon plumbeus) taken by sailboat fishing craft in Laguna de Bay.*

Standard length	Ayuñgin (*Therapon plumbeus*)	
	June, 1950	July-August, 1950
mm.		
31— 35		1
36— 40		1
41— 45	1	1
46— 50	2	2
51— 55	7	1
56— 60	33	6
61— 65	86	23
66— 70	71	15
71— 75	59	10
76— 80	26	9
81— 85	10	1
86— 90	3	
91— 95	1	
96—100	1	
101—105		2
TOTAL	310	72

meters in June, 1950 (text fig. 7). In July of the same year, the size range of the samples taken was almost the same, but the mode was 114 millimeters, an indication that more of the lower size groups were taken during this month.

With the kandule, the size (fork length) composition of fish taken ranges from 33 to 98 millimeters for June, 1950, with the mode at 58 millimeters, while for July of same year the size ranges from 113 to 203 millimeters long with the mode at 133 millimeters (text figs. 8 and 9). It appears that more of the younger groups were taken during June in the fishery just at the close of the breeding season of the fish.

With the ayuñgin, the size (body length) composition ranges from 33 to 98 millimeters with the mode at 63 millimeters long. For July and August, 1950, the size ranges from 33 to 103 millimeters long, with the mode at 63 millimeters (text fig. 10). It is probable that more of the younger groups would have been measured in the sample were they not thrown back into the water during the fishing operation for being not readily marketable.

Sorting.—The catch (Plate 5, fig. 2) of the dredge trawl consists of an assortment of several species of varying sizes. As soon as the catch is landed on deck the undersized *biya*, *ayuñgin* and *kandule* are thrown back into the water while still alive. The murrels (dalag) are placed in a separate bag net (*barcelona*); the kandule, biya, and bigger ayuñgin in

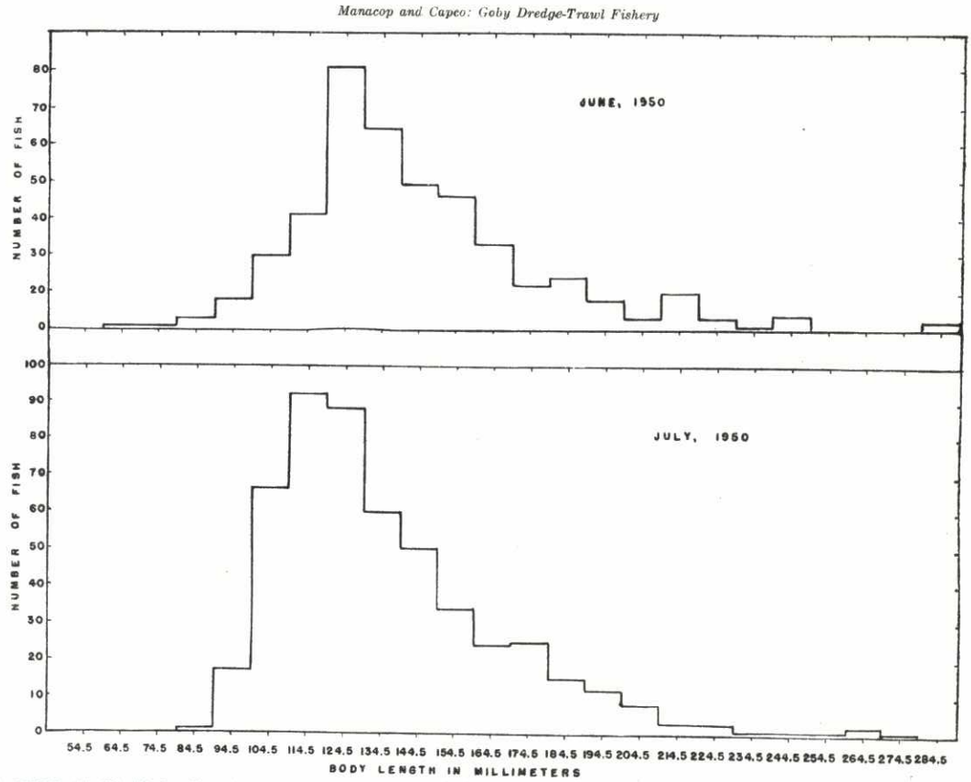

FIG. 7. Length frequencies of samples of biya (*Glossogobius giurus*) taken by sailboat fishing in Laguna de Bay (based on the figures in Table 7).

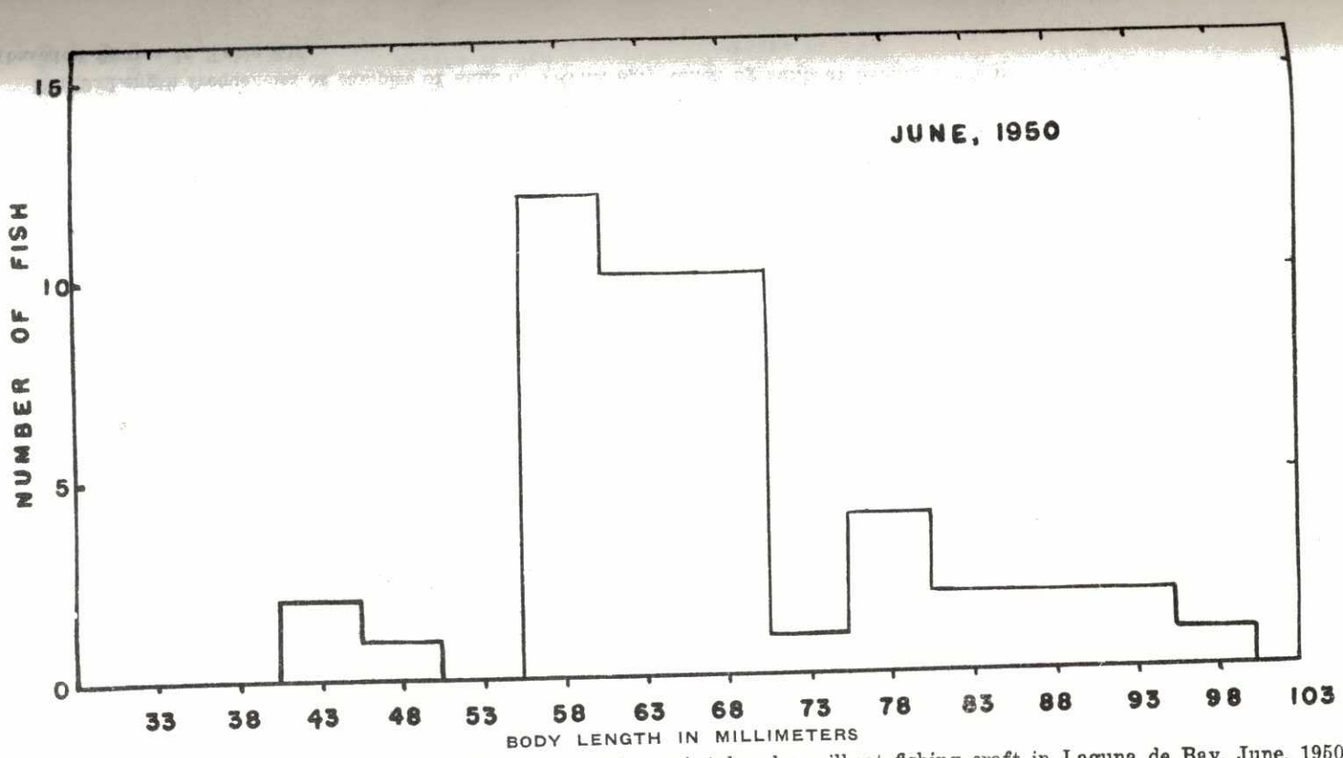

FIG. 8. Length frequencies of samples of kandule (*Arius* sp.) taken by sailboat fishing craft in Laguna de Bay, June, 1950 (based on figures in Table 8).

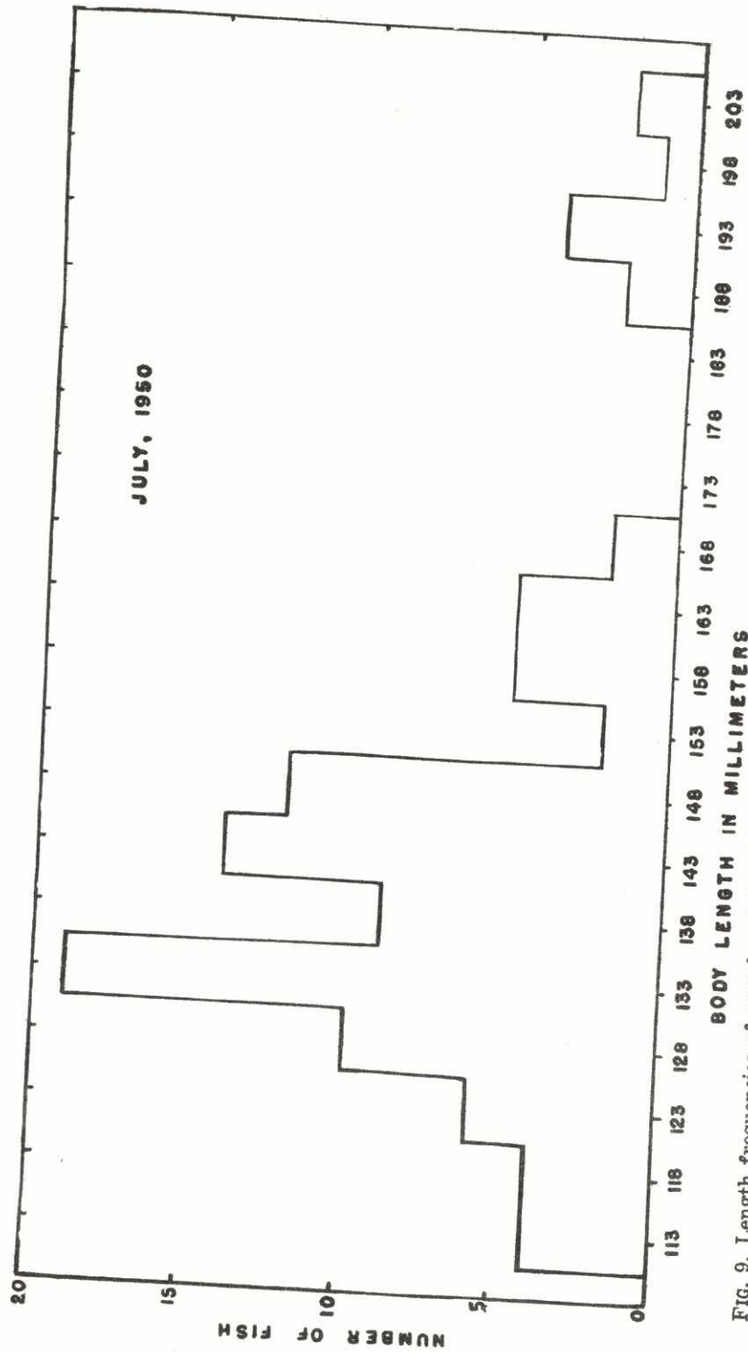

FIG. 9. Length frequencies of samples of kandule (*Arius* sp.) taken by sailboat fishing craft in Laguna de Bay, June, 1950 (based on figures in Table 8).

separate bamboo containers packed in layers with either banana leaves or some aquatic plants. On board motorlaunch-towed fishing craft, when the hold serves as a livewell, all the selected sizes of the commercial species taken are kept alive. The larger ayungin are sorted and placed in bamboo baskets (*kaing*), and later salted and dried by the fishermen.

No icing of the catch is done aboard the fishing craft except at the fish landing when necessary.

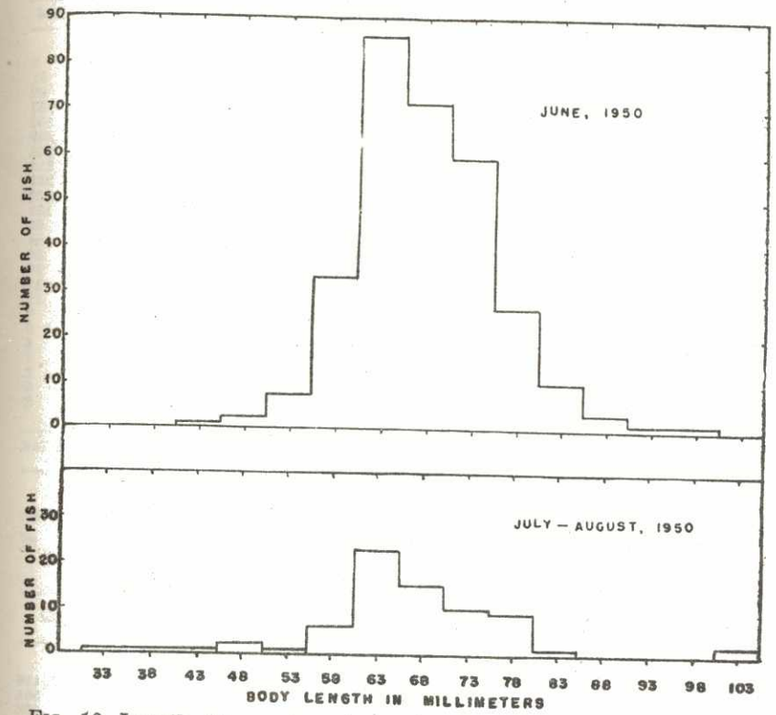

FIG. 10. Length frequencies of samples of ayungin (*Therapon plumbeus*) taken by sailboat fishing craft in Laguna de Bay (based on figures in Table 9).

SIZE COMPOSITION OF BIYA TAKEN IN RELATION TO THE MESH OF COD-END OF NETS USED

In order to determine the possible destructive effect of the dredge-trawl gear on the biya fishery, a comparative analysis of the size composition of the catch of the three different sizes of mesh of cod-ends of nets used by sailboat fishing craft was undertaken. Tables 10 and 11 show the results for June and

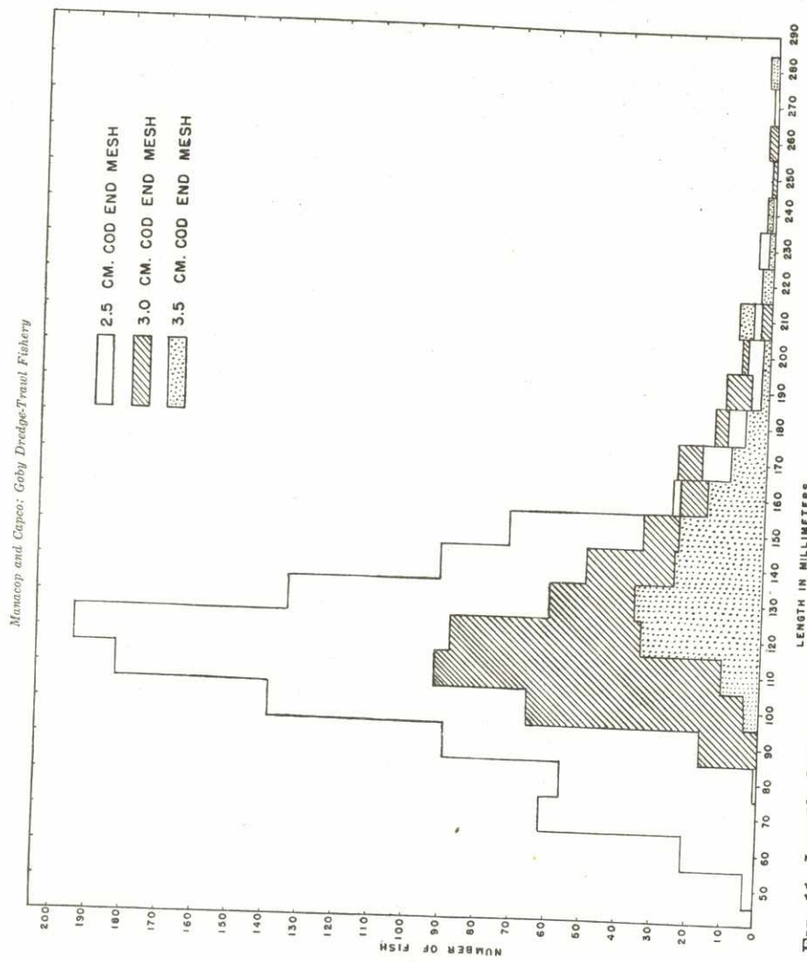

FIG. 11. Length frequencies of samples of biya (*Glossogobius giurus*) taken by different sizes of mesh of cod-end used by sailboat fishing craft in Laguna de Bay, June and July, 1950 (based on figures in Table 10).

Tanning of trawl nets.—Trawl nets are usually tanned every week. The nets are first tanned in a solution of macerated bark of *bakawan* (*Rhizophora candelaria* DC.) and later treated with the blood extracted from an aquatic snake, *duhol*, taken in the hauls. The blood treated nets are dried under the sun and steamed in order to coagulate the blood proteins completely. The net is now ready for use after this treatment.

SUMMARY

A comparatively new fishery was developed and established in Laguna de Bay with the introduction of an indigenous goby dredge-trawl gear, locally called *"kaladkad pangbiya"*, used in the catching of demersal species.

As to mode of propulsion, the fishing craft are classified in three categories; namely, sailboat, motorized and motorlaunch-towed boats. The fishing craft proper consists of the conventional dugout measuring from 12 to 14 meters long, 1.0 to 1.3 meters wide and about a meter deep; about one ton gross capacity.

The rigging of the fishing craft and gear, the fishing operation, handling and marketing of the catch are fully described.

The rate of catch per hour varies in the three kinds of fishing craft used, 4.5 kilograms for sailboat and motorized craft and 12.0 kilograms for motorlaunch-towed vessel. The rate of catch by depth and by area was not ascertained in this study.

The dredge-trawl catches consist of six species of fish represented by six families, five species of shellfishes and a lone species of aquatic snake, *Chersydrus granulatus*. The biya (*Glossogobius giurus*) formed from 65 to 95 per cent of the haul, followed by kandule (*Arius* spp.) and dalag (*Ophicephalus striatus*). The ayuñgin (*Therapon plumbeus*) is generally considered a trash fish in the catch.

The composition of the catch by species was found to range from 54 to 280 millimeters (body length) for biya; 33 to 203 millimeters (fork length) for kandule, and 33 to 98 millimeters (body length) for ayuñgin.

The percentage composition of immature and mature biya taken varies with the different cod-end mesh of nets used. For 2.5-centimeter mesh, 66 per cent was found to be immature; for 3-centimeter mesh, 52 per cent; and for 3.5-centimeter mesh, 24 per cent.

July, 1950, for the three cases. A total of 1,106 individuals taken by a 2.5-centimeter mesh cod-end were measured, 504 for 3.0-centimeter mesh, and 197 for 3.5-centimeter mesh stretched.

TABLE 10.—*Length frequency distribution of biya taken by sailboat fishing craft for June and July, 1950 in Laguna de Bay, by size of cod-end mesh of dredge-trawl net.*

Standard length	Cod-end mesh (stretched)			
	2.5 cm.	3.0 cm.	3.5 cm.	Combined
mm.				
50– 59	3			3
60– 69	21			21
70– 79	62			62
80– 89	56	1		57
90– 99	89	17		106
100–109	139	66	4	209
110–119	182	92	11	285
120–129	194	88	34	316
130–139	134	60	36	230
140–149	91	50	25	166
150–159	72	34	24	130
160–169	26	24	16	66
170–179	18	25	10	53
180–189	6	15	11	32
190–199	5	12	2	19
200–209	6	8	2	16
210–219	5	8	4	17
220–229	1	3	3	7
230–239	4	1	1	6
240–249	1	1	2	4
250–259	1	1		2
260–269		2		2
270–279		1		2
280–289			2	2
Total	1,116	504	192	1,812

TABLE 11.—*Percentage composition of immature and mature biya taken by sailboat fishing craft in June and July, 1950, by size of mesh of cod-end of net used.*

Cod-end mesh (stretched)	Immature fish		Mature fish		Total
cm.	*Number*	*Per cent*	*Number*	*Per cent*	
2.5	746	66.84	370	33.16	1,116
3.0	264	52.38	240	47.62	504
3.5	49	25.52	143	74.48	192

Using 125 millimeters [3] as the mean standard length at sexual maturity of biya, the percentage composition of immature and mature fish taken in the commercial haul was determined. From this analysis of 1,812 specimens examined, it was found that 66 per cent of the samples taken by 2.5 cm. cod-end mesh were immature; 52 per cent by 3.0 cm. mesh; and 26 per cent

[3] Mean size at sexual maturity was determined in a separate study undertaken by the authors during the same period of observations.

by the 3.5 cm. mesh. Conversely, an increased percentage of mature fish becomes evident as the size of the cod-end mesh increases (text fig. 11). The larger meshes appeared to have provided sufficient "escapement" of immature fish to reach maturity in order to spawn and replace the stock. The use of larger meshes in the trawl fishery in the North Atlantic and the West Coast of America is an accepted practice as established by regulatory measures in protecting the immature groups and allowing the fish to spawn even once before they are caught.

DISPOSAL OF THE CATCH

The catch of the dredge-trawlers in Laguna de Bay are usually disposed in three important landings; namely, Pasig and Binangonan, Rizal Province, and Biñan, Laguna. Binangonan and Biñan are the homeports of most sailing boat and motorized fishing craft (Plate 1, figs. 1–2) and Pasig for most motorlaunch, towed fishing craft.

The catches of motorized and sailboat fishing craft are usually marketed in the morning. At the landing, the fish are mostly kept alive in the livewell of the fishing vessel or in live-boxes or crates (bamboo or G.I. wire netting) placed in the lake. The bigger-sized dead fishes upon landing are iced in bamboo baskets while the small-sized biya are kippered, salted and dried (Plate 4, fig. 2). The ayungin are soaked in brine overnight, dried under the sun and staked in pieces of bamboo sticks known locally as "*karingkaring*." The kippered biya are also staked in pieces of bamboo sticks. Both are sold by the hundreds of stakes.

The catches of the motorlaunch-towed fishing craft are sold direct to the fresh fish market in Pasig, Rizal, the fish being kept alive in the livewell during the entire fishing trip. Most of the fish landed in Binangonan and Cardona, Rizal, are transported by trucks to Manila markets early in the morning. In Biñan, Laguna, the fish are transported by trucks to Batangas, Cavite and Laguna town markets.

The wholesale price of the large marketable fresh biya per kilo ranged from 60 to 80 centavos,[4] the small biya, 20 to 40 centavos. At the landing dead biya are usually sold half the price of the live ones. The kandule is considered a delicacy in Laguna and Rizal Provinces and the wholesale price usually ranges from 90 centavos to one peso per kilo.

[4] One centavo is equivalent to one-half cent U. S. currency.

The dredge-trawl nets are tanned with a combination of extracted blood of fresh-water snake and of *bakawan* (*Rhizophora candelaria*) cultch.

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ILLUSTRATIONS

PLATE 1

FIG. 1. Sailboat fishing craft anchored or beached at Kalinawan, Binangonan, Rizal Province.
2. Barrio Kalinawan, Binangonan, Rizal, a home port of sailboat and motorized fishing craft in Laguna de Bay.

PLATE 2

FIG. 1. Sailboat fishing craft in operation on the eastern portion of Laguna de Bay.
2. Sailboat fishing craft towing two nets in Laguna de Bay.
3. A typical sailboat fishing craft in actual fishing operation in Laguna de Bay.

PLATE 3

FIG. 1. A dredge-trawl frame maker, Kalinawan, Binangonan, Rizal.
2. Finished dredge-trawl frames, Kalinawan, Binangonan, Rizal.

PLATE 4

FIG. 1. A typical dredge-trawl net laid out with its coiled tow line.
2. Kippered biya (*Glossogobius giurus*) taken by dredge-trawler strung in pointed bamboo sticks being dried under the sun, Binangonan, Rizal.

PLATE 5

FIG. 1. Hauling-in a dredge-trawl net on a sailboat fishing dugout. Note fish at the cod-end.
2. A typical haul of fish spread on deck of a sailboat fishing craft. Note the catch of fish and snails on the side of the deck, Laguna de Bay.

TEXT FIGURES

FIG. 1. Map of Laguna de Bay showing divisions of reference areas.
2. Deck plan of a typical sailboat fishing craft towing one to two dredge-trawl nets (diagrammatic).
3. Deck plan of a typical motorized fishing craft towing one to two dredge-trawl nets (diagrammatic).
4. Motorlaunch-towed fishing craft in operation towing four dredge-trawl nets (diagrammatic).
5. Dredge-trawl frame (A) side view, (B) top view and (C) dorso-lateral view (diagrammatic).
6. *a*, Cutting diagram of a piece of netting 3-centimeter stretched-measure mesh No. 6 seine twine, 150 × 190 meshes, for making typical fish dredge-trawl net. *b*, The dredge-trawl net after joining the sections shown in figure 6. Joining is done by meshing the various parts together. To form the dredge-trawl net fold-over the top section over the bottom section so that A join with B and A′ with B′ to a point 10 M below the top edge to form the upper flap. Likewise C and C′ is joined with E and D and D′ with E′.

ILLUSTRATIONS

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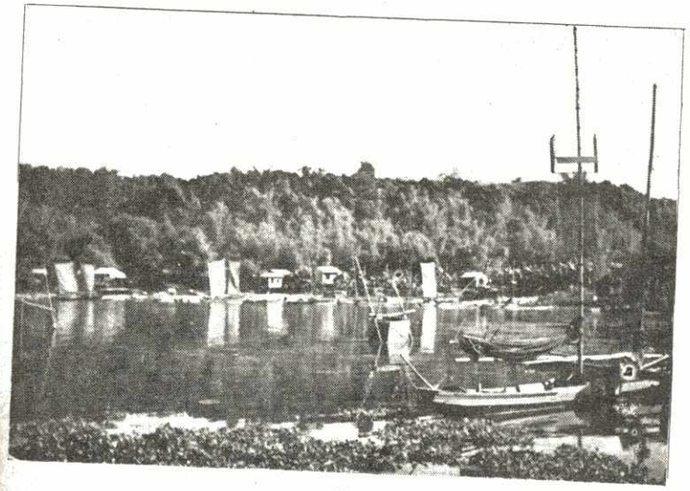

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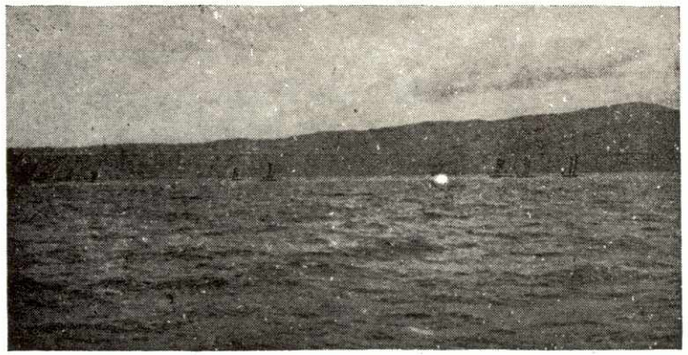
PLATE 1



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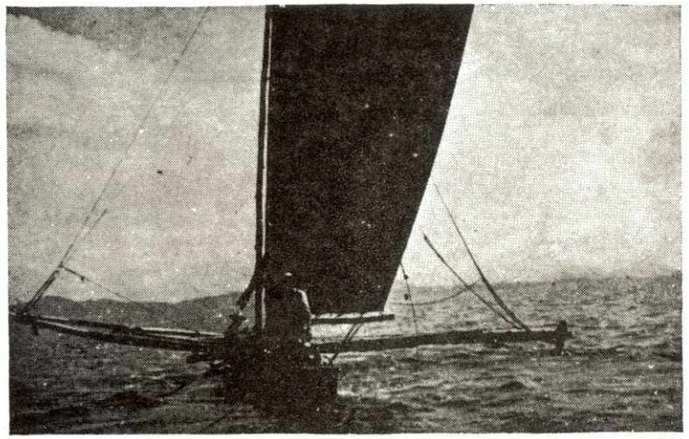

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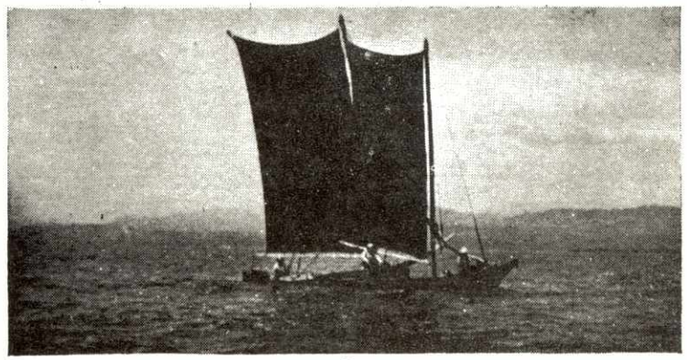

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PLATE 2

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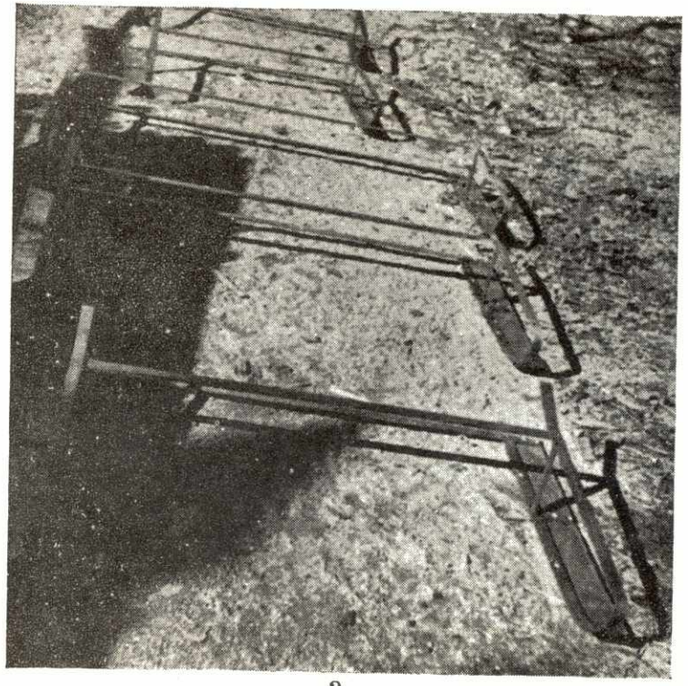
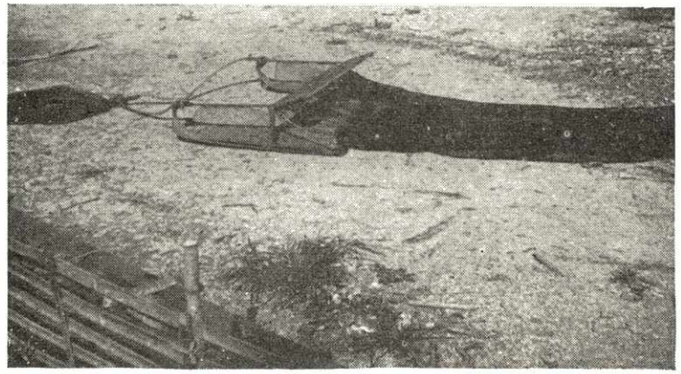
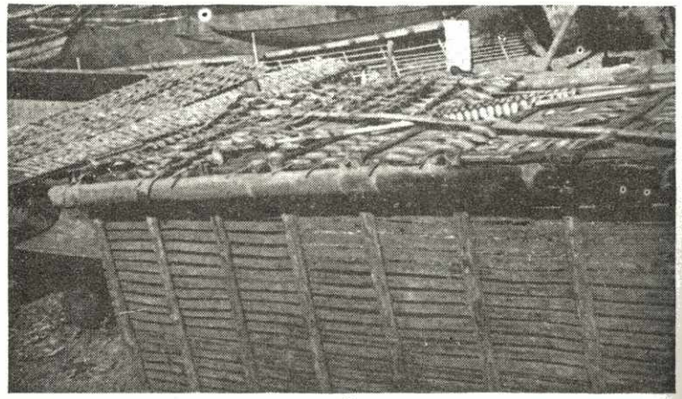


2

PLATE 3



1

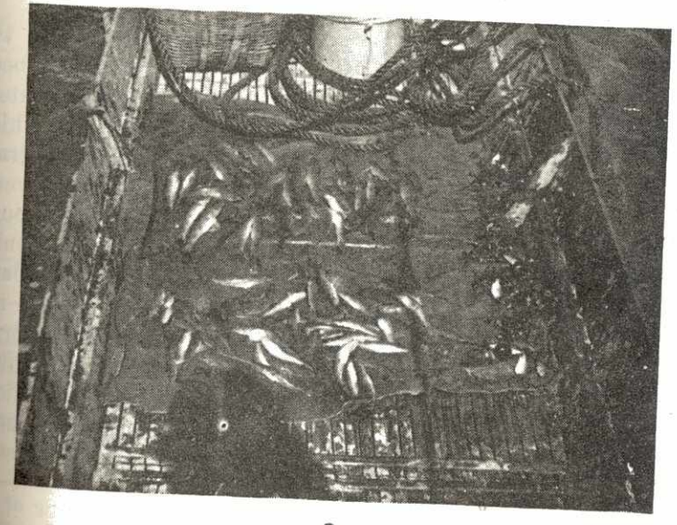


2

PLATE 4

MANACOP AND CAPCO: GOBY DREDGE-TRAWL FISHERY] [PHIL. JOUR. FISH., 2, No. 2

1



2