

THE ABUYAN, AN IMPROVED TYPE OF GOBY FISHING GEAR, USED IN LAGUNA DE BAY, WITH NOTES ON THE COMPOSITION OF THE COMMERCIAL CATCHES.

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SEVEN PLATES AND EIGHT TEXT FIGURES

INTRODUCTION

In Barrio Umboy, Sta. Cruz, Laguna Province, an improved type of fishing gear, the *abuyan*, has been recently developed from the age-old *seket*. The *abuyan* was designed for mechanized operation in catching the white goby (*Glossogobius giurus*), an important commercial fresh-water fish in Laguna de Bay. The introduction of the *abuyan* gear has developed into a sizeable industry with a current total investment of no less than 50,000 pesos worth of crafts and gear used in the goby fishery. The gear is rapidly being adopted in different fishing centers in the lake, and at this writing about 20 pairs of motorized outfits are used in the fishery.

The increased catching efficiency of this gear compared to its prototype, the *seket*, and the widespread complaints by other fishermen against its allegedly destructive effect on the goby fishery have led to the study of the gear and its commercial catches. Field observations on the construction and operation of the gear were conducted at Barrio Umboy, Sta. Cruz, Laguna Province, from January 1953 to June 1953, inclusive.

History and development of the gear.—Before World War II and immediately after liberation the old *seket* was still being used by fishermen of Laguna de Bay in catching the fingerlings of gobies (*Glossogobius giurus*) and *ayunġin* (*Datnia plumbea*) for use as baits for catfish set lines in the lake. A similar gear in the Visayan Islands called *surambao*, or *conay*, is used in catching small mullets in estuarine areas. The scare lines employed then by the old *seket* were much shorter and were towed by one or two wading fishermen at waist-depth of water.

With the extensive postwar mechanization of dugout fishing crafts in Laguna de Bay, the fishermen of Umboy, Sta. Cruz,

have started since 1950 to modify and improve the original scissors-net of the seket into a much bigger landing net. The scare-line chain, which extends operating in deeper water, has been lengthened. The driving operation toward the net is effected by a pair of motorized dugouts. As it is now the abuyan is a marked transition from its original prototype, the seket. The improvement in the net, mode of operation, and mechanization of the fish driving operation have effected much larger landings than those of the old seket. This new gear is now established in Laguna de Bay and its adoption in other fresh-water lakes and possibly in salt water offers tremendous possibilities especially in the catching of demersal fishes heretofore unutilized by existing fishing gear.

THE FISHERMEN

The fishermen operating the abuyan are experienced divers and proficient swimmers. Some even know how to maintain and repair a gasoline engine as two of the three fishing crafts used are provided with gasoline engines which have to be kept in good running condition. From six to nine fishermen operate an abuyan unit. Four men are assigned to the two motorboats (two in each boat), the rest who are responsible in setting the landing net (*panarupit*), to the live-well craft. There is no master fisherman, as all the fishermen composing a unit are proficient in their respective assignments in the outfit. The fishermen themselves undertake the repair of the fishing gear and other accessories during off-fishing operation.

Each fisherman is paid on share basis instead of time wage. After deducting the operating expenses the catch is divided into 12 shares, one share goes to the live-well craft and the net; two shares, to the two motor dugouts; and nine shares, to the nine fishermen. The individual share of each fisherman during the survey ranged from 5 pesos to 16 pesos per day of fishing, a fairly high rate of income compared with those obtained from other commercial fishing craft in Laguna de Bay.

THE FISHING OUTFIT

A fishing outfit consists of a pair of motor dugouts which drag the scareline chain and tow one live-well craft where the fish and fishing accessories are loaded and transported to and from the fishing ground.

The motor dugouts (fig. 1).—Each craft consists of a wooden dugout of *mayapis* [*Shorea palosapis* (Blanco) Merr.], with side plankings of boards of tanguile [*Shorea polysperma* (Blanco) Merr.]. It measures about 8 meters long, 0.7 meter

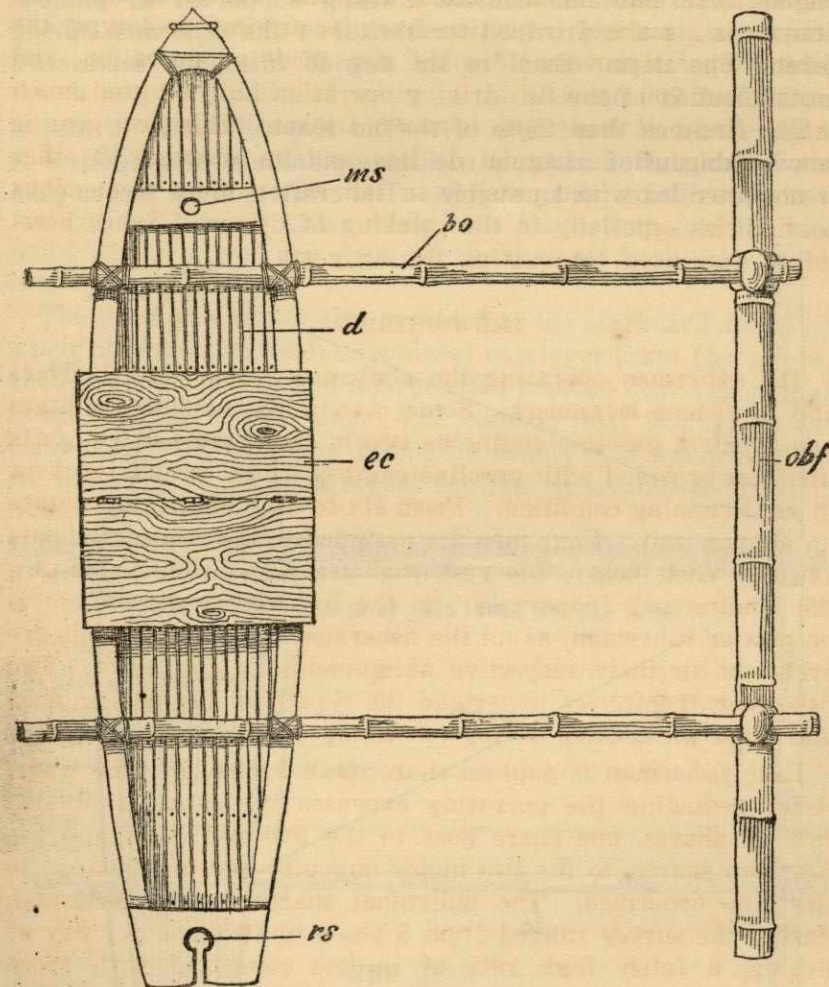


FIG. 1. Deck plan of a typical towing motor fishing dugout used in the abuyan fishery, showing parts (diagrammatic): *ec*, engine cover; *d*, deck; *ms*, mast socket; *bo*, bamboo outrigger; *obf*, outrigger bamboo float; *rs*, rudder socket.

wide and 0.6 meter deep. It is provided with two bamboo outriggers on one side measuring about 4 meters long and a big-sized bamboo float of about 6 meters long. Each motor dugout is propelled by a 12-horsepower gasoline engine installed amid-

ship. A flat galvanized iron or wooden engine coaming is provided as a protection against the weather. The rest of the deck is provided with a removable flooring of bamboo slats. The rudder is controlled by a saber-lever tiller rigged behind the engine. A removable canvass awning supported by bamboo framework is also provided for shelter of the fishermen during fishing operation. Each motor dugout including accessories costs about 700 pesos.

The live-well craft (fig. 2).—The live-well craft is also a wooden dugout of mayapis with side plankings of tanguile. It is not provided with an engine. The craft is much larger than

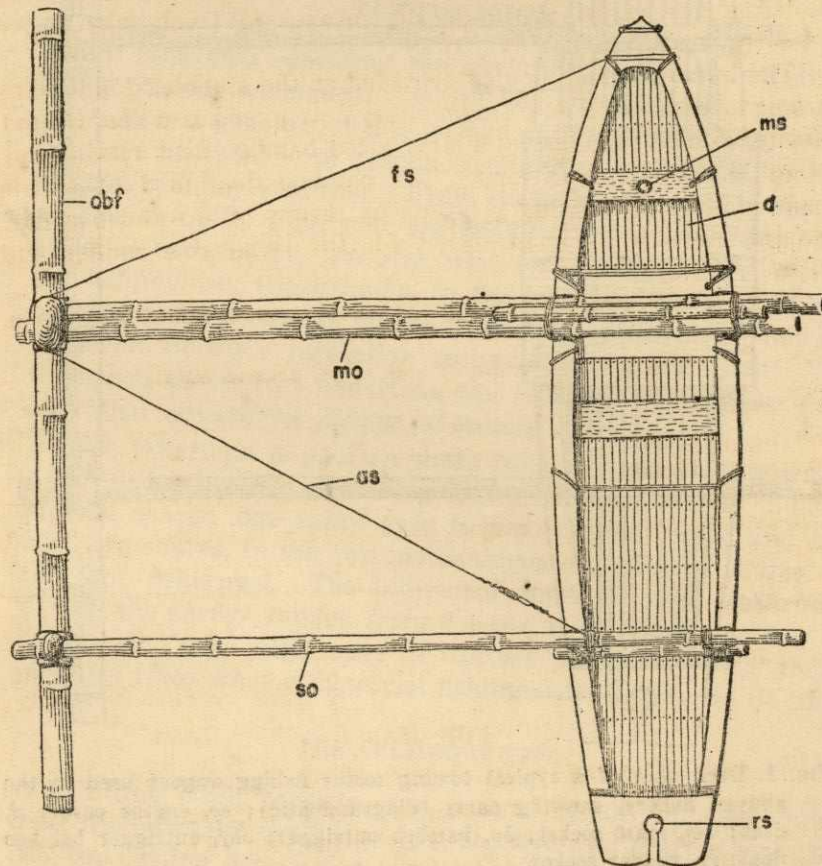


FIG. 2. Deck plan of a typical live-well craft, showing parts (diagrammatic): *obf*, outrigger bamboo float; *mo*, main outrigger beam; *fs*, forward wire stay; *as*, aft wire stay; *so*, secondary outrigger beam;

any of the motor dugouts, measuring from 10 to 12 meters, 0.7 to 1.0 meter wide and 0.8 meter deep. The open deck is provided with bamboo slats flooring which is divided into removable sections. The live-well craft is divided into water-tight compartments, the midsection usually kept open for the bailing out of the water from the vessel. The hull is provided with 12 bottom and 19 side holes of one-half inch diameter which serve as intake of water in the live-well craft. Bailing out of the water from the live-well craft is done by means of a 2½ gallon galvanized iron pails. Constant bailing out of the water from the live-well craft is done in order to allow the free circulation of fresh water while both the bottom and the side holes of the vessel are open for intakes of fresh lake water into the craft.

The live-well craft is also provided at the starboard side with a pair of bamboo (*Bambusa spinosa*) outrigger beam (*batañgan*) about 5.5 meters long and a large-sized bamboo float (*palañgoy*) about 8 to 10 meters long. The bamboo float is fixed to the ends of the two outrigger beams by means of a wooden collar. At the stern is an open socket for the removable rudder and tiller.

The live-well craft including accessories costs about 500 pesos.

TABLE 1.—Estimate of cost of an abuyan outfit.

Items	Cost (Pesos)
One live-well craft	500
Two motor dugouts	1,400
One abuyan net	250
Live-well wooden tank (torpedo)	50
Scareline	110
Towing rope	12
Miscellaneous	20
Total	2,342

THE GEAR

The net.—The net proper consists of 6 pieces of netting, 5 pieces of 200 by 1,000 meshes, or 3 by 15 meters, and another piece, 200 by 600 meshes, or 3 by 8 meters. The net proper is a boxlike affair with one side open. The back side is a rectangular wall of netting, 9 meters long and 3 meters high including selvage; the two lateral sides are trapezoidal, 15 meters long, 3 meters high at the back and 2.25 meters high at the front.

the front end. The bottom side or flooring is also trapezoidal, the mouth is 14.5 meters wide; the rear side, 9 meters and 15 meters along the lateral side.

The specifications of the materials used in making an abuyan net are shown in Tables 2 and 3. The body of the net is made entirely of light cotton netting with 1.3 centimeters mesh, 20/6 thread.

TABLE 2.—Body length frequencies taken from the samples of white gobies (*Glossogobius giurus* Ham.—Buch.) catches of an abuyan outfit in Laguna de Bay for March and April, 1953.

Range	Number of fish			Per cent of immature and mature	
	March	April	Total		
50-59	23	16	39	74.98 (Immature)	
60-69	67	74	141		
70-79	165	104	269		
80-89	306	182	488		
90-99	293	183	476		
100-109	215	118	333		
110-119	159	67	226		
120-129	103	44	147		
130-139	51	35	86		25.02 (Mature)
140-149	48	37	85		
150-159	37	40	77		
160-169	40	28	68		
170-179	26	23	49		
180-189	19	11	30		
190-199	18	18	36		
200-209	14	13	27		
210-219	12	6	18		
220-229	5	4	9		
230-239	5	6	11		
240-249	1	3	4		
250-259	3	3	6		
260-269		2	2		
270-279		3	3		
Total	1,610	1,020	2,630	100.00	

TABLE 3.—Specification of netting materials and accessories used in an abuyan net.

Parts	Materials			Size of mesh	No. of meshes	Hung measure	Length	
	Kind	Twine	No. of nots				No. of meshes	Hung measure
				mm.		meters		meters
Body:								
A	Cotton	20/6	20	13	200	3	600	9
B	do	20/6	20	13	200	3	1,000	15
C	do	20/6	20	13	200	3	1,000	15
D	do	20/6	20	13	200	3	1,000	15
E	do	20/6	20	13	200	3	1,000	15
F	do	20/6	20	13	200	3	1,000	15
Selvage:								
a	Cotton	20/6	17	16	6	0.10	1,000	16.25
b	do	20/9	17	16	6	0.10	1,000	16.25
c	do	20/6	17	16	6	0.10	600	9.75
d	do	20/9	17	16	6	0.10	1,000	16.25
Ropes:								
Floatline	do	20/96						39
Mouthline	do	20/96						15
Securing line	do	20/96						4

The upper selvage is 6 meshes wide and from 600 to 1,000 meshes long. The size of mesh is 1.6 centimeters stretched measure and 20/9 thread. The selvage consists of four pieces, three pieces of 6 by 1,000 meshes ($16 \times 25 \times 0.10$ meters) and a single piece of 6 by 600 meshes ($16 \times 9 \times 0.10$ meters).

The float line rope consists of two pieces of cotton twine, Gold Medal No. 96, 5 millimeters diameter and 39 meters long. The ground line rope is also of two pieces, each 15 meters long and made of the same material as the float line rope. There are four securing cotton line ropes of 4 meters long each.

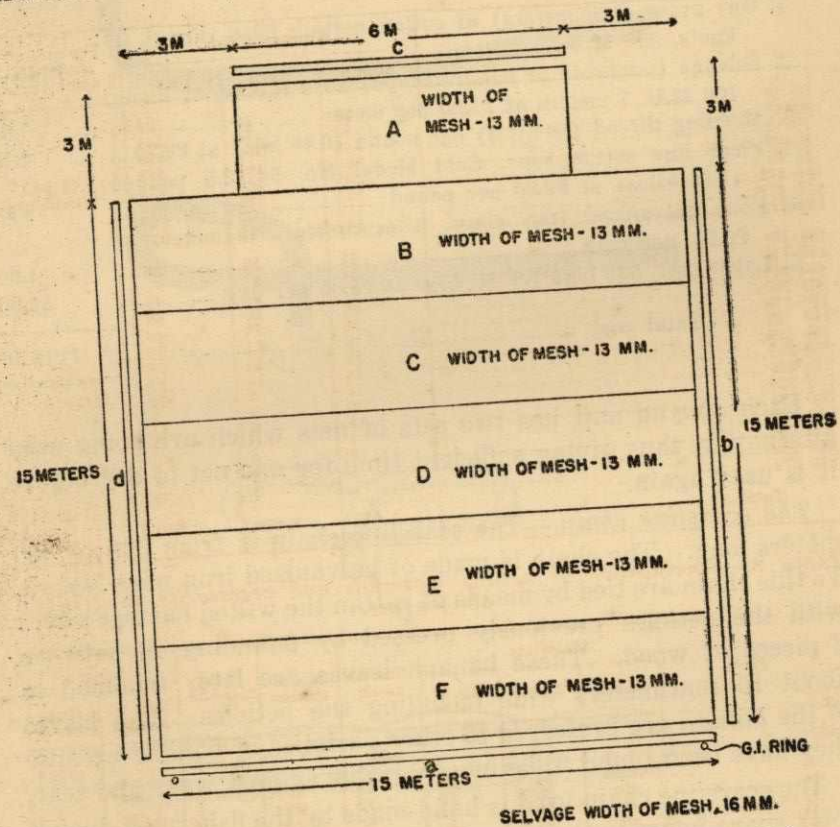


FIG. 3. Structural plan of a typical abuyan net (diagrammatic).

In the construction of the net, the sections are joined along the seam as shown in text fig. 3. Sections A, B, C, D, E, and F are joined together side by side including the two back sides to form a boxlike affair. Then the selvages a, b, c, and d are

joined to the sides. The securing line ropes are rigged to the 4 corners of the net and used to stretch out the net during operation.

Four galvanized iron rings, 3 centimeters in diameter, are provided along the rim of the mouth line, two secured at the two corners and two at a distance of 25 centimeters from the two corners.

The cost of materials and labor in making an abuyan net is as follows:

1. One gross (100 meters) of cotton netting 20/6 thread, 20 knots, 200 M.D.	₱145.00
2. Selvage (<i>panlakad</i> or <i>pangrelengga</i>) 20/9 thread, 17 knots, 100 M.D. 7 meters at ₱1.00 per meter	7.00
3. Mending thread (<i>pamites</i>) one pound (0.45 kilo) at ₱2.70....	2.70
4. Float line cotton rope, Gold Medal No. 96, 3.5 pounds (1.59 kilos) at ₱2.80 per pound	9.80
5. Four galvanized iron rings, 3 centimeters diameter, at ₱0.25 per ring	1.00
6. Labor cost, one man for 10 days at ₱5.00 per day	50.00
Total cost	₱215.50

Each abuyan unit has two sets of nets which are being used alternately, thus giving sufficient time for one net to dry before it is used again.

The scareline chain.—The scareline chain is from 300 to 350 meters long. The chain is made of galvanized iron wire No. 12. To this chain are tied by means of rattan the wilted banana leaves with the petioles previously pressed by pounding in between 2 pieces of wood. These banana leaves are later trimmed to about 15 centimeters wide including the petioles. The leaves of the *butuan* are preferred to other varieties of banana because they have been found to be more durable against wear and tear.

The scareline chain used is hand-made by the fishermen during their spare hours with the use of a carpenter's hammer, a wire cutter and a pair of pliers as hand tools (text fig. 4). Out of one kilo of No. 12, G.I. wire, a chain of 6.75 meters (144 pieces) of chain is made by three men working together for one hour.

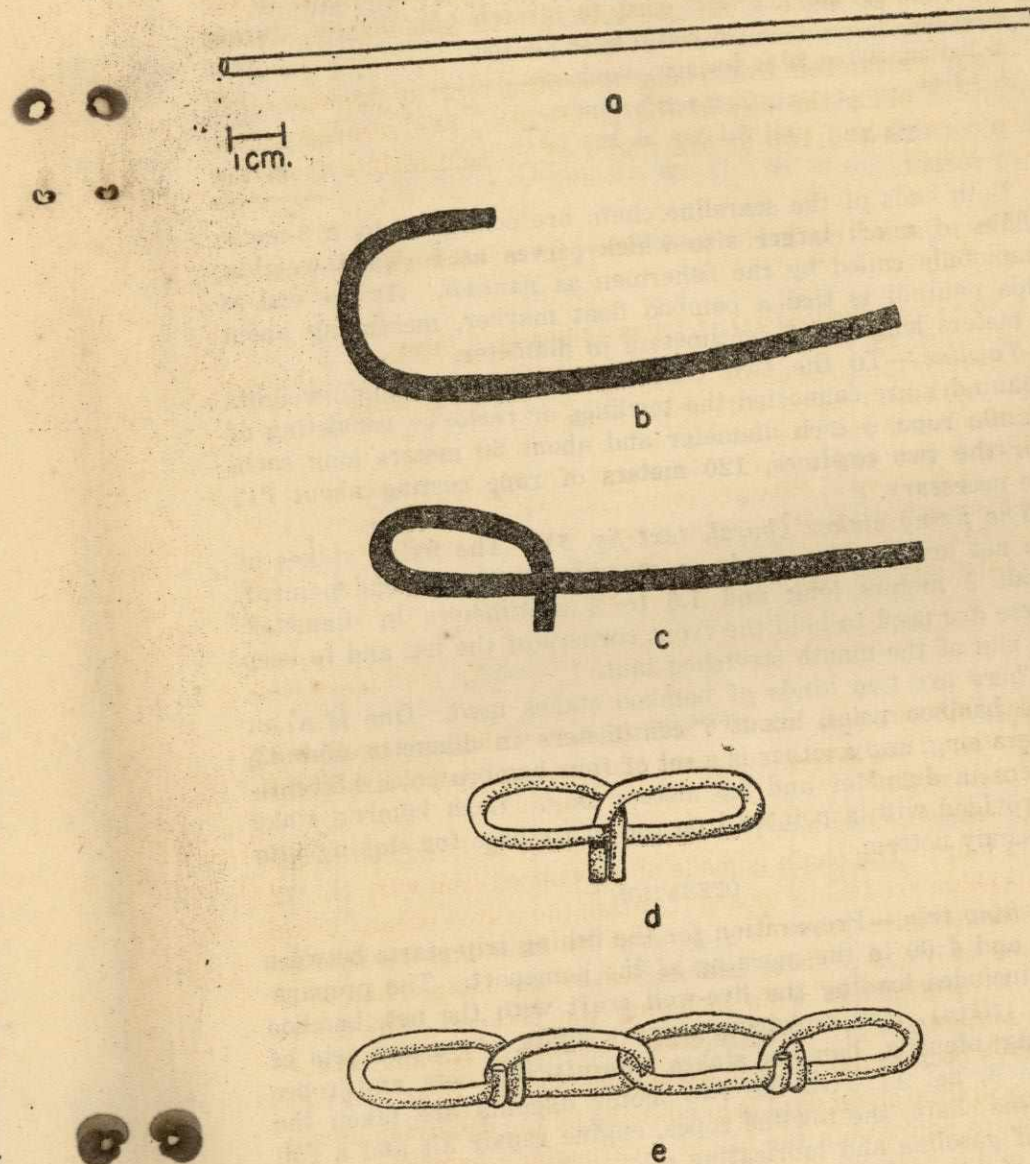


FIG. 4. Construction of scare line chain from galvanized iron wire No. 12 (steps a to e)

1. Chain, 350 meters long or 52 kilos of No. 12 G.I. wire at P0.70 per kilo	P36.40
2. Banana leaves (butuan) 600 at P2.50 per 100	15.00
3. Rattan, 300 at P0.80 per 100	2.40
4. Labor	66.00
Total	P119.80

Both ends of the scareline chain are connected by a 3-meter chain of much larger size which serves as forward weights, commonly called by the fishermen as *panindi*. At the end of this *panindi* is tied a bamboo float marker, measuring about 2 meters long and 6 centimeters in diameter.

Towline.—To the two ends of the forward chain-weights (*panindi*) are connected the towlines or *remorke*, consisting of Manila rope, $\frac{1}{2}$ inch diameter and about 60 meters long each. For the two towlines, 120 meters of rope costing about P12 are necessary.

The fixing stakes (bural, text fig. 5).—The fixing stakes of the net are two iron rods or crowbars with one end pointed, about 2 meters long and 1.5 to 2 centimeters in diameter. These are used to hold the front corners of the net and to keep the rim of the mouth stretched taut.

There are two kinds of bamboo stakes used. One is a set of 6 bamboo poles, about 7 centimeters in diameter and 3.5 meters long, and another is a set of four bamboo poles 4.5 centimeters in diameter and 2.5 meters long. Each bamboo stake is provided with a pointed iron rod at its base for staking into the sandy bottom.

OPERATION

Fishing trip.—Preparation for the fishing trip starts between 3:00 and 4:00 in the morning at the homeport. The preparation includes loading the live-well craft with the net, bamboo poles (*tikin*), iron crowbars, stone weights, stove and sets of cooking utensils, bamboo stakes (*bural*) dip nets and ropes (Plate 3, fig. 1). On the two motor dugouts are taken the scareline chain, the towline ropes, engine repair kit and a full load of gasoline and lubricating oil.

The fishing fleet usually leaves the homeport between 4:00 and 5:00 A.M., arriving in the fishing ground between 6:00 and 7:00 A.M. It returns to port between 2:00 and 5:00 in the afternoon. At the mouth of the river, the fish catches are all

of wooden slats. The live-well tank measures $4 \times 1\frac{1}{2} \times 1$ meters with a capacity of from 200 to 300 *takal*¹ of live goby. It is supported by two bamboo floats on each side and are towed by a carabao upstream during summer to Barrio Umboy, Sta. Cruz, Laguna Province, where the fish are sold in live condition.

Setting the net.—The net is set by the four fishermen from the live-well craft (Plate 4, fig. 1). It is set when the two

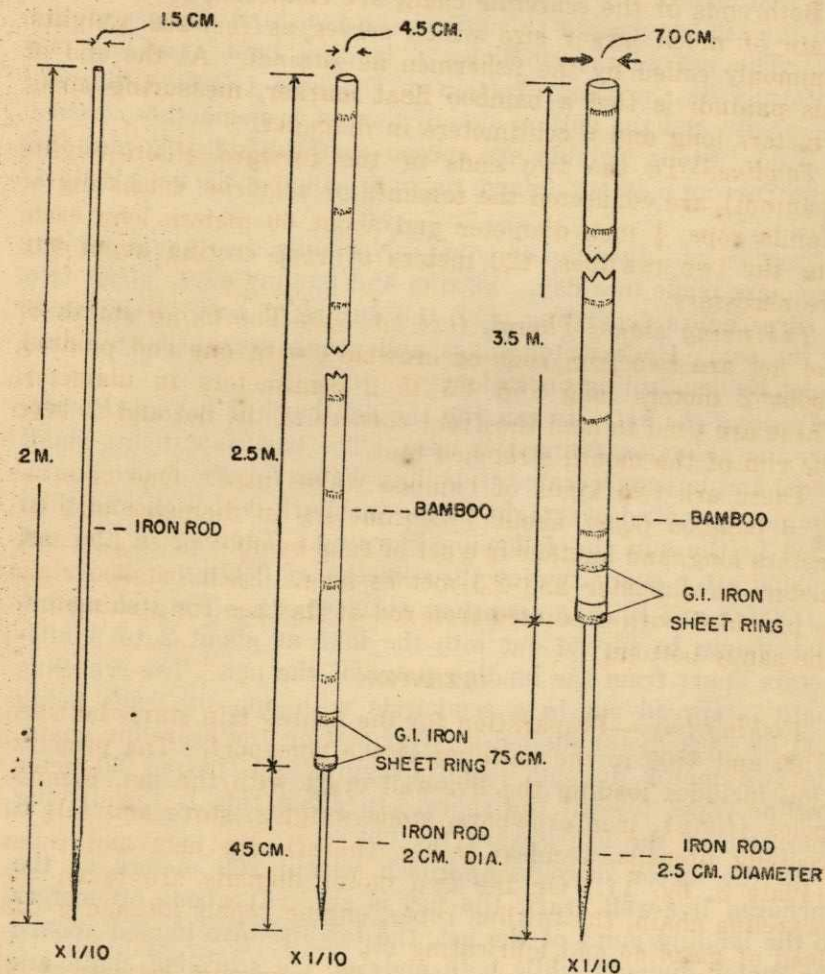


FIG. 5. Accessory fixing stakes used in the abuyan fishery.

¹A *takal* of fish is contained in a two-gallon container with a net

motorboats are about 200 meters to the expected hauling point of the net. At first two iron bars are staked about a meter deep into the sandy bottom at a distance of 14.5 meters apart. The front corners of the net are held by rings secured to the iron bars by means of a securing line.

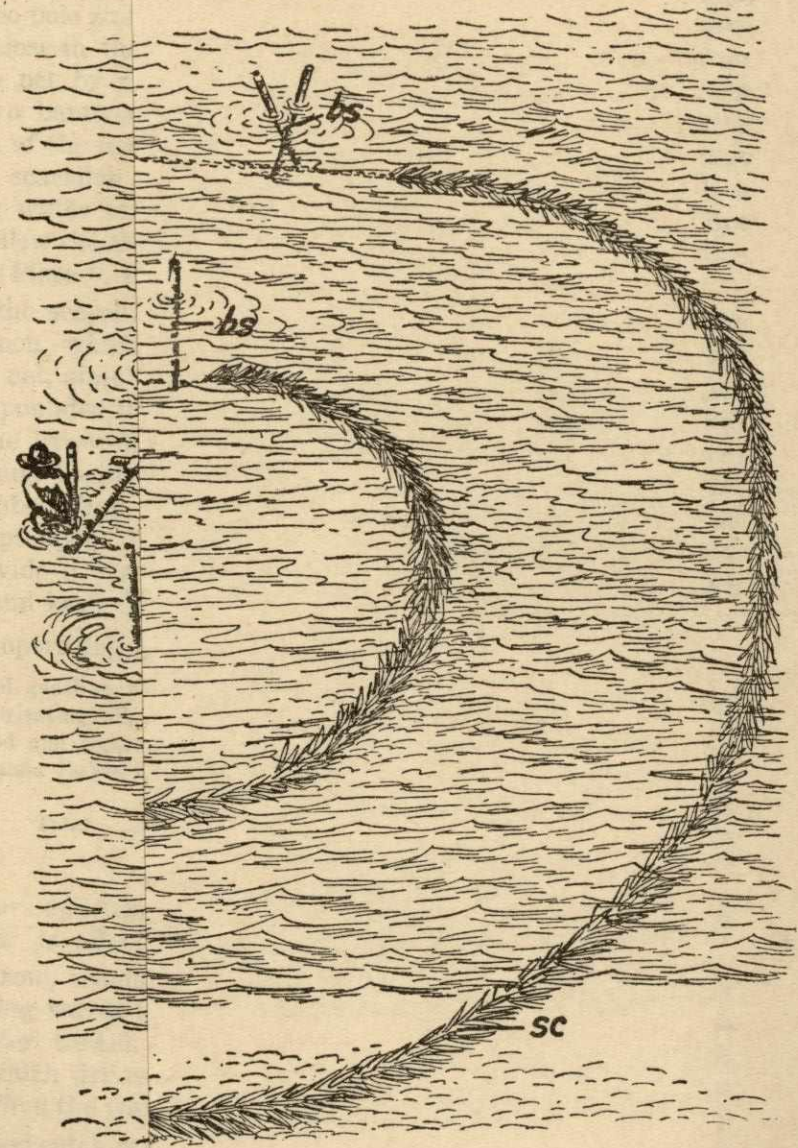
Two bamboo stakes, provided with pointed iron rods, are staked about 15 meters behind the two front iron bar stakes. The rear stakes are set about 10 meters apart. To these are tied the securing ropes to support the two hind corners of the net. The net as set simulates a landing bunt stretched out uniformly on the sandy bottom of the lake (Plate 3, fig. 3). The mouth and the bottom side of the net are smoothly covered by sand. Stone weights are spread over the sides so that the water current may not deform the bunt-shape of the net (Plate 4, fig. 1).

Number and duration of hauls.—Normally, two hauls, seldom three, are made in a day. Setting and hauling cover about two to three hours depending upon the nature of bottom and state of the sea. Underwater snags and rough seas usually delay, if not hinder, fishing operation.

Tanning the net.—In tanning the net, bark of bayog (*Pterospermum obliquum* Blanco) is used. The bark is cut into small pieces and later macerated in boiling water for about five hours. The net is soaked overnight in the tan bark decoction and then dried in the sun the following morning. Tanning of the net is done after every two or three weeks of fishing.

Driving and hauling operation (text fig. 6).—The two motorboats begin to spread out into the lake at about 2 to 3 kilometers apart from the landing point of the net. The scareline chain is spread out in a semicircle with opposite ends being held by each motor dugout. After setting the scareline chain, the two motor dugouts begin dragging the paired 60-meter towline ropes toward the shore. In effect this is the driving operation of the fish toward the net.

As the motor dugouts approach within 200 meters of the anchored live-well craft, the net is set. At about 50 meters to the landing point of the net, the towlines are hauled aboard the motor dugouts while both ends of the scareline chain are secured to each towing vessel. Towing of the scareline chain is resumed till the two motor dugouts meet behind the anchored live-well craft. Here they are hove-to and anchored. The four men on the motor dugout get off the craft and start pulling



bamboo stakes; is, iron bars stakes;

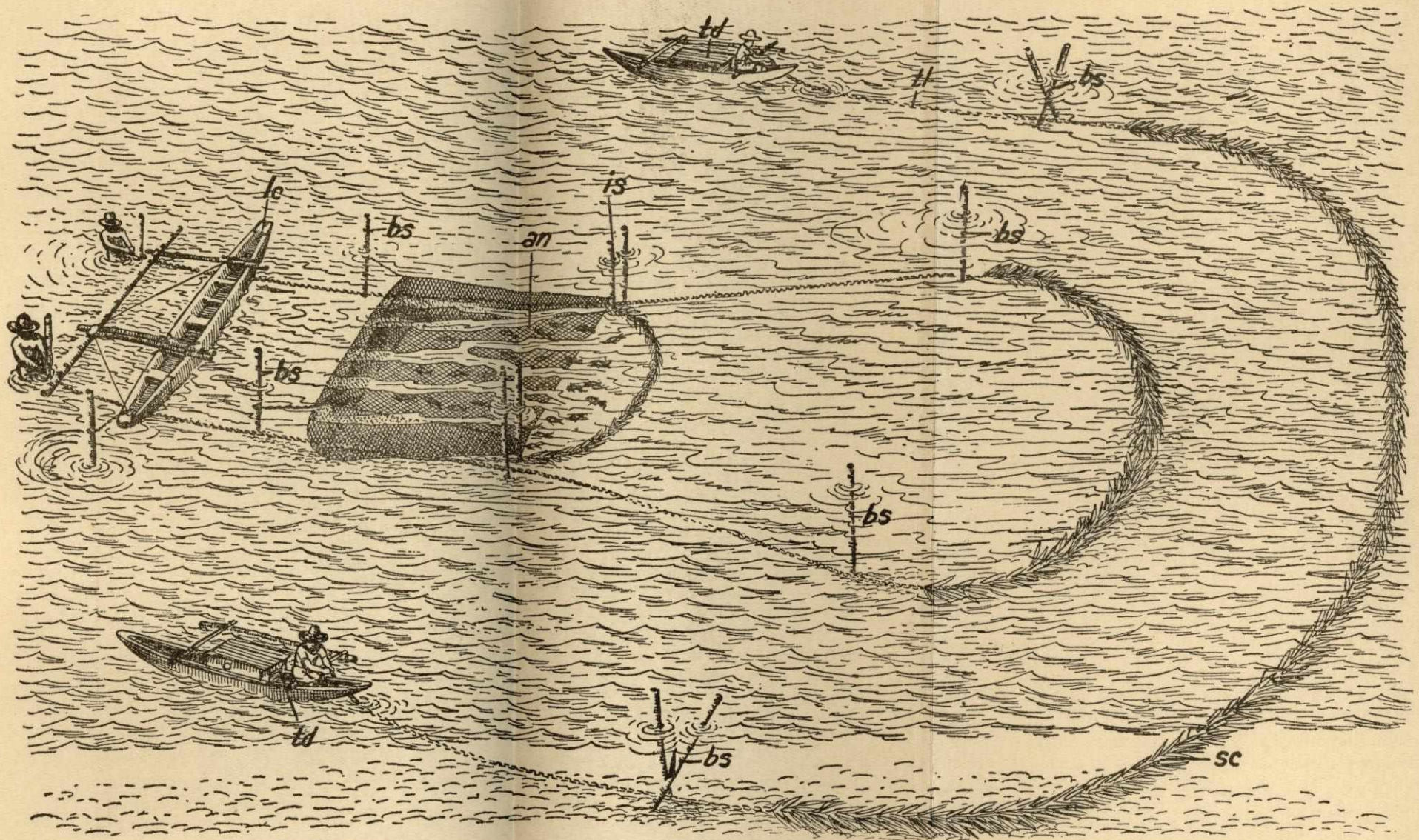


FIG. 6. The abayan in operation (diagrammatic): *lc*, live-well craft; *an*, abayan net; *bs*, bamboo stakes; *is*, iron bars stakes; *td*, towing motor dugout; *sc*, scare line chain.

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the rest of the scareline chain by wading with two men on each end (Plate 5, fig. 1). To facilitate the pulling of the chain, bamboo pole stakes are used to support the thrusting foot. Two men close-in the two ends of the chain near the front corner of the net by means of bamboo pole stakes. Two other men set two bamboo pole stakes about 50 meters in front of the mouth of the net in order to keep the normal semicircular shape of the scareline chain. This is done especially when there is a strong water current. The other three men continue to dive and follow the chain in order to clear off any underwater obstructions (Plate 5, fig. 2).

As the scareline chain reaches the mouth of the net, all the fishermen, which by this time are stationed around the sides of the net, simultaneously lift the selvage of the net. The fish are impounded in the center of the net and immediately hauled into the live-well craft by means of a scoop net or a 5-gallon aluminum basin. The live-well craft is then filled with water up to about half its capacity while the inlet holes of the vessel are kept open. This is done regularly by two men in order to provide a constant renewal of fresh water in the live-well craft and keep the catch alive.

The operating expenses per outfit per day are as follows:

1. Fuel gasoline, 50 liters	P12.00
2. Lubricating oil, No. 40, 2 liters	1.40
3. Food and cigarettes	8.00
4. Banana leaves and rattan	3.60
Total	<u>P25.00</u>

Factors affecting the operation of the gear.—The efficiency of the gear is affected by the following factors:

1. Strong winds are detrimental to the operation of the gear as the big waves inconvenience the divers especially and makes the water turbid. The mud clouds formed by the scareline chain which drives the fish becomes apparently invisible to the fishes when the water is turbid thereby resulting in poor catches.
2. Good catch is often associated with calm and sunny weather. With clear water the scareline chain is effective thereby resulting in good catches.
3. Smooth sandy bottom areas without underwater snags are favorable to the operation of the gear as hauling is facilitated.

4. A good teamwork of all the fishermen is indispensable in the successful operation of the gear.

5. The operating condition of the motor dugout dragging the scareline chain is very important. Any stoppage of the engine during the operation may mean total failure of that haul as the gobies manage to escape over the scareline when hauling is stopped.

6. The time of the day seems to determine the amount of catch. It has been observed that the gobies manage to escape from the enclosure at the approach of sunset. The fish start to swim towards the surface of the water at dusk. They appear to be surface feeders during the night and bottom feeders during the day time. Sets made late in the afternoon often result in poor catches.

7. The efficiency of the gear is also affected by the operation of motorized snail dredge (*kaladkad*) craft in the area as they muddle the water and disturb the goby fish while being driven into the net by the scareline chain.

THE CATCH

Species taken.—Field observations indicated that the principal catch of the abuyan consists of the white goby or *biyang-puti* (*Glossogobius giurus* Ham.—Buch.). In very rare instances, some small *kanduli* (*Arius* sp.), *dalag* (*Ophicephalus striatus* Bloch) and *ayunġin* (*Datnia plumbea* Kner.) are included in the catch, hence they were not considered in the evaluation of the biological data.

Size composition of the commercial catches (Table 2 and fig. 7).—Some 2,630 gobies were measured from samples taken from the catches of 14 abuyan outfits operating in Sta. Cruz, Laguna, during March and April, 1953. All measurements were made with the use of a millimeter ruler, and the distance between the tip of the snout and the base of the tail was taken as the standard body length.

From this analysis it was found that the size of the individual biya from both sexes ranged from 5.0 to 27.9 centimeters long (body length) with the mode at 8.49 centimeters. The large number of the marketable sizes ranged between 8 and 10 centimeters long.

Percentage composition of mature and immature biya.—Table 2 shows the percentage composition of mature and immature biya

(sexes combined) computed from the total number of biya examined during the period of observation. Using the basis of 12 centimeters² as the minimum body length at sexual maturity for both sexes of the white goby, it was found that about 75 per cent of the samples taken from March and April, 1953 were sexually immature and the remaining 25 per cent of the commercial catches were sexually mature. This indicates that the gear, in effect, is operating heavily on the immature population of the fishery which may, in the long run, affect the biya fishery.

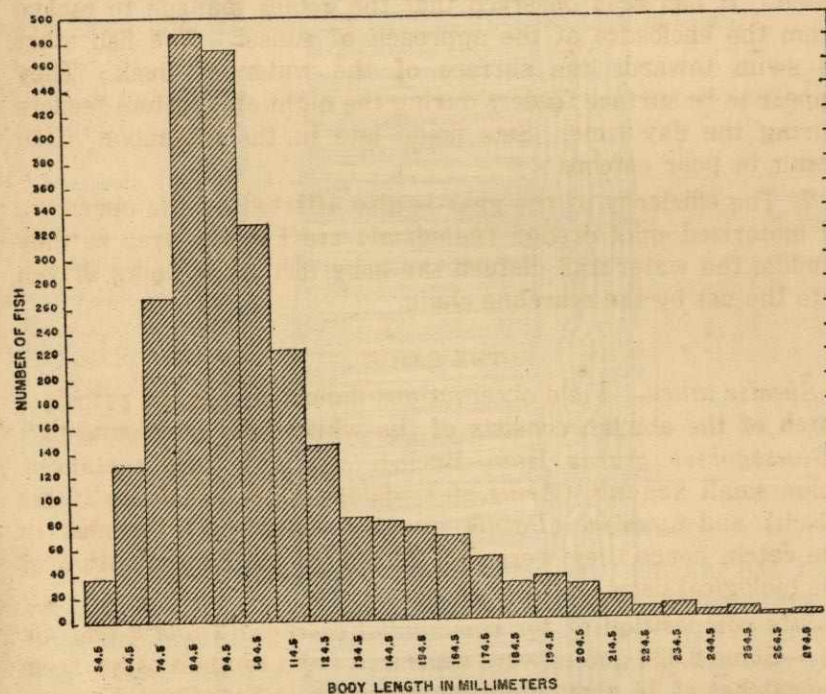


FIG. 7. Size frequency of samples of biya taken from the catch of 14 abuyan outfits from March 1953 to April 1953, inclusive

During the last two or three years, when the abuyan and the goby dredge trawl were introduced in the lake, increasing evidence of decline of the goby fishery is being felt. Decrease catches of biya by fish corral, set-line and gill nets have been noted by commercial fishermen in the lake.

Disposal of the catch.—The catches are usually sold in live state. Upon arrival of the live-well craft, the live fish are

² Size at sexual maturity of biya was determined from both sexes in a separate study conducted by the authors in March and April, 1952.

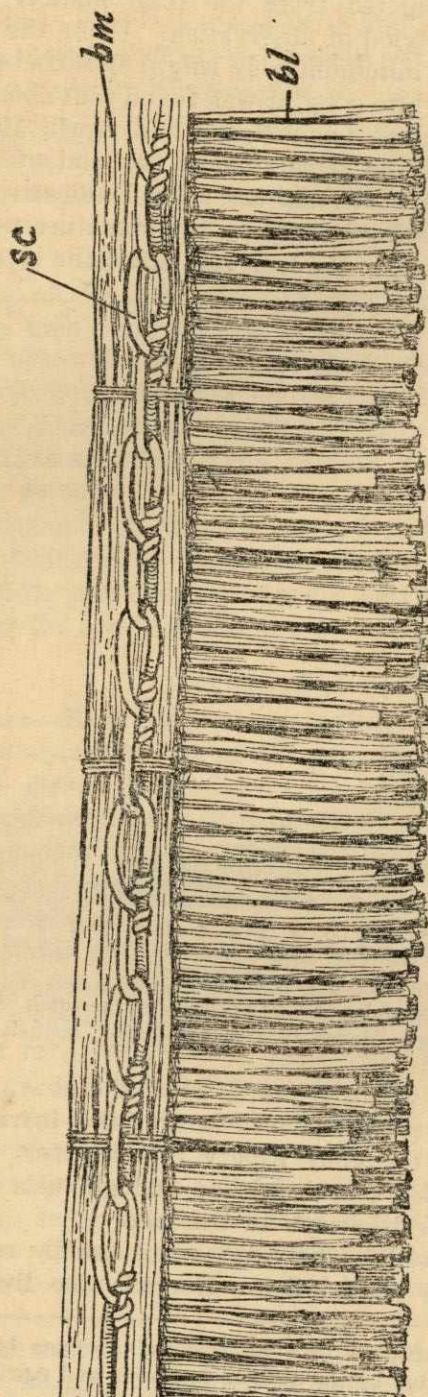


FIG. 8. Section of a scareline chain showing attachment of banana leaf streamers (diagrammatic): sc, scareline chain; bm, banana midrib secured to the chain; bl, banana leaf streamers.

transferred to live-well tanks (torpedo) anchored along the Sta. Cruz River. All dead fish upon arrival are disposed of to wholesalers at the landing. These are split, brined overnight, and dried. They are strung in bamboo sticks and sold in this form.

The live biya are disposed of by *takal* system. A *takal* is the capacity of a 2-gallon galvanized iron basin having a net weight of about 4 kilograms.

The wholesale prices during the survey ranged from 2 to 3 pesos per *takal* depending upon the size of the fish. Small and dead biya are usually sold at 70 centavos³ a *takal*.

TABLE 4.—Daily catches, operating expenses and net return of an abuyan unit "Vanda" of Umboy, Sta. Cruz, Laguna, operating in Laguna de Bay.

Months of operation	Number of fishing days	Daily Average					
		Catch	Value of catch	Operating expenses	Net return	Number of shares	Value per share
		Kilos	Pesos	Pesos	Pesos	Pesos	
1952							
January	8	117.35	81.75	15.89	65.86	10.4	6.33
February	14	128.27	86.96	14.26	72.70	11.4	6.38
March	13	140.07	86.38	18.57	67.81	11.4	5.94
August	13	142.80	84.31	23.46	60.85	10.9	5.58
September	26	179.34	115.06	21.64	93.42	11.6	8.06
October	12	201.26	111.58	23.36	88.22	11.8	7.48
1953							
February	11	174.09	116.08	23.45	92.63	10.9	8.54
March	27	158.04	97.44	23.74	73.70	11.1	6.60
April	23	150.36	104.44	27.10	77.34	11.6	6.64
May	11	148.89	92.41	30.19	62.22	12.1	5.17

SUMMARY AND RECOMMENDATIONS

1. An improved type of fishing gear, the abuyan, has been recently developed in Sta. Cruz, Laguna, for the catching of biya, an important commercial fresh-water fish in Laguna de Bay. Late reports indicate that on account of its catching efficiency, the gear is being adopted in many coastal fishing towns of the lake.

2. The history and development, description and operation of the fishing craft and gear, and an analysis of the composition of the commercial catches have been fully discussed.

3. The catch consists mainly of the white goby (*Glossogobius giurus*) with the *kanduli* (*Arius* spp.) and *dalag* (*Ophicephalus striatus*) being taken incidentally.

4. Analysis of the samples taken from the commercial catches of biya during March and April, 1953 indicates the preponderance of immature fish, the percentage being about 75 per cent of the entire catch.

5. The nonselective action of the fishing gear, in the long run, may have some telling effect on the goby fishery of the lake on account of the considerable destruction to the small and immature fish taken by the gear.

6. For purposes of reducing the percentage of immature fish taken by the gear, the mesh of the landing bag should be enlarged from the present mesh opening of 1.3 centimeters to 2.0 centimeters, stretched measure.

7. The standard length of 12.0 centimeters for biya has been determined in previous work to be the minimum size at sexual maturity for both sexes. It is, therefore, recommended that all fish taken below this size should be set free into the water.

8. The abuyan gear is dependent upon the white goby, the second commercial fish in Laguna de Bay. It is recommended that studies on the life history and biology of this fish be undertaken for purposes of formulating more comprehensive regulatory measures and management of the fishery.

9. It has been claimed by the abuyan fishermen that by increasing the dragging speed of the chain to drive the fish into the net from half a mile to one mile per hour the number of small and immature fish taken is likewise reduced. It is, therefore, recommended that the dragging speed of the scareline chain be increased to not less than a mile per hour in order to allow sufficient escapement of immature fish.

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- UMALI, A. F., and H. E. WARFEL. Reef fishing. *Fishery Leaflet No. 354*. U. S. Dept. Int. Fish & Wildlife Service (1949) 1-28; figs. 1-8; t. 1-4.
- UMALI, A. F. Guide to the classification of fishing gear in the Philippines. *Research Report No. 17*. U. S. Dept. Int. Fish & Wildlife Service (1950) 1-65; figs. 1-53.

ILLUSTRATIONS

PLATE 1

- FIG. 1. Fish landing of the abuyan fishermen, Barrio Umboy, Sta. Cruz, Laguna. Note the abuyan nets (panarupit) hung out to dry in the background.
2. A crowd of wholesale fish buyers around a live-well tank (torpedo) of biya waiting for their disposal.
3. Abuyan nets hung out to dry, Barrio Umboy, Sta. Cruz, Laguna.

PLATE 2

- FIG. 1. A group of abuyan fishermen making the scare-line from galvanized iron wire No. 12, Sta. Cruz, Laguna.
2. A group of abuyan fishermen rigging banana leaves on the scare-line. Note the scareline hung out to dry on the right.
3. Kippered biyang puti caught by abuyan being sun dried over bamboo mattings.

PLATE 3

- FIG. 1. Partial view of deck from aft of a live-well craft. Note the bundled abuyan net, rock weight, scoop nets and bamboo stakes on deck.
- FIGS. 2 and 3. Setting the abuyan net, Laguna de Bay.

PLATE 4

- FIG. 1. Abuyan net as set. Note fishermen setting rock weights along the sides, Laguna de Bay.
- FIGS. 2 and 3. Abuyan in operation. Note the live-well craft anchored behind the net and one of the towing motor dugouts in the background.

PLATE 5

- FIG. 1. Completing the hauling of the scareline. Note the two motor dugouts anchored behind the live-well craft and the fishermen pulling the rest of the scareline.
2. Closing-in of the scareline toward the net.
3. Lifting the net after closing-in of the scareline.

PLATE 6

- FIG. 1. Impounding the catch.
- FIGS. 2 and 3. Brailing the catch.

PLATE 7

- FIG. 1. Anchored abuyan fishing boats. Note the scareline hung-out to dry. Sta. Cruz River, Barrio Umboy, Sta. Cruz, Laguna.
2. Close-up of a live-well tank. Note swimming biya inside. Sta. Cruz, Laguna.

TEXT FIGURES

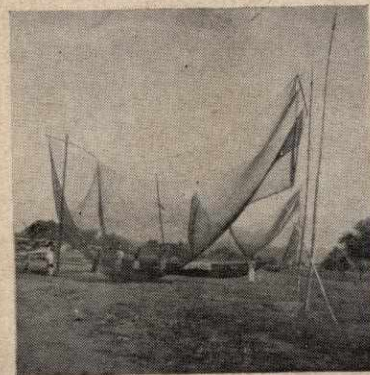
- FIG. 1. Deck plan of a typical towing motor fishing dugout used in the abuyan fishery—showing parts (diagrammatic): *ec*, Engine cover; *d*, deck; *ms*, mast socket; *bo*, bamboo outrigger; *obf*, outrigger bamboo float; *rs*, rudder socket.
2. Deck plan of a typical live-well craft—showing parts (diagrammatic): *obf*, Outrigger bamboo float; *mo*, main outrigger beam; *fs*, forward wire stay; *as*, aft wire stay; *so*, secondary outrigger beam; *d*, deck; *rs*, rudder socket, *ms*, mast socket.
3. Structural plan of a typical abuyan net (diagrammatic).
4. Construction of a scare line chain from galvanized iron wire No. 12 (steps *a* to *e*).
5. Accessory fixing stakes used in the abuyan fishery.
6. The abuyan in operation (diagrammatic): *lc*, live-well craft; *an*, abuyan net; *bs*, bamboo stakes; *is*, iron bars stakes; *td*, towing motor dugout; *sc*, scare line chain.
7. Size frequency of samples of biya taken from the catch of 14 abuyan outfits from March 1953 to April 1953, inclusive.
8. Section of a scare line chain showing attachment of banana leaf streamers (diagrammatic):—*sc*, scareline chain; *bm*, banana mid-rib secured to the chain; *bl*, banana leaf streamers.



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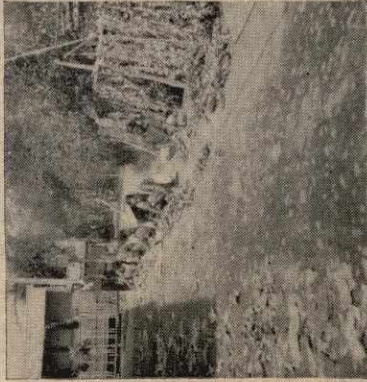
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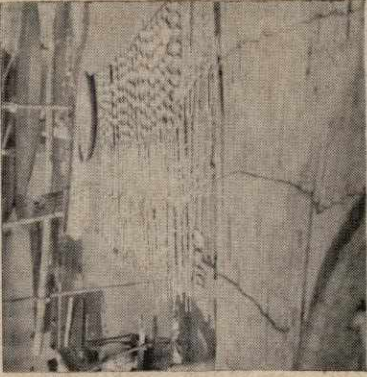
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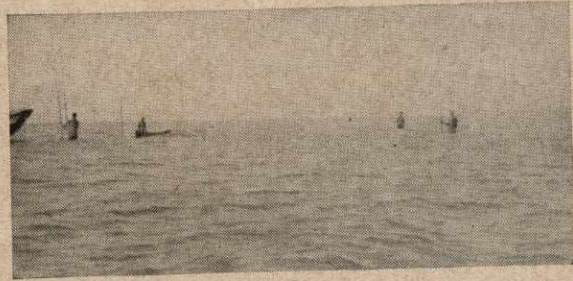


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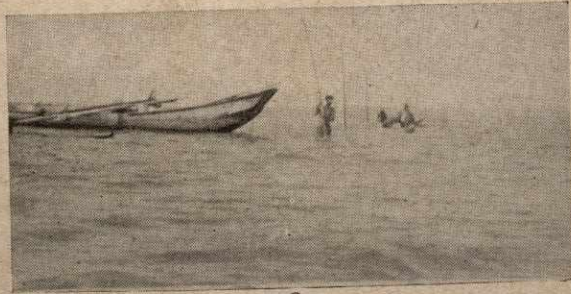
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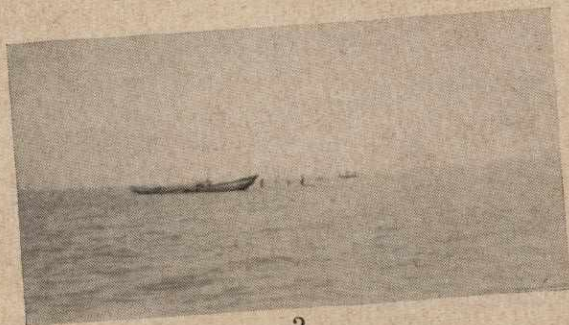
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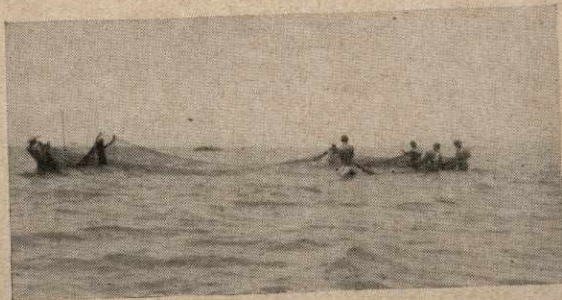
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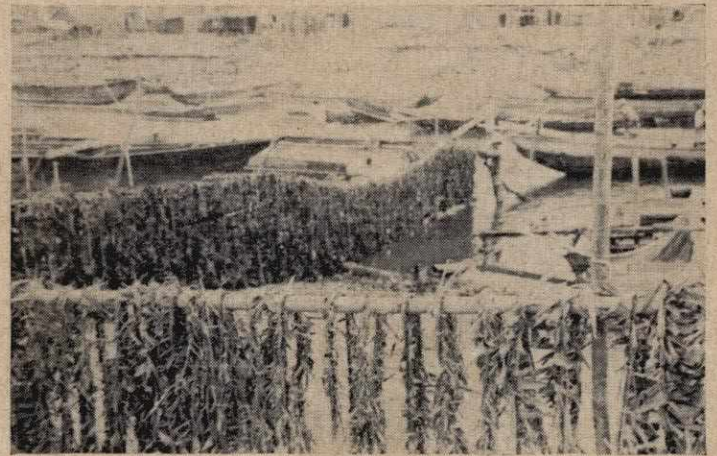
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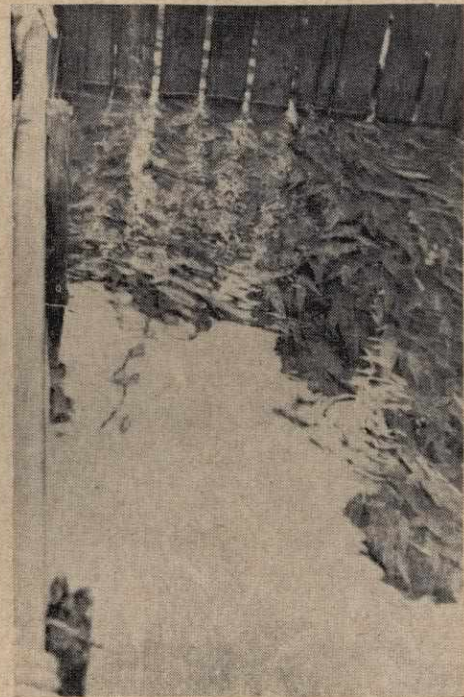
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