

ON THE HYDRO-BIOLOGICAL AND FISHERIES SURVEY OF SORSOGON BAY, LUZON ISLAND*

By

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This survey was carried out in connection with the controversy on the banning of trawl fishing in Sorsogon Bay.

On January 14, 1972, Resolution No. 24 was unanimously approved by the provincial board entreating the President of the Philippines to declare Sorsogon Bay, including the municipal waters of Magallanes, as a conservation area, banning trawls and other apparently destructive fishing methods. The Governor of the province ordered the apprehension of fishermen engaged in such fishing activities. The Governor believed that trawl fishing operation destroys the bottom marine life of the bay causing the fishery resources to be depleted to the detriment of the small fishermen.

A team of biologists from the Bureau of Fisheries and Aquatic Resources was sent to Sorsogon to conduct a survey and study the relevance of the proposed conservation measure as embodied in the above-cited Resolution. The survey was conducted from April 18 to 28, 1972.

THE SURVEY AREA

Sorsogon Bay is a small shallow bay of about 120 sq km, about one fifth the area of Manila Bay. The mouth opens to a narrow channel leading out to Ticao Pass.

The bay has a mean depth of five fathoms. From the deepest part of the bay at 10 fathoms on the southwestern side there is a gradual shoaling of the generally muddy bottom towards the head of the bay.

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The various river systems around the bay drain floodwaters during heavy downpour, thus contributing to the enrichment of the bay water. The high rate of siltation however has been responsible for the bay to become shallower and shallower.

Bottom sampling conducted during the survey showed thick layers of very soft mud or accumulated silt.

MATERIALS AND METHODS

The hydro-biological survey work was conducted on board the fiberglass boat of the Juban Oyster Demonstration Farm of the Bureau. A total of 25 stations were occupied in the bay.

At each station, water temperature readings, surface water sampling for salinity determination, water transparency or visibility determination, plankton collections and bottom sampling were made. A reversing thermometer was used for obtaining temperature readings. For salinity determination the sample bottles were simply dipped in the water for collecting the samples.

An all-white Secchi's disc was used for determining the transparency of the water. A Maru-toku Type B net was used for collecting plankton, fish eggs and fish larvae. A vertical haul was made in each station. At selected stations horizontal tows for 10 minutes each tow were made to collect fish eggs and fish larvae.

An Ekman-Berge dredge was used for taking bottom samples to determine bottom nature and benthos concentration.

In the biological part of the work, market samples were collected to study the fishes and minor sea products landed. The basic biological analyses made were on length and weight measurements, sex and sexual maturity.

Four trawling experiments were conducted in Sorsogon Bay on board a commercial baby trawler. The baby trawler was a 35-foot banca with bamboo outriggers. It was powered by a 10-H.P. gasoline engine. The dragging speed was from 1 to 2 knots. The opening of the trawl net was 6 meters wide. The towing warp was 22 feet and the mesh size of the cod-end or bag was 1½ inches (4 cm) stretch.

Market surveys were made every morning at Sorsogon town market to determine the kinds of fish landed, current market prices and

methods of marketing. Fish samples were bought for laboratory analyses.

RESULTS

1. Hydrography

Figure 1 shows the distribution of surface temperature conditions in Sorsogon Bay. There are three major water masses inside the bay — a warm mass in the southeastern side, a cold mass in the center extending to the northeastern side, and a similarly cold mass in the western side extending to the mouth of the bay to the narrow channel.

Salinity reading inside the bay is low as shown in Figure 2. The pattern of salinity distribution appears to follow that of the temperature distribution.

2. Plankton

Figure 3 shows the distribution of zooplankton concentration in Sorsogon Bay in ml/m².

Plankton concentration is highest in the western side of the bay especially near the mouth of the bay. A value of 8 ml and above up to 18 ml/m² has been observed near Dibughan Island. In the northwestern part of the bay a concentration of 8 ml up to 12 ml/m² has been noted. The area is quite large, about 1/6 of the entire bay. The area northeast of Sablayan Island also shows a concentration of 8 ml up to ml/m² of plankton.

The eastern side of the bay shows concentration of less than 8 ml/m². Figure 4 shows the distribution of fish egg concentration in Sorsogon Bay in number per m². It will be noted that the main area of concentration is in the center of the bay with concentration values from 50 to above 500 eggs/m². The eastern side has concentration values from 50 to 100 eggs/m². The other parts of the bay have concentrations less than 50 eggs/m².

Fish larvae distribution gives a different picture. Figure 5 shows that the highest concentration of fish larvae is found in the eastern side of the bay with values ranging from 30 to above 50 fish larvae/m². Preliminary analyses of the fish larvae showed that they belong to families Gobiidae, Myctophidae, Bregmacerotidae, Serranidae, Scombridae, Gadidae, Clupeidae, in the order of abundance.

3. Benthos

Figure 6 shows the benthos or bottom fauna biomass distribution in Sorsogon Bay in gm/m². The highest biomass concentration is found in the northeastern side of the bay just off Sorsogon town, with values ranging from 100 grams to over 600/m². Other areas of biomass concentration but of much lesser degrees are in the northwestern side off Castilla town with values ranging from 50 to above 200 gm/m² and in the areas southeast of Sablayan Island with values ranging from 100 and above gm/m².

As to population density (Fig. 7), the eastern side, northwestern side and the southeastern side predominate in terms of number of individual bottom animals/m². The density in the eastern side reaches up to 900 individuals/m². While in the northwestern and southeastern sides the densities reach up to 700 individuals/m².

4. Trawling Experiments

Two areas were chosen for the trawling experiments in Sorsogon Bay. One area was off Bucalbucalan in the northwestern side of the bay near Castilla. The other area was off Casiburan Island in the northeastern part of the bay near Sorsogon town. Two drags of 30 minutes each were made in each area, one at daytime and one at night.

Table 1 shows the result of the trawling experiments in these two areas, comparing the catch per hour between day and night trawling and between 2 different depth ranges. Deeper Bucalbucalan area showed higher catch per hour than shallower Casiburan area during the daytime draggings. The Bucalbucalan drag yielded 9.4 kg/hr catch while the Casiburan drag yielded 4.4 kg/hr. catch. The results also showed that the Bucalbucalan area has a higher catch rate than the Casiburan area during the night draggings, being 16.8 and 10.8 kg/hr., respectively.

The histograms on Figures 8 to 11 show the percentage composition by weight (in kg) of trawl catches in the two areas. A comparison of the catch composition between the two areas shows that the blue crabs (*Neptunus pelagicus*) or "Kasag" and the little green crabs (*Tbalamita*) predominated in the Bucalbucalan area than in the Casiburan area, especially during the night dragging.

In trawling at day time in Bucalbucalan area, slipmouths (*Leiognathus* spp.) or sapsap, more specifically *Leiognathus splendens* and *L.*

Table 1. Sorsogon Bay trawling experiments

Date	Haul No.	Area	Depth range (fathoms)	Time		Trawling Time	Total Catch (Kilogram)	Catch per hour kg)
				Set	Haul			
April 25	1	Bucalbucalan	3-4	0850H	0920H	30 min.	4.7	9.4
25	2	Casiburan	1-2	1008H	1038H	30 min.	2.2	4.4
25	3	Bucalbucalan	3-4	1818H	1848H	30 min.	8.4	16.8
25	4	Casiburan	1-2	1935H	2005H	30 min.	5.4	10.8

ruconius predominated the catch. The other predominating fishes were *asu-os* or *Sillago*, *Apogon* sp. and flatfishes or *dapa*.

In the Casiburan area the slipmouths predominated during the night dragging but the day haul showed that lizardfish (*Saurida tumbil*) or *Kalaso* predominated the catch. Other groups showing predominance were the grunts (*Pomadasys argyreus*) or *agoot*, *Apogon* sp., gobies or *talimusak*, shrimps, and the San Francisco or *Charybdis*.

5. Fish Biology

Biological investigations on fishes caught during the trawling experiments in Sorsogon Bay involved length and weight measurements and sex and maturity determinations. Fishes which are dominant in the catch were biologically examined.

Length frequency distribution in per cent of the different fish species are represented in Figures 12 to 15.

Leiognathus splendens — Sizes ranged from 26 mm to 96 mm with a mean length of 63 mm off Bucalbucalan and from 46 mm to 92 mm with a mean length of 64 mm off Casiburan Island (Fig. 12). Examination of the gonads showed that they were still immature (stages I to II). Smaller fishes with lengths ranging from 16 mm to 30 mm were just past their post-larval stage.

Leiognathus ruconius — Length ranges from 24 mm to 68 mm with a mean length of 48 mm off Bucalbucalan and from 36 mm to 74 mm with a mean length of 48 mm off Casiburan Island (Fig. 13). Immature ones were found in the 30-45 mm group and mature ones were from 50 to 70 mm. Two distinct groups were found in the stock.

Leiognathus bindus — In both areas (Fig. 14) length ranged from 32 mm to 64 mm but their mean lengths differed by 1 mm. All of the stock was immature.

The stock of *Leiognathus* seemed to be larger off Casiburan Island than off Bucalbucalan.

Pomadasys argyreus — Larger specimens with a mean length of 85 mm were found off Casiburan Island (Fig. 15) but they were still immature, stages I and II. The smallest specimen measured was 46 mm.

Among the other fishes caught, the ambassids (*Ambassis* sp.) and the theraponids (*Therapon* spp.) were already mature. The rest were small and immature.

The blue crabs, *Neptunus pelagicus*, which were predominantly caught in both areas were gravid. Males were dominant.

6. Market Survey, Fishing Activities and Interviews

The most common fishes observed in the market were *bolinau* (*Stolephorus* spp.), *balanyong* (*Dussumieria* sp.), *burau* (*Rastrelliger* sp.), *sapsap* (*Leiognathus* sp.) and *asu-os* (*Sillago* sp.). Large quantities of *kasag* or *alimasag* (*Neptunus pelagicus*), different kinds of *pasayan* (*Penaeus* spp.) and shells were landed daily. *Baloko* (*Atrina* sp.) was abundant. *Bugitis* (*Venus* sp.), *piyong* (*Arca* sp.), *punao* (*Circe* sp.), *batotoy* or bloody clam (*Arca* sp.) and *halaan* (*Paphia litterata*) were also abundant and commonly sold.

All these fishes, crabs, shrimps and shells were sold either by piece or by bunch or *tumpok*. Price per bunch or *tumpok* ranged from ₱0.50 to ₱1.00 and the prices of the others depended on the size.

The pelagic fish species like the *bolinau* and *burau* were not caught in Sorsogon Bay but in the areas off Magallanes, while some were caught from the Pio Duran area.

Trawl catches were observed to be sold in the fish market. The bigger fishes like *torcillo* (*Sphyraena jello*), goatfish or *saramulyete* (*Upenoides sulfureus*), *asu-os* or whiting (*Sillago sihama*), etc. were separated from the main catch. The rest of the catch was composed mainly of very small fishes (considered as trashfishes) which were still being sold in *tumpoks*.

The trashfish was composed mainly of small gobies, grunts and slipmouths. The gobies were mostly small fishes, while the grunts and slipmouths were small and immature too.

During the survey, fishing activities were also observed and unit counts of gear in operation were noted.

A total of 28 units of fish corrals (*baklad*) were counted. These were observed in the eastern side of the bay, east and west of Sabla-

yan Island and in the southern side of the channel leading out towards Magallanes.

Some baby trawlers (*kaladkad*), gill netters (*pante*) and crablift net (*bintol*) fishermen were observed operating in the Bay. Some fishermen were observed gathering *baloko* in the shallow areas of the eastern side of Sablayan Island. *Sakag* or push net fishermen were also observed fishing in the mangrove swamps off Juban.

From the surveys and interviews conducted by Bureau of Fisheries extension workers, data and information were gathered from four municipalities around Sorsogon Bay and shown in Table 2. The estimated catch in kilograms per day per year was based on an average of 17 actual fishing days per month.

It may be seen that in Casiburan, the average daily catch was some two kilos/fisherman or one kilo per gear. In Juban, it was about one kilogram/day per fisherman gear. In Sorsogon, it was also about one kilogram/day. The catch of the baby trawl does not even allow a kilogram per fisherman. In Castilla, however, it was also one kilogram per gear but about 10 kilos per fisherman in view of the effective use of crab lift nets. This gear is however only seasonal. Considering that the area of the bay is 120 sq km the average production was 20 kg/km²/day. This appears to be very low if compared to other fishing areas like Manila Bay or Malampaya Sound.

Likewise, the production of 1 to 2 kg/fisherman is equivalent to some 365 to 730 kg/man/year. The poor average per gear in the country is 700-800 kg/year, although, the better approximate would be some 1000 kilos/year/fisherman. This shows how overfished Sorsogon Bay is. The 545 fishermen who caught some 2,414.5 kg/day averaged only about 4 kg/day.

In view of the above findings, it is very clear that the bay is biologically overfished and should be regulated. The baby trawl has a great catching power which is destructive to the young fishes in the bay. The trawling experiments had a catch of from 4 to 16 kg/hour.

REMARKS AND RECOMMENDATIONS

The hydro-biological observations made during the survey present only the existing conditions at that particular time. The results of

Table 2. Sorsogon Fishery Resources

Municipality	Number of Fulltime Fishermen	Fishing Gear Used		Catch Average (kg/day)	Estimated Total Catch (kg/day)	Catch composition
		Number	Type			
1. Casiguran Sorsogon	150	46	Gill net	1	46	Halfbeak, mullet, sea catfish, goatfish, common whiting, grunt, <i>Therapon</i> and <i>Caranx</i> Shrimps, blue crab and goby
		16	Scissors net	0.5	8	Blue crab, shrimp, common whiting, flatfishes, goatfishes
		9	Baklad	0.5	4.5	Silver pike eel, sea catfish, grouper
		4	Kitang	1	4	Blue crab, slipmouth, goby, shrimp, flatfishes and sting ray
		2	Beach seine	1	2	Blue crab, shrimp, goby, slipmouth, goatfishes, rays
		16	Drive-in-net	1	16	Slipmouth, blue crab, and goby
		4	(tuy-tuy)	1	4	Blue crabs
		210	Bocatot	1	210	Crevalle, slipmouths, anchovies, hardtail
		1	Lintnet	1.5	1.5	
		Total	150	308		296

Table 2. Continued . . .

Municipality	Number of Fulltime Fishermen	Fishing Gear Used		Catch Average (kg/day)	Estimated Total Catch (kg/day)	Catch Composition
		Number	Type			
2. Juban, Sorsogon	30	8	Gill net	1	8	Halfbeak, mullet, sea catfish, goatfish, common whiting, grunt, <i>Therapon</i> & <i>Caranx</i>
		11	Baklad	1	11	Blue crab, shrimp, common whiting, flatfishes, goatfishes
		6	Kitang	1	6	Silver pike eel, sea catfish, grouper
		6	Hook and line	1.5	9	Snapper, grouper, silver pike eel, <i>Talakitok</i>
		1	Drive-in-net	1	1	Blue crab, shrimp, goby, slipmouth goatfishes and sting ray
		Total	30	32		45
3. Sorsogon, Sorsogon	285	24	Baby trawl	5	120	Shrimp, slipmouth, goby, blue crab, lizardfish, flatfish, goatfish, <i>malakapas</i> , and <i>Therapon</i>
		115	Gill net	1	115	Halfbeak, mullet, sea catfish, common whiting, grunt, goatfish, <i>Therapon</i> , <i>Caranx</i> , and croaker
		31	Bocatot	1	31	Slipmouth, blue croaker
Total	285	24		0.5	12	Blue crab, shrimp, common whiting, flatfish goatfish, croakers, <i>Therapon</i>

Table 4. Continued . . .

Municipality	Number of Fishermen		Fishing Gear Used		Catch Average (kg/day)	Estimated Total Catch (kg/day)	Catch Composition	
	Fulltime	Number	Type	Number				
Sorsogon,		800	Crab lift net (bintol)	1	1	800	Blue crab	
		5	Kitang	1	1	5	Silver pike eel, sea catfish, grouper	
		12	Scissors net	0.5	0.5	6	Shrimp, blue crab, goby	
		5	Hook and line	1.5	1.5	7.5	Silver pike eel, snapper, grouper, grunt	
Total	285	1016				1096.5		
4. Castilla, Sorsogon		13	Gill net	1	1	13	Halfbeak, mullet, sea catfish, common whiting, grunt, goatfish, <i>Therapon</i> , <i>Caranx</i> , and croaker	
		920	Crab lift net (bintol)	1	1	920	Blue crab	
		2	Beach seine	1	1	2	Blue crab, slipmouth, goby, shrimp, flatfish	
		23	Scissors net	0.5	0.5	11.5	Shrimp, blue crab, goby	
		9	Kitang	1	1	9	Silver pike eel, sea catfish, grouper	
		3	Lift net	1.5	1.5	4.5	Hardtail, crevalle, anchovy, slipmouth	
		3	Bocatot	1	1	3	Slipmouth, blue crab goby	
		10	Hook & Line	1.5	1.5	15	Snapper, silver pike eel, grouper	
	Total	80	983				977	

the observations were not sufficient to be used as basis for whatever regulatory measures are contemplated to be enforced to conserve the fishery and marine resources in Sorsogon Bay.

The results of the trawling experiments conducted showed that small immature fishes were taken aside from the big mature ones. Not all the small fishes are immature. There are fish species which are naturally small and do not attain further increase in size.

There is a need for a continuous study of the bay to provide more data and information on the changes in conditions in space and time.

Reliable catch statistics are needed for the proper evaluation of the fishery resources.

It is therefore recommended that:

(a) a program of regular hydro-biological observation and study be conducted every three months from one to two years, and

(b) a continuing program on the assessment of fish stocks be carried out in the bay, so that proper management and development of the resources can be implemented.

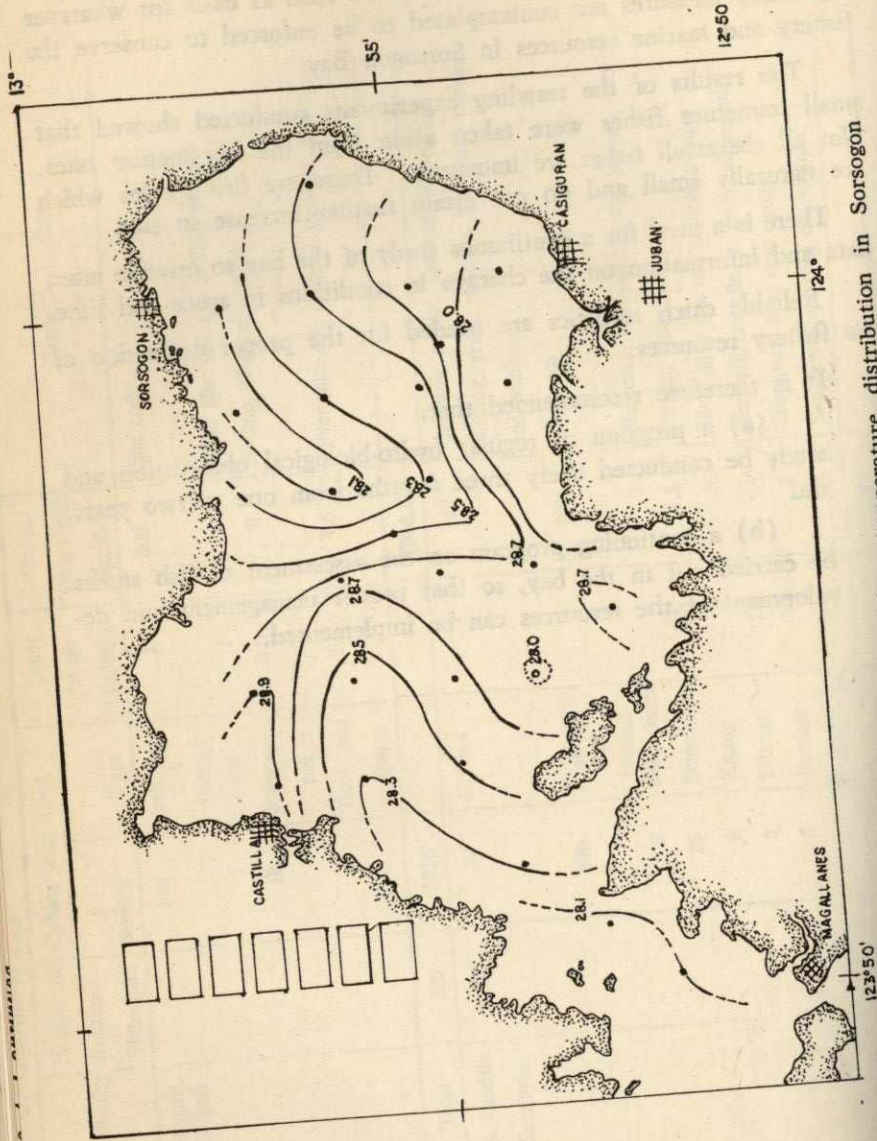


Fig. 1. Chart showing the surface temperature distribution in Sorsogon Bay in °C.

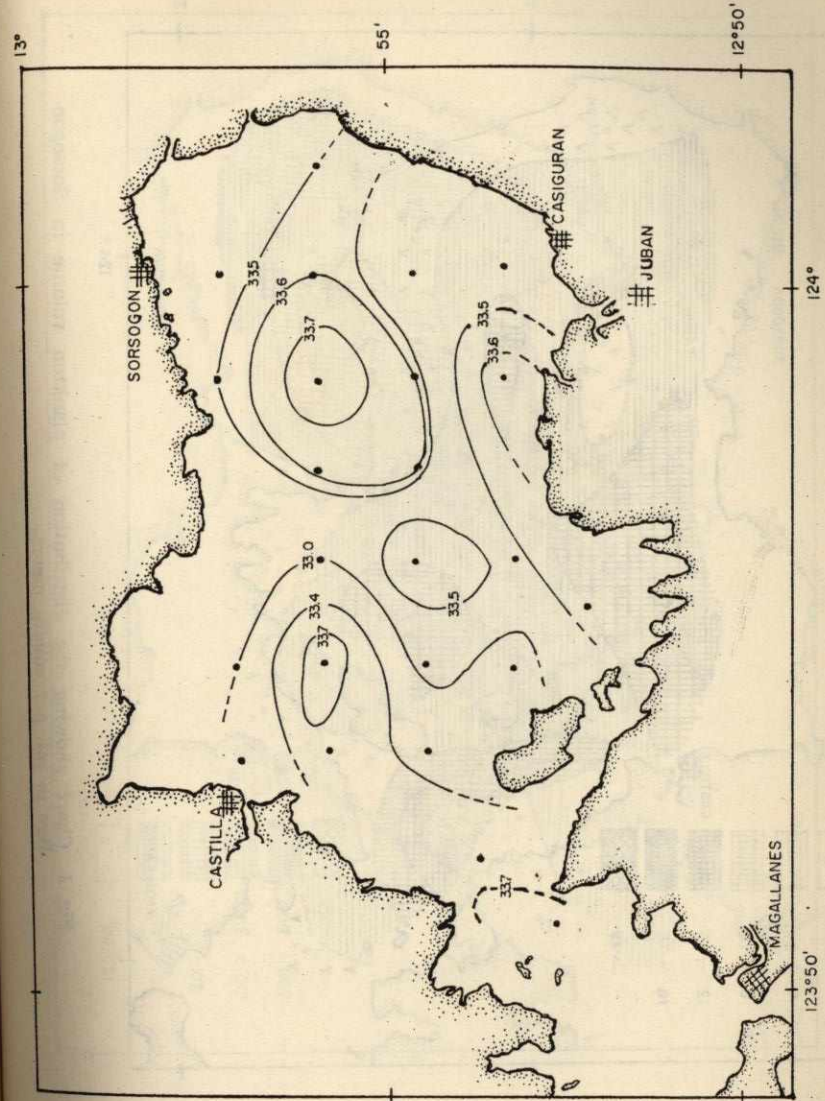


Fig. 2. Chart showing the surface salinity distribution in Sorsogon Bay in %.

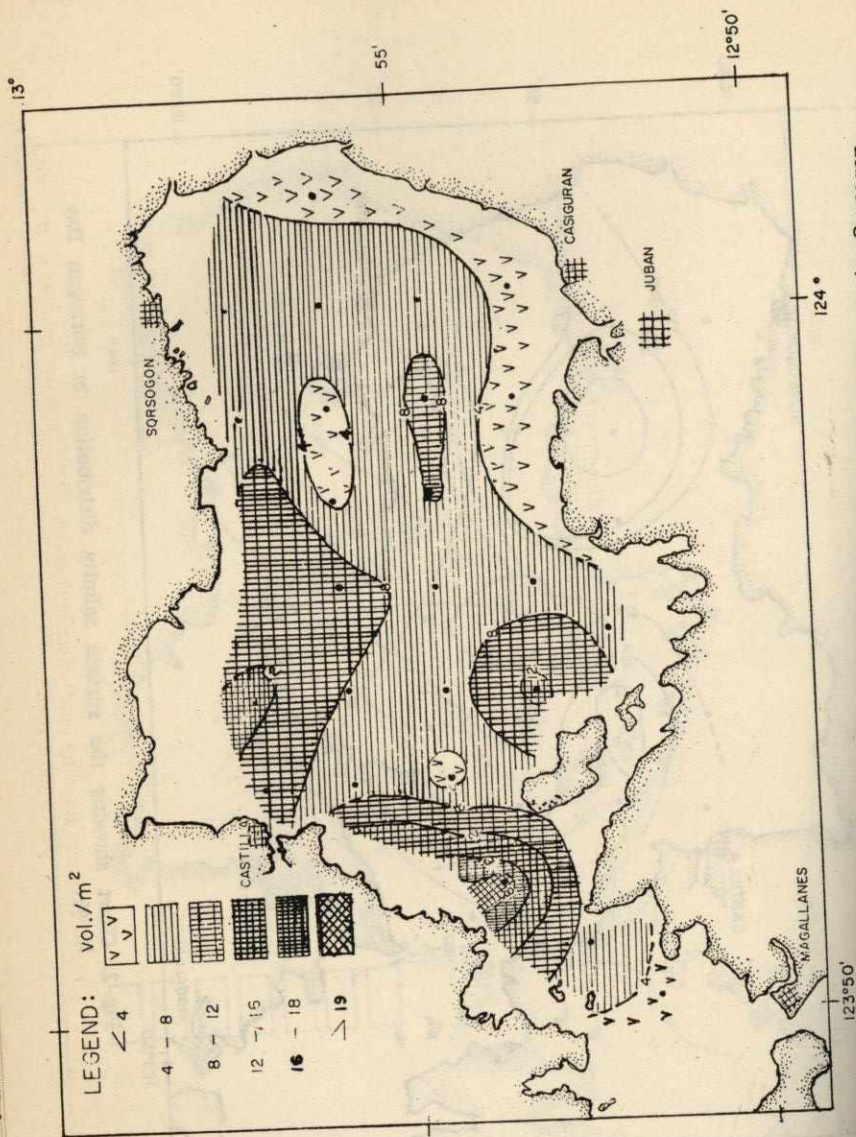


Fig. 3. Chart showing the distribution of plankton volume in Sorsogon Bay in ml. per square meter.

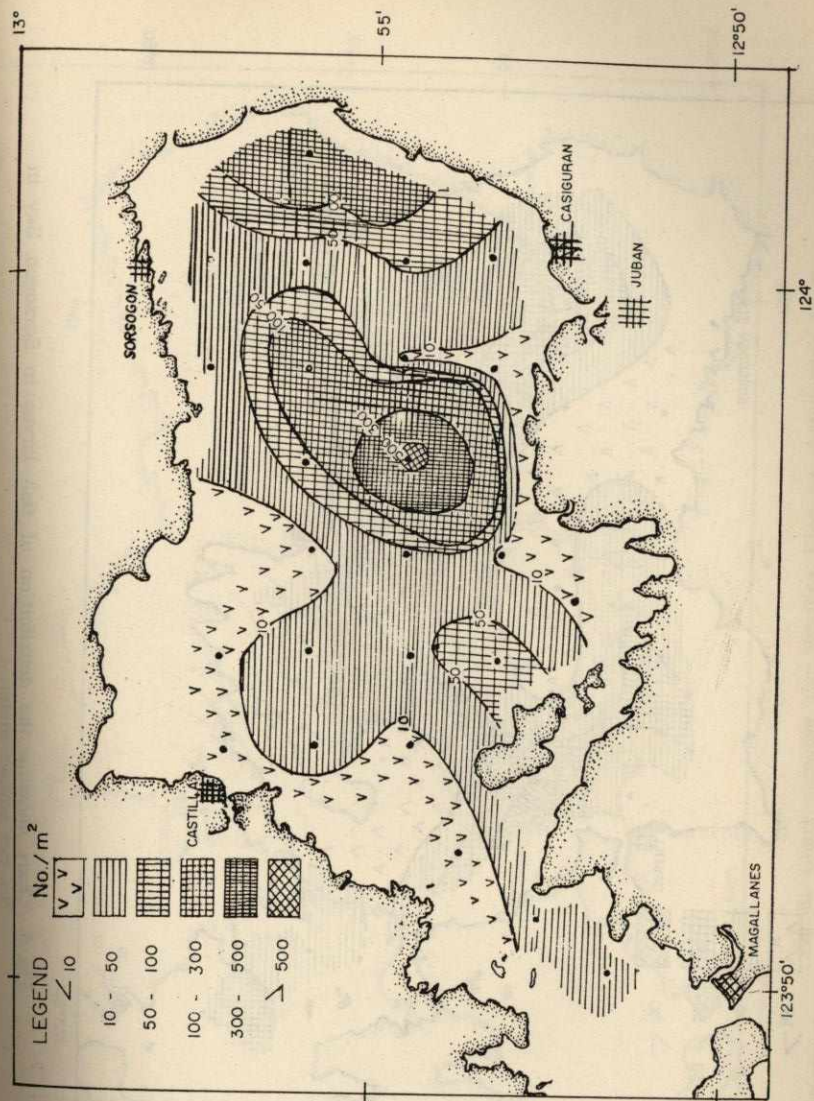


Fig. 4. Chart showing the distribution of fish eggs in Sorsogon Bay in No. per square meter

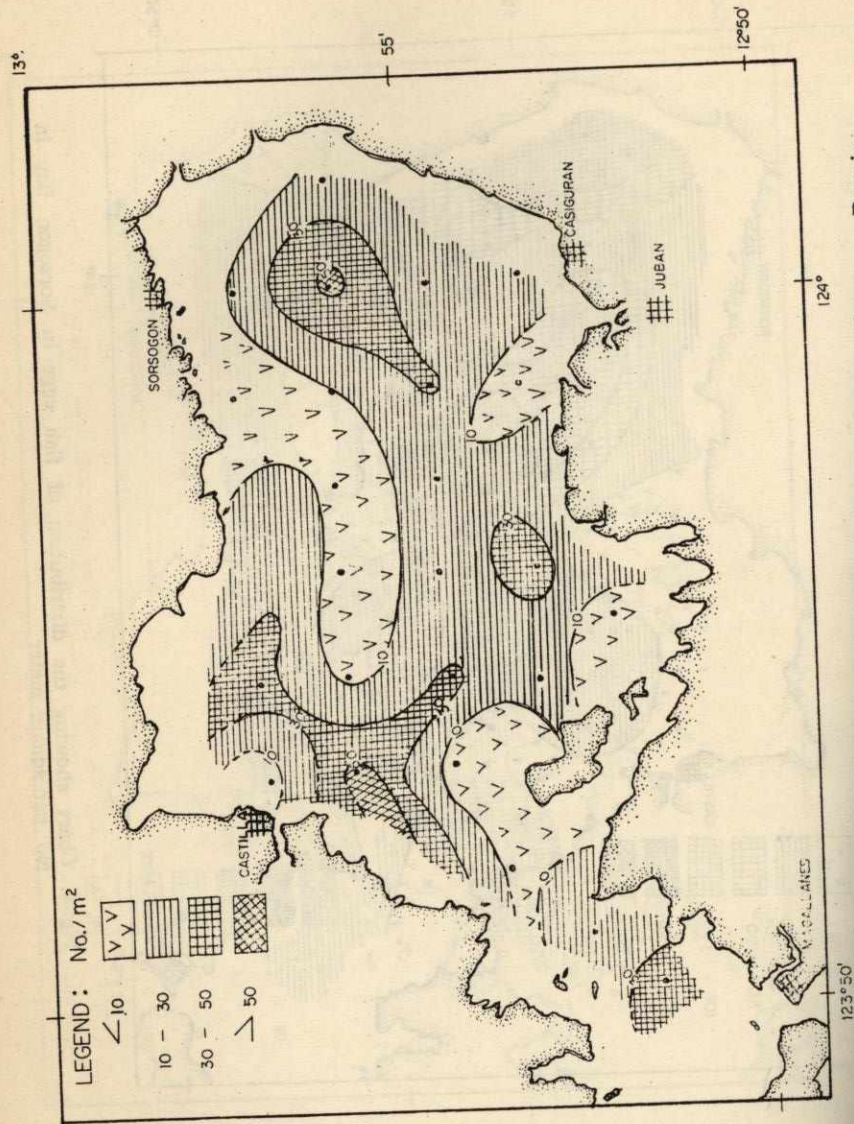


Fig. 5. Chart showing the distribution of fish larvae in Sorsogon Bay in No. per square meter.

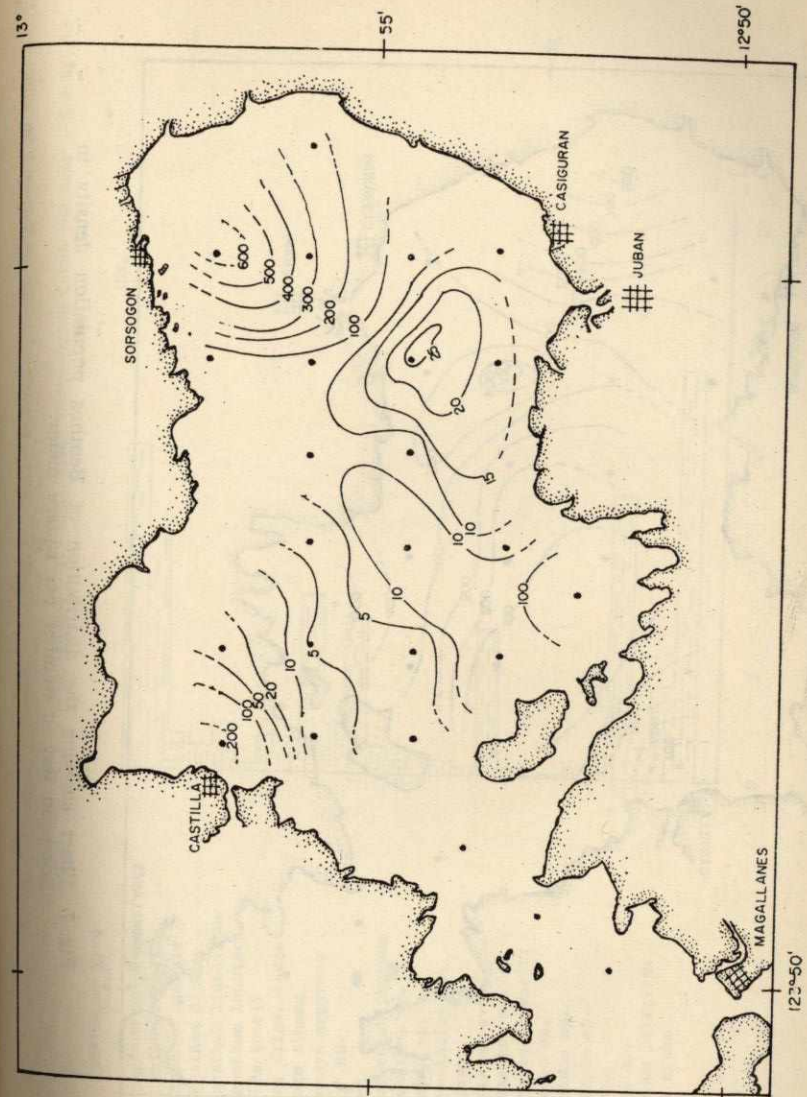


Fig. 6. Chart showing the Benthos Biomass distribution in Sorsogon Bay in grams per square meter.

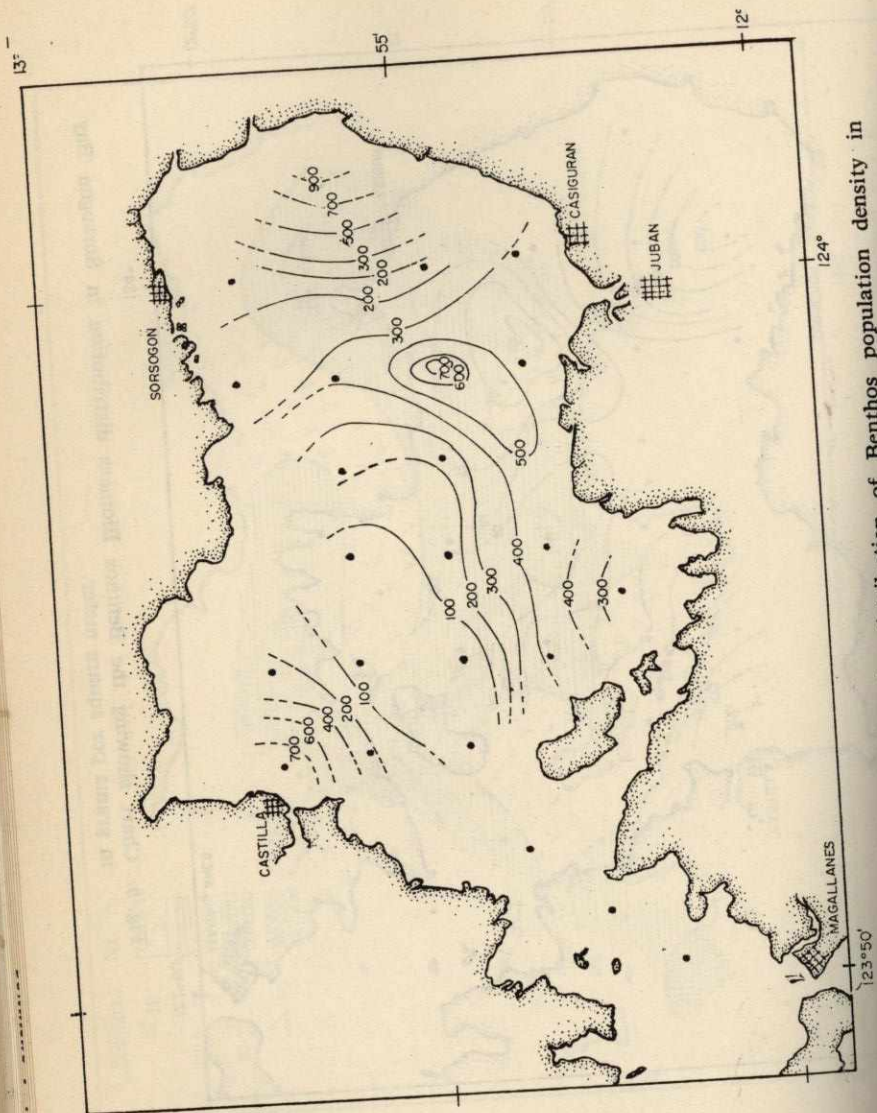


Fig. 7. Chart showing the distribution of Benthos population density in Sorsogon Bay in number per square meter.

Area : Off Bucal-bucalan
 Depth : 3-4 fms.
 Date : 4-25-72
 Trawling time : 30 mins.
 Haul 1
 Total catch : 4.7 kgs. Time : 0850H-0920H Catch per hour : 9.4 kg./hr.

Species or Kind

Leionathus splendens
Leionathus ruconius
Leionathus blochii
Leionathus bindus
Leionathus lineolatus
Leionathus leuciscus
Saurida tumbil
Gerres filamentosus
Sillago sihama
Pomadourys argyreus
Apogon sp.
 Goby
Upeneoides sulphureus
Priacanthus sp.
 Therapon sp.
Platycephalus sp.
 Flatfish
Nemipterus ovenioides
Triacanthus sp.
Du. sumicri hasselti
Lutjanus sp.
Tetraodon sp.
Thalamita sp.
 Shrimps
Loligo sp.
Neptunus pelagicus
 Small crabs

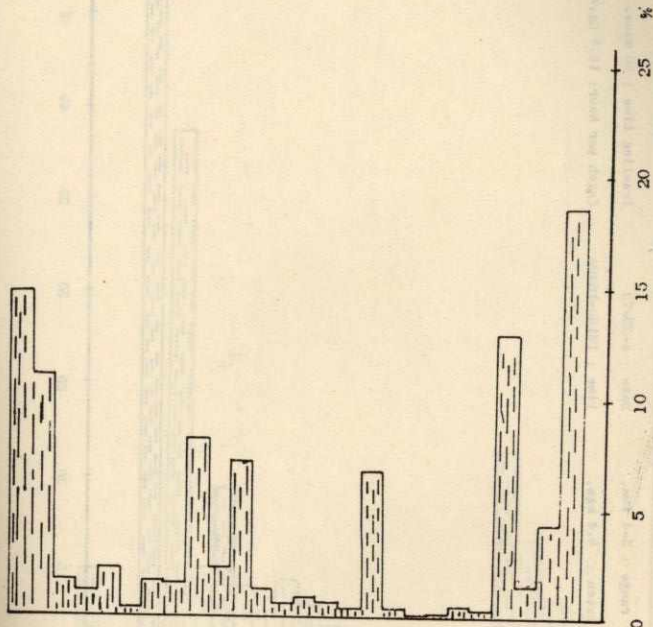


Fig. 8. Catch composition by weight in per cent.

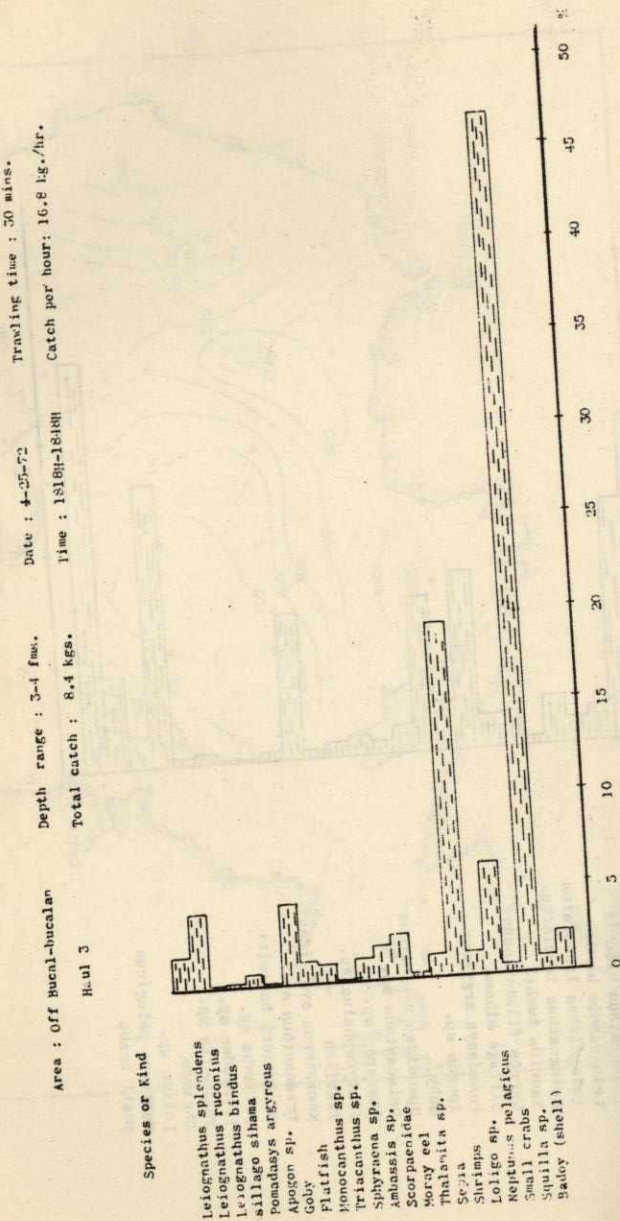


Fig. 9. Catch composition by weight in per cent.

Area : Off Casiburan Island
Haul 2

Depth range : 1-2 fms.
Total catch : 2.2 kgs.

Date : 4-25-72
Time : 1008 H-1038H

Trawling time : 30 mins.
Catch per hour: 4.4 kg./hr.

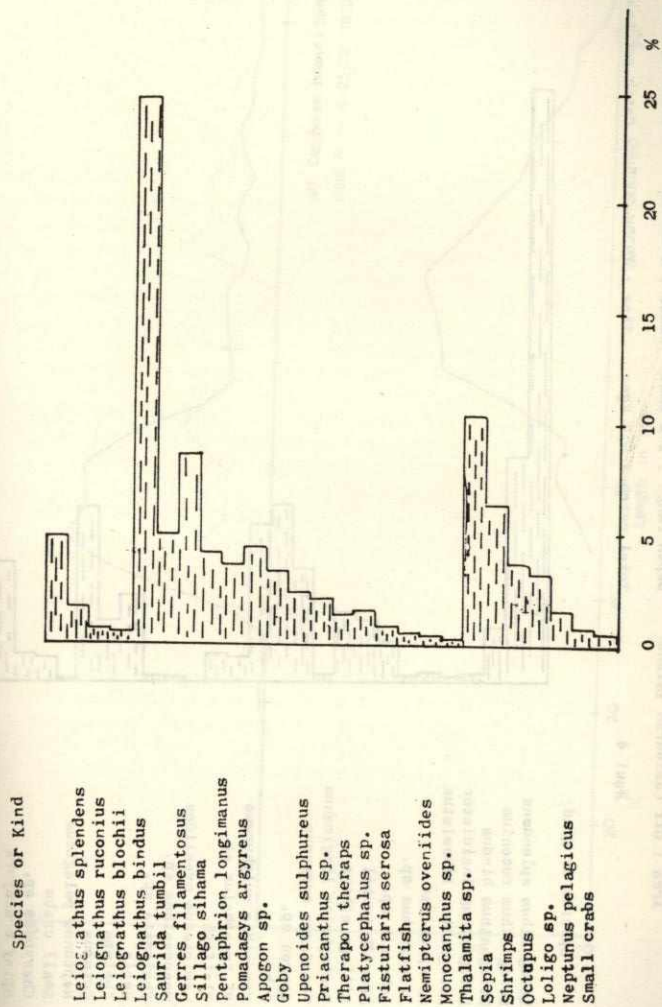
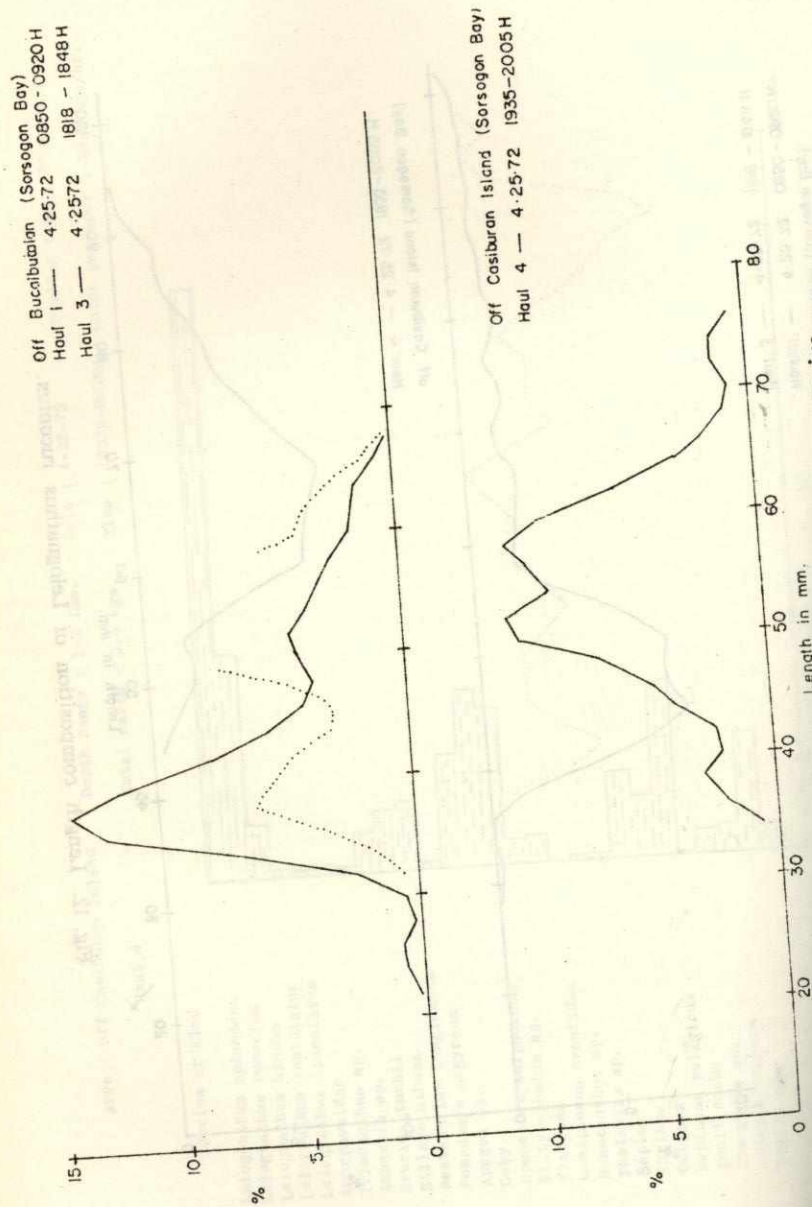
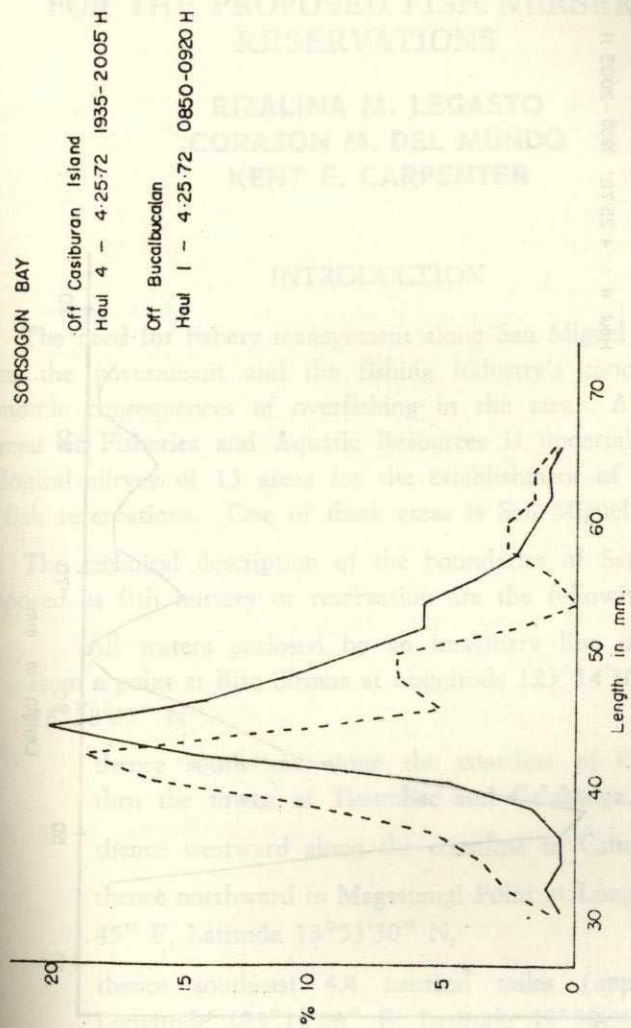


Fig. 10. Catch composition by weight in per cent.

Fig. 13. Length composition of *Leiognathus ruconius*.Fig. 14. Length composition of *Leiognathus bindus*.

SORSOGON BAY (Off Casiburan Island)
Haul 4 - 4-25-72 1935-2005 H

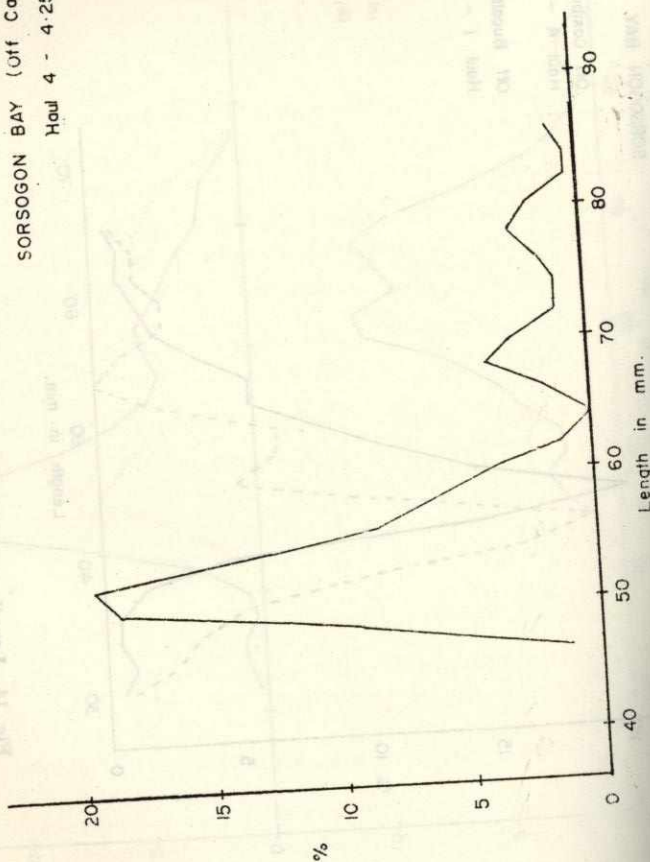


Fig. 15. Length composition of *Pomadasys argyreus*.