PHYSICO-CHEMICAL OBSERVATIONS IN SOME PILOT AREAS DURING THE PEAK SEASON OF BANGUS FRY, *CHANOS chanos* IN VISAYAN PROVINCES *

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ABSTRACT

The research on the biological assessment of bangus, shrimp and eel fry in Luzon, Visayas and Mindanao were ushered in by investigations of the physico-chemical conditions that exist in selected fry grounds during the peak fry seasons in 1974.

The survey conducted in the Visayan islands showed that the distribution of the environmental conditions in a given fishing ground has a deep influence on periodic and seasonal migration and occurrence of fish. The physical and chemical factors influence the abundance of the food indirectly, and the abundance of these species in the fishing areas directly. The results of the survey give us an idea of fish behavior with respect to the environmental conditions.

INTRODUCTION

These physico-chemical observations were made in the Visayan provinces while conducting the research project entitled "Biological Assessment of Bangus, Shrimp, and Eel Fry". The researcher conducted two exploratory surveys on the fry grounds of the provinces of Panay, Negros, Cebu, Bohol, Leyte, Samar and Masbate.

The first survey was conducted from September to November 1973 and the second from April to June 1974. These are the peak seasons of fry collection. The result of the first survey revealed the need for more detailed survey work, to know the factors that influence spawning and the abundance of fry in a certain area.

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In the second survey, the selected pilot areas were Hamtic, San Jose and Patnongon, Antique; Tigbauan, Iloilo; and Argao, Cebu. Observations conducted in these areas were made on the following:

a) physical conditions — weather, air and water temperature.

b) chemical conditions — dissolved oxygen content and salinity.

The changes in the environmental conditions in a given fishing area have a deep influence on the periodic and seasonal fluctuation or occurrence of the fish fry.

The survey was conducted to gain knowledge of fish behavior with respect to environmental conditions. These were observed by the fishermen when locating the most productive fishing areas.

The physico-chemical characteristics of a fishing ground are important in evaluating fishery potentials for its development or commercial exploitation.

METHODOLOGY

Physico-chemical investigations of selected areas were conducted during the fry season. The 12 hydrographic stations established were equally distributed along the fry grounds of each area. A motor banca and a chemical kit were used during the survey. In each station the following physico-chemical factors were observed:

a) weather (prevailing wind direction)
b) topography
c) depth
d) surface water and air temperature
e) water transparency
f) salinity
g) dissolved oxygen content

The raw data were processed and presented in figures and analyzed for a final report.

OBSERVATIONS

Weather in coastal areas

The changes in the conditions of land and air flowing over the sea take place mainly over the coastal waters. Thus, enclosed seas such as those in the Philippines are ideal areas for the study of air exchange between the sea and the atmosphere. The changes in the physical properties of the air are caused mainly by heat. Heat also brings about considerable changes in the thermal properties of water near the coast, cool during the early cold season and warm in summer.

The winds can be different both in direction and in force along coastal areas from those prevailing offshores and inland. While the monsoons are brought about by seasonal variations of temperature and pressure over land and water, their diurnal counterparts, the land and sea breezes are brought about by the difference in temperature between land and sea. During summer, the land is warmer than the sea surface by day and colder by night. The temperature differences bring about slight variations in pressure. These physical disturbances in the atmosphere are manifested as breeze having a landward component during daytime and a component seaward during the night (Hela and Taivo Laevastu, 1961). The day breeze (landward) greatly influence the abundance of bangus fry collected along the shore.

Influence of the environmental factors on fish behavior

The environment interferes with the distribution and behavior of marine plants and animals. For instance, the growth and abundance of all the food organisms of fish are affected by the environmental factors in the complex scheme of environment behavior system. Fish behavior is directly or indirectly the result of the action and interaction of various environmental factors like air and water temperature, water current, dissolved oxygen content and salinity. A knowledge of fish behavior in relation to these environmental factors is most useful to the fishermen since this guides them in the location of areas that have great fish potentials.

The author tried to investigate these factors more or less separately to interpret data more easily.

1. Temperature

Temperature is the most easily determined environmental factor. The temperature of sea water and its flunctuation can be easily cor-

related to the behavior of fish. Temperature may serve as the most useful indicator of the prevailing and changing ecological conditions. The annual range of surface temperature in the tropical waters of the Philippines is between 26°C and 31°C, (Mejia *et al.* 1953). The actual temperature is observed with its range of fluctuation and its horizontal gradients from place to place. The influence and effect of temperature on the movement and distribution of fish was summarized from the findings of the various workers. The influence of temperature on fish behavior was most pronounced during the spawning season as shown by the ripening of the sexual products. Every stock of fish has a normal temperature range according to its seasonal cycle (theory of Devald, 1959). The correlation between water temperature and spawning of marine animals is generally recognized. Ofton (1919) and more recently, Hutchins (1947) have shown that several species of marine invertebrates spawn within narrow limits of temperature.

Figures 1, 4, 7, and 10 showed the gradients of surface temperature and the occurrence of bangus fry along the coast of Hamtic, San Jose and Belison, Antique; Tigbauan and Guimbal, Iloilo; and Argao, Cebu during summer, from April to May 1974. The surface temperature observed varied from 29°C to 30°C along these coastal waters. The warm temperature manifested correlation to the spawning season. The peak months according to the concessionaires are from April to June and from October to November. The coastal surface water temperature observed were higher than those of the offshore waters. This condition was influenced by the heat during summer months. The observed temperature showed that gravid *sabalo* (mature milkfish) responds to the normal oceanographic conditions present during the spawning season. When the spawners do not appear or if they appear late in these areas, the cause could be the prevailing abnormal conditions which force the fish to spawn elsewhere.

The increased rate in the spawning of *sabalo* during the warm water period and the decreased rate during the cold water period seem to be consistent with the geographical distribution of this particular fish species.

Temperature directly influences the rate of development and in conjunction with salinity, affects the buoyancy of the eggs. The

length of the incubation period of eggs and that of larval life depend directly on the temperature of the environment.

Likewise, the prevailing water temperature, together with the other factors like salinity, tidal current and wind direction, determine the abundance of fish.

Temperature also influences feeding, metabolism and growth of fry since it affects the abundance of plankton in these areas which in turn affects the feeding habits of this fish.

2. Salinity

Salinity conditions also influence the reaction of the fish. The salinity variation in the offshore waters is relatively small than that in coastal and bay areas due to the run-off from rivers and streams. This variation affects the osmotic regulation of fish and determines the buoyancy of the eggs of the *sabalo,* which are pelagic in nature.

In general, reduced density due to low salinity can be fatal to pelagic eggs of marine fish. However, the *sabalo* which is a euryhaline species, can tolerate the great changes in salinity of the estuaries found along the coastal areas. These estuaries are fertile regions because of the rich nutrients that are drained from the land. Hence, the presence of spawners in these coastal areas consequently leads to the abundance of fry.

It is evident from the surface salinity contours shown in figures 2, 5, 8 and 11 that the coastal waters reach maximum salinity. However, the salinity gradients at five fathoms are slightly lower than those at 10 fathoms during this survey period, when there was minimum run-off. From the results of the survey from April to June, it was observed that there was a close correlation between salinity and run-off.

3. Oxygen

The minimum layer of surface oxygen observed does not become a limiting factor in the distribution of fish although it may affect the behavior of fish (Johnson and Krough, 1914).

The surface oxygen gradients shown in figures 3, 6, 9 and 12 were observed to be normal. These gradients closest to the shore during April and May were lower than those offshore may be because of the biological activity of the organisms.

RECOMMENDATION

It is highly recommended that the Bureau of Fisheries and Aquatic Resources engage in a comprehensive study (synoptic description) of the various sea conditions of the fishing ground to determine the particular distribution and abundance of a given species.

CONCLUSION

The environmental factors like weather (wind), air and water temperatures, tidal current, salinity, oxygen content, and turbidity may, directly or indirectly influence the distribution and behavior of most plants and animals.

A knowledge of the fish habitat in relation to these environmental factors will be most useful to the fishermen since this will guide them in the location of areas that have great fish potential.

REFERENCES

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Table 1. Physico-chemical observation in Hamtic, Antique, bangus fry ground April 25, 1974

Date 1974	Time	Sta. #	Depth	Chemical Analysis: Temp. H_2O	Oxygen ml/L	Salinity o/oo	Remark
April 26	08:35 hrs	1	Surface	28.8°C	3.97	32.89	
"	09:10 hrs	2	"	29.1°C	3.97	33.61	
"	09:20 hrs	3	"	29.1°C	3.91	33.37	
"	09:30 hrs	4	"	29.4°C	3.91	34.33	
"	09:45 hrs	5	"	29.5°C	3.91	33.13	
"	10:00 hrs	6	"	29.1°C	3.88	32.89	
"	11:00 hrs	7	"	29.6°C	3.91	33.49	
"	11:10 hrs	8	"	29.7°C	3.88	33.61	
"	11:22 hrs	9	"	29.7°C	3.88	33.37	
"	11:30 hrs	10	"	29.5°C	3.88	34.09	
"	11:38 hrs	11	"	28.8°C	3.88	33.85	
"	11:48 hrs	12	"	29.5°C	3.88	33.61	

Physico-chemical observation in San Jose, Belison, Antique bangus fry ground, April 26, 1974

Date 1974	Time	Sta. #	Depth	Chemical Analysis: Temp. H_2O	Oxygen ml/L	Salinity o/oo	Remark
April 26	10:00 hrs	1	Surface	28.8°C	4.27	33.61	
"	10:07 hrs	2	"	28.9°C	3.80	34.09	
"	10:14 hrs	3	"	28.9°C	3.97	34.09	
"	10:25 hrs	4	"	29.0°C	3.88	34.09	
"	10:30 hrs	5	"	28.9°C	3.80	33.61	
"	10:40 hrs	6	"	29.2°C	3.97	33.47	
"	13.00 hrs	7	"	29.6°C	4.05	33.47	
"	13.30 hrs	8	"	29.4°C	4.05	33.61	
"	13.38 hrs	9	"	29.5°C	3.88	33.85	
"	1345 hrs	10	"	29.9°C	3.80		
"	13.55 hrs	11	"	29.8°C	3.71	34.57	
"	14:04 hrs	12	"	29.8°C	3.88	33.61	

Table 2. Physico-chemical observation in Tigbauan and Guimbal, Iloilo bangus fry fishing ground, April 30, 1974

Date 1974	Time	Sta. #	Depth	Temp. H_2O	Chemical Analysis: Oxygen ml/L	Chemical Analysis: Salinity o/oo	Remark
April 30	08:00 hrs	1	Surface	28.9°C	3.63	34.09	
"	08:08 hrs	2	"	29.1°C	3.36	33.85	
"	08:17 hrs	3	"	29.0°C	3.66	34.29	
"	08:24 hrs	4	"	29.2°C	3.85	34.09	
"	08:20 hrs	5	"	29.2°C	3.78	34.09	
"	08:35 hrs	6	"	29.4°C	3.67	34.09	
"	10:04 hrs	7	"	29.9°C	3.88	34.09	
"	10:14 hrs	8	"	29.56°C	3.86	34.09	
"	10:20 hrs	9	"	29.4°C	3.85	34.57	
"	10:21 hrs	10	"	29.4°C	3.80	34.33	
"	10:35 hrs	11	"	30.1°C	3.92	34.33	
"	10:45 hrs	12	"	30.5°C	4.05	34.33	

Physico-chemical observation in bangus fry fishing ground, Argao, Cebu, May 13, 1974

Date 1974	Time	Sta. #	Depth	Temp. H_2O	Chemical Analysis: Oxygen ml/L	Chemical Analysis: Salinity o/oo	Remark
May 13,	12:43 hrs	1	Surface	29.9°C	3.80	33.85	
"	12:50 hrs	2	"	30.0°C	3.80	33.85	
"	13:00 hrs	3	"	30.5°C	4.31	33.85	
"	13:10 hrs	4	"	30.6°C	3.62	33.85	
"	13:18 hrs	5	"	30.2°C	3.53	34.09	
"	13:36 hrs	6	"	30.3°C	3.71	33.85	
"	15:00 hrs	7	"	29.8°C	3.97	34.57	
"	15:08 hrs	8	"	30.0°C	3.97	34.33	
"	15:15 hrs	9	"	29.6°C	3.88	34.45	
"	15:26 hrs	10	"	29.5°C	3.97	34.33	
"	15:35 hrs	11	"	29.6°C	3.97	34.33	
"	15:43 hrs	12	"	29.9°C	3.97	34.09	

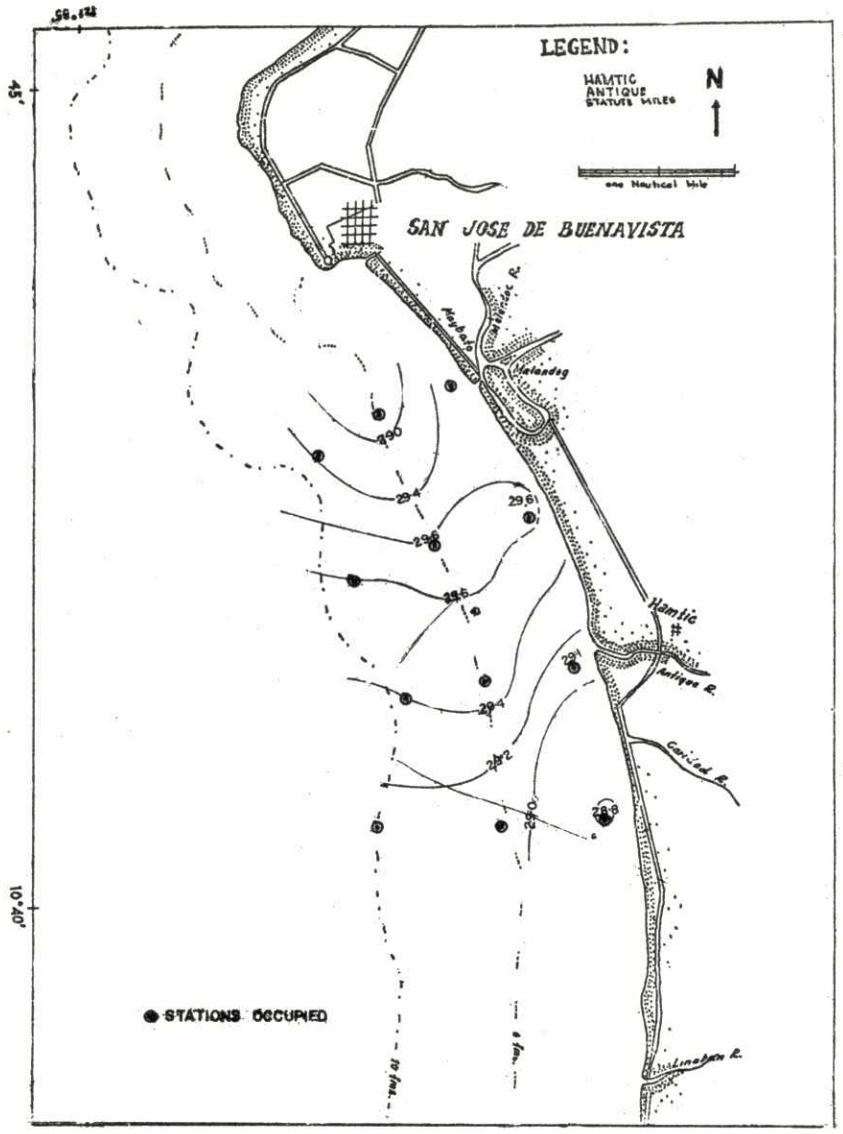

Fig. 1. Surface temperature (°C) distribution and bangus fry occurrence in Hamtic, Antique, on April 25, 1974.

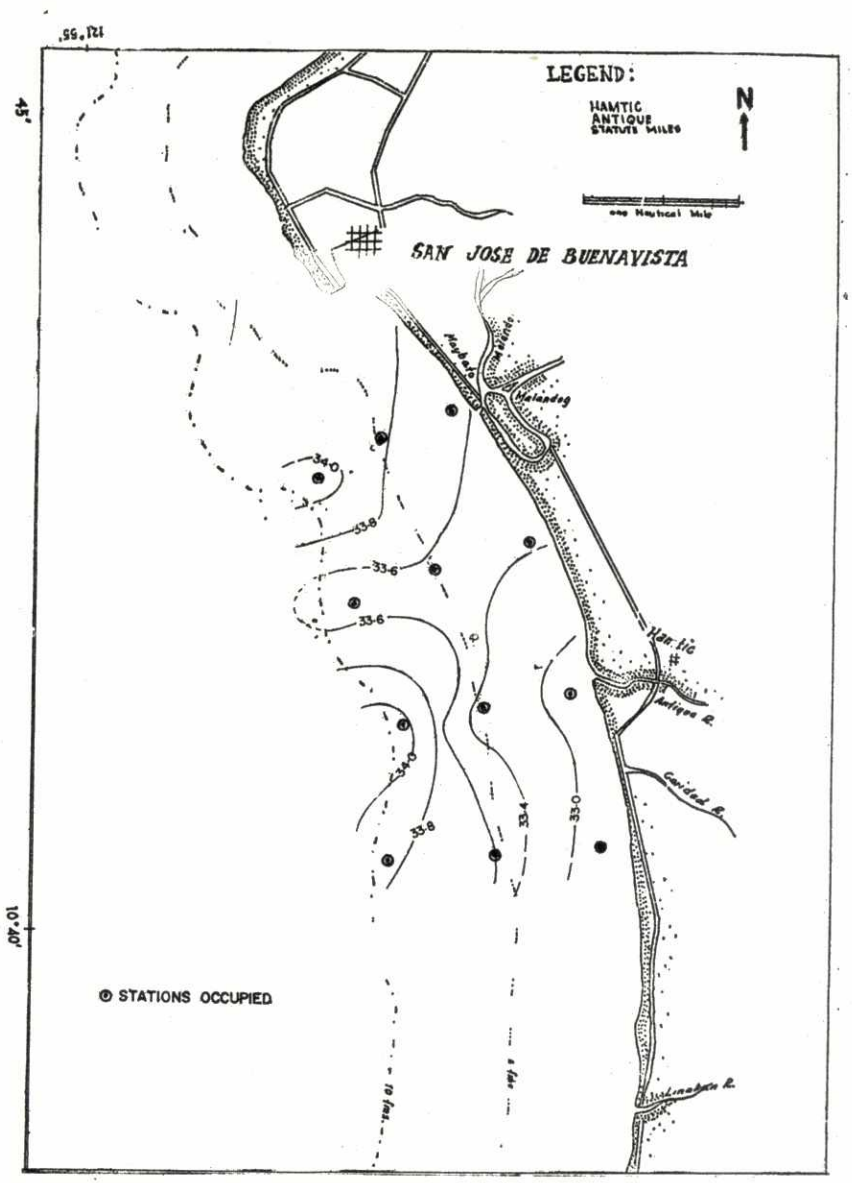

Fig. 2. Surface salinity (°/oo) distribution and bangus fry occurrence in Hamtic, Antique on April 25, 1974.

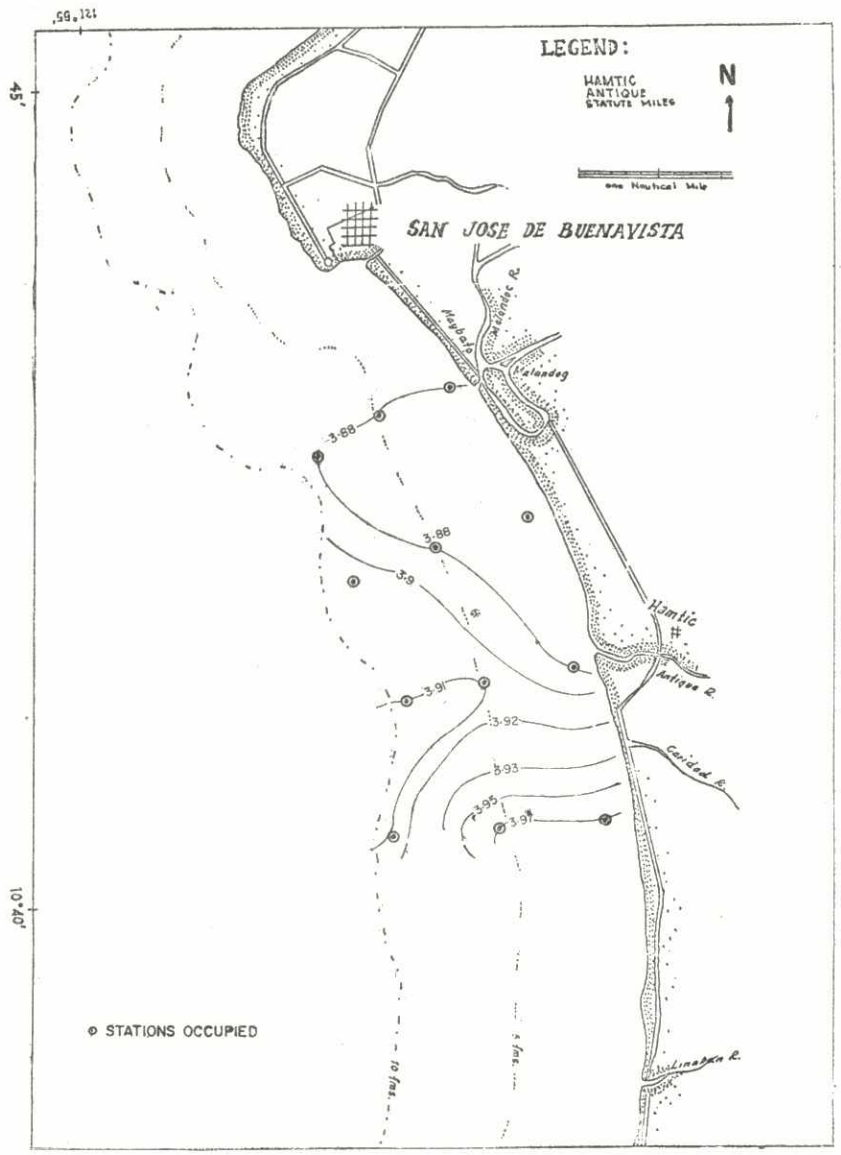

Fig. 3. Surface oxygen (ml/L) distribution and bangus fry occurrence in Hamtic, Antique on April 25, 1974..

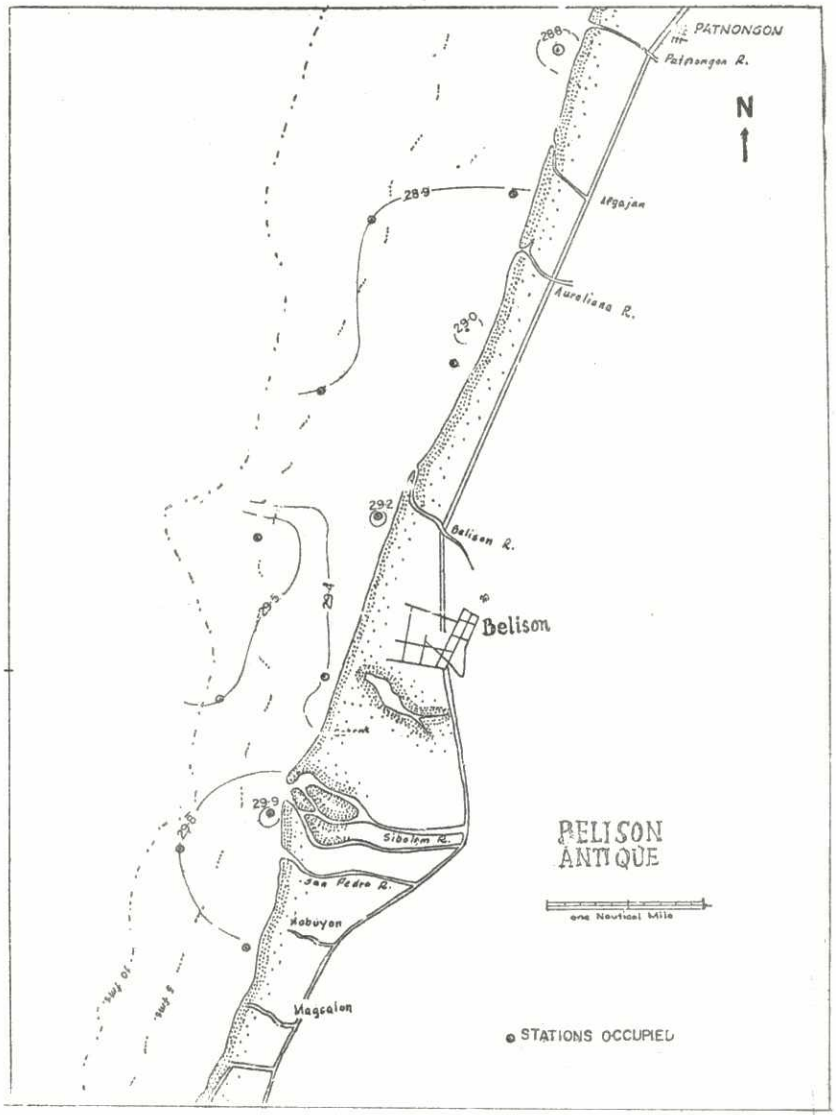

Fig. 4. Surface temperature (°C) distribution and bangus fry occurrence in Belison, Antique on April 26, 1974.

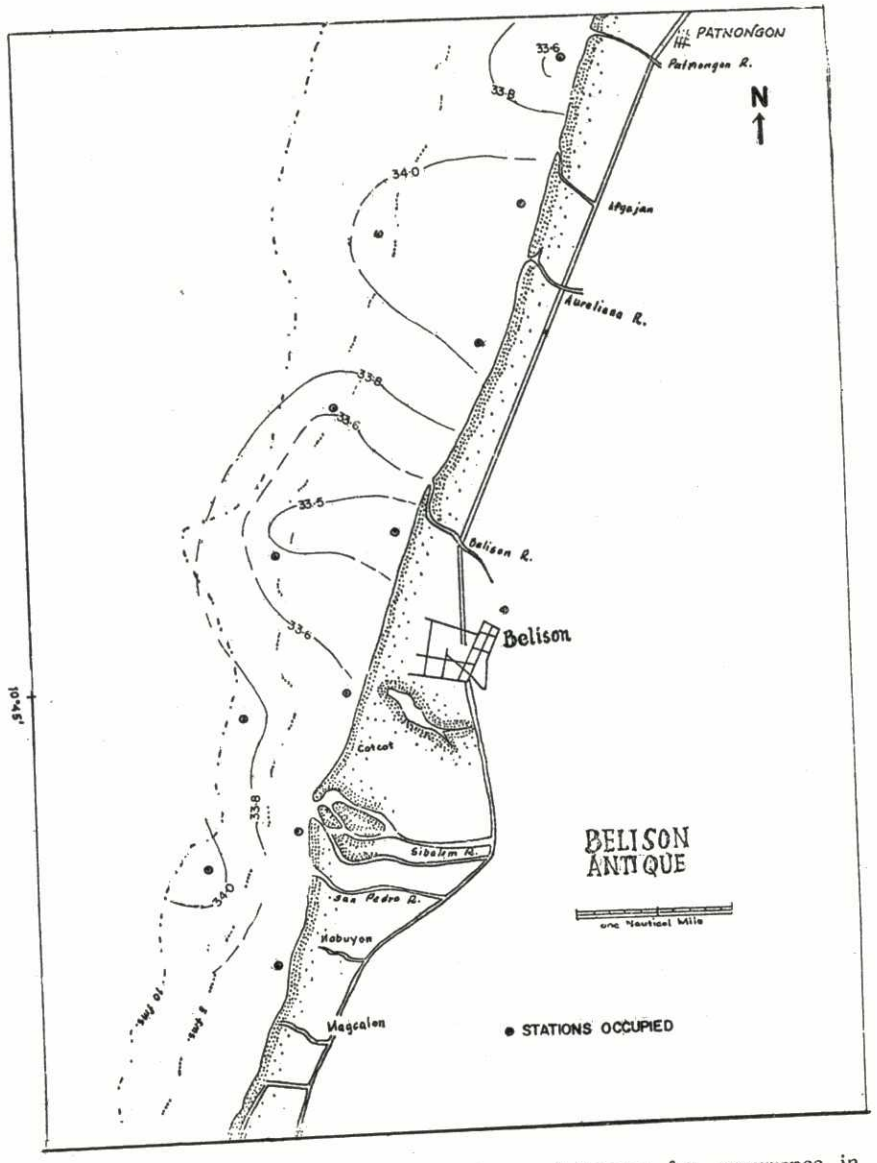

Fig. 5. Surface salinity (°/oo) distribution and bangus fry occurrence in Belison, Antique on April 26, 1974.

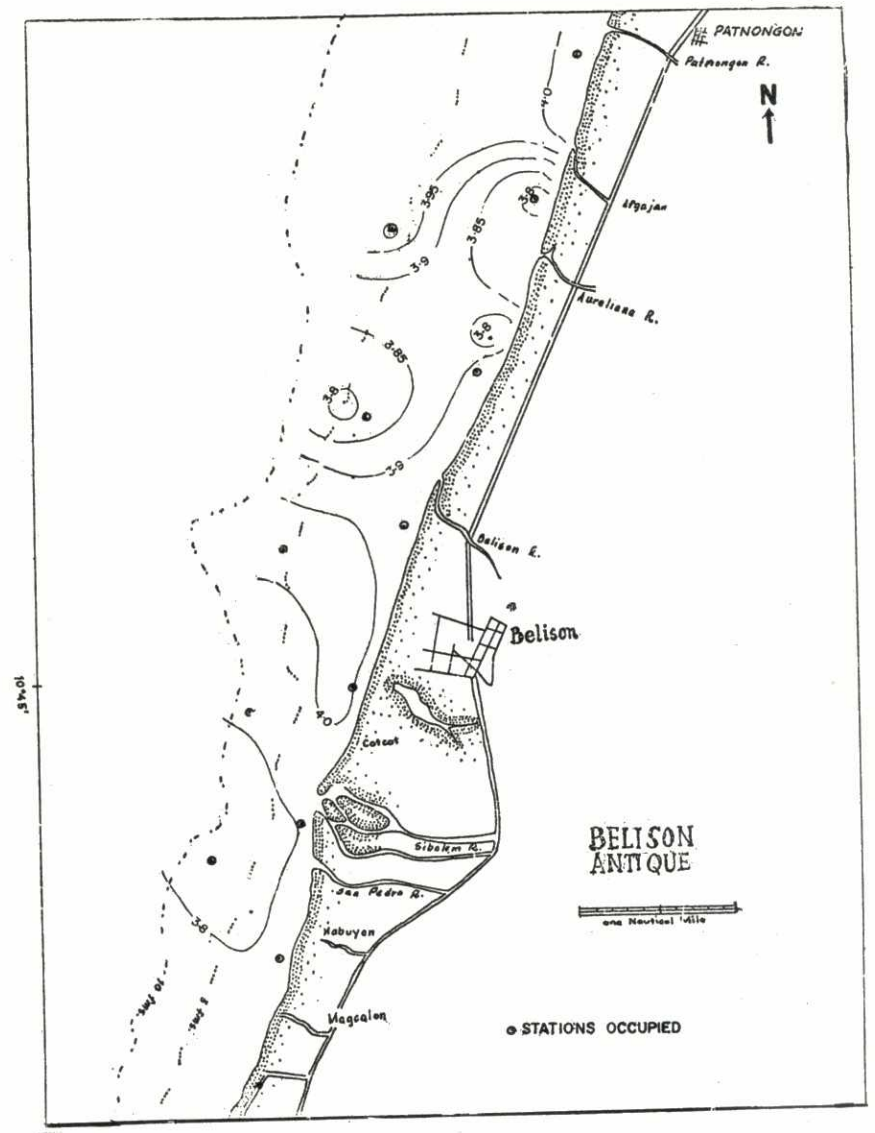

Fig. 6. Surface oxygen (ml/L) distribution and bangus fry occurrence in Belison, Antique on April 26, 1974.

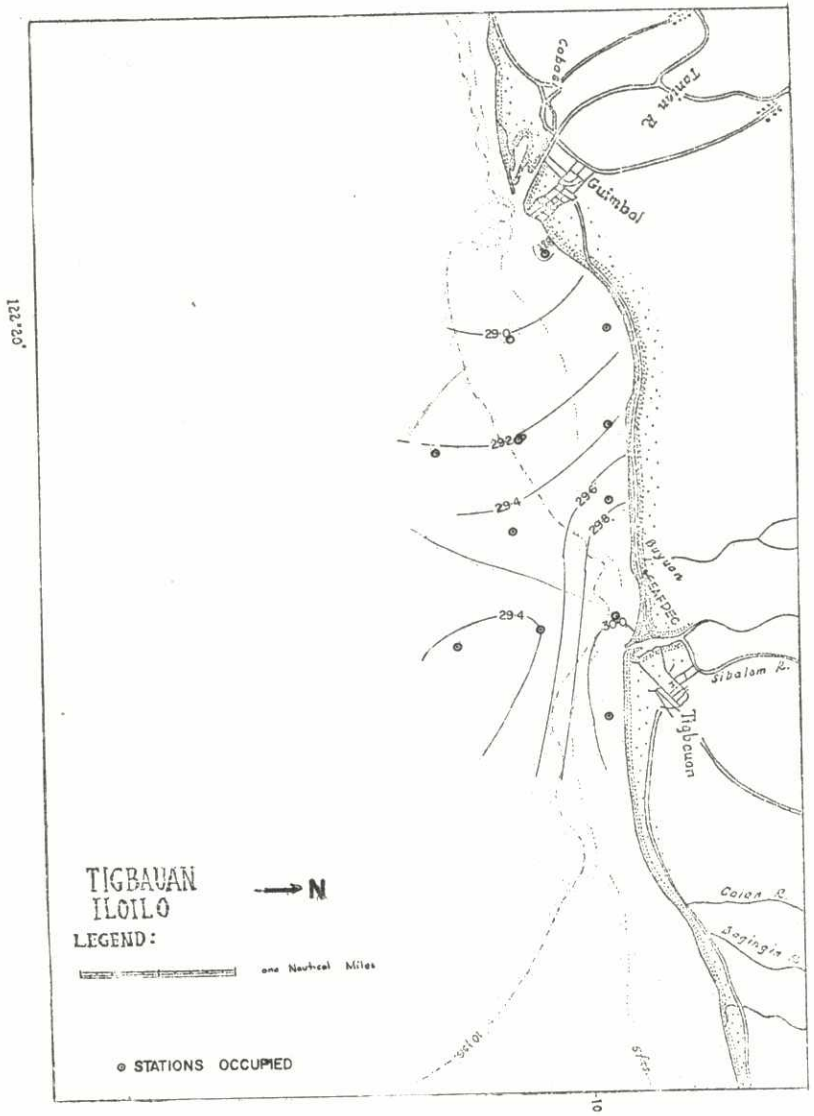

Fig. 7. Surface temperature (°C) distribution and bangus fry occurrence in Tigbauan, Iloilo on April 30, 1974.

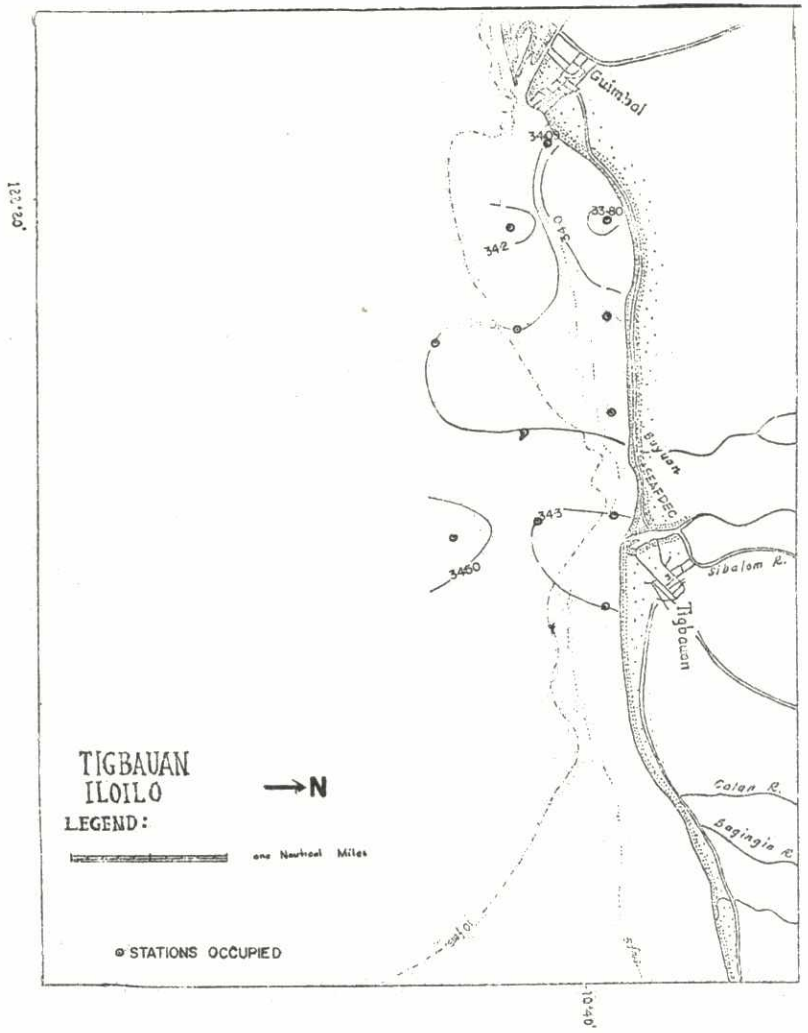

Fig. 8. Surface salinity (°/oo) distribution and bangus fry occurrence in Tigbauan, Iloilo on April 30, 1974.

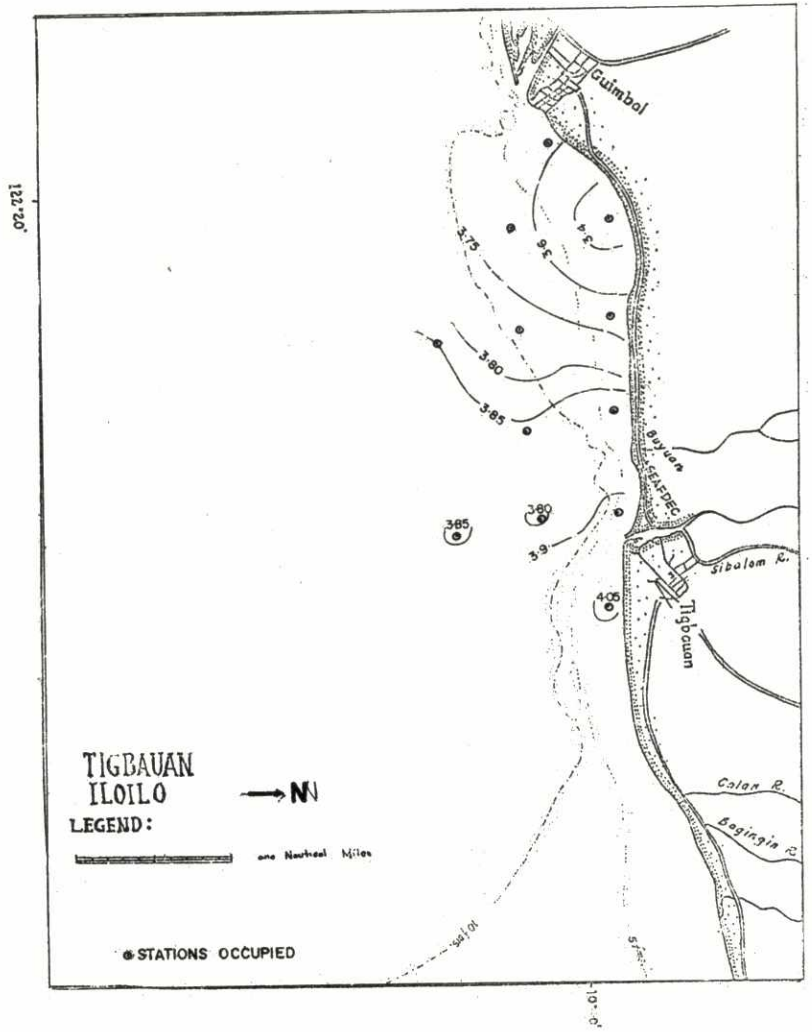

Fig. 9. Surface oxygen (ml/L) distribution and bangus fry occurrence in Tigbauan, Iloilo on April 30, 1974.

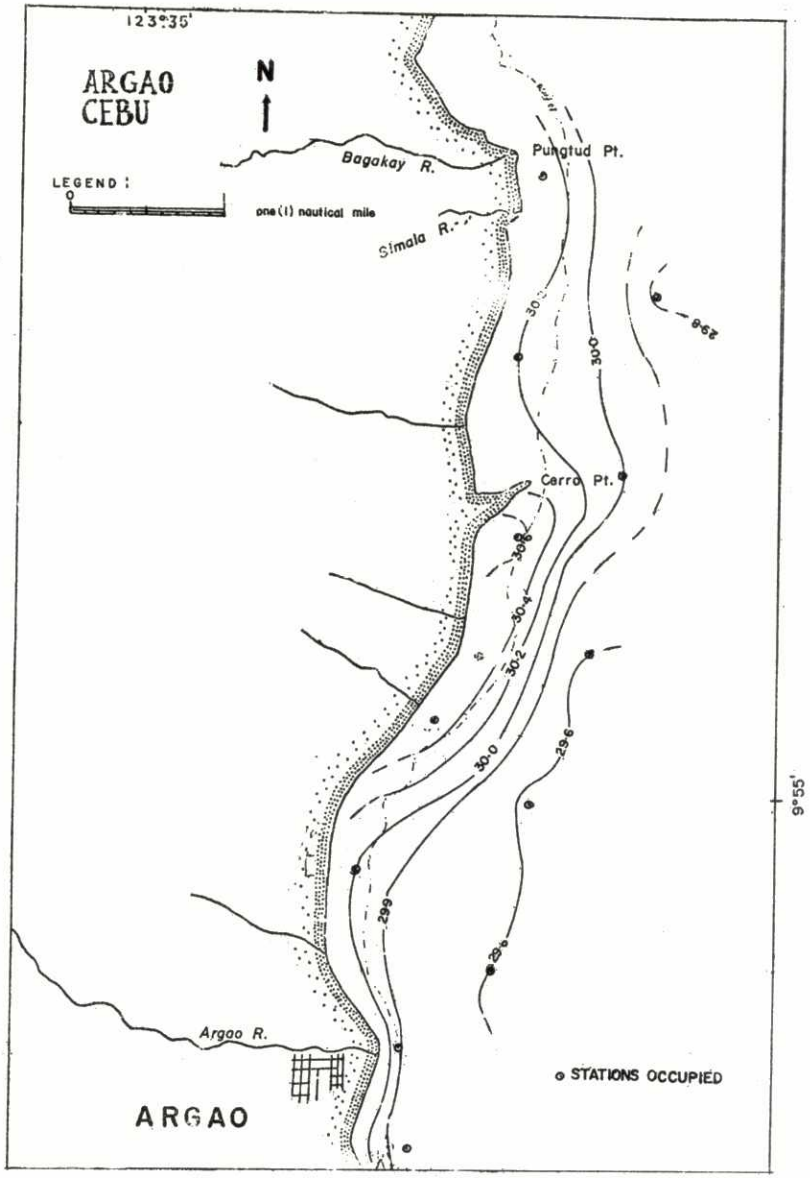

Fig. 10. Surface temperature (°C) distribution and bangus fry occurrence along the coast of Argao, Cebu on May 13, 1974.

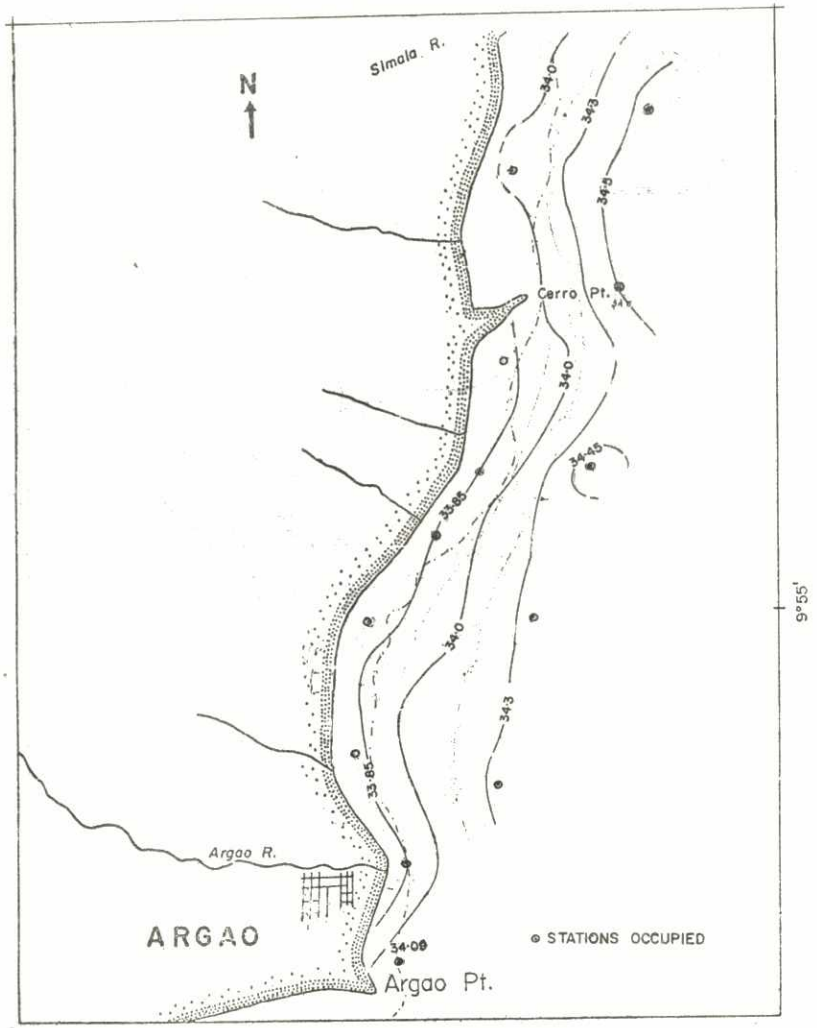

Fig. 11. Surface salinity °/oo distribution and bangus fry occurrence along the coast of Argao, Cebu on May 13, 1974.

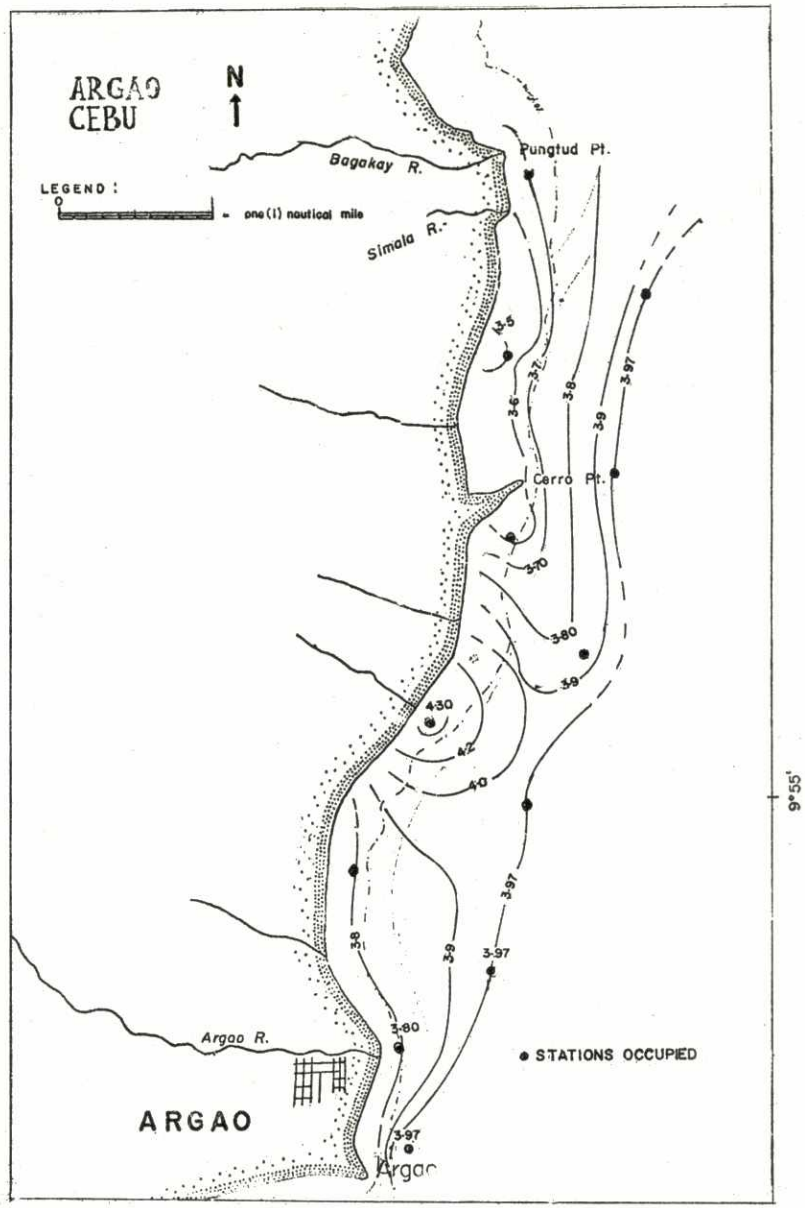

Fig. 12. Surface oxygen (ml/L) distribution and bangus fry occurrence along the coast of Argao, Cebu on May 13, 1974.