OCCURRENCE OF MILKFISH EGGS IN THE ADJACENT WATERS OF PANAY ISLAND, PHILIPPINES

by

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Abstract

Location of spawning grounds of milkfish is one of the most important steps towards gaining knowledge on the spawning habits of the fish as well as the early life history and nature of its eggs and larvae. The present study is an attempt towards this objective. Surveys were made in selected areas in the sea around the Panay Island and milkfish eggs were collected on several occasions from surface to 20 m depth water by towing with larval nets. The eggs floated in the water in a glass jar. The eggs and newly hatched larvae had the same characteristics as described by Delsman (1929). A comparative study has been made to distinguish milkfish eggs from other more or less similar size pelagic eggs of fishes occurring in the same waters at the same time.

Introduction

The Philippines is situated in the center of distribution of milkfish, Chanos chanos (Forskal). Filipino fishermen offer scientists a lot of information on spawning activities and spawning sites of adult milkfish. Milkfish with ripe gonads and others with spent gonads are often caught with gill nets, set nets and hook-and-line in various coastal waters. However, so far nobody has yet succeeded in collecting milkfish eggs from Philippine waters.

Aiming at locating the spawning grounds of milkfish and obtaining knowledge about early life history of milkfish in the wild, the present authors started larval net collections in the waters around Panay Island, Philippines, in early April, 1976. During the period from 4 April to 13 May, 1976, a total of 109 tows with a larval net at various layers ranging from the surface to 30 m deep was made in several areas around Panay Island. Milkfish eggs were found in 18 tows out of the 109, and the total number of eggs amounted to 88. No milkfish larva

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was eoncountered in our larval net samples. On two occasions, a few of the milkfish eggs collected were brought back alive to the laboratory and hatched out successfully in a small glass container. One of the larvae survived for 102 hours after hatching.

In any biological phenomenon, e.g., spawning of fish, distribution of eggs, etc., daily seasonal-, and annual fluctuations may occur. We may therefore, need year-round surveys for at least three years covering a wide area before we come to a conclusion with any certainty regarding, among other things, where and when milkfish mainly spawn, or in which area their eggs are most abundantly distributed. The present authors would like to request the readers of this report not to come to a hasty conclusion regarding the spawning grounds of milkfish.

Materials and Methods

The larval net used in the present study has a mount-opening of 70.5 cm in diameter or 0.4 m^2 in area, and is made of nylon grid gauze of GG 38, about 500 micron in mesh size (Fig. 1). A flow-meter, TSK 4-hands type, was attached to the center of the mouth-opening of the net. At each station and layer, the net was horizontally towed for 10 minutes at about 1,5 knots.

In a surface tow, the net was kept apart from the side of the boat by using the boom so that the net was towed outside the wake (Fig. 2a). In a subsurface tow, two nets for two layers were simultaneously towed, using one of the wire warps for trawl net. A 15-kg depressor was fitted at the end of the warp, and the first net was attached 1.5 m above it. Farther, 15 m above from the first net, one end of a 14-m rope for the second net was attached (Fig. 2b). The two nets were connected with each other by a rope, 5 m in length. The wire was extended to a length three times the desired depth for the first net. Two plastic floats, 10 cm in diameter, were tied to the mouth frame of each of the nets to give a weak bouyancy to the nets. This is to prevent the net from scooping bottom mud when the boat stops to haul the net, and a pecaution not to lose the net even if bridles are broken.

Each larval net collection was usually kept in a specimen bottle, 300 ml in capacity, and preserved in 5% formalin solution in situ. The specimens were examined under a stereo-microscope in the laboratory to sort out milkfish eggs. A trial was carried out with specimens from 16 tows made on 4 and 5 May to pick up milkfish eggs alive in situ aboard the boat. The remaining specimens, after sorting, were preserved in 5% formalin and later they were examined in the laboratory for any milkfish eggs which we might have missed picking out alive on the spot.

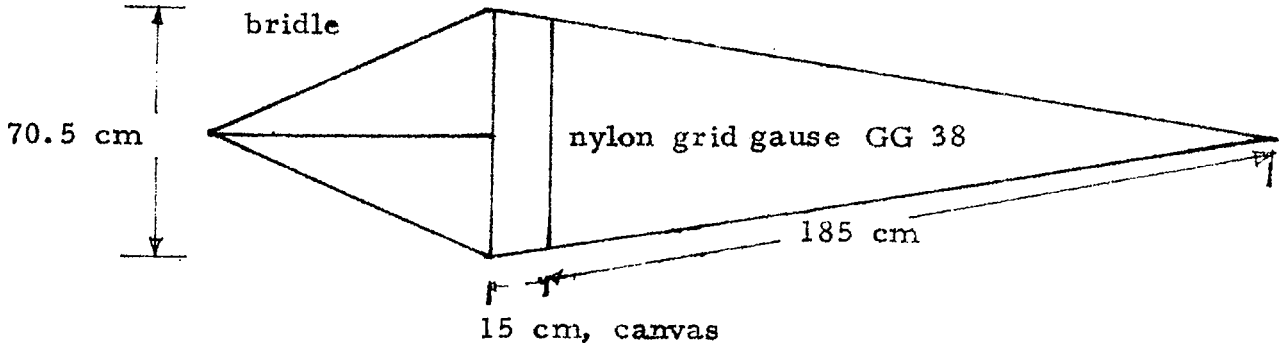

Fig. 1. A larval net used in the surveys of milkfish eggs around Panay Island in April and May, 1976. The net is conical, and made of nylon grid gause GG 38 (mesh about 500 micron). A flow meter was attached at the center of the mouth opening.

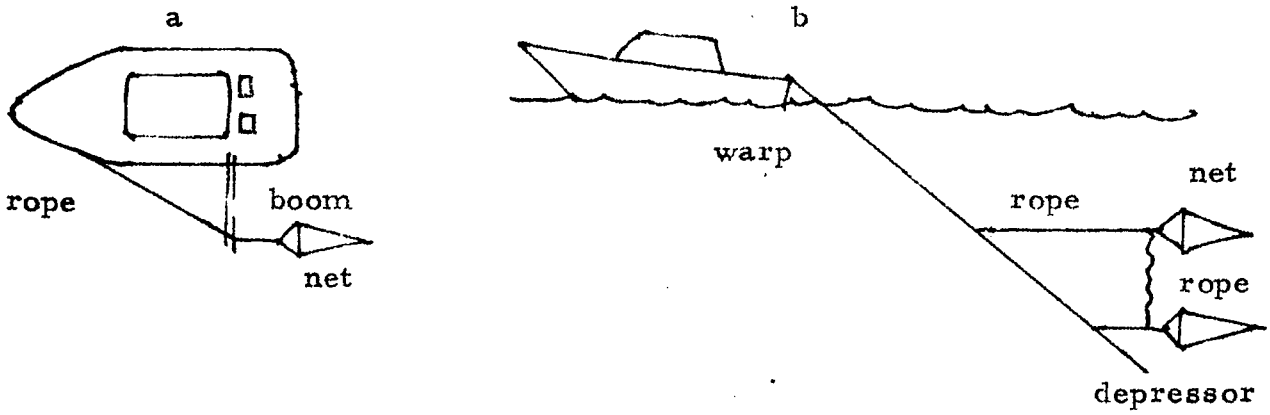

Fig. 2. Methods of towing net at surface (a) and at two layers of subsurface (b)

With the specimens collected in the Antique waters (Antique is one of the four provinces of Panay Island) in early April, not only milkfish eggs and larvae (though no milkfish larva was actually found), but also eggs and larvae of other fishes were sorted and counted. An effort was made to identify, as detailed as possible, these eggs and larvae. Only milkfish eggs and larvae were looked for in the collected samples due to lack of time. Further analysis of these samples will be done during "off season" in the future.

Areas Surveyed

For convenience's sake, the areas covered by the present survey were divided into three regions: 1. Antique waters, 2. Panay Gulf, and 3. Estancia waters. (Fig. 3).

1. Antique waters

Antique Province, one of the four provinces of Panay Island, extends along the entire west coast of the island, facing Cuyo East Pass. Larval net collections were made in three areas in this region: in Panday Bay, around Batbatan Island and off Hamtik.

a) Pandan Bay

Pandan is located at the northern end of Antique coast, where the coast line suddenly turns to the west to form a bay, Pandan Bay. Many fish corrals (traditional fish traps made of bamboo fences) are set in shallow waters along the coast, and four otoshi-amis (large size fish trap made of net)* are set along the northern coast of the bay. Adult milkfish, 70 to 90 cm in fork length and 4.5 to 7.7 kg in weight, some with mature gonads and others either immature or with spent gonads, are often caught in fish corrals and otoshi-ami from April to June, but particularly abundant in May. In 1975, 106 adult milkfish were captured in the otoshi-ami during the period from 10 May to 16 June (Anon., 1976).

A total of 13 tows of larval net collection were made at various layers from surface to 20 m deep in early April and early May. The depth of the sea ranged from 10 to 33 m.

*The word "otoshi-ami" is originally a Japanese word. Local fishermen call the net also "otoshi-ami" because the nets were donated by the Japanese Government and some Japanese experts taught the fishermen how to operate these nets.

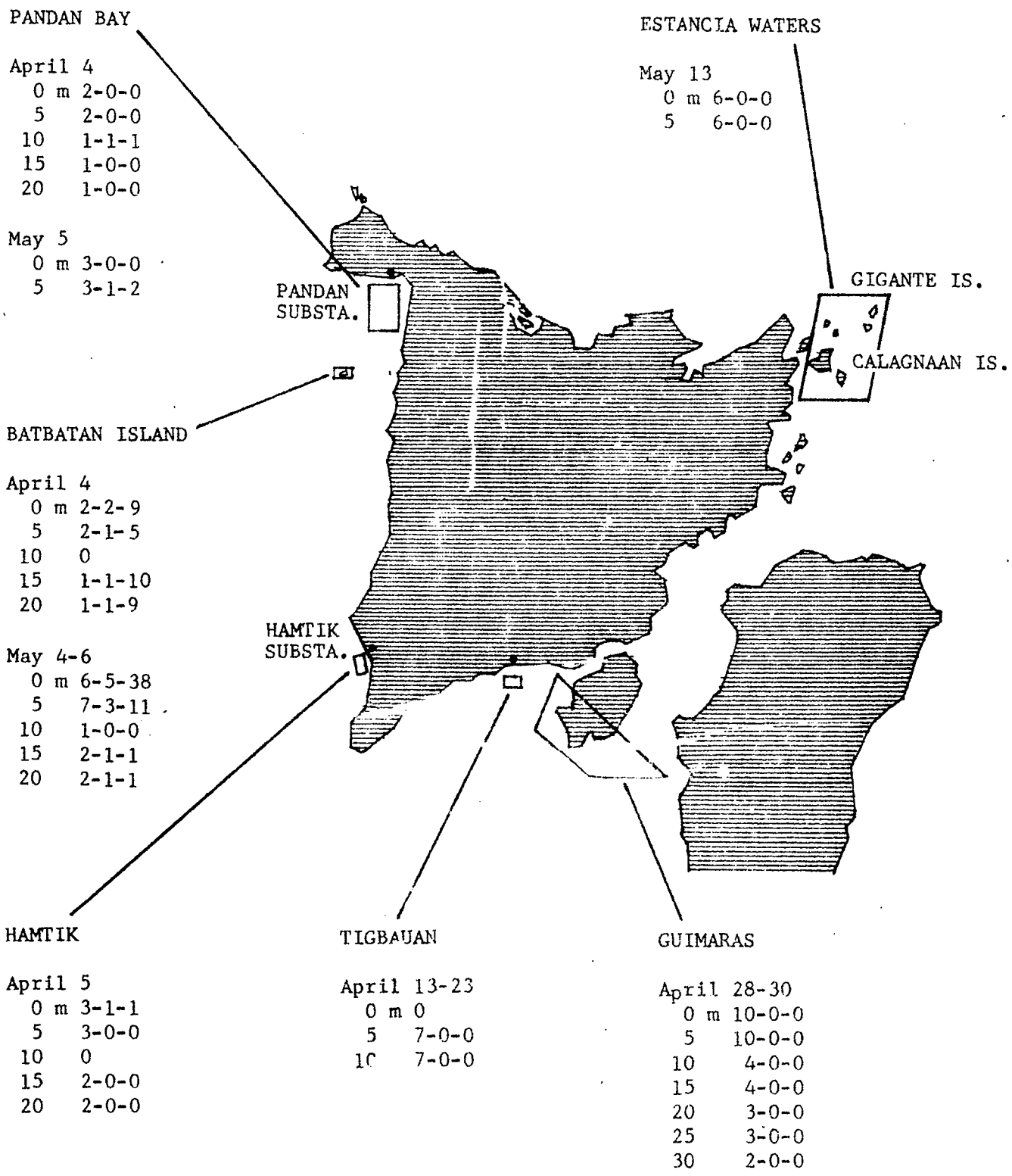

Fig. 3. Record of collections of milkfish eggs around Panay Island in April and May, 1976. Figures below the date, from left to right, show: a) the depth of the layer in which a larval net was towed; b) the number of tows made; c) the number of tows which yielded milkfish eggs; d) the total number of milkfish eggs collected.

b) Batbatan Island

Batbatan Island is a small island, about 4.4 km from east to west and about 1.5 km from north to south, situated about seven nautical miles off Lipata Point, the northern part of Antique coast, and is surrounded by a deep sea of over 200 meters deep. Near the eastern end of the island, a sandy shallow area extends some 100 m or so toward south. A sand-bar develops along the eastern margin of the shallow area to form a kind of cove which opens toward south. Outside, the sandy shallow area is hemmed by a rocky bottom of about 10 to 40 m deep and the sea becomes suddenly deeper farther outside it. According to Pandan fishermen who are engaged in gill net fishery around Batbatan Island, they had often seen milkfish jump near the above-mentioned cove during moon-lit nights as well as dark nights in April and May. The same information was also obtained from the fishermen of the island.

A total of 24 tows with larval nets were made at various layers ranging from surface to 20 m deep close to the island, within 750 m from the coast, and around the above-mentioned cove. The depth of the sea ranged from 10 to 70 m.

c) Hamtik

Situated in the southern part of Antique coast, Hamtik beach forms one of the best beaches for milkfish fry collection in the Philippines.

A total of 10 tows with larval nets made at various layers from surface to 20 m deep in early April. The depth of the water ranged from 5 to 10 m.

2. Panay Gulf

Panay Gulf is surrounded by Panay Island on the north and by Negros Island on the east, with Guimaras Island between them, and opens to Sulu Sea on the south-west.

Adult milkfish are often caught in fish corrals and with gill nets along the southern coast of Panay Island and the west and south coasts of Guimaras Island. In April and in the first half of May, 1976, the Aquaculture Department, SEAFDEC, was able to collect some 20 live adult milkfish from the local fishermen.

This region is arbitrarily divided into two areas in the present report: off Tigbauan and around Guimaras Island.

a) Tigbauan

Tigbauan is located on the southern coast of Panay Island which makes a good fry ground for milkfish. A total of 14 tows of larval net collection at 5 m and 10 m layers were made off Tigbauan, the depth of water ranging from 10 m to 20 m, during the period from 13 to 23 April.

b) Guimaras Island

A total of 36 tows with larval nets at various layers from surface to 30 m deep were made in late April. The depth of the water was from 10 m to 126 m.

3. Estancia waters

Estancia is located at the north-eastern corner of Panay Island, facing the Visayan Sea. According to local fishermen, adult milkfish are often caught with gill nets and hook-and-line in the shallow waters of the Visayan Sea, especially in Asid Bay and the west coast of Masbate Island, around Zapatos Island, near Gigante Islands, and Sicogon Channel. Local people also consider that two bays (of Calagnaan Island) Apad and Balili Bays, as well as the sea around Bayas Island, a small island lying south of Calagnaan Island, are spawning grounds of milkfish.

A total of 12 tows of larval net collection at surface and 5 layers were made around Calagnaan, Gigante, Sicogon, and Bayas Islands on 13 May. The depth of the water ranged from 9 to 10 m.

Occurrence of Milkfish Eggs

Fig. 3 summarizes the results of collections made in April and May, 1976. Explanations from several aspects are given below.

1. Occurrence of eggs by areas

Milkfish eggs were collected only in Antique waters. Not a single egg was obtained either in Panay Gulf or in Estancia waters during the period of the present study.

a) Pandan Bay

In two out of 13 tows made, milkfish eggs were obtained, although the total number of eggs collected were only three. One of them was from the bottom layer at a station 10 m in depth.

The other two were from 5 m layer at a station 33 m in depth. At the latter station, an additional milkfish egg was obtained by a vertical haul from the bottom to the surface with a plankton net, 45 cm in diameter. Water temperature and salinity at the station were 31.0°C and 33.94‰ at surface, and 30.8°C and 33.83‰ at 5 m layer, respectively.

b) Batbatan Island

A total of 84 milkfish eggs were obtained by 15 out of 24 tows made in this area. The largest number of milkfish eggs obtained from a single tow, 29 eggs occurred at surface layer of a station about 750 m north-east from the eastern end of Batbatan Island. The depth of the water at this station was about 70 m, and water temperature and salinity were 30.0°C and 33.97‰ at surface, and 29.9°C and 33.95‰ at 5 m layer, respectively. The depth of the water at the other stations where milkfish eggs were collected ranged from 10 m to 40 m.

c) Hamtik

Only a single milkfish egg was collected with larval nets in this area. It was from surface layer of a station with a depth of 20 m. Surface water temperature was 28.1°C, and salinity 33.96‰.

An experimental collection of milkfish fry has been conducted daily between 0900 h and 1000 h by the SEAFDEC staff of the Hamtik Substation along the beach in front of the substation. At the end of each haul of sagap (net), fry are gathered in a small amount of water, and a collector scoops the fry (with a basin) together with water. On the land, using a small plate, the collector scoops up the fry one by one. During the period from 29 March to 6 May 1976, the water in the basin, after scooping the milkfish fry, was filtered by a plankton net and anything in the water was put into a specimen bottle and preserved with 5% formalin. Such samples were sent to the authors who examined them, looking for milkfish eggs. From the sample of 23 April, a milkfish egg was found.

d) Panay Gulf and Estancia waters

No milkfish egg was obtained either from Panay Gulf or from Estancia waters. Water temperature and salinity in both regions during the survey period were:

In Panay Gulf, 27.8-33.4°C and 32.70-34.44‰ salinity at surface layer, and 27.8-33.0°C and 33.95-34.55‰ at 10 m layer, respectively.

In Estancia waters, 29.5-30.2°C and 33.36-34.17‰ salinity at surface layer, and 29.1-30.1°C and 34.07-34.23‰ at 5 m layer, respectively.

2. Vertical distribution

As the milkfish eggs were most frequently and abundantly obtained in Batbatan waters, collection record was studied from the aspect of vertical distribution of milkfish eggs.

As seen in Fig. 3, milkfish eggs were obtained from any layers from surface down to 20 m layer, the deepest layer at which the larval net was towed. There was not much difference in number of milkfish eggs per tow by layer on 4 April, suggesting that the eggs were almost evenly distributed vertically, at least from the surface to 20 m deep. In the trip made in early May, more eggs were collected from the upper layers. On 5 May, as many as 29 eggs were obtained by a single tow at surface layer of one station, while only three eggs were collected from the 5 m layer of the station. No larval net tow was made at other layers in this station.

In our experiments on hatching and rearing of milkfish eggs, it was observed that live milkfish eggs usually floated to the surface of the water in a glass jar.

3. Daily fluctuation in catch

Within a small area close to Batbatan Island, we conducted larval net sampling on four separate days: one day in early April and three consecutive days in early May. The date indicated in the lunar calendar in parenthesis, the number of tows made at every layer, and the total number of milkfish eggs collected are as follows:

4 April 1976	5 March	6 tows	33 eggs
4 May 1976	6 April	6 tows	no egg
5 May 1976	7 April	3 tows	42 eggs
6 May 1976	8 April	4 tows	9 eggs

4. Developmental stages by time of collection

So far a total of 90 milkfish eggs were collected by larval net sampling, plankton net sampling and from the specimens of fry collection. Among them, 6 eggs were kept alive for rearing experiments and 84 eggs were preserved in formalin in situ. Below is a grouping of these 84 eggs by time of collection and by developmental stages.

Time of collection	Developmental stage*		
	Aa-Ac	Bb	Ca
0800-1000 h	2	1	
1000-1200	1	38	
1200-1400			
1400-1600			23
1600-1800			19

*Aa-Ac: early stages of development up to yolk invasion half completed. As yolk is easily damaged by shock of collection and preserving, it is usually difficult to determine more in detail the developmental stage with preserved specimens.

Bb: embryonic streak reaches its maximum length on the yolk, but its posterior end is flat. (In Bc, the posterior end of the embryo is vertical to the surface of yolk).

Cc: The tip of the tail of the embryo is free from the yolk, but not quite elongated.

Among six eggs brought back to the laboratory, two eggs hatched at 1900 h and two at 1915 h on the day of collection, and one at 0600 h on the following day. The remaining egg died before hatching.

5. Abundance of milkfish eggs relative to eggs of other fishes.

As shown in Fig. 3, a total of 35 milkfish eggs were collected in the Antique waters in early April 1976. The number of eggs of other fishes obtained during the same trip amounted to 10,531. The percentage of milkfish eggs was about 0.33% of total number of eggs collected. Total number of fish larvae collected during the trip amounted to 1,725. We did not get any milkfish larva, except for one doubtful specimen.

Discussion

From the results given above, we know that milkfish eggs are distributed in Antique waters. The eggs were especially abundant in Batbatan waters, suggesting that a spawning ground of milkfish is near the island. However, this does not mean that the majority of fry collected along Antique coast originate from Batbatan waters. Batbatan waters must be just one of the best, or good, spawning grounds of the fish. Further investigation in other waters, especially in the waters of Cuyo Islands, is needed.

Although no milkfish egg was obtained in Guimaras waters and Estancia waters, it is too early to conclude that there are no spawning grounds in these areas. As earlier stated, we did not get any milkfish egg in Batbatan waters on 4 May. This suggests to us the existence of daily fluctuation in the spawning activity of the milkfish. Also at present, we do not know if the spawning activity of milkfish is related to the lunar periodicity (tidal phase) or not. It was on the fifth to the eighth days of the month in the lunar calendar when the milkfish eggs were collected in Batbatan waters, whereas larval net samplings in Estancia waters were made on 15 April in the lunar calendar, that is, on a full moon day. It may be possible that the difference in lunar periodicities might have affected the results.

The live milkfish eggs floated to the water surface in a glass jar. Also, more milkfish eggs were collected at surface layer than at 5 m layer in Batbatan waters on 5 May. On the other hand, a fairly good number of eggs were obtained from deeper layers, at least up to 20 m layer. This may be attributed to the vertical movement of water in the sea. As our data regarding vertical distribution of the milkfish eggs are still very limited, more extensive and systematic studies are needed.

All the milkfish eggs collected at the same time in a day were almost in the same developmental stage. This may suggest that spawning of the milkfish takes place at a certain time of a day, probably in the evening as Delsman and Hardenberg (1931) stated. All the eggs collected by Delsman (1929) hatched late in the evening, some at 2100 h and some slightly later than 2200 h, although one egg which he collected earlier hatched early in the morning (Delsman, 1926). Most of the eggs we collected also hatched in the evening, at about 1900 h; one egg hatched early the following morning. To determine the exact incubation period in the wild, we need a 24-hour sampling.

There is one serious problem for us, however. Although in the earlier portions of this report, the words "milkfish eggs" were repeatedly used, the authors are not actually hundred percent sure whether they are truly milkfish eggs. There is no doubt that the authors are dealing with the same eggs as Delsman (1929) considered milkfish eggs because every characteristic of eggs and hatched larvae agreed with what he described. We will know the truth only when we succeed in rearing hatched larvae up to size of about seven milimeters, the identifiable stage or when we succeed in artificial insemination of milkfish.

Identification of Milkfish Eggs Preserved in Formalin

1. Characteristics of the milkfish egg

Delsman (1929) described the milkfish egg as follows: "The egg is 1.2 mm in diameter, having no oil-globule. No special structure in egg membrane. The yolk of the egg is segmented, but the segmentation is considerably fine so that according to him, he might have overlooked it with some of the eggs. The yolk has a yellow tinge."

Chacko (1950) gave a similar description, except that the diameter of the egg ranged from 1.0 to 1.2 mm.

2. Differentiation of milkfish egg from similar eggs.

Delsman (1921-1939) described about 60 species of pelagic fish eggs, while Mito (1960) gave the keys to 246 species of pelagic eggs.

According to the above-mentioned authors, a majority of fish species have eggs with single or multiple oil globules. Fortunately for us, only a limited number of fishes have been reported, so far, to produce eggs without oil globules - similar to the milkfish egg.

Among the pelagic eggs without any oil globules, we must be careful with the following five kinds of eggs, as the diameter is more or less the same as that of the milkfish egg and many of them frequently occur in the same waters.

Etrumeus microps:	Yolk segmented, diameter of egg is 1.23-1.32 mm, and myotomes in newly hatched larva more than 50.
Saurida elongata:	Yolk not segmented, diameter of egg is 1.20-1.33 mm, and myotomes in newly hatched larva 57-60.
Scorpaenidae type:	Yolk not segmented, diameter of egg is 1.0-1.1 mm, and myotomes of embryo less than 30.
Saurida type:	Yolk not segmented, diameter of egg is 1.0-1.1 mm, and myotomes of embryo more than 30.
Unknown fish 'A':	Yolk not segmented, diameter of egg is 1.2 mm, and yolk probably with a yellow tinge.

Although it is usually difficult to know whether the yolk is segmented or not with preserved specimens, yolk in eggs of Saurida elongata, Scorpaenidae type, and Saurida type in formalin look more transparent and colorless compared to the yolk of milkfish egg. At first sight, egg of unown fish 'A' is almost similar to milkfish egg in size, shape of embryo, and color. However, small melanophores are more densely distributed on embryo and myotomes cannot be recognized clearly with preserved specimens, while in milkfish egg myotomes are marked when viewed from the side. Furthermore, we can ascertain the segmentation of the yolk by tearing the egg membrane and puncturing the yolk with pins.

Differentiation of milkfish eggs from those of Etrumeus microps (Family Dussumieridae) seems to be rather difficult, especially in the early stage of development, although the yolk of the milkfish egg is more finely segmented, about 0.04 to 0.05 mm, than that of Etrumeus microps, which is about 0.06 mm. In later stages of development, we can estimate the number of trunk myotomes of the embryo and the melanophores in the embryo is much thinner in the milkfish egg than in Etrumeus microps.

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