Tagging of Anchovetas (Cetengraulis mysticetus)

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INTRODUCTION

IT IS THE RESPONSIBILITY of the Inter-American Tropical Tuna Commission to investigate not only the tropical tunas of the Eastern Pacific Ocean, but the species that are used for bait for tuna as well. One of the major bait species is the anchoveta, *Cetengraulis mysticetus,* and its most important source of supply is the Gulf of Panama. The anchoveta occurs in numerous shallow bays and estuaries from Mexico to Peru, and meristic studies of the major populations indicate that they are distinct (Berdegué, 1958).

It is desirable to tag anchovetas in order to verify the findings of the meristic studies, to determine the amount of intermixing of fish of different areas within the Gulf of Panama, and possibly eventually to estimate the size of the population and other important parameters. This paper summarizes these studies to the present time.

External Tags

Several short-term holding experiments with various types of external tags were conducted, and it was concluded that the Scottish toggle tag (Wood, Parrish, and McPherson, 1955) was the most suitable for anchovetas. In 1954, 1955, 1956, and 1957, 82,989 anchovetas were tagged in the Gulf of Panama, but only 16 recoveries were made (Schaefer, 1955 and 1958). Most of these had been at liberty only a short time, and complete recovery data were not available for some of them, so the results are of limited value. The low rate of recovery of these tags was attributed to one or more of the following factors: (1) a high tagging and handling mortality; (2) a high shedding rate; (3) a very low fishing intensity; (4) low visibility of the tagged fish in the live wells of the fishing vessels.

Holding Experiments

Live box experiments were conducted in 1955, 1956, and 1957 to test the retention of the tags and to obtain estimates of the mortalities caused by tagging. A series of unfortunate accidents terminated all the experiments prematurely; however they lasted sufficiently long to show that a considerable portion of the tags were shed within a short time after tagging. In 1958 and 1959 successful live box experiments were accomplished with a variety of external tags. It was shown that though the external tags did not cause appreciable mortalities to healthy fish, the tags were shed rapidly, very few of any type being retained more than one month (Schaefer, 1959 and 1960).

The intensity of the local purse seine fishery for anchovetas for reduction increased greatly in 1959. Since metal internal tags are recoverable by use of magnets in the reduction plants, their use became practicable for the first time. Internal tags were tested in the live boxes in 1959 and 1960, and it was found that they are much more suitable for anchovetas than external tags

(Schaefer, 1960). Shedding of the internal tags amounts to about 35 per cent, virtually all of which occurs during the first month after tagging. It is not known exactly what mortality the internal tags cause, for this varies with the condition of the fish and is probably different for fish held in captivity than for fish released into their natural environment. Fish which had been acclimated to the live boxes for about a week before tagging showed no more mortalities after tagging than control fish. The weakest fish that were tagged on the same day they were captured showed mortalities of well over 50 per cent within a few days after tagging, while control fish exhibited mortalities only slightly lower. Unfortunately there is no way to know how well these fish would have survived if they had been released into their natural environment instead of the live boxes.

In 1960 live box experiments were conducted to study such refinements of the internal tagging technique as the use of anesthetics to tranquilize the fish and the use of antibiotics to prevent infection of the tag incision and subsequent death of the fish or loss of the tags.

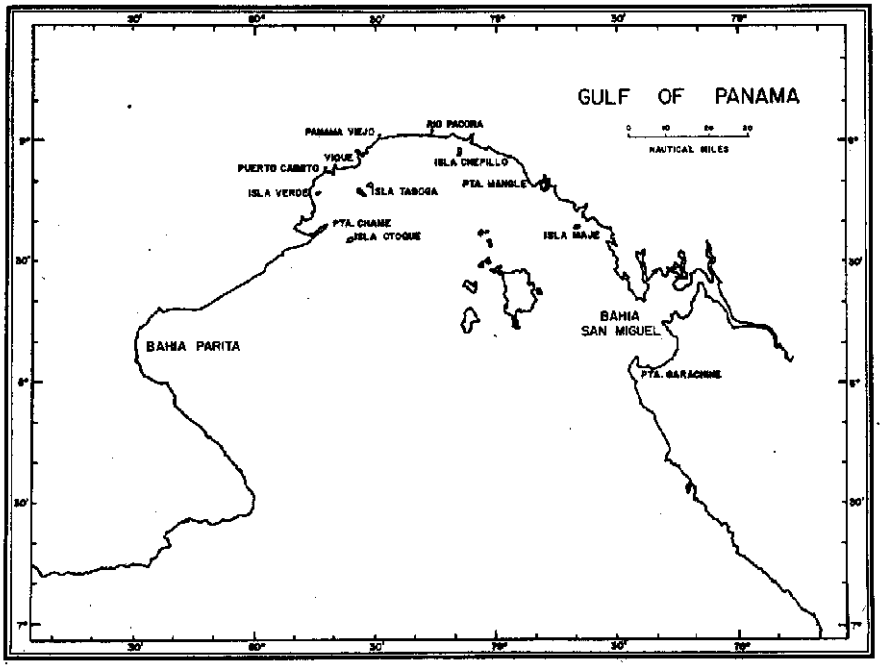

FIGURE 1. The Gulf of Panama, showing locations mentioned in the text.

The Purse Seine Fishery

Adult anchovetas inhabit the shallow mud flats along the coasts of the Gulf of Panama. They occur in Bahia Parita and almost continuously from Punta Chame to Bahia San Miguel (Figure 1). The young-of-the-year reach catchable size for the purse-seine fishery in about April or May, provide the main source of supply for the fishery through the summer and fall, and spawn

principally in November and December. During the fall and winter months their numbers (or at least their availability) decrease rapidly, so that year-old fish make up only a minor portion of the catch except during the winter and early spring. The purse seine fishery for anchovetas for reduction takes place chiefly between Punta Chame and Vique, an area of about 60 square miles. This area will henceforth be called Isla Verde, most of the fishery taking place near this island. The two reduction plants are located in this vicinity, one at Isla Taboga and the other at Puerto Caimito. The purse seine boats fish occasionally at Panama Viejo, and very rarely as far away as Punta Mangle.

MATERIALS AND METHODS

The fish for tagging were caught in shallow water within a mile or two of shore. A log canoe and cast nets were employed for fishing, the fish being put into the live well of the canoe. On several occasions fish were obtained from purse-seine boats fishing in the area; at such times the fish were dipped out of the bunt end of the seine into the live well of the log canoe. When sufficient fish were obtained they were taken to the tagging vessel, a 40-foot West Coast albacore troller, anchored in slightly deeper water. The fish were removed from the log canoe to one of two portable holding pens tied to the side of the tagging vessel. These pens were constructed of aluminum tubing and 7/16-inch stretch Marlon netting and were 65 by 41 by 48 inches deep. The pens were light and easy to handle and allowed the fish to have a plentiful supply of fresh sea water. However they afforded no protection from heavy wave action and strong currents, and could not be towed with the fish in them.

The fish were removed about 10 at a time from the holding pen with dip nets and placed into 2½-gallon plastic buckets containing fresh sea water with 0.2 gram per gallon of MS 222 (tricaine methanesulphonate) and 1 milliliter per gallon of terramycin in liquid form. The water was agitated about every 15 minutes with an electric agitating device, and changed at less frequent intervals. The fish were not left in the buckets long enough for the MS 222 to take its full effect, but it was helpful in reducing their struggles.

Nickel-plated iron tags 12 by 3 by 0.5 millimeters were employed. They were kept in groups of 100, because keeping an individual record of each tag would have been overly burdensome, and no advantage would accrue from such a procedure, since the fish were not measured when tagged and since only the tags, not the fish, were recovered in the reduction plants. The tags were kept in plastic soup bowls with a mixture of procaine penicillin G and terramycin, using 300,000 units of penicillin per 400 tags and enough liquid terramycin to make a pasty mixture that adhered to the tags and was exhausted at about the same time as the tags.

The tagging was conducted at tables specially constructed for that purpose, each containing a recessed plastic pan of sea water in which the fish were partially immersed while being tagged. The plastic bowls of tags were also recessed in these tables. The fish were removed one at a time from the buckets and tagged. The incision was made above the origin of the ventral fins with a Number 11 scalpel blade, the blade being inserted parallel to the body so as not to damage any of the internal organs. The blade was dipped into a vial containing a mixture of penicillin and terramycin before making each incision. The tag was inserted into the body cavity and pushed forward with the fingers

and the scalpel blade. The tagged fish were then dropped into the other holding pen. It was found that an experienced tagger could tag over 200 fish per hour for sustained periods of time. Two taggers worked simultaneously, so the maximum production per day was 3000 to 4000 fish.

When several hundred fish had accumulated in the second holding pen they were released in a group, since anchovetas are schooling fish and since aggregation in such species is considered to afford protection against predation (Brock and Riffenburgh, 1960).

RESULTS

The 1960 Tagging Program

Fish were tagged in all the major fishing areas of the Gulf of Panama except Bahia Parita and Isla Maje. A total of 53,380 fish were tagged, 15,370 at Isla Verde, 11,721 at Panama Viejo, 2,192 at Rio Pacora, 10,882 at Isla Chepillo, 6,629 at Punta Mangle, and 6,586 at Bahia San Miguel. The tagging was commenced on June 21 and continued through September 30. Several thousand fish were first tagged at Isla Verde and Panama Viejo in order to be sure that sufficient recoveries would be made when the fish were tagged and released in the area of the fishery; when this was confirmed the tagging was extended to more remote areas.

Magnets for recovering the tags from the meal were installed in the two reduction plants before the tagging program was begun, and tests were conducted at fairly regular intervals throughout the year to determine the percentage of tags that were recovered and the time lag involved. Each of these tests consisted of tagging 100 dead fish and distributing them in the unloading bins as the fish were unloaded. Disregarding tests made when the machinery at the plants was malfunctioning or other abnormal conditions were in effect, the efficiencies ranged from 87 to 93 per cent at the Isla Taboga plant and 84 to 92 per cent at the Puerto Caimito plant. At the Isla Taboga plant an average of 52 per cent of the tags was recovered after the first group of fish containing the tagged ones was processed. An average of 24 per cent was recovered after the second group of fish was processed, 6 per cent after the third "run," 5 per cent after the fourth run, and 3 per cent after the next seven runs. At the Puerto Caimito plant an average of 44 per cent of the tags was recovered after the first run, 41 per cent after the second run, 2 per cent after the third run, and 2 per cent after the next 11 runs.

A knowledge of the time lag between entry of the tagged fish into the plants and recovery of the tags is essential for studies of migration. The fish were sometimes caught in areas other than Isla Verde, so in order to assign areas of recovery to the tags, it was necessary to make decisions based upon what is known of the migrations of the fish, the time required for the tags to reach the magnets after entering the plants, and the areas of fishing during the periods under consideration. For instance only three tags that had been put on fish at Panama Viejo were recovered. Two of these were recovered following the first runs after fish from Panama Viejo had been landed at the plant, so it was considered that the fish with these tags had been caught at Panama Viejo. The other was recovered when only fish from Isla Verde had been landed at the plant for more than three months, so in this case it was considered that the fish with this tag had migrated to Isla Verde. The decisions as to the areas of

recovery of the tags are believed to be correct in the vast majority of cases although, of course, the nature of the recovery method precludes absolute certainty as to the area of recovery of any given tag.

A total of 425 recoveries had been made through October 8. Of these, 421 were tagged and recovered at Isla Verde, 2 were tagged and recovered at Panama Viejo, 1 was tagged at Panama Viejo and recovered at Isla Verde, and 1 was tagged at Isla Chepillo and recovered at Isla Verde. The fish involved in the last two recoveries were at liberty 3½ and 2 months respectively.

The fact that there is very little fishing for reduction purposes except in the Isla Verde area prevents the determination of the extent of migration of fish from this area. Since large numbers of fish were tagged in areas outside Isla Verde and only two of these tags were recovered there, it is likely that there was very little migration into the Isla Verde area during the period under consideration. Subsequent recoveries, however, may show migration into the area during some other season. Simpson (1959) suspected that there were spawning migrations because anchoveta eggs were found principally between Panama Viejo and Punta Mangle and because of the apparent lack of fish in some other areas during the spawning season; since spawning occurs principally in November and December these migrations are not yet in evidence.

Considerable variations in the percentages of recoveries made from fish tagged at Isla Verde on different dates are evident. The following recovery percentages were made from fish tagged in that area: June 21, 2.6; July 1, 2.6; July 12-13, 0.2; August 4-6, 3.3; August 10-12, 4.1; September 20-21, 3.6; September 29-30, 2.1. Naturally, all other things being equal the recoveries should be highest for the fish tagged earliest in the season. Detailed analysis of the catch and fishing effort data and other factors may shed further light on the reasons for these variations.

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Movements Of Seatrout On The West Coast Of Florida

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Abstract

Spotted seatrout, **Cynoscion nebulosus,** do not travel great distances. Almost 95 per cent of recovered fish were taken within 30 miles of the release site. The greatest distance travelled was 315 miles. Fish which were returned were free as long as 22 months. More fish tagged at Cedar Key moved out of the area than did fish tagged at Fort Myers or Apalachicola. Fish were tagged with body cavity tags and with internal anchor tags which had a plastic streamer protruding from the body of the fish. The overall rate of recovery was 10.7 per cent. Streamer tags were returned at a faster rate during the first six months but after one year were less likely to be returned than body cavity tags.

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A World-Wide Approach To Fish Culture Improvement

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IT IS GENERALLY ACCEPTED that some kind of rudimentary fishing methods were known even to nomadic peoples. Certainly, fish was a well-known source of food in the earliest civilizations.

Not only have ancient fishing implements of good design been discovered, but also these activities were rather precisely recorded in such documents as the Mayan mural in the warriors' temple at Chichen-itza (Morley, 1956) or the Egyptian one dating from around 2500 B.C. found at Giza (Chimitz, 1957b) showing fishes which are easily recognizable as mullets, catfish and