

# Why Sinarapan Almost Disappeared from Lake Buhi

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In the management of small bodies of water, especially freshwater lakes, the actions of only a few people disturbing the environment can have considerable impact on aquatic ecology. Even small changes in the abundance of the different organisms can be symptoms of serious problems which can worsen if the causes are not found and removed. Finding the cause frequently involves an investigation by a trained biologist but depends first on someone recognizing that the problem exists. Solving the problem frequently involves the time-consuming process of making laws to prevent people from continuing their destructive practices. Frequently, by the time the laws are finally enforced, the ecology of the area has been so severely damaged that the laws are no longer useful.

The history of the fisheries of Lake Buhi, Camarines Sur, is presented here to point out the problems involved in fishery management.

## Lake Buhi

Lake Buhi is an 1800-ha lake set in the valley between two ancient volcanoes, Mt. Iriga and Mt. Malinao. According to Spanish historians, it was formed in 1641 when a strong earthquake caused the side of Mount Iriga to collapse, forming a natural dam on a small stream. The lake is as deep as 20 m in some spots and has an average depth of about 10 m. The lake is notable in that even at the start of written records in the area, the main source of fish consumed by the people was already the small (12.5 mm average adult size), transparent goby called sinarapan (*Mistichthys luzonensis* Smith). The fish were exceedingly abundant in the lake, along with a few other gobies, halfbeak and some migratory fish which ascended the river to reach the lake.

When first discovered by H.M. Smith in 1901, sinarapan were believed to be the smallest fish in the world. Later this was amended to "smallest commercial fish" in the world following the discovery of *Pandaka pygmaea* Herre. Perhaps more amazing than the sinarapan's small size is that one man, using a hand-operated scissor net made of finely woven abaca cloth, could catch several kilograms of the fish in an hour. People living in Buhi ate the fish for breakfast, lunch and dinner.



Because of their amazing abundance, few people thought of them as a limited resource and no one took the time to study them in detail.

## Introductions

The 1920s and 1930s were times of many fish introductions. No fewer than five exotic fish species—common carp, three species of goramy, and *Gambusia* or mosquito fish—were dumped into Lake Buhi to supplement its fauna. No records exist as to the effects on the sinarapan fishery of these fish introductions.

In 1955 tilapia (*Sarotherodon mossambicus*, syn. *Tilapia mossambica*) were introduced into Lake Buhi by a

private citizen. The fish multiplied quickly and within a few years large tilapia of more than 400 g were common in the market. During the 1960s, tilapia were stocked on a regular basis by BFAR and private individuals. After the introduction of tilapia to Buhi, a steady decrease in the abundance of sinarapan was observed.

## Damming

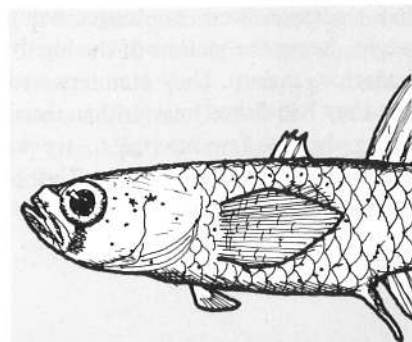
In 1955, a dam was constructed across the river flowing out of Lake Buhi to provide hydroelectric power to the area. Unfortunately, no one recognized that at least five species of migratory fish, on which many of the fishermen depend, would no

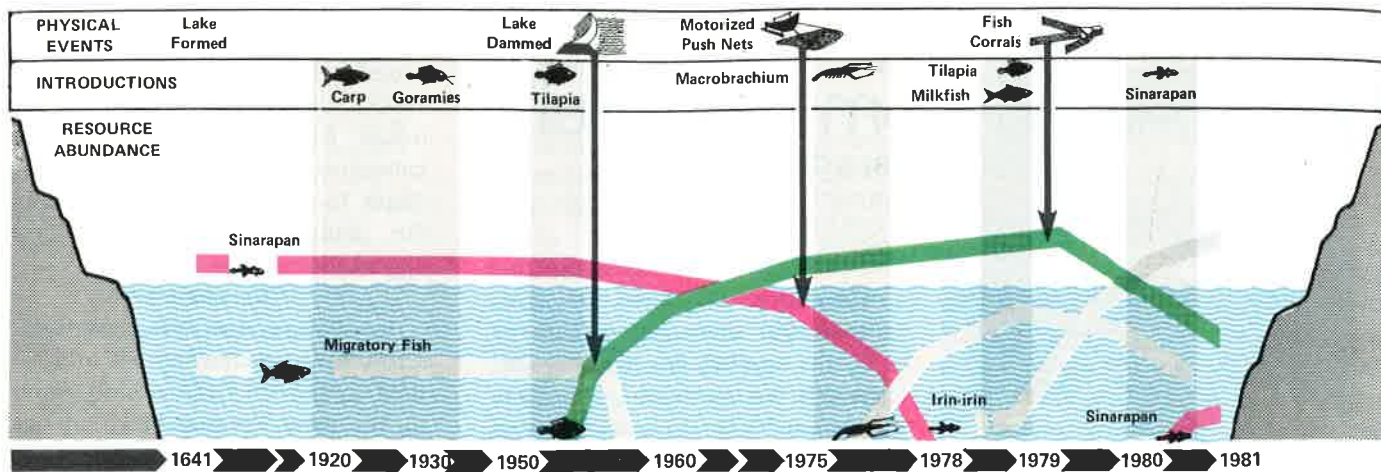
Sinarapan fisherman with fine-mesh net and poor catch: learning that a fishery is not an unlimited resource.

longer be able to enter the lake unless a fish ladder was incorporated into the dam. Only later were petitions submitted to modify the dam so that migratory fish could enter. However, these modifications were not then feasible.

## Motorization

The use of motorized pushnets in Lake Buhi started in 1975. Initially, it was heralded as a technological





advance and the best way to increase the declining catch of sinarapan. Due to the low cost of gasoline, it proved to be a very economical way to catch sinarapan. One 8-10-m motorized banca fitted with a scissor net 4 m in width at the mouth could catch more than 100 kg per day by running several times around the lake.

According to a BFAR survey, there were 34 motorized pushnets and about 490 manually operated scissor nets all with very fine mesh catching sinarapan by 1976 in Buhi.

#### Lake Bato and *Macrobrachium*

In the beginning of 1976, stories were being told in different places in Bicol about the mysterious shrimp which were destroying the once abundant sinarapan in nearby Lake Bato. Fishermen from Bato had started using the motorized pushnets in 1971 and were indirectly responsible for their use in Buhi. Because the Bato fishermen had never caught an abundance of this type of shrimp before, they claimed, wrongly, that BFAR stocked the shrimp in the lake. The shrimp were *Macrobrachium*, their source unknown.

By the beginning of 1977, the more than 100 motorized pushnet operators in Bato confirmed to the rest of Bicol that sinarapan were no longer being caught, being the victims of the highly predacious shrimp. They even reported that they had fished heavier than usual during the last few months to try to rid the lake of the shrimp. Unfortunately the pushnet was not selec-

tive for the shrimp and caught most of the remaining sinarapan that had not been eaten by predators. The shrimp became so numerous that they were caught in greater volume than the sinarapan in Bato had ever been. They were sold in the markets of many different municipalities in Camarines Sur, including Buhi.

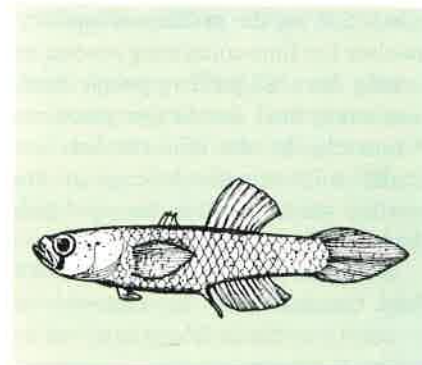
#### Lake Buhi and *Macrobrachium*

It was during this time that the town of Buhi began to be frequented by vendors bringing the live shrimp from Bato. What most townspeople did not know was that the shrimp that were not sold were thrown along the edge of the lake with other market trash. Some of the shrimp apparently survived because by February 1977, the same shrimp which had supposedly caused the demise of sinarapan in Bato were now being caught in Buhi.

The now more than 40 motorized pushnet operators were not too concerned with the appearance of the shrimp. However, for the first time, people were worried that the fish which had given publicity to their town might become extinct. Submissions were made, from late 1976, to BFAR and the Office of the President of the Philippines for the restriction of the use of motorized pushnets.

By February of 1978, more people were becoming concerned about the presence of the shrimp in Buhi. The mayor tried to talk the pushnet operators into voluntarily stopping their day-and-night operation until the sinarapan had a chance to increase.

The pushnet operators claimed that they had to operate for longer hours of the day to remove the shrimp from the lake and give the sinarapan a chance to survive. The Buhi fishermen, just as the fishermen in Bato had done two



years earlier, in turn blamed BFAR for stocking the shrimp in Buhi.

In October 1978, BFAR acted by banning the collection of sinarapan. It also ordered a study of the inter-relationships of the sinarapan and the shrimp. Unfortunately, by then sinarapan were being caught in traces only in contrast with the large volume of shrimp.

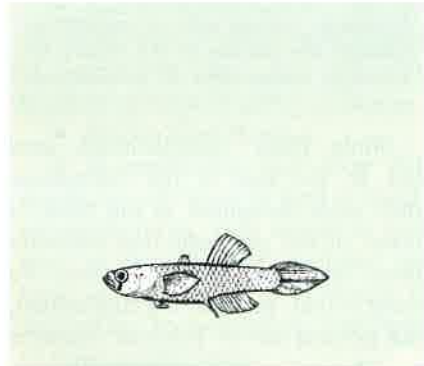
Laboratory studies of BFAR showed tilapia fingerlings to be voracious predators of sinarapan. This is a probable explanation for the observation that as tilapia increased in abundance in Lake Buhi during the 1960s and 1970s, the catch of sinarapan seemed to decrease. It was also found that sinarapan were extremely effective predators of the planktonic larvae of the shrimp up until the larvae were about 5 days old.

However, the studies also showed

that probably there would still be sinarapan present in the lake if it were not for the heavy fishing by the motorized pushnets. The nets destroyed the beds of aquatic vegetation (*Vallisneria* sp.) where sinarapan laid their eggs and hid to avoid predators. The shrimp would probably have never become such a problem if it were not for the overfishing of one of the main predators of their larvae, the sinarapan. Observations in an unfished lake nearby over a 3-year period have supported this view.

#### Fish Corrals

By the beginning of 1979, sinarapan had disappeared from Lake Buhi. The motorized pushnets had now been banned pending the results of the studies being conducted on the shrimp. Some of the operators continued selling their catch of shrimp as fishmeal for animal feeds but many of the others erected fish corrals in the lake. From 1977 to 1979, the number of fish corrals in Buhi increased from 37 to 114. Most of the corrals were made with small-meshed (1-cm) netting and were very efficient in capturing fingerlings of tilapia. Many of the corral operators found that it was more practical to culture the fingerlings they had caught in fish cages made of



nylon netting than to try to sell the small fish in the market or as pig feed.

By October 1980, there were 153 corrals and more than 500 small cages. Almost 80% of the tilapia being sold in the market in Buhi were coming from these fish cages. Unfortunately, the excessive catch of fingerlings in corrals tended to make it more difficult for the poor fishermen using gill nets and spearguns to catch many fish. Many of the fishermen

blamed the low catches of fish on the predation by the still abundant shrimp, while many of the corral operators were able to collect thousands of fingerlings in a day.

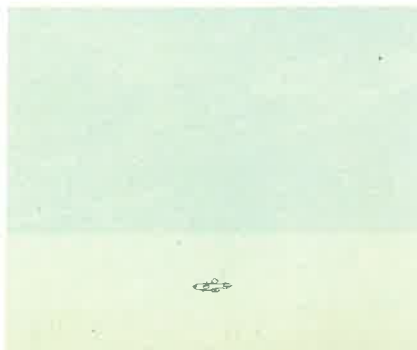
Thousands of tilapia, carp and bangus fingerlings were stocked in Lake Buhi in 1978 and 1979 by BFAR to try to increase the supply of fish in the lake. Information drives were run by BFAR to show, among other things, that the small mesh of the corrals was depleting the tilapia and carp in the lake. The operators argued that BFAR could not supply enough fingerlings for the fishcage business in Buhi, so the small-meshed corrals were necessary.

During the rest of 1979 to 1980, each sustenance fisherman using a gillnet in Buhi could catch only 0-2 kg fish per day. The price of tilapia and carp went up to ₱10.00 (US\$1.30)/kg, which was higher than in Manila. Large quantities of fish from the ocean were now being sold in Buhi to feed its people.

#### Irin-Irin

Meanwhile, there was one fish species which seemed to be increasing in number while all others were declining. Irin-irin (*Vaimosa dispar*), small, 20-30 mm gobies, were being caught in greater and greater quantities. By August 1980, they were the commonest fish by weight sold in the market in Buhi. The fish were originally found in the catch of sinarapan in the 1920s but had always been rather uncommon.

Investigations showed that irin-irin, like other fish species in the lake, ate the shrimp larvae. But the irin-irin were the only fish which could pass in and out of corrals through the small mesh. Further, the males, which had a greatly enlarged mouth compared to the female, guarded the eggs from all intruders (including the females) during the 3-day hatching period and until after the yolk sac was exhausted.



During October and November of 1980, large quantities of shrimp were washed up in the lake shallows, apparently the victims of a natural poisoning of the water by sulfide compounds. These sulfur upwellings are a natural occurrence in the lake during the rainy season. Natural fish populations are able to avoid the upwellings, while caged fish are usually killed.

#### Lake Buhi This Year

As of February 1981, some fishermen were finding sinarapan in their catches again. The shrimp now seem to be declining in number, possibly due to poisoning by the sulfur upwellings and predation by irin-irin. On the request of the mayor of Buhi Town, a stocking program bringing sinarapan from Lake Katugday to Lake Buhi has begun in an effort to accelerate the recovery of sinarapan.

The changes in the lake fauna have taken many complex twists and turns as a result of man's intervention. Serious problems have developed within a span of only a few months, whereas the government agency has taken sometimes years to respond. The existing fishery laws cannot be ade-



quately enforced due to lack of personnel.

What is happening in Lake Buhi illustrates the fact that complex problems of small-scale fisheries are not solved by economic consideration or legislation alone, particularly legislation developed and enforced by remote institutions. Fishing communities, to fully benefit from their fisheries, should have a say in management decisions. Only when community participation is taken into account does legislation and its enforcement become truly effective and meaningful.