

most gratifying. Out of three hundred and fifty cases Mr. Weber says that one hundred families have been reunited, and that in those instances where reconciliation was not effected one hundred and eighty husbands have been induced to, and for the most part do, give support to their families. Only thirty have been indicted and compelled to go through the slow, expensive, and

disheartening stages of trial, conviction, and imprisonment. By their zeal as officials of the state and their distinctly human interest in unfortunates these two men, through the court of their own creation, have healed many marital wounds, maintained many wage-earners as such rather than assisted in their withdrawal from labor and unproductive confinement in jails, and saved the Dis-

trict Government the large expenses that are ordinarily involved in the grinding of court wheels. This has worked to the satisfaction of all concerned, and none are happier in the results than the two officers who originated the plan and have carried it to a successful fruition and who now have the satisfaction of being peacemakers rather than law enforcers.

## FISH AS GUARDIANS OF HEALTH

BY SAMUEL F. HILDEBRAND

**B**ATTLES have been won and battles have been lost because of insect pests. Great enterprises have failed because of the destruction wrought by disease-carrying and disease-distributing insects. In our own country vast areas of agricultural lands are little used and practically undeveloped because of the prevalence of an insect-borne disease, *malaria*! Cities and communities have grown and prospered regardless of endemic yellow fever, which is also an insect-borne disease, but this cannot be said of any place where malaria seriously prevails. Malaria is a disease that works slowly but surely. It is not the immediate cause of death as often as a number of other diseases, but in many instances it certainly is an important contributing factor, for malaria is a disease which debilitates. It saps the patient's strength as it makes its savage attacks from time to time, and thus the powers of resisting other diseases are broken down. Because the disease works slowly and by degrees, and because it is not the immediate cause of death frequently, there is nothing spectacular about it. Consequently it does not frighten the public like smallpox, yellow fever, and typhoid, and it does not receive the attention which it justly deserves. An attack of malaria is bad while it lasts, but it is soon over and apparently forgotten until the next brood of organisms is liberated and fever again results. An attack of the disease is aptly described in the following poem by the late Mr. Gilbert, a Panama Canal Zone poet, who, as is evident, knew malaria from first-hand experience:

You are going to have the fever,  
Yellow eyes!  
In about ten days from now  
Iron bands will clamp your brow;  
Your tongue resemble curdled cream,  
A rusty streak the center seam;  
Your mouth will taste of untold  
things,  
With claws and horns and fins and  
wings;  
Your head will weigh a ton or more,  
And forty gales within it roar!

In about ten days from now  
You will feebly wonder how  
All your bones can break in twain  
And so quickly knit again!

You will feel a score of Jaels  
In your temple driving nails!  
You will wonder if you are shot  
Through the liver-case or what!  
You will wonder if such heat  
Isn't Hades, and repeat!  
Then you'll sweat until, at length,  
You — won't — have — a — kitten's  
strength!

In about ten days from now  
Make to health a parting bow;—  
For you're going to have the fever,  
Yellow eyes!

Public health officers who have had an opportunity to observe and study malaria are fully aware of the seriousness of the disease, and they are making great efforts to enlighten the public. The response has not always been of the desired degree, mainly for two reasons: first, the disease is not one that tends to frighten man to action; second, to control malaria requires funds. The average man will not spend a dollar unless he is sure that he will receive a dollar in return. Some men require a dollar and a quarter or a dollar and a half, and others wish to collect the interest in advance. A dollar spent in anti-malaria work is a most excellent investment, but the burden of convincing the public of this fact falls upon the shoulders of the public health officers, and this is not always an easy matter.

Fine examples illustrating the fact that malaria can be controlled by preventing mosquito production in large numbers are available. We need only refer to work done by the Federal Government on the Panama Canal Zone, and to the cantonment zone work during the recent war. The cost of this work, however, was quite high, and therefore much attention is now being devoted to finding more economical methods of securing the same, or even better, results. As these newer and cheaper methods are being developed the burden of the health officers and the public is becoming lighter, and anti-malaria operations no doubt will be greatly extended.

One of the newer and cheaper methods of fighting mosquitoes and malaria consists in the employment of top-feeding fish. It is the major purpose of this article to convey information concerning the fish used and the manner of their employment for anti-mosquito work.

A word of explanation concerning the relation which the mosquito bears to malaria, however, appears to be in order before proceeding with the subject of fishes in relation to mosquito control. Malaria is caused by an organism which grows and multiplies in the red cells of the human blood, and the only way these organisms can be carried from one person to another is through the females of a certain group of mosquitoes belonging to the genus *Anopheles*. So far as known, the malaria parasite does not live in any other mosquitoes. In the stomach of the *Anopheles* it, however, not only lives, but multiplies. Some of the new organisms then migrate from the mosquito's stomach to its mouth, and when it again bites a person some of the parasites are injected into the blood as the mosquito sinks its proboscis through the skin and into a blood-vessel. In this way, and this way only, is malaria transmitted from one individual to another. The theories that malaria is caused by night air, bad air from ponds and swamps, from the drinking of bad water, from the eating of chinkapins or watermelons after the first of October, are mere trash.

Conquering the mosquito pest by the employment of top-feeding fish, while comparatively new in anti-malaria work, nevertheless is a very old way of checking mosquito production, for it is nature's way. It has been known for many years that certain fish fed on wiggletails, or young mosquitoes, when placed in aquaria, water barrels, cisterns, etc., but their value in larger waters was variously overestimated or underestimated. There also was no definite information concerning the fish which were of most value. Within the last four years much headway, however, has been made in determining which species are the chief enemies of the immature mosquito. (It of course must be understood that the young or immature mosquito, larvæ and pupæ, live in the water.) Considerable information too has been gained concerning the manner of the employment of fish and the degree of control which may be expected from their introduction into waters of various kinds.

Most of the members of the top-minnow family appear to be natural



A SECTION OF A POND SHOWING AN AREA OVERGROWN WITH "SILVER-LEAF GRASS," WHICH FORMS GOOD PROTECTION FOR MOSQUITO LARVÆ AGAINST FISH

enemies of the mosquito, but one species occurring in the Southern States of this country has been found to be of especially great value. This fish is the common, insignificant-looking top minnow, also known in some localities as the "top-water minnow" or merely as "top-waters," in other localities as the "pot-bellied minnow." To science this little fish is known as *Gambusia affinis*. Since only a single species from the waters of the United States is recognized, it hereafter in this article will be referred to as *Gambusia*—a name which, etymologically speaking, signifies "nothing," of no account, a joke or farce, meaning that when you catch a *Gambusia* you catch nothing. It, then, is evident that the naturalist who selected this name failed to guess the importance which these little fish some day would assume.

The female *Gambusia* is much larger than the male and much the mightier sex, but even the giant females rarely attain a length of  $2\frac{3}{8}$  inches. The males have a somewhat more slender body, and rarely, if ever, exceed a length of  $1\frac{1}{2}$  inches. In the aquarium the cruel, ferocious female often pounces upon the small male, making attack after attack, each time inflicting a wound or taking a mouthful of flesh, which is devoured. The result of course is that the male is killed and devoured to the extent of the feeding capacity of the female.

The color in both sexes is a modest gray, but the male may be distinguished from the female by the shape of the anal fin, the fin on the median line of the body situated just behind the vent. In the female this fin is normally developed, consisting of rays connected by membrane, but in the male the rays are united and prolonged, and the fin forms a long spear-shaped prong. This prong

serves as an intromittent organ for the conveyance of the male element (sperms) from the male to the female, for, curiously enough, in *Gambusia* the eggs are fertilized and hatched within the body of the female and the young are born alive, in broods of a few to a hundred or so at a time, each female producing several broods of young during one summer.

The young when born are about one-half inch in length. They are well-developed and fully formed fish, being able to swim with ease and quite thoroughly able to take care of themselves. It is indeed very fortunate for the young fish that they come into the world so well prepared to lead an independent life, for they receive no parental care whatever. Even the mother at once becomes an enemy. In the aquarium, at least, the brutal parent often eats up her own young as rapidly as they are born. The young fish grow rapidly, and sometimes they become sexually mature at the age of three months and themselves then begin producing offspring. Thus two generations result during a single summer.

The fact that *Gambusia* brings forth its young alive is of great advantage in the utilization of this fish for anti-malaria work, for the necessity for a special environment required by egg-laying species for depositing and hatching the eggs is not necessary, as the young are born while the adults move about in the water. Reproduction takes place almost anywhere, even in the aquarium. This enables the anti-malaria worker to use this fish in many kinds of waters, the introduction of a brood stock only being necessary, as the offspring usually soon abundantly populate the water.

*Gambusia* furthermore is of wide dis-

tribution, occurring in at least some of the waters in all malarious sections of the South. Thus it has from the beginning and continues to provide a measure of mosquito control. In other words, *Gambusia* has served as a check on malaria from the beginning of civilization in the South and the consequent introduction of malaria. It is the firm belief of the writer that several large and prosperous cities in the South never would have been built had it not been for this enemy of the mosquito.

It is not claimed that fish in any locality have furnished complete mosquito control. It is not nature's way to permit one form of animal life to exterminate another. Consequently, in many waters barriers have been placed between the fish and the immature mosquito. These barriers may consist of plant growths or of floating or anchored debris, over which the wiggletails hover out of sight and out of reach of the fish. Again, *Gambusia* has enemies, consisting chiefly of larger predatory fishes, water snakes, and birds, which may prevent it from becoming abundant enough to destroy all the wiggletails which are obtainable in the water. There also are waters in nearly every locality which are inaccessible to the fish through natural channels, and consequently have not become populated with members of the finny tribe. It is here where man's help is needed. Plants and floatage providing protection for the immature mosquito against fish may be removed or, in some instances, chemically treated in such a way as to render them worthless as protectors of mosquito larvæ and pupæ. The enemies of *Gambusia* may either be removed from the water or destroyed, or sometimes places of refuge for the minnows may be provided. The waters which have not become populated with top minnows through natural channels should be artificially stocked, and the use of *Gambusia* for bait must be discouraged.

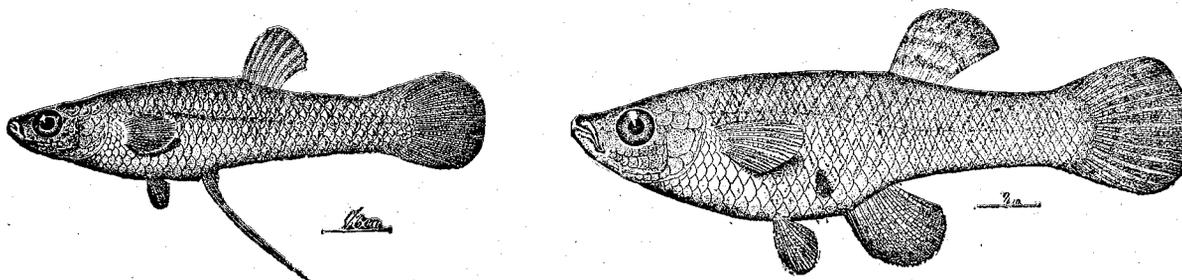
A great reduction in mosquito production and a consequent decline in the development of new cases of malaria will result if the suggestions offered in the preceding paragraph are followed. *Gambusia*, as already indicated, lives and multiplies under a wide range of conditions. It lives in very stagnant water and it endures more pollution than most other species of fish. It may be used in practically all standing bodies of water, sluggish ditches, cisterns, shallow wells, water barrels, etc. *Gambusia* does not live in rivers and creeks with strong currents, in which mosquitoes of course do not breed. Its natural habitat is in the quiet waters, in which it frequents the very quiet, shallow arms and bays, and it seeks and acquires its food at the surface, where the immature mosquito spends much of its life and where it must come for air. The common names "top minnows" and "top-waters" no doubt originated from the fact that this fish so often is seen swimming at the surface of the water. It

is evident from the foregoing that the habits of *Gambusia* are proper ones to make it a serious enemy of the young mosquito.

By the use of *Gambusia* as an agent for the control of mosquito production we get something for next to nothing. But, aside from the initial cost, the fish have the decided advantage over several other methods of control, because the

results are much more permanent. Oil and larvacides must be applied once every week during warm weather, and if for any reason this is not done regularly and carefully one or more broods of mosquitoes get on the wing. When a body of water once is stocked with *Gambusia*, it usually remains stocked indefinitely. *Gambusia* works all day and every day, and without help from

man it will provide a great reduction—from 75 to 100 per cent—in mosquito production, depending, of course, largely upon the conditions which prevail in each particular body of water. This method of mosquito control is now widely used in the South, and it is strongly recommended by health officers for practically all permanent standing and sluggish waters.



Reading from left to right we present Mr. and Mrs. Top Minnow, two of our efficient guardians of the public health. The drawings approximately indicate their relative sizes. From the expression on Mrs. Minnow's face we should judge that she might be as efficient a guardian of her husband as she is of our health.

TOP MINNOW—THE MOSQUITO-EATING FISH

## UNCLE ELLIS

BY DOROTHY CANFIELD

THE FOURTH OF A SERIES OF EXCURSIONS ALONG  
THE BYWAYS OF HUMAN NATURE

I NEVER saw my Uncle Ellis, because he died before I was born, but I heard a great deal about him when I was a child. His step-daughter married one of our fellow-townsmen, and lived next door to us when I was a little girl, and her mother, Uncle Ellis's widow, lived with her till her death. Whatever Ruth did not say about her stepfather Aunt Molly supplied. The two women spent the rest of their lives hating him, and for his sake hated and distrusted all men, especially the smooth, plausible variety. I was brought up on their stories of him, and he stood for me as the type of the traditional house devil and street angel.

The gruesome impressions of married life which float through the air to most little girls came to me from their half-heard and half-understood stories of Uncle Ellis. He had killed his first two wives, they said, just as though he had taken an ax to them, and only his opportune death had saved Aunt Molly from the same fate. His innumerable children—I would not venture to set down how many he had, all in legal marriage—feared and detested him and ran away from home as soon as they could walk. He was meanness itself—secret sneaking meanness, the sort of man who would refuse his wife money for a wringer to do the family wash and spend five dollars on a box of cigars; who would fly into a black raging fury over a misplaced towel and persecute the child who had misplaced it with ingenious moral tortures till she was

ready to commit suicide out of nervous tension, and then open his arms with a smile to the baby of a parishioner. And after mistreating his wife till she could hardly stand she would hear him holding forth to a meeting of boys, exhorting them to a chivalric attitude towards all women.

Aunt Molly died long ago, firing up to vindictive reminiscences to the last. Ruth is dead now, too, in the fullness of time. I am a middle-aged woman, and probably the only one now alive who ever heard the two talk about Uncle Ellis, and I had forgotten him. If he stayed at all in my memory, it was with the vague, disembodied presence of a character in a book.

About a month ago I accepted an invitation to speak at a convention in a town in the Middle West the name of which was vaguely familiar to me. I thought perhaps I had noticed it on a time-table. But when I arrived I understood the reason. It was the town where for many years Uncle Ellis had been pastor of the church. At the railway station, as I stepped down on the platform, one of the older women in the group who met me startled me immeasurably by saying: "We have been especially anxious to see you because of your connection with our wonderful Dr. Ellis Randolph. I was a young girl when he died, but I can truly say that my whole life has been influenced for good by the words and example of that saintly man."

The elderly man beside her, added:

"You will find many here who will say the same. He left an indelible impression on our community."

They took me to his church, where a large bronze tablet set forth his virtues and his influence on the church. They showed me the Ellis Randolph Memorial Library. I was shown the playground which he conceived a generation before any one else thought of such a thing. But what made the deepest impression on me were the men and women who came to shake my hand because I was Uncle Ellis's niece, because they wanted to tell one of his family of the greatness of his value in their lives. The minister of the town, a white-haired man, told me, with a deep note of emotion in his voice, that Dr. Randolph had done more than save his life in his youth, had saved his soul alive. The banker told me that he had heard many celebrated orators, but never any one who could go straight to the heart like Dr. Randolph. "I often tell my wife that she ought to be thankful to Dr. Randolph for a lecture on chivalry to women which he gave to us boys at an impressionable moment of our lives." And the old principal of the school said: "Not a year goes by that I do not thank God for sending that righteous man to be an example to my youth. He left behind him many human monuments to his glory."

What did I say to them? Oh, I didn't say anything to them. I couldn't think of anything to say.