

TROPICAL FISH

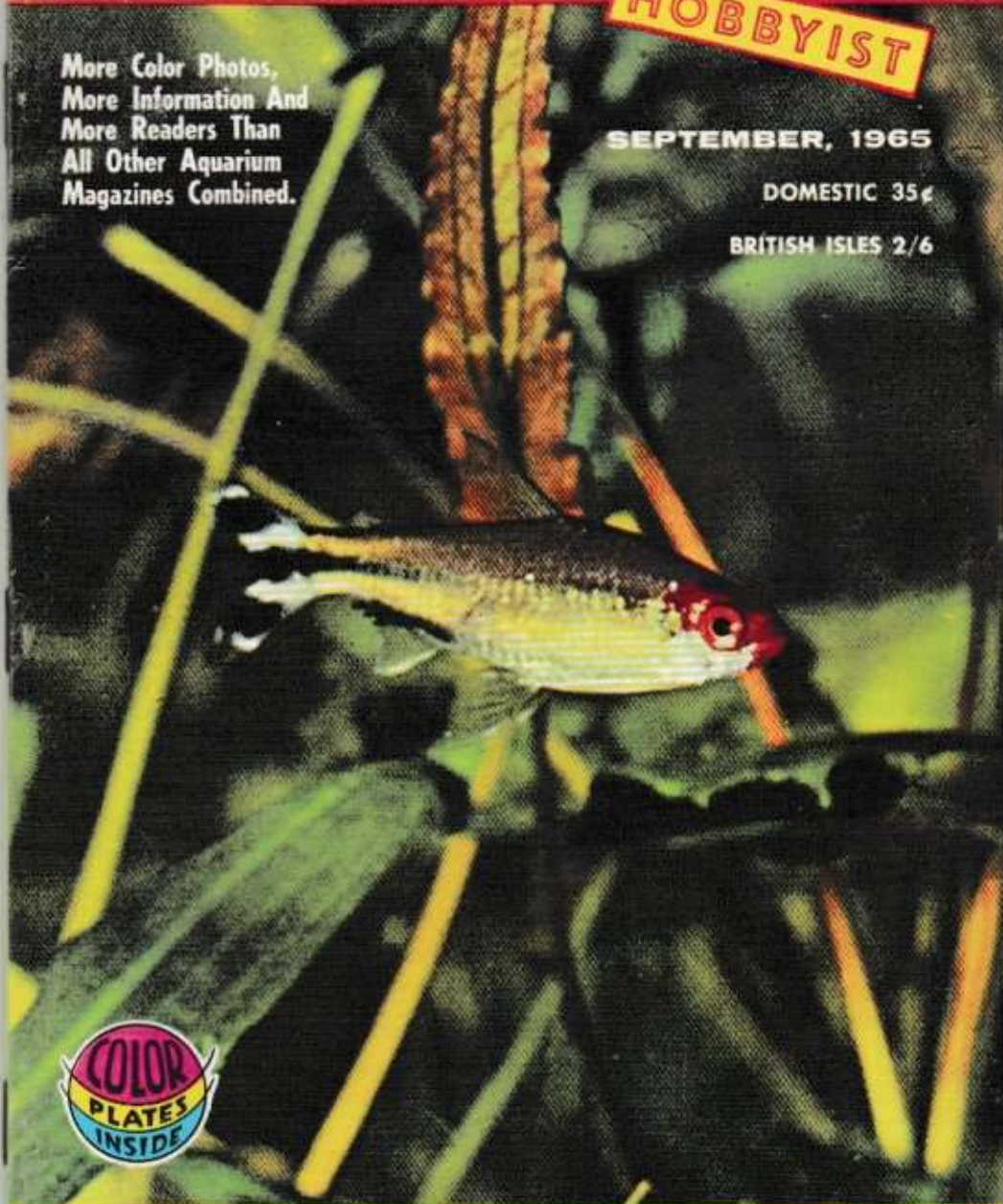
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Another in a series of tropical fish books designed to help both the novice and the advanced hobbyist is Dr. Rolf Geisler's *Aquarium Water Chemistry*. This thirty-two page book has eight information-packed chapters, and is profusely illustrated throughout.

All hobbyists will find it of extreme interest because of the vital information the book contains. Leading topics include Physical and Chemical Properties of Water and the Methods of Measurement; The Native Waters of Fishes; What Water do Aquarium Fishes Need; How to Create Special Water Characteristics; Filtration of Aquarium Water; and Water Care and Fish Feeding.

Aquarium Water Chemistry reveals how to soften hard water, how to harden soft water, how to neutralize or acidify alkaline water, how to make acid water neutral or alkaline, and how to make black water.

Of special interest to the novice fish keeper is the section on how to properly test for water characteristics. Products are also discussed, detailing the functions of each.

Of definite interest to the salt-water hobbyist is a recently developed scientific formula for making a singularly successful synthetic ocean water. Salt-water effects on aquariums are also discussed. Equipment needed to successfully keep a salt-water aquarium is described.

A total of twenty-one illustrations picture either fishes, accompanied by a description of their water requirements, or aquarium chemistry products, with an explanation of their use. There are also photographs showing the natural habitat of tropical fishes.

TROPICAL FISH HOBBYIST

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COVER
There was a time, not too many years ago, when the ornamental tetra, *Moenkhausia trichoptera*, was a member of almost every community tank. It was small, its medium size fringed. How can you really ever see one. And if you ever have trouble making it to come home, it's usually an elderly man who has been keeping fish for a decade or more. As the cover photo shows, the fish is far from appetitive. In addition, the fish is very hard to keep and not so hard to buy. Why the decline in popularity? For some speculations on this and other interesting interferences, check the column, and the story beginning on page 17. Photo by Dr. Herbert R. Axelrod.

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In Canada Tropical Fish Hobbyist magazine and books are sold exclusively through Canadian Aquarium Supply Co., 1125 Telford Street, St. Thomas, Ontario. All subscriptions and inquiries from Canadians should be directed to them.

In England and the western countries send Tropical Fish Hobbyist magazine and T.F.H. Books are distributed exclusively through T.F.H. Publications (London) Ltd., 13 Nether Lane, Bayside, Surrey, England. All subscriptions and inquiries should be sent directly to them.

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Second Class Postage Paid at Jersey City, New Jersey. Published monthly by T.F.H. Publications, Inc., 6145 Cornerstone Avenue, Suite 614, J. P. 07302. Printed in U. S. A.

EDITORIALLY . . .

I don't very often get good and mad at my fellow hobbyists, but once in a while something happens that starts my blood boiling. For instance, I once heard of an aquarium society which was planning a fish show. Nothing unusual so far, but these people came up with a new twist, one which is worthy of much ridicule; there was to be an award given for "Worst of Show." What sort of insanity is this? Every hobbyist is dedicated to improving the fishes he has to the best of his ability, yet now we have a group which wants to give an award to the person who has the worst, most miserable pair of fish entered. It's like holding a dog show and giving an award to the gosh-awfullest mutt that can be dragged in off the street. I've seen some pretty bad specimens exhibited at fish shows, but checking as to who made the entry usually resulted in finding that it was made by some youngster who honestly thought he had something that stood a chance and who may never have seen "show quality" fish before. Every year there is a "Miss America" contest; is there a special award for the homeliest girl? The idea, you will admit, is just as silly, and the society that came up with this brain-child probably abandoned it when they thought it over. Even as a "gag" it wouldn't be particularly funny. I am frequently asked to officiate as one of the judges at these events, and if I were ever asked to make such a decision as "Worst of Show," I'm afraid I would have to bow out in no uncertain terms!

William Vanderwinkler

Tropical Fish Hobbyist

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September, 1963



The young black arana is strikingly colored but very fragile and difficult to keep alive. A tankful of these fellows, however, would be beautiful indeed. Photo by Dr. Herbert R. Axelrod.



The Black Arana

BY DR. MARTIN R. BRITTON
Professor of Life Sciences
Sacramento State College, California

For several years aruanas (or arawanas, if you prefer) have been spectacular exhibits in pet shops and the homes of a few lucky (and financially well-off!) hobbyists. These specimens, while spectacular, were adult or sub-adult and were far too large for the tanks of the average aquarist, and far too expensive, too. Most I have seen were from a foot to nearly three feet in length; their owners cheerfully priced them from \$50 to \$200 and generally had no real interest in selling a pet so comment-provoking. Now, however, large numbers of baby aruanas are beginning to come into the U. S. from Brazil and British Guiana. These baby aruanas are, unfortunately, very fragile and difficult to keep alive. They can stand little handling and crowding, and must have live food continuously. When we learn how to handle them properly on a commercial scale, they should become a nice addition to the aquarium world.

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The Black Aruana

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Most of these young aruanas have their ultimate origin in the collectors employed by Senhor H. Willi Schwartz of the Aquario Rio Negro at Manaus, in the Brazilian Amazon.

Most interesting is the fact that there are other types of these fishes besides the common form which we have been seeing for several years. The common form is also called the silver aruana, but there appear to be yellowish, brownish, and greenish variants which are not much different and which are almost certainly the same species, *Osteoglossum bicirrhosum*. However, two types are markedly different. These are what Sr. Schwartz calls the striped aruana and the black aruana. The former bears more resemblance to the common one, but differs in the well-defined lateral stripe. The black aruana is even more markedly different. The accompanying color photographs show the difference between the young, but Schwartz says that the differences in the adults, while not so great, are still considerable; the adult black aruana, for example, has a dark bluish cast. Apparently the adults of all the types lose the stripes. While I have not seen the adults, the young are, to my eye, perfectly identifiable at a glance. Whether these are distinct species, subspecies, or strongly marked varieties, remains to be seen, but Schwartz has told me that the mouths of various adult females (the aruana broods its young in the mouth until after the yolk sac is resorbed; whether the eggs are hatched in the mouth or externally in the water, with the young being picked up for protection, I do not know) contain only young of the same type; that is, the mouth of the common silver aruana always contains only that type of young and never striped or black young, so that the latter are not merely mutants or sports or rare variants in a normal hatch. The several varieties have been, according to Schwartz, taken from the same general area of the Amazon basin. The black aruanas here pictured came from Lago de Limão on the Rio Branco, a tributary of the Rio Negro, itself a mighty branch of the Amazon.

Catching aruanas, discus, and other fishes which prefer flooded lakes and sluggish or currentless side-channels is a real job. Recently I accompanied Willi Schwartz as he went to meet one of his fishing boats. We left his boat *Fairbanks-Morse* (Schwartz names all his powered boats after their make of engine), which he sends out to meet his fishermen who are collecting in the jungle, speeding through the river channels in an outboard-powered canoe. When we arrived at the fishing boat the wives of the fishermen showed us several tubfull of common aruanas, several of *Corydoras*, and some young pirarucu or arapaimas (these were about six inches long; the adults are six feet!). The men were further up an *igarapé* fishing, so we went to see how they were faring. We proceeded slowly, pushing branches out of our way, and paddling because the dense weeds would foul the outboard. We found the fishermen laboriously throwing waterweeds and flooded terrestrial vegetation out of the net, which they had staked out in a half-circle, the ends tied against

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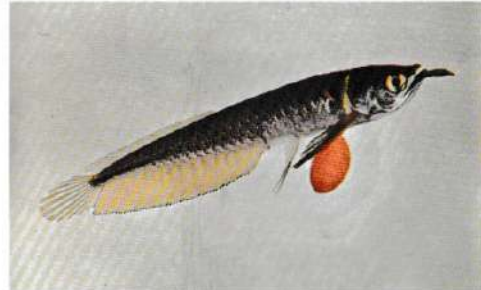
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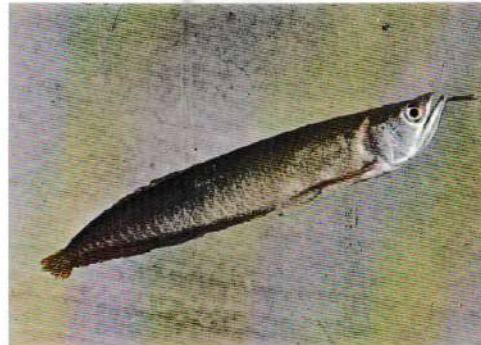
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September, 1965



The young of aruanas other than black aruanas are not very colorful (compare with photo on page 2) but are attractive nonetheless. Note the yolk sac still present on this specimen. Photo by Dr. Herbert R. Axelrod.

Aruanas sold to hobbyists are usually adults or sub-adults. They are 1 to 3 feet long and are not nearly so delicate as youngsters. Photo by Harold Scholtz.



9

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10

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the bank. After an hour's work in chest-deep water, with mosquitoes hovering close about their faces, the net was drawn up. We waited, crenched to the skin, for the thousands of choice fishes to appear, but from the deepest recesses of the bag of the seine there emerged a single ugly "duck-billed" characin, a commercial nonentity. Ah, I thought, a real rarity for my ichthyological collection (I was in Brazil under a T.F.H. scientific grant to study Amazon fishes, with some of my transportation through the courtesy of Paramount Aquarium) but Willi said that we should keep him because he had had the bad luck to be the only one caught, and, besides, he was quite unusual in appearance. Collecting aquarium fishes is much like mining; you either strike it rich or you come in with so few nuggets that it doesn't even pay for your grubstake!

From this trip Willi got only a few hundred common and striped aruanas, both from the same general area of the Rio Branco near the mouth of the Rio Xeruiuni, but a few weeks later one of his other boats, the *Belinda*, brought in both striped and black aruanas from Lago de Limão and the nearby region. Many of these were gotten from the mouths of the parent fish and still had their yolk sacs. Unfortunately the crews usually eat the large parent fishes, depriving science of the specimens, but aruanas are good food and Brazilian fishermen are poor. Willi Schwartz is justly proud of having commercially collected the first black aruanas which he hopes may prove scientifically distinct and which he hopes may be named for his wife, Robine.* A tankful of young black aruanas is indeed a stunning sight to behold!

* It is interesting to note that Henry W. Fowler in his "The Fishes of the Fresh Waters of Brazil" ("Os Peixes de Agua Doce do Brasil," *Anuário de Zoologia do São Paulo*, Vol. VI, p. 28, fig. 21) shows a drawing of a young adult black aruana with a sub-adult common aruana (however, this latter may be of one of the other types; I do not know, as I have seen adults of only the common aruana).

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11



When the rummy-nose is in top condition and under good lighting, its nose glows as red as an ember. Photo by Klaus Payson.

A forgotten favorite . . .

The Rummy-Nose Tetra

BY MIKE REED

It wasn't too long ago that the little rummy-nose tetra, *Hemigrammus rhodostomus*, was a favorite member of many a home community tank. Just why it has fallen out of favor in recent years probably can't be explained by any one reason. In its heyday this little fish was one of only a few tetras on the market. Therefore, the most important reason for its decline, I suspect, is the tremendous number and variety of tetras now competing with it. Many of the newer tetras are more brightly colored and more active. Virtually all of them are easier to spawn. Dealers, of course, must stock what sells best; as a result, even if you want a pair of rummy-noses, it's tough to find them.

I, for one, would like to see this fish make a comeback. It's not only nostalgia that prompts this desire. I think that today the number of hobbyists with sophisticated tastes is greater than ever before. Not that they don't like the flashy, energetic species (such sophistication would be akin to blindness), but they know the value of mixing in a few of the more subtly beautiful, somewhat less active fishes for contrast. This is probably the major reason for the constant popularity of such fish as the regal pearl gourami.



Sometimes the nose of the rummy-nose is not fully colored. This happens when the fish is frightened, is poor health, or under improper lighting. At these times the rummy-nose looks very much like the scissortailed rasbora. Above, rummy-nose tetras. Below, scissortailed rasbora. Photos by Dr. Herbert R. Axelrod.



Many new or relatively new hobbyists are not at all familiar with the rummy-nose. They rarely see it, and if they do they often mistake it for a scissortailed rasbora, or some other similarly shaped fish, with an injured nose. The few that take the trouble to question the dealer are invariably anxious to have the fish. However, the rummy-nose usually loses most of its color when it is netted and all too often the prospective buyer cannot be convinced that it will come back in his home aquarium. The result? The dealer must return the fish to his stock.

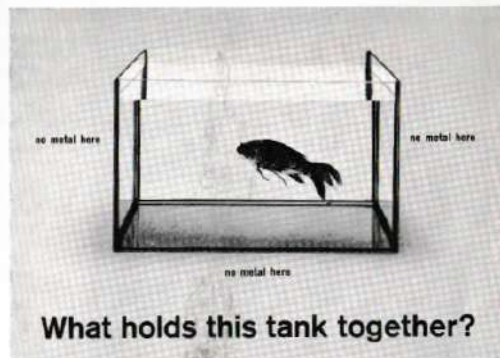
If I have not made it clear up to now, let me emphasize that I am promoting relative subtlety for contrast, not drabness and listlessness. Neither am I asking those who prefer such beauties as the neon and cardinal tetras to switch allegiance. Rather, I suggest that such hobbyists might add a few rummy-noses to their collection and see how much they improve the total effect.

The body of the fish is translucent silver. A black line runs from the rear of the body, through the caudal peduncle and into the center of the forked tail fin. In addition, there is a large black spot on each of the lobes of the tail fin. The nose and forehead are bright red, giving the fish its common name.

The rummy-nose tetra grows to about 2 inches in length. It is peaceful and moderately active. It lives happily and is particularly attractive in a well-planted, well-heated tank. It has no special pH or DH requirements and gets along well on dried food supplemented occasionally with live or frozen natural foods.

Those who like the challenge of a hard-to-breed fish will be given a run for their money by the rummy-nose. Relatively few people have turned the trick, and even fewer have reared many of the delicate fry to anywhere near adulthood. If you're game to try, however, the following is one method which has met with some success.

The fish is comparatively easy to sex. Females are larger than males and, when in breeding condition, their bellies are swollen with eggs. Three females and two males should be conditioned in five small tanks. Live daphnia are supplied constantly. A 10-gallon tank should be prepared for the spawning. Freshly conditioned tap water, adjusted to a pH of 6.8, a temperature of 74° F., and close to zero hardness, is used to fill the tank to three-quarters of its capacity. A liberal amount of *Nitella* should then be added as the only plant in the tank. The fish are placed in the tank late in the evening; if luck is with you, small yellowish eggs will be seen amongst the *Nitella* strands within 24 hours. Remove the parents and, to protect the eggs from attack by fungus, add 7 or 8 drops of 5 per cent methylene blue. A hatch of 150 fry represents excellent success. They should be started on infusoria and as soon as possible be put on sifted daphnia and newly-hatched brine shrimp. If you get over half the fry to adulthood, write and tell us how you did it!



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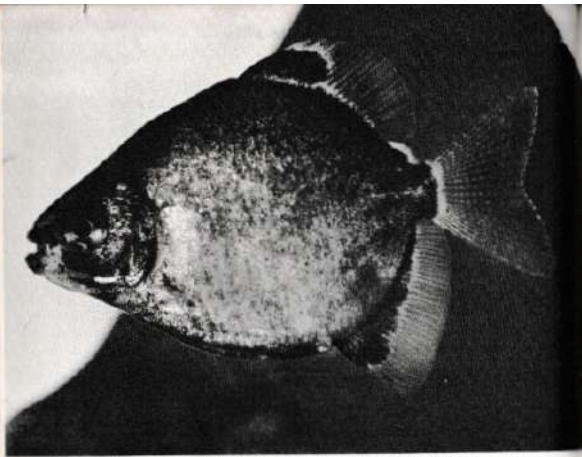


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An enlarged view of a small Leaf Pacu, about three-quarters of an inch long. The outer part of the dorsal, caudal, and anal fins are extremely transparent, almost invisible in the water. They swim like a dead leaf drifting in the current. Body is chocolate-brown to black, sometimes spotted.

An account of a TFH expedition to Central Brazil.

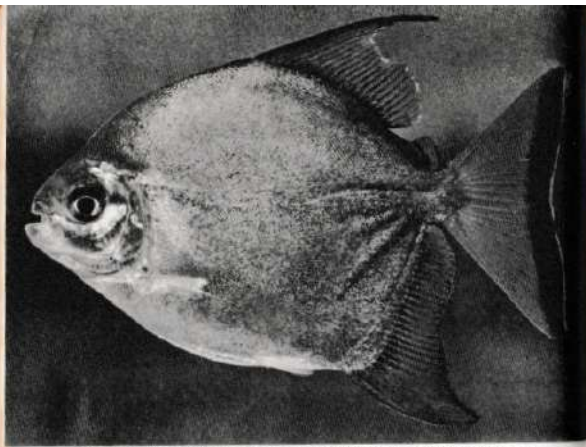
The Secret of the Leaf Pacu

BY HARALD SCHULTZ
Museu Paulista, São Paulo, Brazil
Photos by the Author

In Brazil, the name Pacu is given to all the more or less peaceful silvery Tetras belonging to the genera *Metynnus*, *Myloplus*, and *Myletes*. An ichthyologist will have to decide in which genus the subject of my story belongs, because I am using the popular name leaf pacu.

My story begins in the middle of the dry season in Mato Grosso. My party and I were sailing downstream on the upper Jurueña River to get to our headquarters with the Ergitá Indians.

"Senhor Harald, look at that crazy fish!" the rubber gatherer



A half-grown Leaf Pacu, showing its half-extended "fags" on the dorsal and anal fins. A broad black edge frames the lemon-yellow tail. They are real beauties and not plant-eaters like the other *Metynnus* and related fishes. At least they do not destroy all the beautiful vegetation in an aquarium.

Milton Gattiboni called to me. "It staggers when it swims and lets itself be carried in circles by the current like a dark, decaying leaf. I've never seen one like that!"

It struck me like a bolt of lightning. This must be the little Pacu about which a 7-year-old boy named Riomar told me. Despite his tender years, Riomar was an excellent fisherman who was well acquainted with all of the Upper Jurueña fishes. His parents are civilized Indians, and the boy has all of the qualities of his ancestors: a love of nature and wonderful powers of observation. Almost daily the little boy sailed away alone in his boat to supply his family with tasty fishes and turtles;

some of the fishes he caught were dangerous and almost as long as he was.

I jumped up as soon as Milton called me. He was sitting in the bow of a motorboat which was tied to the shore near one of the huts. This boat arrives only once a month in this remote region, sometimes staying away for two months. It supplies the rubber gatherers with the necessities of life: rice, salt, sugar, coffee, clothes, and, of course, ammunition, without which nobody would venture into these lonely woods. Anything else the rubber gatherer needs must be provided by the river or forest.

My own boat lay idle because my

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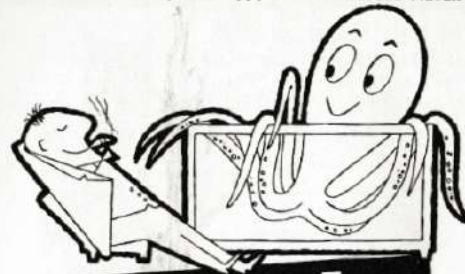
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Tropical Fish Hobbyist

12-horsepower outboard motor lost its tiller while we were right in the middle of one of the most dangerous rapids, called "Cinco Bocas" (Five Mouths). The boat, which is built of aircraft metal, landed with a crash between two boulders and scraped its way to a stop. There was no damage, not even a scratch or leak, only a small, almost unnoticeable dent in the bow. But now we had to wait in the middle of the jungle for the provisions boat to come and take us back. But things could have been worse!

The Arinos and Upper Jurueua are dangerous rivers, with many rapids, reefs and boulders everywhere. And on the banks there is the broad and unknown jungle. Every five or ten miles or so one may find the lonely grass hut of a rubber gatherer. Most of the rubber gatherers are bachelors, and many are fugitives from the law. They have excellent reasons for preferring their hermit-like existence, which at least carries with it freedom, rather than the confines of a dark prison cell.

But my friend is not one of those questionable characters. He went into the jungle because he was lured by a love of adventure, wanting to hunt jaguar in their own haunts and to make friends with the fierce Ergitsá Indians.

"You can see only the pointed mouth, like the stem of a leaf, but no tail! Do we want to catch this fish?" With a single motion I pulled out the net, which was made of plastic gauze. It is 13 feet long and 3 feet deep. I brought no hand net, which would have been more useful to catch this tiny fish, but that's how it goes!

"It can't be hard to catch these comical fish," the rubber gatherer remarked. "They swim as if they were drunk!"

The current was quite strong near the shore and formed a whirlpool. The tiny fish, which was only about 1 1/2 inches long, swam near the surface. Yes, there it was, staggering like a drunkard, looking very much like a leaf drifting in the current. The one end, the head with its tiny mouth, came to a point; the tail end was somewhat wider, looking fringed. Dorsal, anal, and caudal fins could not be seen at all from above.

Suddenly I was almost afraid that I would not catch the little fish; I had hoped so long to find it, and here it was at last! Milton held one end of the net spread out, the weighted side down in the water, and at the same time pulled ahead. I held the other end, or rather part of it, because 13 feet of net are not necessary to catch a 1 1/2-inch fish.

But there was not much room in the bow of the motorboat. Slowly we approached the swimming fish with the net. This net was grass-green in color and the water crystal-clear. The little Pacú slowly staggered away, always spinning with the current. It seemed that the fish had no power of his own, but watching it for a time showed that he swam wherever he wanted—in this case out of range of the net.

He was gone. No, he came back again; turning, spinning, tiny, brown, ragged as a decaying leaf. He swam into a stronger whirlpool and reappeared in exactly the same spot. I watched him carefully, not letting him out of my sight. Now he's over the net. Up! Missed!



Although the young ones are found singly, adult Leaf Pacús are found in small schools of four to seven individuals. We caught them in a nylon seine but could not bring any of them home alive. The Upper Jurueua is very far from civilization.

Gone!

"We've got him!" Milton yelled. "He's so little!"

In my hand he was quite hard to the touch. The body was brown with darker markings; dorsal, anal, and caudal fins were transparent as glass. The fish's tiny mouth came to a point.

All I had to put him in was a small cooking pot. I just had to take this fish with me. If he lived until tomorrow I would take him upstream to my headquarters, photograph him, and then preserve him in formalin.

The little Leaf Pacú swam about restlessly. I covered the pot as a precautionary measure. "Precaution is dead of old age!" is what the Brazilians say.

The next day my little fish was just as active as ever. The rest of our trip would have to be made in an open boat, with no motor and in the hot Amazon sun. I put my laundry

bag over the pot and after that could not give it any more heed. But three days later the fish was just as perky and even took some food, a grain of boiled rice, and a tiny bit of meat.

Gradually a few more Leaf Pacús were added. They all looked the same, except that some of them were a little darker; all were active and peaceful, and all ate well. But they were predators; I caught about 20 tiny livebearers in a pond in the center of an island in the river. In only a few days my Leaf Pacús had stuffed themselves with them.

It would be about three months before my return home. They might not be able to stand confinement this long in the tiny photographing tank. This little fish is found unpredictably in the upper part of the Arinos and Jurueua Rivers. One is seen suddenly, perhaps in the shallows near a sandbank or in flowing water near the shore. They seem to lead a seasonal existence. It is

possible that the ones I caught were young specimens. Shortly before the onset of the rainy season is the best time to find them. They are fond of hiding among and under rocks, twigs, and branches which lie in the water. But always one finds them singly.

The natives here claim that this is one of the smaller Pacús, (possibly *Metynnis*), which gets to be no longer than a bare 2 to 2½ inches in length. Maybe you will soon see the Leaf Pacú in some of the larger dealers' establishments. It happens so frequently that one reports on a fish and thereafter there is a mad scramble for it. Of course, the Leaf Pacú is no Neon Tetra or even a Blue Discus (which are being shipped in large quantities from the Amazon, and at what prices!). The discoverer usually gains nothing but pure pleasure, which nobody can take from him. I think that pleasure multiplies and carries over to others, when given with a pure heart.

The Solution of the Riddle:
Three Leaf Pacús now swim in my large community tank, in company with numerous other Characins, Catfishes, and small Cichlids. The Leaf Pacús behave very peacefully, as long as there are no smaller, delicate fishes with them. In the course of a week they killed five of a school of very small and feeble *Hyphessobrycon callistus*. I can blame none of the other fishes, because it did not happen previously. However, it could also be that these fish were too weak to get used to the large tank without some losses. As the rest of the school got bigger and stronger no more died. One never saw a genuine attack by a Leaf Pacú, never any more than an

annoying nibble, but they like to stage battles among themselves.

In any case it has been found that healthy fishes the size of a Neon Tetra can be kept with them without any cause for worry. It is a good thing to observe the fishes in a community aquarium. One can soon see if their behavior is good.

Three months have passed. There are only two Leaf Pacús left. After growing slowly at first, they are putting on size at a furious rate. They are not displeased with anything and eat whatever is offered to them, as long as it is edible. And they are hardy. Carelessly I introduced Ich into their tank, causing the death of many smaller fishes—my poor eyesight could not identify them at first, but this devastating disease did not bother the Leaf Pacús at all. Only while they are still very small and as thin as cardboard is their sensitivity greater, as with all young fishes.

It is pleasing to watch how they swim daintily with quick, short fin strokes—almost like a *Scatophagus*—but now comes the surprise: for the past few days the dorsal and anal fins have been growing. Flag-like extensions are forming. The anal fin is becoming blood-red. The tail is lemon-yellow and has a black border. Sometimes the body is almost silvery and at others it is light brown, chocolate brown, or black, as it was when they were little youngsters.

The Leaf Pacú is therefore a juvenile form. Later it becomes one of the prettiest of the *Metynnis* (?) species which I have ever seen from Central Brazil. It is a very small species which never gets bigger than 4 inches and is not a plant-eater like the others of its genus.

30



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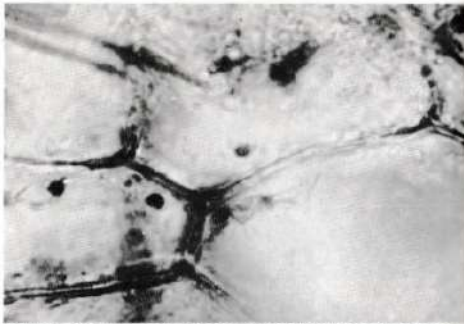
*To figure pool size; length x width x depth (in feet) x 7 = gallons.



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Tissue under the microscope after the decomposition of the living substance by putrefactive bacteria. The cell membrane is damaged. The dark stick-like bodies are released crystals of calcium oxalate. Complete decomposition will follow.

Cryptocorynes are marsh plants. In their native country, during the dry period, they grow out of the water. In the aquarium, the plant must stay under water in artificial light. This weakens their natural resistance and ability to adapt themselves to further changes in their living conditions. Thus, the plant often reacts to even a slight change by the loss of leaves. Vital functions, however, are preserved in the underground rhizome, and new leaves shoot from it. In such instances, it takes a long time for the plant to reach the size it was before transplantation. If the environment is less suitable the leaves grow to a smaller size, and the whole plant can become stunted in its growth. Some *Cryptocorynes*, e.g. *C. affinis*, *C. griffithii*, and *C. wendtii*, are especially sensitive to transplantation. If the rhizome, which contains reserve nutrients, is not strong enough the plant may perish.

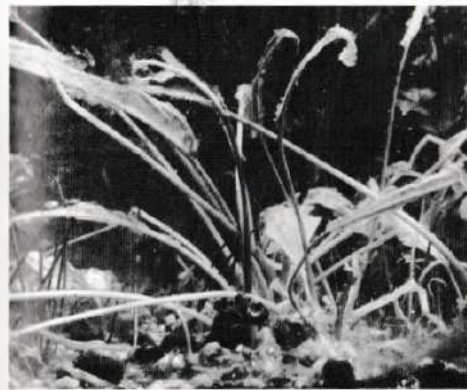
The rapid decay of *Cryptocoryne* leaves can be observed not only after transplantation but also in other situations. It often happens, for instance, in plants which are taken from natural to artificial light or vice versa. Decomposition of leaf-tissue can occur even in plants that are raised in hothouses and are not transplanted. This sometimes happens during foggy autumn months when light intensity is lowered. The opposite also occurs. *Cryptocorynes* grown in dispersed light lose their leaves as soon as they are put in a sunny place.

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Sudden changes in the chemical composition of tank water also causes decomposition of *Cryptocoryne* leaves. For example, a lowering of the water's hardness when filling up a tank with rainwater is followed by the decomposition of leaf tissue. In this case the main cause is the sudden change in osmotic pressure. Another frequent cause of such decomposition is the poisoning of the leaf tissue due to high concentrations of nitrogen compounds in tanks crowded with fish. *Cryptocorynes* can bear accumulation of the waste products of the metabolism of fish and other organisms up to a certain degree of concentration. The sudden decay of *Cryptocoryne* leaves can arise even in tanks with clean water and with fish and plants in good condition. This happens as a result of higher concentration of certain nitrogen compounds (especially ammoniates and nitrites) if their chemical change into nitrates does not proceed quickly enough. In this case a partial change of tank water can alleviate the situation.

In all cases mentioned above decomposition of the leaves seems to proceed in the same manner. At first the leaf loses its natural color and becomes "glassy". If we observe this first stage of leaf decomposition under the microscope, we see that the chlorophyll grains are plasmolyzed (that is

Putrid decomposition of the leaves of *Cryptocoryne affinis*.

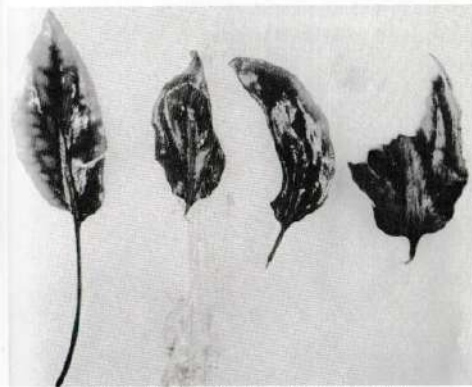


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drawn to the center of the cell) assimilation ability is interrupted and protoplasm is disappearing. Between the chloroplasts (chlorophyll-containing bodies) and the cell membrane we can see a great many putrefactive bacteria which are breaking down the cell's vital substances. In the next stage of decomposition, saprophytic bacteria absorb and digest the withered vital substance, leaving only the filmy cell membrane. Next, the cell membrane tears and tiny needles of calcium oxalate are released into the water. Then the leaf disintegrates into a greenish, slimy organic substance. Saprophytic bacteria cause rapid decay of the remaining leaf tissue, but the substance they attack must already be dead.

We have seen that such putrid decomposition of *Cryptocoryne* leaves can be transferred from an attacked plant to a sound one. In the case of the second plant, then, the disease results from infection. It is possible that the originators of this infectious leaf decay are types of organisms from the group actinomycetes, for they can be observed on the decomposed *Cryptocoryne* leaves. These organisms, of uncertain systematical classification between mycetes and bacteria, have not been investigated to any extent, and little is known about them. We know that they exist everywhere in water and soil, and that some of them are parasites. Although they may cause decomposition of *Cryptocoryne* leaves, parasitic bacteria or viruses can be the causes of such decay also.

Healthy specimens of *Cryptocoryne undulatae* grown under proper conditions.



Chlorosis and mycosis of the leaves of *Cryptocoryne griffithii*.

Apart from putrid decomposition of their leaves, *Cryptocorynes* suffer from other diseases. One such malady is chlorosis, which can be caused by lack of some biogenic elements, especially iron, magnesium, or phosphorus. The leaves of plants suffering from chlorosis are bright green only around the veins. It is natural that in a tank with very limited space a gradual exhaustion of some biogenic elements takes place. In such cases partial water changes can help. Chlorosis in *Cryptocorynes* can also be caused by a viral infection, just as it occurs in terrestrial plants.

In our tanks we meet with still other leaf diseases. One such disease is mycosis. This is a local disease caused by fungi. The plant defends itself by forming a bark layer around the attacked portion. The center decays and falls out leaving a hole. The rest of the leaf remains quite normal. We must not confuse the resultant holes with holes caused by voracious water slugs or by mechanical damage.

Aquarists should pay more attention to diseases of not only *Cryptocorynes*, but all their aquatic plants and try to find out the causes of their failures. In correct living conditions such plants grow well and can decorate the tank beautifully.

Races of the Chinese Paradise Fish (*Macropodus*)

BY DR. GEORGE S. MYERS

The paradise fish, *Macropodus opercularis* (Linnaeus), was probably the first exotic aquarium fish brought into Europe subsequent to the goldfish. A French consul named Simon, resident in China, sent or brought some live paradise fish to France in 1869. There, they were soon bred by Pierre Carbonnier, a fish culturist who had previously given his attention to the propagation of French fishes.

However, the Swedish zoologist Linnaeus knew of the fish 100 years previous to the French importation, and had provided it with the specific name *opercularis*. Moreover, several zoologists during that intervening century had provided names for fishes which later research showed to be synonyms of the name provided by Linnaeus.

Well developed male paradise fishes in aquariums turned out to develop such long, beautiful fins that the idea soon became prevalent that the paradise fish represented a sort of fancy breed developed in China from a presumably much less well-endowed fish. Undoubtedly, the knowledge that Chinese breeders had developed many fancy breeds of goldfish fostered this idea. It is, indeed, quite true that a much duller species of *Macropodus* does exist in China, and some writers pointed to that fish as the wild stock from which the "cultivated" paradise fish had been developed. As a matter of fact, the view that the forked-tailed paradise fish was a cultivated fancy strain of a much less resplendent round-tailed wild fish persisted in ichthyological literature up to 1930, and even later.

By 1930, however, I had seen and kept both the forked-tailed and the round-tailed fishes alive for many years, and had become thoroughly convinced, from aquarium observation, that the forked-tailed fish was no cultivated variety but a quite distinct and separate species from the dull-colored, round-tailed form. Also, by that time, preserved specimens of both fishes, caught wild in a number of localities in China, had accumulated in the research collections at Stanford University.

Study of these wild-caught fish specimens immediately demonstrated a number of anatomical characteristics of the well known paradise fish which differed so constantly and so greatly from those of the round-tailed fish that it was obvious that the latter could have had nothing to do with forked-tailed fish—the real paradise fish. Most important of these characteristics was the

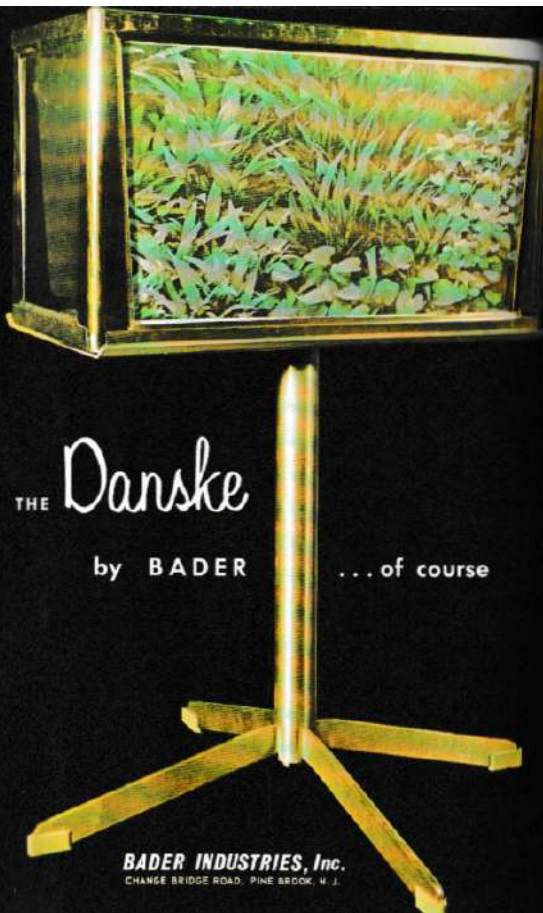
shape of the preorbital or lacrimal bone. Moreover, the forked-tailed fish showed no signs of "throwbacks" to the round-tailed fish in any of the many thousands of aquarium-bred live paradise fish that I had seen. In 1932, in the Lingnan Science Journal, then published by Lingnan University in Canton, China, I published my findings, and references to the paradise fish as a "cultivated variety" began to disappear from the literature.

I determined that the original account of Linnaeus referred to the forked-tailed fish, which thus became *Macropodus opercularis* (Linnaeus), and that the "round-tailed paradise fish" must be called *Macropodus chinensis* (Bloch). Only one ichthyologist seriously doubted the application of these names. Nichols, as indicated in his "Fresh-water Fishes of China," still thought that the name *opercularis* belonged to the round-tailed form, while he applied the name *viridi-aureatus* to the forked-tailed fish. Very recently, Dr. H. Rendahl, of Stockholm, has reviewed the material on which Linnaeus based the name *opercularis*, and agrees with me that it represents the forked-tailed species.

Just previous to World War II, E. Ahl of Berlin got a uniformly dark-colored, forked-tailed fish from Indo-China, which was named *Macropodus concolor* Ahl. This fish entirely lacks the vertical bars found in examples (especially the males) from Kwangtung and more northerly localities. Specimens of this dark colored fish have been seen in the United States, but I have never happened to see one myself. However, about the only important difference given by Ahl to distinguish it from *opercularis* is the color, and it is my belief that the color becomes darker and the bars become more obliterated in successive populations to the south of Kwangtung Province. Probably, then, the proper name for the barred populations in China proper is *Macropodus opercularis opercularis* (Linnaeus), while the dark ones from the southern end of the range would become *Macropodus opercularis concolor* Ahl.

M. o. opercularis is common in Formosa and in Okinawa, but I doubt that *M. chinensis* is found on those islands. There is an undoubted specimen of *M. o. opercularis* in the Stanford collection labelled as being from Korea, but I am inclined to doubt the locality. *M. chinensis* appears to be commonest in east central China, especially the lower Yangtze River and associated waters. I have not seen both species from the same locality and all of the *Macropodus* that I have seen from Kwangtung Province, in South China, are *opercularis*. However, the range of *opercularis* does overlap that of *chinensis*.

To my 1932 paper referred to in this article the following addition should be made: *Polyosteorhynchus yangtzei* Dabry de Thiersant, 1872, "Pisciculture et la Pêche en Chine," page 183, plate 38, figure 7, from the Yangtze River, is a synonym of *Macropodus chinensis* (Bloch).



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MAIL CALL

By William Vorderwinkler

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Unseen fry

Q. 1. I have had guppies for a long time and have read that guppies eat their fry. Not so long ago, I put my guppies in a tank by themselves. The female gave birth and none of the fry were eaten. I still have old and young in the tank. Why didn't they eat the fry?

2. I have some male bettas together. They are about 6 or 7 months old. When will they fight?

Joey Currie, Los Angeles, Calif.
A. 1. In their home waters, guppies seldom eat their fry because they don't get a chance to; if your fish are well fed and uncrowded they may not go to the trouble of catching their youngsters. But this will last only for as long as there is a sufficient amount of other food to be had.

2. A male betta does not attack another male unless it feels that the other is intruding on what he has established as his territory. A few male bettas can be kept together with fairly good peace and tran-

quility if the tank is large enough. It could be that your bettas have matured very slowly and are not yet ready to choose their own places. My advice is not to put a female with them, or they will quickly lose their good manners.

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Tropical Fish Hobbyist

Suckers as scavengers

Q. There is a stream near my house, and in the spring there are baby sucker fish in there after the big fish spawn. I was wondering if these could be used for cleaning algae in my tropical fish tank.

Dave Durocher, Oswego, N.Y.
A. Suckers generally come from quite cold water and would not do at all well in a tank which is kept around 76°F. It might be worth while to get a few and try and get them to acclimate to your higher temperatures, but I think you'd probably be wasting your time.

Believe it or not!

Q. About 2 1/2 months ago I purchased a piranha of about 1/4 of an inch in length. He is now 7 inches long. I have had him in a 100-gallon aquarium and have fed him frozen brine shrimp, hamburger, worms, and dry shrimp pellets. Is this growth unusual for a piranha? Is he dangerous for his age? When do his teeth become fully developed? I would like to know how big he should grow in

the aquarium, assuming that he is a black piranha. Could you please give me the description of a young black piranha?

Greg Perrault, Vancouver, B.C., Canada

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A. Shades of Ripley! From 1/4 of an inch to 7 inches in 2 1/2 months? There were times when I would have doubted you, but people have slapped me in the face with proof to often that now I am often referred to as "Gullible Vorderwinkler." The answer could be the 100-gallon tank, and you must have fed your fish very skillfully. Yes, I would say that such growth is highly unusual for a fish. At 7 inches, a black piranha is about as big as it will get in captivity, and its teeth should be fully developed. Although it is not regarded as one of the really dangerous species, treat it with caution. When young these fish are silvery with large brown spots and reddish fins. As they grow older the spots fade and the fins and the head area become black.

Watercress in the aquarium

Q. I would like to know whether or not it is possible to adapt watercress to an



Watercress, *Rorippa nasturtium*.

aquarium environment. I have tried some and it seems to be doing quite well. Also, if this is possible, would the plant be harmful to the fish?

Jacqueline Camp, Douglaston, N.Y.

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September, 1965

A. *Waterwrens* is not a strictly aquatic plant, but neither are some of the plants which have been adapted to aquarium life with a great deal of success, for instance such bog plants as *Ludwigia*. As for it being harmful, if a fish happened to have a hankering for some sassa salad and nibbled on it, I'm sure no harm would be done.

Detergent
Q. Lately I have noticed tiny white bubbles forming under the return flow of my filter. I have been informed that this is a detergent that cannot be removed from the water. Can this hurt my fish? I have noticed nothing unusual yet, but two firemouth panchax (*Epiplatys chaperi*) died within the

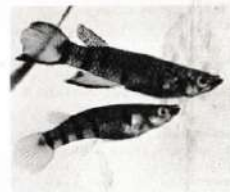
and wash it out with clean water; don't try to save the gravel by washing it, but use new gravel. Wash out the filter thoroughly and use new charcoal and glass wool. Then after setting it up with fresh water and letting it stand for a few days, put your fish back in it.

Betta feeding

Q. I am a subscriber to your magazine and always read your column. I have a problem and would appreciate your help. I have a male betta approximately one year old which is very beautiful. My problem is the feeding of this fish. When I first bought him, I didn't know what kind of food to feed him (he is the first and only betta I have) and fed him dry food from the can. He started getting pale and looked very sickly. Then one of my friends told me that bettas had to have bloodworms so I bought and fed him bloodworms, and within a week he started looking better and began to get his color back. Now he is really gorgeous, but he won't eat anything but the bloodworms. I have tried brine shrimp; he won't touch them. What I would like to know is will bloodworms alone supply all the nutrition that he requires and if there is another type of food that he will eat. I would appreciate any help that you could give me. I have grown quite attached to this fish and wouldn't want to lose him.

Hedy Weaver, Northfield, N.J.

A. *Hedy*, if the only food that bettas would ever eat is bloodworms, there



Epiplatys chaperi pair.

same week, both gasping on the bottom for a day before they died; both had seemed healthy the day before. Could the detergent have caused this?

Becky Williams, Akron, Ohio

A. The late Rachel Carson, in her book *Silent Spring* tells how disastrous the introduction of detergents into waters where fish are found can be. I do not know how you got the detergents into the water, but you might have made the mistake of washing the aquarium, gravel, or rocks with a detergent solution and then not rinsing it out meticulously. Never use any detergent or soap when washing your aquarium or anything that goes into it. My advice is to empty out the aquarium



Male betta.

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wouldn't be many bettas! There are many bettas around that have never tasted a bloodworm. Where they come from, they seldom get anything but mosquito larvae, and maybe sometimes tubifex worms. Many successful breeders give them mostly daphnia as live food, with feedings of prepared foods alternating. Bloodworms are an excellent food without a doubt, but there are many times of the year when you just can't get them!

Spawning neons and angelfish

Q. I am greatly interested in spawning angelfish. I have heard of the group pairing method used in mating many cichlids. Would 10 young angelfish pair off in an aerated, filtered 10-gallon aquarium with a temperature of about 76°F?

2. One German aquarist spawns neon tetras by using all-glass aquaria for the procedure. Does it really make so much difference whether it is all glass or not?
Chris Evans, Westwood, N.J.

A. 1. An angelfish is also a member of the cichlid family, but 10 young ones in a 10-gallon aquarium would soon require much larger quarters, long before they were large enough to pair off. A tank of at least 30 gallons would be more adequate for your purpose.

2. The Germans use all-glass aquaria much more than we do. Neons require scrupulously clean water, and an all-glass aquarium is much easier to clean than an ordinary one. This does not rule out the frame aquarium, but it must be carefully cleaned in any case.

Thermometer readings

Q. I have a bottom thermometer in my 10-gallon tank. It is buried in about a half-inch of gravel. In a treatment for ich I raised the temperature to 85°F, according to this thermometer. When I felt that the water was overly warm I checked the temperature with another thermometer (one that hangs on the side) and found it to be 10 degrees above

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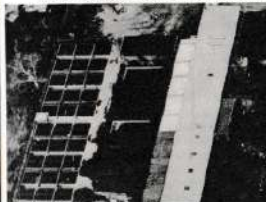
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the indicated temperature. As the water cooled down I dug out the thermometer and set it upon the gravel in almost the same spot. After about 2 hours the two thermometer readings were the same. Do you have some explanation for this?

Steve Webber, Menominee Falls, Wis.

A. Warmth rises, so the top layers of an aquarium are always first to heat up. The bottom, therefore, remains cooler for an amount of time varying with a number of factors. The water in the gravel is not only the lowest level, but also does not get circulated into warmer upper layers easily. All these facts would explain the readings you got. Even temperatures are most easily obtained when you are heating a tank up by supplying relatively vigorous aeration. This "mixes" the water, not allowing layers to form at all.



Corydoras arcuatus.

"Blinking" catfish

Q. I have a female betta, an opaline gourami, a female red swordtail, a platy, and a male green swordtail. All of the above fish, especially the betta and gourami, will nip my fingers when I feed them snails. Every time I put my fingers in the water now, the fish will nip them. The betta even jumps out of the water to snatch a piece of snail off my fingers. Is this normal?

2. One day as I was watching my cat-

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fish (*Corydoras arcuatus*) he seemingly "blinked." Please tell me what happened.

3. I have a babyswordtail. He is about 1 of an inch long. I don't know how big he should be to put him in.

Kathleen Hall, Owatonna, Minnesota

A. 1. The fish have learned to connect your fingers with food and, for this reason, rattle at them when you put them in the water.

2. The *Corydoras* species have no eyelids and are therefore incapable of blinking. Their eyes are capable of being turned to a great degree, however, and when they look down they seem to be blinking.

3. To put him in what? What I presume you mean is that you want to know how big he should be before he can go back into the big tank. As soon as he is large enough so that he cannot be swallowed, he can go back.

Fertile angelfish eggs

Q. I have a male black lace angelfish and a common female. They have spawned seven or eight times on a piece of slate. When the eggs are left in they eat them. When they are taken out and placed with an airstone to fan them they fungus. I feel that the parents are fed enough to keep them from eating the eggs because of hunger. I have been told that if the eggs are not fertilized they will fungus, and that this is what is happening. Is this true? Could my problem be in the one being a black lace and the other a common?

Ada Clark, Winston-Salem, N.C.

A. Things point to the fact that the eggs are infertile. When a male angelfish is left with a batch of eggs, his instinct tells him not only to fan them but also to keep on mouthing them to keep them clean. An infertile egg quickly decomposes and when

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the fish subjects it to the very slight pressure of licking it off in his mouth in bursts, the foul matter being expelled through the fish's gills. Many breeders think the eggs are being eaten, but I am fairly certain that this is never the case. What you need is another male, one capable of fertilizing the eggs properly. The fact that your present male is a black lace is not your problem; he may be perfectly healthy in other ways, but is probably sterile. I do not know if your fish is immature, but doubt it if he has already gone through the spawning act seven or eight times. There is one other possibility; you may be "spawning" two females! Such false matings occur with angels. In any case, changing the black lace angel will solve the problem, so long as the fish you replace it with is definitely a male.

Trout eggs

Q. I have a 10-gallon tank with all the accessories. I raise guppies and swordtails and have two catfish in my

aquarium. I have started lately to feed them a new food, trout eggs from the trout I catch while fishing. They tear them out of my hand when I put them in the water. I would like to know:

1. Is this a good food nutritionally?
2. Is it OK while fresh?
3. Frozen?
4. Are all types of eggs taken from the fish in this way OK to feed to tropical fish?
5. What is the best food for fish?

Ross Hoffman, Norristown, Pa.

A. 1. Fish eggs, if they are fresh and of the right size to be easily swallowed, are an excellent food of high nutritional value.

2. When they come from a freshly caught fish, fine.

3. The eggs taken this way can be frozen and will keep for a long time in this state, but thaw only what you will feed.

4. You need not limit yourself to trout eggs; other fish like bass or perch are fine.

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Eggs from saltwater species will do just as well, provided they are small enough to be swallowed by the species to which you feed them, and that they are strictly fresh. There is a great temptation when you have a good catch of fish to be a bit more generous than you should be.

Snails

Q. I have a problem with snails. Every one I put into a tank dies within hours after being placed in it. My tank is a 15-gallon one with an inch and a half of gravel and a few plants including

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Cubomba, Sagittaria and Vallneria. Could you tell me what kills them?

Henry Reids, Hickory, N.C.

A. Your letter is an unusual one; most people complain about snails getting into their tank somehow and multiplying to a point where they can't get rid of them. But you want to keep snails, and that is your own business. My guess would be that your water has become acid, a condition which most snails abhor. Alkaline water is what you want for them.

Guppy unlike leopard

Q. I have a guppy which changes the color of his tail from almost all black to just a black spot on it. Is this rare or common in a guppy? This one is not a fancy strain.

Larry Stanley, Kansas City, Mo.

A. No, this is not at all uncommon. A guppy will often show unexpected colors when he gets excited.



By Paul Hahnel

Three-quarter blacks

Q. I am a beginner at trying to raise guppies. I have some that I got purely by accident which are beautiful, and I have been told that they are German half-blacks. These are even more beautiful than any I have seen for sale anywhere. They are black from the gills down to about 1/3 of the tail, and the rest of the tail is red. The dorsal fin is so long that it practically reaches the last third of the tail. I have two males of which I am most proud. They are as I described except that one male's tail looks like a top sword-tail and some of his young have the same tail. Also, some young from these two males are beginning to get light pastel tails instead of red tails. These look pretty good to my untrained eyes. Is there any way you could tell me if I have prize

winner or a new guppy variety, or if I am just dreaming as a Technician?
Ron Kwilinski, Chicago, Ill.

A. What you describe are three-quarter blacks. We have them with blood-red tail fins here on the East Coast. If the young ones do not show vivid colors, it might be due to a deficiency in environment or food. Try to use only the most colorful of this strain of guppies for breeding. The most outstanding breeder of this kind of guppy is Fred Samelson, 2416-65 St., Brooklyn, N.Y. The best way to find out if you've got anything unusual is to take a pair of your fish to a show. The reactions you get there should be indicative.

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Bacon as guppy food?

Q. 1. For a year I have been feeding my fish bacon (the lean meat). Will this hurt them?

2. In trying to keep my guppies virgin I let them stay together for 3 weeks then separate each fish into a pint jar until I can be sure of sex. Is this good?

3. My females seldom throw over 10 young but there are huge. Please explain this. They get dried foods, bacon, brine shrimp and boiled spinach.

4. I have a community 10-gallon tank, a 5-gallon tank, a 2-gallon tank, and numerous gallon jars. After sexing my guppies, I put all my males in the community tank to mature and put 2 virgin females in each algae-covered jar and wait until they are large enough to let a male join them. Do you approve of this set up?

5. Name an aquarium society in Arkansas, please.

Jerry Wilson, Dumas, Arkansas

A. 1. I have frequently read in German magazines how fish have been fed ham, Sausage, horse meat, etc. But bacon is new to me; I think that even the leanest bacon would contain too much fat to be fed to guppies.

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2. Don't you think a pint is a little too small? Such a small amount of water can get polluted in only a few days and do a lot of harm to the fish. Try using larger containers. To separate each individual fish at 3 weeks of age is a sure way to get what you want.

3. You are fortunate to get large babies. The reason your females have such a small amount of babies may be due to their size, which does not leave room to develop more youngsters. It is also possible that your females may be eating some of the newborn fry. The menu of your fish could be more varied.

4. Yes.

5. I have no address of a club in Arkansas; write to the Mississippi Valley Guppy Club, Missouri Botanical Garden, Museum Bldg., St. Louis, Missouri. Maybe they can help you.

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Salts From The Seven Seas



By Alfred A. Schalts

Q. 1. Just recently I went to our pet-shop and told them I wanted to start a marine aquarium. They told me it was too hard for me to do. I am fourteen. They also told me that if you make one little mistake everything isn't good any more. Is this true?

2. Is it true that you can turn freshwater tropical fish into saltwater fish?

3. I would like to know also where I could get a pair of dwarf star fish. Can I order them through TFH?

Jim Shaif, Garden City, Mich.

A. 1. It's true, Jim, that one little mistake can lead to a general catastrophe, but when they told you that setting up a marine tank would be too difficult for you, they were wrong. Given the proper attention, a

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marine tank is not much more difficult than a freshwater setup. The only thing is, you have to be just a bit more careful, and there are more things to watch.
2. Yes; guppies, swordtails, and, of course, mollies can be converted to salt water.
3. The TFH advertisers can help you here. Do not order from the magazine, because we do not sell such things.

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Q. I am thinking about raising sea horses and would like some information concerning them. Here are the pertinent questions:

1. What is the required solution of salt water needed for sea horses?
2. What are the plants that could be included in the aquarium housing the sea horses?
3. What is the smallest possible aquarium size (in gallons) necessary? Will a 10-gallon one do?
4. What are the temperature and type of foods required?
5. What is the normal life-span of a sea horse in the aquarium? Is it true that they die easily?
6. What type of fish, other than pipe-fish, can be kept with sea horses?

Nello Capone,
Niagara Falls, N.Y.

- A. 1.** 1.025.
2. None.
3. Yes.
4. Like newly hatched brine shrimp. Best temperature is about 73° F.
5. Two to three years. Yes, they are fairly delicate.
6. None.

Q. 1. I want to start a saltwater tank. Can a regular tank be used, or must it be all-glass or all-plastic?

- 2.** How many fish can be kept in a 10-gallon tank?

- 3.** Must all saltwater fish be fed live food?

Terry Hesse,
Toledo, Ohio

- A. 1.** A regular tank can be used, but it must be thoroughly cleaned.
2. Three moderately small ones.
3. Yes, they can be fed prepared foods occasionally in small quantity, but live foods should predominate.

Q. I know you have had much success with saltwater fish, and I am willing to spend time and effort to achieve success.

1. Do you use potassium permanganate to sterilize?
2. What do you use for fungus and parasites? Can fungus be introduced with live brine shrimp?
3. What kind of filter is best, and do you use the resin filter? I can't find a source of supply, or is it a deep, dark secret?
4. Will silicone sprayed on the hood be toxic? What else can be used to cut down rust?

Mrs. B. T. Whitaker,
Tucson, Arizona

- A. 1.** No.
2. Copper sulphate. No, it is very useful.
3. I get good results using a power filter with glass wool only.
4. It is better to use a glass cover which fits between the hood and tank.

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The trunkfish, *Tetraodon gibbosus*, is just one of a number of morries that can exude a poison that is deadly to fishes. Photo by Klaus Payson.

These Fishes are Poison!

BY RODNEY JONKLAAS

I am inspired to write this article due to my good friend Jurgen Grobe of Hannover, Germany, perhaps one of the top amateur marine aquarists in Europe. Jurgen visited Ceylon a few months ago, and I was privileged to

accompany him on several jaunts into the countryside and to some reefs to collect and take motion pictures of tropical marines. Naturally we did a great deal of talking about fishes. Jurgen was astonished when I spoke of the incompatibility of certain well-known marines with others due to their ability to exude toxins from their skins. So, I promised to write this article, mainly for him, but also for many other enthusiasts who I hope will benefit from my (bitter) experiences.

Most fishes are capable of exuding substances from their skins; discuss do this to produce the first food for their newborn fry; others exude evil-smelling juices as a form of protection when they are alarmed. But the fishes we are interested in here can actually poison their enemies with skin exudations.

For quite some time I had a pet *Grammistes sexlineatus*, a small representative of the grouper family. His name was "Chaucer," but he's dead now, poor fellow. He poisoned himself to death. One day I decided to give his tank a new look, so I caught him up and foolishly put him in a gallon jar temporarily, while his tank got a scrubbing. I then went out of the room for a few minutes for something or other, and when I got back, poor Chaucer was dead as mutton. It all took less than 5 minutes. I had forgotten that some *Grammistes* are extremely sensitive to any disturbance and when unduly alarmed exude a poison which not only kills any other fishes confined with it, but also kills itself! The water in Chaucer's bottle was milky from the great amount of toxin he had exuded. I should have known better from past experience: many years ago, when I first started experimenting with collecting marines underwater by skin diving, I recall the mysterious deaths of other fishes I had put in with *Grammistes*. They all died in a few minutes. I soon found that *Grammistes* were the offenders and learned to keep them in separate containers, where they would not be unnecessarily disturbed by other fishes.

Another member of the grouper family, also small, but flatter and broader than *Grammistes*, is *Diploprion bifasciatum*. This fish, common in Ceylon's waters, is colored a rather striking pale yellow and black. Like that of *Grammistes*, its body is soft and almost jelly-like. But even more than *Grammistes*, this fish is poisonous . . . far, far more poisonous! *Diploprion* specimens can only be collected by night-diving. They sleep tucked away in the folds of large *Meandrina* corals or similar hard coral species. Once netted, they go almost berserk with alarm. I placed a newly captured specimen in a can with perforated sides and lid underwater only to find that within 5 minutes, despite the flow through the perforations, it had poisoned itself to death!

Other well-known poisonous fishes are some of the boxfish. The most familiar representatives from Ceylon are *Ostracion lentiginosum*, *O. cubicus*, and *O. tuberculatus*. They are not quite as self-toxic as *Grammistes* or *Diploprion*, but they kill other fishes just as effectively. In addition, any one of the three can poison the other two, yet survive itself, when they are kept together in a fresh-caught condition.

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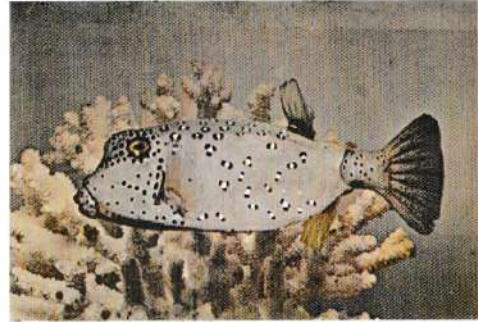


Several Ceylonese boxfish exude poison. This *Ostracion lentiginosum* is one such fish. Photo by Klaus Payson.

Another poison-exuding boxfish, *Ostracion cubicus*.



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Still another *Ostracion* species that exudes poison is *Ostracion tuberculatus*.

This is *Gasterin pictus*. Several of them were kept overnight in a perforated basket with *Tetraodon gibbosus*. By morning the pictus had succumbed to the poison exuded by the gibbosus. Photo by Dr. Herbert K. Axelrod.



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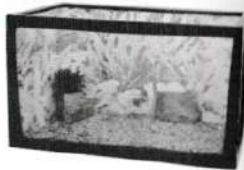


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More recently I discovered that the cowfish (*Lactophrys cornuta*) and the trunkfish (*Tetraodon gibbosus*) are also poisonous but less virulently so. Last year I collected, by deep diving at night with aqualung and flashlight, a nice selection of *gibbosus* and a few of the wary *Gasterin pictus*. The *gasterins* succumbed to the insidious poison of the *gibbosus* the next morning, even though they had been kept overnight in the sea in a basket through which there was ample circulation.

Keeping this in mind, you may well imagine the problems confronting a marine tropical collector. There is a constant demand for boxfish, *Grammistes*, and cowfish: I can never collect enough of them. But on a diving trip it is not profitable or economical to collect only these; other lovelies of the reefs show up, and it is only sensible to net them too. Thus, the number of containers carried must be increased, and a net used to collect boxfish cannot be used, without drastic rinsing, on another, non-toxic fish. When you bring a netful of gasping boxfish to the surface, just watch the extra-heavy froth and bubbles. This is caused by the exudation of toxin and is a useful danger signal. Still another problem with boxfish is that you cannot crowd them either. They are not only prone to poisoning themselves, causing a mass execution, but they also love to fight with one another!

Working down deep, looking for other marines, I carry an aluminium container with perforated lid and sides. This has a spring-lid which assures that it stays shut under the water, opening only when I want to introduce a new capture. But what do I do when I catch a boxfish or a *Grammistes* and the can has already got some harmless tenants? Or what do I do when I have a mess of boxfish and a nice young *Pomacanthus imperator* turns up? As I have already said, even with perforations on lid and sides of a container, it proves fatal to combine toxic and non-toxic fishes. Well, I now carry another type of container, plastic with a screw lid tied to the can. Carrying several cans is tiring and confusing. A rival diver I know does this too and often forgets which fishes are in which can, and he ends up with a lot of dead beauties. As for me, into the plastic container go the poisonous ones, and into the metal can go the others. Above water, the same kind of problems are on the increase . . . more bags, more containers, more diffusers, more everything! Sometimes I wish I could strike the poisonous fishes off my price-list and save myself all this trouble. But the demand is astonishing, and I have to please my clients in Europe and America.

An interesting fact is that by frequent water changes you can temporarily exhaust the poison supply of the poisonous fishes mentioned here. They just can't keep exuding poison indefinitely. After the supply runs short, the exhausted fish gets a bit pale and quiet, but it lives. In stock aquariums and also in home aquariums, one often sees the poison-exuding fishes living peacefully with others. The secret is that they were introduced when lacking or deficient in poison, and, once settled down, they do not need to exude it.

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But frighten the fishes in the tank with a net and disturb the poisonous ones unduly, and you're in for a lot of cloudy water and casualties. Yet, poison-exuders have certain advantages over other marines. For one thing, they all are extraordinarily exempt from attacks of *Oodinium* fungus, No. 1 fish killer in the marine aquarium. Perhaps the fungus is repelled by an exudation of poison when it tries to gain a foothold. They are also quite immune to attacks from other fishes when introduced (after several rinsings, of course) into a community marine aquarium. They simply don't taste good, and even the tiniest boxfish if swallowed by a grouper or lionfish, is hastily ejected! The pugnacious *Dascyllus* and sergeant majors, once established, will not hesitate to attack even the largest intruder into their domain, but after one nibble at a poison-exuder they change their minds.

On the other hand, nearly all the poison-exuders are quarrelsome with their own kind. You can put several *Grammistes* into a tank simultaneously, and they'll get on fine. But introduce a newcomer after the original fish are established, and you are in for a battle royal with every chance of a deadly mass-exudation of toxin. Boxfish are probably the most quarrelsome and unpredictable. A bunch of small ones may get on fine till suddenly one turns bully, and unless you take speedy action you'll find the others dead or dying with frightful abrasions all over them. Large adult boxfish are particularly quarrelsome, especially *Ostracion lentiginosum*. And for an exporter like myself, it is not always economical or convenient to have every boxfish in a separate tank. I must also bear in mind that a tank occupied by a boxfish (or any other poison-exuder) is unsafe for normal marines even after the original occupants are gone. It has either to be reserved for poison-exuders of the same species as have previously occupied it, or it must be thoroughly cleaned, rinsed, and filled with pure fresh saltwater. True, saltwater is readily obtainable in Ceylon, but all this takes time, and time costs money!

It seems that all poison-exuders have personality. They make singularly charming pets when kept by themselves. Occasionally they are friendly

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Cowfish, *Lactophrys cernata*, another poison-exuding marine found in Ceylon.

towards one or more of their own kind, and some lucky marine aquarist can have a group of them in a tank. But *Diploprion* still presents a knotty problem. I have not yet found a suitable way of collecting, storing, and shipping these rather attractive fishes. This is particularly sad because they are not quarrelsome and get on fine together. Finally, I have learned from bitter (and expensive) experience that poison-exuders don't take kindly to tranquilizers during shipment. This means shipping fewer per carton with much greater care than usual.

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