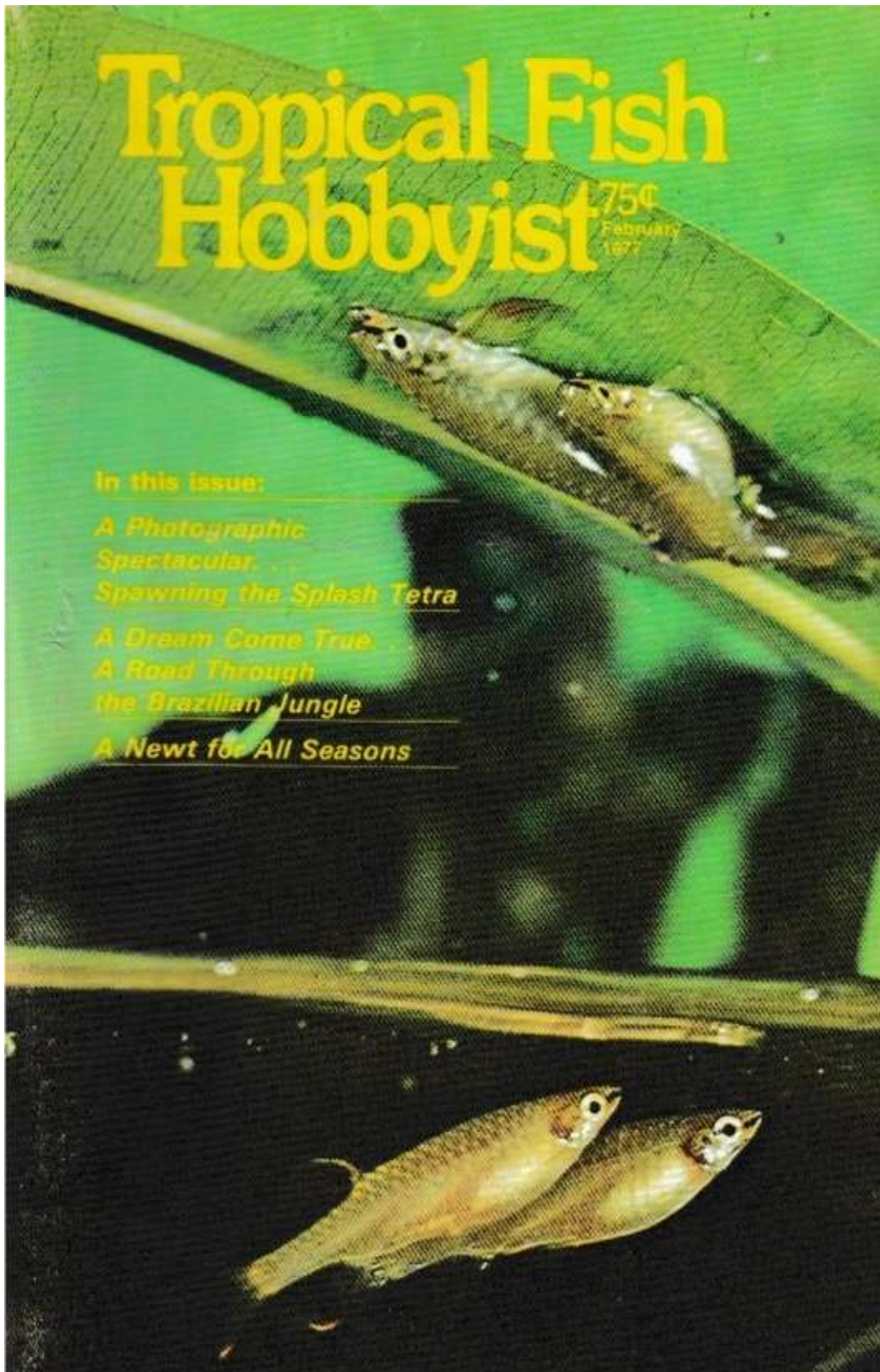


Tropical Fish Hobbyist

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February
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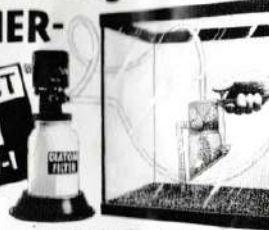
In this issue:

- A Photographic Spectacular*
- Spawning the Splash Tetra*
- A Dream Come True*
- A Road Through the Brazilian Jungle*
- A Newt for All Seasons*



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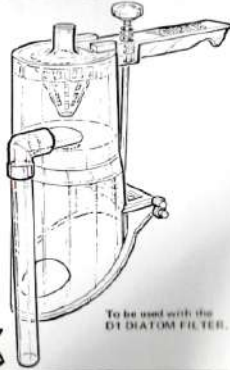
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Tropical Fish Hobbyist

VOL. XXV, February 1977 (#252, No. 6)



Cover
A pair of *Copelia
arnoldi* (splash
tetras) spawn on the
underside of an
emergent leaf while
two other gravid
females patiently
wait their turn to
spawn with the male.
Photo by R. Zukal.

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The shield on the ferryboat proclaims the DNER highway-through-the-jungle feat of Brazil, but the sole life preserver on the huge ferry brings one down to earth very quickly.

Collecting

A Dream Come True... A Road Through the Brazilian Jungle

by Dr. Herbert R. Axelrod
Photos by the Author

Part I

When Heiko Bleher invited me to join him on his first trip through the Amazon jungle, I could hardly believe that the Brazilians had finally finished the Transamazonica Highway which was to open the "riches" of the jungle to the civilized world. Unfortunately, I couldn't join Heiko on his expedition, a daring two-week trip from one end of the highway to the other, but I did harbor a slight feeling of jealousy when I heard that he was going anyway. . . with his brother, Michael, and with Hans Baensch of Tetraworks. Of course my jealousy didn't really ignite until I visited Heiko at his home in Germany, where I viewed the magnificent photographs of his adventures

along the way. . . including an attempted hijacking! "O.K.," I said, "Let's plan on another trip, and I promise that I will go this time!" So we planned a trip for late summer, 1976. We actually kept our date and met in Manaus, Brazil.

Then the trouble started. On Heiko's previous expedition he had spent a huge sum of money buying special boats and motors, a special truck to carry everything and a special gear for sleeping, cooking and living in general. When we met in Manaus we had only a few nets, some assorted photo gear and lots of courage. What a surprise to find out that we could not rent a vehicle to take out of Manaus,

OOPS! If we hadn't noticed that this bridge was washed out we could have simply disappeared into the river without a trace! The army is constantly rebuilding and repairing the bridges. When the bridges wash out, ferries are brought in to maintain the traffic across the water.



because Manaus is a free port, and anything you take out of Manaus into Brazil proper is dutiable!

As usual, Willy Schwarz came to the rescue! He had a VW Kombi that had been brought outside Manaus and could take it back out anytime! Heiko also found a small VW bug... so off we went heading straight down the highway connecting Manaus with Humaita a distance of 666 kilometers, or 400 miles. Along the way we had to use seven ferry boats, but essentially the trip was interesting and fun.

Our party consisted of Dr. Jacques Gary of France, the world's leading authority on characoids (his book *Characoids of the World* will be published in 1977 and will be the most complete work done on characoids ever!); Guy van den Bossche, a collector of shells and butterflies from Harelbeke, Belgium; Adolf Schwartz, son of Willi Schwartz, and, of course, Heiko and me. We loaded our truck down with 10 pounds of salami my mother

provided for me when I stopped in Miami to say goodbye, 100 liters (about 25 gallons) of gasoline, fish preservative (formalin), food, nets, cameras, sleeping bags, insect repellent, foam mattresses, fish boxes and bags in which to bring home our beautiful new discoveries (if there were to be any!).

We arrived in the downtown section of Manaus, where our first ferry was to take us across the Amazon river to Careiro at 6:00 AM. Another ferry later on took us across the Rio Tupana, Rio Acara and various unnamed tributaries which ran from the mighty Rio Madeira. We had a four-hour wait for the first ferry because trucks have first priority and cars are loaded onto the ferry only after the trucks are on. The first ferry ride took two hours! After this first ride the other ferry crossings were only a few minutes, except for the ferry crossing at Humaita, which took us across the Rio Madeira to Paraiso (Paradise). The ferries are open barges pulled by motor boats. They

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hold a hundred people or a dozen cars and trucks. They are well built and have a symbolic life-preserver made of cork and broken into several pieces so that more than one person could share it should there be a need! When I asked the captain why there was only one life-preserver (and that one uselessly broken) for so many people, he merely shrugged and said "Muito piranhas aqui," which I guess means "lots of piranhas here" . . . and the shrug meant . . . "So why worry?" I didn't tell my friends what was said, for all along I had told them not to worry about piranhas!

We finally got off on the road running southwest from Manaus, the only road for THOUSANDS of miles through the jungle. How exciting!!! How often had I been on the various rivers of Brazil wondering what it would be like to be able to go straight through the jungle and to find little pools and ditches that contained fishes no one ever dreamed about! Now I had my chance, and I could hardly wait for us to come upon our first stream.

All along the jungle highway, at almost every river crossing, we were forced to detour because the bridge was washed out. Many bridges were only half washed out, though . . . the center half being missing, and the unsuspecting driver who just kept going would find himself in for a very dangerous bath, because in most cases if he went into the river his vehicle would sink out of sight and no one would ever know where to look for him. Hundreds of vehicles and their drivers have disappeared from the road without a trace. Most people believe these disappearances are the work of a gang of bandits who drop a large tree across the road. When the unsuspecting driver gets out to remove it, he loses his life and vehicle at the same time. Anything left dead in the jungle is quickly consumed by foraging scavengers, not limited at all to the *urubú*, or

8

vultures as we know them in English.

Heiko told me that on his previous trip along the highway some men tried to stop his truck this same way, but Heiko and his friends were able to speed right through the barricade, thanks to the quick thinking of Michael Bleher and the excellent driving of Hans Baensch. Were they less courageous, they might not have returned to tell us about their great adventures.

I didn't have to wait too long to see my first new fish, for at Rio Tupana we decided to pull off the road at the ferry dock to have a swim and catch some butterflies. Someone had tried to get at a honeycomb and had knocked a piece of the bees' sweet comb onto the ground. It attracted thousands of magnificently colored butterflies that Guy wanted to take back with him to Belgium. While Guy caught butterflies, Heiko put on his flippers and mask and snorkel and took a look around.

"Hey, Herbert, come here and see a few millican catfish!" I rushed over to the edge of the river and could hardly believe my eyes. The fish were so thick

you couldn't see the bottom of the river. On one side of the river were millions of *Hemiodontichthys acipenserius* and *Rineloricaria* of several species, while on the other side of the river were naked catfish of the genus *Pimelodella*. We all got our bathing suits on and started snorkeling. The armored catfish were so plentiful you could catch them with your hands. But we had nets, which made it much easier. Unfortunately we weren't interested in bringing any of these things back alive, and after an argument about whether the long-snouted fish were males and the rounded-snout ones females, we preserved a good bunch of them for further study, took the ferry across the river and had a dinner of canned soda, dry biscuits, salami and fresh fruit. It was getting dark, so I took another swim in the river, diving among the fallen logs in hopes of finding something like an all-red discus. I searched for almost an hour while my colleagues feasted on their dry biscuits. I was just about to give up when I caught a glance of a pair of huge angelfish. Im-

agine, looking for hours and finding only millions of catfish and one pair of angelfish—and then I couldn't even catch them since there was too much debris. Ah, the debris! I saw the same debris when they blew up coral reefs to make ports . . . the same debris when they raped the jungle to make roads . . . dead trees, empty fuel drums, beer cans, old clothes, old tires and dead from pollution as the oil drips from the tired motors which strain, day after night, to pull a heavy barge ferry across a rapidly moving river.

We drove on and on for hours. I followed the brown dusty snake that was a typical Brazilian unpaved highway. Without warning the highway would suddenly be paved . . . at equally without warning huge potholes could tear the wheels off the truck and send you careening down the embankment to be buried forever in the u-

One of the stream-dwelling catfishes that we encountered on the trip was the *Ancistrus* species. This bizarre fish is known as the branched bristle-nose catfish.





The huge (six feet in diameter) corrugated drain has formed a "flood pool" by the erosive action of the quickly moving water.

named river which formed alongside the road... the same "canals" that are so common in Thailand and Holland. Klungs without names.

These ditches deserve lengthy discussion, for they are certain to have a huge impact upon the ecology of the area. When the roads were built through the jungle, they had to be elevated above the water line or they would be submerged during the rainy season. In order to get the dirt with which to elevate the highway, huge bulldozers dug deep ditches on each side of the road and piled the dirt in the middle, raising the road 20-40 feet above the low part of the dirt-ditch. Spaced along the way were huge corrugated tubes about six feet in diameter; these tunnels allowed the water to escape from one side of the road to the other, depending upon the origin of the water. Often a stream overflows, causing the water to rise on only one side of

the road. As this water searches for relief against the dam effect of the road, it rushes out of the tunnel with great force, splashing some 20 feet away and digging a deep pool at the same time. This pool may be 30 feet deep as the silt is washed away under the constant pressure of falling water. One saving grace from all this wanton destruction is the "take-over" of the area by a beautiful and delicate bamboo.

If you can imagine a huge torrent of water plunging into the soft, rock-free soil which forms the garden from which sprang the Amazon jungle, you can imagine the cocoa-brown mud which would be carried away by the resultant deluge. This mud is not carried too far before it is deposited, layer upon layer, waiting patiently to trap unwary animals that might creep towards the inviting pool laying in its center. Unfortunately I was almost one of its victims.

As soon as we learned that these "flood pools" were really big traps seemingly set by nature just for ichthy-

INTRODUCING...



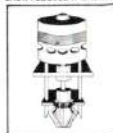
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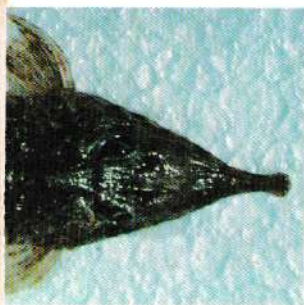
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Except for the elongate snout, these two loricate catfishes can easily be mistaken for different forms of the same species. The fish shown above is actually a member of the genus *Rineorhynchus*, and the one below is *Hemiodontichthys acipenserinus*. We found both of them at the same place along the Rio Tupana.



ologists who wanted a good sample of the small fishes to be found in the area, we rushed to each one as we passed it along the highway. The "flood pools" were always 20-30 feet down from the top of the highway, and since the slopes of the sides of the road were very steep, almost too steep to walk down, we developed the habit of running down them, since this proved to be the safer way of descending.

Unfortunately, I descended into one which was surrounded by silt. Were it not for the quick thinking of Guy van den Bossche, who gave me a helping hand, I might still be sinking into that muddy ooze, perhaps on my way to becoming a fossil which might be found a million years from now by some future Ph.D. student who would write about a tribe of giants six feet tall and 195 pounds who lived among the small Indians of the jungle, dominated them and wore clothes while the five-foot tall, 110-pound Indians were forced to go around almost naked! Oh, Art Buchwald!

One of the most serious effects of the "flood pool" syndrome is that the silt spreads out, more or less in a concentric circle from the point of impact. As the fine, dust-like earth settles, it chokes off the soil's natural porosity to form a type of clay and help retain the water which the fishes need... but which is death to the trees and larger plants that require water to reach their roots, which may be 20 feet deep. This results in huge barren wastelands punctuated with hundreds of huge, dead trees. As the trees dry they become tinder for lightning fires... and lightning fires are one of the most common catastrophes in the jungle. So intense and smoky are these fires that their heat and fumes kill every living thing within a thousand yards from the center of the raging inferno. This effective clearing of the land then enlarges the sphere of influence of the "flood pool," which expands with each tor-



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rental rain until finally it becomes a very permanent, soft-bottomed dead lake. The organic material trapped in the silt is devoured by anaerobic bacteria (bacteria that live without oxygen which give off a poisonous gas that smells like rotten eggs). This gas is trapped in the lower reaches of the lake and prevents anything from living in the water. Thus, without any infusoria growing in the lake, fishes are usually unable to reproduce and have suitable food for their newly hatched fry; this means the lake will become almost devoid of any interesting fish life.

In order to avoid this phenomenon, Brazil will have to work quickly to put in a drainage system that will preserve the integrity of the various river systems. But Brazil is hard-pressed for oil, and it takes a lot of oil to surface the highways... to build the drainage ditches, etc. But the drainage system

must be completed, because already the ditches along the sides of the highways are eating under the highway itself, and all along the way we came upon huge chunks of highway that had simply caved in because the water had eaten into the sloped banks and removed the supporting earth from underneath the highway. The jungle was fighting back!

Editor's note: Because of the length of Dr. Axelrod's trip along the Transamazonica Highway and his many exciting adventures and observations along the way, this article will be continued in the next issue of Tropical Fish Hobbyist.

The "flood pools" are rich in fish, since many tiny fishes are trapped as the waters recede, and the only place they can go is into the waters of the "flood pool." We fished every "flood pool" we came to.



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Editorial

As I See It. . .

Every month TFH receives hundreds of letters from hobbyists around the world. These letters contain questions covering a plethora of subjects ranging from identifying and breeding various species to curing diseases and, believe it or not, even to the edibility of certain aquarium species! Although every inquiry is read, unfortunately it is not possible for all of them to be answered. To answer all of these letters would require that we have a full time staff of ten people having nothing else to do. As a more practical alternative, letters are chosen that cover the most pertinent and oft-repeated problems, so that they are of interest to the greatest number of readers, and these are used in the "Mail Call" column.

Of the many types of inquiries that come across my desk, the one that I can almost bet on seeing at least three times every day is the one from the motivated hobbyist who, with good intentions, has just purchased an expensive and unusual fish about which he knows nothing, and he is now pushing the panic button because the fish is lying in a corner of his tank slowly dying.

If that is you, take comfort in the fact that you are not alone. I too have been guilty of such impulsive buying without first researching the needs of my intended pet. Fortunately for my piscine acquisitions, though, I have in my fishroom several vacant tanks that are each maintained under different chemical and physical conditions so that they can be used as hospital tanks or acclimation tanks for new residents when the need arises. In addition, we (the fish and I) are lucky in that I have a spouse who has no objection to having at least one or two rooms in the house decorated wall to wall and floor to ceiling with aquariums. Such, unfortunately, is not the case with most of the hobbyists from whom these inquiries come, so fast answers are often needed.

Of course we shall endeavor to continue answering these inquiries via "Mail Call" whenever possible, but when a letter is received in February the answer won't appear in print until April or May and very often even later than that. By the time the hobbyist receives his answer, the fish in question has long since departed to that "great aquarium in the sky!"

February, 1977

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The solution is not to stop writing to "Mail Call," but rather it is to resist the temptation to purchase a fish that is new or unusual until you can get some information on how to keep it alive and healthy. You may feel that by the time you gather the necessary information all of the fish of the species you want will be sold and you'll never see them again. I can understand this feeling, for I have experienced it myself. Be advised, however, that if the fish are worth having in the first place, your dealer will most likely get some of them in again, and if he is a sharp businessman, he will take your phone number and call you when they arrive.

So before writing to TFH, you should first exhaust all local sources of information. The best source is, of course, your dealer because if the fish in question is alive and healthy in his tank, he must be doing something right! Ask him about the water chemistry and what he is feeding it. If it is not eating for him, it is not likely to do so for you either, and perhaps you should forget it for the time being. However, if you are still determined to own this fish you might try the hobby literature. There are very few aquarium fishes about which nothing is said of their requirements in one or another of TFH's many books. If your dealer doesn't have such a book (and that is very unlikely), most public libraries have at least a few basic hobby books on their shelves. In addition, you can contact other hobbyists in your area. If you don't know any, then contact a nearby aquarium society. Your dealer should be able to tell you whom to contact.

If, after you have exhausted all close-at-hand sources of information, you still don't have the needed facts to enable you to keep the fish you want alive and happy, then it is time to write to TFH. Tell us that you are contemplating the purchase of a certain species and **before doing so** you would like to know something of its requirements. Very often we can refer you to a source of information, and a stamped self-addressed envelope will usually bring a reply. Alternatively, your letter may be chosen for publication in the "Mail Call" column, in which case your question will be answered as completely as is possible in the limited amount of space that is available. A simple, straight-forward, single question has a much better chance of being selected than a lengthy letter containing a long list of questions.

Following the suggestions I have outlined here will certainly increase the probability that you will be successful with the unusual species that you would like to own.

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Meet the Hobbyist

**Claudio Eduardo Limone...
The King of Guppies in Brazil**

by Dr. Herbert R. Axelrod
Photos by the Author



Healtia Coutinho Limone and Claudio Eduardo Limone (and their famous Pekingese that bit the author as soon as he walked in the front door) pose proudly in front of their guppy rack.

translates into English as "the Rio de Janeiro Association of Aquarists, Fish-breeders and Ichthyologists," in November, 1976 I hardly expected to meet a man who raises guppies equal in quality, size and condition to the best guppy breeders in the world! Across the brand-new bridge which joins Rio de Janeiro with Niteroi

When I was invited to speak to the ACAPI (Associao Carioca de Aquariofilia Piscicultura e Ictiologia) which

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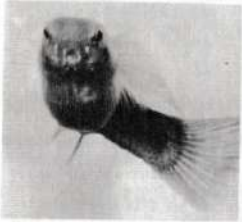
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The good health of Claudio's guppies is evident in these photos. His half-black males such as the one on the right are all active swimmers. His females, like the one below, are all robust and alert. In the bottom photo Claudio Eduardo Limone examines some special guppies at his home in Niteroi.



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Tropical Fish Hobbyist



From left to right: Dr. Burt Frank, world's leading *Neisseria* specialist, Limone, Claudio de Souza Fragran, William Zeraick, Jr. and Mrs. Limone. Controlled guppy matings are done in small glass tanks, then the developing fish are separated by sex and placed in rearing tanks (left).

there is a bank manager whose name is Claudio Eduardo Limone. He lives with his wife, two kids and a mean Pekingese in a high-rise apartment which contains about 50 tanks full of guppies. I didn't envy the people living underneath him! The weight he had on the floor was, I am sure, quite in excess of the recommended load. But this didn't stop Limone from having an immaculately clean, well-organized guppy room. He feeds his fishes like clock-work. The fry are fed five times a day for the first two months of their lives; the adults are fed two to three times daily. The meals consist of one healthy feeding of newly hatched brine shrimp and/or live white worms which

he cultures; subsequent meals are prepared Wardley's or Tetramin. Limone is most concerned about the shortage of brine shrimp eggs, even of the worst quality eggs! He just cannot get them. . . neither can anyone else.

Limone really raises giant females! I saw one that was almost three inches long. He has no secrets, though. Everything he did was right. The right food and changing 25% of the water twice a week.

Claudio started raising guppies almost three years ago and in short order he won all the prizes there were to win in Brazil! He hopes to be able to enter some of the American and European competitions soon to see how he measures up. I have never seen nicer guppies in terms of color, size and health, but with the various standards as regards uniformity of colors in dorsals and tail, who knows how he'll do.

The racks and setup that Limone has are evident from the accompany-

February, 1977

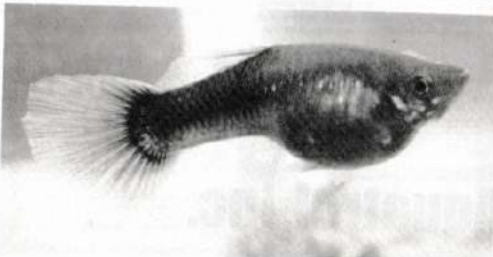
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Claudio raises his guppies in bare tanks containing some free-floating and potted plants. Since raising prize guppies requires very heavy feeding, bare tanks make maintenance a lot easier.

ing photos, and I was impressed that even though it took a long hour's ride to Niteroi from my hotel in Rio and our visit wasn't over until about midnight, Limone felt that he had to drive all the way back with me to see the new *Corydoras* we discovered in the region. . . but that's another interesting story!

For those traveling to Rio, perhaps you might like to contact Claudio Eduardo Limone, Rua Visconde do Rio Branco, 661, apartamento 802, Niteroi, Estado do Rio de Janeiro, Brazil.

A three-inch long Limone female guppy.



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Tropical Fish Hobbyist

Idea of the Month



Steady Heat by Erik Spalding

As the cold winter months approach, are you having trouble keeping the temperature in your aquarium constant? This is an especially difficult problem in an aquarium that is situated against a cold outside wall or a win-

dow. Buying an oversized heater is not the answer, because it is difficult to control in a small aquarium since the heat will rise too fast.

Try using a five cm (two-inch) layer of fiberglass roof insulation glued to the back and sides of your aquarium. If your tank is on a stand so that the bottom is open to the air, glue the insulation to the bottom of the tank as well.

So that your tank keeps its pleasing aesthetic look, the insulation can be wrapped in colored foil such as that sold by your pet dealer for use as an aquarium background. This insulation can be glued to the reverse side of almost any aquarium background and will give you a steadier aquarium temperature, greater heater efficiency and—as an added bonus—a lower electric bill too!

Enjoy your fish? You'll enjoy them more in a bigger tank.



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For Beginners

pH
pH
pH...

What is it? Why is it important?

by Marshall E. Ostrow

One frequently encountered item in many hobbyists' arsenal of equipment is the inexpensive and fairly accurate pH test kit. We buy these kits because most hobby literature correctly advises us that pH is important to our fishes' well-being. Did you ever wonder what pH really means or why it is so important?

The symbolic representation for hydrogen ion (H⁺) potential is pH. Hydrogen ion potential is merely a way of mathematically expressing the concentration of H⁺ ions in the water at any given time. Measurement of H⁺ concentration tells us how acid or alkaline the water is.

Many molecules, water being no exception, have a tendency to dissociate into electrically charged sub-units, one being positively charged and the other negatively charged. H₂O, better known as

water, dissociates into H⁺ ions and OH⁻ ions.

The proportion of molecules dissociated at any given time in a given container of water depends upon physical factors such as pressure, temperature, purity, etc. The dissociation is reversible; that is, H⁺ ions and OH⁻ ions tend to recombine into H₂O molecules. When we say that dissociation and re-association has reached equilibrium, we do not mean that this activity has ceased. On the contrary, ionization results in a dynamic equilibrium. When we speak of equilibrium, we speak of a balance of rates; that is, at equilibrium, the rate of dissociation of water molecules exactly equals the rate of re-association of H⁺ and OH⁻ ions. Depending upon physical conditions, the equilibrium point for the rates of these reactions varies.

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This now brings us to the elusive term pH. What does it mean? It is simply a measure of the concentration of H⁺ (and OH⁻ ions) in the water at any given time. That concentration is measured in moles per liter. (We won't go into that here. If you are interested, moles/liter is clearly defined in any high-school or college chemistry text.)

The concentration of ions is expressed as a fraction of 10⁻¹⁴ moles/liter. At a pH of 7.0 (neutral) the rates of dissociation and re-association are such that the concentration of H⁺ ions is 10⁻⁷ moles/liter and the concentration of OH⁻ ions is 10⁻⁷ moles/liter. When the H⁺ ion concentration is 10⁻¹ moles/liter, the OH⁻ ion concentration is 10⁻¹³ moles/liter. In this case the rates of dissociation and re-association, to be sure, have come to equilibrium, but the rates are much faster than they were at an H⁺ concentration of 10⁻⁷, so that at the time of measurement, there were many more H⁺ ions present.

How can you have a higher concentration of H⁺ ions over OH⁻ ions if the rates are at equilibrium? This occurs when there is something else in the water that produces H⁺ ions and some other form of negative ion. Suppose that somebody had dropped some sulfuric acid (H₂SO₄) into the water. H₂SO₄ dissociates into two H⁺ ions and one SO₄²⁻ (sulfate) ion. But H₂SO₄ has a much greater ionization potential than water. Since H₂SO₄ is adding H⁺ ions to the water, but

the negative ions are SO₄²⁻ rather than OH⁻, the concentration of H⁺ ions at any given time is much greater than the concentration of OH⁻ ions. So that when the H⁺ ion concentration is 10⁻¹ moles per liter (remember we are dealing with negative exponents so that 10⁻¹ is a larger number than 10⁻², etc.) the pH measurement reflects that concentration and in this case the pH is 1.0. That would indeed be a very acidic solution.

Therefore, when the pH is neutral it is 7.0 and the H⁺ concentration is 10⁻⁷ moles per liter. When the water is acidic, the pH is less than 7.0 and the H⁺ ion concentration is greater than 10⁻⁷ moles/liter (i.e. 10⁻⁴ moles/liter). When the water is alkaline, the pH is greater than 7.0 and the H⁺ ion concentration is less than 10⁻⁷ moles/liter (i.e. 10⁻⁸ moles/liter).

An important question to be answered now is: Why is it important when moving fish from water of one pH value to water of a different pH value to do it gradually? After all, one might very logically reason that 10⁻² (pH 7.0) is such a small H⁺ ion concentration (one ten-millionth of a mole per liter) that 10⁻⁸ (pH 6.0) is not really that much different. However, for your fishes sake, be advised that you are dealing with numbers that are of different orders of magnitude. 10⁻⁸ equals one one-millionth of a mole per liter which is ten times as great as 10⁻⁷ (one ten-millionth of a mole per

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liter). Therefore the H⁺ ion concentration at a pH of 6.0 is ten times as great as it is at a pH of 7.0. At a pH of 1.0 the H⁺ ion concentration is one million times greater than it is at a pH of 7.0.

As a rule of thumb, the pH of a fish's water should never be lowered or raised by more than 0.4 in 24 hours. For example, it should not be decreased from 7.0 to anything lower than 6.6 in a 24 hour period. It is important too, that the change be made in steps of no more than 0.2 each, and each change should be separated by at least a few hours. Any changes more drastic than this will damage the delicate gill fila-

ments and cause respiratory distress. More rapid changes will also upset the cellular osmotic balance (equilibrium of ion concentration inside and outside the cells). This kind of stress can result in a slow and agonizing death for your fishes.

It should also be kept in mind that each species has its own particular ecological requirements. Some fish are more sensitive to change than others, while some have a broader range of tolerance for different pH values than others. Before making any intentional pH changes, one should familiarize himself with the pH requirements of the species in question.

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**Salts
From the
Seven Seas**



**Octopuses
in the
Aquarium**

by Warren E. Burgess

Without a doubt the most intelligent invertebrate that can be kept in the home marine aquarium is the octopus. They are often seen for sale by marine pet dealers at a reasonable cost but can easily become one of the most priceless possessions of the aquarist in a very short time. For those people who want a special rapport with their aquarium inhabitants, the octopus fills the bill very well.

The intelligence of these creatures has been put to the test in many different ways and it has been found that they indeed score very highly on these "IQ" tests. In a college behavior course, our class team devised a simple experiment to see what an octopus would do when presented with certain problems. First we placed a crab (a natural prey of the octopus) in a plastic bag and placed the bag in the octopus tank. We thought that the crab would be visible but that no odors or sense of touch would be available to the octopus for reference. Without hesitation the octopus dashed across the tank, seized the bag and covered it with its



When swimming by jet propulsion the octopus keeps the arms close together and trailing behind. Photo of a blue-ringed octopus by U. Erich Friese.

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body and arms so it no longer was in view. A few seconds later the empty bag was pushed away and the octopus was ready for its next meal. The plastic bag seemed to be no obstacle, so we decided to make things more difficult by placing a crab in a glass screw-top bottle. Again the crab would be visible, but this time not as accessible. The same reaction occurred and the bottle also disappeared under the octopus. After a few moments of very rapid color changes the normal color returned and the empty bottle and loose cap suddenly appeared. The octopus was easily able to unscrew the top and reach the crab. After a few trials with additional crabs the octopus became quite adept at opening the bottle and no longer even changed color.

All that an octopus requires for its well-being is a large enough tank, clean water, sufficient food and some nice places to hide. This last requirement can be met by providing a number of rocks, shells or other such decorations in the tank. The octopus will arrange things as it pleases, usually piling up small stones and/or bits of shells or other loose items in front of its home. The tank must be covered carefully. It is quite astonishing how small a crack or hole a medium-sized octopus can get out through. With a very supple and pliable body and strong arms to move the top or other obstacles, an octopus can get out rather easily in most instances. A favorite route out of the tank is past the filter siphons or air hoses.



A colorful octopus from the Great Barrier Reef of Australia. Photo by Keith Gillett.

One of the octopuses' favorite foods is crabs or other crustaceans, but they will take pieces of fish and clams as well. Young octopuses often thrive on a diet of fiddler crab legs in the aquarium.

The octopus has eight arms, each provided with two rows of suckers, smaller at the tips and becoming progressively larger toward the body. It is with the use of these suckered arms that the octopus can move about over the bottom with ease. For faster movement in open water, however, they use a form of jet propulsion. spurts of water are forced through the siphon to provide the power for this type movement. In case of danger the octopus will jet away after leaving behind a cloud of ink, a substance which blocks the view of the escape route or is distasteful to the aggressor. If the octopus reaches its hole safely it may protect itself by placing some arms in the way with the suckers facing the intruder. In cases of dire emergency it may lose an arm to a predator; this will eventually regenerate, but the remaining seven arms are enough to keep things going.

Collecting octopuses in shallow water can be very easy. An inspection of old tin cans, bottles, large shells, etc. will eventually produce an octopus or two. Larger ones in their holes are more difficult to dislodge as even small octopuses can be surprisingly strong if

they are well anchored. A gloved hand is recommended as they can (and do) bite with their parrot-like beaks.

The many moods of an octopus can be seen by the various color displays they put on. They may exhibit different colors when frightened, angry, feeding or even just changing position in the tank. These changes, like those of their close cousins the squids, occur instantaneously, and several patterns may flash on and off in seconds.

Most octopuses are of a basic brownish or brownish-gray color and are often difficult to identify. One that is sometimes available is identifiable by the presence of a bluish ring on either side of the head at the base of the arms. These are not easily seen, and one must look carefully to find them. This one is *Octopus hummelinki* (if from the Caribbean) or *O. cyaneus* (if from the Pacific). The Hawaiian *O. ornatus* and the Caribbean *O. macroopus* are more easily identified by the white tubercles that cover the body and arms. One of the most famous octopuses is *Hapalochlaena maculosa*, the venomous blue-ringed octopus of the Pacific. As the common name indicates, this species is covered with blue rings or ring-like markings, making identification an easy matter; it is venomous. Its bite is very dangerous and is reported as fatal to humans (at

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least in eastern Australia). In other areas it is not supposed to be as dangerous—but I certainly would not test that theory.

Octopuses sometimes lay eggs in captivity. Mostly these are females that have been carrying sperm packets left by the male under the mantle cavity, although with several octopuses in the same tank it is conceivable that they will breed in captivity. The female, after depositing her eggs in a relatively safe place (usually out of direct sight of the aquarist, but they could also be in plain view on the side glass), will care for them until they

hatch. She will irrigate them with a stream of water from her siphon much like certain fishes will fan their eggs with their pectoral fins. After hatching, the miniature octopuses (with large heads and small arms) usually do not survive very long in the aquarium. In nature they normally lead a planktonic life, a situation which cannot easily be duplicated in a home aquarium. Some people have been successful in raising a few, so it is not an impossible task. The female often dies after brooding her eggs.

The male can be distinguished from the female by his third right arm,



This octopus has retired to its grotto and placed an arm, with suckers facing outward, over the entrance to help ward off would be attackers. Photo by Allan Power.

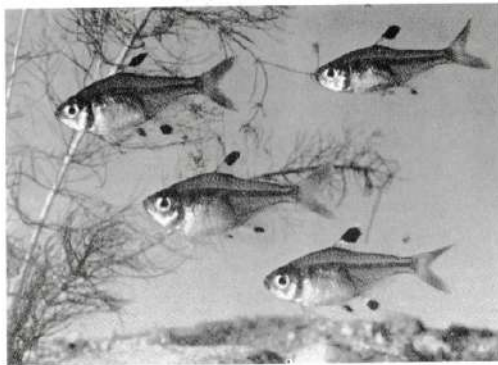
which is modified into a spoon-shaped tip with a membrane and groove just below the tip; this arm is called a hectocotylus. The hectocotylized arm is used for the placement of the sperm packet in the female's mantle cavity. Unusually enlarged suckers are present on the second and third pairs of arms.

So for an experience in keeping something different in your home aquarium, try taking home an octopus.

Ichthyology

Pristella maxillaris, A New Name for an Old Favorite

by Warren E. Burgess



Pristella maxillaris (commonly known as *P. riddlei*) is a pert little fish that is easy to breed in the aquarium and a small school of them is a sparkling addition to a community tank of small fishes. Photo by S. Frank.

name for the fish is *Pristella maxillaris*. This has come about by the findings of Dr. James Böhlke. He discovered (back in 1954) that *P. maxillaris* and *P. riddlei* are synonymous and that *P. maxillaris* is the older name, being described in 1894, thirteen years before Maek described *riddlei* in 1907. Since the rule of priority applies here, the *pristella* should now be called *P. maxillaris* (Lilreg). It is quite surprising that in over 20 years this finding has not become more familiar in aquarium circles.

One of the old favorites of aquarists is the *pristella*, *Pristella riddlei*. It was brought to my attention by Dr. Jacques Gery, one of the foremost authorities on characoid fishes and author of the forthcoming book *Characoids of the World*, that this name is being incorrectly used. The correct

Catfishes

The Peppered Corydoras, *Corydoras paleatus*

by Hans Joachim Richter, Leipzig, DDR • Photos by the Author

There certainly is something unreal about armored catfishes. Looking at them makes one think of a prehistoric animal of some sort rather than a modern-day fish. Many species of armored catfishes are known today, and some of them are very attractively colored. Of the great variety of *Corydoras* species available to aquarists,

one of the best known is the peppered corydoras, *Corydoras paleatus*. This perennial favorite was introduced to the aquarium world in 1876 when a few were given to a Parisian aquarist. In 1878 this French aquarist (Carbonnieux was his name) became the first person to spawn them in captivity.

The native range of the peppered



corydoras is southeast Brazil, from LaPlata to Argentina, where it lives in slow moving waters. Typically, callichthyid catfishes are able to extract oxygen from atmospheric air in the gut. This oxygen supplements that normally taken in by the gills, and from time to time corydoras will dash to the surface to collect air. This occurs more often in warmer water than colder water, since warmer water holds less dissolved oxygen. In polluted warm waters the air-collecting trips made by corydoras are even more frequent than they are in clean warm waters. Because of this special way of securing oxygen, many catfishes can go on living in waters that would long since have been fatal to many other fishes. That the *Corydoras* species are par-

ticularly happy in such water is, of course, highly unlikely, and it goes without saying that the quality of the aquarium water provided for them should be just as high as that provided for other fishes.



Sexing the peppered corydoras is easy. The male (left) is smaller and has a high dorsal fin.

Adult specimens of the peppered corydoras are fairly easy to sex. The male is about five cm. (two inches) long and has a sharply pointed dorsal fin that is slightly higher than that of

the female. The female reaches a length of about seven cm. (two and three-fourths inches) and has a stockier build, particularly during the spawning period. In addition, her dorsal fin is not nearly as pointed as that of the male.

Being very peaceful and undemanding as to water conditions, the peppered corydoras can be kept in a community tank just as easily as it can be kept in a tank devoted to only one species other than the catfish itself. In either situation they are a useful addition to the aquarium. Food organisms that have just died and any tubifer or white worms that may have crept into the bottom layer are tracked down and eaten by the catfish. On the other hand, these catfish should not be ex-

pected to live on dead food organisms alone. Catfish love their food and need plenty of it! Also, their food must be of good quality, especially if you wish to spawn them. Ideally, they should be fed on daphnia, tubifer and white worms. Since the catfish love rum-

ble to live on dead food organisms alone. Catfish love their food and need plenty of it! Also, their food must be of good quality, especially if you wish to spawn them. Ideally, they should be fed on daphnia, tubifer and white worms. Since the catfish love rum-

bling around in the bottom layer, it is advantageous to use fine gravel in the aquarium; this makes burrowing in search of food a little easier.

Keeping peppered corydoras presents no problem whatsoever. They can tolerate a wide range of temperatures ranging from 18 to 28° C. (64 to 80° F.). They do, however, prefer the middle of this range.

Spawning is most readily achieved when the sexes are kept apart for a time and the fish are given a generous and varied diet. When the female has become obviously heavy with eggs (when the belly looks markedly swollen), both sexes are transferred to a breeding tank which need not exceed 38 liters (about 10 gallons). The water in this tank should be new and should

have a temperature of 18 to 20° C. (64 to 68° F.). A bottom layer can be done away with altogether, but some sort of filtration should be used to keep the water moving.



The mouth structure and barbels of the corydoras catfishes make them very adept at extracting worms and other bits of food from the gravel in an aquarium.

In an effort to get free. These movements seem to act as the trigger for the discharge of the sperm. The male bends his body into an "S" shape and, visibly trembling, gives off the sperm which is transported to the female

These fish spawn best in groups, and you should use two females and two to four males. After a few hours the females become restless and begin to swim up and down the aquarium sides. The moment a female comes to rest on

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genital area by movements of her fins and opercula. Once the female breaks free of the male's grip, she begins to move backwards, scooping the eggs and sperm into a pocket formed by the folded pelvic fins. Generally three to six eggs are discharged into this pocket. With the fertilized eggs secure in the pocket, the female, followed by the male, swims to one of the previously cleaned spots and presses the adhesive eggs onto the chosen spot. Meanwhile the male swims around the female with apparent agitation, leading one to believe that he is keeping an eye on things to make sure that nothing goes wrong. This, however, is not his motive; as soon as the female has finished sticking the eggs to the spawning substrate, the male resumes his passionate courtship. One spawning embrace is followed by another until about 150 eggs are laid. When the spawning is over all of the catfish remain motionless at the bottom, and at this point they should be removed from the tank.

Depending upon the water temperature, the eggs will hatch in six to fourteen days. One day after hatching

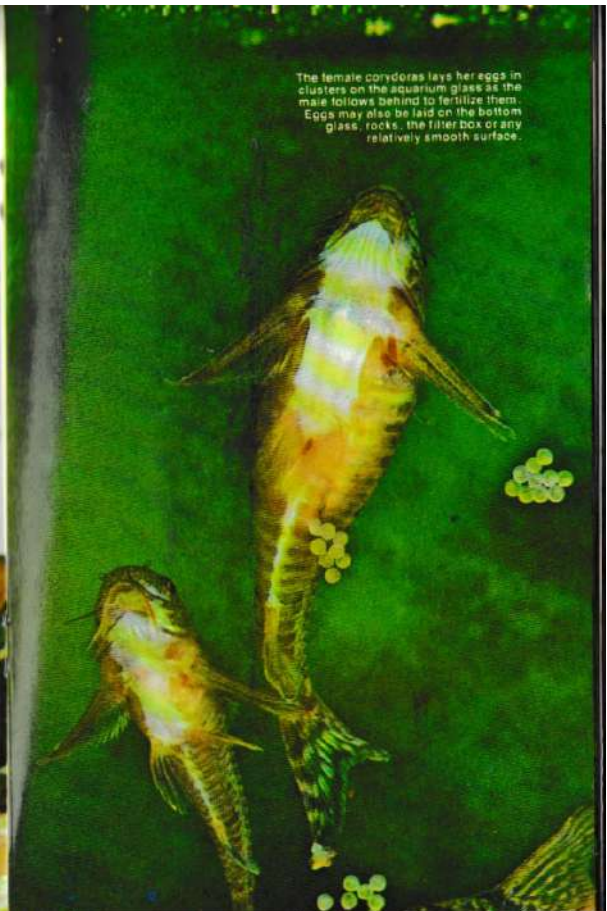
the fry will begin to feed. Initially this should consist of microworms, and after a few days they will take finely grated dry food, preferably with vegetable ingredients. It is now important that you change some of the water every day and make sure the tank is well aerated. This will minimize losses of the delicate fry. When the fry are a week old they can take newly hatched brine shrimp nauplii, but according to my observations it is advantageous to continue giving them dry food too. Later on other larger food organisms can be added to the diet.

Corydoras paleatus was scarce on the aquarium scene in Canada and the United States for a long time, although it remained in plentiful supply in Germany and Scandinavia. In the last five years, though, it has been showing up in Canadian and American pet shops much more frequently. Because of its unusual spawning method and comical-looking face, the peppered corydoras deserves a status of its own in your community tank. You will be missing a lot of enjoyment from your fishes if these interesting little catfish are regarded only as scavengers.



The peppered corydoras is essentially a bottom dweller and can be seen both during the day and night combing the bottom in search of food tidbits.

The female corydoras lays her eggs in clusters on the aquarium glass as the male follows behind to fertilize them. Eggs may also be laid on the bottom glass, rocks, the filter box or any relatively smooth surface.





Post-Mortem Examination

by Dr. Mark P. Dulin

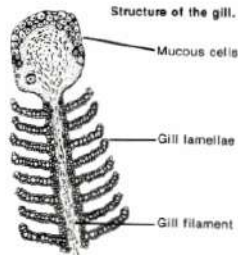
If you are an inquisitive aquarist and are conscientious about your fishes' health, undoubtedly you want to know why a particular fish has died. By knowing the specific cause of death, steps can often be taken to prevent future mortalities. For your fish's sake, it is best to diagnose a particular disease based upon the clinical signs of disease which may appear during life. For example, the appearance of white spots on your fish's skin gives a clue that it may be suffering from "ich." Sometimes these useful signs are missing, and the fish dies for no apparent reason. It is especially these deaths from mysterious maladies which should be thoroughly investigated.

Many of the techniques of investigation are too sophisticated and complex to be performed by the average aquarist, but the basic post-mortem examination is relatively simple. Of course, a diagnosis can not always be made based upon the simplified scheme of examination which follows. It takes a good deal of training and experience (and sometimes luck) to successfully diagnose fish diseases. The most fundamental prerequisite is a thorough understanding of fish anatomy. Before you can recognize abnormal tissue, you must first be familiar with the normal. Many times the

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aquarist will still need to obtain professional help—you certainly won't be very proficient on your first dissection, but everyone has to start somewhere.

Now I know some of you are a bit squeamish and could never dissect your deceased pet. Admittedly, this month's topic may appeal only to those aquarists who are biologically inclined. I also want to emphasize that there are certain inherent dangers involved in conducting a post-mortem examination (necropsy). Aside from the possibility of cutting yourself with a scalpel, you could become infected with certain bacteria known to exist in diseased fish. For example, fish packers in sar-



dine canneries sometimes acquire lesions on the hands caused by bacteria in the genus *Serratia*. More rarely, aquarists have acquired localized skin lesions from handling fishes suffering from piscine tuberculosis (mycobacteriosis). I am not trying to scare you, just warn you! The chances of your acquiring an infection from handling a diseased fish are certainly minimal, but caution should be exercised just the same. Just as you wouldn't swim in a lake if you have cuts and scratches on your body, you

Tropical Fish Hobbyist

shouldn't dissect fish if you have a cut finger. As an additional precaution, rubber gloves could be worn by the investigator.

Only a few instruments are needed for a standard necropsy procedure. If a scalpel, iris scissors and fine-pointed thumb forceps are not readily available, a single-edged razor blade, manicure scissors and household tweezers will suffice. If you have access to a microscope, by all means use it to your advantage. If not, an ordinary magnifying lens will help you detect parasites and lesions. A good camera with close-up capabilities is a valuable asset; it can be used to photograph any unusual pathological changes. Should you need to obtain help in diagnosing the disease, color transparencies (slides) accompanied with preserved or frozen tissues will aid the fish pathologist in diagnosing the disease.

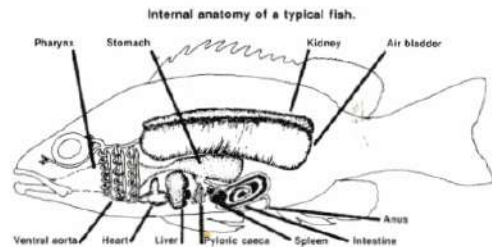
Only recent mortalities are valuable for a necropsy procedure. Tropical fishes will rapidly undergo decomposition in a warm tank, and these post-mortem changes can interfere with a proper diagnosis. If you cannot examine the dead fish immediately, refrigerate it until later. Generally, it is best to necropsy the fish upon discovery; bagging it in the refrigerator only leads to

procrastination and will delay your knowing the cause of death. Other fish may soon show clinical signs of the same disease, and unless you know why a given fish died you are not likely to know how to treat the survivors.

EXTERNAL EXAMINATION:

Skin: Examine the skin for external parasites or lesions such as raised scales, nodules, ulcers, nipping wounds or reddened areas. If you have a microscope, make a skin scraping from the periphery of lesions, from beneath raised scales, behind fins or any "suspicious" area on the fish. This material can be placed on a microscope slide along with a drop of water, coverslipped and examined microscopically.

Fins: Careful examination of the fins is important, because many diseases cause a loss of tissue integrity. Frayed fins and reddening at the base of fins should be noted, as these things are often a sign of an acute systemic bacterial infection. Frayed fins without reddening may indicate attacks from more aggressive fishes, malnutrition or a variety of external parasites. Examine material scraped from frayed fins for microscopic organisms.



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Body Openings: Carefully inspect the mouth for reddening or ulceration. Check the vent, a swollen or reddened vent area may indicate a gastrointestinal problem.

General Morphology: Examine the fish from the side view as well as looking down on the fish. Deformations in normal body symmetry should be noted. Is one eye protruding (pop-eye) or is the abdomen swollen (dropsy)? Record your findings.

Gills: The gills should be red during life and shortly after death. Pale gills generally mean the fish is anemic. Look closely at the gill filaments. Parasites may be attached to the filaments and cause a ragged appearance. If you have a microscope, remove a gill arch and then snip a small section of filaments from the arch. Place this on a microscope slide with a drop of water and apply a coverslip. Examine microscopically under low power and low illumination. If a microscope is not available, look at the gills with a magnifying lens.

INTERNAL EXAMINATION

The Dissection: Using a sharp scalpel or single-edged razor blade, make a very small incision just below the heart. Insert one blade of the scissors

into this opening and lift up on the skin. Cut posteriorly along the ventral midline, lifting up with the buried scissor blade as you cut. This will reduce the chances of your puncturing the gastrointestinal tract. When your incision reaches the vent area, cut upward on the fish's left side. Continue this incision cranially all the way to the gills so that you have essentially removed the left body wall of the fish.

Peritoneal Cavity: Look at the abdominal wall and musculature for reddened areas or nodules. Check for fluid accumulation within the abdominal cavity (ascites), an indication of "dropsy." Observe all the visible body organs closely before you start moving tissues around with a probe. If you see any obvious abnormalities you may want to photograph them or at least record them in your notebook.

Viscera Examination: Examine the entire gastrointestinal (G.I.) tract from the esophagus to the anus. Make note as to whether there is food in the gut or whether the intestinal tract feels flaccid and fluid-filled. Snip the esophagus and pull the G.I. tract posteriorly along with the attached liver, spleen, pancreas and pyloric caeca. Cut the vent free of its muscular attachment and set the viscera on a moist towel for later

examination.

Heart: Snip the heart free and look for lesions and areas of discoloration. Now is a good time to observe the blood of recent mortalities. The blood should be red, not chocolate brown. Brown blood indicates the fish was suffering from nitrite toxicity (caused by a buildup of metabolic wastes in the aquarium).

Gonads: The gonads (sexual organs) are often hard to find, especially if the fish is not sexually mature. The ovaries appear egg-filled, while the testes are white and exude milt if the male is "ripe."

Air (Swim) Bladder: Examine the air bladder, then remove it to expose the kidney.

Kidney: Check the kidney for obvious swelling, then remove the sheath which covers the kidney. Check for abscesses or other lesions. Examine the ureters and urinary bladder for evidence of parasitism.

Liver and Gall Bladder: Now go back to the viscera you had previously removed and examine the liver and gall bladder for any pathological changes. If swelling and lesions are present, record these findings. The gall bladder may be very swollen with greenish bile if the fish has not eaten recently. Parasites may be lodged in the bile duct, so examine thoroughly.

Spleen: Examine the spleen for evidence of lesions or swelling. It should have sharp discrete edges and not be rounded or have a football appearance.

Internal G.I. Tract Exam: Run the intestine between your fingers and feel for nodules in the intestinal wall. Fibrotic nodules are often the site of thorny-headed worm attachment. Open the entire gut from the esophagus to the rectum and look for the presence of food, lesions or parasites. If you find parasites you may want to pre-

serve them for later identification (rubbing alcohol or vodka will suffice). Check for microscopic parasites by making a wet-mount preparation from material scraped from the rectal wall. Add a drop of water to this material before applying a coverslip so that motile organisms can be provided with a medium for movement. You may see *Hexamita* swimming about; these flagellated protozoans can cause enteritis and are thought to be the primary cause of hole-in-the-head disease of discus.

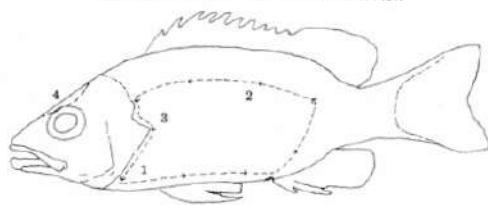
Brain: Using your scalpel or razor blade, cut off a portion of the cranium. Do this cautiously and don't use the scalpel as a "pick," because a piece of the blade may break off and fly in your face. Use forceps or tweezers to chip off the cranium. Check the brain for lesions and reddened areas. Systemic bacterial diseases can often invade the brain, causing a reddened (meningitis) condition.

PRESERVATION OF TISSUES

Should you decide to obtain help in determining the specific cause of lesions you have found, ask the fish pathologist who has agreed to help you how he wants the tissues preserved. If they are to be cultured for bacteria identification or virus detection they should be kept refrigerated or frozen for transport. If you want to submit them for histopathological examination they will need to be quickly preserved in 10% formalin or Bouin's fixative. Because of individual preferences, the pathologist who is doing the study should be consulted for details on preservation and transport procedures.

Hopefully I have generated some enthusiasm for conducting the necropsy. Although brief, this capsule summary of post-mortem techniques should provide the aquarist with the basic principles of this important, but often neglected, diagnostic procedure.

INCISIONS TO BE MADE IN DISSECTING A FISH



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Terrariums

A Newt for All Seasons

by Jerry G. Walls



Although their skin is thicker than that of adults, efts cannot withstand desiccation. After handling a newt, never put your hand near your mouth or eyes; salamanders secrete an irritant chemical which can be very painful if it comes in contact with delicate eye and mouth tissue. Photo by F.J. Dodd, Jr.

The beginning keeper of herps (a useful slang term for reptiles and amphibians) is often awe-struck by the beauty and exotic appeal of expensive imports which seldom live long in his care. Instead of spending \$10 on an imported European newt, try the easily available red-spotted newt of the eastern United States. For a dollar or so you get an attractive long-lived sala-

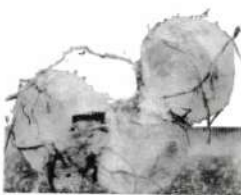
mander which is easy to care for and can provide you with the basic experience necessary for keeping and raising more expensive and delicate amphibians.

The newts are a group family Salamandridae of largely aquatic salamanders easily recognized by the crested tail of many forms and the rough or even warty skin in the terrestrial stages. Unlike most other salamanders, the fine vertical grooves along the sides between the leg insertions (costal grooves) are indistinct or absent, a very useful identification character. Most newts, including the Asian, European and Pacific American genera, live most of their adult life in moist situations on land and return to ponds and other shallow standing water for only a few months each year to breed. Except for a few species which give birth to living young, all lay eggs which give rise to aquatic larvae.

Although the eastern American newts closely resemble the European *Triturus* in body form and some aspects of color pattern, they differ in life cycle and have been placed in the genus *Notophthalmus* (formerly called *Diemictylus*). *Notophthalmus* can be distinguished from other newt genera in the aquatic adult stage by the relatively smooth skin without large obvious glands behind the head, the simple crest on the tail, two bony ridges on top of the head, greatly enlarged hind legs with brown patches in breeding males and the common presence of distinct black and red spots on the sides. In addition, the eastern American newts have permanently aquatic adults and a distinctive non-breeding juvenile terrestrial stage (often bright red) called the eft.

There are three full species of *Notophthalmus*, but only one is likely to be seen by the average hobbyist; fortunately this species, the red-spotted newt, *N. viridescens*, is the hardiest and most attractive of the genus.

N. meridionalis, the black-spotted newt, is found only in southern Texas and the northern coast of Mexico; since ponds and standing water of any type are not common in this nearly desert area, newts are few and far between. It is easily recognized when seen (which is rarely) by its relatively chubby and heavy-set body with a bright orange belly bearing numerous large round black spots; the back and sides are light olive green without red lines or spots, but with scattered large round black spots and two irregular yellowish lines on the upper sides. Efts are uncommon and resemble the adults except for the rougher skin and subdued pattern.



Although fertile eggs develop readily in small containers with clean water and little light, *Notophthalmus* eggs often have a high incidence of infertility, and many will not hatch. Infertile eggs can be fed to adult newts. Photo courtesy American Museum of Natural History.

The seldom seen striped newt, *N. perstriatus*, looks like a common red-spotted newt except that *N. perstriatus* has a continuous red stripe from the back of the head to the tail on each side; the red stripe is bordered by a dusky line and not a strong black stripe. This species is found only in northern Florida and southern Georgia, so it seldom reaches pet shops.

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The animal is more slender and weaker looking than the red-spotted newt and has longer, thinner legs. The few I have kept were very susceptible to fungus attacks with temperature fluctuations and did not feed well. Since both *N. perstriatus* and *N. meridionalis* come from restricted areas and are not abundant even if you know where to look for them, in the interests of conservation they should not be kept by beginners.

The mainstay of the newt-selling pet shop is the various subspecies of the red-spotted newt, *N. viridescens*. This robust and active animal survives well under all normal aquarium conditions, is colorful, will reproduce successfully in the aquarium and has a remarkably attractive eft. Many pet shops sell both aquatic adults and efts of this newt, and both can be heartily

recommended for the beginner.

There are four obvious color patterns in adult red-spots which readily identify the subspecies; all are occasionally found in pet shops, depending on where the dealer obtained his stock. The most attractive is the common red-spotted newt, *N. v. viridescens*; this is the newt of ditches, ponds, swamps, small shallow lakes (with few fish) and river margins from south-eastern Canada and the eastern Great Lakes south through the Ohio valley and eastern seaboard to Georgia and Alabama. Adults are of various shades of olive green or pale brown with a yellow belly bearing small black flecks. On each side of the body is a row of round black spots with a large red dot in the center; the number of spots is very variable, but the red centers are distinct.



Newts should not be handled by children. They have very delicate and thin skins and are subject to fungus if the skin is abraded. The gravel in this aquarium is much too large and sharp for the safety of the inhabitants. Photo by J. Dommers.

The broken red lines on the sides of the broken-striped red-spot give it an elegant appearance. This subspecies is somewhat smaller than the common red-spot but does well in the aquarium. Photo by M. Roberts.



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Tropical Fish Hobbyist

Farther west in the Mississippi valley and in most of the southern states the red centers disappear, and often the black spots become broken

An eft of the common red-spotted newt displaying exceptionally clear and contrasting red spots. Notice the rough skin and the two ridges on the head. Photo by Dr. Sherman Minton.



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and irregular; this type of pattern identifies the central red-spotted newt, *N. v. louisianensis*. In the southern half of Florida the dorsal pattern almost disappears because the background color becomes a dark brown or even black, strongly contrasting with the yellow belly; this is the seldom sold *N. v. piapicolae*, the peninsula red-spotted newt.

Often you will see a tankful of what look like common red-spots, but with a row of red dashes along the side instead of round spots; the dashes are bordered above and below with black lines like the black spots of the common red-spot, and there may even be a few normal rounded red spots in the pattern behind the head. This very attractive newt is the broken-striped red-spot, *N. v. dorsalis*, a subspecies which occurs only in the eastern part of the Carolines. It is heavily collected and finds its way to pet shops throughout the country; in some areas it may be offered for sale more commonly than the common red-spot.

Keeping adult newts is no problem. They live well even in community

tanks (without active fish to pick on them) but do better if given their own small (40 liters) tank with a box filter or undergravel filter. Even when not breeding, the sexes are fairly easy to tell apart because of the enlarged hind legs of the male. These are slow-moving, peaceful animals which normally do not fight, so two or three pairs can be kept in the same aquarium. They are carnivorous and eat a variety of insects (try fruitflies), small spiders, tubifex worms, all-meat dog foods, baby guppies, earthworms and adult brine shrimp.

Although they are not too choosy about water chemistry or temperatures (adult red-spots are active even under the ice in midwinter), cool temperatures reduce their activity and dull the colors, while warm temperatures may increase the incidence of fungal infections. 60-70° F. (16-22° C.) is probably best, with breeding occurring at the warmer temperatures. Because they absorb oxygen largely through the skin, newts should have clean and well aerated water. Having a few sprigs of elodea or other aquatic plants in-

(Continued on page 86)

Newts shed their skin periodically by splitting it at the mouth and peeling it back in one or many pieces. It is eaten after shedding is completed. Photo by J. Dommers.



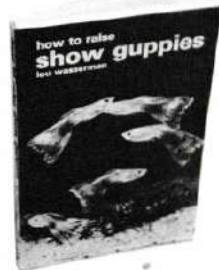
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Mail Call



by Marshall E. Ostrow

If you have an aquarium question that you would like to have answered, send it to MAIL CALL. Letters containing questions of course cannot be acknowledged or answered personally, but each month a number of the most interesting questions and their answers will be published in this column. Address all questions to: MAIL CALL, T.F.H. Publications, Inc., P.O. Box 27, Neptune City, New Jersey 07753. Please do not confuse MAIL CALL questions with correspondence about subscriptions or book orders.

Gaseous Exchange

Q. I have been told by some people that I should keep the return stem of my outside power filter directed down into the water in my aquarium. Others I have met prefer to direct the return flow across the water surface. Which is the correct way?

Shelly Gertner
San Antonio, Texas

A. It is not really a matter of a right or a wrong way. Rather, it is a matter of getting the greatest amount of efficiency and utility from your filter. In either case, the return flow should be directed away from the intake so that you get the maximum possible amount of new water passing through the filter bed.

If the return flow is directed down into the water, then an extra 90° elbow can be added to the end of the return stem so that the water will flow toward the end of the tank opposite the intake. The extra turn in the tube may cause a slight amount of back pressure on the pumping mechanism, but if your filter is powerful enough (as most are), this should not make a significant difference in its output.

There are certain advantages, however, to directing the return flow across the surface. For one, the extra 90° bend in the tube is unnecessary. Secondly, such a setup creates greater surface turbulence. This has a distinct advantage in that it allows for a greater rate of gas exchange in the sys-

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tem. Most oxygen is taken into the water at the surface. Likewise, undesirable gases such as carbon dioxide and other noxious decomposition by-products are released from the system at the surface. The greater the surface turbulence, the greater will be the amount of oxygen dissolved in the water and the greater will be the amount of undesirable gases released—a positive advantage for fishes living in a closed system such as an aquarium.

Salty Scats

Q. I have recently purchased a pair of ruby scats (*Scotaphagus rubrifrons*) and a pair of green pufferfish (*Tetraodon lineatus*). Right now I am keeping them in fresh water but I would like to keep them in brackish water. I've tried looking around for books on converting fresh water to brackish water but was unable to find one. Would you clue me in on what the procedure is and the

does I should give them to convert them from fresh to brackish water?

There are many books about breeding fish on the market today. Could you please tell me which one in your mind would be the best one for me to purchase?

Girard DiNardo

Ridgewood, NJ
A. Brackish water is highly variable in its salt content (at least when compared with sea water or fresh water) because it is a mixture of sea water and fresh water runoff from rivers and streams. The salt content of brackish water varies considerably from place to place, season to season, day to day and even hour to hour, depending upon the amount of rainfall, the winds, the tides and many other factors. Therefore to give you a brackish water formula would be impossible. Just do what nature does: gradually mix sea water and fresh water until the salinity produces the best over-all color and



Scotaphagus rubrifrons (the ruby scat) inhabits brackish estuarine waters along the coasts of the tropical Indo-Pacific, and in the aquarium it is an avid plant eater. Photo by M. Chvojka.

department in your fish. Keep accurate records of how much salt you use and measure the salinity of the water with a hydrometer. Take note of the hydrometer reading when you have the water as salty as you want it and use that reading as your reference point in the future. To make certain that your fishes get the essential trace minerals they need to survive, it is best to use a prepared marine salt mix rather than straight non-iodized table salt. Although TFH publishes many books on breeding fishes, we would

hesitate to recommend a specific one in this case, since you make no mention of which fishes you would like to breed. Most tropical fish dealers carry an assortment of books and your dealer will be glad to advise you as to which one is most appropriate for your specific needs.

Dropsy—Disease or Symptom?

Q. I have a group of black angelfish in a 55-gallon tank. Recently one of them died, and from the books that are available to me I think he died from abdominal dropsy. Two of his tankmates died a week later of what appeared to be the same disease. After the death of these fish their abdomens were bloated and had turned white. I would like to know if this disease will affect any of the other angelfish in the tank and, if it will, what is the cure? My dealer says that he has never heard of any way to cure dropsy. I have heard that antibiotics or sulfonamides can help but I'm afraid to put medicine in my tanks without due cause.

Bill Peace
Scarsdale, New York

A. Your fear of the indiscriminate use of medications shows good thinking on your part! Dropsy is a clinical sign of disease and is not in itself a specific diagnosis. A swollen abdomen can be caused by many things, both infectious

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A classic case of dropsy (shown here in *Rivulus marmoratus*). Note the swollen appearance of the body and the protruding scales. Photo by R. Zukal.

and non-infectious. A gravid female could easily be mistaken for a fish having a dropsical condition in its early stages before the scales begin to protrude. A fish with liver degeneration caused by malnutrition could also show a dropsical condition.

Generally the swollen abdomen is caused by the accumulation of body fluids within the visceral cavity. If the fish is suffering from malnutrition and liver degeneration, ascitic fluid can accumulate just as it does in humans. (This condition is often seen in malnourished children of impoverished countries, and it is called Kwashiorkor rather than dropsy.) If the dropsy is caused by a non-bacterial disease antibiotics or sulfonamides would be of little value.

Infectious dropsy can be caused by a number of different strains of bacteria. If these bacteria attack the kidney, as they do in bacterial kidney

disease caused by *Corynebacterium*, a retention of body fluid generally results, and in this instance the fluid is usually clear. If the bacteria are growing and multiplying within the abdomen, as is often the case with *Pseudomonas* species, the abdominal fluid will probably be creamy or pus-like. In either case antibiotics would be in order. For more specific information we suggest that you see *Textbook of Fish Diseases* by Dr. Erwin Amdacker, which is available at most tropical fish shops.

Ravishing Rainbows

Q. I recently bought a pair of Australian rainbows and would like to know how to breed them. In what size tank should they be bred?

Craig Curless
Overland Park, Kansas

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The photo below shows a mature male *Pseudotropheus aurora*, first described on page 52 of the May 1976 issue of T.F.H. magazine. The Latin word *aurora* means "dawn" and was chosen because of this fishes bright yellow lower head and chest, highlighting its sky blue body. *Aurora* was previously and incorrectly called *P. lucerna*. Both these species have large eyes, which may have caused this mix-up.

A hardy and active aquarium fish, *aurora* breeds readily at 3" when kept well fed in a clean aquarium. Large (4") mature females mouthbrood as many as 75 fry, which can immediately eat baby brine shrimp and grow fast.



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The Australian rainbow (*Nematocentrus fluviatilis*) is one of the most peaceful of the larger tropical aquarium fishes, and it will seldom bother even small tetras. Photo by H.R. Schmidt.

A. There are several fish species commonly available that are known as Australian rainbows, and they all breed in a similar manner. One of the perennial favorites is the pink-tailed rainbow (*Nematocentrus fluviatilis*), also known as the Queensland rainbow. It is a peaceful fish that reaches five to six inches at maturity. A 15-gallon tank would be the minimum size for a successful spawning. It will do well under a variety of water conditions from

slightly acid to slightly alkaline with a moderate amount of water hardness. It will readily take a variety of live and prepared foods, but it is always a good idea to condition any fish that you wish to breed on a preponderance of live foods. It will breed at a temperature of about 80° F. (25° C.). It scatters its eggs among fine-leaved plants such as Myriophyllum, and the eggs will hatch in a day or two. Although the parents don't usually eat the eggs, they may eat the fry and should be removed from the tank.

Little Old Crust Baker

Q. I have a 55-gallon tank with a 200-watt heater. The heater develops a thick dark brown crust at the bottom of the tube which never rises past the heating element. I scrape it off each week, but it comes back again. Is it a mineral deposit? Does it harm the fish? Does it harm the efficiency of the heater? The water has a pH of 6.9 and my pipes are copper. Any information would be appreciated.

Adam Stern
New Rochelle, New York

NOTICE

Tropical Fish Hobbyist traditionally has its pages open to a broad spectrum of editorial features covering widely differing points of view. It also is open to commercial announcements of all sorts regarding products and services for sale. In fact, in most cases we are prevented by law from discriminating among advertisers.

There are a number of long-established and reputable mail order houses in the tropical fish field. There also are a number of firms that lack experience with this highly specialized method of selling and are not always willing or able to cope with the problems it creates for them in terms of customer satisfaction. On that basis, readers should always be aware of the dangers involved with making purchases by mail. Additionally, they should bear in mind that price alone—even for a standard manufactured item like a pump or filter—is not the only basis for deciding from whom it should be purchased. A "bargain" or "discount" price on an item may not be any bargain at all when it comes time to service the item or obtain information about it; what one seller offers by way of price may be more than offset by not having a reputable local tradesman to back up its servicing and delivery of full satisfaction. In general, products available locally should be purchased locally.

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Tropical Fish Hobbyist

A. The dark brown crust is a mineral deposit (mostly calcium) that is stained by the organics in the water; perhaps there also is a bit of baked algae on the heater. Although the crust itself does no direct harm to the fish, indirectly it can harm your fish in that it acts as a blanket of insulation around the heater, reducing its efficiency and making thermostatic control very erratic. Continue cleaning this material off as you have been doing, being careful not to remove or replace a hot heater.

Wingless Flies That Fly

Q. I recently purchased some wingless fruitflies to feed my swordtails and bettas. My problem is that when my flies reproduced the new flies had wings and began flying all over my fishroom. Is there any way to keep these flies from sprouting wings or is there a strain available that really doesn't have wings?

David Marks
Miami, Florida

A. Your fruitflies (probably a mutant form of *Drosophila melanogaster*) are not wingless, but rather are a vestigial-winged variety. They do have wings, but the wings are shriveled up or stumpy and of little use for flight. The vestigial-winged character is the result of a temperature-sensitive gene mutation that causes abnormal wing disc development during juvenile stages of the insect's life cycle and results in deformed wings when the adult fly emerges from the pupa case. If the larvae are reared at temperatures over 78° F (25° C), the vestigial-winged mutation is masked and the flies develop nearly normal wings. In addition, at higher temperatures these flies are generally smaller and lack vigor. The higher temperatures, however, do not destroy the mutation and if the next generation is reared at a lower temperature, the flies will once again

February, 1977

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In fruit flies (*Drosophila* species) the males (lower left and upper right) have a shorter abdomen that is round at the tip. The females (upper left, center and lower right) have a longer abdomen that is more or less pointed at the tip. Photo by P. Imgrund.

show the vestigial-winged character. Although there are other causes for loss of the vestigial-winged character, your problem can possibly be solved by keeping the cultures at about 70° F (22° C). Keep the cultures away from heat vents and out of direct sunlight.

Another reason that your fruit flies could have sprouted wings is that your cultures may have become contaminated by some non-mutant wild-type flies. This can be prevented by making certain that your cultures are always covered even when fresh food is cooling after it has been prepared.

If cooler temperatures do not prevent normal wing development in the very next generation, the cause is almost certainly contamination of the culture. Your best bet then is to discard your flies and start over again with new stock but take the precautions outlined herein. If no new stock is available, then carefully select a few males and females that do have the vestigial-winged character and start new cultures from them. Females can easily be distinguished by their larger, more pointed abdomens. In doing this, it is important that you select virgin females, since females do store sperm. If your new breeders are selected from among flies that are out of their pupal cases no longer than five hours, you can be sure that the females are virgins. The best way to collect virgin flies is to dump out all of the adult flies that are presently in the culture, then wait for the new adults to emerge. The greatest number of adults emerge during the first few hours of daylight. From these newly emergent flies your breeding stock can be selected.

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Poetic Justice

Q. Enclosed is a photo of my beta named Bill.

The photo was taken whilst he was quite ill.

I'm afraid that my fish named Hilda and Herman.

Might also die from this terrible vermin.

If Hilda or Herman develop this rot, Tell me what I should do and what I should not!

Otis Huddleston

Kansas City, Missouri

A. Bill's photo arrived a bit overly tinted.

And we're sorry to say it could not be printed.

But of poor Bill not much can be said. For surely he will not return from the dead.

For old Hilda and Herman we'll help you out.

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Follow the directions on the label. Or Hilda and Herman will be under the table.

Soft Coal in Your Tank

Q. I just got back from Pennsylvania where I picked up a large piece of soft coal. I know hard coal is used in filter boxes, but I would like to know if I can use soft coal as an ornamental stone without having it give off some poisonous gas or substance that I'm not familiar with.

Bruce MacHahn

Mahopac, New York

A. One of the reasons that soft coal is soft is its high sulfur content. Abandoned soft coal mines must be sealed, because if water running over and through this sulfur-bearing coal is allowed to escape from a mine (as it unfortunately often is) streams, rivers, and even some groundwater would become polluted by the sulfuric acid from that drainage. It is very likely that soft coal in your aquarium would do the same thing, so it is best to keep it out of your tank. Although rocks purchased from a reliable pet shop seem rather expensive, they are worth the price if for no other reason than to feel secure in knowing that they will not pollute or poison the water in your aquarium.

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Stunt or Runt?

Q. I recently purchased four pairs of lyretail swordtails. At the time of purchase two of the females were pregnant, and within two days gave birth to 60 fry. Ten days later my guppies also gave birth. It has now been over a month and the guppies' growth has exceeded that of the swordtails. All of the guppies are doing well, but only one-fourth of the swordtails are still alive.

SIERRA LEONE NEEDS TROPICAL FISH ADVISOR

The International Executive Service Corps is a non-profit organization that sends experienced men and women, together with their spouses, to serve in the developing nations as volunteer advisors to locally owned enterprises that request technical assistance. All of the volunteer's expenses are paid. IESC is in its eleventh year and has completed well over 5500 projects. The volunteers are usually retired U.S. citizens.

This organization has come to TFH with a request. In Sierra Leone, Africa, there is a man who wants to collect the tropical fish that live in its waters and sell them to markets in the United States and other countries. He would like to know the best methods for collecting and transporting the fish and knowledge of the market involved. It is expected that the fulfillment of this project would involve a stay in Sierra Leone of approximately three months.

If a reader would like to participate in this project, or if he would like more information, write Edward T. Hetzler, Executive Recruiter, International Executive Service Corps, 622 Third Avenue, New York, New York 10017, or call 212-490-6830. Hetzler will accept collect calls.



In the lyretail strain of the swordtail (*Xiphophorus helleri*), both sexes have extended outermost rays in the caudal fin. The female is the lower fish. Photo by H. Hansen.

Could the shock of moving the pregnant swordtails from the supplier's tank to my own have caused a premature birth and thus a stunted growth rate?

Robert J. Sarvaide
Tuxedo, New York

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A. Any time a fish is disturbed or stressed it is likely to have a shock reaction. Moving a fish from one tank to another can induce shock if the fish is in poor condition. In addition, female livebearers that are gravid and very near the time when their young are due to be born will often show a shock reaction by giving birth to their brood prematurely. The premature birth of the young causes shock and other difficulties and the fry rarely survive this stress. If they do survive, their chances for normal development are reduced, but that does not necessarily mean that their growth will be stunted.

The lesson to be learned here, of course, is never move a female livebearer that appears to be about to give birth. It is always best to choose one that is less gravid.

This Isn't Acne

Q. I have read that male goldfish have longer pectoral fins at about one year of age than females and that the place where the anal fin connects to the body is concave for males and convex for females. How can I tell their sex when they are young? Can they be grown to



This is a three-year-old male shubunkin goldfish showing the sex tubercles on the operculum. Photo by Laurence E. Perkins.

four or five inches in body length without placing them in a large pool? I have a four-inch oranda, a four-inch lionhead oranda and a three-inch red oranda in a 20-gallon long tank with an external filter, an undergravel filter and an aerator. I also have two 10-gallon tanks with each one containing three fish that are each one to two inches long. I wish to grow these fish to a large size but presently I fear that they may not get as big as I would like them to due to crowding.

Steven F. Stober
St. George, Kansas

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Tropical Fish Hobbyist

which it was developed. There could be a number of reasons for some of them being lighter than others. A strong possibility is that the color differences between gold and cream colored gouramis are genetic in origin, and each may have come from the stock of different breeders. You could also be observing different color phases that are environmentally caused. This fish can change its color somewhat as a response to different chemical conditions in the water or differently colored aquarium decor or lighting. Another environmental difference could be in their food. A fish with a predisposition toward yellow, orange or red coloration will show brighter colors if there is a high percentage of carotenoids in its diet. This compound is usually derived from red and yellow vegetable matter.

That's Amore

Q. I had a pair of mated cichlids and for some reason unknown to me my female suddenly died. Following her death the male remained in a corner of the tank for a few days, refusing to eat, until he too died. Could the male have died as a result of the loss of his mate?

Kenneth Martin
Brooklyn, New York

A. We seriously doubt that your male cichlid's hunger strike had anything to do with his pining over the death of his "beloved." To begin with, it would take more than a few days of such starvation for a fish to starve to death. Some species can go four weeks or longer without food, while most can last at least two weeks without a morsel to eat.

If your cichlids were African mouth-brooding types, they were not what one would consider a mated pair.

A. The pectoral fin length and anal fin insertion shape may well be signs of sexual dimorphism in goldfish, but using these techniques requires that the hobbyist make judgments that may not always be correct. One traditionally reliable method of seeing living goldfish is by observing the white tubercles that appear on the opercula of the male during the spring breeding season. These tubercles resemble large salt grains and to some people have a pimply-like appearance. Since they appear only during the breeding season, the fish will be about a year old before you can reliably determine their sex. Other than dissection, there is no other reliable way to tell their sex if they are younger.

As to their living space, most goldfish have the potential of growing to a very large size and in a 10-gallon tank they will not even come close to that potential. You can get fair size out of them in larger aquariums without having to put them in a pool, but they must be fed well and generally well cared for.

A Touch of Gold

Q. About a year ago I purchased a male golden gourami. It has now grown to about four inches but has never taken on the golden color I have seen in other gold gouramis. It is a cream color. I have recently seen other gold gouramis in a dealer's tank that were also cream colored. I would like to know why some are gold and some are cream. Also I would like to know its scientific name.

Kurt Elcherti
Philadelphia, Pennsylvania

A. The gold gourami is merely another color strain of the blue gourami, *Trichogaster trichopterus*, which has been developed by commercial breeders. The gold gourami does not exist *per se* in the wild, and this artificially developed strain goes by the same taxonomic designation as the fish from February, 1977



A male gold gourami (*Trichogaster trichopterus*) approaches a ripe female (under the bubble nest) to begin the spawning embrace. Photo by R. Zukal.

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Tropical Fish Hobbyist



A mated pair of angelfish (considered to be substrate spawners—leaves being the substrate) spawning on a leaf. The female (front) deposits the eggs while the male waits patiently to fertilize them. Photo by R. Zukal.

The courtship and spawning ritual among these fishes is a transient affair. They do not form pair-bonds as in the South American or African substrate spawners.

With reference to the substrate spawners, we have heard numerous reports over the years of a fish refusing to eat following the death of its mate, this ultimately resulting in its own demise. These reports are particularly numerous with reference to angelfish and Oscars. However, it has been our experience that "widows" or "widowers" among substrate spawners will usually form new bond-pairs if given a choice of potential mates.

We feel that your male did not die of a severe case of loneliness, but rather of the same thing that did your female in! Since there were no external

ERRATUM
Our apologies to John Lindley, the author of "The Elusive Fancy Guppy," an article that appeared in the January, 1977 issue of *Tropical Fish Hobbyist*, whose name was inadvertently omitted from the article.

February, 1977

signs of disease or damage (at least you didn't mention any), there may have been some chemical abnormality in the tank that killed them both.

American Killifish Association Convention

The American Killifish Association's Fifteenth Annual Convention and Show will be held May 28-29, 1977. Memorial Day weekend, in San Francisco at the PSA Hotel San Francisco on Market Street. Convention co-chairman are Al Castro and Royal Ingersoll. Send inquiries to Al at 111 Arieta St., San Francisco, Ca. 94134 or to Royal at 315 Aragon Blvd., San Mateo, Ca. 94402.

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Starting a Club

Q. I am interested in starting an aquarium society here in Woodland, California but need a little assistance from your staff. I would like to know how much cost would be involved in starting such a group, and does the group need any sort of license or permit? What kinds of special activities could we get involved in as a group? There are many people here in Woodland who desire a local society, and I do hope with your help and advice that we can start a good and effective one.

Jimmy L. Longan
Woodland, California

A. We suggest that you contact the Federation of American Aquarium Societies (FAAS) for assistance. FAAS can provide you with many ideas on starting your group and will offer much help in developing worthwhile pro-

grams. Write to FAAS President Larry Brande, Apt. 106, 6601 S.W. 48th Street, Davie, Florida 33314. We wish the tropical fish enthusiasts of Woodland good luck and look forward to receiving a copy of the first journal of your new club.

American Specialty Organizations

If you are interested in joining any of the following specialty organizations, send a stamped, self-addressed envelope with your inquiry to the person indicated.

North American Native Fish Assoc.
Harry Abrams, Jr.
RR 1, Box 76
Greenwood, Indiana 46142

Goldfish Society of America
Gerrie LaCosta
748 Broadway E.
Seattle, Wa. 98102

American Livebearer Assoc.
John Buhle
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Clear Lake, Iowa 50428

American Killifish Assoc.
c/o The Sellers
1906 Bryan Road
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American Catfish & Loach Assoc.
Joe Vitale
3840 N.W. 3rd Terrace
Pompano Beach, Fl. 33064

American Cichlid Association
Jon & Lee Pierce
15019 No. 21st Place
Phoenix, Arizona 85022

International Beta Assoc.
John Stanton
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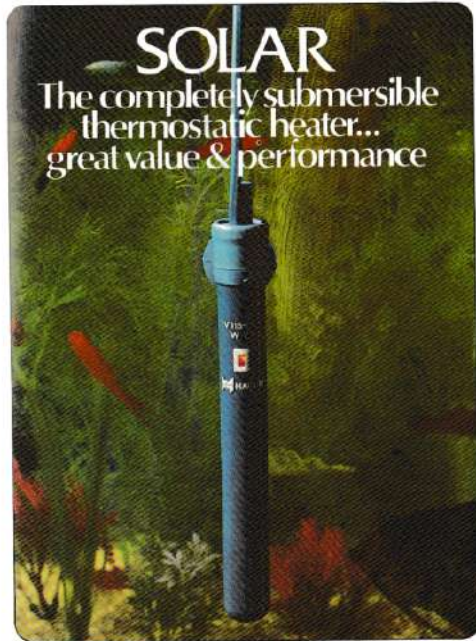


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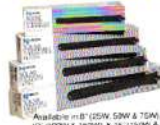
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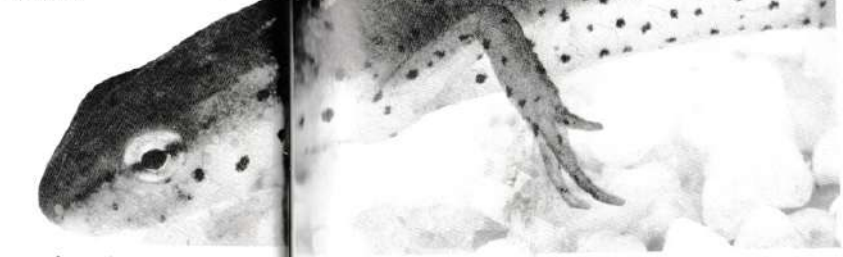
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Newt: Continued from page 84

proves the appearance of the tank and gives the females a place to lay eggs; it also gives the animals something to crawl on and hide in. If a piece of Styrofoam or cork is floated on the surface, some red-spots will crawl out and "sun" themselves for a few minutes each day. Needless to say, light intensity above the aquarium must be low and there must be a secure cover to prevent the animals from climbing out and drying in a corner or under the sofa; all salamanders are very prone to desiccation, and adult newts (and eft) are no exception.

Breeding occurs in the spring months and may continue throughout the year if the temperature is satisfactory and food is abundant. Males develop brown horny patches on the thighs, soles, and toes of the hind feet to hold the female during the elaborate mating dance. At this time the cloaca of the male also enlarges and becomes very protuberant; it serves to shape the spermatophore or sperm bag which transfers sperm to the reproductive system of the female. This spermatophore is like hard jelly in consistency, with a basal portion shaped like a thick thorn bearing an oval sac of sperm at the tip. Spermatophores are deposited on the bottom of the tank after the courtship and taken into the cloaca of the female for internal fertilization of the eggs. From 150 to 400 eggs are laid soon after mating, each attached individually or in small groups to the leaves and stems of aquatic plants or to hard debris on the bottom. After three to five weeks the eggs hatch into small gilled larvae which can be fed canned dog food, brine shrimp nauplii or chopped tubifex worms. Adults will eat eggs and larvae in the confines of an aquarium, so the eggs should be

This detail of the head shows clearly the fine blood vessels near the surface of the skin which allow newts to absorb oxygen underwater without the aid of gills. The thin skin is also the reason newts dry up so rapidly after they escape from an aquarium. Photo by M. Roberts.



removed soon after they are laid and the larvae raised in a separate aquarium or small dishes.

In two or three months the larvae reach full size, begin to resorb the gills, develop the color pattern of the eft and leave the water for an extended existence on land. At transformation they are about 30-40 mm in total length. After going through the terrestrial eft stage they will return to the water as permanently aquatic adults. This cycle can be completed in the aquarium and terrarium if care is used. Losses can occur in the eggs, which are subject to damage from light and fungus, and at transformation of the larvae; always have dry land or at least floating cork available for the larvae to crawl onto when they lose their gills.

Although the efts are brilliantly colored orange to red with the same spot pattern as the adult, they are

harder to maintain, because they must be kept in a terrarium. They require humid conditions and subdued light for best success and seem to like cool temperatures. Keep the terrarium tightly covered with glass to prevent excess evaporation and spray the plants with water often enough to maintain a high humidity; standing water is not necessary for efts. Efts forage during the day and night for small insects (such as vestigial-winged fruitflies), spiders, small worms and even smaller salamanders if they can find them; most will eat canned all-meat dog food very well. When the efts reach about 75 mm in total length (after one to three years depending on food, temperature and locality), they should be given access to water in case transformation into aquatic adults is approaching. Efts near transformation

often form large groups which travel across roads on rainy days in search of ponds.

Efts are common only in the eastern part of the range of the red-spot, so usually only the eft of *N. u. viridescens* is offered for sale. For some reason the brightest colors seem to occur in individuals from mountains and other high altitudes, with efts from coastal areas being more brownish than reddish.

So if you are trying herps for the first time, start with a red-spot. With good care and some luck, adults will often live three to four years or longer in the aquarium. Few other herps offer so much to a beginning terrarium hobbyist, for red-spotted newts are inexpensive and very colorful, and with a little careful planning by the hobbyist they will go through the entire complex life cycle in the home terrarium.

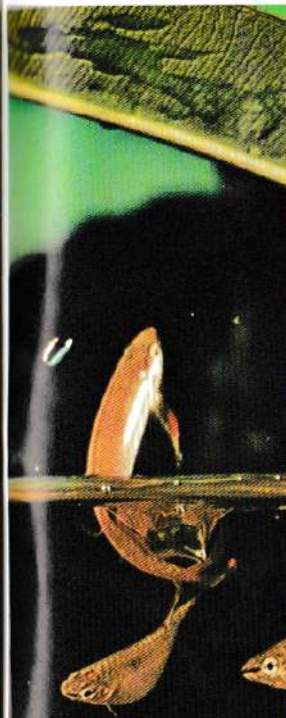
Characoids

Copella arnoldi

The first photographic report on spawning the splash tetra. No other fish spawns the way this one does!



As a male splash tetra (rear) examines a potential spawning site, several gravid females excitedly crowd around him.



by Ruda Zukal
Photos by the author

The splash tetra was earlier known under the name of *Copeina arnoldi*, but those ichthyologists working on characoids (namely Drs. Gery, Weitzman, et al.) have since changed the genus to *Copella*. In 1905 the first specimens of splash tetras were imported into Europe from the Amazon river basin in Brazil. According to present reports, this is a very common characin and is to be found from one end of the Amazon to the other... including all its tributaries. This wide distribution demonstrates that it has a great tolerance for diverse water conditions and that its feeding and breeding requirements are easily met. Why then is this the only fish in the world that deposits its eggs out of the water and keeps them damp by splashing water onto them from time to time?

In Brazil, where Dr. Herbert R. Axelrod has collected thousands of them, they are always found in shallow streams, pools or sometimes even in flooded grasslands, and when they are found they always occur in great abundance. They are also found with other members of the same genus (at least in the same "old" genus *Copeina*) but these other close relatives spawn in a completely different manner.

The male splashers reach 8 cm in length (that's more than 3 inches); the females are a bit smaller. They are long, slender fishes with their fins located far back on their bodies. They are elegant swimmers and spectacular jumpers.

As part of the spawning site examination the male may emerge from the water to have a better look.

If you want to spawn the fish you can follow the same arrangements I used as outlined in this article. Use a small, very clean aquarium with water initially at a temperature of about 20°C (68°F). The top must be tightly covered with a glass plate or the fish will jump out. Use a mixture of fresh water which is a few days old and some old aquarium water which is free of disease and very clean. Feed the fish foods that float or stay near the top of the tank. The fish prefer mosquito larvae and insects that are found near the surface of the water, but when they are hungry they will come to the bottom for tubifex worms, too. In nature they are fond of jumping out of the water and catching insects that fly too close to the surface. In the Rio Trombetas, Brazil, Dr. Axelrod found ants among the stomach contents of every *Copella arnoldi* he examined, but it is quite possible that their diet changes with the seasons.

If the females are ripe, place a few of them in with a male. Place a strong leaf right above the surface of the water but don't let it touch the water; this seems to be very important. The male will soon take an interest in the leaf and will spend a considerable amount of time examining it. As he continues his investigation, the females begin to crowd around the male, and soon his visual inspections force his body into an almost perpendicular position relative to the surface of the water. When the females see him in this perpendicular position, they become quite excited and gather closely around him. His tail fin at this time opens wide, and suddenly he springs out of the water with one female exactly parallel to him and at his immediate side. The fish's bodies assume a snake-like S-curve immediately prior to springing. The fish turn their bodies as they hit the leaf, with the female's head just below the edge



A lateral view of the male *Copella arnoldi* clearly reveals the longer upper lobe of the caudal fin, which aids the fish in leaving the water and in caring for the eggs.

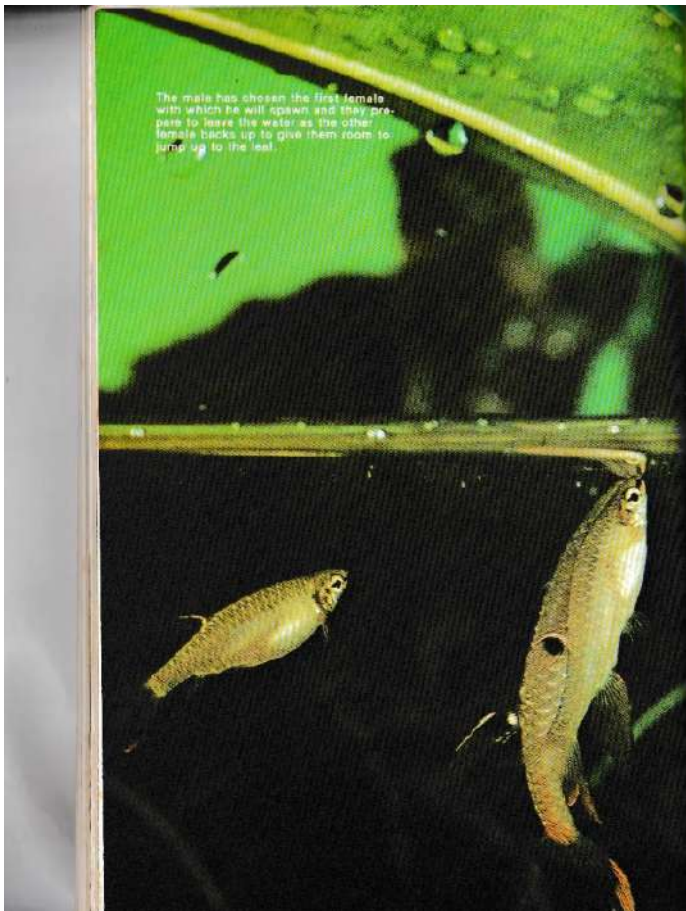
As they bend their bodies into a sigmoid shape, the pair begins to emerge from the water.



of the male's pectoral fin on the left side. The paired fins on the left side of the male's body are held close to his body while the fins on the right side of his body are extended to support his body against the pressure exerted by the spawning female. Even his broad anal fin is pressed to the right side. All of this happens in a split second, and the male continues to repeat the process with all of the females that are willing to join in the ritual. It is quite



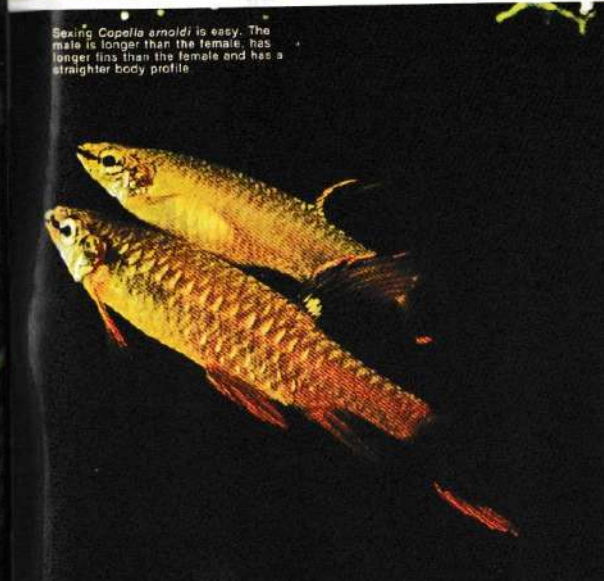
As the pair hits the leaf, the female's head lies just behind the male's left pectoral fin. The male's left pectoral and pelvic fins remain folded during the spawning act, but the right fins remain spread to brace the male on the leaf as the female pushes against him.



The male has chosen the first female with which he will spawn and they prepare to leave the water as the other female backs up to give them room to jump up to the leaf.



The pair adheres to the underside of a leaf above the water as they shed their eggs and sperm. Just how the spawners are able to adhere to the leaf is not known.



Sexing *Copella arnoldi* is easy. The male is longer than the female, has longer fins than the female and has a straighter body profile.

possible with one male and two females to get more than 100 eggs!

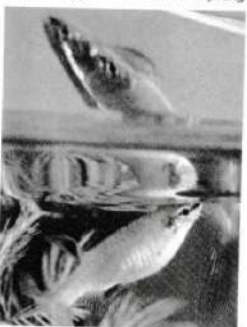
The spawning process goes on and on—almost nothing interferes with the devotion of the breeders to their reproductive acts, and even the presence of other fishes fails to diminish the ardor of the spawning fish. Usually when one male becomes active, he inspires other males to breed as well, so it is not unusual for pairs to be jumping all over the tank laying an egg or two every time they jump!

The glass cover serves several purposes. Not only does it keep the fish from jumping out (and keeps dirt and inquisitive fingers or paws from getting in as well) but it also serves as a "leaf," and the fish often lay their eggs on the underside of the cover. Most *Copella arnoldi*, however, prefer an opaque object upon which to deposit their spawn, and if you put a book or something else on top of the glass they will usually lay their eggs under this opaque area.

Once the eggs have been deposited, the females lose all interest in spawning and the male is left to guard the sacred spot. He does this religiously; every few minutes he thrashes about on the surface of the water, splashing water on the eggs with his tail. If you examine his tail closely you'll notice that the upper lobe is extended, thus facilitating this egg-protecting practice. It takes only 48 hours for the eggs to hatch; they simply fall off the spawning site right into the water. Of course the other fishes are waiting to eat them as soon as they fall, and if you want to save the fry you have several alternatives.

If possible, simply remove the leaf and put it into a small spawning tank which has no other fishes. Let the leaf project just above the water line and the young will fall into the water. By placing an airstone that produces a fine mist of bubbles under the eggs (but deep in the water) and connecting it to

a strong pump, the spray thus generated will keep the eggs moist enough. On one occasion the eggs even hatched for me when the male ignored his watering duties, so perhaps the airstone is not necessary if the environment around the eggs is humid enough (a very tightly sealed lid may do the trick). You can also remove the eggs from the leaf or glass with a razorblade and let them fall into a very shallow dish containing just enough water to keep the eggs moist. When the young



As soon as the spawning pair drops back into the water another female moves into position to jump out with the male.

hatch, the water level can be raised. Feeding the fry is not a problem, since they eat anything. Of course there is almost nothing better for fishes than newly hatched brine shrimp, but any good infusoria will serve the purpose. Egg yolk infusions seem to get the most growth from the fish, but in any case their first month's growth is slow. The second month they grow much faster.

It is interesting to read some of the very old accounts of how these fish were spawned, because most of our hints come from the old masters. Fifty years ago breeders used to put the fish into an aquarium which had a waterfall in it. This was supposed to imitate the rain and thus stimulate the fish to spawn. The rain was significant to the fish for two reasons: it meant the start of the rainy season and thus a new abundance of food; and it meant that the humidity would be high and the eggs wouldn't dry out. Now we don't have to worry about waterfalls. By just looking at the barometer we can ascertain when they are likely to spawn, for a sharp drop in barometric pressure (which usually precedes rainy weather) will almost surely trigger spawning behavior. I did just this in order to photograph the fishes. As you can imagine, I didn't want to stand by with camera in hand for 12 hours every day until the fish decided to spawn, so fortunately I

discussed this bit about the barometric pressure. I used a 20-gallon tank with a spawning temperature of 25-26°C (77 to 79°F) and I attached a lig leaf right at the surface of the water. I dropped the level of the tank so the fish wouldn't spawn on the glass. The distance from the surface of the water to the leaf was 6 cm (about 2 1/4 inches). The male always had females waiting for him; they vied for his attention. One female always jumped with him, though not necessarily the same one. It was much harder to photograph the fish than it was inducing them to spawn.

If you have a few pair of *Copella arnoldi* and they are in good condition, they will spawn by themselves and require no special preparations except for a place upon which to deposit their spawn. Look for them at your local pet shop and try spawning one of Nature's most unique innovations, a fish that lays its eggs out of the water!

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