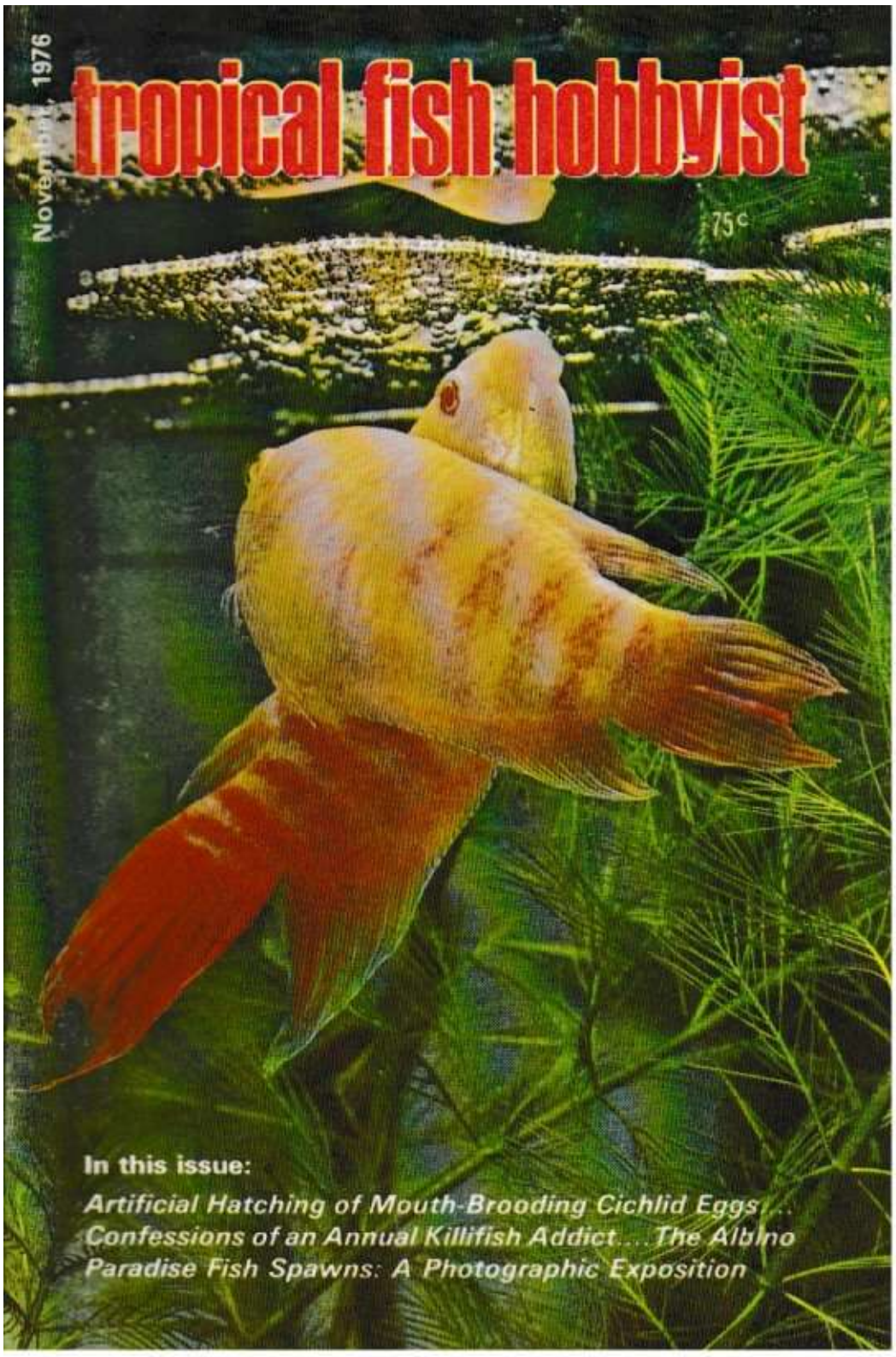
November, 1976
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Artificial Hatching of Mouth-Brooding Cichlid Eggs...
Confessions of an Annual Killifish Addict... The Albino
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tropical fish hobbyist

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☼ exotic tropical fishes supplements

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Cover

A pair of albino *Macropodus opercularis* begin the spawning embrace beneath the bubble-nest. Photo by J. Elias.

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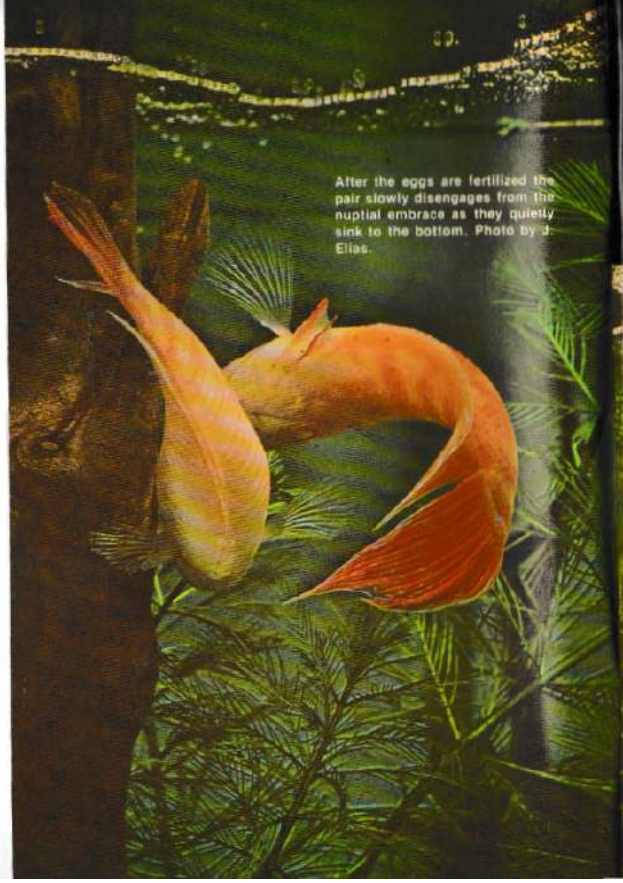
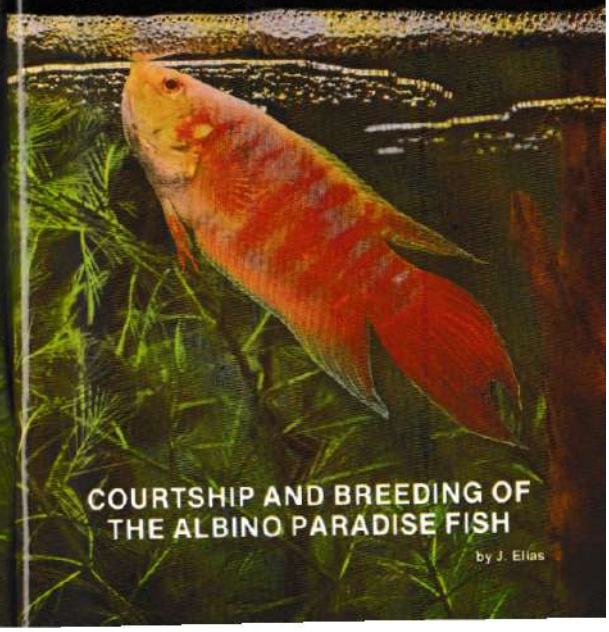


After the eggs are fertilized the pair slowly disengages from the nuptial embrace as they quietly sink to the bottom. Photo by J. Elias.

November, 1976

To aquarists of both amateur and professional status, the keeping and breeding of the paradise fish, *Macropodus opercularis*, is a subject of great historical significance. Captive propagation of ornamental fishes is an ancient art among many Oriental cultures and the paradise fish was among the first to be cultivated by the Chinese. The systematic description of *M. opercularis* was carried out by Linnaeus in 1758, but the fishes' popularity among Western cultures did not begin to

During the early phases of the courtship ritual the male albino paradise fish builds a loosely constructed bubble-nest. Photo by J. Elias.



COURTSHIP AND BREEDING OF THE ALBINO PARADISE FISH

by J. Elias

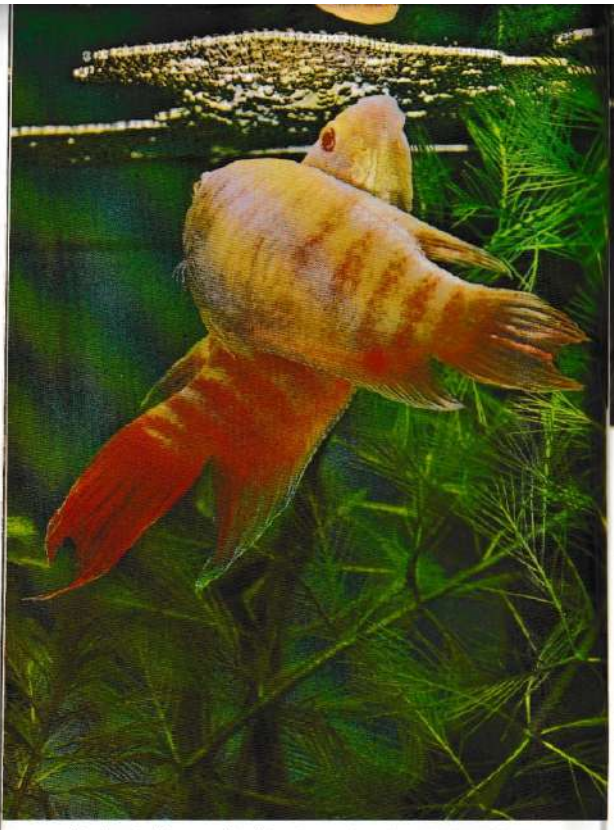
grow until more than a century later when, in 1869, the first successful commercial shipment arrived in Europe. These fishes fell into the hands of a French aquarist, Pierre Carbonnier, and since that time their rise to popularity has seen few parallels in the world of commercial and private fishkeeping. This popularity was due, of course, to its garish coloration and its "willingness" to breed in captivity.

The utility of *M. opercularis* to science has become well known and this species is now being used commercially in mosquito eradication programs. A number of scientists have found this fish to be quite useful in behavioral research and much of what is known today about visual and olfactory communication among fishes resulted from work with this species.

As with many of the more popular exotic fishes, *M. opercularis* became the subject of intensive breeding programs that resulted in the production of several new color varieties including a black strain and an albino strain. The latter, in addition to being a very beautiful fish, seems to be more gregarious than the natural strain. This peacefulness may account for the rapid rise in popularity of the albino paradise fish to the extent that its sales may now exceed those of its natural cousin from which it arose.

I recently acquired three magnificently colored adult albino paradise fish from Mr. Martinek of Prague, Czechoslovakia. The fishes were in excellent health and the female was full of eggs. I chose a tank of 15 liters (approximately 5 gallons) in which to spawn and photograph these fish. I used tapwater having a hardness of 8.0 to 10.0 DH and a pH of 7.0. The water was kept at 24° C. (75° F.) for both maintenance and propagation.

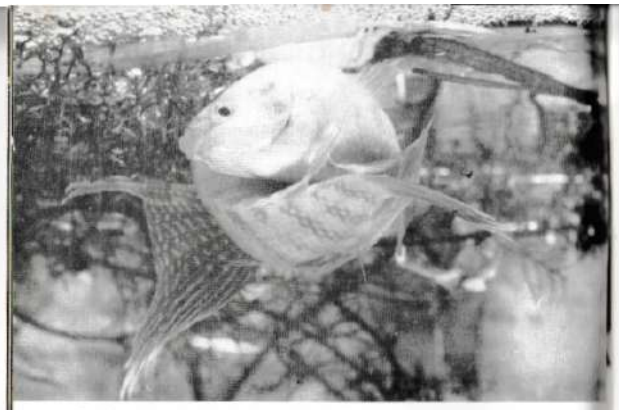
Two days after they were introduced into the tank the fish began to spawn. The male started to construct his bubble-nest in the early morning hours. Up until the time that the actual spawning began, the nest was rather loosely constructed, but once the spawning was completed the male continued to work on the nest until it resembled the firm head of a good German beer! Throughout the course of courting and spawning the male's behavior was rather surprising. Instead of aggressively attacking the female and harassing her into submission as do most of the familiar bubble-nest builders, the male courted his partner with utmost "consideration." Finally, as evening drew near, and after a few false starts, the actual spawning



The female albino paradise fish swims to the male as their nuptial embrace begins. Photo by J. Elias.

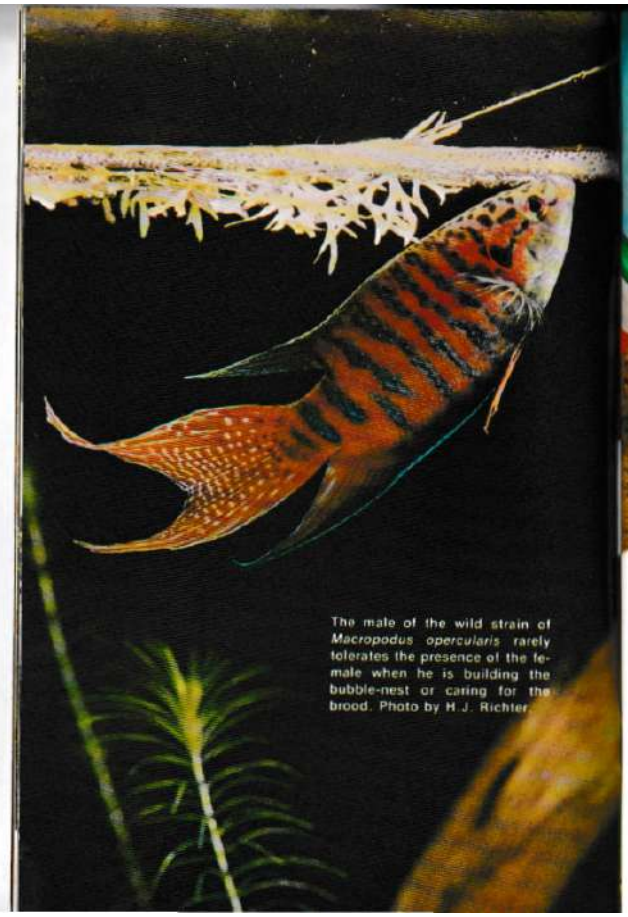
As the embrace progresses the female turns upside-down and t male surrounds the female as he bends his body into a U-shape. Pho by J. Elias.

The black form of *Macropodus opercularis* is another mutant stra that has been developed by selective breeding. Photo by R. Zukal.



As the male wraps his body around the female he appears to be forcefully turning the female upside-down. Photo by M. Chvojka.

As the spawners release their embrace, eggs can be seen drifting toward the bottom of the tank. Photo by M. Chvojka.



The male of the wild strain of *Macropodus opercularis* rarely tolerates the presence of the female when he is building the bubble-nest or caring for the brood. Photo by H. J. Richter.

act began. Only a few eggs resulted from each of the first few encounters, but the number of eggs increased with each new embrace. Their spawning act was so peaceful that the female even helped the male pick up the eggs and blow them into the bubble-nest. Afterward she also helped him expand and fortify the nest.

The actual spawning took place according to the rules. The female swam to the male who was poised under the bubble-nest. The fishes pursued each other in ever-narrowing circles until they finally embraced in the typical anabantoid fashion with the male wrapped around the upside-down female and theirs vents in close apposition. After the eggs were expelled and fertilized, the pair gradually loosened their embrace and slowly drifted toward the sandy tank-bottom. Immediately following a brief respite from this intense sexual activity, both the male and the female began to gather the eggs and blow them up into the bubble-nest. The entire spawning sequence was repeated a number of times until about 350 eggs had been produced.

Post-spawning care of the eggs and fry followed the normal routine for bubble-nest building anabantoids except that both parents participated in the brooding activities. During this time I observed no skirmishes between the parents. About three-fourths of the eggs hatched and were subsequently reared to maturity. As they grew their beautiful red and white colors and red eyes became quite vivid, and at maturity their color exceeded all expectations. **t.f.h.**

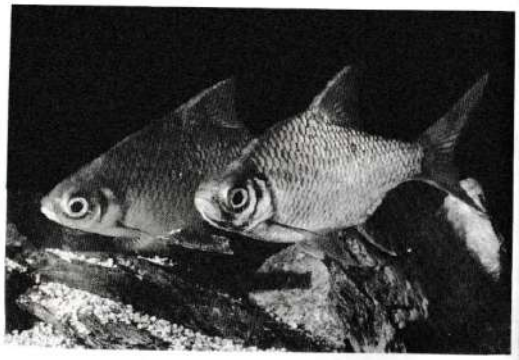
GOLDFISH SOCIETY OF AMERICA

Hobbyists interested in joining the Goldfish Society of America should write to the organization at 1510 William Way, Concord, California 94520.

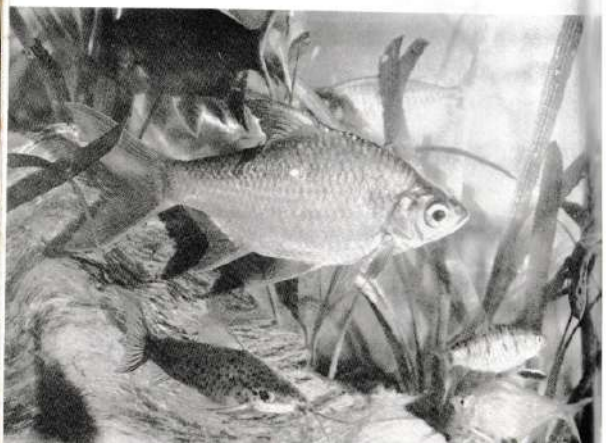
HOW LONG DO FISHES LIVE?

Recently, a number of European hobbyists were surveyed as to their fishes' longevity. Here are a few of their replies on some of the species important to American hobbyists:

Kuhli loach, *Acanthophthalmus kuhli*	6 years
Leopard catfish, *Corydoras julii*	4 years
Red-tailed black shark, *Labeo bicolor*	4 years
Serpae tetra, *Hyphessobrycon serpae*	2 years
Guppy, *Poecilia reticulata*	6 years



The tinfoil barb's large shiny silver scales, combined with its strong schooling instinct, make a group of these fish a sight that one is not likely to forget. Photo by George Hartman.



Tinfoil barbs are voracious plant eaters and can even destroy tough fibrous plants like *Vallisneria* or *Sagittaria* if they are not provided with adequate vegetable matter in their diets. Photo by Dr. Herbert R. Axelrod.

Once you've seen your first tinfoil barb, you'll never have any difficulty identifying the species. They have a chunky, heavy-set body that is covered with large reflective silvery scales. As the fish matures, the back gains in height and the belly deepens, giving it a progressively stockier appearance. The fins are a striking orange-red color, with the caudal lobes each bordered by a black bar, and the dorsal fin sporting a black tip. With age, the colors become more intense. In very young fish, the fins often have a yellow hue.

What does it take to keep tinfoil barbs happy and healthy? Well, consider the fact that they are among the most hardy, undemanding fishes you could purchase. They'll eat absolutely any food offered to them, whether it be commercially prepared, your own concoction, or alive. When it comes to pH and hardness, just avoid the extremes and your barbs will be comfortable. The same goes for temperature. Readings in the mid to upper seventies suit them fine. To top it off, tinfoils are extremely disease resistant, and, being very peaceable, get along with all but the tiniest of companions. But before you rush out and buy a school of *schwanenfeldi* barbs, make sure you're aware of all of their requirements and can meet them.

First is the question of size. With good feeding your two-inch tinfoils can be expected to reach a total length of nine inches within two and a half years. That's a lot of fish. Also realize that they're a schooling fish, and as such are much more at ease and give their best appearance in groups of at least three. Add to this the fact that it is a very active species requiring a great deal of swimming room, oxygen and food. All of which results in an incredible amount of waste being produced, obviously calling for the best filtration systems, and frequent (weekly) partial water changes. Try to be realistic in your outlook. Unless you are willing to devote at least a 30-gallon aquarium to these fish, don't consider keeping

them. Another drawback is their dietary need for goodly amounts of vegetation. If you use plastic plants and supply substitutes such as spinach and lettuce, fine. But if underwater gardening is an important facet of your fishkeeping, you could have a real problem on your hands. One possible solution to such a situation might be to restrict plantings to the strip along the back edge of the tank, and then use a section of glass to block off this small area from the fish. This has the added feature of making it much easier to net your fish if the need arises.

Keep in mind that even though they are not aggressive, their very size can make them dangerous to smaller tankmates. When an acquaintance of mine ran past his aquarium, which contained large tinfoils and very large angelfish, the barbs panicked and one of them batted an angel so severely that it died in seconds. For this reason the best companions can be chosen from among the many other fast moving species available. The *Metynnis* species and the other fishes generally offered under the heading of silver dollars are excellent choices, since their maintenance requirements are quite similar. One last word of caution: tinfoils take to the air with the slightest provocation, so a sturdy cover, which should be employed no matter what species you maintain, is an absolute necessity with *Barbodes schwanenfeldi*.

Tinfoil barbs are bred in large numbers by commercial breeders in the Far East, and possibly other areas, but for an aquarist to make an attempt an extremely large container would be required. Additionally there seems to be no certain means to discriminate between the sexes, though males could logically be expected to have more intense coloration and to be somewhat slimmer than a ripe female. So unless you have a pool and enjoy experimentation, I'd suggest leaving their breeding to the professionals.

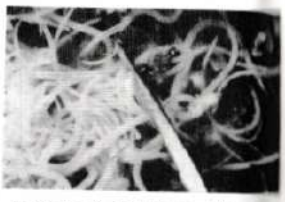
A NEW WAY OF COLLECTING FISH

We recently received a report from Mr. P. Kleinschmidt who formerly was a ranger for the Northern Rhodesia Department of Game and Tsetse. As a ranger, he had occasion to clear a harbor of floating islands of grass, reeds, and papyrus. After throwing the material on the beach, Mr. Kleinschmidt found many fishes entwined among the roots of these plants. To increase his collection of fishes, he merely had to pick them up off the beach. . . easy pickins!

WHITE WORM CULTURE

by L. Edward Stansbury
Photos by John Nordheim

Many tropical fish hobbyists, through the years, have cultured white worms, *Enchytraeus albidus*, to assure their own dependable source of inexpensive and convenient live food (3, 5). Recently, animal nutritionists have demonstrated the value of white worms over other live foods. For example, compared to daphnia (7) and tubifex (4), white worms have up to 290% more protein and 5 to 20% more fats. Until recently, almost no scientific information has been available on white worms. This paper dispels many old ideas and opinions on white worms by providing facts and figures concerning their biology and culture. A proven method is described in detail and close adherence to these precepts will assure successful cultures.



Close-up of *Enchytraeus albidus*.

THE CULTURE BOX

The best box is an unvarnished, unpainted wooden box made from ¾-inch stock. It should be 4 to 6 inches in depth and from 12 by 18 inches to a maximum of 20 by 20 inches square (7). Size isn't too important, but smaller boxes are better for starting cultures. A tight fitting top is essential. It helps control moisture, protects the culture from insects, and keeps the culture dark, which is important as the worms are very light sensitive.

THE SOIL

The soil used should be an equal blend of garden loam (clay or sandy soils are unacceptable) and organic matter. The organic matter keeps the soil loose, holds moisture, and helps provide an ideal pH range of 6.2 to 6.7 (7). Peat moss or leaf mold is an excellent source of organic matter. *Do not* use commercial potting soils as the chemicals added to kill soil insects, fungi, and other pests will also kill white worms. Heat the mix in an oven at 150° F. for 2-3 hours to kill all insect pests and their eggs. Then fill the box ⅔ full of the sterilized soil and allow to cool.

MOISTURE AND WATERING

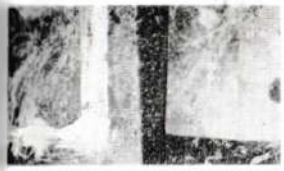
Since white worms cannot prevent water loss from their bodies, the soil must be kept wet enough to maintain 100% humidity within the air in and above the soil. Yet the soil must not be soggy, as this will inhibit gaseous exchange in the soil and will kill the worms. When the proper moisture level has been achieved, add the worms to the soil.

The culture should be watered after harvesting or feeding. Water should never be poured onto the culture. Instead, the culture should be sprayed lightly using a fine mist sprayer similar to those used for house plants. The proper amount of watering can be learned only by experience; most beginners tend to keep cultures too dry.

TEMPERATURE

Optimum reproductive temperatures for white worms are 15° to 21° C. (59° to 69° F.). The worms will live and reproduce, although at lower rates, down to 8° C. (46° F.) and up to 25° C. (77° F.). Temperatures above 27° C. (80° F.) are lethal (7).

Close-up of the cover glass shows masses of worms feeding at the surface.



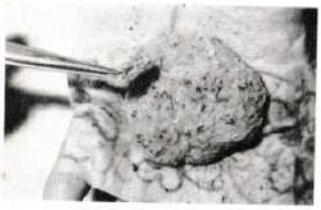
White worms during cleaning. The black specks are harmless pieces of peat moss from the soil.

FEEDING

Old texts and old-timers often recommend feeding mashed potatoes, cooked oatmeal, dog foods, cheese, etc. (3, 6, 8). More recently, fish nutritionists have proven that finely ground flours of wheat and rye are the best foods for white worms. In lieu of this, nothing is easier, more readily available, or as productive as white bread (7).

Many people recommend the food be buried in shallow trenches or in holes (5, 6, 7, 8). This does feed the worms well. Others, including myself, prefer to crumble the bread over the surface of the soil and then spray it lightly with water. I then cut a piece of single strength glass approximately an inch or two smaller in each dimension than the soil surface, and place it over the soil and bread crumbs. This insures a high moisture content and allows direct examination of the culture.

Only small portions of bread should be fed to a starter culture. Feed only as much as the worms completely eat in two or three days. If all the bread is eaten, increase the amount provided at each feeding. However, if any bread is left over, remove it (the left over pieces will only encourage insects, fungi, and bacteria; it will not be eaten by the worms) and feed a smaller amount of fresh bread. A starter culture may eat as little as ½ square inch of bread, while a mature culture may eat a whole slice every other day!



A one-week harvest of clean worms from the author's best culture; enough to feed hundreds of fish!

HARVESTING

After a culture is 2 months old, you should be able to harvest worms for your fish. If the bread is fed in shallow trenches, the worms will be found below the soil surface. To separate the worms from the soil, place a spoonful of soil in a dish with enough water to cover the dirt. The worms will crawl free of the dirt and can be gathered to be fed to your fish. Another method uses a small funnel fitted inside with a fine screen mesh which allows passage of the worms, but not the soil. Place the funnel, filled with soil and worms, in a glass of water and position under a strong light. The worms, being light and heat sensitive, will burrow downward through the soil, screen, and into the glass of water (8). If the bread is fed on the soil surface rather than in trenches, the worms will be clustered on the soil where they can easily be collected.

Regardless of the harvesting method employed, leave the worms in a small amount of water for 30 minutes. They easily survive this treatment and will void their intestinal tract of dirt and semi-digested food. They can then safely be fed to your fish, either whole or chopped. Whole they can live up to 48 hours in your aquarium. To insure that these worms do not burrow into your aquarium gravel and die, extra siphoning or extra catfish may be necessary (2).

YIELD

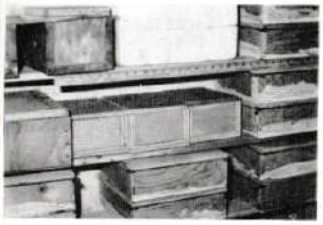
During the first month, the population of your culture should double or triple. Every subsequent 20 to 30 days, the culture's population will increase from 4 to 7 times (7). This extraordinary growth rate means that within 2 to 3 months of starting a culture you can harvest a walnut-size ball of worms every week without depleting the culture!

ENEMIES

Ants, mice, and beetles are your culture's worst enemies, and a tight-fitting lid on your culture box is the best prevention. Most cultures end up with mites, which don't harm the worms, but do compete for the bread. Mites can be held to a minimum by lowering the soil moisture content slightly, placing the food deeper in the soil, and smearing the inner surface of the box with petroleum jelly or kerosene (7).

PRECAUTIONS

It has been reported that some fish suffer fatty degeneration of the reproductive organs from eating high protein diets (1, 9). The glass fish, *Chanda*



An example of culture boxes maintained by the author.

lala, and its relatives appear to suffer from this, which makes them unsuitable as breeders. In nature, these fish eat small crustaceans which are very low in proteins and fats. A diet of protein-rich white worms is, therefore, unnatural and possibly unhealthy (9).

Remember, a steady diet of almost any single food is inadequate. A varied diet consisting of both live foods and processed foods is better than either one alone for most fish.

Another problem concerns disturbing the cultures too often. The disruption of feeding and reproduction slows the culture's growth; limit your feeding, watering, and harvesting to 2 or 3 times a week.

These fundamental biological and physical facts, plus a little experience, will provide an important year-round food which can be used as a breeding conditioner or as a supplement to your regular feeding routine. It will improve the condition of your fish and boost the size of spawns. Try them!

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NEVADA SHOW

The Nevada Aquarist Society will hold their annual show on November 3-7, 1976, at the J.C. State Fair Convention Center. For more information contact Dianne T. Higley, 2205 Dogwood Avenue, North Las Vegas, Nevada 89030.

A male *Amphiprion ocellaris* tends to a brood of newly hatched young that are adhering to a rock surface. He fans them to provide oxygen and to sweep away debris that may have settled among the fry. Photo Dr. Jens Meulengracht-Madsen.

ON REARING THE FRY OF MARINE TROPICALS

TFH has received and published, from time to time, reports of successful captive spawnings of a number of species of marine fishes. Very few of these reports, however, gave any indication of successful rearing of the fry to adulthood. Early problems inevitably arise in getting the fry to eat. Many hobbyists who have overcome this problem have met with later failures in getting the fry to metamorphose.

We recently received a report from the U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Center (SEFC), that Barbara Jayne Palko, one of their fisheries biologists, has had great success in raising the fry of the Pacific clownfish, *Amphiprion melanopus*, past the critical metamorphosis. The eggs were supplied to SEFC by Drs. Sally and Joseph Bauer of Strongsville, Ohio, who collected the spawning pair of Pacific clownfish at Eniwetok Atoll in July of 1974. The Bauers kept the clownfish in a 50-gallon aquarium at their home. On May 10, 1976 the *A. melanopus* spawned and the

eggs were shipped to the SEFC on May 14th, where they hatched on May 17th.

After hatching, the larvae were placed in a 20-gallon aquarium containing an abundance of *Chlorella*, an easily cultured marine alga that gives the water a green tint. In addition, the fry were fed a cultured rotifer species, *Brachionus plicatilis*, and 35-micron plankton that were collected daily off the Miami laboratory dock. The main stripe on the head of these fish was present by May 29th when metamorphosis had taken place. Three days later the large pigment spot at the base of the dorsal and caudal fin began to appear. This spot is not present on the adult.

As this issue was going to press the juveniles were doing well and feeding on 295-micron (0.295 mm.) plankton and live brine shrimp nauplii (the Great Salt Lake strain). The fry are being held in a 20-gallon aquarium without bottom filters, and some water is changed twice weekly.

In addition to *A. melanopus*, scientists at this laboratory have reared third-generation tank-spawned *A. ocellaris*. The latter were also spawned at the Bauer residence. The juveniles are now back in the possession of the Bauers, and it is hoped that they will spawn in about 18 months.

To date, personnel at SEFC have reared 55 species of marine fishes of commercial and recreational importance, as well as some of those species popular with tropical fish hobbyists. Tropicals such as French angels, neon gobies, hogfish, sergeant majors, hamlets, *Monodactylus sebae* (a successful spawning of this species was reported in the October, 1976 issue of the *Tropical Fish Hobbyist*), barracudas, flounders, soles, and snappers have been reared to juveniles. Most of these fishes were collected as naturally spawned eggs off the coast of Miami. Some of the eggs, however, were supplied to the SEFC by the Bauers and other hobbyists.

It is understood, of course, that facilities at the SEFC are much more elaborate than those of even advanced marine hobbyists, and it would require excessive amounts of time and expense to duplicate conditions at the SEFC. It is our hope, however, that as a result of the apparent par excellence work being carried out by the people of the SEFC and by dedicated hobbyists such as the Bauers, breeding of marine tropicals will soon be within the practical reach of the average marine hobbyist.

Labeotropheus fuelleborni eggs at three days post-fertilization. The blastodisc is well formed at the animal pole (narrow end) of the eggs. Each line equals one millimeter. Photo by Dr. D. Terver, Nancy Aquarium, France.

ARTIFICIAL HATCHING OF MOUTH-BROODING CICHLID EGGS . . .

A BOON TO COMMERCIAL AND SEMI-COMMERCIAL CICHLID PRODUCERS

by Ron Ching

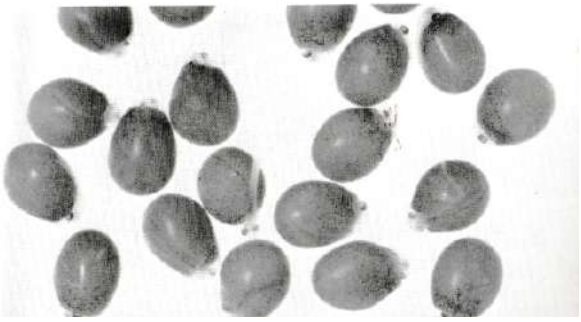
Breeding and selling African cichlids can be both challenging and financially rewarding if one can produce them frequently and in sufficient quantities. Interest in these cichlids is still very strong despite high costs for the rare and new types and an oversupply of the rather common varieties. Although the new and rare species still demand spectacular prices, the more prolific and common varieties continue to sell well and help introduce many hobbyists to this fascinating group of cichlids. Even though some prices have dropped drastically within the past year, one can still realize some profit or at least break even, by selling the offspring from successful spawnings. Of course, prime specimens, no matter what species, will always command good prices.

For the past year, I have been successful in mass producing mouth-brooding African cichlids by artificially hatching the eggs of various species. Through experimentation I have developed a simple but effective technique that has produced very good results. Artificial hatching has three main advantages over the normal mouth-brooding instinct: 1. the risk of loss of eggs or fry is eliminated or greatly reduced; 2. species or individuals that do not feed during the long brooding period will not "waste away" and become emaciated, requiring a long reconditioning process; 3. spawning will occur more frequently as the brooding stage is eliminated or cut short.

Egg retrieval from the female can occur immediately after spawning or at any time during the brooding period. Some females are notorious egg eaters while others have a difficult time retaining them. For females brooding for the first time, I usually let them brood for the full term. This seems to fixate the brooding instinct. Of course, this does not always occur as some individuals will spit out the eggs while being transferred to a brooding tank or during periods of excitement.

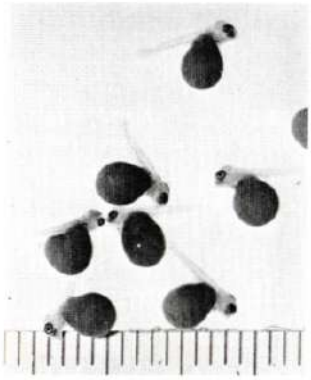
A female can be gently stripped of all eggs with a minimum of fuss and bother. Naturally, the larger the fish, the more risky it becomes. But most of my breeders are young

Well developed *L. fuelleborni* embryos at five days post-fertilization have begun to lift their heads and tails from the enormous yolk sacs. Photo by Dr. D. Terver, Nancy Aquarium, France.



and do not exceed four inches. I would probably think twice before stripping a seven- or eight-inch *Haplochromis moorii* or *Cyphotilapia frontosa*. Stripping consists of gently prying open the mouth of the female with a pointed but not too sharp instrument such as a filed down pen-knife blade. The fish must be kept under water and firmly grasped as she will struggle to get free. Try to minimize the fish's movement as much as possible by turning her upside down. Opening her mouth may take some time as most females will keep their mouths tightly closed. Persistent but gentle probing usually brings results. Continue to hold her mouth open and before long she will cough out the eggs or embryos. Do this until all eggs have been removed, then peer down into her mouth cavity to make certain nothing remains. Upon release, most females will start feeding shortly thereafter.

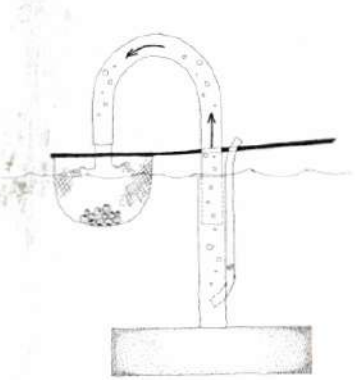
Very little equipment is needed to artificially hatch the eggs or to maintain the embryos past the yolk sac stage. I use a small aquarium with the same water as the brooding tank, a small brine shrimp net, a sponge filter, some fungicide, and a J-shaped piece of plastic tubing that will fit into the stem of the sponge filter. After attempts at bubbling air through various



At eight days post-fertilization, *L. fuelleborni* eggs have hatched. The fry will receive all of their nourishment from the large yolk attached to the abdomen until it is completely absorbed, at which time they become free-swimming and begin to feed. Photo by Dr. D. Terver, Nancy Aquarium, France.

sizes of rigid plastic tubing, positioning air stones just below a net full of eggs, or churning the water with heavy aeration, I've had much better results with the following technique. A brine shrimp net is used because water will pass through freely and small currents are created by the inflow of water. The sponge filter provides sediment-free water and its outflow can be regulated. Any fungal growth is curtailed by the use of a fungicide. The water level of the tank should be adjusted so

A simplified device for artificially hatching the eggs of mouth-brooding cichlids utilizes an inexpensive sponge filter and a brine shrimp net. The net is placed across the top of the tank and the filter is positioned to empty into the net. The churning action of the water passing over the eggs in the net simulates the resulting action of the brooding female's chewing motion.



that when the net is laid across the tank top, it is filled about two-thirds with water. The eggs are put into the net and are gently tumbled about by adjusting the positions of the sponge filter and net. African cichlid eggs are so heavy that they must be constantly shuffled about to prevent the yolk from settling to one side and destroying itself. As a disinfectant I use Tetra's Fungistop® and it does not have any effect on the development of eggs and embryos. In a few days, little eyes and a splinter of a tail can readily be seen. Once the yolk sac has been completely absorbed, the fry can be removed from the net and fed the appropriate foods. **t.f.h.**

CONFESSIONS OF AN ANNUAL KILLIFISH ADDICT

by Marshall E. Ostrow

The fire killie, *Nothobranchius rachovi*, is a typical plougher. Here several eggs are seen just after they were fertilized in the substrate. Photo by H.J. Richter.

The *C. alexandri* male is one of the most colorful of the South American annual killifishes, particularly when it is in breeding condition. Photo by Dr. Bruce J. Turner.

I was recently involved in a rather hotly debated discussion with several well known ichthyologists and aquarists (whose names shall forever remain anonymous due to the crushing defeat I dealt them) as to why killifishes have never become as popular among aquarium hobbyists as have other families of fishes. My first reply to their attack dealt with misunderstandings centered around the alledgedly aggressive behavior, short life-spans, and lack of availability of killifishes.

My would-be adversaries agreed with my interpretations of these generally false notions and even stuck their conservative necks out so far as to admit, albeit with tongue in cheek, that tropical killifishes are among the most beautiful of our aquarium species. "BUT," replied these petulant perpetrators of piscean partiality to schooling tetras and brooding cichlids, "what do killifishes do that is interesting?"

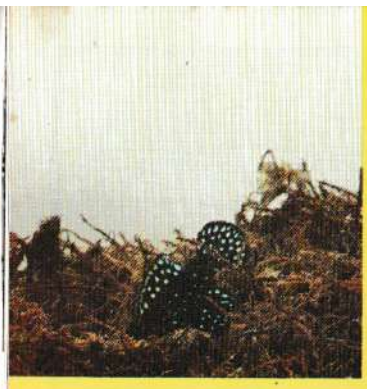
At once the hair on the back of my neck stood erect, my canine teeth bared, my muscles became taut, and my heart-

beat quickened as my adrenal glands pumped themselves dry! Then I let these rapacious ruffians have it with both barrels! With quiet confidence I replied, "If Raquel Welch entered your home in a teeny weeny yellow polka-dot bikini (for the benefit of the female aggressor in the group I tactfully added 'or Burt Reynolds'), would you not be so entranced by her beauty and form that you would do little else but gawk in utter speechlessness?" Then I reloaded and fired a second shot for all it was worth! I said, "How many cichlids and tetras do you know of that dive into the bottom mud or sand, entwined about each other, to lay their eggs?"

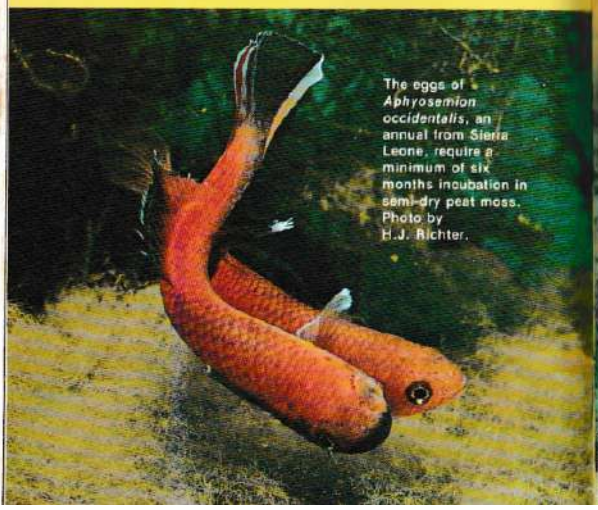
I am proud to say that a major victory for killifish nuts of the world has been won! My antagonists lowered their heads (in reverence, I hope) and quietly left the room, dragging their drooping tails behind them in utter defeat!

This vignette now leads us into my discussion, the annual killifishes. Annual killifishes do not derive their name from their spawning frequency, but rather from the fact that *in nature* they live for only one spawning season. Most of them inhabit shallow ponds in the forest-savanna ecotones or in the open savanna (grasslands) that dry up annually. However, their unique method of spawning effectively preserves each species in each habitat. Most of the African annual species (i.e. of the genus *Nothobranchius*) are known in the trade as ploughers: that is, pairs plough through the bottom mud of their ponds, depositing eggs an inch or so under the surface of the substrate. The South American species (i.e. mostly of the genera *Cynolebias* and *Pterolebias*) are known as the peat divers. Here, pairs dive as deep as four or five inches into the peaty bottom, concealed from the view of predators, where they then deposit their eggs.

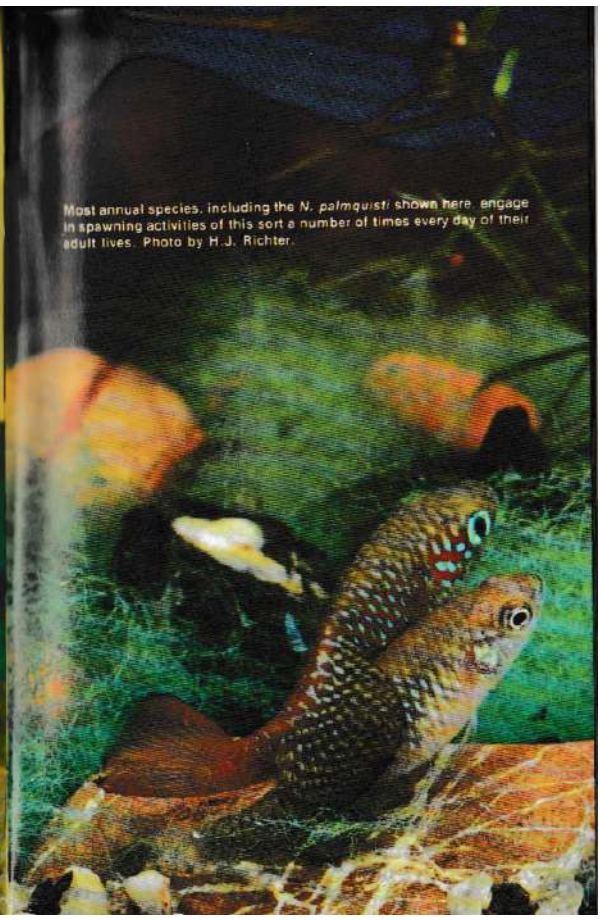
In both peat and mud-bottomed habitats these ponds, more often than not, completely desiccate for the duration of the dry season, which lasts from three to six months. During this time, the spawners, of course, die, but the eggs develop slowly in the moist underlayers of the dry substrate. During their development, the embryos go through several diapauses (resting stages). When the hot tropical rainy season begins the eggs start to hatch as the ponds once again fill with water. Because of their short life-span, the fry grow quite rapidly, often reaching sexual maturity in less than six weeks; then the cycle begins anew. These short life-spans, however, are con-



Only the posterior end of the *Cynolebias nigripinnis* male is visible here as the fish pursues a female deep into the peat moss bottom. When they are completely submerged in the peat moss the pair will lay and fertilize a few eggs at a time. Photo by R. Zukal.



The eggs of *Aphyosemion occidentalis*, an annual from Sierra Leone, require a minimum of six months incubation in semi-dry peat moss. Photo by H.J. Richter.



Most annual species, including the *N. palmquisti* shown here, engage in spawning activities of this sort a number of times every day of their adult lives. Photo by H.J. Richter.

siderably extended in captivity merely by keeping the fishes' water at 70° F. or lower. I have had *Cynolebias whitei* actively spawning at the ripe old age of 22 months and *Nothobranchius guentheri* busily "doing their thing" at 18 months of age.

If you have had no experience with annual killies, you are probably thinking that I am going to ask you to try to duplicate the rainy and dry seasons of the tropical savanna. Not so. I am merely going to ask you to provide them with a ½-inch to 4-inch layer of fine peat moss on the bottom of their tanks. The depth of this layer depends upon the species that you acquire. For any of the *Nothobranchius* species or some of the *Aphyosemion* species such as *Aphyosemion occidentalis*, the golden pheasant killie, you can use about ½-inch of finely sifted *unfertilized* peat moss placed in a 4- or 5-inch diameter shallow bowl and gently lowered to the bottom of the aquarium. (Be sure to saturate the peat moss before placing it in the bowl.) For the peat divers such as *Cynolebias bellotti*, *C. whitei*, and *Pterolebias peruensis*, cut a 2-inch diameter hole in the top of a 4- to 5-inch deep plastic bowl such as the kind that ice cream comes in. Place 3 to 4 inches of finely sifted saturated peat moss in the bowl, replace the lid, and lower this receptacle into the aquarium.

If the *Cynolebias* or *Pterolebias* disappear into the bowl, you may be certain that they are busily spawning in the peat moss. The *Nothobranchius* and *Aphyosemion* species will very quickly side by side drop their posterior halves into the peat moss, with the male's dorsal and anal fin encircling the female as the eggs are deposited one by one.

After a week or two of intensive spawning activity, the peat moss may be removed, in both cases, and gently wrung out in a fine-meshed net or in your hand. Then the peat moss should be spread out on several layers of paper towels and blotted as dry as possible. It should remain on the towels, exposed to the air, until it attains the consistency of fresh pipe tobacco. Now you can dump the peat moss into a plastic bag and seal it to enclose a small amount of air. The bag should be stored in a dark cool place (68° or 70° F.) for the duration of the incubation period. The bags could contain anywhere from 50 to 300 eggs, depending upon the age of the spawners and their physical condition. The lives of the spawners can be extended if the sexes are separated and they are rested for a few weeks between spawning sessions.

Aphyosemion filamentosum is not a true annual but spawns in the same manner as the ploughing annuals. The eggs require five to seven weeks incubation in dry peat moss. Photo by R. Zukal.

The eggs of most annual species should be incubated for at least three or four months. In certain cases, such as with the golden pheasant killie and some of the South American annuals, the eggs must be incubated for as long as six months before any will hatch. Hatching is relatively easy. Simply dump the peat moss into water. The eggs will begin to hatch in a few minutes, and all that are going to hatch at this time will have hatched within 24 hours. The fry can be siphoned or netted out and placed in rearing tanks. Some species can take newly hatched brine shrimp nauplii right away; others are smaller and should be fed microworms or infusorians for a few days before switching them to brine shrimp. The latter is particularly true with the nothos. It is important that you *do not* throw the peat moss away at this time. Many of the embryos may have gone into a second diapause and will hatch subse-

A. sjoestedti will spawn in a floating mop although they will produce a greater egg yield if provided with a soft substrate for bottom spawning. Photo by R. Zukal.

A breeding pair of *Pterolebias peruensis*, an attractive South American annual species, begins to dive into the spawning medium. Photo by R. Zukal.

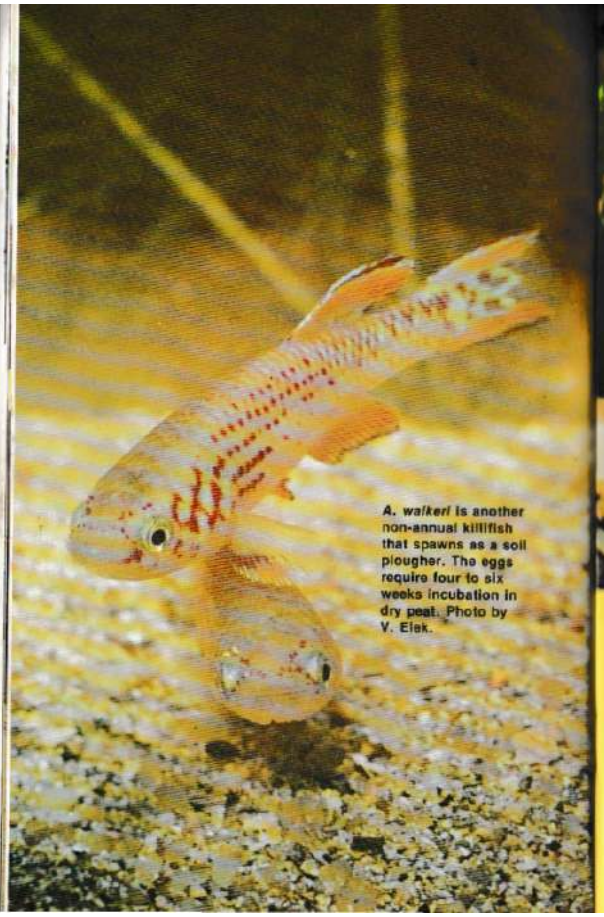
quently. The peat moss should be dried again and stored for another month; the soaking can then be repeated. I have had nothos hatch out after the fifth soaking. If nothing hatches out the first time, don't be discouraged. Dry the peat and try again a month later. No harm will be done by soaking the eggs prematurely as long as they are dried again within 24 hours.

Most annual species do well in soft acid water at a pH of about 6.4 or so. However, as with the two-week plant-spawners, I have had equal success with most of them in hard alkaline water. The chances of success, however, will be shifted in your favor if you soften and acidify the water somewhat.

Many of the annuals are highly susceptible to "velvet disease," caused by *Oodinium limnectum*, a protozoan parasite. However, this susceptibility is easily eliminated by dissolving one teaspoon of NON-IODIZED salt per gallon in their water. The salt effectively prevents this parasitic invasion.

In most killifish species, the bright colors are seen only on the males. The most colorful of the true annuals are the *Nothobranchius* species of eastern and southern Africa. Most of them have bright blue-green edges on each scale and a cherry-red caudal fin with a jet black posterior edging on some. The prettiest of these, and unfortunately one of the scarcest, is the fire killie, *N. rachovi*. In this fish, the red of the caudal fin is broken up by patches of sky-blue and dark vertical bars. A recent discovery in this colorful genus is *N. korthausae*, which hails from the island of Mafia, about 75 miles due east of Dar-es-Salaam, Tanzania. This fish looks almost exactly like *N. rachovi* except that the red is replaced by an unbelievably brilliant yellowish-chartreuse. The golden pheasant, *Aphyosemion occidentalis*, is an over-all golden color with sky-blue edges on the caudal fin and a rich indigo blue color covering the chin and throat. Caution must be observed with this species, however, as it is one of the larger exotic killies, and its pugnacious temperament unfortunately spreads a bad name to all killies. I find the extra trouble necessary with this species well worth while, as its coloration is exquisite.

The South American annuals tend to be more drab than the African species, but they have a subtle beauty all their own. Most of them tend to be a brownish color, with dark vertical bars and many small blue-green spangles. Some, such as *Cynolebias nigripinnis*, are black but have the same blue-green spangles.



A. walkeri is another non-annual killifish that spawns as a soil plougher. The eggs require four to six weeks incubation in dry peat. Photo by V. Elek.

The male *Nothobranchius korthausae* literally grasps the female with his dorsal and anal fins as their posterior ends sink into the substrate where the eggs are expelled. Photo by H.J. Richter.

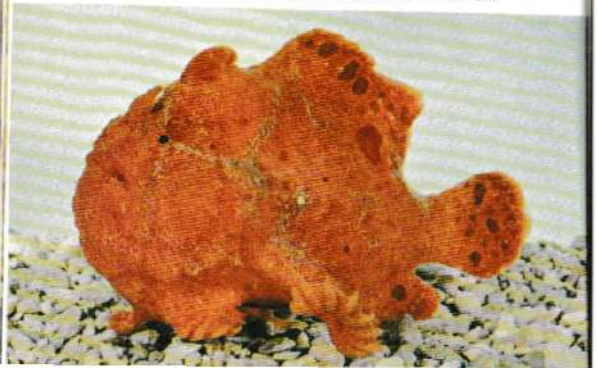
When one considers the unusual spawning behavior of the annual killies, it becomes obvious why my antagonists, mentioned at the beginning of this article, met their Waterloo when they told me that killies were uninteresting. If you would like to try your luck with something that is really different and relatively easy to handle, give the beautiful annual killifish a whirl. **E.F.B.**

Hobbyists interested in joining the American Killifish Association should write to the Membership chairmen, Jerry & Bev Sellers, P.O. Box 4231, Sarasota, Florida 33578.

One of the more common questions I receive about fishes (both fresh water and marine) is, "How do you interpret the numbers given as meristic characters in the various books and scientific papers?" Clearly, many of these numbers are very significant in identifying the fishes, but when one does not know what they are all about they are quite useless. I will try and give you a short course in the methods of counting and

The rays of the anterior dorsal fin of *Apogon margaritophorus* are all spinous as is the first ray of the second dorsal fin. Its fin-ray formula is VII-I,9. Photo by Dr. Herbert R. Axelrod.

The anglerfish *Antennarius multiocellatus* has several independent spines that lie anterior to the dorsal fin and appear as fleshy protuberances. The lure-like appendage seen on many of the anglerfishes is a modified independent dorsal spine. Photo by Aaron Norman.



abbreviation of these meristics.

First, the fishes' fins are generally referred to by a single letter, usually the first letter of the name of the fin. The dorsal fin is D, the anal fin A, the caudal fin C, and the pectoral and pelvic fins are P, but differentiated by P1 for the pectoral and P2 for the pelvics (older literature often terms the pelvics the ventral fins and uses the abbreviation V for them). This is purely for convenience.

The fins themselves are composed of two basic kinds of ray elements, spines and soft-rays or segmented rays. The spines are generally stiff, sharply pointed, and unsegmented, the ones that stick you in the fingers all the time or get caught in the nets. Some fishes, like the pseudochromids, have relatively weak spines that are very soft-ray-like but on close inspection can be seen to be unsegmented (they lack cross divisions along their length). The soft-rays are mostly, but not always, branched and are always segmented. To distinguish the two types of rays (spines and soft) on paper, the spines are designated by Roman numerals and the soft-rays by Arabic numerals. For instance, a fish with 10 dorsal fin spines and eight dorsal fin rays would have a count of D X,8. If the anal fin had three spines and eight soft-rays, the count would be A III,8. If you count a number of fishes you will find that not all have the same number of rays (the term *rays* can be used for both spines and soft-rays), so you must give a range, such as D IX-XII,8-10; A III,8-10. Some fishes have two (or more) dorsal fins, with the first composed of spines and the second of spines and soft-rays. A hyphen is used to indicate this as in the goatfishes or apogonids (D VIII-I,8). In anglerfishes with several separate spines before the soft-rayed part of the fin, the abbreviation can be stated as D I-I-I-12 (or D I+I+I+12). Sometimes unbranched soft-rays are indicated by small i's so that a fin count may read D III-ii,25, meaning that there are two fins (a single fin would read D III,ii,25), the first composed of three spines and the second of 27 soft-rays, the first two of which are unbranched. If there are no spines in the fin there will be no Roman numbers; if no soft-rays there will be only Roman numbers.

The pectoral fin usually has a stiff ray along its upper edge which some workers indicate as a spine, others not. Therefore a pectoral count may read P1 I,i,11-13 or P1 ii,11-13, or even P1 13-15. Usually the pectoral fin is abbreviated P instead of P1 since the pelvic fin is often not reported due to its near non-variability within the species of higher fishes.

The lateral line is a row of scales containing sensory pores along the body of a fish. In many fishes this line is easily observed and the scales are counted along it from the upper angle of the opercle to the base of the tail. The count is often given as

The dorsal spines of *Pseudochromis paccagnellae* are quite flexible and on superficial examination appear to be more like soft-rays than spines. Photo by Dr. Herbert R. Axelrod.

The lateral line on *Hypoplectrus gemma* has an upward curvature that follows the dorsal surface of the fish. Photo by Aaron Norman.

lateral line scales 23-24, pored scales in the lateral line 23-24, lateral line pores 23-24, tubes in the lateral line 23-24, or simply abbreviated L.l. 23-24. Sometimes the lateral line is a high arc or ends before the caudal base; in such case a second count is taken, the scales in a longitudinal line. These are counted from the opercle to the caudal base in a relatively straight line. This count is referred to variously as longitudinal row scales, diagonal rows of scales in a lateral series, etc. Scales in a vertical series are those from the origin of the dorsal fin to the lateral line and from the origin of the anal fin to the lateral line. Other scale counts, such as cheek scales and scales around the caudal peduncle, may also be given.

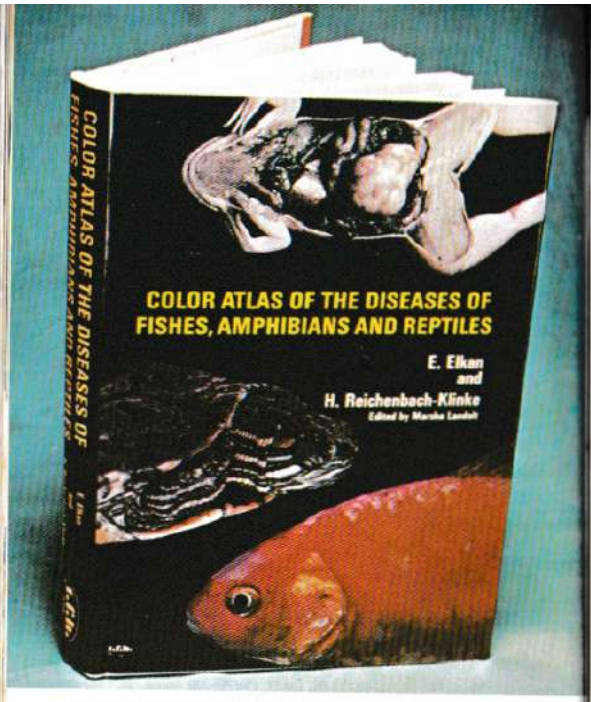
There are always some exceptions to these methods (such as interrupted lateral lines which, for example, are indicated as 23 + 10 L.l. pores), but I hope this short discussion of meristic methods has been of some help to you in understanding the ways of ichthyologists.

MORE INFORMATION ON ENDANGERED SPECIES REVISIONS

We very recently received more specific information on species of fishes included in the Department of the Interior's list of Endangered and Threatened Species. The list, as published herein, is by no means complete but we have included those species that we feel may be of interest and concern to some hobbyists. They are as follows:

Acipenser fluvescens	Lake sturgeon
Acipenser sturio	Baltic sturgeon
Arapaima gigas	Arapaima
Stenodus leucichthys leucichthys	Beloribitsa
Salmo chrysogaster	Mexican golden trout
Plagopterus argentissimus	Woundfin
Ptychocheilus lucius	Colorado squawfish
Cynolebias constanciae	Annual killifish
Cynolebias marmoratus	Annual killifish
Cynolebias minimus	Annual killifish
Cynolebias opalescens	Annual killifish
Cynolebias splendens	Annual killifish
Xiphophorus couchianus	Monterey platyfish
Latimeria chalumnae	Coelacanth
Neoceratodus forsteri	Australian lungfish

More complete information may be obtained by writing to:
U.S. Department of the Interior
U.S. Fish and Wildlife Service
Washington D.C. 20242



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 combine MAIL CALL questions with correspondence about subscriptions or book orders.

Downstream Plants

Q. I have a large tank that contains plenty of plants and is filtered by a large outside power filter. Can the flow of water or the stream of bubbles from such a powerful filter harm the growth and appearance of the plants, particularly *Anacharis* or tall *Sagittaria*?

David Louis Burg
City unknown

A. *As long as the stream of water is not so strong as to cause mechanical damage to your plants we see no reason why their growth should be retarded provided there is enough light and nutrients available. As far as appearance is concerned, this is strictly a matter of taste. If you like the aesthetic effect of plants waving in the current then keep them in the filter stream.*

Discus Dilemma

Q. I have four questions I would appreciate your answering.

1. Would a 30- or 50-gallon aquarium be large enough to house six blue discus?

2. What kind of plants would be suitable for the soft acid water associated with keeping discus?

3. Are scavengers necessary, and if so which species would be best?

4. Would it be possible to put a Gro-lux bulb into a fluorescent light fixture used in a basement?

Steven Freed
Lake Bluff, Illinois

A.1. *The 50-gallon aquarium would be best.*

2. *Cryptocorynes, water sprite, etc. Cryptocorynes are shade tolerant and do well in acid water. Dis-*

Cryptocoryne beckettii is a shade tolerant plant that does well in slightly acidic water. Photo by Frans Driessens.

cus are shy and do better in dimly lit aquariums, containing slightly acid water. Seems like a perfect marriage.

3. *Scavengers are good in any aquarium and particularly in one containing oddly shaped fish such as discus, which are not too adept at picking bits of food out of cramped crevices. Any of the standard Corydoras species will do.*

Most catfish of the genus *Corydoras* are suitable as scavengers for a discus tank. Photo by Dr. Herbert R. Axelrod.

4. If you are speaking of the standard 48-inch bulbs, yes, but they are usually only available through electrical parts jobbers. Your discus would be far better off if you used a regular aquarium fixture made for a large tank such as yours. These fixtures, available at most pet shops, would allow you to better control the light distribution in the tank so that the naturally shy discus would have the security provided by a shady spot in the tank.

There are a number of reliable discus books on the market which should be most helpful to you in answering the many questions of a new discus fancier. The newest of these books is the TFH book Discus, *by Gunter Keller.*

Meteor Minnow

Q. I've been interested and have kept common tropical fish for many years. I "discovered" the white cloud mountain fish about two years ago and was impressed by its hardiness, adaptability, and unique beauty. It was with much interest, therefore, that I read of the meteor minnow in the November, 1975 issue of *Tropical Fish Hobbyist.* Living in such a large city as New York, I was sure I could find the fish offered somewhere. Well, it's been quite some time now and I still haven't been able to find anyone handling or selling them. Many shops don't even know they exist. I would certainly appreciate any help you could offer in obtaining this beautiful fish.

David Smith
Queens Village, N.Y.

A. *As with any new mutation, considerable time and effort is involved in getting the mutation fixed and easily reproducible. Once the new mutation becomes stabilized, the*

breeder must be able to produce the fish in quantities sufficient to meet the demands of the market. This too is not an easy task as it takes a considerable investment in tanks, brine shrimp, etc. Before one is willing to make such an investment of time and money he must have some reasonable assurance that there will be a market for his product. The market can only be developed by letting people know that the possibility of the product becoming available does exist. Then the breeder must allow time for the laws of supply and demand to take effect. Perhaps your inquiry will arouse the interest of others. When they too begin to place demands on the dealers for this fish, perhaps the demand will become great enough to stimulate the interest of a breeder whose operation is large enough to produce them in quantities. We suggest that you **keep looking and keep demanding.** *Hopefully this will eventually produce the desired result.*

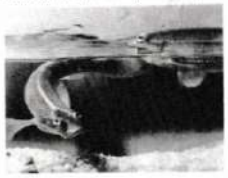
The meteor minnow is a mutant strain of the white cloud mountain fish, *Tanichthys albonubes*, that was developed by Mr. Edward Sollory of Canada. Photo by Dr. Herbert R. Axelrod.

On the Light Side

Q. I heard recently that the use of a black light over an aquarium is good for plants that do not get natural sunlight. Is it alright to use a germicidal light for this purpose? It won't hurt the fish to look up at it, will it?

Eric Wachter
Louisville, Kentucky

A. *Ultra-violet rays of both the long and short wave (germicidal) type are absorbed rather than transmitted by glass, so that even if your aquarium was receiving natural sunlight, the U.V. waves would be absorbed if not by your windows, then by the aquarium glass itself. In either case, the plants would not be exposed to it. Furthermore, U.V. light is absorbed in the first few millimeters of water it passes through. Even aquatic plants in natural habitats do not receive such light, unless you are speaking of surface dwelling plants, but most of these are not*



The foureyes, *Anableps anableps*, is equipped for vision above and below the water surface, and could be damaged by an overhead ultra-violet lamp. Photo by G. Marcuse.

true aquatics. Therefore, it does not seem logical to us that U.V. light would benefit your plants. The only way it could damage the fish would be if they were surface dwelling species such as Anableps anableps. *The use of germicidal U.V. lamps in aquarium fixtures, however, could be dangerous to you or other inhabitants of your household, particularly unknowing children, if they were to look directly into it.*

Ultra-violet light is useful in the aquarium as a germicide, but only when it is built into special equipment that is sold for that purpose by your pet dealer. In these devices the mechanical problems of U.V. absorption by water are taken care of by the nature of their design, and safety features are built in.

Planarians are a diverse group of flatworms of which some smaller species are commonly found in aquariums where decomposing organic matter has been allowed to accumulate. Photo by Knaack.

Unsightly Pests

Q.1. In the pet shop where I work we have two problems that occur continually. After a tank has been

set up for a while we notice small white worms swimming in the water and gliding over the glass. Are they harmful to the fish or are they a form of food that has been introduced via new fish put in the tank?

2. While cleaning out our tanks I have noticed tiny "bugs" darting around in the small amount of water that remains when the gravel is removed. Also there are string-like clusters of eggs on the underside of the U.G. filter. What are these organisms and are they harmful to the fish?

3. Why can't we get rid of snails once the eggs have been introduced into a tank? Don't they all hatch out at the same time, or do young snails lay eggs right away?

We really enjoy your magazine at the pet shop. Three of us have subscriptions and we're always learning new things that we can pass on to our customers. Thanks for the very informative articles and for trying to answer the questions that are sent in.

Judy Fischer
Bedford, Ohio

A.1. *With reference to the white worms, we receive at least a dozen letters every month on this problem alone. The worms you describe are probably planarians, members of the phylum Platyhelminthes, which are the flatworms. These worms glide onto bits of meat or other decaying matter and suck in small bits of dead food through a proboscis located in the middle of their underside. Since they feed on dead material, they will not hurt your fish, but the environmental condition that stimulates their growth*

and reproduction will not do the fish any good. Because of their ability to withstand long periods of starvation, planarians are difficult pests to get rid of. Most fish for some unknown reason do not eat them. However, some of the gouramis such as the blue gourami will devour them if the fish are offered no other food.

2. *The small "bugs" are likely to be cyclops, copepods, ostracods, or possibly even small daphnia. It is doubtful that any of these organisms are detrimental to the fish. If they are ostracods [which look like miniature swimming clams] most fish will not eat them. If they are any of the others, they will usually be eagerly eaten by most fish. These organisms also feed on decaying matter such as leftover fish food.*

We have seen the string-like clusters to which you refer and believe them to be the hyphae of a fungus species. These fungal hyphae are often seen in the filters of perfectly healthy tanks and are nothing to worry about.

3. *Snail eggs are difficult to get rid of because of the prolific nature of most snails and because of the cryptic nature of the egg masses. Again, we recommend blue gouramis as a means of getting rid of snails.*

Finally, we thank you for the compliments, and we are delighted to know that we have been able to help you and your customers.

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Leporinus Mixup

Q. I recently acquired six *Leporinus* sold to me as *L. fasciatus*. Five of them are unmistakably *L. fasciatus* but one appears to be a different species or perhaps it carries a mutation. I hope my enclosed sketches will help in its identification. In contrast to the orange-yellow ground color and ten black bands of *L. fasciatus*, the odd one has a grayish-blue ground color and eight black bands. In this odd fish the ground color actually varies to a grayish-brown depending on the fish's mood. Its ventral and anal fins are charcoal gray with a yellow edge, in contrast to the ventral and anal fins of *L. fasciatus* which are colorless. In all other respects the fish are identical. I would appreciate any help you can supply in identifying this odd fish and telling me something about the breeding habits of *Leporinus* species.

Lawrence Crilly
Somerville, New Jersey

A. *According to your excellent sketches it appears that you do indeed have two species of* Leporinus. *The five that are alike fit the documented descriptions of* L. multifasciatus

Leporinus fasciatus with two vertical bands that are in the process of dividing to form two new bands. Photo by H. Schultz.

rather than L. fasciatus *and the odd one seems to be the true* L. fasciatus. *Ground color is not a good identifying character because, as you say, the color varies with the "mood" of the fish, as it does with most fish. The black bands are not a good identifier either because, contrary to most fish in which the juveniles lose markings as they mature,* L. fasciatus, *and we assume* L. multifasciatus, *increase the number of bands as they mature. This is done by the splitting of a band at the top and bottom later followed by separation of the split at the middle. This normal growth process remarkably resembles, in slow*

motion of course, a microscopic view of chromosome division. The only obvious morphological characters that enable these two species to be readily distinguished are the almost entirely black anal and adipose fins of L. fasciatus. *These fins are almost entirely transparent in* L. multifasciatus. *There may be meristic differences in tooth pattern and scale and fin ray count, but these differences would be more difficult for most hobbyists to determine. Little is known of their breeding habits since both species are not really mature until they have reached 12 or more inches in length, a size that few aquarists have the tank capacity to accommodate.*

The freshwater pipefish, *Syngnathus spiciter*, is a fresh or brackish water relative of the seahorse. Photo by A. Van Den Nieuwenhuizen.

lems in keeping this species healthy in the aquarium, it is a very fussy eater. Once it is acclimated to a proper habitat, it will feed on baby

Picky Pipefish

Q. I recently bought six freshwater pipefish and I am unable to find any information on them. I have tried feeding them brine shrimp, microorganisms, plankton, and frozen squid. They have refused to eat any of these foods. Could you please give me some information on them and tell me what they will eat?

Scott Russman
City unknown

A. *The freshwater pipefish,* Syngnathus spicifer, *is found in shallow weed beds of estuarine habitats on the island of Ceylon. Since it is actually a brackish water fish, it should have some salt added to its aquarium. It does not do well in tanks that are heavily aerated, as it is not equipped to cope with strong currents. In addition, it requires fairly warm water (75° to 85° F.). Aside from all of the aforementioned prob-*

guppies, but only when all of its other ecological requirements are met. The freshwater pipefish is an interesting fish to watch, but unfortunately, because of its rigorous requirements, it is one of those species that should only be kept by advanced aquarists who are thoroughly prepared to meet all of its critical needs.

A rotifer in a typical feeding position with its telescopic body and "toes" fully extended and its ciliated "wheel" organs sweeping food particles into its mouth. Photo by Emmens.

Multi-celled Microbe

Q. I have heard and read about small pond animals and crustaceans, but I doubt if many of us have seen photos of these animals in publications. One in particular is the rotifer. Do you have a picture of a rotifer?

Lester Ray
Santa Ana, California

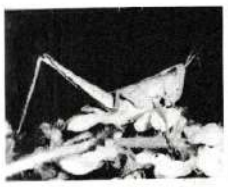
A. *Rotifers, which are members of the phylum Nemathelminthes, are among the few microbial sized animals that are multicellular. They*

contain numerous cells, most of which serve some specialized function. They are one of the most interesting organisms to watch under the microscope. The organism has a telescopic body and two telescopic "toes" at its posterior end which it uses to make its way through the detrital debris and algae clumps in which it lives. At its anterior end it has two ciliated organs which, when the cilia are beating, give the appearance of two tiny rotating wheels, hence the name rotifer. These beating cilia do not function in locomotion as they do in most ciliated organisms, but rather serve to sweep small food particles into the mouth. They are easy to culture and are an excellent first food for very tiny fish fry such as those of the anabantids or some of the small tetras. Information may be obtained on culturing them in the TFH publication Encyclopedia of Live Foods *by Charles O. Masters. This book includes many photos of a variety of rotifer species as well as many other interesting fish food organisms.*

Strictly Verboten!

Q. I would like to know if any of the following are good safe foods for larger fishes such as cichlids: grasshoppers, houseflies, common baby gamefishes smaller than one inch (bluegill, bass, etc.), or common fishing minnows; these seem to be an inexpensive replacement for goldfish that usually seem to be the only food to feed larger fishes.

Shon Stevens
Youngstown, Ohio



As long as they have not been exposed to insecticides, grasshoppers are a safe food for large cichlids. Photo by Muller-Schmida.

A. *Cheapest is not always best; in fact, it rarely is. Grasshoppers are an excellent food for large fishes if they are captured far away from farms where they might have been exposed to insecticides. Their avail-*

are quite frustrated at not being able to cure them. What do you suggest?

Clyde Quick
Roseville, California

A. *Most of the species you mention are usually considered rather aggressive and are quite prone to fin nipping. Some, such as the silver dollars and the scat are fast moving active fish, while others such as the furupari and the gouramis, as well as the angels, are rather sedentary by comparison, but also quite aggressive. In addition, the long filamentous fins of the angelfish do resemble tasty morsels to the other tank inhabitants. This is the fallacy of combining so many species in one community tank with no regard for the behavioral differences between them. In short, your angelfish are being victimized by an assortment of incompatable tankmates. The only "cure" will be to provide them with tankmates that are more ecologically compatable.*

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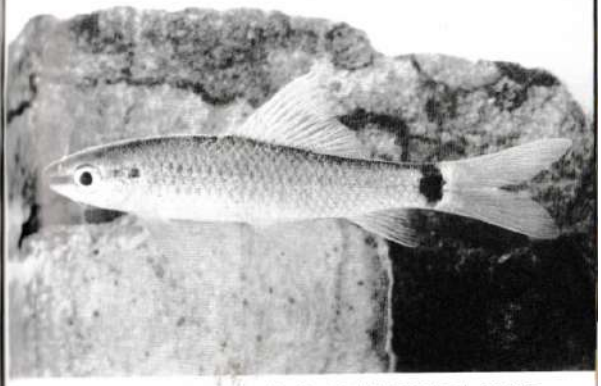


Labeo erythrurus is closely related to, but a bit larger than *L. frenatus*. Both species are indigenous to Thailand. Photo by Dr. Herbert R. Axelrod.

SPAWNING *LABEO FRENATUS*

by Anatoly Noznov

Although considerably smaller than most members of the genus, seldom exceeding three inches at maturity, *Labeo frenatus*, a native of northern Thailand, bears many of the typical markings of its larger cousin, *L. erythrurus* which is also indigenous to Thailand. It bears a dark band running from the tip of the snout, through the eye, to the posterior edge of the operculum. In addition, it has the same oval or diamond shaped black spot at the base of the caudal fin.

In body shape and behavior, the *frenatus* is unmistakably a member of the popular genus *Labeo*. It has a typical pointed snout, long cylindrical body, large shark-like dorsal fin, and deeply forked caudal fin. *L. frenatus* is a territorial fish which,

when placed in an aquarium with a group of its own kind, quickly establishes a pecking order. More submissive members of the social order may remain back in a corner of the aquarium in a nose-down position for hours. If a dominant fish happens to stake out the feeding area as its home base, the weaker fish will not get much food. It is best, therefore, to frequently change the feeding site.

In the aquarium *L. frenatus* is quite adaptable to a variety of physical and chemical conditions. It seems to do equally well in hard or soft water having a pH ranging from slightly acid to slightly alkaline. At temperatures lower than 72° F. its activity level slows down and the fish becomes much less aggressive.

During the winter of 1974 I purchased three *L. frenatus* and placed them in a 10-gallon aquarium. Before long they had grown to about three inches. The largest of the three

The red-tailed shark, *Labeo bicolor*, is the most colorful member of this genus. Recently much progress has been made in breeding this frequently imported fish. Photo by R. Zukal.

Labeo frenatus is easily identifiable as a member of the genus *Labeo* by its typical body and fin shape. Photo by R. Zukal.

When a male *Labeo frenatus* comes into breeding condition the red blush seen on the fins in this photo changes to an overall fiery red color. Photo by Braz Walker.

developed brighter colored fins with a black border on the anal fin. I later determined that this was the male.

In order to breed my fish, it seemed appropriate to move them to more spacious quarters. All of my larger aquariums were occupied by big cichlids, but I was able to make use of a 120-gallon aquarium at the home of a friend. This tank contained an assortment of tetras and other small characins which I decided to leave in the tank. The corners of the aquarium contained luxuriant potted *Echinodorus* plants. When the fish were placed in this tank the male immediately occupied one of these pots, remaining near the base of the plant. He soon began to show his courting behavior, trying to coax one of the females into his newly established territory, while he continually chased the third *frenatus* away.

Spawning began early the next morning. By then the spawning fishes' color had changed drastically. The male's fins became fiery red and his pelvic fins now had the same black border as the anal fin. The body color of the pair became nearly black. They began to swim side by side from one *Echinodorus* plant to another. Then the fish swam into the thickest of the plants and again assumed a side-by-side position, but this time with their tails in contact and their heads apart. They began to rock their bodies back and forth. Suddenly, for a brief moment, their bodies came into complete contact, during which time several yellowish eggs were expelled and fertilized. As the eggs fell through the plant the pair swam off, each in a different direction. Unfortunately, the other residents of the tank closed in and devoured the eggs. The pair of *L. frenatus* continually repeated this spawning behavior for about three hours, but each time the eggs were eaten by the other tank residents.

After the first spawning I prepared a 30-gallon tank with the same water, plants, and caves. The fish were placed in this new tank and I began my long vigil. The fish did not come back into breeding color for another year, but as luck would have it, the male killed the female.

EDITOR'S NOTE: Now that Mr. Noznov has provided us with the basic information on their spawning technique, it is our hope that some interested reader who owns a pair of these attractive fish will attempt a spawning and report a successful rearing of the fry to us. **T.F.H.**

When Johannes Lourens' fish are brought back from the field they are kept in aquariums that are hand made by his wife Millie. Here Johannes inspects the result of his latest collecting trip.

THE FLYING DUTCHMAN AND HIS ANNUALS

by Dr. Herbert R. Axelrod
Photos by the author

Killifish specialists are a breed to themselves; they are usually grossly misunderstood and survive because they have the ability to rationalize that anything done on behalf of their killifishes is beyond the realm of human judgment. Thus, when Johannes H. Lourens came home and told his wife Millie that he wanted to take a tour of duty in Tanzania "because that's where many *Nothobranchius* are found. . . ," she accepted without argument. She already knew that you don't argue with a killifish specialist when it comes to his determination to "save a fish from extinction." So, as a very good and obedient Dutch housewife, she packed her bags and followed her husband to Dar-es-Salaam, Tanzania.

Into a lovely flat they went, tanks, kids, bags and baggage and even before she could unpack, Johannes was dipping his net into every pond and ditch he could find. Within a year,

Nothobranchius korthausae is a recently discovered species that Johannes is capturing on the island of Mafia which lies off the coast near Dar-es-Salaam.

Nothobranchius guentheri is one of the many colorful annual killifishes that Johannes is collecting in Tanzania.

Johannes and Millie Lourens and their children in their flat in Das-es-Salaam.

Johannes had covered more than 200 km (about 120 miles) in a radius from Dar-es-Salaam, checking every possibility for *Nothobranchius*. His quests were extremely rewarding, for he found at least five different species, including *melanospilus, guentheri, korthausae,* and *papi* (a new species named after Jan Pap, another Dutchman). His interest centered around two river systems, namely the Wami and the Ruvu.

Johannes is lucky! His wife tolerates his hobby and even takes care of the fishes. She makes the tanks, as well, and as a reward Johannes allows her to keep some pretty little tetras and cichlids which get stuck in his net when he really wants to catch only *Nothobranchius*.

Since Johannes and his wife both speak perfect English. . . and knowing how many killifish people will write asking for their address. . . perhaps you might write to them for additional information? It might be better if you sent the mail as REGISTERED AIR MAIL, RETURN RECEIPT REQUESTED. The following is the proper address:

Mr. Johannes H. Lourens, at U.N.D.P., P.O. Box 9182,
Dar-es-Salaam, Tanzania. **t.f.h.**

YOUR FISHES' HEALTH

Drug Abuse in the Aquarium

by Dr. Mark P. Dulin

So your fishes are acting strange, looking sick, or not eating—time to pop a Tetracycline* capsule in the tank for a one-shot cure all? Think twice before you act. . . when's the last time your doctor told you to take a single capsule to cure your illness? Take it from me, there are no single dose panaceas capable of bringing about a cure to bacterial fish disease, just as there are no one capsule cures for human infections. Not only is a one dose treatment ineffective, it could do your tank some harm. Just this year Dr. Collins reported that a single dose of erythromycin (50 mg/liter) placed in an established aquarium stopped nitrification for a 14-day period. More simply stated, it killed off the "good guys" in the gravel and biofilter that break down the fishes' metabolic wastes. Without these beneficial flora, toxic levels of ammonia and nitrite can accumulate. But wouldn't a single dose also kill the "bad guys"—those evil little bacteria that are making your fish sick? It's very unlikely that a sustained therapeutic dose would occur within the fishes from a single dose in the aquarium. Furthermore, it is very difficult to calculate a therapeutic dose when tank debris and activated charcoal are rapidly binding with the drug and rendering it ineffective. That is why I emphatically encourage aquarists to conduct antibacterial treatments in a separate all glass, bare aquarium and *not in the exhibition tank*.

Single, sub-therapeutic doses of antibiotics can even aid the bacteria in killing the host rather than deter their development by creating a more hardy, drug resistant strain of organisms. Aquarists themselves have been responsible for creating some drug resistant strains of bacteria with these ineffective doses of antibiotics. Now I know some of you hard core drug abusers will argue that point so allow me to digress on a little history of antibiotics to support my argument on this phenomena of drug resistance.

Antibiotics were probably produced and used by microorganisms long before the evolution of man. Microorganisms can produce effective growth inhibitors or toxins to inhibit or destroy potentially competitive microorganisms, thus "biological warfare" is a part of their daily existence. Pasteur (1877) was perhaps the first to observe the effects of antibiotics (microorganism produced antimicrobial agents). He noticed that airborne contaminants were inhibiting the growth of his isolates of anthrax bacteria. Other early scientists observed similar effects and it wasn't long before they realized that these inhibitory chemicals produced by microorganisms had a possible therapeutic value. Florey and Chain (1943) showed beyond a doubt that penicillin was effective in controlling certain bacterial diseases of man. In the late 1940's, antibiotics began to be discovered and used at an ever increasing rate, but during these past thirty years of antibiotic usage many drug resistant strains of bacteria have developed. Bacteria are extremely adaptable and have a very short generation time (20 minutes for some species), so that mutants develop which can survive antibiotic treatments, especially if only low doses are used.

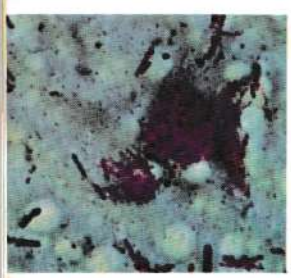
Now if everyone is convinced that low, sub-therapeutic dosages are bad, here's some more bad news. High sustained doses of antibiotics can also have adverse effects on your fishes' health. Overdoses can have a direct toxic effect on the fish and extended treatments can kill off the beneficial flora in the fishes' gut, thereby rendering them more susceptible to non-bacterial invasion. So we are dealing with a relatively narrow margin of safety when using antibiotics—don't use too little and don't use too much.

It's not possible for me to give a single course of therapy proven to be correct for all of the bacterial infections in the wide variety of species you are likely to have in your aquarium. I'm not going to recommend the average aquarist give antibiotics by injection, nor am I convinced that antibiotic medicated food is the answer. Generally sick fish don't eat well, so the fish that don't need it eat it and the fish that need it don't eat it.

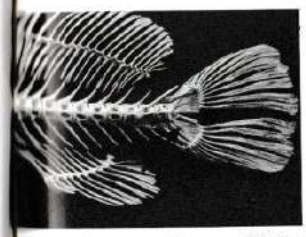
The mode of therapy I recommend to the average aquarist faced with a bacterial disease is placing the appropriate dosage of a broad spectrum antibiotic in a treatment tank and maintaining a therapeutic level for five to seven days. One such antibiotic which is readily available at most pet shops is Furanace® This drug has been shown to provide the fish with high circulating antibiotic levels when the fish are placed in the proper dosage solution of one capsule (3.8 mg) per ten gallons of tank water. This treatment should be repeated every third day for up to a total of three treatments.

Alternatively, one of the less used and abused drugs might prove valuable in controlling bacterial diseases of your fishes. Some of these antibiotics include Chloramphenicol, gentamicin

Treatment of this severe bacterial infection should have been initiated much earlier although it is still possible to cure this disease by placing the fish in a treatment tank for a course of therapy with a broad spectrum antibiotic. Photo by Frickhinger.



This magnified, stained, skin imprint from a diseased tropical fish shows two types of bacteria. The large blue rod-shaped bacteria are non-pathogenic while the red clumps of bacteria are pathogenic *Mycobacteria* which cause piscine tuberculosis. Unlike most bacterial diseases, piscine tuberculosis does not respond favorably to treatments with broad-spectrum antibiotics. Prolonged Isoniazid and Rifampin® treatments can, however, cure this otherwise fatal disease. Photo by Piscisan Ltd.



These neon tetras are all victims of an acute bacterial infection. Notice the reddening of the skin and loss of the caudal fin. Therapy should have begun much earlier in the course of this disease. If the caudal fin becomes eroded past the hypural plate (arrow) then regeneration of the fin cannot occur.

Fishes in the exhibition tank are prone to "pick" at open lesions on sick fish, thus ulcers like this can serve as a source of infection. This albino paradise fish should be placed in a separate antibiotic treatment tank until the lesion has healed. Photo by Frickhinger.

sulfate, and kanamycin sulfate. These are prescription drugs, however, and may only be obtained from a veterinarian or by prescription. In addition, these are not approved by the Food and Drug Administration for use in fishes, even though your fishes are not likely to be used for human consumption. When placed in solution, the dosage of *either* chloramphenicol, gentamicin, or kanamycin is 250 mg/5 gallons of water. The treatment should be continued for a total of 5 to 7 days even if the fishes begin to show signs of improvement during the first 3 days. To avoid the toxic accumulation of metabolic wastes and to maintain a therapeutic level of the drug, siphon out 25% of the water from the treatment tank every other day and refill with fresh water. After the water is replaced add an additional 200 mg of the drug that you are using to the treatment tank.

In summary, once clinical signs of a bacterial infection develop you should:

1. Withhold food for 24 hours; tank transfer is stressful and stressing sick fish with a full stomach can have a deliterious effect.
2. Prepare a treatment tank. The water must be of the same temperature, pH, and salinity if it's a saltwater tank. The water must also be free of chlorine and have an adequate dissolved oxygen level; you can accomplish both of these objectives by 24 hours of vigorous aeration prior to introducing the fish.
3. Thoroughly mix the appropriate levels of the desired antibiotic in solution.
4. Place the affected fishes in the solution and keep them on a therapeutic dosage of the antibiotic for 5 to 7 days.
5. Reduce the quantity of organisms in the exhibition tank by cleaning the tank and restocking it with suitable water. If the disease affected many of the fishes at one time and appears to be spreading then complete tank disinfection may be required. This drastic step should be avoided if possible, however, as it necessitates restocking the biofilter with beneficial flora and waiting at least 2 weeks for them to become established.
6. Place the treated fish back in the clean exhibition tank *after* they are free of clinical signs of disease.
7. Above all—avoid drug abuse in the aquarium. **t.f.h.**