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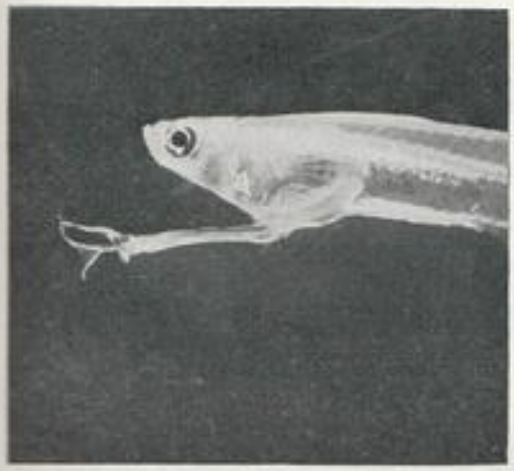

Photo: N.Y. Zoological Society

The "arm" of this fish is in reality an anal fin modified for reproductive purposes. Called the "little Tom," the species has interesting habits which are described by Dr. Myron Gordon on page 111

Editorial

A FEW months back an event in the world of fishes which appeared to attract universal attention from the daily papers was the Operation on the Bat Ray's Eye. The story came from the U.S.A., and seemed rather to smack of a publicity bid for a public aquarium in California, but it was most certainly a successful one, catching the notice of papers from the Antipodes to Sheffield. Examining the various cuttings of reports of the incident revealed certain minor variations here and there, due no doubt to the varying enthusiasm of sub-editors, but in the main the stories tallied.

An unfortunate bat ray (answering to the name of Charlie) became blind after damaging one eye in his large aquarium. Since Charlie was a special pet an eye surgeon was called in, and he went to the extraordinary length of donning a rubber suit and oxygen mask and descending into 22 feet of water to operate on the fish. From another healthy bat ray the cornea was taken under anaesthesia and transplanted into Charlie, whilst he too, was anaesthetised. The operation took from 23 minutes to half-an-hour (according to the paper relating the event) and the donor bat ray was destroyed after the operation. One kindly sub-editor introduced the theory that it "failed to revive, apparently from an overdose of anaesthetic." No one bothered to explain what prevented Charlie from being hauled out of his tank when anaesthetised and operated upon on the floor. The underwater-surgeon appeal would then have been lost, which introduces the thought that the aquarium should keep the surgeon permanently on view underwater as a unique exhibit and get rid of Charlie.

Collecting news paragraphs on fish topics such as this one makes a wonderful hobby, particularly if the same item is culled from different papers. But some paragraphs are really calculated to make the aquarist irate, like the one which appeared in a London evening paper last month. Reporting that at a radio factory fete an aquarium had been built into the empty case of a television set, it said this "was so realistic that many children thought it was an interlude film." Juvenile delinquents, obviously.

A New Treatment for Finrot and Fungus

by RAYMOND YATES

ABOUT two years ago a new chemical came to the notice of aquarists under the trade name "Phenoxetol" (phenoxy ethyl alcohol) which had proved of definite use in combating certain fungoid troubles, and it was thought that it might possibly be equally useful for the treatment of fish diseases. Experiments soon showed this to be true but there were difficulties. In the first place it was an expensive chemical to buy and the proportion to be used had to be exact or toxic results showed up in the fish. This made it almost impossible to use for the average fishkeeper on the grounds of expense and the lack of facilities for accurate measuring of quantities.

Some months ago the Liquifry Company of Dorking experimented with this chemical in conjunction with Dr. Boehm of Nipa Laboratories Ltd., with the object of placing on the market standardised quantities of this product so that any aquarist could use it with safety and at a price within the reach of all. It is now available at most dealers where it finds a ready sale. The package consists of two capsules, each containing roughly 45 drops of phenoxetol, together with a detailed chart giving accurate instructions for its use. The main advantages of this chemical are that it is colourless, is harmless to plants and does not deteriorate, practically the opposite of almost all other drugs used in the aquarium.

First Trials

The reader will be particularly interested in details of the use of this remedy. Mr. Ian M. Rankin of the Association of South London Aquarist Societies carried out many tests and experiments over a considerable period and he may be considered to be the originator of this treatment. He looked after the "sick bay" at the annual A.S.L.A.S. show last year during which all cases of fungus or finrot were definitely cured by prompt treatment with Phenoxetol. Mr. Rankin experimented on various cultures using 1.25 per cent. Phenoxetol and in each instance the organisms were killed within five minutes. Other instances were a goldfish with practically no tail due to finrot—recovery complete. A veiltail two years old, suffering from acute finrot during winter-fast—complete recovery. Male veiltail seven years old suffering from virulent combined fungus, finrot and fin congestion. Slight improvement in 24 hours, within three days the fish was swimming on an even keel and within five days the fish was eating normally and all trace of fungus had gone. Two weeks later the fish was free from infection and new fin growth had commenced. A black mollie one year old with mouth fungus visible between 12 and 24 hours was treated at 72° F. and cured after 48 hours' treatment. A tropical community tank had all its inmates seriously affected by bacterial infection. All fish removed and treated individually. Fish which were returned to the tank subsequently died but those placed in cleaned tank all recovered—this was before it was decided that the actual tank itself should get the Phenoxetol treatment. Three goldfish suffering from ichthyophthiriasis complicated by internal streptococci, vibrios, spirilla infection and finrot: in this case treatment was ineffective. Phenoxetol has proved excellent with fighters who are rather prone to fin troubles.

In use the fish probably seem to slow-up a little once the chemical has been added to the tank water but this is of no consequence. It is important that only the correct amount should be used; this is most important, so there must be no little extra for luck. If an overdose has been given some fish will turn over and lie on their sides. If they are immediately removed and put into normal tank water they will just as immediately right themselves as regards balance. The treatment tank should then be reduced in strength. This chemical is particularly effective on certain gram-negative bacteria, that is to say those most commonly met with in aquaria, whereas many anti-biotics are used mainly against gram-positive bacteria. Phenoxetol gives rapid results, within a matter of hours or one or two days, and is probably the most rapid "cure" available to-day. The Liquifry Company Ltd. are to be congratulated on making this chemical so easily available to the hobby in general, and it is worth mentioning that they have sent out sample packs to most of the public aquaria in Britain so that their product can be given every trial. Although I have been writing about Phenoxetol it is marketed under their own trade name as "Liquitox" but it is Phenoxetol none the less. I can recommend this product with confidence to fellow aquarists, but remember it is not a cure-all for all the ills of the piscine race—it won't cure white spot for example.

Leaky Exhibition Tanks

WHEN visiting aquarist exhibitions I have been struck by the number of leaky tanks. I know that it is very difficult to keep these tanks safe, as once a tank is emptied the pressure of the water on the glass is removed and the glass may move slightly. Added to this is the fact that many so-called helpers are unaware that it is bad policy to clean an empty tank glass by rubbing on the outside unless some form of internal support is given to prevent the glass from being pressed in.

Some clubs go to considerable expense and trouble to seal these leaky tanks and I wondered whether there was not an easy way to overcome the difficulty. I know that there are types of liquid bitumastic compounds which can be used to paint the seams inside but often a tank has become wet before any trouble has been discovered. Considering this I suddenly thought of the ideal method of sealing any leaky tank at a show.

Many aquarists will know the plastic bags which are used for carrying fishes. Why not place a plastic bag inside the leaky tank? The top of the bag could be pegged to the top frame to save it from dropping too low and once the bag was filled no water could leak from the tank even if half the putty was missing. The bags could be used for future occasions and in fact it might be possible in time for an exhibitor, providing he knew the size of the tank to be used, to bring his own water and fish in such a bag ready for inserting into the show tank. Various sizes of bags could be used to fit the differing tanks, and as long as the top of the bag was not allowed to slip down I am sure no water could possibly leak on to the floor.

A. Boarder

Discovering the Secrets of the Little Toms

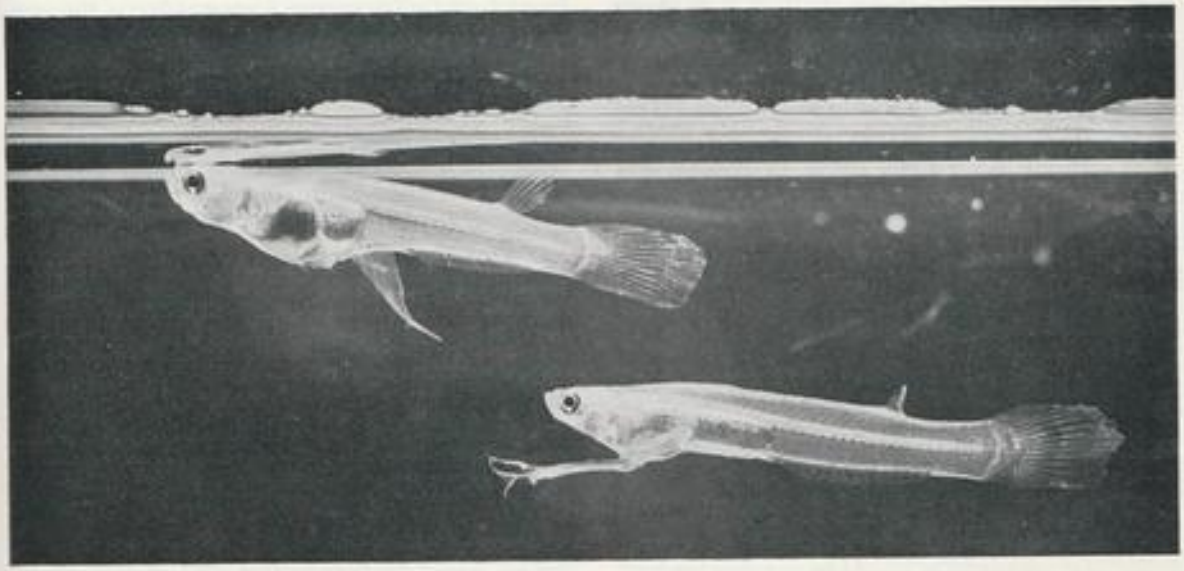

Photo : New York Zoological Society

The pair of little Toms referred to in the article (male lower fish), here shown enlarged two times

by Dr. MYRON GORDON

Geneticist to the Aquarium, New York Zoological Society

ON a day early in June, 1954, I received a telephone call from Herbert R. Axelrod, who requested aid in identifying some curious, inch-long, semi-transparent fish that had been shipped up from South America in a large consignment to the World Wide Aquarium Supply Company of New York, importers of tropical fishes.

He said, "World Wide got some small strange fish by air freight through Trinidad. They aren't interested in them because the fish aren't colorful and have no commercial value. What's more, they're very delicate; most of them are dead. I've just a single live pair left out of a hundred or more. You can have them all, dead and alive, if you like. I'm just curious to know what they are." The Genetics Laboratory of the Aquarium gets many inquiries like that and I took the call for assistance as routine and I agreed to look them over.

That afternoon, Herbert came in with two pint cardboard coffee containers. One was marked "Live," the other "Frozen." I poured out the live fish into a small, oblong glass observation jar. I looked closely at the tiny, translucent slivers of fish that swam in a peculiar way across the length of the five-inch jar. Although they were only an inch long they were adults and a pair. The thinner member of the pair resembled the males of live-bearing fishes like guppies and platyfishes in one outstanding trait—in the peculiar make-up of the anal fin. It originates just behind the head and continued close to and parallel to its body to about a third of the fish's entire length. Extending from the end of this most complex fin was a remarkable pair of antler-like processes. I stared at that incredible organ and the fantastic creature that owned it. I thought back to the time, not long ago, I had seen a picture of that unforgettable fin. Almost immediately I recalled that Donn Rosen, my associate, had made a drawing of it together with many others of the variously constructed anal fins of live-bearing fishes for our study of the functions of these organs. The males do not use their anal fins for swimming but rather for transferring sperm to the females during mating. Because of their new function the anal fins of males are called gonopodia, sexual appendages.

I took down the Society's scientific journal *Zoologica*, for April, 1953, and found what I was looking for; I re-read the caption beneath the figure. It said, in part, "Distal tip of the gonopodium of *Tomeurus gracilis* Eigenmann."

"That's it," I said to Herbert, pointing to the figure. "Your fish is a *Tomeurus*; there isn't another fish in the world with an anal fin like that. Donn made his drawing from a rare pickled specimen in the Museum of Zoology of the University of Michigan. Hardly anything is known about its manner of life. Someone said that the female *Tomeurus* doesn't give birth to living young, as you might expect. It is supposed to lay one egg at a time. As far as I know these are the only living fish of their kind in the United States."

"That's right," Herbert said, "I gave a pair each to two aquarist friends of mine, but they couldn't keep them alive. This is the last pair. But how are you going to keep them alive?"

I had no time to look up the scarce scientific records in journals that might indicate the kind of water from which they were caught, as a guide to their requirements. My problem was to rig up an aquarium immediately in order to keep them alive. Then we might be able to learn something

about their behaviour, manner of courtship, mating and reproduction.

I glanced at the tiny fish again. They kept near the surface of the water, swimming in a peculiar way for so small a fish; it was in a sinuous fashion like an eel or an aquatic snake. While they were swimming at the surface I got the impression that this habit of theirs might be associated with a pelagic life in large water areas. I thought that this new fish might frequent the broad mouths of South American rivers, like those of Venezuela and British Guiana. They were know from those parts of the world. On a hunch I decided to do two things. I lowered the level of the water of an aquarium to about four inches. This would give them a large surface area in relation to the volume of water. Then I dissolved two heaping teaspoons of coarse, pure table salt, in a small quantity of water and poured it into the aquarium. If they were inhabitants of river mouths, a bit of salt would make them feel at home.

The Little Toms' Food

Once the pair was settled in the shallow waters of an aquarium I gave them a thimbleful of live *Daphnia*. They went after these tiny aquatic crustaceans, lifting their heads in a peculiar way. They had a surprisingly large mouth for so small a fish; they easily swallowed the adult water fleas. The important thing at this moment was they were eating. To be sure that they obtained an optimum of nourishment I sprinkled a little pulverised fish food on the surface of the water. I was gratified to see that the fish opened their mouths, picked the food from the surface film and swallowed it. For the time being I felt that I had done everything I could; the rest was up to the fish. In the meantime I ordered some dried brine shrimp eggs. I decided that the newly hatched shrimp nauplii might be one of their natural live foods.

Now it may seem strange that an ichthyologist is confident in his ability to identify a species of fish on the basis of the shape and details contained in the tip of one of its fins, a tip so small that it measures less than an eighth of an inch. But the anal fins of male livebearing poeciliid fishes are no ordinary fins. Each is a highly complex organ, fitted with many jig-saw puzzle pieces that are all developed out of three of its fin rays. These rays, instead of being pliant rods made up of many fairly similar segments, are made up of many different kinds of closely fitting parts, some in the shape of combs, hooks and spines. Each group of segments has a special name like "serrae, hooks and claws." Each segment plays a part in producing an effective intromittent organ by which the male is enabled to provide the female with its sperm for the propagation of its kind. Male guppies, mollies and similar fishes have small wattle-like palps attached to their anal fins, or gonopodia. Platyfish and swordtails have no gonopodial palps. Things like that are enough to categorise whole sub-divisions of these live-bearing poeciliid fishes.

Not many of the tiny structures in the gonopodium can be seen by the naked eye so that in the routine study of these fishes the ichthyologist removes the tip of the fin, mounts it on a glass slide and studies it under the microscope.

Frozen Specimens

Fortunately, the people at World Wide had the fore-thought to put the fish that died into their deep freeze. I emptied the second coffee container into a shallow dish. The fish were stuck together like anchovies in a can. As they thawed out I separated them and found to my delight that there were many males among them. Their antler-like anal fins stuck out in grotesque angles and it took a bit of delicate manipulating to detach them. I had no trouble in arranging one entire male under the binocular microscope in such a way that the tip of its anal fin was brought into focus. Just one glance at the amazing combination of prongs, spines, hooks, pads, and other special structures for which no names have yet been coined, confirmed my original guess that the fish was *Tomeurus*. Its anal fin was unique and as diagnostic as a fingerprint is to a criminologist. When I sorted out the frozen mass I was gratified to find more than a hundred specimens, divided into fully developed males and females, and a goodly number of immature fishes, including seven embryos not yet hatched from the egg. The embryos' eyes were well formed but hidden beneath wisps of transparent tails that were coiled full swing around their bodies. Finding seven dead embryos well along in their development was puzzling. I could not remember another instance of embryos being collected with their parents. Furthermore, the embryos, still within their eggs, were attached by filamentous tissues to the gono-podium of the male.

I let my imagination take over. Could the function of the extraordinary complex anal fin of the male be to use as a sort of grappling organ to latch on to the egg by the mass of sticky attached threads just when it was expelled from the female? This would call for some sort of a preliminary courtship and a co-ordinated mating performance. Of the mating habits of the adults nobody knew anything. The idea that the gonopodium was a sort of a basket to catch, to hold and to carry the developing egg until the embryo is ready to hatch I admit was fantastic but it had one virtue; it could explain why the fertilised eggs and embryos were found attached to large males.

First Egg

Next day, the first thing I did when I came to the laboratory was to see if the *Tomeurus* were still alive. They were. I called William Bridges, the Society's curator of publications, urgently requesting him to send Sam Dunton down to us with his camera right away so he might photograph what I boldly said was the most unusual and rarest live pair of fish in the United States. I said that I didn't know how long I could keep them alive and that the pair I had were the last survivors from a lot of more than a hundred.

Sam, as usual, did a beautiful job in photographing the small, pale and filmy *Tomeurus* while they actively swam about in a small aquarium, although the creatures were as photogenic as a pair of ghosts on the run in a London fog. At my suggestion Sam had photographed them in such a way that the male's bizarre, antler-like gonopodium was clearly visible. While we did not harm them in the least in the process of photographing them I did not entertain the idea that they would survive for many more days. The only record I was ready to settle for was getting a photo-graph of a living pair of *Tomeurus*. They fooled me.

On the third day the "little Toms" looked better than on the second. On the seventh day I was surprised to find a single embryo in its egg floating on the surface, but it was dead. That was unfortunate, but it indicated that the pair apparently had bred and might breed again. Every day I looked to see if I could spot an egg in their aquarium. Dur-ing July and August I had to be away. I left the little Toms in the special care of an assistant with instructions to observe and feed them on the special diet of *Daphnia*, dried food and brine shrimp. When I got back to the Genetics Laboratory after the summer vacation the pair of little Toms were better than ever, but no one had seen another egg or embryo while I was gone.

Then one day I noticed that the female's belly bulged lopsidedly. Since she was as pert as ever in her behaviour I suspected her of carrying an unreleased egg. Next day she was her trim self again, so I searched for the egg that she might have shed. Nothing. Maddeningly during days that followed she would be alternately bulging and trim, yet we found no results of her body changes. I am sure now that the pair had actually bred many times during times which suited them, not us. We simply weren't aware

of what was going on and consequently we never searched diligently enough for the eggs that must have been there. September, October and most of November went by. If the little Toms had bred, nobody caught them in the act, nor could anyone prove it by evidence in the form of an egg or embryo.

During the last few days of November, Donn Rosen finished his two-year stint in the army and returned to his post as assistant scientist in the Genetics Laboratory. He asked me what luck we had with *Tomeurus*. I knew of no one who had a better background of experience with live-bearing fishes related to them than he did. I suggested that he take the pair of little Toms to his section of the laboratory and watch them. About a week later, one morning as I walked down the hall, Donn intercepted me and asked me to look at the little Toms' tank. He pointed to the lower left corner. I looked there but saw only a mass of *Nitella* filaments and gravel particles. The pair of fish were swimming about in their usual manner.

Hatching Disappointment

"Take the hand lens and look at that *Nitella* filament," he said, pointing out a particular strand of algae. I did so and there it was, an egg! It was in an early stage of development, beautifully camouflaged in the slightly brown-tinted water. The egg was about one-eighth inch in diameter, semi-transparent and amber coloured. One could easily have mistaken it, as I did, for a small snail clinging to a plant stem.

"That confirms it. *Tomeurus* is an egg-laying species," I said. Then as I was about to go Donn said, "Wait a minute, there are two more eggs in the aquarium." I was astounded! Way back in the aquarium one egg was stuck to the glass of the aquarium and another was nestled among the gravel particles. All of the eggs looked clean, free of fungus, definitely alive. In one, the dark black eyes of the developing embryo were bright, a good sign that it was healthy.

In the next few days those little Tom eggs were inspected many times a day with more than parental anxiety. The changes within them were imperceptible. But as the days and the weeks went by we became concerned because none of the eggs hatched, yet they seemed as viable as the day they were found. Why didn't they hatch? We knew that the eggs of other tropical fishes, like the medaka and paradise fish, hatched within a week, many in two or three days. Could it be that the eggs of the little Toms required a special environment? Before we did anything radical, however, we decided to make a thorough inspection of one of the more advanced embryos still in its egg. We carefully lifted it out of the aquarium, lowered it carefully in a small glass dish and placed in under the microscope. With its eyes covered by the tail within its cellophane-like enveloping membrane, it appeared shy in its nakedness. The embryo looked just as good as it ever did. When we saw that circulation of its blood had started, we decided that all the eggs needed to hatch was more time.

After seeing half a dozen eggs in the little Toms' aquarium, finding another egg each day became routine. Donn's curiosity was thoroughly aroused. One day in my office he said, "Now that the female has laid her eggs attached to plant filaments, on the glass side of the aquarium and on the gravelly floor, I wonder how she does it. Does the male participate in the egg-laying process?"

"You may have to get up very early in the morning to find out," I replied. "Some fish, like the Japanese medakas, spawn just as dawn of day is breaking. Maybe we can trick the little Toms into thinking it is dawn. Try covering up their aquarium and then take the cover off at your convenience. That's the way Dr. Robertson and Dr. Rugh induced medakas to spawn on command."

Donn went back to the little Tom's tank and placed cardboard around the aquarium, leaving just the front glass open. That darkened the tank considerably. In a few hours, I supposed, Donn would lift the cover off and create an artificial dawn. Within a few minutes Donn was back in my office saying, "Well, I just saw the female lay an egg."

"But you covered them only five minutes ago!"

"I did," he replied, "just as I completed covering the aquarium I noticed that the female separated herself from the male, getting as far away from him as she could. In a far corner she seemed to be looking about, testing spots here and there by mouthing the plants, the gravel and the glass of the aquarium. Then, as if her mind were made up, she went into a sort of vibratory dance, twisting her body into an S-like curve. She then tilted her body as if she were going to lie down on her side. Still vibrating she drifted this way to within a quarter of an inch of her chosen spot and released her egg with some force. The egg hit a jagged part of the glass in the corner of the aquarium and stuck to its point of contact by many adhesive threads. I could lift the egg out of the aquarium simply by latching on to those sticky threads with a long needle."

"I guess the little Toms spawn at dusk rather than at dawn," I said.

"That's right," Donn replied, "But I wouldn't call its

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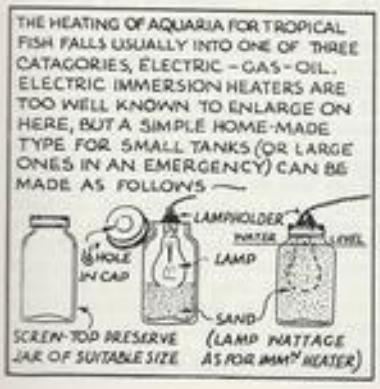
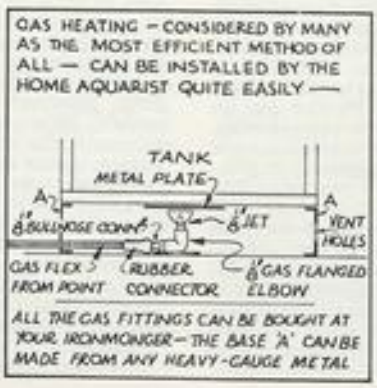
THE PRACTICAL AQUARIST

Heating





egg laying *spawning* because the male had nothing to do with it. It was a solo performance, more like a female insect ovipositing an egg."

Secrets of the Mating

The secret of the mating behaviour of the little Toms was discovered a little later. In ordinary light, during the day, when the little Tom male attempted to contact its mate, she repelled him in a curious manner. She was able to hold him at a safe distance, perhaps by several inches, simply by facing in his direction. If he was intent in approaching her, he manœuvred about her, swimming back and forth in a wide circle around her and awaited for an opportune moment. If she was intent that he maintain his distance she pivoted her body in such a way that her tail swung in a wide circle; her head turned but moved hardly at all from its initial position. In this way, she constantly faced him.

If she relaxed her vigilance the male dashed toward her, with his gonopodium held forward like a lance and ready for the crucial moment of contact. In bright light he rarely succeeded because she was on the alert. Once they met head on, their mouths were open, their jaws locked. They struggled for an instant and as they broke away the water surface in the wake of their struggle was turbulent. She often lunged at him with as much force as he did at her. What motivated these games of tag was not clear. From the human observer's point of view, and in anthropormorphic terms, they certainly were a scrappy couple.

In dim light the female was either more receptive to her mate's advances or she just could not keep him constantly in her view. On several occasions when the light in the aquarium was reduced by covering all but the front glass, the female's guard was down. The male approached her from behind and from below. Then he lunged at her with his gonopodium thrust forward and struck her from below. Instantly the water was agitated violently as the male almost leaped out of the water. If this was the consummate act in their mating performance, it was far from that of viviparous fishes such as the platy or guppy.

Immediately after this curious behaviour Donn lifted the covering from the aquarium to find out what happened to the female. He noticed six tiny white cyst-like objects attached to her large, keel-like anal fin. Donn had previously noticed similar tiny white oval bodies on her anal fin but thought they were the cysts of the protozoan *Ichthyophthirius*, a dread disease organism known as "ich" to every keeper of tropical fish. But the white spots on the female always disappeared in a short time so Donn gave the little Tom no special treatment.

White Spermatophores

What was the significance of those white dots on the female's anal fin? They weren't there before the male made his gonopodial contact. Donn decided that he had to find out. He dipped the female out of the aquarium immediately after one of their successful contacts. He carefully removed one of the oval bodies that was stuck by some adhesive-like substance to her anal fin. He then put her back in the aquarium, none the worse for the operation. Under the microscope, on a glass slide, he crushed the oval cyst and found a flowing mass of transparent, flagella-propelled oval objects. They were spermatozoans! The cyst was a spermatophore.

Donn reconstructed the curious sequence of events in the little Tom's behaviour when the light is dim. In the male's successful dash, which culminated with its gonopodial contact, he managed to direct the point of the transfer of its spermatophores to the genitalium of its mate. Sometimes his timing and direction was off slightly so that the self-sticking spermatophores were ineffectually planted on its mate's anal fin.

From 8th December, 1954, to 1st February, 1955, we spotted 42 eggs, somewhat less than about one a day, but the little Tom may have laid more than one egg during a single day. The first one to hatch, on 3rd January, required 30 days at 76° F., and survived for only four days. The second one to hatch, on 10th January, lived for 25 days. We thought he was going to make it. The third, fourth and fifth babies disappeared within a day. We are a long way from knowing all their requirements. Donn thinks that they do better at 80° F. than at a lower temperature. We don't know how much salt the babies need in their water. We have learned that hatching out of the egg does not insure their survival.

News that the Society's Genetics Laboratory was harbouring a pair of living *Tomeurus* spread across the country. In September, I received a letter inquiring about them from Dr. George S. Myers, Curator of the Natural History Museum at Stanford University in California. He said that he had been trying for years to get live *Tomeurus* to finish up his study of them in co-operation with Carl L. Hubbs of the University of California. I replied then that I had just a single living pair and did not dare risk losing them in shipping them to the west coast. I offered to send him six pairs from our preserved collection of little Toms, which he accepted.

"Lowa-lowa Lice"

From the time the pair of *Tomeurus* arrived at the laboratory, I kept the Zoological Society's staff informed of the fish's behaviour in our aquarium. Eventually, in December, I was reporting that Donn had managed to observe the pair's mating activities, the female's method of oviposition, and the hatching of the embryo. At last, I said, I had enough information to do a story on little Toms for *Animal Kingdom*. This announcement aroused James W. Atz, Assistant Curator of Fishes and the Society's bibliophile, to search all possible sources of information concerning *Tomeurus* to enable us to fill in the information we needed concerning their habitat and habits under natural conditions. We all knew that little had been published about them. But Jimmy tapped a source of information none of us had thought of before—the unpublished field notes taken 25 years ago on the fishes at Kartabo in British Guiana by John Tee Van and Clifford Pope, when they were working with Dr. William Beebe at the Society's tropical research station. The unearthed field notes yielded a rich bonanza of pertinent information. They filled wide gaps in our knowledge of their natural history.

To the Creole peoples of Kartabo the little Toms are known as "lowa-lowa lice." The white people of the region call them the sword-finned minnow because of their conspicuous lance-like gonopodium. The local Indians have no name for them, possibly because the tiny fishes are of no importance for food. *Tomeurus* lives in the mouth of the Rio Essiquibo and under the influence of oceanic tides. On this point, my lucky guess that the little Toms required some salt in their water environment was correct. They swim, sometimes in scores of individuals, close to the surface. When surprised near the banks of the river or its tributaries the lowa-lowa lice scoot out into open water, seeking shelter underneath masses of river froth, floating leaves and sticks. They feed on small winged insects and on spiders that fall and are held in the surface film. Beneath the surface the fish catch smaller crustaceans, like shrimp, copepods, and daphnids. Often the fish are trapped in backwater pools which are often exposed to the strong rays of the tropic sun; yet the lowa-lowa lice tolerate the heat. On this point Donn's hunch that they require somewhat warmer water than we generally maintain at our laboratory was also correct.

The most dramatic notes by Clifford Pope were the day-

by-day history of the six live embryos that he squeezed out of a gravid but dying female *Tomeurus*.

"23/VII/20. The female spoken of just above died yesterday, late. This morning I took her out and *easily* pressed out six eggs—all with embryos. It would appear as if they had been carried there as they were only joined to her by loose threads. Circulation in 4 is very plain; also jerking movements of the embryos.

"24/VII/20. The five eggs doing well. Each is 1¼ mm. in diameter.

Tomeurus is easily approached and the only fish of Kartabo beach that can be readily caught with a short-handled net. When once in the net they spring around like little jumping jacks.

"25/VII/20. Embryos developing; all five eggs alive.

Examined another female *Tomeurus*. Found three "eggs," two clear—one a small embryo.

"28/VII/20. The five eggs of *Tomeurus* (first batch) doing well. The dark blotches still growing larger and running together as are the red ones. The eggs show tendency to become translucent. The eyes (? dark bodies one on either side at one end of embryo) are very dark for first time.

"30/VII/20. *T. gracilis* eggs alive.

"2/VIII/20. The black of the five *T. gracilis* eggs is losing its intensity, continuing to become more and more like the branched red spots. The body of embryo is beginning to be differentiated. Pulsations still originate just anterior to head of embryo.

"6/VIII/20. Yesterday the two eggs of *T. gracilis* in a separate dish were dry—the whole dish was dry—as I was sick and did not attend to it. One egg was alive and is still so to-day, the other I threw out to-day. Two of the five also were not good this morning and I threw them out.

"7/VIII/20. Last one of the two *T. gracilis* eggs doing well.

"21/VIII/20. Getting ready to leave. The last of the six *T. gracilis* eggs is apparently about to hatch."

Biological Paradox

Pope's observations throw a revealing light on *Tomeurus*, close affinity to viviparous poeciliid fishes. The little Tom female is capable of retaining within her body not only fertilised ova but well-developed embryos as well. They explain why we found embryos among adult little Toms in the frozen mass preserved by World Wide. Some females while en route to the United States had apparently released their embryos and the filamentous threads attached to the embryos' eggs became entwined about the gonopodia of the dead males. Pope's discoveries also explain why I found a single, not-long dead embryo in our laboratory aquarium after our pair of *Tomeurus* had been with us for only six days.

Why are the leading ichthyologists around the world concerned about this tiny, diaphanous fish? It is because *Tomeurus* is a biological paradox. Although the male has an elaborate anal fin designed for the transfer of sperms to insure internal fertilisation, yet the female lays eggs. If the little Toms were like all other livebearing fishes to which they are definitely allied by many anatomical traits, the most outstanding one being that the males have gonopodia, the females might be expected to give birth to living young. She doesn't and therein lies the paradox.

The paradox will be resolved only when we learn more about the rarer livebearing fishes and their egg-laying relatives. We are already aware that one egg-laying species, like *Fundulus*, the killifish of our Atlantic coast, occasionally retains embryos within its body, like livebearers. On the opposite end of the range of variability, the livebearing mosquito fish, *Gambusia*, of our southern states, may be induced to release her embryos prematurely and the early embryos so born survive. The more we study the livebearing and egg-laying fishes the more we are drawn to the conclusion that viviparity and oviparity are relative terms and not necessarily mutually exclusive.

The little Toms were discovered in 1909 by the late Carl Eigenmann. He left it up to the reader to discover why he gave them their scientific name of *Tomeurus gracilis*. He described this fish as being slender and knife-like and that, loosely, is what the scientific name means, because *tome* from *tomon* in Greek refers to a cutting, and *gracilis* in Latin means slender. But the interesting puzzle is what meaning *urus* has. Zoologists often use *urus* to end a generic name and maybe that is all Eigenmann intended. Sometimes it refers to the tail part of an animal, from *oura*. But perhaps Eigenmann was thinking of the meaning *urus* has in Germany, the country of his origin. There, *urus*, a Latin word of Teutonic derivation, refers to a longhorn wild ox. If Eigenmann saw a resemblance between the long horns of the wild ox and the antler-tipped anal fin of the male little Tom, then perhaps *Tomeurus* means a small cutting from the longhorn. I think the first meaning is correct but I like the last.

Related Species

Half-way around the world along India's west coast in the brackish waters of Bombay, some ichthyologists have said that *Tomeurus* has a worthy rival in a fish about its own size and superficial appearance. The male of the Indian species has a gonopodium equally massive and complex, but actually its anal fin is entirely different in its many structural elements. The female, like its counterpart in *Tomeurus*, lays filament-bearing fertilised eggs; these, too, become attached to branching water plants and other objects. These remarkable fish of India were discovered in 1937 by C. V. Kulkarni, then Piscicultural Assistant, now Director of Fisheries in the Taraporevala Aquarium of the Government of Bombay. He named them *Horaichthys setnai* in honour of two of India's leading ichthyologists, S. G. Hora and S. B. Setna. These experts recognised the new fish's many unique traits which were like no other species in the far east. Jointly the older men urged Kulkarni to make a thorough study of the fish in the field, on the dissecting table and in the laboratory aquarium. This he did and he published his report in 1940 in the Records of the Indian Museum, Calcutta.

A New Family?

Kulkarni's fish was so different that he decided to establish a new family of fishes, which he called Horaichthyidae. His purpose was to classify the fish on a high level of distinctiveness. In this country, at about the same time, the singularity of *Tomeurus* characteristics has convinced two of America's best known ichthyologists, Carl L. Hubbs and George S. Myers, in 1940, that *Tomeurus* should represent a new family of fishes to be called Tomeuridae. On the basis of information then available, Donn Rosen and I expressed the thought in our 1953 paper that the idea had merit. That was before we received a windfall of specimens which made possible a microscopic analysis of the preserved fish and observations of the behaviour of the living little Toms. We are not quite as sure now.

In the meantime far from New York, California and India, but in Moscow, Russia, the Soviet Government published a book by Professor G. V. Nikolskii on "Special Fishes," or Chastnaia Ikhtiologia. In it Nikolskii first met the bid of American ichthyologists that *Tomeurus* represents a brand new family of fishes (which he mis-spelled Tomeiurdae by adding an extra i). Then he upped the ante by declaring that *Tomeurus* represents a species so unique that it is one degree higher than a family category. It belongs, Nikolskii declared, to the super-family Tomeuiroidae (again mis-spelling the basic term).

Microscopy for the Aquarist—12 *by* C. E. C. COLE

THERE is a vast number of aquatic creatures which can be easily and comfortably examined by the low power objectives in which we have so far invested. Most of them are visible to the unaided eye—a fact which tends to lift them out of the category of "microscopic" into that of "*macro*scopic" animals. Nevertheless, the fascinating and absorbing study of their detailed structure cannot be undertaken at all without the assistance of a microscope and a few accessories.

Before examining small portions of an object it is an excellent policy to use an objective which will give us a correct idea of its general overall shape and proportions. Therefore for macroscopic organisms up to $\frac{1}{16}$th of an inch use your $\frac{1}{2}$ in. objective, or a $\frac{1}{3}$rd in. should you have been unable to procure the former, with a X5 eyepiece. Over $\frac{1}{16}$th in. and up to $\frac{1}{8}$th in. use the 1 in. objective and a X5 eyepiece. Exceeding $\frac{1}{8}$th in. up to $\frac{1}{4}$ in. substitute the 2 in. objective, but use the X5 eyepiece as before. The use of a higher power eyepiece will have the same effect as a higher power objective.

So far, so good. But many fully grown larvae and other aquatic organisms are much bigger than $\frac{1}{4}$ in. overall. How can we examine these all at once? With the 2 in. objective in use we have racked up almost as high as the nosepiece can rise. If your microscope is equipped with a drawtube, and I recommended obtaining one that was, if you remember, pull it out and examine the bottom end of it. In some better quality instruments removal will necessitate first unscrewing a collar at the top of the body tube.

The end of the draw tube will be found to possess a thread which is identical with that of the nosepiece, into which an extremely low power objective can be screwed. The one I have found most useful is a 100 mm. (4 ins.). As far as I am aware, only two firms manufacture them. The Watson 100 mm. costs £4 6s. and the Baker 100 mm. £2 6s.

Using a normal X5 eyepiece and either of the above objectives we get a very useful field of view of just over 1 in. diameter. With a Baker X11 (times eleven) orthochromatic eyepiece, the field remains at over an inch with increased magnification of the subject. The eyepiece costs £3 10s.

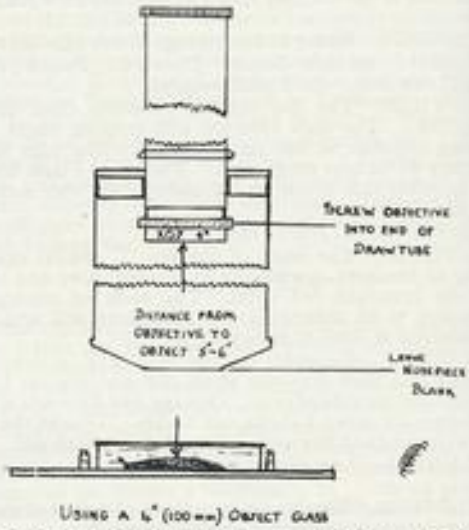
Examining Larger Specimens

Many of the large aquatic organisms which it is now possible to examine will be unable to be accommodated upon the normal 3 ins. by 1 in. glass slip or cavity slip. We need something larger, with sides which will prevent the creatures clambering or sliding out of the containers before we have looked at them properly. Many of the small cosmetic and cream jars now on the market can be utilised and may be provided by sympathetic female relatives. Alternatively more expensive "Petri dishes" or staining jars may be substituted. Whatever is finally used should be covered by thin, clear, glass.

Focusing is quick and simple. The draw tube is pulled out for just as far as is necessary. If it is too loose a fit its weight will cause it to slip. In this case it will have to be held in position by the fingers, or a piece of thin tissue paper wrapped round the neck of the body tube where the draw tube enters it. Should we have been using a revolving nosepiece and have left all objectives screwed into position it will be necessary to remove one before we are able to focus the four-inch object glass.

Summer is rapidly passing, but in garden pond, natural pond, and lake, there are innumerable creatures waiting to be netted. While there is yet time, before the cold, wet months are upon us, start collecting specimens of anything and everything for examination at a later date. A few screw-top jars, a fine mesh net, and a little care are all you need.

In one of the jars have a little 2 per cent. formalin. Thus equipped, make a few sweeps with your net among the marginal vegetation of pond or lake. Fill one of the jars with water, reverse the net over the mouth of the jar, and let the creatures you will have caught swim or fall into the water.



USING A 4" (100 mm.) OBJECT GLASS

Sectional diagram showing arrangement of lenses, etc., for examining large aquatic organisms under the microscope

A second jar can be filled with specimens from more open water, and a third with a portion of mud from the bottom of the pond. It will help if you label each jar with the date, place, and a description of the environment of the contents. Any creature placed in the formalin will be killed and preserved indefinitely if left in the solution. From this jar it will be possible to remove specimens for closer examination during the long dark evenings ahead.

QUERY

I wish to buy a magnifying glass to study various things in my aquarium. Can you advise me on the best type to get? Also I wish to set up a culture of *Euglena*; where can I obtain some organisms to seed the medium?

Magnifying glasses are usually denoted as ×6, ×8, ×15, etc., referring to the magnification obtained when an object is viewed. It thus depends on what you wish to examine whether you use a medium or high power lens. Messrs. C. Baker, Holborn, London, W.C.1, supply various powers:—×6, ×8, ×10, ×15, ×20 for 45s. each. These are aplanatic lenses and are first-class. The most likely place to obtain cultures of *Euglena* or other Infusoria is Messrs. Gerrards, Pentonville Road, London.

AQUARIST'S Notebook——

by
RAYMOND YATES

FISHES are not so finicky as many hobbyists think and will stand far greater extremes of temperature than "it says in the book." It is funny the way some people blindly follow aquarium literature to the letter and permit no deviation however slight. This may be all very well as regards quantities of chemicals used in disease treatments but there is much more latitude as regards temperature. It is remarkable what fish will stand. I have several times seen tanks where the heating has failed in winter with all the fish dead in a temperature of 40° F. except for zebras and white clouds, which were swimming round as if nothing had happened. Similarly at high temperatures most tropicals die between 95° and 99° F. but anabantids will generally survive over 100° F. This is not to say these fish will not subsequently show the effects in the form of shimmies or worse effects. We all know how a chance chilling of only a few degrees can bring on white spot, and yet if one deliberately chills fish for weeks on end they seem to thrive. After all, it is this uncertainty which makes the hobby so interesting.

Recently I had some swordtails in a small tank of dirty water for about two months, during which time the water temperature was almost constant at 58° F. They showed no ill effects whatever. I also tried out a similar experiment with *H. rosaceus*, neons, *Corydoras*, head and tail lights, velifera mollies, and unidentified tetras. A low temperature of 58° F. for weeks on end had no effect on *Corydoras melanistus*, beacons, unidentified tetras, *M. veliferas* or swordtails. The neon I used only lasted ten days (I had expected much longer) and *H. rosaceus* just over three weeks. Colour is not so pronounced and the red in the eyes of beacons goes altogether with low temperature. No white spot appeared, which makes it hard to believe that it is present in all water, waiting the chance to attack, a theory put forward in some quarters and to which I have never put much credence. For my own part I prefer a rise and fall daily between 72° and 80° F., but 72° to 75° F. range seems to suit the *Panchax* and its relatives better than the higher figures.

* * *

We have all seen the prize freshwater fish, in glass cases on the walls of country inns and it is surprising nobody has yet dealt with large angels in this way. It is not, of course, an easy job and is professionally expensive, a fee of £5 being quite reasonable for the angler's specimen fish. The aquarist can keep his dead prize-winners in jars in the house, suitably pickled, but the results are not good on the whole. Alcohol (70 per cent.) is the best fixing agent but is difficult to obtain and impossibly expensive (about 4s. 6d. per fluid ounce) which leaves us with a choice from industrial meths or formalin. The latter is easy to obtain and quite cheap, but is not so good in action as industrial methylated spirit. This can only be obtained with an excise permit but this is not an unsurmountable obstacle as most clubs have at least one member who is scientifically inclined and who could obtain a permit (free) on the grounds of "Use for biological purposes." It should be remembered that the colours fade and the only tropical I know which retains its colours well is the tiger barb. Of course, the fish in the glass case have splendid colour but this is usually artifically applied and varnished over. Where colour is of no importance, however, there is much pleasure in preserving fish, as for example, in those instances where the fish died of an obvious disease, and the specimen can be used to show others as an educational exhibit. A large number of dead fish can be kept in a single Kilner jar (in formalin) and individuals removed as needed. A certain amount of sediment, etc., will appear in such jars but it can be removed by filtering through filter papers or even ordinary blotting paper. Fish can be killed by putting them into formalin, death being practically instantaneous. This has the advantage of retaining the freshness of the fish before any fungoid growths have made their presence known.

* * *

For cleaning purposes, most hobbyists use water, soft rags and elbow grease, but there are other avenues open. Nylon scrubbers are quite useful, chamois leather helps the outside glass and even tank grit or glass wool can be used with effect on occasion. Nail brushes are excellent for scrubbing away blue-green algae from equipment or tank covers (inside), and even from certain plant leaves. Other ideas for cleaning include acetone for paint, varnish or lacquer stains and alcohol for sterilising the interior of a tank or wiping down the outside glass. Vacuum flasks can be cleaned with warm water and a little bicarbonate of soda. The cork stoppers can be boiled. Cork in the tank as decoration can be rubbed with an emery cloth. Rust can be removed with steel wool and paraffin. (It is no use painting or covering over rust, it will continue under any overcoating and must be removed.) Steel wool should only be used once or gloves worn. If rusty it can be very dangerous. If kept in a jam jar of water to which has been added about three tablespoonfuls of bicarbonate of soda it will not rust. Mercurochrome stains on clothes can be removed by sponging with equal parts of water and alcohol; follow up with glycerine to loosen the stain and when the stain has almost gone wash in warm soapy water and ammonia. Coloured fabrics are best tested first to ascertain how fast is the colour.

* * *

White spot having reared its ugly head in the tanks of a certain aquarist, he went along to the local chemist and asked for a certain quantity of quinine sulphate to be made up with which to combat the disease. He explained to the chemist the purpose for which it was intended and, in due course, dosed the tanks with the requisite amount. The water took on a bluish tinge and before long all the fish were dead. Quinine can be dangerous with certain types of fish, if used without aeration, but it does not produce a blue tint, although sometimes a cloudy effect is seen. Being no beginner in the hobby the aquarist duly went back to the chemist to enquire if a mistake had been made and was told that he had been given quinine sulphate as asked "plus some acid crystals to enable the sulphate to dissolve in water." When the matter was explained to the chemist he was most apologetic and promised to refer the matter to his trade association.

Unlike some fishy stories this one had a happy ending for the aquarist who received a cash payment to offset his loss. This sort of thing could occur to anybody, and it is always best to explain the use to which chemicals are to be put when ordering. The same aquarist on another occasion was unlucky with some other fish which died after being fed some raw halibut direct from the fishmonger, although the family felt no ill effects. It is a wise plan to thoroughly wash all meat and fish offered to your tank inmates as a precaution. I do not know about fish but meat can be treated chemically so that it looks very fresh when it is quite th

reverse, rather on the lines of adding luminant to the water of swimming baths to give sparkle to water which would otherwise be anything but bright. It should be remembered that many chemicals in use to-day have little if any effect on humans but can be fatal to fish. Even tinned crab or salmon should be rinsed before being used as a tit-bit for the aquarium.

* * *

A dealer told me of an unusual case recently. He received a shipment of various fish and emptied the lot, as he thought, into various tanks before putting the container away. Six days later the container was required and it was then discovered that some fish had been overlooked. These turned out to be half a dozen scissor-tails which, not surprisingly, were stone cold dead, and a similar number of *Badis badis* which were quite lively, although this occurred in cold weather. I have heard of several cases of chilling where fish have survived very low temperatures but scissor-tails have no resistance in this respect. Danios, white clouds and livebearers usually come off best when this sort of trouble comes your way. Angels soon give up.

An amusing incident on the chilling aspect happened to a friend of mine who lives in a rather wild rural area. He arrived home to find the current off but did not panic as he felt sure it would soon be on again. The fish room was warm and he felt justified in going out for an hour or two, feeling sure all would be well on his return. The current was still off, however, three hours later, so he immediately rang up the electricity authority and complained about the lack of current and told them he stood to lose valuable stock. Within half an hour two men arrived, to ask if he knew Mr. So and so, and where was the farm? When he told them that the valuable stock consisted entirely of tropical fish they nearly had a fit. One man even suggested they take the fish away with them overnight. In the end the fault was rectified on the spot and all ended happily.

* * *

Talking to a breeder recently he rather surprised me with the remark that nobody can call himself an aquarist unless he breeds fish. What a lot of nonsense this is! Nevertheless, I think there are many breeders who suscribe to this view. For obvious reasons there are few breeders in the country who breed a large number of different species of fish; most content themselves with two or three varieties. With these they are very successful generally, and undoubted authorities. On other types of fish, however, they are often quite ignorant. Most beginners start with the idea of breeding fish and almost all have some success with livebearers. There interest stops, because breeding other varieties requires more space, time and patience. Interest in the hobby does not decline, though, and some of these non-breeders become, in time, very well versed indeed in the hobby. There are numerous fish available which defy all efforts at breeding—are these to be relegated to a back place; are biologists, microscopists and other knowledgeable people in the hobby to be written off as useless? Many good dealers are aquarists of high standing but they are not breeders. From another angle, how many people breed canaries, budgies, parrots, or even dogs seriously? Let us keep a sense of perspective and not become too enthusiastic for our own particular section of the fancy, to the detriment of other, equally keen and enthusiastic aquarists.

* * *

A suggestion was put forward recently that the tingling shock sometimes obtained from tank water (usually through a cut in the skin) is the result of static electricity which builds up in the tank, and that subsequent shocks immediately afterwards are far less obvious. There have been many articles on earthing tanks, on electricity dangers and the like but the broad fact seems to be that nobody knows much about what can or does happen. In all these years in which the hobby has been popular no fatal accident has been recorded to my knowledge, which is somewhat surprising knowing the way some hobbyists fool around with their electrical gear. There must be many competent electricians in the hobby—is there not one who can clearly define the actual dangers and risks, what follows when a heater cracks and the effects on fish in the tank? There is a wide field for some expert who can give definite data and not vague generalisations. Can you help?

* * *

There are some very go-ahead aquarium clubs in Britain but I have not yet heard of one which has built a public aquarium. This is exactly what is being done by the Canadian Aquaria Society of Toronto who propose to build an aquarium at the Zoological Gardens at Riverdale Park. Needless to say this most ambitious project has caused a great deal of local and national interest and has been featured in the Press, Radio and Television. Quite apart from the public interest which will bring in some considerable revenue, the club hopes that the new aquarium will prove useful to club members in many other ways. There will be a research laboratory and a development hatchery, and it is hoped that some study will be made of fish diseases and treatments. Another angle contemplated is the production of colour films on the various aspects of keeping and breeding tropicals. Illustrated lectures open to the public will be given in the auditorium, rather on the lines of those now given at South Bank, London.

It is proposed to have a printing shop on location at the Aquarium which will produce small booklets on the life history and other details of tropical and local game fish. These are for the use of the public, schools, angling societies and so on. The society has some experience in this line as it has published a number of booklets in the past as well as its monthly magazine *The Candian Aquaria*. Young people are to be catered for where possible and it is hoped to sponsor youth groups within existing service organisations. In time the society hopes that surplus funds will accumulate and these are to be put in a trust fund with the object of building other Public Aquaria in other major Canadian cities. British followers of the hobby will wish this venture every success. In this country there are, at most, only about a dozen public aquaria so that most people have few facilities for regularly seeing a set-up aquarium display. One or two clubs have made up for this by displaying several tanks in the local library or art gallery throughout the year. It needs a little organisation but proves a wonderful advertisement for the club and the hobby.

* * *

Some time ago I had occasion to give a talk to a fairly new club in a rather remote area. I was particularly struck by the obvious keeness of all concerned and by the tremendous club spirit which was so obvious. This club is some way from any other society and miles from any dealer, and the members make it a point of honour to bring fish back with them from their travels so that other members can purchase anything they fancy. It was most refreshing to learn that some fish which most aquarists consider quite commonplace nowadays had not, as yet, been kept by any of the club members or even seen in the town. These included such well known fish as *Pristella* and Belgian flag tetras. I felt there was a moral here for those clubs where club spirit is not so obvious and where internal troubles prevent fishkeeping from being fun.

* * *

A large chain store which has branches in almost every town in Britain is offering semi-circular "posey holders" in coloured glass for two shilling each. These make excellent plant holders for burying below the compost. Another novelty is a plastic egg tray to hold 12 eggs, this selling at 1s. 6d. This can be turned into an excellent micro worm hatchery or one for even larger forms of live food.

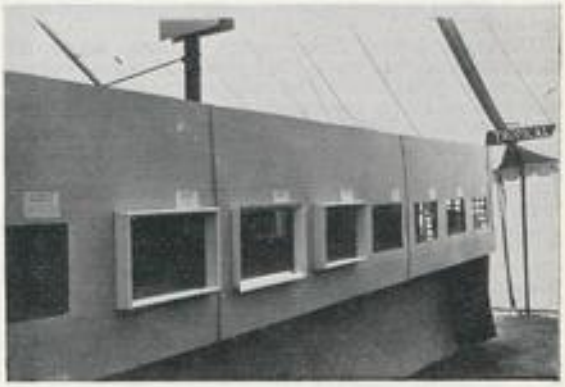
HENDON A.S. Successful New Style Show

Photographs by J. SKIPPER

HENDON'S sixth annual show held last month included as usual a comprehensive display of the Borough's activities, which set a high standard in exhibition technique. It was therefore a specially meritorious effort on the part of Hendon and District Aquatic Society that won the council trophy awarded each year for the best display at the show. Within a large marquee the society had created most attractive surroundings for aquaria and exhibits, in contemporary style. The central region was occupied by five three-sided blocks of aquaria masked by boarding painted in harmonious pastel colours. Signs showing tropical, coldwater, marine and reptile sections employed white lettering on black background. This style was also used on cut-out abstract shapes attached to black lattice panels arranged all round the walls of the marquee; on these numerous photographs of fishes together with informative notes about them were displayed. Across one end of the marquee was the society's "shop," where fishes, plants and accessories were on sale. At the other end an information desk flanked a screen upon which were automatically projected from behind a continuous series of colour pictures illustrating activities of the society, by a device known as the Autoscope.

The ends of three of the triangular blocks of aquaria are seen in this view

Lattice screens round the marquee walls carried fish pictures and information on abstract "shapes"



The three different styles of tank framing seen here were used to indicate first, second and third awards

Photographic enlargements of Hendon members' fishes were displayed on the fascia board

The Mayor of Hendon presenting the Freedman Trophy for the best display at the Borough Show to Hendon A.S. chairman

Swordtails

(Xiphophorus helleri)

ORDER:—Microcyprini, from Greek *mikros*—small, and Greek *kyprinos*—a kind of carp.

FAMILY:—Poeciliidae—from Greek *poikilos*—many coloured.

SPECIES:—*Xiphophorus helleri*, from Greek *xiphos*—sword and Greek *phoreus*—a bearer or carrier.
Helleri—after the collector, Carl Heller.

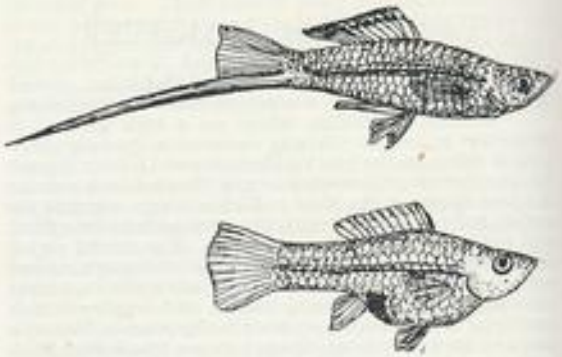
THE swordtails rank high among the fishes responsible for the existence of the hobby of tropical fish-keeping. Many of the oldest fanciers, by which I mean oldest in the hobby, not in years, have always included them in their collections. There is no doubt at all that the long swordlike extension of the lower rays of the caudal fin, from which the popular name is derived, and which is exclusively a male character, is most striking and unusual, and is primarily responsible for many a tyro attempting to breed them.

Originally hailing from eastern Mexico, where the maximum body size was in the region of 2¾ inches, we have for many years been absolutely independent of fresh importations of the commoner varieties. It is somewhat strange to reflect that under home-bred conditions, the size of the original green swordtail has lessened, but the more colourful varieties have slightly increased in average size. Many are the variations developed from the original wild stock, either from sports or the results of deliberate crossings with platys.

Swordtail Varieties

Where a true-breeding line has been established, with or without the aid of platy blood, it has been recognised by the F.B.A.S. and a standard produced as an ideal for exhibition purposes. Among the variations recognised are the red—the ideal being a fish with an intense scarlet body and yellow sword edged with black; the golden, with clear yellow body and yellow sword; the black (very rare) with the body and fins an unrelieved black; the red Wiesbaden, divided into an upper scarlet half to the body and a lower black half, with a red sword edged with black; the green Wiesbaden, with green taking the part of red in the previous fish, except for a red lateral line dividing the two zones, and a yellow sword edged with black; the London, with a combination of colours: an orange body, overlaid with regular spangles of metallic green centres with black edging, the fins yellow with black markings—the sword yellow with black edges. Of most recent recognition is the group of wagtail swordtails—yellow, red, and green. All fins of all colour varieties should be completely black, and not merely the *rays* of the fins.

With so many varieties from which to choose it is not surprising that some years ago serious consideration was given to the formation of a "Swordtail Specialist Society." Like so many other good suggestions, however, it was never actually adopted, so to this day breeders of these lovely fishes are scattered over the length and breadth of the land without any guidance as to procedure to follow to improve their fishes except what can be gleaned from occasional articles published on the subject.



Swordtails—male fish above

Special treatment may be regarded as unnecessary in order to breed swordtails, for the veriest beginner can place a male and female fish together in a community tank with the almost certain knowledge that later on the female will give birth to a brood of youngsters. It is strange how many people regard themselves as breeders when this occurs—there is nothing more that they need to know. Yet when they visit an exhibition—particularly an open one—they look a little doubtful as they contemplate the prizewinning exhibits and mentally compare them with those they themselves possess. For like almost any species of fish, the swordtails are much improved by a little special attention.

Firstly, they like room and clear, healthy water. A 3 ft. long aquarium gives them exercise and tones up their muscles—clear water usually contains less suspended solid matter, and less foulness than the murky, neglected tank. Water containing free-swimming algae is healthy enough, the algae producing quite a lot of oxygen, and furnishing a proportion of food for the fishes, which are omnivorous. If the algae on the plants or in the water is sparse, a little chopped lettuce or spinach should be substituted. A layer of duckweed on the water will help also, for the fishes will browse upon the roots.

Sword Development

Temperature tolerance varies according to the particular strain of fishes. By that I mean that if obtained from a breeder who consistently keeps his tanks at a temperature of 80° F. they will suffer badly if transferred to an aquarium which never exceeds 75° F. The converse does not necessarily apply—in a higher temperature they will simply live their lives faster, and reach their ends quicker. Fortunately they can be acclimatised to much lower temperatures than their normal if subjected gradually over a period of months or years. The ideal temperature is from 72°-75° F.

Above this there is a tendency for males to develop the sword when their body size is small. Once the sword is developed there is very little increase in body size, and the result is a small male. When breeding for exhibition purposes this is a point that should be borne in mind. Otherwise I can see no particular objection, for I must admit there is a strong fascination in fully developed but undersized males. Many aquarists prefer them for their community tanks.

The larger the females the more youngsters they will deliver at a time. A well-grown female, with body size of three inches, frequently gives birth to as many as 200 young

in a matter of a couple of hours—sometimes less. A young, half-brown female will continue to increase in size after giving birth to her first brood. For line-breeding, however, it is essential to use only the best fishes, and it is not possible to tell which are best until they are fully grown.

Segregation of the sexes is necessary to prevent precocity, so a careful watch is necessary in order to detect the first signs of developing masculinity. All the young are alike when born, and remain so for several weeks afterwards. The first indication of the male is a gradual thickening of the rays of the anal fin which will form the gonopodium, and a changing of shape from rounded extremities to pointed in the pelvic fins. At the same time the body ceases to increase so much in depth, developing a streamlined contour typical of a male.

As soon as young fishes manifest any of the above signs, net them out and keep them separately. You may make one or two mistakes at first, netting out thin females instead of males, but this does not matter, for thin females are little use for breeding purposes.

Separate the Sexes

If you are consistently watchful you will soon have separated the sexes, but if you are unobservant and leave a single developing male in with your females, most of your good work will be undone—he will fertilise the whole of them in a matter of days. To be absolutely certain of success, of course, each of the youngsters you decide to raise should be kept on its own from the time it is a couple of weeks old. Unfortunately this necessitates a whole battery of small aquaria—beyond the range of most of us. All aquaria used for swordtails should be closely covered, for they are great jumpers, even when only half an inch in length.

After fertilisation, a female kept at about 75° F. will give birth to several successive broods of youngsters at intervals of about six weeks. The youngsters are delivered folded head to tail, and several may be expelled at one time as the female moves around the aquarium. Occasionally there is quite a proportion of yolk sac attached to the fry, which makes them too heavy to do other than lie wriggling on the bottom of the breeding tank. At other times they unfold and are able to swim strongly, albeit jerkily, immediately after their mother releases them. They make for cover near the surface of the water—*Riccia*, *Salvinia*, or duckweed afford excellent protection, and should always be present.

Mother should be removed immediately she has given birth, before she can eat any of her babies, and fed well with nourishing live foods, such as *Daphnia*, gnat larvae and pupae, *Gammarus*, bloodworms, etc., for several days.

The young probably consume what Infusoria they find in the aquarium, but are large enough to catch and digest powdered dried food, baby *Daphnia*, *Cyclops* nauplii, new hatched gnat larvae, micro worms, etc., without difficulty.

If you are wise you will spread the fry around among a number of aquaria, for it is silly to attempt to raise as many as 200 in a small tank. Cull them regularly, discarding misshapen or crippled specimens, and keep a constant watch for any which appear different from the others. There is a great chance that you will spot one or two, for after many years hybridising there are practically no 100 per cent. pure swordtail strains left, and anything might turn up.

Some years ago, several males appeared which began to develop an upper extension to the caudal as well as a lower. High hopes were entertained at that time of establishing a strain of double sword swordtails, but accidents like stuck thermostats and failing heaters, power cuts and so on put paid to all those I ever heard about or saw. With those fishes died all sorts of interesting possibilities, but with swordtails you never know—perhaps in the future even more extraordinary specimens will appear.

Cacti in the Fish House

MANY cacti can be increased by taking cuttings, for it is a fact that almost any piece of a cactus plant will make roots and grow a new plant. Take cuttings during the warmer months of the year and remove them with a sharp knife from any place where the wound will not show up too much. Dry the cutting in the sun and plant in sharp sand or coarse Vermiculite. Spray occasionally and the cutting will soon make strong roots, when it can be potted up and treated like an adult plant.

FRIENDS & FOES No. 39

Ptychoptera

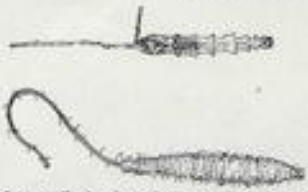
PHYLUM:—Arthropoda, from Greek *arthron*—joint, and *podos*—foot.

CLASS:—Hexapoda, from Greek *hex*—six, and *podos* foot.

THERE are seven species of British Ptychoptera. The yellowish larvae are common in very shallow water, but are not easily found, for the whole of the body is buried in the mud or silt at the bottom, and only the tail is free in the water. If anxious to find some of these larvae, look very closely at the surface of the water. If the larvae are there they betray their presence with the end of their tails. These make the minutest depressions in the meniscus of the water where they break it. Take hold of one of these depressions between finger and thumb, and lift, and up comes the larva. The same procedure can be followed to catch rat-tailed larvae (described in the July and August issues of *The Aquarist*). In both cases the tails are used as respiratory organs.

The pupae of Ptychoptera bear no resemblance to the larvae. The tail is still carried, but in addition

Crane Flies



Larva (below) and pupa of crane flies

there is a secondary small projection at right-angles to it. When ready for the imago to emerge, the pupa rises to the surface of the water and entangles the long tail in vegetation, after which it pulls and pulls until the case is burst open—a most interesting spectacle to watch. The flies are not much bigger than a gnat, very hairy, with speckled wings, also fringed with hairs. I have so far not fed these to fishes, but they would probably be appreciated if the fish don't mind their hairy outer covering.

C. E. C. Cole

OUR EXPERTS' ANSWERS TO READERS' QUERIES

Many queries from readers of "The Aquarist" are answered by post each month, all aspects of fish-keeping being covered. Not all queries and answers can be published, and a stamped self-addressed envelope should be sent so that a direct reply can be given.

Please can you give some information about keeping and breeding mollies. My female mollie has just dropped six babies; four were born dead. The other two seem to have swim-bladder trouble. I never seem successful with mollies.

Mollies should have plenty of swimming space in shallow, well-oxygenated water. As slightly saline conditions are appreciated, add about one teaspoonful of ordinary kitchen salt (or evaporated sea salt) to every gallon of water in the aquarium. The aquarium should be placed in a sunny position. If you cannot place the aquarium where it will get some sunlight, a few hours of bright electric toplight should be given to the fish every day. Bright light encourages the growth of algae, and mollies like to eat algae, or other soft green food. The temperature for these fish need not be very high. Any temperature between 72° and 75° F. suits them very well. A gravid female should not be moved to another aquarium, for this often results in her babies being born dead. As mollies are susceptible to chills, it is advisable to guard against cold draughts striking the aquarium from a door or window.

I have a large community aquarium containing several species of gourami, neon tetras, pristellas, catfish, mollies, guppies and one Siamese fighting fish. Every now and again, I find one or more of the guppies lying dead on the bottom. The guppies are all young fish, and I cannot account for it. Do you think one of the other fishes is killing them?

We think that your guppies are being worried to death (or killed outright) by either the Siamese fighting fish or the gouramies. It is advisable to keep the smaller species by themselves, for as the gouramies grow they often develop into bad bullies and keep the smaller fishes away from food, and chase them about the aquarium. Siamese fighting fish often take sly nips at other fishes after dark; that is, when they are quiescent at the top or bottom of the water.

Can you please tell me something about the breeding habits of *Apistogramma ramirezi*?

According to all reports, the behaviour of *A. ramirezi* is unpredictable. Sometimes the female mounts guard over the eggs; sometimes she is not at all attentive, and leaves the care of the young to the male. Some breeders recommend that the parent fish should be transferred to another aquarium as soon as the eggs have been laid. The eggs hatch out within two or three days. Two days later the fry will need Infusoria for the first week or so, after which they may be fed with micro worms, tiny *Daphnia* and chopped white worms.

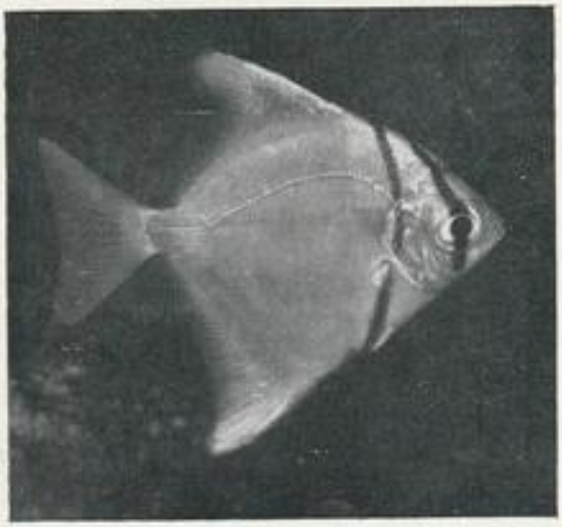


Photo: Lourence E. Perkins

Monodactylus argenteus, a fish with a liking for some salt in its environment

Please can you tell me something about the requirements and disposition of *Monodactylus argenteus*?

Monodactylus are found in fresh, brackish and salt-water. Most specimens sold by dealers are acclimatised to fresh water, and flourish quite well in it, but like scats and puffer fish, they prefer slightly saline conditions. *M. argenteus* are easy to feed, for they will take raw or cooked red meat, butcher's offal, earthworms, chopped raw or cooked shellfish, and the usual live food such as *Daphnia* or *Tubifex*. The temperature of the aquarium should be kept at about 78° F. The species is not pugnacious, but it would not be wise to keep large, healthy specimens in a tank containing tiny livebearers or characins.

Would it be safe to use perforated zinc to divide my aquarium into two separate compartments, and to use solder wire having a flux core to anchor the plants to the compost?

Your fishes will soon die if you use perforated zinc in your aquarium, or weigh the plants to the bottom with solder wire having a flux core.

I wish to try and breed *Hyphessobrycon serpae*. Please can you tell me something about the breeding requirements of these small characins?

Give the fish a clean aquarium filled to a depth of about eight inches with matured, soft water. Tie washed bunches of fine-foliaged plant life to scrubbed stones and place them in the corners of the aquarium and towards the centre of the aquarium. Shade the aquarium from bright light. If the light strikes down from overhead, place floating vegetation on the surface of the water. Maintain a temperature of about 78° to 80° F. After the fish have spawned, remove them from the tank, and shade the sides with tissue paper. Feed the fry on fresh cultures of Infusoria and micro worms. Keep the bottom of the aquarium as clean as possible.

My wife uses a hand lotion to keep her skin soft and well nourished. A friend has told me that if my wife puts her hands into the aquarium, it is not unlikely that the lotion on her hands will upset or even kill the fish. Is this true?

It is very easy to contaminate aquarium water by placing creamed, lotioned, or freshly soaped hands in it. In fact, it is always best to rub the hands together under running water for a minute or two before placing them in the aquarium.

I have just bought some young nigger cichlids and should very much like to grow them on to a large size. Unfortunately, I am not in the position to obtain a regular supply of earthworms. What other foods should I obtain or use to grow these fish on to a good size?

We suggest that you try your fish on any of the following: minced, washed liver; minced shellfish, such as shrimps, crab, and the like; minced horseflesh; raw steak; fresh cod's roe or live foods such as *Tubifex*, white worms, or *Daphnia*.

COLDWATER FISHKEEPING QUERIES *answered by* A. BOARDER

My goldfish spawned and after ten days there is no sign of fry hatching although I can see plenty of eggs on the plants. Are eggs fertilised as they are laid? Is the milt visible?

As the female lays the eggs the male in close attendance releases the milt and the eggs are fertilised. It is possible that the great majority of eggs which are fertilised are entered by the sperm within ten minutes of being laid. The eggs swell up just after they leave the female to almost double their size and it is then that most of them are fertilised. Unfertilised eggs become white and fuzzy with a form of mildew within a couple of days. The eggs will take nearly a fortnight to hatch if the temperature of the water is not much above 50° F. The milt would not be visible to you, although if a little is pressed from the male it can be seen quite clearly as a milky fluid. It would soon become colourless as it spread in the water and is not likely to be recognised then.

I have tried a formula of chemicals in the water where I have a number of goldfish fry to make them change colour. They are still bronze in colour. What have I done wrong and how can I get the fry to change colour quickly?

I do not like the idea of using chemicals to hasten the colour change from bronze to gold in young fish. Some of the chemicals can be fatal to fish if used in wrong quantities. The weather and the warmth of the water often has an effect on the coloration. A lot depends on the strain of fish too. If the parent fishes used for breeding themselves took a long time to change it is possible that the fry will also take a long time. Even if you could hasten the change in your fry it would make no difference to their young when they eventually breed. It is better to breed for a quick colour change by using for breeding only those fishes which change colour by at least the year after they were hatched.

My concrete fish pond leaks down to a level of six inches from the top and then remains level. If I paint the top part with water glass will this seal the leak?

It is possible to seal the leak by giving the concrete a coat or two of water glass but it is likely that there may be some leaks lower down. When your pond is filled with water it weighs a considerable amount (a gallon of water is about ten pounds). This weight creates a pressure and forces the water through any crack in the pond. Once a lot of water has gone the pressure is reduced and the water may not leak out. It is a good plan to empty most of the water on a warm drying day, and if there are any cracks they will show up plainly as they stay wet after the good part of the concrete dries.

I wish to stock a pond 16 feet by 6 feet and 1½ feet deep; what fish shall I have and can fancy goldfish be kept in the pond all the winter?

The difficulty with your pond will become apparent in the winter. It is not deep enough to be safe in a hard winter. It should be at least two feet deep and another six inches is better still. It will be much safer if you keep to common goldfish, shubunkins and fantails, and do not have those types with flowing finnage. Any fish with a long tail is at a disadvantage in cold spells. The ends of long fins are always very susceptible to fin rot and fungus and although such fishes might go through some winters with safety the severe one will come one day and the fish will be in trouble. As for the number of fishes, I suggest no more than a dozen. The less fish you have the easier it is to keep them healthy and they have a good chance to grow and also to breed. If you start with too many fish in the first place you will find that they do not grow as well and may eat all fry which are hatched.

Photo: Laurence E. Perkins

Porous stone "diffuser" at end of aerator line

I want to use an aerator which produces small mist-like air bubbles. The best I can do is to use glass tubing which I plug fairly firmly with cotton wool, but this does not act for long. Can you suggest anything else?

There are plenty of aerator diffuser stones on the market and you will find them advertised in *The Aquarist*. The accompanying photograph shows the type of stone in action. It must be remembered, however, that no matter what type of stone you use this will only function well providing other conditions are correct. In the first place the aerator must be of sufficient strength to be able to force the water out of the tube and so enable the air bubbles to come into the water. Also the aerator must have sufficient power to serve the number of diffusers used. Another point to watch is that the amount of air a pump can force into the water depends a great deal on the depth in the water of the diffuser. Every inch of tubing in the water means more weight of water to be forced out.

I shall be grateful for some advice on coldwater fish breeding I wish to go in for showing but am bewildered by the various standards for fantails and shubunkins, which are the ones I am interested in. Which society should I join to seek further information on selective breeding?

You have no need to join any society to find out about show breeding. You are already in a good aquarists' society and all you need do is to get the book of standards from the Federation of British Aquatic Societies. From these standards you can get ideas as to what is required. The important shows held in this country are under Federation rules and so those are the ones you should study. It would not assist you to join the Goldfish Society as they do not recognise the two fishes in which you are interested. My advice to you is to try to visit the British Aquarists' Festival next month or similar project and examine the fishes which win. If you can get a word or two with the judge you may learn more in ten minutes than you could in a lifetime of ploughing a lone furrow. There are at present three types of standards in this country and, of course, there appears nothing whatever to prevent any new society making and using standards of their own. It is sometimes

easy if you cannot win under one set of standards to get others in being to which you can breed.

Can you tell me if fantails and shubunkins could be kept with our goldfish, what do they eat, and what do they cost?

Fantails and shubunkins could be kept with your goldfish and would eat exactly the same kinds of food. There need be no special feeding but you must realise that these fish are only a variety of goldfish and so they could all interbreed. This could give you many badly-shaped fish which may not resemble any of the parents. However good the fish of the original strain might be the youngsters could be mostly a collection of runts and be worth nothing. As to the cost of them it depends on so much. The quality of the fish is the first consideration, and then the size or age. It is possible to buy very young fry at as little as a shilling each, even good strain fish, but you may have to pay many pounds for an adult fish which was of good quality. Again, what might be recognised as a good quality fish by many aquarists would be perhaps thought little of by an expert. You could not expect to get a very good quality fantail or shubunkin of a year or more in age at under a pound each.

Do you know of any chart for measuring British freshwater fishes so that it is possible for an angling society to give the limits for fish to be taken from their waters? We have a chart published in 1867 giving the weight per inch of many fishes but would like a more up-to-date one.

I have by me a fishing ticket which gives the sizes of fish to be taken from the waters of the society as follows:—pike 16 inches; bream, 10 inches; roach, 8 inches; tench, 8 inches; dace, 7 inches; gudgeon, 4 inches; and perch, 8 inches. No fish should be taken under these limits. You say you would like a chart to give weight per inch. Well, the weight per inch of fish depends on a great deal more than one factor. A female may weigh more than a male of the same length; fishes which have recently spawned would weigh less than before. Fish in bad condition could weigh as little as half the weight of a healthy fish. In 1915, my father caught a pike weighing 16½ lbs.; the fish was 3 feet 6 inches long. If this fish had been in good condition it could have weighed as much as 35 lbs. I feel that a limit of size is the better system for you to work on.

A photograph taken in 1915 of Mr. J. Boarder with a 3ft. 6ins. long pike, weighing 16½ lbs. caught by him at Tring Reservoirs

As it is not possible to obtain *Daphnia* in this district I wondered whether it would be possible for me to grow my own in preference to white worm as it would be more sport for the fish. Can you give me instructions as to how to breed them?

Daphnia can be bred but I often think that unless you have ideal conditions it is almost as hard as breeding some kinds of fishes. If you could make two or more small ponds it would not be very difficult. *Daphnia* eat small Infusoria and tiny vegetable matter and so it is necessary to provide plenty of this food for them. They are also soon in trouble if overcrowded and have insufficient oxygen in the water. To commence the culture use a small pond or a large container and fill it with strained pond water. See that no pests are present or they will eat the *Daphnia*. Produce a good culture of Infusoria with crushed lettuce leaves or other materials and when plenty can be seen introduce a few *Daphnia*. When they have multiplied well some can be taken for feeding. After a time it may be noticed that the numbers get less or perhaps disappear. This is probably because the water has become too foul or all the Infusoria have been eaten. This is where the second pond or container comes in. This should have been started when the first is well established and is providing plenty of *Daphnia*. Once the second pond is working well the first can be cleaned out and restarted. If you try to breed your fleas by using one container you may find one morning that all have disappeared and then it is difficult to get a supply going again. The container may need covering to exclude flying pests, such as water beetles and dragon flies.

I wonder if you can advise me on how many plants my son should put in his tank, 24 ins. by 12 ins. by 15 inches, also how many goldfish should be put in. There is an aerator and filter; how long must they be on for each day?

The number of plants depends on their size. It must always be remembered that providing conditions are satisfactory the plants will soon grow and so there is no need to go to the expense and trouble to fill the tank in the first instance. Keep the front half of the tank clear of plants except for a few at the ends. The back corners can be well planted and a few plants can be placed along the back of the tank. Try to get the plants growing before adding any fish. The tank will hold comfortably about 12 inches of fish excluding the tails. If you have less than this the fishes will be happier and healthier and they will have a chance to grow. A tank which is filled to capacity with fish must soon get overcrowded and need thinning out. A filter and aerator are only necessary if you try to keep too many fishes in the tank, and the time you would have to keep them going depends on the extent of the overcrowding.

A friend of mine has kept a seven-inch goldfish in a small tank for seven years and it has been fed solely on the plant enclosed. This can be found on any waste land. Have you or any aquarist heard of anything like this before?

The plant was rather withered but I could recognise it as the scentless May-weed, *Matricaria inodora*. It is a common wayside plant resembling some types of water plants such as *Myriophyllum* and *Ceratophyllum*. It can be distinguished from the stinking May-weed by its absence of smell. It was used many years ago as a cure in uterine affections and so is probably harmless to fish. It is perhaps not sufficiently realised that goldfish eat vegetable matter as well as animal and are very fond of some kinds. I have not heard of a goldfish being fed on the weed you sent but have heard of a lady who fed her fish exclusively on watercress. Some goldfish will eat large quantities of duckweed whilst others ignore it.

In the Water Garden in SEPTEMBER *by Astilbes*

WE have now reached the time of year when all planting operations for the pond are over. The water lilies will not grow much more but many leaves will start to decay. The question whether to remove these or not will depend a great deal on the type of pond and the amount of nourishment in the bottom. The decaying vegetation can be of much use to the plants the following year but it is necessary to be very careful about how much of this is allowed to remain in a small concrete pond. As far as small ponds are concerned it is a good plan to clean out the pond each late autumn to prevent the pond becoming choked with too much decaying vegetation, which can cause considerable pollution. Although the water plants might be quite safe under such conditions it is certain that any fish in the pond would be far from happy.

At this time of the year it may be found that the underwater-growing plants have grown apace and may have become too dense. A good crop of these oxygenating plants is always of value but they must not be allowed to encroach all over the pond to the detriment of other plants and fish. Some types such as *Egeria densa* can grow at a fantastic rate in warm weather and if allowed to go unchecked can fill a small pond in a few weeks. The average pondkeeper hates to remove too much of this weed but it is well to make an effort and clear out a large quantity before all the swimming space in the pond is filled up. Most oxygenating plants are very brittle and can soon be broken off. If out of reach a large knife should be tied to a long stick and the weeds cut through at a low level. When they float to the surface they can be drawn out with a rake. These weeds will be useful as a mulch in the garden or may be allowed to rot down for compost.

When removing any oxygenating plants it is essential that great care is taken over the task. If the plants are not severed from the root system it will be found that pulling the plants out with the roots attached will cause much black mulm to be drawn up into the water and this will soon spoil the look of the pond. It is a better idea to deal with only a small portion each day so that the water is disturbed as little as possible.

Pond-side plants must not be allowed to spread into the water too much. If left undisturbed for some time it is possible that parts of the plants at the water's edge will grow over into the water. If too much of this is allowed it will be found that during dry spells the plants can take enough water from the pond to cause a serious loss. Any shrubs which are growing too near the pond should have some attention now. Where shrubs and overhanging trees abound there are sure to be too many leaves falling into the pond later on and if this happens the water can be badly affected. Some kinds of leaves are definitely dangerous to fish life if allowed to remain in the water. Therefore if the overhanging parts are cut away now it will save a lot of trouble when the leaves fall.

If any leaks have appeared in the pond they should be attended to before the winter's approach. There are many ways of dealing with a leaky pond but whichever system is used it will be found better to see to this before this month is over. Of course, the ideal way is to empty the pond completely if this is possible. The cracks will then become obvious especially as the sound surface will dry out first. The trouble with mending leaks is that the compounds used are waterproof and so will not adhere to anything wet. All cracks should be dry before being filled and it may be possible to dry them out with a blow lamp. Quick-drying cement can be used and this should be forced into the crack as firmly as possible. There is no need to allow the cement to spread out over the edges of the crack. There are several types of bitumastic compounds for sealing cracks but it is possible that the winter's freeze-ups may open the cracks again. Where a pond has become badly cracked the only possible lasting remedy is to refloat the whole inner surface of the pond to a depth of at least an inch.

When any repair work is undertaken it is essential that the water plants removed from the pond are not allowed to dry out at all. They should be placed in another pond or in a large tank until they can be replaced. Where large pots have been used for the initial planting it will be found quite simple to remove these.

If cement has been used to repair cracks in the pond there need be little fear that the free lime will do much harm as the exposed surface will only be small, but when a complete refloating has been carried out it is essential that the surface gets a good scrubbing to see that all is safe before refilling.

Make sure that all rockery stones near the pond are quite firm and have not been loosened by growing plants. If these are made secure before the severe frosts arrive less damage is likely to happen.

Concerning Snails

WHEN my garden pool was transformed into a sanctuary for goldfish, a handful of snails was flung into the water along with the other and diverse articles required to cause a goldfish to settle down to a life of fruitful domesticity.

These snails were inserted into the pool on the best and most authoritative advice. I have no very precise notion what their function was to be or, in the alternative, I am too nice-minded to particularise about it. At any rate, everybody said, "You must have snails." So I had snails in rather rich abundance and now I'm a trifle unhappy about it.

The reason I'm unhappy about these snails is that I keep finding their empty shells cast up on the shore line of the pool. Almost every morning when I dash out to greet my fish, I find one of these poor vacant little houses lying on the bank.

I can't say that I'm exactly moved to tears about it because no great depth of cordiality has yet developed between the snails and myself. But I dislike mysteries, except between paper covers, and the gradual cutting off of my snails in the very flower of their vigorous youth constitutues a problem large enough to be worrying.

* * *

One goldfish fancier to whom I referred the Case of the Vanishing Snails informed me that the fish were probably eating them. "If a snail gets on his side," he said, "the fish will chew him right up."

That may be so. But I refuse to believe that I purchased a set of snails so feeble-minded as to lie on their sides and allow fish to nip hunks out of them. Each one of those snails was as bright as a dollar.

Moreover, I find it difficult to visualise a goldfish polishing off a snail and then tossing the shell over his shoulder and right out of the pool like Henry VIII and the chicken bones in Charles Laughton's somewhat ancient but memorable film.

Another expert I consulted said, "Robins," His view was that robins were fishing the snails out of the water and making snacks of them.

This theory too, I beg leave to doubt. Not that my robins aren't capable of anything. I have perhaps, the most disreputable robins in Greater Vancouver, uninhibited creatures of no morals and a sulphurous vocabulary.

But my snails have always stayed well down in the deeper water. I just can't see these robins, voracious and savage as they are, wading into a 20-inch depth to knock off a snail, particularly with earthworms fairly asking for extinction on every square yard of lawn.

* * *

My private theory is that it's something much more sinister than fish or robins. My private theory is that these snails are either committing suicide or just simply walking off the job, leaving their shells behind so they can't be traced.

I base that theory on my observation that it must be highly humiliating to be a snail. Say, for instance, that we have visitors. The ladies kneel or bend over and admire the goldfish.

"Oh, the little darling!" they'll exclaim. And then, "What are those black things on the bottom?"

"They're snails."

"Snails! How disgusting!"

Gentlemen, too, admire the goldfish, only in more robust terms. One will say, "Look at that little red so-and-so go!" And then, "What's that lumpy thing down there?"

"That's a snail."

"Mucky beast, isn't it? Ugh!"

I believe a snail can take just so much of this sort of thing before his self-control snaps. That's why I don't put any stock in this robin or fish theory. I think all these blabbermouth boobies have broken my snails' hearts.

(From *Vancouver Sun*, Canada)

OUR READERS *Write . . .*

Other letters received have been held over for the next issue

Ingratitude

I HAVE a small pond in the garden, and recently I procured two wild minnows and introduced them therein. I put over the top a piece of wire netting, not particularly carefully, as this is only intended to discourage my pet cats. I then went to another part of the garden. Almost immediately workmen, who were then taking their "elevenses" in the garden, saw three little sparrows creep under the wire netting, seize one of the minnows, and make off! The men shouted, I turned, and the bird, startled, dropped its prey. The minnow was still alive but so badly pecked that I destroyed it.

Is not this unusual for so small a bird and so relatively large a fish? Especially at this time of the year when there is no shortage of bird food. Ironically, too, when I was turned away from the pond, I was contemplating a blackbird's nest and wondering how best to protect the young from the cats! A poor return for my solicitude!

(Miss) M. CHAMBERLAIN,
London, W.2.

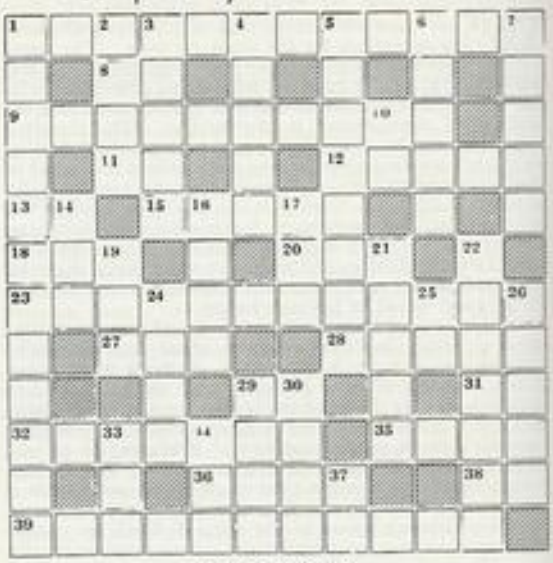
South African Aquarist

WHEN I lived in Manchester I used to keep several varieties of goldfish and was very pleased when I obtained my first hatching. That was 30 years ago. In Durban, Natal, it was a tri-annual occurrence to spawn my fishes in the ponds. Now, in Colenso I have fitted 50 two-feet aquaria each with a little window around the room, and my efforts with tropical fishes please me very much.

DR. G. FURNISS,
Colenso, Natal, South Africa.

The AQUARIST Crossword

Compiled by J. LAUGHLAND



CLUES ACROSS

1 Gill worm genus (12)
8 Common sound of approval at fish shows (2)
9 Gill worm species best known to aquarists (10)
11 Copper more formally (1, 1)
12 This vessel would be useful to marine biologists (5)
13 A title of British monarchs (1, 1)
15 Go on knees, chiefly after eel (5)
18 Spiky tail of terrapin (3)
20 Very Important Person is a bit of a snake (1, 1, 1)
23 Reproduction without seed in lower forms of life (12)
27 Spirit to which clear tank water is often compared (3)
28 Sound you might expect from water hog louse? (5)
29 Title of tench? (2)
31 X Division of the Dark Continent, and of *Lemna* (1, 1)
32 See 39 (7)
35 Call of an owl (4)
36 Artificial basin frequently of interest to anglers (4)
38 You and I are not all wet although aquarists (2)
39 and 32 Swordtail (11, 7)

CLUES DOWN

1 Pygmy killifish (5, 7)
2 Crucian, Golden, leather, mirror, Prussian —— (4)
3 and 33 Feature of thick-lipped gourami (5, 3)
4 *Asellus aquaticus* if the water type (5)
5 *Thymallus thymallus*
6 *Rutilus* (*Leuciscus*) *rutilus* (5)
7 Coalfish (5)
10 Thanks in a vulgar manner (2)
14 How to get lugworm (3)
16 Light of the aquarium (4)
17 She used an apple as bait (3)
19 Horse, but not seahorse (3)
21 Rod, pole, or *Perca fluviatilis* (5)
22 Commonly any small fishes; correctly *Phoxinus phoxinus* (7)
24 Grind (4)
25 Carburettor of the suckers (1, 1)
26 Condition (5)
29 Let fall (4)
30 Wealthy (4)
33 See 3 down (3)
37 This one is a knock-out (1, 1)

PICK YOUR ANSWER

1. "Seamen have a custom, when they meet . . . , to fling him out an empty tub by way of amusement." The missing word, in the quotation from Swift's *Tale of a Tub*, is: (a) Shark. (b) Tunny. (c) Turtle. (d) Whale.
2. Members of the Cyprinodontidae family are found throughout Africa except in: (a) Cape of Good Hope. (b) Kenya. (c) Morocco. (d) Nigeria.
3. The blue chromide is a popular name of: (a) *Badis badis*. (b) *Cynolebias bellotti*. (c) *Etroplus suratensis*. (d) *Gambusia punctata*.
4. Which is the smallest of the following species? (a) *Apistogramma agassizi*. (b) *Apistogramma corumbae*. (c) *Apistogramma pertense*. (d) *Apistogramma pleurotaenia*.
5. The leaves of *Hydrocharis morsus-ranae* (frog-bit) are: (a) Cordate. (b) Piliform. (c) Lanceolate. (d) Reniform.
6. The optimum temperature for *Hygrophila* is: (a) 67° F. (b) 72° F. (c) 77° F. (d) 82° F.

G. F. H.

(Solutions on page 128)

News from AQUARISTS' SOCIETIES

Monthly reports from Secretaries of aquarists' societies for inclusion on this page should reach the Editor by the 5th of the month preceding the month of publication.

A copy of *The Aquarist's Directory of Aquarium Societies* will be sent free to any reader on receipt of a stamped, self-addressed envelope.

MEETING of the **Cambridge and District Fishkeepers' Club** on 5th September will comprise a film show. Films include "Breeding the Blue Gourami," "Under the Sea," "Fighting Fish of Siam" and "Tropical Fishes."

* * *

DISBANDMENT of the **Dartford Aquarists' Society** has taken place, owing to lack of support.

* * *

PRIZES at the **Federation of Guppy Breeders' Societies** show this month are to be presented to winners by Mr. Harry Seacombe, B.B.C. comedian, on 25th September, at approximately 3 p.m.

* * *

IN July a successful show was held by **Hastings and St. Leonards Aquarist Society** in conjunction with Hastings' Carnival Week. A home aquaria competition was judged by members of Bexhill A.S. Speakers at recent meetings of the society have included Mr. R. O. B. List, Mr. L. Katritsky on water plants, and Mr. A. Smith on the biology of the fish and its natural surroundings. Meetings of the society, at which visitors are welcome to attend, are held the first Wednesday each month at the Junior Library, Claremont; the secretary may be contacted by telephone (Hastings 6490).

* * *

PROGRAMME of the **Inverness and District Aquarist Society** for the next few months is as follows: 6th October, lecture; 3rd November, general meeting; 1st December, club dinner; 12th January, "Bring and buy"; 2nd February, film show; 2nd March, table show. Meeting place is the Inverness Royal Academy; details may be obtained from the secretary, Mr. J. A. Mackintosh, 19a, Attadale Road, Inverness.

* * *

TABLE show of native fishes, judged by Mr. J. Budding, was held at last month's meeting of the **Peterborough and District Aquarists' Society.**

* * *

FOLLOWING the resignation of Mr. H. Lightfoot from the secretaryship of **Nottingham and District Aquarists' Society,** until an election is held the assistant secretary, Mr. A. L. Kirchen, 42, Stratford Road, West Bridgford, Notts., will be performing the duties of secretary.

* * *

AT the annual general meeting of the **Warrington Aquarist Society** last month, it was shown that the last year had been a profitable one for the society. For the next 12 months meetings of the society will be held at the Gown and Sceptre Hotel, Warrington, on the second and fourth Thursdays of each month. Officials elected at the meeting were president (Mr. J. Petley); chairman (Mr. E. W. Palmer); secretary (Mr. H. Moulsdale, 9, Myrtle Grove, Latchford, Warrington).

* * *

NEW show secretary of the **Willesden and District Aquarists' Club** is Mr. E. G. Lynch, 78, Burmans Way, Neasden, London, N.W.10, who will be pleased to receive show schedules, etc., from other clubs. At the annual Novices Trophy Competition, held in July, the results were as follows: Coldwater—1, Mr. Beddoe (common goldfish—Cup); 2, Mr. White (scaled veiltail); 3, Mr. Leon (common goldfish). Tropical —1, Mr. Prince (*Panchax lineatus*—Cup); 2, Mr. Verrinder (tiger barb); 3, Mrs. Stafford (nigger barb). Judge was Mr. Moore of the F.B.A.S. Successful entries were made by club members at the Hendon A.S. show last month (Messrs. Lynch, Phillips, and Wingrove), and the club entries in furnished aquaria classes, both tropical and coldwater, were awarded third. Following a table show for barbs, guppies and common goldfish at last month's meeting, Mr. H. E. Batey, a club member, gave an impromptu talk on setting up aquaria for both domestic and show purposes.

Hendon Show Results

PICTURES of the **Hendon A.S.** show, held last month, as part of the Hendon Borough Show, appear on page 119. These are the results: **Class 1,** Club Furnished Aquarium (coldwater)—1, Independent A.S. (69 pts.); 2, West Middlesex A.S. (68); 3, Willesden A.S. (65). **Class 2,** Club Furnished Aquarium (tropical)—1, Stoke Newington A.S. (75); 2, West Middlesex A.S. (72); 3, Willesden A.S. (66); 4, Arnold A.S. (58). **Class 3,** Individual Furnished Aquarium (coldwater)—1, Mr. A. Sutton (76); 2, Mr. S. Wingrove (75); 3, Mr. P. R. Chapman (71). **Class 4,** Individual Furnished Aquarium (tropical)—1, Mr. A. Baldock (73); 2, Mr. J. Robertshaw (72); 3, Mrs. G. Skipper (69); 4, Mr. T. Hobday (67). **Class 5,** Breeders' class (coldwater)—1 and 2, Mr. F. T. Barry—veiltail goldfish (65,55); 3, Mr. S. Wingrove—veiltail goldfish (53). **Class 6,** Breeders' class (tropical)—1, Mr. S. Brown—perma mollies (78½); 2, Mr. W. G. Phillips—flagtail guppies (78); 3, Mrs. F. A. Barry—moon platys (77½); 4, Mr. E. G. Lynch—perma mollies (77). **Class 7,** Breeders' class (tropical egg-layers)—1, Mr. E. G. Lynch—neons (91); 2, Mrs. B. Robertshaw—*Aplocheilus lineatus* (89); 3, Mr. R. Walford—leeri gourami (86); 4 (tie), B. Calrow—blue gularis, Mrs. B. Robertshaw—*Rasbora pauciperforata* (85). Judges at this event were Messrs. H. Russell Holland and J. Carnell (tropical); Messrs. A. Boarder and C. J. Saunders (coldwater).

B.H.S. Journal

LATEST number of the *British Journal of Herpetology*, official organ of the British Herpetological Society, is dated June, 1955, and this 34-page number completes the first volume of the *Journal*. It contains articles on breeding records for frogs and toads last year and poisonous snakes in captivity. A section entitled "Notes" includes a note on the use of penicillin in the treatment of reptiles and amphibia, and some observations on snake charmers. The *Journal* is free to members and can be purchased, price three shillings, by non-members from the secretary, Mr. J. I. Menzies, British Herpetological Society, Regent's Park, London, N.W.1.

"Hykro Winner"

WINNER of the competition organised by the manufacturers of "Hykro" foods and aids for fishes and cage birds is a well-known Yorkshire aquarist, Mr. Cyril Walker. His prize is a seven days holiday for two in Denmark. Mr. Walker is a member of the committee of the York and District Aquarists' Society.

British Aquarists' Festival—5th-9th October

NEXT month, from 5th to 9th October, the **British Aquarists' Festival** will be open to visitors in the Exhibition Hall at Belle Vue Zoological Gardens, Manchester. Admission to the exhibition includes admission to the Zoological Gardens and to the Belle Vue Aquarium. At the exhibition the best examples of furnished tropical and coldwater aquaria entered by aquarists' societies together with finest specimens of fishes will be on show, grouped in attractive surroundings provided by each of the competing societies. In addition there will be aquatic dealers' display stands and items of special interest arranged by the Federation of Northern Aquarium Societies. The Federation has organised the Festival in collaboration with *The Aquarist*. On *The Aquarist's* stand at the exhibition, Mr. A. Boarder, authority on aquarium and pond-keeping, will be in attendance to answer queries from visitors, and it is hoped that as many as possible of our readers will attend and call at our stand.

The Aquarist's Badge

PRODUCED in response to numerous requests from readers, this attractive silver, red and blue substantial metal emblem for the aquarist can now be obtained at cost price by all readers of *The Aquarist*. The design is pictured here (actual size). Two forms of the badge, one fitting the lapel button-hole and the other having a brooch-type fastening, are available.

To obtain your badge send a postal order for 1s. 9d. **together with the Aquarist's Badge Token cut from page vi,** to Aquarist's Badge, *The Aquarist*, The Butts, Half Acre, Brentford, Middlesex, and please specify which type of fitting you require.

Highly popular with the visitors to the Hendon A.S. Display at the Hendon Borough Show last month was this collection of common freshwater animals and plants arranged by the society's junior members under the direction of Show Secretary Mr. M. Hartnup.

Microscopical Society

READERS in the Birmingham area who are keen microscopists will be interested in the meetings of the **Birmingham Microscopical and Naturalists' Society.** The society is undertaking an ecological survey of fresh water in various parts of Birmingham, so that whatever the special interest of the aquarist microscopist by joining the society he will be able to participate in the work. Meetings of the society are held on alternate Thursdays, 7 p.m., at the Muirhead Room, University of Birmingham, Edmund Street, Birmingham, 3, and the secretary is Mr. A. G. Sabell, 138, Farren Road, Northfield, Birmingham, 31. Next meetings will take place on 8th and 22nd September.

"Midland Aquarist"

NEW project of the **Midland Association of Aquarists' Societies** is the publication of *The Midland Aquarist*, a mimeographed journal to be issued quarterly for distributing M.A.A.S. news and information to members of affiliated societies. The first issue, now available, contains a helpful article on marine aquarium keeping, reports from affiliated societies and a list of secretaries' addresses for these societies.

Secretary Change

CHANGE of secretary has been reported from **Edinburgh Aquarist Society.** New secretary is Mr. J. Wilson, 1, Melgund Terrace, Edinburgh, 7. The society meets every Tuesday evening, 7.30-10 p.m., at 28a, Albany Street, Edinburgh, and aquarists visiting the city are welcome to attend.

New Societies

Independent Aquarists' Society. *Secretary:* Mr. L. W. Dare, 17, Lady Somerset Road, Kentish Town, London, N.W.5. (Phone Gulliver 6709). Intending members from N.W. London region are invited to contact the secretary.

St. Albans and District Aquarist Society. *Secretary:* Mr. K. Brewin, Town Hall, St., Albans, Herts.

Aquarist's Calendar

8th September—**Yeovil and District Aquarist Society** furnished aquaria exhibition at Yeovil Agricultural Show.

8th-10th September—**Coventry Pool and Aquarium Society** annual show at Queen's Road Baptist Church Hall. Opening 2.30 p.m. first day, 10 a.m. others.

9th - 10th September — **Bethnal Green Aquatic Society** show. Details and show schedules from show secretary Mr. F. Fox, 130, Whitecross Street, Old Street, London, E.C.1.

10th-11th September—**Willesden and District Aquarists' Club** show at the Willesden Show, Roundwood Park, Willesden.

15th-17th September—**Peterborough and District Aquarists' Society** annual open show at St. Paul's Hall, New England, Peterborough. Schedules from secretary Mrs. Y. J. Stockdale, 2, Home Place, Eastgate, Peterborough.

16th September—**British Herpetological Society** (London Group) meeting: "Young Animals," 7 p.m., at the Linnean Society's Rooms, Burlington House, Piccadilly, London, W.1.

17th September—**Lambeth Aquarist Society** annual show at St. Luke's Church Hall, Norwood High Street, London, S.E.27.

23rd-24th September—**Rhondda Aquarist Society** first annual open show at the Boys' Club, Treorchy, Rhondda. Details and show schedules from secretary Mr. S. Rosser, 16, Dunraven Street, Treherbert, Rhondda, South Wales.

24th - 25th September — **Federation of Guppy Breeders' Societies** show at the Pavilion Cafeteria, Zoological Gardens, Regent's Park, London, N.W.1.

24th September—**Dublin Society of Aquarists** annual show, 3 p.m. to 6 p.m. at 89, Walkinstown Road, Crumlin, Dublin. Entries confined to members of societies affiliated to the Irish Federation of Aquarists' Societies.

30th September-1st October—**Bristol Aquarists' Society** annual open show and exhibition at the Central Y.M.C.A. Concert Hall, Colston Street (Trenchard Street entrance), Bristol. Schedules available from secretary Mrs. G. Grimston, 10, Queens Road, Knowle, Bristol 4. Closing date 12th September.

5th-9th October—**British Aquarists' Festival** organised by the Federation of Northern Aquarium Societies in collaboration with *The Aquarist* at Belle Vue Zoological Gardens, Manchester. Schedules available from show secretary Mr. S. W. Cooke, Spring Grove, Field Hill, Batley, Yorks.

6th-8th October—**Gloucester and Cheltenham Aquarists' Society** fourth annual members' show at Empire Hall, Cheltenham. First day open 2 p.m.; other days, 10 a.m.

13th-15th October—**Reading, Oxford and High Wycombe Aquaria Societies** annual Three Counties Show at the Palmer Hall, Reading. Schedules available from Mr. F. H. Crane, 26, Kensington Road, Reading.

20th-22nd October—**North Birmingham Pond and Aquarium Society** fifth annual show and exhibition at the Alexander Sports Ground, Perry Barr, Birmingham.

24th October—**British Herpetological Society** (London Group) meeting: "Crocodiles and Tortoises," 7 p.m., at the Linnean Society's Rooms, Burlington House, Piccadilly, London, W.1.

27th-30th October—**Accrington and District Aquarist Society** sixth annual show at the Town Hall, Accrington. Details and schedules from show secretary Mr. F. W. Hartley, 47, Tremellen Street, Accrington, Lancs.

28th-29th October—**Corby and District Aquarists' Society** first annual open show at the Rockingham Road Infants' School Hall, Corby. Schedules from show secretary Mr. R. H. Dicks, 62, James Watt Avenue, Corby, Northants.

Don't forget the dates!

5—9 OCTOBER

British Aquarists' Festival

at Belle Vue, Manchester

Crossword Solution

D	A	C	T	Y	L	O	G	Y	R	U	S
W	■	A	H	■	O	■	R	■	O	■	A
A	U	R	I	C	U	L	A	T	A	■	I
R	■	P	C	■	S	■	Y	A	C	H	T
F	D	■	K	N	E	E	L	■	H	■	H
P	I	N	■	E	■	V	I	P	■	M	■
A	G	A	M	O	G	E	N	E	S	I	S
N	■	G	I	N	■	■	G	R	U	N	T
C	■	■	L	■	D	R	■	C	■	N	A
H	E	L	L	E	R	I	■	H	O	O	T
A	■	I	■	D	O	C	K	■	■	W	E
X	I	P	H	O	P	H	O	R	U	S	■

PICK YOUR ANSWER (Solutions)

1 (d). 2 (a). 3 (b). 4 (c). 5 (d). 6 (c)