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AND PONDKEEPER

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Editorial

THOUSANDS of diaries, resolutely commenced with a detailed entry for the first of January, in the space of the next few weeks will be the subjects of increasing neglect as interest of their owners wanes. Whatever the value of acquiring the "diary habit," it is certain that for aquarists note-making is a most desirable activity to follow. Once an aquarium notebook is started it has the advantage over the diary in that the tedium of daily entries is not what is required.

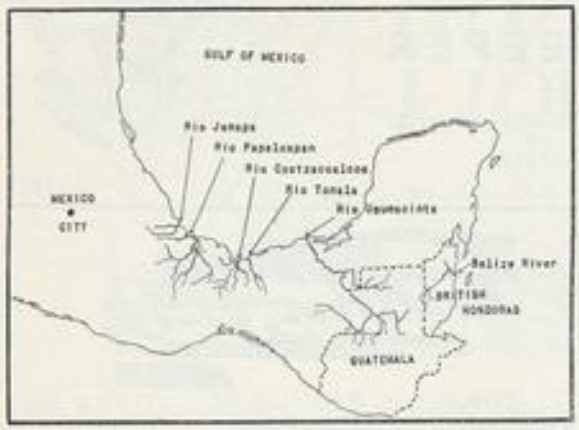
All that is wanted is that all interesting events taking place in pond or aquaria should be noted at the time they are observed. The frailty of memory in most of us demands that the writing should be done as close to the time of the event as possible if the record is to have its full worth. Additions to stock, exchanges, births, deaths, matings and experimental work should all be recorded together with definite observations upon such matters as temperature, lighting, drug dosage, etc. Which of us has not at some time or another experienced the frustration of attempting to recall details of some treatment used successfully in the past, without written record at hand, or of trying to recall the date of acquisition of a fish so as to estimate its age, or of vainly endeavouring to remember the pond from which a certain plant or organism could once be collected? Only the possession of a regularly employed notebook can remove the doubts and put accuracy into fish-keeping.

The book should be kept somewhere close to the aquarium, and it is a good idea to have a pencil or ball-point pen tied to it with string. It is then most likely to be used in the way that will obtain the kind of record which is of the greatest use. As the months and years pass, the aquarium "log" will come to be a most valued possession, and will constantly be consulted. But do not forget to share your records—a review of 12 months' "logs" can make an interesting evening for society members, and, of course, *The Aquarist* also exists to pass on your observations for the benefit of all in the hobby.

Platyfish Reunion—after 30,000 Years

by Dr. MYRON GORDON
(Geneticist, New York Zoological Society)

Photographs by SAM DUNTON, N.Y.Z.S.



Platys used in these investigations came from the rivers shown on this map. The area has not changed geologically in 30,000 years, so that the fish of the rivers have been isolated for that period

ONE of the six New York Zoological Society Aquarium Expeditions to the Atlantic coastal rivers in the tropic jungles and swamplands of north-eastern Central America sought to bring back living stocks of elusive platyfish and swordtails from the Rio Coatzacoalcos, a river known by the natives of the Isthmus of Tehuantepec as "The Lair of Serpents." The fishes were needed to test a genetic theory of the origin of cancer, an interpretation which is tied directly to the theory of the origin of species.

Modern ideas of the origin of species are influenced strongly by recent discoveries by geneticists who have been studying the interplay of the forces of reproduction, heredity and ecology. Not many years ago the geneticists' views on evolutionary theory were not taken seriously by other biologists. After all, non-geneticists said, what bearing has work done with tiny fruit flies that are caught hovering about open garbage pails in city streets, upon what happens to wild animals living under natural conditions in primeval areas of the world. Non-geneticists saw no significance in the strange, milk-bottle-bred, freakish variations of eyeless, wingless and legless flies that emerged from maggots living on an artificial diet concocted from fermenting corn mash, yeast, and molasses. The geneticist was called the milk-bottle biologist, who rarely left the little, tight sanctuary of his laboratory. He was thought to be completely divorced from contact with the free living creatures that populated the green fields, running brooks and forests.

Geneticists kept working accumulating the facts of the intricacies of the hereditary processes. They kept recording the origin and frequencies of the rare hereditary variations, the new mutations. If they had to breed, raise, study and count 50,000 flies to get a single mutant or new type they would do so. Then another geneticist would raise 100,000 flies more to repeat the experiment in order to confirm or deny the results of the first. Their work was precise. Their conclusions were capable of being checked and rechecked.

Geneticists began to trace the specific effects of the environment. They studied the effects of special diets upon the expression of hereditary traits. At the same time they followed the effects of relative humidity, high and low temperatures on pure-bred stocks of flies and learned that some hereditary traits could be temporarily suppressed, other characters exaggerated. Flies were grown under 24 hours of daylight and under conditions of total darkness, and the influences were recorded. Long before the atomic bomb, geneticists learned to evaluate the hereditary consequences of exposing fruit flies and corn plants to the penetrating effects of radioactive chemicals. With X-rays they learned to speed up the production of mutants (new forms) in plants and animals 100-fold, but unfortunately most of the new mutants were monstrosities. Ultraviolet light and X-ray machines became standard equipment in genetic laboratories. As their special requirements increased and their needs expanded, some geneticists became biochemists; others bio-physicists.

Some geneticists reverted to their early naturalistic tendencies. They began collecting specimens living under completely natural conditions, in forests, in deserts, far up mountain slopes, away from the common haunts of men. And they found what they had predicted they would find, that natural populations were as varied as populations within urban areas. Most of the mutations which they had previously detected in laboratory cultures, reappeared among the offspring of normal, wild-caught insects. Geneticists, with the help of biological statisticians, began to apply the discoveries they made in the laboratory to natural populations. Their studies provided a strong impetus to a renewed and vigorous study of the old problem of evolution. They brought new ideas and technique to the study of the origins of species, the most important being the experimental method.

The geneticist's methods in the field are, in part, no different from those of the traditional biological explorer. He collects his plants and animals in remote areas, preserves them and then ships them to the laboratory for later study. But the field geneticist does not dry, skin or otherwise preserve his entire collection. He makes sure that he brings some of the organisms back alive to his laboratory so that he can breed and raise them under uniform conditions and study the characters which they might inherit. The field geneticist's activities combine the methods of a collector for zoological parks and botanic gardens with the techniques used by the collector for old-fashioned natural history museums.

Scientifically, up to the time of our expedition to the Rio Coatzacoalcos, practically nothing had been known of the fishes of that river nor of the smaller and more easterly Rio Tonala; both rivers flow northward through the jungles of the Isthmus of Tehuantepec to the Atlantic. The Rio Tonala is notable politically for it separates the swamplands and mangrove tangles of the southern Mexican states of Veracruz and Tabasco.

Our mission to the river of "The Lair of Serpents" and Tonala was to collect as many fish species as we could, but we specially wanted hundreds of platyfish. These would enable us to determine accurately the kind and frequencies of the many colour varieties of this fish in the two river

populations. Fortunately we obtained over 1,400 platyfish from the river of serpents, and 50 miles farther to the southeast, in the Rio Tonala, we got a smaller but a significant sample of platyfish.

Previously, in the expeditions of 1932 and 1939, we obtained, farther to the north of the Rio Coatzacoalcos, a fine series of platyfish from the Rio Jamapa in Veracruz and from the Papaloapan in Oaxaca. And in 1935 a group of ichthyologists from the University of Michigan collected over 500 specimens of this same species farther to the southeast of the Rio Tonala in the highland lakes of Peten in Guatemala and in the headwaters of the Rio Usumacinta.

As fish systematists we could find no significant difference between the platyfish members of Rios Jamapa, Papaloapan, Coatzacoalcos, Tonala, and Usumacinta.

The platyfishes from these five river populations constitute a single species, *Xiphophorus (Platypoecilus) maculatus*. Yet by a genetic study of the kinds and frequencies of the platyfishes' easily distinguishable heritable colour patterns, definite population units were distinguished. Platyfish from the Rio Coatzacoalcos and Rio Tonala resembled each other in their colour patterns but those from other rivers differed from each other in small but measurable details.

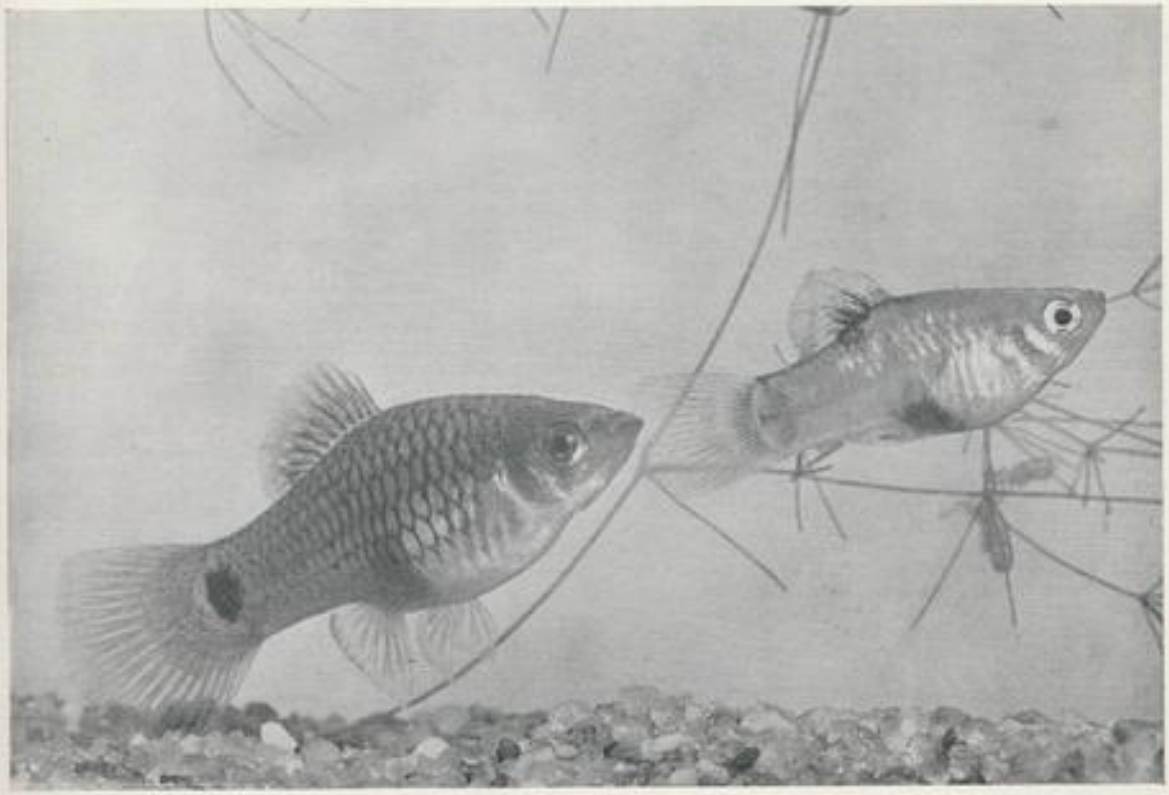
For example, the platyfish members of the Rio Papaloapan have a total of seven distinct patterns on or near their tail fins: 1, One-spot; 2, twin-spot; 3, crescent; 4, crescent complete; 5, moon; 6, moon complete; 7, comet. Each of these is inherited as a simple Mendelian dominant gene. Fishes from the Rio Jamapa have only five of these tail patterns; two are missing. On the other hand, the striking comet pattern is present in platyfish of the Jamapa and Papaloapan rivers, but comets are not found in those of the Rio Usumacinta, and they are extremely rare in the Rio Coatzacoalcos.

Geneticists found another group of colour patterns on the body proper which is equally effective in separating the various river populations of the platyfish as the tail patterns. These are the "spotted-body" patterns of which there are five so far known, and they are of vital importance in cancer research: 1, Spot-sided; 2, stripe-sided; 3, spotted-belly; 4, spotted dorsal fin; 5, black-banded.

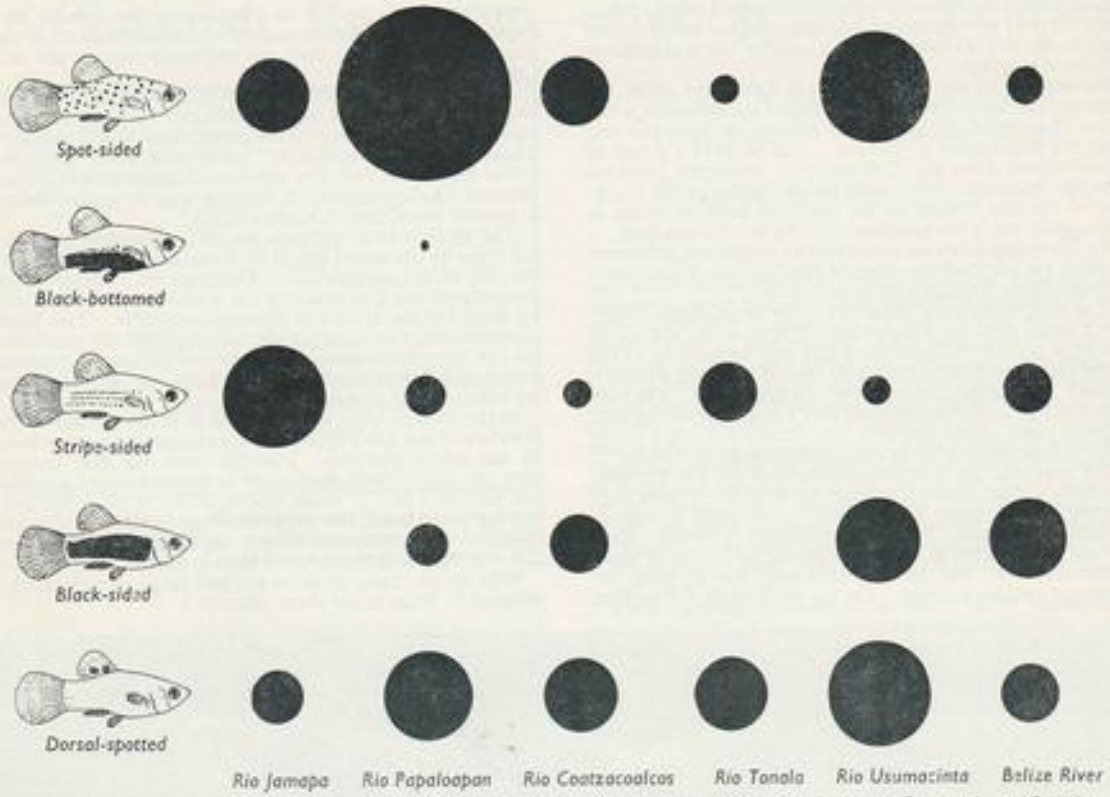
The spotted-body patterns are distinguishable from the tail types by the naked eye in most cases, and, definitely, by the aid of the microscope. The pigment cells or black chromatophores that make up the spotted series of patterns are large and are known as *macromelanophores*. The black pigment cells that make up the tail patterns are small and are the *micromelanophores*. These two groups of patterns complement each other and are useful in distinguishing the various river populations.

In the spotted-body series, as well as in the tail series, the platyfish of the Rio Papaloapan are outstanding—they have all the colour patterns. Platyfish from the Rio Jamapa have the stripe-sided, spot-sided or spotted dorsal patterns but they lack two of them, one of which is black-banded. On the other hand, the platyfish living in the Rio Coatzacoalcos contain members having the black-banded pattern and it is very well represented among them.

Why are the individuals of the various river populations different? What made them different?



Two of the platys re-united after 30,000 years. The male (on the right) has the dorsal-spotted pattern. This pair produced young after 29 days



The extent to which each of five macromelanophore patterns occurs in platys from six rivers of Mexico, Guatemala and British Honduras is represented here by the size of the black disk level with the fish

Geneticists say that, when a population of individuals is separated into two aggregations as by a geological accident, or by some other force, and that separation is maintained rigidly so that interbreeding between them is prevented, the two populations will in time become genetically distinct. The isolated populations become different owing to the mutational changes which constantly appear in each population. The important point is that the mutations that appear in members of the first population are not likely to be the same as the mutations that occur in the second. In time the random mutational deviations accumulate in each of the two populations and eventually they make the two groups recognisably different. The rapidity of the changes depends on the size of the breeding population as well as upon time. As genetically interpreted, the piling up of these small changes constitutes the very beginning of the speciation process—a process which if continued long enough may eventually lead to the formation of new species.

Since the time factor was of great importance in our studies, I asked a geologist to tell me something about the earth history of Mexico's east coast. I particularly wanted to know the answer to this question: How long have the Mexican rivers of the Atlantic coast had essentially the same territories as they have to-day? He said the chances were that there had been no major change in manner in which the rivers flow into the sea in the last 300,000 years. Another geologist said this was too high by more than 200,000 years.

But 300,000 or 30,000 years, what has all this to do with the origin of cancer?

Let us go back to the spotted-body series of platyfish with their large, black pigment cells or macromelanophores. First, let it be known that in over 20,000 platyfish collected from most of the rivers of Mexico, Guatemala and British Honduras, among which 2,000 had a number of macromelanophores, not a single fish was found with a black cancer or melanoma in nature. Yet every living member that has a spotted pattern is potentially a cancer carrier. This can be proved.

All you have to do is to place a virgin spotted platyfish (*X. maculatus*) and a virgin swordtail (*X. helleri*) of the opposite sex in an aquarium. In most instances the unlike fish species, having little choice in the matter, mate and in time hybrids are born. The *black-spotted* hybrids develop melanomas. But it must be emphasised, at this time, that their *unspotted* brother and sister hybrids escape the malady and are normal; some of them are larger, longer lived, and more vigorous than their parents. This kind of hybridisation experiment has been performed by many independent investigators in America and in Europe. All of them report essentially similar results.

But some observers may object to these experiments, saying such matings are unnatural because platyfish do not breed with swordtails under conditions in nature. This is true; although platyfish and swordtails frequently live side by side and are caught together in their natural habitats in Mexican waterways, no hybrids between them have been found, as yet. But it must be added that hybridisation in nature between fish species as diverse as platyfish and swordtails is not uncommon.

Consider now this series of experiments conducted with four species of platyfish each from a different river system: Matings between the spotted Southern platyfish (*X. maculatus*) from the Rio Papaloapan and the Northern platyfish (*X. couchianus*) from the Rio Grande, species that are separated by 500 miles of sea water of the Gulf of Mexico, produced the greatest pigment-cell abnormalities in their spotted hybrids. Matings between the spotted Southern platyfish *X. maculatus*) from the Rio Papaloapan and the spike-tailed platyfish (*X. xiphidium*) from the Rio Soto la Marina, species that are separated by 350 miles of sea water, produced pigmentary disturbances in their hybrids to a lesser degree. Finally, the spotted hybrids between the spotted *maculatus* platyfish and the *variatus* platyfish from the Rio Panuco (the rivers' mouths are only 250 miles apart) are only slightly affected. Again let me emphasise the important point that the *unspotted* hybrids never develop melanotic tumors, and many of them are quite large, vigorous and long-lived.

The observer may object to these experiments, too, because the abnormal hybrids were, in part, the result of mating unlike species.

In order to overcome the objections arising from the mating of separate species, we needed platyfish of the same species but of different geographical origins, and therefore probably of different genetic constitutions. That is why on one of our expeditions we made our 8,000 mile fishing trip to the Rio Coatzacoalcos. We wanted living platyfish from this region so that we could cross them with the same platyfish species from the Rio Jamapa—a stock of which we have maintained in the Zoological Society's Genetics Laboratory since 1939.

In the telling of his experiences on our recent "Long Distance Fishing Trip," James W. Atz, the Aquarium's Assistant Curator and my invaluable field and laboratory associate, anticipated what was to be a remarkable event. We were to reunite, after 300,000 or 30,000 years of separation, the members of two long-separated tribes of a single species.

In explaining the purposes of our collecting trip, Jimmy said:

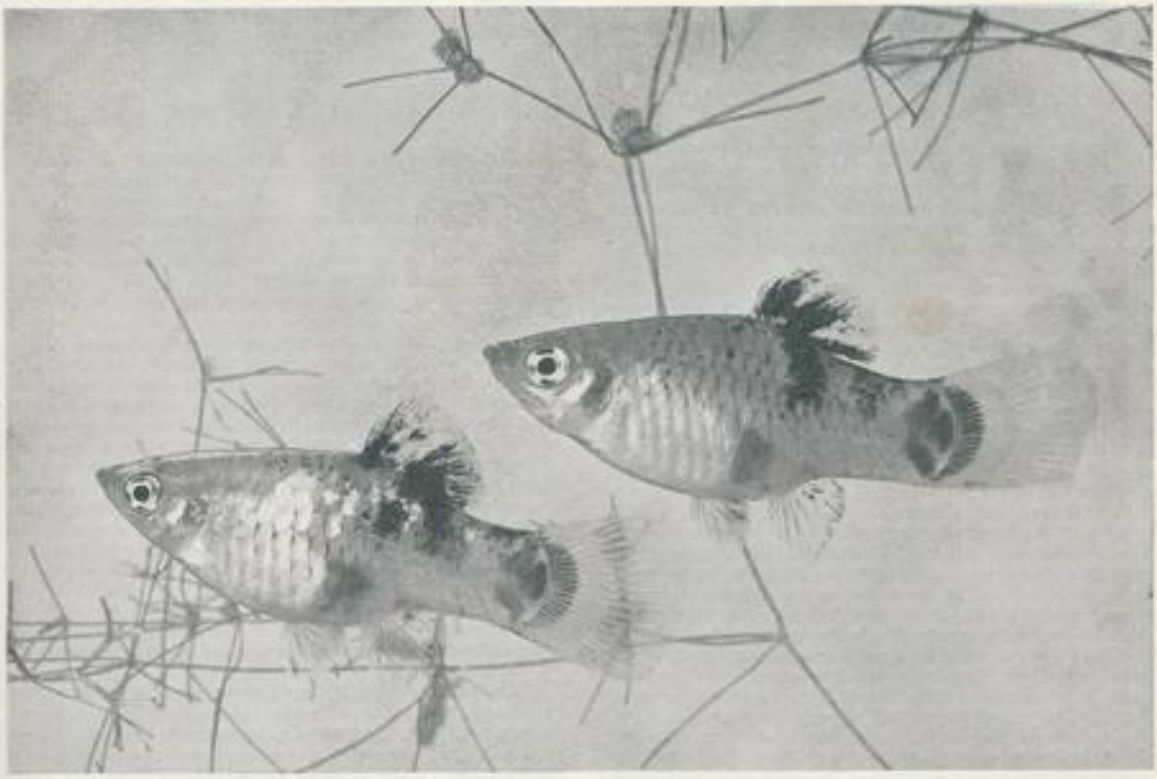
"Specifically, we wanted to learn what happens when a spotted platyfish from one river system crossed with a platyfish of an identical species from another river system. Maybe nothing happens except a swarming brood of healthy platyfish. Or maybe something else happens and we learn a little more about the inheritance of cancer . . ."

His story trailed off, unfinished. Another part of that story may now be told.

The Rio Coatzacoalcos tribe of platyfish that we caught near the village of Minatitlan in southern Veracruz, were flown to Mexico City. After a short rest period there, our living platyfish, representing the first air-shipment of their kind out of Mexico City, were flown directly to New York City.

The first reunion of the scattered platyfish tribes in thousands of years took place in the Society's Genetics Laboratory on 20th May, 1948.

A Rio Coatzacoalcos male platyfish (*maculatus*) with several large black spots, all normal macromelanophores, in



Two of the young from the parents pictured on page 211, after reaching maturity. In these fish the black in the dorsal fin spills over the body

its dorsal fin, was placed in an aquarium. Then two vigorous, virgin females from our stock tank of pure Rio Jamapa stripe-sided platyfish (also *maculatus*) were introduced into the same aquarium.

Would the different platyfish members from the Rio Jamapa tribe and from the Rio Coatzacoalcos tribe accept each other after being separated many centuries?

They did completely, within 24 hours.

On 16th June, 28 days plus one after their reunion, one of the Jamapa females produced a large brood of young, and a day later so did the second.

Would those macromelanophores in the dorsal fin of the hybrids grow normally or atypically? We focussed our magnifying glass on the new-born hybrid fish. We saw no large black pigment cells anywhere on their bodies. But within a week we discovered a few large black spots in the dorsal fins in some of the tribal hybrids. Those tell-tale macromelanophores were of great significance, for they appeared so early.

In all the pure platyfish that we previously had observed, the large black spots developed normally only after the fish were about four to five months old. In some platyfish the spots in the dorsal fin required eight months to show, and in others the marks were so small, even in fully mature fish, that a reading glass had to be applied before the important pigment spots could be detected.

Yet the offspring of the Rio Coatzacoalcos dorsal-spotted platyfish father and the Rio Jamapa platyfish mothers were practically born with macromelanophores in their top fins. This meant that the growth of the large black cells had been speeded. As these animals grew, the spots in the top fins became larger and larger until some of the macromelanophores "spilled over" to the body of the animal. It was obvious, when the hybrids were six months old, that the growth of macromelanophores was stimulated abnormally. This response was almost identical to that previously observed when we crossed a spotted dorsal fin Rio Jamapa platyfish with a swordtail.

Since results obtained from crosses between members of the same species were essentially similar to those made between matings between two unlike species, the factor of species hybridisation should be regarded as of minor importance. *The significant point is that the parents used in each type of mating represent different populations each of which has a distinct genetic constitution.*

Look at it this way. One in about every five platyfish in the Rio Coatzacoalcos, in the Rio Jamapa, and in the three other rivers carries macromelanophores. Every one of over 2,000 of these *spotted* platyfish from the five rivers examined thus far, was perfectly normal as far as we could tell. Every one of their pure-bred spotted descendants was normal, too, at least as far as their large pigment cells were concerned. This must mean that the developmental rates of growth of the macromelanophores in the members of each pure, geographical population are under rigid genetic control.

But the hereditary forces, the genes, that limit the normal growth of the large pigment cells in the members of the Rio Coatzacoalcos platyfish, for example, cannot control the growth of the macromelanophores in the Coatzacoalcos—Jamapa hybrids. The genetic balance was upset by the intrusion of the Rio Jamapa platyfish genes in the Coatzacoalcos—Jamapa population hybrids.

What is the nature of the genetic mechanism by which the potentially dangerous large black pigment cells are kept under control in the members of their own proper, pure, geographical populations?

There was a period far back in geological time when the platyfishes were like most fishes of their kind that are uniformly coloured, unmarked by macromelanophores. A time came when the first "spotted" mutant platy appeared in a platyfish population, and transformed some previously existing cells into macromelanophores. The nature of the mutation process is not yet clear but it is believed that mutations act like enzymes and affect the body chemically. Like most mutations, the one concerned with macromelanophores was probably harmful. We know from many experiments that most mutations are not only deleterious but lethal. This is so because most mutations first upset an organism's established genetic balance and this has immediate repercussions on the chemical balance in the developing organism.

The newly created large pigment cells developing in the genetically unprepared platyfish probably grew, multiplied without restraint, and produced a melanotic tumor. Perhaps lethal spotted mutations occurred several times in the evolutionary history of the platyfish before it finally became established in the population. Macromelanophores could have become established in the members of the population only because the platyfishes were made ready genetically, in advance.

We now have to account for what happened in the indefinite, but probably long, period between the time when the spotted gene was an unrestrained killer and the time when it was prevented from doing any harm, when, indeed, it produced a useful colour pattern.

In that critical interval in the history of the platyfish other mutations, having all sorts of physiological effects, were being produced from time to time. Most of these mutations too, were either deleterious or lethal. The relatively few hereditary changes that persisted either were neutral in their effect upon the platyfish or contributed but a slight advantage to the mutant form. Many may have had no specialised effects of their own, at the time of mutation, but developed important functions at a much later period, when they acted jointly with others, when they began to modify and control the action of certain other genes. Such mutations, known as "modifier" genes, probably accumulated in the members of a population owing to their original neutrality in their host.

It appears to me that before the spotted mutation's successful establishment in the platyfish population, mutations which were to serve, in part, as modifiers and controllers of the activity of macromelanophores first accumulated and then neutralised the lethal effects of the spotted mutant when it re-occurred. The platyfish had to be made ready genetically for the coming of the spotted mutation. When ready the platyfish accepted macromelanophores without danger.

It must be obvious that this explanation is pure speculation. Yet the hereditary factors for macromelanophores can be demonstrated, their frequency in a population measured. The hereditary modifiers of macromelanophore factors can be demonstrated also as well as modifiers of other hereditary pigment-cell factors in these fish.

Do these genetic experiments with geographical populations of fishes have any parallel in human biology? Separate human populations such as the present isolated populations of platyfish in the various rivers of Central America no longer exist. We are many thousands of centuries too late to do anything about keeping geographical groups of people "pure" even if that were possible or even desirable. A large part of the human species at the present level of our civilisation is a genetic mixture of many geographical types. Here is how the authors of *Heredity, Race and Society* sum up the point:

"If all peoples on earth were to intermarry at random, the resulting humanity would not, as is frequently but mistakenly supposed, be some kind of a compromise between all the now existing races. It would rather be an extremely variable lot: some persons resembling each of the now existing races would continue to be born, but other indi-

(Continued at foot of opposite page)

JOURNAL of a Marine Aquarist

SEASHORE hunts and trawler trips are always disclosing some creature rare in museums and hardly noticed in the books. Quite lately, when trawling in Seaford Bay, only two miles from shore in about nine fathoms, I found the hairy hermit, poorly dealt with by Bell, but given some notice by Allen and Todd, of the *Marine Biological Association Journal*, 1900, and Crawshay.

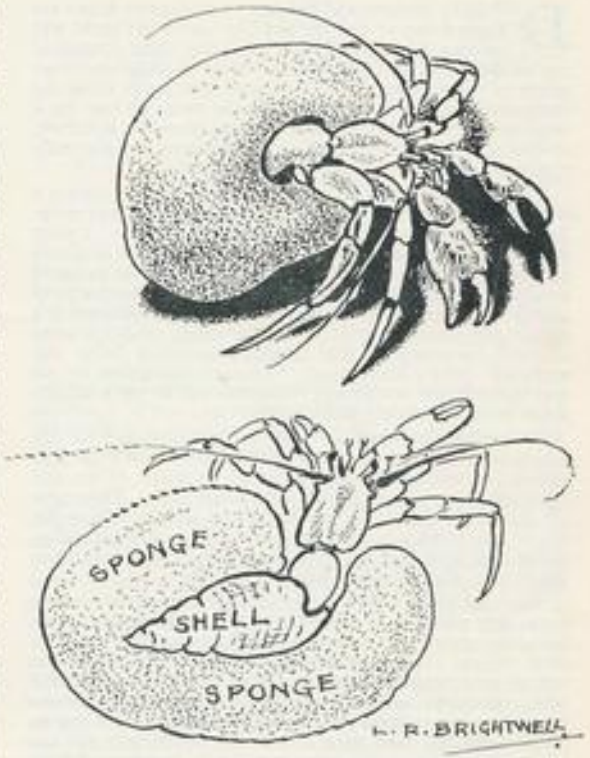
This hairy hermit, *Eupagurus cuanensis* (Thompson) is much smaller than the common or the purple hermit, and like so many of the clan is a commensal. My specimen revealed itself by suddenly poking out of a hole in a fig sponge (*Ficulina ficus*). The sponge, about the size and shape of a fig, is usually rich jade green, but may be white and is always characterised by a most powerful aroma of cucumber. It entirely covers the *Nassarius*, or dog-whelk shell, in which the hermit has found a home, and like the anemone, which often accompanies the common hermit, gets a good deal of benefit by being continually carried to fresh feeding grounds. In its turn it protects the hermit from foes. This, and another sponge, *Desmacedon*, often harbours a quaint little lobster-like animal, *Typton*, not unlike *Alpheus*, with one huge claw so contrived that it can "snap its fingers" quite loudly. Opinion is divided as to whether this is a device to kill small prey by concussion, or to act as a mating call.

My hermit did well for a month, when the sponge showed signs of trouble. So I carved it off the shell, and the hermit, though Brighton born, later changed into a gorgeous *Elenchus* from the Indian Ocean.

Sewage is very much in the news nowadays and is as big a curse to the marine as to the pond or riverside aquarist. Here in Sussex the Portobello sewer, which pours the unwanted matters of all Brighton and Hove into the sea near Telscombe and Peacehaven, has been making itself very noticeable. It has done its work steadily for something like a century but only during the last five years have detergents come into the picture, and their effect has been devastating.

In 1951 one could find at Ovingdean our giant chiton (*Acanthochiton fascicularis*), the great dahlia anemone, the opelet, hosts of squat lobsters (*Galathea*) and many other much-wanted beasts, with prawns, small lobsters, the purple sea urchin, etc. All these have now vanished. Even the ubiquitous shore crab is getting scarcer, and baby edible crabs, normally inshore haunters, are seldom seen. Between Friar's Bay, Newhaven and Black Rock, Brighton seaweeds become scarcer almost daily. Mussels are poorly developed but this may partially be due to the increase of a copepod parasite. Another noticeable feature is the steady covering of the rocks with a greyish and intensely slippery mud quite unlike any normal silt.

Luckily the homely winkle seems largely unaffected. A conservative sea snail, it keeps between high-water mark and the baneful sewage zone, feeding on lichens and the green weed, *Enteromorpha*.



Hairy hermit crab and its double protection

These melancholy facts are now common knowledge, and this writer's complaints amply corroborated by the biology students of Brighton's two Colleges and Varndean Field Club; that other local bodies should evince no trace of interest is typically Brightonian. Indeed, the only real natural history centre on the Sussex coast is Bexhill. It has a seashore museum any town might well be proud of.

L. R. Brightwell

Platyfish Reunion—After 30,000 Years

(*continued from opposite page*)

viduals would have combinations of traits that are rare or non-existent at present."

It is fortunate that we have in Mexico, Guatemala and British Honduras pure populations of the platyfish which we may collect, study and subject to genetic analysis. These organisms are our tools, our reagents by use of which we will learn by continuing research which genetic combinations lead to greater vigour, which produce abnormal growths.

Our attention is being focussed sharply upon the nature of macromelanophores, for those are the cells which are capable of being changed radically from normal cells to cancerous ones by changing their genetic environment. The melanomas so produced in fishes contain almost a pure culture of melanocytes, the cells characteristic of human and mouse melanomas. The melanocytes of these three vertebrate representatives have almost identical structures when viewed under the microscope. The three probably have the same phylogenetic history. What chemical and physical forces can change normal macromelanophores to the cancerous melanoblasts? What chemical and physical agents can reverse the process in changing the cancerous melanoblasts back to normal pigment cells? Those are the problems for to-day and to-morrow.

The Garden Pond in JANUARY

by A. BOARDER

DURING January and February some severe frosts are likely to occur and the need to watch the pond will become evident. Frosts of fairly short duration, say of two or three days, are not likely to cause so much worry to the pondkeeper as prolonged cold spells when the temperature never rises above freezing point all day for a week or more. Although such hard spells are not common, at least in the southern part of the country, we generally experience at least one such spell each winter.

The need for any special attention to a pond is always a debatable point; there are aquarists who say that they never interfere and do not make any opening in the ice. A great deal depends on the size of the pond, whether it has a natural mud bottom and whether the water is in good condition. As is generally known, when ice forms on a pond it creates a pressure on the water and the more ice then the greater this pressure can be. In a fair-sized pond this is not of itself dangerous to the inhabitants. Most fishes can withstand quite a fair amount of pressure and unless the ice was so thick that hardly any water was left in the pond the fishes are not usually killed by it.

An experiment was made with some half-inch-long fish which were left out of doors all the winter in a coldwater cistern. Although there was a good thickness of ice and considerable pressure the fish were unharmed. There was no mud or mulm at the bottom of the tank to relieve the strain and when a small hole was bored in the ice, water gushed up under pressure for some time. The water was quite pure and this, of course, was the secret.

When fishes die under the ice it is almost certain that the water was polluted and filled with poisonous gases. The foul gases cannot escape and so the fishes become asphyxiated. Great care must be taken to see that during the winter nothing is put into the pond in the form of food which would be likely to foul the water. Too many decaying leaves can also turn the water foul and so as many as possible should have been removed. Where a pond has been cleaned out in late autumn and kept free from falling leaves it is more likely to be a safe place for the fishes than if it had been left uncleaned.

It is well known that it is very dangerous to the fish if the ice is struck with a heavy object. The concussion could kill a fish. The easiest and safest way is to place a water can filled with boiling water on the ice. A round hole will soon be formed and the can will be prevented from falling into the water by the spout and handle. If the ice has been left until it is very thick it is better to cover the water can, when on the ice, with a large sack or other covering. This will prevent the water from cooling too quickly.

Indoors or Out?

When valuable fancy goldfish are kept in an outdoor pond it is often a matter of concern to the aquarist whether the fish will be safe there all the winter. Some aquarists take their fish from the pond and keep them in tanks under cover, but all are not able to do this. Many types of fancy goldfish would be quite safe in the pond all the winter as long as the water was quite pure. Whether the particular type you have would be safe depends a good deal on whether the fish have large and flowing fins or very short thick bodies. There is no doubt that the fish with flowing fins, such as veiltails, moors and orandas, are very prone to attacks by fungus disease, although this might not be apparent until the early spring.

Many pondkeepers have been quite pleased to see that their fishes appear quite healthy soon after the ice has cleared from the pond but are disappointed when some of them develop fungus in March or early April. The fancy goldfish which should be quite safe in a healthy pond are shubunkins (especially the London type), fantails (especially the scaled type) and comets. If there are valuable fish in the outdoor pond and the owner has no means of housing the fish under cover for the winter it is possible to use a heater in the pond and so keep the water from freezing. A suitable heater could be inserted in the pond and it need only be switched on during very cold nights. The radio usually gives out frost warnings but if one looks at the sky during the evening it is fairly easy to foretell a frost. If the sky clears after an easterly wind there is almost sure to be a frost during January and February. On the other hand cloudy conditions usually bring warmer air.

Pond Heater

A fairly small pond could be prevented from freezing over completely, but the larger pond would have to be kept free in one place only. The usual types of tank heaters could be used but it would be possible to use one of the soil-heating cables for the purpose. There is one supplied by the G.E.C., which is 80 feet long and plugs in to the main; no transformer is needed. There is an insulated lead so that the cable could be plugged in to a box near the pond and the cable is of the type that has no return plug. The end of the cable could be placed in the pond and the rest of the cable wound about round it. The wattage of such a cable is 300, and so it would cost somewhere about a penny for three hours where electricity is about or just over a penny a unit.

There is a smaller type on the market which is only 50 feet long and is 120 watts. This has an out and return cable to the same plug. It is not suggested that any heater should be kept on for long periods; only at night, when it is freezing hard, would be enough. If valuable fish were in the pond the cost would be well worth while if it meant saving the fish. It must be realised that the idea should not be to create warm conditions for the fishes during the winter, only sufficient heat should be used to prevent a part of the pond from freezing over.

Most fish of the goldfish types are better when kept at fairly low temperatures during the whole of the winter. They are then able to have a complete rest and the food they have stored up during the previous autumn is likely to sustain them longer than if they are encouraged to move about too much by warming the water. Many goldfish types show when the water is too cold for them. They lie on their sides on the bottom of the pond but move away normally when disturbed. Some fish will do this if their swim bladder is not in order, but most fish if continually lying on the bottom on their sides soon recover to a normal position if given slightly warmer water.

If the pond has been frozen over for some time it is wise, once the ice is melting, to remove as much of it as possible and to run the hose into the pond. Should the water smell or look milky it should be emptied if possible and replaced with fresh water.

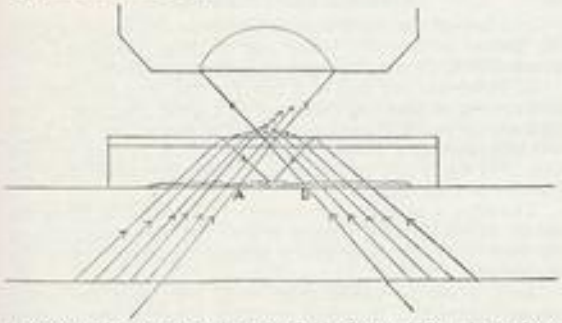
Microscopy for the Aquarist—26 *by* C. E. C. COLE

WHAT is glare, how does it occur, how can it be overcome or minimised? Glare is an unnecessary and irritating excess of light, which 1, interferes with the resolving power of an objective; 2, may destroy all or part of contrast; 3, dazzles and distresses the eyes. The primary causes of glare are faulty operational technique or dirt in parts of the optical train, or both.

The remedies seem obvious—correct our mistakes in operation and keep our instruments clean where it is most important. Let us deal with the question of dirt first.

To minimise the amount of dirt which can collect upon and in the microscope, a cover of some sort is absolutely essential. It is not necessary for an elaborate affair. If the instrument is only occasionally used, replacement in its case is the obvious answer. When one is fortunate enough to possess a room where tidiness is not the first essential, a polythene bag of sufficient size to envelop the microscope completely is most useful and cheap. In these circumstances the microscope can be left ready for instant use.

Despite the greatest care, a little dirt is almost certain to find its way into the body or draw tube of the instrument and this is precisely where it can cause glare by stray reflection. A soft cloth should be pushed down and all dust wiped out of the tube.

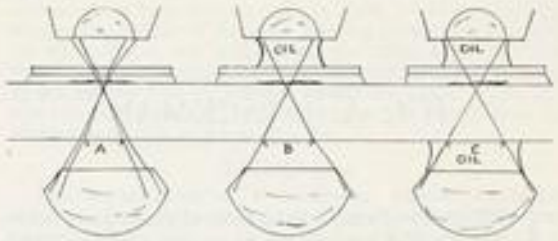


Light should be restricted to the field of view (AB). Light from outside this area causes glare and loss of clarity of the image

Stray light is also caused by dust on the surfaces of lenses and the tops of cover glasses. Dusting off with a soft camel-hair brush will remove hard particles after which a lens tissue should be used to polish the glass. Books of lens tissues made for the purpose can be obtained from suppliers of microscope materials for a copper or two per book. It pays to use the correct article. Hard cloth can do irreparable damage to delicate and comparatively soft lens surfaces. The tissues should be kept in a small dust-proof tin, and each one should be used only once.

Earlier in this series I explained how light may be totally reflected within the medium through which it is passing should it encounter the outer surface of that medium beyond the critical angle. This is a frequent cause of glare when an area larger than the field of view is being illuminated. Reflection from parts of the object outside the field causes confusion within the field. Obviously, to prevent this sort of thing we must confine illumination to the field of view.

The iris diaphragm on the front of the lamp housing of our general-purpose lamp is provided for this purpose. Close the diaphragm a little, watching the field through the ocular. It will depend upon the power of the objective in use whether or not a plain or a faint image of the diaphragm will begin to appear round the extreme edges of the field of view. The higher the power the fainter the image. As



Principles involved in the use of oil-immersion objectives: A, it is impossible to utilise all the light from the condenser because of refraction; B, the base of the admissible cone of light is broadened by a film of oil between objective and slide; C, the cone of light is further broadened by an additional film of oil between condenser lens and slide

soon as the outline shows, the source has been sufficiently reduced. When a different objective is used open or close the diaphragm, whichever is required, as a different setting is necessary for each power.

Field Stop

What happens if we close the substage-condenser diaphragm at the same time? Try it and see. As it closes the field darkens and the outline of the lamp diaphragm (the Field Stop, as it is called) becomes plainer, and depth of focus seems to increase slightly. We are introducing greater contrast. This can only be done at the expense of part of the rated numerical aperture (N.A.) of the objective. This is perfectly permissible if the increase in contrast enables hitherto invisible details to be seen.

Take out the ocular of the microscope and look down the inside of the draw tube at the objective. With the substage diaphragm closed, most of the back lens of the objective is greyish in appearance. Through the tiny aperture of the diaphragm a brilliant spot can be seen—the light source.

Open the diaphragm; the spot will grow and the greyish area get narrower. Continue to open the diaphram until its outline just fails to disappear—it remains framing the image of the light source, just inside the perimeter of the back lens (the aperture lens). In this position it is utilising the full rated N.A. of the objective; the resolution of detail is at its greatest.

If the eye is still dazzled the light is too intense. This can be adjusted by placing a piece of ground glass in the filter holder of our lamp or by using a less powerful lamp.

Next month we will discuss "perfect illumination" and how best to obtain it.

Aquarium Limpets

In my aquarium are several organisms which I had taken to be small snails. They are greyish-white in colour; the largest is about one-sixteenth of an inch long and they have thin shells and glide over the aquarium glass. They appear in great numbers after the lights are turned out.

The specimens submitted have been identified as fresh-water limpets, species *Ancylus lacustris*, the lake limpet. As far as I am aware, the little creatures are harmless to fishes and probably also harmless to plants. You need not take any special action to get rid of them. Test if the fishes will eat the limpets by crushing the shells of those you can see on the glass front or sides of the aquarium. If they are eaten you have a potential source of live food just where it is most useful.

Marine Aquarium-keeping

by L. A. J. JACKMAN

This article consists of extracts from the author's book "Marine Aquaria", published this month (17th January) by Cassell & Company Ltd. (price 18s.)

THE choice of sand will be to some extent governed by the material available in your own neighbourhood, but this should never prevent your using more decorative sand if it can be obtained. The term "more decorative" does not include mixtures of fancy coloured chipped glass and brilliantly coloured manufactured sands. Such mixtures merely detract from the natural beauty of the creatures you are keeping and eventually become an eyesore.

When deciding on the amount of sand required it is well to remember that a thick covering of more than a quarter of an inch will inevitably lead to trouble in the form of black deposits. These deposits not only take oxygen out of the water, but look very unsightly and will soon develop a most unpleasant smell. Thick layers of sand always lack oxygen and water circulation cannot cope with such a depth. Moreover, fragments of food soon disappear under the sand and decompose.

The most successful covering is one that just obscures the base of the tank, and if the odd crab disturbs this layer and exposes the tank floor it is an easy matter to redistribute it by using a glass rod or small stick. It is better to do this regularly than develop other troubles later through using too thick a layer of sand.

The particle size of the sand is also important. Very fine sand tends to bed down tightly but will be disturbed by actively moving creatures and tend to cloud the water a few inches above the tank floor.

The ideal mixture is one in which the sand particles range in size from a match-head to a small pea.

With fine sand the discharged matter from your sea creatures will never settle on the bottom if you have a good circulation of air or water. There is nothing to "bind" it down. With a coarser mixture these waste matters tend to settle between the larger grains, whence they can be readily siphoned off at regular intervals.

Many aquarists delight in cleaning out their tanks, and regularly take out all the sand and give it a good wash under a running tap. From the smell of such sand they wrongly conclude, "It's a good job I did that." The fault lies in the sand being too thick, and experience will show that in small tanks the cleaning of sand should never require attention more than once a year at most, if then.

Air diffusers can look quite unsightly if left bare on the sand. Try using a whelk shell, and by boring a hole to take the airline the diffuser can be hidden within. Admittedly the air bubbles may look a little incongruous, but at least you are using natural material for camouflage purposes, and this is surely warranted.

Sometimes the aquarist will decide that an odd stone placed on the sand will add to the effect of the general layout. This is permissible providing it is moved quite regularly, or else cemented to the base of the tank. Loose stones invite decaying deposits and provide a bank for trouble.

There are many and diverse opinions concerning the correct type and quantity of light to be used for marine aquaria. Primarily one should bear in mind the question of costs. Fluorescent tubes may well cost more to install but once you have them they will give far greater light for far less money.

As an instance, two four-feet long tanks can be lit by a single four-feet 80-watt tube placed three feet above the water level. Five two-feet long tanks can be illuminated by the same size tube placed 18 inches above the water level. This latter will of course give more intense illumination over the centre and less at the sides, but by carefully sorting your specimens you can place the light-loving creatures where it is brightest.

Tube lighting of this type will give you a fairly good growth of weed which will not become excessive if the total amount of light-hours do not exceed twelve per day.

Ordinary bulbs are ideal for a single tank and there is something to be said for the play of shadow that results, whereas with the tubes you will get a shadowless light.

Aeration and Filtration

It is hoped that most marine aquarists will secure a good air pump so that the water can be both circulated and aerated with filtration progressing the meanwhile.

If, however, you feel it is not yet the time for that, an improvised system can make use of a small reservoir. For this set-up you will need something in the nature of a large wooden barrel, a plastic bucket or small cistern so that extra sea water can be stored at a higher elevation than the surface of your tank.

The idea is to keep this container filled and to allow the water to trickle slowly from it into the aquarium, thence by way of an overflow into a second container below the aquarium.

Such a set-up works quite well, providing the water passes through a filtration medium between the outflow and the bottom container. It is better still if you can filter the water before filling the reservoir, but this must be done each time. The entire apparatus is kept working by merely transferring water from the bottom to the top reservoir. Once a day is sufficient, but do not expect such good results as if you used an air pump.

In the majority of cases, perhaps, the marine aquarist will not find himself in a position to obtain unlimited supplies of sea water. It therefore follows that his available supply must be safeguarded and used to the best possible advantage.

To filter or not to filter? That is the question that is so often debated, for those in favour of filtration know the crystal clarity of clean water, whereas the other school maintain (and correctly) that filtering removes too much life from the water.

Most filters used by amateur aquarists are of the air-lift type and work by bubbles of air lifting drops of water. An air-lift of this kind can be purchased cheaply at any aquarist supplier, and providing the air control is well adjusted, it will lift a good quantity of water into the filter bed. As an example: a two-foot tank with fairly cloudy water can be cleared in 48 hours. On the other hand, if you have such a filter already fitted, and providing nothing "crawls away and dies," the water will remain crystal clear for an indefinite period.

The adjustment of air to these filters is often quite delicate, and it is wrong to suppose that the more air there

is available the better the flow of water. A good steady flow is far better than the spluttering upheaval that follows an overdose of pressure. An extra strong air pressure usually blows out through the bottom of the air-lift tube or else delivers a steady flow of air into the aquarium cover. So you should exercise moderation and adjust the control cock carefully.

There is a wide choice of filter mediums available, some cheap and others costly, but one of the easiest is without doubt glass wool and charcoal.

The glass wool can be obtained from any reliable chemist, and even if he does not stock it he will always get it for you, although if there is an aquarist shop near by try them first. Place the glass wool in a one-inch layer over the bottom of the filter, then add a one-inch layer of granulated charcoal, and finally cover this with a further layer of glass wool.

Make sure the charcoal is *granulated*, because the powdered is useless and very quickly fills your aquarium with black "dust."

A filter of this type working a two-feet tank will need a top layer of glass wool changed about once a fortnight, and the charcoal can be replaced every other month. At the end of the first week of use, the glass wool can be cleaned by washing it under a flowing tap, but be sure to keep the wool loose, or it will bind tightly together and be of no further use. Sometimes a batch can be washed a second and even a third time, but for efficient filtration fresh glass wool should be used each time.

We have made no mention of limestone chips. What about our pH? I suppose if you really *must* stick pH papers into the water and have sleepless nights over increased acidity, it is as well to place a few on top of the glass wool. Frankly, we have never found this necessary.

Sand makes quite a good filtering medium, but is very much slower than those we have mentioned. To get good filtration with sand you must use really fine sand, and this does tend to clog up and its tighter particle packing cuts down the water-flow. With small amounts of water it is quite satisfactory.

In filters where the water drips through holes in the bottom of the filter box, the sand can be retained by placing glass wool as a bottom layer. This must be watched, of course, because the glass wool tends to clog up and the material should be changed every fortnight so that the water-flow through the filter is not impeded. Only those who have had blocked filters running over the top rim will appreciate how much accumulated filth is carried back into the tank when this happens.

If sea water is very valuable to you and the collection of a fresh supply means a long journey, the best safety precaution is the use of several filters. Either have two filter boxes each with two air-lifts attached or one filter box with four air-lifts. Any good air pump will give sufficient pressure for the work, and you will have perfectly clear and safe water.

To sum up then, it can generally be said that filtering is worthwhile for most aquarists who want to have a tank that is a pleasure to look at, and who intend to keep animals other than filter feeders. It is, moreover, essential to those who have to fetch their supplies of sea water from long distances.

Most of the creatures we keep in marine tanks benefit from a circulation of water, and the easiest way to ensure this, apart from using a water pump which has to be non-contaminating, is by good aeration.

It is our opinion that the whole question of aeration rests primarily on the amount of circulation caused by the up-rush of the air. This keeps the surface water moving and constantly changing, and it is here that the real absorption of oxygen will occur.

The incidental effect of this circulation is no less important than the value of the increased oxygen made available. I remember how this was first brought vividly to my notice. A small two-spot goby which I had had for several months, used to rest inside an empty otter-shell. Some days he was particularly active, but on other days he remained for long periods "out of sight." Then, due to a mechanical failure of the large aerating pump that supplied all the tanks, I was without air for three days. During that entire spell, the goby remained inactive, but as soon as the air came on he was out swimming again. The fish was not inactive due to lack of oxygen, but simply because there was no *flow* of water.

Maintenance

The maintenance of a successful marine aquarium demands little more than plain commonsense application of a few simple rules. Normally, an aquarium should remain perfectly clear for a number of years, without any drastic and complete changes of water.

The greatest enemy to clean, fresh sea water is decaying animal or vegetable matter, and it really is surprising how quickly a tank will "go off" once trouble sets in. Since prevention is better than cure, it is a good plan to ensure that all uneaten food is removed about two hours after feeding your stock. This can be done by using a siphon, and passing the outlet through a filter which will trap the waste and allow the clear water to settle in a container below.

In a small tank, say up to three feet in length and less than two feet deep, a glass tube will do the job very tidily with little loss of water. The method is as follows: hold the tube in your right hand with the first finger over the open end at the top. Lower the tube into the water until the open end at the bottom is over the material to be picked up, and then release your finger. The water rushes up the tube and takes with it the rubbish. Replace your finger, lift out the tube and again release the finger, allowing rubbish to run into your waste can.

Food is not the only source of contamination, however, and careful watch must be kept on any shellfish or small hermit crabs, and especially anemones. Of these three, the shellfish are the most likely to cause trouble, so watch out for the odd one that settles down in one place for a few days. Unless it is a limpet, the chances are it is dead, and building up a little trouble for you. You can easily touch it occasionally with a glass tube, and as long as there is a reaction it is living, but beware the shellfish that never moves when it is touched.

Small hermit crabs will sometimes leave their shells when ill, and crawl away to some corner before dying. If you spot an empty hermit shell, find its late owner.

Anemones are usually very hardy animals, but some have a habit of dying so slowly that it is difficult to observe until sudden decomposition sets in. A dead anemone often looks so like one that is behaving in the normal manner of these creatures that only the smell when it is removed convinces the aquarist of his suspicions. And we know of nothing as offensive as a dead anemone.

Plumose anemones have a habit of sloughing-off long mucous-like slime trails, that are very nearly transparent. These trails settle on the bottom of the aquarium and will collect all manner of rubbish on their adhesive coils. Remove at once, and the best way is to use a siphon and suck them off the living anemone before they drop.

Before introducing whelks into a tank, let them crawl around a stone jar for a day or so. The reason for this is that whelks, after travelling for a few hours either out of water or in restricted water space, very soon collect a good deal of slime on their large foot. If you introduce them right away into your aquarium that slime will be left all over the glass or on the sandy bottom. Wherever it is left it is difficult to remove, so let them settle down first.

Once you develop a routine for the introduction of new

specimens and the removal of food, you have progressed a long way towards a crystal-clear aquarium.

It must be appreciated that crystal clarity, although a desirable goal where the fish are concerned, is by no means a criterion to success where filter feeders are concerned. If after some weeks your aquarium has become clear, and you have it set up as a community tank containing various creatures, give your filter feeders an occasional "holiday." Stir up the bottom of the aquarium by moving a thin piece of wood over the top of the sand, and so disturb some of the sediment that has settled there in spite of all your care. Turn on the air a little more fiercely so that the sediment is kept moving, and you will find all your plumose anemones opening right up to catch the suspended particles, whilst fan-worms and mussels and their like will all take their toll of the floating food that you have released. If this is done just before you go to bed most of the silt will have cleared by the morning, and the air can then be reduced.

Such treatment also tends to release some of the minerals that have been retained by the silt, and in a very small way helps to maintain your sea water at its correct mineral level.

Even when glass covers are provided, a certain amount of evaporation will still occur, and after a month or more in summertime, the water level begins to drop. Make up to your "water level" mark with fresh tap water. Remember that only water vapour has gone, and the salts have been left, so if you add sea water you will merely be concentrating it still further. Topping-up should be done as often as once a week during warm weather to prevent any sudden change in the salinity of the water.

You will often find a rim of salt on your glass cover, where the tiny bubbles from your aerator have burst and splashed sea water on to the glass. Remember that this salt is no longer in your water, so try and regulate your air supply so that too vigorous aeration does not occur.

Having maintained perfectly balanced aquaria for very long periods without any artificial aids, we are convinced that the chemistry of sea water is best left untouched in small home aquaria.

Some Hints

If the water goes suddenly from crystal clarity to a misty whiteness, look for the "body" that is providing food for the bacteria that form that cloud. Remove it and aerate freely for 24 hours.

Do not play around with your sea water once it is settled down.

If you are one of the unfortunate individuals who must "do things" to your aquarium, try sitting in front of it. Next record your observations and make a few sketches. In this way you will find a new interest—and the aquarium will improve.

Remember that maintenance of a good marine aquarium takes very little time, and it is only the poor ones that need much attention.

What's New on the Market?

- pH Comparator
- Plant Fertiliser Tablets

AQUARISTS are always interested in the pH value of their tanks, more particularly because this is an ever-changing factor. Some years ago the importance of pH was rather over-estimated by hobbyists, but the fact remains that it does have an effect on many aspects of fish-keeping. The pH of a tank is affected by the addition of new rockery and gravel, by the state of the plants therein, by darkness and daylight, by the introduction of fresh or topping-up water, by chemical "tonics" or "cures" and by the general cleanliness or otherwise of the aquarium concerned. The majority of tropical fishes prefer slightly acid water but most water plants do best under somewhat alkaline conditions. On the other hand practically all the pests and troubles which attack our fishes find life hard in acid waters, and many fishes are reputed not to spawn unless the right pH is provided.

In the U.S.A. quite a number of pH-testing sets are available to the aquarist, but in Britain very little has been done in this direction. It is with pleasure, therefore, that I have to report on a new pH Comparator Set which is really first class and which should be in the possession of every club. It consists of a comparator rack to hold six tubes so arranged that the water under test can be viewed against comparator tubes on each side of it, a second rack to hold the six comparator tubes, four test tubes graduated at 5 mL, a pipette graduated for 0.5 ml. and a 50 ml. bottle of bromothymol blue indicator. The whole is enclosed in a box roughly 6 in. by 6 in. and very well packed.

To determine the pH of your tank water one of the test tubes is filled up to the 5 ml. mark shown thereon. With the pipette 0.5 ml. of the indicator is added to the tube and it is well shaken. This gives a colour change dependent on the pH of the water. The test solution is now compared with the comparator tubes by placing it in the centre hole of the rack and viewing it through the slots provided whilst the comparator tubes are placed on each side of it. The comparator shades vary from green to blue—green to blue, but even the beginner could not be in doubt as all the shades are so obviously distinct from each other. The comparator tubes themselves are each 4½ in. long, 1½ in. in diameter, sealed at both ends and contain water of known pH which has had the indicator added to it, giving a shade for that pH against which comparison can be made. Each tube is labelled with the pH of the contents, with the range pH 6.6, 6.8, 7.0, 7.2, 7.4, 7.6. This covers the normal values found in most tanks, but if the test solution is bluer than the pH 7.6 comparator tube then the water is more alkaline (above pH 7.6). If, on the other hand, it is greener than the pH 6.6. tube, then it is more acid than (below) that reading.

Sometimes the tank water is dirty or cloudy and this can be compensated for by placing a test tube of pure water behind the tube of water under test and by placing tubes of tank water behind the comparator tubes in the comparator rack. This allows accurate colour matching. I think a sheet of white paper behind the rack is helpful. The manufacturers (Marsh, Brooks, Ltd., Bolton, Lancs.) are to be congratulated on putting such a neat set on the market. It will appeal to all aquarists and I can recommend it to clubs. The complete set costs £1 11s. post free. Comparator tubes for other pH ranges from pH 2.2 to pH 10 are available at a cost of 12s. per set of six tubes with intervals of pH 0.2. Further bottles of bromothymol blue indicator solution can be obtained for 3s. Each bottle allows 100 tests, so the cost of testing is negligible.

Fertiliser Tablets for Aquarium Plants

The use of fertilisers in the garden is understood by all, but relatively few aquarists have bothered to do anything in this line with their aquarium plants. Plants which get good daylight for long periods, especially overhead light, need no extra nourishment, but few aquarists have such excellent conditions. The use of commercial garden fertilisers in aquaria is risky, as the fishes may be affected, but one good method is to collect some old, dried sheep manure and put it in tiny paper bags which are then buried

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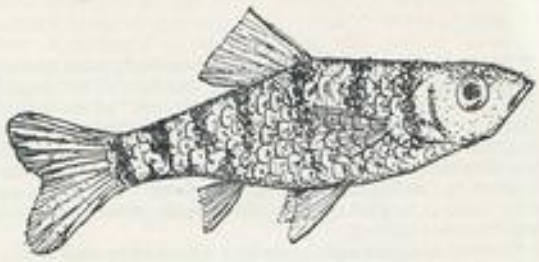
Half-banded Barb

(Barbus semifasciolatus)



ORDER:—Ostariophysi, from Greek *ostarion*—a little bone, and *physa*—a bladder.
FAMILY:—Cyprinidae, from Greek *kyprinos*—a kind of carp.
SPECIES:—*Barbus semifasciolatus*, from Latin *barbatus*—bearded, Latin *semi*—half, and Latin *fasciola*—band, plus Latin *latus*—a fish (of the Nile).

BARBUS semifasciolatus is not the showiest of barbs, being of an overall brassy hue with six to eight short vertical bands of darkly pigmented flesh or skin on its trunk, more or less at equal distance one from the other. The first is just behind the head, and the last at the root of the tail.

Its good nature and peaceful habits have made it popular with a large number of people, who have no hesitation in placing it with their mixed communities. In my opinion, if in a community tank, it needs to be with the larger species, for it may grow to almost three inches in length.

At first glance it may seem to be without barbels (the "beard" which gives this group of fishes the generic name). Close examination reveals that it has two very small ones.

It seems to prefer the bottom portion of the tank, and if exhibited in shows, therefore, needs to be raised above the bottom angle iron on a layer of compost, where it lies quite quiet and permits the judges to peer closely. I have seen some remarkably good specimens at fish exhibitions in unplanted tanks. In fact, one specimen was awarded "Best Fish in Show" about two years ago, competing with far more colourful and exotic species.

Of extreme hardiness, it can tolerate conditions of temperature and water which would kill many other species. A range of 30°, from 60° or even lower to 90° F. and over, will leave it apparently unaffected.

Feeding is quite easy. If no live food is available dried food can be given for long periods at a time, but under these conditions the sheen which is one of its attractions tends to lessen, and it looks less fit.

For breeding, of course, it is always as well to give the best conditions it is within your power to provide. Ideally, a large aquarium (36 in. by 15 in. by 15 in.) heated to 75° F. and well planted with fine-leaved plants will provide adequate space for exercise and love-play.

Liberal feeding with live foods—*Daphnia magna*, Mayfly larvae, bloodworms, *Tubifex*, freshly chopped earthworm, *Gammarus*, etc., will help to induce first-class condition.

The spawning drive is fast, and may last several hours with intervals for rest. It has never been satisfactorily established, although generally taken for granted, whether the female throws her eggs *before* the male ejects his milt, or afterwards. It is difficult to stage an experiment in which this can be proved one way or the other. These barbs are, of course, of sufficient size to permit handling, and stripping the female before the male, and *vice versa* with another pair in separate aquaria, with a comparison of the results, might help a little. I shall be very interested to hear of any experiments along these lines. Maybe I'll do it myself when I have time.

The eggs are adhesive, and stick quite firmly wherever they land, on the plants, the front of the glass, or the compost.

When the spawning drive is over, the fish should be netted from the aquarium to prevent them making a meal of the eggs, and a little dried food is sprinkled on the top of the water.

The alevins burst from the eggs within two days and hang like glass splinters from the plants. Occasionally they make short and very erratic journeys, getting their muscles into trim for life ahead.

As soon as their swim bladders are inflated, the fish assume a horizontal position and are able to move freely around the aquarium. It is now that they can begin to feed upon whatever Infusoria are present in the water. It was to assist in the development of these that the dried food was placed on the water surface.

Powdered egg or crumbled yolk of egg can be added to supplement the Infusoria. The oft-recommended diffuser block working slowly just below the meniscus of the water will keep the powdered food moving. As the result of the movement much more of it will be eaten.

After a week or 10 days the fry should be large and strong enough to tackle small *Daphnia*, *Cyclops*, new-hatched shrimp, micro worm, gnat larvae, Mayfly larvae, new-hatched *Asellus*, *Gammarus*, etc.

After this stage, and in such a large aquarium, feeding presents no further problems. The fry will grow rapidly, and apart from sorting out deformed or stunted specimens, the real work of raising a brood is finished.

What's New on the Market?

(continued from opposite page)

under the compost alongside the plants. This method gives excellent results.

Town dwellers have little chance for this sort of thing and with this in view the well-known firm of Brosiam Ltd. have marketed some aquatic fertiliser tablets for use in aquaria. These are three-eighths of an inch across, dark green in colour and are made from a growing plant which is washed, dried, ground and made up with nothing added, not even a binder to help the tablet form. No chemicals are used in any way. They are safe if eaten by animals or children although unpleasant in taste.

They are best used by pushing a whole tablet under the gravel near the plants. The manufacturers (Organic Herbal Products for Brosiam Ltd.) suggest crushing the tablets, but my experience is that this is rather unsatisfactory because, although most will sink, a fine suspension can make the water look cloudy. During the winter months in particular these tablets should prove a boon to hobbyists.

Raymond Yates

AQUARIST'S Notebook——

by

RAYMOND YATES

IT is safe to say that just about everybody who has kept tropicals has had at least one fighter. This popular fish is certainly high up in the "top ten" of the tropical fancy, as it deserves with such gorgeous coloration. Easy to breed, it remains an unfortunate fact that there is little sale for young fighters until they are sexable, and even then most of the males lack really good colour. For this reason most fanciers buy adult fish which already possess the colour and finnage required.

You can keep a single male in a community tank but not two. One might think that generations of British-bred fighters would have resulted in a diminution in the desire to fight with other males, but this is not so. Keep a fighter away from other fighters, male or female, for months on end and it will immediately be ready for a scrap if another male is introduced. Put the newcomer in a floating jar and very little notice is taken of it by the fighter already at home in the tank, but it is a different matter once the second fish is actually emptied into the tank to swim freely around. As soon as the two fish meet they show off their finnage and spread their gill covers but no actual fighting takes place for between five and ten minutes, the showing off being interrupted by both fish for visits to the surface.

Once attacks start they are vicious and the fish must be separated if fin damage is to be avoided. The rips in the flowing fins heal up quickly, often within a day or two, but they never look quite so perfect again. Fighters are subject to a complaint in which the anal fin splits or goes into holes and rots away—in this instance regeneration is slow; often no regeneration takes place and you are left with a very queer looking fighter which looks quite as odd as a bald-headed budgerigar.

Do not make the mistake of trying to keep a female fighter in your community tank; keep her for breeding in a separate tank if you must bother with the female. Colour means nothing in this fish, all colour varieties are just the same in temperament. Paradise fish don't always mix well with fighters and they are best kept apart. After all they are close relations and you know what relations are!

It is possible to keep a number of males together in one tank because when this is done little fighting occurs. The more the better. The reason is probably that they are all so ready and alert keeping an eye open on all points of the compass that an individual scrap with one other fish is impossible. Damage does occur, however, even in these circumstances, no doubt after dark.

It is said that fighters never show any sign of fear but this is not strictly true. Between themselves they are fearless but they show every sign of abject terror when confronted with large fishes such as the Jack Dempsey or the Texas cichlid.

* * *

The Swedish aquarium magazine *Akvariet* has given some interesting details of the most northerly aquarium in the world. This is situated at Tromso in Norway, some 250 miles beyond the Arctic Circle. A biological station was built here in 1952 which included an aquarium section comprising eight large marine tanks and laboratories. Private subscriptions and grants from the fishing companies provided the capital required. The tanks contain mainly local food fishes, which is not surprising when one considers that fishing goes on here all the young round, the harbour being free of ice. Indeed, in July the water temperature can reach 50° F. The station is about two miles outside the town and commands a magnificent view of the fjords; from it one can also see the sunken battleship "Tirpitz." There is also a local aquarium society with a membership of over 30 enthusiasts. This must surely be the most northerly club in the world.

* * *

Most people can read but the extent to which they can understand what they read is limited by circumstances. It is no use writing unless readers can understand what has been written. Fleet Street understands this very well and caters accordingly. In literary circles use is sometimes made of an American system called the "Fog Index," which takes into account numerous aspects of written work based on number of sentences, capital letters, number of words of more than two syllables, clauses, etc., and arrives at an index number. Roughly speaking the more popular daily newspapers keep within a range of 7 to 9 on the code. Over 12 on the code the average reader begins to reach the limit and is a bit fogged by what he is reading. Some of the more cultural newspapers such as *The Manchester Guardian* regularly write much above this figure. In aquatic literature one must write for all, so that the "Fog Index" must be approximately within the range of the popular daily press. Some writers, however, overlook this point and turn out technical articles, usually of an advanced scientific nature, which are quite beyond the understanding of ordinary, non-scientific people. Some writings on fish diseases which I have read (not in *The Aquarist*) seem to be written for university students only. Whatever is the use of writing, however correctly, if the people who are expected to read it find it unintelligible? Technical writers should not assume that because nothing is said that this means their writings are generally understood. Few people care to admit their shortcomings.

* * *

During the last two or three years the hobbyist has found good swordtails harder and harder to obtain. In fact it is now the exception rather than the rule to see good specimens of this fish at a show, and where such fish are on view they attract considerable attention. Not so many years ago one could choose at the larger dealers from a variety of red, green, black, albino, golden, tuxedo and red-eyed-red swordtails, almost all of grand colour, top size and shape and excellent condition. Nowadays the picture is very different. Undersized, weak-coloured runts are often all that is offered. The golden, tuxedo and red-eyed-red varieties are almost non-existent, and truly red swordtails very scarce. Haphazard interbreeding by careless aquarists is mainly to blame. There is a demand for good-quality swordtails but the fish are just not there to meet the demand.

However, many readers will remember the wonderful swordtails bred by Mr. R. R. Brough of Manchester, which were in such great demand all over Britain and which won him the coveted *Daily Dispatch* trophy at the 1951 British Aquarists' Festival. Mr. Brough's swords were probably the best known in all Britain and when one heard of winning swords they usually turned out to be connected with his stock, one way or another. After business changes and a severe motor accident, Mr. Brough felt compelled to give

up the hobby a year or two ago but readers will be pleased to learn that he has now started up again and is hoping to produce swordtails the equal of his previous high standard.

* * *

The effect of the hobby on the divorce rate is not known but it is quite true to say that fishkeeping is itself a disease. The humble beginner is introduced to the hobby by a friend or by what he sees at a show. Before long he wants another tank, then another in the hall; more follow in the kitchen, the wash-house, the lounge, the bedroom, and so on. Domestic bliss, already undermined, finally crashes when he tells his wife that he needs the back-bedroom for some more tanks and that he is sorry but her mother will have to go.

Joking apart, most fishkeepers never think seriously before they start just what they need. There are tanks and tanks. Some are for decoration in the dining room or the lounge, usually furnished aquaria, a joy to behold. Others are for breeding and need certain lighting restrictions and peace and quiet, away from the family. Isolation tanks are needed for the treatment of disease and these also require to be away from noise and bustle. Often a tank is needed for a single type of fish which requires special conditions, and other tanks are required to bring on young fish, although not for public view. Finally, the aquarist who sells fish as a side line needs a tank or tanks to display those fishes which are for sale, one which is easily available to visitors.

Sales tanks are best when they are well planted like a community tank. The customer sees the fishes as they will look in his aquarium and all fishes look hopeless in a bare tank, devoid of plants or gravel. He will make allowance for the upset caused by catching the fish with a net. Bare sales tanks are bad business; that is why so few dealers offer their fishes in this way.

* * *

I was talking to an aquarist friend recently who is also an electrician, and we were discussing the troubles which beset hobbyists from the thermostat angle. The majority of the commercial thermostats on the market are first class and thoroughly reliable, but there is always the chance that one can stick in the night and so boil the fish. Actually, it is very rarely that a thermostat fails to contact, thus freezing the fish, but the contacts do sometimes stick and the results of this could be quite serious, especially when one thermostat govern a battery of tanks. The well-known "Sirenstat" is a warning device but my friend suggested another method which he adopts. The thermostat is set for 75° F. and wired in series to a second thermostat which is set for 78° F., which controls the tanks. If the first one sticks the second cuts out at 78° and all is well. This method is pretty well foolproof but does not guard against electricity failure or lowering temperatures. However, although most aquarists are scared to death of the temperature falling, almost all temperature troubles are the other way. Fishes rarely get really boiled but temperatures above a hundred can be obtained and these are fatal for all fishes except anabantids, and even these can stand only short periods of such high temperatures.

* * *

Just about anything can be bought to-day on the instalment plan and materials for our hobby are no exception. There is no doubt that "easy terms," as they are called, are a boon to those fanciers who are unable to pay cash. As a rule most firms limit this concession to the purchase of equipment such as pumps, heaters and thermostats and tank frames, but accessories of lesser value can usually be included with larger items. One of the firms which cater for aquarists on the "easy terms" basis is Joseph Sanley, Ltd., of Angelina Street, Birmingham 12, and for them the financial side is arranged through J. G. Graves, Ltd., of Sheffield; all the aquarist has to do is to order the goods selected from the firm's price list and an Easy Payment form is sent for him to sign. This form will state the exact total cost of the goods chosen, the deposit required and the monthly payment to be made. When signed, the form is returned to the suppliers, who pass it on to the finance company for acceptance. The goods ordered are despatched direct to the purchaser from Birmingham. A rough idea of now this system works can be obtained from the following example. Goods are ordered which cost, say £5. To this add 5 per cent. for terms, making a total due of £5 5s. The deposit required is 20 per cent. or £1 1s., leaving a balance due of £4 4s. payable at 10s. 6d. a month, which allows eight months' credit.

* * *

There must be many readers of this magazine who have numerous back numbers stacked away which never see the light of day. There are some keen aquarists who retain every issue and have them bound into volumes in the course of time, but most people, however well intentioned, just forget about the older back numbers and leave them to act as dust collectors. I used to do this myself. Space presses in time and I decided to keep several albums of cuttings filed under such headings as fishes, diseases, plants, equipment and so on. I cut out all items of special interest and then pass on the slightly mutilated issues to beginners who may never have seen the magazine before. They are not worried if an odd page or two are missing and are only too delighted to read through the issue, advertisements and all. This way new readers and new enthusiasts to the hobby are made, not to mention new friends for yourself. Of course, I prefer to retain back issues for about four months before passing them on.

* * *

Platys are not favourites of mine, that is until I see some prize specimens in a show. The trouble is one never sees good platys for sale nowadays, nor, for that matter, good swordtails. Once upon a time you could buy fine swordtails almost anywhere. What a pity that the popularity of the fish and constant careless inbreeding has pushed out the better specimens! Really good golden swordtails and red-eyed reds are just about non-existent. The black swordtail seems to be available in many areas but, of course, is useless for breeding purposes.

* * *

Aquarists who use the fluorescent-strip lights often find these are unsuitable for plant growth, and the light given tends to detract from the true colours of their fishes. There is no need to worry as it is possible to obtain strip-light lamps of the same size in the ordinary tungsten type which will grow plants, make them look green and show the fishes in their true colours. A 60-watt strip light is excellent for a two feet tank. These lamps give out more heat than the fluorescent variety.

Cacti in the Fish House

AT the beginning of the year it is a good plan to go over all the cacti plants and pots to make sure that they are in a healthy condition. First scrape the top soil away carefully, say up to one-half inch deep. Remove any moss or weeds, and examine the base of the plant to see that there are no pests such as mealy bug there. When all appears clean, top up the pot with a little fresh potting soil to the old level. When topping up do not bring the level of the soil to the top of the pot or you will be unable to water properly when necessary. Make sure that all your plants are in such a position that they can get the maximum sunlight. Nothing harms a cactus plant more than the lack of light. Many will just exist under poor conditions but they become drawn up and atypical.

Which Species Will Breed?

by AQUARIUS

MANY of the tropical fishes breed so easily that all that appears necessary to get good results is to have healthy fishes, plenty of room, and well-oxygenated tanks. However, there are some species which do present difficulties, and later in this article a list will be given of the easier ones to breed and another of those which up to the present have proved more difficult. With the less common species it is necessary to use a good deal of common sense and also to learn as much as possible about the fish that one is trying to breed.

To be sure of breeding with any species the main points are: both sexes must be present, the fish must pair well (in other words they must be suitable to one another), they must be in the pink of condition, they must be old enough to breed and the conditions of water, light, etc., must be right. With these main features listed, others which might have a bearing on whether the fish are likely to breed or not can be considered.

Breeding Conditions

Their natural habitat may indicate the conditions in the spawning tank likely to encourage the fish to spawn. Obviously all those species which are found naturally in running water must have a well-oxygenated water in which to breed; lack of oxygen would be a sure bar to successful spawnings. Some fishes will only spawn when there is a certain amount of direct sunshine on the tanks, whereas others prefer partial shade. If the natural habitat of the fishes is known it will soon be realised that fish from an open running stream are more likely to require plenty of sunshine than those which have originated from slow-moving or stagnant waters.

For example, fishes from the slower parts of the River Amazon, which may be almost covered with vegetation which cuts out a great deal of the sunlight, cannot be expected to be at their best in a tank which is receiving full sunshine. Such fishes from these types of waters must therefore be given some shade when being encouraged to spawn. With these types it will be found an advantage to have a fairly large tank so that it is possible to provide two distinct conditions of light and shade in it. One end of the tank can receive a little sunlight and the other end can be fairly well shaded. The fish will then have some choice as to conditions and success with them is more likely than if they had one condition only.

Given the right conditions it is possible that the fish will spawn, provided that they are ready. This latter point is very important. The main function in the life of living animals is to breed and so to continue the species. Therefore any healthy normal animal will be ready to breed as long as conditions are right. It is only necessary to get suitable pairs of fish in the pink of condition, give them the right surroundings and they should breed. Such factors as the pH value of the water do appear to affect the chances of a spawning with certain species, but must not be over-emphasised; it is known that correct pH is not the only requirement. Some aquarists have bred their fishes in an acid water whereas others have been equally successful in alkaline waters. Often an aquarist hits on the right conditions quite by accident and then is sometimes unable to establish again the exact conditions and is unsuccessful on another occasion.

Many tropical fishkeepers who have failed with a certain species have only used very small tanks for spawnings. This is a mistake, as most of the more difficult species of egglayers prefer a tank which is sufficiently long to enable them to dash from end to end in vigorous chasings before any eggs are likely to be laid. The water need not be deep, but it must be very clear and free from foul gases and decomposing food or vegetation. Where the more tricky species are put up for spawning it is an advantage to dispense with sand or compost in the base of the tank. This can house many pests which could attack the eggs once they are laid. Also with nothing at the base it is an easy matter to siphon out any droppings or uneaten food each day.

For those fishes which prefer water plants in which to spawn it is possible to provide plenty of this without putting any soil or compost into the spawning tank. A useful plant for this purpose is hornwort (*Ceratophyllum demersum*); there is absolutely no necessity to provide any base medium for its growth. When grown in clean conditions this plant is ideal for all those types of eggs which are adhesive. Even eggs like those of the zebra fish, which are non-adhesive, will fall among the dense vegetation and be fairly well protected from the parent fish.

Methods adopted to encourage the fish to spawn are varied according to the aquarist's preferences, but one method which rarely fails to produce a spawning is to separate the sexes for a time by a glass partition. Then, when this is removed, the fish will usually spawn almost to order. The conditioning of the prospective breeders is, of course, most important, and this is where the aquarist should investigate fully the types of food on which the fishes exist in nature, or at least get to know their preferences. There are very few fishes which will not eat small pieces of garden worm, and this food has been found to condition most fishes as well as any other known food.

Where fishes are almost entirely carnivorous it is not of much use trying to condition them with dried or packet foods. Such foods as white worm, *Daphnia* and clean *Tubifex* are valuable, but where a plentiful supply of these cannot be obtained do not forget the cheapest and probably the best, the garden worm.

Classified List

Now for a little advice on the types of fishes with which a novice could succeed and also some indication of the more difficult ones. A complete list would take up too much space, but if any aquarist would like to know more of this subject he can apply for a list from the Federation of British Aquatic Societies, which classifies most of the kinds found in our tanks according to the difficulty of breeding, with a number—20 points being given to the most difficult and 10 points to the easiest species.

Among the characins some of the difficult ones are: *Abramites microcephalus; Alestes chaperi; Arnoldichthys spilopterus; Brycinus nurse; Carnegiella marthae, C. strigata; Chalcinus elongatus; Characidium fasciatum, C. rachovi; Charax gibbosus; Chilodus punctatus; Creagrutus beni; Crenuchus spilurus; Ephippicharax orbicularis; Exodon paradoxus; Gasteropelecus sternicius; Gephyrocharax atracaudatus, G. valencia; Glandulocauda inaequalis; Hemibrycon guppyi; Hemigrammus elegans, H. marginatus, H. rhodostomus; Hemiodus semitaeniatus; Hyphessobrycon gracilis, H. heterorhabdus, H. innesi, H. metae; Leporinus* species; *Metynnis* species; *Mimagoniates barberi, M. microlepis; Myleus pacu; Petersius caudalis; Phenacogrammus interruptus; Phoxinopsis typicus; Prochilodus insignis, P. taeniurus; Pseudocorynopoma doriae; Tetragonopterus chalceus.*

Some of the easier characins are: *Anoptichthys jordani; Aphyocharax rubripinnis; Astyanax species; Copeina arnoldi, C. guttata; Ctenobrycon spilurus; Gymnocorymbus ternetzi; Hemigrammus caudovittatus, H. ocellifer; Hyphesso-*

brycon flammeus, H. scholzei, H. serpae; Pristella riddlei; Pyrrhulina rachoviana; Thayeria sanctae-mariae.

Among the cyprinids the first named are the more difficult: *Epalzeorhynchus kallopterus; Esomus malayensis; Labeo bicolor, L. chrysophekadion; Osteocheilus* species; *Rasbora argyrotaenia, R. daniconius, R. dorsiocellata, R. einthoveni, R. elegans, R. heteromorpha, R. jacobsoni, R. lateristriatus, R. meinkeni, R. pauciperforata* and *R. taeniata.*

The more easy cyprinids are: *Aphyocypris pooni; Barbus binotatus, B. callipterus, B. chola, B. conchonius, B. cumningi, B. duenckeri, B. fasciolatus, B. nigrofasciatus, B. oligolepis, B. partipentazona, B. phutunio, B. semifasciolatus* and var. *schuberti, B. stoliczkanus, B. terio, B. tetrazona, B. ticto, B. titteya, B. vittatus; Brachydanio albolineatus, B. nigrofasciatus, B. rerio; Danio devario, D. malabaricus; Tanichthys albonubes.*

All the loaches can be classed as difficult to breed, and the catfishes, with the exceptions of *Corydoras aeneus* and *C. paleatus.* Among the egglaying tooth-carps the more difficult ones are: *Aphanius* species; *Aphyosemion australe, A. bivittatus, A. sjoestedti* and all other species of *Aphyosemion; Aplocheilichthys* species; *Chriopeops goodei; Cubanichthys cubensis; Cynolebias bellotti; Cynopoecilus melanotaenia; Leptolucania ommata; Nothobranchius* species; *Pterolebias longipinnus; Rachovia brevis; Valencia hispanica.*

Some of the easier tooth-carps are: *Aplocheilus* species; *Cyprinodon variegatus; Epiplatys* species; *Jordanella floridae; Oryzias latipes, O. javanicus; Pachypanchax playfairi; Rivulus* species.

Under the silversides, *Telmatherina ladigesi* is the more difficult. Among the nandids both *Monocirrhus polyacanthus* and *Nandus nandus* are difficult, whereas *Badis badis* and *Polycentrus schomburgkii* are easier. Among the anabantids the more difficult ones are: *Anabas testudineus; Belontia signata; Ctenopoma* species; *Helostoma temminckii; Parosphromenus deissneri; Sphaerichthys osphromenoides; Trichopsis pumilus* and *T. vittatus.* The easier ones are: *Macropodus* species; *Betta splendens; Colisa* species; *Trichogaster leeri, T. pectoralis* and *T. trichopterus.*

All the snake-heads are difficult. In the cichlid division the more difficult ones are: *Apistogramma* species; *Cichlasoma aureum, C. festivum, C. severum; Cremicichla* species; *Etroplus maculatus, E. suratensis; Herichthys cyanoguttatus; Nannacara* species; *Pelatochromis* species; *Pterophyllum scalare; Symphysodon discus* and *Uaru amphacanthoides.* The more easy ones are: *Acarpopsis nassa; Aequidens curviceps, A. maroni, A. portalegrensis; Astronotus ocellatus; Cichlasoma bimaculatum, C. biocellatum, C. coryphaenoides, C. cutteri, C. facetum, C. meeki, C. nigrofasciatum; Geophagus* species; *Haplochromis multicolor; Hemichromis* species; *Tilapia macrocephala* and other species. In the division sunfish, *Elassoma everglades* is difficult and also are all species of *Ambassis.* The archer fish (*Toxotes* species) are also difficult to breed.

To conclude the list the following are all considered difficult: the scats, the monodactylids, the gobies, the flatfishes, the spiny eels and the puffers.

Where a species cannot be found among the fish listed it can be taken that it appears somewhere near the dividing line between what is easy and what is difficult; obviously there cannot be a strict line, and again it must be realised that as some aquarists are able to breed certain species with more ease than others in different parts of the country, it is not to be expected that the list would meet with universal approval but it is at least a fair guide.

OUR EXPERTS' ANSWERS TO TROPICAL AQUARIUM 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.

I have not been keeping tropical fishes for many months, but I should like to introduce some angel fish into my community tank. Are angel fish difficult to keep? And will they live on friendly terms with the other fishes?

Small angel fish are quite suitable for inclusion in a community tank housing peaceful fishes, but when angel fish attain middle- to full-size they often develop into bullies, and drive more timid species into the plant life and away from food. We would tell you at once that angel fish need some understanding, for they are temperamental and little things can quite easily upset them—such as the introduction of a new fish into the aquarium, vibrations in the water, or the sudden flooding of the aquarium with a very bright light. When an angel fish shows signs of fright or "nerves," it is wisest to leave it well alone. In other words, do not tap on the glass, or try to induce it to leave the shelter it has taken in the plant life, or behind rockwork. If the fish refuses to take food, do not worry it, but tempt it to eat again by dropping white worms or similar live food close to where it is sheltering. Once it starts to eat again, it will soon recover from its shock and swim out again into open water. Some angel fish, however, never appear to be troubled by attacks of "nerves."

Several months ago I bought a plant called *Aponogeton crispum* for my tropical aquarium, but just lately it has lost a lot of its leaves and appears to be dying down. Can you tell me whether it is natural for this plant to die down in the winter?

Most of the *Aponogeton* plants grown in the tropical aquarium have a resting period during which they lose most if not all their leaves, and remain dormant or semi-dormant for some little time. But you must remember that the dark days of an English winter often lead to a sudden decline of tropical water plants, and it is strongly advised to supply them with a few hours of artificial lighting every night until the return of the longer, brighter days of spring.

I am setting up a 36 in. by 15 in. by 15 in. tropical aquarium very shortly. Will you please tell me how many plants I will need to provide a solid green background and sufficient hiding places for the fishes?

Obtain between three and four dozen *Vallisneria* plants and plant them in a double row along the back of the aquarium. When these plants become established, they will form a pleasing green background. The two ends of the aquarium may be planted with the slower-growing *Cryptocoryne* or *Limnophila* (*Ambulia*), which always look attractive and flourish well in most heated tanks.

Some time ago I spawned *Barbus gelius.* Lots of the eggs must have hatched out, for I soon had plenty of fry swimming in the tank. Unfortunately, the tank got in such a dirty condition that I decided to clean it out. I caught the fry in a nylon net and transferred them to a large jar. I wrapped this jar up in a piece of woollen cloth, and stood it in a warm place while I cleaned the aquarium. When I had finished the cleaning and refilled it with soft water, heated to the same temperature as the jar, I re-introduced the young fish. They swam about quite normally, but next morning every one of them was dead on the bottom. Can you give me any idea why they died so suddenly?

It was very unwise to subject young fish to a sudden

change of water. Then again, netting young fish is always a risky business, for the shock of being caught does not do them any good. So long as the water in the aquarium was not actually polluted, you should have left the fry to grow on for another week or two before moving them. Another point: *B. gelius* fry are rather delicate, and should always be treated with more consideration than, say, the fry of *B. conchonius* or *B. semifasciolatus*.

I am a beginner in the tropical fishkeeping hobby, and my aquarium soon gets clouded over by a mossy green growth, known, so I have been told, as algae. I have read somewhere that water snails eat this green growth and keep the glass sides clean. Is this information correct?

Water snails do eat the mossy algae which forms on the glass sides of the aquarium, on the leaves of the plants, and on rockwork. But although water snails can be of some use in the aquarium, they can also become a nuisance, for too many of them will ruin the look of the plants by eating holes in them. Furthermore, if you want to breed an egglaying fish, every snail must be removed from the aquarium, for snails like to eat the eggs of fishes. Then again, if a snail dies and you are not aware of the fact, its body will decay and not do the water any good. In fact, the sudden pollution of the water may often be put down to dead snails becoming lodged behind rockwork or among a tangle of plant life. We have always found the best way to keep the glass sides clean and sparkling is to scrape them once a week with a safety-razor blade pushed into one end of a cleft stick or length of cane. The final polishing may be carried out by removing the razor-blade and substituting a piece of soft muslin or old nylon stocking in its place. After scraping the algae from the sides, always remove it from the floor of the aquarium by using a dip-tube or siphon tube.

My fishes do not seem to be enjoying very good health just lately. Some of them have gone off their food, while others have frayed fins and tiny boils or ulcers on their sides. The aquarium is in perfect condition, the plants are healthy and the water is beautifully clear. But I might as well mention that I never give the fishes any live food. All they have is dried food twice or thrice every day.

We think that the completely dried-food diet is the cause of your trouble. If you cannot obtain live food, give your fishes frequent meals of finely minced shellfish such as shrimps, prawns, cockles or mussels, scraped red meat or offal such as liver, heart, kidney or the hard roe of herring or cod. Most fishes enjoy a feed of crumbled hard-boiled egg or scrambled egg rinsed in water to remove any grease used in cooking.

Photo: Laurence E. Perkins

Sail-finned mollies are distinct species of livebearing fishes in which the males show greatest colour and fin development and sometimes grow to five or more inches in length

I am contemplating setting up a filter for my tank of 15 gallons capacity, and have been told that I should include a quantity of animal charcoal rather than vegetable charcoal in the filter. As I have not been keeping tropical fishes for many weeks, I should be obliged if you will tell me what sort of charcoal I should use, and where I may obtain it?

Vegetable charcoal may be used in an aquarium filter, but animal charcoal has greater powers of absorption, and does not become clogged so quickly as vegetable charcoal. But most aquarium dealers sell specially prepared charcoal or granulated carbon for placing in a filter. One packet will last you quite a time.

COLDWATER FISH-KEEPING QUERIES answered by A. BOARDER

Do young lionheads have the hood or crest when they are young or do they develop it later?

Lionheads and orandas do not show the hood when they are very young. The age at which this feature is developed depends not only on the strain from which they are bred, but also individual fish vary. Some of these types do not get their fully formed hood until they are up to three years old and also a few in the brood may never get a decent hood at all. As a rule those which are going to be any good show the hood by the time they are a year old, although it may not be fully grown by then. The lionheads should have no dorsal fin at any stage in their development.

I have made a pond in my garden as a paddling pool for my children. After a couple of years or so I hope to make it a fish and lily pond. It is about 9 ft. by 4 ft. and 2 ft. 9 in. deep. As there will be no plants or fishes in the pond for some time can you tell me how I can keep it clear of green water and slime? A cheap remedy please, as I shall have to empty and re-fill now and then.

I think that the best way to keep the pond water clear would be to put some form of copper in it. I have even known strands of copper wire over the pond to do the trick. A small amount of copper in the water would be enough to prevent the formation of algae, etc., which is the cause of water turning green. A solution of copper sulphate or pieces of clean copper could be put into the pond. Do not overdo this; the amount you need can be adjusted according to how the water reacts and should not harm the children or animals. Once you decide to use the pond for fishes you must make sure that all traces of copper are removed. It is possible that the copper will also prevent the infestation of the water by the larvae of mosquitos and other insects. These would be eaten by fishes if present but could be a nuisance if left to themselves.

I have a large natural pond in which goldfish have lived and thrived for the past three years. They have been so numerous that when the sun shone the pond appeared red. Now there is not a fish to be seen. Do they all suddenly disappear at any time of the year or is it pollution?

This is difficult to answer as there may be nothing wrong

at all. Goldfish do bask at the surface of the water at certain times, mostly during warm spells. Once the weather turns cooler they go deeper into the water, but still occasionally rise to the top. If the pond is fairly deep the fish may not be seen much from autumn onwards, but it is unusual for them to disappear altogether in mild weather. If the water was polluted and the fish were killed it would be expected that many dead bodies would have floated to the surface, and unless dead ones have been seen I should ignore the pollution theory. There are, however, other reasons for the disappearance of the fish, if they have gone. It is possible that predatory fish have been introduced either accidentally or deliberately; such fish as pike, perch or catfish could soon make short work of the goldfish. Again there are a few birds such as herons, kingfishers or gulls which could eat large numbers of the fish. Herons will visit a pond during the early hours of the morning and can soon clear a pond. Kingfishers usually only take the smaller ones and will fish throughout the day, often returning to their post within minutes of having been chased away. Gulls will often take pond fishes, usually only in cold weather but not always so. Without further information I cannot say what has happened but suggest that observation be kept to make sure whether the fish are still there or not. A piece of brown bread crust thrown on the water during an afternoon when it is not too cold should soon bring some of them to the surface.

We are thinking of stocking a pond about 30 ft. in diameter and 4 ft. deep. There is a lot of water weed with long stems and pairs of leaves in the pond. What fish shall we put in the pond to eat up the weed?

I know of no fish which would eat up all the weed in your pond. From your description and sketch it appears to be *Lagarosiphon major*. Many fishes such as carp, goldfish, roach and bream eat a fair amount of vegetable matter. This is often the finer kind such as filamentous algae and the young shoots or leaves of the more tender plants. The amount of plant life they would eat depends to a great extent on the other available food. Most of the fishes mentioned would prefer moving things such as *Daphnia*, gnat larvae, young snails, worms, etc., to the plant life, and so if the fishes are required to eat the vegetation they must not be given other foods. However, I do not think that the introduction of fishes for the purpose stated should be the main issue. All ponds should have some fishes therein to keep down the larvae of mosquitos, etc., as well as improving the look of the pond and giving it an added interest. The weed you complain of will assist in oxygenating the water and so help to keep the fishes healthy. I recommend for your pond: one dozen golden orfe, two dozen goldfish, a dozen shubunkins, six green tench, six golden rudd and six hi-goi carp. If you want to breed some fish in the pond you must cut out one of the goldfish types; that is, have all goldfish or all shubunkins. If both are left together they will inter-breed and so the strain will be spoiled. If the expense is not the question I would prefer shubunkins to ordinary goldfish.

Can you please advise on stocking my pond with plants and fish? It is 6 ft. 6 in. by 3 ft. 3 in. by 19 in. deep. There are three 3 in. goldfish at present; what else can I add?

I hate to disappoint you, but your pond is not deep enough for fishes to be safe during the winter. Your district, Sunderland, may not get too severe frosts, especially if you do not live far from the sea, but it is almost certain that at some time you will experience sharp and prolonged frosts which could freeze your pond almost solid. In such conditions your fishes would probably be killed. In any case a pond without one part at least two and a half feet deep is of no use for goldfish types during the winter. In fact it is not too good in the summer, as the water would be subjected to quickly varying extremes of temperature. It could get too hot in summer and cool quickly at nights. You could have up to a dozen goldfish or half that number and six golden rudd, but I only recommend these if it is possible for the goldfish at least to be taken to a safe place for the winter, otherwise I hold out little hope of successfully wintering the fish. It is a pity that pond makers on the whole do not consider more carefully this depth question before starting to make the pond. It would save a lot of trouble and expense if all ponds were made deep enough in the first place, as it is not often an easy task to deepen a pond once it has been completed.

I have a garden pond with ten big goldfish, also a lot of young ones changing colour. There is a frog in the pond. Will it harm the fish?

I do not think the frog will do any harm to the fish. I have never seen a frog, that is the common one, eat under water. I have tried to make them do so when they are in the water at the edge. I have dropped small worms on the pond side and the frogs have quickly eaten them but as soon as the worm falls into the water even under their noses they appear to take no notice of them whatever. However, a friend was watching at one of my ponds once and he states that he saw a frog under water snap at a smooth water newt which was swimming by and take a piece off its tail. I must admit that this was a new idea to me and it would be interesting to hear if anyone else has noticed anything like it. Each year I encourage many frogs to come to breed in my ponds so that I can get the spawn to hatch elsewhere to grow on the tadpoles for fish food. If I thought there was any danger I would not allow them to occupy the same pond as a dozen of my prize breeding fantails. On very rare occasions it has been known that a male frog will clasp a fish during the breeding season but in all my many years of fishkeeping I have only had this happen in my pond on one occasion.

I am shortly moving to a new house where there are a lot of pine trees. I wish to make a pond. Do you think the falling pine needles will pollute the water?

Too many pine needles falling into the water could cause pollution, but so would excess of any other leaves as well. As soon as a quantity of leaves fall into a pond they will start to decay and give off foul gases. The amount of pollution will depend on the size of the pond and the amount of leaves. I should make the pond as far away from the trees as possible. The needles will not be as liable to blow into your pond as would other lighter types of leaf. If your pond is not too large it would pay you to clean it out at least once a year to remove all leaves.

I have three fantails in a coldwater tank size 20 in. by 10 in. by 10 in. I have had them for over a year and have never changed the water, which is clear and has no smell. During the past week all three have shown small white spots on them, mostly on the tails; one fish stays mostly on the bottom. Will you please advise?

The spots may be the signs of "white-spot" disease, although if you have not added any fresh fish this may not be the case. It is, of course, possible that the disease could have been brought in with live foods such as *Daphnia* or *Tubifex*. Probably the trouble is only a slight attack of fungus, which should respond to treatment. You can try the salt treatment and if fungus is present this should soon clear it up. Use a solution of a tablespoonful of salt to a gallon of water and leave fish in for a few days. If the small spots appear slightly raised and do not clear with the salt treatment, white-spot disease may be present and you are advised to see the article on this in *The Aquarist* for February, 1956.

I intend to stock a pond at this school in Cornwall, and it is 20 ft. by 8 ft. with a varying depth of from 2 ft. 6 in. to 4 ft. The

pond has had no fishes or plants in as yet but has been filled with water for eight months. It is well populated with *Daphnia* and algae. The pool is fed by rain water from the roof, which is quite clean and free from pollution. However, there may be some salt from spray off the sea. Would this harm the fishes or plants? Is the enclosed list of plants suitable and could you suggest the best kinds of fishes for the pond?

This is a very good size for an outdoor pond and you should be able to make quite a success of the venture. As for the rain water from the roof, I am not too happy about this. I tried this system many years ago but was forced to give it up as the water was too polluted. However, my pond was in a different district from yours. Trouble can occur after a dry spell during which soot from the chimneys settles on the roof in fair quantities. It is safer to be able to turn the water away from the pond on occasions and only let it run into the pond when the roof has been well washed first. The small amount of salt is not likely to harm anything. The fact that the *Daphnia* are alive in the pond would mean that fishes would also live there.

I hope you have considered the point that sea gulls may visit your pond and take the fishes unless some form of protection is provided. You can choose stock from the following: common goldfish, shubunkins, fantails, comets, rudd, green tench, golden orfe and golden tench. The problem with the goldfish is that they may all interbreed, when you will get a lot of worthless runts and cross-breeds. If you intend to let the fishes breed then it may be better to limit the selection of fishes to one variety of goldfish only, but that is up to you. The list of plants you sent is quite suitable but do not over-do this planting: remember that most water plants grow at a fast rate, and your pond could soon get filled with them, when it would look less ornamental.

Could you tell me the thickness of glass required for a tank 36 in. long, 15 in. wide and 12 in. deep? Also if teak is used for the framework would it have any ill-effect on the fish?

The glass for the ends of the tank could be what is known as 32 oz., but for the sides and base it should be ¼ in. plate. When dealing with a good length of glass it is essential to make sure that the glass is not likely to bend or whip. The weight of water is so great that any jar to the tank might cause the glass to crack if of insufficient thickness. The teak should have no ill effects on the fish. In a properly glazed tank no part of the frame comes in contact with the water.

I have a tank 36 in. by 15 in. by 12 in. which I made myself, glazing it with an advertised compound. Although there are no visible signs of this between the glass I continually get an oily scum on the water. This has been going on for the past 12 or 18 months. Do you think the compound is to blame?

I do not think that your trouble is coming from the compound. It is possible to get a slight oily scum on the top of the water when a tank is freshly set up after reglazing, but if this scum is skimmed off with a sheet of paper now and again it will soon clear up. It is quite possible to get an oily scum on the water through wrong management, such as overfeeding or feeding with something the fishes do not quite clear up. Also decaying plants in the tank can have the same effect. Just run over all that you have done and you may hit on the solution. I would not blame the glazing material until all other causes have been considered.

Please can you give me the names of one or two good books on goldfish breeding? I have a pond 15 ft. by 9 ft. and some goldfish about eight inches long. I would like to breed for profit. Do you think there is a market for goldfish at the present time or in the near future?

My book *Coldwater Fishkeeping* will tell you all you need to know about breeding goldfish and it costs only 2s. 8d.

FRIENDS & FOES No. 52

Ichneumon Flies

HYMENOPTERA

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

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

THE majority of members of the Hymenoptera (from Greek *hymen*—membrane, and *pteron* wing) are terrestrial, but the ichneumon group contains a number of species which spend larval and pupal stages in water, and in order to lay their egg, many females are forced to penetrate the surface.

For instance, the females of the genus *Agriotypus* seeks out the larva of the Phryganidae caddis flies, and deposit eggs within their cases. When the grubs hatch they feed upon the body of the caddis larva, but leave it sufficiently alive for it to complete its larval stage and seal down its pupal shelter. Then the fly grubs finish the hapless creature, spin their own cocoons within the caddis cases and pupate in comfort and safety.

Many aquatic creatures are subject to parasitising by the grubs of ichneumon flies. Some water beetles, alder flies, *Notonecta*, *Ranatra*, damsel flies, rat-tailed maggots and bloodworms, are a few of the victims.

The Chalcidoidea ichneumons lay their eggs within the eggs of the above creatures. Upon hatching the fly grubs feast upon the yolk and the growing embryo by which they are surrounded. After consuming it,

Prestwichia aquatica (× 50)

they pupate, still in the borrowed eggshell, emerging only as adult flies.

The flies are small, and usually black, and unlikely to attract much attention. It is possible that fishes prey upon those that visit water, but I have no evidence to prove or disprove this contention. If anyone has, I shall be pleased to hear from them.

C. E. C. Cole

post paid from *The Aquarist*. As for breeding for profit I do not think there is much scope for you in this country either now or in the near future. Goldfish can be imported from abroad, especially Italy, at such low prices that you would not be able to compete. In warmer climes the fish change colour far more quickly and also grow quickly. The only chance you would have to make a little profit would be to breed a particular fancy type of goldfish, such as shubunkins, fantails, veiltails or moors. For outdoor work I consider the two first named the best and for selling purposes the shubunkin is by far the best. These change colour at a very early age and so are more easily sold than, say, young scaled fantails which can take a year or more to change from their natural bronze to the desired red. When you breed fancy goldfish you will only get a few fish which can be sold at a fair price if the strain is good, but for every good saleable fish you will get dozens of throw-outs which will remain on your hands. For breeding the more fancy fish such as veiltails, moors, orandas, lionheads and celestials I consider that you need a fish house, or frames to give some protection and shelter for the fry in the early stages. I advise you to give up the idea of breeding goldfish for a profit but do it as a hobby, and you will be surprised how much pleasure you can get out of it. I have been breeding my strain of fantails for nearly 20 years and for every fish I could sell at a pound or over I get at least 200 I hardly have the cheek to ask 2s. 6d. for.

I propose to construct a fairly large pond to the enclosed specification and would welcome your advice as to the construction of the 18 in. high sides. Should I use bricks floated over with cement or should I use a strong concrete for this raised portion? Do I need an overflow pipe?

From your plan it appears that the pond will be of a useful size and shape. It should turn out well as long as sufficient thickness of concrete is used to strengthen the pond against severe freezing. I do not advise you to use bricks for the sides. These are often all right for some time but after a few years they may crumble through the action of frosts. Of course some bricks are harder than others, but the Fletton is too soft for this purpose. You will do much better with a good concrete. You can incorporate some wiring as reinforcement, and see that you have a good thickness of concrete, about 9 in. is the minimum. You will need shuttering round the edges. Do not float over the top coat of cement and sand to the lower part of the pond until the outside is ready for construction or you may find that the fresh concrete will not wed with the old. See that the cement is fresh and that the aggregate and sand are quite clean and free from earth and lumps of soft sand. Work as quickly as possible so that no part of the concrete has a chance to dry out before the next lot is added.

As for the overflow pipe, this is not necessary, but advisable. During heavy rains the pond can overflow and it is not always well to have this happen all around the pond. It is much better if the overflow can be controlled in one special place. There is no need to have a pipe for this, a shallow trench in one spot will take the surplus water and so tend to keep the surrounds more tidy.

How can I clean a tank which has the three sides and bottom concrete and only the front of glass? It has been used for transporting tropicals on board ship and I want to disinfect it.

Let the tank remain quite dry for some time then fill it with water. Add a teaspoonful of Dettol to each four gallons of water and leave for another few days. When washed out it should be quite safe.

How can I get rid of blue-green algae which has appeared in my tank?

Blue-green algae is not always easy to eliminate in the aquarium, for it is one of those forms of lower plant life which are nourished by certain elements in the fishes excreta, especially those fishes which eat a lot of rich, meaty food. Cichlids, for instance, and some of the larger barbs and characins help to keep blue-green algae alive. Alkaline water also encourages the growth of blue-green algae. Given time, the algae exhausts its food supply and dies away of its own accord. But until it disappears of its own accord, it can be kept in check by stirring the sandy floor of the aquarium with a pointed stick to stop the algae spreading like a blanket over the compost, and by scraping it from the sides of the aquarium. Straining the water through peat will help to inhibit the growth of blue-green algae. We think now that the shorter days of winter are with us again, you will have more luck in eradicating the algae from your tank, for long hours of bright light usually help the troublesome growth to spread over the aquarium.

Telmatherina ladigesi

THIS little beauty is called after Dr. Werner Ladiges, the well known German breeder of "Aquarium Hamburg." No pet name has yet appeared although some dealers have offered it for sale under the title of 'glass neon,' perhaps a rather apt description. Coming from the Celebes, these fish have a wide temperature range (70°—86° F.) and belong to the same family as the better-known Australian rainbow. They are very peaceful and harmless to other occupants of a community tank but are better kept on their own with their own special tank conditions laid on.

They are not a fish for the newcomer because in unsuitable conditions they will quickly give up the struggle; success therefore demands close attention to their main requirements. In the first place it is as well to remember that they have marine connections, and some salt is essential —roughly one teaspoonful to two gallons. A high pH (about 7.6) is called for but the hardness of the water seems to be immaterial. A mean temperature of 80° F. seems most suitable for breeding, this fish offering little difficulty if provided with floating plants and dense aquatic foliage. The eggs are laid under the leaves, mostly near the surface. Real sunshine or adequate artificial light is important and so is reasonable privacy.

The fry grow very slowly no matter how well fed. *Telmatherina* are a swamp fish and enjoy *Daphnia*, but also need a vegetarian diet, in particular soft algae, although they can be offered spinach and the like as well as dried foods. Fry require the very tiniest microscopic food and this is the major difficulty, because *Telmatherina* as an adult will not prosper unless it has really sparkling clear water, free of all sediment, bacteria and Infusoria. This is the main reason why so many aquarists find it difficult to keep.

In the wild this fish reaches three inches and more but most aquarium specimens are about one-half this length. Sexing is easy when the fish is adult because the male has fantastically elongated rays on his second dorsal and anal fins, which are a striking black and give the fish a rather ragged look. The colours are somewhat translucent and proper lighting is essential to see the fish in its full beauty. The overall olive shade has a yellow and blue-green sheen which is hard to describe. There is a suggestion of a lateral blue line and some yellow in the fins. This fish is always on the go but never dashes about wildly under normal conditions.

Well-fed parents won't eat their eggs but there is no particular point in leaving them in once the rather large yellow eggs of a spawning have been observed in the tank.

Rodney Yorke

our readers write

Readers are invited to express their views and opinions on subjects of interest to aquarists. The Editor reserves the right to shorten letters when considered necessary and is not responsible for the opinions expressed by correspondents.

Address letters to The Editor, *The Aquarist,*
The Butts, Half Acre, Brentford, Middlesex

Manufacturers' Apathy

I HAVE noted with considerable interest the recent correspondence on the subject of the F.B.A.S. Testing Scheme for apparatus and instruments. I have also noted, without surprise, the editorial comment to the effect that such a service is already available by *The Aquarist*, albeit badly neglected by most manufacturers.

From my own experience, I am convinced that no such scheme, whether free or charged for, can possibly succeed. This is due entirely to the apathy shown by most manufacturers to any suggestion put forward with the object of improving their products. There are, of course, a few notable exceptions, but on the whole these are found amongst the smaller firms who are still in the "striving" stage, and unable to rest on their laurels.

My firm, whilst admittedly of very little consequence when compared with the giants of the industry, is nevertheless in a very advantageous position to judge the products of others, for the simple reason that 90 per cent. of our business is concerned with the repair of other firms' products. In this, we can observe the type of fault most commonly occurring, and compare the one make with the other. In the light of several years' experience, we can now forecast, with almost complete accuracy, what particular fault is present in any item of well-known make submitted for repair, *before examination*.

To quote a case in point, one very well-known make of heater (and a very good one, by the way) appears to have an average useful life of about two-and-a-half years. By the introduction of a *very small* alteration in the material used for one component, the life could be extended by at least another year, and probably more. One cannot help thinking that the makers must be aware of this, as it is such a simple thing, and one is led to conclude that they consider two-and-a-half years to be good value for money, and not under any circumstances to be improved upon. On the other hand, this heater is in all other respects the best of its type at present on the market, and one cannot but feel that if the necessary improvement were to be made, it would not be long before the public realised that an extra year or so on the average life would make it the best "buy" obtainable. It all depends on the manufacturer's policy.

Finally, as regards the latter, I would say this. About four months ago, my firm circularised a section of manufacturers, to point out that we are in a position to supply facts, I repeat *facts* and not opinions, regarding the types of faults occurring in their particular products after a period of actual use. We also emphasised the difference between the results of actual use by members of the public, and results obtained on the test-bench. For this service we charged a fee, which, although very small, was sufficient to cover our expenses. The results were as follows: number of circulars sent out, 16; number of acknowledgements received, 3; number accepting the service, 2. The two firms who called for our reports immediately adopted the recommendations set out, and have expressed their pleasure at the outcome.

I think further comment would be superfluous.

L. WARBURTON,
Warburton & Company,
Stockport, Cheshire.

Mr. Jack Lester

MANY of your readers will have watched Mr. J. W. Lester showing animals on television and also enjoyed his lectures given to aquarist clubs. They will be grieved to hear of his untimely death. He leaves a widow and four daughters.

The committee of this Society has decided to open a memorial fund and would be glad to receive any sums of money for this, whether from members of the Society or not. The object of this fund will be, firstly, the erection of a small memorial plaque in the Reptile House of the London Zoo; this project has already been approved by the council of the Zoological Society. Any further money will be handed over to Mrs. Lester.

We should be very grateful if you could make your readers aware of this fund. Donations should be sent to the secretary of this Society. No sums are too big or too small for the fund to handle.

J. F. D. FRAZER, *President*
MONICA GREEN, *Secretary*,
British Herpetological Society,
c/o Zoological Society of London,
Regent's Park,
London, N.W.1.

Keeping Tubifex

I READ quite frequently in aquatic magazines about *Tubifex* being difficult to keep, only a few days seeming to be the average period for keeping them alive and then apparently only under constant running water. This rather surprises me, because I can keep *Tubifex* for 2-3 weeks and could probably keep them longer if the supply did not run out.

The method I employ is to put them in a bucket immediately I arrive home and give them a good swill under the coldwater tap (ours has quite a pressure, which is an

advantage because this really breaks the cluster of worms, giving them a thorough rinse). When the worms have settled to the bottom I pour off the water and then put them (usually a cluster 2-3 in. across) into a shallow enamel container measuring about 10 in. by 7 in. containing cold tap water to a depth of about 1 in. and kept in as cold a situation as possible. I repeat the above process at least every 24 hours or just before I feed them to my fishes. With this method I always have a healthy cluster of blood-red *Tubifex* handy for feeding to all my fishes, for chopping up into smaller pieces for younger fish and fry by placing a few on a piece of wood and using a razor blade.

I have fed *Tubifex* for years without any trouble and wonder sometimes what I should do if I could only keep them alive and healthy for a day or two!

K. SMITH,
Bradford, Yorks.

Electrical Circuit

THE article by Mr. G. P. Gladman in the November, 1956 issue of *The Aquarist* is erroneous insofar as the attempted electrical analysis of the circuit is taken. The "mathematical proof" that Mr. Gladman offers is neither mathematical nor proof; it is simply an attempt to apply Ohm's Law without taking into account variables of a first order that make the calculations useless.

In the first instance resistance of the lamps and heaters is calculated from their rated wattage, and it is assumed that this resistance is a constant. This is entirely wrong, especially for the lamps. Resistance is proportional to the temperature of the element and can be expressed approximately as $R_t = R_o(1 + \alpha t)$, where R_t is the resistance at temperature t, R_o is the resistance at zero temperature and α is the coefficient of increase of temperature with resistance, which of course depends on the material from which the element is made. Suffice it to say that the resistance of an electric lamp varies considerably with the amount of current flowing through it.

Mr. Gladman finishes his calculations by stating that the lamps are operating at 57 per cent. efficiency. If he had been correct in his resistance calculations he would have still been wrong in this, since the amount of light emitted from a lamp is proportional to the temperature of the filament, which is not in direct proportion to the power consumed by the lamp; for example, a 100 watt lamp made to consume only 50 watts by lowering the voltage applied to it would not give anything like 50 per cent. of the light that it would do when it was consuming 100 watts.

B. A. CURTIS,
Ripley, Surrey.

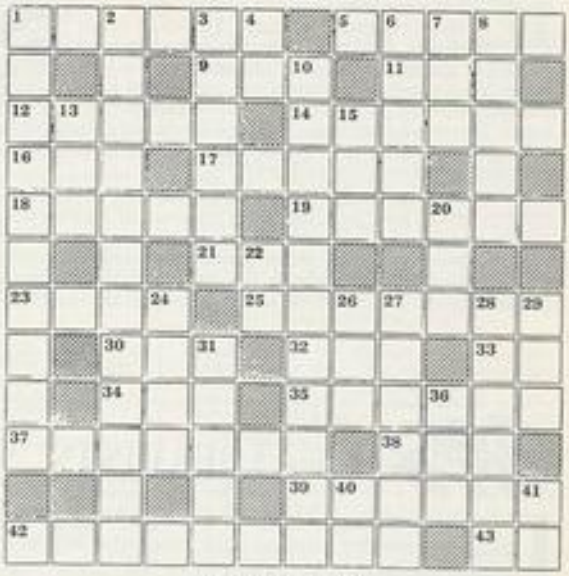
Glowlight Tetra

IN your November issue "Pisces" called the glowlight tetra *Hemigrammus erythrozonus*, the name that Mr. A. Fraser-Brunner considered to be the correct one. According to Axelrod and Schultz (*Handbook of Tropical Aquarium Fishes*) the correct name is *Hemigrammus gracilis*, since *H. erythrozonus* has two or more rays to the anal fin and approximately three more scales. Therefore, if these authors are correct, the glowlight tetra has twice been wrongly named.

C. MARRIOTT,
Southend, Essex.

The AQUARIST Crossword

Compiled by J. LAUGHLAND



CLUES ACROSS

1 Alternative to pearl for a lovely kind of gourami (6)
5 Bog (5)
9 A poet might conceivably so describe a goldfish bowl (3)
11 She is a leader in Idaho (3)
12 Egg-shaped (5)
14 Liza stands before the little road to catch the eye of the herpetologist (6)
16 Given the fin she might be a haddock (3)
17 Idol, but not the moorish variety (5)
18 Ignominious colloquialism for *Daphnia*, *Moina*, etc. (5)
19 This fish would certainly give the congé to any normal home aquarium (6)
21 Famous salmon river of Loch-invar fame (3)
23 Three of these are the distinction of one kind of gourami (4)
25 Exponent of natation (7)
30 These are opposed to the noes (3)
32 She returns from the centre of Paris (3)
33 A little look should give you the answer (2)
34 Clerk of the Privy Council (1, 1, 1)
35 Obtain from Erie, D.V. Er, dive? (6)
37 From the disc her zoic friends get lively music (7)
38 Orfe (3)
39 Drinkers cannot quite be winners (6)
42 Probably the lowest kind of fish ever seen through glass (4-5)
43 Little saint, but no angel fish (2)

CLUES DOWN

1 Platys (10)
2 Most commonly found loaches (12)
3 Treat with iodine (6)
4 Little credit for this (2)
6 Dry up (5)
7 Madam is a girl at heart (3)
8 This girl takes the biscuit (5)
10 Negresses mourning their husbands? (5, 6)
13 A bit of a saint, perhaps; or of aquatic grass (3)
15 I do this before I come back (1, 2)
20 Pearl gourami or African jewel fish? (3)
22 Steamer (1, 1)
24 Kind (4)
26 There is some heat when a thousand get out of the mire (3)
27 Pertaining to, or of, the sea (6)
28 Young eels (6)
29 Fish eggs (3)
31 Fighting fish of Siam do not regard this as a waste (5)
36 *Leuciscus idus* (3)
40 This is it! (2)
41 The Saint Again! (2)

PICK YOUR ANSWER

1. "To let leap a . . ." The missing word in the proverb is: (*a*) mackerel; (*b*) salmon; (*c*) trout; (*d*) whiting.
2. *Macrognathus aculeatus* (the arrow nose) is referred to the family: (*a*) Channidae; (*b*) Luciocephalidae; (*c*) Mastacembelidae; (*d*) Notopteridae.
3. Green rivulus is the popular name of: (*a*) *Rivulus cylindraceus*; (*b*) *Rivulus dorni*; (*c*) *Rivulus ocellatus*; (*d*) *Rivulus tenuis*.
4. Which is the largest of the following species? (*a*) *Barbus dunckeri*. (*b*) *Barbus lineomaculatus*. (*c*) *Barbus oligolepis*. (*d*) *Barbus semifasciatus*.
5. *Ranunculus delphinifolius* is indigenous to: (*a*) East Africa; (*b*) North America; (*c*) South America; (*d*) West Africa.
6. *Hemianthera* is popularly known as: (*a*) mud plantain; (*b*) mud purslane; (*c*) mudweed; (*d*) mudwort.

G. F. H.

(Solutions on page 233)

Sandy Road to Success

HERE is a modern "rags to riches" story of an enterprising American farmer. Stoddard Jess's starting capital a few years ago was an abandoned "dude ranch" in the Mojave desert. Located only a few hundred miles from the Pacific Coast, the ranch was cut off from coastal rains by towering mountain ranges. To obtain water, Jess dug a deep well. Then he irrigated a small patch of land. His next step towards making the desert land more productive was to grow turkeys.

From then on things started taking care of themselves. Turkey litter, used as a fertiliser, resulted in an excellent alfalfa crop, which was used to feed the turkeys. This resulted in more litter, more productive land and more alfalfa. So much more alfalfa, in fact, that beef cattle were brought in to eat some of it. Meanwhile the patch of productive land grew; the need for water did also, so Jess built a series of ponds. The ponds were "seeded" with baby trout which promptly multiplied.

The result? Now, in addition to marketing turkeys, livestock and alfalfa, Jess also markets over one million trout a year from his own packing and quickfreeze plant.

The antibiotic Terramycin, Jess claims, has helped to keep his business a thriving one. In addition to safeguarding his turkeys and livestock, Jess states: "Occasionally the trout in the ponds begin dying from diseases of unknown causes. I have been able to clear up the trouble by adding Terramycin to their diet."

This true success story was reported in the U.S. farming journal, *Farm Quarterly*.

(*Editorial note:* In the United Kingdom, Terramycin is governed by the Therapeutic Substances Act. It must be administered in conjunction with a veterinary practitioner.)

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.

AT a recent competition held by the **South-West Middlesex Aquarist Association,** the Diana M. Charles trophy was won by Riverside Aquarium Society who beat **Spelthorne Aquatic Circle** by 23 points to 14 points. In the Coldwater competition the placings were: 1, Spelthorne Aquatic Circle (Goldfish); 2, Uxbridge Aquarist Society (Fantail); 3, Southall Aquarist Society (Shubunkin). The best fish of the show was an *Apistogramma agassizi* belonging to Mr. B. Ainsworth of Riverside.

* * *

AMONG the recent activities of the **East London Aquarists' and Pondkeepers' Association** was a film show. The meeting nights are the first Friday and third Tuesday in the month at which new members and other clubs are welcome. The hon. secretary is Mr. D. A. Gregg, 54, Castle Street, East Ham, E.6.

* * *

RECENT activities of the **Edinburgh Aquarist Society** included the annual Aquaria at Home competition for the Smith Trophy. The result was as follows: 1, Mr. Lawrie; 2, Mr. McDonald; 3, a tie between Mr. Kennedy and Master Prior.

* * *

AT the annual general meeting of the **Bridlington and District Aquarist Society,** Mrs. M. Lambden was returned as chairman, and Mr. L. Wardell as hon. secretary. It was proposed to hold the annual dinner early in February.

* * *

A LARGE entry was received by the **Cambridge and District Fishkeepers Club** for their members, table show. The best fish in the show was won by Mrs. D. Felts with a fine siamese fighting fish which also won for her the Sadler Trophy. Other results were as follows: Livebearer cup, Mrs. D. Conder; Fuller Shield (Coldwater), Mr. Fuller; Yallop Shield, Mrs. D. Felts; Lambert Shield, Mr. Thurston; Pairs Cup, Mr. Savidge; Reserve Cup, Mr. A. B. Wilson.

THE **Bath Aquarists' Society** annual meeting was held last month. The chairman, Mr. P. J. Simmons, was re-elected, the new treasurer being Mrs. O. E. Roose.

* * *

LEEDS **and District Aquarists' Society** enjoyed a visit recently from their neighbours, the **Bradford and District Aquarists' Society.** The result of an informal inter-society quiz was a draw. The annual general meeting will be held in January.

* * *

THE **Sheppey Aquarist Society,** in association with the Kent Education Committee, invited George Cansdale to lecture at the Sheerness County Secondary School for Boys recently.

The audience consisted of members and friends of the Society, together with governors of the school and a number of boys and girls. Dr. M. DeLacey, O.B.E., T.D., President of the Sheppey Society, presided at the meeting which was illustrated with black and white and colour slides. A popular feature of the evening was the introduction of "Polly," the bush-baby, and one of Mr. Cansdale's pythons.

* * *

AT the societies' Annual Show held in conjunction with Crayford U.D.C. Arts and Crafts Exhibition, the Hallett Trophy for inter-club Furnished Aquaria was shared between **Greenwich Aquarists' Society** and **Erith and District Aquarists' Society.** The public judged the members' aquaria and the final result was a win for Mr. Croucher with a tank of tiger barbs. At the Greenwich Society Exhibition held at Charlton House, the **Erith and District Aquarists' Society** competed in the Tropical and Coldwater competition, and obtained the first award in both classes.

* * *

MIDDLESBROUGH **and District Aquarist Society** exhibited a display of furnished aquaria at the Chrysanthemum Show held recently at the Town Hall. As a result a number of new members was obtained making the efforts worthwhile. Although attendances early in the year were poor and disheartening there is now a strong following in the district and this is most encouraging to the committee in providing new interest within the club. The annual meeting will be held in January.

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AT the last meeting of the **Leinster Pond and Aquarium Club,** Mr. George Crisp gave a talk on "Live Foods." A competition with Gallaher's Aquarists' Club resulted in a win for Leinster.

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In the semi-final of the Federation of Irish Aquarist Societies T.E.A. Cup, **Derry Aquarists** reached the final with a close win over Ulster.

* * *

NORTHAMPTON **and District Aquarist Society** held their 10th anniversary dinner at the Wedgwood Chambers. The president's wife, Mrs. A. Vernon Ashford, presented the awards for the year's activities, and these were won by Messrs. W. H. Snedker, N. E. Lyon and Tony Dascombe.

* * *

AT a recent meeting of the **Gloucester and Cheltenham Aquarists' Society** the members were given an interesting talk by Mr. C. Roe of Shirley Aquatics, on his experiences of fish collecting and fish-keeping. A table show was won by Mr. Leaney.

* * *

MEMBERS of the **Southport Aquarist Society** held a "quiz" against a team from the **Merseyside Aquarist Society.** The quiz lasted nearly the whole evening and was won by the visitors by 39 points to 31 points. A tank has recently been set up in the Publicity Showrooms, Cambridge Arcade, by Mr. Hilton, chairman of the society, and Mr. J. Taylor, a committee member. It is hoped that it will be of interest to the many using the arcade.

* * *

HOUNSLOW **and District Aquarist Society** heard Mr. Russell, one of its members, give an interesting talk on how he built a fish house and explain the most successful method of heating and running it. Mr. Russell has also bred many types of tropical fish in addition to growing many kinds of cactus plants.

* * *

THE recently formed **Widnes Aquarist Society** held an interesting meeting when one of the members, Mr. A. Morris, lectured on the breeding of zebras. The society unanimously accepted a proposal from the **Warrington Aquarist Society** that membership of one club should automatically confer membership of the other.

* * *

MEMBERS of the **Nottingham and District** and the **Burton-on-Trent and District**

Aquarists' Societies were the guests of the **Derwent Aquarist Club.** Dr. F. N. Ghadially was the lecturer, the subject being "Feeding the Fishes." His lecture was illustrated with lantern slides made from photographs taken by himself. Mr. D. Hunt, of Draycott, won first and second awards in a Table Show of "True Pairs of any Variety."

* * *

AT a recent meeting of the **Peterborough and District Aquarists' Society** the evening's speaker was Mr. Tomblesen. His main theme was native fish suitable for pond and aquarium. Dealing first with pond fish, he stated that rudd, dace, bream, carp, tench, roach, perch and the common minnow were all suitable although breeding presents some difficulties in most species. Several interesting specimens were available for inspection—the most unusual one being a lamprey.

* * *

AT a public exhibition depicting the progress of the Borough, **Stourbridge and District Aquarists' Society** were allocated a leading position. Literature, giving detailed accounts of the society and its activities together with awards and photographs, was displayed and an attractive tank was also on view. Recent table show winners were Mr. G. Adams, Mr. J. Bennett and Mr. B. Davis. Miss Pearl Bennett was the trophy winner for the highest aggregate of points during the year.

* * *

NUNEATON **and District Aquarists' Society** were given a lecture by Mr. C. Roe on the subject of Aquarium Plants, especially the new varieties which have been recently discovered. It was stated that there are now so many of these that a reorganisation of collections of aquatic plants is now in progress by leading botanical centres.

* * *

THE annual general meeting of the **Federation of Guppy Breeders Societies** will be held on Saturday the 19th January at Friend's House, Euston Road, London.

* * *

HORNSEY **and District Aquarist Society** reported a successful year at their annual general meeting held recently. Apart from the many table shows, in outside competition, the Club had been successful at quite a number of shows during the season. Much information and expert advice had been given to individuals and bodies possessing aquaria. The secretary is F. Hazell, 18, Muswell Road, Muswell Hill, London, N.10.

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 **2s. 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.

THE annual cup competitions of the **Brighton Amateur Aquarists** resulted as follows: Show Tank Competition—1, Mr. J. Wilson; 2, Mr. R. Coldman; 3, Mr. M. Barker. Livebearers—1, Mr. J. Wilson; 2, Mr. R. Coldman; 3, Mr. Illmanoff. Egglayers—1, Mr. F. Braby; 2, Mr. J. Wilson; 3, Mr. R. Coldman. Best bred fish of the year—1, Mr. F. Braby; 2 and 3, Mr. R. Coldman.

* * *

THE following officials were elected at the annual general meeting of the **Hastings and St. Leonards Society**: Chairman, Mr. L. Quickenden; Secretary-Treasurer, Mrs. H. M. Wilson; Public Relations Officer, Mr. G. H. White, 24, Woodbrook Road, Hastings. Aquarists interested in membership should contact Mrs. H. M. Wilson, 4b, St. Matthews Road, St. Leonards. The monthly meetings are held at the Citizens Advice Bureau, Hastings, on the first Wednesday of each month at 8 p.m.

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AMONG the coming events of the **Nottingham and District Aquarists' Society** will be an illustrated lecture on plants by Dr. Kaminsky, at the general meeting on the 29th January at Church House, Park Row. Mr. and Mrs. Webley, who have now moved away, have been asked to become vice-presidents of the society.

* * *

AYLESBURY **Aqualife Association** held their annual dinner and social last month. During the evening the members and friends were entertained by a showing of coloured photographs.

* * *

DECEMBER was a busy month for the **Dublin Society of Aquarists.** The society installed a tropical tank in the Children's Hospital, Baldoyle. The chairman, Mr. T. Walker, said that this was the fifth tank presented to hospitals. At the annual party a record number of members attended and after dinner the Society's cups and trophies were presented. During the month the Society's judges attended the first council of judges of the Irish Federation of Aquarists. All information regarding the above society may be had from the hon. secretary, Mrs. E. Spurling Jewell, 89, Walkinstown Road, Dublin.

* * *

MEMBERS of the **Walsall Aquarium and Pool Society** held their annual dinner last month. Mr. S. Millis-Clarke, president, in proposing the toast of "The Society," said the society was still doing well. Though it was not very strong numerically it was very strong in spirit. Mr. Whiting, in replying, said that the only way to increase membership was to get as many young people as possible interested in the keeping and breeding of fish. He also stressed that the society was strong because of the spirit which existed between the members.

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AQUARISTS of the fair sex were well to the fore at the **Leicester Aquarist Society** annual dinner, where Mrs. E. G. Harding and Mrs. H. Speak were awarded the first and second prizes for obtaining most points in the season's competitions.

Changes of Secretary

CHANGES of secretaries and addresses have been reported from the following societies: **Redhill and District Aquarist Society** (P. R. Keeley, 137, Hitchings Way, Woodhatch, Reigate. Tel.: Reigate 3975). **Bath Aquarists' Society** (L. E. J. Challenger, 6, Belmont, Bath). **Bromley Aquarists' Association** (J. B. Lucas, 174, Village Way, Beckenham). **Yeovil and District Aquarist Society** (M. Entecott, 93, Highfield Road, Yeovil. Tel.: Yeovil 839). **Merseyside Aquarists' Society** (B. T. Roe, 9, West Way, Liverpool, 15. Tel.: Chi 3655.)

More than 20 varieties of tropical fishes in separate aquaria and a small display of marine aquaria were seen by over 7,000 visitors to this exhibition staged by Weymouth and District Aquatic Society

Crosswood Solution

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PICK YOUR ANSWER (Solution)

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

CLASSIFIED ADVERTISEMENT ORDER FORM

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