

The AQUARIST AND PONDKEEPER

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QUERIES

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The Editor accepts no responsibility for views expressed by contributors.



Photo:

"The Star"

Weighty exhibit at London Zoo Aquarium is this 44 lb. carp, caught by an angler last month (see page 193)

Editorial

THE strange sight of masses of white foam bedecking the surfaces of our rivers, a happening reported from many parts of the country recently, is not one to gladden the eye of the naturalist. It was called a "terrible phenomenon" by Mr. Justice Vaisey in the High Court of Justice last month, although it is but new evidence of an older and no less terrible state of affairs.

Synthetic detergents now widely used in homes and factories are responsible for the excessive water frothing. By giving this tangible evidence of their presence in natural waters these agents direct attention to the extent to which rivers are still being used as readily available disposal channels for town sewage and industrial wastes. Along with the foam go other materials whose presence is less easily detected. Less easily detected, that is, by others than the naturalist, aquarist, angler or river-user who chooses to look carefully below the water surface. To these observers the sight of disappearing aquatic plant and animal life is evidence enough, and all too familiar evidence at that.

It cannot be doubted that public awareness of the evils of river pollution is growing, and the laws in existence to deal with pollution are certainly being more frequently and more rigidly applied. Yet the legal proceedings in which the above observation of His Lordship was delivered, when Luton Corporation successfully applied for a further suspension of an injunction, requiring them to prevent pollution, first made over four years ago, also demonstrate with what vigilance the matter needs still to be pursued in order to ensure effective remedial action being taken.

A Merry Christmas
to all our readers

IN THE Water Garden—by Dr. W. E. SHEWELL-COOPER

LET us talk this month about some of the favourite rock garden plants, bearing in mind those that are so useful for the crazy paving which surrounds the pools, or for the rock garden area which may easily have been planned in conjunction with the water.

I would like to start with the New Zealand burrs—low-growing carpeting plants with attractive foliage and inconspicuous flowers. I always think the leaves are the prettiest part of the plants because they can be had in varying shades. These plants are very suitable for steps or paving, because they will put up with a certain amount of traffic. They thrive in sun or shade and will grow in almost any soil. However, do not plant them near to your pets or you may lose them because these New Zealand friends scramble all over the place!

My favourite is *Acaena microphylla*, which has very decorative bronze leaves and though the flowers are not much the seed heads are covered with bright red spines. *A. m. mermis* has bronzy leaves, too, but they are slightly larger than the former and the rather dull little flower heads are borne on four-inch stems. From New Zealand we come to South Africa, where we fall in love with the shrubby blue daisy known as *Agathea coelestis*. This is not really very hardy, but what I always do is to put a few cuttings in a pot of sandy soil and keep this in a frame during the winter; then I have plenty of replacements should there be any calamities! Normally the plants only grow nine inches high, bearing clear, true-blue flowers with a golden centre.

If you like a prostrate little plant not unlike clover then try *Anthyllis montana rubra*. It only grows three inches high and produces masses of crimson flowers in June; if you want to increase it, it is quite an easy matter to take cuttings of soft side shoots in the summer. A plant with a very peculiar name, "spilt milk," is *Arenaria balearica*. This gets its nick name because it produces thousands of tiny white flowers in May and June, and they cover the face of the rock if planted in a moist position in semi-shade. There is no rock plant that produces such a close carpet of little green leaves.

Very often I am particularly asked for plants that prefer shade or semi-shade, and I am happy to be able to recommend the woodruff for this position. It is a low-growing plant with narrow leaves. You will like *Asperula hirta*, which makes underground shoots and would easily run through stony soil and cover a large area. The white flowers are produced in July and August and they gradually fade to pink. You find them on stems three inches long. A better plant by far is *A. ruberosa*, but, unfortunately, it needs some protection from winter damp because it has grey woolly leaves. It produces lovely delicate pink trumpet flowers in June and that is a great thing in its favour.

A very useful little carpeter that will grow almost anywhere is *Cortusa squalida*. It can easily be increased by division, it is not easily killed either by walking on or by cold, and it produces lovely bronzy green leaves plus somewhat inconspicuous flowers. It never grows higher than an inch. The mountain avens is another that can go into the carpet group. It has stronger leaves than many of this type and it produces quite nice flowers plus attractive seed heads. It is worth recommending because it will do in semi-shade or in sun, and it is quite happy in very light land. Its correct name is *Dryas octopetala*. The flowers are white and have golden anthers, followed by fluffy seed heads. The plants are at their best any time from June to August.

Some of you will want to plant a few of the baby bulbs you have seen at shows. You know—the little daffodils that do not grow more than three or four inches high. One of the best carpeters for these is *Globularia bellidifolia*. This likes to be planted in a sunny position where the soil is well drained—the leaves are dark green and shiny, and the round heads of powder-blue flowers are brilliant in June. I love blues, and here is a plant which only grows three inches high and yet which looks magnificent. If you want a slightly taller type then grow *G. tricoastha*, which spreads very quickly indeed but produces its flowers on stems six inches tall.

FRIENDS & FOES No. 9

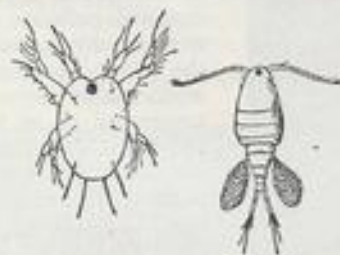
NON-PARASITIC COPEPODS

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

CLASS:—Crustacea, from Latin *crustaceus*—having a shell.

THERE are over 100 different species of these beautiful little creatures, ranging in size from mere specks to just over one-eighth of an inch. Volumes have been written on them, but to the average aquarist they will all be classed as "cyclops," whether they are or not. Some of them carry very long antennae, some quite short; some females bear two egg sacs—others only one, and these sacs are often beautifully coloured. Invariably the males are smaller than the females. Both swim in very rapid jerks.

Food usually consists of dead and



decaying animal and vegetable matter. I have quite often heard it said that "cyclops" will attack fishes and fry, but unless they are parasitic species like those described last month I have no evidence to support such a contention. I do know, however, that vast numbers of the little creatures are consumed by

Non-Parasitic Copepods

most species of fishes, and the new hatched nauplii form an admirable food for baby fishes.

Frequently in the spring and summer months "cyclops" will be found which appear to be suffering from fungus. This is often so thick that it hampers their movements. Examination of such specimens will reveal that the apparent fungus is actually tremendous colonies of a small Infusorian—*Cothurnia*, which somewhat resembles *Vorticella* (the bell animalcule).

One species of tapeworm, which undergoes different stages of development in different creatures, regards *Cyclops* as a halfway house and parasitises it, hoping for its host to be swallowed by a fish in order to continue its evolution.

C. E. C. Cole

THE AQUARIST

The Air-Bladder in Selective Breeding

by ————— N. E. PERKINS

Photographs by L. E. PERKINS

MUCH has been written on the subject of air bladders but, as with all matters relating to biology, many partial truths have been accepted as whole truths. Now, while we may sometimes recognise tendencies, it is as well to realise that the whole truth may never be ours, for to know the whole truth, even of one small part of living matter, would be to know the secret of life itself. To be dogmatic about a subject may influence others to believe that one is an authority on that subject but all too frequently such individuals who adopt this attitude have little experience of the subject in question; were it otherwise they would be more humble for, to quote Maerterlinck: "To estimate more and more completely the extent of what it does not know is all that man's knowledge can hope for."

However, we are able to conduct various experiments and to draw our conclusions from the results. That these conclusions may have to be modified from time to time as a result of further experiments is obvious but the accumulation of ideas engendered by such experiments tends to widen the field of approach.

It has been said that the hind lobe of the air bladder in the round-bodied types of goldfish assumes a larger size to compensate for excessive caudal development and shortened body. Now, knowing that the external characteristics of these fish are capable of such great variation, it would surely be absurd to imagine that the internal characteristics accurately follow a set plan. The best that can be said is that there is a tendency for the hind lobe to enlarge but that this is not always achieved. Of course, with the shortened body comes the need for much greater accuracy in the mechanism of balance (try balancing a cube of wood on a knife edge as against balancing a ruler on the same knife edge). I have opened and examined many specimens of the twin tail varieties and have found the air bladders vary in comparative size in every case and in one case there was but one lobe, this being almost spherical.

If we examine a newly hatched fish under a low power microscope we shall find no air bladder present. If we continue to examine specimens at intervals we shall find, after one or two days (temperature controlling rate of

jar containing submerged muslin-covered glass cylinder holding eyed ova, used in the experiment described



development), that a small bud has appeared as an off-shoot to the gullet. This gradually develops, becoming first one air bladder and, later, two. If the young fish under observation happen to be veiltail goldfish we shall be struck by the fact that the air bladders, plainly discernible up to three weeks after hatching, are quite normal for any common goldfish and show no sign of any development of the hind bladder. We may notice a few deformities, such as the presence of one air bladder instead of two at an age when the two should have developed, but these occurrences will be rare. It appears from this that any development in fry would be fatal since it might, by causing the fish to float tail uppermost, prevent the creature from obtaining food and preclude its ability to take advantage of the oxygen in the atmosphere should the necessity arise.

I recently set up an experiment to satisfy myself that this free air was necessary for the initial growth of the air bladder. A few "eyed ova" adhering to blanket weed were chosen and kept below the surface of the water by means of a glass cylinder covered with fine muslin. The jar containing this cylinder was then wrapped in black paper to exclude light, thereby preventing the possible formation of oxygen by plant photosynthesis and the subsequent collection of this gas under the muslin. Such a pocket of free oxygen below the surface, in a position where the fry had access to it, might have defeated the object of the experiment although further experiments will be necessary in order to verify this for the nitrogen content of air is probably necessary also. Eyed ova were chosen because, with the



Danubian catfish dissected to show single air bladder at centre of gravity



Normally developed air bladder of the goldfish



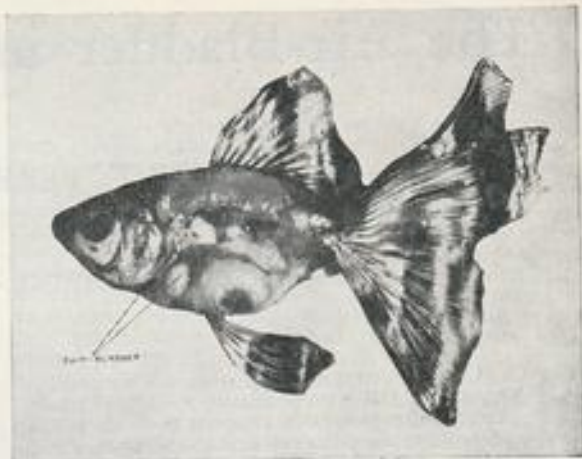
exclusion of light, the blanket weed would speedily die and the formation of bad gas as this occurred might asphyxiate the ova before it had time to hatch. (I have had this occur on a large scale due to the removal of blanket weed on which fish had spawned from an outside sunlit position to an indoor sunless tank.)

As the ova hatched some were allowed to escape from under the cylinder to the surrounding water in the jar. It was very noticeable that those fry remaining under the cylinder continually tried to penetrate the muslin and although growth occurred (they became twice as large as when first hatched) they did not develop air bladders and died after one week. The fish in the jar had all developed air bladders after three days. From this it would appear that goldfish fry must obtain free air to start the development of the air bladder.

When the position of the air bladders of various species of fish is considered it appears that their centre of gravity is the guiding influence. The Danubian catfish, in which the weight is concentrated mainly in the head, has the bladder—single lobed—situated just behind the head. Where the fish is streamlined with no particular concentration of weight, as in the herring, we find a long cylindrical bladder. In this particular case an inlet from the gullet is retained, and there is also an outlet to the vent, thereby enabling the species to cope with considerable variations of water depths.

Most breeders of the twin tail varieties of goldfish have come across specimens which seem continually to be back-peddalling in order to maintain their balance. These fish, if opened, will frequently show a faulty development of the air bladder. It is probable that indiscriminate crossing of types of goldfish has created numerous difficulties for a balanced development of the offspring and that these contradicting tendencies persist in many of the fish bred from such a strain.

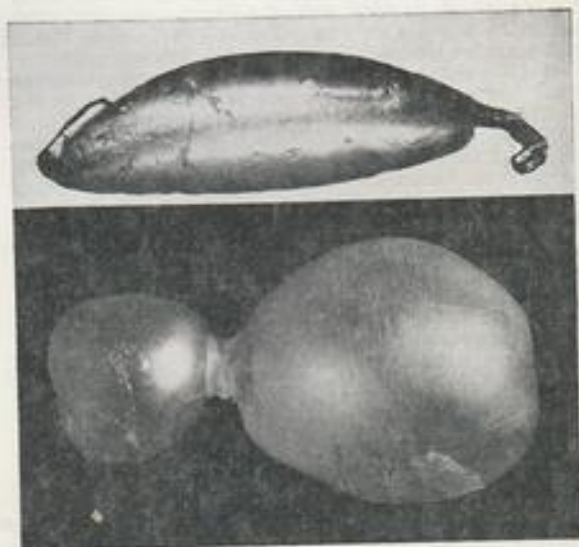
These fish may be subjected to inherited tendencies which are in conflict with the mechanical laws of nature so far as the fish's survival or balance are concerned. To suggest that mechanical laws so affect genetical tendencies that they are immediately compelled to conform does not bear investigation and reminds one of the two schools of thought: Mendelism and Lysenkoism. Over a long period, of



Left: Veiltail goldfish swimming abnormally owing to abnormal development of air bladder. Above: Veiltail goldfish dissected to show the abnormally enlarged front lobe of air bladder which caused imbalance

course, the effect might be decisive, but many generations may have to pass under that influence before all traces of conflicting inheritance are removed. It is probably true that all properties of matter are the result of the pressure of environment providing we set no limit to the time required.

When breeding the twin tail varieties of goldfish it is, therefore, very important that fish showing any sign of unbalance should be discarded and only the more vigorous and robust specimens retained. This, in the long run, will prove more satisfactory than the retention of those which appear to approach the standard more nearly for shape and colour but which have constitutional defects.



Upper picture shows air bladder of the common herring. The normal air bladder of the veiltail goldfish, with its large rear lobe, is shown below

OUR EXPERTS' ANSWERS TO READERS' QUERIES

I have an angle-iron frame measuring 48 ins. by 18 ins. by 24 ins. and would like to know what sort and thickness of glass I should use to glaze it.

Three-eighths plate-glass may be used for the sides and ends; the base should be of toughened glass or wired glass of the same thickness.

I have a community aquarium populated by swordtails, guppies, beacon fish, catfish, black mollies, fighting fish, paradise fish and small angel fish. A few days ago I noticed one of the angel fish lying on the bottom, and closer inspection revealed that most of its long ventral fins were missing. Do you think the paradise fish were to blame?

It is not unlikely that the angel fish got the worst of an encounter with one of the paradise fish. Paradise fish are very untrustworthy, and are best kept among their own kind or with fish well able to take care of themselves. Angel fish are soon injured if they receive a bang on the side, and paradise fish are adept at giving out bangs to more timid fishes. However, your fish may not be permanently injured; and so long as it is not subjected to fresh attacks and the temperature of the water is kept constant, it should make good recovery. Meanwhile, help it regain confidence by feeding it with nourishing live food.

After our female guppies have babies, they become "bumpty-backed" and their tails droop down. One or two of them have died soon after having young. Can you tell me what is wrong with our fish?

It is doubtful if there is anything wrong with your fish. Livebearer females always take a few days to get over the effects of bearing young, and until they make full recovery they always look rather "droopy" and emaciated. Probably the fish that died were old. The life span of a female guppy is not much more than two years, and the strain of delivering a brood of young at an advanced age often leads to rapid deterioration of health and sudden death.

I have two black and green-spangled fish which I bought as a pair of black swordtails, but they both look the same, and neither has the characteristic prolongation of the bottom rays of the caudal fin to form a "sword." Would you say I have two females, or just two fish as yet immature?

Some black swordtails never develop a proper sword-shaped tail-fin. All the same, the sexes can be distinguished by comparing anal fins. The male has his anal fin modified to form a gonopodium; the female has a fan-shaped anal fin. If your fish are young it may be some little time before sexual distinctions can be seen. A tropical temperature and plenty to eat will hasten development.

I have a pair of *Hyphessobrycon gracilis* which spawned in a newly cleaned and set up aquarium. After the eggs hatched out, the fry vanished into the plant life and have not been seen again. I presume they are dead. Can you tell me something about the breeding requirements of this fish?

Hyphessobrycon gracilis is not one of the easiest species to breed. After the eggs have been laid, the parent fish should be removed to fresh quarters. The temperature of the breeding tank should average about 74° F., and the water should have an acid reaction. Bright light inhibits the development of the eggs, and most successful breeders of this species say that shady surroundings are best for eggs and fry.

Can you tell me why eggs laid by my angel fish failed to develop? Although they were fanned by the parent fish they soon turned white and became covered with fungus.

It may be that your aquarium is getting too much bright light. The eggs of cichlids often develop fungus disease when the light is too strong; shady aquariums suit them

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.

best. Some breeders say that acid water is essential, but this is a matter of opinion, for many breeders have hatched fine broods of fry in water having an alkaline reaction. Separate your fish for a week or two, then try them again in shadier conditions.

For about three months I had a Madagascar lily bulb in a submerged earthenware pot. As it failed to grow I uprooted it and replaced it with a new one. I did not renew the compost. Soon after doing this I noticed the fishes were drooping their caudal fins, and before many more hours had passed all of them were dead. What was the cause?

It is likely that you went wrong in not throwing away the compost in the pot when you uprooted the original lily. If the first lily failed to grow there must have been considerable pollution and poisoning of the water. Uprooting it released more poison into the water and so killed your fish. If plants with plenty of rootstock, thick rhizomes or potato-like tubers fail to grow, do not hesitate to throw them away at the earliest possible moment. Left in the aquarium they pollute the compost and suffocate the fishes by producing poisonous gases.

I have recently bought a glass tank which has been used for preserving eggs. The interior is badly stained with the water-glass used. Can you suggest some way of removing the stains?

So long as your glass tank is not actually scratched, or the surface damaged, it may be cleaned with ammonia. If this fails to remove the stains, we advise salts of lemon. This is dangerous to leave around and must be used with care. Apply it to the inside of the glass with an old brush and, after rubbing it over the surface, wash the aquarium out with several lots of water. Soaking the aquarium overnight in strong soda-water might do the job as well as salts of lemon, and without so much time and energy being expended.

Can coal be used to decorate a tropical aquarium?

Coal can be used as a planting medium and for building up a background in a tropical aquarium. Before introducing it into an aquarium it must be soaked for several days in a bucket of water, but pour away all scum and fine particles, and rinse thoroughly and scald with boiling water before spreading it over the bottom. Plant life seems to prosper in a coal bed, and the water always looks healthy and clear, providing, of course, that uneaten food is not left to foul the bottom.

How can I stop the growth of blue-green algae which is spreading over the sand, over the rockwork, and is smothering the higher plant life?

There is no guaranteed way of calling a halt to the spread of blue-green algae. In time it dies away of its own accord. But it can be encouraged to grow by some rockwork, and some planting composts containing limestone chippings and crushed shell. Empty your aquarium of water, plant, and fish life, and after wiping the inside all over with a rag, layer the floor with a thin covering of peat mould. On top

of this spread the usual two-inch thickness of sand or fine grit. You will find that the peat does a lot towards keeping the water acid, and this will help to prevent the growth of all algae growths, though it in no way retards the healthy growth of higher plant life.

On returning home the other evening I found my male fighting fish had built a bubble nest though he was separated from the female by a glass partition. I removed the partition, and the couple spawned. Both fish worked hard collecting the eggs and blowing them into the nest. Then the male chased the female away; so I removed her to another aquarium. After doing this, I noticed that the male seemed to lose all interest in the nest which, by the next day, had practically disappeared.

COLDWATER FISHKEEPING QUERIES *answered by* A. BOARDER

I am about to set up a tank which has the base and ends of teak. It is water-tight but I think it will look dull. Can I paint the teak cream and would ordinary paint stay on the wood under water?

I do not think that the paint will last well under water. There is really no need to paint at all, as after some time the ends would green up with a growth of algae. You can also plant the ends rather densely with sufficient plants to hide the wood or insert a piece of green glass at each end and secure it with bitumastic putty; better still, why not a piece of mirror glass? This, if kept clean, would give a reflection so that the tank would appear almost endless and the number of fishes multiplied.

I have two goldfish in my pond but cannot keep the water clear. The pond is 3 feet by 14 inches wide and 9 inches deep. I had soil in the bottom, a water lily in a basket, a few big stones and some chips. Can I add more plants now and which shall I use?

Your pond is very small and when you consider that you have a basket with a lily, stones, soil and chips, there is not much room for fish. I do not think it is any use adding more plants as they will not grow much, if at all, at this time of the year. Most plants are dormant during the winter. Stop feeding on dried foods for a time, remove the soil from the pond and the water may clear by itself. It will be safer to take the fish indoors for the winter as your pond may freeze almost solid during a severe spell.

My fish have gill flukes. I have only one tank and so am unable to remove them into another tank. Could you give me a cure?

The usual method for clearing fish of gill flukes is to catch them and give them a Dettol bath. This could be done in a washing bowl. If you do not want to do this you can try the methylene blue treatment. Have a 5 per cent. solution of methylene blue in water made up by your chemist and add two drops to each gallon of water in your tank. It is possible to add a similar dose the next day. Be careful when adding the blue as it is easy to let too much drop in at a time. Run the drops into a cup in the first instance and then the solution can be added to the tank in safety. Fish can live in the blue for a long time whereas diluted Dettol will kill fish left in it for more than about 15 minutes.

I have golden orfe, shubunkins and goldfish (average size 4 ins.), all thriving in my pond, 10 feet by 6 feet and 15 inches deep. I fear frost in the winter and could put the fish in large tanks indoors for the period. Do you advise this latter?

The pond is rather shallow and I should not feel that my fish would be safe outdoors in such a pond in my district—but you live on the Isle of Wight, and I doubt very much

No fry resulted from this spawning. Can you tell me what went wrong?

Your bad luck was probably due to the disturbance of the nest when you removed the partition. It is unwise to interfere with the fish during the latter stages of courtship, or actual spawning. However, the fish should be ready to spawn again after two weeks' rest. There is no need to remove the female immediately after spawning, that is, unless she is being very badly treated by the male. When it becomes necessary to remove one, or both of the parent fish from the spawning tank, it is best to do this after dark, when a small net can be introduced into the aquarium without disturbing the nest or scaring the wits out of the fish.

whether you will get enough frost to do much harm to your fish. The cold in itself will not harm your fish and I do not think that there is much chance of the pond freezing solid. You could put the fish indoors if you wish as you appear to have sufficient room in your tanks, especially whilst you clean out the pond. I do feel, however, that if adult fish are kept at too warm a temperature during the winter they do not appear to breed as well the following year as if they had received colder treatment. Considering all points, I think that your fish can be safely left outside.

I am soon going to glaze a 36 ins. by 16 ins. by 16 ins. tank with 1/2 in. plate glass. Can you give me a reliable formula for a long-lasting and leak-proof cement which could be made at home?

I do not think that it is worth while making the glazing cement. There are so many kinds on the market and several are advertised in *The Aquarist*. Ordinary putty is quite good, and it would only cost you about a couple of shillings to do the job. If you want to make your own you can do so with fine powdered whiting and white lead with sufficient linseed oil to make it plastic. A little gold size could be added. See that the cement is free from all hard lumps. When glazing place the base in first, then the sides and finish off with the ends. Do not continue the pressure at the edges until nearly all the cement has been squeezed out. Enough must be left to take the strain of the weight of water, which should be run into the tank as soon as the glazing is done.

I have had a tank given me which has a metal base; this is rusting. Is there any special paint which will stop this rusting?

There is a new paint on the market which, it is stated, can be applied over rust and it appears to galvanise it. I should feel inclined to clean off most of the rust first, although the makers say this is not necessary. If the metal is badly worn it might be better to use some cement and fine sand. Use equal parts, mix well and add water to make it rather sloppy. Run this all over the base of the tank and I think that it will be all right. I have some tanks in use now which I treated in a similar manner many years ago and they still hold water. After the cement has slowly dried you must wash out the tank thoroughly so that all the free lime is removed. The failure to clean out the lime can cause death to your fishes.

I am a beginner at fish-keeping. Can you tell me the difference between male and female in coldwater species?

The coldwater fishes usually kept are all egg layers. These are not at all easy to sex. Many types and species have no easily recognisable differences. In some fishes the male carries white tubercles on the gill covers but this character can vary in different fishes of the same species.

When fishes are in breeding condition the female usually has a plumper body than the male. With some of the short-bodied types of fancy goldfish it is not always an easy task to sex these kinds; even experienced fish-keepers can be mistaken.

I have been offered some baby orandas of about three-quarter inch body length. How can I tell which are likely to make good fishes?

It is a very difficult task to pick out good orandas at such a small size. I could not do it myself and so I cannot tell you how to do it. I could, however, pick out all those which would never make good ones, and that would be something to start with. The most important feature of the oranda is the hood. This should be in the form of a large raspberry covering the whole of the head. This does not develop until the fish is at least a year old as a rule; sometimes two years must pass before you can be sure that the fish will be well hooded. There are many other points for you to examine and so I will tell you how to start. First look for fish with a good "cobby" body. Refuse those with a flat back and those with a snout. The back should rise from the mouth in a nice sweeping curve. The body should approach a sphere in form. The tail (caudal fin) should be completely divided. It should not be deeply forked like a fantail's but should show a tendency to be very full and flowing like the tail of a veiltail. The tail should be well developed even in such a small fish and it should already show a tendency to droop. It must not be held as stiffly as that of a fantail. The anal fins must be paired. If you find fishes with these points you will be well on the way to finding good ones, and as for the hood, you will have to wait for this to develop. Of course, even if you do pick out fishes such as I have described, there is no certainty that they will all get the correct head. Time alone will tell.

I collect *Tubifex* from a pond near here, but I also get plenty of mud. How can I separate the *Tubifex* from the mud?

The best way to clean *Tubifex* is to use a sieve like a large tea-strainer. Place the *Tubifex* and mud in this and swirl round and round in the water. The mud will be washed away and the *Tubifex* will ball together in the bottom of the sieve. Do not feed the worms to your fishes until they have been kept under running water for at least 12 hours.

I bought some goldfish for 6d. each in Club Row. I have had trouble with some of them. One has red patches on its gill and another had fungus. How can I cure the affected fish?

The sores on the fish may have been caused by a fish louse or by leeches. They may have gone by now. Give a bath for 15 minutes in a solution of Dettol (a cubic centimetre to a gallon of water). The fish you bought were no doubt recently imported from Italy and may have had rough treatment. Many such fish do not recover. You can hardly expect to get strong healthy fish for 6d. each. Being a Cockney I should not dream of making purchases in Club Row and like most other Cockneys I get a certain amount of fun when watching people being blatantly caught there.

I have a tank 15 ins. by 13 ins. by 24 ins. deep with six small fish therein. I also have a small tench in it which I caught with a hook. Is the tench a doctor fish and will it keep the other fish healthy?

Your tank is too deep in relation to the surface area. Depth is the least important thing to look for and surface area is the more important. The tench is not a doctor fish and would not be able to keep your fish healthy in such a tank as yours. All the knowledge you can obtain will not help you to keep many fish in such a tank and to save you many disappointments I suggest, in all earnestness, that you

use the tank to grow plants and buy yourself a tank of better proportions.

I have some catfish in my pond. Are they hardy and is there any way of distinguishing the male?

Your catfish will be probably the American type, cold-water and not tropical. They should be quite safe in your pond with a depth of 2 ft 4 ins. I know of no sure way of telling a male catfish from a female. As with most of the egg-laying species this sexing business is very difficult. If you can compare fish near the breeding season, the plumper ones would be the females as a rule.

I have bred from two shubunkin types of fish. Neither has a double tail yet among the young are some with single tails, some with tri-tails and one or two with double tails. If I go to work with the latter can I breed a strain of fantails?

Your fish were from fantail or veiltail strain and were throw-outs or "runts." When breeding with any types of double tailed fish many single and other types of tails are produced. If these are bred from, all sorts of types result. Do not waste your time trying to breed something good from dross. Why not get some decent fantails and start right—it will save you many disappointments and save years of effort.

Sea Horses by Air

TWELVE Australian sea horses were recently shipped by air on the Qantas Empire Airways South African Service. Well-known Sydney philanthropist and chairman of the Taronga Zoological Park Trust, Sir Edward J. Hallstrom, who has already successfully demonstrated the transport of sheep, fish and animals by air, sent the sea horses to the East London (Cape Colony) Aquarium.

To ensure that the sea horses arrived in South Africa in good condition Qantas engineers installed two special pumps in the Constellation aircraft to deliver a continuous supply of oxygen to the sea horses during their three-day trip. The pumps were driven by their own electric motors, receiving power from the aircraft's batteries. The sea horses were shipped in a five-gallon can, similar to a dairy milk can.

Qantas engineers perfected the shipping of fish by air in 1949 when Sir Edward Hallstrom chartered a Qantas aircraft to carry 20,000 live brown trout from Sydney for release in the streams of his experimental stations at Nondugl, New Guinea. Sir Edward now hopes to receive a supply of tropical fish in exchange for the sea horses. These fish are also to be transported back to Australia by Qantas in the five-gallon container.

500 M.P.H. FISH

IMPROVED strains of tropical fishes, which usually have a high mortality rate as long-distance air travellers, are being flown successfully from Britain to South Africa in B.O.A.C. Comet jetliners. Sail-fin mollies, neon tetras, guppies and glowlights—from North and South America—have been included among freight being flown by Comets from London Airport to Johannesburg, a journey completed in under 24 hours.

The fish, which travel in groups of 50 contained in special cannisters with breathing tubes, are being sent by Phillip Castang Limited—a London firm of livestock experts which celebrated its 250th anniversary this year—to private aquaria in South Africa. Mr. Phillip Castang sent the first experimental consignment of tropical fish to Johannesburg by Comet this summer. There is now a rapidly expanding market abroad for tropical fish, and B.O.A.C. is including them on its growing list of strange air freight.



BOOK

REVIEW

Creatures Great and Small

Under the Sea Wind by Rachel L. Carson. Staples Press. 12s. 6d.

THOSE who enjoyed reading *The Sea Around Us* will be equally delighted with Miss Carson's study of life and death among creatures great and small which live in or close by the sea. There are chapters devoted to the birth of a mackerel, the amazing journey undertaken by eels to their spawning ground miles down in the ocean somewhere to the south of Bermuda, and the ways of sea trout; there are detailed descriptions about such things as the protective devices adopted by nesting sea birds, the strange underground life of lemmings, the feeding habits of angler fish, which, according to Miss Carson, will rise to a duck asleep on the waves as a salmon to a fly; and the movements of fishes "down the sloping meadows and prairies of the sea" to escape the creeping cold of winter.

As readers of *The Sea Around Us* will already know, Miss Carson is an accomplished and fascinating prose style. In a few words she can evoke the salty, green-tinged atmosphere of the mysterious deep: "Above the eels was the sunlight world where plants grew, and small fishes shone green and azure in the sun, and blue and crystal jellyfish moved at the surface. Then came the twilight zone where fishes were opalescent or silver, and red prawns shed eggs of bright orange colour, and round-mouthed fishes were pale, and the first light organs twinkled in the gloom."

The book is provided with a 33 page glossary, in which Miss Carson dilates on such diverse matters as ctenophores, pteropods and plalaropes, those small birds which normally feed on plankton, but are said sometimes to alight on the backs of whales to pick off sea lice. A number of black-and-white illustrations by C. F. Tunnicliffe adorn the text. There is no question that *Under the Sea Wind* will take its place among the best non-fiction works of the autumn publishing season.

JACK HEMS

Tropical Hobby

Tropical Fish as a Hobby, by Herbert R. Axelrod, with chapters by Dr. Myron Gordon and James W. Atz. 264 pages. Two colour plates, photographs and line illustrations. McGraw-Hill Book Co., Inc., New York, 36. Four dollars.

SUB-TITLED "A guide to selection, care and breeding," this latest American work on the hobby of tropical fish-keeping is likely to become very popular. It is an attractively produced work and attractively written too. The approach of the author to his subject is practical, and ambitious as well in places (he uses the neon fish in illustration of the breeding procedure for characins). The total number of tropicals included is necessarily restricted because each fish is discussed in good measure. The extent of the book's coverage of species is increased, however, by an appendix in which over 100 fishes are listed with brief notes on breeding each one.

A welcome innovation for this type of book are the chapters written by specialists—two acknowledged authorities on aquarium matters. Dr. Myron Gordon writes on the scientific naming of fishes and on genetics of some live-

bearing tropicals; Mr. James W. Atz's excellent critical assessment of the term "balanced aquarium" which appeared in *The Aquarist* (which for all the comment it brought forth has not yet been answered by anything worthy of serious consideration) is also included together with the same author's review of the functions of water plants in aquaria.

The book's photographs are very good and the line figures excellent. When such care has been taken with typography and lay-out, as has been the case with this book, the single fault of allowing misprints to remain unadjusted (regrettably also the case with this book) becomes a heinous offence.

Keeping Vivaria

Vivarium Life by Alfred Leutscher. 230 pages, 112 illustrations in line. Cleaver-Hulme Press Ltd., 42A, South Audley Street, London, W.1. 15s. net.

THIS book has six chapters devoted to the inhabitants of vivaria—frogs, toads, newts, snakes, lizards and tortoises, and four other chapters dealing with coldwater fishes, aquarium plants, pond life and live food for aquarium and vivarium animals. The salient features of a number of the most commonly kept specimens in these groups are described together with details of habit, hibernation, feeding and breeding. Mr. Leutscher is a practical herpetologist of long standing and gives valuable notes on the care of his subjects in captivity when he introduces each group in his book, although many readers will wish that he had given more freely of his practical knowledge under the heading of each species as it is presented.

The classified note form of the bulk of the text makes this a book for reference rather than a fireside companion for the herpetologist. Mr. Humphrey Dakeyne's line drawings of fishes, plants and pond life are commendable, but this artist is certainly not at ease with reptiles as sitters; the illustrations of batrachians, lizards and tortoises are largely crude caricatures and unworthy of an otherwise informative book.

Aquatic Naturalist

Caddis, by Dr. Norman E. Hickin. Field Study Book No. 5; 50 pages, illustrations in line and colour drawings. Methuen & Co., Ltd., 36, Essex Street, London, W.C.2. 9s. 6d. net.

The British Amphibia and Reptiles, by Dr. L. Harrison Matthews. Field Study Book No. 6; 54 pages, illustrations in line and colour drawings. Methuen & Co., Ltd., 36, Essex Street, London, W.C.2. 9s. 6d. net.

THE Field Study Books are published under the auspices of the Council for the Promotion of Field Studies and the two titles under review are excellent examples of the series. They are both extremely well produced and illustrated and authoritatively written.

Caddis has the distinction of being the first English work to deal with those ubiquitous larvae of pond and stream which build movable tubes of mineral, vegetable and even animal material. The biology of these larvae is discussed and their anatomy fully demonstrated by drawings; directions for catching them are given and comprehensive "keys" to the families, so that they may be readily identified, are included. An appendix gives the complete list of British caddis flies. A book which the pond naturalist must have available.

The relative paucity of British fauna in reptiles and amphibia does not preclude the student from making valuable contributions to herpetology, as Dr. Harrison Matthews's delightful book shows. With colour drawings to aid identification of species, field observations on habits and distribution and the author's suggestions for investigations which will supply badly needed data, *The British Amphibia and Reptiles* is calculated to fire any lover of the countryside with enthusiasm to find out more for himself about these interesting but neglected animals.



*A page for
the beginner
contributed
by*

A. BOARDER

IT is now possible to examine the season's results and to assess the value of the lessons learnt. Each year brings its problems and no two seasons appear to follow a regular plan. We often find that what has meant success in one year has been the opposite next time. However much we may know about the art of keeping and breeding fish, there is always more to learn, and I for one am always experimenting to try to improve on my methods. Once the general rules of fishkeeping in pond or tank have been fairly well mastered there is then the added fascination of breeding the fishes. It is in this sphere that we soon realise that we can all continue learning, for the fool-proof method of breeding is not yet known.

Looking back over the past season I have to admit that it has been a very good one as far as spawnings have been concerned. My breeding fantails in the outdoor pond spawned four times in the year, in May, June, July and August. The number of eggs was all that could be desired and the subsequent hatchings were in every case splendid. I had so many eggs laid that I had no need to resort to artificial spawning or stripping to obtain eggs. This procedure I have already fully described in *The Aquarist* (December, 1950).

As usual I had far more fry than I could possibly raise in the space I have available. Many have been reared by friends and I have received good reports on the progress of the young fish. The early part of the summer was very good for rearing but unfortunately this early promise did not hold out and we had a bad autumn. If September had been a little kinder it would have made a great deal of difference to the growth of the fry. A warm month then does give the youngsters a splendid chance to make headway before the days shorten and the temperature drops. This brings me to the old question as to whether we should keep the fry under cover for the first winter or let them cool down and remain dormant throughout the cold weather?

So much depends on the size of the fry and also on the size of the pond in which the fry are to be kept. In a fairly large pond there is no doubt that many of the fry will come through the winter in safety. I do not think that they will grow very much as the cold water will have the effect of retarding the growth of the fish. It is well known that the colder the water the less will they eat. If on the other hand the best of the fry can be kept in a tank either in a greenhouse or an indoor room, I am sure that with careful feeding and lighting they can be grown on quite well in the winter. It is no use trying to feed well at this time of the year unless you are able to supply artificial light to compensate for the loss of the daylight. I suggest that over-head lighting should be used for at least four hours each evening. This will warm the water slightly and also enable the fish to see and eat the food.

I have heard many laments from breeders because they have lost many fry soon after they have hatched. In many cases the fish have spawned in a pond and the eggs have been taken, on the water plants, from the pond for hatching

under cover. After promising hatches the fry have gradually disappeared. I am sure that the cause of many of the losses is due to the fact that the water plants are usually teeming with all types of pests which prey on the fry as soon as they hatch. I think that the very best plan is to remove all the fry from the hatching tank to a fresh, clean container as soon as they are free swimming. In this way you are sure to save many fry. The fry can be caught best by dipping a small milk bowl into the tank and carefully lifting the fry out. The white bowl will enable you to examine the catch so that if any larvae of dragonflies or other insects are seen, they can be killed to make sure that only the fry are put into the new clean tank.

In my own case, through being away from home at the most important times I lost many fry. Two hatching tanks had a splendid number of fry but I was unable to get the time to change the fry to fresh tanks. After about a week the number of fry in the tanks had decreased, although no dead fish were seen and the water appeared quite sweet and healthy. All the water plants on which the eggs had been laid were still in the tanks, so much that it was impossible to see the bottoms of them. After a fortnight not a fish could be seen in either tank and it was not until over a month later that I found time to examine them. On emptying them I found no fry at all but one tank held a fully-grown larvae of the short-bodied dragonfly whilst the other tank had a similar-sized larvae of the long-bodied dragonfly. It is possible that there may have been several of these larvae in the tanks but as the fry were soon eaten they had fallen out among themselves and the survivor of the fittest was the plump solitary survivor in each tank. I know that my pond is visited all the summer by various types of dragonflies but it is impossible to stop them from laying eggs or to remove the eggs from the plants once they are laid.

I hope that all beginners have taken every opportunity to pay a visit to a fish show or two. Only in this way can one learn about the correct shapes required for successful exhibiting. Unfortunately more shows than ever appear to be only placing on classes for set up tanks each year and no classes are offered for individual types of fish. This will mean that the specialist breeder is not catered for, and if the drift goes on for long there will be a noticeable decrease in the quality of the fishes bred. As only 12 points are allotted for quality for the fish out of a 100 possible for furnished tanks it can be realised that a tank containing runts can be put first as long as the other features of the tank receive a high rating. If only clubs would get together and agree to put on at least one class for a type of fancy goldfish, it would be possible to supply one class each season for each of the recognised types. If they were properly advertised the specialist breeder would know where he could show his fish. In conclusion, may I suggest that you look back over the past season, find your failings and make up your mind to profit from your failures another year.

Inheritance in Aquarium Fishes

3. The Genetics of the Wagtail Platy

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

WE are now prepared to analyse the genetic basis for the development of the golden wagtail platy. You will remember that when the wild one-spotted platyfish ($OO GG$) was mated to the domesticated golden platy ($oo gg$), their hybrids were like their one-spotted wild parent in appearance ($Oo Gg$). This was so because $OO GG$ looks like $Oo Gg$. Remembering this, compare these results with those which I obtained from the mating between the wild grey comet and a domesticated gold platy, which may be described genetically as follows:

P_1 Wild grey comet platy \times Domesticated gold platy
 $CoCo GG \times coco gg$

I expected that the young would be grey-coloured owing to the dominance of grey (G) over the golden (g). This I found. I also expected that the young would show the comet pattern because in mating previously described, the comet (Co) was dominant over the plain type (co). But comets did not appear as such.

The black lines on the upper and lower margins of the tail fin, which formed the comet pattern in the parent, were present in their offspring but they were indistinguishable because the rest of the tail fin was darkened to the same degree of pigmentation. Not only did I notice that the tail was blackened but even more surprising I saw that all the other fins were equally black. The additional pigmentation followed the outline of the hybrids' mouths as well as the rim around portions of their operculi or gill covers. This unusual hereditary response I called the wagtail reaction. This hereditary response you will recall was not found when the one-spot platy was mated to the gold platy nor when the six somewhat similar tail patterns were tested in the same way. Only the comet produced the wagtail effect. Why? Because, I found later, the comet gene Co is affected by another gene.

This additional gene radically changed the usual effect of the Co gene which ordinarily produces a simple comet pattern and caused a much greater pigmentary response. To express this extension effect, I called the gene " E ," the extensor of Co . This E factor must have been brought to the hybrids by the gold platy since none of the wild platyfish had it. If this were true then the mating, involving three rather than just two hereditary factors, may be expressed as follows:

P_1 Wild comet platyfish \times Domesticated gold platy
 $CoCo GG ee \times coco gg EE$
 F_1 All wild grey wagtails
 $Coco Gg Ee$

At this point we cannot be sure of the accuracy of this formula. Only the results obtained by observing the offspring in the next generation can confirm or deny its correctness. That is the uniqueness of the science of genetics. You can come up with the most radical notions and then, by logical tests, prove or disprove them. Let us assume that the formula is correct. Then I may predict the numbers and frequencies of each type of offspring in the second generation.

In an earlier experiment when only a single pair of characters was involved, as, for example, the mating between

a grey one-spot platy and a grey unspotted platy, we obtained three one-spotted to one non-spotted in the second generation. When two characters were contrasted, as when one-spot, grey platy was mated to a gold platy, we found nine one-spotted greys to three one-spotted golden to three greys (without the one-spot), to one plain gold platy. The ratios, when two contrastings are involved, is $9:3:3:1$ or $(3:1)^2$. Four visibly different types or phenotypes were involved.

Three Contrasting Characters

In the new cross involving the wagtail, that is, between the wild grey comet and the gold platy, apparently three contrasting characters are involved and we may expect that the various colour groups should appear in a ratio according to the formula $(3:1)^3$. The expansion of the $(3:1)^3$ formula is obtained as follows:

$$\begin{array}{r} 3:1 \\ 3:1 \\ \hline 9:3:3:1 \\ 3:1 \\ \hline 27:9:9:3:9:3:3:1 \\ (1)(2)(3)(4)(5)(6)(7)(8) \end{array}$$

From this preliminary calculation I could predict I would get eight visibly different colour combinations or phenotypes. Among the eight phenotypes I would find the desired golden wagtail.

The eight phenotypic groups arranged from 1 to 8 contain varying combinations of dominant characteristics. For example, I knew from previous experiments of this sort that:

Group 1, consisting of 27 members, contains one each of the three dominant genes Co, G, E .

Groups 2, 3 and 5, each consisting of nine members, contain two of the three dominant genes either Co, G, e ; Co, g, E , or co, G, E .

Groups 4, 6 and 7, each consisting of three members, contain one of the three dominant genes either Co, g, e ; co, G, e or co, g, E .

Group 8, consisting of one member, contains only the recessive genes co, g, e .

Now I know that the golden wagtail is made up, first, of a recessive golden gene, g ; second, the wagtail depends upon the interaction of two dominant genes, the comet gene Co working together with the extensor gene E . Thus the formula for the golden wagtail contains two dominant genes and one recessive, as follows: $Co E g$. Since it has two dominant genes, this genic combination should occur nine times in every 64 young in the second generation. This generation developed from parents, each of which was $Coco Ee Gg$, and which in turn had wild grey comet ($CoCo ee GG$) and gold platy ($coco EE gg$) parents. That is the reasoning for predicting that I expected to get a specific number of golden wagtails. Let us see if this prediction was justified by following the standard method of analysis.

By recombining the eight possible types of gametes produced by the F_1 grey wagtail males ($Coco Gg Ee$) with similarly constituted gametes produced by F_1 grey wagtail females ($Coco Gg Ee$), the number of various kinds of F_2 zygotes (fertilised eggs) should be 64 (or 8×8). This again can be worked out by Punnett squares. Although it

is laborious to set up, and equally laborious to read, it does provide the answers we seek. It takes time to work out problems of this kind, yet the time is well spent. All things considered, it certainly takes less time this way than the trial and error methods of breeding which never assure you of definite results. At any rate, here it is:

The desired type, the golden wagtail, must have *Co* and *E* the two dominants needed for wagtail reaction and *g* the recessive for golden colour. As may be determined by counting the squares and as summarised in the table of phenotypes, this sort of gene combination occurs nine times in 64.

F ₂ Female Gametes:	F ₁ Male Gametes:							
	I <i>Co G E</i>	II <i>Co G e</i>	III <i>Co g E</i>	IV <i>Co g e</i>	V <i>co G E</i>	VI <i>co G e</i>	VII <i>co g E</i>	VIII <i>co g e</i>
I <i>Co G E</i>	1 <i>CoCo GG EE</i>	9 <i>CoCo GG Ee</i>	17 <i>CoCo Gg EE</i>	25 <i>CoCo Gg Ee</i>	33 <i>Coco GG EE</i>	41 <i>Coco GG Ee</i>	49 <i>Coco Gg EE</i>	57 <i>Coco Gg Ee</i>
II <i>Co G e</i>	2 <i>CoCo GG Ee</i>	10 <i>CoCo GG ee</i>	18 <i>CoCo Gg Ee</i>	26 <i>CoCo Gg ee</i>	34 <i>Coco GG Ee</i>	42 <i>Coco GG ee</i>	50 <i>Coco Gg Ee</i>	58 <i>Coco Gg ee</i>
III <i>Co g E</i>	3 <i>CoCo Gg EE</i>	11 <i>CoCo Gg Ee</i>	19 <i>CoCo gg EE</i>	27 <i>CoCo gg Ee</i>	35 <i>Coco Gg EE</i>	43 <i>Coco Gg Ee</i>	51 <i>Coco gg EE</i>	59 <i>Coco gg Ee</i>
IV <i>Co g e</i>	4 <i>CoCo Gg Ee</i>	12 <i>CoCo Gg ee</i>	20 <i>CoCo gg Ee</i>	28 <i>CoCo gg ee</i>	36 <i>Coco Gg Ee</i>	44 <i>Coco Gg ee</i>	52 <i>Coco gg Ee</i>	60 <i>Coco gg ee</i>
V <i>co G E</i>	5 <i>Coco GG EE</i>	13 <i>Coco GG Ee</i>	21 <i>Coco Gg EE</i>	29 <i>Coco Gg Ee</i>	37 <i>coco GG EE</i>	45 <i>coco GG Ee</i>	53 <i>coco Gg EE</i>	61 <i>coco Gg Ee</i>
VI <i>co G e</i>	6 <i>Coco GG Ee</i>	14 <i>Coco GG ee</i>	22 <i>Coco Gg Ee</i>	30 <i>Coco Gg ee</i>	38 <i>coco GG Ee</i>	46 <i>coco GG ee</i>	54 <i>coco Gg Ee</i>	62 <i>coco Gg ee</i>
VII <i>co g E</i>	7 <i>Coco Gg EE</i>	15 <i>Coco Gg Ee</i>	23 <i>Coco gg EE</i>	31 <i>Coco gg Ee</i>	39 <i>coco Gg EE</i>	47 <i>coco Gg Ee</i>	55 <i>coco gg EE</i>	63 <i>coco gg Ee</i>
VIII <i>co g e</i>	8 <i>Coco Gg Ee</i>	16 <i>Coco Gg ee</i>	24 <i>Coco gg Ee</i>	32 <i>Coco gg ee</i>	40 <i>coco Gg Ee</i>	48 <i>coco Gg ee</i>	56 <i>coco gg Ee</i>	64 <i>coco gg ee</i>

By inspecting each of the 64 members of the F₂, a table of the visibly different kinds or phenotypes in the brood may be determined. For instance, if we count every form which has at least one each of the three dominant genes *Co*, *G* and *E*, one would find such a combination in each square along the extreme left vertical column. This would indicate squares 1 to 8. Similar triple combinations may be found in the series along the top horizontal column, squares numbered 9, 17, 25, 33, 41, 49 and 57. Another run of the triple dominants may be found conveniently by drawing a diagonal line from the left lowermost square 8 to right uppermost square 57; this would include squares 15, 22, 29, 36, 43 and 50. These total 22 squares that have at least one each of *Co*, *G* and *E*. Five others may be found in squares 11, 13, 18, 21 and 34, making a grand total of 27 *Co G E*. Visibly these 27 are grey wagtails and indistinguishable from each other.

By seeking out the other types and recording the number of squares that are involved, so that each square is accounted for, the following result is attained:

No.	Phenotypes	Colour Type	Frequency	Squares	Number
1.	<i>Co G E</i>	Grey wagtail	27	listed previously	
2.	<i>Co G e</i>	Grey comet	9	10, 12, 14, 16, 26, 30, 42, 44, 58.	
3.	<i>Co g E</i>	Gold wagtail*	9	19, 20, 23, 24, 27, 31, 51, 52, 59.	
4.	<i>Co g e</i>	Gold comet	3	28, 32, 60.	
5.	<i>co G E</i>	Grey	9	37, 38, 39, 40, 45, 47, 53, 54, 61.	
6.	<i>co G e</i>	Grey	3	46, 48, 62.	
7.	<i>co g E</i>	Gold platy	3	55, 56, 63.	
8.	<i>co g e</i>	Gold platy	1	64.	
			64		

Some Golden Wagtails Produce "Throwbacks"

The golden wagtail is a genetic curiosity. Its black-trimmed pattern is so neat and uniform that unless one knows its origin one would not expect the golden wagtail to throw comets and plain golden offspring when two of them are mated together.

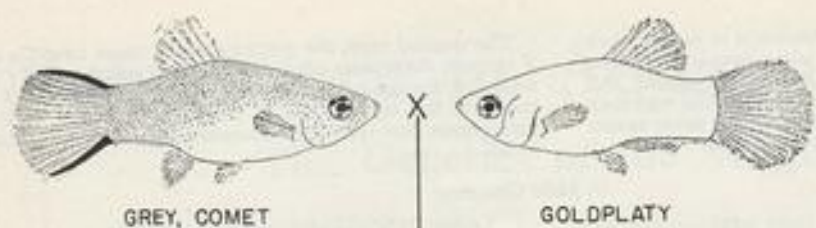
The throwbacks in the form of comet markings and the plain gold platy are readily explained. Examine the genetic constitution of the first golden wagtails found among the squares. Their genotypes vary although their phenotypes *Co E g* are similar:

Genotypes	Phenotypes	Frequency	Squares
<i>CoCo EE gg</i>	<i>Co E g</i>	1	19
<i>CoCo Ee gg</i>	<i>Co E g</i>	2	20, 27
<i>Coco EE gg</i>	<i>Co E g</i>	2	23, 51
<i>Coco Ee gg</i>	<i>Co E g</i>	4	24, 31, 52, 59

The pure (homozygous) breeding type *CoCo EE gg* appears only once among the nine golden wagtails. They all look alike but they will not necessarily produce similar results when bred. Of course, by chance, one may be extremely lucky and select a male and female *CoCo EE gg* for breeding purposes.

The only way to distinguish the various genotypes among similar appearing golden wagtail phenotypes, is to run a series of breeding tests. The genetic constitution of these fish can be determined by the kind of offspring they have.

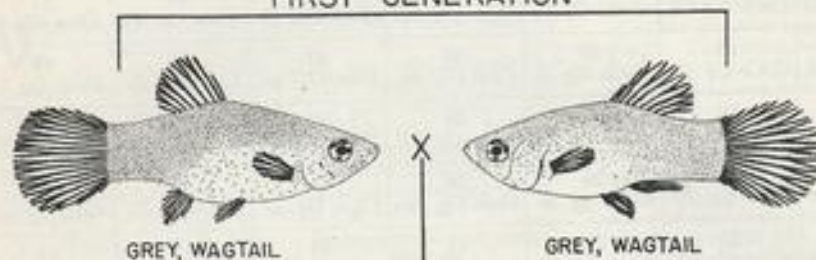
To make a proper test as accurately and as efficiently as possible, a suitable test platyfish is of utmost importance. In this instance the wild plain platy female should be used for the following reasons: it is recessive for comet (it is *coco*) and it is recessive for the comet extensor (it is *ee*).



GREY, COMET

GOLDPLATY

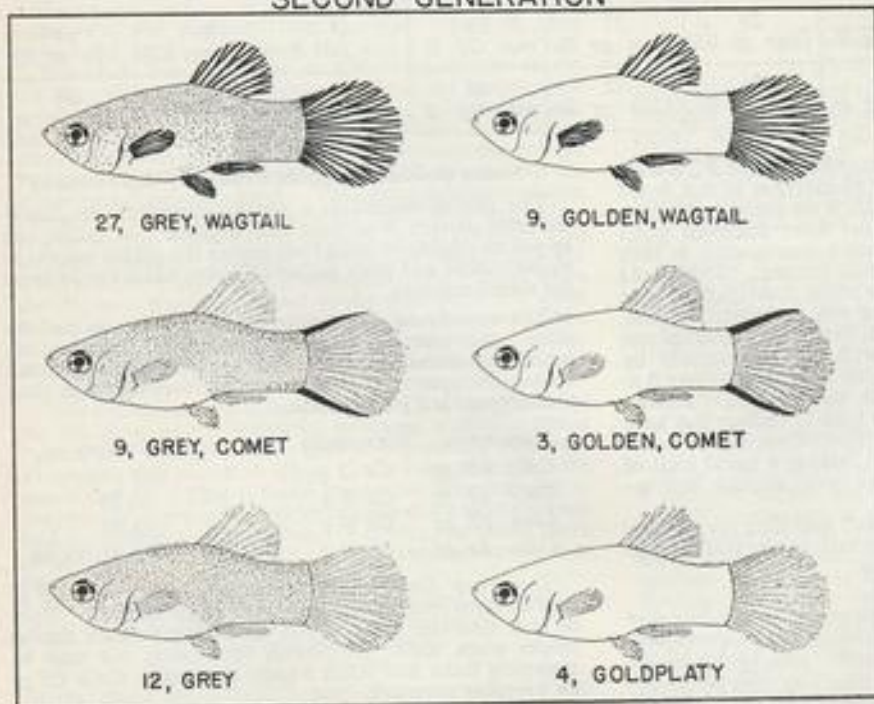
FIRST GENERATION



GREY, WAGTAIL

GREY, WAGTAIL

SECOND GENERATION



27, GREY, WAGTAIL

9, GOLDEN, WAGTAIL

9, GREY, COMET

3, GOLDEN, COMET

12, GREY

4, GOLDPLATY

Inheritance of Two Traits, One Simple, One Complex

When a grey, comet platyfish is mated with a gold platy a new pattern appears in the offspring of the first generation. They are grey wagtails. When the grey wagtails are inbred, brother to sister, they throw six kinds of colour patterns in definite proportions, as indicated in the diagram. An analysis of these results indicates that the comet pattern is influenced by another dominant gene which we have called the "E" pattern. To produce the wagtail pattern two hereditary factors are necessary: "Co" for comet and "E" for its extensor. Actually, then, three dominant genes are involved in this mating, "Co, E," and "G" for grey body colour. The pattern which is most desirable is the golden wagtail, which contains two out of the three dominant genes, "Co" and "E".

When a plain wild platy female and all their offspring appear to be wagtails was homozygous for both may be explained as follows:

Tester
 P_1 = Wild grey
 $coco ee GG$
 F_1 = All grey w
 $Coco Ee$

If all the offspring of a mating wagtails were not all grey wagtails then the genotype of the golden w homozygous. Its exact constit comparing the proportion of its proportion of one grey wagtail to the golden wagtail parent must be for the comet gene *Coco*, but hom be expressed by the following:

P_1 = Wild grey
 $coco ee G^1$
 F_1 = 50 per cent
 50 per cent

If in a mating using a similar a they produced a number of thro greys, the genetic constitution *Coco Ee* heterozygous for both C as follows:

P_1 = Wild gre
 $coco ee G$
 F_1 = 25 per ce
 25 per ce
 50 per ce

The last two genotypes are visib

Peculiarity of

The golden wagtails heteroz extensor gene *Coco Ee*, when m be explained in Mendelian terr appears as follows:

P_1 = Golden wa
 $Coco Ee$
 F_1 = Phenotype
 $Co E$; Golden v
 $Co e$; Golden c
 $co E$; Golden
 $co e$; Golden

Instead of a 9 : 3 : 3 : 1 rat ratio to be actually 9 : 3 : 4. 1 ratio appeared it must be reme differs from *co e*; both are gol plus one of *co e* produce four o

Selecting True-Breeding Golden Wagtails

To build a stock of true-bre golden wagtails it is necessa select not just any golden wa Only those whose breeding formance showed that they homozygous *CoCo EE* can qu The male golden wagtails after have been tested and found homozygous can be used immed (Please turn to page 190)

t 1

mated with a male golden wagtail
grey wagtails, then the male golden
met and its extensor. The mating

Homozygous
Golden wagtail
 \times $CoCo EE gg$
sils

TEST NO.

$CoCo EE$

1



GREY, WAGTAIL



GREY, WAGTAIL

t 2

etween the wild grey and a golden
contained a number of other kinds,
sil parent would be known nor to be
a could then be determined by
ous offspring. If they were in the
se plain grey then the genotype of
been $CoCo EE$, that is, heterozygous
ous for its extensor EE . This may

\times Golden wagtail
 \times $CoCo EE gg$
grey wagtails $CoCo Ee Gg$
wild grey $coco Ee Gg$

$CoCo E+$

2



GREY, COMET



GREY, WAGTAIL

t 3

ring golden wagtail with a wild grey
sils in the form of comets and plain
be golden wagtail must have been
ed E . This is conveniently written

\times Golden wagtail
 \times $CoCo Ee gg$
grey wagtails $CoCo Ee Gg$
grey comets $CoCo ee Gg$
plain grey $coco Ee Gg$
 $coco ee Gg$
distinguishable.

$Co+ EE$

3



GREY



GREY, WAGTAIL

Wagtail Inheritance

as for the comet gene and comet's
together produce results which can
st in a modified way. The mating

\times Golden wagtail
 \times $CoCo Ee$
Frequencies:

9
3
(3) } 4
(1) }

pected we observed the phenotypic
der to understand why this modified
ed that $co E$ has no visible effect that
Thus three combinations of $co E$
dim.

$Co+ E+$

4



GREY, COMET



GREY, WAGTAIL



GREY



GREY

Tests for Purity of Golden Wagtails Obtained in the Second Generation

Of the golden wagtails obtained in the second generation, some represent true-breeding types (homozygous, $CoCo EE$); others are not ($CoCo E+$; $CoCo EE$; $Co+ E+$). Each of the golden wagtails of the second generation must be tested to find out which are the pure breeding types. This test requires that each golden wagtail be mated to a pure, wild grey platyfish. From such a mating, if all the offspring are grey wagtails, then one knows that its golden wagtail parent was pure ($CoCo EE$). This is indicated in test No. 1. If some golden wagtails, when mated to the wild grey platyfish, produce grey comets and grey wagtails in the same brood, the test indicates that the wagtail was pure for the comet pattern, but not for its extensor E . The wagtail was $CoCo E+$; this is indicated in test No. 2. If some golden wagtails, when mated to the wild grey platyfish, produce grey platyfish and grey wagtails in equal numbers, then the test shows that the golden wagtail was not pure for the comet factor but was pure for the extensor gene E . The wagtail was $Co+ EE$; this is shown in test No. 3. If some golden wagtails, when mated to the wild grey platyfish, produce grey comets, grey wagtails and greys, then the test shows that the golden wagtail used was not pure either for the comet or its extensor factor. The wagtail in this instance was $Co+ E+$. This is shown in test No. 4. From these tests it may seem that only the golden wagtail that produced none but grey wagtails, as indicated in test No. 1, is the desirable type for further breeding with another golden wagtail that tests similarly.

in mating with suitable female golden wagtails. The difficulty lies in getting suitable female golden wagtails. Once a homozygous golden wagtail female is discovered by testing with the wild grey, she must first be allowed to get rid of all the grey young she will continue to produce. This may be accomplished by segregating the homozygous golden wagtail female as soon as possible. After she has had one brood of grey wagtails, about a month later she will probably have another brood of grey wagtails. She is capable of producing several broods of young, although she is completely segregated, owing to the fact that one successful insemination provides her with sufficient sperm to last many months. The sperms remain alive within the folds of the female's oviduct and fertilise successive complements of eggs as they mature every month.

One might assume that such a female would be useless for other types of matings, but such is not the case. Fortunately there is a way of utilising this type of female for the production of golden wagtails. Remember it is golden in colour. Thus if she is placed with a homozygous male golden wagtail as determined by a previous test, the golden wagtail female's ova may be fertilised by the sperm provided by the new golden wagtail male. The experiment may be described genetically in two steps as follows:

1. P_1 = Golden wagtail female \times Wild grey male
 $CoCo EE gg \times coco ee GG$
 F_1 = All grey wagtails
 $Coco Ee Gg$

This result shows the P_1 golden wagtail female is homozygous and the one we are looking for. Isolate it and allow it to produce two or more broods all of which will be the same, that is, grey wagtails.

Take a golden wagtail male which had previously been tested and found to be homozygous and place it with the isolated homozygous golden wagtail female. The chances are that this female will continue to throw many wild greys owing to its previous mating. But sooner or later it will throw a number of golden young as a result of the mating with the golden wagtail male. Save every one of the golden young—rear them carefully, for each is a pure-breeding golden wagtail. Nothing less than a mutation will change them, and a mutation is a rare event.

Quicker but Less Lasting Results

Very early in the story I said that the golden wagtails could be obtained not only by mating together two grey wagtail hybrids of the first generation (that is, $Coco Gg Ee \times Coco Gg Ee$) but also by mating one of the grey wagtails back to a gold platy. I said further that from this type of mating I could predict that I would get one golden wagtail

in every four young. Let me try to show why this prediction could be made. It must be remembered that the gold platy carries the factor E for the extension of comet Co in a homozygous state, that is, pure EE . This mating may be set down as follows:

F_1 Grey Wagtail hybrid \times Pure gold platy
 $Coco Gg Ee \times coco gg EE$

By the use of the square method the various recombinations may be predicted in advance. Note that all the gametes produced by the gold platy are similar since it comes from a pure line.

F_1 Grey wagtail Gametes:	Gold platy Gametes		Appearance
	co	$g E$	
	1		
$Co G E$	$Coco Gg EE$		Grey wagtail
	2		
$Co G e$	$Coco Gg Ee$		Grey wagtail
	3		
$Co g E$	$Coco gg EE^*$		Golden wagtail*
	4		
$Co g e$	$Coco gg Ee^*$		Golden wagtail*
	5		
$co G E$	$coco Gg EE$		Grey platy
	6		
$co G e$	$coco Gg Ee$		Grey platy
	7		
$co g E$	$coco gg EE$		Gold platy
	8		
$co g e$	$coco gg Ee$		Gold platy

Summing the results in the squares, there are two golden wagtails in eight of the possible combinations—thus the golden wagtail appears once in every four times.

One might point out this method of backcrossing the F_1 grey wagtail hybrid to the gold platy is more efficient than inbreeding two F_1 grey wagtails together for the purpose of producing golden wagtails. The former yields one in four or 25 per cent. of the desired type while the latter yields only nine in sixty-four or just less than 15 per cent. of the wanted colour variety. If the tropical fish market conditions were such that the immediate need required a rapid production of golden wagtails, the backcross method of mating is certainly to be recommended. But if additional time were available, the second method is preferable since it permits the breeder to select the pure breeding types of golden wagtail. The backcross method would never produce the true breeding type of wagtail—for the comet factor Co would always be in a heterozygous condition, that is, $Coco$.



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Aquarium in the Picture

Beacon fish, rosy tetras, harlequins and zebra fishes form the community in this tropical aquarium, which was an entry in this year's Kingston and District Aquarists' Society Annual Show. Plants with pale green foliage are massed to the left—*Hygrophila*, Indian fern and Cabomba—a giant variety of *Vallisneria* is planted along the back and species of *Cryptocoryne* occupy the aquarium centre and right side. Flat rocks with a number of smaller water-worn pieces harmonise with the small gravel used as base medium.

Photo: Valerie Lilley

THE AQUARIST

Tropical Fish-breeding Records

Detailed records of breeding experiences with tropical fishes of the egg-laying species are invited from readers. One guinea will be paid for each record published in "The Aquarist" under the above heading.

Breeding the Medaka

On 15th August this year at 9.20 a.m. I saw a bunch of spawn on a female medaka in my community aquarium. The eggs were wiped off on to *Ambulia* at 10.40 a.m. and at noon I clipped off the top of a plant and so obtained about 15 eggs. These I placed in a jar of old aquarium water.

I first saw movement in the eggs under a magnifying glass on 25th August; two fry broke away from the eggs on 26th August and fell to the bottom with no further movements. No more hatchings took place until 14th September (35 days), when I was going to discard the eggs, but on second thoughts placed them in a saucer at 12.30 p.m. Five of the nine hatched at 12.53 p.m., two more hatched at 1.38 p.m. and single eggs hatched at 1.57, 3.05, 3.40, and one between this last time and 7 a.m. next day, after which another egg hatched during this day. I watched the hatchings under a lens and noticed that when the fry dropped from the egg they at once swam strongly away; they were without signs of yolk sacs, so I conclude these had been consumed during their very long stay in the eggs—about 25 days over their usual hatching period.

Charles Helms

Australia.

Thick-lip Gouramies

A FEW days after placing a pair of thick-lipped gouramies in a 24 ins. by 12 ins. community aquarium I noticed that the male was blowing bubbles in the far left corner of the tank. I partitioned off this end of the tank (about half of it) as I had no surplus aquaria and left the pair alone to see what happened.

On 15th March I saw the male enticing the female beneath his nest of bubbles, which was attached to a floating fern. She made her way towards him willingly and they began to "barrel-roll" under the nest. In a few seconds her eggs were floating to the top of the water, and this procedure continued for about half an hour. After the female had finished laying she retired to a clump of *Vallisneria* but the male began diving at her and biting her sides so I moved her to the other half of the tank.

The male soon went back to the nest and was continually blowing bubbles into it. At 12.15 p.m. on 15th March, the top of the aquarium was a mass of pin-head-sized fishes, about 100 to 150 in total number; the water temperature had been 87° F. For the first day I left them without food and then I placed a small piece of an egg, which had been boiled for 20 minutes, in a piece of muslin and drew it to the surface over the water surface so as to make a small "cloud" of particles. This was in place of Infusoria. After a week I started to add a pinch of Fry Fish Food, which they readily took, and after a fortnight I gave them their first sifted *Daphnia*.

A week or so on this diet saw quite a change. Within a month the number of fry was dwindling to about four dozen, but these were of good size so I moved them to another tank. The male gourami had been left with the youngsters up to this stage. After three months the gouramies were large enough to be sexed.

F. M. Grant

Pearl Danio Breeding

BEFORE spawning any tropical species I always carry out the following sequence. (1) Read past issues of *The Aquarist* for information on the species concerned. (2) Condition the parents in separate tanks for two or three weeks, giving plenty of live foods. (3) During the conditioning (a) a 16 ins. by 8 ins. by 10 ins. tank with a 40-watt heater is thoroughly cleaned; (b) the aquarium compost and river pebbles are boiled and all water plants are washed in warm water to which a few drops of vinegar are added to kill germs; (c) an Infusoria culture is commenced, spare glass jars are collected, a micro worm culture is started and brine shrimp eggs and white worm cultures are checked; (d) position of the breeding tank is chosen.

Setting up: tank layered with two inches of coarse compost and river pebbles set to form egg traps. Half of the tank thickly planted with fine-leaved plants, other half left clear. Boiled and cooled water added to a depth of seven inches and plants arranged to leave two inches clear water space above them. Temperature 78° F. Pair of danios added during late Saturday evening just before dark, to allow full day's observation on Sunday.

Spawning: day 1: female danio driving male! Day 2: male began driving early morning. At 2.30 p.m. eggs were seen to fall when both fishes were side by side and the male whipped his tail over that of the female—action repeated at five to ten minute intervals during first hour but afterwards at longer intervals. Dull white or creamy-coloured eggs released in batches of eight to fifteen at a time. At 4.10 p.m. female's belly looked flat, male spent. Both fish returned to stock tank. Day 3: temperature 80° F.

Hatching: day 4: eggs began hatching, a few minute fry observed hanging from plants. Day 6: more fry seen, one pint of Infusoria at tank temperature fed to aquarium. Day 8: Infusoria increased to one and a half pints daily. Day 16: fry two weeks old, about 5/16 in. and beginning to show pink bar towards tail. Infusoria two pints daily and micro worms being given.

At three weeks of age the fry were progressing well on micro worm, and at four weeks they were receiving newly hatched brine shrimp eggs, after these were well cleaned. Fry resembled pearl danios, size half an inch. Rearing was considered complete at six weeks when 50 fry were moved to a larger tank for growing on.

In the summary of this breeding my record ends "pearl danio: easy to bring into breeding condition. Fry are very minute when hatched (two to three days) but grow very quickly if allowed to swim in Infusoria. No top-lighting was used until fry were four days old, when one 25-watt lamp was put into use. A good magnifying glass was used to check density and concentration of Infusoria and to check progress of the fry."

T. G. Glover

Post-Mortem Examination of Fishes:

W. Harold Cotton, F.Z.S., 39, Brook Lane,
King's Heath, Birmingham, 14.

Specimens should be sent direct to Mr. Cotton with full particulars of circumstances, and a fee of 2/6.

It is important that the following method of packing fish be adopted:—Wrap fish, very wet, and loosely in grease proof paper and then in wet cloth. Re-wrap in greaseproof or wax paper and pack around with cotton wool in tin box. Despatch as soon as possible after death, with brief history of aquarium or pond conditions.



Fig. 1



Fig. 2

Balsa Cement to the Rescue!

by F. CALLON

THE following article has nothing to do with the Kon-Tiki expedition, raft making, or even balsa. It is intended to introduce aquarists to an easily obtainable substance which will be of great help on many occasions for both tropical and cold water tanks.

Balsa cement is a special type of glue—celluloid dissolved in an amyl-acetate solvent—available in tubes from almost any model shop. It gets its name from the fact that it is the ideal medium for making joints in that very light, soft wood known as balsa, but it might just as well have been called "celluloid cement" since it works better than any other adhesive with that substance. What happens is this: as soon as the semi-liquid balsa cement is exposed to the air, the solvent evaporates (giving off the characteristic odour of pear drops) until in a few minutes there is nothing left but hard celluloid. When applied to something made of celluloid, the solvent in the cement first dissolves the top layer of the object before evaporating, so that the additional amount of celluloid remaining is perfectly fused into the original piece, giving the strongest joint imaginable.

A moment's thought will show how useful this fact can be to the aquarist. So many aquarium accessories are made either entirely or in part of celluloid, and with the help of balsa cement that it becomes a simple matter to mend breakages, add new components, or in some cases even to make your own accessories for a fraction of their normal cost. No difficulty should be experienced, for instance in building a breeding trap from sheet celluloid, while there are numberless small but useful jobs, like attaching cork floats, fixing air tubes to celluloid components, making T joints in tubing, or patching leaks, which can be dealt with successfully.

A Practical Example

Perhaps the best way of describing how to use balsa cement would be to give a practical example in detail. The occasion was the rearing of a batch of 130 Siamese fighters, and anyone who has done any breeding knows that what with weeks of Infusoria, shredded worms and plenty of light, the tank at such a time is scarcely a show piece. In this particular case the water had become very cloudy indeed, and it was decided that the filter had to be employed. But if this were done the fry would inevitably be drawn up the filter tube, and no cover was available for the intake. There was the problem. The photographs show how it was solved.

In Figure 1 a $\frac{1}{8}$ in. drill (the size of the intake tube) is

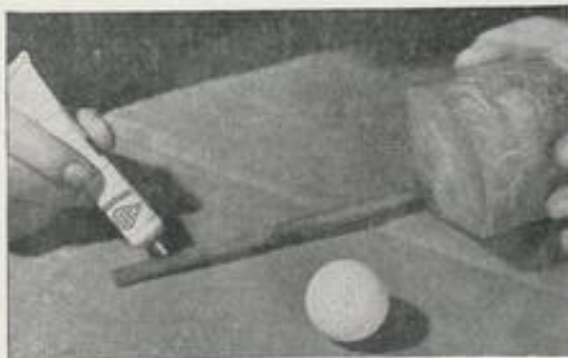


Fig. 3



Fig. 4

being turned by hand to make a circular aperture in a table tennis ball. The ball was then punctured all over with the help of a large darning needle, as shown in Figure 2.

Next, the bottom inch of the intake tube of the filter was carefully dried and the algae scraped off its surface with a tooth. Some balsa cement was then applied to the surface (Figure 3), rubbed well in with the finger tips, and left for a minute or two to dry, after which the end of the tube was inserted into the $\frac{1}{2}$ in. aperture in the ball, and a generous "bead" of cement applied all round the joint—see Figure 4.

Although, as has been said, this cement dries very quickly, it was thought best to leave the unit in the air for an hour or so to make sure that the job was brittle-dry, since there would be no further chance of hardening after immersion in water.

Figure 5 shows the unit as it was lowered into the tank some six months ago. It has been in constant use ever since and has given no trouble at all, so there does not seem to be any in removing it even though the fry for which it was made are now grown up—and largely converted into bass (sorry!).



Fig. 5

The finished article—a filter with novel fry protection attachment fitted with balsa cement

44lb Carp at London Zoo Aquarium

A CARP of the great weight of 44 lb. has taken up residence at the London Zoo. It was caught with rod and line in a West Country pond on 13th September and has spent for some weeks in a darkened tank in the Zoo aquaria to aid its recovery from the shocks of capture and transportation and some superficial injuries received when first landed.

It seems to have appreciated this curative treatment. Nevertheless the carp has been on public view, and as it is leading a long and not unhappy life may lie before it. In its new quarters the carp has so far been fed on bread, the main ingredient in the bait it took.

The tank is shared amicably with a 16 lb. pike and some sea bass. The carp and the pike are about the same length, perhaps a yard, but the carp's depth at its thickest is more or less three times that of the pike. When it is remembered that the biggest authenticated British pike—outside Britain—weighed 37½ lb., the 44 lb. carp establishes its status as the greatest of our freshwater fish next to the salmon.

This specimen may fairly be described as a giant for, well, its capture by Mr. Richard Walker, of Hitchin, Hertfordshire, the biggest of the species ever landed in this country, so far as is known, was one of 31 lb. 4 oz., caught a year earlier. Large carp are distinctive in the sight of the fishermen not through any particular rarity in their commercial haunts but because no other British fish is so numerous and crafty when beset by the angler's wiles. What is interesting is that, after generations or centuries of unproductive non-success, the small but dedicated company of carp-fishers is now achieving results almost startlingly different.

Increased Catches

Carp up to about 30 lb., or even larger, have long been known to exist in Britain, but before 1930 the largest catchweight carp appears to have weighed not much more than 20 lb. In 1930 Mr. Albert Buckley took one of 26 lb. from a Dorsetshire lake, and as lately as 1950 it still ranked as the biggest. But although only four carp of 20 lb. or more, including Mr. Buckley's, are known to have been caught up to 1957, five more of that size were captured between 1941 and 1950. This year, in the three months

from the 16th June—carp-fishing is a summer occupation—no fewer than eight from 20 lb. to 44 lb. have been taken.

These recent captures do nothing to confirm—if they do not contradict—the common idea that carp live to a great age. The 44 lb. carp is believed to be only between 14 and 15 years old; the pond from which it has been extracted was stocked with carp from a Surrey fish farm in 1934, and this specimen is assumed to be of the first generation bred in the pond from parents then introduced.

It is a testimonial to the essential truthfulness of anglers that its weight was first announced as 41 lb. Not until it reached the Zoo, to be laid on a wet sack and weighed by the curator of the aquarium, Mr. Vinall, was the true weight pronounced to be 44 lb.—*The Times*.

At "Frogmen" Level

SURELY there are thousands of us who would enjoy the ability to join fish in their own element—in clear water, of course—and with as easy mobility. Still more in imagination glide and wander about the "caves" and swaying plants with pets or stock in tank and pond.

Now two fisheries biologists in Canada on occasion forsake their test tubes and microscopes for life as "frogmen," to study the reactions of fish in home waters. For commercial purposes, naturally, though this prompts ideas. The scientists are now working at depths from 45 to 50 feet in waters adjacent to the Pacific Biological Station at Nanaimo, British Columbia. With experience it is expected that depths of 100 feet may be reached.

This new method of observing fish in their natural surroundings may have an important bearing on fish conservation as scientists can watch the reactions of fish to fishing gear while actually on the spot. The scientists wear the standard equipment of frogmen. When under water they carry a short spear in case of attack. Dr. J. L. Hart, Director of the Pacific Biological Station, says octopuses, wolf eels, blackfish or killer whales can be dangerous at close quarters.

British Freshwater Snails

by

G. F. HERVEY & JACK HEMS

A PART from some rare species (e.g. *Limnaea involuta* which has been taken only from small lakes in the west of Ireland) and varieties, 33 species of snails inhabit British fresh waters. They may be classified* as under:—

Family: Neritidae.

Genus: *Theodoxus*.

Species: *T. fluviatilis* (the nerite)—(Figure 1).

The shell is almost globular in shape, of a yellowish, greyish or brownish colour, and generally checkered with little elongated patches of various tints. The spire is flat and the mouth semi-lunar.

It is found attached to stones and the like, in rivers, lakes and canals in many parts of England, and in a few localities in Scotland and Ireland.

Family: Hydrobiidae.

Genus: *Bithynia*.

Species: *B. tentaculata*—(Figure 2).

B. leachii.

The shells of both species are conical. That of *B. tentaculata* has five or six whorls, a shallow suture, and a somewhat pointed apex. That of *B. leachii* has four or five whorls, a deep suture, and a sharply-pointed apex.

Both species are widely distributed, and are to be found in rivers, canals, streams and ponds, particularly among clumps of *Fontinalis*.

Family: Viviparidae.

Genus: *Viviparus*.

Species: *V. viviparus* (the river snail)—(Figure 3).

V. fasciatus (Lister's river snail).

V. viviparus is dark grey with burnished mottlings, and the shell is not very glossy. The apex is blunt, and the

suture is fairly deep. *V. fasciatus* is dark grey with golden spots, and the shell is thin and glossy. The apex is pointed, and the suture deep.

Both species are widely distributed and may be found in slow-flowing rivers, ponds and canals in many parts of England.

Family: Valvatidae.

Genus: *Valvata*.

Species: *V. piscinalis* (the valve snail)—(Figure 4).

V. cristata (the flat valve snail).

V. macrostoma.

V. piscinalis has a brownish shell shaped like a top. There are five or six rounded whorls, a circular mouth, and a pronounced suture. *V. cristata* has a discoid and glossy shell. There are five whorls, a circular mouth, and a deep suture. *V. macrostoma* has a dark-coloured shell. There are three and a half rapidly-enlarging whorls, a circular mouth and a deep suture.

All three species are found in slow-flowing rivers, streams and ponds. *V. piscinalis* is found throughout the British Isles, though, as yet, not north of Aberdeen. *V. cristata* is found throughout the British Isles, though it is absent from Cornwall and rare in the Scottish Highlands. *V. macrostoma* is very local.

Family: Limnaeidae.

Genus: *Limnaea*.

Species: *L. auricularia* (the ear pond-snail)—(Figure 5).

L. glabra (the mud snail).

L. palustris (the marsh snail)—(Figure 6).

L. pereger (the wandering snail)—(Figure 7).

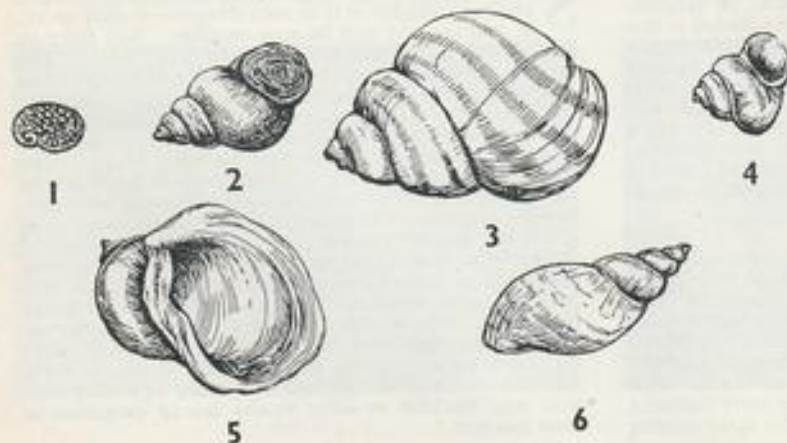
L. stagnalis (the great pond-snail)—(Figure 8).

L. truncatula (the dwarf pond-snail).

Genus: *Myxas*.

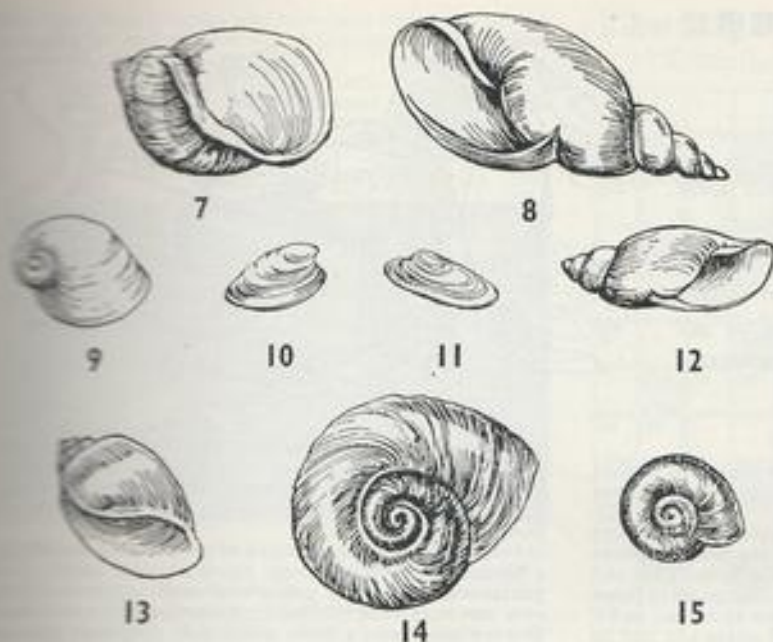
Species: *M. glutinosa* (the glutinous snail)—(Figure 9).

Members of this family are noted for the variations in the shapes of their shells. The shell is thin, glossy, and of a pale yellowish to brownish colour. *L. auricularia* has four or five whorls, the last much expanded, and a very short and acute spire; the shell is globose, the mouth very large, the suture deep. *L. glabra* has seven to eight whorls; the shell is an elongated cone, the mouth oval and comparatively small. *L. palustris* has six or seven whorls separated by a fine white line; the shell is conical and tapering, the mouth



1 *Theodoxus fluviatilis*; 2 *Bithynia tentaculata*; 3 *Viviparus viviparus*; 4 *Valvata piscinalis*; 5 *Limnaea auricularia*; 6 *Limnaea palustris*

Drawings by Eileen M. Hill



7 *Limnaea pereger*; 8 *Limnaea stagnalis*; 9 *Myxas glutinosa*; 10 *Ancylastrum fluviatile*; 11 *Ancylus lacustris*; 12 *Aplecta hypnorum*; 13 *Physa fontinalis*; 14 *Planorbis corneus*; 15 *Segmentina nitida*

near shaped. *L. pereger* has five whorls and an extended and sharp spire; the shell is ovate, the mouth large and oval. *L. stagnalis* has six to eight whorls, tapering to a fine point and separated by a deep suture; the mouth is nearly oval and large. *L. truncatula* has five or six whorls separated by a deep suture; the shell is conical, the mouth ovate. *M. glutinosa* has three or four whorls, the last much expanded, and a very small spire hardly rising above the body; the shell is globose, the suture fairly deep, the mouth nearly oval and contracted above.

Most are common in ponds, ditches, and slow-flowing waters throughout the British Isles, and *L. pereger* is probably the most common of all British fresh-water snails. *L. glutinosa* is local and found mainly in the north of England. *M. glutinosa* is very local and rare.

Family: Ancyliidae.

Genus: *Ancylastrum*.

Species: *A. fluviatile* (the river limpet)—(Figure 10).

Genus: *Ancylus*.

Species: *A. lacustris* (the lake limpet)—(Figure 11).

The shell of *A. fluviatile* is greyish in colour, sinistral, and oval in shape. The shell of *A. lacustris* is glossy, dextral, and oblong in shape. In both species the shell is very thin.

Both species are widely distributed. They may be found attached to stones, pieces of sunken wood, etc., in slow-flowing waters.

Family: Physidae.

Genus: *Aplecta*.

Species: *A. hypnorum* (the moss bladder-snail)—(Figure 12).

Genus: *Physa*.

Species: *P. fontinalis* (the bladder-snail)—(Figure 13).

The shell of *A. hypnorum* is of a yellowish or reddish colour, with six or seven whorls; the mouth is narrow and long. The shell of *P. fontinalis* is very thin, glossy, and with four or five whorls; the mouth is wide and oval.

Both species are found mainly in ditches and sluggish streams.

Family: Planorbidae.

Genus: *Planorbis*.

Species: *P. albus* (the white ram's-horn).

P. complanatus (the flat ram's-horn).

P. contortus.

P. crista (the nautilus ram's-horn).

P. spirorbis (the button ram's-horn).

P. vortex (the whirlpool ram's-horn).

P. carinatus (the keeled ram's-horn).

P. corneus (the great ram's-horn)—(Figure 14).

P. laevis (the smooth ram's-horn).

P. planorbis (the ram's-horn).

P. vorticulus.

P. acronicus.

P. dilatatus (the trumpet ram's-horn).

Genus: *Segmentina*.

Species: *S. nitida* (the shiny ram's-horn)—(Figure 15).

In all species the shell is glossy, and apart from *P. albus*, which is white or creamy in colour, the colour varies from a dark reddish brown to almost black. There are four to six rapidly enlarging whorls. The suture is deep, the mouth rounded.

P. albus, *P. complanatus*, *P. contortus*, *P. crista*, *P. spirorbis* and *P. vortex* are widely distributed and common. *P. carinatus*, *P. corneus*, *P. laevis*, *P. planorbis* and *S. nitida* are more or less local. *P. vorticulus* is rare. *P. acronicus* is confined to the Thames basin. *P. dilatatus* is confined to Lancashire and Cheshire.

Most snails breed freely in the aquarium. *Planorbis* snails, the species most usually introduced into aquaria, deposit their eggs at any period of the year. The eggs are encased in jelly-like capsules affixed to stones, the leaves of plants, and on the glass of the aquarium. The egg-capsules are obicular in shape, colourless, and contain from about 12 to 40 eggs. The young hatch out in about three or four weeks, according to the temperature. They bear transparent shells with a fine velvety skin. Young snails may be fed on dried and powdered lettuce-leaf, flour and powdered fish food.

Adult snails are very partial to lettuce-leaf, boiled white fish, spinach-leaf, tomato skin, banana, and decomposing meat and earthworms. In a well-established aquarium no special feeding is necessary, for they will find plenty of algae and decaying matter on which to feed. It is only in a clear aquarium that special feeding is necessary.

The water should have an alkaline reaction; snails cannot survive if there is a deficiency of lime in the water. Acid water eats into their shells and causes them to become pitted and scarred with greyish-white depressions. In fact, the condition of the shells of the snails in an established aquarium or pond furnishes a rough guide to the pH value of the water. The more acid the water, the more pitted and scarred are the shells of the snails.

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.



Coal in Aquaria

SOME time ago reference was made to the use of washed coal in aquaria, with the claim that fish, plants and water benefited in such tanks.

I have tried this in my coldwater aquarium with very good results indeed; although I cannot say that the plants show any improvement the water remains crystal clear and the fish also appear to be in fine fettle. Except when fishes are ill I do not like to add chemicals to the aquarium, and if it is necessary a separate tank is used—I might add that no troubles have occurred since a "lump of nature" has been added!

I use a siphon aerator for one hour each day. The overflow from the aquarium is fed to a jug under the table, a filter being used between the two, so that the same water can be used again and again or changed easily without upsetting the aquarium itself.

J. E. BICKERSTETH,
Nantwich, Cheshire.

Gadgets

WITH reference to the correspondence on gadgets I find a very good and cheap gadget is an ordinary dish mop. It removes algae from the glass of an aquarium in no time and is easily washed afterwards or can be boiled if necessary.

R. SEXTON,
Belmont, Surrey.

Axolotls and Carp

MOST aquarists regard carp as essentially peaceful fishes, but the following episode will show that this is not invariably true. During the last two years I have kept axolotls together with various goldfish and Crucian carp, always being careful that the fish were bigger than the axolotls. I never had any trouble with this arrangement, until in August I introduced a newly arrived Crucian carp into a tank containing two fairly large axolotls.

The three lived peacefully for three weeks, but then early one morning the carp was seen to make a violent attack on its companions. On inspection they were found to be in a sorry state although both had been in excellent condition when fed the previous evening. Both had lost half an inch of tail and there was extensive damage to the delicate skin over their entire tails. In addition one axolotl had a fractured fore-limb.

J. E. HARRISON,
East Kirkby, Notts.

Aquarium Disaster

DURING September last I went on holiday for a week and left my community tank, which contained some 15 fishes, without supervision. Unfortunately the heater failed and on arriving home I found a few survivors bravely swimming around in water at a temperature of 55° F.

From the condition of the dead fish I deduced that the heater had failed soon after my departure on holiday, and it was quite possible that the temperature of the water had reached even lower figures during the cold nights experienced at that time.

Originally my stock consisted of guppies, red swordtails, a beautiful red male Siamese fighter, a glass catfish, leeri gouramies, neon tetras and several small characins. The only survivors after this rather disastrous occurrence were two red swordtails, a black widow fish, *Corydoras paleatus* and a red flame fish. The latter, at the time, lay on its side on the bottom of the tank, minus a tail, and appeared very near the end. All the live fish were coated with a white fungus but apart from rather sluggish actions were swimming about the tank.

I removed all the dead fishes and installed a spare heater, gradually raising the temperature to 75°-78° F. over the next three days. That was nearly a month ago and to-day all the survivors are in a fine condition, having completely recovered from their experience. These results have convinced me that although each species of fish can tolerate fairly wide temperature variations, providing they occur slowly, the final criterion appears to be the constitution of individual specimens. The black widow, which I have had for two years, had experienced temperatures ranging from 55° to 90° F. through all the trials I have had with white spot etc., at odd times, and it appears set for a really grand old age.

L. F. LINNETT,
Tonbridge, Kent.

Rhodesian Society

I AM writing on behalf of our newly formed Northern Rhodesian Aquarist Society (of which I am the secretary). Our society has not been going very long, neither has it a very large following as yet, but we hope to increase our membership as people get to know more about us.

We are very keen to obtain "tropicals" from our local streams and rivers and, one Sunday alone, our chairman and myself caught three new species, bringing our total of "locals" to seven species. One appears to be a type of cichlid and another shows peculiarities common to the loaches and catfishes. We also have the more usual types of tropicals—platys, zebras, guppies, etc.—and one member has just bred about 50 red swordtails, the first "births" in our society! I might add that all these regular type of tropical fish have to be flown here either from the Union of South Africa or from Salisbury in Southern Rhodesia. They appear to stand these journeys quite well.

We would be very glad to hear from any other societies or individuals who would care to write to us, and perhaps if you have space in your correspondence columns we may

hear from those societies who have been longer established than we have and who are willing to impart a little of their experience to us.

A. P. BOLTON, *Secretary*,
Northern Rhodesian Aquarist Society,
Single Quarters E5, Room 1,
Nkana Mine, N. Rhodesia.

Decoration for Aquaria



HERE is a new idea for a show tank that may appeal to readers. I have found that colour plates from back numbers of *The Aquarist* showing different species of fish make very fine silhouettes when they are cut out and suitably arranged on a piece of hardboard made to fit exactly inside the angle at the back of the aquarium and painted a medium blue.

Any adhesive tape will hold the board in position, and in my aquaria, which have wagtail platys (in the top aquarium of the two photographed) and a dozen blue gouramies with a pair of red Siamese fighters (bottom aquarium) the effect in each case is very pleasing.

W. E. CLAPINSON,
Tooting, London, S.W.17.



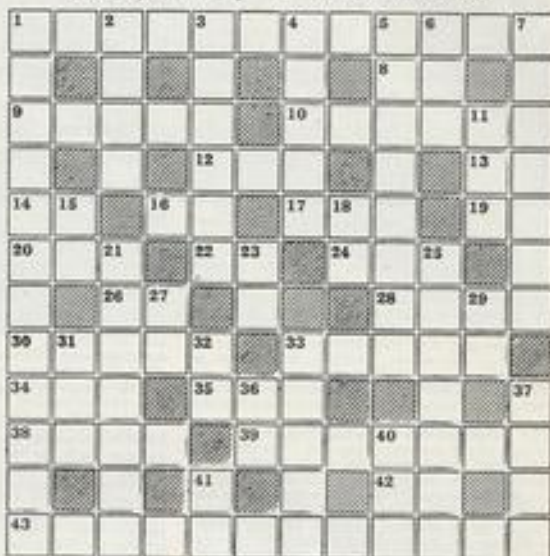
Photos:

R. L. 30-47

Mr. Clapinson's aquaria have colour background scenes made from colour plates, shown in the blue gourami aquarium pictured on this page

The AQUARIST Crossword

Compiled by J. LAUGHLAND



CLUES ACROSS

- The lampreys belong to this family (12)
- Not off, the tail of salmon (2)
- May describe oyster or gourami (5)
- Yes, not for 9 across (6)
- Informal receipt for loan (1, 1, 1)
- Governing body in a sport and in fancy fish (1, 1)
- This certainly is (2)
- Abbreviated angel? (2)
- The toadfish (3)
- Impossible to be this and drink like a fish! (1, 1)
- Find fault, but not like a seahorse! (3)
- Halting interjection in speech (2)
- So in sickness (3)
- No returns of neons (2)
- Rent (4)
- Treats with medicines (5)
- in a teacup (5)
- 34 and 35 Best loved fishes (3, 3)
- Aquarists' favourite tide (4)
- Favourite aquarium plant contains war weapon (7)
- Little water violet? (2)
- Jacksharps (12)

CLUES DOWN

- The guppy, swordtail, etc. group (12)
- Burn the British fish (4)
- Limestone grained like fish roe, hence the name (6)
- Walton's "wily" fish (5)
- Midge fish with a midge-like name (8)
- Its supposed eggs were sold as goldfish food (3)
- Enclosed space and hill make this aquarium accessory (7)
- Newt (3)
- One time colony of sardines (1, 1)
- Fifteen returns in the bass (1, 1)
- I go a rum mixed for this fish group (7)
- Sapper (1, 1)
- Cram ice into pottery (7)
- Tail of the herring is useless (1, 1)
- Amphibians start off in the morning (1, 1)
- Regret (3)
- Sir (2)
- Ophidian (5)
- There is a tank here without fish (1, 1)
- A low fish? (4)
- Egg (3)
- Reverse of 27 down (1, 1)

PICK YOUR ANSWER

- The specific epithet *cordata*, as in *Cryptocoryne cordata*, implies that the leaves are: (a) Heart-shaped. (b) Large. (c) Reddish on the under surfaces. (d) With well-marked veinings.
- Salvinia* is represented by: (a) 12 species. (b) 14 species. (c) 16 species. (d) 18 species.
- The Goodeidae family is native to: (a) Central Mexico. (b) Mississippi basin. (c) Northern Brazil. (d) Southern Texas.
- Prickle-headed goby is the popular name of: (a) *Brachyogobius darwini*. (b) *Gobius nakamondoi*. (c) *Hypoleicis cyprinoides*. (d) *Parakribiauchenichthys*.
- The usual secondary host of the fluke that causes "liver rot" in sheep is the snail: (a) *Ancylostoma*. (b) *Bithybia tentaculata*. (c) *Limnaea truncatula*. (d) *Planorbis* sp.
- The rat-tailed maggot is the larva of: (a) Crane-fly. (b) Hover-fly. (c) Moth-fly. (d) Stone-fly.

(Solutions on page 199)

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 the general meeting of the National Aquarists' Society, held in September, the lecturer was Mr. W. C. Cleveland, and his subject "Aquarium Plants." On this subject the speaker listed many aquatic plants, both popular and rare, and discussed the merits and requirements of each variety in detail. A further gathering was arranged one Sunday, when members and their friends were invited to visit Fernwood Nurseries, Ashford, Middlesex, as the guests of the president and his wife, Mr. and Mrs. L. B. Katterna. A pleasant afternoon and evening was enjoyed by all, with the opportunity to view choice plants and fish on the premises. The president has introduced members and visitors to the concrete aquarium. He showed a specimen tank which he had produced in conjunction with Mr. A. Bryden and planned to use in his business. He informed members that such a tank, when once the mould was prepared, was cheap to produce, rustless, light in weight and easy to move without damage. Recent experiments had proved that fish thrived in them and plants showed exceptional growth. The inside cement was painted with a special black bituminous paint prepared for the job and he hoped to be able to announce details of the solution (which is only known by a formula number at present), and issue drawings of the tank construction to all members in the near future. Mr. Bryden then elaborated on the construction methods used and answered numerous technical points.

MEMBERS of the Plymouth and District Aquarists' and Pondkeepers' Society visited the Paignton Zoo Aquarium in September, and they were met by members of the Torquay Aquarists' Society who later showed them their own collections of fishes at their homes. The two societies have also co-operated in a social evening held in Plymouth.

PORTSMOUTH Aquarists' Club meetings are now being regularly attended by over 100 members. Mr. G. F. Hervey recently lectured to this club on the scientific aspects of breeding, a table show following this successful evening's meeting.

FEEDING aquarium fishes was the subject of a talk by Mr. G. W. Kingston to the Southampton and District Aquatic Society. A table show of characins (winner Mr. A. Smith), and labyrinth fishes (winner Mr. L. Egerton), followed the lecture.

SEVEN thousand people saw the exhibition of aquaria made by the Taunton and District Aquarists' Society. Staged in a large marquee the central display of 40 aquaria illuminated with fluorescent lighting was supported by additional exhibits of amphibia and reptiles. During the show a large brood of fry was hatched in an aquarium containing blue gouramies.

A "QUIZ" and "swap" night formed a recent meeting of the Warrington Aquarist Society and talks have been given by Mr. D. Shepherd on live foods and by Mr. J. Jackson on genetics. The society has arranged outings to Chester Zoo Aquarium and a visit was made to the B.A.F. in Manchester last month.

AT the livebearer and anabantids show the Wolverhampton and District Aquarists' Society had a total of 83 entries in 11 classes. The prize for the best fish in the show (anabantid) was won by Mr. F. H. Fisher (fighter) and Master D. Palmer (livebearer—rainfin mollie). The judges were Messrs. W. L. Mandeville and F. Woodall, with representatives of the M.A.A.S. panel of judges.

COLDWATER fish culture was the subject chosen by Mr. L. G. Emery for a talk given to members of the Stonehouse and District Aquarist Society. Mr. Emery dealt chiefly with pond construction and the protection of fishes from various pests and parasites.

A TALK entitled "The Life Cycle of the Salmon" was heard by members of the North of Scotland Aquarist Society recently. Last month, Dr. P. de Kocks lectured on aquatic plants and this was followed by a table show of swordtails.



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 above (actual size) and the only lettering on the badge (*Aqua Cuncta Vitae Ager Nobis*) is borrowed from *The Aquarist's* crest. Broadly translated this Latin inscription means "Water, the cradle of life, is our field of study." This has, of course, an international appeal, and it is hoped that aquarists all over the world who wear the badge will find that it serves as an immediate introduction to fellow fish-keepers. The angel fish and the shubunkin are symbolic of the two main branches of the hobby. Two forms of the badge, one fitting the lapel button-hole and the other having a brooch-type fastening, are available.

To obtain your badge send a postal order for 1s. 6d. together with the *Aquarist's* Badge taken cut from page xiii, to *Aquarist's* Badge, *The Aquarist*, The Bunts, Half Acre, Brentford, Middlesex, and please specify which type of fitting you require.



British Aquarists' Festival, 1952, trophy winners: (left to right) Mr. T. F. Whalley—"The Aquarist" Trophy for best egg-laying fishes; Mr. F. Bates—St. Martins Aquaria Trophy for outstanding breeder's effort; Mr. A. Morgan—F.N.A.S. Trophy for best labyrinth fish exhibit; East London Aquarists' and Pondkeepers' Association member (Mrs. L. C. Holloway) with Cussons Trophy for best furnished aquarium

General view of this year's annual show staged by Kingston and District Aquarist Society

THE Redhill and District Aquarist Society held its first show last month in the foyer of the local Odeon Cinema. It was open for two weeks, and the 14 aquaria loaned by members were displayed together with a giant map of the world indicating the habitat of each fish shown.

AT the October meeting of the Bath Aquatic Society, Mrs. W. Meadows was welcomed as speaker by members, and aquarists from the neighbouring societies of Bristol, West Wilts. and Midsummer Norton, were visitors to this meeting.

Secretary Changes

CHANGES of secretaries and addresses have been reported from the following societies:
Canterbury and District Aquarist Society (Mr. D. W. George, c/o 97, Heaton Road, Canterbury, Kent); **Cardiff Aquarists' Circle** (Mr. C. G. Dawkins, 109, Gabalfa Avenue, Gabalfa, Cardiff); **Dundee Aquarium Society** (Mr. W. Gordon, 28, South Tay Street, Dundee, Angus); **Greenwich and District Aquarists' Society** (Mr. E. Covington, 32, Bowater Place, Blackheath, London, S.E.3); **Hartlepool and District Aquarists' Society** (Mr. D. C. Crisp, 3, Albany Road, Norton, Stockton-on-Tees); **Hull and District Pond and Aquarium Society** (Mr. A. T. Rimmington, 57, Lincoln Street, Hull); **North Staffs. Aquarist Society** (Mr. A. Davies, 17, Children's Homes, Penkhill, Stoke-on-Trent, Staffs.); **Oxford Aquaria Society** (Mr. H. D. M. Overton, 14, Stapleton Road, Headington, Oxford); **Walworth Aquarist Club** (Mr. R. D. Cosham, 3, Calais Street, London, S.E.5); **Weston-super-Mare and District Aquarist Society** (Mr. A. W. Wyatt, 45, Addicott Road, Weston-super-Mare, Somerset).

New Societies

A.P.V. Aquarist Society: Secretary: R. A. Mathews, A.P.V., Wandsworth Park, London, S.W.18. Meetings: Second Tuesday of each month.
Crawley and District Aquarist Society: Secretary: H. F. J. Lusty, 28 Oak Way, Northgate, Crawley, Sussex. Meetings: First and third Thursdays of each month, 8 p.m. at The



Photo

Valerie Lilley

Livingstone Room, Congregational Hall, Crawley.
Glasgow Eastern District Aquarium Society: Secretary: J. P. Mullin, 15, Gallowhill Street, Rotherghlen, Glasgow.
Guest Keen and Nettlefolds Sports Club (Aquarists' Section): Secretary: D. Cockbill, Atlas Works, Darlaston, South Staffs.
Keynsham and District Aquatic Society: Secretary: R. L. Vince, 8, Vandyck Avenue, Keynsham, Nr. Bristol. Meetings: First Thursday each month at Hugh Stokes Restaurant, Keynsham.
North Bucks. Aquarist Society: Secretary: T. W. Hatch, 79, Stratford Road, Wolverton, Bucks. Meetings: Fourth Friday each month.
Pisces Aquarist Club (Dulwich): Secretary: H. Buck, 6, Havelock House, Honor Oak Road, Forest Hill, London, S.E.23. Meetings: Alternate Fridays, 8 p.m. at 8, Beauval Road, East Dulwich, London, S.E.22.
Wellingborough and District Aquarist Society: Secretary: H. Deakin, 35, Gordon Road, Wellingborough.

Aquarist's Calendar

13th December: Wallington and Carshalton Aquarists' Society display of aquaria at the Carshalton and Wallington Cage Bird Show in the Public Hall, Carshalton, Surrey. Show opens 2 p.m.

Crossword Solution

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

PICK YOUR ANSWER (Solution)
 1 (a). 2 (b). 3 (a). 4 (d). 5 (c). 6 (b).



British Aquarists' Festival, 1952, trophy winners: (left to right) Mr. S. Davies, National Aquarists' Society Trophy for best cichlid; Mr. J. R. Taylor, Whitwell and Smykala Trophy for best angel fish; Mr. L. Heeson, "Daily Dispatch" Trophy for best fish in show; Mr. R. R. Brough, F.N.A.S. Trophy for best breeder's livebearer exhibit

PREPAID ADVERTISEMENTS

Ad. per word (12 words minimum)

Best No. 6d. extra

FOR SALE

AQUARIUMS, tropical fish, and accessories. Plants, tubifex, etc. Baldry's—Aquarists—Warner Street, Accrington (two minutes centre). Phone 2264.

WESTMORLAND, Mendip and other stone, suitable for ponds, aquariums, walling, paving. London stock to suit all requirements, large and small pieces. Descriptive price list on application. Fitzpatrick's, Garden Stone Merchants, 455, Old Ford Road, London, E.3. (ADVance 2991.)

EASY terms, heaters, thermostats, aerators, filters, aquariums and all accessories. Straightforward easy terms arranged, send stamp for lists and full particulars. Joseph Sanley Ltd., Aquatic Experts, 17, Smallbrook Street, Birmingham, 2.

TROPICAL Fish, Tanks, Equipment. Easy terms, callers only. Hours 9 till 6. Tropical house open evenings by appointment. Phone EIG 4826. Bensted's (R. E. Barber), 22, Park Parade, Harlesden, N.W.10.

AQUARIUM accessories (glass). Sediment removers, autophones, fry catchers. Any quantity supplied. Send your enquiries to Star Neon Sign Service, 131, Vicarage Road, Watford, Herts.

FOR tropical and coldwater fish of first rate quality, and dependable equipment. The Portland Aquaria, 79, Portland Road, South Norwood, London, S.E.25.

WE have had 23 years' experience of tropical fish breeding. That is your safeguard. Only clean healthy fish sold. The Portland Aquaria, 79, Portland Road, South Norwood, London, S.E.25.

STAMBRIDGE Trout Fisheries offer goldfish, shubunkins, golden orfe for pet shop. Brown trout, rudd, roach, carp, tench, bream, perch and pike for restocking. Plants and water lilies. Trout Fisheries, Great Stambridge, near Rochford, Essex.

GUARANTEED cultures with instructions—Microworm 1s. 3d., whiteworm 1s. 9d., 5s., Lower Hill Road, Epsom, Surrey.

AMERICAN magazine subscriptions—One year—"Aquarium" (edited and published by Innes) 21s. 6d.; "Aquatic Life" 16s.; "Aquarium Journal" 20s. Books by W. T. Innes—"Exotic Aquarium Fishes" 60s.; "Aquarium Highlights" 45s.; "Goldfish Varieties" 45s. Hobson, 79, Southbrook Road, Buxton.

AQUARIUM immersion heaters—50, 75, 100, 125, 150 watts, 200-250 volts. 6 months' written guarantee. All types 7s. 6d. each p.p. Trade enquiries invited. Simpkins, 33, Dalebury Road, London, S.W.17.

TUBS, watertight, 36in. x 18 in. 38s. delivered, numerous smaller sizes. Water but list free. Capt. Battersby, Hermoncoeur, 5s.

WHITE worms are one of the finest live foods and are suitable for all fish. Splendid cultures, complete with instructions for all the year round supply, 2s. 6d., 4s. 6d. and 7s. 6d. Micro worm cultures with instructions, 2s. 6d. and 4s. 6d. Dried Daphnia or dried shrimp 1s. 6d. and 2s. 6d. All post paid and dispatched next day without fail. Satisfaction or money back. D. Joel, Malvern, Victoria Avenue, Landon, Essex.

MICRO worms and white worm cultures, complete with instructions, no waiting, satisfaction or money back, 2s. 6d. and 4s. 6d. D. Joel, Malvern, Victoria Avenue, Landon, Essex.

MASON-SMITH, Christmas cards—harlequin, zebra, widow, angel, fish, cichlid and clown fish designs. Six cards for 3s. 6d., with envelopes. Hand-coloured 10d. each. Stare designs. Satisfaction or money back guaranteed. Trade enquiries invited. Dept. A, 18a, Gray Road, Cambridge.

AQUARIUM frames of rustless 1 in. steel angles: 36 x 12 x 12 in., 29s. 6d.; 30 x 12 x 12 in., 27s. 6d.; 24 x 12 x 12 in., 25s. Special sizes and trade lists. Westby's, Barton, Ormskirk.

MICROSCOPES—Suitable for examining tank water. A few very good instruments with standard lenses (new) at £12 10s. (carriage 7s. 6d.). Second-hand microscopes from £4 10s. Please call, if possible, as we cannot undertake to send on approval. Deepes Ltd., 35, Beak Street, Regent Street, London, W.1 (Gerard 2560).

WEST Bromwich Aquarists for all aquatic supplies, tropical and coldwater fishes, postal service by return (S.A.E. for lists) or visit us at 117a, Paradise Street, West Bromwich.

LIVE white worms—Fourteen days' supply for community tank, 3s., post free. Elliott, 54, Oak Road, Crowtham, Broomsgrove.

SPECIAL Offer—Innes "Exotic Aquarium Fishes," 55s. plus 1s. 3d. postage. Ideal Xmas present. Kethena Aquarists, 22, Avenue Road, Herne Bay, Kent.

FISH Foods—We as fish salesmen cannot afford to lose fish through bad feeding. For years we have been making and using Fish-Food. We pack meat, vegetable, liver, Infusoria, Daphnia (coarse and fine), ordinary food for any fish, shrimp (coarse and fine), goldfish food. Send P.O. 1s. for generous supply of any kind to W. & H. Pinkard Aquarist Supplies, 83, Wellinboro Road, Northampton.

TROPICAL and fancy fish; foods and appliances; budgerigars, canaries and foreign birds. Edward Tippins 2b and 2c, Gillingham Road, Gillingham, Kent. Telephone 59407.

"EXOTIC Aquarium Fishes" by Innes. World's finest book on tropicals; latest edition. 500 pages, 350 photos, including natural colour, 60s. "Aquarium Highlights" (Innes). 500 informative pages on fish, aquariums, etc., hundreds of illustrations, 45s. "Goldfish Varieties and Water Gardens" (Innes), covers all types of goldfish, ponds, pools, etc., hundreds of illustrations, 45s. "Aquarium Magazine" 25s. yearly. Direct from Innes. Stamp for leaflet, Hergs Ltd. (AF), 7, Havelock Road, Hastings, Sussex.

WHITE Worms—Best winter food for all fish, 2s. 6d. per culture, post paid, with instructions for successful breeding, regular weekly supplies arranged at low cost. Aquarist, 1a, Electric Parade, Seven Kings Road, Ilford, Essex.

DEALERS—Make sure of a regular supply of fresh, clean tubifex, 7s. per lb. Special offer to wholesalers. Write, A. Penman, 15, Hanover Park, Peckham, S.E.15.

LIMITED number selected, well-mottled 2½-3 in. shubunkins for disposal, bred from 1952 British Aquarists' Festival winner. Enquiries, S.A.E. H. R. Gibson, Mayfield Nursery, Stamfordham Road, Newcastle-on-Tyne, 5.

BEAUTIFUL blue fighters, 5s. and 7s. 6d. each; red wags, 2s. 6d.; black swords 3s. 6d.; green, red swords 2s.; mountain minnows 3s. 6d.; midnight mollies 5s. 6d.; scarftail guppies 6s.; home bred. Neons, harlequins, serpas, glowlights, angels, barbs, limias, etc., good size at reasonable prices. No order under £3 sent. Callers welcomed. S.A.E. for plant list. Tappenden, "Roma," Kempshot Lane, Worting, Basingstoke.

RELIABLE aquarium heaters, guaranteed six months, 200-250v., 50-120w., 7s., post free. Lee, 221, Boundary Road, Plaxton, H.13.

SPATTERDOCK, beautiful plants, 1s. 6d., 2s. 6d., C.W.O. Higgs, 52, Westacre Road, Cheddar, Somerset.

PLANTS—Tropical: Hygrophila 5s.; Hornwort, Ludwigia, Myriophyllum, Vallis spiralis, Vallis toeta, Sagittaria natans, 6s., all per dozen; Duckweed, Bladderwort, Riccia, 9d. cubic inch; Indian fern 9d.; Cabomba, Herpestes 1s.; Brox = saf Indian fern 1s. 3d.; giant Sagittaria 1s. 6d.; Cryptocoryne Beckettii 1s. 9d.; Willisi 2s. 3d.; Cordata 2s. 6d.; water Hyacinth 2s.; dwarf Amazon 2s. 6d.; Nymphae stellata, Aponogon undulatum, Ulvaceous 3s.; Amazon weed 4s. 6d. Coldwater—Crispa, Densa, Hornwort 5s.; Myriophyllum 6s., all per dozen; Micro 1s. 6d.; whiteworm 2s., per culture; dried Daphnia, shrimp, 6d. per packet, 1s. 6d. per drum; Vygro, quality fish food, 9d. and 2s. Trade priority given to summer customers. Postage 6d. orders under £1. The Kingfisheries, 505, Croydon Road, Beckenham. Bec 9909.

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HEATERS—50, 75, 100, 125, 150 watts, 200-250 volts, 12 months' guarantee, 7s. 6d. post paid. Fluorescent lighting for your tank, from 39s. 6d. S.A.E. for details. Trade enquiries invited. Post orders only, please, to J. Simpkins, 19, South Molton Street, Mayfair, London, W.1.

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SURREY—Aquarists living in central and west Surrey should visit us before purchasing aquariums, accessories, foods, etc. For the best selection of tropical fishes and everything for the hobby, call at Wingate, 8, Guildford Park Road, Guildford. Telephone: 62725. (Adjoining Cathedral exit—Guildford station.)

FOUR tanks complete with four heaters, two thermostats, plants, ballast and feeders, plus 100 fish all in good condition. Delivered, £10. 79, Brixham Crescent, Rustlip.

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VALLISNERIA, Ambulia, Hygrophila, Myriophyllum, Elodes Crispa, 4s. 6d. dozen; Indian fern 6s. dozen; broad leaf fern 1s. each; Riccia 1s. portion; Cryptocoryne beckettii 2s. 6d. each; Amazon sword 3s. each; willow moss and hornwort 6d. bunch. Heaters, thermostats (guaranteed), aquariums, fish foods, and accessories. Post and packing 6d. extra. Tropical and coldwater fish (callers only). Spencer, 32, Turnberry Road, Great Barr, Birmingham, 22A.

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