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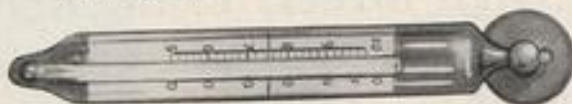


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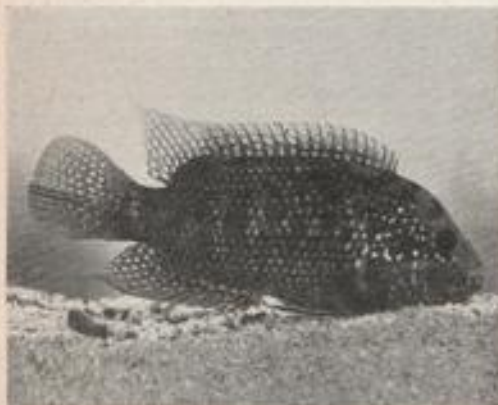


Photo:

G. Timmerman

The only fish to be named after a pugilist is the Jack Dempsey cichlid, pictured above and discussed on page 241

Editorial

AS may have been remarked before—"it fair beats the band!" The number of aquarists' societies in these islands is now well into its third century, and this month our list of the most recently formed clubs is longer than ever. There is, of course, something of a cumulative effect in the formation of these societies—each band of aquarists that develops introduces, by its activities, the hobby to others and before long another society is called for.

In recognition of the difficulties found by those unfortunate officials of the smaller societies faced with the task of making out programmes for evening meetings, we have included two articles in this issue which offer some helpful suggestions for them. We would also endorse the plea of one of our contributors that societies should hold more meetings in conjunction with neighbouring bodies of aquarists; the exchange of opinions and ideas fostered by these joint meetings is most valuable.

It goes without saying that where this exchange can take place between aquarists not only from neighbouring towns but from widely separated regions, the value is greatly increased. Few of us, unfortunately, have either time or sufficient resources to undertake long journeys with this object in view, but there is a period approaching when most of us, with our families, will take part in the annual temporary shuffle of population which occurs in Britain. For an all too short spell sometime during the months of June to September we all have a chance to make acquaintance with aquarists in our chosen holiday town.

We feel sure that visitors are always welcome—in the past many societies in coastal resorts have extended invitations through our pages to readers who were to be holiday-makers near them. So this year we wish more actively to help by publishing full details in advance of meetings, etc. to which readers can consider themselves possessing an open invitation.

For this we obviously need the co-operation of society secretaries and others in towns most favoured at holiday seasons. If they will send dates, times and places in good time for a kind of aquarists' holiday guide in our coming issues we promise to do the rest.

Design for a Shallow Pond

by W. H. MACEY

TO suggest keeping fish throughout the year in very shallow ponds may appear rather unusual, but I have been doing this quite successfully for many years. If we delve deeply into the mysteries of our fish-keeping hobby, we find that the popular "deep pond," holding two feet of water or more, is constructed with a view to protecting the fish from ice, but actually it only enables the poor fish to exist in a larger, or deeper volume of water while under ice.

However, hundreds of valuable fish die in these ponds, year after year without abating, especially each spring, and the numbers vary only according to the severity of each winter. On the other hand, few fish die in nature's ponds. She must either provide them with suitable protective accommodation, or ensure that her fish are in a perfect condition to pass successfully through the winter, and it may be both. Therefore if we could only find a way of protecting our fish during the winter, and encouraging them in summer to become strong, we would reduce this annual slaughter to a minimum. The more serious dangers our fish have to meet in winter are:—complete blackouts for long periods caused by snow resting on the ice, and ice sealing the pond. Sudden changes in temperature, over-feeding, and marauders are other dangers, and unfortunately our popular deep ponds have no answer to them. In fact they tend slightly to aggravate some of them.

The shallow pond to be described, with its small covered pond attached which the fish use as a kind of retreat, will overcome, or reduce, all the dangers mentioned above. Its depth is nine inches, but during the summer months the water is allowed to evaporate to a minimum of six inches in depth. This enables the heat of the sun to raise the temperature to a very high yet perfectly safe degree, and as all fish thrive much better in warmer water, they become much stronger to fight against the forthcoming winter dangers. All the fish enter the retreat on the approach of cold weather, and often remain there for weeks on end. There they are protected from all dangers, including marauders. Complete

blackouts cannot occur due to the light passing through the ventilation space at the top. Ice will not readily form inside the retreat. When hail falls in early autumn while the temperature of the pond water is high, or should a sudden thaw occur in winter, the change of temperature inside the retreat is very gradual. The fish are fed daily throughout the year at the same place and time, but no food of any kind is given unless most or all of the fish are in the pond.

The cost of building this shallow raised pond, compared with a deep surface level pond, is at least 60 per cent. less in labour and material, and most of the work can be done at the builder's leisure. Being a raised pond it prevents slugs, snails, and other unwanted creatures entering to die and rot, and it simplifies siphoning out surplus sediment if necessary, removing dead leaves, attending to plants, and it will give a better view of both fish and plants. My two stock ponds are constructed on the same principles as the one shown, the only differences being their shape, and the retreats are partitioned off inside the pond. One was built in 1933, and the other in 1936. Neither has given any trouble, and each winter they hold an average of 50 inches of fish, including small offspring of the year's spawnings. No fish has died in them during the winter months, and only three in mid-summer, all prior to 1937. One, a newly purchased golden orfe, died of white spot, and the others, a lionhead and an oranda, probably of old age. Both ponds are fitted with the automatic sediment remover described in *The Aquarist* (January 1947), and when ice is expected to form, but not before, a log of wood is placed in each pond to take the strain of the ice pressure. Hawthorn lilies are grown in the retreat, where they flower and produce their floating leaves all the year around.

Construction Details

Pond construction methods have been outlined often, and I will only describe the main details of this pond. It is 10 feet in diameter, and the retreat is four feet by two feet. The lily bed of the pond is four feet in diameter, and that in the retreat is 24 inches by 12 inches. The site is prepared and the pond marked off with short lengths of old iron tubing which remain embedded into the walls. The foundation for the walls is laid first, eight inches wide and three inches deep, using a mixture of one of cement, two of sand, and three of chippings. The walls are 12 inches high and three inches thick, and all corners of retreat and joints to the pond are reinforced with short lengths of old fencing wire embedded into the mixture near the top. (Mixture one of cement to four of sand.)

The walls of the lily beds are six inches high and two inches thick, and all bottoms are laid two inches deep on pieces of old roofing slate and flat stones. (Mixture one of cement to three of sand.) A three-inch high ridge runs around the pond about 10 inches from the wall for the submerged plants, and marginal plants are grown in pots resting on inverted flower pots stood on the floor of the pond. The connecting hole to retreat and pond is four inches in diameter and placed centrally. The retreat is covered with long sheets of glass to overlap well, and arrangements made for the glass to rest, not more than a quarter of an inch off the wall at the back, for ventilation. The pond and the retreat are given two or three coats of cement wash before filling. (Mixture one of cement to one of very fine sand well mixed as it is put on.)

When the pond is first filled it may seep badly for a day or two, but will eventually close up and become perfectly watertight without any further attention.



Plan view of shallow pond and "retreat"

Jack Dempsey Cichlid (*Cichlasoma biocellatum*)

by JACK HEMS

I AM fond of cichlids. Although the majority of them cannot tolerate rooted plant life, and are always ready to fight one another with all the abandon of drunken Irishmen, their good points, I think, far outweigh their bad ones.

They are, for example, easily taught to take food from their owner's fingers, and oh! how happy is the aquarist whose aquarium pets will perform this entertaining trick before friends. Then, too, they are splendidly patterned with either bright or subdued colours; or, perhaps, marked with a dark longitudinal stripe or several straight or slightly wavy bars on a paler ground. Not a few of them are studded with flashing, multi-tinted scales.

Cichlids are long lived. Unless cut off by accidents or disease, most cichlids will maintain life for at least a decade, and cichlids kept in large public aquaria often reach an age beyond 15 years. They are fascinating to breed. ("The typical breeding actions of cichlids are certainly the most interesting and highly organised of any known aquarium fishes," writes William T. Innes in *Exotic Aquarium Fishes*.) It is therefore hardly surprising that cichlids appeal to those who have got over the initial excitement of breeding some of the more popular tropical fishes.

Coloration

Cichlasoma biocellatum, better known under its popular name of Jack Dempsey, is one of the handsomest members of this singularly handsome family. Even in its playful youth, its stone-grey to light olive body is flecked with pretty tints of blue, and two gold-margined matt black patches adorn the side; one equidistant between the head and the tail, the other on the caudal peduncle. But at nine months to a year, the fish begins to show the colours of maturity. Then shades of blue shine out from almost every part of the body. Row upon row of azure-tinted scales line the side. The head is streaked and banded with green-blue; a soft grey-blue suffuses the full lips of the pugnacious mouth; light blue and green-blue spots ornament the soft portions of the caudal, dorsal and anal fins. By way of contrast, a crimson red band runs along the top edge of the pointed dorsal fin. Telling the sexes apart is not very difficult, for though the male may not show brighter colours than the female, he does develop longer extensions to his dorsal and anal fins.

A fully grown fish of about seven inches—the maximum size for aquarium raised specimens—has a big appetite, and needs plenty of animal food. It is not a faddy feeder, and most meaty scraps from the dinner table can be minced and fed to it. Of live foods, it needs something more bulky than a tangled ball of *Tubifex* or a cupful of hopping "fleas." Gentles, freshwater shrimps, woodlice, frog tadpoles, earthworms and unwanted livebearer fry are swallowed with quite evident relish. There are other things which the fish will eat, such as cooked vermicelli, but they are too many to detail here.

As will be readily realised, such a hearty eater excretes bulky droppings. In order to keep the aquarium sweet, it is a good plan to set some time aside every week so that a gallon or more of water may be siphoned from the bottom and fresh water added to make good the loss. Water to be added is best drawn several hours previously and matured

in china or glass vessels stood outdoors. Better still is water taken from a covered water butt. Daily filtration of the water through glass wool and charcoal will prevent dust-fine sediment from settling on the glass sides and rockwork. This brings us to the furniture of the aquarium.

Although *C. biocellatum* is no lover of rooted plant life, this does not mean that the aquarium should be left bare. Much can be done to make it look attractive with large pebbles, slabs of waterworn stone or lumps of granite.



Photo:

G. Timmerman

Jack Dempsey cichlid—male below, female above

Like most cichlids, Jack Dempsey is fond of looking out on the world from a dim cave formed of piled granite, or from the shadowy far-side of a tall stone.

Breeding

It is in such an abode that the species likes to lay its several hundred eggs. Before egg-laying, there is the usual trial of strength. Males and females interlock jaws and push and pull each other about the aquarium. Besides such caveman tactics, there is much spreading of fins and swaying of the body from side to side. Now comes the important job of preparing a bed to receive the eggs. Both fish set about this task with zest. They suck at the slimy rockwork, they spray sand on it, they scour and polish it until the chosen rock shows a spotless surface. By this time, both fish will have developed a short tube from the vent. The female's tube is longer and more pointed than the male's. The female uses her tube or ovipositor to place the eggs just where she wants them; the male uses his tube to direct his milt into their midst. On the face of it, this seems a much more sensible way of ensuring proper fertilisation of the eggs than just releasing the milt into the water during the excitement of a hectic chase.

After the eggs have been laid, the parent fish mount guard over them and keep sediment away by agitating the water immediately above the rock with powerful movements

of their pectoral fins. While one fish fans the eggs, the other one usually keeps a watchful eye open for intruders. At a temperature of 75° F., the eggs hatch in three or four days. Just before, or just after the fry hatch out, the parent fish may move their offspring to another rock or depression previously made ready in the sand. Sometimes the babies are carried in the mouths of both parents, but occasionally one parent only does the carrying while the other one looks on. Sometimes the babies are moved so quickly from one depression to another that the aquarist is never quite sure where the babies have been placed. But all this time, the fry are resolving from what looks like a tight-packed, quivering mass of brownish jelly into hundreds of distinct, dark-eyed youngsters.

A few of the more precocious ones will zig-zag up the sides of the depression as though to escape parental authority. But in an instant, the adventurous ones are snatched up in father's or mother's mouth and tossed, or expertly spat, head-over-tail back into the centre of the nursery. A week or so after hatching out, the fry swim up and down the aquarium with their parents. But no dawdling is allowed. One parent heads the procession; the other brings up the rear. Now that the young are free-swimming,

they need plenty of small live food. Freshly hatched *Daphnia*, chopped white worms and chopped *Tubifex* worms will suit their requirements for a fortnight, after which they should be got on to larger food.

How soon after hatching out should the baby fish be separated from their parents is largely determined by the size of the aquarium and the attitude of the parent fish towards their young. For it must never be forgotten that the artificial conditions under which the parent fish are kept often lead to an outbreak of cannibalism.

According to Innes, the popular name of Jack Dempsey was given to the fish by a Philadelphia, U.S.A., dealer more than 25 years ago in recognition of the species' fighting qualities. There is no denying that it was a brilliant idea on the part of the dealer, for at that time the great boxer's name was a household word, and the fact that a fish had been honoured with it helped to arouse greater interest in the then comparatively new hobby of tropical fish keeping.

In those early days, the fish went under the erroneous scientific name of *C. nigrofasciatus*, but this was corrected in the early 1930's to *C. biocellatus*. Jack Dempsey is native to Guatemala, and was introduced into European (Germany) aquarium circles in 1904.

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

THERE are a very large number of dwarf growing herbaceous plants which can be used in beds and borders surrounding a pool or which can be planted, so to speak, as an introduction to a water garden. It's always difficult in an article of this kind to carry in the mind's eye the many types of gardens in England to-day in which water has been introduced in one form or another—the informal pool, the dish-shaped and round pool, the larger lake, the formal square pool, the natural water garden, the narrow slip of water in between wider flower borders.

However, it is useful to know that there are dwarf plants, perennial in character, which do not need staking, which can be planted at this time of the year and which needn't be disturbed for three or four years. Surely the perennial is far more popular than the annual or biennial. It is true that the initial cost is higher, for a number of the plants that will be mentioned this month may cost anything from 1s. 6d. to 2s. 6d. each, but if this means permanency and if it is to be spread over a number of years, then surely the capital outlay is really worth while.

Let us then examine a number of plants which only grow a foot or 18 inches high and which come into the category outlined above. It will be convenient if we start alphabetically, combing as it were through one of the latest and best catalogues and picking out the plants which the writer has found extremely satisfactory. One of the advantages of being principal of a horticultural training centre is that it is possible to try out all kinds of schemes and numerous varieties of perennials. There's an *Achillea* known as *Taygetea* which produces compact heads of lemon coloured flowers. It will grow in any good soil and never seems to be attacked by pests and diseases.

For those who have a rather shady spot, there's *Adonis amurensis plena*. This again produces double yellow flowers and in the early spring at that. I love blues, and so I always insist on including *Anchusa myosotidiflora*, which comes into flower in April and gives a second show in August, and on each occasion, there are brilliant blue forget-me-not flowers to admire. It is absolutely hardy and grows almost anywhere. It isn't everybody who knows that there is an *Aquilegia* or columbine called *Clematiflora* because it produces blossoms like the clematis. Here you

have a very free flowering plant and one which prefers, if anything, sand to heavy clay soil.

For very late flowering, say October, there are the baby Michaelmas daisies. I have a big collection of them. There's Victor Vokes, Pearl Rose, Marjorie Ward, and Princess Elizabeth. A friend of mine raised these and we have got them planted all along the end of the office; they are always greatly admired in the late autumn. For moist soil, there's a lot to be said for *Caltha monstroza flora plena*, which produces very large double yellow flowers even if it does grow only a foot high. It's a member of the marsh marigold family and a real treasure.

A borage which can go into this list is the *Cynoglossum vastum*. It produces pretty pale rose coloured flowers. Unfortunately, its cousin *Cynoglossum nervosum* grows two feet high, else I should certainly include it because it produces its large deep blue flowers not only freely, but continuously as well. There are large numbers of sweet scented *Dianthus* for those who love the single pinks. Highland Queen for instance, a dark crimson; Ipswich Crimson; Little Jock, the pale pink, and Joseph Rudd the deep salmon with a dark centre whose flowers are truly double.

The finest pink *Erigeron* I have ever seen is known as Pink Pearl. It is far better than Quakeress and doesn't grow so tall either. Do you like a blue foliaged grass as a foil for the more brilliant blooming plants? Then grow *Festuca glauca* and it will be much admired. We have only got as far as the K's to find a lovely *Kuiphofia* or red hot poker, known as Nelsoni. It flowers in the autumn, producing slender spikes of bright orange red flowers in the typical poker fashion. The leaves are grasslike and dainty. While in the evening primroses there's a variety with a very long name—*Oenothera glauca fyrverkeri* which produces masses of golden yellow large flowers, and yet is very compact in its habit of growth.

What about *Omonis rotundiflora*, which produces rose coloured blooms and has the appearance of a shrub? Or if you've a shady place there's *Ourisia coccinea*, which I think is one of the most outstanding dwarf plants grown. The brilliant scarlet flowers are tubular in shape and the spikes on which they are borne are very graceful.

Jim—a fish with “Radar”



by

A. FRASER-BRUNNER

Gymnotus carapo has an interesting method of locomotion—a rippling movement of the large anal fin determines its course

TALKING about large fishes reminds me to write something about Jim. He has been with us for about two years, and has become a family pet. Some people would consider him among the most unprepossessing pets imaginable, for his face is not distinguished by any charm of expression. As someone once said of Victor McLaglen, he is beautifully ugly.

The name Jim is a rather unimaginative abbreviation of the scientific name *Gymnotus carapo*, but it suits him well enough. He belongs to the South American family *Gymnotidae*, and is nearly related to the celebrated electric eel (*Electrophorus electricus*), which packs an electric shock in its tail strong enough to stun a horse. Fortunately, *Gymnotus* has no such awe-inspiring powers, but is nevertheless not entirely without galvanic equipment. In his case the effect is too weak to be felt by the human hand, but serves a valuable purpose as a sort of echo-sounder. Impulses discharged through the water are reflected back from solid objects (plants, rocks, the sides of the tank), and the exceedingly small interval between discharge and reception informs the fish of the nearness and probably of the size of the object. Consequently he is able to move with ease in any direction among intricate tangles of plants; he is also sensitive to the slightest disturbance of the surface of the water, and usually rises to the point where the movement occurs with great accuracy.

Weak Visual Powers

The eyes of this fish are very small, and although they gleam like opals they seem to have very low visual power, so that the search for food has to be carried on with the aid of the electrical device already described and the keen sense of smell. The large front nostrils, each protected with a thick, fleshy lid, are situated actually in the upper lip, the hind ones further back, almost between the eyes.

The mouth is wide, running transversely across the front of the head in almost a straight line; a notch in the upper lip at each corner gives the expression a perpetual sneer, or snarl, while the large, projecting lower lip can be thrust up over the mouth to give a bull-dog appearance. There is a row of strong pointed teeth in each jaw, making it advisable to avoid letting him think the tip of one's finger is part of the food being offered.

What makes Jim a show-piece, however, and the delight of all who see him, is his fascinating means of locomotion. He has far fewer fins than most fishes, no dorsal, no pelvis, no caudal—in fact only a pair of pectoral fins and an anal

fin. The anal fin, however, is exceedingly well developed and extends forward on to what would be the chest in ordinary fishes. It is supplied with very strong extrinsic muscles which move the rays from side to side in a rhythmic manner, so that waves pass along the fin. If the waves pass backward from head to tail the fish moves forward; if they pass forward he moves backward. Supposing that he darts forward expecting some food, and finds none, he will not bother to turn round, but simply reverses the fin motion and speeds backward, pointed tail first, among the plants, his echo-sounding device enabling him to avoid collisions. By the most complex and intriguing combinations of these backward and forward movements he can regulate his movement and position to a variety of situations.

Size and Diet

Another curious feature of the anatomy of this fish is the position of the vent, near the throat, just behind the gill-membranes, so that the intestine has to pass forwards from the body-cavity to find its outlet. In colour *Gymnotus carapo* is light-brown, the sides transversed by numerous oblique stripes of darker brown; the anal fin is entirely dark brown.

When I received my specimen he was about six inches long; now he is nine inches, but has increased in bulk by more than four times. He shows a decided preference for *Tubifex* and white worms, but will eat crushed snails, small live fish or bits of raw meat—earthworms only when hard-pressed. He lives in a two-foot tank, which he will not share with any other fish, and seems very much at home amid a dense jungle of *Cryptocoryne ciliata*; from this domain he has made only one excursion—to make an appearance at the British Aquarists' Festival at Manchester last year, where he moped for most of the time and was very obviously glad to return to the familiar haunts. Soon, however, he must be transferred to a larger tank, for according to the textbooks this species may reach a length of 20 inches. He will never grow so large in his present quarters.

An Interesting Problem

There is a very interesting relationship between the size of an aquarium and the size to which fishes will grow in it, irrespective of the food, oxygen, heat or other factors that may be present; the mechanism by which this comes about is not understood, and will prove an interesting problem for someone with the necessary time and facilities to solve in the future.

Breeding the Livebearing Species

by MARGERY G. ELWIN

UP till now in this series we have been dealing solely with oviparous fishes, i.e., with those which lay eggs. We now come to the viviparous species, or livebearers as they are commonly called. In these the young pass through the early stages of their development within the body of the mother, although there is never the intimate connection between mother and young that exists in the mammals. There is nothing at all corresponding even to a rudimentary placenta in these fish, except, perhaps in the case of *Heterandria*, where there is some intimate approximation of embryonic and maternal tissues. This species incidentally, is exceptional in another way inasmuch as it does not produce its young in batches but gives birth to one or two at a time at irregular intervals, so that at any one time a pregnant female will be found to contain several embryos, all at different stages of development.

But, although there is no placenta, the developing young do obtain nourishment from the mother. They absorb this from the maternal fluid which surrounds them and they are consequently quite large, compared with newly-hatched oviparous fish, when they are born. The number of fry produced is, of course, much smaller than one expects from a spawning of an oviparous species but, since the young are so much larger and better able to take care of themselves, very few die; in fact, under favourable conditions the death rate should be practically negligible.

Most of the livebearers with which we are familiar produce broods at intervals of about four weeks, and several broods can result from a single fertilisation. This is made possible by the fact that the female can retain living sperm within her body for a considerable period, this being used to fertilise successive batches of ova. This has very important practical consequences for the aquarist, for, while on the one hand, this means that it is possible to obtain offspring from a particular male for some months after he has been removed or has died, on the other hand it is most important, when arranging particular matings, to ensure that the female has not previously been mis-mated. Ensuring virginity is in fact, one of the biggest practical problems when trying to establish new strains. Incidentally, I believe it is theoretically also possible to obtain mixed broods, in which some of the young belong to one father and some to another, though I do not know whether such broods have ever actually been observed.

Ready Breeders

Straight breeding of livebearers is simple. Most species breed very readily; in fact, given reasonably good conditions, you can't stop them. The young are quite a reasonable size when born and are consequently easy to feed. Mostly they are omnivorous and will readily take any of the normal fish foods provided they are of suitable size. Of course, since they cannot eat much at a time, they should be fed frequently and care should be taken to provide a good mixed diet. The mollies are perhaps the most difficult to raise successfully. This is simply because their natural food is mainly soft algae, on which they browse all day long. Given this you will have no trouble; plenty of healthy youngsters will be produced and they will grow

apace. Without it, however, there is a tendency for the young to be born prematurely or for growth to be poor. One of the best substitutes, in my opinion, is Bemax which, of course, is made from the germ of the wheat and is rich in vitamins. Since in nature they feed more or less continuously, like cattle, *Mollies* fry should be given as many meals as possible.

The only precaution which needs to be taken with livebearers in general is to guard against possible cannibalism. In the community tank, where a number of large fish are present, most, if not all, of the fry will get eaten. Where only a few fish are present and the aquarium is well planted, especially if there is an adequate cover of floating plants, probably all the fry you will want will escape attention, but if the whole brood is required it is best to remove the mother to a separate aquarium some days before the brood is due. Of course she herself may eat them but, in my experience, this is unusual if she is being properly fed. Cannibalism is, I think, largely due to a craving for fresh food in a fish which has an inadequate proportion of live or fleshy foods included in its diet.

Line Breeding

But most of us are not content with just breeding livebearers. The great interest of these fish is that it is possible to "improve on nature," that is, to produce strains which seem to us more attractive than the normal wild type. Obvious examples are the black mollies, the many attractive colour varieties of swordtails and platys and the beautiful strains of *Lebistes* produced by the guppy specialists. This field is inexhaustible and offers much scope to the aquarist who is interested in this type of work. To be successful, however, you require some knowledge of the general principles of inheritance and it is with these, in particular relation to fish, that I now propose to deal.

All breeding of this type is based on the familiar principle that "like begets like." This is not by any means strictly true if you are considering simply the parents and the offspring. If, for instance, a red swordtail is crossed with a green, you will probably find all the young are red; none will resemble the green parent. But the offspring when mated with each other will produce a proportion of greens; the green has, in fact, not been lost but only temporarily hidden. It is even possible in some cases to produce offspring which are quite different from either parent. The orange coloured, pink-eyed swordtail, if mated with an ordinary green swordtail, will give offspring which will all be red, dark-eyed fish—that is, of course, if it produces any at all since this variety is very frequently sterile.

Although the characters of the offspring are not necessarily the same as those of the parents, as a general rule they will always be found in some of the ancestors, often in the grandparents. Except in the case of "sports," where a new character suddenly appears, the potentiality to produce any character must be inherent in the stock. You are extremely unlikely, for instance, to get any red swordtails from a line of greens.

There are two main methods of establishing special strains. The first of these is known as line-breeding and is quite a simple process. The second involves arranging special matings with the object of obtaining new combinations of desirable characters. Both processes involve constant and careful selection of the young so as to ensure

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Ideas for Programme Secretaries

1. Informal Evening Meetings by RALPH H. DEAN

(Gloucester and Cheltenham Aquarists' Society)

MANY club secretaries, especially of those societies which meet more regularly than once a month, must find it rather a headache at times to know how to fill up those blank spaces on the programme. Aquarists' societies are at a disadvantage to many clubs—photographic societies for example, which have at their disposal the facilities of a lecture service offered by several firms manufacturing photographic materials. (Enterprising firms dealing with our hobby please note—here is a method of cheap advertising, which would also ease the burdens of the poor programme secretary.)

However, the purpose of this article is to put forward some ideas for informal meetings, and let me state at the outset that these are something more than mere stop-gaps.

Social Function

The greatest services performed by any club are the facilities it offers for a social "get together" of people with a common interest, and a full programme of formal lectures, leaving no time for the inter-change of ideas between members, is a mistake. Our "natter nights" as they are called, are not only popular, but I think very valuable as well, and a few are invariably included in our yearly programme. The only organisation that is necessary, is for the chairman to stop everyone talking at once. In our experience there is no difficulty in getting a discussion started; there is always a member with some achievement he wishes to publicise, or another with a problem he is anxious to solve.

Taking this idea a stage further we have an evening's programme composed of short lectures, say of 10 minutes' duration. Volunteers may be obtained beforehand, or to add a little excitement to the proceedings, let the chairman draw names of members present out of a hat! Everyone has some "fishy" experience worth relating, and it's all good fun, even if the instructional level is not always as high as it might be!

"Quizzes" of various sorts have been a popular source of entertainment on the radio for several years, and this popularity can be exploited in the club room. Firstly, let us consider the "Brains Trust" type of programme. The "Brains" can be selected from the more experienced members of the club, and the "Trust" should be about six in number. It is a good idea for questions to be written out and handed to the chairman at the beginning of the evening. Members' personal fishkeeping problems, or problems of a controversial nature, are to be preferred to the type of question the answer to which can readily be found in a book.

Team "Quiz"

Two opposing teams, each of four or five members, can form the basis of a different, but none the less enjoyable and instructive quiz programme. The chairman is armed with a list of about 40 questions. This works out at 20 to each team, and assuming there are five members to the team it makes it a four-round contest which should last about an hour. Questions for this type of quiz should not be of a controversial nature, but should any argument arise, the chairman must assert his authority and give his ruling.

Question one is put to the first member of team A. A satisfactory answer earns that team two marks. If the question is not answered fully, but the member shows some

evidence of knowing what is required, the chairman can at his discretion give one mark. If the first member of team A admits that he does not know the answer, the same question is put to the rest of the team, and any member giving the correct answer earns one mark for the team. This discourages guessing, for once an incorrect answer has been given, the chairman passes on to the next question, which is put to the opposing team.

Individual "Quiz"

The next type of quiz gives each member of the club at the meeting an opportunity to take part, and paper and pencil are needed by each competitor. It would detract far too much from the pleasure of the evening if members were expected to write lengthy answers to two or three dozen questions, so in this quiz the correct answer has to be picked from three possibilities. In other words, is it A, B or C? One letter is all that has to be written down against each number after the quizmaster has read out the question and three "answers."

To discourage guessing, the quiz-master can, if he so desires, make a ruling that one mark is gained for a correct answer, and one subtracted for every incorrect answer! If these rules are enforced anyone in doubt about the answer is well advised to put a dash. In compiling questions for this type of quiz, care must be taken to ensure that only one of the three "answers" given can possibly fit the question. There must be no room for ambiguity.

Picture "Quiz"

The last type of quiz programme I wish to mention has proved very popular, but in order to be given really satisfactorily, an epidiascope (or an episcopes) is required. This could be called a "Do you know your fish?" quiz, with perhaps a few pictures of other aquatic animals or plants included to make a little variety. The size of the picture used for projection depends largely on the type of instrument being used, but something around post-card size or a little smaller is usually satisfactory. The majority of fish illustrations in *The Aquarist* serve the purpose very well. About three dozen pictures will be sufficient to give a good programme, and each picture should be projected for about 20 seconds. Time is then allowed for the competitors to write down the name of the fish they have seen on the screen before the next picture is projected.

If any club finds difficulty in obtaining an epidiascope, the local photographic dealer may be able to help. Some dealers hire out such apparatus at a reasonable cost. Alternatively, a member of the teaching profession might prove a useful contact—most schools have an epidiascope as part of their visual aids equipment.

If no projector is obtainable, no doubt this type of quiz could be run by mounting the pictures, and pinning them round the walls—or passing them around among the members.

In conclusion I should like to put forward the possibility of neighbouring clubs entering into competition with each other. The team type of quiz lends itself to this development admirably and has proved a most enjoyable way of spending an informal evening with this club and one of our neighbours.

2. Making Ends Meet by ROY WHITEHEAD

(Peterborough and District Aquarists' Society)

PERHAPS the problems of keeping their society on a sound financial footing and preventing interest from flagging are the two most difficult that the average secretary and committee have to face. The officers of my own society are tackling this dual problem in numerous ways. None of them are new but they may be useful to remember if your own club appears to be going "downhill."

Auctions of fishes, plants and surplus equipment are held at every second meeting, and have proved very successful. The beginners amongst our ranks are particularly enthusiastic, as the more common livebearers and egg-layers usually sell at a reasonable price. These auctions also enable our budding breeders to dispose of their surplus fishes. The chairman of the meeting acts as auctioneer and the society takes one-third of the selling price.

Instead of the more usual terse reminder cards, a monthly letter service has now been instituted. This reminds members of the next meeting and arrives about four days before the date fixed. Apart from details of arrangements made for the coming meeting, it contains a few simple but useful hints and notes on fishy subjects. It is not always possible for members to attend every meeting and this letter serves to inform them of the activities of the society. Members can have advertisements inserted under the headings of "Wanted" and "For Sale" at a charge of one shilling per insertion, and these receipts help to defray the cost of postage. As membership of the society increases it

is hoped to expand this letter into a duplicated monthly magazine.

A sixpenny draw is held at every meeting for a small prize, usually a piece of equipment to the value of about five shillings. This yields a small but useful profit. During the early autumn of last year a community tank show of aquaria in members' own homes was held. Two of our veteran aquarists acted as judges and a small silver trophy, generously given for the purpose, was awarded as first prize. The entry for this competition was disappointing, as only 17 members took part. However, much interest was stimulated and there are hopes of a much larger entry this year, particularly as the society are purchasing another trophy.

In addition to our usual programme of lectures and discussions arranged for the coming months, we hope to hold a table show, run a public dance, a social evening for members and their friends, and also arrange a Sunday outing to one of the professional breeders or public aquaria. Plans for a membership drive, with a prize for the most new members introduced, an ambitious public exhibition, and the purchase of a film projector are now being discussed by the committee. With attendances at monthly meetings risen by 300 per cent, and funds by an astronomical percentage in eight months, it is no longer felt that our society is threatened with extinction.

Breeding the Livebearing Species

(Continued from page 244)

that only those types which most closely approximate to the aquarist's requirements are used for breeding. I will end this article with a brief description of the method of line breeding and continue next time with the more complex problems of the second method.

The first essential with line breeding is to obtain really good stock. It is well worth while spending considerable time and trouble searching for the fish which most closely approximate to your requirements. You know the old saying "You can't make a silk purse out of a sow's ear"? Well, though you expect to improve your stock you will only establish a really good strain if you start with at least reasonably good fish. Be sure that both parents are good. They contribute more or less equally to the inheritance and it is senseless to mate a good male with a poor female, unless you have no choice. This even applies to fish like the guppy, where the character you are interested in probably does not show in the female. She transmits the colour pattern, etc. of her father, so you will require the daughter of a male of the right type.

It is very important also to obtain healthy, well-grown, vigorous fish for your breeding stock. Remember that you intend to inbreed very closely and this will soon show up any inherent defects. If, on the other hand, your stock is really sound, inbreeding will not do much harm. Avoid also any fish which show poor sexual development, especially when dealing with swordtails and platys. Most of our coloured strains of these fish have been obtained by crossing the two species at some time and this hybridisation has in some cases considerably reduced fertility. In order to avoid this always try to pick an active, virile male and a nice full-bodied "feminine-looking" female.

Having obtained your stock, give them the very best conditions you can. When you obtain a brood, grow the

youngsters up also under really good conditions; optimum temperature, plenty of space and plenty of good food. It is best, if you can, to separate the sexes as they mature, since breeding too early seems to be harmful. You may be able to make your first selection quite soon, throwing out any obvious duds, but it is best to wait some time before making your final selection, as coloration, etc. may develop slowly and at different rates in different individuals. Sometimes a slow developer turns out the best fish in the end. Your final selection should be rigorous and only the very best specimens should be used for further breeding. There is no objection at all to mating the daughters back to the father if he is still better than any of his sons. The reciprocal mating—son to mother—is impracticable as the mother will still be fertilised by the father, as was explained at the beginning of this article.

If this process of rigorous selection and breeding for the best, always under good conditions, is continued, you should soon notice a very marked improvement in the strain, though there is a limit to the possibilities of this method and you will probably find after a while that you can get no further. You may also find eventually some deterioration in general physique through the close inbreeding. This is always a danger but should not be marked if the original stock is good. This risk can be reduced if two lines are established and these are occasionally crossed so as to bring in "fresh blood."

Post-Mortem Examination of Fishes:

W. Harold Cotton, F.Z.S., 29, 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.

READERS' QUERIES ON COLDWATER FISHKEEPING

Points about the Shubunkin

Last June my shubunkins spawned in the pond and I have managed to save a few. What are the points I should look for? Some have black bulging eyes; are these Bristols?

It will help you to sort your shubunkins if you have by you a good illustration of a shubunkin and, if possible, the Show Standards. The fish with bulging eyes are probably from a telescopic-eyed strain and will not be of value as show specimens. The Bristol is a streamlined fish with a rather large tail or caudal fin. This should be about three-fifths the length of the body and be rounded at the tips. The colour should be a blue ground with red, yellow, brown and violet in small patches. The whole of the fish should be speckled with black. You may find that the darker coloured young ones will turn out to be the best. Those which are almost transparent are not likely to be of much use. The secretary at your local club can probably lend you a copy of the Federation booklet on the standards, when you will be able to make comparisons. You must not be too critical however, as very few fish to-day have all the points required for a show specimen. When examining the bodies of the fish discard all those which have any

answered by A. BOARDER

breaks in the curve of the body such as a humped back or a "snout." By snout I mean the dip in the curve in front of the eye, as in the perch. From the mouth of the fish the outline should run over to the tail in one smooth sweep. The lower curve should correspond.

I have seven nice young veiltails in a 24 ins. tank, and I think that I shall have to have more room in the spring. I have some plate glass to make a new tank. What size angle iron will I require for a pair of tanks, one 38 ins. by 19 ins. by 19 ins. and the other 14 ins. deep? I want to make a two tier outfit with the shallow tank beneath the other. How many fish will they hold and will the flooring of a flat hold the weight?

The size of the angle iron will have to be one inch. It is not an easy job for the novice to make the framework of such a large pair of tanks. They need welding and if you know someone who can do this for you the glazing is a task which you can manage yourself. I do not know how strong the flooring is, but the weight of water in the upper tank will be about 400 lbs., and the lower one about 350 lbs. Add the considerable weight of the frame and glass and you will see that the whole is likely to weigh in the neighbourhood of 7½ cwt. Your top tank could hold about 50 inches of fish and the lower one almost as much. The reduced depth of the lower tank will not affect the number of fish very much as it is the surface area which is the more important. You say that you are feeding on chopped earthworm and white worms. This food is quite good,

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.

but for veils I suggest the addition of some form of starchy foods such as Bemax and oatmeal. With aeration you will be able to keep more fish alive but I do not think that they are likely to grow once they reach the maximum size for the surface area.

I keep several golden orfe in a 24 ins. tank. Recently one of them died without any sign of illness and now the others spend best part of the day at the bottom of the tank almost motionless. Why is this?

From your description I would say that the fish died from lack of oxygen. You do not say how many orfe were in the tank or their size, but golden orfe are a type of fish which require a large amount of oxygen and space. I have found that directly the oxygen content of a pond or tank is lowered the orfe are among the first to become



Mr. A. Boarder netting some of his prize fantail goldfish from his breeding pond for transfer to an exhibition aquarium

troubled. Some years ago I had some large orfe die in my pond during a hot, thundery night. I found all of my orfe dead or dying and I immediately played the hose on those still alive. In a few minutes they were swimming around as if nothing had been the matter. This proved to me, conclusively, that they were only lacking oxygen. As a rule when any fish is found to have died very suddenly without any previous illness and shows no signs of damage it can be taken for granted that lack of oxygen was the cause of death. Often the larger fishes in a tank will be affected first; this is to be expected, as they require more oxygen.

Check up the number of inches of fish in your tank and you may find that there is insufficient room for all you have.

Golden orfe are all right in a tank when very small but as they grow fairly large I consider that when they are three inches long overall, they should be transferred to an outdoor pond. If the fish are in a living room you must remember that there is not likely to be enough fresh air if two or three people are also there; smoking in the room also is harmful to the fish. Change most of the water in the tank and see that the numbers of fish do not exceed the maximum.

Can you inform me which water lilies would be best for my pond, 11 ft. by 11 ft. square and grading in depth from 2 ft. to 2 ft. 6 ins.?

Your pond is suitable for four or five lilies. You may find that for a year or two they will not provide a great deal of cover but as most of them are rapid growers once they are established it does not pay to overcrowd them in the first instance. With the depth you have available it is possible to grow some of the best kinds, but if you keep to four lilies you can add one or two other good water plants such as *Pontederia cordata* (the pickerel weed); *Sagittaria japonica*, *alba flor pleno*; *Butomus umbellatus* and a reed mace. These will break up the flatness, as they all send their leaves well above the surface of the water. One plant of each of the latter will be sufficient. There are many lilies suitable for your pond and you can choose from the following:—*Reds*: Escarboucle, James Brydon; *pinks*: Helen Fowler, Rene Gerard; *yellows*: *Odonata sulphurea grandiflora*, Sunrise; *whites*: Gladstone, Albatross. Your best plan is to write to an established firm dealing with water lilies, giving particulars, and ask for their advice. They know which plants are likely to do best in your district and under your conditions.

My aquarium shubunkins swim with their dorsal fins down. They appear healthy and energetic. Sometimes they dash along the bottom and rub first one side and then the other. I have examined them with a magnifying glass but can see nothing on them. Can you suggest what is wrong?

As I have remarked before, I do not like to see fish with the dorsal down continuously. There is almost always something wrong when this happens. The dashing along the bottom does suggest flukes on the fish and if this is so it will account for the lowered dorsals. The fish may be attacked by a tiny fluke known as *Gyrodactylus gracilis*. You would not be able to see this with an ordinary magnifying glass unless you spotted one or two on the edge of the fish. They are transparent and very tiny, and do not show up at all on the body of a fish. It is only when they are on the outside that they may be seen waving about like miniature leeches. They can also be seen moving about on the fish by means of a looper action. I do not think that permanganate of potash will effect a cure. Place the fish in a bath of Dettol—a cubic centimetre to a gallon of water—and leave the fish in for 5 to 10 minutes. Keep a watch all the time and remove if the fish is very distressed. Some fish will stand the treatment longer than others and the larger they are the more they can stand. After removing the fish place them in fresh water for a time to recover. A further dosing may be necessary in a week's time.

I have recently become interested in coldwater fish-keeping and am now wondering how to manage when I go away on holiday. If I leave a number of *Tubifex* will this be all right?

Your fish will be quite all right if left to themselves for a fortnight. Feed as usual before going away and do not give the slightest bit extra the day you leave. If you do the uneaten food will pollute the water and harm the fish.

My fish are left every year without any attention and they include not only the large spawners in the pond but the fry in tanks. I have never yet found one dead of starvation. If you leave a number of *Tubifex* some may keep alive at the bottom of the tank but I do not think it a good plan to give a lot before you leave. The fish will probably gorge themselves for a day or two, then the excess droppings from them can set up plenty of trouble for you by fouling the water. I have noticed repeatedly that some goldfish do not appear able to digest *Tubifex* easily and the worms are often voided almost unchanged. You can imagine how soon this will upset the balance of the tank.

Can you tell me at what age shubunkins start to breed and what is their approximate size then?

Shubunkins can breed at a year old and when they are about three inches long overall. A great deal will depend on how they have been fed and how quickly they have grown. Providing they have had plenty of space and have been well fed the fish can be expected to spawn as above providing all the requirements have been given. It must be remembered that a fish requires a certain amount of food to keep it going and extra to assist the formation of eggs, etc.

I have been trying to obtain some good type comets for some time but without success. Those which I have sent away for are found on arrival to be nothing like the comet standard. Do you think it fair for people to send out fish which are not good quality?

This question ties up with what I have often said, and that is, if you want winners you must breed them. I know that it is easier said than done, but no one is likely to sell his best fish if he can help it. There is no need to have a pair of fish perfect in all details for them to produce good youngsters. If they are bred right they will produce at least a few good ones, in all probability better than the parents. These can then form the basis of your stock. Fancy goldfish breeding is not a five-minute job. It can take years to build up a strain. Another point which you must remember is that there are not many people to-day who know what a good comet looks like, and so the people who have sent you poor fish may be acting in ignorance. You apparently expect to obtain comets which are exhibition fish and are disappointed when they do not arrive.

Among fancy goldfish fry only one in a hundred turns out nearly perfect—note the nearly perfect; I have not found a perfect one yet. If you can find a breeder and obtain some unsorted fry early in the season when he is overcrowded you will doubtless find among the youngsters all the good ones you require. Few expert breeders to-day have sufficient room in which to raise all their fry and are forced to part with them at an early age, generally at 10 days old. In this way the breeder may and often does lose some of his best fish but he takes that chance as well as you. (If breeders interested in comet goldfishes will write to me c/o *The Aquarist*, I shall be pleased to put them in touch with other aquarists with the same interest. Please enclose a stamped, addressed envelope and mark the outer envelope "Comet.")

I have a small pond in the garden which is of irregular shape and about 4 ft. by 2 ft. and 6 to 18 ins. deep. I have four goldfish in it. Do you think I shall be able to breed them in the pond?

Your pond is large enough to breed a few fish (it is possible to do this in a tank 24 ins. by 12 ins. by 12 ins.). However, the pond is too small to be a safe place for the fish in the winter. It can freeze almost solid and so may kill the fish. The size you state the fish to be can mean that they will spawn but general surroundings and conditions do have a great effect on whether fish spawn or not.

Functions of Water Plants in Aquaria

by JAMES W. ATZ

(Assistant Curator, New York Aquarium*)

ALTHOUGH plants have been grown in home aquaria for more than a hundred years, their functions in such small bodies of water are still largely misunderstood. Not only aquarists, but teachers and scientists as well, have entertained incorrect ideas about the part that plants play in the so-called balanced aquarium ever since vegetation was first put into tanks with fishes. Strangely enough, this century of error has not handicapped the keepers of home aquaria to any great extent. Being empirically minded, aquarists have accepted and employed practices and techniques that "worked," without concerning themselves too much as to just why they worked. This practical attitude has produced beautiful tanks and healthy fishes but has sometimes placed fish fanciers in the comfortable but somewhat strange position of doing the right thing for the wrong reason.

Can there be "Balance" ?

There are perhaps half a dozen different reasons why the aquarist should try to keep plants in his aquarium, but the oxygenation of tank water is *not* one of them. In fact, the idea that the fishes and plants of an aquarium balance each other in their production and consumption of carbon dioxide and oxygen is a false one—of such long standing and general acceptance that it perhaps deserves to be called a myth.

The usual concept of the balanced aquarium is quite simple—a little too pat, it turns out. Fishes and aquatic plants utilize the gases, oxygen and carbon dioxide, that are dissolved in water. Animals, including fishes of course, respire, taking in oxygen and giving off carbon dioxide. Plants also respire, but in the presence of light that is strong enough and of the proper wave lengths they also carry on the process of photosynthesis, as a result of which carbon dioxide and water are taken in and oxygen released. In the actively photosynthesising plant, this process well over-balances that of respiration so that the net result is the consumption of carbon dioxide and production of oxygen.

The respiring animal "burns" carbohydrates and other energy-producing materials and obtains energy. On the other hand, the photosynthesising plant stores up energy in

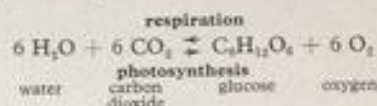
*The author wishes to express his appreciation and thanks to Dr. C. M. Breder, Jr., of the American Museum of Natural History, Curator-Aquarist C. W. Coates and Geneticist Myron Gordon of the New York Aquarium, and Drs. F. W. Kavanagh and H. W. Rickett of the New York Botanical Garden for their invaluable advice and assistance in the preparation of this paper. Drs. Gordon and Rickett were also exceedingly helpful in editorial matters for which the author is especially grateful. The article first appeared in "The Aquarium Journal" last year.



Photo:

An aquarium without plants loses much of its attraction, and although their presence does not make for "balance" they have essential functions to fulfil.

manufactured food with the aid of green chlorophyll. Here is a chemical simplification of the essential processes involved:



It is obvious that these processes counter-balance one another, and it might be thought that this is evidence in favour of the idea that plants balance fishes in an aquarium. This reasoning involves one false assumption, however, namely that an aquarium is a closed system, cut off completely from the outside world. To be more specific, the oxygen and carbon dioxide in the air above the water have not been taken into consideration.

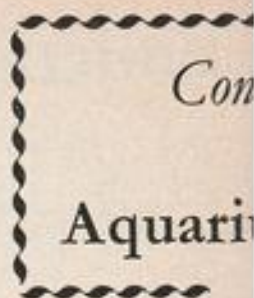
It was Dr. Charles M. Breder, Jr., who first pointed out that the oxygen dissolved in the water of an aquarium comes, not from the plants, but from the atmosphere. He found that whenever tank water was oversaturated or undersaturated with oxygen to the slightest degree, it very quickly returned to equilibrium with the oxygen in the air above—whether or not plants were present or whether the measurements were taken in bright sunlight or in the dark. Obviously plants could not have been affecting the oxygen content of the water to any significant extent. The oxygen comes in from the air as fast as the smallest deficiency exists in the water. Similarly, surplus oxygen immediately passes off into the atmosphere whenever any excess is present. Except under extraordinary conditions there is neither any lack nor any excess of oxygen in an aquarium.

Lethal Gas

How is it, then, that fishes sometimes seem to "smother" so obviously—in an overcrowded aquarium for example? The answer is that carbon dioxide causes their distress and eventually kills them. According to experiments made by physiologists, fish can be killed by carbon dioxide even though there is plenty of oxygen present. Carbon dioxide moves in and out of water much more slowly than oxygen. When aquatic plants were actively engaged in photosynthesis, Breder found that the amount of carbon dioxide in tank water remained far below the equilibrium point. In



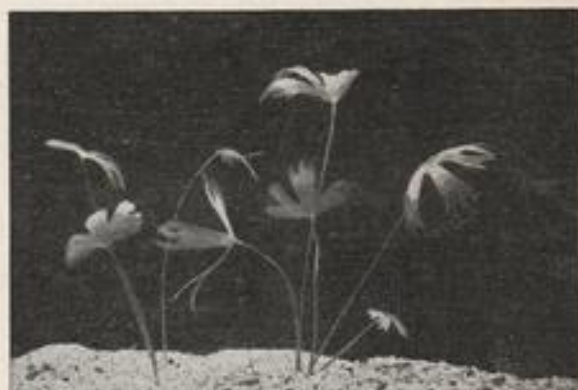
Left: a bog plant used by Continental aquarists as an aquarium aquatic is the cardinal plant (*Lobelia cardinalis*)



Photograph

Lower left: pennywort (*Hydrocotyle vulgaris*) is another damp-loving terrestrial plant like creeping jenny which will take to aquatic conditions

Below: *Ranunculus intermedium* variety, having leaves and habit resembling that of the common buttercup



other words, plants can use up carbon dioxide more rapidly than it can enter the water from the air. Similarly, the amount of dissolved carbon dioxide can accumulate in an aquarium more rapidly than it is able to pass off into the atmosphere. Unless the carbon dioxide content is then reduced in some way, the fishes are unable to adjust themselves to the excessive accumulation of this gas and may die—even though there is plenty of oxygen all around them. It should be realized that the amount of carbon dioxide dissolved in water is to all intents and purposes independent of the amount of dissolved oxygen and *vice versa*.

Cause of "Gaping"

When fishes come gaping to the top of an aquarium, the cause is an excess of carbon dioxide, not a deficiency of oxygen—except under extraordinary conditions when an oxygen deficiency may exist. For instance, a tank that has gone completely "bad" may contain so many bacteria that the oxygen content of its water is kept dangerously low. Even in such aquaria, however, the accumulation of carbon dioxide must also play a part in causing the distress of fishes, since bacteria produce this gas just as do higher plants and animals.

It has been shown in *experimental tanks* that the greater the carbon dioxide content of water, the higher must be the concentration of oxygen to "offset" its harmful effects. Anything that tends both to lower the oxygen and increase

the carbon dioxide will have a doubly detrimental effect, so to speak. Nevertheless Breder's measurements show that carbon dioxide, not oxygen, is the limiting gas, so far as respiration (breathing) is concerned, under all ordinary conditions in aquaria.

What Artificial Aeration Does

Carbon dioxide and not oxygen should therefore be the aquarist's concern. When a tank is aerated artificially by airpumps, very little if any oxygen is being introduced—since the water is practically saturated with that gas at all times—but the release of carbon dioxide is being facilitated—carbon dioxide which can build up to dangerously high concentrations, since it can be produced more rapidly than it can escape into the atmosphere. In effect, the myriads of tiny bubbles rising from an aerator increase the surface through which the gas can leave the water. As has been emphasized by a number of experienced fish fanciers, the surface of water exposed to the atmosphere is the all-important factor in a standing aquarium. In calculating the number of fish that a certain tank will comfortably support, the most critical element is the area of the water's surface, not the volume. Another result of aeration may be the circulation of water within the tank, preventing stratification and bringing carbon dioxide-laden water to the surface.

It is often said that keeping plants in an aquarium will enable it to maintain more fishes. If plants were actively

tors

Beauty

Timmerman

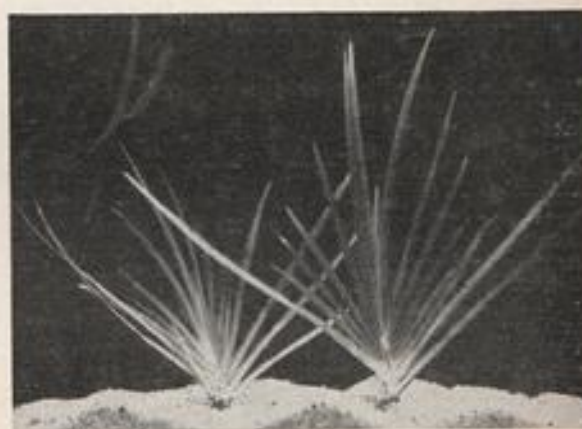
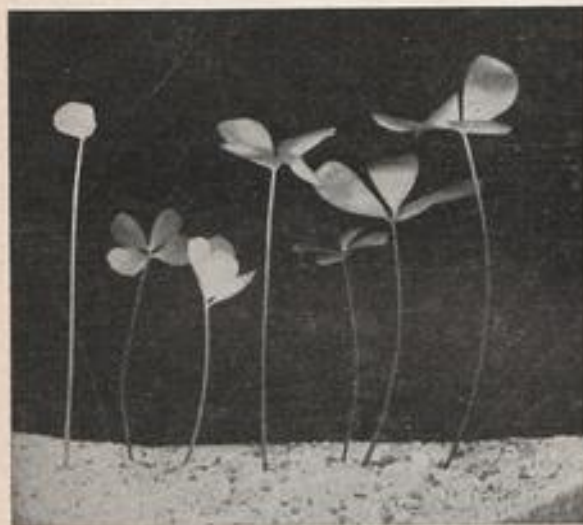


Below: a relative of the ferns is the "underwater clover" (*Marsilea quadrifolia*). It takes kindly to life in the tropical aquarium



Above: an old favourite, *Heteranthera zosterifolia*

Below: *Acorus pusillus*, a Japanese dwarf flag



photosynthesising at all times, they would keep down the carbon dioxide concentration appreciably, as Breder showed, thus permitting more fish to live in a given tank. But plants continually respire just as animals do, and it is only in bright light that their respiration is more than offset by photosynthesis with the net result that carbon dioxide is consumed and oxygen produced. At night or on dark days, when they are not engaged in photosynthesis, plants produce carbon dioxide and consume oxygen exactly as fish do. At such times, the presence of plants theoretically lessens the number of fish a tank will support. The amounts of gas exchanged by plants during respiration are much less than these by animals, however, so it is doubtful whether the consumption of oxygen and production of carbon dioxide by plants is ever of sufficient magnitude to cause aquarium fish any trouble. For this reason the aquarist need hardly ever worry about having his tank too heavily planted. In all probability, a tank would have to be almost completely choked with plants before any effect would become noticeable.

Aquaria Without Plants

Anyone who wants proof that plants are not essential to any so called balanced aquarium need only remove all of them from such a tank; the fish will show no respiratory distress whatsoever. This simple experiment should convince aquarists that plants do not oxygenate the water

in an aquarium. They should not wonder, however, at their longstanding misapprehension in these matters, because only one leader in the field has ever tried to set them right—Christopher W. Coates, Curator and Aquarist of the New York Aquarium and author of a weekly column on tropical fishes and home aquaria in the *New York Sun* for the past 19 years.

Principal Functions of Plants

Since plants act as oxygenators only to an insignificant extent in an aquarium, it might be thought that they are useless or even deleterious. That such a view is completely erroneous will be apparent from the following remarks, outlining the principal functions of plants in aquaria. For convenience these have been treated under six different headings:

1. *To decorate the tank.* This is put first even though it may seem the least utilitarian. If aquaria could not be made attractive or an asset to the appearance of a room, how many fish fanciers would there be? To be sure, there are many who are interested in fish *per se*, but by and large, it is the beauty of a well-decorated tank that attracts people to the hobby. We believe that the vegetation of an aquarium is by far the greatest contributor to its beauty.

2. *To minimise the likelihood of excessive multiplication of algae.* In general, tanks that are well planted suffer less frequently from green water or any other over-abundance



A page for
the beginner
contributed
by

A. BOARDER

THE month of March should encourage your breeding fish to become more active and start to take food in plenty. Although we may yet experience some sharp frosts there will undoubtedly be many bright days to liven up the pond fishes. Feeding should now become an important task, as it is essential that food is given to spawners as often as they will accept it. Whilst worms should form the major portion of the diet some cereal types of food such as Bemax and oatmeal can be added. A lump of porridge dropped in the pond near the side will give the fishes something to nibble at for some time and if it is placed where it can be seen it is possible to tell when it is eaten. The fishes will appreciate any live foods which can be given now and frog tadpoles are an excellent conditioner.

Should the water in the pond look cloudy it is well to change a quantity of it, as it may have become foul through some prolonged freeze-ups. You must look out for any fungus which may appear, as this month is the worst time of the year for this trouble. It usually attacks any fishes which may have been weakened by lack of nourishment or which have received any damage to their mucous covering. An ailing fish will often leave the others and sulk away in a corner. Any fish acting in this way should be caught immediately and examined.

I know of nothing better than the salt treatment. Put the fish in a gallon of water, add a tablespoonful of sea salt and leave in the shade. Add a similar quantity the next day and if the fish shows no sign of improvement add another dose in a few days. As a rule a cure will be effected in about four days, when the solution should be weakened by the addition of fresh water. Start to feed the fish on worms as soon as it will take them. I have cured badly affected fish by this means but the salt bath for an hour will not often give the cure which some people imagine.

Your first spawning in the pond may occur this month. (In the north spawnings will be later.) It will depend not only on the weather but also on the position of the pond. Where the early morning sun can reach the pond it will be a great assistance to the incitement to spawn. See that bunches of water plants are placed in the shallow part. The best kinds are those with fine and closely packed leaves. Eggs will stick to almost anything including a glazed bowl, but if some of the eggs can fall between the leaves of water plants they are less likely to be eaten. Let the bunch be about a foot across and anchor it to the side of the pond so that it cannot wash out into the middle. Each day the bunch must be washed up and down in the water to remove any dirt or muck. This would otherwise cause many eggs to fall to the bottom. Willow moss (*Fontinalis antipyretica*), hornwort (*Ceratophyllum demersum*), *Myriophyllum* and *Elodea canadensis* are very suitable plants for protecting the eggs when laid.

There is no need to do anything to try to encourage the pond fishes to start spawning; May is quite soon enough but one has to be prepared in case a sudden change of the weather starts the fish chasing. Occasionally the spawners

will be seen following one another during the evenings. This often means a spawning during the following morning. As I have mentioned before, the actual temperature of the water does not have much effect on spawnings, as I have had them at 50.5° F. and at most temperatures between that and 76° F.

You will have no doubt when the fish are actually spawning as the males will chase the females vigorously, and some people are afraid that some harm will come to the female and remove it from the pond. There is no need for this, and the fish will continue chasing and pushing until many eggs have been laid. When the fish appear to flutter over the plants almost out of the water this is when the eggs are laid and fertilised. It is a good plan if you are at hand to remove the first bunch of plants as soon as you can see many eggs. Lift the bunch from the water and you will see them sticking to the leaves, looking like amber-coloured beads of jelly about the size of a pin's head. Place the bunch in your hatching container with some water from the pond where the eggs were laid. Place it in a warm spot such as a greenhouse or a sunny window. The sun may shine on the tank as long as it has opaque sides, but do not use an all glass tank unless the sides are shaded.

A temperature of 70° F. will ensure a hatch in four days; this is an ideal time. Should the water be colder there is no need to worry as the eggs should eventually hatch out even if (at 50° F.) they take a fortnight. I consider that a four day hatch is the best; the longer the fry are in the egg the longer is there for various pests to attack them. Snails are not the only things which may eat eggs. Some tiny gnat larvae, almost too small to see without a magnifying glass, are often present on the water plants and these can do a great deal of harm.

Just under two days after the spawning many of the eggs may become covered with fungus, and these will be the infertile ones. The good eggs may then be almost transparent and will not be noticeable among the plants so you may think you have only bad ones. Have patience though, as there will probably be very many fry hatch out. The fry attach themselves to the plants or sides of the tank and will not move unless disturbed. They should be left as quiet as possible and will then use up some of the yolk-sac with which they were born. The time this takes to be wholly absorbed depends again on the temperature of the water. The fry will become free-swimming as soon as the yolk-sac is used up and they must then be fed. As they are so tiny at this stage it is useless to try to feed on anything but the very smallest of foods. They can only take foods smaller than you can see and these will be the Infusoria and algae contained in the green water which I advised you to obtain in my article last month. There may be over a thousand fry in one hatching and so you must realise that they will require a fair amount of the right type of food.

Next month I shall deal with the feeding of the young, the treatment of reluctant spawners and artificial spawnings.

Journal of a Marine Aquarium



Photo :

G. Timmerman

by L. R. BRIGHTWELL

This marine aquarium is one housing the tropical coral fishes and sea horses. Sea anemones can be seen midst the rocks and coral

THERE must be so many readers of *The Aquarist* dwelling on the coast, quite ideally situated to keep marine aquaria, that it is cause for some surprise that this journal is not inundated with enquiries and controversies centering round a branch of aquarium-keeping offering almost illimitable possibilities. The movement however, progresses slowly, but it still progresses, and for this reason I propose, with the Editor's approval, to offer from time to time notes on my own sea water tank, in the hope that some may profit from my many errors, and very occasional modest successes.

The tank under consideration is an all-glass one, 14 inches long, eight wide and six high. With the Peacehaven shore only a few hundred yards from my back garden, I can, of course, scrap the lot (weather permitting) and start afresh, should anything go seriously wrong. But this is not my idea of aquarium-keeping.

How Many Animals?

Wisely or otherwise I have covered the floor of this tank with two inches of small shingle and water-worn flint pebbles ranging from threepenny bit to halfpenny size. Detritus of all kinds promises to sink between these stones, but how nice they look! The tank is filled to a depth of four inches with sea water, topped up as required, and aerated (fine bubbles) with one of the ordinary 30s. gadgets. I close it down to cool off for about one hour in every 12. What of the animals? I ask because the amount of life such a small body of water should be expected to support is problematic. I know of no literature on the subject. The old standard of an inch of fish to a gallon of water we all know varies with the kind of fish—one fish's fair quota of oxygen being another's asphyxiation point. And how does this apply to anemones, ascidians, molluscs and crustacea? Please note, that since I am writing largely for town dwellers, a few gallons of sea water stored in stone jars forms part of my equipment. Though a lucky coast dweller I am endeavouring to play fair!

For just one month now my tank has supported, without mishap, and only one partial change of water, two edible crabs one-and-a-half inches across the shell, one inch-across shore crab minus its left claw, three half-inch shore crabs, a three-quarter inch hairy crab—*Pilumnus* (nearly related to the edible kind), 10 common sea anemones and one large strawberry variety, six small daisy anemones (*Cerius*), a dozen winkles and top shells (*Cibbula cenerius*), and half-a-

dozen mussels. These last I renew from time to time as required, for reasons which will appear. One or two stones and top shells have emerald green enteromorpha attached. The whole makes a charming picture, and there is something "on" all round the clock.

How do my animals behave? Since I cannot arrange a tidal rise and fall, the winkles supply this by climbing above the water mark and remaining there, often for days at a time. Then the urge comes to feed, and they fall back to browse on the enteromorpha. The anemones are always open save when closed for an hour or so digesting. I feed them twice a week on scraps of mussel, raw or chopped worms, squeezed clean of their contained earth. The shore crabs clear up all leftovers.

I must get a cover for this tank. Yesterday in the small hours, my dog, who sleeps in the studio, raised a fearful din. I found him defying a sort of bun composed of fluff such as collects beneath and behind bookcases. The "bun" was hopping round the room sideways, a crab claw, pinching wildly at the air, protruding from it. After a rinse under the tap I returned my one-armed shore crab, which had used the winkles, packed above the water line, as stepping stones to higher things.

The edible crabs are heavy, slow-going beasts, with no thoughts of escape, but they have enormous power—at least under water. One easily raised a two-pound weight by just standing tiptoe beneath it. I must find its strength limit. A less than two-inch shore crab has been found to lift thirty pounds, under water of course, with one claw.

Fate of Mussels

These edible crabs remain hidden completely beneath the shingle throughout the day, whereas all hours are the same to the tireless shore crab. But at night the edible crab slowly rises, glides towards a mussel, and cleverly chips away the edge of one shell. It should be said that this mussel has been weakened by a dog whelk which, sitting atop for days, drills and drills with its radula until it touches the meat within, when, of course, the mussel gapes.

The common anemones are in constant movement, slow as the hour hand of a clock, but as effective. The daisies are now very static. Normally they live on the undersides of stones (at least in this area), their columns bent round in the slimy silt beneath. I placed mine in the tank so that they faced the sky. In two days they took up a position on

(Please turn to page 256)

News and Reviews

SWEDEN

IT is exactly 25 years ago since the well-known Swedish aquarist Mr. Edvin Brönsson started a paper which he called *Akvariet*. Little did he then dream that after an elapse of a quarter of a century, this paper would have a circulation of 5,000 issues representing practically every Swedish aquarium society. Despite economic difficulties, the lack of manuscripts and all the other troubles which are involved in the production of even the most modest of publications, Mr. Brönsson with unflinching enthusiasm edited *Akvariet* for 15 years.

In 1942 Dr. Gert Aurell became its editor. The six years during which he held this post, were not easy ones. The war cut off all imports, and contact with the outer world scarcely existed. The continual shortage of paper did not make matters better. Wisely foreseeing the advantage of having a financially strong organization behind the paper it was largely due to him that Sweden's Aquarists' Societies National Federation was formed. Success met his efforts and *Akvariet* not only has its readers at home and abroad but the number of Swedish aquarium societies increased threefold.

Swedish aquarists owe a debt of gratitude to those two men. Both pioneers, it is largely due to them and *Akvariet* that the interest in the hobby is so widespread in Sweden to-day. In 1948 Mr. Ragnar Olsson took over Dr. Aurell's post, with Mr. Paul Jacobsson as advertiser and financial expert. Under their leadership the paper continues its upward progress, and to-day there are few aquarists in that country who are not subscribers to their popular journal.

HOW to get rid of green algae has been the subject of much discussion amongst the members of Stockholm's Akvarieförening, and one of its members describes the results of the use of tannic acid for this purpose. Not only were the sides of his aquarium algae-covered, but also every plant was coated and even the sand had a green carpet. By means of an indicator the water was found to have a pH value of almost 8.0. Two grams of tannic acid crystals were dissolved in a pint of water and filtered. The solution was stirred into the waters of a 25 gallon aquarium which had continuous aeration. The fish showed an immediate reaction, huddling in corners. After half an hour even, although they were not particularly lively, they ate food given them. The pH value was controlled and was now almost 6.0.

Four hours later the water was a decided brown and despite the aeration most of the fish were at the surface snapping after air. Those least affected were *Hemigrammus ocellifer* (head-and-tail-light fish) and angels, while *Brachydanio rerio* and *Tamichthys albomaculatus* were in great distress; but worst of all were *Barbus tetrazona* and *B. conchomius*, both of which were unable to keep their balance. Platys and swordtails lay gasping on the bottom. After a renewal of three-quarters of the water in the tank most of the fish recovered. There was no doubt that the fall in the pH value was too abrupt; possibly better results would have been attained had the chemical been introduced more slowly, stretching over a period of a week or more.

What happened to the algae? After the elapse of two weeks the pH value was not quite 7.0 and the author thought a slight reduction of the algae was noticeable; at least, it had not increased. Even a few leaves and stones, which formerly were coated, had clean patches, but it was impossible to give any definite answer to the question. A more positive result was noticed in the case of a large angel fish which had been on "hunger strike" for several weeks. The ventral fins were diseased and seemed glued together,

but after the tannic acid bath there was a decided improvement. Its appetite had returned and the fins, although somewhat ragged, were no longer folded and were in use.

GERMANY

THE January issue of the German *Aquarien & Terrarien-Zeitschrift* contains a detailed description and breeding hints for *Aphyosemion bivittatum*, which had been imported from Nigeria in 1950. This importation was apparently the first one since the war. For breeding, only small tanks with old, soft water containing a trace of salt (one teaspoonful to two gallons of water) are necessary. The eggs are deposited almost continuously on plants, *Riccia*, etc., and are best collected every evening and transferred into small glass dishes. These dishes are kept

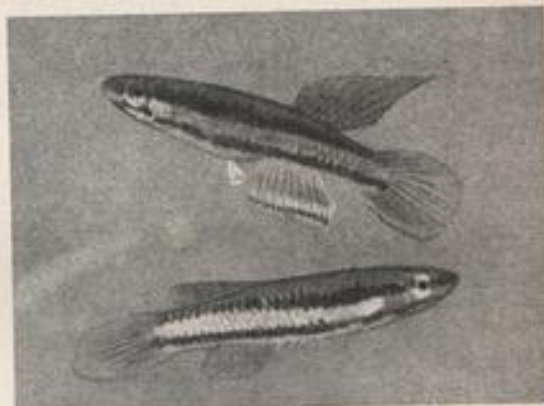


Photo:

Aphyosemion bivittatum G. Seiffert ("D.A.T.Z.")

in special incubators at about 75° F. After 16 to 20 days the eggs are hatched and the young fishes are transferred into a larger tank. Food during the first weeks consists of Infusoria, later on *Cyclops*, and chopped white worm and *Tubifex* can be given.

An article on mollies with large dorsal fins describes *Mollismina latipinna*, *M. califera* and *M. petenensis*. This last species, very similar to *M. latipinna*, had been imported to North America before the war, but has not been heard of since.

A report on breeding the catfish *Loricaria parva* is most interesting. This is probably the third time since the first importation that *Loricaria parva* has been bred successfully. These fish are very difficult to sex. The eggs were deposited on a flat stone and taken care of by the male. They hatched after several days at 80° F. The rearing of the young fish was difficult. Chopped *Tubifex* appeared to be the best food for rearing.

In a short article on the incompatibility between *Cryptocoryne* and twisted *Vallisneria* the possible causes of this puzzling fact—well known to aquarists in this country—are discussed.

A new parasite of labyrinth fish has recently been described by Prof. Schaeperclaus; a report on several consecutive broods of paradise fish infested with this newly discovered parasite (*Pillularis*) confirms Prof. Schaeperclaus's observations. It is thought that this parasite is responsible for the death of many young labyrinth fish before their labyrinth organs are properly developed.

Some very good photos and a short descriptive article show the system of fish ladders on the River Columbia in North America. These fish ladders enable the salmon to

overcome the obstacles of the Boneville and Grand Culec dams. For the vivarium enthusiast there are three articles on successfully hatched cobra and horned viper eggs, on newts and on the vision of crocodiles.

A home-made heater and thermostat are described in great detail. The construction of these gadgets would hardly appeal to the British aquarist, but for the heater a new method is used. Alternating current passes through a U-shaped glass tube filled with salt water. In this issue there is also a translation of Mr. Fraser-Brunner's letter on the International Federation of Aquarists. The original letter was printed in *The Aquarist* (November, 1951).

R. HELLER

BOMBAY

IN May last year was opened the Taraporevala Aquarium, Bombay, 39 years after the proposal for it was put forward by the secretary of Bombay's Natural History Society. The long struggle to obtain financial support for the scheme was further prolonged by the last war, but the magnificent two-storied building now occupying over 5,000 square yards only 200 feet from the sea-wall is a monument to the persistence and enthusiasm of all concerned. In addition to exhibition halls of aquaria open to the public there are research laboratories for marine biologists, a library, and the aquarium has attached to it a survey vessel and barge for the collection of specimens and pure sea water. Circulation of fresh and sea water between the aquaria is achieved by a closed system of gravity feed tanks, filtration and settling tanks, underground reservoirs and pumps; aeration is supplied by air compressors.

Journal of a Marine Aquarium

(Continued from page 254)

the side of the rock and there they are still. The crabs are kept well fed, to avoid their eating each other, or searching the interiors of the anemones for any food they contain. This is a common "last hope" of many crabs, including the hermit, which thus will cheerfully rob its own commensal anemone whenever it can get at its interior.

Because an animal lives close inshore, and is habitually exposed for 12 hours, perhaps to all weather, it is no guarantee that this animal is "tough," as aquarists understand that term. The limpet will survive a few days only, though a green weed eater. But it *must* have a non-stop supply of fresh sea water the clock round. The acorn barnacle, a plankton feeder, will live a few weeks only in unchanged water.

Two examples of the hairy porcelain crab (*Porcellana platycheles*), I introduced some days ago. These at once made for the underside of the anemone rock. They slide forth stealthily at night only, and eat only the softest food. Being really hermits that have not acquired the borrowed shell habit, they may be partial plankton feeders. Very small patches of a brown alga are now appearing on the glass—my tank is in a window facing east—but the tops and winkles keep them in check.

Last night most of the daisy anemones decamped, burying their long worm-like columns in the shingle, and now have their white and gold discs pointing upwards, hard to discern, but very potent living mantraps. A party of tiny rough winkles (*Littorina neritoides*) and chink shells, always found at or just above high water mark, were placed in the tank. Within a few minutes the whole contingent had found its way on to the studio floor—or well up the walls and hiding behind picture frames.

So at the end of a month I can report all's fairly well. But should casualties occur, two pairs of edible crab's eyes are there, just below the shingle, watching . . . always watching.



BOOK

R E V I E W

Natural History of the Sea

The Sea Around Us, by Rachel L. Carson. Staples Press, 12s. 6d.

IN the course of a year I read a great many books on a variety of subjects, but rarely is it my good fortune to come across a book so beautifully written and so packed with highly entertaining and interesting information as *The Sea Around Us*. Miss Carson is an American, and an erudite student of the sea and sea life. She has taken part in oceanographic surveys; she has dived among the coral reefs in Florida; and while writing her latest book she had the advice of eminent oceanographers and research workers in Europe and America.

Her opening chapter describes how billions of years ago the gradually cooling crust of the earth was enveloped in dense clouds of steam, and not until the earth had cooled down a lot did it receive its first rainfall. But once started, the downpour went on and on and on without cessation for months, for years, for centuries. And as the waters swept over the surface of the earth, they gravitated into the basins or depressions formed when parts of the earth's crust were flung off into space, or were moulded while still plastic by the pull of the sun.

And so the sea was born. But the young sea was not a salt sea. Millions more years were to pass before the salts and other elements dissolved out of the hardened crust gave to it its briny content. And here Miss Carson reminds us that since this process has never stopped since the initial flooding, the sea is daily becoming more bitter or salty. Of the many absorbing passages in this two hundred and twenty odd pages book, those that touch on the Sargasso Sea, and the queer creatures that live among its floating brown weed, should appeal to most readers of this magazine; so also should Miss Carson's observations on the fantastic fishes that live at depths greater than 1,500 feet.

The author has some interesting things to say about the sounds fishes can produce underwater, "strange mewing sounds, shrieks, and ghostly moans" that have been picked up in listening devices lowered into the water. "During the second world war," writes Miss Carson, "the hydrophone network set up by the United States Navy to protect the entrance to Chesapeake Bay was temporarily made useless when, in the spring of 1942, the speakers at the surface began to give forth, every evening, a sound described as being like 'a pneumatic drill tearing up pavement.'" Investigation of this queer phenomenon revealed that the strange sounds were made by fish called croakers which, in the spring, move into Chesapeake Bay from their off-shore wintering grounds.

The Sea Around Us is illustrated with two bathograms, charts of the ocean currents, and a double page chart of the history of the earth and its life. It concludes with a very useful bibliography, and a well compiled index. My advice to all aquarists is to buy this book for enjoyment and reference.

Jack Hems

THE AQUARIST

OUR READERS WRITE

Address letters:

The Editor, *The Aquarist*, The Butts, Half Acre, Brentford, Middlesex.

Readers are invited to express their views and opinions on subjects of interest to aquarists. A selection from queries received will also be answered here. The Editor reserves the right to shorten letters when considered necessary and is not responsible for the opinions expressed by correspondents.

Late Spawning

REFERRING to readers' queries in the December, 1951 issue I note that one reader's fish spawned in October and that it was stated that the chance of rearing any fry so late in the year was very remote. The following might therefore be of interest to other readers.

Last May I purchased and set up for the first time a 38 in. coldwater tank and stocked it with a breeding trio of shubunkins. During the season I religiously followed all the advice obtainable from text-books in an attempt to get the fish to spawn, but all in vain! However, on the very cold morning of 15th December I was very surprised to discover that the fish were spawning. Unfortunately I was unable to remain at home that day to give any attention, and it was 12 hours later before I returned, when I separated the fish from the remaining eggs.

From that time until now (seven weeks) I have kept a 40-watt bulb burning over the aquarium continuously, maintaining a temperature of approximately 62° F. Five days after spawning I discovered that the eggs were hatching and also that the water in the tank was teeming with microscopic life. Within 48 hours about 50 fry were counted. Lettuce and banana skin were dropped into the tank in the hope that the microscopic life would be encouraged. The fry were fed for about a fortnight on hard-boiled egg and, later, finely powdered dried shrimp and Bemax.

I have this past week started feeding the fry on shredded *Tubifex* and they have developed fine tails and finnage and vary in size from 1/2-in. to 1-in.; at present I am able to count 17 with certainty.

W. J. MORRIS,
Haverfordwest, Pembro.

Aquarium-keeping in Russia

I HAVE no information regarding aquarium-keeping in the U.S.S.R. (Editorial, *The Aquarist*, February) but would like to refer you to No. 7, July, 1951 of the magazine *Soviet Union*, which contains an account of experimental fish breeding in connection with the gigantic construction schemes going on in that country.

ANTHONY CARTER,
London, S.W.10

Temperature and Mollie Breeding

FOR the past nine months I have been endeavouring to breed speckled mollies from a medium-sized female but until recently have met with only moderate success, having produced up to 15 young at one time at the most.

However, recently having mated her with a third male for one week, she produced over 60 young fishes four weeks after the male was removed. I have tried to ascertain the reason for this improved yield and can only assume that the temperature was the decisive factor.

The female has been kept in a 24 ins. by 12 ins. by 12 ins. aquarium which is well planted and contains a liberal quantity of natural sediment. The top of the tank is completely covered and illumination is provided by two 40-watt lamps which are switched on for eight hours each day, and the tank is aerated at night only. Until the last mating the temperature varied around 80° F. but since the latest male was introduced to the female the temperature has been kept at a steady 75° F.

The youngsters were large at birth and none have been molested by their mother, who is still with them. The female was fed on dry food daily, with *Tubifex* every other day, and *Daphnia* fortnightly (which I use as a laxative only for all my fish). The fry are eating fry grain solely, to which the mother also appears to be very partial!

REX. W. GIBSON,
London, S.W.8

Selimang Trouble

TOWARDS the end of November last year, I was lucky enough to purchase a selimang—*Epalzeorhynchus kallopterus* (*The Aquarist*, February). This fish was about 2 ins. long, and extremely lively and happily settled in a tank which contained plenty of algae for its requirements.

One month later a lump started to appear underneath its body, and within a fortnight had grown so that the selimang resembled a large hatchet fish. At the final stages of this growth, the fish could only stay at the surface of the water on its back with the growth uppermost. This growth was now thought to be a tumour, and the fish was given up as lost. One morning on examination, however, this lump had disappeared, having apparently burst, and the selimang's body was a mass of hanging raw flesh in the centre of which was a large hole.

The fish was netted and treated with 2 per cent. mercurochrome, and put into another tank on its own, where, after a further application of mercurochrome, its body healed, and the hole began to fill in. The fish was by this time practically as lively as at the start. After a few days however, the fish appeared to have great difficulty in eating. It was hungry, and live food and dry food alike was taken in its mouth only to be blown out again. The fish eventually would not leave the bottom of the tank, and a few days later it died.

On examination after death the selimang was found to be completely hollow. I wonder if this is going to be a complaint peculiar to this particular type of fish? Perhaps some other aquarist has had experience of this and could offer some suggestions as to what it may have been?

(Mrs.) S. D. HARDISTY,
Carlisle, Cumb.

Agar in Infusoria Culture

I WAS very interested to read the article on foods for newly hatched fishes by Margery G. Elwin (*The Aquarist*, January). In this article agar is mentioned as being "a kind of sugar used extensively in cultivating bacteria."

May I take this opportunity of pointing out that agar is not a sugar and has no nutritional value whatsoever as regards bacterial foodstuffs. It is used extensively in the cultivation of bacteria but only as a "setting" agent for the jelly or medium on which the bacteria live. It is usually added to the nutritional foodstuffs in the proportion of from

1.5 to 2.5 per cent., and the medium, when poured into suitable plates then sets, due to the action of the agar, and this is the only use for which agar is employed in the bacteriological laboratory.

ROBERT RAWLINSON,
Clitheroe, Lancs.

Agar is a "polysaccharide," one of the carbohydrates—a group of substances to which the sugars also belong.

Tubifex Storage

I HAVE for some time tried various ways of keeping *Tubifex*. One method I have found very satisfactory, is to prepare a number of 1 lb. or 2 lb. jam jars by putting 1/2-in. of fine gravel into each, then filling with water. Into each jar I put a small quantity of *Tubifex* and place in a cool, not too light place; the water in the jars requires changing once a week. The *Tubifex* burrows in the gravel and does not roll into a tight ball as they would if placed in jars with water only.

The method of removing the worms for feeding is this:—stir the contents of the jar with a piece of wood or old spoon; this causes the worms to come free of the gravel and they can be siphoned out quite easily.

P. BOWEN,
Watford, Herts

White Spot Treatment

THREE weeks before reading the article in *The Aquarist* (January) on the quinine treatment of fish I had treated my fish by dissolving a five grain tablet of soluble sulphate of quinine in each 24 ins. by 12 ins. by 12 ins. aquarium. Lights were left on and the temperature remained at 75° F. Four days later there was no trace of white spot.

I was naturally very concerned lest the fishes were all sterile, as the footnote to the article suggested they might be. I therefore immediately spawned some zebra fishes and great was my relief when over 100 fry hatched a few days later and are now flourishing. It will no doubt be of interest to many to know that zebras are not affected by this treatment and I hope to prove within a week or two that white cloud minnows, tiger barbs and fighters are similarly fertile following quinine treatment.

H. K. SAYER,
Swanley, Kent

YOUR contributor to the January issue dealt with the use of quinine to cure the more difficult type of white spot, taking some five weeks to effect a complete cure. I would like to pass on the treatment I used in clearing this stubborn white spot, which appeared very quickly round the eyes and on the body of a perma black mollie.

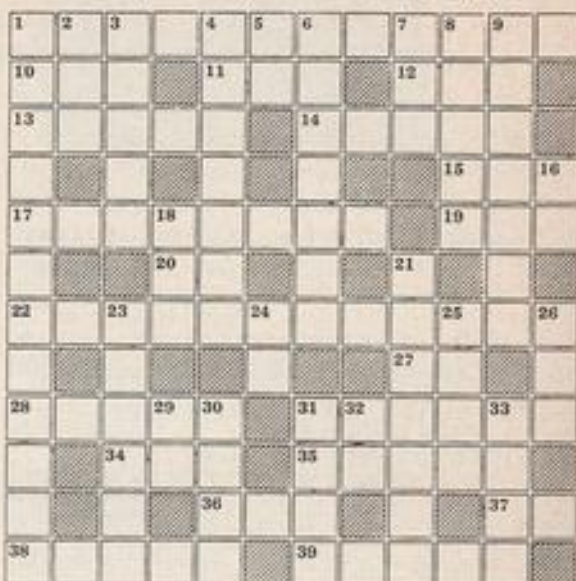
The fish was placed in a 1 lb. jar filled with tank water and floated in the aquarium (75° F.). Sufficient of a 2 per cent. solution of mercurochrome was added to colour the water. This mixture was emptied and renewed every third day, the operation being repeated four times, during which time the fish continued to feed well and showed no ill effects. After 15 days the fish was completely free of the disease and was returned to the aquarium in first-class condition.

A solution of 2 per cent. mercurochrome can be obtained from most chemists and costs only a matter of a few pence for a small bottle which will last a considerable time. A word of warning—mercurochrome has a detrimental effect on plant life and it is advisable to use it only when a fish is isolated.

D. H. GIBBONS,
York

The AQUARIST Crossword

Compiled by J. LAUGHLAND



CLUES ACROSS

- Sticky beginnings (8, 4)
- fly larvae are aquatic (3)
- Swallowed tail of skate (3)
- Turn tail of scalars for age (3)
- This snake counts (5)
- One who rules (5)
- Nest (3)
- Consisting of eggs (8)
- Did will do (3)
- Head of an angel (2) (7, 5)
- Betta's scrap (paraphrase)
- Salt-water N.C.O. (1, 1)
- Jag-shaped (5)
- Popular aquarium plant (6)
- Half a league (3)
- A bog (4)
- Shy nature of some fishes (3)
- No back in the neck (2)
- One of the Ophidia (5)
- Stinking fish? No; just its name (5)

CLUES DOWN

- Female warriors' weapons or aquatic plants (6, 6)
- Parent of torpid adder (3)
- Hardly mixed menace to young fry (5)
- Young pilchard (7)
- This is it (2)
- Green freshness of plants (7)
- British fish from Sargasso (3)
- Welsh river turns after royal cypher. Piscine and human trait! (5)
- Mix rash fig for fish (7)
- Award for commissioned spare-time military (1, 1)
- Black sheep of the gouramies (3)
- Tope, sir (anagram) (7)
- Fairy moss (6)
- Thus in the sole (2)
- Higher than the angels? (4)
- Bellevues and mixed 11 (3)
- This means that is (1, 1)
- Dart or dart. British fish (4)
- Genus of tortoises (4)
- Look in glowlight tetra (2)
- Islet (4)

PICK YOUR ANSWER

- "Fundulus from Togo" is the popular name of: (a) *Aphysanemus filamentosus*, (b) *Aphysanemus gardneri*, (c) *Fundulus chrysostris*, (d) *Fundulus pallidus*.
- Among domesticated goldfish the number of scales along the lateral line is: (a) 18 to 24, (b) 20 to 26, (c) 22 to 28, (d) 24 to 30.
- A dioecious plant (e.g. *Pallismeria*) is one that: (a) Has grass-like leaves, (b) Grows best in still water, (c) Reproduces by seeds and runners, (d) Has male and female flowers on separate plants.
- Which of these fish is reputed to eat *Argulus* (fish louse)? (a) Dace, (b) Minnow, (c) Roach, (d) Tench.
- Snails that inhabit British fresh waters number about: (a) 11 species, (b) 22 species, (c) 33 species, (d) 44 species.
- The Centrarchidae (freshwater sunfishes) are native to: (a) North Africa, (b) South Africa, (c) North America, (d) South America.

G. F. H.

Solutions on page 260

SHORT talks on cherry barbs, water plants and beaçon fishes were given by Messrs. Poulton, Read and Marley at the January meeting of the **Bournemouth Aquarists' Club**. In future two meetings each month are to be held; a five-day exhibition is planned for August.

MR. R. G. MEALAND judged a table show of livebearers and coldwater fishes at a meeting of the **Canford Aquarium, Reptile and Pondkeepers' Society**, and he also gave his comments on the exhibits. The society's 30 members have presented a tropical aquarium to Lewisham Hospital.

A YEAR of exceptional successes in showing and meetings was reviewed at the annual general meeting of the **East London Aquarists' and Pondkeepers' Association** last month. Messrs. P. S. Campkin, G. R. Howlett and Miss C. Bonser were awarded trophies.

THE **Erith and District Aquarists' Society** recently presented a stocked tropical aquarium to their local hospital. The society's annual dinner and annual general meeting were held early this year.

HIGHLIGHT of 1951 was judged to be the presentation of a large furnished aquarium to the Children's Hospital, Sydenham, when the treasurer of the **Forest Hill and District Aquaria Society** gave his report at the annual general meeting.

MEMBERSHIP of 28 is now reported by the **Gosport and Fareham Aquarists' Club** in its fifth month of activity. Lectures have been received on aquarium management and cold-water fish keeping and breeding at recent meetings.

AT the last monthly meeting of the **Halifax and District Aquarists' Society** members stood for one minute's silence in memory of his late Majesty King George VI; a resolution expressing condolence with the Royal Family was passed. Mr. G. W. Cooke spoke on the principles of tropical fish breeding. A table show for livebearers is to be held at this month's meeting.

PROCEEDS from an exhibition of 40 aquaria held last year, a sum of £24, were donated by the **Hartlepool and District Aquarists' Society** to the Hartlepool Workshops for the Blind. Electricity and the aquarium was the subject of a lecture given by Mr. W. Fawley to the society last month. Table shows continue to be popular items at this society's meetings.

A LARGE audience of aquarists attended a Gaumont British film show at the January

News

from AQUARISTS' SOCIETIES

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

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

meeting of the **Hendon and District Aquatic Society**. Last month Mr. C. Cole spoke on enemies of fishes.

LECTURES and discussions on breeding tropical fishes and an outing to Birmingham are on the programme of the **Huddersfield and District Aquarist Society** for this year. Meetings are held on the third Tuesday of each month at the New North Road Baptist School.

A JOINT table show between the **Nelson and District Aquarists' and Colne and District Aquarists' Society** has been arranged to take place shortly. A large number of questions was put to the speaker after a talk on breeding white cloud mountain minnows given by Mr. K. Anness to the Nelson Society recently.

ANNUAL dinner of the **North London Aquarist Society** was held last month; included among the guests were the well-known aquarists Mr. and Mrs. L. Katters, who presented trophies to members of the society.

MR. G. WARBURTON gave a talk on show management and organisation to members of the **Rochdale and District Aquarist Society** recently. Last month a table show of egg-layers up to two inches in length was held.

AFTER the **Scarborough Aquarists' Society** "Scale" table show of plants, Mr. L. Briggs, the judge, awarded first prize to Mr. T. Eagle and second to Mr. H. Hall. A "quiz" was held last month at which Mr. G. E. Lyon acted as question master.

MEMBERS of the **Southall Aquarist Society** raised their current problems and difficulties for discussion and solution after the annual general meeting. Table shows, country rambles to collect live foods, film shows and

lectures and public exhibitions are included in the society's plans for the year's activities.

A FILM show and a lecture on genetics were recent events taking place at meetings of the **Swinton and District Aquarists' Society**. A junior section of the society holds individual meetings under the guidance of a senior member.

DESPITE short notice a successful show of aquaria was staged by the **Tyneside Aquatic and Biological Society** at a local bird society's exhibition held in Newcastle. Good publicity was obtained and the furnished aquaria attracted considerable interest from the public.

MEMBERSHIP of the **Walsall and District Aquatic Society** has nearly doubled in the past year, it was reported by the secretary at the annual general meeting. Last month Mr. W. L. Mandeville gave a lecture on practical fish-keeping to members.

FOLLOWING the death of Mr. P. Templar, oldest member of the **Welsh National Aquarists' Society**, a sale of fishes and plants on behalf of this aquarist's widow was held. Mr. K. Barker has given a lecture on F.B.A.S. standards for guppies, mollies and fighters to members.

AN EXHIBITION of fishes was held last month by the **Weston-super-Mare and District Aquarists' Society**. At the previous meeting a lecture on the scientific approach to fish-keeping was given by Mr. G. B. Wadham. Meetings of the society are held at Albert Hotel, Beach Road, Weston-super-Mare.

READINGS from *The Aquarist* and discussion of articles made an instructive and interesting evening meeting for members of the **Aquarists' Section of the Weybridge Natural History Society**, held at 12, Outlands Avenue, Weybridge, Surrey.

A.T.A. Dinner

More than a hundred members and guests attended the annual dinner and dance of the **Aquatic Traders Association**, held in London in January. Mr. R. Smith (Brosiam) was in the chair and many leading traders were present. During the evening a presentation was made to Capt. L. C. Betts by Mr. J. North on behalf of the Association, and Mr. and Mrs. R. Fairbairn (Fairbairns Aquaria Limited) deserved congratulations on their organisation of the enjoyable function.



March, 1952



Presentation of a tropical aquarium to the Neithrop Hospital, Banbury, by the Banbury and District Aquatic Society. In the picture are the matron of the hospital, two patients and Messrs. C. G. Tomlinson and H. L. Hazlewood, secretary and chairman of the society

The Indian Aquarist

FOR some time now we have enjoyed receiving each month *The Indian Aquarist*, a monthly bulletin of The Aquarist Society of India (secretary, Mr. M. Manal, 251, Hornby Road, Bombay, 1). The reported meetings of the society are always highly practical; thus, at a meeting last October a talk was given by Mr. F. Hodges on the methods he uses to acclimatise the salt water fishes occurring around Bombay to life in fresh water aquaria. A large scale show was held in Bombay by the society last December.

Fish Breeding Course

A WEEK-END instructional course on "Breeding Fish" has been arranged by the Urchfont Manor Residential College for Adult Education (nr. Devizes, Wilts.), starting 7.30 p.m., Friday, 28th March and ending Sunday, 30th March, which aquarists can attend for a maximum inclusive fee of £2. Lectures are being given by Dr. F. S. C. Knowles on inheritance in fishes, fish anatomy, breeding factors, etc., and discussions and a practical demonstration at Marlborough College Aquarium are planned. Application to participate should be made to Warden Paul Cherrington at Urchfont Manor as early as possible. The fee includes accommodation and meals.

New Societies

Ayr and District Aquarium Society: Secretary: (Mrs.) Moryson, 15, Inverhar Road, Ayr. Meetings: First Thursday of each month, Unionist Committee Rooms, 1, Wellington Square, Ayr.

Barrow and District Aquarium Society: Secretary: K. Ralph, 8, Malton Crescent, Barrow-in-Furness, Lancs.

Brechin and District Aquarist Club: Secretary: J. Garros, 119, Montrose Street, Brechin, Angus. Meetings: First and third Thursdays of each month.

Carlisle and District Aquarists' Society: Secretary: S. Crosby, 120, Borland Avenue, Carlisle.

Chippenham: Aquarists in this area interested in becoming members of a new society there are asked to write to Mr. P. Chapman, Crosslands, Christian Malford, Chippenham, Wilts.

Dawnham Aquarist Society: Secretary: J. Carden, 39, Launcelot Road, Bromley, Kent. Meetings: Every Tuesday, 8 p.m., at Durham Hill School, Dawnham, Bromley.

Deal and District Aquarist Society: Secretary: G. Townshend, 115, Blenheim Road, Deal. Meetings: First Wednesday each month, 7.30 p.m., at the Swan Hotel, Queens Street, Deal.

Irish Federation of Aquarist Societies: Secretary: J. S. Adgey, 38, Buckingham Street, Belfast.

Lancaster, Morecambe and District Aquarists' Society: Secretary: L. G. Lucas, 39, Regent Street, Lancaster. Meetings: Fortnightly, 7.30 p.m., George Hotel, Torrisholms, Lancaster.

Lyons Club Aquarists' Section: Secretary: V. White, Lyons Club, Hammersmith (phone: CH15wick 4742).

Midsomer Norton, Nr. Bath: Aquarists in this area interested in becoming members of a new society there are asked to write to Mr. H. F. Gregory, 123, High Street, Midsomer Norton, Nr. Bath, Somerset.

Royal Leamington Spa Aquarist Society: Secretary: G. Jewell, 4, Avendale Road, Leamington Spa, Warwickshire. Meetings: Second Wednesday each month at The Green Man, Tachbrook Street, Leamington Spa.

Sunderland and District Aquarist Club: Secretary: W. Brindley, 13, Blind Lane, New Silksworth, Co. Durham.

Wigan and District Aquarist Society: Secretary: N. A. Brown, 145, Woodhouse Lane, Wigan, Lancs. Meetings: First Tuesday and third Wednesday each month at the Ship Hotel, Millgate, Wigan.

Secretary Changes

CHANGES of secretaries and addresses have been reported from the following societies: **Blackpool and Fylde Aquatic Society** (Mr. G. Robinson, Maxwelton, 17, Victoria Road, Poulton-le-Pyldes, Blackpool); **Bristol Aquarists' Society** (Mr. W. E. Ridler, 9, Friendship Road, Bristol, 4); **Chingford and District Amateur Aquarists' Society** (Mr. R. Macfadzean, 46, Nevin Drive, Chingford, E.4); **City of Salford Aquarist Society** (Mr. A. P. Huddart, 16, Buckland Road, Salford, 6, Lancs.); **Gravesend and District Aquarist Society** (Mr. V. L. Trew, 3, Overcliffe, Gravesend, Kent); **Hendon and District Aquatic Society** (Mr. M. G. Freeman, 24, Golders Manor Drive, N.W.11); **King's Lynn**

and **District Aquarists' Society** (Mr. A. W. Wakeham, 72, London Road, Long Sutton, Spalding, Lincs.); **Kodak Aquarist Section** (Mr. P. A. L. O'Hara, K.R.S. Aquarist Section, Kodak, Wealdstone); **Leyton Aquarium and Pond Society** (Mr. R. Hull, 190, Hainault Road, Leytonstone, E.11); **Luton and District Aquarists' and Pondkeepers' Society** (Mr. R. J. Taylor, 30, Kennington Road, Luton); **Meridian Aquarists** (Mr. C. E. Collins, 19, Longbury Drive, St. Paul's Cray, Orpington, Kent); **Oxford Aquaria Society** (Mr. E. N. Ingram, 4, Stoneburge Crescent, Bucknell Road, Bicester); **Southampton and District Aquatic Society** (Mr. H. J. Gilbert, 16, Yew Road, Bitterne, Southampton); **Southport Aquarist Society** (Mr. M. B. Hilton, 14, Queens Road, Southport, Lancs.); **Staines and District Aquarists' Society** (Mr. G. R. Clarke, 51, Riverbank, Staines, Middlesex); **Sydenham and Penge Aquarist Society** (Mr. R. H. Wright, 43, Lennard Road, Penge, S.E.20); **Thames Valley Aquatic Society** (Mr. A. R. Bowden, 61, Manor Drive North, New Malden, Surrey); **Wembley and District Aquarium and Pool Association** (Mr. W. Peplar, 16, Turton Road, Wembley, Middlesex); **Wembley Aquarist Society** (Mr. M. Hollinshed, 72, Park View, Wembley, Middlesex); **Winchester City Aquarists** (Mrs. P. M. Inge, 31, Hinselley Road, Chandlers Ford, Eastleigh, Hants.); **Willesden and District Aquarist Club** (Mr. F. W. Keen, 18, Walton Close, Cricklewood, N.W.2); **Workington and District Aquarist Society** (Mr. B. Smith, 75, Harrington Road, Workington, Cumberland); **Wombwell and District Aquarists' Society** (Mr. G. M. Charlesworth, 5, York Street, Wombwell, Nr. Barnsley).

Aquarist's Calendar

8th March: London County Council Free Lecture, "British Reptiles," by Mr. Alfred Leutscher, 3.30 p.m., at the Horniman Museum, London Road, Forest Hill, S.E.23.

7th April: British Herpetological Society (London Group) meeting, "Newts and Salamanders (Caudata)," 7 p.m., at the Linnæus Society's Rooms, Burlington House, Piccadilly, London, W.1.

16th May: British Herpetological Society (London Group) meeting, "Snakes (Ophidia)," 7 p.m., at the meeting room of the Zoological Society of London, Regent's Park, London, N.W.8.

21st to 24th May: Edinburgh and East of Scotland Aquarist Society's Premier Show, in the Waverley Market, Princes Street, Edinburgh.

Crossword Solution

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

PICK YOUR ANSWER (Solution)

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

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Paris	136	<i>Platypharodon</i> species	29, 213	Poisonous metals	218	Polymyxin	16	<i>Polyporus terrae</i>	40	Ponds, Informal and Formal	36, 82, 92, 126	Pond cleaning	134, 162, 192, 220	Pond making	142	Pond skaters	14, 112, 124, 171, 240	Pond sponges	168	Pond matting	14, 167	<i>Protophylla anserina</i>	124	<i>Protophylla</i> species	40	Puffer fish	169, 233	<i>Pyrrhulina racheotana</i>	106	 		Q		Quinine treatment	104, 206	 		R		<i>Ramsdellia intermedia</i>	251	<i>Rasbora heteromorphus</i>	129	<i>Rasbora maculata</i>	107, 129	Reptiles	17, 85, 140, 150, 251	Respiration	249	<i>Riccia</i>	38	Rickets	70	Rock garden	38, 64, 82, 102	Rockwork for aquaria	5, 14, 28	Rotifers	77	Rudd	4	Runs	34	 		S		<i>Sagittaria natans</i>	79	<i>Salvinia</i>	38	Sand for aquaria	5, 11	Scallops	42	<i>Scaphiopus argus</i>	19	Sea urchin	19	Selective breeding	52, 122, 232, 244	Selming	228	Setting-up aquaria	5, 34, 63, 77, 142	Sexing fish	18, 31, 212	Shimmying	76	Show furnishing	181	Show standards	52, 78, 95, 142, 168, 247, 248	Shubunkin	52, 247, 248	Siamese fighting fish	40, 99, 130	Sirhan, Automatic	54	Skin, Amphibian	164	Snails, Water	7	Snake Temple, Penang	150	Society meetings	245	Southsea Aquarium	80	Spatterdock	108, 150, 182	Specific diseases	75	Split tail	25	Starwort	12	Stickleback breeding	226	Streptomycin	15	Sunfish, Black-banded	39	Swimming, Mechanism of	222	Swordtail hybrids	29, 71	<i>Synodontis angolensis</i>	159
Hospital Aquarium Fund	PAGE																																																																																																																																																																																																																																																																																																																																																												
Hybridisation	26, 116																																																																																																																																																																																																																																																																																																																																																												
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<i>Hyphessobrycon gracilis</i>	202																																																																																																																																																																																																																																																																																																																																																												
<i>Hyphessobrycon innexi</i>	232																																																																																																																																																																																																																																																																																																																																																												
<i>Hyphessobrycon pulchripinnis</i>	17																																																																																																																																																																																																																																																																																																																																																												
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<i>Ichthyophanes</i>	76																																																																																																																																																																																																																																																																																																																																																												
Inbreeding	246																																																																																																																																																																																																																																																																																																																																																												
Infusoria culture	10, 77, 108, 137, 204																																																																																																																																																																																																																																																																																																																																																												
Inheritance	244																																																																																																																																																																																																																																																																																																																																																												
International Federation, Proposed	171																																																																																																																																																																																																																																																																																																																																																												
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<i>Kryptopterus</i> species	140, 195																																																																																																																																																																																																																																																																																																																																																												
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Labyrinth fishes	179, 185																																																																																																																																																																																																																																																																																																																																																												
<i>Lacerta</i> species	85, 140																																																																																																																																																																																																																																																																																																																																																												
<i>Lagarosiphon major</i>	12																																																																																																																																																																																																																																																																																																																																																												
Lagging aquaria	145																																																																																																																																																																																																																																																																																																																																																												
<i>Laimneria zibonensis</i>	88																																																																																																																																																																																																																																																																																																																																																												
Leaka, Aquarium	20																																																																																																																																																																																																																																																																																																																																																												
Leaky pond	51																																																																																																																																																																																																																																																																																																																																																												
<i>Lethis reticulatus</i>	79, 232																																																																																																																																																																																																																																																																																																																																																												
Lemon tetra	17																																																																																																																																																																																																																																																																																																																																																												
Lighting, Aquarium	28, 98																																																																																																																																																																																																																																																																																																																																																												
Lighting canopy	98																																																																																																																																																																																																																																																																																																																																																												
Line breeding	52, 122, 232, 244																																																																																																																																																																																																																																																																																																																																																												
Livebearers	79, 129, 163, 244																																																																																																																																																																																																																																																																																																																																																												
Livebearer troubles	76																																																																																																																																																																																																																																																																																																																																																												
Live foods	53, 63, 73, 84, 92, 101, 177, 205																																																																																																																																																																																																																																																																																																																																																												
<i>Lebia cardinalis</i>	250																																																																																																																																																																																																																																																																																																																																																												
Loggerhead turtle	232																																																																																																																																																																																																																																																																																																																																																												
London Zoo Aquarium	19, 65, 88, 170, 194, 232																																																																																																																																																																																																																																																																																																																																																												
<i>Loricaria parva</i>	255																																																																																																																																																																																																																																																																																																																																																												
<i>Lutjanus xanthurus</i>	231																																																																																																																																																																																																																																																																																																																																																												
Luminous organs	215																																																																																																																																																																																																																																																																																																																																																												
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<i>Macropodus opercularis</i>	115																																																																																																																																																																																																																																																																																																																																																												
Madagascar lace plant	118																																																																																																																																																																																																																																																																																																																																																												
Maggots as food	53																																																																																																																																																																																																																																																																																																																																																												
Making aquaria	183, 207, 247																																																																																																																																																																																																																																																																																																																																																												
Making holes in jars	54																																																																																																																																																																																																																																																																																																																																																												
Malayan burrowing snail	16, 87, 143																																																																																																																																																																																																																																																																																																																																																												
<i>Margaritifera margaritifera</i>	97																																																																																																																																																																																																																																																																																																																																																												
Marine aquarium	19, 42, 170, 194, 254																																																																																																																																																																																																																																																																																																																																																												
Marsh marigold	13, 27																																																																																																																																																																																																																																																																																																																																																												
<i>Martilia quadrifolia</i>	251																																																																																																																																																																																																																																																																																																																																																												
<i>Melania tuberculata</i>	16, 87, 143																																																																																																																																																																																																																																																																																																																																																												
Melanosis	76																																																																																																																																																																																																																																																																																																																																																												
<i>Melanostoma maculata</i>	139																																																																																																																																																																																																																																																																																																																																																												
Methylene blue	17																																																																																																																																																																																																																																																																																																																																																												
<i>Mogurnda mogurda</i>	105																																																																																																																																																																																																																																																																																																																																																												
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Mosquito fish	148, 244																																																																																																																																																																																																																																																																																																																																																												
Mosquito larvae	73, 101																																																																																																																																																																																																																																																																																																																																																												
Mouth fungus	120, 129																																																																																																																																																																																																																																																																																																																																																												
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<i>Myriophyllum</i>	12, 79																																																																																																																																																																																																																																																																																																																																																												
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<i>Nannacara species</i>	105																																																																																																																																																																																																																																																																																																																																																												
<i>Nasella trimaculata</i>	17																																																																																																																																																																																																																																																																																																																																																												
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Neon fish	125																																																																																																																																																																																																																																																																																																																																																												
Neon tetra disease	17, 75																																																																																																																																																																																																																																																																																																																																																												
Net filter, <i>Daphnia</i>	33																																																																																																																																																																																																																																																																																																																																																												
New York Aquarium	41																																																																																																																																																																																																																																																																																																																																																												
News	8																																																																																																																																																																																																																																																																																																																																																												
Nicotine and fish	48, 149																																																																																																																																																																																																																																																																																																																																																												
Nile shrimp	33																																																																																																																																																																																																																																																																																																																																																												
Nuphar	108, 150, 182																																																																																																																																																																																																																																																																																																																																																												
<i>Nymphes danubiana</i>	118																																																																																																																																																																																																																																																																																																																																																												
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<i>Ocimum intermedium</i>	75																																																																																																																																																																																																																																																																																																																																																												
Octopus	PAGE																																																																																																																																																																																																																																																																																																																																																												
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<i>Pachypanchax pleurostictus</i>	57																																																																																																																																																																																																																																																																																																																																																												
<i>Palomares esgaris</i>	170																																																																																																																																																																																																																																																																																																																																																												
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<i>Paramoecium</i>	10																																																																																																																																																																																																																																																																																																																																																												
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<i>Petersonia caudalis</i>	159																																																																																																																																																																																																																																																																																																																																																												
<i>Phenacogrammus interruptus</i>	159																																																																																																																																																																																																																																																																																																																																																												
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Plaster of Paris	136																																																																																																																																																																																																																																																																																																																																																												
<i>Platypharodon</i> species	29, 213																																																																																																																																																																																																																																																																																																																																																												
Poisonous metals	218																																																																																																																																																																																																																																																																																																																																																												
Polymyxin	16																																																																																																																																																																																																																																																																																																																																																												
<i>Polyporus terrae</i>	40																																																																																																																																																																																																																																																																																																																																																												
Ponds, Informal and Formal	36, 82, 92, 126																																																																																																																																																																																																																																																																																																																																																												
Pond cleaning	134, 162, 192, 220																																																																																																																																																																																																																																																																																																																																																												
Pond making	142																																																																																																																																																																																																																																																																																																																																																												
Pond skaters	14, 112, 124, 171, 240																																																																																																																																																																																																																																																																																																																																																												
Pond sponges	168																																																																																																																																																																																																																																																																																																																																																												
Pond matting	14, 167																																																																																																																																																																																																																																																																																																																																																												
<i>Protophylla anserina</i>	124																																																																																																																																																																																																																																																																																																																																																												
<i>Protophylla</i> species	40																																																																																																																																																																																																																																																																																																																																																												
Puffer fish	169, 233																																																																																																																																																																																																																																																																																																																																																												
<i>Pyrrhulina racheotana</i>	106																																																																																																																																																																																																																																																																																																																																																												
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<i>Ramsdellia intermedia</i>	251																																																																																																																																																																																																																																																																																																																																																												
<i>Rasbora heteromorphus</i>	129																																																																																																																																																																																																																																																																																																																																																												
<i>Rasbora maculata</i>	107, 129																																																																																																																																																																																																																																																																																																																																																												
Reptiles	17, 85, 140, 150, 251																																																																																																																																																																																																																																																																																																																																																												
Respiration	249																																																																																																																																																																																																																																																																																																																																																												
<i>Riccia</i>	38																																																																																																																																																																																																																																																																																																																																																												
Rickets	70																																																																																																																																																																																																																																																																																																																																																												
Rock garden	38, 64, 82, 102																																																																																																																																																																																																																																																																																																																																																												
Rockwork for aquaria	5, 14, 28																																																																																																																																																																																																																																																																																																																																																												
Rotifers	77																																																																																																																																																																																																																																																																																																																																																												
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