The
AQUARIST and
POND-KEEPER
(Incorporating "The Reptilian Review")
Devoted to the Study of Aquatic Reptilian and Batrachian Life

EDITORIAL

FISHES have been in the news quite a lot just lately. One unfortunate aquarist, we read, had the misfortune to set fire to his home through his paraffin heater, used for a tropical aquarium, bursting into flames. Fortunately, the fire was a small one and speedily put out, but it should serve as an object lesson to many. Paraffin lamps are a cheap and simple means of heating tropical aquariums, but they need careful and constant attention if they are to be kept trouble-free.

Fishes again appeared in the news when an unwise pedlar exchanged some for old clothes, or something, the magistrates ruling that it was "again the law." We are glad to learn this, for many a fish meets an untimely end by this means, and when so cheaply and easily obtained it does not encourage a further study of their requirements and care. In passing, we would mention one well-known aquarist who stole his father's trousers many years ago, to effect a similar deal, before it was against the law to do so, but wild horses would not draw his name out of us! No, it wasn't us!

Then, again, the papers are reporting late spawnings of goldfishes in garden pools, due to the prolonged spell of mild weather, regretting that nothing will come of the spawn. It is too bad they have not aquarist correspondents on their staffs, since it is well enough known that that spawn will do as well as the earlier spawnings if brought indoors and cared for under aquarium conditions.

Yes, fishes certainly have been in the news, and the hobby must be getting better known by this means, no matter what that news may be.

* * *

As long ago as January of this year we published an article on "Barbus partipentazona and its Relatives," by A Fraser-Brunner, an article commissioned by us in order to relieve the confusion existing over the misnaming of *Barbus tetrazona*. Subsequently, an article appeared in a contemporary which, while rightly making use of certain sections of this article, ignored the essence thereof and misconstrued Fraser-Brunner's explanation of the reason why the name "sumatranus" cannot be used.

Fraser-Brunner replied to this in a later issue of the *Aquarist and Pond-keeper*, once more

THE AQUARIST AND POND-KEEPER

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Aqua, Cunæ vitæ, ager nobis

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All communications for the Editor should be addressed: "The Editor, *The Aquarist and Pond-keeper*, 20 St. Andrew Street, London, E.C.4." In every case the name and address of the writer must be given.

The Editor welcomes the opportunity of considering original contributions on all branches of the hobby and its allied interests; authentic breeding records, personal experiences, and photographs. Contributions should be typed or clearly written on one side of the paper only. MSS or prints unaccompanied by a stamped addressed envelope cannot be returned, and no responsibility is accepted for contributions submitted. Correspondence with intending contributors is welcomed. Copies of any article published, together with its illustrations, in pamphlet form, for the use of schools, museums, clubs, etc., may be obtained on application in quantities of not less than 50 at prices to be obtained from the publishing offices.

QUERIES

Postal replies are made to all specialised queries providing a stamped addressed envelope is enclosed. **This privilege is afforded only to registered readers and direct subscribers.** In all cases letters should be addressed to the Editor.

Specimens for identification, etc., should be securely packed and be accompanied by return postage if return is desired.

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Wrap fish in clean wet cloth without squeezing; then wrap in greaseproof paper, pack round with cotton wool in tin box, and despatch as soon as possible after death. This method of packing is important.

EDITORIAL—*Continued*

explaining the point which our contemporary appeared to be unable to understand. It would appear that the rulings of the International Commission for Zoological Nomenclature, and the finer points of systematics, are still not quite appreciated as much as they should be.

In a more recent issue of this contemporary, the subject is again brought up in a defensive article which quotes de Beaufort and Meink as correcting Fraser-Brunner's identificati Curiously enough, Meinken's statement, wh was quoted, was merely an attempt on his p to explain the matter to a German aquari- club, including the gist of Fraser-Brunne article appearing in the *Aquarist* and *as f from contradicting his classification, Meink had already sought Fraser-Brunner's advice the matter*!

As regards de Beaufort, Fraser-Brunner w in correspondence with him before he wrote h article, and de Beaufort had already ackno

ledged that Fraser-Brunner's classification the species, as published in the *Aquarist*, wa correct, *actually correcting a date error in hi de Beaufort's, paper on the subject, previousl published*! Now de Beaufort is quoted a contradicting Fraser-Brunner's statement!

We ourselves do not profess to be competen to argue the pros and cons of systematics, bu we do realise that those who are recognise authorities are being dragged into a journalisti controversy not of their own making, which i neither pleasing to them nor likely to add t the standing of the journals concerned.

It has ever been the policy of this journal t ensure that its scientific articles are contributed by the leading authority available on any par ticular subject, and we thus have Fraser Brunner's assurance that there is nothing t add, and nothing to correct, in his articl defining the Barbs in the issue of this journa for January-February, 1938, articles in othe aquatic journals notwithstanding.

COLOUR AND PATTERN IN FISHES

By A. FRASER-BRUNNER, F.Z.S.

QUESTIONS are frequently raised by aquarists concerning the changes in colour and pattern to which nearly all fishes are subject, and now some correspondence has been received from a reader which provides an opening for a discussion of the matter.

This gentleman has, in a three-foot community tank, a specimen of *Nannostomus trifasciatus* which, he says, puzzled him for months, since he could never find it at night, whereas there was another fish which he could not find by day. Now he has discovered that these "two" fishes are, in fact, the same individual with a totally different pattern.

As many will probably know, this is not by any means the first observation of the nocturnal change of pattern in this species; Innes remarked on it in his "Exotic Aquarium Fishes," and Arnold and Ahl took pains to illustrate it in their "Fremdländische Süsswasserfische."

But our correspondent has an inquiring mind, and he goes on to ask:

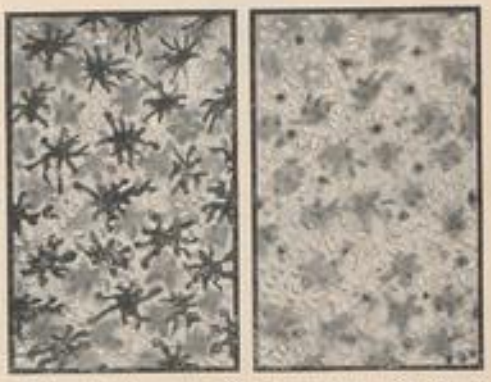
"Now, Sir, the change in *N. trifasciatus* must have a reason and be of some benefit to the fish. Why does it do it? Can we have an article in our journal explaining the reason?"

Before complying with his request, I would point out, at the risk of appearing pedantic, that it is not usual for biologists to look for reasons in natural phenomena. The "natural scheme of things" is really a balance, never quite stable, brought about by cause and effect in the course of evolution, and resembling a plan (as conceived in the human mind) because of the inter-dependence of its parts. A change in any of the parts produces an effect, which itself becomes the cause of a further change in some associated other part; sometimes such changes are large and obvious, more often they are infinitesimal and imperfectly understood by us. The good scientist does not ask "Why?" but "How?"

The relevance of these remarks will be appreciated as this article proceeds, for the explanation as to how the colour and pattern changes of fishes are brought about is a story of cause and effect.

To answer our correspondent adequately we have to tackle the question of coloration in fishes generally, and to approach it from two angles, the physiological and the evolutionary. We will consider the physiological aspect first, and inquire by what means colour and pattern are achieved in the individual.

Now, white light, as every schoolboy knows, contains all the colours visible to the human eye, and it is only when the light rays fall upon, or pass through, a substance which absorbs some of them that we are able to receive the remaining rays as the colour they



Left: **Portion of skin from the side of a fish, with melanophores (black pigment cells) expanded**
Right: **The same, melanophores contracted. The cells appearing grey are orange chromatophores, and among them are numerous iridocytes**
(Highly magnified)

represent. Thus, a substance which absorbs the short light waves at the red end of the spectrum will appear blue or violet to us because the long waves are reflected back to our eyes.

The substances which serve this purpose in fishes are the *pigments*. They are highly complex chemically, granular in structure, and belonging to two series, the *lipochromes*, consisting of reds, orange and yellows, and the *melanins*, consisting of blacks, some of which serve as blues. Pigments have been shown to be by-products of metabolism. They may be said originally to have been part of the waste left over at the end of food conversion and were deposited in the skin in an effort at excretion. Later, special cells supplied with nerves

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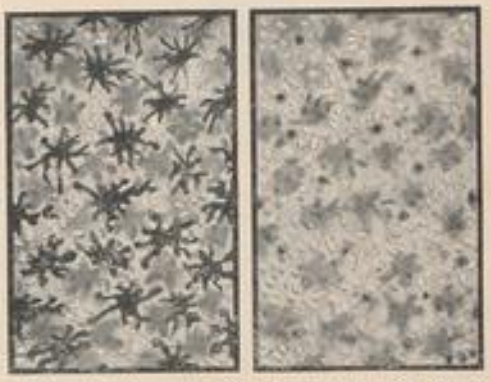

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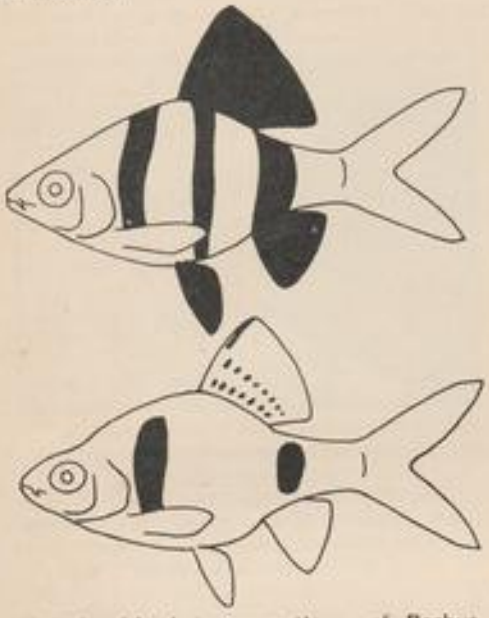
became modified to contain them and it is to the presence of these pigment-cells (chromatophores) in the skin that most of the colours of fishes are due. A mixture of black and yellow chromatophores produces a green effect, black and orange give brown, and so on.

Certain black pigments are not entirely waste products, however, but can be reabsorbed as food. Some goldfish are prone, in times of plenty, to produce black patches in the skin, which later, if food becomes scarce, or for some reason fails to maintain them, will be metabolised.



Relationship between patterns of Barbus nigrofasciatus and B. cumingi (below). Diagrammatic

The presence of a certain amount of light seems to be necessary for the production of pigment, since many fishes living in total darkness, as in caves, are quite colourless; by reflecting light from a mirror on to the blind side of a flounder, Cunningham caused pigment to be developed on that side, which normally has no colour.

In addition to pigment-cells, most fishes have also a quantity of minute crystalline reflecting bodies called iridocytes, composed of guanin, also a " waste " product. These may be present in one of two layers, or in both. When forming an inner layer (known as the argenteum) they produce the silvery whiteness characteristic of the sides and belly in many species; when in the outer layer, they produce iridescence by interference with the light rays. Usually where the pigment is most abundant, as on the back, the iridocytes are more scant. The iridocytes also produce the metallic gleam in the iris of the eye possessed by most fishes.

In the majority of cases, the colour-cells can be expanded or contracted, an operation controlled by special nerves, and herein lies the secret of the fish's ability to change its pattern. When the chromatophores in one area of the skin are expanded a patch of colour results, which fades or disappears when the cells are contracted. There is no evidence that the fish can change its pattern " at will." The process seems to be quite involuntary. Either a stimulus is received through the eye, which is conveyed by way of the nervous system to operate the chromatophores (by which means many species match their surroundings), or an emotion produced by sight, scent, hearing or feeling, or by glandular secretion, affects the nerves and so the colour-cells. Illness likewise produces neuroses which affect the colour system.

In the case of *Nannostomus trifasciatus* it is easy to understand that the arrangement of the pattern in daytime is associated with the dynamics of locomotion, certain groups of chromatophores being expanded by the nerves affected, whereas the condition of rest is accompanied by the contraction of these and the expansion of others. It might be thought that light and darkness would act as a visual stimulus controlling this, and it possibly is to a slight extent, but it has been observed that the fish will sometimes adopt its nocturnal livery during the daytime during brief periods of rest or under emotional stress, so that the dynamic theory is more probable.

This change is comparatively slight when compared with those that occur in some other fishes, specially marine species. Often such changes do not merely affect the arrangement of the black pigment, but completely alter the whole colour scheme of the fish. Usually such changes are associated with a different environment or depth of water, but remarkable examples have been shown to be due to emotional stimuli, and in a few cases investigators claim to have associated certain colour-phases or patterns with definite emotions, such as fear, greed or rage.

Generally, however, there is a distinct, predominant pattern characteristic of the

species in which it occurs. He would be a bold man who essayed to be dogmatic as to the factors which govern the arrangement such a pattern shall take in a given species, for they are varied and involved, but it seems likely that fundamentally it depends on the shape and manner of locomotion of the fish. Just as the scales were formed by the wrinkling of the skin, so the pigment is distributed by its flexures.

Thus, if a survey were made of all the species with longitudinal stripes the great majority would be found to be the ordinary torpedo-shape of the typical fish; whereas a similar survey of those with transverse bars would show the majority to be deep-bodied, compressed forms. This is because the "lines of force" employed in locomotion are quite different in the two shapes; often the "centre of energy" from which the fish gets its impetus is marked by a spot or ocellus. Of course, numerous exceptions will be found, but are not necessarily objections to the theory, for they can be explained by the impingement of various other factors. For example, *Barbus cumingi* of Ceylon is closely related to *B. nigrofasciatus* from the same region, but whereas the latter has the transverse bars to be expected from its shape, the former has but two dark patches on the side; upon examination, however, these patches are found to agree in position with two of the stripes in *B. nigrofasciatus*, whose heavy black dorsal fin is represented by a few black spots. The explanation is that the inherited physiology of *B. cumingi* allows for a much lower melanin production than that of its relative—its specific pigmentation is lower.

The spots of the Two-spot Gourami, *Trichopodus trichopterus*, have a similar relation to the lateral stripe of *T. leeri*, and numerous other examples can be found.

But whatever the fundamental mechanics of coloration may be, the final determination of the livery a species shall wear rests with natural selection, and that brings me to the evolutionary aspect of the subject.

(To be continued)

A copy of the first issue of the Ceylon *Homes and Gardens* has reached us, which is to be published quarterly at 1s. 6d. Very similar in design, lay-out and general appearance to our own *Homes and Gardens*, this lavishly-produced journal deals with the modern bungalows and estates of Ceylon with beautiful illustrations of their gardens, pools and other features, and should prove invaluable to readers interested in this part of the world and to those whose acquaintance of this lovely country need an organ to keep them fresh. It is obtainable from 10, Victoria Arcade, Colombo, Ceylon.

NOTES ON BREEDING SCALARES

By A. Pritt, Tower Aquarium, Blackpool

I remember this fish first about 1908. It was a new fish to the average aquarist, and it was the general opinion that it was impossible to breed them.

The first time that I remember them to be bred in captivity was in Philadelphia, though I believe they had been bred in Germany before that time. One thing to bear in mind if one wants to have healthy Scalares is that they must have a temperature of at least 80 deg. F., for these fish come from the Equatorial regions of S. America and Rio Negro, therefore they are a truly tropical fish. They breed at about 84 deg. F.

There are certain principles to follow if you have a mated pair. (1) A large tank at least 12 ins. x 18 ins. x 30 ins. or much larger if you have one. All successful breeders use extra large tanks up to 200 gallons. (2) Good strong plants, giant Sagittaria preferred. (3) Two glass tubes fastened tightly side by side, and at an angle of 45 deg. Fill the tubes with sand, because Scalares do not like clear glass. (4) Aeration if possible, not violent, but a single slow stream beneath the eggs. (5) Privacy. Allow no one to go near them during time of hatching, only the one who is in the habit of feeding them. (6) Don't have too much sun on them; a subdued light is best. (7) Salinity—about one ounce of salt to twenty gallons of water. This has proved very successful and it helps also to stop the fungus growths.

To condition the fish for breeding, feed chopped worms and small water boatman and when they are about two weeks old, mince water boatman very fine and their growth should be rapid.

Always bear in mind that Scalares are carnivorous and prefer animal foods. Babies will take fine dry foods if there is sufficient carnivorous matter in it. A record of our last two spawnings will follow this issue.

BOOK REVIEW

A contribution to the aquarist's library, this is essentially a beginner's book, but, perhaps, from the aquarist's point of view, is the better for that, since it is not every aquarist who has either the time or the inclination to take up this science seriously. The value of a microscope, and some small knowledge as to its use, cannot be gainsaid, for a closer aquaintance with infusorian life, upon which the existence of fish fry depends so much, is invaluable to the fish-keeper. Two chapters are devoted solely to pond life microscopy and Desmids, Diatoms and Foraminifera, while the author deals particularly with infusorian life generally, cyclops, daphnia, etc.

"The Microscope Made Easy," by *A. Laurence Wells.* 182 *pp.*, 7 x 5; 12 *photographic plates*, 25 *line ills.* 3*s.* 6*d. net.* *F. Warne & Co., Ltd.*

BRISTOL AND DISTRICT AQUARIST SHOW

THE eighth annual show was held at the Drill Hall, Old Market Street, Bristol, on Wednesday and Thursday, the 9th and 10th November, 1938, with well over 400 entries. With the addition of one more member, Mr. F. G. Denman, the "Old Guard"—Messrs. Brown, Phillips, Blunsden, Watson, Wakeley, and Brooks—acted as Show Committee, and their long experience ensured the staging of entries with the usual slickness of Bristol; order being produced out of chaos in practically no time. It is amazing how speedily this can be done when members work so well together, and under the leadership of Messrs. Phillips and Blunsden, with Mr. Perkins, of the Bristol Zoo Aquarium, as Show Secretary, this hardy perennial was no exception.

Incidentally, it was a great pleasure to see Mr. Phillips dashing about like a two-year-old. Last year he was all but a physical wreck, hardly able to walk, and Bristol can ill-afford to lose him.

Entries were well up to standard, but curiously divided, inasmuch as the stock which was bad was very bad, whereas the good stock, and there was so much of it, was extraordinarily good, rendering the judges' job a most difficult one. The three judges were hard at it from 9 a.m. until the time of the judges' luncheon at 1.30 p.m.

Bristol, it must be admitted, have always led with these annual shows and the quality of their fancy goldfish, and it is, and should rightly be, recognised as the Mecca of fancy goldfish fans, but this year they dropped one particularly heavy brick. Introducing a class for furnished tanks, they received an entry of three, none of which would have stood an earthly chance at a London show. In fact, I know several show managers who would have ordered their removal from the hall. The awards made have no bearing whatever on the quality of these three exhibits, one of which leaked very badly, and in London all awards would definitely have been withheld. Bristol does not, however, agree with the London method of withholding awards where the quality of entries falls below a certain standard, and makes all seven awards irrespective of quality.

One rather wonders what the Bristol Tropical Fish Club were doing not to support a two-day show with more entries, particularly of this character. They have not yet realised, apparently, that it is these exhibits of furnished aquariums which sell the hobby to the public, and bad exhibits are worse than none at all.

They were, however, the only bad exhibits, and it should not be assumed that they detracted from the value of more than 400 other exhibits. Far from it.

Outstanding examples were Mr. Z. Webb's Telescope Moor, best fish in the show and a magnificent example of this variety; Mrs. Browning's Scaled Comet, winner of the Best Comet Special Silver Cup and the Best Lady's Exhibit; Mr. R. G. Watson's Jap. Scaleless Fantail, and Mr. Stoke's Scaled Veiltail. Mr. Phillips' Shubunkin was a problem to select from a score of other splendid specimens, while the first three prize-winners in the Ordinary Common Goldfish class are also more than entitled to special mention.

I would like to see more trade stands there. It seems a pity, and probably a losing one at that, not to see more trade support at such a show, where so many thousands of people gather, and for the success of which the Committee and exhibitors alike work so hard to achieve—and succeed. Another point which struck me was the celerity of the local press. The *Bristol Evening Post* was on sale inside the hall carrying a full report and full list of awards, with three photographs, one a large reproduction of the hall at the prize-giving by Miss Vera Wills, less than three hours after this latter event.

I was the unfortunate wight chosen to respond for the judges at the after-luncheon speeches, and took the opportunity of expressing our very great appreciation, emphasised again here, of the assistance rendered us by the committee, which helped to make our difficult job that much easier.

AWARDS LIST

Class 1, Ord. C. Goldfish, Red, 5-in. limit.—1 (*Aquarist and Pond-keeper* Bronze Medal), E. Thurston Davis, fish as near perfect as possible; 2 (Marmalade Jar), F. H. Ridd, fish almost as good and

difficult to separate; 3 (Bartmann's Special), A. E. Rowles, practically tying for second place; 4, (Cut Glass Vase) and V.H.C., E. Thurston Davis; H.C., R. J. King; C., A. E. Rowles. Class 2, Ord. C. Goldfish, Yellow, 5-in. limit.—1 (Aquarist and Pondkeeper Bronze Medal), W. J. Roles, excellent specimen, and 2 (Crystal Sugar Basin and Cream Jug), good fish, falling in finnage behind 1st; 3 (Bartmann's Special), F. H. Ridd, very good quality; 4 (Chromium Stamp Case) and V.H.C., F. G. Denman; H.C., Mrs. A. S. Charlton; C., Alan Mitchell. Class 3, Ord. C. Goldfish, Var., 5-in. limit.—1 (Tea Caddy), Mrs. A. Mitchell, an excellent black and red, even marked fish; 2 (Mag. Glass), Major MacEwen, a good red and white; 3 (Bartmann's Special), Seth Thomas, good red and red; 4 (Chromium Stamp Case) and H.C., Mrs. A. J. McGregor; V.H.C., Alan Mitchell; C., Mrs. Browning. Class 4, Shubunkins, 5-in. limit, Bristol Standard type.—1 (Silver Cup), A. Phillips; 2 (Cut Glass Bowl), C. R. Cooke; 3 (Cigarette Case), A. Barnard; 4 (1-doz. Teaspoons), R. G. Watson; V.H.C. and H.C., Z. Webb; C., W. Howard. From a critic's point of view superlatives wasted on this class, for there were some eighteen entries all deserving of awards, all being most difficult to separate. Class 5, Shubunkins, 5-in. limit, novices.—1 (Wallet and Note Case), Mrs. M. Whitehead with a good quality specimen which took also the Percy Gibbs Cup for Best Novice with class 20; 2 (Novelty Cigarette Box), R. J. King; 3 (Cake Stand), H. Rose; 4, (Bartmann's Special), E. Skrine; V.H.C., E. Wakely; H.C., W. Howard; C., J. A. Edwards. Class 6, Jap. Sc. Fantails, Pl. or Tel.-eyed.—1 (1-doz. Cut Glass Tumblers), W. J. Stokes, with a beautiful red fish; 2 (Elec. Immersion Heater), C. F. Whitehead, a good red, falling slightly for body shape; 3 (Toast Rack and Preserve Dish), G. F. Russell, also a good red; 4 (Bartmann's Special), A. Phillips; V.H.C., C. F. Whitehead; H.C., Z. Webb; C., W. J. Stokes. Class 7, Jap. Cal. Veiltail, Pl. or Tel.-eyed.—1 (Table Cigarette Lighter), E. R. Blunsden, with an excellent quality, good coloured fish; 2 (Cut Glass Bowl), Alan Mitchell; 3 (Cigarette Case), C. R. Cooke; 4 (Cut Glass Cruet Set), C. F. Whitehead; V.H.C., Seth Thomas; H.C., C. F. Whitehead; C., R. G. Watson. All the entries "in the money" in this class were first-rate fishes. Class 8, Jap. Sc. Fantails, Pl. or Tel.-eyed.—1 (Case Tea Knives), F. T. Moore, with a magnificent little fish, all but perfect; 2 (Chromium Clock), C. F. Whitehead, finnage made this fish unlucky to lose; 3 (Case Teaspoons), D. E. H. Knights, an unlucky third, from the Midland Club; 4 (Bartmann's Special), E. R. Blunsden; V.H.C., A. Phillips; H.C. and C., C. R. Cooke. Class 9, Jap. Cal. Fantails, Pl. or Tel.-eyed.—1 (Tea Tray), R. G. Watson, ex. quality; 2 (Chromium Clock), C. R. Cooke, good quality, but failing for first on account of slight colour faults; 3 (Case Teaspoons), R. G. Watson; 4 (Bartmann's Special), C. R. Cooke; V.H.C., Alan Mitchell; H.C. and C., C. F. Whitehead. Class 10, Jap. Moors, Orandas, Lionheads.—1 (Telescopic Ash Tray) and Special, Best Fish in Show, Z. Webb, with a magnificent Moor; 2 (Cigarette Lighter), C. R. Cooke, another good Moor, but slightly paler in colour; 3 (Tea Caddy), C. F. Whitehead, with a well-finned var. Lionhead; 4 (Chromium Toast Rack), W. J. Stokes, with a similar fish; V.H.C., Z. Webb; H.C., C. R. Cooke; C., A. D. J. Brooks. Class 11, Nymphs, Sc. or Cal., 5-in. limit.—1 (10s.) and 2 (5s. 6d.), C. F. Whitehead, sharing the honours of four first-class Nymphs with 3 (5s.) and 4 (2s. 6d.), C. R. Cooke; V.H.C., J. A. Edwards; H.C. and C., Mrs. E. R. Blunsden. Class 12, Cal. Comets, 5-in. limit.—1 (10s.), Alan Mitchell, best of not-too-good quality exhibits; 2 (7s. 6d.), C. R. Cooke, colour first-rate but body not equal to it; 3 (5s.), C. R. Cooke, almost the reverse description of the 2nd award; 4 (2s. 6d.), C. F. Whitehead; V.H.C., E. R. Blunsden; H.C., R. G. Watson; C., C. R. Cooke. Class 13, Sc. Comets, 5-in. limit.—1 (Chromium Clock), Mrs. A. L. Browning, with T. Thornton Wills Cup for Best Fish exhibited by a lady, and the Warry Crystal Goblet for Best Comet in Show, an excellently coloured, well-finned fish; 2 (1-doz. Teaspoons), F. H. Ridd, a good yellow; 3 (Bartmann's Special), W. H. Millard, an excellent little fish failing only in size, well col.; 4 (Cigarette Box and Ash Trays), W. H. Millard; V.H.C., Mrs. Browning; H.C., F. H. Ridd; C., A. E. Rowels. Class 14, Col. Domesticated Fishes.—1 (Pr. Serving Tongs), W. Howard, with a lovely Golden Orfe; 2 (Glass Sugar Dredger), E. Thurston Davis, with an unlucky Golden Orfe; 3 (Bartmann's Special), S. G. Brayley, Golden Orfe; 4 (Cigarette Box and Ash Trays), F. H. Ridd, Golden Orfe; V.H.C., W. H. Millard, Golden Tench; H.C., A. D. J. Brooks, Golden Carp; C., W. H. Millard, Golden Rudd. Class 15, Freshwater Fishes, with reservations.—1 (Pr. Serving Tongs), Alan Mitchell, with a fair C. Sunfish; 2 (Glass Sugar Dredger), D. E. H. Knights, a nice Peacock-Eyed Sunfish, unfortunately almost mature and losing its "eye"; 3 (Bartmann's Special), J. A. Edwards, with an attractive shoal of Minnows; 4 (Cigarette Box and Ash Trays), J. A. Edwards, with a very nice Pike, unlucky to be placed so low in the scale; V.H.C., A. D. J. Brooks, with a Blue-Green Sunfish; H.C., A. D. J. Brooks, C. Sunfish; C., W. Howard, G. Tench. Class 16, Best Two Ord. C. Goldfish, 3½-in. limit.—1, A. J. Macgregor, really excellent pr.; 2, Calne Senior School; 3, Mrs. L. M. Clark; 4, W. H. Millard; V.H.C., Master R. Perkins; H.C., Mrs. A. L. Browning; C., A. E. Rowles. Prizes to the value of 15s., 10s., 7s. 6d. and 5s. respectively, to be selected from catalogues of Brown & Sons, horticulturists. Class 17, Shubunkins bred by exhibitor. The winners in this class were good, but the class was not quite up to the standard expected.—1 (10s.), J. G. Keys; 2 and 3 (7s. 6d. and 5s.), E. R. Blunsden; 4 (2s. 6d.), A. Phillips; V.H.C., G. F. Russell; H.C., W. J. Stokes; C., E. R. Blunsden. Class 18, A.O.V. Gold or Fancy Fish bred by exhibitor.—1 (Tobacco Jar), Mrs. J. W. Harper; 2 (Cuff Links), C. F. Whitehead; 3 (Chromium Clock), C. F. Whitehead; 4 (Bartmann's Special), C. F. Whitehead; V.H.C., R. G. Watson; H.C., Alan Mitchell; C., Mrs. J. W. Harper. Some really ex. little youngsters were exhibited in this class. Class 19, A.V. Gold or Fancy Fish bred 1938, not necessarily by exhibitor.—1 (Cut Glass Bowl), C. R. Cooke; 2 (Cuff Links), 3 (Cigarette Box), 4 (Mag. Glass), and V.H.C., Mrs. J. W. Harper; H.C. and C., C. F. Whitehead. This also produced some excellent fish, several having attained a splendid size for their age. Class 20, A.V.F. Goldfish, novices. An encouraging class, suggestive of the fact that if run again, novices will know what to run for.—1 (10s.) and 2 (7s. 6d.), Mrs. M. Whitehead; 3 (5s.), G. E. Waits; 4 (2s. 6d.), E. Wood; V.H.C., A. H. Jacobs; H.C., J. Mitchell; C., W. Howard. Class 21, Axolotls.—1 (Cut Glass Scent Bottle), 2 (Marmalade Jar) and 3 (Jam Spoon), Miss Hilda Weekly, with three exceptionally fine and large specimens; V.H.C., Calne Senior School; H.C., J. C. How; C., B. E. Neale. Class 22, Furnished Tanks, 24-in. limit. To be provided and set up by exhibitor.—1 (Pr. Serving Tongs), Seth Thomas, and Special Edgbaston Silver Cup for Best Furnished Tank, the best of three very poor exhibits; 2 (Mag. Glass), Calne Senior School, tank leaking very badly, an attempt at under-water lighting misfiring badly in more senses than one; 3 (Cigarette Case), M. W. Chivers. Class 23, Tropical Community Tanks, size of tank provided 12 x 8 x 8 ins., fish up to three pairs. A rather surprising class, expectations being that the tanks would be furnished, instead of which the three pairs entered were in bare tanks.—1 (Ex-Es Heater), R. G. Watson, with splendid pairs of Ctenobrycon spilurus, Blue Gouramies, and outstanding Green Swordtails; 2 (Chromium Clock), C. Templeman, with excellent pairs of Blue Gouramies, Leeri Gouramies, and splendid Butterfly Fish; 3 (Cigarette Case), F. H. Amos, with good pairs of Red Swordtails, Green Swordtails and Black Mollies. Mrs. J. W. Harper took the Mrs. Blunsden Silver Cup for best fish bred by exhibitor in 1938; Mr. E. R. Blunsden the Spencer Trophy for best Veiltail in Show, a magnificent best at that; Mr. Z. Webb the Eric Butler Silver Cup with his splendid Moor, best Fish in the Show; and the Child Challenge Shield, for second best exhibit, went to Mr. W. J. Stokes.

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IN LIGHTER VEIN

MERE MEANDERINGS

(2) POST MORTEMS

THE postman has just arrived. His expression conveys "Take it, Thy need is greater than mine—take it quick." The generous expediency with which he has handed over the parcel indicates that it contains a dead fish for post-mortem. The Postman's whole bearing denotes that his opinion of people who send and receive dead fish is not exceptionally high. The moral of the whole story is that my parcels are *never* detained at the local Post Office for a later delivery.

The disadvantage of being born with honest tendencies is that one feels compelled to follow the straight and narrow path of duty. Take this question of post-mortems, for instance. The easiest way of dealing with the whole problem is to put six fully Latinised names of fish diseases in a hat, and draw one for each arrival —not forgetting to burn the body within five days. The result of this happy-go-lucky method of post-mortem would be assured. "Postmortemees" would be happy in receiving a really classical report and not even blame their fish for dying on them. With my hand on my heart I turn my back on this diabolical but attractive scheme. Sadly but truly some of my "postmortemees" must still receive a report that their fish died from nothing more than a common cold. A chill receipt for their P.M. fee.

The parcel which has just arrived means work anything from ten minutes to two hours. If, by some lucky chance, it happens to be one of the more obscure diseases with a classical name it won't take long, but if it happens to be a "common cold" job it'll probably take the full two hours. This is where my nobility of character shows to its full. I hate to have to tell people that their fish died from some simple cause, so that if I suspect it I go through the whole rigmarole of thorough post-mortem just to be sure.

The easiest post-mortems, particularly the parasite cases, are those which come from the pond to the microscope within two or three hours. As the time between death and examination increases so the job becomes more difficult. The common Gill Fluke (Gyrodactilus) which, by the way, is I believe much more common than suspected, is a case in point. Your fish becomes lazy, mopes and dies for no obvious reason, and when you take it from the pond, excepting for a little congestion in the fins, looks as clean as a pink. I had a case recently. A fish was brought to me which had been dead for about four hours. I suspected Gill Fluke and opened the gill plates. Only one fluke was present. The condition of the fish was so good that I hesitated to confirm the verdict of Gyrodactiliasis. I fetched a sickly and nearly dead fish from the same source and examined the gill plates while it was still alive. It was infested with the Fluke.

Now, the Gill Fluke is an unreasonable organism. As soon as the host dies the Fluke appears to curl up and accompany it on its immortal journey. This is not all because while the fish retains its normal shape and merely develops an abnormal smell, the Fluke dissipates into an almost unrecognisable mass. It hasn't much internal organisation anyhow, and all that it leaves is a suggestion of head and a set of graspers. After seeing hundreds of these remains I am getting fairly expert at recognising the relics, but I was unable to convince a fancier friend the other day when re looked at them under the microscope. If you bear this in mind and happen to recognise the symptoms I have described, don't let your specimen be over long in coming to me.

You will have read in the front of this magazine the note telling you how to send dead fish for examination. Sometimes they come to me wrapped in preservative-impregnated cloths, such as Formaldehyde. This is quite sound from the post-mortem point of view and a much pleasanter way of receiving dead fish. The body and organs are preserved very cleanly and make for good cutting. At the same time, although these examinations are classified as post-mortems, their purpose is to define what caused the death of your fish, and if it happens to be Gyrodactiliasis or the Lernœæ Parasite, then post-mortem, in the sense of examining the internal organs, is not necessary. I think I'd rather have the smell of the fish than the preservative since the latter tends to destroy all trace of a parasitic Fluke or Infusoria. They may be deadly, but they're also delicate.

I don't get many fish sent to me with Fungus. The reason for this, I think, is that the idea is

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SETTING UP A NEW AQUARIUM

By H. W. HEATH

SETTING up a new aquarium is a job that requires very careful thought and consideration in order to obtain the best possible effects, although many beginners seem to think this merely consists of putting in sand, filling with water and sticking in plants without paying any attention as to the position of same.

After the site for the tank has been decided upon and the aquarium has been thoroughly washed out, the first thing to consider is the growing medium for the plants. This is always a contentious point amongst aquarists, as some advocate a layer of loam and then a covering of sand, whilst others say peat should be used underneath the sand or compost in order to get the best results from the plants. Personally I have never used anything other than well washed sand, mixed with a proprietary brand of compost, and my plants make luxuriant and rapid growth, in fact, every few months I have to keep them thinned out or they would soon overrun the tank. For the beginner I would definitely advise him to use only sand or compost and not attempt to experiment with loam, because there is always the danger that the water will turn foul, as the loam usually sets up bacteria growth which takes a great deal of trouble to get rid of and generally means emptying the aquarium and starting up afresh.

For plants to grow well they must have a certain amount of light each day, and it is best, if possible, to use artificial lighting, as by this means it can be regulated according to the progress they make. About five or six hours per day of electric light with a 60-watt bulb or strip-light is sufficient, as if kept on longer there is a tendency to draw up the plants too quickly, causing them to become weedy and straggly.

The next thing to consider is the lay-out, and this is perhaps the most important part of setting up a new aquarium, as it either makes or mars the whole effect. From personal experience I have always found it best to visualise how the tank will look when completed and to make a few rough sketches on paper of each particular lay-out that presents itself to the mind. Anyone with a little imagination can do this, and it saves much time and wasted energy than to actually plant

A setting displaying considerable artistic taste and an appreciation of tactful juxtapositioning of rockwork and plants. Failure to acknowledge the necessity for various trials when first setting up an aquarium can mar the most attractive collection of aquarium stock.

the aquarium and then find oneself disappointed with the result.

Recently I visited a friend who had purchased a very expensive chromium-plated tank complete on stand, which contained between thirty and forty tropical fishes, but the whole appearance of the aquarium had been spoilt in consequence of the poor lay-out and indiscriminate planting. The sand, which was about 1¼ inches deep, was absolutely flat, while the plants were all mixed up together and stuck in without any idea of trying to obtain a natural effect. Pieces of Ludwigia were growing amongst clumps of Myriophyllum, and a very nice Cryptocoryne was stuck in the middle of a clump of Vallisneria. Two large pieces of rock, almost square, occupied the front of the tank, each being about equi-distant from the centre. Now if only a little care and foresight had been used in setting up this aquarium what a different picture it would have presented.

After the sand or compost has been thoroughly washed it should be put in on the bottom, the level at the back of the tank being higher than that at the front, as this will help to let any uneaten food fall to the front, when it can easily be taken out with a sediment remover. Owing to refraction, the width of an aquarium is consequently foreshortened in appearance after it is filled with water, but by so arranging the increased area of bedding compensates for the refractive effect and an impression of width is given.

In order to obtain a natural appearance the growing medium does not want to be just a gradual slope from back to front, but should present an uneven surface, and this can be done by using small stones, pebbles or pieces of rock to bank it up in various places. With a long aquarium some very pleasing effects are possible by banking the sand or compost high at each end and then dropping to a low level towards the middle.

To complete the lay-out, one or two pieces of natural rock or coloured stones may be used, and artificial rocks made of coloured glass can be purchased, though great discretion is required in making use of these or the whole appearance of the tank may be spoilt. Model castles, mermaids, lighthouses, etc., should be avoided, because as soon as these are introduced the natural effect completely disappears.

The tank should now be filled almost to the top with water and planting can be commenced, as from personal experience I have always found it easier to do this with water in than when empty. Two wooden sticks with a small notch in one end, which can be fashioned out of a piece of an old wooden box, will prove very useful, because the plants are naturally buoyant, and unless they are held well down and pressed firmly into the bedding medium they will soon float to the top again. The back and sides of the tank can be well planted, but the front should be kept as clear as possible in order that a good view of the fishes is permitted.

The positions for the various plants will, of course, have been planned according to the particular lay-out chosen, and they should be set in small clumps, each species being kept separate and not all jumbled up together. There is no need for me to go into detail as regards choice of these as a suitable collection can be made up from the following, which are all easy to grow, soon establish themselves, and are reasonable in price:—

Cold Water Aquarium.—*Vallisneria spiralis*, Sagittaria, Myriophyllum, *Elodea densa*, Ludwigia, Dwarf Rush, Hair Grass.

Tropical Aquarium.—Same as above, also *Vallisneria spiralis torta* (Twisted Vallisneria), Cambomba, Ambulia, Cryptocoryne.

After the planting has been completed, the tank should be filled to the top with water and, if a tropical one, the thermostat adjusted to the required temperature and then left for about ten days or a fortnight before introducing any fishes in order to give the plants a chance of getting well rooted.

Many unusual effects can be obtained by using different coloured electric bulbs in conjunction with the strip-light, as with these it is possible to get sunset scenes, but probably only the more experienced aquarists will care to experiment in this direction.

GROWING THE SUMATRA FERN

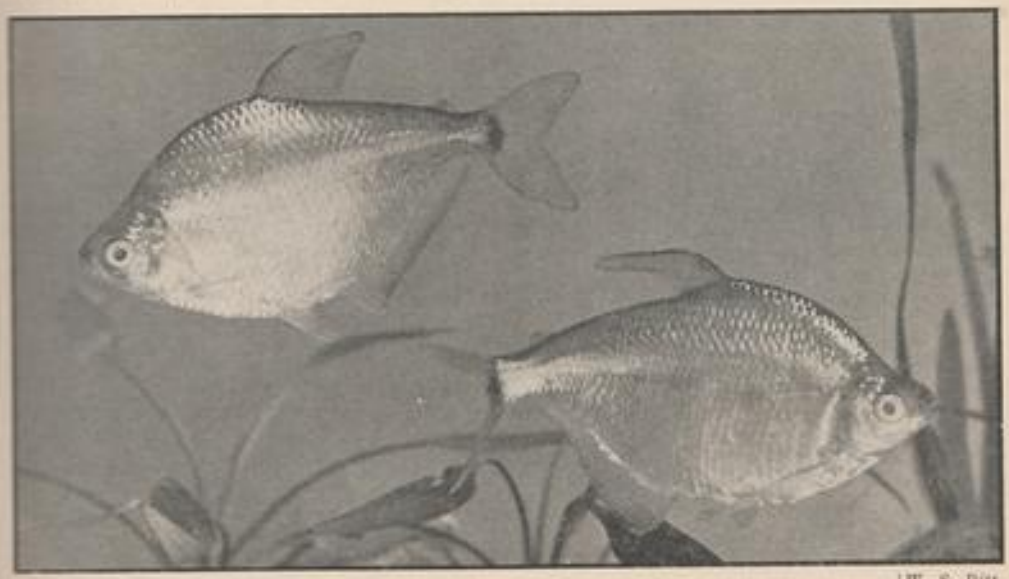
This popular plant is oviparous (a full description appeared in the issue of this journal for September-October, 1937), the young plants breaking through at a leaf joint on the parent stem. If these young plants are floated on the surface of water of a depth of three or four inches or so, in a good light and the average tropical tank temperature of 75 deg. F., or so, the tank having an inch or two of loam on the bottom, they will rapidly throw down their roots to penetrate the loam, and promptly grow apace, this method avoiding the usual slow growth of the baby plants. If allowed to stay in those conditions, the leaves continue growing to an extent to cover the whole surface.

THE HARDY SILVER TETRA

By JACK HEMS

THIS Characin, which of recent years has become somewhat neglected by aquarists interested in "tropicals," should be given a "new deal," for although it grows to a length of about three inches, and is as boisterous as a healthy Rosy Barb, it is not pugnacious, and unless placed with fishes smaller than a normal-sized male Guppy, is quite safe in the average community tank.

The species is very common in the coastal waters of steaming Guiana, and is commonly



[Photo] [W. S. Pitt

Ctenobrycon spilurus

listed as the "Silver Tetra" or "Knife Fish." Both these common names fit it admirably. Its scientific appellation means: "Rough scaled Brycon with a tail-spot." There is no need for newcomers to our hobby to think that they cannot afford it, for a good-sized pair can be obtained from most dealers for about half-a-crown.

The flashing, silver body, overcast in places with a sheen of light gold, is rounded diamond-shaped and very laterally compressed, or flattened from side to side. When viewed before or under a bright light, numerous colours will be seen winking on and off as the fish hurries up and down in front of the tank, or dashes in and out of the water plants. The colours most usually seen are different shades of green, blue and mauve.

Halfway along the body from the head, a light green stripe runs as far as the tail, the base of which is marked with a dark spot. Another dark spot is present on the "shoulders." With the exception of the female's anal fin, the posterior portion of which is tinged with red, the major fins of this fish are yellowish to gin-clear. The anal fin is narrow and extends from just behind the ventral fins to the base of the forked caudal fin, while the dorsal fin is rather small and is held stiffly erect. The pectorals are so clear as to be almost invisible.

Sexing these fish is easy, for apart from the dash of red colour on the female's anal fin, she invariably grows longer than the male and is plumper in the body. In common with many other male characins, the male Silver Tetra has some microscopic barbed hooks in his anal fin which almost always become entangled in soft

cloth like muslin or georgette. So if several of these fish be lifted out of the water in a fine-meshed net and then turned out again quickly, the females will slither back into their natural element, while the males—for a moment or two, anyway—will remain behind.

The Silver Tetra may be fed with live, flesh and dried food. Naturally, it grows bigger and keeps in better condition when fed with plenty of the two former articles of diet. Like many other Characins such as *Metynnis* and *Leporinus*, the Silver Tetra consumes a considerable amount of vegetable matter. If there is not sufficient duckweed, feathery roots of floating water plants, or mossy *Algæ* growing in its tank to keep it satisfied, it may nibble holes in the flimsy leaves of plants such as *Aponogeton ulvaceum* or *A. elongata*. But the best way to keep the fish from browsing on one's plants is to keep them well supplied with green food in the form of Nitella—if you can grow enough of this interesting Alga—chopped boiled spinach, chopped boiled turnip tops, or minced, bruised lettuce leaves.

Unlike Scalares and Discus, *C. spilurus* never appear to suffer from "sitiophobia," nor do they observe any "table manners." At feeding times they charge about snapping up the morsels of food as if they haven't a moment to lose. If Silver Tetras are being kept in a community tank, it is advisable to drop food into more than one place at a time, so that the smaller and more timid fishes may be sure of getting their share.

For breeding purposes, the aquarist requires a tank holding about fifteen gallons of matured, clear water. The plants most suitable are those having hair-like (*Myriophyllum*) or bushy-growing (*Ambulia*) foliage. The reason for this preference is because the eggs of the Silver Tetra are adhesive and cling to whatever they fall into or brush up against. The quickest way to bring these fish into spawning condition is to place them in the prepared tank, and while keeping them separated from each other with a sheet of glass for a week or so, feed them several times every day with live and flesh food, and maintain the temperature of the water about ten degrees above the average in which they have recently been living. If everything goes smoothly, the female's sides should fill out, and the reddish colour in her anal fin may become more intense. At the same time, the male's sides shine more brightly, his fins usually become very yellowish, and his eagerness to be with the female is plainly demonstrated in the way he swims up and down his side of the glass partition.

If you think the time is propitious—though some aquarists think it best to place the couple together overnight—remove the partition and settle down to watch results. Almost immediately the male will start chasing the female in and out of the submerged vegetation, nuzzling his head against her swollen sides whenever he gets the chance, and generally behaving himself in a very love-sick manner.

However, in due course the male will so excite the female by his actions that she will begin to lay her eggs. She lays only a few at a time, and the male, close behind her, fertilises them with his milt. An hour, or maybe several hours later, the female will have laid all her hundred to eight hundred eggs and both male and female should be removed to fresh quarters before they get much chance to start eating their eggs—an annoying, but much-loved pastime.

In a temperature of about 78 deg. F. the eggs hatch out in about seventy-eight hours. The baby fish are translucent silver, and for a day or two do not move about much, but stay quiescent near the surface of the water, resting in the foliage of the plants, or clinging to the sides of the aquarium. Directly they become free-swimming, i.e., after they have absorbed their yolk sacs, they should be fed with *infusoria*. A large brood requires about a pint and a half of *infusoria*-laden water every day. Besides micro-organisms, "green" water should be emptied into their tank as often as possible.

In about three weeks' time, the babies should be big enough to swallow tiny water fleas, brine shrimps, small Tubifex worms, tiny or crushed *Enchytræ*, and powder-fine dried food. The latter, however, should be used only when live food becomes unobtainable. Fed properly, and given plenty of room in well-oxygenated, clean water, the young Silver Tetras reach a length of about two inches in six months. From that time onward their growth is much slower.

Needless to say, unless one has plenty of spare tanks, it is impossible to save all the fry out of every spawning, and it is best to feed a lot of the freshly-hatched-out youngsters to your other fishes and so ensure the remaining alevin having sufficient food, space and oxygen, rather than endeavour to raise every baby hatched out and only become depressed when, day after day, you watch scores of them sinking to the bottom to die of hunger and want of oxygen.

HUNTING THE "HOPPER"

By L. R. BRIGHTWELL, F.Z.S.
(Member of the Marine Biological Association)

One of the Longshore "Queer Trades"

THE experienced aquarist well knows that there is no finer "live food" for a change, at least, to titillate his fishes' appetites and generally tone them up, than the ubiquitous and all too lively sand hopper. To the ordinary sea-side holiday maker, this little crustacean is one of the flies in his ointment. Very literally it is often a fly in his sandwiches, his luncheon basket, and his trouser turn-ups! No place is safe from it. It reappears when least expected on the homeward bus journey, or even in the privacy of the apartment bedroom. In fact the creature is a mere nuisance and its excessive energy and genius for inserting itself into unlikely places, makes the "beach flea" generally disliked. Few holiday makers will think any more kindly of the creature, when told that it is one of the sea shore's most tireless scavengers, and that twenty thousand have been found, "cleaning up" a single dead sea urchin.

To the aquarist, as already stated, it is a desideratum, for this near relative of the fresh-water shrimp is far more abundant than that crustacean and though of the salt salty, will live long enough in a fresh-water tank to rouse the fishes' appetites. But the capture of the beast in quantity is a seemingly hopeless task. For every one that can be grabbed and safely boxed, a hundred get away. The idea of ever collecting the beast alive, on the grand scale, will strike most as comparable to Shakespeare's "numbering sands, and draining oceans dry." Yet for several generations a Sussex family has lived solely by capturing the sand hopper, and marketing at a reasonable profit.

Pursuit of this queerest of queer trades led me the other day to track down its present prosecutor, Mr. George Hooker, at his residence, in Sussex Road, Hove, from which haven he has supplied hoppers to the Zoo, Brighton and other aquariums, beside private enthusiasts for many years.

There was little difficulty in running the hopper king to earth. A prevailing "hopperishness" was noticeable several doors away. A number of fine specimens were sporting on the kerb and I even had the pleasure of meeting

Sand Hoppers
(Considerably enlarged)

one on the rim of my saucer, when we sat down to talk "hoppers" over a cup of tea.

"Hoppering" is a trade that knows no holidays, for aquariums must be fed at all times, fair weather and foul. Mr. Hooker seeks his quarry the year round between Newhaven and Littlehampton. For the hopper is a migratory and nomadic animal, shifting back and forth along the Sussex shingle, as that shiftless stuff is alternately banked up, or spread flat by the ever changing sea.

Presently we took the field—Mr. Hooker armed with a sackful of enormous butterfly nets, made of cheese cloth, a big tin, a shovel, whilst his single assistant tottered under a load of what looked like miniature trench props. By means of these long, heavy timbers, the hopper hunter achieves the seemingly impossible. He contrives, with infinite labour, to sink deep shafts in the rolling stones. Into each shaft a net is sunk, and filled to the brim with fresh

seaweed. It stays thus, just above high water mark for twelve hours. Dozens of these nets are sunk each day and I was told large numbers lost, or irreparably damaged. Once Mr. Hooker "caught" a small dog in one, whilst dead porpoises, rubbish of all kinds, and endless treacheries on the part of the winds and waves make the job a truly arduous one.

But on this occasion all went well. One after another yesterday's traps were taken up and the contents shaken—dirt, shells and what-not together—into the big bin.

Back at Sussex Road, the fun began. The hoppers—grubby and gritty—were ladled out into a tin saucer poised on a yard-high pole, set in the middle of an old zinc cistern. In the saucer the hoppers danced a feverish dance, until one by one they danced themselves over the saucer rim and on to the zinc floor below. By the time a hopper had done that it had shaken every partical of dirt from off its many-legged person, leaving the rubbish behind in the saucer poised upon its stalk. The cleaned hoppers made a clearly audible hissing noise, as they skirmished, in a sort of honey coloured mist, on the bottom of the cistern. Then they were scooped up, packed with clean weed, in pint tins and rushed by bus or train to their various destinations, for the shore hopper may be classed as highly perishable goods. Present market rates stand at a few shillings the pint, and a pint is good value for money, since many hundreds—or possibly thousands, must go to the measure.

Besides aquarists the hopper finds favour with private investigators engaged in Mendelian experiments, whilst aviarists also find in the animal a useful change of diet for their feathered pets. In winter the lady hoppers may be found with ova carried beneath them—much as crabs and prawns carry their broods; and the sexes once mated cling together with commendable fidelity. Darwin, it may be remembered, recounts how, when a marked pair were separated and turned loose amongst a horde of other hoppers, they sought for each other feverishly until a reunion was effected.

There is a steady demand for the hopper, and when one thinks of what sinking those nets in shingle during mid-winter, or the equinoctial gales, must be like, one may be happily confident that Mr. Hooker's queer trade is never likely to be killed by over competition!

VITAMIN FEEDING

IT is unfortunate that more research has not been done into the question of balanced feeding of aquarium fishes, but that vitamins are as necessary to them as to all other living creatures, none will deny. Much progress has been made since the days when efforts were made to keep fishes on a single-component food, and the experts wisely play for safety in advising continual variety in feeding, to the extent even of arranging that each meal of the fourteen given in one week differs from every other.

Despite this, we frequently find aquarists adhering to one form of food only, usually with drastic results, but even when every endeavour is made to ring the changes on the diet, stomach and intestinal disorders still occur with objectionable frequency, and particularly with fancy goldfish, the accompanying swimming bladder trouble removes one's fishes with annoying regularity. It is a well enough known fact that Vitamin D can be made up in fish food with the assistance of cod liver oil or halibut oil, and there are few aquarists who have not experienced the vast improvement in growing fry when this is done. Vitamin A receives little attention, probably because few fishes are prevented from access to vegetation, the chlorophyll and carotene (colouring matter) being rich in this vitamin. It is noteworthy that the depth of colour is not unrelated to the vitamin content, hence the high value of spinach, so frequently used for feeding fishes, particularly Mollienisias.

Vitamin B_1 and B_2 are those tied up more intimately than any others with the digestive system, the lack of them leading to many disorders of a kind with which aquarists are only too frequently acquainted, and it is most interesting to note, therefore, that we have secured permission from the proprietors of Bemax to publish their analysis, for this food is being used more and more as an adjunct to the other foods which are used for the feeding of fishes, particularly in many of our public aquariums, though it first found favour among the smaller fish-keepers and breeders. Given once or twice weekly, or more often when such foods as *enchytræ* are used, it it invaluable for providing roughage and the necessary bowel stimulus, without being in any way a medicinal purgative. It is not a proprietary food in the sense that we recognise that word, but a registered standard production of wheat germ,

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due to the fact that the children are not led to write about their own vivid experiences. They are not led to see the magic use of words, matching the colours of real sights with words accurate and colourful too. Talks based on the aquarium, on tadpole hunting, on the marshes where strange birds gather, on the journeys made by fish, on all the exciting happenings that occur under water, all these will give an impetus to the children's own writing.

3.—"What about feeding the creatures and looking after them?"

This of course depends on the type of school, the elasticity of timetables and so on. Even when the school is shut up very strictly each week-end, it is always possible to keep an aquarium, even if other creatures are out of the question. A well-balanced, mixed aquarium in which there is a large population of water fleas and other minute life should be self-supporting. I have kept newts for over a year at a time with no extra feeding and they have always grown and been in good condition. There is never any lack of volunteers for feeding and cleaning duties, the only need is to make careful lists and see that only the true custodian is doing the job each day! The majority of creatures need little attention, and children are always ready to read directions posted up and take their duties most seriously. It is a mistake for the teacher to do any more than supervise, for the experience of taking care of live things is the most important thing we can arrange for our town children.

Town children are the ones who are most in need of aquarium work, and any teacher who manages to introduce a simple tank into the classroom will be more than repaid by the delight of the pupils. It is surprising how the presence of an aquarium can be a great help in many lessons that one would suppose very far removed from its main subject. The attitude of the children can be gauged from the fact that they nearly always take visitors and new children first of all to see the aquarium, quite sure that its fascination will put them at their ease and make a pleasant basis for conversation! "Come and see the newt!" is the current invitation.

Finally, it is a good plan to disband the aquarium at the end of each term, or at the end of each school year. This is so that new pupils shall have the experience of starting it again, and to make sure that they understand the basic facts and are not having things too ready-made.

BOOK REVIEWS

AN announcement appeared in this journal some time ago regarding the planned publication of "Water Gardening" by "Country Life," in the early summer. Somewhat delayed, this work, written by Frances Perry, has now appeared, an extremely valuable addition to aquatic literature. Books on aquariums and garden ponds have, generally speaking, been overdone, a spate of them during the past two years defeating their own object, since so many have arrived that beginners hardly know which one to select and frequently end up by buying none of them. "Water Gardening," however, is in an entirely different category, being a classic in a class of its own. Frances Perry is the daughter-in-law of the old pioneer, Amos Perry, and this book should fill him with pride that the next generation arises to follow where he has led for so many years. A lavishly illustrated, 353-page volume covers, with exact and minute detail, every branch of pool construction; planting and propagation; formal and informal design; hardy water lilies; tender lilies; nelumbos and nuphars; sub-aquatics; floating and submerged aquatics; hardy waterside ferns; hardy bog orchids; insectivorous plants; ornamental grasses and bamboos; backgrounds and windbreaks; aquaria; diseases, pests and other troubles of the water garden; fishes; and closes with an appendix, glossary of botanical terms and bibliography.

Frances Perry pays gracious tribute to her father-in-law and other collaborators, and a foreword by E. A. Bowles, V.M.H., Vice-President of the Royal Horticultural Society, introduces the book to readers. The very name of Perry is in itself a sufficient recommendation, but it may be stated, without fear of contradiction, that "Country Life" have rendered a meritorious service to gardeners and lovers of aquatic life in producing so complete a work by so erudite an authority. Nothing is omitted, no detail too troublesome to explain, and the classification of many aquatic plants is cleared up, the scientific angle not affecting in the slightest its appeal to the beginner. The expert can learn much from it, and its appeal is to the novice as much as to the landed proprietor.

The photographs of established pools are magnificent, and some line drawings make construction a matter easy enough to enable the constructor to do without the written instructions so lucidly explained and accompanying them. Some of the plant photographs have appeared in this journal, which is honoured to be so associated with a work which will remain for many years in a niche of its own.

"Water Gardening," by Frances Perry. 353 pp., 9 x 5½. 104 photographic illustrations. 15s. net. Country Life, Ltd.

Another most valuable contribution to the library of the serious student-aquarist is Methuen's "Animal Life in Freshwater," by Helen Mellanby, B.Sc., Ph.D., of the Department of Zoology, University of Sheffield. Covering, in a most workmanlike manner, life in fresh-water generally, and in particular the fresh-water sponges, hydroids, flatworms and round worms, the true worms and leeches, crustacea, insects, arachnids, molluscs, polyzoa, rotifers and protozoa, the whole is carefully indexed, and being written in a manner which assumes the minimum knowledge of animal structure and classification, it should be found an invaluable guide to the novice, particularly those desirous of pursuing their studies into the infusorian life which means so much to the breeding aquarist. For schools, as an introduction, it should prove similarly valuable, and Methuen's have done a service to a very wide public in the publication of this book. Definitely a book to add to your bookshelves.

"Animal Life in Fresh Water," by Helen Mellanby, B.Sc., Ph.D. 296 pp. 7½ x 5. Copiously illustrated with text figures. Bound Willesden Green canvas, 8s. 6d. net. Methuen & Co.

A CORAL REEF

By DR. A. S. PEARSE, Duke University, U.S.A.

(Continued from page 283 last issue)

One of the most interesting examples is Lybia (Melia), a coral reef crab of the Pacific. This crab deliberately removes certain anemones from the rocks to which the latter adhere, and carries them fully expanded in its first or clawed pair of legs. When it is attacked it defends itself by pushing these anemones toward the assailant; as the anemones, in turn, capture food the crab takes it, or part of it at least, and transfers it to its own mouth. Inasmuch as the anemones have so many more opportunities for obtaining food by being moved about, they can well afford to share their catches with their partners.

Longley also tells of crabs that deliberately tear bits of living sponge off the rocks and hold them on their own shells until the sponges takes root, so to say, and begin to grow. Thereby the crabs secure effective protection from their enemies, for the species of sponge which they thus utilise is distasteful to many creatures as it is packed with flinty, needle-like bodies and, besides, gives off a very disagreeable odour.

Then there is a vividly coloured fish, about an inch and a half long, that is always hovering about the giant sea-anemone. Upon the slightest alarm, it darts for the anemone "blossom" and disappears among its feathery tentacles. When danger passes the finny occupant emerges from its protective cover. It is said that this fish is so dependent upon the anemone that it dies if the two are permanently separated.

Other creatures common at Tortugas, such as the sucker-fishes, attach themselves to larger fishes. The most notable of the group, the Remora, bears on its head a sucking disk which is a modified back-fin, looking much like the corrugated rubber heels of shoes. This fish is frequently found clinging to sharks to which it affixes itself in order, apparently, to obtain a free ride to the spot where a kill is made. Upon arriving it detaches itself from its host and feeds upon the fragments.

So powerful is the suction of the disk of the Remora, that the natives of Chinese waters use the fish for catching turtles. Attaching a thin line to its tail, they cast it into the water near a turtle toward which it promptly darts, fastening itself quickly to the under surface. If the turtle is not too heavy and powerful, it can thereupon be drawn to the boat and firmly secured.

[Photo] (Carnegie Inst. (M. Lerand)

A crab, Macrocœloma trispinosum, found at Tortugas and elsewhere, which conceals itself beneath a covering of sponge. This serves as a protection to the crab, as its natural enemies avoid sponges in any form. The upper illustration shows the crab without its covering

Longley also tells of the strange relationship existing between sea-cucumbers, sluggish, repulsive-looking, sausage-like creatures living on sea-bottom which, at Tortugas, grow to a length of two feet or more, and a certain slender fish, six to eight inches long, called Fierasfer. This fish, which feeds independently like other fishes, when alarmed, retreats to a sea-cucumber and backs into the latter's food canal at its posterior end, remaining therein until hunger overcomes its fear, whereupon it reappears.

Perhaps an idea of the extent to which the practice of symbiosis and commensalism is carried by these marine creatures can best be conveyed by referring to the results of a study of the occupants of sponges, made by me when I spent several months of 1931 at the Carnegie Institution Marine Biological Station at Tortugas, where I made the investigation.

I removed a "loggerhead" sponge, which was about the size of a large washtub, and placed its base in a container so that no animals would be lost. I thereupon sliced the sponge into thin sections, as one would slice a loaf of bread. Each slice was carefully examined and the animals picked out, placed in bowls, and counted under a reading glass of considerable magnifying power. When the count was completed, I discovered that this particular living hotel was housing 17,128 guests, which meant that there were approximately two animals to every cubic inch of its volume.

Among this great host of creatures, were five fishes of the genus *Evermannichthys*, each about an inch in length, having exceedingly slender bodies, well adapted to life in the canals of the sponge. Members of this genus are regular inhabitants of sponges, never having been found elsewhere.

Annelid worms, numbering 229, were taken

The illustration above shows two shrimps occupying sponges. The upper shrimp is Synalpheus brooksi, which Pearse found in very large numbers. The lower species, Typton tortugas, which also lives in the sponge, is not found in quite such large numbers. In both species one of the claws of the first pair of walking legs is greatly enlarged. They are both brilliantly-coloured, crayfish-like animals, less than an inch in length. The two slender-bodied fishes at the bottom of the illustration are Evermannichthys, regular occupants of sponges, never found elsewhere. They grow to about an inch in length, and are well adapted to life in the canals of the sponge.

Photos
(Carnegie Inst. (M. Lorant)

On the left is an illustration of the living coral polyps, Eusmilia fastigiata, taken under water in the aquarium at Tortugas. The fringe of waving tentacles at the top should be noted. On the right is an illustration of this same species, showing the skeletal structure of the polyps after the removal of the living matter. All the beautiful corals known to most people, and used for diverse ornamental purposes, are so hidden when populated by their builders.

from the canals and, embedded in the tissues of the sponge, 28 barnacles were counted which, however, were in direct connection with the sea through surface holes. Ostracods and amphipods, very small crustaceans, were also represented, but by far the greatest number of animals which had taken up abode in this single specimen of the loggerhead sponge were small synalpheid shrimps, the count registering the enormous number of 16,352. These shrimps, in turn, served as hosts to two types of parasites of which 324 specimens were obtained.

Shrimps the Most Numerous

Synalpheus, the genus of Crustacea so dominantly represented among these sponge inhabitants, includes a large number of small, brilliantly-coloured crayfish-looking animals which, though widely distributed, occur in greatest abundance and variety among the sounds and inlets of coral reefs.

Indeed, nearly every mass of sponge, of alga, of coral rock, or of living coral brought up from the bottom and broken in pieces contains specimens of one or more species of Synalpheus or their near relatives, Crangon (Alpheus) while, frequently, pieces are found which fairly swarm with these tiny animals.

The most conspicuous of the characteristics of these shrimps is the great enlargement of the claws of the first pair of walking legs. Both claws are large but one is relatively enormous; indeed, in some species this claw is nearly as big as the body of the animal.

In nearly every species the large claw terminates in hard, powerful forceps. This part of the claw is provided with a plug which fits into a socket in the joint. When the forceps are opened the plug rests loosely at mouth of the socket. When the forceps are closed it suddenly and violently snaps back and the hard bony points, striking together, produce a sharp metallic report.

In some regions these shrimps are so abundant that at low water along shore they keep up a constant fusillade and well merit their common name, "pistol crabs." The particular species which I observed in the sponge in such numbers (*Synalpheus brooksi*) are said to come out of their retreat only at night and even then they rarely leave the surface of their host.

Living Guest Houses

In speaking of this practice of utilising the living sponge, Longley says:

"Apparently the use of sponges as guest-houses is an old-established custom among marine animals. Sponges are inert, stolid masses of tissues which have no nerve cells and no proper nervous activities. Small wonder that they are set upon by more astute animals and used as food and for shelter.

"Some of the guests are permanent residents which never live elsewhere; others are transient and only stay overnight. Some take only small organisms from the water which a sponge is continually waving through its canals; others gnaw away the tissues of the sponge and are therefore classed as parasites rather than symbiots or commensals. But the sponge, in such case, with its low degree of specialisation, readily replaces lost or injured parts and soon recovers from small or even serious injuries.

"Some sponges are quite inhospitable and have developed qualities which make them distasteful by growing spicules or by producing noxious odours. Apparently these qualities have made them as repugnant to guest animals as to humans; at any rate, such sponges as the prickly, foul-smelling *Stematumenia fœtida*, rarely harbour any occupants.

The Snappers (Lutianus) are perch-like fishes common in tropical seas and valued as food. In this picture a shoal of Grey Snappers (L. griseus), which feed on crabs and grow to about eighteen inches in length, swims between fleshy corals or gorgonians (on left) and "pepper coral" (on right). The spines of a Sea Urchin show in the lower right-hand corner.

A shoal of Yellow Goatfish (Upeneus martinicus) is here seen swimming between clusters of coral polyps. They get their name from the "beard," consisting of two sensory barbels on the chin which lie in a groove along the lower jaw when not in use. Their European relative, the Red Mullet, is sometimes seen in London fish-shops, and was much esteemed by the Romans.

At the bottom of the picture are two specimens of the Striped Grunt (Haemulon sciurus), so called on account of the harsh grating noise emitted when the fish is taken from the water. Various corals form the background.

Photos
(Carnegie Inst. (M. Lerant)

NATURE AS AN ILLUMINANT

By ERIC HARDY, F.Z.S.

The Glow-Worm and Her Little Lamp : Cold Lights in Fishes

"DO you know, you can make your fortune if you can produce a cold light as bright as that, without any wasted energy producing unnecessary heat!" It was my good friend Dr. Mc—— speaking and we were discussing the glow-worm I had for study in my insectarium, and my futile effort to photograph its light which was not constant and the creature was never still. Yet Nature as a luminant still defies man in the production of the most economic of all lights, the cold light of phosphorescence, whether it be in the glow-worm, the luminous cave moss Schistosega, the firefly of the tropics, or the cold lights that illuminate the deep-sea fish of the oceans.

The glow-worm, by way of explanation, is not a worm, but a beetle, and the bulk of the light is produced from a couple of yellowish-green swellings under the tip of the abdomen of the flightless female beetle, who looks very much more like some sort of dark-bodied centipede with yellow borders to each segment of her body, only that she has the typical six legs of the insect. Her light is supposed to attract her flying male suitor, and she controls the volume of light by the flow of air from her tracheæ or breathing tubes which are adapted to produce the oxygen necessary for the combustion of the fatty chemicals in her tail. But in my insectarium I noticed the light was also an indication of her feelings and her excitements. Trying to photograph it was hopeless, for it would come and go as she wandered about. I placed a cardboard ring around her and she struggled to climb to the top, which she eventually reached, and as if to portray her success, "lit up" her lights, and as she climbed over the top she gave an extra bright light and then extinguished her lamp as she crawled down the other side to freedom. I thought she was dead when only the colder days of autumn had numbered her for winter hibernation, and when I pinned her to the setting-board, I noticed two days later that she was still alive, for a constant glow from her tail was evidently an expression of pain.

In the damp valleys and hillsides we come across the glow-worm's lamp shining in the dark with a delicate tint of pale green and seen from many yards distance; but so soon as we approach to pry closer, the insect extinguishes it. If this were not so, the insect could never escape its enemies. These glow-worms are useful creatures, for they feed on slugs and snails, and one large black common field slug was devoured by my glow-worm in two days, and lasted her for food for a week. She merely bit the slug's tail with her forked sucker until it drew itself up into a hump, and then she gradually sucked away its very tissues. After the meal the glow-worm cleans its body most carefully with the aid of about a dozen thin, white cleaning organs underneath its tail. The precious tail possessing the delicate organs of light is carried as carefully as a scorpion carries its tail, only that it is curved the other way, raised a little and with the lights folded under except when in use. The tail end is used as a sort of walking stick to help push the creature along when its six little legs at the head end of its body cannot walk fast enough. At each moult of growth, the glow-worm appears forth in a soft pale green and salmon pink skin, which rapidly darkens to its normal dark brown, edged with yellow.

There are more than five hundred glow-producing insects in the world, but the wonder of the cold light has still baffled man to produce it on a commercial scale. The Lampyridæ beetles are remarkable, for nearly all of them possess illuminations. The famous Waitomo Caves of New Zealand, where the light in the "glow-worm grotto" is good enough to take a photograph, the insect here is the grub of a two-winged, gnat-like fly, Bolitophila luminosa, and its glow gives the snow-white stalactites an unearthy beauty famed with travellers. There is no floodlighting required in these caves, for in order to feed, each grub suspends itself from long threads, which add to the effect of their lights, for they light up to attract little insects, which get entangled in the threads and are then quickly caught.

Then there is Noctiluca, the tiny phosphorescent creature of the sea which we often find

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CONSTRUCTING A TROPICAL FISH-POOL . . . .

By JOHN C. PATERSON

THE process of construction outlined here was adopted in order to obviate the necessity for wooden forms, and also from the point of efficiency and economy. The final product has proven well worthy of the experiment in construction, and I have no hesitation in recommending the system to anyone desirous of having a pond in his green-house or fish-house.

Primarily, however, I should like to point out that such a pool can be of no use whatsoever as a cold-water pond in the garden, as it is not constructed to stand freezing. It is designed for a position which will ensure freedom from ice, and as such it will give every satisfaction.

Whether a hot-water system is used or not, the main construction of the pool is the same; the hot pipes are easily installed. The following is a description of the procedure adopted in my own case, which could be modified more or less to meet individual requirements.

The pond was constructed inside my own fish-house, and was designed to stand up from the floor rather than to be sunk, so as to render the use of the hot pipes a practicable scheme. The size of the pool was fixed at 15 feet long by 9 feet broad by 2 feet deep, and accordingly a rectangular piece was cut out of the wooden floor to allow about 6 inches margin all round; that is to say, about 16 feet by 10 feet. As the floor is not more than about 12 ins. or 14 ins. above ground level, it was a simple matter to support the joists as they were severed, and thus preserve the strength of the building.

The ground was then covered by a mixture consisting of all the old bricks and rubble we could lay our hands on, made into a mortar with cement and smashed down level. This rose to within six inches of the floor level, and was surmounted by a layer of whin-stone concrete, and finished off at floor level by a layer of whin-dust cement, giving a level and perfectly smooth finish. Round the dimensions of the finished pond, a groove was made 3 inches by 3 inches, by imbedding wooden strips of this section in the concrete and removing them after it was dry. This groove was to provide a foundation for the walls of the pond.

Instead of trying to make forms and pour concrete into them, we commenced to build the walls by setting pre-cast concrete slabs on end into the groove provided for them. These slabs were 27 inches long by about 20 inches broad by 2 inches thick. They were set into a strong cement mixture in the groove and allowed to set firm. When all was set, they were pointed together very carefully and finally the whole pond was given a cement wash. I may add here that water-repelling cement was used for all the parts of the pond which were liable to contact water.

To provide the necessary heat for breeding tropicals, it was decided to use an ordinary greenhouse low-pressure boiler and hot-water pipes. These pipes had to pass through the pond, from the boiler which was set into the wall of the fish-house, so as to be coaled from outside. Holes were made in one of the concrete slabs, to take two 4 in. diameter pipes, prior to cementing the slab in position. These holes were placed so that the lower pipe should be as near as possible to the floor of the pond, in order to keep the pond water in a state of convection, and to prevent all the hot water from collecting at the surface, leaving the floor cold.

The hot pipes were set in position round three sides of the pond, and supported while all elbow-joints, etc., were tightened up. Buttresses were now built of brick, two on each side of the pond, and one on each end, the hot pipes being built right into the buttresses and thus held as firmly as possible. Little or no " run " was given to the pipes. The expansion box was fitted at the outward end of the system, and the brick buttresses were pointed with water-repelling cement, then plastered over with the same and finally cement-washed. An aquarium cement made the joint through the outside wall of the pond perfectly tight and this joint was painted with bitumen. Finally, all the iron work was painted and allowed to dry.

This pond was soaked for a day then emptied. Sand was placed over the floor, water was admitted, and when the pond was full the heat was turned on. It was found that it was quite an easy matter to maintain a temperature of

90 deg. F., and that if full heat were given, the pond would become too hot for any fish to live in. The water cooled so slowly that even if the fire went out, the pond could be left overnight without heat, and would only lose a moiety of the heat it had gained from the hot pipes. Naturally, also, the temperature of the atmosphere of the fish-house tended to rise, and all the tanks round the walls containing tropicals required a great deal less heat to maintain them than they did before the pond was installed. The walls of the fish-house being constructed to prevent loss of heat, even in cold weather the temperature is that of genial warmth, in which palms and ferns, etc., thrive amazingly. Incidentally, the pond provides an ample breeding haunt and playground, and could accommodate literally thousands of fish without overcrowding. In this particular case the pond has been fitted with movable partitions, which can give anything up to six sections, and this facilitates the handling of the fish, though without doubt it detracts from the æsthetic aspect of the pool.

There is absolutely no leakage and the walls of the pond can withstand the pressure of the water without difficulty. In fact, one can stand on the edge of the pool without any fear of disturbing the walls.

NATURE AS AN ILLUMINANT

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on our own shores, or at night, giving the peculiar glow or blue flashes to the waves, or a yellow scum on the tide line. This is a little flagellate protozoan with a body only one-sixtieth of an inch in diameter, and moving about by means of its whip-like tail. There are also the luminous fishes from the depths of the oceans, as found on the famous "Challenger" expedition. Some of these cold lights of the sea are in the form of a row of lights along the fish's body, but with some of the relatives of the angler fish, the creature has a light on the end of its angler's rod, an adaptation of a fin-ray above its head, so that it lies on the dark depths with its great mouth open, and the light above attracts other fish above that yawning chasm and to their doom. The luminous fish are usually below the 1,000 fathom line, but the first ever dredged, off Messina, in 1810, was a little black fish with large eyes and some white spots, and the discoverers did not know these were luminescent in life. They named it Myctophum, or night-light, and in later years over a hundred luminous relatives were brought to the surface for science, from almost all seas at great depths. They all bear luminous spots or photophores, about the size of a pin-head.

CASUAL OBSERVATIONS

The San Francisco Aquarium Society are inviting photographs for the cover of their "Aquarium Journal" for 1939, to take the place of the Dragon Fish now used for this purpose. There are no rules for the competition, and non-members of the organisation can compete as well as members. Photographs should be sent to Mrs. C. J. MacMeekin, 3515, Fillmore Street, San Francisco, as soon as possible. The prize offered is a copy of Ida Mellen's "1,001 Questions about your Aquarium."

* * *

There is obtainable from engineers' sundriesmen a varied selection of stout glass tubes, several sizes of which are of value to the aquarist. One size, twelve inches long and with an internal diameter of slightly under half an inch, is invaluable for attachment to a length of rubber tubing for use as a syphon. Both ends are smoothed off inside and out, making it most unlikely for a fish to be damaged if accidentally drawn up by the syphon, while its stoutness is such as to stand more than the usual rough usage given them. They are technically known as "steam gauge glasses."

* * *

Early this year, not for the first time, we damaged a watch, this time beyond repair, by accidental immersion in an aquarium. You know that impulsive movement you prevent, only too late, when setting up an aquarium? Well, it finished this one; we then invested in a watch at a comparatively low price which has been deliberately immersed scores of times since then, owing to the fact that it was guaranteed waterproof, and there have been no ill after-effects. It has been plunged into water time and time again, daphnia pools, fish cans, tanks, and so forth, and still keeps time more or less to a second. Certainly, the water has had no effect upon it, and if you are interested, drop a line to the Editor for further information. Distinctly, it is an adjunct to the life of the aquarist!

90 deg. F., and that if full heat were given, the pond would become too hot for any fish to live in. The water cooled so slowly that even if the fire went out, the pond could be left overnight without heat, and would only lose a moiety of the heat it had gained from the hot pipes. Naturally, also, the temperature of the atmosphere of the fish-house tended to rise, and all the tanks round the walls containing tropicals required a great deal less heat to maintain them than they did before the pond was installed. The walls of the fish-house being constructed to prevent loss of heat, even in cold weather the temperature is that of genial warmth, in which palms and ferns, etc., thrive amazingly. Incidentally, the pond provides an ample breeding haunt and playground, and could accommodate literally thousands of fish without overcrowding. In this particular case the pond has been fitted with movable partitions, which can give anything up to six sections, and this facilitates the handling of the fish, though without doubt it detracts from the æsthetic aspect of the pool.

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NATURE AS AN ILLUMINANT

(*Continued from page* 323)

on our own shores, or at night, giving the peculiar glow or blue flashes to the waves, or a yellow scum on the tide line. This is a little flagellate protozoan with a body only one-sixtieth of an inch in diameter, and moving about by means of its whip-like tail. There are also the luminous fishes from the depths of the oceans, as found on the famous "Challenger" expedition. Some of these cold lights of the sea are in the form of a row of lights along the fish's body, but with some of the relatives of the angler fish, the creature has a light on the end of its angler's rod, an adaptation of a fin-ray above its head, so that it lies on the dark depths with its great mouth open, and the light above attracts other fish above that yawning chasm and to their doom. The luminous fish are usually below the 1,000 fathom line, but the first ever dredged, off Messina, in 1810, was a little black fish with large eyes and some white spots, and the discoverers did not know these were luminescent in life. They named it Myctophum, or night-light, and in later years over a hundred luminous relatives were brought to the surface for science, from almost all seas at great depths. They all bear luminous spots or photophores, about the size of a pin-head.

CASUAL OBSERVATIONS

The San Francisco Aquarium Society are inviting photographs for the cover of their "Aquarium Journal" for 1939, to take the place of the Dragon Fish now used for this purpose. There are no rules for the competition, and non-members of the organisation can compete as well as members. Photographs should be sent to Mrs. C. J. MacMeekin, 3515, Fillmore Street, San Francisco, as soon as possible. The prize offered is a copy of Ida Mellen's "1,001 Questions about your Aquarium."

* * *

There is obtainable from engineers' sundriesmen a varied selection of stout glass tubes, several sizes of which are of value to the aquarist. One size, twelve inches long and with an internal diameter of slightly under half an inch, is invaluable for attachment to a length of rubber tubing for use as a syphon. Both ends are smoothed off inside and out, making it most unlikely for a fish to be damaged if accidentally drawn up by the syphon, while its stoutness is such as to stand more than the usual rough usage given them. They are technically known as "steam gauge glasses."

* * *

Early this year, not for the first time, we damaged a watch, this time beyond repair, by accidental immersion in an aquarium. You know that impulsive movement you prevent, only too late, when setting up an aquarium? Well, it finished this one; we then invested in a watch at a comparatively low price which has been deliberately immersed scores of times since then, owing to the fact that it was guaranteed waterproof, and there have been no ill after-effects. It has been plunged into water time and time again, daphnia pools, fish cans, tanks, and so forth, and still keeps time more or less to a second. Certainly, the water has had no effect upon it, and if you are interested, drop a line to the Editor for further information. Distinctly, it is an adjunct to the life of the aquarist!

AN INTRODUCTION TO THE KEEPING OF TROPICAL FISHES

By H. W. CASTLE

(*Continued from page 277 last issue*)

5. FEEDING AND DISEASES

TROPICAL fish in an aquarium are living under artificial conditions, and although they are protected from enemies and supplied with sufficient food without the need of searching for it, still the inevitable restrictions of the average aquarium must damage their health unless the aquarist takes pains to reproduce, as closely as possible, natural conditions. In my article on Plants and Aeration, I stressed the importance of this copying of nature, but in the matter of foods and feeding it is even more vital. Variety of diet is the first essential in keeping any fish healthy.

Numerous brands of dried food can be bought from dealers; each has its merits, but the aquarist should not look on them as the staple item of diet. Dried foods may be rendered more palatable by mixing into a paste with meat and vegetable extracts, boiled yolk of egg, or fish pastes.

Except for very small fish or fry, the fine grades of dried food should be avoided, as uneaten particles are difficult to find; the medium grades of food are more suitable. It is best to keep several brands of dried food in stock so that even when all other sources of supply fail, the diet can still be varied.

When feeding dried food, a feeding ring is almost essential. It consists of a piece of glass tubing bent into the form of a square or circle and can be purchased ready-made for a few pence. It floats on the surface of the water and should be moored to the side of the tank. Dried, or other floating food is placed inside the ring which prevents the food from spreading over the whole surface of the water. In this way uneaten food, which slowly sinks to the bottom, will all be found on the sand directly beneath the ring and not spread all over the plants in every nook and cranny. Excess food can then be removed with a dip-tube. This consists of a glass tube about eighteen inches long, with a bulb in the middle. A finger is placed over one end of the tube and the other end dipped into the aquarium and held over the object to be removed. When the finger is taken away from the top of the tube, water rushes in carrying with it quite heavy objects. If the finger is then replaced over the end of the tube, the tube and its contents can be lifted out of the tank. This cleaning of the tank should be done regularly; at least once a day if the tank is to remain clean and healthy.

The most beneficial foods for tropical fish are undoubtedly those which come under the heading of "live" foods. Foremost amongst these is the common Water Flea (*Daphnia pulex*). Supplies of this little crustacean can be obtained from dealers, or the aquarist can collect his own. Daphnia are found in most bodies of water, but unfortunately they are seldom present in sufficient quantities to warrant the trouble of collecting them. The best time of day to net them is early in the morning or in the late afternoon; they can be collected in a large, fine silk net and carried home in a fish can.

It is possible to breed Daphnia in garden pools, water butts, etc., but the results seldom warrant the trouble and smell.

Another live food which can be bought from dealers is the larvæ of the fly Chironomus, known as the Bloodworm. This is a small red worm about half an inch long and is readily taken by most tropicals. They should be kept in a cold place in a bowl of water and will then survive for two or three days.

The most successful way of keeping a steady supply of live food is by means of a culture of Enchytræ. These worms can be bred in the following manner. First a box is filled with a compost of equal parts silver sand, peat and loam. The compost must be firm and very slightly damp to the touch. Next a hollow is scooped out and a few Enchytræ placed in it. A paste of sour milk and biscuit is then prepared and spread on a sheet of glass; this is placed paste-downward on the surface of the compost. The whole is then placed in the dark. When some of the worms are needed, they will be found to have collected at the surface of the compost against the glass. A culture such as this will provide a constant source of live food for months, and sometimes years, without renewing the original supply of worms.

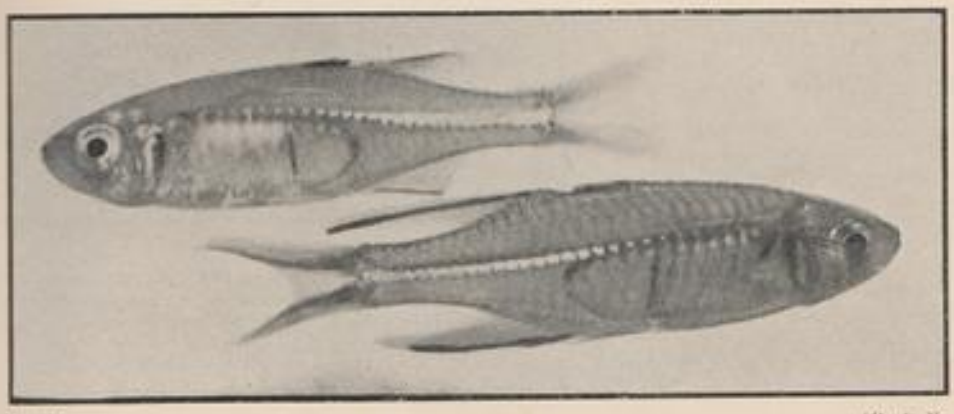
Another useful source of food is the common earthworm. These should be killed by a sharp

blow, then chopped up small and washed. They are then readily eaten by all tropical fish.

To supplement and vary the diet, small pieces of tinned crab or prawn, white boiled fish, chopped liver and Bemax may all be used. In this way it should never be necessary to employ the same article of food more than once a week.

Most of the aquarist's troubles arise from faulty feeding. The usual mistake is over-feeding; one result of this is constipation for the fish; the other is water pollution due to the decay of uneaten food. Constipation can usually be put right with the very human remedy of a pinch of Epsom Salts, but water pollution is liable to pass unnoticed until too late. The chief symptom is the tendency of the fish to remain at the surface attempting to gulp down bubbles of air; the only remedy is to empty the tank and start again.

Disease is a comparatively rare occurrence with tropical fish; the most common and dangerous is undoubtedly White Spot. This disease if caught in its early stages, can, however, be fairly easily cured, but if absolute cleanliness is not the rule, it will spread from tank to tank with alarming rapidity. To minimise the risk of infection, all aquarium accessories, such as nets, dip-tubes, etc., should be sterilised in boiling water every few days, and if possible a separate set should be kept for each tank. The disease can only get a hold on weakened fish and usually follows on sudden chilling or incorrect feeding. It can be first recognised by the appearance of small white spots about half the size of a pin-head on the fins and tail of the affected fish. These white spots are colonies of a parasitic protozoan, *Ichthyopthirius multifolius*, living on the blood of their host. After a few days the parasites leave the fish and fall to the bottom of the tank, where they rapidly increase to some hundreds of parasites. In a few hours they swarm through the water to find a new host. At this stage they are comparatively easy to deal with, but whilst they are in the cyst or on the fish, any disinfectant strong enough to kill the parasite would also seriously damage the fish. The treatment of this disease has been dealt with in past issues of this journal. Plenty of live food should be fed to restore the fish to normal, as the disease rapidly lowers their vitality. Other diseases are so rare as to be almost negligible. Fungus is occasionally encountered but is usually quickly cleared up by painting with a dilute solution of Potassium Permanganate.



Photo] *[B. & F.*

Telmatherina ladigesi

A very handsome and striking fish from the Celibes, known on the Continent as the Celibes Sail Fish, and in this country as the Neon Glass Fish. Closely resembling Ambassis lala in colour, the fins are yellowish, and strikingly marked with black, this latter colouring being much more prominent in the male, seen as the lower fish in the photograph. The light line along the side on both sexes is brilliant sky-blue. Growing to a length of two and a half inches, it carries its fins well spread and the dorsal very high, dropping them instantly when stopping or hovering stationary in the water. The male has much longer finnage than the female. It is apparently a peaceful fish when mixed with other species, and is omnivorous

THE CHAMELEON AT HOME

By J. SAUER VAN PLETSEN

THE average person is afraid of the chameleon, simply terrified by it, and this notwithstanding the fact that he is perfectly well aware of the creature's absolute harmlessness. This is probably the reason why the man in the street, not to speak of those in the offices and shops and tearooms in the same street, know so little about the chameleon.

For instance, how many people know that the chameleon is:—

(a) Divided into two distinct types or classes, the one type laying eggs which are hatched out by the heat of the sun, and the other type giving birth to fully developed baby chameleons?

(b) That thousands and thousands of chameleons are born every year, and parts of the world would long ago have completely been over-run by these creatures had it not been through nature rigorously, sternly, upholding the balance? Tree snakes, many species of ground snakes, various kinds of birds and even rats wage a ceaseless war on the luckless baby chameleons, devouring them in such multitudes that very often out of a group of babies totalling several hundreds, not more than four or five attain maturity.

(c) That no chameleon is able to change its colour into absolutely pure, milk white, nor can it attain a deep blue?

(d) That it is only on rare occasions that a chameleon can more or less instantly change colour, this "instantaneous" transformation in colour occupying at best two to three minutes?*

(e) That slow, methodical and cautious as the chameleon is in all its habits and manœuvres, it can at times put up quite a burst of speed, swing along through the branches of a tree at a pace conforming more or less to that of a lame or wounded rat? And that the creature is by no means an awkward or ungainly swimmer?

In the Transvaal, South Africa, I kept some thirty chameleons of all ages, shapes and sizes under observation for a very long time. They lived in semi-captivity, since they were caged in an enclosure spanned around trees, shrubs, grass and creepers. I made some interesting observations. The idea that these creatures live all their lives without ever drinking water is so much nonsense. True, they can go tremendously long periods without water, but the fact is that they will drink water two or three times a day whenever they find it handy. They sip it up in the most minute quantities by approaching dew-laden leaves or blades of grass or even sipping the dew off their own bodies. I used to hang up bunches of fresh oak-leaves, spray these with water and immediately the chameleons would come along to sip the water drops off the leaves.

The sinuous, horny tail of the chameleon forms one of the most important parts of the chameleon's anatomy. A chameleon without a tail is hopelessly lost and he, in fact, succumbs in the long run from starvation. No, his tail to him is worth its weight in gold. Unlike the majority of the lizard family, whose tails sprout forth again after they had been broken off or

(Photo) (P. H. Arnold

The Dwarf Chameleon of South Africa, C. pumilis, the live-bearing species commonly imported into this country. It is relatively hardy, and grows to a length of 5 to 6 inches.

* A change from deep green to yellow was timed to take place in 18 secs., and could be guaranteed, by our own, under the influence of a water spray.—Ed.

otherwise lost, the tail of the chameleon, once gone, is lost forever. That tail, or rather, the grip it is able to maintain by means of its tail, does duty for brakes, for an anchor, for accurately judging and measuring distances, and it is the creature's standby in the case of furious battles. There are occasions when the chameleon chances such a long shot at a fly or some other insect that its whole body as it were rocks on a recoil spring, like a howitzer fired off. It only chances shots like these because it feels certain that its tail-grip is not going to let it down. Then, too, it has a favourite way of swinging down to a lower branch, hanging on only by its tail-end to the branch above, and remaining in that position until it had found a good and perfect hold for its front paws on the lower branch.

During the mating season the males are continually engaged in mighty battles over the various lady-loves. In a chameleon fight the idea is for the one combatant to get hold of the other by the scruff of its neck, wrench it bodily from off the branch whereon it happened to be perched and bodily cast it earthward. The human-like hands of a chameleon have a good and firm grasp, but its tail has an even better and firmer one. The winning combatant will always succeed in first getting the grip of the hands loose, swiftly proceeding thereafter to wrench the opponent free from its tail-grip as well.

I have put a tail-less male amongst my collection of chameleons and it's spent its life flying from one chameleon to the other. It was simply helpless, for although it was big of body and in perfect condition, it could not fight. It had no grip.

Strange to relate, many of them lose their tails by having them eaten off by ordinary fresh-water crabs! Chameleons do not, as is generally thought, spend all their time in trees, in creepers and in shrubs. No, they get down on to the ground as well, scout and hunt around through the densest grass and matted undergrowth, crawl along the cress-grown, wild rhubarb covered banks of streams and furrows and before they know where they are a crab has grabbed one by its horny tail! Of course, the chameleon at once clutches the nearest object in reach of its hands and holds on for dear life. The crab, finding it impossible to drag its catch into the water, does the next best thing. It philosophically commences to make a meal there and then of so much of the tail that it has managed to grab!

I have carried out innumerable experimental tests, but the nearest I could get their colour to pure milk white was merely a dirty, smoky white. The nearest to deep agapanthus blue was a dull, greyish black. You can get them to assume a two-colour scheme. The portion of the body, from the hindlegs to the tip of the tail, resting on the surface of a sunflower, assumes the deep, golden yellow of the flower, but the ribs, front legs and head, hidden in the bunch of green twigs you have stuck into the sunflower, remain a vivid green. Such a chameleon looks rather a fearsome fellow.

It is not true to state that they adopt these variations in colour, getting their bodies to match and blend perfectly with their surroundings, solely for the purpose of hiding themselves, making themselves as it were invisible. They do it more to get insects and flies and things to come and sit on their own bodies and thus be easy prey.

I have even noticed a golden yellow chameleon go and perch on the tip of a bright green leaf and remain golden yellow for quite a while. The vivid splash of colour on the green leaf invariably attracted all kinds of butterflies, day moths and even grasshoppers. While on the subject of colour changing, the creatures only resort to sudden, swift changing when fleeing from an enemy, generally from man or a tree snake. I have chased a chameleon along the branch of an orange tree, seen it climb energetically over into the branch of a peach tree in full bloom, growing immediately alongside, and then magically vanish! I found it bunched up in the tip of the peach tree branch, a perfectly lovely pink specimen. In under two minutes it had changed completely from a deep sea-green to a lovely pink.

In their wild, or even semi-wild state, chameleons do not as a rule look upon flies as forming much part and parcel of their ordinary day's food. They are mighty trenchermen, eating practically the whole day long, and hundreds of flies per day would not satisfy them. No, their favourite foods consist of ordinary crickets, which they industriously ferret out from their hiding-places, the praying mantis, or hottentot's god, as it is called in South Africa, grasshoppers of all sizes, some of these attaining a length of over four inches and giving the chameleon no end of trouble to pop the head and part of the forelegs into its mouth, all and any species of worm, including earthworms, cutworms and caterpillars, honey-bees, wasps,* baby mice, baby snakes and, of

(*Please turn to page* 331)

* On no fewer than three occasions we have seen chameleons die less than 5 mins. after eating the English wasp.—Ed.

A PLEA FOR DIRTIER TANKS!

PERHAPS the title of these few notes needs a little qualification. Dirt is dirt, whether in rooms, food or tanks; and the very name suggests something to be expelled or cleared away. To speak of clean dirt is a paradox that only confuses. Good soil is dirt in food, but in a garden it is clean, healthy stuff.

My plea is really no more than that; but even so, I expect I shall find some to disagree with me. If the editor is willing, however, I should personally be interested to read in "The Aquarist" any experiences on this subject, either for or against me.

My remarks do not concern the show tank of the drawing-room but the one which the aquarist keeps for himself as a sort of pond-in-little. They also relate to tropical tanks only. They ought to apply to cold-water tanks, too, but these are beyond my recent experience and I write only of what I think I know.

To read some of the books on aquarium-keeping, one would think the hobby was a full, spare-time job. "Be careful," they say, "to give your fish no more food than they will eat up in ten minutes, and carefully remove all discarded fragments." If the poor fish are having no more than a ten-minute meal a day, this may not take up too much time; but if you have to wait watch in hand (having perhaps nothing particular to fill in so short a time) and then go grubbing round the tank siphoning up the remains twice a day, aquarium-keeping may become a labour of hate.

Then, again, these writers tell us to go carefully—always carefully—round the tank for dead snails or decaying leaves and remove them before they pollute the water. These writers would, apparently, have fish kept just as the civilised human being is tending more and more to be kept—with denaturised, pasteurised milk, dyed butter and jam, bleached flour, and blue-bag whitened sugar—refined of all vitamins and good, healthy dirt.

The "cleanest" tank I had this summer is one which was not touched at all for at least six months, except to siphon out some sediment twice or three times for a purpose mentioned later. It is a 24 x 12 x 10 ins. deep tank, and all the time it was in use it had in it about half a dozen male Guppies, two female Swordtails, a pair of Dwarf Gouramies, three small black Mollies, a pair of Platys, two young Siamese Fighters (which thrived and grew into fine big fish), a hybrid Swordtail, a Catfish and a Sucker Fish. There were occasional changes of fish to and from other tanks, but this was roughly its permanent population.

When the tank was first set up it looked so clean that I put in about twenty snails—Australian pond and ramshorns—to dirty it a bit quicker. Unfortunately they bred so quickly that I had to get rid of them in twenties and thirties at a time, as they grew to a size big enough to handle. The tank was placed so that it projected about six inches in front of a west window; so that for part of the day it got sunlight striking across one end of it. It also got some diffused sunlight in front of it, diagonally, from a south window about six feet away. The back of the tank is painted so that the light from the west window would only pass into the tank from the top and through the left side.

The plants grew rich and green—Hairgrass, Dwarf Saggitaria, Ludwigia, Indian Fern, Riccia and Floating Fern. In the shadier part of the tank they only "just grew." The end of the tank most exposed to the light gradually became spotted with green algæ on the glass, and a little blanket weed grew among the hair grass. The shadier part of the glass sides gathered a film of brown algæ on it. This and the green algæ were scraped off occasionally, for the purpose of seeing the inhabitants better, and the scrapings were allowed to settle and remain in the tank. Blanket weed and the Hairgrass were also removed twice for the sake of the eye, and not for the sake of the fish, because there was not sufficient to impede their swimming.

If a snail died, it was left. If it was a big one I pulled it out when I noticed it. If any dried food was uneaten I didn't know. The only time I removed uneaten food was when I occasionally gave tinned crab. But I did not wait ten minutes for the fish to have their gorge; I waited two or three days, according to circumstances. Sometimes I didn't need to remove any discarded crab—the snails had done it for me.

And all through the six months the water was crystal clear, and not a fish died. I did not use aeration, but on the occasions that I siphoned out some sediment I replaced water

from the tap (after warming it), letting it run through a fine jet.

I siphoned out the sediment for two reasons —because it used to heap up round the plants and " for the looks of the thing " I thought it should come out; and because of a little experiment I was making with another tank into which I emptied all the sediment I could obtain from my other tanks.

This second tank, an 18 x 12 x 12 ins. was set up to grow Corkscrew Vallisneria, and I wanted to see what effect an excess of sediment had both on the plants and the water. I kept some snails in it but no fish. After a time I put a few daphnia into it that I had left over. A few days later the tank was alive with pinpoints of life, and although they did not all grow to mature daphnia, the tank has kept me supplied with an occasional change of diet for my fish ever since.

Despite the amount of sediment I have put in, including water from soaked banana-skin for the " fleas," the water in this tank, too, has been wonderfully clear all the time, and the sediment to be seen in the tank at the moment of writing is not, to all appearances, as bulky as the amount I have put in during the summer. Presumably the plants have fed on it. It must be remarked that this tank has had the benefit of considerable sunshine, which is a great preventive of the ill-effects of excessive decay, and there has been a " circulation " of the water to this extent—that I have siphoned off " fleas " and put into other tanks with the water therefrom, and replaced the water from other tanks.

When I emptied the 24-ins. tank to put my fish in a cabinet for the winter, and washed the sand preparatory to setting up some more plants to grow, there was a perceptible smell from the disturbed sand, though there was no smell from the water. This may be an argument for the " clean tankers " to use against me; but I still point to the results — crystal water, thriving plants and no fish losses. I found, also, quite a quantity of small empty snail shells. But the fish may have eaten these. I base my opinions for a " reasonably dirty " tank on the following. Go to any pond and you will find masses of decaying matter. Lift up some of the soil from the bottom, and you will find it black underneath and more than " smelly." Fish, if any, snails and the like must remain in it when they die.

This could not happen without detriment in a tank, of course, because a pond has these advantages—it has a comparatively very wide disturbed surface exposed to the air, allowing full surface aeration; it has all the sunlight there is; and it is nowhere near so crowded as the average tank, while in it live all sorts of scavengers which it would be impossible to keep in the average aquarium. Bearing these things in mind and endeavouring to strike a balance, my conclusion is that an immaculately clean tank is undesirable and not so " healthy " as a studiedly " dirty " one

H. N.

THE CHAMELEON AT HOME

(Continued from page 329)

course, baby chameleons. The males in particular are atrocious baby snatchers.

Taken in general, the chameleon has to live a hard life and a very dangerous one. It has many enemies, chief of these being tree snakes. The latter are always on the look-out for chameleons, exhibiting quite remarkable powers of patiently lying in wait for the slow moving chameleon to crawl forth out of the mass of twigs and leaves, to get out on to a more open space and thus enable the snake to pounce, get a firm grip on the head and commence its own swallowing process. The chameleon is absolutely defenceless. It hisses terribly, inflates its throat and stomach to tremendous proportions, but the snake takes not the slightest notice of any of these forms of bluff.

If too hard pressed by such a snake the chameleon resorts to a desperate remedy. If there is a pool of water or a running stream immediately below, it lets go with hands, tail and everything and falls plop into the water, swimming to safety again with frantic, energetic kicks and strokes. Even so, it very often does not escape. Tree snakes are bonny swimmers as well, and in a flash the reptile would be in the water itself and with quivering, S-like curves on the water's surface, briskly set off in pursuit!

The Chameleon makes an attractive pet, as quaint in appearance as it is unusual in character, but it is useless attempting to keep it without proper provision for its welfare. It needs all the sunlight that can possibly be obtained, and warmth, a temperature round about 70 to 80 degrees F. being ideal, and it persistently refuses food which is not alive, butterflies, house-flies, grasshoppers, and occasionally mealworms, forming an ideal diet.

REFLECTIONS IN A FISH TANK

[" One of the aspirations of the tropical fish-keeper in general and of the Guppy breeder in particular, is the production of a coloured female Guppy."—*The Aquarist and Pond-keeper (incorporating 'The Reptilian Review,') Oct.*, 1938.]

With what stern tasks
Do you occupy your leisure?
You wash down the car?
You exercise the puppy?
Contemplate the fish-man's esoteric pleasure:
Colouring
The female
Guppy.

I'd like to be an aquarist by sticklebacks befriended:
My calm would be phenomenal, untouched by any crises:
I shouldn't be distracted if a holocaust impended
So long as I were left to my aquarian devices.

Deaf to the mutterings
Of war between the nations,
Heedless of the headlines in
The public prints,
The fish-man calm amid successive Situations,
Tries to give his
Guppies
Tints.

I wish I were an aquarist and kept a little pond:
No threats would ever worry me, because I shouldn't hear them:
I'd stare at my aquarium and not an inch beyond—
My little fish would need their boss continually near them.

O would there were a hint
Of aquarist's ambition
In the Great Big Stiff
Whose fault the whole mix-up is.
How nobly unaggressive is the fish-man's mission—
To brighten up
The hues of
Guppies!

If Hitler were an aquarist with fishes to amuse him,
Preoccupied with problems of their colour and their sex,
There mightn't be so much that one felt called on to refuse him;
If only he would concentrate on fish instead of Czechs!

R.M.

"Reproduced by permission of the Proprietors of 'Punch.'"

VITAMIN FEEDING

(*Continued from page* 316)

recognised by the leading dietary authorities as a basic preparation of vitamins.

The vitamin content is as follows:—

Vitamin A—280 International Units per oz.
do. B1—400 do. do
do. B2—280 do. do.
do. E—High concentration (no unitage exists).

Chemical Analysis

	%		%
Protein	34.0	Fat	8.5
Starch	39.0	Mineral salts	4.5
Soluble carbohydrate	8.5	Water	5.0
		Fibre	1.5

Mineral Analysis

	%		%
Calcium	0.058	Magnesium	0.31
Phosphorus	1.11	Sodium and Potassium	0.64
Iron	0.0047		
Copper	0.0015	Chlorine	0.017

Aquarists having experienced much gastric disorder among their fishes are advised to try the introduction of Bemax into their feeding system.

MIDLAND AQUARIUM AND POOL SOCIETY

Fourth Annual Show, Botanical Gardens, Birmingham, 22nd October, 1938. Awards List:

Class 1, C. Goldfish.—1, D. E. Knights. Class 2, Comets.—1 and 2, W. Carter. Class 3(a), Sc. Veiltails.—1, H. Taylor; 2, C. S. Smith; 3, E. Hemsoll; V.H.C., J. Edwards; H.C., Z. Webb; C., H. Taylor. Class 3(b), Cal. Veiltails.—1 and Best in Show, W. E. Barrett (Telescope Calico Veiltail); 2, W. E. Barrett; 3, Z. Webb; V.H.C., W. E. Barrett; H.C., J. Edwards; C., Z. Webb. Class 4, A.O.V. F. Goldfish.—1, Z. Webb; 2, G. Atkins; 3, H. Taylor; V.H.C., J. Edwards; H.C., Z. Webb; C., A. Phillips. Class 5, Shubunkins.—1 and 2, Z. Webb; 3, W. E. Barrett; V.H.C. and H.C., J. Graham Keys; C., A. Phillips. Class 6(a), Shubunkins bred 1938 by exhibitor.—1, 2, 3 and C., J. Graham Keys; V.H.C. and H.C., H. Taylor. Class 6(b), A.O.V. Goldfish, bred 1938 by exhibitor.—1 and 2, Z. Webb. Class 7(a), A.V. Goldfish, novices.—1 and C., P. Thomas; 2 and V.H.C., A. Mason; 3, D. E. Knights; H.C., J. Bodycote. Class 7(b), Domesticated Fish, ex. Goldfish.—1 and 2, D. E. Knights (Sunfish and Peacock-Eyed Bass); V.H.C., F. Dyer (Sunfish); H.C., W. Capener (Sunfish). Tropicals judged as one class, inc. Characins, Carps and Minnows, Guppies, A.O.S. Livebearers, Anabantids and Other Families.—1, N. W. Gilbert; 2, A. Capener; 3, V.H.C. and C., J. Vindon; H.C., A. Capener.

D. E. Knights, Hon. Sec.

READERS' RECORDS

Alligator Growth.—I was interested in the article "Rate of Growth in Alligators." I think there must be some mistake in one weight given. I purchased an alligator in November, 1936, which I took to be a year old. The following particulars of its growth may be of interest.

November, 1936	18 inches.
November, 1937	27 ,,
March, 1938	30 ,,
May, 1938	34 ,,
August, 1938	38 ,,
October, 1938	42 ,,

Present weight, when three years old, nine and a half pounds.

D. Losh Thorpe.

(The sentence, due to a printer's error, stated that "in the third year the length should reach 45 inches and the weight 45 pounds." This should have read "14 pounds." Any more records as methodically kept?—Ed.)

A Heath Robinson Aquarium.—If the screen that surrounds my aquarium were taken away, the "works" might look like a Heath Robinson cartoon come to life. I started out to keep an efficient aquarium at as low a cost as possible. I bought a large electric light accumulator glass case to begin with, and when I had stocked this tank with various kinds of cold-water fish, I bought another tank of the same sort. As the water in these tanks was necessarily deeper than the width, I was for some time troubled as to how to aerate it, and I also needed a filter. This is how I overcame the difficulty. I made a platform to cross both tanks at a height of about a foot. On this I placed two seven-pound marmalade jars, and below the table on which the tanks stood I put a large bucket. I then bought some yards of wind-screen wiper tubing at a garage, and this I cut into four lengths. Two to syphon water out of the marmalade jars, and two to syphon water from the tanks into the bucket. The tubing had a very small bore, and so it was a very thin stream of water that flowed through it. By sucking the end of the tubes I was able to draw the water out of the tanks into the bucket, and using a jug I tipped the water in the bucket into the marmalade jars, and syphoned the water from these in long thin streams back into the tanks, and so on. This solved the aerating cheaply. Later I fixed to the shelf two pepper tins with a hole in the lid and a hole in the bottom of each. The hole in the bottom was covered with a piece of perforated zinc, with a piece of muslin on top of it, and this was covered with a mixture of washed sand and compost. The water from the marmalade jars flowed through these improvised filters, and so into the tanks. The contraption has now been working for some months and gives very satisfactory service. It is not, of course, kept working all the time, but is started now and again when I feel that the water requires it. I have now installed lighting above the tanks, and built a wooden screen round them, with windows in the front, so that from the outside it might be a pair of show tanks in a professional aquarium. In one tank, I have a comet, a fantail, a shubunkin, a golden orfe and a catfish, and in the other a green tench, a golden tench and a bronze carp. All these fish have kept in perfect condition for over six months.

Michael B. Ordish.

IN LIGHTER VEIN

(*Continued from page* 310)

held commonly that Fungus is a disease common to fish and inevitable, and anyhow what's the use sending for a post-mortem examination just to be told your fish has Fungus? Now, peculiarly enough, the number of fish which die from pure unadulterated Fungus is very small indeed. It is quite wrong to think that a good fat healthy fish is suddenly spotted by a Fungus Spore, attacked and carried off in its prime. No, Fungus doesn't attack any fish unless something has happened to that fish to make it weak and sickly. It might be bad conditions, spawning, disease, internal or external parasite, but it must be some definite foundation before the Fungus attacks the fish. Look into the question a little deeper before you dismiss the next fish death as mere Fungus.

Just a closing word. If you have ever received a disappointing post-mortem, remember that it is not always plain sailing for the one who has done it. After all, particularly when they come from experienced aquarists, the specimens sent for examination are obviously not plain sailing straightforward cases, and the study of fish diseases is not very advanced.

As one who makes post-mortems, I can bear the disapproval of the Postman better than the frowns of my aquatic friends.

W.H.C.

PUBLIC AQUARIUM Notes and News

BLACKPOOL. *Open daily*, 9—11. Ent. 1s., *inc. access to ballroom, roof gardens and menagerie.*

In the Tropical section we have a pair of fish that are worthy of mention — *Astronotus ocellatus*. When the Tower Company received these fish three years ago, they were about 2½ ins. long. At the present time they are 8½ ins. long and in wonderful condition. I have heard it said they are the finest pair in the country. In the next section there is a fine male specimen of *Channa asiatica*, commonly called "Snakehead," about 11 ins. long. We received a pair of these fish from West Africa over two years ago, the male was about 7 ins. and the female 4 ins. long at that time, and they lived peacefully together for over a year. On coming one morning, however, I was informed that the male had killed his mate. He certainly made a good job of it as he had nearly severed her in two. Since that time he has been alone, except when he is fed sticklebacks, and I know you will not wonder what happened to them.

BRIGHTON. *Open daily, inc. Suns.*, 10—5.30. *Ent. 6d., Ch. 3d.* The most interesting recent addition to the tanks is a "shoal" of 150 herrings. Owing to their thin and delicate scales, which fall off when the fishes are taken from the water, it has been found impossible to transport them to inland aquaria, for so soon as the scales are lost the fish succumbs. It is probably on account of this difficulty that in no other aquarium in the world—than at Brighton—can a "shoal" of living herrings be seen.

The Herring (*Clupea harengus*) is the most abundant of the Herring family, which includes some of the most important food fishes in British waters, among them being the Sprat, Pilchard and Shad.

Other arrivals include a group of a hundred Silver Whiting (*Gadus melangus*), which look more attractive in life than when displayed on a fishmonger's slab, British Sharks in variety, Dory, Grey Mullet, Pout, and various members of the Crustacea.

CHESTER. *Open daily*, 10 *to dusk. Ent. to Gdns., 1s., Ch. 6d., inc. Aquarium.* Various removals have taken place in the Aquarium in the last month by changing fish to different tanks where they will appear much better displayed to the public. For instance, the Neon Tetras have been moved to the one formerly occupied by the Flame Fish. This tank has a black background, and is only about half the distance between the front and the back of the one they were in before; the result is the Neon Tetras show themselves to much greater advantage than formerly.

The young *Aequidens curviceps*, which have now grown considerably, have been placed along with their parents in a tank of their own, which has made a very interesting exhibit.

EDINBURGH. *Open daily*, 11 *till dusk. Ent. 6d., Ch. 3d. Sat. only, 4d. and 2d.* Naturally, the inclemency of the weather affects the attendance at the Scottish National Zoological Park, but still they come, and the Aquarium, which still maintains its high standard, seems a favourite place for the majority of visitors.

Aquarists and others are surprised to see the tanks in such perfect condition so late in the season, where one would expect the aquatic vegetation to be dying off. The plant life is as beautiful as if it was early summer.

The tanks are stocked to full capacity with flora and fauna in perfect condition which appeal to all lovers of nature as a beautiful scene of animation. In the entrance hall there is the tidal pool well stocked with a large number of diverse and fascinating creatures from the Firth of Forth.

The Scats (*Scatophagus argus*), which occupy one of the table tanks, offer a show to be seen to be believed. The first exhibit in the Aquarium is the Giant Turtle, Kitty. Kitty came from Antigua, over three years ago. She seems to enjoy the confinement and now weighs over a quarter of a ton. There is a splendid show of marine animals from the North Sea and Firth of Forth.

One of the large sea-water tanks is closed to public view. The staff are busy rebuilding the rock work, in expectation of the arrival of new fish. The Fresh-water Section is second to none with many very fine exhibits of large Golden Orfe, Chub, Pike and others.

The Tropical Section still maintains the interest of the visitors with hundreds of fascinating and beautiful coloured fish which include Neons, Tiger Barbs, Rasbora, etc.

BRISTOL AND DISTRICT AQUARIST SHOW

(*Continued from page 309*)

Cards were given for 1, 2, 3, 4, V.H.C., H.C. and C., excepting in class 21, which had no 4th award.

Mr. George Bartmann judged classes 7, 8, 9, 16, 17, 18, 22 and 23; Mr. H. Gould, classes 14, 15, 16 and 21 and Mr. F. Austin Watson, classes 1, 2, 3, 12 and 13. Messrs. Gould and Bartmann jointly judged class 11 and Messrs. Gould and Watson, classes 4, 5, 6, 19 and 20.

Given away during the show were many hundreds of copies of a little volume *Fish-keeping as a Hobby*, published by the Bristol Aquarists' Society, containing the rudimentary rules of pond and aquarium keeping, an admirable effort calculated to enlighten the merest novice. An admirable occasion, too, was chosen for the distribution of the booklet.

The Committee can retire after their eighth splendid effort with the knowledge of another job well done, but those weak points, particularly the furnished tank question, can well repay a little concentrated effort, not so much on their part as on the part of the local exhibitors.

LONDON AQUARISTS' SOCIETY

THE table show held at the Central Hall, Westminster, S.W.1, on Thursday, 10th November, 1938, received greatly increased interest owing to the addition of a class open to all clubs, for the L.A.S. President's Cup, presented by Mr. H. Riddell, for furnished aquariums. Ten entries, a surprisingly large number in view of the fact that but two hours were allotted to the show, were received, several clubs being prevented from entering owing to distance and time limits. It is hoped that, on another occasion, it will be possible to hold this show on a Saturday, when more time is available. To erect and furnish an aquarium complete before 8 p.m., only to dismantle it two hours afterwards, is a real job of work requiring time as well as enthusiasm. Two points to which attention could be paid on a further occasion is the heightening of the tanks to eye level, and if possible a larger hall, for the huge crowd, speaking well for their enthusiasm and the energy of the club, made it impossible for dozens of people to see a single exhibit, and many left without having seen them all.

Let it not be thought that this criticism detracts in any way from the success of the show, which was well ensured. For a table show it was more than a success and some first-class fishes were on show, notably Mr. Atherden's Green Fighter and Mr. Ward's Leeri Gourami, Best Fish Bred and Best Fish in Show respectively. It was impossible to find fault with either of these entries, and every class received excellent support.

The Inter-Club Furnished Tank class provided some interesting comparisons, and it was difficult to separate the first and second, so good were they both. A thermometer affixed right in front of the second entry was the deciding factor, and the runners-up could learn much from the natural effect gained by the first prize-winner, South London Aquarists. It was unfortunate that the Bristol exhibitors could not see this class (see Bristol Show Report), for though the water was slightly cloudy, owing to the short space of time which elapsed between their erection and the judging, many of the tanks would have been an ornament to any lounge once they had cleared. A clear and brilliant entry was spoiled by the artificial effect of white marble; overdone in quantity also. The L.A.S. did well—very well, to stage this show, and it is certain that the support they received will encourage them to go further with this inter-club competition. What about some teams of fishes, say "Six Tropicals," "Six Fancy Goldfish," "Six Cold-water Fishes," and so on?

AWARDS LIST

London Aquarists' Society President's Cup.—1, South London Aquarists; 2, Croydon Natural History and Scientific Society; 3, West Surrey Pond-keepers' and Aquarists' Club; 4, Ilford Aquarists' Society; 5, Harrow and District Aquarists' Club; 6, North London Aquarists' Club; 7, London Aquarists' Society; 8, Shooters Hill and District Aquarium and Pond Socy.; 9, West Middlesex Aquarists' and Pond-keepers' Society. Class 1, Livebearers, Prs.—1, R. G. Mealand, Weisbaden Swordtails, very good; 2, G. F. Pengilly, Berlin Platys, good; 3 and V.H.C., R. Hill, Red Platys and Liberty Mollies, well-matched pairs. Class 2, Labyrinths.—1, C. H. Ward, Leeri Gourami, very fine; 2, A. E. Atherden, Siamese Fighter, not showing well; 3, R. G. Mealand, Pearl Gourami; V.H.C., G. F. Pengilly, *Colisa labiosa*. Class 3, Barbus.—1, C. J. Stiff, *Barbus tetrazona*, showing ex. colour; 2, A. E. Atherden, *Barbus everetti*, good but nervy; 3, C. H. Ward, *barbus nigrofasciatus*. Class 4, Characins.—1, C. H. Ward, *Gym. ternetzi*, ex. large and well coloured; 2, A. E. Cocks, *Copeina guttata*; 3, E. J. Barnacle, *H. candorittatus*; V.H.C., A. E. Cocks, *Copeina guttata*. Class 5, Cichlids.—1 and 2, A. E. Atherden, *Astronotus ocellatus* and Angel, good fishes in ex. condition. Class 6, A.O.V. Tropical Fish.—1, E. F. Evans, *Panchax lineatus*, a perfect youngster; 2, A. E. Atherden, *Scatophagus argus*, excellent; 3, H. R. Mumford, Blue Glass Catfish; V.H.C., E. F. Evans, *Corydoras melanistius*. Class 7, A.V. Tropical Fish, bred during 1938.—1, A. E. Atherden, Siamese Fighter, marvellous exhibit; 2, R. G. Mealand, *Corydoras æneus*, good class; 3, E. F. Evans, Mollie Guppy hybrid; youngster; V.H.C., A. E. Atherden, *Colisa labiosa*. Class 8, A.V.

Cold-water Fish.—1, H. G. Wheeler, Veiltail Moor; 2, R. J. Affleck, Oranda; 3, H. G. Wheeler, Lionhead; V.H.C., C. J. Stiff, Shubunkin. Class 9, A.V. Cold-water Fish, bred during 1938.—1, H. Riddell, Bronze Veiltail; 2, H. G. Wheeler, Scaled Telescope; 3, C. J. Stiff, Shubunkin; V.H.C., H. G. Wheeler, Scaled Telescope. Judges.—C. W. Creed, Tropicals; W. F. Gent, Cold-water; F. Austin Watson, Inter-Club Competition.

THE SCOTTISH AQUARIUM SOCIETY

Our entries numbered about 350 and required about 250 tanks to house them; Tropical and Cold-water Sections being almost equally balanced. The former were housed in tanks ranging from 10 ins. x 7 ins. x 7 ins. for Guppies, to 20 ins. x 12 ins. x 12 ins. for Angel Fish. The heating was done on the oven principle and proved very successful. Overhead lighting was provided and tanks were well planted for decorative effect. The tanks for Cold-water fishes were from 12 ins. x 8 ins. x 8 ins. to 36 ins. x 12 ins. x 12 ins., two fish belonging to one owner being housed together. There were 35 entries in the Shubunkin class, whilst the various "Bred by exhibitor in 1938" class, attracted 34 entries including Neon Tetras and White Cloud Mountain Minnows bred by Mr. Peter McNish.

The principal awards were: "Best Fish in Show"—the Beltrus Shield—Mr. C. H. Thomson with a very fine Police Male Fighter, which also won a Silver Cup for Best Fish in the Tropical Section.

The "Keau" Cup—Best Fish any Section bred by exhibitor in 1938, went to our President, Mr. O. Sneeden for the third time, this time with a very fine young Veil.

The McNish Cup—Best Fish in Cold-water Section went to Mr. E. Cunningham for a small Shubunkin of very great promise. This member also takes the Wilson Medal for Shubunkins.

The "Daily Record" Silver Gilt Medal for the Best "Home" Aquarium was won by Mrs. George Ross, a new member, but obviously a keen and capable aquarist. It was a tropical aquarium, well stocked with a community of very fine fish. The term "Home" Aquarium is used by us to mean one that the "Lady of the House" would not object to in her drawing room, and which is maintained according to the best aquarium-keeping principles.

Wilson Medals were also won by Mr. L. H. Wilson—Other Fancy Goldfish—with a fine Veiltail, and Mr. Wm. O'Neill in two classes, one for a 9-in. Yarrill's Catfish, or Indian Eil, and the other a 9-in. Golden Rudd.

Special medals were awarded to Mr. J. W. Wilson for a Compressor and Tilter Unit, beautifully built out of scrap materials. To Mr. R. Duncan for a Cabinet Aquarium's Collection of Pond Life, and to Mr. A. McLachlan for his collection of Mounted Butterflies and Moths—a marvellous collection comprising 10 cases of Tropical and other foreign Moths and Butterflies.

The "President's Prize" for the best Common Goldfish was won by Miss G. Cochrane for the third successive year with the same fish.

AWARDS LIST

Cl. 1.—Common Goldfish, Red, 19 entries.—1, Miss G. Cochrane; 2, Miss Sutherland; 3, Jas. Hastie. Cl. 2, Common Goldfish, self-coloured other than Red, seven entries.—1, Mr. D. Jamieson; 2, Miss Sutherland. Cl. 3, Common Goldfish, Variegated, three entries.—1, Mr. H. C. Lawson. Cl. 4, Fantails, Scaled or Scaleless, 17 entries.—1, J. W. Wilson, Red and White Scaled Fantail; 2, L. H. Wilson, Calico Fantails; 3, J. W. Wilson, Red and White Scaled Fantail. Cl. 5, Veiltails, Scaled or Scaleless, three entries.—1, Mr. L. H. Wilson. Cl. 6, Shubunkins, 35 entries.—1, E. Cunningham; 2, J. Graham; 3, H. C. Lawson. Cl. 7, A.O.V. Fancy Goldfish, seven entries.—1 and 2, J. Graham, Orandas. Cl. 8, Golden Rudd, Tench, Orfe and Carp, 23 entries.—1, Wm. O'Neill, Rudd; 2, Mr. D. Craig McCallum, Golden Tench; 3, Mr. A. Crechton, Golden Orfe. Cl. 9, A.O.V. Carp, four entries.—1, Mr. D. Craig McCallum, Mirror Carp. Cl. 10, Common Roach, Rudd, Dace, Silver Orfe, etc., 14 entries.—1, Mr. A. Crichton, Roach; 2, Mr. H. C. Lawson, Silver Orfe. Cl. 11, Pope, Perch, Pike, Sunfish, 12 entries.—1 and 2, D. Craig McCallum, Common Sunfish and Peacock Orfed Bass. Cl. 12, A.O.V. Cold-water Fish, 11 entries.—1, Wm. O'Neill, Yarrill's Catfish; 2, D. Craig McCallum, Dog Fish. Cl. 13, Shoal of Minnows, three entries.—1, Mr. Wm. O'Neill. Cl. 14, Shoal of Sticklebacks, no entry. Cl. 15, Home Aquarium, six entries.—1, Mrs. George Ross, Tropical; 2, T. J. McConnel, Cold-water. Cl. 16, Marine Aquarium, no entry. Cl. 17, School Aquarium, shown by Scholars, two entries.—1, Glasgow High School. Cl. 18, Home Aquarium, shown by Junior, six entries.—1, Miss E. McNish; 2, J. H. Robertson. Cl. 19, Pond Fish—normally kept in a pond, 11 entries.—1, S. Kerr; 2, J. Hastie. Cl. 20, Common Goldfish, bred by exhibitor in 1938, two entries.—1, F. R. Robertson. Cl. 21, Fancy Goldfish, bred by exhibitor in 1938, four entries.—1, Dr. Sneeden, Veiltail. Cl. 22, A.O.V. Cold-water Fish, bred by exhibitor in 1938, two entries.—1, Raymond Sneeden. Tropical Section: Cl. 23, Group of small Livebearers, six entries.—1, Mr. Peter McNish. Cl. 24, Pair of Swordtails, Mollies, Platys, 19 entries.—1, Mr. Peter McNish, Red Swordtail; 2, Mr. J. Bruce, Red Swordtail; 3, Mr. H. C. Lawson, Red Swordtail. Cl. 25, Livebearer, bred by exhibitor in 1938, 11 entries.—1, Mr. O. Sneeden, Red Swordtails; 2, R. S. Kerr, Mollies; 3, Mrs. G. Ross, Red Swordtails. Cl. 26, Group of small Egglayers, seven entries.—1, C. H. Thomson, Neon Tetras; 2, R. L. McLellan, Mixed; 3, Mrs. Ross, White Cloud Mountain Minnows. Cl. 27, Angel Fish, 11 entries.—1, J. Bruce. Cl. 28, Cichlids, four entries.—1, Dr. O. Sneeden, Geophagus. Cl. 29, Nestbuilders, 27 entries.—1, C. H. Thomson, Fighter; 2, Jas. Wallace, Gourami; 3, H. C. Lawson, Fighter. Cl. 30, A.O.V. Tropical Fish, 18 entries.—1, Dr. Sneeden, Barbus partipentazona; 2, Mrs. G. Ross, Rasbora; 3, P. McNish, Tetras. Cl. 31, Egglayers, bred by exhibitor in 1938, 13 entries.—1, 2 and 3, P. McNish, White Cloud Mountain Minnows, Neon Tetras and Angel Fish. Cl. 32, Community Collection of Tropicals, seven entries.—1, Mrs. G. Ross; 2, Mr. A. Crichton; 3, D. Hobson.

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" "	4—5	1/6	15/-
" "	6—7	3/-	33/-
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" "	4—5	1/6	15/-
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" "	4—5	1/9	18/-
Catfish	1—3	3d.	2/6

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	1—2	10d.	9/6
	2—3	1/6	16/-
	3—4	2/6	27/-
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" "	3—4	2/6	27/-
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'OR POND & POOL GREAT SPRING POOL OFF

NYMPHAEAS

We now offer our Season's Stock of Water Lilies. All good specimens true t and Colour.

OWING TO GREAT DEMAND, ORDER EARLY TO PRE DISAPPOINTMENT

NYMPHAEAS

Colossea—Flesh Pink	5/-
Escarboucle—Carmine	9/6
Glorioso—Deep Carmine	8/6
James Brydon—Rich Crimson ...	8/-
Laydeckeri Fulgens—Salmon Red ...	8/6
" Rosea—Soft Pink	8/6

NYMPHAEAS

Mary Exquista—Soft Pink ...	7/6
Mrs. Richmond—Light Red	15/-
Mrs. Woodrow Wilson—Purplish Blue ...	18/-
Marliacea Albida—Snow White	5/6
" Rosea—Deep Pink	5/6
Odorata Eugenia de Land—Deep Rosy Pink	8/6

NYMPHAEAS

Odorata Sulphurea Grandiflora—Sulp	
Yellow	
" Kawasse—Variegated Leaves, P	
Paul Harios—Light Copper-Rose ...	
Pygmea Helvola—Dwarf—Sulphur Yello	
Sultan—Cherry Red	
Wm. Falconer—Deep Crimson ...	

FOR DISPATCH MARCH—APRIL. When ordering Nymphaeas please give alternatives should the particular kind be sold out.

NOTE : Lily Baskets 9d. each, postage 6d., postage on Nymphaeas 6d.—1/-

SET BELOW ARE SUITABLE PLANTS FOR DECORATING, AERATING AND OXYGENATING, ALL ARE GOOD, STUR CULTIVATED STOCK.

Submerged Aerating and Oxygenating Plants

Starwort	6d. Ptn.	Whorled Milfoil	3/- Doz.	Mares Tail ...	3/- Doz.
Hornwort... ...	3/- Doz.	Parrots Feather	3/- "	Water Violet ...	3/- "
Anacharis ...	6d. Ptn.	Spiked Milfoil ...	3/- "		
Curled Anacharis	3/- Doz.	Dropwort... ...	3/- "	**Floating Plants**	
Giant Anacharis	3/- "	Water Crowfoot	3/- "	Fairy Moss ...	6d. Ptn.
Water Soldier ...	9/- "	Arrowhead ...	3/- "	Water Hyacinth	1/6, 2/- each
Ludwigia	3/- "	Vallarsia	6/- "	Frogbit	3/- Doz.
Vallisneria ...	3/- "	Willow Moss ...	6d. Ptn.	Duckweed ...	6d. Ptn.
Water Creeper	3/- "				

Decorative Marginal Plar

Sweet Flag ...	3/- Doz.	Potamogeton ...	
Water Plantain	3/- "	Water Celery ...	
Flowering Rush	3/- "	Water Dock ...	
Marsh Marigold	3/- "	Arrow Head ...	
Water Iris ...	3/- "	Bull Rush	
Water Mint ...	3/- "	Club Rush ...	
Water Musk ...	3/- "	Water Parsnip...	
Forget-me-not...	3/- "	Bur Reed	
Marsh Orchis ...	4/- "	Brooklime ...	
		Spiræa, Var. ...	

NOTE : Orders for a dozen or more can be assorted. These prices plus postage, 6d.—1/-. Plant Baskets, 1/- Doz.

—10/- STOCK OFFER—

SUITABLE FOR 50-75 GALLON POOL.

Pair 4-5 in. Breeding Goldfish, 1 Golden Orfe ; 2 Canary Fish, 1 Doctor Fish (Green Tench), 1 Scavenger (Thunderfish), 1 Golden Rudd ; 1 Yellow Lily, 4 Assorted Variegated Goldfish, 3 Freshwater Mussels, 12 Planorbis Water Snails, 6 Assorted Marginal Plants, 1 Portion Aerating Plant, 4 Assorted Oxygenating Plants.

—20/- STOCK OFFER—

SUITABLE FOR 75-100 GALLON POOL.

1 Pair 6-7 in. Breeding Goldfish, 1 Pair 3-4 in. Golden Orfe, 1 Pair Golden Comets, 2 Doctor Fish (Green Tench), 2 Scavengers (Thunderfish), 12 Assorted Variegated Goldfish, 6 Fresh Water Mussels, 25 Planorbis Water Snails, 12 Assorted Marginal Plants, 2 Portions Aerating Plant, 8 Assorted Oxygenating Plants, 1 Yellow Lily; 1 Lily Basket.

—30/- STOCK OFFI

SUITABLE FOR 150-200 GALLON

1 Pair 7-8 in. Breeding Goldfish, 1 P Golden Orfe, 1 Pair 4-5 in. Bronze Ca Golden Comets, 3 Doctor Fish (Gree 3 Scavengers (Thunderfish), 2 Mirr 12 Variegated Goldfish, 12 Water 50 Water Snails, 1 White, 1 Yellow W 4 Aerating Plants; 2 Lily Baskets, 9 Oxygenating Plants, 18 Assorted Margi

—10/- FISH OFFER—

SUITABLE FOR 50-100 GALLON POOL.

1 Pair 5-6 in. Breeding Goldfish, 1 Pair Golden Rudd, 2 Carp Variety, 2 Golden Orfe, 2 Scavengers (Thunderfish), 2 Doctor Fish (Green Tench), 12 Assorted Variegated Goldfish.

—20/- FISH OFFER—

SUITABLE FOR 200-250 GALLON POOL.

1 Pair 6-7 in. Breeding Goldfish, 1 pair Golden Rudd, 3 Bronze Carp, 4 Golden Orfe, 2 Silver Orfe, 2 Golden Comets, 3 Shubunkins, 2 Scavengers (Thunderfish), 2 Doctor Fish (Green Tench), 15 Variegated Goldfish.

—30/- FISH OFF

SUITABLE FOR 300-350 GALLO

1 Pair 7-8 in. Breeding Goldfish, 1 P Breeding Goldfish, 1 Pair 4-5 in. Gol 2 Mirror Carp, 2 Silver Rudd, 3 Si 2 Canary Fish, 3 Doctor Fish (Gree 3 Scavengers (Thunderfish), 25 Assor gated Goldfish.

5/- PLANT OFFER

AQUATIC PLANTS

6 Marginal
9 Oxygenating
1 White Lily
3 Aerating

10/- PLANT OFFER

AQUATIC PLANTS

9 Marginal
15 Oxygenating
4 Portions Aerating Plant
1 White Lily
1 Yellow Lily

20/- PLANT OFFER

AQUATIC PLANTS

24 Marginal
4 Aerating
24 Oxygenating
3 Water Lily Baskets
1 White Lily
1 Red Lily
1 Yellow Lily

—LIVE FOODS—

Bloodworms—3/6 ½ lb. ; 1/- portion.
Live Daphnia—2/6, 3/6, 5/- portion.
Mealworms—1/1 oz.
Fresh Water Shrimps—1/- for 25 ; 1/6 for 50 ; 2/6 for 100 ; 10/- for 1,000. All Post Free.

—" PRUFEX "—

The perfect cement sealer for applying to inside walls of pond. A sure and certain remedy against acid effect from new cement work. Packed in tins with full directions for use.
3/6, 6/6 per tin. Post Free.

Free Book on Pond Management on Orders 15/- or over.

DRIED FOODS

DAPHNIA—2/6 lb., 5/6 gal. (P
1/- pt. ; 1/9 qt. (Postage 4d.)
FLIES—1/6 lb. SHRIMPS—3/6 lb.
MIXED FOOD—2/6 lb. (Post Fr

WATER SNAIL

Doz., 6d. ; 50, 2/- ; 100, 3/6 ; 500, 25/-. Posta

MUSSELS

Doz., 3/- ; 50, 9/- ; 100, 15/- ; 1,000 ,100/-. Post

Aquariums—All Glass, Iron Framed, Ornaments, etc. Wr

All offers in this Advertisement carriage paid. Terms—C.W.O. or C.O.D. ; Write for Coloured and Aquatic Plant Spring Pool List. Note.—Surplus postage is returne

The WATERLOO GOLDFISHERY CO. (DEPT. A.P.K.) 47, Gt. Guildford St., Boro, London, S.E.1. (N Hospital, Southwark Bridge Road.) Phone WA

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