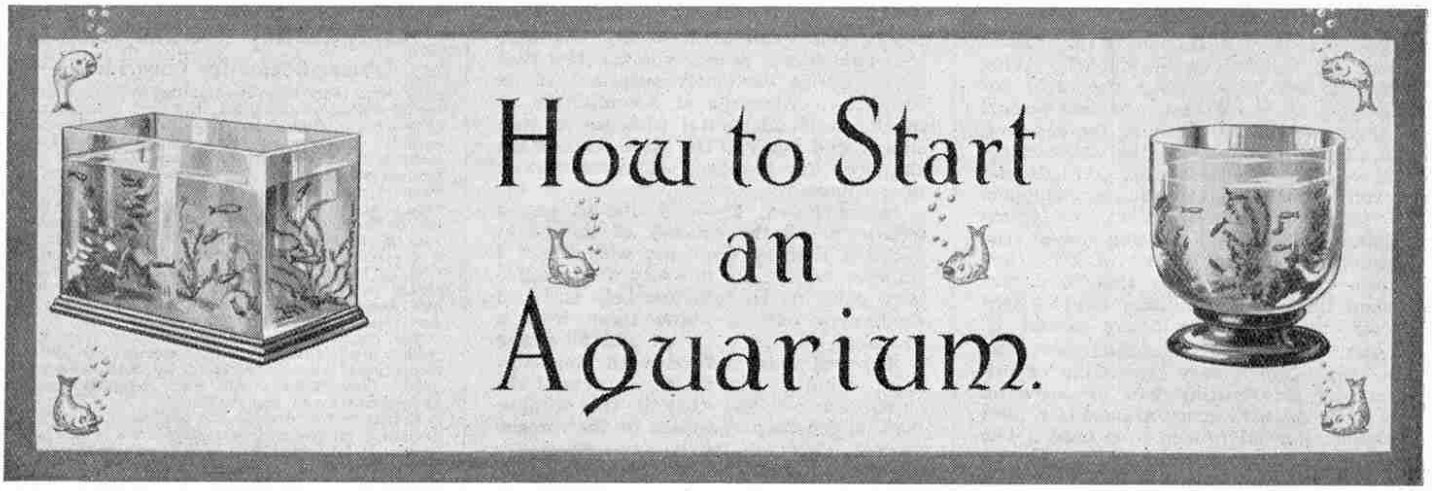


By W. COLES-FINCH
(Resident Engineer, Chatham etc. Water Co.)

MORE POND INSECTS

THE life-histories of some of the more prominent pond insects were described last month. There are a few other pond creatures, however, of such interest that they must not be overlooked. Among these is the familiar Gnat.

The Unpopular Gnat

The Gnat cannot be regarded as by any means a popular creature and indeed many people cherish for it a deadly hatred. It certainly is a near relative of the mosquito but it has not the latter's objectionable habit of conveying disease. We frequently speak of "gnat bites," but as a matter of fact gnats do not bite, neither do they sting, and it is only the females who can do any damage at all for the males are perfectly harmless.

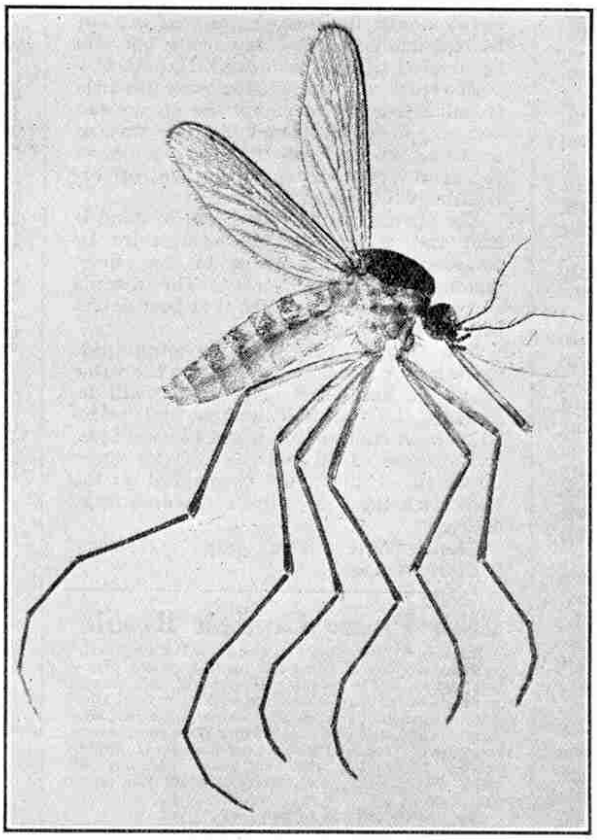
It certainly appears to be a fact that the female gnat has a great liking for human blood, and many of us know to our sorrow how persistent she is in her attentions when she is on the lookout for a meal.

An Engineering Operation

The methods by which the female gnat obtains her meal may fairly be regarded as an engineering operation. First of all, undeterred by all our waving of caps, newspapers or any other weapons that may be handy, she selects a tender place for her operation, settles upon it, and quickly makes an incision by means of her boring apparatus. The hole thus produced is not yet large enough for her purpose and so she sets to work with an implement that may be described as a minute saw, and enlarges the hole. Having obtained the necessary diameter she then inserts a tube through which she extracts the blood of her victim.

The effects of attack by gnats vary greatly with different individuals but in every case the resulting pain and swelling is not due to any kind of poison injected by the creatures, but to irritation caused by the engineering operations just described.

The life-history of the gnat is very interesting. The female when laying her eggs settles on a piece of floating stick, leaf or grass, and builds up the eggs into a sort of raft by joining each egg to the next by a sticky substance. The raft may consist of from one hundred to three hundred eggs and it is so perfectly arranged and balanced that it is unaffected by even the most violent disturbance of the water. Showers of rain will not sink it and if it is deliberately pushed below the surface of the water it rises again immediately. The eggs, which are shaped something like a cigar, hatch in a few days. A tiny door in the egg then opens and the gnat larva drops out into the water below.



The Gnat as seen through the Microscope

A Curious Creature

The gnat larva is a curious looking little creature. It is not entirely aquatic but is dependent on atmospheric air. It breathes in a very peculiar manner, and Bateman in his book "Fresh-Water Aquaria" describes the process as follows:—"This breathing arrangement consists of a small tube which is fixed to the eighth segment of the body. When the creature wishes to take in a fresh supply of air, it protrudes the end of this tube above the surface of the water, and the bristles which guard the orifice open in a star-like fashion, admit the air, and close again to prevent the ingress of the water as the larva with its extraordinary motion dives down again to the bottom of the pond, ditch or tub. . . These creatures swim by alternately straightening and bending their bodies. They never seem to make any journeys except those between the bottom of the water and its surface.

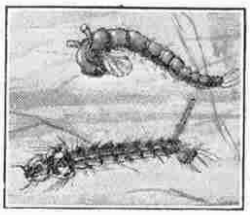
"If one should go, during warm and sunny weather, cautiously to the side of some old tub or butt, full of water, he will most likely see several of these larvæ busily taking in fresh supplies of air, but directly they notice any movement upon the observer's part they will wriggle and jerk their way down to the bottom out of sight."

The larvæ are useful in devouring decaying matter in the water and are useful as food for other aquatic creatures.

During the three or four months that elapse before the gnat larva turns into a pupa it undergoes several moults. The pupa is a curious, top-heavy creature. It swims about by means of a series of jerks, but takes no food. Presently it comes to the surface, the pupa case splits and the perfect gnat emerges and, after a short rest on the floating skin in order to dry its wings it takes to flight—possibly to the subsequent annoyance of some unfortunate human being in the vicinity!

We now come to another creature which has rather a bad reputation—the Midge. Like the gnats, these insects spend the

larval and pupal stages of their lives in water. Midges generally are very gnat-like in appearance and this is particularly the case with members of the genus *Corethra*.



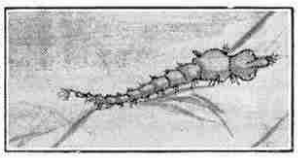
Above: Pupa of Gnat
Below: Larva of Gnat

The Phantom Larva

Corethra plumicorus is particularly interesting on account of its really extraordinary larva. This is frequently referred to as the "phantom" larva and the name is extremely suitable. The creature is so transparent that it is very difficult to see it in the water and it is extremely restless, continually reversing itself, so as to face in the opposite direction, with almost incredible speed. Apparently it makes use of its transparency in order to capture its prey.

This larva is of great interest for microscopic examination as, on account of its transparency, the digestive canal, heart and other internal arrangements may be plainly seen. The pupa resembles that of the gnat.

In the course of our pond hunting we shall come across a red worm-like creature continually twisting itself about as it wriggles through the water. This is the larva of another gnat-like insect *Chiromonsus plumosus* and it is familiar to anglers as the "blood worm." This creature builds for itself, with remarkable speed, a little house of decaying vegetable matter, mud, etc. Its career is unique in many respects and the following description from "Pond Life"* by Mr. E. C. Ash is well worth quoting:—



Phantom Larva of Corethra

A Peep into Larva-land

"Life among these little worms is one of activity, for some of the members are always either making or leaving a home. It often happens that a larva settles near to a burrow tenanted by another member of its family. Then a most amusing incident occurs, the newcomer gradually makes its way in, whilst the owner most unwillingly makes its way out, and probably fearing that the visitor is purely on business bent, hesitates not but swims away to a fresh spot, where it either plays the same game on some other unfortunate larva, or else rapidly weaves a few pieces of mud and decaying leaves together to form a fresh home. If a large number of these larvæ are present in a small pool they will gradually arrange the mud in so many little heaps that give a most curious effect.

"While at home they are by no means sleeping, but are continually undulating so as to produce a constant stream of water through their habitat, and at times they vary the monotony by pushing their tail-end out and waving it to and fro, in order to obtain any free oxygen that is present in the surrounding water. Every now and again the head end makes its appearance, and after making a quiet survey of the neighbourhood and having collected any mud that it may require by means of its clawed feet, withdraws again."

* "The People's Books," T. C. & E. C. Jack

An Aquatic Caterpillar

Most collectors have come across at some time or other a creature neatly wrapped up in a garment of leaves or pieces of some aquatic plant, and resembling to some extent a Caddis worm. This is the caterpillar of the "China Mark" moth and it holds the proud position of being the only moth caterpillar that is aquatic.

Water Caterpillar of China Mark

The larvæ eat their way into the plant upon which they are hatched and set to work to make a home for themselves by joining together pieces of its leaves. It is very interesting to know that, as the creature grows larger, it effects a corresponding enlargement of its house, and also carries out any repairs that may become necessary!

The "China Mark" moths are quite small, the largest species measuring only about one inch across its fully extended wings, which are white with markings of brown, yellow or black.

The May-fly

The most delicate and graceful of all pond insects is the May-fly, and there is no more interesting sight than a swarm of them dancing, rising and falling regularly and ceaselessly with every appearance of keen enjoyment. These beautiful insects usually have two pairs of wings, one large and the other small, and the body terminates in two or three slender tails. Very curiously they do not possess a mouth and are therefore incapable of taking food of any kind.

Larva of May-fly

Possibly no other insect has to face so many dangers in the course of its brief career. Fishes regard the May-fly as the very daintiest of food and this opinion appears to be shared to a great extent by insectivorous birds of all kinds.

The female lays her eggs upon the surface of the water and these sink to the bottom among stones and weeds. Both the larva and pupa of the May-fly may be kept in a small aquarium and their interesting metamorphosis may then be watched.

Pond Skaters

There are also the Pond Skaters, *Gerridae*, those little creatures that skim so quickly the surface of our pools, and which offer a mystery for our unravelling. They are poised on four small and delicate feet covered with fine velvety hairs which, in spite of all we know of the laws of buoyancy and displacement, support their entire weight, enabling their body to be propelled with great speed clear above the surface of the water. The only indication of displacement of water to support the weight of the creature is a slight depression on the surface round each foot, so small and shallow as to be scarcely visible.

In this column the Editor replies to letters from his readers, from whom he is always pleased to hear. He receives hundreds of letters each day, but only those that deal with matters of general interest can be dealt with here.

Correspondents will help the Editor if they will write neatly in ink and on one side of the paper only.

N. C. King (Peterborough).—We regret that we cannot undertake the valuation of second-hand bicycles. Why sell your machine at all? Unless you intend to purchase another we feel sure that you will be very sorry when it is gone.

Hermann Jacobsen (Johannesburg).—We note that since Mr. Cobham's flight all the children are suffering from Aeroplanitis! It sounds pretty serious, but we are not surprised, for there was quite an epidemic here, too. We are glad to know that the three dogs are as mischievous as ever. We have two terriers and they are a handful at times. But you may tell Billy, Prince, and Lady that a dog that is polite and well-behaved is only half a dog, in our opinion!

—?— (Coldwater, Ontario).—You wrote a very interesting letter to us, but omitted to sign your name. The only address given is Coldwater, Ontario, so we have been unable to reply. Please write again and let us know your name and full address this time.

J. Fletcher (Dunedin, N.Z.)—Your letter, written on the special notepaper issued by New Zealand and South Seas International Exhibition, was very welcome, and you evidently had a very enjoyable time. We are interested to hear of the Railway exhibit, which contained the largest sleeping car yet built in the Dominion.

H. F. Cook (Atwell, Nr. Derby).—We will see what we can do about describing some tours around Birmingham. The mileage you cover in a day depends, of course, entirely upon your physical strength and energy, and the time at your disposal. To Lichfield and back should be a very nice run and we hope you will write and tell us how you enjoyed it.

E. Griffiths (Grahamstown, S.A.)—We are not in the least bored by your letters, E.G., and you must write oftener. Acrostics are very interesting we agree, but there are so many interesting subjects for the "*M.M.*" that some have to be missed from sheer lack of space.

"Noel's Mother" (Wrexham).—Your kind remarks are much appreciated and we were very much amused by the tactful family friend's remark! We hope that Noel is to be one of our permanent friends and no doubt before long we shall be having letters from Jack, whom we hope is progressing well.

A. Mac Pherson (Roseville, N.S.W.)—Of course you may enter the various competitions, Allen! There are special sections for overseas boys, and we look forward to receiving your entries. Your drawings are very good.

R. Plumb (Ruislip).—"I look forward to the time when the "*M.M.*" has about 500 pages and is published every week!" Pity the poor Editor! Your artless remark nearly caused a strike, R.P., and we are afraid that if you continue to look for this your sight will fail before your dream is realised!

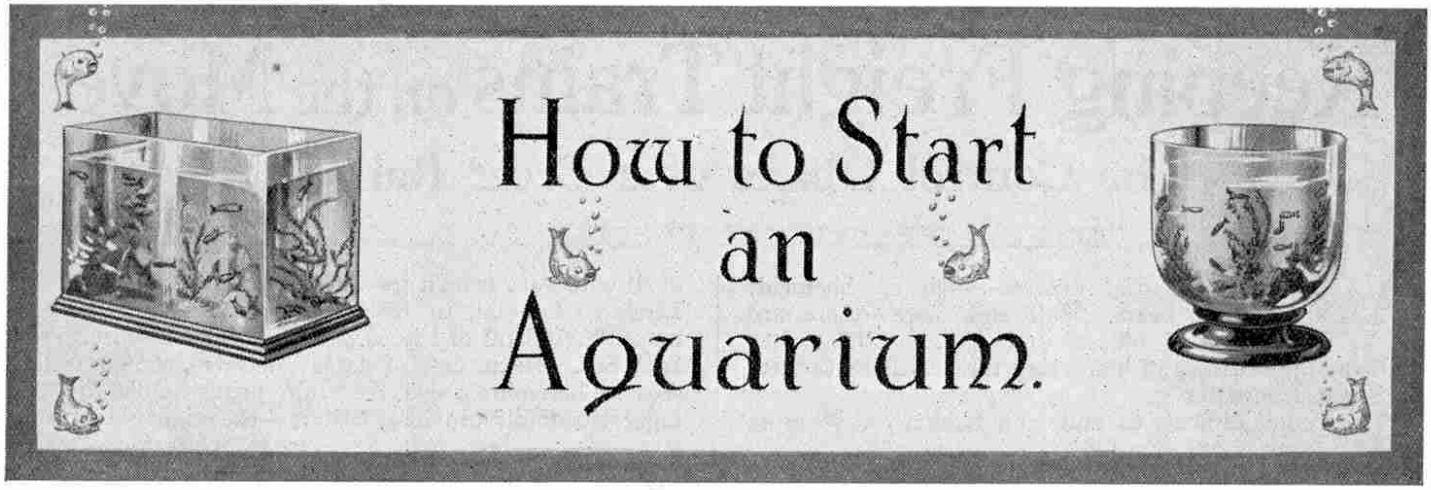
Gerado Pena (Tucuman).—Your model of an Electric Crane won a silver medal in our Model-Building Competition of 1925. The medal was duly sent to you, but has now been returned by the postal authorities. If you will write us, giving your new address, we will again forward the medal to you.

J. Phillips (Glasgow).—We have not sufficient space here to give you general advice on choosing a machine. You will find the subject was fully dealt with in the "*M.M.*" for December, 1924.

A. C. Thompson (Ramsgate).—We much appreciate your tribute to the high standard reached by the "*M.M.*," and we are glad to know that "all the family enjoy reading it." It gave us pleasure to reward your boy for his good work in our recent model-building competition.

E. Hayward (Perth, W.A.)—Your statistics, which demonstrate that if we increase the size of the "*M.M.*" in the future in the same proportion as we have done since June 1922 it will consist of 1,152 pages in December 1929, stagger us. It might be done, of course, Eric, but each number would look like a Family Bible and the postman would break down under the strain of delivering them. In any case you couldn't read all those pages every month, could you? And then again think of the poor Editor with twelve times 1,152 pages to fill every year. The answer, Eric, is a positive negative—if there can be such a thing!

J. F. Parke (Salisbury, Rhodesia).—"The fact that you allow overseas readers extra time to send in their entries to your competitions is much appreciated out here." Our overseas readers are very numerous and very dear to us, Julius, and our overseas mail increases every month, much to our satisfaction.



By W. COLES-FINCH
(Resident Engineer, Chatham etc. Water Co.)

GARDEN PONDS

As the result of my articles in this series I have received a large number of inquiries regarding the possibility of keeping fishes in some kind of pond in the garden. Such a scheme is not only possible but easy, provided that a supply of water is available. It may be said at once that it is not in the least necessary to have a large garden for this purpose, because even a small pond may be made to give as much pleasure, relatively, as a large one.

Gardens vary so greatly that it is impossible to give detailed instructions regarding the situation, shape and size of the pond. The most important point is that of situation. In order to obtain the best results, the pond should be situated so that it is sheltered for at least a portion of the day from the full glare of the summer sun, and also sheltered from the coldest winds of winter. In any case, whatever the situation may be, the pond should be of the "sunk" type, in order that the natural warmth of the earth surrounding it may offer some protection against frost, and at least delay the freezing of the water. This is very important because, if the whole mass of the water should become frozen solid, the occupants of the pond would be killed and the containing structure would burst.

Fig. 1

Protection Against Frost

The depth of water should be not less than 24 inches in order that, when the early frosts have thrown a thin coating of ice over the surface of the pond, the protection afforded by this coating, aided by the warmth of the surrounding earth, may result in keeping open sufficient water below the ice to provide for the requirements of the occupants.

In considering the position of the pond, the question of water supply should not be overlooked, and before the pond is finally completed the necessary supply pipe should be introduced and arrangements made for the overflow, and for draining the pond dry when required.

When these preliminaries have been dealt with satisfactorily the necessary excavation should be completed. The earth surrounding and at the bottom of the excavation should be well rammed, and a coat of concrete 4 inches in thickness should be spread over the bottom and lightly beaten down with a shovel to ensure solidarity. This concrete should be composed of five parts of fine Thames ballast, or other good quality river sand, and one part cement.

Constructing the Pond

After two or three days have elapsed, the design of the pond should be marked out carefully on the concrete floor, and the sides built with hard square stock bricks, well bedded in cement and sand mixed in the proportion of three to one. This brickwork portion of the structure should be done with the greatest care in order to render it as solid and water-tight as possible.

When this stage is successfully completed, the pond should be covered with a coat of clean sand and cement, and finished with a smooth layer of cement laid on neatly with a trowel. If this is done carefully, there should be no

leaks, and the pond should give no trouble.

Concrete may be used for the sides, instead of brick, in the case of a small pond of simple shape.

Our pond is now completed, but it is not by any means ready for the introduction of fishes. For at least a week or two frequent changes of water must be given to eliminate all taint from the newly-constructed work. The next step is to empty the pond and cover the bottom with fine gravel that has been well washed, and to introduce the plant life which, as we have seen in previous articles, is necessary for preserving the balance of aquatic life.

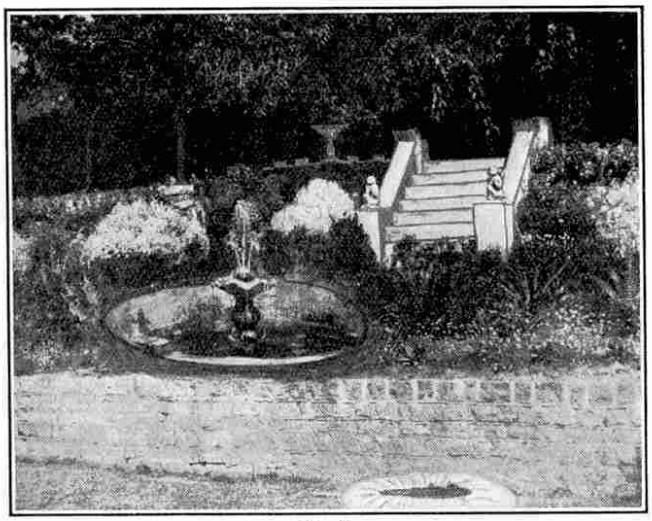


Fig. 2

Preparing for the Fishes

Having inserted the plants, fill the pond slowly and carefully and then allow a tiny trickle of fresh water to flow continuously through it or, alternatively, change part of the water—not the whole of it—at frequent intervals. When the plants show signs of flourishing and the water is bright and clear, floating plants may be added, together with a little duck-weed for shade. At this stage a few more days should be allowed for the thorough establishment of the plant life.

A few water snails should now be introduced, and if they prosper, the pond may be regarded as fit for habitation and the fishes may be installed in their new home. Most of the hardier fishes will thrive well in a garden pond, and the following in particular may be recommended :—Golden Carp, Common Carp, Prussian Carp, Golden Orfe and Minnow.

An infinite amount of pleasure may be obtained from a perfectly plain and unpretentious pond, but from an artistic point of view various decorative additions are recommended. These will vary so greatly with local circumstances that it is impossible to give any definite advice. Perhaps the best way of indicating what may be done in a comparatively small garden, and at small expense, will be to describe briefly the garden in which the writer is most interested.

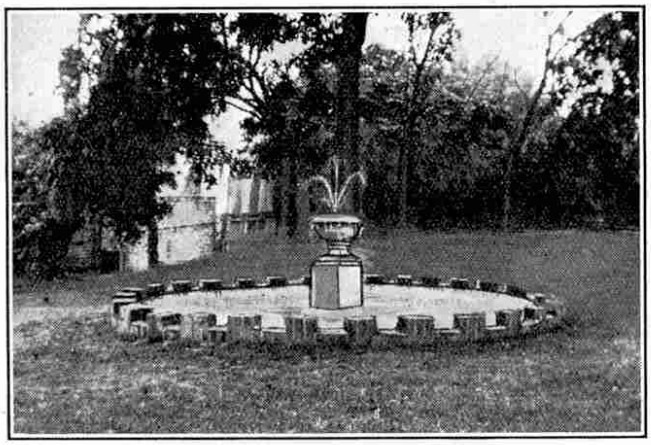


Fig. 3

Typical Garden Ponds

This garden is situated on the slope of one of the secondary ridges of the North Downs, and it necessarily takes the form of a terraced garden rising from the back of the house. The upper terrace consists of a narrow strip of lawn, not lending itself to any special artistic effort. Here is constructed a circular sunk pond 12 ft. in diameter and 24 in. in depth, with a turreted margin of old red bricks, as shown in Fig. 3. In the centre is a pedestal and vase, with a fountain jet. In summer each indentation and projection of the turreted margin is decorated by a large pot of trailing flowers of all descriptions, adding considerably to the general appearance.

The overflow from this pond is conducted by pipes to another pond in the second terrace, a general view of which is shown in Fig. 2, this view being taken from a window overlooking the terrace. Unfortunately the picture fails to convey to the reader the refreshing beauty of this little cameo of loveliness. It is a riot of colour, scent and beauty, to which is added the charming music of a fountain.

Birds' Bathing Pool

This second pond is 8 ft. in diameter, and in the centre of it a trio of dolphins spread their tails, supporting a delightful bath in which the birds revel and chatter as they bathe, subsequently flying off to the surrounding trees to preen themselves and complete their toilet. This scene affords delight almost the whole year through, for even in winter a burst of sunshine sends our feathered friends to their familiar resort. During the hot and dry days, when the daily ablutions of the feathered visitors are over, bees from every hive around come in battalions to the pond to sip the cooling water (Fig. 3).

The overflow from this second pond is led into a tank in the conservatory, where it is utilised for plant-watering. From there it passes beneath a little stone bridge into a plain dipping-tank, from which is taken all the water for garden purposes. Thus every drop of water plays its part in providing pleasure through the medium of two ponds, and is afterwards utilised for plant-watering in the conservatory and garden.

Beauties of a Fountain

The foregoing detail has been given with a definite object. There is a general impression that a fountain is a luxury, confined to the wealthy on account of the cost of the necessary water. This is not the case. If a garden-water charge be paid, there should be only a small increased charge for a pond and fountain, provided that there is no overflow to a drain, and that the pleasure obtained from the fountain is limited to the period necessary to replenish the tank from which the garden-water can be legitimately obtained.

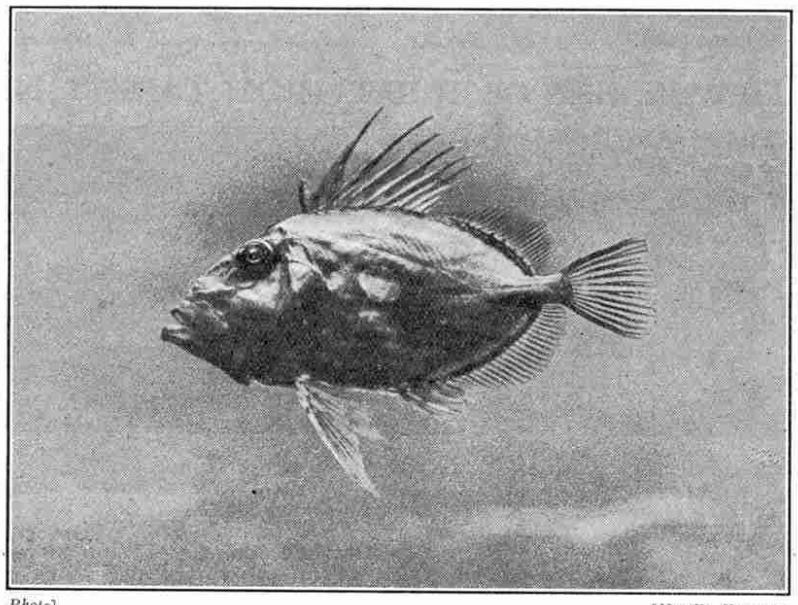
Fig. 1 is a photograph of a garden well known to the writer and which remains pond-less, although it contains many nooks and corners that literally seem to be calling for little pools. In this photograph a cross marks the place where the writer would construct a pond and fountain, thereby adding almost infinitely to the beauty of the garden.

It is wonderful how much real interest is afforded by a garden, a fountain and a little pond.

How to Start an Aquarium

by W. Coles-Finch

IN the articles under this heading that appeared last year in our June-August, October and November issues, and which were re-commenced this year in the March number, I have endeavoured to give some idea of the great fascination of aquarium-keeping and to show how simple a matter it is to achieve success. In response to many requests I am devoting the present article—the last of this year's series—to a brief consideration of large aquariums with particular reference to the magnificent aquarium of the Zoological Society of London.



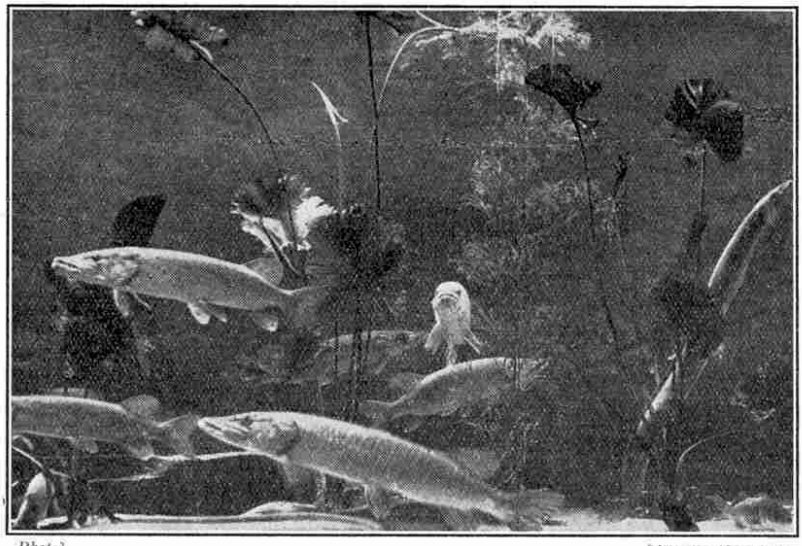
Photo] [Neville Kingston

John Dory, with back fin erect, in the Aquarium at the London Zoo

Early Aquariums

The earliest aquariums as used by the ancient Egyptians and by the Greeks and Romans were merely ponds in which fish were kept and fed until they reached a size suitable for the table. In the case of the Romans these ponds were constructed on an extremely costly scale in order to provide the fashionable banquets of fish. In later ages every abbey and monastery had its "fish-stew." Frequently these were of large size, capable of containing as many as 20,000 eels. In these "fish-stews" carp in particular were fed until they reached an enormous size.

It is impossible to trace the beginning of the aquarium as a means of studying aquatic life. It is probable, however, that marine animals were kept in confinement for the purpose of study and observation as far back as three centuries ago. Sir John Graham Dalyell of Edinburgh, the author of "Rare and Remarkable Animals of Scotland," 1847-48, and other works, utilised a simple form of aquarium for the study of marine animals and it is known that some of the creatures lived in his tanks for a very long period. We are told, for instance, that one sea anemone placed in a tank in 1828 was alive and flourishing in 1873.



Photo] [Neville Kingston

Pike and Eel, in the Aquarium at the London Zoo

Growing Popularity of the Aquarium

About the year 1840 a good deal of attention commenced to be given to the construction and maintenance of aquariums, but the movement did not achieve any great popularity on account of the difficulty of keeping the water fresh. A year or two later came the great discovery that the fact that plants absorbed the carbon-dioxide generated by animals and in turn liberated the oxygen required by animals, could be utilised in aquariums in such a manner as to maintain the aeration and freshness of the water. Experimental work was carried on by various London investigators in order to ascertain the best means of balancing vegetable and animal life, and the publications of some of these investigators, particularly those of Mr. P. H. Gosse, were enthusiastically received by the public. Aquarium-keeping very rapidly increased in popularity and became almost a mania after the construction in 1853, by the Zoological Society of London, of the first public aquarium. This marine aquarium was faulty in construction and had only a short life. It is interesting to know that the building is still in existence and is now known as the "Diving Birds' House."

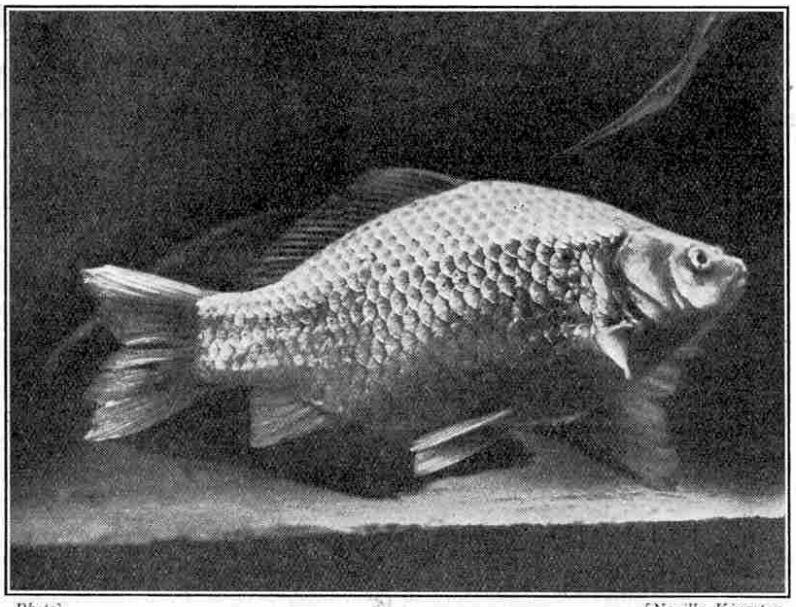
In the late 'seventies large aquariums were constructed in London and various provincial towns, notably at Brighton, but for various reasons the popularity of these institutions waned and to-day

few of them are in existence. At the present time the aquarium of the Zoological Society of London, in Regent's Park, is the only British inland public aquarium of any importance. Abroad there are magnificent and popular aquariums in New York, and in Berlin, Amsterdam, Naples and other Continental cities.

The Regent's Park Aquarium

The want of a first-class aquarium in Regent's Park had been felt for many years by the Council of the Zoological Society and in 1922 it became possible to fill the gap. The aquarium which then came into being is the most up-to-date of its kind. It cost nearly £55,000 and took over a year to build.

The aquarium is situated underneath the Mappin Terraces, by the hills of which it is protected, and its exposure is to the north-west. The building takes the form of a crescent-shaped gallery with tanks on each side. The tanks on the outer side of the crescent are illuminated by daylight and those on the inner side by electric light from special lamps that give a light almost identical with daylight. The building has a total length of nearly 450 ft. and it is divided into three principal parts. The Fresh-water Hall has 25 tanks varying in length from 6 ft. to 30 ft.; the Marine Hall has 25 tanks, two of which are more than 30 ft. in length; and the Tropical Hall for fresh-water fish has 40 tanks, most of which are small.



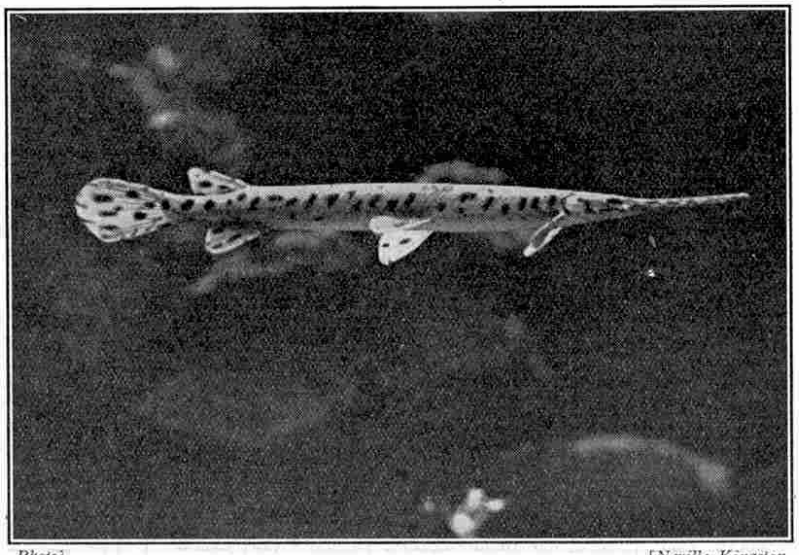
Photo] [*Neville Kingston*

Carp, in the Aquarium at the London Zoo

Aeration of Large Aquariums

As we have already seen, the aeration of the water in a small aquarium can be carried out by means of water plants, which provide the necessary oxygen. It is not possible to aerate a large aquarium on these lines, however, and constant circulation of the water must be maintained.

In the Regent's Park aquarium there are provided underground reservoirs of 120,000 gallons capacity for sea water and 60,000 gallons capacity for fresh water. From these reservoirs the water is pumped to storage tanks situated in the peaks of the Mappin Terrace mountains, from which it falls by gravity into the show tanks. The overflow from the show tanks passes through a series of sand filters and returns to the underground reservoirs. Further oxygenation of the water is obtained by passing compressed air directly into the tanks.



Photo] [*Neville Kingston*

Gar Pike, in the Aquarium at the London Zoo

The amount of sea water in the show tanks is roughly one-fifth of that in the reservoirs and filters, and one-third in the case of the fresh water. Iron supply and drainage pipes in the marine section have an enamel lining to prevent rust.

It is interesting to know that the sea water was obtained from the Bay of Biscay. It was brought to the London docks in the ballast tanks of the General Steam Navigation Co.'s vessels that run between Bordeaux and London. On arrival at the docks the water was transported to barges, which travelled up the Regent's Canal to the Zoological Society's Gardens, and was then pumped into the underground reservoirs through a hose 605 ft. in length. This sea water will not need to be renewed for many years.

The Show Tanks

The show tanks are constructed of slate or concrete and are decorated with rockwork arranged to suit the requirements of the inhabitants. The rocks are of various kinds and have been obtained from the moors of Westmoreland and Yorkshire and the coasts of Devonshire and Cornwall. The glass that forms the front of the tanks is naturally one of the most important items and it is also one of the most expensive. In the case of the larger tanks the glass is $1\frac{1}{4}$ in. in thickness. For feeding and cleaning purposes a large service passage is provided behind the rows of tanks. This passage is not open to visitors.

The aquarium is fitted with an elaborate system of hot-water pipes and of air circulation by which the Fresh-water and Marine Halls and tanks are maintained throughout the year at a temperature of about 55°F. while the Tropical Halls and tanks are maintained at about 78°.

Connected with the aquarium is a well-equipped laboratory where important work of a zoological and economic nature is carried out. Any of our readers who are able to do so should not fail to visit this wonderful Aquarium.