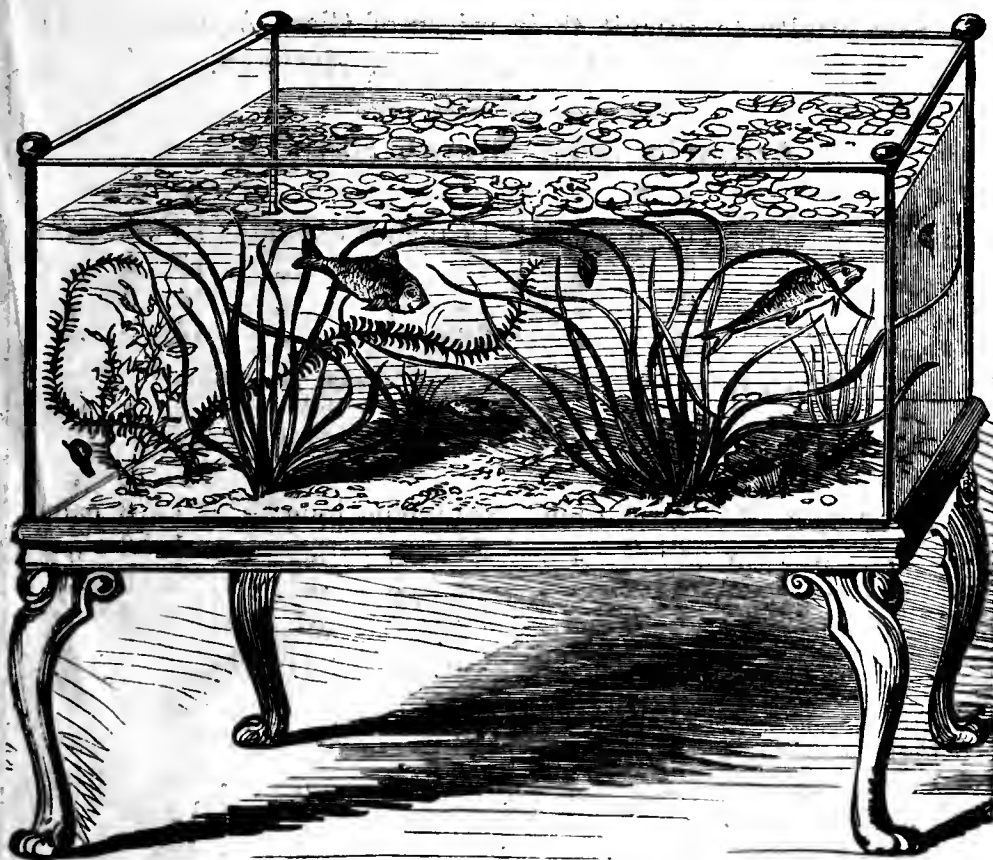


THE
FRESH-WATER AQUARIUM.



BY SHIRLEY HIBBERD,

Author of "Rustic Adornments for Homes of Taste," &c. &c.

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THE BOOK
OF
THE FRESH-WATER AQUARIUM;
OR
PRACTICAL INSTRUCTIONS,
ON THE FORMATION, STOCKING, AND MANAGEMENT IN ALL
SEASONS, OF COLLECTIONS OF RIVER ANIMALS
AND PLANTS,

BY SHIRLEY HIBBERD,

AUTHOR OF "RUSTIC ADORNMENTS FOR HOMES OF TASTE," &c., &c.

LONDON:
GROOMBRIDGE & SONS, PATERNOSTER ROW.

—
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P R E F A C E.

EVERY day adds to the popularity of the aquarium, but every day does not add to the accuracy of the published descriptions of it, or the perspicuity of the directions everywhere given for its formation and maintenance. Lately the periodical press has teemed with essays on the subject; but it does not require a very close scrutiny for the practical man to discern that a majority of such papers express the enthusiasm rather than the knowledge of their authors,—a few weeks' management of a tank seeming to be considered a sufficient qualification for the expounding of its philosophy, though it demands an acquaintance with the minutest details of the most refined departments of botany and zoology to do anything like justice to it.

I have done my best to explain and illustrate the whole *rationale* of marine and fresh-water tanks in my lately published work, *Rustic Adornments for Homes of Taste*; but since that work, owing to the expense incurred in its

PREFACE.

production, is published at a price which every lover of the Aquarium cannot command, I have thought it no less a duty than a pleasure to treat the subject more briefly, but still practically, and I hope profitably, in a volume of less dimensions and less cost, written for another class of readers.

The object of this little work is to teach the beginner how to proceed safely and pleasantly in setting up aquaria, whether for mere ornament or for the study of the novel forms of animal and vegetable life which these collections enable us to observe closely, no less for the increase of our knowledge of the world, than for the exaltation of our sense of the omnipotence and benignity of Him who created it.

THE BOOK OF THE AQUARIUM.

PART I.

THE FRESH WATER TANK.

CHAPTER I.

WHAT IS AN AQUARIUM?

The Name.—The term *vivarium* was first applied to the vessel containing a collection of specimens of aquatic life, and the first vivarium of such a kind, on anything like an extensive scale, was that opened to public exhibition in the Regent's Park Zoological Gardens. Many naturalists had previously made experiments to ascertain some certain method of preserving aquatic animals in a living and healthy state; and the vivarium, which is the result of those experiments, may be considered as an imitation of the means employed by nature herself in the preservation and perpetuation of the various forms of animal and vegetable life which people the oceans and the streams.

The vivarium is, therefore, no recent or sudden discovery, but a growth of years; and its present perfection is the fruit of many patient investigations, trials, disappointments, and determinations to achieve success.

The term *vivarium* applies to *any* collection of animals—to a park of deer, a rabbit warren, a menagerie, or even

THE FRESH-WATER AQUARIUM.

a travelling show containing an asthmatic lion, a seedy cockatoo, and a pair of snakes that are hourly stirred up with a long pole. Hence such a term could never convey the very special idea of a vessel containing such specimens as form the stock of the aquarium. When this was felt, the affix *aqua* was added, to convey the idea of the watery medium in which the specimens are immersed, and hence we had *aqua-vivarium*, a compound of too clumsy a character to remain long in use. It is the *water* that gives the collection its special character ; and water always reminds us of old Aquarius, who treats us to an annual drenching from his celestial watering-pot. Aquarius triumphed, and the pretty prison in which his cool companions of the sign Pisces were doomed to be confined acquired his name ; and, since it is better to follow than to oppose usage, we leave the philological part of the question to the learned, and adopt *Aquarium* as the name of our collection

The Object of the aquarium is to enable us to study the economy and derive pleasure from the contemplation of various forms of aquatic life, contributed by the lakes, the mountain rills, and the "resounding sea." Collections of objects that inhabit rivers and lakes are of course called Fresh-water aquaria ; those that owe their origin to the sea are called Marine aquaria. A more simple name for the first would be *River aquarium*, which I humbly suggest it shall in future be called. But an aquarium is not a mere cabinet of specimens ; it is a water garden in which we cultivate choice plants, and it is also in some sort a menagerie, in which we see living creatures of

THE FRESH-WATER AQUARIUM.

kinds hitherto the least studied by naturalists, displaying to our close gaze their natural forms, and colours, and instincts, and economy, as freely and as happily as if they were still hidden from us in their native depths. In this sense, the aquarium remunerates for any trouble it may cost, in the lessons it affords of the workings of Almighty Wisdom, in those regions of life and wonder to which it introduces us.

The Philosophy of the Aquarium must be clearly understood by those who purpose to cultivate it. It is a self-supporting, self-renovating collection, in which the various influences of animal and vegetable life balance each other, and maintain within the vessel a correspondence of action which preserves the whole. A mere globe of fish is not an aquarium in the sense here indicated; because, to preserve the fish for any length of time, the water must be frequently changed; and even then the excess of light to which they are exposed, and the confinement in a small space, in which they quickly exhaust the vital properties of the water, are circumstances at variance with their nature, and sooner or later prove fatal to their lives.

In an aquarium, *the water is not changed at all*, or at least only at long intervals, as we shall explain hereafter; and besides the enclosure of fishes in a vessel of water, *growing plants* of a suitable kind, always form a feature of the collection. Formed on this plan, an aquarium is an imitation of Nature on a small scale. The tank is a lake containing aquatic plants and animals, and these maintain each other in the water in the same way as terrestrial

THE FRESH-WATER AQUARIUM.

plants and animals contribute mutually to each other's support in the preservation of the purity of the air.

What happens when we put half-a-dozen gold fish into a globe? The fishes gulp in water and expel it at the gills. As it passes through the gills, whatever free oxygen the water contains is absorbed, and carbonic acid given in its place; and in course of time the free oxygen of the water is exhausted, the water becomes stale, and at last poisonous, from excess of carbonic acid. If the water is not changed the fishes come to the surface and gulp atmospheric air. But, though they naturally *breathe air as we do*, yet they are formed to extract it from the water; and when compelled to take air from the surface, the gills, or lungs, soon get inflamed, and death at last puts an end to their sufferings.

Now if a gold fish globe be not over-crowded with fishes we have only to throw in a goodly handful of some water weed, such as the *Callitriche*, for instance—and a new set of chemical operations commences at once, and it becomes unnecessary to change the water. The reason of this is easily explained. Plants absorb oxygen as animals do; but they also absorb carbonic acid, and from the carbonic acid thus absorbed, they remove the pure carbon, and convert it into vegetable tissue, giving out the free oxygen either to the water or the air, as the case may be. Hence, in a vessel containing water plants in a state of healthy growth, the plants exhale more oxygen than they absorb, and thus replace that which the fishes require for maintaining healthy respiration. Any one who will observe the healthy plants in an aquarium, when the sun

THE FRESH-WATER AQUARIUM.

shines through the tank, will see the leaves studded with bright beads, some of them sending up continuous streams of minute bubbles. These beads and bubbles are pure oxygen, which the plants distil from the water itself, in order to obtain its hydrogen, and from carbonic acid, in order to obtain its carbon.

There is one more feature, which no writer on the aquarium has yet noticed, namely—when a tank is properly stocked, the water soon gets crowded with infusorial animalculæ, which swarm among the plants, and on the sides of the glass in countless thousands, visible only by the aid of the microscope. These are in accordance with a natural law; the presence of vegetable matter in water always induces them. But observe their value: they contribute to the sustenance of the smaller fishes, by supplying them with food; and, strangely enough, the researches of modern chemists have proved that these minute creatures respire in much the same way as plants. While all other animals absorb oxygen, and perish if the supply of that gas is withdrawn, these minute organisms absorb carbonic acid, *and give out oxygen in abundance*. This has been proved by Professor Leibig, who collected several jars of oxygen from tanks containing infusoria only. Every one who has had experience in the management of tanks must have noticed that the water in a tank which has been established some months will sustain a much greater amount of animal life than one of the same dimensions, but recently stocked. The presence of infusoria in immense numbers is *one* of the reasons for this.

So far I have endeavoured to explain the theory of the

THE FRESH-WATER AQUARIUM.

aquarium, in the merest outline. Still, brief as this chapter must be, I must here impress upon the mind of the beginner, that unless the leading features of the theory are borne in mind, success can never be achieved in the establishment of water collections of any kind.

If a tank requires frequent cleansing, or frequent changing of water, if the fishes come to the surface for air, or perish through the presence in the water of offensive matter—in fact, if the whole affair has not a distinctly self-supporting character, such as will preserve its purity, and strength, and beauty, without alteration of any kind—it must be concluded that it has been either unskilfully stocked or injudiciously managed.

It is my object to explain briefly, but clearly, the whole *rationale* of aquarium management, whether the tank be adopted as a mere ornament—than which there is nothing more beautiful—or as a museum of instruction and a school of study—than which there is nothing more suggestive, nothing than can afford finer lessons of the subtlety of the forces, or the refinement of the instincts, that give life and loveliness to the “world of waters.”

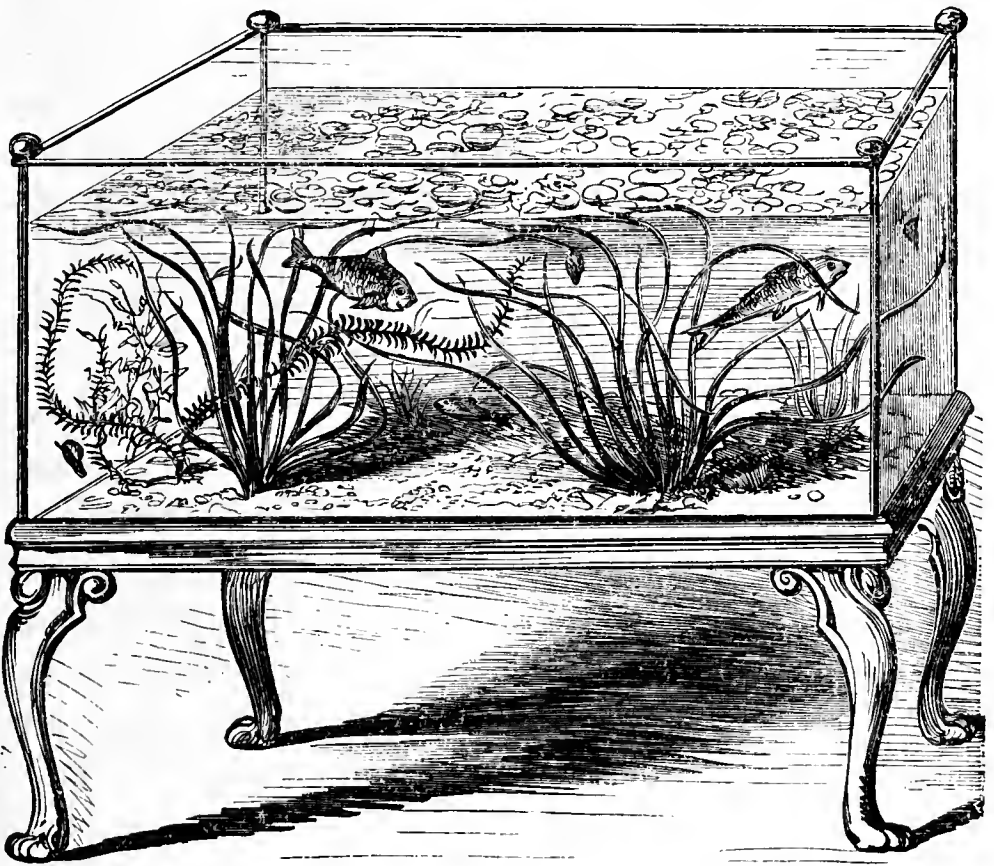
CHAPTER II.

PROPER KINDS OF VESSELS.

Rectangular Tanks.—Any vessel that will hold water may be quickly converted into an aquarium; but as we desire to have at all times a clear view of the contents of the vessel, glass takes pre-eminence among the materials

THE FRESH-WATER AQUARIUM.

for tanks. For elegance and general utility, a properly built vessel of rectangular outline, having at least two sides of glass, is found by most aquarists to be the best. Of course, no rule can be laid down as to the dimensions or



VALLISNERIA SPIRALIS, ANACHARIS ALSINASTRUM—GOLD
CARP ROACH, AND MINNOW.

forms of tanks—those details will best be determined by the means and tastes of the persons requiring them—but a few general remarks may prove useful.

The tanks in use at the Regent's Park Gardens were

THE FRESH-WATER AQUARIUM.

constructed by Messrs. Saunders and Woolcot, of 54, Doughty Street, London, and that firm has since set apart a portion of the premises in Doughty Street, to meet the new and increasing demand for vessels for domestic aquaria, and have brought the manufacture to a perfection which leaves little to desire.

For the adornment of a dwelling room or a conservatory, an oblong tank, measuring three feet by one foot four inches, and one foot six inches deep, would be very suitable, and would be supplied by Messrs. Saunders and Woolcot for £5, though vessels of smaller dimensions are sent out by them at from £2 to £3. In my work on "Rustic Adornments," I have given several designs for rectangular tanks, but must here beg my reader to remain content with a simple explanatory outline. Messrs. Treggon and Co., of 57, Gracechurch Street, and 22, Jewin Street, London, are also manufacturers of tanks for aquaria. I can recommend either of these houses with the greatest confidence.

Construction of Tanks.—As this work may reach many remote districts, where an aquarian would find it difficult to get a tank properly made, a few hints on the proper mode of construction may be acceptable.

It must be borne in mind, then, that when a tank is filled, its weight is enormous, and hence it is difficult, sometimes impossible, to move it without first removing the whole or greater portion of its contents. Strength in the joints to resist pressure from within, and strength in the table or other support on which the tank is placed, is of the first importance. The bottom of such a tank as we

THE FRESH-WATER AQUARIUM.

have figured above is best formed of a slab of slate, and the two ends may be of slate also; the front and back of plate or very stout crown glass. The most elegant form for such a body is that of the double cube, the length of the tank being just double its width and depth, so that if it were cut into two equal parts two cubes would be formed. The glass must be set in grooves in the slate, and bound outside with zinc or turned pillars of birch wood. The best cement is white-lead putty, or what is known as Scott's cement; the composition of which it is not in my power to inform the reader. If a coating of shellac, dissolved in naphtha, and made into a paste with whiting, were laid over the white-lead cement, as suggested by Mr. W. Dodgson, of Wigton, the water would be kept from contact with the lead, and the tank would require less seasoning.

The use of slate at the ends is to enable us to affix rockwork or carry across a rude arch; the cement used in constructing rockwork does not adhere to glass. But if rockwork is not thought desirable the slate ends may be dispensed with, and the vessel may be composed wholly of glass, except the bottom, which may be of slate or wood.

In some districts slate is not to be easily obtained, and wood or stone are then the best substitutes, wood being preferable of the two. I have seen some handsome tanks composed wholly of wood and glass; it is only necessary to choose well-seasoned material, and unite the joints very perfectly.

The yellow clay used by potters would be found suit-

THE FRESH-WATER AQUARIUM.

able in some districts; and if the two ends and bottom were formed of such a material, and buttressed together by means of a rude arch, the fire would unite the whole, and render it as hard as stone. Mr. Dodgson, of Wigton, states, through Mr. Gosse's pages, that he has formed two tanks of this kind of clay: they measure three feet long by thirty inches broad and high, holding thirty gallons each. The weight being very enormous, the cost of carriage is so serious a matter that such tanks can only be had in the neighbourhood of a pottery. In London, the substitute for the clay would be *terra cotta*.

Mr. Warrington's Tank is of a peculiar construction, and is intended to admit the light from above only, and also to enable the water to absorb atmospheric air freely. Mr. Warrington says:—"After five years' and upwards experience, I have now adopted an aquarium, the form of which consists in a four-sided vessel, having the back gradually sloping upwards from the bottom at an angle of fifty degrees. The chief peculiarity of this tank is, that it admits light at the top only; the back and sides are usually composed of slate."

Bell Glasses, or vases, are now largely used for aquaria. Mr. Hall, of the City Road, was the first who thought of turning a propagating glass upside down to extemporise an aquarium; but he surely never thought that in a few months the aquarium would gain thousands of new followers through that simple trick of his in creating a cheap and elegant tank. Bell glasses for aquaria are to be obtained of any of the dealers in aquarian stock, and at most horticultural glass warehouses. The sizes range

THE FRESH-WATER AQUARIUM.

from ten inches to twenty inches in diameter, and the prices from one to fifteen shillings. For general purposes of use and ornament, I should recommend vessels of from twelve to eighteen inches. Those below twelve inches are too small to be of much service, and those above eighteen are liable to fracture on the occasion of any sudden change of temperature, especially in winter. Messrs. Phillips have lately, at my suggestion,



produced a bell-glass expressly for aquarian purposes; those in use hitherto were made for gardening purposes, and were carelessly blown. The shape I have suggested is one nearly approaching to that of the blossom of the great bearbind, the sides of the vessel describing straight

lines, and the edges lipping over in an elegant vase-like form. These are made of whiter and stouter glass than the common propagators, and are, of course, charged at a slightly advanced rate.

Stands for Vases are to be had of various forms and materials. Those formed of turned wood have the preference for elegance and safety; and, as the knob of the vase fits loosely in the depressed top of the stand, the vase can be turned round for inspection. It would be well to glue a piece of green baize to the bottom of the stand before putting it to use; and if the depression were filled in with sand, so as to touch the vase and ease the pressure from the rim, there would be greater safety, and the vase could still be turned round, if necessary.

Where extreme cheapness is an object, a deal box with a hole cut in the centre to receive the base of the vase, will make a suitable stand, or a common seed-pan filled in with sand and the vase pressed down into it may answer, at a cost of only fivepence. A stone vase, or any ornamental object, with a suitable depression in the top, can also be turned to account for the purpose.

When an earthenware or stone stand is used, a piece of India rubber tubing should be placed around its edge where it comes in contact with the glass, to prevent fracture. The rigidity of the material renders this necessary, and enables it to receive freely any expansion of the vase which may be caused by a change of temperature.

Glass jars, confectioner's show-glasses, a foot-bath of earthenware, or a few glass milk-pans, may be used for the preservation of aquatic objects, when a properly con-

THE FRESH-WATER AQUARIUM.

structed vessel is not at hand; and even as adjuncts to high-class tanks, such vessels are frequently necessary and have special uses of their own. Still the tank, whether rectangular or vase-shaped, is a distinct thing in itself. The beauty is to be found in its completeness and the extent afforded for a variety of objects; and when we speak of an aquarium, we mean a vessel holding at least eight to thirty or more gallons of water, formed partially or wholly of glass, and stocked with plants and fishes in a living and healthy state. A glass lid is essential to prevent the entrance of dust and the escape of any of the inhabitants. Fishes will sometimes leap out, and reptiles will crawl out; and without a lid, some pretty objects may thus be lost.

CHAPTER III.

FITTING UP.

Rockwork claims the first consideration when we proceed to fit up and furnish a tank. For a fresh-water aquarium, I do not recommend rockwork of any kind; and in the case of a vase, rockwork is positively dangerous, from its weight, and, unless very skilfully managed, will be ugly rather than ornamental. In the marine tank a few pieces of rock add to the beauty of the scene and the comfort of the creatures.

In fitting rockwork, some amount of taste and judgment must be brought into exercise. Shells and filagree work are largely used by some folks; but they belong properly to the child's aquarium—they suggest dolls and battle-dores. Some rough fragments of any kind of non-metallic

THE FRESH-WATER AQUARIUM.

stone may be built up into a dark arch, or piled up after the fashion of a cromlech—one flat piece resting on two or three vertical pieces, so as to form a rude table-like structure. These may be fixed firmly in the places they are intended to occupy by means of Roman or Portland cement, which can be purchased at any building yard. The cement should be made into a stiff paste, and worked into the form required. Indeed, the rockwork may be wholly composed of such cement, especially if it is to have the form of an arch. The most important matter in the construction of rockwork is to give it a natural, rugged appearance, and to avoid loading the tank with superfluous weight. I have seen large shells and branches of coral in fresh-water tanks, and always thought the spectacle disgraceful to the owner. In a marine tank, such things are proper enough. Whatever is done should be made secure, the pieces of stone well embedded in cement, and the whole firmly united. The tank must be well seasoned, be frequently filled and emptied, to dissolve out any free salts before being put to use.

The Bottom must be composed of coarse river sand and small pebbles, the whole well washed before being introduced to the tank. Mr. Gosse condemns red sand and silver sand, as certain to stain the water. But I have two tanks now at work, both bottomed with such material, and the water preserves a crystalline brightness. I have also a marine tank, in which the bed is formed of common silver sand and garden pebbles: it has been in use nine months, and with no unfavourable results. In each case the sand was washed till the water could be poured away

quite clear, and no matter what kind be used, the washing must be attended to. The coarser the grit the better its appearance, and, therefore, I do not recommend common sand, I merely show that it may be used when better is not attainable.

Mould has been extensively recommended as a bottom for tanks. I used it myself till I became convinced that it could be dispensed with altogether. It necessitates frequent changing of the water for at least a fortnight after the first stocking of the tank, in order to get rid of the soluble vegetable matter, which the water dissolves out of it, and its presence promotes the growth of *confervæ*, and other low forms of aquatic vegetation, that become obnoxious to the sight, and even hurtful to the health of the collection. I now use sand and pebbles only, and I find that aquatic plants of all kinds root freely and flourish in it, and, indeed, if pebbles only be used, they flourish just as well if their roots are covered.

Planting is next to be performed. The arrangement of plants will depend on the shape and size of the vessel. Generally speaking, massive plants look best if set back with lighter plants before them, just the same as a painter sets his chestnuts and elms in mid-distance, and his lady birches in the fore-ground. *Stratoides*, *Potamogeton*, and other plants of a massive and decided character, are well seen through the interstices of *Myriophyllums*, *Callitriche*, and such like fragile and delicate structures. The flowering rush makes a fine centre piece for a vase, and appears to good advantage when seen through an archway, in a tank containing rockwork.

THE FRESH-WATER AQUARIUM.

If there is a bed of two or three inches of sand, the roots may be gently pressed down into it, and a few clean pebbles laid over the spot to keep the plant in its position. Some plants will require a stone to be attached to them by means of a thread to fix them properly. Crowns of *Stratoides* that have not formed roots, may be planted in this way. First cut away any black or decaying matter from the stem, and pull off any discoloured leaves, taking care not to injure the centre, then pass a piece of bass round the base, and attach a small stone. The plant will remain firmly where placed, and will throw out roots, and fix itself before the rotting of the bass takes place. It will then throw up new crowns and become a very ornamental object. Loose stems of *Chara*, *Anacharis alsinastrum*, or *Callitriche*, may be gathered together, fixed by means of a stone in the same way, a strip of bass being better than string for attaching them. They will generally get well rooted in a fortnight, and remain firmly where planted.

The Water should be pure and bright when introduced to the tank, and if the supply is at all faulty, it will be best to pass it through a filter before using it. Spring water will do very well, but must stand a day or two to allow the plants to soften it, before the fishes are put in. My tanks are all filled with spring water, which I find altogether unobjectionable; but for the marine tank I think it preferable to any other in the manufacture of artificial sea-water. Writers on the aquarium usually insist on the use of river water, but in many places this is not attainable, and it is satisfactory to know that artesian, or well water, will serve the purpose admirably.

THE FRESH-WATER AQUARIUM.

In filling the tank, hold a plate in the left hand, as low down as possible, to receive the dash of water from the vessel in the right, so as to wash up the sand as little as possible. A syphon may be used if a source of supply is near the position of the tank.

Aspect.—Sunshine is good for the tank at all seasons of the year. But in high summer it should have only an hour's sun, morning and evening; the fierce solar heat of mid-day will give the water so high a temperature as to be fatal to its animal inhabitants. Comparing tanks one with another, I must give a preference to a south or east aspect. A north aspect will do very well, from May to October, but, during the winter months, a tank in such a position, would be feeble, and want watching. Good exposure to daylight is, of course, essential; but it should be borne in mind that the fresh-water tank needs more light than a marine one. My fresh-water tanks I find to prosper best when placed close to the windows, but marine tanks may be kept back two or three feet, in a south aspect. In fact, if you have a cabinet of water-insects in a series of jars, the marine tank may very well stand behind them, and get sufficient light there, but the light should fall uninterruptedly on the fresh water vessels.

CHAPTER IV.

WATER PLANTS FOR THE AQUARIUM.

How to stock a Tank quickly.—It is usual to fix the plants and fill up the tank to within a few inches of the top, and then leave the whole for a week before com-

THE FRESH-WATER AQUARIUM.

pleting the collection by the introduction of fishes. Where a beginner has sufficient patience to wait, this is very advisable, because the whole gets well settled, the plants start into growth, and the water gets softened and charged with oxygen. But this plan is not the only one that may be followed, and if well-washed pebbles be used instead of mould, as I have advised, the fishes may be introduced the same day as the plants are inserted, by



CALLITRICHE.

first taking care that you insert plenty of large healthy plants, and then throw on the top as much of the brook starwort—*Callitriche autumnalis*—as will cover the whole. I lately stocked two tanks in this way, and performed the whole in less than two hours, forming the bottom, planting the vegetation, and adding the fish,—perch, tench, Prussian and British carp, roach, minnows,

THE FRESH-WATER AQUARIUM.

gudgeon, and chub,—and all went on as well as if the tank had stood a month to strengthen, the water being from the first moment as brilliant as any of the Castalian springs that flow through classic verses. The lovely green of the starwort, spread over the whole of the surface of the water, has a fairy-like effect. It is necessary to get a good supply of starwort from a brook, throw it into a large vessel of clear water, pick off the green heads, with four or six inches of stem only to each, then wash all these picked portions till they are bright and clean, and throw the whole into the tank to take its chance. You must be lavish as to quantity. It soon spreads over the surface, and arranges itself most beautifully, forming a rich green ceiling, giving the green shadow which a new tank wants; it grows freely, lasts for months, continually throwing out new roots and shoots from the joints, and creates abundance of oxygen, from the first hour of its being thrown in. Whenever it seems desirable it can be got rid of by simply lifting it out. My own are the only tanks I have seen stocked in this way.

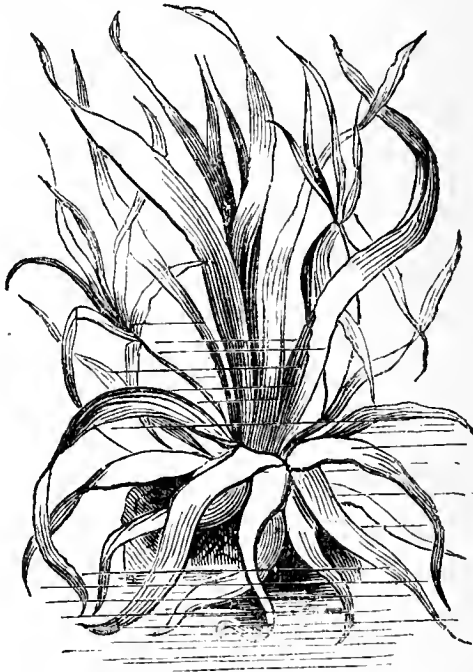
Selection of Plants.—There is scarcely any aquatic plant but may be grown in an aquarium, and unless some attention is given to the botanical department, only half the pleasure and instruction it is capable of affording is attained. I cannot agree with Mr. Gosse that the vegetation of a tank has so strictly a secondary place—“preserved because they cannot be dispensed with,”—for in either a marine or fresh-water vessel the vegetation is a special source of beauty and interest, and fairly divides attention with the animals. Supposing it were impossible

THE FRESH-WATER AQUARIUM.

to keep animals in such vessels, they would still be acceptable for the formation of aquatic gardens.

Beauty of form and adaptability to confinement are the requisites for this purpose, and the more the lakes and rivers are explored the more the botanical department of the aquarium will be extended, both as to ornament and usefulness.

Water Soldier.—Among the plants easily attainable,

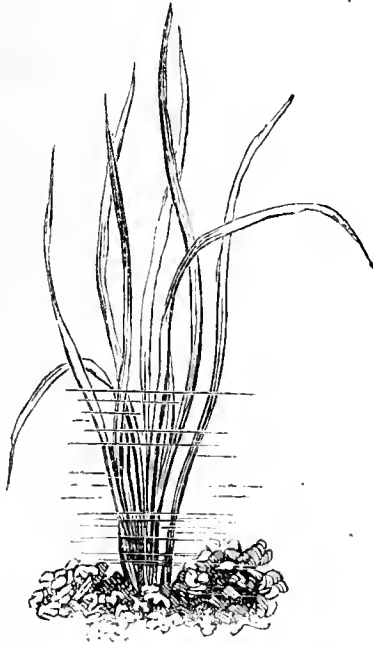


STRATOIDES ALOIDES.

and which combine grace of outline with cleanliness of growth, and tendency to create oxygen, I can recommend, first of all, the famous water soldier—*Stratoides aloides*—a lovely cactus-like plant, which grows equally well with or without a root, as indeed most water-plants do. In form it closely resembles the tuft of herbage on the crown of a pine apple, and its leaves have similar serrated edges.

THE FRESH-WATER AQUARIUM.

If thrown in, it floats on the surface, and puts forth new heads in plenty, each new head springing from the base of a leaf on a long stalk. By separating these when pretty well grown, and removing the stem from the base, any number of new plants may be formed. If it be wanted to root at the bottom (as indeed is best) cut away the decayed portion of the base, and trim off every dark-coloured leaf and throw the plant in again. In a few weeks it will throw out roots, and it may then be attached to a stone



VALLISNERIA SPIRALIS.

by a piece of bass, and dropped in to fix itself where wanted, without in any way disturbing the tank.

Starwort I have already spoken of, as a good purveyor of oxygen. It is a pretty plant of a delicate green hue, which appears on the surface of brooks and ditches everywhere, both in this country and all over the continent. At a little distance it has so much the appearance of duck-

weed as to be recognised with difficulty. Its old botanical name is *Callitriche aquatilis*, but owing to its liability to vary its appearance, botanists have lately divided it into several species, the two most common which are *C. autumnalis*, and *C. Vernalis*.

Vallisneria spiralis is essential to every fresh-water tank. It is a native of Italy, and is named in honour of the Italian naturalist, Vallisneria. The blooming of this plant is very curious and worthy of close scrutiny. It likes abundance of light, and must be grown as a bottom plant, flourishing only when well rooted.

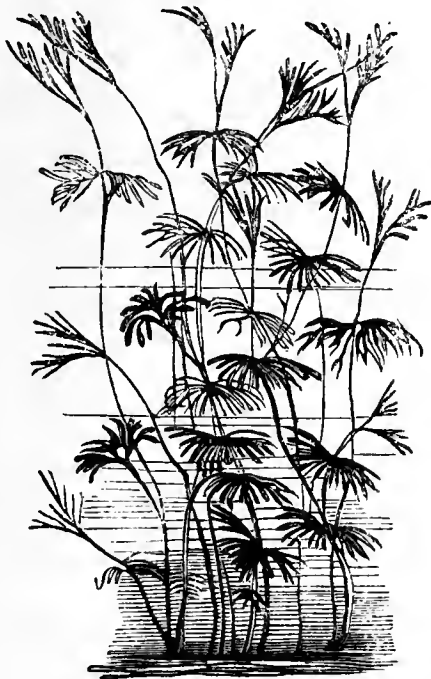
Anacharis alsinastrum, or the New Water-weed, is an interesting plant that grows freely, whether rooted or not; but it can only be considered ornamental when springing from the bottom. It thrives just as well without a root as with one, but, if firmly fixed, usually sends down a number of white rootlets from joints on the stem. I have seen roots of this kind sent down a distance of six inches to reach the bottom, while the lower part of the stem was decaying rapidly.

Myriophyllum contributes some lovely members to the aquarium. All the plants of this genera are of elegant structure, the leaves finely divided and of a delicate emerald green. *M. Spicatum* is perhaps the best, but there are other species to be had of the dealers that are worthy of attention.

Potamogeton is an extensive genera of water-plants, numbering not less than fifteen species in the brooks and rivers of this country alone. *P. fluitans*, *crispus*, and *densus*, are most easily obtained, and they flourish in the

THE FRESH-WATER AQUARIUM.

tank, and make rich branching masses for the centre, or to climb over rockwork. They are all rather coarse and apt to shed their lower leaves, but, if well placed, produce a striking effect. They blossom freely in the aquarium, and that is a great recommendation.



MYRIOPHYLLUM SPICATUM.

Nuphar lutea is the best of the water-lilies for the purpose: it grows freely and produces graceful outlines below and above. It should be planted early in spring to secure blossom; but if it does not throw up blossoms in summer it may be removed, and its place supplied by a plant in full bloom.

Ericaulon, or the pipewort, sends its only English species—*E. septangulare*—to the tank. It is a bog plant, rises six inches high, and does not succeed if immersed more than three inches; hence it is suitable for

THE FRESH-WATER AQUARIUM.

the top of an arch, but not for the deep water of the tank. The plant is perennial and produces a white blossom, with one petal and four stamens. The flower-stem is velvety, and the leaves spread in a tuft from the root.



POTAMOGETON DENSUS.

Utricularia Vulgaris, or the hooded milfoil, may be recommended as a botanical curiosity, but is met with only (as far I know) in the brooks of the southern counties,—Hants and Surrey especially. It produces a yellow blossom in June and July, The root has a curious inflated appendage. There are two other species, *U. minor* and *U. intermedia*, differing but little in general aspect from the common sort.

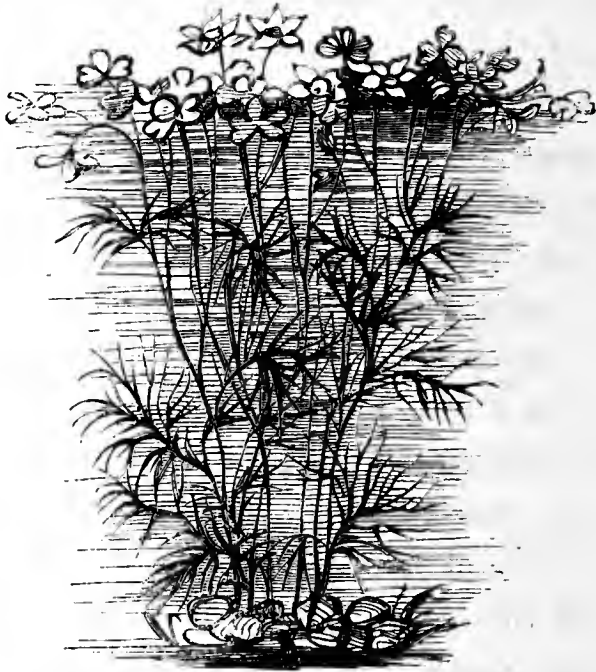
Isolepis fluitans, or the floating Isopelis, is another of the curiosities of water botany. It is somewhat common in English ponds and slow streams. The blossom is inconspicuous, having no petals; the stamens are three in number, and there is but one petal.

Subularia aquatica is one of the few aquatic plants furnished by the great family of crossworts, or plants of the cabbage and wall-flower kind. Its common name is awl-wort, and suggested by the awl-like foliage which it produces under water. It is to be found only in clear mountain lakes, for it is a true aquatic alpine, frequent only in the North of England, and in Scotland and Ireland. The aquarian who resides near any mountain lake or pool, should seek for it, and treasure it as the choicest gem in his collection. The lower leaves are curve-pointed like a cobbler's awl, and in July it sends up a short stalk, bearing a head of snow-white four-petalled blossoms, and presents a somewhat unique example of a flower in full bloom under the water. My attention was first called to this plant by Mr. Dowden's charming work on wild plants, called "Botany of the Bohereens."

Ranunculus aquatilis, or the water crowfoot, must be known to everyone who has been in the habit of rambling in the country quite sober and with eyes open. It is to be found in almost every pond, and by the middle of May is in full bloom, continuing gay till far into autumn. It is a member of the buttercup family, and may be recognised as a buttercup of a snow white, with a bright yellow centre. If you step carefully to the edge of a pond or river, where this crow-foot covers the shore-water with its

THE FRESH-WATER AQUARIUM.

floating foliage and thousands of snow-flakes, you will not be in a hurry to disturb it, it is so truly beautiful. But reach forth your hand, and tenderly take up a head; and, as you draw it from its plashy bed, you will find that it is truly amphibious in structure, no part of the undergrowth being at all like that which floats above in the air and sunshine. The floating leaves are fleshy and



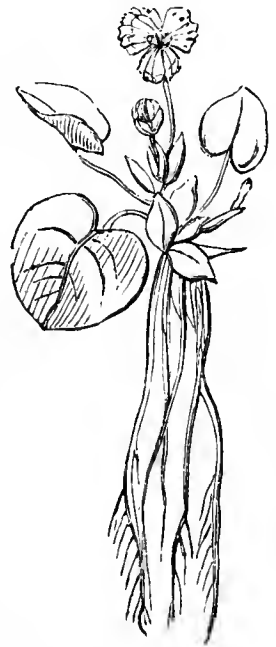
RANUNCULUS AQUATALIS.

neatly lobed, the lower ones are as finely cut as fennel, and from every joint numerous white rootlets will be seen protruding, on their way to find root at the bottom. This plant requires good washing in clear water before it is fixed in the tank, or it may be the means of introducing many objectionable growths. It will be best to cut away the lower portions, and root it from a good joint, allowing it just length enough to float its ark of green and white

THE FRESH-WATER AQUARIUM.

upon the surface. When you have secured as many complete plants as you require—and two strong stems will be enough for any tank—pick off a dozen or more blossom-heads, taking each at a clear joint. When the roots are planted, sprinkle the short flowering tops over the surface, and you will have at once a wide spread of snow-white flowers that will continue gay till the end of the summer, while the fixed roots will give a graceful effect to the vegetation of the mid-water.

Hydrocaris morsus ranæ, or the common frog-bit, may be obtained of the dealers, and is common in brooks and rivers. It is a perennial, interesting in its growth, very curious when in flower, and a good maker of oxygen.



HYDROCARIS
MORSUS RANÆ.

Alisma, of several species, may be obtained from brooks and rivers in plenty. It is the Water Plaintain of the old botanists, and has an ancient renown, which cannot be dealt with here. The long stems and lanceolate leaves of this genera give a pleasing variety to the vegetation of the tank.

Lemna.—The four English species may be used to advantage. If the whole of the surface be covered with the pretty grass-green fronds of this very common plant, the effect is good, and it gives a salutary shade to the finny creatures. A single frond thrown in will soon spread and cover the tank in time, and its growth cannot

THE FRESH-WATER AQUARIUM.

be contemplated without pleasure. *L. triscula* is a very pretty kind, common in the neighbourhood of London.

The sweet scented Rush, members of the *Alisma* tribe, the noble *Sagittaria* of six species, the Hornwort (*Ceratophyllum*) of two species, and for more delicate purposes, *Chara* and *Nitella* may be recommended as suitable additions to the botanical department of the Aquarium.

CHAPTER V.

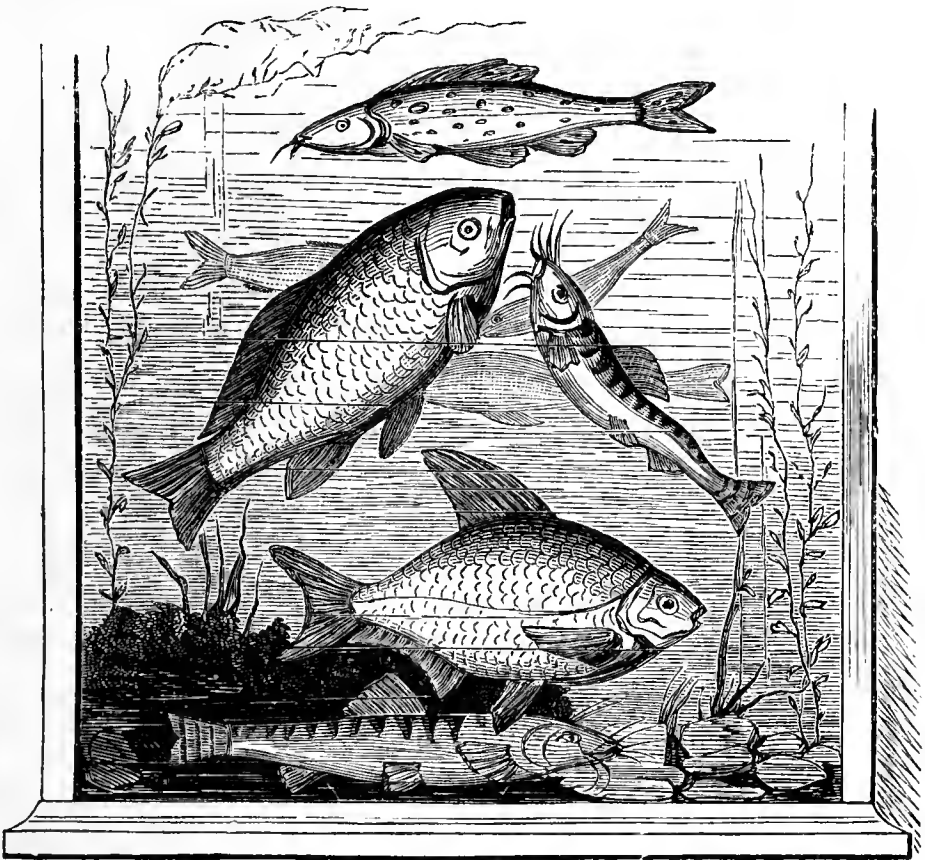
FISHES FOR THE AQUARIUM.

I SHALL here give the names and a few particulars of the history of the fishes that are most suitable for the aquarium, reserving my notes on the grouping and general stocking for a subsequent chapter. It is to the interesting family of *Cyprinidæ* we are to look for our chief supplies. This tribe of fishes belongs to the great division of *Malacopterygii*, or those having their fin-membranes supported by flexible rays, which are either pointed or branched, or both.

Cyprinus carpio, the British carp, is a handsome fish, differing slightly in structure from the Prussian and gold carp; yet, in general outline, preserving the true carp type—plumpness of body, iridescence of colour, and ease of movement in the water. This carp has a moderately-developed pair of moustachios, in the form of a barbule, at the upper part of each corner of the mouth, and a second one above it, on each side. Like the rest of its kindred, it is very tenacious of life, and does not quickly suffer from exhaustion of oxygen. It is an old fish, so to speak,

THE FRESH-WATER AQUARIUM.

for it was a favourite with the ancients. Pliny and Aristotle both speak of it in high terms of praise, and record that it lives to a hundred years of age, becoming, in that time, as white and hoary as becomes an "ancient mariner." It is not indigenous to our rivers, though, as



GUDGEON, PRUSSIAN CARP, LOACH, & BREAM.

far back as 1496, mention is made of it in the "Boke of St. Albans," quoted by Mr. Yarrell. It has been known to attain to a weight of twenty pounds, and in Holland is frequently kept alive in wet moss, and fattened on boiled potatoes. In this way it is said to live three weeks.

C. gibelio is the noble Prussian carp, unquestionably

THE FRESH-WATER AQUARIUM.

the best of all fishes for aquarian purposes. It will survive the wreck of a whole establishment, even if the water gets putrid and almost exhausted of oxygen. The easy, graceful motions, the beauty of the colouring, and the docility, of this fish, must make it a favourite and a pet wherever it is kept. I have always had a large number of them, some of considerable size; they group themselves like friends on good terms of acquaintance, take an interest in whatever goes on in the room where the tank stands, and will watch their proprietor, elegantly poised in mid-water, for hours. Small, red earth-worms, young water snails, and home-made bread, are the best of foods for them. They will seldom eat bread at first, but soon get to like it, eat it greedily, "and ask for more." The Prussian carp may be taught to feed from the hand, even more boldly than the minnow, and readily assemble themselves for inspection when the side of the glass is gently tapped with the finger-nail. None of the carp family are carnivorous in any great degree. Mr. Yarrell says the Prussian carp will recover after having been thirty hours removed from water.

C. carassius.—The crucian, or German carp, is easily distinguished from its compeers by its bream-shaped back, which rises from the nape into a high arch along the line of the dorsal fin. It is to be found in the Thames, between Hammersmith and Windsor, whether for the angler to kill or the aquarian to preserve. It is less hardy than the Prussian carp, and a little subject to fungoid growths.

C. auratus of Linneaus, the lovely gold carp, will hold pre-eminence among domestic fishes for its splendour of

THE FRESH-WATER AQUARIUM.

colouring, though among true naturalists I think the Prussian carp will always compete with it to advantage, for the gold fish is certainly the dullest-minded of the family, and, like most fops, lazy and unteachable. Pennant says, "In China every person of fashion keeps them for amusement, either in porcelain vessels, or in the small basins that decorate the courts of the Chinese houses. The beauty of their colours and their lively motions give great entertainment, especially to the ladies, whose pleasures, from the policy of the country, are extremely limited." This carp appears to have been introduced into Britain about 1611, though the precise date is now difficult to determine. Mr. Yarrell leaves it an open question.

A large number of those reared for sale are the produce of waters which receive the waste steam from factories, and which are thus kept to a temperature frequently as high as 80 degrees. In fact this carp is most prolific in tepid water, though those that are bred at a lower temperature are more beautiful. The gold carp is not the only fish that can bear such high degrees of heat, perch and mullet have been found in waters at 86 degrees; live eels were found by De Saussure in water heated to 113 degrees, and other instances, mentioned in Bushnan's "Study of Nature," show the adaptability to temperature in fish of many other species. I had minnows frozen into a solid mass last winter, and the same day they were thrown into a tank, in a room where a fire was burning, and in a few hours were sporting about in a genial warmth of 60 degrees, a change of more than thirty degrees in a few hours.

THE FRESH-WATER AQUARIUM.

The trade has been so long established that a modern gold fish is truly a manufactured article, and the patterns vary from high class beauty to very decided deformity. Domesticated creatures are all liable to vary from their original type, but in the gold carp this variation proceeds to an extent not observed in any other animal which man has taken under his care. Their colours are as various as their forms; some have stumps instead of dorsal fins, with perhaps tails as large as their bodies; some have triple forked tails, and perhaps no trace of a dorsal fin at all, and in purchasing, it is as necessary to look to the structure and outline of the fish as to its colours, or, on after inspection, the purchaser may find himself in possession of creatures as bright as morning sunshine, but in form as ugly as toads. There is no better food for gold fish than the crumb of bread. Many writers condemn this; I can only say that they thrive for years upon it, but if more be given at a time than the fish can eat, it soon renders the water impure and does mischief.

Cyprinus Brama, the common bream, is a fish of bold outline and pleasing habit. The depth from the dorsal to the ventral fin is nearly equal to the length of the body, and justifies the comparison applied to a high-shouldered biped, "backed like a bream." There is a prettier species called the *Cyprinus Buggenhagi*, Pomeranian Bream, a specimen of which was lately supplied me, with a parcel of other fish, by Mr. Hall, the intelligent naturalist, of the City Road.

C. Leucisus, the dace, *C. rutilus*, the roach, and *C. alburnus*, the bleak, may be classed together, as fishes

THE FRESH-WATER AQUARIUM.

well known to all who were ever seduced into playing truant, to try their boyish luck with a blood-worm and a bent pin, or who have since sunned themselves in the holiday pages of Izaak Walton, to fall in love with milkmaids, and dream all night of reedy rivers that sing and sparkle, and fishes fried in meadow cowslips. These are delicate fish, whether for the table or the tank. As the latter concerns me most here, let me warn the reader to proceed cautiously, for these lovely creatures have a sad habit of perishing quickly in confinement. In winter time they may be kept with ease, but as spring approaches, the best care for them will only be rewarded by the spectacle every morning of one or two floating on the surface, never to swim again; while they do live, there are no more interesting creatures to be found for the gratification of the domestic circle. Bleak are even more sportive than minnows, and will chase a fly or small spider thrown in to them, till they tear it into shreds, and then will fight like Irish lads for the pieces. An aquarium, stocked with bleak and minnows, is a perpetual Donnybrook Fair, and will provoke the laughter of the dullest melancholic that ever looked at water as a medium wherein to end his imaginary woes. They soon feed from the hand, and eat bread greedily, darting after the crumbs with even more eagerness and vivacity than a party of school boys scrambling for halfpence. Their dazzling silvery scales, marked with the bright lateral line of spectral green, their taper forms, and large bright eyes, enlist all our sympathies, and compel us to doat upon them. If they are the best of fishes in this respect, they realise Wordsworth's famous passage—

“ The best die first,
But they whose hearts are dry as summer's dust,
Burn to the socket.”

and hence as to longevity they prove themselves the worst. Dace are very tameable, and soon grow bold and familiar in captivity, comporting themselves in their attitudes and motions much like Prussian carp. Of the three, dace are the most hardy: I have some which have survived eighteen months' confinement, and are now enjoying the sunshine in the garden.

The aquarian, contemplating the silvery spangles of his white fish, may like to be reminded that the scales of dace, roach, and bleak, were formerly used in the manufacture of Oriental pearls, and are still used to some extent in making the imitations of pearl that occasionally gleam under the chandelier upon the brows of laughing belles.

C. phoxinus, the minnow: An aquarium without minnows is no aquarium at all—it is a makeshift. With a shoal of minnows and a few Prussian Carp an aquarium may be considered fairly stocked, because there is really something to look at, something to amuse, and something to instruct. The minnow is a bold and impudent fish; he is at his ease in less than an hour, and in a week will show a sign of attachment and familiarity. They do not live beyond three years, but will reach that age in the confinement of a tank. Like carp and tench (and asses), minnows may be said never to die, for they survive the severest trials of heat and cold, neglect and bad treatment. The colours are pleasing, and bear some close resemblance to the mackerel; but fright will make them assume a pale fawn colour in an instant. Disease seldom attacks them,

and when it does, they speedily recover if thrown into a large pan under a jet of water. Minnows spawn in June, and just before that time acquire their gayest mottlings of green, and bronze, and silver, losing colour considerably after spawning.

C. gobio—The gudgeon is an every-day sort of fish, proper enough in a general collection, but where room is scarce it may very well be spared. In its markings the gudgeon has a striking appearance. It is a hardy fish, and rarely shows signs of exhaustion.

C. Tinca.—The tench is a quiet, shy fish, distinct in outline, and easily recognised; but, like the gudgeon, destitute of any highly attractive features. The tench is the most tenacious of life of any fish in the collection, and never shows signs of exhaustion by gulping air from the surface. Tench are easily tamed, and take great pleasure in nibbling their proprietor's fingers. Mine eat bread and cheese with me, and nibble my fingers fiercely whenever I permit them.

C. Barbus.—The barbel takes the lead in the aquatic moustache movement. His barbs are really ornamental, and altogether he is a handsome but shy fish. The dorsal and caudal fins are very symmetrically shaped, and the lateral line arrests the eye when we contemplate his pleasing colours. If small newts, small carp, and minnows are kept in the same tank with barbel, they are likely to disappear one by one; for when all is quiet he makes his meal without seeking aid from the culinary art.

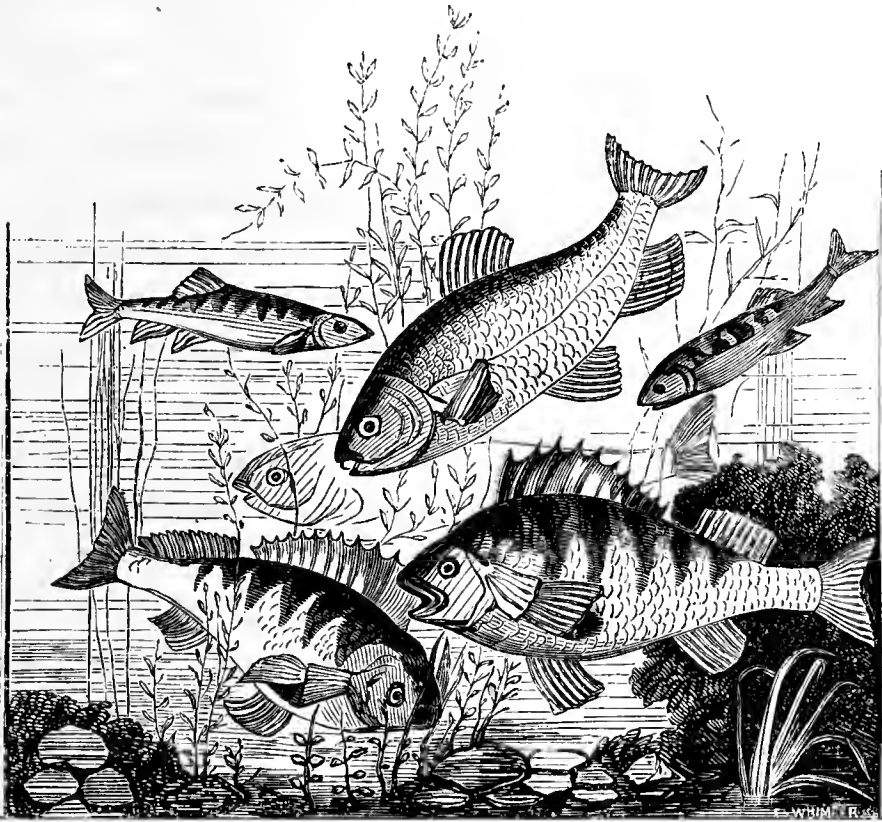
C. barbatula is perhaps the most interesting fish in the tank, considered as an individual. With no attractive

colours, and with an outline as straight and rigid as a piece of bark, he surprises you with his graceful motions as he hawks along the surface of the glass, propelled by the easy undulatory action of the caudal end of the spine. Towards dusk he wakes up from his day-light stupor, and commences his queer, but pretty gyrations; and, after gliding ghost-like all round the tank, suddenly drops down as if dead, and rests on any leaf or stone that may receive him, remaining motionless, and in any attitude—on his head, his tail, or his side—that the power of gravity may give him. Then, with an uneasy fidgetting, he flounders up again, and off he goes, as graceful as before, his pectoral fins spread out like samples of lace, looking as much like an eel with frills as it is possible to conceive. When ascending, his motion is so undulatory that he may easily be mistaken for a smooth newt, going up for a bubble. Nor is our interest in him lessened by his displays of individuality of character. He is a savage on a small scale. When he is quietly dozing, half hidden among the sand and pebbles, throw in a small red worm, and, as soon as the water is tainted with the odour of this favourite food, he is awake and on the search. A triton seizes the worm, and shakes it as a cat would a mouse. The loach hunts him down, snaps at him fiercely, and tears the worm from his mouth, and woe to any minor fish that attempts to remove it from those bearded jaws. He flounders from place to place, shaking the prey as he goes, and stirs up such a cloud from the bottom, that the beauty of the scene is spoiled for an hour; at the end of which time you will probably find him gorging the prog, half of which still protrudes from his mouth, while

THE FRESH-WATER AQUARIUM.

two or three hungry minnows loiter about, looking wistfully at what they dare not hope to obtain.

It is a pity the loach is so delicate ; it shows signs of exhaustion sooner than any fish in the collection. If oxygen fails, it comes to the surface to gulp air, and at last rolls over on its back, and pants in a way that is very



MINNOW, TENCH, & PERCH.

painful to witness. Removed to a pan, under a jet of water, it soon recovers ; but if long confined in a vessel the least overstocked, especially in warm weather, finishes his career by convulsive gaspings at the surface.

A curious species of loach, known as the spine loach, is met with occasionally in Wiltshire, in the Trent, near

Nottingham, and in some of the tributaries of the Cam. Mr. Yarrell describes it; but as I have not yet had the good fortune to possess a living specimen, I can only refer to it casually.

C. cephalus.—The chub is a good aquarium fish. It is shy, but grows familiar under good treatment. Insects sooner attract it than any other food. Mr. Jesse says, that those in his vivarium throw off all reserve at the sight of a cockchafer, which they devour with eagerness.

Among the *Acanthopterygii*, or the spiny-finned fishes of Cuvier's arrangement, the only one suited to the fresh-water tank, is the noble perch, *Percidæ*. These are bold and dignified, and their decisive markings make them attractive in a general collection. They require plenty of room, or they soon show signs of exhaustion; and, under the best of circumstances, cannot be pronounced a hardy fish in confinement. They are capricious. I have had healthy specimens, taken by net, die off in a week; and weakly ones, taken by the hook, with portions of the lower jaw torn away, recover, and live for a year, after the ragged portions had been removed by scissors.

Gasterosteus needs a word or two. The sticklebacks are all pretty and interesting fish, plentifully found on the sea-coast, and in brooks and ponds all over the country. The species most frequently met with are *G. semiarmatus*, the half-armed stickleback, and *G. pungitius*, the ten-spined, but *G. brachycentrus* (short-spined), and *G. spinulosus* (four-spined), are rare.

Aquarian amateurs seem a little divided about the policy of keeping these in tanks. I can only advise the beginner to be careful, or he may regret having made

THE FRESH-WATER AQUARIUM.

their acquaintance. They are all savages, untameable savages, that delight in destruction, even if they cannot eat what they destroy. They will attack anything, and, with their spiny armour, dare the stoutest to retaliate upon their mischief-making pertinacity. In fact, they pass all their time in worrying the more peaceful members of the aquarium; and any one who has a few months' experience of them, will consider them the savagest of imps.

I have tried them on several occasions, and found them at spawning time more savage than usual; but at all other times savage enough. My favourite Prussian carp, that love me as I love them, that come when I call them, that hurry to the side when I fillip the glass with my finger-nail, that watch me with all their eyes when I sit in the room with them, and that feed from my hand as a dog would, show at the tips of their pretty tails the sanguinary signs of gasterostean vengeance. Their transparent tails are ragged through the attacks of those sharp-toothed savages, and more than one has succumbed to their persevering spite since my recent trial of them under the persuasion of a little friend who begged me to put in some "robins" he had caught at the brook. "Robins," indeed, the red jaws of *G. aculeatus* are suggestive of his blood-thirsty propensities, and he now does penance with a dozen of his kindred in a glass jar of *Callitriche autumnalis*. With tench, gudgeons, and minnows they do better, but they are very annoying to carp of all kinds.

CHAPTER VI.

REPTILES, MOLLUSKS, AND INSECTS.

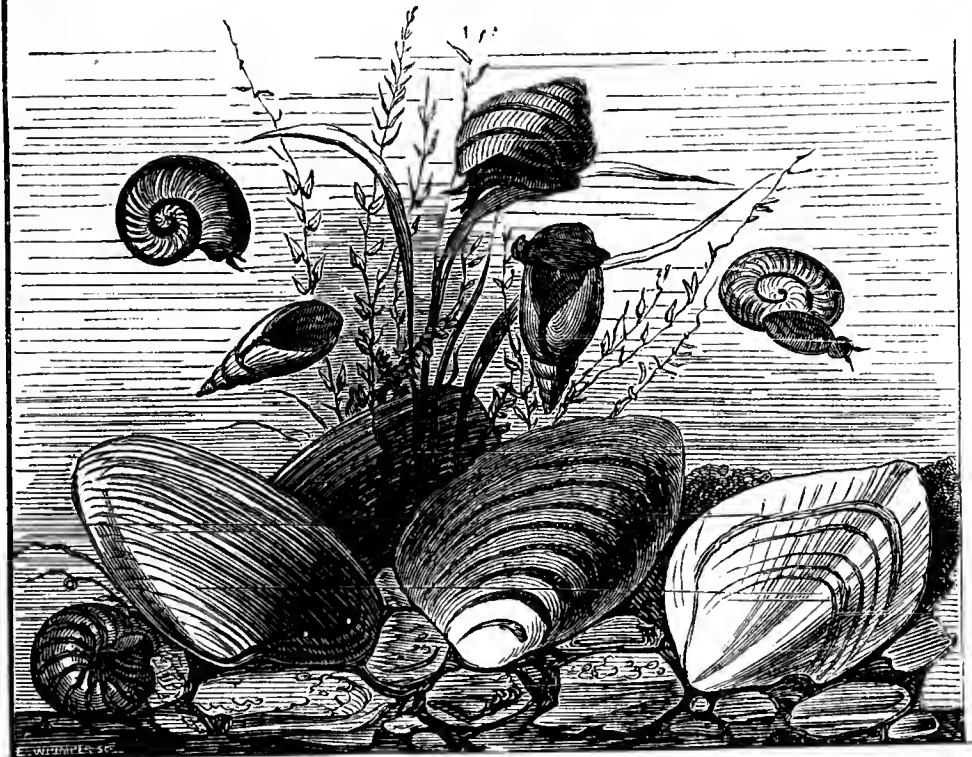
THE lower orders of creation supply many interesting specimens for the aquarium. Among the reptiles, newts, or water lizards, and the common frog, may be recommended as offering some forms of positive elegance, and some habits worthy of observation. The smooth newt, the warty newt, and the noble triton, are almost essential to the completion of the collection, and as they respire air at the surface, they do not exhaust the water of oxygen. The beautiful markings on the belly, and the graceful motions of these strange creatures, are sure to afford entertainment to those who can overcome the very common repugnance felt towards such creatures.

Some of the mollusks commend themselves for their beauty, and will be prized by the aquarian enthusiast. Among the univalves, *lymnea*, *physœ*, *planorbis*, and *paludina*, are the most useful and ornamental. I must caution the amateur against the too ready adoption of any species of *lymnea*; they are destructive, and particularly fond of *Vallisneria*, *Stratoides*, and *Callitriche*, and while they are the best of cleaners, they are also the most indiscriminate of gluttons.

Paludina Vivipara is a handsome snail, with a bronze tinted, globular shell; but *Planorbis Corneus* and *carrinatus* are still handsomer, having a spiral form, resembling the horn of a ram. These latter are to be trusted anywhere; they are good cleaners, and seldom attack the plants. Water snails breed rapidly in tanks, but the carp devour the

THE FRESH-WATER AQUARIUM.

young as fast as they appear; hence it is advisable to remove the spawn into jars containing healthy plants, such as *Callitriche*, in which they may remain for observation of their growth, till stout enough to be committed to the tank.



PLANORBIS CORNEUS, PALUDINA VIVIPARA, LYMNEA, STAGNALIS,
UNIO PICTORUM, TUMIDUS, & ANODON CYGNEUS.

Among the bivalves, the fresh-water swan mussel, *Anodon cygneus*, and the Duck mussel, *Unio pictorum*, are interesting burrowers, and perform a great service in the tank. They act as scavengers, not by the process of eating off objectionable growths, as in the case of uni-
valves, but by the straining off of matters held in suspen-

THE FRESH-WATER AQUARIUM.

sion in the water, and filtering it in a pure state, by the mechanism of their syphons, and ciliated gills. It is very interesting to watch them thus engaged, and to note the force of the stream which they project from time to time.

The only creature of the insect kind that I can recommend for general adoption is the caddis worm, a comical and interesting creature, that can never mar the beauty of the tank. Half-a-dozen may be thrown in, and searched for occasionally—the search will always be well rewarded. When the cad closes his hybernacle, it will be well to remove it to a jar, to obtain a better opportunity of witnessing the transformation of the dormant worm into a four winged fly of Stephens's family of Phryganea.

CHAPTER V.

SELECTION OF STOCK.

THE first thing to guard against is over-stocking, the common error of all beginners; taking large fish with small, I think about two or three to every gallon of water is the utmost that should be attempted. For a vessel of twelve gallons, I should recommend the following, as giving great variety, with considerable safety:—Six Prussian carp, of various sizes, one at least of five inches in length; two small Crucian carp; two small perch; two small loach; two tench, of five or six inches; six or eight minnows; one small eel; a dozen *Planorbis corneus*; half-a-dozen *Paludina vivipara*; three or four fresh-water mussels; and a dozen of different sorts of newts.

THE FRESH-WATER AQUARIUM.

A tank so stocked, will be well filled with life ; and if the plants be strong, and in a good light, all will go well.

Another, and to some perhaps, prettier selection, might be made thus :—Three gold carp, of various sizes ; three Prussian carp ; two perch ; four large loach ; a dozen minnows ; half-a-dozen bleak ; and two dozen planorbis.

If stocked with great care, with a bottom of pebbles only, this would do very well ; and the sides would never want cleansing. For a smaller vessel, the same selection might be made, but with a proportionate reduction of the numbers.

Those who make their own selection, may choose from the following :—

Plants.—*Vallisneria spiralis*, *Anacharis alsinastrum*, *Callitriche vernalis* and *autumnalis*, *Nuphar lutea*, *Potamogeton crispus*, *densus*, and *fluitans*, *Stratoides aloides*, *Ranunculus aquatilis* (apt to foul the water in a north aspect), *Myriophyllum spicatum*, *Myosotis palustris*, (the real forget-me-not—it flowers above the surface) *Butomus umbellatus* (for the centre—it flowers above the surface), *Lemna*, *Nitella*, and *Chara*. For a list of suitable ferns and instructions on their culture I must refer the reader to my work entitled, “Rustic Adornments for Homes of Taste,” where this department is amply treated.

Fishes.—Gold carp, British, Prussian, and Crucian carp, pike, perch, tench, minnows, chub, loach, gudgeon, bream, and in winter, roach, dace, and bleak.

Reptiles.—The smooth and warty newt, tadpoles, frogs.

Mollusks.—*Univalves*, *Planorbis corneus*, and *carrinatus*, *Paludina vivipara*, *Lymnea stagnalis*, *putris*, *auriculata*, and *glutinosa*, *Physa fontinalis*, *Bythinia tentacula*.

THE FRESH-WATER AQUARIUM.

Bivalves.—Anodon cygneus, Unio pictorum, tumidus and margaritiferous, Dressinia polymorpha, Cyclas corneus.

CHAPTER VI.

GENERAL MANAGEMENT.

FEEDING should be performed twice or thrice a week, and will be as amusing to the observer as gratifying to the fishes. Bread is not so objectionable as many have stated. Carp, bleak, and minnows eat it greedily, and soon grow tame if regularly fed with it. Most small fishes take insects, such as flies, spiders, ants, and soft larva, greedily; but the large fish disdain such diet. Small red worms, and white of egg, are good general foods, and seem highly beneficial. When feeding, see that the carp get enough, for they are slow fish, and get robbed wholesale by their more lively neighbours. Food not eaten will decay, unless speedily removed, hence care must be exercised on this head.

Confervæ.—When the tank has been established a few weeks, the inner sides of the glass will show signs of a green tinge, of a slimy nature. This is owing to the growth upon it of minute forms of vegetation. If this is allowed to go on unchecked, the glass will in time become opaque, and the view of the interior will be lost. Hence it must either be kept down in growth or occasionally removed.

Uses of Mollusks.—It is to prevent this rapid growth that water-snails are registered among the tenants of

THE FRESH WATER AQUARIUM.

right, for these creatures subsist on vegetable matter only, and if a goodly number be thrown in, they will be found perpetually at work, eating the green growth from the sides, and thus preserving an open prospect.

Objections to Mollusks.—In a highly ornamental tank, water-snails may be thought objectionable, as interfering somewhat with the beauty of the scene. I know the ardent naturalist will cry out against this remark, and ask me if I can find a prettier object than a *Planorbis corneus*, coiled round like a horn of plenty; or a full-grown *Paludina* with its globular hybernaculum richly bronzed and mottled. I tell my friend that I love the pretty creatures as much as he does, yet, as I write for everybody who wishes to keep an aquarium, I feel bound to consider how it is to be managed without them, if their absence is desired. I confess too, that I do object to their appearance in some cases myself, as I do also to beetles, and all other insects in a tank fitted up for the adornment of a drawing-room, however necessary they may be in the tank of a student.



In the first place, *Paludinæ* and *Planorbis* are the only kinds to be trusted in a general collection of plants, and the last is most trustworthy of any. *Lymnea* are all fond of substantial dishes, and eat as much *vallisneria* as they do of the mucuous growth. A dozen of these gentry will most effectually check the vegetation of the tank, by eating holes in the handsomest leaves of the

THE FRESH WATER AQUARIUM.

Stratoides, and biting into the very heart of the Vallisneria. Starwort, too, they are very fond of, and soon clear the bottom of every fragment. Yet, the *Lymnea* are admirable cleaners, the pity is, that they will not see what is required of them, and do that only.

Again, the univalve mollusks do not keep the sides so clean, but that an occasional cleansing of another kind is sometimes necessary, and if the aquarian is not disposed to keep an army of quite semi-efficient scavengers, the remedy will be found in an occasional cleansing of the sides, by means of a sponge attached to a stick, which must be plied over the whole surface, and occasionally taken out and washed in clean water, to remove the green scum, that it soon gets covered with.

Use of Confervoid Growths.—But I should object to any frenzy about cleansing tanks. As I said at starting; they should be self-supporting, and if Planorbis or Paludinae are used in the proportion of about four of each to every gallon of water, a good view will always be preserved with the use, now and then, of the sponge alone.

Periodical Cleansing.—When a tank has stood twelve-months or more, the water not having been changed at all during the whole time, it may be necessary to turn out the contents and restock it. This is not to be done unless the bottom has become black, and the roots of the plants show signs of decay, in fact, not unless it really wants it, and if bottomed with mould it certainly will, and it must be done accordingly. The live stock should be removed by means of a hand-net, the water drawn off by means of a syphon of glass, or gutta percha, and the plants taken out carefully and put by themselves, and then after removing

THE FRESH WATER AQUARIUM.

the bottom the glass can be quickly cleaned with the aid of water and fine sand, or rotten-stone.

Exhaustion of Oxygen is made manifest by the fishes coming to the surface to gulp air, and it is also manifested by their retiring to the bottom, and quietly extending themselves on their backs in "horizontal repose"—the repose of death. If too many animals be crowded into the vessel, this will soon happen, and either the number must be reduced or the water must be frequently changed, or we must have recourse to aeration. I consider the two latter remedies a proof of the incompetency of the aquarian—the necessity marks very bad management indeed.

Temperature.—If the aquarium be too much exposed to the heat of the sun in summer, or to the heat of a fierce fire in winter, the water will get tepid, and signals of distress will be shown by the protrusion of many panting mouths at the surface. I find that if the temperature rises above sixty degrees, things do not go on so well. The use of a blind or paper screen is, therefore, essential in summer time.

On winter evenings, when the room is made cozy by blazing blocks of coal, the collection will often show signs of distress. By opening the lower window-sash one or two inches when leaving the room for the night, things may be restored to a normal state in a few hours, and even if the weather is somewhat severe no harm will be done. At the same time intense cold checks the growth of the plants, and throws the fishes into a state of torpor, and the freezing of the water may cause the bursting of the tank.

THE FRESH WATER AQUARIUM.

In summer time, if the tank should get accidentally heated, it may be quickly cooled by wrapping around it a coarse cloth saturated in water, and keeping it wet from time to time. These matters may be much simplified by fixing a small thermometer within the tank below the level of the water.

Dead specimens must be removed as quickly as possible. Bivalves are generally very hardy, but if death happens to one, the production of sulphuretted hydrogen is very rapid, and quickly fouls the tank.

Disease of Fishes.—I have tried numerous remedies for the diseases which beset fishes in winter, but with very little success. When the caudal fin gets coated with a fungoid growth, I have at once cut it off by means of a pair of scissors, and it has usually grown again in a few weeks. I have a couple of minnows now, that were so operated on last winter, they are as hearty as ever, and their tails are quite renewed. Diseased animals should always be removed to a pan of fresh river water, and placed in a quiet cool place, where they will probably recover.

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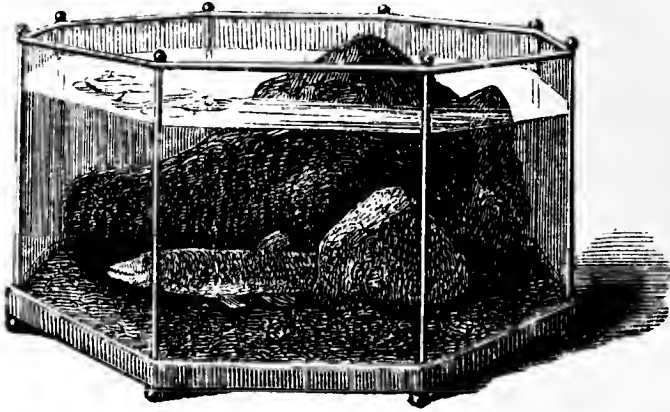
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