HABITAT AND AQUARIUM.

by F.F. Schmidt.

(Summary of a talk on the 23rd. Hendon Convention - 17th. April, 1982)

Asia, Africa, America, fatherland of our exotic aquariumfishes and plants. From all parts of the world aeroplanes bring boxes with plants and fishes to importers and petshops to meet our desire for exotic pets.

Sooner or later they are sold to some aquarist and they are bound to live the rest of their lives in captivity. Although the situation in the natural habitats mostly is far from ideal: Dry season, lack of food, predators and so on greatly endanger the lifes of the fishes, I think we have the obligation to treat the fishes and plants as well as we can and as close to the optimum as is possible within the limits of captivity.

In Holland about 90% of all fish and plants are kept in a so-called "furnished aquarium".

We could describe a furnished aquarium as a tank in which we combine plants and fishes from all parts of the world to an aesthetic total.

It will be clear that the accent in this type of aquarium is on aesthetics. That means is it nice to look at: Does the aquarium-exterior harmonize with the furniture and decoration of the room and is the composition of the aquarium-interior up to a certain standard.

From this point of view it is very seductive to select plants and fishes merely for their shapes and colours, but since we are dealing with live creatures this only can be one of the selection-criteria. Another and more important thing to consider is: Can we create an environment in which plants and fishes can live comfortably.

In nature fortunately in most habitats environmental circumstances vary greatly during the year. Temperatures and waterqualities can differ greatly between dry- and rainseason for instance.

To cope with these differences our plants and fishes must have a possibility of adjustment, that makes it easier for us to create an acceptable "home" for them.

Before turning to practice something must be said about water. Chemically pure water, H_2O if you like, does not exist in nature. It can only be found in a laboratory. In nature water is always mixed with other components: mineral salts are dissolved in it and when water containes only a bit of dissolved minerals we call it soft, when it contains many it is called hard. For aquaristic purposes the hardness is measured in degrees German hardness. 1 degree German hardness is equal to 10 milligrams of lime or 7.14 milligrams of magnesia dissolved per liter water.

The total amount of hardness depends greatly on the soil through which the water floats. In Amazonia the water floats through dilluvial soils, that do not emit many salts and so the water over there is very soft. In the Mexican Chihuawa-desert the soil is almost pure calcium, that dissolves very easily in water and the water in the oases over there is extremely hard.

But in all known waterqualities live fishes, even in seawater.

Another aspect of water is its acidity, which is measured in pH. The neutral point is 7. If pH is under 7, the water reacts acidic; if pH is over 7 the water is alcalic.

Since fishes are coldblooded animals, their activities depend greatly on the surrounding temperature. If the water is too cold for them, their activities will be on a very low level and their colours will only be faint. If the temperature is too high, activity will also be high, which may negatively affect the duration of their lifes.

As I said before, fortunately most fishes can cope with differences in waterquality and temperature as far as differences may happen in their natural habitats. By the way, this does not concern breeding. When we want our fishes to breed we must rather exactly create the environment of the spawning habitat. This point of view concerns only the keeping of plants and fishes in an aquarium.

For that purpose we can distinguish three different waterqualities: under 8 dGH and acidic;

between 8 and 12 dGH and neutral;

over 12 dGH and alcalic.

It is a matter of course that the behaviour of the fishes is also a reason for selection. Piranas or snakeheads cannot be kept in company of other smaller fishes: they will eat them. Sanddiggers, like many Cichlids will ruin the architecture of the aquarium completely. The same is valid for plant-eaters like the Scat or a Metynnis-species.

Selection of suitable plants is even more simple than fishes. Plants are generally not critical as far as temperature is concerned. There may however be a problem with regard to hardness and acidity of the water. Since plants need mineral salts, especially calcium, to build their bodies, they cannot grow in too soft water. Under 3 dGH plantgrowth is impossible. Most plants also do not like very hard water and in water over 20 dGH growth of most plants will come to a standstill.

A thing we must consider in the selection of plants is the usefullness of the plant.

Let us first look at the situation in nature! Many plants we use in the aquarium continuously submers, that is "under water", in nature grow emers, that is "outside the water". These plants grow on benches or other rather moist places and sometimes, in rainseason when the waterlevel is extremely high, it happens that they get temporarely under water.

It has turned out, that many of these, so-called "moor-plants" can be kept permanently under water, without harm for the plant. Only in most cases the looks of the plant in emers and submers form is completely different. So different that you don't recognize it.

Of course we use also plants in the aquarium that are real waterplants; that means plants that in nature too are always submers.

Most real waterplants have in their leaves special organs, called hydropotes, that means "waterdrinkers", which enable the plant to take in its food directly from the surrounding water. The roots are mostly only a means to settle in the bottom and have very little or nothing to do with the feeding of the plant.

As you will understand emers growing moorplants cannot take food from the surrounding air and therefore moorplants have no hydropotes and are unable to take in food through the leaves in the submers situation. They have to depend fully on the roots as the feeding organ.

That leads us to the conclusion, that genuine waterplants in the aquarium are far more useful than the moorplants. The waterplant acts as a natural filter and helps us to keep the aquariumwater pure. So it is rather important that a fair part of the aquariumplants is real waterplants.

In this respect in aquaristic circles the expression "biological balance" is often used. I dare say that in an aquarium a biological balance is absolutely impossible. Apart from the fact that in comparison to nature every aquarium is overpopulated, a number of other factors make a balance impossible.

A biological balance exists if the organic debris, like faecalia of the fishes, dead fishes, dead plants or parts of plants, is completely reduced by bacteria into anorganic salts, like nitrates, phosphates and sulphates, which in their turn are completely consumed by plants - that is also botanic plankton, say algae - which serve as food for the animals in the habitat. More abstractly said: Producents, reducents and consuments should balance.

One of the aids in nature to maintain a perfect balance is waterflow. In nearly every habitat is a continuous inflow of clean water from wells, rain, etc. and a continous outflow of more or less polluted water in the direction of the sea.

In the aquarium the situation is completely different. To keep our overpopulation alive we have to feed our fishes and that means that daily an extra dosis of organic waist is entered into the aquariumwater. Even if the bacteria in the aquarium and filtersystem succeed in reducing the overdose, it is absolutely impossible that the aquariumplants consume all anorganic salts, moreover since we do not allow any development of algae in the aquarium.

A good help in keeping the water as pure as possible under the circumstances is a regular change of a part (25 - 30%) of the aquariumwater by tapwater. In doing so we change the aquariumwater, polluted by plant-nutrients by relatively poor tapwater. Another help can be an adequate chemical filter system. Adequate means that pumpcapacity and quantity of the filtermass must be adapted to the aquarium involved.

Chemical filtersystem means, that the used filtermaterial should have the ability to adsorp nutrients. In aquariumfilters mostly activated coal is used for this purpose.

The best and most natural help however is the waterplant with its ability to take nutrients directly from the water. It will be clear that the faster a plant grows, the more nutrients are absorbed. So it is rather important to stimulate plantgrowth and that can only be done with light. Do not forget that the fluorescent tubes over the aquarium replace the tropical sunshine in the original habitat of the plant. It is a fact that even in the shadow in the tropics the amount of light is higher than we ever can imitate. So the more light you use, the better it is for the plant.

Often the story is heard, that algae in the aquarium are caused by light. This is only partly true. Algae are certainly not caused by light, but by waterpollution. Every hydrobiologist can tell what is wrong with the water if he looks at the algae by means of a microscope. It is true however, that the development of the algae is stimulated when the duration of lightning is too long. In the tropics the day lasts from six in the morning till six in the evening. That is the light-rhythm the tropical aquariumplant is adjusted to. That is the time it assimilates and grows. In our region the situation is different. In summer we have very long daylight-times, from about 4 o'clock in the morning until nine o'clock in the evening. In winter daylight is only about 6 hours. Non tropical plants have the ability to adjust to the summer-daytime and continuously assimilate and grow, no matter how long the day lasts.

The algae in a tropical aquarium are for over 90% non tropical, so if we have the lights on from early morning until bedtime, like many aquarists do, an algae problem will rise. Since the tropical plants cannot take in nutrients after about seven p.m. the algae take their chance and start growing during the evening.

What we should do is to give the aquarium as much light as possible to stimulate the growth of the tropical plants from about 7 a.m. until 7 p.m., that is the so called"grow-light".

In the evening from 7 o'clock the lights should be switched out, exept for one tube, the front one, which allowes you to observe plants and fishes, buth which is insufficient for any plantgrowth, including algae. This is the so-called "looking-light".

The colour of the light is not so very important. We know, that the blue and the red part of the spectrum are important for plantgrowth. Any fluorescent tube that produces enough red and bluo will do. The "warm-white de luxe"-tube for instance, is a good choice. Never use the "Gro-lux"-type tubes. These tubes produce only red and blue and the visual effect on the plants and fishes is very unnatural.

Now let us turn to the aesthetic aspects of the furnished aquarium. Of course it is impossible to give a complete recipe: Everyone has his own taste, but some general rules can be given. If you can see the wallpaper on the wall at the back of the aquarium, you accentuate that the aquarium is a very small and undeep unit. Cover the sides and the back with something dark. Black or darkbrown polyurethan foam is a good material. It is poisonfree and offers an opportunity for some plants, like Javafern of Javamoss to grow on. A very simple solution is to paint the outside of the aquarium in black. Of course there are many more possibilities: Cork, stones, and so on.

The bottom should not be too flat. Some differences in bottomlevel will improve the architecture of the aquarium. The so-called terraces can be made out of wood, stone, etc.

The character of the Dutch furnished aquarium is determined by the rather abundant use of plants. From the aesthetical point of view we can give some general rules:

Tiny plants should be used in the front; big plants in the back of the aquarium. There should be variation in colour and form. Plants should be used in groups. An exception hereupon is a so-called "solitary-plant", that is a big, attention-drawing plant, like a Lotus or an Anazone-swordplant, that can be used alone. In that case it should fulfill a real function in the aquarium-architecture. In other words it should be used on a spot, you want to draw attention to.

Red-coloured plants in fact should be used in the same way. They are quite popular nowadays: They are expensive and as practice has turned out, rather difficult to keep. In nature red plants only can be found on sunny places and the red colour is an extra pigmentation as protection against the enormous overdose of sunlight

No matter how much light we use over the aquarium, compared to the tropical sunlight it will always be insufficient for red plants and the result is that most red-coloured plants tend to green again after a relatively short period. Moreover, in the tropics like in our region, nature is green and a different coulloured plant is rare. That is also the way to use them: An attention drawing group on the best lighted spot.

There is also an aesthetical side in the choice of the fish population. Here too contrasts are important and that is why we select fishes contrasting in shape and colour. Fishes that live in shoals in their habitat should also be kept in groups in the aquarium. In nature every waterlayer has its own population. That means, that there are fishes at the surface of the water; other fishes can only be found in the middle regions and on the substrate you'll find the so called bottom-dwellers. This situation should be imitated in the aquarium. About 25% of the population should be surface-fishes; about 25% should consist of bottomdwellers and the rest, that is 50% are fishes that normally swim in the middle part of the water.

As I said before, fishes should contrast in shape and colour. For instance, Barbus nigrofasciatus and Barbus tetrazona are both soft-water fishes from Southeast Asia. From a biological point of view they can be combined very well, but since shape, colours and also behaviour of the two species are similar the aesthetical combination is not very good. One of the two species should be replaced, for instance by Hyphessobrycon erythrozonus of Hyphessobrycon ornatus. Another example is a combination of Rasbora caudimaculata and Micralestes interruptus. Biologically speaking not bad, but since both species are silvery and elongate, it is better to replace on of the species by, for instance, Glossolepis incisus.

A last question is: How many fishes can be kept in the aquarium? There is a very specific answer: In a well planted aquarium, one gram of fish can be kept in three litres of water, but since it is rather difficult to weigh your fishes and because no lists of weights exist in Great-Britain - as far as I know - I think it is better to use the rule of thumb that an average aquariumfish needs 10-15 litres of water.

In all my talks from the audience the remark comes, that the Dutch planted aquarium is unnatural. Of course it is, but I think, that every aquarium, planted or not, is unnatural. The planted aquarium at least is nice to look at and can be an ornament in your living room.

In the second part of this lecture we will see that an aquarium can be decorated in a completely different way. In the so-called "specialist-aquarium" it is tried to imitate the natural habitat as well as can be done.

Before we start this part, let us have one more look at planted aquaria.

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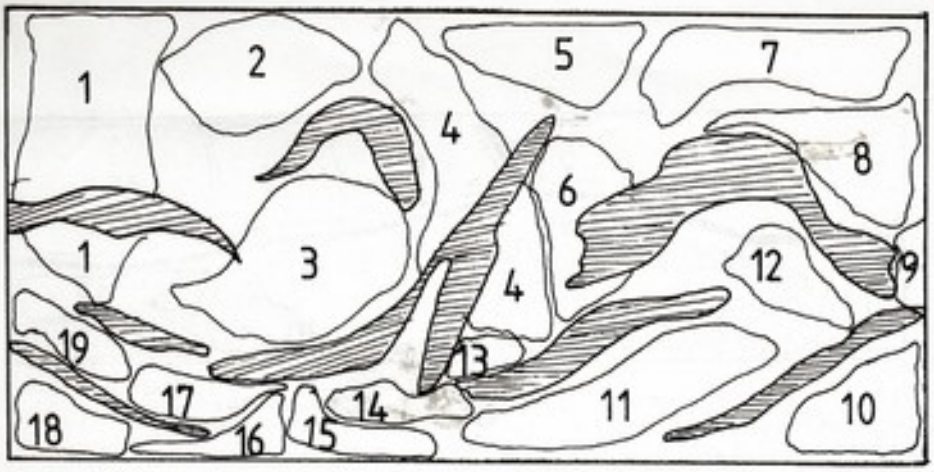

Sizes: 200 cm. length x 90 cm .deep x 70 cm. high.
Light: 575 Watt Fl.

Plants:
1. Limnophila aquatica
2. Rotala rotundifolia
3. Alternanthera rosaefolia
4. Hygrophila difformis
5. Vesicularia dubyana
6. Ammania gracilia
7. Ludwigia repens
8. Hygrophila stricta
9. Najas minor
10. Cryptocoryne beckettii
11. Saururus cernuus
12. Nymphea lotus (red)
13. Glyceria maxima
14. Micranthemun micranthemoides
15. Cryptocoryne petchii
16. Heteranthera zosterifolia
17. Lobelia cardinalis
18. Cryptocoryne wilissii
19. Valliseria spiralis var.torta

Fishes:
15 Aplocheilus lineatus
8 Micralestes interruptus
13 Hyphessobrycon erythrostigma
8 Barbus lineatus
7 Barbus pentazona
7 Barbus sp. "Odessa"
5 Otocinclus affinis
11 Botia sidthimuncki

Sizes: 195 cm. long x 55 cm. wide x 60 cm. high.
Decoration: Slate and wood.
Light: 390 Watt Fl.

Plants:

1. Rotala rotundifolia
2. Alternanthera lilacina
3. Hydrocotyle vulgaris
4. Hygrophila difformis
5. Cryptocoryne wendtii
6. Ludwigia repens
7. Heteranthera zosterifolia
8. Hygrophila corymbosa
9. Nymphea lotus (red)
10. Cryptocoryne willissii
11. Alternanthera rosaefolia
12. Vallisneria spiralis
13. Cryptocoryne petchii
14. Cryptocoryne walkeri

Fishes:

18 Cheirodon axelrodi
12 Hyphessobrycon ornatus
10 Nannostomus beckfordi
8 Hasemania marginata
9 Micralestes interruptus
8 Corydoras julii
8. Poecilia variatus
8 Thoracocharax securis

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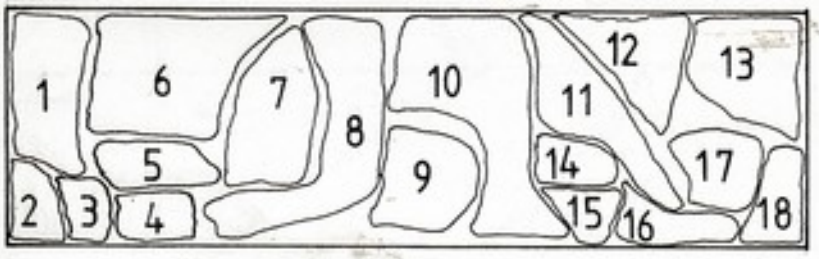

Sizes: 170 cm long x 50 cm wide x 45 cm high.
Light: 250 Watt Fl.

Plants:

1. Alternanthera lilacina
2. Vallisneria spiralis
3. Anubias nana
4. Cryptocoryne wendtii
5. Nymphea lotus (green)
6. Ludwigia repens
7. Heteranthera zosterifolia
8. Alternanthera rosaefolia
9. Cryptocoryne wendtii
10. Lobelia cardinalis
11. Nomaphila siamensis
12. Ludwigia glandulosa
13. Hygrophila difformis
14. Ammania gracilis
15. Cryptocoryne petchii
16. Hottonia inflata
17. Alternanthera lilacina
18. Potamogeton gayii

Fishes:

9 Rasbora heteromorpha
6. Acanthophthalmus kuhli
6 Petitiella georgiae
5 Megalamphodus sweglesi
10 Nematobrycon palmeri
8 Cheirodon axelrodi
2 Loricaria parva
5 Poecilia maculata
2 Otocinclus affinis
5 Trichogaster leeri

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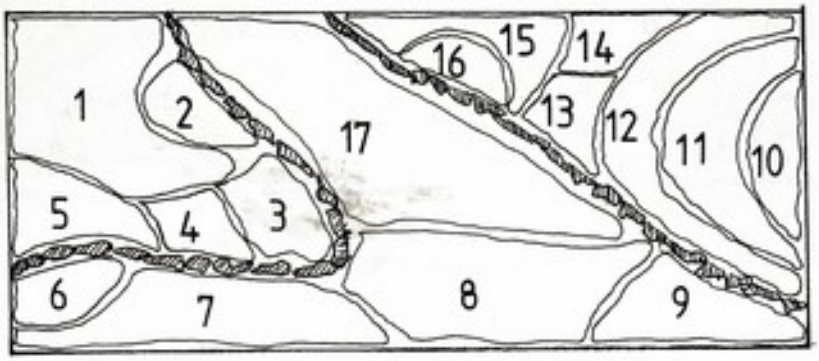

Sizes: 130 cm long x 55 cm wide x 45 cm high
Decoration: Lava-stones
Light: 240 Watt Fl.

Plants:

1. Hygrophila stricta
2. Nymphea lotus (red)
3. Rotala wallichii
4. Ludwigia repens
5. Vallisneria spiralis
6. Micranthemum micranthemoides
7. Sagittaria subulata f. pusilla
8. Saururus cernuus
9. Cryptocoryne balansae
10. Cabomba caroliniana
11. Alternanthera rosaefolia
12. Lobelia cardinalis
13. Myriophyllum matogrossense
14. Ludwigia repens
15. Bacopa amplexicaulis
16. Cryptocoryne blassii
17. Mayaca vandellii

Fishes:

10 Cheirodon axelrodi
6 Carnegiella strigata
6 Corydoras paleatus
5 Barbus oligolepis
6 Nematobrycon palmeri
10 Pyrrhulina filamentosa
8 Hyphessobrycon ornatus

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PART 2.

As was said in the first part of this lecture, about 90% of the Dutch aquarists are fans of the furnished aquarium. The remaining 10% however are true fish addicts and they try to do everything to offer their fishes the same environment as in nature. They keep a so-called "specialist-aquarium", which not only means that the aquarist considers himself to be a specialist, but far more refers to a certain specialism in the aquarium.

In fact two types of specialist-aquarium can be distinguished. One, specializing in keeping plants or fishes from specific genera. For instance a Cryptocoryne-tank, a catfish-aquarium or a Southeast Asian barb-aquarium.

Practice turns out that mostly this type of aquarium is rather dull, since plants or fishes from a specific genus mostly have a more or less similar appearance and behaviour. It may be very fascinating to the owner, studying the behaviour of maximally developed fishes, to watch them spawning, fighting courting, or whatever, but the interior decoration of such an aquarium does not make a "thing of beauty" in the drawing-room. It is better kept in a separate fish-house. Actually most aquaria I have seen in Great-Britain are this type and consequently are set up in separate rooms.

Far more attractive is the other type of specialist aquarium, that we could call "the habitat aquarium". It is an imitation of a specific habitat in nature and in it we try to attend to fishes and plants in a way similar to nature.

If we select an attractive habitat, an aquarium of this type can be beautiful and certainly deserves a place in our home.

It is not easy to set up an aquarium of this type. Much research is required to find out what fishes and what plants occur in the selected habitat. The same is valid for waterquality and temperature. But it can be done. Nowadays many aquarists travel to tropical countries for the purpose of catching fish, collecting plants . It is only rational to take chemicals or electronic meters to analyse watersamples and a thermometer to measure watertemperatures.

Since papers on conditions in tropical habitats nowadays are rather abundant in the hobby- as well as in scientific literature everybody can get the information needed for a habitat-aquarium. There is no need to venture a tropical trip yourself, although I can recommend a suchlike adventure.

In spite of all the information that is available it always will be impossible to make a perfect imitation of a habitat. That does not concern waterquality or temperature. When the tapwater has not the same quality as the water in the selected habitat we can alter it. We can make it softer by means of a ion-exchanger or make it harder by adding sodium-bicarbonate. We can make it more acid by filtering through peat or make it more alcalic bij filtering through marble or lime-stone. For temperature-control the petshop offers today rather advanced electronic devices, that even make it possible to effect a difference between day- and night temperature.

However it will be impossible to feed our fishes with the same food they find in the original habitat for the simple reason, that such food is not available over here. But there is not so much difference between tropical mosquito-larvae and the inland larvae; tropical daphnia and inland ones are very similar.

It is also nearly impossible to imitate dry-season and rainseason in the aquarium. Another difference - and a rather important one - is that we can not keep any predatory fish that may be present in the original habitat.

Within these limits a habitat-aquarium certainly is possible and it is a challenge to do it as well as possible.

One of the most popular types of specialist aquarium to day is a Discus-aquarium. Mostly it is a bare tank only containing water (I hope of the right quality) and one or two earthenware pots to give the animals a substrate to spawn. In an environment like that the animals can not be happy. Why not try to give an imitation of the real habitat.

Waterquality: Hardness under 5°GH;
pH 6.0 - 6.5
temperature 25 - 29° C
Electrical conductivity: 15-30 mS.

In a waterquality like this we can not use many waterplants. For most plants the water will be too soft and too acid. However we could try some Echinodorus-species like Echnidorus latifolius and Echinodorus cordifolius and perhaps Cabomba australis will stay alive as well. We should use a lot of wood in the decoration, since in the habitat we also find lots of dead branches an stems in the water and the Discus likes to hide under the wood for the sunshine. For the same purpose we use a floating plant like Eichhornia crassipes or Pistia stratiotes.

Discus is not the only occupant of the habitat. We find other attractive fishes in the same biotop. Of course it is impossible to keep in the same aquarium a predator like Cichla occelaris, but other fishes are certainly suited for our habitat-aquarium.

On the substrate we cought bottomdwellers like Corydoras-species and Agmus lyriformis. Also some other Cichlids were present as Uaru amphiacanthoides, Cichlasoma severum, Cichlasoma festivum and Pterophyllum altum. Characins were not absent: Anostomus trimaculatus, Chilodus punctatus and Hemiodopsis gracilis are very attractive fishes from the same habitat as the Discus.

To conclude a warning: The cardinaltetra, Cheirodon axelrodi is not found in the Discushabitat. One often sees this fish in a Discus-aquarium. It is wrong. Although the Cardinaltetra has a very similar habitat we should keep it in company of the Hatchetfish, Gasteropelecus sternicla, Anostomus anostomus and Corydoras-species.

Completely different is the habitat in the Central-American Lake Nicaragua:

Hardness 7 - 10°GH;
pH 8.5 - 8.7
Temperature 26-29°C;
Electrical conductivity: 300 nS.

Owing to the extremely high alcalinity of the water it is impossible to grow plants, so we only can decorate the aquarium with wood and stones. The area is very volcanic and we could use here lava-stone, but also whimstone can be used.

Apart from a predator like Lepisosteus tristoechus and

We have a rather good number of suitable aquariumplants like Anubias nana, Ammania senegalensis, Crinum natans, Nymphea lotus, Najas graminea and Bolbitis heudelotii.
Fishes: Synodontis nigriventis or Synodontis nummifer, Calamoichthys calabaricus, Micralestes interruptus, Ctenopoma maculata, Gnathonemus petersi and Pantodon buchholzi make a interesting population.

In South East Asia, the island of Sri Lanka is the country of many aquariumplants and fishes.
In the habitat of Singhira in South East Sri Lanka I measured the following waterquality

Hardness o.8°GH;
pH 5.5
temperature 27°C
Electrical conductivity 10 mS.

Plants: Aponogeton crispus
Limnophila aquatica
Nymphea lotus
Marsilia quadrifolia.

Fishes: Garra ceylonensis
Noemacheilus botia
Rasbora vaterifloru
Belontia signata
Danio aequipinnatus
Rasbora daniconius

For a change let us have a look at the paludarium in my living room, containing plants and fishes from Sri Lanka. Paludarium comes from the latin word "palud", which means bench of shore. As you can see it tries to give an imitation of the bench of the little brook in Singhira.

A paludarium is an ideal combination for the aquarist who is a botanist as well. Moreover it is possible to keep various small amphibians of reptiles in the land part. If the paludarium is big enough it even is possible to keep little birds in it. For instance humming birds in a Central-american paludarium.

To conclude this lecture I want to point out to you that a marine-aquarium also is a "specialist tank". But since techniques for a marine-tank are completely different, it takes another talk to explain that. So when we are looking

at some close-ups from marine life I want to use the opportunity to thank you for your attention and endurance. I sincerely hope that you will try to set up a Dutch furnished or specialist aquarium. Believe me it is not as difficult as you think. Even the Dutchmen know how to do it..

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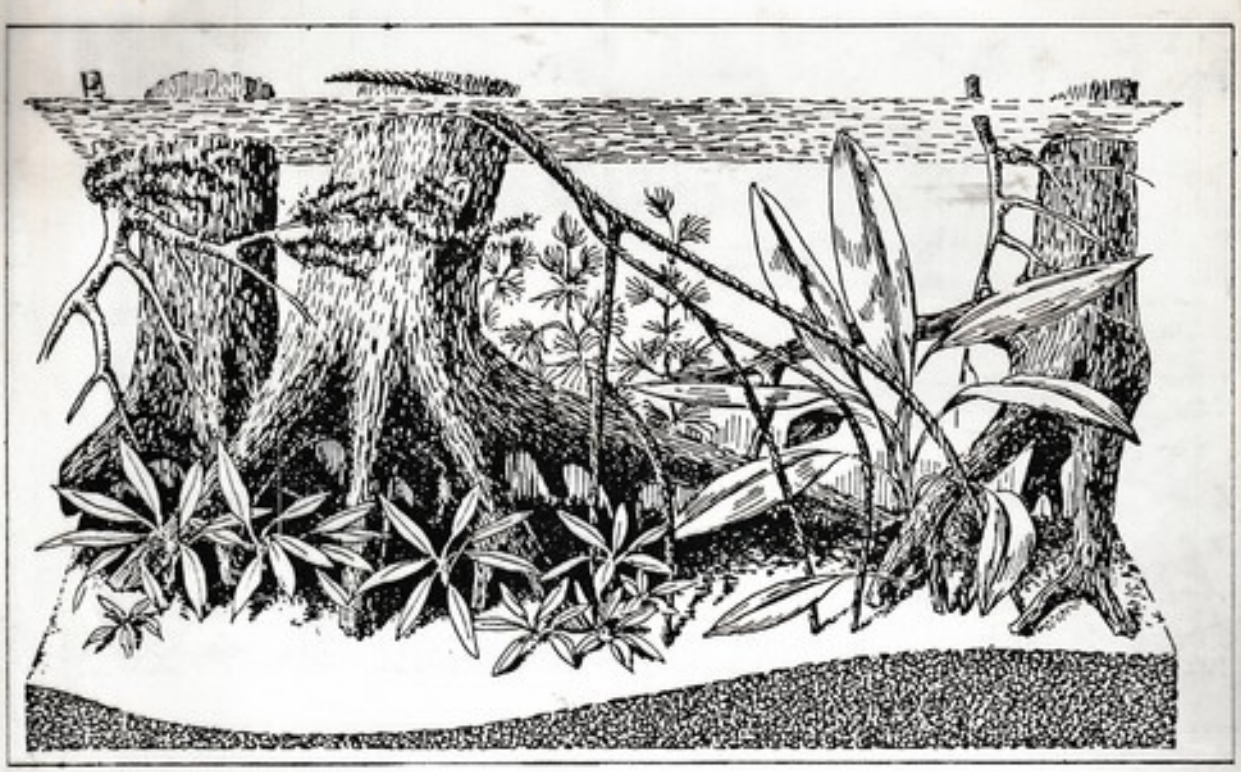
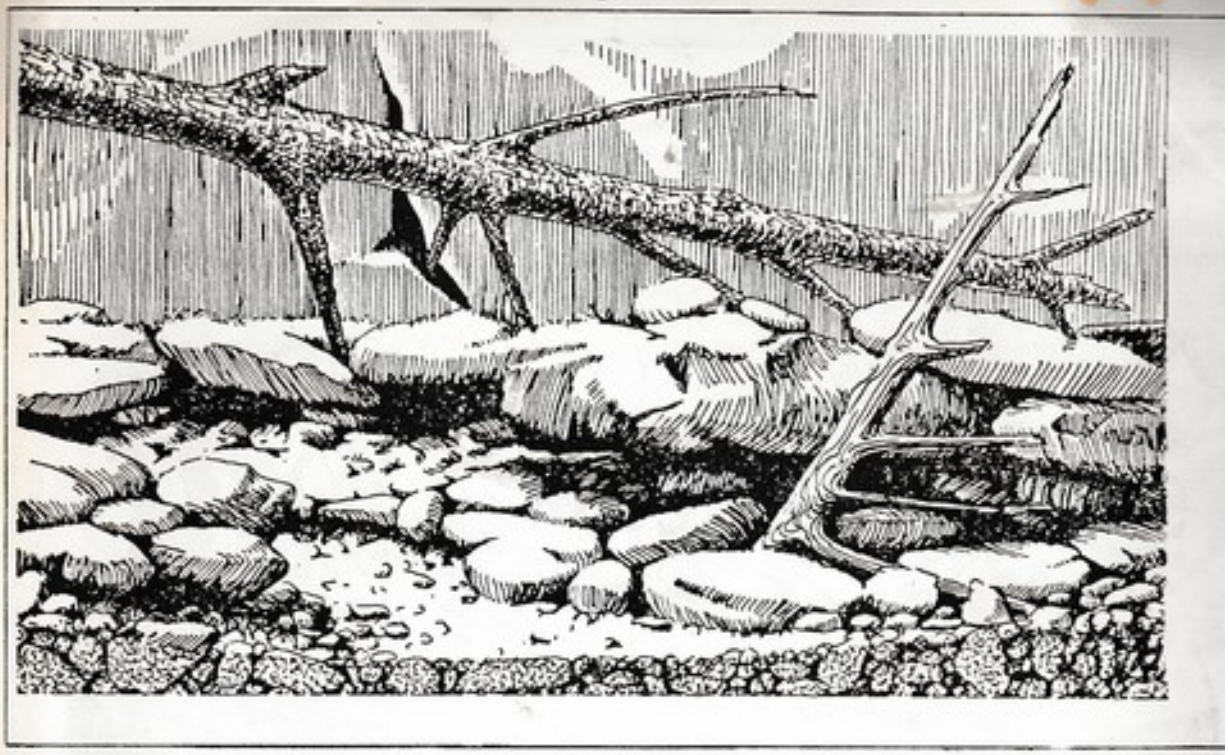


Discus-aquarium.

Lake Nicaragua - aquarium.

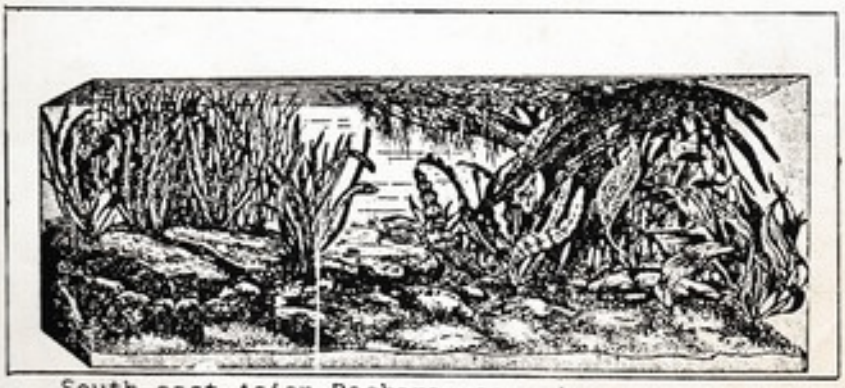


Tanganiyika - aquarium.

African jungle-type aquarium

Sri Lanka - aquarium

South-american Characin - aquarium



South-east Asian Rasbora -aquarium.