



Just one part of the hi-tech equipment that today is being used to create better, and new varieties of plants for the Hobby.

Tropica also made an innovation, in passing on to the aquarists much more detail about what was required to maintain the plants they sold. Needless to say serious hobbyists appreciated this kind of technical advice and help.

The next major milestone came a few years later, when a German aquarist by the name of Horst Kipper decided to create a company devoted to high technology in planted aquariums, as well as Reef Aquariums. This company is called Dupla Aquaristik., He had cooperated with a Kaspar Horst in the development, of several important new innovations, and this cooperation continued over the next 15 years or more.

Kaspar Horst had been a keen devotee of plants for aquariums, and has several important discoveries to his credit. These include the problem of iron deficiency, as well as the use and method of introduction of CO2 gas to the aquarium, in a practical manner. In 1976 he with others created a Plant register in Germany, and until 1981 edited a magazine for specialists called Aqua Planta. He went on many expeditions to Sri Lanka, Thailand, Malaysia, with devoted hobbyists and sometimes Horst Kipper, with whom he was on excellent terms. Together with Horst Kipper, they wrote a milestone book on planted aquariums called Das Perfekte Aquarium. 2

Horst Kipper, was a keen aquarist since early childhood. He met Kaspar Horst in 1966, and they cooperated together for several years. At that time Horst Kipper, was running a German Aquarium company which was subsequently taken over by Tetra. In 1977 Horst Kipper founded his own company Dupla Aquaristik in his home town of Melle, and Horst Kipper became a partner. It would seem that it is no coincidence that Melle is not only the home of Tetra, but also of many other famous names in the German Aquarium scene, even today. Anyway the Dupla company had an enormous success for several years, as their high quality and beautiful planted aquariums, and Reef Aquariums, which were shown worldwide at every important trade show, were the envy of the competition and rapidly had devotees in all the important countries.

However as Dupla did not produce plants, it made a strategic alliance with Tropica, with the result that in many countries where Dupla sold it's products, the same agent would also vend the Tropica plants. This cooperation was beneficial to both parties, as it ensured that high quality technology would be available to those dealers and hobbyists who wished to maintain long lived and beautiful planted aquariums. This cooperation led to the next major development in the history of Landscaped Aquariums. Regrettably in 2002 the company Dupla went into bankruptcy.

In Germany there was a major grower of aquarium plants called Dennerle. This company was probably the leading producer of Aquarium Plants in what was at the time West Germany. They began to feel a major impact and potential long term threat to their business by the alliance of Dupla & Tropica. Therefore in the early 80's Dennerle, began to create an alternative range of products to Dupla, and of course was then able to offer their customers, the advantage of plants and equipment all from the same source. The approach of Dupla and

Dennerle differs in some aspects of their suggested technological approach, but it not the purpose of this book, to make a decision for or against either method. Suffice it to say, that the major inputs such as CO2 systems, and lighting are not all that different from each other. Both companies have their devotees, just as we do in America, between the consumers of "Coke" or "Pepsi" and other similar competing brands.



One of the largest plant farms that serve the Hobby.

Dennerle not only offered a range of products as well as high quality plants, but began to offer schematics to their dealers and hobbyists, which showed how to plant in varying combinations to achieve a really spectacular effect. This made it possible for many whom may have lacked artistic skills to reproduce selected scenes with reasonable accuracy.

While Dupla entered the market first, and was initially very successful, later on they made many major marketing mistakes, by working with agents who were not reliable, and also by lack of follow through which is vital in a technology based group of products. This was probably accelerated when Horst Kipper, went to live in Australia, and to some extent lost the day to day control of his company.

Dennerle however, was very thorough in his marketing approach, and by the end of the 80's and early nineties, had an enormous market, not only in Germany and Europe, but also throughout most of the countries of Asia, such as Japan, Singapore, Taiwan, and many others. This tremendous success, led to the next major development.

Japan has a special interest in plants house and related subjects. These plants are ubiquitous in the tiny houses and apartments that predominate that country. Japanese housing is typically miniscule compared to US or European, and this minuteness, leads them to be especially creative in decoration to compensate. It is the Japanese after all that developed the art of Bonzai. Japan also had several stores which sold only aquarium plants, these shops do not sell fish. This was to the author an astonishing revelation, as nowhere else in the world had I come across such specialized stores. When in 1993 I visited two such stores in Tokyo, one could see immediately that they were doing very large dollar sales, and of course were selling a great many Dennerle, and Dupla products, as well as quite a number of Japanese made items.

In Japan, which was possibly after Germany Dennerle's largest market, a former professional cycling champion, and world class photographer, by the name of Takashi Amano watched carefully at the impact of Dennerle on the Japanese market. He also had an aquarium store in a small village near the town of Nigata on the North West coast of Japan. Amano decided that he could improve upon the offerings of both Dennerle and Dupla. Around 1994 he burst upon the Japanese scene, with a vengeance, having created not only a range of products which paralleled Dennerle/Dupla etc, but also came with a couple of very important innovations of his own which made the aquariums even more beautiful. He was able to promote his products, with tremendous success, above all because of his ability as a photographer was utilized to promote his range of products with brochures, a magazine, books and more, to a degree and quality which competitors could not match.

Amano also brought to the hobby, an exceptional capability in terms of artistic landscaping of the plants. Neither Dennerle nor Dupla could compare to the aesthetic beauty of his creations, nor his publications,3

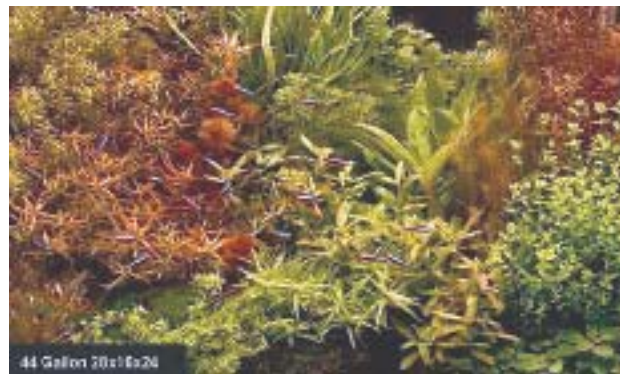
commune with nature, as it gives them a real opportunity to have the satisfaction of making something grow, which has been part of mankind's experience, for several millennia.



This stunning Aquarium won the best in show. L.Navarro photo

In fact it is only in this nearly departed century, that humanity has left his roots in the earth and created an artificial existence. Landscaped Aquariums can at least in a small but important way recreate that natural urge to plant and grow as was done by the vast majority of our antecedents.

Finally there is the challenge, to learn and master the technical challenges which have so inspired tens of thousands of aquarists who today maintain Reef aquariums. The Landscaped Aquarium also has it's own set of rules which must be mastered in order to succeed. When this is done, the reward is at least as beautiful as a Reef aquarium, and the satisfaction and pleasure not a jot less. Success will be no accident, and will come to those who have mastered the criteria.



An example of dramatic use of color contrasting

What factors must be taken into account to create a Landscaped Aquarium?

The following are the principal parameters that are essential if the hobbyist is to succeed in their endeavor.

Water quality. Lighting, The Substrate. A functioning CO2 system, with all its accessories. Fertilization. Algae control. Filtration. Heating. The selection of plants according the desired Biotope to be created. The selection of suitable fish.

Each of these topics, will be dealt with in detail in subsequent chapters, but it should be stressed at this point, that all the topics must harmonize, and be paid close attention to. Just as a chain will break at its weakest link, so will a planted aquarium break down, if any aspect of the environmental requirements of the Landscape are seriously neglected.

It is the purpose of this book, not only to show the technical inputs needed and the how-to and why, with

each technical input, but we will constantly strive to elucidate the relationship of each input to the other techniques that are required.

Because your Aquarium will be heavy, it should be placed on whatever stand you use, with a half inch layer of polystyrene board to ensure that the weight is evenly distributed and avoid any risk of breaking the glass. It is best to whenever possible to site the aquarium away from direct sunlight, so as to reduce the risk of algal buildup, and enable one to totally control your lighting

It should be pointed out at this stage, that a good Landscaped Aquarium will cost a fair amount of money. However the pleasure of the finished product, by common acclaim more than repays the outlay, and the cost thereafter in maintenance is relatively small, and can if the hobbyist wishes, as we have said, be substantially defrayed, by selling the excess plants to their local store.



It is necessary to trim fast growing plants, this kit makes it easy.

practical in an aquarium), we term these salts the Temporary Hardness. Those salts which remain after boiling, such as Calcium sulfate and others, are termed the Permanent Hardness.

The GH or Total Hardness is comprised of the sum of the Temporary Hardness + the Permanent Hardness.

Therefore we should be aware that Calcium and Magnesium can also combine with sulfur, nitrogen, and chlorine, to form sulfates, nitrates, and chloride salts, to constitute varying amounts, according to geography, of the total hardness of GH.

These latter salts are highly soluble and combined account for what is termed the permanent hardness. There are also a few other minerals that can form salts which comprise the GH, these others are most commonly Barium and Strontium, though from time to time there can be a few others. To all intents and purposes, the principal salts we have to concern ourselves with are Calcium and Magnesium.

It will now be apparent to the reader, that the KH will always be, either lower than the GH, or in a few and rare cases almost equal to it. This latter is where nearly all the hardness is only in the form of carbonate salts, which can be removed as we said by boiling. The writer has seen natural waters where the KH was 80% of the GH value, but never where it was 100%.

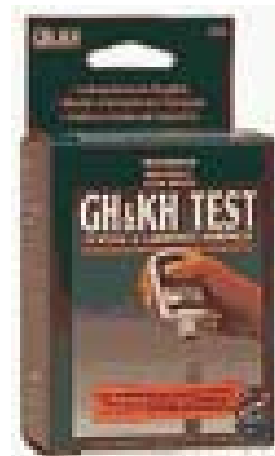
It is also vital when considering the question of hardness, to pay close attention to the type of gravel (substrate) you will select. (See further on the chapter on gravel and substrate).

However the reduction of hardness is somewhat complex. We can take a couple of different approaches to the preparation of suitable water for a planted aquarium, if it is too hard.

One method to reduce any excessive hardness after ascertaining the characteristics of your tap water, is by purchasing distilled water from a vendor. Garages, and several other outlets are available that can supply you with such. Most potable water vendors also offer a fully distilled quality. Of course you must ascertain that the reduction of the hardness will by "cutting it" in a straight line reduction, arrive at the ratio needed of GH to KH as shown above.

If for example the GH hardness was 15, and the Carbonate hardness was 10, then by adding distilled water to the tap water in the ratio of 2 parts distilled to one part tap water, would produce water with a GH of 5, and a KH of 3. This would be close to an ideal value.

Should however the GH be much higher than the KH, so that by obtaining a GH by dilution of the correct number of degrees, but now the KH would be too low, we must adopt another technique. We can supplement the KH by the addition of a suitable amount of baking powder added judiciously until the KH level is at the desired value.



Make sure you check both KH and GH with a good liquid titration yesy kit like this one, by Aquarium Pharmaceuticals.

It can also happen that one would obtain a value of GH and KH so that the relationship is of the KH as a percentage will be too high. When one would dilute the water with distilled or R.O. water to arrive at say 8 GH,

the KH would be for example 7KH. This would be higher than desirable. To overcome this we can increase the Permanent Hardness of the water, by the addition of some salt (it must be non iodized or one should by some of the mixes sold in aquarium stores for African Cichlids). One could increase the GH before dilution, or more easily afterwards. In both cases, one must use and record carefully measurements with a good quality hardness kit.

In any of these scenarios the amount of either chemical you will need to add is dependent on the obtained values of your KH and GH, and of course the size of your tank. It is difficult to give a precise formula for these additions, as each water will vary in some way. However I prefer to make up a solution of either additive at a concentration of 50grams/litre, and add some 2-3 ml, to a tank of 50 gals. Wait for half an hour and measure again, repeating same until the desired values are reached.

Another method of "softening" your tap water is to use a deionization cartridge. This will take various ions out of water, using an exchange method. In Germany they use a double reactor system, often called "Kati" and "Ani". This is because the two reactors act differently. One exchanges Cations, or metallic salts, which "subtract" typically Calcium and Magnesium for Sodium, whilst the other removes Anions usually sulfates, nitrates etc replacing them with Chlorides. If you have an excellent knowledge of chemistry, and ensure that you ask all the right questions and obtain the precise modus operandi of the resin beds, this may work for you. Too often it makes a water quality that is unsuitable go from bad to terrible, and for the average Aquarist I do not recommend it. They also tend to be relatively expensive. One mixed bed model available in Aquarium Stores claim usually about 150 gallon of treatment, but most people I have spoken with say it treats far less than that.

As the replacement of evaporated water, as well as periodic water changes is needed, to maintain your Landscaped Aquarium, I feel there are better alternatives.

Possibly the best way is to use a Reverse Osmosis unit. Many types are now available, and these remove almost all dissolved solids from your water. The price depends on the amount of water the unit will treat in a 24-hour period. It is not necessary to purchase a unit that gives you the throughput equal to the size of your aquarium. When beginning, you can "save" the water treated until you have the right amount, and then dilute your tap water to make up the required hardness values.



In many parts of the country hard water can make plant culture difficult. R.O. systems like these make it easy to "cut" the water to the desirable level of hardness.

In a most popular 55-gallon size tank, a Reverse Osmosis unit capable of producing as little as 5 gallons a day will be adequate. You may have to dilute your tap water by a factor of say two to one. Then by running and saving the output of the unit for about 7 days, you will have sufficient R.O. water.

As we will see later in the Chapter on Carbon Dioxide addition, there is a complex relationship between the carbonate hardness, the amount of CO2 and the pH value. Therefore it is necessary to be aware for optimum results a pH value of 6.8 –7.1 is in most cases the best. This is the ideal range for a typical assortment of plants that will be utilized by most hobbyists. Those Hobbyists that wish to have a Landscaped Aquarium with Discus fish as their major attraction, often decide to keep a pH value lower than 6.8. This is of course possible, but will limit to some extent, the variety of plants which one can keep successfully in such Aquaria, and can also have some potential other problems with heavy metal toxicity. It is also IMPORTANT to note, that if your KH value is less than 3 KH, then it can be dangerous to add CO2 to the Aquarium, as there will not be adequate buffering capacity in the water, to avoid the possibility of causing a dramatic and sudden drop in the pH value. Should this be the case ensure you increase the KH by addition of some CaCO3 (calcium carbonate).

**Heavy metal toxicity**, is far more common than many of us may expect. This especially so, as we expect our local water boards to protect us against levels of contaminants, that could affect our health. Copper, Lead, and others however are often present, in amounts that may be life threatening to our fish and plants.

You can make a simple test that may help you to visualize the problems that can be encountered. Most houses have copper pipe which bring the hot and sometimes the cold water to the faucet. Most waters will interact with the copper and this will augment the dissolved copper, often to the level that can kill sensitive fish like Tetras very easily. Try testing with a reliable Copper Test Kit, the first water from your tap, early in the morning, when it has been lying overnight with no movement. Then test it again after running the water for a few minutes. We have observed differences of Copper levels from as little as 0.01 ppm(mg/L), to as high .3 ppm(mg/L) . It is a fact that levels above 0.1 ppm, can have an adverse effect on fish, and levels much above this will also effectively impact not only the fish but also many plants.

Should you observe this phenomena then it is incumbent to remember to run the water, when making water changes, or top ups, for a few minutes before taking the water one needs. This will bring the copper level to its background level, which in most cases will not be a problem. We have seen aquarists, not aware of this, take healthy Neons, Catfish and others, from a store, introduce the fish to their new tank, (no plants present), and within a few minutes all were dead. It was eventually found out that the house was in a new housing estate, and the Copper pipes were new. Over time the copper pipes become less active as chemical reactions take place, but the potential for trouble never goes away completely.

Of course Copper is not the only heavy metal that can be present and cause toxic effects. Others are Cadmium, Chromium, Lead, Mercury, Nickel, Zinc, and more. The levels of these can often vary according to the time of year, drought, and other factors. It is not possible for the average Hobbyist to constantly monitor all these elements, and measure them to the levels that are required. It is much simpler, to use nature, to detoxify any excess levels by using plants, and adding humic factors to the water.

Although it is a fact that in nature most of our plants grow in a slightly acid and rather soft water, it is important to be aware, that the more acidic, and softer the water, the greater the potential for heavy metal toxicity. Harder waters and higher pH have usually more Calcium, and this tends to compete with the heavy metals for uptake, in a way that makes it less of a danger. It is therefore most important that the Discus fish lovers among you, who typically keep their pH and hardness values at a lower than average level, to be especially vigilant, in taking steps to ensure that these toxicities do not become a problem.

The oxygen that live plants emit during daylight hours, is beneficial to the fish, and helps under the right conditions, to keep the aquarium clear, as well as pathogen free. This occurs because oxygen can help reduce heavy metals, as well as providing the needed environment which assists in the growth of beneficial organisms, on the roots of the plants. It also assists in the uptake of other elements vital to the plants physiology.

The Nitrogen cycle is a part of our world Ecosystem. For many years it has been known, that the excretory products of fish, in the form of Ammonia (NH3/NH4) are converted by an active filter bed, by nitrifying bacteria to Nitrite(NO2), and then further converted by another group of bacteria to relatively harmless Nitrate (NO3). Unless this process is active in an aquarium, then fish will die from a combination of Ammonia and Nitrite poisoning. In a planted Aquarium however it has been found that the plants have a preference for the ammonium ion (NH4). This preference can also help to ensure that the typical ‘new tank syndrome’, does

not occur. New Tank syndrome is almost always caused by inadequate bacterial biomass, which is unable to handle the newly introduced excretions of the fish, plants by taking up the Ammonium ion, greatly help to ensure that this does not occur.

Some of you reading this book, may be fortunate in having tap water that fits the hardness and other specifications above. Those areas of the U.S. that tend to have water that is near the preferred values, are for the most part on the Eastern seaboard, also the Pacific Northwest. Regrettably in most of the rest of the country the majority of you, will find their tap water is much harder than the ideal. Often it will also have added chlorine and more, which the bodies charged with supplying us household potable water, deem fit to add. These additives are also made even when the water is suitable for our plants so pay attention. It is astonishing to the writer that Chlorine is added ubiquitously, yet it is a well known carcinogen. It would appear sometimes as if we all have a death wish, as there are other alternatives, which can be adopted to ensure the safety of our water supply. As well as Chlorine in some states, Chloramine is also added to the municipal supply as well in some areas Fluorine.

The well being that plants bring to the fish in the aquarium is anything but theoretical. The writer had tried for many years without success to breed the Harlequin fish *Rasbora herteromorpha*, as well as the Cardinal Tetra *Paracheirodon axelrodi*. We have a very large personal tank in our home, some 220 gallon capacity. Into this very large numbers of plants which were in excess in the nursery were placed. Very little attention was given to the fishes, other than to feed them about 5 times a week. One day we suddenly observed very tiny fry swimming around the tank, and these turned out some of both species. We are convinced that the fish reproduced only because of the many complex factors in the water, which created a Biotope that was so conducive to their well being that they reproduced and in fact continue to do so. The amazing thing is that reasonable numbers survive and grow even though we added no special fry foods.

**Water changes and evaporative make up.**

The water which evaporates each day from the aquarium, needs to be replaced. It should be noted that this water contains no minerals, thus any replacement water needs to be ONLY distilled or R.O water. As the rate of evaporation is usually constant, the top up water can easily be made, by adding some simple type of drip feed over the rear of the tank. There are several automatic units for adding solutions to Reef tanks, that are on the market, and any of these could also be used.

Methods of softening water for the Aquarium Hobbyist		
	For	Against
Dilute with distilled water	Easy to use, distilled water readily available. Not too expensive for smaller tanks.	Means constant ongoing purchases.
Demineralize with ion exchange resins	Can arrive at precise values required, good units will last a long time, and show when resin bed needs replacing	Chemistry is not easy to understand for the average aquarist. Because water quality differs all over the country, no one type of unit will suit all needs. Cost is not too high if one finds right unit.
Use R.O. unit. (Editors choice)	Can be used constantly for water changes, and original water. Quality with good units is very high.	An initial capital cost is involved, and a smaller membrane replacement cost. Needs to be plumbed into your system.

As water “ages” due to the complex biological activity in the aquarium, it becomes somewhat polluted. Therefore once a week about 20% of the water should be exchanged. This will make a spectacular difference to the health of your plants, also the fish. The new water should obviously be prepared in the same manner as your original water, as in this instance, you will siphon away water containing a percentage of minerals. Remember