The Mud Pond ALTERNATIVE

Thought provoking ideas from the UK

WRITTEN BY **MIKE SNADEN**
PHOTOGRAPHS COURTESY OF **MIKE SNADEN**

Do not fall into the trap of thinking that Nishikigoi are simply a coloured **sub-species of the carp** you find in lakes close to your home.

Most people start out keeping Koi because of their fascination with these beautiful creatures and because of the relaxing effect that they have upon our frame of mind. However much we intend to keep the hobby 'low key', we inevitably find ourselves a few years down the track obsessed with the wellbeing of our Koi and with the visible condition of the water in which they reside. In our striving for perfection, we inevitably buy just about every conceivable piece of equipment that is 'Guaranteed to revolutionise Koi Keeping!' Of course, by now, we are testing ammonia, nitrite, nitrate, and perhaps dissolved oxygen on a daily basis. In addition to this, we are also throwing in liberal amounts of the 'Highly Recommended' mineral additives, and feeding the most expensive food available, because after all you get what you pay for, right!? Well, maybe not.

It is quite possible, that despite your best efforts, state of the art robot feeders, and heating systems, your Koi seem to run through the same 'usable lifespan' before you move them on to 'good loving homes'. What perhaps is happening is that your Koi run through the same scenario each time. You buy it as Nisai and it looks lovely. As Sansai, it has grown a whole 5cm/2in, bulked up beautifully, and coloured up to the most vivid red you could ever imagine. You give yourself a pat on the back! A year later, the same Koi is maybe 3-4cm/1-1.5in longer, and obese, but the Beni is now a hard red, and starting to break up. The Koi is also starting to develop Shimis, and a little Hikui. You console yourself by knowing that you did your best with your 'State Of The Art' pond. You put it down to the fact that you cannot buy the level of Koi that your wonderful pond deserves and move the Koi on. Perhaps you also rush out and buy a new piece of equipment that is 'guaranteed' to stop this happening in the future?

The above scenario happens all too often in this hobby, and the sad part is, that no matter what happens, there is always someone who will come to the rescue, to sell you something new.

CONSIDER ANOTHER PERSPECTIVE

If the scenario above seems all too familiar to you, please, take the time to think about how things are in Japan, the 'home' of Nishikigoi. Do not fall into the trap of thinking that Nishikigoi are simply a coloured sub-species of the carp you find in lakes close to your home. Koi are far different from this! It is of prime importance that you think long and hard about where Koi come from, and then to re-evaluate the environment that you have yourself created for your own Koi.

There are many factors involved when it comes to Koi. The biggest bottleneck is genetics. Genetics are the key in determining what any Koi is capable of becoming.

Koi such as this Kohaku have a huge future ahead of them. Raising Koi like this one takes an immense amount of skill and dedication.

The Koi's environment then dictates whether the Koi will become what it is potentially capable of becoming. This does not mean that if a Koi is not genetically capable of becoming a 'World Class Jumbo', you should not bother with it… far from it! A lesser Koi will also benefit greatly from a habitat close to that of Japan, so do not think that just because your Koi are not capable of becoming the aforesaid 'World Class Jumbo', that you should not bother trying to get the most from them anyway.

A Koi keeping nation will generally have a similar climate, with similar water chemistry. As such, we have a tendency to judge our success by that of our neighbours. If we look at the way the Japanese and other Asian countries can raise Koi, it should help us to realise that we should be able to get more success from our Koi. The reason that Asian countries get better results with growing Koi to their potential is not because they are simply buying better Koi!

THE JAPANESE WAY

It is extremely important that we first understand the way the Japanese raise Koi. This is the key to understanding our shortfalls. Firstly, if you have visited Japan, did you examine the various Koi breeders' ponds that you saw and compare them to your own pond back home? If the answer is yes, then it is most likely that you concluded that your own pond was better than the ponds of the breeders. If this is the case, then you missed the point of just what the purpose of a breeder's pond really is. You see, nearly every breeder uses their indoor concrete ponds simply to keep the Koi alive during the winter months. We will come back to this later.

Through many generations, the Japanese have bred and grown Koi. No hobbyist can learn about Koi more quickly than a breeder learns about Koi. This is because of the numbers of Koi raised, year after year. By tradition, breeders grow their Koi in mud ponds. They usually place the fish in the ponds in late April or early May, and leave them there to grow until October or November. Contrary to popular belief, water in Japan is incredibly soft because the soil in Japan is nearly devoid of minerals. In Niigata, farmers generally only grow rice, because only rice will grow! This makes farming extremely tough, as is often reported in the newspapers and on television.

The soft water is extremely good for Koi. In the spring, the breeders put their 'Tategoi' into the mud pond. From this point on, the Koi grow rapidly, but unfortunately, it is not quite as simple as that, for a mud pond is fraught with risk. Since the soil is so lacking in minerals, the water in the mud ponds is incredibly soft, with pH levels usually somewhere between 6.5 and 7, and TDS levels often as low as 35 ppm, which gives you an indication of just how soft the water really is (we'll cover TDS later).

The months of May and June are generally good for growing Koi in the mud ponds. The warm water and fair weather combine to allow breeders to feed the fish consistently. However, July brings the rainy season.

Consider a Koi's pigment cells as being **a living creature** in its own right, somewhat **like coral or an anemone.**

This is a particularly worrying time for the breeder, as the water in the mud ponds has virtually no stability at all, and the rain that falls over most of this two or three weeks is acidic. During the rainy season, breeders can often be seen throwing sack upon sack of crushed shells into the pond in a desperate effort to stop the pH falling too low.

After the rainy season is over, the real Japanese summer begins around the end of July. Once the water is back in good condition, breeders feed their Koi heavily. This is when the Koi really start to grow well. August and September are the best growing months of all, and this is due in part to the Koi's food no longer powering egg production. Even this part of the season is not as simple as it seems. Although the water temperatures often run at around 32C/89F, there can be periods when the temperatures exceed this, and hence, when the water becomes too hot. This is very dangerous for the Koi, so the breeders suspend feeding the Koi until the water temperature moderates and it is safe again.

The mud pond has a lot to offer on the other hand, in terms of supplemental food in the form of insects, bugs, and algae. Another advantage of having a mud pond is that, because of sheer volume, the water/fish ratio is so high that the pH is often lower than in a concrete filtered pond. This has a benefit for the colour pigment cells of the Koi.

WATERS EFFECT ON COLOUR

Consider a Koi's pigment cells as being a living creature in its own right, somewhat like a coral or anemone. In good water (mud pond), the pigment cells stand up, and flourish. The colour becomes soft, but of a condition with great Teri (lustre), and Tsuya (shine). As far as lustre is concerned, I generally explain this to people as being a fine, 'high resolution' colour. After harvest when the Koi return to the harder water of the concrete pond with its higher pH, the pigment cells try to create a protective barrier, seemingly by lying flat like a trampled lawn. This makes the Koi initially look redder, which is generally more appealing for the Koi Show. During the winter months, the effect of Teri damage generally becomes more obvious.

The reason I previously described the breeders indoor ponds as being 'Life support systems', is that these ponds are just that! The Koi housed in them during the winter exhibit a slow but certain deterioration in condition. Most often, these Koi will not see a single pellet of food from the time of their harvest in the autumn until the time of their return to the mud ponds the following spring. Any damage to the Koi's condition that occurs over winter quickly heals in the mud ponds the following summer, which is why the breeders show little concern over this.

The benefit of the mud pond does not lie solely in the lower pH however, and in this respect, I really feel that Koi are far from stupid! They know what is good for them. At least they know what feels good. Mud ponds are far from 'crystal clear'. Their water is usually very green, or sometimes a grey/green. This water offers the Koi a form of shading. This is where the best benefit comes into play! In the hot summer months, the duration and intensity of sunlight can be extreme for the Koi. This is why in the hotter months the breeders generally feed their Koi twice daily.

You see, in the morning, the sun is not so strong, and the temperatures will not be so hot. Therefore, the Koi will be up near the surface, and very eager to feed. However, in the height of the day, the Sun becomes extremely intense, and with elevated water temperatures. At this time of day, the Koi will go down into deeper water, using the turbidity to shade them. Towards the end of the day, when the sun becomes less intense, the Koi come up higher in the water again enjoying the remaining light, and are eager to feed.

This is where I feel that Koi are so clever. Koi in the mud pond seldom suffer from colour damage due to excessive exposure to the sun. However, if the water in the mud pond were clear, this

A Japanese mudpond, water doesn't come much softer than this. 36 ppm is the TDS reading, so it stands to reason that with the KH, GH, and all other ions totalling this figure, the water clearly has very little of anything dissolved in it.

A Reverse Osmosis plant can be an extremely useful piece of equipment for reducing water hardness to whatever level you have the desire to run.

would not be the case. Have you noticed that if you swim in a pool on a sunny day, you will feel cool when in the water, but later on, you will find that you have a bad case of sunburn? Koi know what is comfortable. In turbid water, they will use the murky depths to avoid over exposure. The other beauty of Koi having such water is that on days with lesser amounts of sunlight, they will tend to be near the surface more. In short, the Koi choose to moderate how much 'suntan' they get on a daily basis, and this in turn helps their colour quality no end!

STATE OF THE ART PH

Keeping in mind the benefits of the mud pond, let us look back at our wonderful 'State of the Art' Koi pond. If the mud pond scenario makes sense to you, then you will now start to see many obstacles within our own ponds. Bear in mind that in the case of the breeder, any damage he causes in his filtered ponds quickly heals in the mud pond during the following summer. Whereas in our own pond, once the Koi is in there, it stays there until we ruin it. We do not have a mud pond!

Problem number one with our 'State of the Art' pond is that the pH will most likely run higher than 7.5. A pH of 7.5 is tolerable long term, although not ideal if you wish to make a Koi peak later in life when you have grown it to jumbo size with the intention of winning your National Koi Show. In this respect, I think that a pH of 7.0 to 7.3 is far more desirable. A pH of 7.8 or more is simply no good at all. It will usually result in 'high-end' Gosanke passing their best within a few years of going into the pond.

FILTERING DOWN FILTRATION

The next issue is filtration. We spend so much money in this department, but there are still major downfalls that most of us make. First downfall lies in the turnover rate of the pond. It is generally accepted that a once every two to three hour turnover rate is ideal. Personally, I think that the slowest turnover you should choose if you want the best from your Koi is once per hour. There are a number of reasons for this. The main reason being that although Koi are robust, their colour condition is delicate. A pond with a once every two or three hour turnover rate will have fluctuations in the ambient ammonia and nitrite levels in the water. A faster turnover rate reduces these levels much more quickly. Another reason for using a faster turnover rate is controlling the many strains of bacteria that thrive in the pond environment. Many of these have a positive effect on the Koi, and as such, if we have effective filtration, we can make the pond become more 'alive' with these bacteria.

The downside to having a once every hour turnover rate is that you cannot simply pump your water through your filters faster. The Japanese generally work on an 8-10m/26-32ft rule. What this means, is that in order to get 'complete' filtration, including effective carbon dioxide and nitrate removal, your water should pass through your filters at a rate of between 8-10m/26-32ft per hour. In short, if you have a filter bay of 1m x 1m/3.3ft x 3.3ft, with the water rising upwards through it, then you should have a flow rate

Imagine a sand filter as being **a huge teabag.** The fish waste trapped and held in this type of filter **acts much as tea leaves** in a teabag.

of 8,000-10,000 litres/hr or 2,100-2,641 US gallons/hr. But, if you were using this filter bay (and you would probably have two or three of these bays in series) to filter a pond at a once per hour turnover, then the pond would be 8,000-10,000 litre/2,100-2,641 US gallon capacity, with a filter taking up a 3m x 1m/9.8ft x 3.3ft footprint, a prohibitively large space! Having designed ponds using filters following this principal, I have to say, it certainly seems to work well.

TEA TIME

Our next problem with the high tech pond is the use of sand filters, or pressure filters. Imagine a sand filter as being a huge teabag. The fish waste trapped and held in this type of filter acts much as tealeaves in a teabag. All of the pond's water flows through it causing the trapped waste to dissolve into the water.

One of the benefits of selling Koi is that I get to see so many ponds, and see how the fish develop in each. This brings up the case of 'Bob.' My friend Bob lives in Wales. He takes great pride in his water and his Koi. For several years, I argued with him that he should remove his sand filters. Bob was always pleased with his Koi, but to me, they always lacked shine, and seemed to suffer from Shimis and Hikui. Going back last year, Bob expressed his disappointment in a Kohaku that he had bought from me some three years earlier. I told Bob his filtration system caused this and that if he trusted me and removed his sand filters, I would sell him a Kohaku that I had at a loss. He duly did so and took the Kohaku. This Koi was this year's Grand Champion at the Welsh Show, and Bob admitted to me that all of his Koi are now in much better condition.

Our quest for crystal-clear water whilst pleasing for us, it is far less so for the Koi. Look back to the mud pond scenario for clues on this one! With a filtered pond, we try our best to shade the pond according to what we feel appropriate for the Koi. However, this is, at best, a very hit and miss thing to do. In water that is crystal-clear, it is better to leave the pond open to morning sun, and shade it from afternoon sun. This is because the morning sun is less harmful to the Koi, as the ambient temperature is lower, and this sun will not affect the pond temperature very much. However, the ambient temperature in the afternoon is much higher and the sun will cause more of a temperature fluctuation and be more harmful than direct morning sun. The pitfall of this is that we do not actually know how much sun the Koi need, only the Koi knows! If we shade too little, the Koi's colour becomes too red, and eventually breaks up. Too little sun causes the colour to become to pale and thin particularly in the Fukurin (skin between each scale). The biggest problem though, is that even if we get it just right, what happens on the cloudy days? Simple, the Koi do not get enough light at all!

To my mind, it is far better to run the pond with a little turbidity, or let it go green (so long as you can do so without the pH running too high). In this instance, the decision passes back to the Koi to decide their own sun exposure. If it is too sunny, they will stay deep out of sight. This is the way that I run my best growing pond.

Welsh Bob was one of many people who for several years kept lecturing me about making the water in this pond clear, to enable me to sell its inhabitants. I argued every time with him that I knew every Koi in this pond, and could easily pull them up to show people in the bowl. Nowadays, Bob, and anyone else who visits, fully understands the magic of how this pond performs. Every time you pull the Koi up, they look to be in their absolute best 'Tategoi' condition, with thick soft Beni, that is as glossy as can be. This

In the autumn of 2007, this Koi measured 70cm, and was grown only during this summer. Normally, Koi are expected to grow from 59 through to 68cm in this time. This Koi should grow to around 78 to 80cm by autumn of 2008, and should be around 85cm at 5 years of age.

The pipe on the left is RO water, which is being used to 'dilute' the hardness level of the untreated water coming out of the other pipe.

Safe and sound. The fruits of the harvest can be seen for the first time. This is when Koi are pretty much in their best condition.

is the best condition you can have if you want to make Grand Champion Jumbo Koi with your pond. Remember, turbid water is really 'smart shading'.

HARD TALK WITH KH

Talking of green water leads me onto the next subject, water hardness. Hardness has a huge influence on the way we can raise Koi. In Japan, breeders generally agree that water hardness (GH) should be lower than 50 ppm. If it is higher than this, you should lower it. KH, however, is a highly controversial topic! For reasons unknown to me, some people think that you should run KH levels at a minimum level of 5 dh or in some cases 8 dh (app. 140 ppm). This aforementioned advice baffles me, so let me explain.

Contrary to popular belief, a bio-filter does not 'use' KH in order to function! A bio-filter produces hydrogen ions as a by-product. These ions are acid and without the carbonate (KH) ions being present to 'mop up' these hydrogen ions the water will turn acid. KH does tend to have a 'sliding scale' effect against pH, so this is worth bearing in mind if you are trying to run at a lower

I employ an RO (Reverse Osmosis) plant to strip out minerals from my very hard mains water.

pH, or trying to run green water without algae blooms driving the pH high. I intentionally run a low KH on my 4,400 UK gallon/2 ton/5,300 US gallon growing pond where I keep all my best Nisai. The KH level in this pond is around 2 dh (35 ppm). This results in the pond running a pH of 7.3, a level with which I am generally very happy. If I were to run a KH of perhaps 1dh, then the pH would fall to around 6.8 to 7. I would be happy with this if I were not selling the Koi to ponds with higher pH levels, or if I were checking these levels twice daily! However, I do not, so I need to stay in favour of stability, hence, 2dh.

If I run this pond up to a KH of 3, then the pH will rise to around 7.4 to 7.5. A KH of perhaps 5 would result in a pH of around 7.8, and a KH of 8, would result in a pH between 8 and 8.4. Beyond this point, no matter how high you run the KH, the pH will naturally run at 8.4. However, algae blooms can cause pH swings of over 9 when the KH is high. In my experience, so long as you do not have all day full sun, a low KH does not seem to be susceptible to these pH swings, even with green water. There is no need to run a high KH level because of fear of a pH crash. Even in my pond, with a KH of 2, I can leave the pond for a full week without any checks or maintenance without fear of depleting the KH.

THE TDS FACTOR

Whilst talking about water hardness and KH, we now come onto what I feel is the single most useful test reading that we can possibly have when testing our water, namely, 'TDS', or Total Dissolved Solids. The 'Solids' part is used loosely, as this reading in fact accounts for any ions present in the water, whether solid, liquid, or gas. TDS is the best tool you can have, simply because it tells us the condition of our water. TDS levels are tested very quickly and reliably with a TDS dip meter, and it is the 'TDS Differential' that is the handy part to know.

When I refer to 'Differential', this is when we test the pond in relation to our fresh mains top-up water. For instance, if your fresh mains water measures a TDS of 300 ppm, it means very little on its own. If your pond measures 600 ppm on its own, it also means very little. However, when you test both, you immediately have a clear indication that you have not been changing enough water in your pond!

Think about things this way… Perhaps when you first filled your pond, and put your initial collection of fish in there, the mains water and pond water both measured 300ppm. After one year of feeding 1kg/2.2lbs of food a week, and changing 10% of water per week, your pond TDS has risen to perhaps 350 ppm, which is fine. Where it all goes wrong is in the second year. Your Koi have grown and you have been feeding 2kg/4.4lbs of food per week, but are still changing 10% of water per week. In this instance, there is a lot more waste produced by the Koi, so the TDS level increases. Unless you cut down on food, or change more water, the TDS level will continue to rise. Of course, you would eventually find a balance point between the TDS and any steady level of water

changes. However, if you upped the changes to 20% per week, you would then see the TDS steadily fall over a long period.

It is important to understand, that all kinds of dissolved matter will contribute to the TDS figure, including pheromones, etc. Given the theory that these pheromones limit the growth of the Koi, this presents another argument in favour of chasing low TDS Differentials. However, I do not really subscribe to the pheromone theory, but more so to the high TDS loaded water being the limiting factor. So, do not regard TDS levels as a 'water condition test'. It may seem hard to grasp, but water that appears extremely dirty can actually have low dissolved solids, like even the dirtiest of mud ponds. However, suspended solids cause a mud pond's murky water and have no bearing on TDS levels. This is Turbidity.

As mentioned earlier, mud ponds are very much devoid of minerals. The TDS levels of the mud pond reflect this. It stands to reason that if a mud pond has a TDS as low as 35 ppm, then it is physically impossible for any significant level of GH, KH, or any other minerals, gases, or indeed ions of any form to present in any significant numbers!

ORP VS TDS

Many people favour the use of ORP (Oxidation Reduction Potential) to get an idea of water condition. Sure, ORP does gives us some idea of condition, but two things must be born in mind here: 1) Low TDS Differentials (pond versus mains TDS) usually go hand in hand with high ORP, and 2) If our ORP levels are low, we can use Potassium Permanganate to temporarily 'dress things up'. However, this really is just a temporary fix, as the TDS levels will remain untouched and may continue to climb further.

To push a step further on TDS, GH, and KH levels, I employ an RO plant (Reverse Osmosis) to strip out minerals from my very hard mains water. An RO plant will reject everything from the water, leaving just pure H2O as the finished product. This water is extremely unstable on its own, as its pH has no buffer one way or the other. However, I use this water to 'dilute' the minerals in my mains water. I generally do this using 75% RO water, and 25% mains water. With the mains TDS generally being 320 ppm with a KH of 10dh, the result of this mixing is water with a KH of 2.5 dh and TDS of 80 ppm. This makes for parameters much closer to the mud pond environment, but with a good margin of safety from pH crashes!

WHAT'S YOUR GOAL

To summarise this article, if your aim is to use your pond to raise young Koi either to win Grand Champion one day at the Koi Show, or just to get every last bit of potential out of your Koi, then you have an awful lot to think about. If you can manage the perfect balance of temperature, exposure to natural light, TDS levels, pH, KH, and GH, then you should find the hobby extremely rewarding. Sure, you may say that you do not like big Koi. But, if you one day found yourself able to grow Koi to 85cm/33.5in with mind blowing quality, would you instead prefer NOT to let them grow?

TDS and water hardness can easily warrant an article all of its own in order to be properly covered. If this is something you would like to read more about, please contact the *KOI Nations*.

Mike Snaden lives in Bristol, England. He has been keeping Koi since 1993 and started Yume Nishikigoi in 2000. Mike's forté is being able to 'read' young Koi and understanding how they will develop and grow in the future. Reach him at writers@koinations.com.