# TESTING TIME IN JAPAN

## Is soft water best for Koi growth?

STORY AND PHOTOS BY MIKE SNADEN

**Back in 1998, I believed that I had found the "missing link" with regards to growing Koi. However, it took a few more years before I discovered a way to make such water for my own ponds.**

**When I first started keeping Koi back in 1993, it was generally accepted that if you wanted Koi to grow big and develop to their potential, you had to leave them in the hands of the breeders in Japan. Not being satisfied with this, I was always trying to grow Koi but the results were always disappointing. In 1998, I stumbled across a Japanese hobbyist via the internet who was of the opinion that soft water was best for Koi. I was very curious of this, and having obtained a Total Dissolved Solids (TDS) meter (along with conventional GH and KH test kits) in 1998, set about checking my friend's ponds, and water supplies, to see if there was any form of link between water chemistry, and growth rates. In the early days, it seemed that there was indeed a link, but for me, the jury was still out due to not having friends with enough of a variance in mains in their supply water for it to be conclusive.**

### The Turnaround

Things changed for me when I started dealing in Koi in January 2000, as this meant that I was now in touch with people that had massively different water chemistries to our own. I often found myself travelling to customer's ponds, to check their growth rates and water chemistry. Things started to become incredibly interesting, as it was evident that customers in softer water areas, like Wales, Devon/Cornwall, and the North were getting much better growth, than hobbyists who lived in harder water areas.

In late 2001, I discovered what seemed to be the solution to my frustrations, in the form of Reverse Osmosis (RO). Shortly after I started treating my mains water with such a system, it became apparent that the hobby (albeit as a dealer) was seriously changing for me! At this point, I started to write about the virtues of soft water, both in magazines, and on the internet, and such news was met with very mixed responses. Some people saw sense in the soft water approach, yet it seemed that the majority of people saw this new "fad" as simply something to fight against.

Things have changed over the last few years as many people worldwide have ventured down the "soft" road, and proven things for themselves. It seems the only people that remain as 'non-believers' are those that have soft water, but don't realise it, or people selling equipment such that they perceive RO as being a threat to future sales.

### What is good growth?

I often hear people declare that they get good growth rates despite being in a hard water area, but the truth of the matter, is that anyone can grow Koi. Where the differences lie however, are in what people perceive as 'good growth', and at what stage in life the Koi are growing. Growing Tosai for example, from say 30cm/11½in, to become Nisai of 50cm/19½in is child's play, in any kind of water. If the Koi don't grow, just crank the temperatures up a little more, and force some more food down their throats! But, this isn't the right approach, as it often grows the Koi at the expense of quality. In an ideal world, you should be able to achieve such growth at 22°C/72°F or 23°C/74°F, without having to feed so much food that the Koi look like they are about to burst. Hard water is the bottle-neck that restricts Koi growth. The bigger the Koi are, the more restrictive such an environment becomes.

Having written about soft water several times before, I am trying to take a slightly different approach with this article, rather than just cover the same old ground. One thing that continues to surprise me is people's standpoint on a couple of misconceptions... Many people believe that Koi need to extract minerals from the water surrounding them. Whilst this may be true, they would only need trace levels of this, not the quantities that our water is generally laced with. Furthermore, Koi feed contains all of the vitamins and minerals that a Koi needs, and this can be seen by the rising levels of mineral content in a heavily-fed pond, whereby the mineral content of the water elevates higher than the new water that is added to the pond. One of the most disappointing things though, is that people observe the skin and colour of Koi, and come to the conclusion that if the Koi looks more "vivid", then the water 'must' be better, when in fact this simply isn't the case. You see, Koi develop in time, and harder water just causes the Koi to finish up too soon, and then deteriorate earlier in life. In reality, we should be trying to grow the Koi, and postpone the development until later in life, as the end result, is a much more beautiful Koi, that keeps its condition for much longer.

### Living isn't thriving

People assume that because carp thrive in hard water, then Koi must also be genetically suited to such conditions. But, people miss the point here as Koi are grown in Japan, in incredibly soft water, and over many generations, have become adapted to this kind of water. Looking at other fish species, people go to great lengths to keep them in very specific conditions in order to keep them alive. But, just because a Koi stays alive, doesn't mean that the environment is good! Furthermore, people also miss the point when they visit Japan, and see breeders' indoor ponds with bags of oyster shells in the filters. It is important to remember, that these ponds are purely to keep the Koi alive during the winter months without crashing the pH, and that these Koi in 99% of cases, receive absolutely no food whilst residing in these ponds. We really should forget about breeders' indoor ponds altogether, as this simply isn't the environment that the Koi are raised in. Instead, we should focus on the mud ponds, and this is what this article is all about. In the past, I have written about mud pond water, but never actually proved that the water is the way that I have said it is... This time, I have tested more comprehensively, and obtained photographic evidence, rather than just taking not of my findings, so I hope this will be of interest.

**It was clearly evident that customers in softer water areas, like Wales, Devon/Cornwall, and the North were getting much better growth, than hobbyists who lived in harder water areas.**

### The testing equipment

With this article, rather than just testing water hardness, KH, TDS and pH, I have conducted the following tests:

- **GH** (Aquarium Pharmaceuticals kit). A simple liquid colour change kit, which is very consistent.
- **KH** (Aquarium Pharmaceuticals Kit). A simple liquid colour change kit, which is very consistent.
- **Calcium** (AP kit). A very consistent test kit, but given the low hardness levels in Japan, this is a bit of a "coarse" measurement,

as it forms only part of the GH. None of the ponds tested showed any Calcium content whatsoever as the levels were lower than the minimum level of this kit.

- **Nitrate** (AP kit). A simple kit, which is easy to interpret.
- **Phosphate** (AP kit). A simple kit, which is easy to interpret.
- **Organics** (Salifert kit). I am not certain as to how good this test really is as the colour changes are somewhat subtle, so the results could be perhaps one drop either way from the results I obtained with this kit.
- **TDS** (dip meter). This is a simple TDS meter that I have had for 11 years now. It works well though, and very consistent, though doesn't have temperature compensation. For reference purposes, the conversion factor of this meter's TDS vs conductivity is 0.5.
- **pH** (electronic test). All of the electronic tests were taken with a state of the art multiparameter meter, which is one of only a few that are GLP Compliant, meaning that its calibration methods meet strict laboratory requirements where results need to certified, and all test results and calibration data are automatically time and date stamped.
- **O2** (electronic test). An O2 test is only accurate if the meter is first calibrated in air immediately before each test. Calibration was carried out every time. This meter also automatically compensates for temperature, and barometric pressure.
- **Temperature (**electronic test).
- **Conductivity** (electronic test).
- **ORP mV** (electronic test). This test is only really for comparative means, as even when calibrated, the readings are somewhat hit and miss. It should be noted that ORP calibration solutions are more often referred to as 'ORP checking solutions'. However, this test is to my mind worthwhile, since many people seem to put great emphasis on the importance of ORP levels.

### High or low ORP?

I have a very good client and friend, who is very scientifically minded, and has been of the opinion that the water in mud ponds would have a reasonably high ORP. I have had an opposed opinion to this, feeling that the ORP levels would be very low. You see, a mud pond is a very natural environment for Koi. The water is predominantly rain water, though mountain stream water is also often used. This makes for incredibly soft water, with little or no mineral content. In the first season of using a new mud pond, the results tend to be very poor, with a high pH, and poor condition of the Koi. In subsequent years however, the bottom of the pond becomes lined in a soft silt-like substrate, which is a slowly and thoroughly decomposed by-product of fish excreta. This is not the same as the heavily decomposing waste we find in filters, but something that occurs much more slowly due to the relatively low stocking rates within the ponds, and the many insects and micro-organisms that further break down the waste, in addition to many strains of bacteria. This waste serves a very important purpose in creating the eco-system that is the "mud pond". To try to replicate this within a filtered hobbyist's pond would be fraught with disaster! The result of this environment, as you can see by the test findings, is one that is very different from what we would desire to see in our filtered pond. The ORP levels are indeed very low, and I think this to some degree is one of the secrets in the mud pond's performance. I feel that the very low oxidative properties of the mud pond, is partly why the colour pigment cells of the Koi thrive so well.

Of course, a healthy filtered pond would never run anywhere near these levels unless it was a in a terrible state! The sheer nature of the water changes we carry out and maintenance dictates that the ORP will always be higher than the mud pond. The best performing pond we have at Yume Koi for growing Koi, generally runs at an ORP of just below 200mV. I am comfortable with this, given the outstanding colour condition and growth that this pond produces. ORP is a topic in its own right really, and should be considered as a battle between the positive and negative side of ORP. If water becomes too polluted, the negative guys start winning the battle, and pull the ORP lower, and into a negative mV reading. If the positive guys are winning, then the reading rises higher. This battle is an ongoing one, whereby if you don't change enough water over a prolonged period of time, then the reading will continually spiral downward until an equilibrium is reached. In a clean well-maintained environment, the level will rise until it reaches an equilibrium. In our own filtered pond environment, the same effect can be seen with TDS levels, and this is the reason that TDS levels should be checked and compared to that of the fresh water that is being added. If the differential between the two is too high (say 50ppm), then more water should be changed in order to reduce this differential. In doing so, you would also find that this would go hand in hand with higher ORP levels. I do believe though, that if the ORP level is too high, then the water is a little too oxidative, and that this would have a negative effect of the Koi's pigment cells, which are a living entity in their own right. A lot has been said of clays used for human skin, which is of an anti-oxidant nature and supposed to be good for keeping skin in good health. Such clays have a negative ORP, and though I haven't checked, I think that you would find the same trait with the substrate at the bottom of the mud ponds. This negative ORP substrate is fighting against the positive ORP of the new water, and finding its own equilibrium, which I think is all part of the magic of the mud pond.

### Raising Jumbo

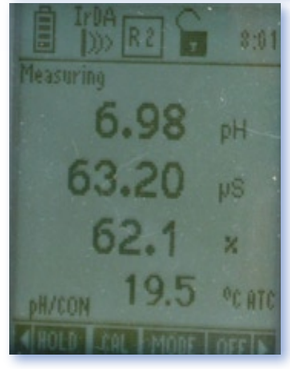
Of course, raising Jumbo Koi is far more complicated than just simply trying to replicate mud pond water hardness, and pH levels. It isn't feasible to run our filtered ponds with absolutely no KH/GH, as this is what leads to a pH crash. But if we run at hardness levels that allow us to run a more neutral pH, then I think that is probably the safest and best way forward. The heavier the pond loading, the lower the pH will tend to run though, so if you run with very low stocking levels, you will find that you can run a more neutral pH with lower hardness levels, more akin to the mud ponds. If you chose to go this route, you would have to get a feel yourself for how comfortable chasing these raising techniques. To me, the art of raising Koi, is all about optimising and prolonging the rate at which the Koi grow and finish, in order to raise a Jumbo Koi, that is finished later in life, rather than being finished too early and hence on its decline before it has grown to its size potential. In subsequent issues of KOI Nations, I hope to cover other areas of raising techniques.

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

## TEST FINDINGS

### Takigawa 'Sakura Ike'

GH test 0 (less than 17ppm), KH test of less than 1dH (17ppm). Calcium test 0. Phosphate, less than 0.25mg/l, Nitrate less than 5 mg/l. Organics 1 ~ 2. pH 6.98, TDS 29ppm, Conductivity 63.20, ORP 102.7mV, O2 a little low at 62%. Takigawa-san said that a high O2 level makes the Koi more active, so they eat more and grow faster, but it's not good for the condition of the gills. This pond has a fountain that is on a timer though, and at the point of testing, it wasn't running. Temp 19.5°C/68°F. One important thing with the testing of the mud ponds, is whether or not the ponds are being fed, as in the case of heavy feeding, more acids are produced, resulting in a lower pH, so in the case of a pond not being fed, the results have little meaning.

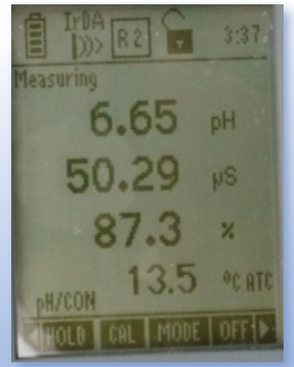








### Takigawa 'Sakura Ike' - New Water

This water comes from a mountain spring, and is piped to the mud pond. This water has a TDS of just 20ppm, conductivity of 50.29, O2 of 87.3%. KH of less that 1dH (17ppm), GH, and Calcium levels of zero, pH of 6.65, and ORP of 376.5mV. The pH and O2 levels of this water is irrelevant really, as this water will be influenced by the pond that it is running into.



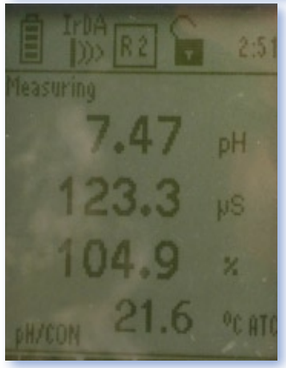







**Matsue Koi Farm...**
**Sansai mud pond**

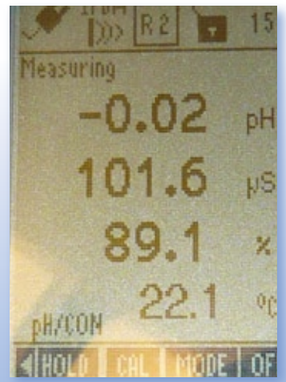
GH test 0, KH test 0, Phosphates less than 0.25mg/l, Nitrates 0, Organics 2, pH 7.30, TDS 34ppm, Conductivity 71.81, ORP 94.6mV, O2 94.4%, at a temperature of 19.3˚C/68˚F.






**Ueno Koi Farm**

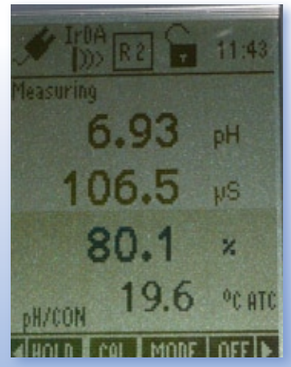
GH less that 17.9ppm, KH 34ppm, Nitrate 20mg/l Phosphates 0.5mg/l, Organics 3, pH 7.47, TDS 48ppm, Conductivity 123.3, ORP 137mV, O2 104.9%, at a temperature of 21.6˚C/72˚F.






**Matsue Hotel**

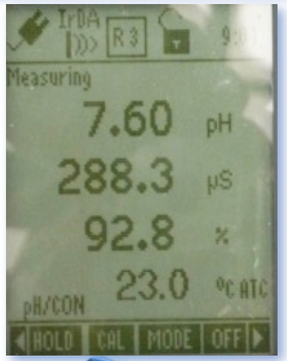
Water in hotels is really of little relevance, but I tested conductivity and ORP as these were at least indicative of the kind of water you could expect if you were a hobbyist local to the hotel. pH is an extremely volatile parameter in regards to fresh water, as it is very easily influenced by the body of water (pond) that the water is running into. Nonetheless, the hotel's water had a conductivity level of 101.6, TDS of 49ppm, and ORP of 190.2mV.






**Tokyu Inn Hotel, downtown Hiroshima**

This water isn't used to top up any ponds that I know of, so is of little importance. But nonetheless, it had a KH of 1dH, GH 1dH, pH 6.93, TDS 61ppm, Conductivity 106.5. ORP of this water was a very surprising 713.4mV.





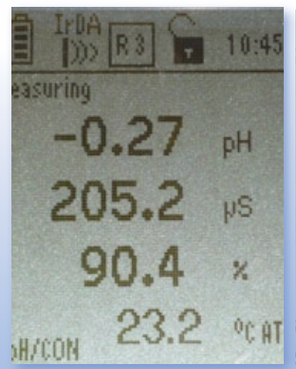

**Okawa Koi Farm indoor growing pond**

pH 7.60, Conductivity 288.3, O2 92.8%. TDS 151ppm, ORP 130.0mV. This was the highest TDS level of any pond I have tested in Japan, ever. It is still very good by UK standards though!




**Yamatoya Koi Farm... Nisai to Sansai pond**

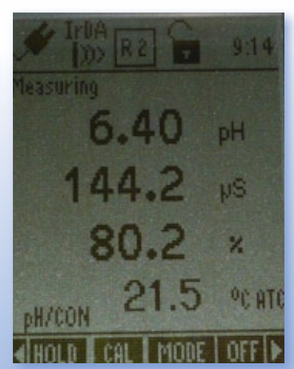
pH 7.24, Conductivity 61.12, O2 93.8%, TDS 27ppm, GH none, KH 17.9ppm, Nitrate just detectable, Phosphate just detectable, organics 2. ORP 188.8mV.





**Okawa Hotel**

Conductivity 205.2, ORP 463.1mV. Kyushu is generally known to have water with a very high iron content, so this will be a contributory factor to the conductivity level here.






**Kabe Business Hotel, Hiroshima prefecture**

GH approx 30ppm, KH approx 34ppm, pH 6.40, Conductivity 144.2, TDS 81ppm, ORP 390.2mV