

A Case study of the occurrence of KHV in our pond and the events leading to final diagnosis.

Written by Brian McGivern August – September 2006

I have written the attached in response to a suggestion by Duncan Griffiths. By publishing the information and recent happenings we have experienced it is hoped it will increase awareness and help other Koi keepers with an earlier diagnosis.

It also helps us come to terms with the outcome.

First some background information.

My wife Jennie and I have kept Koi for 20 years.

I am a member of the BKKS Health Standards Committee and prior to that a BKKS HLO.

I have undertaken considerable training through the BKKS and also with Dr David Hoole at Keele University and latterly undertaken the OATA training in water quality and fish Health. I have gained considerable experience over the years I have owned Koi. As part of the HSC I have treated many ponds and fish conditions over the last 6 years and offered advice to many koi keepers.

Unfortunately the happenings of the last two - three weeks have increased my experience many fold. Sadly it has been a costly and emotionally draining time and I don't feel it is over yet.

Our latest pond was built in 1995 and contains the following: -

6000 gall pond block built, rendered and fibre glassed

Two 4" bottom drains

1000+ galls filtration. vortex, brushes, Japanese matting, K1, alpha grog, 110 watts UV

Vegetable filter

Two 1.5" returns

Temperature kept at 20C (68F)

Vortex and bottom drains blown down weekly approx 150 galls water change

Water parameters pH, ammonia, nitrite, oxygen, checked frequently and have been fine.

Occasional pH falls which are countered with shells and other mineral additives

We have not experienced any unaccountable fish deaths for 6 -7 years.

All fish are quarantined in a separate facility for between 3 and 6 months before introduction to the pond

Start of problems.

Beginning of April 2006

Large water change (25%) following failure of automatic feeder and my failure to turn off a pump after blowing down the drains.

Action. Water level topped up straight from tap no de-chlorination added.

Result, No immediate problems with fish or filters both monitored closely for next week. I considered myself very lucky to have escaped problems.

2 weeks later fish are flicking and looking stressed.
Water parameters all checked and found to be fine
Scraped 3 fish and found Trichodina in large numbers.

Treated with PP at recommended dose followed 24hrs later by 10% water change and again 10% 24hrs after that.

3 weeks later fish not fully recovered, still stressed, not happy but feeding ravenously
Water parameters all fine
A Further scrape revealed white spot. Closer examination showed some redness to white skin areas and some fins with a shade of pink.
Checked gills and they were all fine.
Some fish excreting excess mucus on body, some fish with very little mucus

I dosed with MF for the white spot, as recommended days 1, 6, and 13 with water changes in between.

At this stage I am considering this is possibly bacterial / water problem reducing fish immunity and permitting parasites to multiply.

I suspect a water problem.

Discussing with other keepers and obviously mentioned KHV but discounted because none of the normal KHV symptoms exist. Gills checked repeatedly, no sign of necrosis or heavy mucus in gills, no body ulceration etc. Some of these keepers have seen KHV at first hand. So I was particularly pleased to hear I had none of the typical symptoms.

Concerns still remain over water quality although tests for usual parameters are still showing normal. I am testing chlorine in tap water and oxygen measuring as standard

Checked and blew down all filter chambers. Cleaned the brushes, flushed the matting chambers to waste with pond water. Dirty water released but no serious amount of mulm or debris found in any of the chambers.

Increased oxygen supply to pond and added two submersible pumps circulating pond water creating high levels of agitation.

Fish are still not happy. Some fish lying up but not always the same fish. Some becoming lethargic and just hold position at approx 6" to 12" deep. This is not a head down "hanging" position as happens with some parasite infestations. Fish are horizontal and stationary.

The redness of skin was still persisting and in some cases getting worse. Excess mucus appearing in a non-uniform way, appears to be in lumps on some fish, particularly doitsu sanke and hariwake.

Most fish are still feeding very well. Scrapes indicate white spot and Trichodina have been eradicated. No other parasites visible at x150 and x400

4 weeks later scrape identified Trichodina again.

Water parameters still ok

Dosed again with PP followed by 10% water change after 24hrs and again 24hrs later.

Up to this point all fish are feeding energetically although food had been cut back earlier.

3 days later fish very stressed, lethargic not feeding, still suspected bacterial / water problem.

"If I was offering advice to another koi keeper I would lean towards septicemia as a diagnosis, but the underlying cause still evades me".

Treated on 3 consecutive days with Chloramine T at 10grms per 1000 galls

1 day after third C/T treatment two fish died. This occurred whilst we were at work so it is not known what the final symptoms were.

Examination indicated only reddening of white body areas, no gill problems. Gills checked as on all previous scrapes, no body damage or ulcerations.

One of the dead fish was an ochiba, there were black patches on the scales before death. Similar patches to these have appeared on most ochibas and chagois in the pond. I can only assume this is the equivalent to a white skinned fish going red as though it was suffering from septicemia

General consensus following discussions with various people appears to be over treatment following initial high water change with chlorinated water.

"I was having to come to terms with this being totally my fault. I would be very critical of anyone doing the same as I had done those months earlier when I filled the pond with tap water."

I purchased and fitted a water purifier. I commenced water changes at 2gpm with purified water.

Third fish died a day later. Closer examination of fish, gill covers removed and gills examined in detail. There are no apparent problems with the gills.

Started to add salt slowly while continuing with water changes and reached approx 0.15% saline

Two fish died within 2 hours

I ceased adding salt.

I continued with water changes at 2gpm with purified water.

There are still no other signs that don't point to water quality problems or a bacterial disease, albeit the latter would need to be totally internal as there are no external symptoms apart from the redness and discolouration patches on chagois and ochibas.

6 days after first death I set up vat with 400 galls purified water with no additives I raised temperature to 20c with heavy aeration. I moved 6 of the most stressed looking fish from pond to the vat.

One fish in the vat died within two hours

I switched testing kit to Hanna C203.

Water test of pond revealed Ammonia at 0.13 using Hanna electronic test

Nitrite 0.03 with Hanna

pH 6.9 / 7.0 using calibrated hand held.

This is the first time I have had an ammonia reading but this is with a Hanna and I could not be sure this was not being affected by salt addition.

Checked filters again, no apparent problems

Second fish in vat died.

There appears no improvement with fish in fresh water in the vat. Redness continues.

Fish still lethargic

This makes a total of 8 deaths

There is no improvement with fish in pond or in vat. Feeling I could slowly lose them all.

Jennie has a good contact in the water board and we contact them. We explain we are desperate to find the cause and that we are not seeking to place the blame anywhere. We just want to prevent more deaths.

Within hours water board have come and we discussed the problem. The following morning a technician arrived and sampled tap water and pond water and contents of my pre-filter, I await results but am not too hopeful as I feel problem started some time ago and any evidence will now have been lost.

The water board have kindly also provided records of chlorine dosing for previous 12 months. The records show over the period when the initial water change took place chlorine dosing at source was 0.4mg/l with high spots at 0.8mg/l

I was very concerned about this level but Duncan's opinion was that even with 25% water change chlorine residual levels would not cause the damage I was currently experiencing. Neither would it hit the filter bacteria hard enough to cause failure of the filters.

Indeed had the filters been knocked back during this period resulting in high ammonia and or Nitrite there would be more evidence in terms of burning of the fins and or gill problems and I feel sure I would have recognized them.

There are no signs other than stressed fins and white areas and general lethargy, most fish are affected in a similar way.

The scaleless fish (doitsu) show severe reddening of the lateral line. Perhaps this is just because it is far more visible than on a scaled fish but the line looks like a cut with a craft knife, and is raised and inflamed.

There have been no additions to the pond for 6 months and these were from my quarantine set up and had been in there for 6 months prior to introduction.

We are now at the 8th day after the first death. Following a further death now 9 in as many days I have spoken with Duncan and with Paula Reynolds from Lincs Fish Health.

The consensus of opinion appears to be that there is a possibility that it could be a virus (not showing the normal symptoms) as all other possibilities have been ruled out with the exception of water toxicity. (I am still waiting results from the samples taken 48 hours earlier)

There is this dark cloud hanging over everything we do.
I am late for work most mornings and making excuses to leave early each day.

On day 10 the water report is received from the water board. At the preliminary report stage the pond water, tap water and filter sample are all within acceptable bounds with no exceptional indications. A final report following bacterial culture will follow.

With this news on the water quality, the leaning towards a virus causing the problems gets increasingly stronger. I speak with Paula Reynolds again. Paula reports occurrences of KHV fish deaths which have not shown the usual symptoms.

The worst scenario is beginning to unfold.

On day 10 I take a fish to Paula in Lincolnshire for examination.

24 hrs later Paula rings me with confirmation that it is KHV.

From her examination she has said this is an attenuated outbreak. It lacks the gross gill necrosis and skin ulceration typical of so many cases. Although she has experience of fish deaths with even less outward signs than my fish exhibited.

The news is devastating to both Jennie and myself.

The following day another fish dies bringing the total to 11.

We are currently coming to terms with the outcome. It is day 14 and for two days there have not been any deaths although there are 4 fish in the pond looking particularly ill.

The last two days has also seen the first ulceration. A large sanke developed a raised brown swelling about the size of a 50p coin. The lesion, contained a number of dead scales. The scale pockets and underlying skin were brown and necrotic. The fish was sedated and topically treated. The fish was returned to the pond and looked fine for a day. On the second day further brown patches developed on the side and shoulder.

I have 20+ fish left in the pond. I am raising the water temperature to 30C in the hope of stopping the effects of the virus.

If we are successful we will have to then make a decision what to do with them. Donation to one of the research teams seems the most appropriate. If I cannot stop the deterioration then it will have to be euthanasia. Apart from the suffering the fish are being subjected too we cannot stand waking every morning with the death of another fish.

I have tried to be as factual as possible and unemotional and reported the occurrences as they happened whilst attempting some explanation of my reasoning for taking what action I did at the time.

My only regret is that it could have been diagnosed earlier, unfortunately for me and the fish, not all the symptoms were present.

At day 15 returned from work to find two more dead fish.

Examination reveals no outward signs. The gills show slight necrosis but only on one fish and this is localized to a small area. The gills are pink rather than red but this is due to them dying some hours earlier.

Whilst reviewing the situation we decide to examine the three sickest looking fish in the pond: -

A shusui is lying up and is having difficulty holding position

A Shiro Utsuri is almost pink

The sanke I treated a few days earlier has deteriorated considerable.

The sanke is the first fish to show gill problems there was hemorrhaging from both gills with jelly like lumps coming out.

I euthanized all three fish.

Attached are some of the photographs we decided to take to record the condition. The date on these photos are incorrect they were all taken on 6/9/06.

The following photographs are of five fish examined on day 15. The first two had died some hours before examination the other 3 were immersed in anesthetic until they died and were then examined.



A kohaku that died on day 15. The reddening of the skin is clearly visible. Note the indentation above the top jaw. Apparently this is a KHV symptom and has been obvious on a number of fish after death



The above shows the same Kohaku which died on day 15. There is no body or fin damage, the body is pink in places. The gills are pink but the fish had been dead for a number of hours before it was examined.



It was noticed on the kohaku the scales became detached very easily.



A gin rin chagoi that died on day 15. No visible damage



The gills on the gin rin chagoi show some necrosis at the top. The colour is pink as the fish died some hours before examination.



Examination of the chagoi shows some darkening area above the gill plate. The indentation on the top jaw is just visible



This photograph shows a shisui which has been struggling for some time. I have decided to euthanase it. The picture shows the reddening of the white underside and fins and what looks like the start of an ulcer under the jaw.



The shusui with the gill plate removed. This is immediately after death. The gill colour is good and there is no necrosis. This is more typical of the earlier fish mortalities.



The two photographs above show a shiro which has been struggling for some time. The skin is heavily inflamed. There is also some fin damage visible. This is day 15 and I have decided to euthanase this one also. Although not shown the gills on the shiro showed no problems.



This picture shows the sanke which was topically treated some days earlier. Note the extensive reddening of the facial area



A sanke showing an area of earlier treatment below the dorsal, forward of the sumi near the tail. There are also patches of necrotic tissue starting on the band of red across the shoulder.



The first fish examined with serious gill problems. Removal of the gill plate revealed massive haemorrhaging in the gill cavity.

I cannot face any more this evening.

This brings the total lost to 18.

I hope this encourages earlier testing and greater awareness for anyone who suspects they have a problem. I know it won't prevent the loss of the fish but it will reduce the heartache of watching so many fish dying over a longer period and maybe get the damage limitation process started a bit earlier.

With the 10 fish still in quarantine I will attempt a chill / heat cycle to try and bring out the virus if it is there. Currently I cannot reduce the temperature below 17C so will have to wait until the weather gets a bit colder.

On a final note, people's concern is obvious, when they are told of the problem they understandably want to identify how vulnerable their ponds could be. The question is always the same!!

Where did you have your last additions to the pond from?

This is quite a normal reaction, however we will not speculate and at this time we have no proof one way or the other. We have always restricted our purchases to reputable dealers and in recent years become very reticent about buying from other than two or three sources as more and more problems in the Koi world have come to light. Taking advice from Paula it is possible the virus could have been existing within the pond on a "carrier fish" for some time a trigger was all that was needed, this could have been the hot spell we experienced earlier in the year. I am assuming it could also have been the introduction of new fish from my quarantine tank or any of the treatments added to combat parasites.

I do not know and that disturbs me.

I would like to thank Duncan Griffiths and Paula Reynolds for their help, advice and words of comfort in what is a testing time. I would also thank our many friends who have been supportive over the last weeks.