

**You take care of the water and the koi will take care of themselves...
You can't heal fish in a toilet...**

95 % of all koi health problems can be traced back to problems with water quality...



When I started the hobby I spent the majority of my time testing water and incessantly adjusting *everything* toward perfection. Know what? My fish paid the consequences. They became ill and some died from my over exuberance. In an earlier article, I talked about:

“Benign neglect” and noted our job is to “house, feed and change their linen ever so often.” (Biggio, 2007)

The same holds for water quality. More is not always better. Here our job is to:

Periodically test, spot trends and correct water quality problems.

This month we expand on Joe's Water Quality article.

Spotting trends: How do you do that? You record your tests so you can identify parameters that are changing up or down. As Joe said ‘*koi don't do well with change*’. The reason has to do with stress and the “General Adaptive Syndrome”. So, if a parameter is outside its diurnal (morning to night and night to day) readings or consistently moving in one direction or the other, that parameter is **treanding** in that direction. Here is an example of a simple form you can use to track your test results:”

Pond:	[Type Pond ID...]				Frequency	
	<i>Test</i>				<input type="checkbox"/> Daily	
	Acid/Base Balance	Ammonia	Nitrite	Alkalinity	<input type="checkbox"/> Weekly	
Date	7.0 – 8.5 pH pts	0 ppm	0 ppm	0 - 200 ppm (100 ppm ideal)	<input type="checkbox"/> Monthly	<i>Ideal Range</i>

This leads us to the **frequency of testing**. There are probably as many opinions about the frequency of testing as there are koi keepers. Joe mentioned weekly testing, some of the literature says daily and the KHA program says monthly. So what's right? Actually they all are. The KHA program teaches that **for the average koi keeper with an established pond monthly testing is adequate**. But it also notes that this isn't always true and there are times when you need to test more often.

- **New ponds with uncycled filter or old ponds with a new uncycled filter**
You need to check water quality daily until nitrates start showing and **no** ammonia or nitrites are registering.
- **New ponds with cycled filter**
Until new pond stabilizes and readings of major parameters stay stable you should test weekly. (I have been unable to find any definition of the period of time during which a pond is considered new, but my personal opinion is 6 months is probably intended). (Meck, 2004):

Personally I check Ammonia and nitrite monthly and for pH and KH, I test:

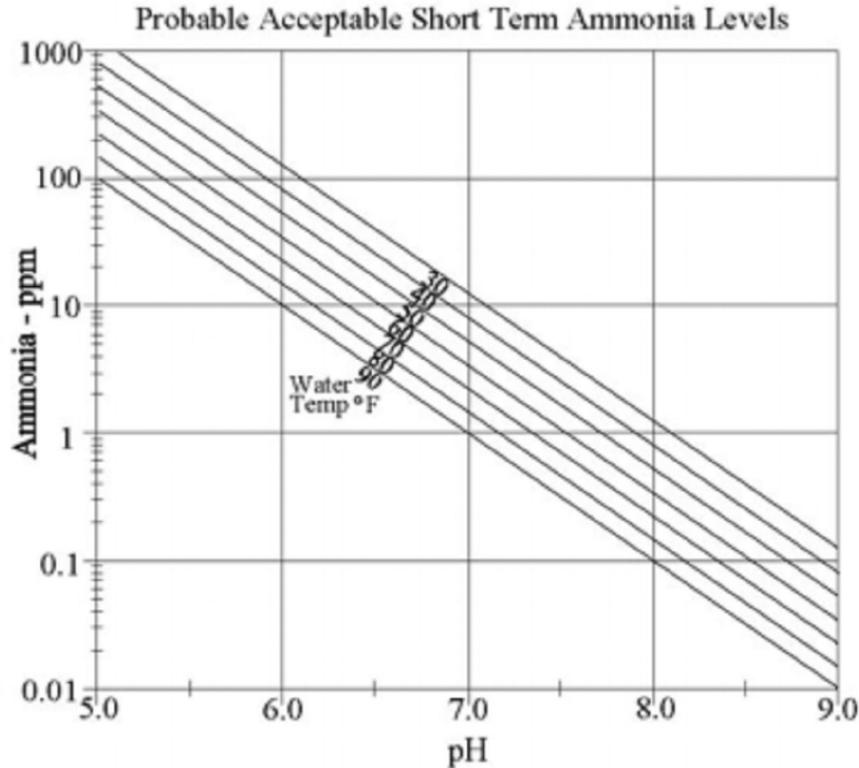
- **Weekly** during spring and summer and
- **Monthly** during fall and winter

As with everything you must exercise judgment and common sense and do more frequent testing as events unfold. A good example is after a **pH Crash**:

- Test acid/base balance, alkalinity and ammonia daily for the next several weeks. (Since several is more than 2 or 3 let's say about a month).
- Test nitrite weekly for next two months. (Roark, 2000)

So what do you need to test? Again opinions are all over the place. The KHA program thinks the average pond owner can get by just testing **acid/base balance, ammonia and nitrite**, but recommends **alkalinity**; and, if adding salt, salinity. Any other tests are considered ‘nice to have but not essential.’ (Meck, 2004) Joe suggested replacing tests every year. A good way to do this is to write the purchase date on the kit and buy new reagents 1 year later. He also noted that pH reagents normally last 2 years. Alkalinity also lasts two years. (Meck, 2004)

Water itself is a very complex molecule (http://en.wikipedia.org/wiki/Water_%28molecule%29) and that makes water quality complex.. All these parameters are **interrelated and interdependent**. Mess with one and you could possibly change one or more of the other parameters. I've been asked a number of times about the interrelationship between Ammonia (<http://en.wikipedia.org/wiki/Ammonia>), pH ("power of hydrogen" -- <http://en.wikipedia.org/wiki/PH>) and temperature (<http://en.wikipedia.org/wiki/Temperature>). Here is a chart that shows the **probable acceptable** short-term ammonia levels.



$$NH_3 = \frac{\text{Total Ammonia}}{(1 + 10^{[(0.0902 - \text{pH}) + (2730 / (273.2 + \text{Temperature}))])})}$$

(After Meck, 2004)

How to use the graph:

- Find where pH crosses the temp line in the table, and then read the ammonia level for that point.
- Any Ammonia reading at or above that point is toxic, requiring **immediate** action
- Any Ammonia reading below that point is survivable if corrected **within 1-3 days**. (Meck, 2004)

Note: In the presence of chemicals that detoxify ammonia, only Nessler kits read incorrectly and are the reason why we suggest the use of a salicylate-based test kit. (Nessler kits use colorimetrics that change from clear to yellow or yellow orange, while salicylate-based kits use colorimetrics that change from light yellow to bluish-green).

Warning: If your replacement water has a higher pH, contains ammonia or chloramines, then you may be making the problem worse if your replacement water isn't treated first.

To correct the ammonia levels in your pond do the following:

(after Meck, 2004)

pH	Established pond	New bio-converter / pond
	Increase aeration, adding supplemental air if possible	
	Stop Feeding for one week	Feed half rations for one week
	Check bio-converter for cleaning and clean as needed	Discontinue UV, ozone generators and foam fractionators
Below toxic	10 % Water Change	Chemically treat for 2 times ammonia detected (I use Amquel +)
At toxic	25 % water change	
Any line above toxic	Move any surviving koi	
	Retest ammonia in 12 to 24 hrs and repeat above steps as needed.	

Whenever 0.25 ppm or more of nitrite is detected do the following:

Nitrite	Established pond	New bio-converter / pond
	Increase aeration, adding supplemental air if possible	
	Stop Feeding for one week	Feed half rations for a week
	Discontinue UV, ozone generators and foam fractionators	
Less than 1 ppm	10 % Water Change	Add 1 lb salt / 100 gallons and maintain at 0.1 %
For all higher	Add supplemental aeration	
Between 1-2 ppm	25 % water change	Add 2 lb salt / 100 gallons and maintain at 0.2 %
Greater 2 ppm	50 % water change	Add 3 lb salt / 100 gallons and maintain at 0.3 %
	Retest nitrite in 24 hrs and repeat above steps as needed	

(After Meck, 2004)

Technically, there should be 6 ppm of chloride ion present for every 1 ppm of nitrite ion to prevent toxicity So you would add 3 ml of salt / 100 gal for each 1 ppm of nitrite. (It takes 1.67 ppm of sodium chloride to equal 1 ppm of the chloride ion, so, you would need to add 10 ppm of salt for every 1 ppm of nitrite that is present.)

Next month we'll continue the series on water quality with the inter-relationships between alkalinity, hardness and pH and how to recover from the **dreaded pH Crash**.

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Sources:

Biggio, Harold. *Koi CPR – Ulcers*. Newsletter: Atlanta Koi Club, Vol 19, No 6, 2007.
 Meck, Norm. *Pond Water Chemistry*. The KHA: Course Sections. AKCA, Rev. 2001.
 Roark. *Water Quality*. Roark's Experimental Puddle. Ventura, Calif. 2000