



President Corner

Thank you to the Panters for hosting our February meeting. Another big thanks to all who attended. Our up and coming meeting is at the Essig's house. I sure hope to see all of you there. Big thanks in advance for hosting our Club.

Just a quick reminder: your **Dues for 2005** are due March 1st. 2005. Don't forget to send them in, or bring them to our meetings. Also **scholarship applications** for the AKCA Convention are due at the March meeting. Thanks.

Spring is in the air, and so are a lot of other things. Just hope your pond has a skimmer of sorts. It is very beneficial in removing all sorts of surface plant matter, and other types of pallin. If you do not have one you might consider putting one in. The Job it performs on your pond out weigh the cost.

Pond Tour 2005 is coming soon. Tell everyone you know. This will be a great tour. Mark your calendar for May 7&8, 2005. Ya'll Come.

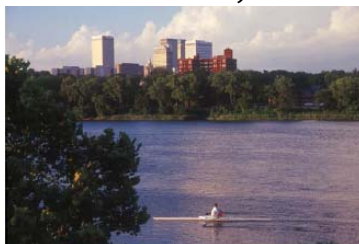
For the love of Koi,

Bob Panter

Bob Panter
President SAKA



Destination: Koi Powwow in Tulsa, OK 24th Annual AKCA Convention June 23-25, 2005



Located in the center of the country on historic Route 66, Tulsa was created by Oil Barons (large collection of art deco buildings) with renowned Southern Hospitality and a touch of Western. The 2005 AKCA Seminar will be held in Tulsa, Oklahoma at the Crowne Plaza Hotel-Tulsa. Seminar special room rate is \$80/night. Registration for the hotel at 1-800-227-6963



The Koi Powwow will be just as unique as it's host city.



Thinking of flying? Upon arrival, you will be greeted with a special **Powwow welcome**. Check in to a first class, newly renovated hotel with high-speed Internet connections in every room.



The **city tour** is comprised of shopping, gardens, unique museums with private docents, casinos, an aquarium and, of course, lunch. You select where you would like to go; stay as long as you would like. The Powwow express will shuttle you.



The Friday morning opening *don't miss!* Will be followed by seminars and break out sessions on topics including the current status of the Koi industry in Japan, the affect of shade on Koi color, picking and raising show Koi, Bonsai and many more for both the seasoned pro and the new hobbyist.



No seminar would be complete without a raffle. The Powwow raffle will donate half the proceeds to KHV research. Items are coming in weekly. To date, items include: Champion Nishikigoi, Tetra Pond Dynamag 500 pump, Aqua Ultraviolet, Hikari, Chengro Koi Foods, Mighty Pump, a 67" umbrella, Emperor Aquatics 40 watt Smart UV, a Samurai sword, original artwork and much, much more.



Remember; bring your key from Hawaii! Didn't go to Hawaii?

Not to worry, each club will be receiving keys or get one in Tulsa. You don't want to miss the unlocking of the lock.

Register on line today!

Breeding Koi

Reprinted from "[Tetra Encyclopedia of Koi](#)";
Tetra Press

Sexing Koi

It is impossible to sex Koi smaller than about 25cm(10in) in length, because they are sexually immature. Once the Koi exceed this size, the testes (in males) and ovaries (in females) begin to develop. The ovaries are much larger organs than the testes. Females are usually easier to spot, as the belly of a mature female Koi is generally plump, whereas males remain streamlined and more 'torpedo' shaped. When males are ready for spawning, they develop breeding tubercles on the head and pectoral fins, principally along the bones of the fin rays. These breeding tubercles appear as fine raised spots and could be mistaken for white spot (Ichthyophthirius). The tubercles are most profuse on the pectoral fins, where they are quite rough to the touch and arranged in fairly regular rows. They are used during breeding, when the male nudges the female with his head and fins to induce her to spawn.

Spawning

Koi will naturally spawn in the hobbyist pond in the early summer. A water temperature of 20C (68F) is ideal, although Koi will occasionally spawn at a temperature of 17C (63F). As the water in the pond warms, the Koi will try to spawn 'en masse'. This is known as flock spawning and, although it can produce very healthy offspring, the quality of the patterns and colour are generally poor. The female Koi deposits her eggs - approximately 100,000 per kilogram of her body weight - over the pond walls, floor and on any plants. Unfortunately, it is very difficult to collect eggs deposited in this random manner in order to incubate them in an environment where they will not be eaten by their parents or attacked by parasites. If left to their own devices, a few of the eggs will hatch and you can then collect the offspring and raise them in an aquarium.

You can, however, ensure the survival of a greater number of eggs by placing artificial spawning ropes in the pond. The Koi will deposit their eggs on these in preference to using the hard pond wall. To make these spawning ropes, cut 10cm(4in) lengths of 10-15mm (0.4-0.6in) thick nylon-fiber rope and thread these between the strands of a 120cm (4ft)- piece of the same sort of rope. As the Koi prepare to spawn, you will notice males chasing a female, nudging her side with their mouths. The female will occasionally stop and suck at the sides of the pond in an attempt to clean an area on which she can deposit her eggs. This is the time to gently lower the spawning ropes

into the pond. Spread out the coils of rope into a fanlike shape and anchor them to the side of the pond.

Try to avoid disturbing the fish before and during spawning, but keep a careful eye on them, as the males may bully some females. If this happens, remove the female and place her in a separate pond. Koi may prefer to spawn around dawn but they may also spawn throughout the day, when they have finished spawning, the females hang head down, respiring heavily, and the other fish will become less excited. Gently remove the spawning ropes and carefully place them in a vat for incubation. Koi are not good parents and unless you remove the eggs from the pond quickly, they will begin to eat them. Immature Koi may also eat the eggs, so if you want to rear them, you should separate the spawning Koi from others in the pond.

Incubating Koi eggs

The incubator should have a reasonable capacity - a household water storage tank (about 450 litres/100 gallons) is ideal - and should, of course, be made of non-toxic materials. It will need a valve-operated water inlet point, and an outlet with as large a surface area as possible, screened with a fine (0.3-0.5mm) stainless steel or plastic mesh. Fine nylon stockings may provide an adequate alternative, although they are less robust.

Lay the ropes out in the vat with 0.2mg/liter malachite green solution to stop fungus (Saprolegnia) from attacking dead eggs and spreading infection to living eggs. Place three lengths of string across the vat to keep the ropes (2in) below water level. Do not add any more water at this stage, but place an air stone on the floor of the vat to gently and continuously aerate the water, as developing eggs need plenty of oxygen. When you begin to see the growing koi's eyes in the egg - after one or two days - run a fine trickle of water into the incubation vat. The day before the Koi hatches, the eyes in the egg will have a shine to them. Soon afterwards, the young Koi will begin to wriggle then, gradually, over the next few hours, it will break out of its 'shell'. It will take three to four days for the Koi eggs to develop and the fry to hatch at temperatures of 20-22C(68-71F). Koi fry can develop at temperatures as low as 17C (63F), in which case their incubation will take five or six days, or as high as 25C(77F), which will decrease their hatching time. However, there is a greater chance of the fry being deformed at such extreme temperatures.

The development of the Koi egg and fry

When the fry have hatched, they will instinctively seek shelter and hide in any

cover they can find. The spawning ropes are ideal for this. Using a special sticky pad on their heads, the fry attach themselves to the ropes' fronds, or to the vat wall. At this stage in their development, the young Koi have no swim bladder, mouth or vent. They breathe by absorbing oxygen through the fine blood capillaries that surround the yolk sac, which is still attached to the gut. It is essential that there is plenty of oxygen entering the water at this stage, as a reduction in the quantity of dissolved oxygen in the incubator could lead to mass mortality.

The Koi fry have only one fin, which encircles the posterior end of the body. As the Koi grow, feeding on their yolk sac until all the yolk is utilized, they develop paired fins, a mouth and other organs. After two or three days, the young Koi swim up to the surface and take two or three gulps of air, which they force into their swim bladder. They then start to swim freely in mid water, usually congregating around the air stones - a sign that they are ready to be fed.

First feeding

Koi fry at the 'swim up' stage do not have any developed taste buds and so must detect their food by sight. Therefore they need to have food all around them. Hard-boiled egg yolk is an ideal food for the first day or so - this has very little dietary value, but will increase the size of the stomach. Newly hatched brine shrimp (*Artemia salina*) larvae are also a good food source for young Koi fry. Start feeding the brine shrimp when the Koi are about one week old. After another week or so, the Koi will be ready for a mash diet (the powder dust that is left after the manufacturing process of fish food). From this time onwards, feed the Koi food of a size that can be taken by the smallest fish in the vat.

You will need to remove accumulated debris and waste frequently during this first feeding stage. A siphon made from aeration tubing is ideal for removing settled and suspended waste from the incubator, and an old toothbrush is useful to clean the outlet screen. You should also add fresh water regularly to the vat to remove nitrates and ammonia. Tap water, which contains high concentrations of chlorine, should be aerated before it is added to the vat, to allow the chlorine to evaporate. After three or four weeks, the fry will have grown to 5-10mm (0.2-0.4in) in length and will be starting to take larger quantities of more generously sized foods.

Growing on

At this stage, move the Koi to a growing-on facility, such as an aquarium, tank or

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pond. Watch the young Koi carefully, as cannibalism is not uncommon. If you suspect this, remove any larger fry to another tank. You can heat this to 20-25C(68-77F) to provide faster growth rates, but be careful; if Koi grow too fast, they lose their colour. One-month-old Koi need about five percent of their body weight in food and should be fed little and often. As they grow, Koi need less food - about two percent of body weight (6in) or larger. The size of pelleted food is critical; not all fish grow at the same rate and it is too easy to look at the larger Koi and select the pellet size to suit them, forgetting the smaller fish. Unfortunately, Koi that are nearer to the common carp in appearance grow faster than the prettier Koi. This is because nishikigoi are highly inbred - that is, they are mated with other Koi to which they are closely related, such as either parents or siblings - and, as with any highly inbred animals, nishikigoi are not as hardy as their wild counterparts.

SALT TEST ON PLANTS

Adapted from Bonnie Hale @ koivet.com
http://www.koivet.com/html/articles/articles_details.php?article_id=131&category=1&name=Plant%20Information.

Many ponders run 0.1% salt in their ponds routinely for general fish health. In the case of parasites, it is generally recommended that ponds be salted at .3% for a minimum of 2 weeks. The plant versus salt test was run for 2-week periods at each salt level to see which plants would survive a .3% salting, and which would need to be removed from the pond. The test was run two separate times to ensure validity. Healthy, actively growing plants were set in a 600-gallon stock tank, with full aeration for circulation of salt. Salt was measured weekly using a refractometer and LaMotts salinity test kit. Each plant was physically removed and inspected before the next level of salt was added. Water lost to evaporation was replaced as needed. The letter "D" represents the level of salt at which the plant died.

PLANTS HIGHLIGHTED IN BOLD (IN THE .4% AND HIGHER COLUMNS) ARE SAFE AT .3% SALINITY

PLANT	0.1 %	0.2 %	0.3 %	0.4 %	0.5 %	0.6 %	NO TESTS
Arum - Calla			D				
Bacopa			D				
Blue Bells Chic-Chi			D				

Bog Bean			D				
Bog Lily				D			
Button Bush				D			
Canna					D	Top die back @ 0.5 %	
Cat Tail - Gracefull				D			
Cat Tail - Mini			D				
Cardinal Flower			D				
Cotton Grass			D				
Duckweed			D				
Fairy Moss					D	Brown @ 0.5 %, lived	
Floating Heart			D				
Forget-Me-Not			D				
Frog Bit			D				
Hibiscus					D	Top die back @ 0.5 %	
Houttuynia			D				
Iris				D			
Lavender Musk		D					
Lizards Tail				D		Top die back @ 0.4 %	
Manna Grass			D				
Papyrus, Dwarf				D			
Papyrus, Egyptian				D			
Parrots Feather				D			
Pickering Rush			D				
Perennial Rice					D		
Primrose Creeper			D				
Rush, Blue					D		
Rush, Striped					D		

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Rush, Zebra				D			
Sensitive Plant				D			
Star Grass		D					
Sweet Flag					D		
Taro - Black Magic			D				
Taro - Green					D		Top die back at 0.3 %
Thalia delbata						D	Top die back at 0.5 %
Umbrella Palm						D	
Water Baby's Breath			D				
Water Celery						D	Top die back at 0.5 %
Water Chestnut						D	Top die back at 0.5 %
Water Clover					D		
Water Clover, Variegated					D		
Water Fringe		D					
Water Hyacinth	D						
Water Lettuce	D						
Water Lily						D	Top die back at 0.4 %
Water Mint		D					
Water Snowflake		D					

Incredibly Edible Aquatics

*By Anne "Kelly" Billing via Pond Keeper

I met a gentleman last summer who, after witnessing a large pond installation, wondered why anyone would go to such great lengths for some colorful fish and beautiful flowers. To a few, you plant trees

for an orchard, and you plow the land for a vegetable garden.

He had entertained the thought of having a pond on more than one occasion the sparkling sun dancing on the water, the rising mist on a cool morning. It would be something, but it had to produce more than sheer beauty in return.

I understood completely, for he was very much like my own grandfather, and I was happy to share some practical possibilities. There are many plants, both common and unusual, found in ponds and wet places that are edible. He inspired me to take my limited knowledge and learn more.

What follows is a list of some wonderfully edible aquatic plants and how you would prepare and eat them.

LOTUS (*Nelumbo sp.*) My favorite part of this almost entirely edible plant are the seeds. When they are still green, but firm, the flavor resembles a cross between raw sweet corn and young peas. They may be eaten peeled or whole. As the seeds mature, they develop a slight mahogany color on top. These peeled seeds split easily in half to reveal the young, green, bitter leaves (remove) and have a very nutty flavor.

I was given a recipe for Chinese Sticky Rice and Lotus Seeds as follows: Toss cooked rice and peeled seeds. Place single servings in the center of fresh cut lotus leaves. Fold the leaves similar to a small package with the ends wrapped under. Steam for 10- 15 minutes until leaves become tender. Unfold and serve using the leaf as your platter.

Lotus tubers, shaped like bananas and harvested in the fall or spring, are said to be comparable to a sweet potato when baked. Cut crosswise, they reveal a beautiful pattern inside. I recall having seen sliced lotus tubers baked on a cookie sheet then dipped immediately into confectioners sugar, making a lovely candied delicacy. This may require some experimentation, since I don't recall the baking time and temperature.

The young leaves can be collected prior to uncurling and steamed like spinach. The mature leaves can be cut with 12" - 18" stems. Pierce the very center of the leaf, fill with wine, and hold overhead to draw the wine through the stem. This is believed (by the Japanese) to extract the life-giving juices from the lotus. I don't know about that. But it's sure to liven up any pond-side party!

Speaking of parties, my four-year old daughter, Colleen, and I have found that these leaves make spectacular party hats when placed upside down on your head.

WATER MINT (*Mentha aquatica*) A mild herb plant with a delightful fragrance, water mint, is not nearly as pungent as

most of the other mints I have tasted. It can be harvested almost year-round and can be added fresh to fruit salads and used to garnish cakes, platters, and cold drinks. Fresh or dried, it flavors jellies, sauces, and dressings.

My favorite is to add one whole lemon (squeezed) and a fistful of fresh mint (crushed in hand) to two quarts of warm water or brewed tea. Ice and serve. There is nothing more refreshing on a hot summer day.

WATER CRESS (*Nasturtium officinale*)

This is a plant that is highly under used, considering it can be found in most cool running streams throughout the United States. A fresh bunch purchased at the grocery store is easily rooted and cultivated as well. When collecting, cut only the foliage above water, as most underwater growth has sprouted roots, and they are not as palatable as the leaves. Aside from cress sandwiches, for which it is commonly known, water cress can be added in quantity to a multitude of dishes and salads, including tossed, tuna, potato, and egg. They all benefit from the zesty flavor it provides.

Watercress makes an excellent steamed green vegetable in place of spinach, kale, or Swiss chard. It can also be added last to all kinds of stir-fried dishes. Remember to never cook longer than until the leaves are just softened, or the valuable vitamins and minerals it is rich in will be lost.

A combination of watercress, Parsley, chive, and water chestnuts chopped and added to sour cream creates a delicious dip. The same combination mixed with butter will make a tasty topping for steamed green vegetable

WATER CELERY (*Umbelliferae oenanthe. javanica*) The young leaves are milder than the mature ones, but both are suitable for use in all types of salad. The distinct celery flavor makes this an excellent addition to soups, baked meats, and stuffing for poultry. The leaves can be dried and brewed for tea. The tea can be used as a remedy for an upset stomach although I haven't tried it.

This is one of the more vigorous aquatic plants, and it is a pleasure to know that the regular trimmings it requires will not need to be wasted.

ARROWHEAD, DUCK POTATO, WAPATOO (*Sagittaria latifolia*) Found coast-to-coast in wet areas, ponds and streams. Arrowhead was a staple food for the American Indians. The Indians would wade in the cold, shallow water during fall and spring to dislodge the tubers from the mud with their toes. They quickly float to the top for collection. For the water gardener. They can be sifted from the mud in the pot, saving a few for the following

year's crop. Braving the cold water barefoot seems like something I wouldn't want to do all the time, but something I'm sure I would like to experience at least once.

Try some Sagittaria Salad. It's easy. Quick, and something a little different: One quart of tubers boiled and peeled. Add mayonnaise. Diced hard-boiled egg, onions, and pickles to taste, enjoy. All of these plants are easily grown in your backyard pond, except watercress, which is better suited to a stream or lightly shaded area. They are all versatile and easy to prepare, making them an excellent starting place for turning your water garden into a source of food and nourishment.

There are an endless number of plants that are not only edible, but also extremely nutritious and great fun for the entire family to collect and prepare. For more information on edibles, try the following books. In them you will find recipes for cattails, bulrushes, marsh marigolds, wild callas, bog cranberries, and more! Bon Appetite!

WATER GARDEN PLANTS FOR SO. AZ

By Gail Barnhill

The Tucson Watergardeners

<http://tucsonwatergardeners.tripod.com>

The most popular water plant is, of course, the water lily. There are two major types of water lilies, the hardy water lily and the tropical water lily. The later *may* freeze here in the winter unless it is protected by placing it in the deepest part of the pond (probably minimum of 24") or the tuber lifted and kept in damp sand.

Another much loved water plant is the lotus. However, this *might* grow in So. AZ, but it does not bloom due to the combination of high heat and lack of humidity.

Most water plants multiply *very* rapidly. Free floating plants are the most notorious for this, and when you run out of friends to give the excess plants to, they make wonderful compost fodder.

In addition to many nurseries in town, a great source of water plants is The Tucson Watergardeners. Club members regularly bring their excess water plants to meetings to be given away as free door prizes. The Tucson Watergardeners also hold a water plant sale in May each year where you can find some of the more uncommon or unusual water plants to be had.

There are *many* other water plants worth growing, some of which are:

Free Floating (not planted in a pot): These are also good "filtration" plants as well as favorite spawning places for fish:

Azolla, Water Hyacinth, Water Lettuce
Frog Bit, Duckweed

Marginals or Bog Plants: The majority of "other" water plants are plants that thrive in very moist to boggy soils or in the watergarden with the top of their pots 1"-6" (depending on variety) below water level:

Louisiana Iris and Pseudacorus Iris
Japanese Iris (bloom season only)
Taro and Elephant's Ear
Papyrus, Giant, Dwarf, Miniature
Umbrella Grass
Water Hawthorne
Canna (yes, the garden kind)
Flowering Rush
Pickerel Rush
Corkscrew Rush
Marsh Marigold
Swamp or Bob Lily
Horsetail (Dwarf & Giant)
Cattail (Dwarf & Giant)
Manna Grass
Ribbon Grass
Daylilies (in boggy soil, not pond)
Chameleon Plant
Water Pennywort
Water Primrose
Water Clover
Water Forget-Me-Not
Parrot's Feather
Water Sensitive Plant
Water Snowflake or Water Fringe
Arums
Arrowhead Plants
Lizards Tail

FULLY SUBMERGED PLANTS: These are primarily plants that help oxygenate and clean the pond and provide nourishment and spawning areas for pond insects and fish:

Parrot's Feather, Sagittaria, Grasses:
Cabomba, Hornwort, Anacharis
Hair Grass, Canadian Pondweed
Giant Tape Grass

POTTING UP WATER PLANTS:

Because you do not want a rich soil in your pond that can contribute to an algae bloom, use a very lean soil – desert dirt is fine – unscented kitty litter (it's just clay) is easiest to obtain and work with.

Use fertilizer tablets monthly, or time-release fertilizer granules (available in 3, 6 or 9 month formulas) deep in the center of the pot. Put an inch or two of pea gravel in the top of the pot and when putting a pot in the watergarden, put it in at an angle, not straight down, so the water gently covers the top of the pot and doesn't disturb the soil as much. Use upside down black plastic nursery pots or brick (not concrete

block because of lime) to raise or lower the pot to the proper level.

POTTING UP POND PLANTS

My favorite method

By Gail Barnhill

The Tucson Watergardeners

Everyone seems to have their preferred method of potting up pond plants. While none are radically different, there are many subtle variations on the theme. This is my favorite:

The one thing you read over and over about potting medium for water plants, is that the soil should be very "lean" — in other words, not rich in organic matter. Just plain old "dirt" is dandy. If, however, you've worked for years on transforming your "dirt" into garden soil, it can be difficult to quickly come up with dirt for pond plantings. It also seems that most neighbors frown on you digging holes in their unimproved dirt...so what's a water gardener to do? Well, I head to the market and buy the cheapest, unimproved, unscented kitty litter! Read the ingredient label to be sure it only contains clay.

Store kitty litter in a 5-gallon bucket with a lid to keep it dry. Besides the convenience of having a readily available source of planting media on hand, kitty litter is very easy to work with. It is easy to moisten quickly and evenly whereas dirt isn't.

My favorite planter is the rigid black plastic "mesh" type. If I don't have one available, a regular black nursery pot will do. If using the mesh type I line the entire thing with fiberglass screen material, letting the screen fold over the top edge of the container by an inch or so. For regular nursery pots I simply cover the drain holes with screen. You can also use coffee filters. They eventually disintegrate, but by then roots will keep the soil in the pots.

Begin filling the pot with kitty litter, being careful you don't collapse the screen material. As soon as you've added about 3" of litter, moisten it well (but not "soaking"). I like to have about 90% of the litter wet, any more and your pot gets awfully heavy to lift! Continue adding/moistening until about 2" from the top of the container.

Next mix in some fertilizer. With a mesh container, be sure the fertilizer is deep in the center pot, as you don't want it right against the sides and leaching into the pond. The fertilizer can be more widely spread in a nursery pot. I prefer the ease of

using a time-release fertilizer rather than monthly plant tabs to feed my pond plants. I use one (Osmocote) that lasts for 9 months. There are other formulas that last 3 or 6 months as well. Push the litter back over the fertilizer and add more litter and moisten if needed.

Push aside the litter again as needed to insert the plant, and firms down the litter well, adding more if needed. Then add about 1-2" of washed pea gravel on top of the litter, pushing it down slightly into the litter. Note that any water draining out of the pot will be "chalky" from the clay, but when placed in your pond this will quickly settle.

When putting a potted plant into a pond, tip the container slightly so that the pond water gently begins to fill the pot. If you submerge the pot "on the level", the pond water will "whoosh" over the top of the pot and disturb the soil much more.

Newly planted water plants with few leaves and short stems can be placed on top of bricks or another inverted pot to raise it closer to the water surface and sun. Once the leaves have grown and the stems elongated a bit, lower the pot either in graduated steps over several days, or all the way to the appropriate level.

Another, much appreciated benefit of using kitty litter, is that it's MUCH easier to unpot overgrown plants. It doesn't form as solid a mass as soil does.

The following are some lists found in Pond & Garden magazine of water lilies best suited to different pond situations.

FOR SMALL PONDS/TUB GARDENS (3-4 ft. spread)

All below are Hardy Lilies

Perry's Fire Opal (rich pink)
Pink Beauty, aka "Fabiola" and "Luciana" (med pink)
Pink Opal (coral-pink)
Pink Sparkle (apricot pink)
Ellisiana (brilliant red)
Froebeli (burgundy-red)
James Brydon (rose-red)
Little Champion (vivid red)
Perry's Baby Red (deep red)
Perry's Dwarf Red (brilliant red)
Perry's Red Wonder (bright red)
Berit Strawn (reddish apricot)
Chrysantha aka "Graziella" (sunset changeable)
Indiana (sunset/changeable)
Paul Harriot (sunset/changeable)
Solfatara (apricot peach)
Hermine (white)
Walter Pagel (white)

Helvola (yellow pygmy)
 Chromatella (yellow)
 Joanne Pring (pink pygmy)
 William Falconer (deep red)

SHADE TOLERANT WATER LILIES:

Tropicals:

Most blue tropicals (day bloomers)
 Director Geroge T. Moore
 Isabella Pring (white)

Hardies:

James Brydon (red/rose range)
 Lucida (red/rose range)
 Attraction (red/rose range)
 Escarboucle aka "Aflame" (red/rose range)
 Froebeli (red/rose range)
 Masaniello (pink)
 Hal Miller (white)
 Chromatella (yellow)
 Comanche (sunset/changeable)
 Paul Harriot (sunset/changeable)
 Chrysantha (sunset/changeable)
 (A "sunset/changeable" is a lily that is in the yellow/peach/white range....first day bloom is one color and it gradually changes over the 3 days of bloom.)

WATER LILIES THAT REPRODUCE

VIVPAROUSLY

These are lilies that produce tiny "clone" plants where the stem meets the leaf. These tiny plantlets do not display much growth until the parent leaf begins to yellow and die. Remove the plantlet once you see root growth and pot in small containers and place in shallow water, protecting them from direct sunlight.

All below are day-blooming Tropical Lilies:

August Koch, Bagdad, Bluebird
 Charles Thomas, Daubeniana aka Dauben
 Edward D. Uber, Isabella Pring
 Margaret Mary, Mrs. Martin E. Randig
 Panama Pacific, Patricia, Paul Stetson,
 Peach Blow, Pink Platter, Royal Purple

>>>READ THIS ARTICLE AND KNOW MORE THAN 97% of the USUAL KOI FANATICS<<<

Doc Johnson

<http://www.koivet.com/handouts/ph.doc>

Ya'll have gotten enough from me on the latest and greatest on the web site, so this time I am filling your in-box with an article on pH.

Do you know everything about pH?

Let's look at some terms:

pH - A rather abstract measurement of the amount of free 'Hydrogen ions' in the water. In perfect balance, the pH is 'neutral' and is reported as 7.0. An 'acid' pH (a lot of free Hydrogen ions) would be something like 5.0 or 6.0. An alkaline pH,

with very little free Hydrogen) would be something like 9.0 - These hydrogen ions come from lots of places, but quite a contribution comes from Ammonia molecules as they are reduced to Nitrite.

NH3 → Activity of Nitrosomonas → NO2
 (Hydrogens released, Oxygens required)

The significance of pH in the most general terms, is that your animals will die if they are exposed to a pH that is very low, or very high. We will talk more about the behaviors of pH a little later.

Alkalinity - Amount of carbonate molecules in the water. See *carbonate activity*.

Total Alkalinity - Amount of carbonate molecules (activity) in the water.

Buffering Capacity - Carbonate (buffering) activity is exhaustible. When the carbonates are used up, the carbonate activity is gone. The capacity to stabilize pH is gone with it. If there's lots of Carbonates, the capacity to 'buffer' or stabilize pH is great. 'Buffering capacity' then refers to the amount of carbonate activity in terms of contribution to the 'neutralizing' capacity of the water.

Examples in context include: "Wow, my water has almost no carbonate alkalinity/activity - I'll bet the buffering capacity is therefore pretty low. I can certainly expect pH fluctuations." OR:

"Man, look at this Alkalinity! It's 200 ppm! My buffering capacity must be out the roof! My pH will remain rock solid." **Carbonate activity** - is the action of the carbonate molecules. We will discuss the behavior of carbonate molecules so you can understand their importance in one moment.

Hardness - Is nothing but the mineral (Calcium and Magnesium) content in the water. Other minerals contribute to this number, but Calcium and Magnesium are the most prodigious contributors.

Softness: A term for water that is virtually free of minerals. A term, which is irrelevant to pH.

GH - General Hardness - The Germans measure the water's buffering capacity in terms of "units of carbonate buffering capacity." General Hardness is a number, which combines Hardness (mineral content) and Carbonate activity.

KH - Karbonate Hardness - Concurrent use of the word Hardness *with* Carbonate is actually a misnomer, since the conventional application of the word 'hardness' should only apply to the mineral content of the water. However, the KH is basically the GH (General Hardness) with the mineral number subtracted.

"How do I actually measure the PH and Total Alkalinity?"

There are several kinds of tests to measure pH. I use the drop-type test kits, which use Bromthymol Blue dye as the reagent. I use the Aquarium Pharmaceuticals test kit for economy and accuracy. The test kit costs about five bucks. For a yellow result with the Bromthymol Blue dye as the reagent - we find the water to be 'acid' or low in pH. For a green result, we interpret neutrality, pH of about 7.0 and for a blue result; we interpret an Alkaline pH with a number over 8.0

The test for Total Alkalinity is available wherever human pool supplies are sold. There's even a cheap test kit which uses test strips and are readable in seconds. I found these at Home Depot in their pool supplies section. Kmart is also reputed to have these strip-type tests. A desirable result would be in the range of 80-150 ppm (parts-per-million) but numbers higher than that (to 300+) are also okay. I have seen illness in fish in very alkaline water, specifically a Total Alkalinity of over 400 ppm.

So we know that pH is an abstract measurement of Hydrogen ions in the water, and lots of these Hydrogens come from Ammonia reduction. Let's look at this dynamically.

An Ammonia-molecule is floating along when suddenly it is gripped firmly by its husk. A Nitrosomonas bacteria has it in its clutches. With greedy, red eyes darting nervously back and forth, the Nitrosomonas bites deeply into the Ammonia molecule and rips off the three or four Hydrogen ions and discards them into the water. (At the same time, it grabs a couple Oxygens from nearby and screws them onto the Nitrogen to make a Nitrite, but that's a whole 'nother story.)

Those recently cleaved hydrogens float along, and build up in the water to result in a lot of free Hydrogen in the water. This makes the water 'acid', and the pH to test low, like 6.0. This would be the natural state of affairs except for a rescue by Carbonate Activity.

Carbonate Activity is the activity of the 'carbonate molecule', which likes to act as a kind of "Federal Reserve Bank" for water. What this means in simple terms, is that when Hydrogen ions start to accumulate, the carbonates 'pick up the spares'. To the contrary, when the Hydrogen concentration is declining, the Carbonates can liberate some Hydrogens and keep the pH stable or unchanging.

"Where do Carbonates come from? "

Well, **Baking Soda** is nothing but Sodium Bicarbonate. When Baking Soda hits the water, it splits off the Sodium, and the carbonate is left. Addition of Baking Soda (Sodium Bicarbonate) results in a higher Carbonate Alkalinity but does nothing to Hardness.

Oyster Shell is nothing but Calcium Carbonate and Magnesium Carbonate. When the Oyster shell dissolves due to the presence of acid water, it liberates Calcium, Magnesium, and Carbonates. These mineral liberations increase the hardness of the water (contributing nothing to Buffering capacity) and the Carbonates increase the Alkalinity. Thus, the pH is stabilized.

Crushed Coral is Calcium Carbonate and Magnesium Carbonate but also contains a central structural molecule of Calcium Hydroxy-appetite. (I didn't name the stuff.) The significance of this is that when the crushed coral dissolves, it leaves behind the insoluble Calcium Hydroxy-appetite, which is not a contributor to pH stability. While crushed oyster shell dissolves and vanishes, letting you know when to add more, the crushed coral remains, looking good but doing nothing.

"How do you use crushed oyster shell?"

Well, first, you have to realize it's not how much you use, but *how* you use it. If you put 300 pounds in a thousand-gallon pool, and run the water AROUND it, there will be no effect. I was reminded by Betty Roemer, that if you bag it and leave it on the bottom, there would form a slime layer on it, which will also impede the dissolution of the particles. However, even five pounds of crushed oyster shell in a thousand-gallon pool will work wonders if ALL the water is forced through the bag in the filter. I had one customer fill a five-gallon bucket with oyster shell and supply it's own pump to it. Raised the water to 120ppm total Alkalinity almost overnight. *Powdered* oyster shell is easier to use, although it clouds the water to a milky color initially during its application. I use one cup per thousand gallons as a touch up to total alkalinity.

"If I understand correctly, it's possible to have hard acid water".

Sure, if you took distilled water, (which has nothing dissolved in it) and added Calcium Chloride, you'd get real hard water without any contribution to total alkalinity.

"It's also possible to have soft alkaline water".

Sure, you could take the same distilled water, and add Sodium bicarbonate and get a pH of 8.3 and have no hardness at all. No hardness because there are no minerals.

"How do plants modify pH?"

Well, you'd have to understand in detail, how Carbon Dioxide usually behaves in water. [Which I don't]. All I know is that given the usually normal condition in the environment, every bit of Carbon Dioxide given off in water becomes Carbonic Acid, dragging down pH.

Recall that during the nighttime, the plants grow, taking oxygen and liberating carbon dioxide, which becomes carbonic acid, dropping the pH towards the acid range. During daylight hours, plants reverse their respiration and give off oxygen taking in carbon dioxide. Without carbon dioxide around in the water to make carbonic acid, the pH rises into an alkaline condition.

"Why should I care about having an adequate Total (carbonate) Alkalinity?"

Well, the bacteria in your filter which are responsible for breaking down Ammonia won't function well at lower pH. In fact, these heterotrophs "shut down when the pH nears 5.5! If you're trying to bring a filter online and cycled as fast as possible, I must emphasize to you that warmth, oxygenation and support of carbonate alkalinity are the three key ingredients.

Water 'clarifies' better with higher Alkalinity. It's a simple fact that I cannot correctly explain but has to do with settling out positively charged particulate debris (proteins, or nitrogen based molecules).

Fluctuations in pH will be minimized by carbonate buffering. A stressful or potentially fatal crash of the pH can be avoided by the reinforcement of carbonate buffering.

"What does this boil down to?"

- 1) pH should be neutral or pretty close to it. A high pH is not worth worrying about unless Ammonia is in the water. (But that's a whole 'nother story.) A low pH should be brought up right quick! Don't bring it up slowly or the fish can die while waiting for their rescue.
- 2) pH will fluctuate a lot if there's not a buffer to 'grab up' or 'give off' the Hydrogen molecules. Carbonates are needed for this reason. Supplementation of carbonates to the pond will raise the Total Alkalinity and stabilize the pH.
- 3) Carbonates can be supplied in the form of specialized powders from

commercial sources such as SeaChem's Neutral Regulator (my fave) or from Crushed Oyster shell.

- 4) Your water will be clearer with a higher Total (carbonate) Alkalinity.
- 5) Hardness is not a measurement that can be associated with pH.

"What are my 'action items'?"

- Have a pH test kit and check your water at least weekly, if not more.
- Have a test kit for Total Alkalinity (pool supply store has these) and test after major water changes or anytime water is in question.
- Use a commercial buffer (baking soda or powdered oyster shell) to insulate yourself against losses due to pH crash.



Kawarigo Korum

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Koi Club of San Diego Koi Show

March 13, 2005

Warren Essig

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Annual Pond Tour

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SAKA NEWS

July 24, 2005

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