Tucson Watergardeners' Tour 2000

Photos by Carlene Huesgen

Ask any of these Tucson pond owners "Why?" and you'll hear the unanimous answer: "To create an oasis!" In the midst of desert conditions, Tucson water gardeners do create oases. The rest of us can only envy the low maintenance surrounds of these watery islands of tranquility. Join us for a peek into the backyards of members of the Tucson Watergardeners during their second annual public pond tour.

Loring and Susan Green

After having built a pond some 20 years ago, Loring Green knew he wanted another pond when he and Susan built their new home within view of the Catalina Mountains. The in-ground, shot-crete pond is recessed into a tiled patio and surrounded by large stucco blocks . Carl Ragel of Natural Pools and Gardens comments, "This project still stands out as the most complex layout and integration of modularity I have been involved with in thirty years of doing this kind of work."

The pond measures 9' x 9' by 2' and holds about 900 gallons. Plant shelves, 12 and 18 inches wide and 6 inches below the water's surface , line three sides of the pond.A 300 GPH pump recycles the water over the offset ledges. A bottom drain facilitates cleaning. Monitoring their goldfish population, the Greens do not need a bio-filter. The pump is set within a plastic dishpan, enclosed within fiberglass window screen bag to prevent the pump's clogging.

Loring and Susan most enjoy sitting pondside with their mountain view beyond.

Ed and Sue Boers

It wasn't easy using a heavy-duty post-hole digger to excavate their backyard pond, but the Boers' garden now includes the relaxing sight and sound of water.

Inspired by their two-tiered fountain and a ceramic container water garden in the front entry, Ed and Sue Boers wanted a real water garden in the backyard. With caliche soil and rains that wouldn't evaporate, the heavy, sticky soil belabored their efforts. Finally, the 1,000 gallon pond was finished. Shredded PVC acts as bio-filter media in their 30-gallon barrel, topped with water hyacinths for extra nutrient-removal.

Flagstone decking makes for easy maintenance around the Boers' pond.

A blue-glazed pot becomes a container water garden with Judy's creative touch.

Lyle and Judy Calvert

Judy and Lyle's garden contains two in-ground ponds, three container water gardens, bird baths and special watering features for butterflies and hummingbirds. Picks, shovels, and a jackhammer were often necessary. Judy chuckles, "I thought for sure the neighbors would think we were open-pit mining when we brought in the jackhammer, but we hit caliche at about two feet and really needed it." Lyle did all the digging, and Judy did the design, rock placement, and planting.

Judy has created a "garden café" in a corner of their garden, complete with painted "walls" and a whiskey barrel garden filled with aquatic plants and a bell fountain.

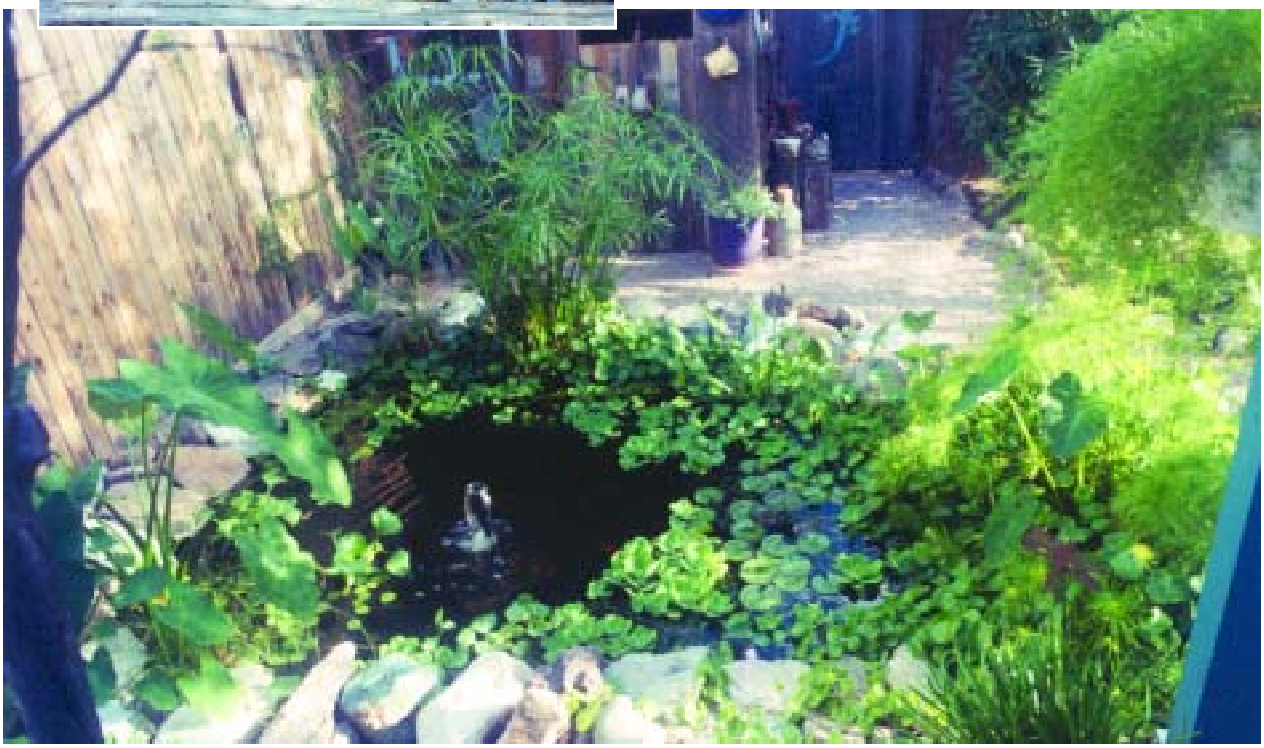
Both ponds are lined with vinyl PVC and edged with river rock and interesting rocks collected across the state. The larger pond holds about 1,000 gallons and has two stepped down levels at 18" and 24"for plants, with the remainder of the pond 32" deep. A 1,000 GPH pump circulates water through a bubbler fountain. The bio-filter is a plumbed 11 x 10 inch by 8-inch deep plastic box which holds stippled PVC strapping as the bio-media.

Judy shared some of her secrets of aquatic

The cooling sound of water can be heard from all corners of the Calverts' garden.

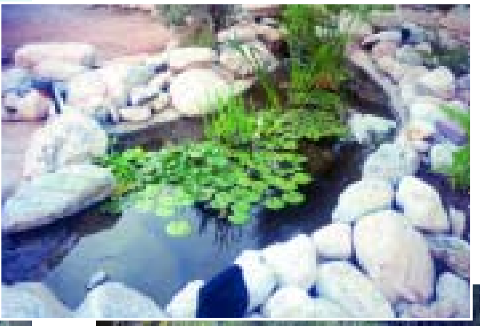
plant success. Weight the bottom of the pot with three or four stones to keep it from tipping over. Use plain unscented cat litter as the planting medium. Insert slow-release fertilizer well into the cat litter and around the plant. Top-dress the container with large gravel to confine the media and to keep the koi from rooting around the base of the plant.

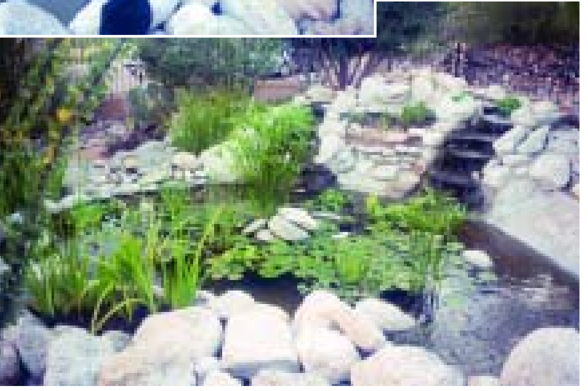
A special collection of gathered rocks edges the main water garden in the Calverts' backyard.



(above) Like most water gardeners, Judy doesn't throw away her extra plants; she just finds more containers for them!
(inset) Upon entering the Calverts' garden with its xeriscaped entry, one would never suspect the oasis waiting inside.

The evening sunset is mirrored in the Farrells' desert pond.





A double waterfall feeds the main pond in the Farrells' front yard. Plants are grown in the channels' pockets.

Bob and Melva Farrell

Melva and Bob purchased their home partly because they were so attracted to the stream-linked ponds tumbling diagonally across the front yard. For business reasons, they left Tucson in 1992, renting the house, only to return five years later and find five bog garden additions. Their pond renovations had begun.

Their concrete-lined ponds are tucked into a desert landscape with split waterfalls flowing down the hill to a large bottom pond. A 2500 gallon sump pump re-circulates the water to the feeder ponds at the top. Granite rocks and boulders edge the water features.Melva uses plain desert soil for planting her aquatic plants, washing it first to remove dust and small particles. Topped with gravel, the soil stays in the submerged pots.

Melva wears sneakers into the pond to navigate the steeply sloped sides, noting she wouldn't have built it that way!

Joy Rice

Hooked by her first pond built to attract cardinals to her garden, Joy Rice built another…and another. Joy did most of the digging herself, with the traditional Tucson-tool – a pick. The smaller ponds are 12 x 4, holding 360 gallons, and 10 x 10, holding 750 gallons. The largest pond, 15 x 5 and 3 1/2 feet deep, holds nearly 1800 gallons.

Following a club program on bio-filters, Joy built her own with a 40-gallon plastic trash barrel. She also uses a UV clarifier with the filter. Joy keeps goldfish, mosquito fish, Dojo loaches, and Porky, her sole-survivor koi left behind in a heron raid.

Joy first became hooked on ponds as she created a backyard habit designed to attract birds, especially the brilliant cardinals.

Joy's two smaller ponds are only 12 inches deep, perfect for growing shallow-water aquatic plants and supplying an attractive water source for the birds.

The birds love Joy's cascading basins!

Carl and Cyndi Ragel

Carl and Cyndi's backyard is a magical creation devoted to Carl's tests of integrating water gardening, hydroponics, and aquaponics, as well as ideas for his own pond-construction business. Carl designed an above-ground construction to provide additional elevation for gravity-operated water flow and to favor his bad back. Along

Surprisingly, Carl and Cyndi's huge pond is built above ground! Concealed along one side are the extensive filtration elements Carl tests, including skimmer systems, fluid bead filters, a vortex separator, upflow filters, and UV clarifiers.

Carl's main pond measures 52' long with widths ranging from 12 to 16 feet. Depths range from 18 to 44 inches. Carl's experiments have resulted in a lush, tropical oasis in the Arizona desert.

with the pond, the Ragels' yard includes an enclosed Veg-o-return vegetable garden, a hydroponic greenhouse, and an 18,000-gallon, underground, water collection system made from recycled gasoline tanks. Carl meter-registered over 220,000 gallons run through the system in little more than a year.

Besides koi, Carl studies his catfish, 3 Plecostamus, several hundred goldfish (fantails, comets, and shubunkins), and lots of mosquito fish.

Carl runs three to six pumps, depending on what project he is currently researching. Waterfalls returning the cycled water provide aeration for his fish collection.

Tom and Nancy Quick

Since Tom is a Master Gardener, his and Nancy's garden is a cornucopia of desert gardening ideas. Water, whether in ponds, container gardens, or in fountains, lends aesthetic and spiritual elements to the garden. The lush entry vignette only hints at the garden beyond.

Bamboo, garden statuary and lighting, flowering plants…and a feather rock waterfall greet visitors to the Quicks' home.

The Japanese theme in the backyard is captured with a lighted lantern next to the pond.

Another tiered fountain is framed on the shaded porch.

The larger backyard pond, adjacent to the swimming pool, measures 17 x 4 feet with 18 to 36 inches of depth. Plants, especially water hyacinths and water lettuce that burn in the harsh sunlight, are rotated into a smaller, shadier pond near the patio. The pond also gives a reprieve to plants nibbled by fish.

Tom and Nancy's backyard ponds evidence Tom's Master Gardener touch!

A special thanks to Gail Barnhill and the Tucson Watergardeners for sharing their 2000 pond tour with us!

Natural bamboo fencing surrounds the 30-gallon bio-filter barrel, containing stippled PVC strapping media. A 950 GPH pump circulates pond water to the bio-filter and over the waterfall.

Are You a Culturist?

by Ray Giacobone

The key to pondkeeping – the Nitrogen Cycle!

Just what is a culturist? I use the term as one who raises cultures. To raise anything, you must provide a protective home, water, food, and a suitable gas to breathe.

If you have koi (or any fish), I believe you are a culturist, twice over. Simply put, keeping and raising koi means you must provide the protective home (the pond and its liner), clean water (free of waste products), food (the proper amount of protein at the right time), a suitable gas (the proper percentage of oxygen in the water), and all of this at the proper operative temperatures.

The second culture you must raise is the proper bacteria to keep the water cleaned of waste products (Ammonia, Nitrite, Nitrate). Their protective home is the filter tank. They need to live in a water environment. The food is Ammonia and Nitrite. The suitable gas is oxygen.

If you keep fish in your pond, you are a culturist.

Nitrogen Cycle

Without any one of these components your bacterial culture and, therefore, your koi culture will not flourish. If they don't flourish, your fish easily get sick and die. To be successful at raising koi, you must understand the Nitrogen Cycle. Being a cycle, one part of the cycle is very dependent on the other. As I explain, please keep referring to the graphic of the Nitrogen Cycle on page 48.

Ammonia as Food

Let's start with the koi's natural activity of eating. From this eating there will be liquid waste. In this liquid waste is ammonia. There is also solid waste, and it is broken down by bacteria, with one of the products being ammonia. The excess food that is not eaten decays and produces ammonia. So let's talk about the ammonia.

Ammonia is the food that the rod-shaped

nitrosomonas bacteria need and use to live and grow. The *nitrosomonas* take this chemical out of the water and digest it. The waste product of this activity is nitrite. Looking at the chart, you also see that the bacteria need oxygen in the water to do this digesting. This is accomplished by replacing the hydrogen (H) in the ammonia (NH_3) with oxygen (O_2) to make nitrite (NO_2). Good aeration is imperative for the success and life of the *nitrosomonas* bacteria. Also, this bacterium grows in sheets or very thin layers. This enables the bacteria to more readily come in contact with and access the oxygen and ammonia in the water, making it is much easier to absorb and chemically work these compounds.

The drawback presented here is that in order to grow good quantities of *nitrosomonas* bacteria, you need to provide a large surface area. This criterion affects both the size of the filter and the type of media inside the filter. Usually, when purchasing media, you can find out its surface area to compare with that offered by other types of media. The filter size and its media are critical factors in the efficiency of your filter. To refer back to what was said earlier, *to have a successful culture, one important component is a protective home*. The filter and media you provide are the bacteria's home.

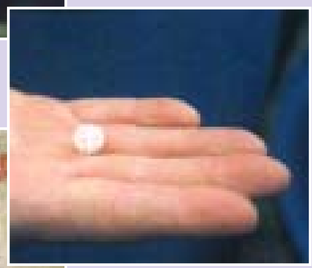
In talking about a protective home, the bacteria also must be kept out of sunlight and at a proper temperature. Sunlight restricts their growth. The colder the temperature, the slower they work. When the temperature gets below 50 degrees, the bacteria go dormant. This means *no* ammonia is being taken out of the system. If the temperature rises above 85 degrees, the bacteria die off, which also means *no* ammonia removal.

Bio-Filter Media Options

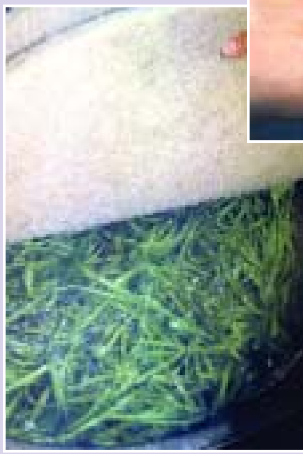
Lava rock works but is hampered by weight and higher maintenance.

Volcanic rock is smaller and lighter in weight than lava rock. It can be stirred within its chamber for cleaning..

Bio-balls are plastic fabrications with much surface area for bacteria.

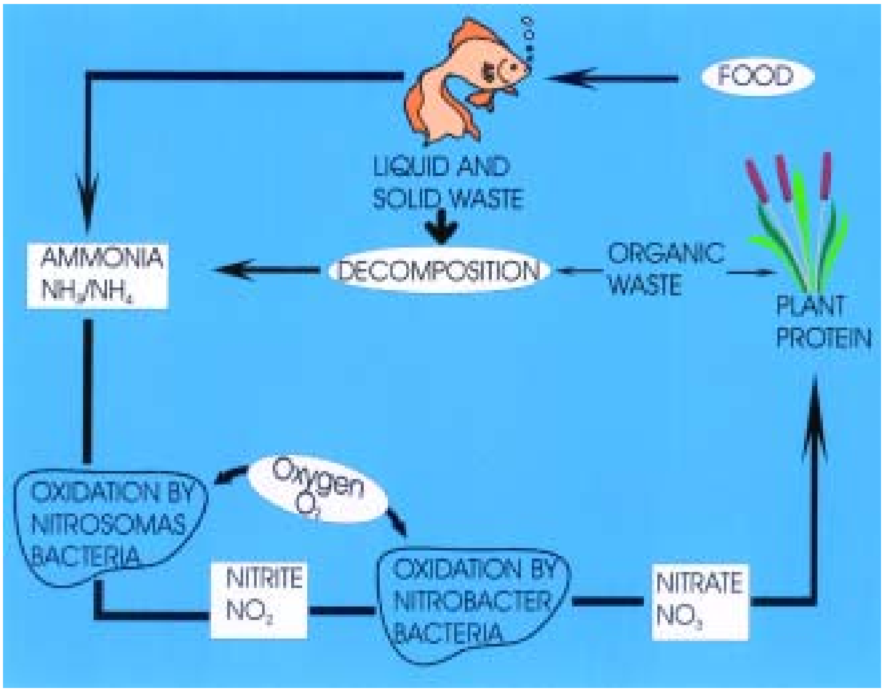


Mini, plastic bio-balls offer extensive surface area.



Thin plastic ribbon, known as bio-ribbon, is a popular, light-weight media. The foam layer protects the bio-media from sunlight and particulate matter.

Any one of these factors — insufficient surface area, low oxygen levels, sunlight, and water temperature — can retard the growth of your *nitrosomonas* bacteria. These are the "good guys." If they are gone, ammonia builds up and drastically affects your fish's health.



Nitrite as Food

The next step in the Nitrogen Cycle involves *nitrobacter* bacteria, which are also rod-shaped and "good guys." Their food of choice is nitrite. *Nitrobacter* bacteria share some cultural characteristics with the *nitrosomonas. Nitrobacters* are also sheet-forming bacteria. This means that housing requirements – temperature and gas— are the same as well.

The differences are the food and the condition of the water. The food is not ammonia but nitrite. Again, looking at the chart you can see that the *nitrobacter* takes nitrite (NO_2) and turns it into nitrate (NO_3). Look at these two formulas. What is the difference between them? The number of oxygen atoms. Nitrite has two oxygen atoms, and nitrate has three oxygen atoms. Now you can see why it is so important to have a good oxygen supply in your filter. Either the water coming into the filter must have a good amount of oxygen, or you can add it with a bubbler.

The other difference is that *nitrobacter* bacteria don't like fast moving water. They can't attach to a surface as easily as can the *nitrosomonas*. You can take advantage of this characteristic. If your filter system has a backwashing function, by speeding up the water when backwashing, you can easily break loose the old, dead bacteria and flush it away. Both types of bacteria grow layer on top of layer. This eventually plugs up your filter, impairing mechanical filtration and resulting in the death of bacteria by oxygen deprivation or suffocation. Long before you realize it, water flow is constricted enough to drastically reduce oxygen and food flowing past the bacteria. Often they begin dying before you realize there is a problem. You can tell something is going wrong by testing the water for ammonia and nitrite regularly. If the water tests positive for ammonia and/or nitrite, the filter media may need cleaning.

Nitrate as Food

Going to the next step on the chart, we see a picture of plants. Nitrate is a common component of plant fertilizers. Plants need nitrogen to grow, and nitrate is a usable form, as is nitrite, although plants use nitrate a lot easier and faster. Keep in mind that nitrogen exists throughout a plant. When the plant eventually dies, or in some cases, is eaten, this plant material falls back into the water where other bacteria decompose it and produce ammonia. This decaying matter (detritus) must be removed from the pond. If the detritus content becomes too high, the resulting addition of ammonia causes extremely unhealthy conditions: the "good guy" bacteria might not be able to handle the over-load, and you are back to sick fish.

Some pond owners have few or no plants in their ponds. This can lead to high nitrate conditions, which can foster algae growth or, in extreme cases, sick fish. Frequent water changes prevent nitrate build-up. The good news is that if this high-nitrate water is good for water plants, then it is also good for terrestrial plants. When you are getting rid of this pond water, put it on your land plants.

Additional Factors

Some additional factors that interfere with the growth process of bacterial culture are water pH, alkalinity, space, and medicinal chemicals. The best operating pH range is between 6-9. Yes, you can have a higher pH and do fine, but the higher you go, the less efficient is the growth. The worst pH scenario is to change the pH quickly (more than .5 to 1 pH integer), even if it is within the acceptable range. Such quick change stunts growth immediately.

The alkalinity of the cultural system provides the carbon needed by the bacteria to create cell structures. If alakalinity is too low, cells cannot grow.

Heterotrophic bacteria (bad, anaerobic bacteria that produce fish-toxic wastes) grow 5 times faster than the autotrophs (good, aerobic bacteria). This presents a significant competition for growing space. If there is a lot of decaying material for the bad bacteria to use, then space is limited for the good bacteria. Particulate matter in the pond is usually organic. Therefore, high amounts of solids in the pond probably indicate a high number of the bad bacteria. Water changes, filter backwashing or cleaning, and bottom vacuuming are then in order.

When adding medication to the pond to cure fish health problems, consider its effect upon the good bacteria. Always check labels to see if the medication kills the bacterial culture and how to administer it without affecting the filter's culture.

Conclusion

None of the good bacteria culturing process happens overnight. Good bacteria are inefficient at cell production and, therefore, slow-growing. Even though you have provided all the good bacteria's cultural needs, ammonia, nitrite, and nitrate will spike before bacterial numbers and chemical concentrations balance in optimal numbers. Commonly these spikes occur in the spring as the bacteria re-establish. (This offers part of the explanation for spring's green pond water.) Establishing a culture takes even longer, creating problems for fish in a new pond or in one that has been cleaned extremely well. Also, adding too much fish mass at one time can create chemical spikes.

If you find that ammonia and nitrite are registering a presence in your pond, think back to your nitrogen chart. Ask yourself if you are providing all the proper components, including time, to keep your good bacteria happy.

Ray Giacobone is a reired science teacher from Troy, Michigan, who now writes and gives programs on ponding topics.