

Koi Pond *Beginners*



Compliments of
Southwest Koi and Pond Association

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Preface

This booklet has been prepared as a tool for new pond owners and for misinformed pond owners so that they may know how to improve and correct bad decisions made during pond construction. Some pond builders build beautiful ponds that are not at all functional for raising of koi. Most of these pond builders know very little about the koi hobby. This booklet explains what is needed in pond construction to make your pond suitable for koi. There are much more involved than digging a hole, filling it with water, and throwing in some fish. The articles in this booklet describe what is needed and how to overcome unexpected obstacles.

Koi have been highly developed over the years and have been studied by many breeders and koi hobbyist. You will learn some of the features of their anatomy, how they may act under certain conditions, about their nutrition, and historically how they were developed from the common river carp.

Most importantly the reader of this material will appreciate the value of bacteria in our ponds and filters. Without this bacteria, our koi could not exist without frequent water changes to eliminate ammonia and nitrites. You will learn that in most cases pond problems and koi health problems can be prevented and overcome.

This booklet is dedicated to the members of the Southwest Koi and Pond Association who have devoted much of their time in improving and promoting the organization and advancing the koi hobby.

Don Harrawood

Information for Koi Pond Beginners

There are many things that beginners need to know in order to have a successful experience raising Koi as pets. It is not just a matter of filling a hole with water and throwing in some koi. Years of experience of koi owners and veterinarians have revealed a host of important lessons learned and the reasoning behind some very logical thinking and conclusions. The following information is a necessity for the many things involved in successful pond building and koi keeping. Keep in mind that when problems arise, there is help available from established members of the Southwest Koi and Pond Association (SKAPA).

www.skapa.org Phones (915) 833-9339 and (915) 584-6293.

Pond Construction:

There are three basic kinds of ponds, Garden Ponds, Garden Ponds with fish, and Koi Ponds. Garden Ponds feature aquatic plants. Garden Ponds with fish are the same but include some fish, generally gold fish with a few koi. Koi ponds contain primarily koi with little or no plants. I will discuss koi ponds and how they should be constructed.

Koi ponds can be sealed with a rubber liner or with concrete. Both are satisfactory kinds of construction, but each has their own peculiar faults and advantages. I will point some of them out for you.

- Liner construction should include an EPDM Rubber lining material 0.045" thick. This material is warranted for 20 years to not deteriorate, whereas some pond builders use a similar looking material that is plastic instead of rubber. This material deteriorates in two to three years, becomes very brittle, and punctures easily. This material is much less expensive than EPDM rubber, but causes lots of misery in the long run due to major leaks occurring because of premature deterioration. Overall, liner construction is less expensive than concrete construction; however assembly of a liner results in many unsightly folds of the liner material inside the pond. Most pond builders hide these unsightly folds with a lining of rocks. All these rocks and folds trap waste in the pond bottom and sides. This condition is unhealthy for the koi and is not recommended by most koi keepers.
- Concrete construction is more permanent than liner construction, and has the advantage of having smooth bottoms and side surfaces. A smooth bottom with bottom drains and no rocks is very beneficial in that the pond bottom will remain relatively clean throughout the year. This occurs because the bottom drains pull debris from the bottom and deposits it in the filter. This cleaner pond bottom is a big benefit to your koi, since koi

are naturally bottom feeders and are constantly sucking material from the pond bottom. Another advantage of a concrete pond is that it can be shaped in so many different ways and made more pleasing to the eye. Concrete ponds have two major disadvantages in that they generally cost more to construct, and when new, there is always a high water pH condition because the cement in the concrete leaches into the pond water and causes an increase in pH. This pH condition must be reduced and controlled before koi can successfully live in the water. New concrete ponds after filled with water can result in pH readings as high as 13.0. This value must be reduced and maintained to 9.0 or below before adding fish to the water. Koi can live successfully in water with pH from 6.5 to 9.0 with no apparent problem; however they may die when they are subjected to pH above 9.0 or to a rapid change in pH. (For instance, taking the koi from water with 7.5 pH and placing them into water with 8.5 pH, the shock could kill them.) pH values are logarithmic and are not based upon a 1 to 1 ratio. A pH value of 8.0 is ten times higher than a pH value of 7.0. The high pH condition can be reduced by the addition of muriatic acid. The acid must be added over a period of time until the cement stops leaching out of the concrete. pH values should be measured with an accurate pH meter, and not with the less accurate pH test strips. Pond water must remain below 9.0 for a period of two or three days after the last addition of acid. After that, the pH should remain relatively stable and may not need further reducing. A second way to reduce pH is through many water changes. This may be more costly. For your information, water from the El Paso City water supply runs about 8.5 to 8.6 pH.

- Pond construction in general should include these features:
 - The pond should be at least 3 feet deep in some area. Deeper is better, since koi will remain in the deepest part of the pond during winter hibernation. This depth will also discourage many predators.
 - Pond sides should be vertical, since this will also discourage predators from feasting on your koi.
 - Pond bottoms should be void of gravel and rocks. Gravel and rocks are for beautification purposes only. This material collects debris which decays and forms hydrogen sulfide gas, unhealthy for koi, and when in excess, can cause their death. Smooth bottoms with bottom drains are recommended.
 - Ponds should have a bottom drain every linear 10 feet of bottom space. A bottom drain is effective for about a 5 feet radius. It is beneficial to have the bottom surface slope slightly toward the drain.
 - Ponds should have a skimmer for continual removal of floating debris. Although skimming can be done manually with a skimming net.

- Ponds should have an automatic water level control valve. This keeps water level constant without having to add water manually with a hose.
- A pond should have a good means of aeration, or adding oxygen to the water. One of the best ways is to construct a waterfall to flow and agitate water as it flows back into the pond. A waterfall that is spread out and runs into various basins prior to running into the pond will supply much more oxygen to the water than a waterfall built like a chimney which dumps water directly into the pond. Water running through a long stream prior to entering the pond is even better. Cold water absorbs and holds a greater amount of oxygen than does warmer water, therefore aeration is more important in warm weather. In lieu of a waterfall, the pond owner should supply oxygen to the pond through the use of an aerator pump during warm weather.
- Shade over the pond is not a necessity; however it furnishes shade for the fish and will keep water a few degrees cooler during hot weather, as well as reducing algae in the pond.
- Ponds should have adequate filtration and water quality control equipment. This is discussed later in this material.
- Last but not least, ponds should be constructed with raised sides above ground level. This prevents ground water from the yard running into the pond during rain storms. Pesticides and fertilizers from the yard are deadly to koi.

Filtration:

- An efficient filtration system is probably the most important equipment needed for a koi pond. There are many different kinds of filtration equipment on the market today. Most do an acceptable job, some do not. Others do a good job but take lots of maintenance. For lowest maintenance, I recommend a pressure type bead or media filter. These filters are more costly than most; however excellent filtration and low maintenance are the resulting benefits. These filters require periodic backwashing which can be done in about 5 minutes without getting your hands wet. You need only to turn a lever on the control head. In addition to installing a good filter, it is important that you have a pump that will circulate your pond water volume approximately hourly. In addition, the installation and maintenance of a suitable Ultraviolet Light will prevent a green water condition from ever happening in your pond. Please note that the lamp inside the U.V. must be replaced every 12 months of operation, regardless whether it still glows. These lights gradually lose their effectiveness over operating hours and must be replaced yearly.

Maintenance:

Assuming your pond is supplied with the appropriate equipment, the following is the expected amount of maintenance:

- Backwash the filter approximately every two weeks during the summer months. Backwashing may be required more often, depending upon the surrounding conditions and the fish load in the pond. Generally, time for backwashing can be determined by the increased reading on the pressure gage or by the amount of water coming from the discharge back into the pond. After backwashing, make sure to add de-chlorinator to the pond prior to refilling with city water. Chlorine is a quick killer of koi if not neutralized during pond refill.
- Water over time will accumulate a heavy load of particulates in the pond due to evaporation and other causes. Pond water should be refreshed weekly with a 10% water change, meaning drain 10% of the water out of the pond and replace it with fresh water. Backwashing of the filter can replace the water changes, since water is replaced during this process. Don't forget to add de-chlorinator (Sodium Thiosulfate Solution) prior to refilling the pond.
- Every week or two, clean the debris out of the leaf basket at the pump. Too much debris in this leaf trap will cause a drastic reduction in water flow. Very low filter gauge pressure indicates time to clean the leaf trap.
- Skimmer baskets should be emptied periodically, depending upon the amount of leaves and other debris that is removed from in the pond.
- Replace the U.V. lamp every 12 months.

Beneficial Bacteria:

Unknown to most new koi keepers is the value of beneficial bacteria and how bacterial colonies are established, and what these bacteria do in the scheme of things. Let's start with the koi – koi are constantly excreting ammonia from their gills during their water/air exchange. In addition, decayed matter in the pond also causes ammonia in the water. When the ammonia concentration gets to the point that koi take in more ammonia from the water than they can expel, they become sick with ammonia poisoning and if not corrected immediately, they may die. Our Savior is the lowly beneficial bacteria. There are basically two types of beneficial bacteria. One type feeds on the ammonia and they change ammonia to nitrites. Both ammonia and nitrites are poisonous to koi. A second strain of beneficial bacteria feeds on the nitrites and transforms the nitrites to nitrates, which are detrimental to koi only under very large concentrations. In a new pond, it takes about 5-6 weeks for beneficial bacteria to form in such concentrations to consume the ammonia and nitrites. This time period varies with the water temperature and by the fish load in the pond. Since all the pond water flows

through the pressurized filter every hour, and the filter media contains millions of beads, the surface area inside the filter is a great place for the bacteria to colonize. Although the bacteria will form inside the pond walls, the filter is the primary place for bacteria colonization, since all the water flows through. The bacterial colony will not flourish in cold water (winter time), but will start multiplying as water temperatures get warmer.

In new ponds, with the addition of fish (assuming pH is stabilized below 9.0); ammonia concentrations will rise until the bacteria colony grows appropriately to neutralize the ammonia. The pond owner should have and use ammonia and nitrite test kits to measure levels of these toxins, until sufficient bacteria is established. In cases where bacteria is not established, ammonia and nitrite levels can be controlled through appropriate water changes in order to lower ammonia and nitrite concentrations. Don't forget to add de-chlorinator to make-up water. With our high pH level in city water, ammonia is much more toxic to koi than in water with lower level of pH. Under this condition, it is not acceptable to accept any level of ammonia in pond water as being ok. Ammonia is much more toxic to koi than nitrites. Use the "drop" type of test kit for checking ammonia and nitrites, since the strip types are usually not as accurate.

Pond Water Volume:

Every pond owner needs to know their total pond volume in order to properly add the right amount of pond water additives to accomplish the desired results without harming the koi. For instance, an algaecide label states to add six ounces of algaecide per 1000 gallons of pond water. Do you know how many ounces to add? If you know your pond volume, it is just a matter of math. If you do not know the volume, it is a guess. Sometimes guesses can be deadly.

There is an easy and very accurate way to determine your pond volume without calculating measurements or draining and refilling your pond. This method is called the "Salt Method". This method is very simple; however it requires the use of an accurate salinity meter graduated in percent (%) salinity.

Determining Pond Water Volume Using Salt

- Check the pond water salt content (starting percent salinity) with the salinity meter.
- Add a known pounds of salt.
- After the salt is dissolved and evenly disbursed, take a final salt concentration reading (ending percent salinity).

Formula:

(pounds of salt) x 12 ÷ Change in percent salinity = gallons

Pounds salt added times 12 divided by (ending % salinity minus starting % salinity) equals gallons pond water including the entire system.

Example:

A pond was initially checked and found to have a salinity of 0.10 percent. 40 pounds of crystal salt was added (dissolved and disbursed thoroughly) A final check showed salinity of 0.23 percent. Using the formula:

(pounds of salt) x 12 ÷ Change in percent salinity = gallons

$$\frac{(40 \text{ pounds salt}) \times 12}{(0.23 - 0.10)} = \frac{480}{0.13} = 3692 \text{ gallons}$$

Notes:

- Use only crystallized salt with no additives (water softener crystal salt)
- A salinity meter is available from KHA members of your pond club.
- Calculating pond water volume by the salt method can be vastly effected by a large leak in the pond during the dissolving and disbursing period of this process. A major leak will reduce salinity and cause erroneous results.

The salt formula is further broken down to find the following unknowns:

Pond Volume (Gallons) = (pounds salt added X 12) divided by Change in percent Salinity

Change in percent Salinity = (Pounds salt added X 12) divided by Pond Volume (gallons)

Pounds salt to add = Gallons X (desired percent change in salinity) divided by 12

In order to get accurate checks of salinity, it is necessary to use a salinity meter graduated in percent salinity.

Pond Leaks:

Ponds are subject to losing water through leakage. Leaks lose water and water is money, so we need to find and stop water leaks. The majority of water leaks are not found in the pond proper, but are usually found in the waterfall or streams leading to the pond. It is very simple to determine if the pond leaks, not so simple finding the leak.

Does the pond leak? To determine if there is a pond leak, turn off all makeup** water and establish a point on the bank at the top surface of the water. Wait 24 hours (with pumps running) and find the reference point to see the water level change. In 24 hours it is common to see a ½ inch drop in water level due to our high rate of evaporation. If you see any more leak than the ½ inch, there is a pond leak present. **Most ponds have a float valve that maintains a fixed water level in the pond.

Where is the leak? First, determine whether the leak is in the pond proper, or in the waterfall. With the makeup water valve shut off, establish a reference point on the pond bank at the top surface of the water. Turn the pump off and after 24 hours, check the reference point for water level. If the level goes down more than ½ inch, there is a leak in the pond proper. Determine how many inches water loss has occurred during this period.

If the water level is around ½ inch, then the leak is in the waterfall. Note: It is possible to have a leak in both the pond and the waterfall. In this case, with the pump off, mark the reference level to see how much the pond leaks, then remark the reference level and turn on the pump to see how much additional water is lost with the pump running in 24 hours. In most cases, the pond proper does not leak, but the leak is in the waterfall.

Finding and fixing the leak. This is generally the hard part. Look for moisture around the pond bank or the waterfall. The presence of wetness may lead you to the source of the leak. Leaks generally start from a crack or a hole in the sealing material inside the pond or waterfall. If the pond is concrete, holes and cracks can be filled with Pond Epoxy. This material is the consistency of putty and comes in two parts that must be mixed well before use. The mixture can be applied under water and will harden under water in about an hour. In some cases the surface to be patched must be dried and resurfaced with pond plaster or coated with pond epoxy paint. This epoxy comes in clear or in colors. Do not attempt to patch a waterfall leak from the outside wall. Find the leak point inside and patch it there. Patches on the outside will not generally permanently stop a leak.

Note: When the water temperature is warm, pumps should not be turned off for 24 hours without adding aeration for oxygen.

If the pond leak is in a liner pond, look for water overflowing the top or the liner around the pond bank or inside the waterfall. If water is running over the liner, raise the liner at the leak point and back fill behind the liner with dirt or rocks so the top of the liner stays higher than the water level. If a hole or split is found in the liner, the liner should be dried off and patched with appropriate liner patching materials.

Koi:

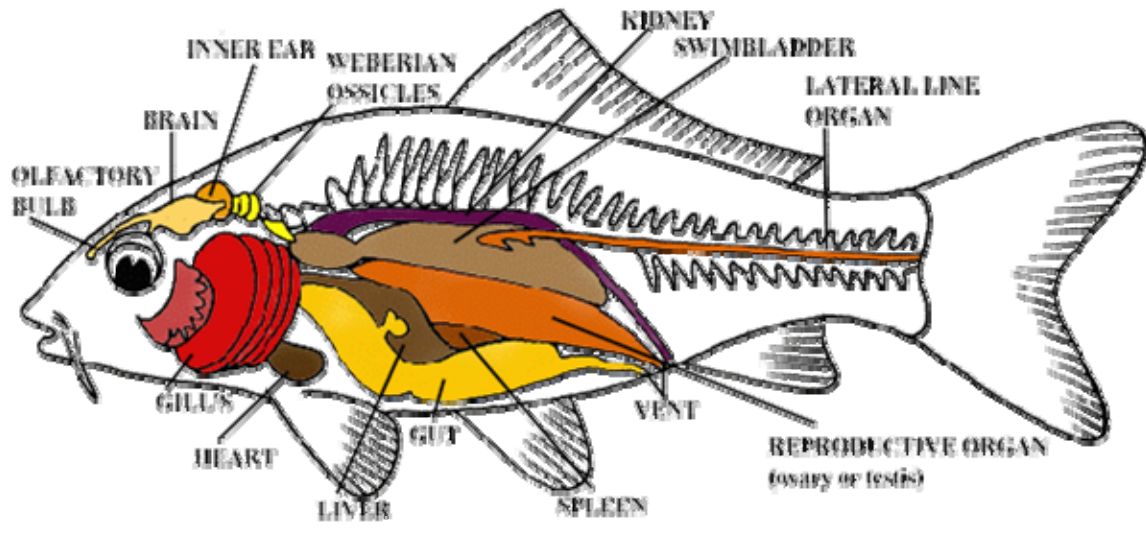
Koi were originally developed in Oriental countries like Japan, where carp fish were grown in rice paddies for food during winters. Some of these carp showed some coloration and these were selected for breeding. Over the years, today's koi, were developed through selective breeding. Following are a few known facts about koi:

1. Their maximum life span is about 200 years in exceptional cases. Normal life span is more like 25 to 35 years if cared for properly. It is said that koi will live until their owner kills them.
2. Their maximum length is about 3 feet depending upon blood line and proper care.
3. Koi have no stomach, but have a straight gut. In warm water, koi will digest their food in about 4 hours. For maximum growth in warm water, they should be fed what they will eat at 4 hour intervals. Koi eat less in colder temperatures.
4. Koi will eat many things; however it is best to feed them a well balanced koi food, containing at least 35% protein.
5. The value of a koi mostly depends upon size, pattern, and color. Realistically, a koi is only worth what someone is willing to pay.
6. Koi can withstand a wide range of temperatures and pH values; however a rapid change in either value can cause undue stress and many times will cause death. (Water temperatures from 35° F to 90° F, and pH from 6.5 to 9.0)
7. Koi ponds should have areas that are at least 3 feet deep for koi to hibernate in winter, and should have some shade so they will not sunburn (in very shallow water) in summer.
8. Koi are "schooling" type fish that desire to be with other koi. To keep your koi content, always have more than one koi in your pond or tank.
9. Koi continually excrete ammonia into their surrounding water. If the ammonia level is allowed to become excessive, koi can no longer excrete their waste ammonia and may die from ammonia poisoning. Do not over crowd your pond with fish, and do not over feed them. Either condition will add ammonia to the water. A good biological converter will absorb the ammonia and keep your fish healthy.
10. Koi get oxygen from the water through absorption in their gills, where oxygen is absorbed directly into their blood stream. Pond water should be kept well oxygenated all year by waterfalls or other means of aeration.
11. Koi Produce thousands of eggs during spawning season. Male fish fertilize the eggs by spraying the eggs with milt. If the eggs are laid in an

- open area (no plant cover), they are quickly eaten by the other koi. Baby koi will hatch in 3 – 7 days depending upon water temperature. Less than 50 percent will survive.
12. Koi get along well with other species of fish, as long as the other fish are none aggressive. Koi will eat their young until the fry show some color on their bodies.
 13. After transporting koi to another location, float their water bag in the new pond or tank about 30 minutes to equalize water temperature before releasing them. Do not pour water from the bag into the pond or tank. This is a bad practice and can spread disease and/or parasites.
 14. Many koi have some parasites. Most parasites are microscopic and cannot be seen without the aid of a microscope. A trained specialist can examine your fish and determine if your pond or fish should be treated to eradicate parasites. (Koi Health Advisors are trained specialists).
 15. Know the water volume of your pond. Koi can be placed under undue stress and sometimes die because the pond owner over dosed their pond with medication, algaecides, or other additives. It is important to know the pond water volume when applying these additives. Proper concentrations will generally not cause undue stress to the fish. Remember, decimal points in determining dosages can kill. Be accurate with calculations.
 16. Pond water volume can be accurately calculated by checking the salt concentration of the water, adding a known weight of salt, and then again checking the salt concentration. The formula is:
$$12 \times \text{number pounds salt added} \div (\text{final percent salinity} - \text{initial percent salinity}) = \text{gallons in entire system.}$$

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Koi Anatomy:



Koi have no stomach, but have a straight gut. They digest and pass their food approximately every four hours. For maximum growth in warm water conditions, feed them every four hours. Koi, if fed well, are known to grow about seven inches per year for the first three years of life. They grow at a slower rate every year afterward.

Did you know that koi can smell and taste? Koi have an acute sense of smell and, combined with their sense of taste, these are the primary senses in locating food in a natural environment, even more so than by their eye sight. If a substance dissolves in water, it has the potential of being detected by smell.

Did you ever notice the little flaps on each side of a koi's nose just in front of their eyes? These are organs, called nares (nostrils), and are used for smell. The cavities can be thought of as "U" tubes in which water enters through the front and exits through the rear. Just behind the forward opening of the U tube cavity is a flap of skin that directs the water into the forward opening and out the rear opening of the nare when the fish is in motion. This flap of skin is most noticeable on butterfly koi.

Taste buds are numerous on and around the lips, mouth, and tips of the barbels. Koi have two sets of barbels (whiskers) that can be used to distinguish them from goldfish and many other species.

Did you ever notice that when one of your koi spooks, they all do? This is because koi have a very keen sense of water motion. Koi have what is known as

the lateral line. The lateral line is a line of scales from head to tail located midway along the side of the fish. Holes in these scales lead to a canal beneath the surface that contains a mucus substance. Water movement in any direction striking the sides of the fish will cause the mucus in the canal to vibrate. These vibrations stimulate the cells that are linked to the nerve system and provide one of the most effective perceptions for survival known as “flight reaction”. It should be noted that in some “scale less” koi there may not be any scales along the lateral line. These fish have the holes in the skin along the lateral line that perform the same function.

Koi have two swim bladders. The rear bladder keeps the fish in neutral buoyancy and stays constant. The front swim bladder has a tube running to their gut where they can inflate and deflate as needed. The front bladder allows the fish to submerge or surface at will.

The gills are the organs by which gases are exchanged between the fish and the surrounding water. Through the gills, fish are able to absorb oxygen and give off carbon dioxide. Like the lungs in mammals, the gills have a large area for gas exchange. Gills are sometimes damaged by the presence of chlorine in the water. Koi need healthy gills in order to prosper.

Koi have very good eye sight. Their eyes are stationary and do not move, however due to their location, the koi has a very good field of vision. They have no eye lids and cannot shut their eyes.

Observe your koi:

Fatalities of your koi can often be avoided by simple observation. Look for unusual actions that will distinguish a koi that is in distress.

- Koi are schooling fish and want to stay together most of the time. Watch for a fish that continually distances itself from the pack. This fish may stay constantly under the waterfall or some similar place. This signals that the fish is not normal and probably has a health condition that needs to be diagnosed.
- Observe your koi to see if any of them are flashing against the bottom or side of the pond, or some other object in the pond. This flashing generally indicated there is an itch or irritation that needs to be scratched. This condition is generally a result of parasites (which are microscopic and cannot be seen with the naked eye) irritating the fish. This condition should be examined by a Koi Health Advisor, who can diagnose the condition and treat the fish and/or the pond for parasites. (Note: The Southwest Koi and Pond Association in El Paso has two certified Koi Health Advisors. If needed, please call Don Harrawood, (915) 833-9339 or Ken Austin (915) 584-6293).
- Look for koi sitting on the bottom of your pond with their side fins clamped against their body. This is an indication that the koi is in distress and the koi and the pond water condition should be examined. The problem could be caused by parasites, water condition or other conditions.
- The most obvious health condition will be a koi observed to have one or more ulcers on their body. This can include mouth rot, fin rot, and tail rot.

These conditions are caused by aeromonas bacteria and must be treated topically and/or with antibiotics in order for the koi to survive. Koi Health Advisors may be able to help if the condition is not too far advanced.

Aquatic Plants:

There are many different species of aquatic plants. Most do well in our area. I will discuss plants versus koi. Koi are basically vegetarians; however they will eat fish protein and animal protein. Koi like to eat from the pond bottom because they are by nature bottom feeding fish. We give them floating food so we can see them come to the surface where they can be enjoyed. When the pond owner submerges flower pots in the pond, the koi will root around inside the pot hunting for worms and bugs. The next thing you know, the pot no longer has any soil or gravel inside it. Koi eat some aquatic plants, and some they ignore. For instance, koi love water lilies. When a small shoot comes out on the water lily tuber, koi will nip it off and it becomes salad. Koi will eat on most water plants that have tender leaves. Some plants, such as iris and cattails are left alone.

Awhile ago I discussed oxygen in the pond. Plants play an important role in oxygen levels in your pond. During the daylight hours, through photosynthesis, plants absorb carbon dioxide and expel oxygen into the pond water. However, during night time, the process is reversed and plants absorb oxygen from the pond water. The pond water oxygen level will be the lowest about dawn each day because of this process.

Predators:

Koi have predators depending upon their location. In our area we are concerned with these long legged birds, blue cranes, herons, and egrets. In addition, in some areas we have raccoons, feral cats, and the occasional hawk. Nearly all these predators can be foiled by two conditions in your pond.

- Ponds at least three feet deep with straight sides will be a great hindrance to most predators. Long legged birds cannot wade in water this deep, and most of them cannot swim.
- The deeper and larger the pond (more water-more space) gives koi more room to escape predators. These conditions should be considered when designing and building a new pond.

Koi Nutrition:

- There are many good koi feeds available to the Koi Keeper. Some not so good.
- **Protein.** Protein is the major growth source for koi. This protein should be derived primarily from fish meal, and **fish meal should be the first ingredient** listed in the contents label. Several less desirable fish foods list **plant or animal protein** sources as the major ingredient. In general, a good koi food for growth will contain from **32 to 38 percent protein**.

- Koi food should be sealed and stored in a cool, dark, dry place in order to preserve freshness. Unseal the food only as it is used.
- Food that is not cared for properly can become **rancid**. You should be able to tell if food is rancid by the smell. Fish that are fed a diet of rancid food often develops **fatty livers** and/or liver cancer. “If in doubt, throw it out.”
- For **maximum growth**, koi should be fed at least 4 times per day in warm water temperatures. Koi have no stomach and digest their food in about 4 hours. Feed only what they will eat in a few minutes because excess food left in the pond will increase ammonia content of the water.
- In **late Fall**, when the water temperature approaches 50° F. stop feeding, since at that temperature a koi’s **digestive system is shut down**. Feed high protein food until the 50° F cutoff temperature, but in much smaller portions.
- Normally koi will not eat at 50° F, but if they do, it is **unhealthy** for them, since the food will not digest and will just decay in their intestines.
- In the **spring**, when water temperature is above 50 degrees for a few days, resume feeding. Gradually feed high protein food until water temperatures reach about 60 degrees. Feed normally after that.
- As you can see, it is important to be able to determine your **pond water temperature**, so if you don’t have a **pond thermometer**, you should get one. There are good **digital thermometers** with water probes on the market for around \$30. **Feeding, water treatments, and medical treatments** are all **temperature related**. For instance, antibiotic injections of koi in water below 55 degrees have absolutely no effect, since the koi’s **circulation system** is at a standstill. Circulation increases with increases in temperature.

Algae:

Green water and *string algae* are different forms of algae. Both can cause considerable problems for ponds throughout the year. Green water differs from string algae in that it cannot be physically removed from the pond; whereas string algae is hair like, and can be physically removed.

What Causes Green Water?

Green water is caused by the presence of millions of microscopic algae particles, each consisting of one cell. This algae occurs naturally in almost all bodies of water, and can be a problem in ponds during the spring and summer months. Algae require light and nutrients in order to grow. An excess of either light or nutrients can result in heavy string algae growth and very green water. The nutrients required for algae to grow are normally nitrate and phosphate. Green water is normally worse during summer months when days are longer,

temperatures are warmer, and light is stronger. These factors greatly increase the rate at which green water will occur.

What Causes String Algae?

String algae occurs naturally in almost all bodies of water and is encouraged to grow by the presence of phosphate, nitrate and sunlight. Phosphate is a vital component of fish foods and therefore enters the water through uneaten food and fish waste. Nitrate is produced as the end product of the biological filtration and through the natural breakdown of organic matter in the pond. Nutrient concentrations tend to build up in the pond over time particularly in the summer when the fish are more active and being well fed. The increased sunlight plus these increased nutrient levels dramatically accelerate the growth of string algae with some species being capable of doubling its weight each day or two.

Steps for Avoiding Green Water and String Algae Problems

There are a number of pond management techniques that can be called upon to help reduce the growth of algae:

- First, you should feed your fish only high quality fish food. Poor quality diets are not well digested by the fish, resulting in excess waste being produced that contribute greatly to a high nutrient load into the pond. This excess of nutrients will stimulate an increased growth of both types of algae.
- Adding plants to the pond can also help limit the growth of algae, since aquatic plants compete with the algae for the nutrients in the pond water. Water lilies in particular are great for this purpose, since their leaves help cover the ponds surface and shut out much of the sunlight required to stimulate the growth of algae.
- Keep the pond bottom clean and clear of sediment. Decaying of this sediment increases the nutrient load for stimulating the growth of algae.

Controlling Green Water

The most effective way to control green water is the addition of ultraviolet sterilizers (U.V. lights) to the pond water circulation system. These devices work by irradiating the pond water that flows through them with ultraviolet light. This ultraviolet light kills green water algae, allowing it to clump together, so that it can be separated from pond water by a filter. This is an excellent method of keeping a pond free from green water year around. It is important to size the ultraviolet light correctly, as its effectiveness depends on the contact time between the light and the water passing through. In general, an ultraviolet light should support a flow rate that allows the pond total water volume to pass through the light every hour. U.V. bulbs should be replaced every 12 months in order to keep the unit working effectively. The quartz sleeve containing the bulb may be cleaned periodically. If it gets very dirty it will cut down on the amount of ultraviolet light reaching the water.

There are other means of removing green water if you do not have an ultraviolet light. These methods are more temporary. There are many products on the market for adding to pond water to remove green water algae. One I will mention is called AlgaeFix. This product when added, as directed to your pond water, causes the green water algae to clump, so it can be filtered out with a pond filter, or can be skimmed off the water surface with a skimmer net.

The addition of aquatic plants to compete with the algae for nutrients, and to shade the pond to deprive algae of essential light are two natural means of reducing the green water effect. A large water change will remove green water temporarily; however it returns rather rapidly.

Controlling String Algae.

The most effective way of removing string algae is by mechanical means; however this method is distasteful to most people. Again, there are numerous products on the market that will kill string algae. AlgaeFix does a very effective job of killing string algae and eliminating green water when used as directed. Other products, Algae-Off and Green Clean, are granular products and are very effective on string algae in shallow water, such as streams and waterfalls.

Numerous plants in the pond will reduce algae by competing for nourishment from pond water. The addition of shade to the pond will decrease the growth of string algae, since it deprives it of needed sunlight in order to thrive. After the string algae are killed, you will need to remove the floating dead algae from the pond.

Winter:

Although winters in our area are somewhat mild compared to other areas, there are things you should know about winterizing your pond and your koi. Following are some important items to consider in the winter months:

- Winterizing your pond:
 - If you have fish, it is important that you keep your pumps and filters running 24/7 the year around in order to maintain good water quality and to keep ammonia levels in check.
 - In late fall, clean the pond as well as you can in order to keep decayed plants and other organic materials out of the pond.
 - Filters will still need to be backwashed but not as often as the rest of the year. Backwashing may only need to be made monthly during November through February. This frequency is determined by your actual situation and may vary from location to location.
- Winterizing your koi:
 - In late fall, slowly reduce the amount of food given to your koi. Give them only what they will eat in about 5 minutes. Stop feeding when

the water temperature tends to stay below 50 degrees. At or below this temperature, the fish's immune system and digestive system will completely shut down. This means they are in hibernation and will not eat, or if they do eat they cannot digest their food and it will decay in their intestines. Koi will easily go without food for several months until water temperatures again rise above 50 degrees. This fasting period generally runs from December through February in our area, much longer in Northern States. Don't feel sorry for your koi and feed them during this period. You will be doing them a favor by not feeding.

- Koi can withstand pond water temperatures in the mid 30 degree range, but not in freezing water. It is important to keep your waterfall running so the pond will not become iced over, thus starving your fish of oxygen.
- In winter, your koi will sit on the pond bottom in the deepest spot, since this generally is the warmest in winter. Koi will not grow while in hibernation. If you want them to grow, you must heat the water to about 65 degrees and feed them.
- March is the most deadly time for koi in our area. The reason is that both koi and aeromonas (destructive bacteria) are in hibernation. In March, when the water starts warming up, the aeromonas bacteria become active before the koi immune systems do. For about 3 – 4 weeks, the koi are very vulnerable to aeromonas attacks, resulting in body ulcers, fin rot, tail rot and mouth rot. This period of time is known as Aeromonas Alley.
- Watch your koi closely during this time of the year. If your koi get infected, it is best to treat them as soon as possible. If koi need medical attention, the owner should have a quarantine tank where sick fish can be isolated and the water heated to 70 degrees or above so medication will be most effective.

This information is offered to new pond owners in order that they become aware of some of the dangers to their koi and pond. Most new pond owners are not aware of what is involved in maintaining a quality pond for their koi. By reading the above information, you do not become an instant expert; however you may know more than you did.

The above information is presented as a learning experience for new pond owners by Don Harrawood and the Southwest Koi and Pond Association. If you feel the need for additional information, or an explanation of items presented in this booklet, please feel free to contact me or the club.

www.skapa.org

Don Harrawood

Koi Health Advisor Vice President
Southwest Koi and Pond Association
Phone (915) 833-9339 or Cel. (915) 727-1166.



S.K.A.P.A.

Southwest Koi and Pond Association

1105 Eagle Ridge, El Paso, TX 79912

www.SKAPA.org

As a pond owner, you are invited to become a member of the Southwest Koi and Pond Association.

As a member, you can enjoy the benefits of associating with other local pond owners and educating yourself in proper pond building techniques, pond maintenance, and koi husbandry. SKAPA holds monthly meetings from March through December. These meetings are generally held at a member's home, where their pond and/or water garden is shown and discussed along with the club meeting. Any questions you have about ponds, koi, pond equipment, pond maintenance, and aquatic plants will be answered by experienced pond keepers. By asking questions, many errors made by novice pond keepers can be avoided.

There are major benefits to which our members are entitled. These include, but are not limited to the following:

- Free education and advice regarding pond building, pond maintenance, pond equipment, koi food, koi feeding, aquatic plants, pond filtration, water quality, etc.
- Free diagnosis and treatment of sick koi by our highly trained Koi Health Advisors. (Small costs for medical supplies and travel expenses may apply)
- Free pond water testing when needed for substances detrimental to your fish.
- Ten percent (10%) discount on **all items** at Nash Gardens, 150 E. Sunset Rd.
- Ten percent (10%) discount on pond supplies, pond equipment, koi, and koi food from Denco at Nash Gardens, 150 E. Sunset Rd.
- Ten percent (10%) discount on aquatic supplies at Valley Feed/Pets Barn stores.

A current year SKAPA identification card is required for all discounts.

To join the club, please address a check to SKAPA for the appropriate amount based on the time of year (see attached membership application) and send to: **SKAPA, 1105 Eagle Ridge, El Paso, TX 79912.**

Don Harrawood
Vice President and Koi Health Advisor
Southwest Koi and Pond Association
(915) 833-9339, dharrowo@elp.rr.com



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APPLICATION FOR MEMBERSHIP

Name:	
Address:	
City, State, Zip:	
Telephone:	
E Mail Address:	

Family Membership: Calendar year membership (Jan. – Dec.)
Present Members \$25

Dues for New Members joining during the year are pro-rated by Quarter as follows:

(Jan. – Mar.) \$25

(Apr. – Jun.) \$18

(Jul. – Sep.) \$12

(Oct. – Dec.) \$25 includes following year dues.

Business Membership: Calendar year membership \$100

Please mail application and payment of dues to:

S.K.A.P.A. (Please make checks payable to SKAPA)
1105 Eagle Ridge
El Paso, TX 79912

If you have any questions regarding the Club or this membership application, call Don Harrawood at (915) 833-9339, or Ralph Smith at (915) 532-5219.

Email address:

Don Harrawood dharrowo@elp.rr.com

Ralph Smith ralphsmith507@aol.com