BREEDING KOI IN THE CITY **by Douglas Dahl**
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Why do you want to breed koi, I ask? You could respond "imported koi are too expensive", or "you want to learn how they change so you can purchase baby koi with more confidence" or "you are just bored and want to try it". This discussion addresses city breeding. Country or farm breeding can be a very different process in many ways due to available growing ponds and I leave that discussion to the professionals.

What is Needed

My experience in city breeding suggests the following list of needed items:

- 800 gallon tank or pond for breeding (use as medical tank when not breeding)
- 3000 gallon tank or pond to grow some of the baby koi for 1 year
- separate small tank or pond area to rest the female after breeding and for culling
- working filter for both the 800 and 3000 gallon tanks or ponds if they are close together
- submersible pump with strainer on intake (18" drilled PVC tube surrounded by foam 6x6x18)
- 1/6 hp pump for the 3000 gallon system
- Air pump and air stones for breeding tank
- GFI electrical outlets for all pumps
- Net to cover breeding tank to keep breeding fish in
- Brine shrimp jugs, air system and light for food breeding
- Several kinds of food (to be described later)
- Net, tub, plastic bags to transport breeders and catch babies
- Ammonia and nitrite test kits
- Source of de chlorinated water (3000 gallon tank while 800 gallon tank in use)
- Breeding media (hyacinth plants, podocarpus branches, mop heads, breeding nets)
- About $1500 to spare for expenses
- Strong back and strong stomach
- HARD HEART FOR CULLING
- Someone to feed the babies every 3-4 hours during the day

Timing, Romance and Birth

The time to prepare for breeding is one month before pond water reaches 70 degrees F. The first task is to start your filters for the breeding tank, order food for the first 10 weeks, set up the breeding area and set up the brine shrimp breeding area in the garage. When the water temperature reaches 70 degrees F you have the earliest time to breed koi and get good hatching results (mid April in So. Calif). On the **morning** of the breeding day, place fresh water into the 800 gallon breeding tank 18" deep and 12" below the rim and de chlorinate it. Turn on the air pump and air stones for oxygen. The submersible pump is not running during breeding. **At about noon** place the chosen female into the breeding tank along with breeding media that has already been cleaned and treated for parasites by dipping into Formalin or similar agents. The female is usually 3 years old minimum, bulky due to her eggs and chosen for configuration, quality and bloodline but not for pattern. Stretch a net over the breeding tank to make sure the female does not jump out. **At 5pm** place one male into the breeding tank. The male is chosen for conformation, quality, bloodline and pattern. If you use two males you will get better fertilization but you will never know which male produced the best koi and with one male I get more babies than I know what to do

with anyway. Breeding show koi is not recommended because of potential damage and fading colors following breeding. **Between 4am-8am the following morning**, mating usually occurs. If not, wait one more night. If not the second night, something is wrong and you need to return the koi to your pond and start over at another time. YOU need to be available during the breeding activity to make sure the female is not damaged. Breeding is a violent event and females have been thrown out of the tank or worn to death by aggressive males. Ladies, now is the time to look at your male counterpart and say "you brutes". I have had one aroused 30" female break off the top half of her tail in a plastic tub while I tried to strip the remaining eggs out of her at the end of breeding. Luckily the tail grew back but I will not try that again. Learn from a professional how to strip females if you feel you need to. The mating process starts when the female sticks her nose up into the floating, breeding media and releases pheromones into the water that signal the male to start shoving. The male will use his shoulder, with gill plates that are like sandpaper at this time of the year, to push the female up into and thru the media, out of the water and back with a splash. This is the reason for the net stretched over the tank and the 12" from water surface to the rim. As the female passes thru the media, she lets fly hundreds of eggs that tend to stick to everything including the media and the surfaces of the tank. The male backs into the media and swishes his tail to release material to fertilize the eggs. Then the male finds the female, who is more interested in eating eggs than continuing, and he steers her forcefully back to the media to start all over again. This is done over and over with both koi taking breaks to eat eggs for energy. By the end of the 4-5 hour romance, both sides of the male are stripped of slime and are very rough. The female may show signs of bruising or torn fins. This is one reason for excellent water and parasite free media. **When it appears they are eating more than they are laying or when one of the breeder koi looks too weak to continue,** remove the male from the tank, check him for damage needing treatment and return him to your normal pond. Here is where the male pays for his indulgence. Every male in your pond will smell the pheromones from the female on the male and will try to mate with the male who is already very tired. Your pond could instantly go into uncontrolled breeding by all of the remaining females and males creating a froth an inch thick. If this happens, you need to change 10-20 percent of your polluted pond water to maintain water quality. But first, the female needs to be removed from the breeding tank and placed into an isolation tank for 4-24 hours with excellent water quality for rest before being returned to your pond. Inspect her for damage and provide treatment if needed. **At the end of the first day** replace 1/3 to 1/2 of the polluted water from the breeding tank with fresh, de chlorinated water without letting the water level change in the tank. The walls of the breeding tank will be covered with eggs and you do not want to uncover them. The easiest way to do this is to add dechlorinated water to the top of your breeding tank with one pump while you remove polluted water from the bottom of the breeding tank with the submersible pump and foam strainer. The eggs are sensitive to temperature changes so slower water replacement is better. This task can also be done by draining the breeding tank by bottom drain at the same rate you add de chlorinated water if the bottom drain has a mesh covering to keep the eggs from being flushed down the drain. You can now turn on your submersible pump plus foam strainer to circulate the breeding tank water through the filter and back into the pond. The reason the pump has been left off for the day of breeding is to maximize fertilization of the eggs instead of 1/4 of it being wasted in the filter tank. Some breeders put Methylene Blue into the breeding tank water at this time to reduce fungus on the eggs. I have not seen this to be necessary and in fact it is harmful to good bacteria in the filter. **In 2-3 days** you should see two tiny black spots in each transparent egg that are the eyes of the koi. Unfertilized eggs will be opaque and quickly covered with white fungus. **In 4-5 days** at 70 degrees F, you should observe small, transparent, 1/8", free floating babies clinging to the sides of the tank by the thousands. You can actually see the dark food going thru the intestines of the baby koi. At

this time, they are at least 24 hours old and I denote this **day 1** of their lives.. All eggs should hatch within 7 days at 70 degrees or longer if in colder water. **Now** is the time to remove the breeding media and as much of the unfertilized eggs as possible to reduce the bio load on the filter. Normal koi nets will catch this material but allow the babies to swim through at this age. Put as much oxygen as possible into the tank for the **next 6-7 months** because 5,000-20,000 baby koi create a great need for oxygen. Don't be afraid that the oxygen is blowing the babies all over the tank, it won't hurt them. I have killed 1/2 to 3/4 of a total hatching by giving in to this concern. Also, plug the oxygen pump into an outlet controlled by a separate GFI circuit breaker from the one used for the circulating pump in case one of the breakers opens. This is also a lesson I learned the hard way. **From day 6-28**, you will have to remove and clean the foam prefilter on your circulating pump DAILY. I clean the foam by turning the pump off, swinging the pump and foam out of the tank onto the ground and hosing the foam down with water while I compress it with my feet to squeeze the trapped matter out of the foam. **At 4 weeks**, the foam can be replaced with a 5 inch plastic or brass strainer with thousands of tiny holes at the intake to the circulation pump. The strainers also need cleaning daily.

Feeding

Mother nature takes care of the feeding in natural lakes and mud ponds used by commercial breeders. But what do you do if you are hatching baby koi in a pond or tank. Baby koi will take advantage of algae on the sides of the pond but need protein to grow at the proper rate. The following article describes what I feed baby koi when I breed them at my home.

Before I breed koi, I order the food required for the first 10 weeks. This usually consists of:

27 tubes of Liquifry #1 (red) ($92)**	week 1
27 tubes of Liquifry #2 (green) ($92)**	week 1
1.1pound can of Larval AP100 diet (100-150micron) ($19*)	weeks 2-3
3 15oz cans of freeze dried brine shrimp eggs ($222*)	weeks 2-6
11 pounds of TetraMin flake food ($124*)	weeks 4-10
6 pounds of freeze dried krill (75% protein)($204*)	weeks 4-10
50 pounds of rock salt ($3)	

COST FOR THE FIRST 10 WEEKS $756 (*Aquatic Ecosystems catalog)

**** Aquatic Ecosystems may offer a cheaper replacement product for Liquifry. Some people have used powdered milk water and spirulina powder to replace Liquifry ingredients of dextrin, pea flour, whole egg, powdered spinach(in #2) and yeast)**

Also needed later:

Eggs for egg mixture
Weekly 550 count frozen Daphnia cubes from pet store ($38/week) #
20 pounds of 40% minimum protein large koi pellets to grind into powder
20 pounds of 33-45% protein sinking baby koi pellets

 # If you can find a source of live Daphnia to replace the frozen cubes, great.

Feeding starts with liquid food and slowly increases in food particle size to koi pellets as the baby koi grow in stages. **On day 1** start feeding 1 tube of Liquifry #1 every 3 hours (7am,10am,1pm,4pm,7pm). Shake the tube well to mix the contents before using. Feeding every 3 hours will continue until October. **By day 4** the amount has increased to 3 tubes per feeding. When Liquifry #1 is gone start with #2 that has spinach powder added. **On the evening of day**

4, I start preparing the first 5 gallons of brine shrimp eggs. This is done by filling 5 one gallon, plastic pitchers with pond water (not fresh with chlorine). 1/2 cup of rock salt is mixed into solution in a blender with 1 quart of the water and 1/3 of this mixture is added to each pitcher. Add to each pitcher, 1 tablespoon of brine shrimp eggs and stir to get them wet. Each pitcher has been provided with an air stone driven by a common air pump and a fluorescent light above all 6 pitchers with both operating 24 hours per day. (See photo.) The eggs hatch in 24 hours and will easily last for 3 days if needed. The next day I start the other 5 gallons of brine shrimp eggs. Each evening, the 5 pitchers used from the row that day are refilled for feeding 2 days later. So the setup is two rows of 5 pitchers each with each row alternating days to feed the babies. I keep this clear by putting tape tags on the wall behind each row stating M., W., F., Su. for row 1 and Tu., Th., Sa. for row 2. Because 2 rows does not divide into 7 days, individual tags move back and forth between rows as required to keep it straight. **Starting day 6,** when the Liquifry is gone, feed 1 pitcher (brine shrimp, water, egg casings and all) to the babies in the breeding tank for each feeding. The few gallons of salt water will not affect the 800 gallons in the tank due to the water changes and tank bottom cleaning to remove debris not eaten. For 2 feedings, feed the Larval diet powder and for the other 3 feedings use 2 squirts of the egg mixture described below. When the Larval diet powder is gone or the baby koi are large enough for larger sized food, replace it with a crushed mixture of 1/3 TetraMin flakes, 1/3 ground koi pellets and 1/3 ground krill mixed. I use a Braun coffee grinder to crush the flakes and grind the krill and koi pellets and then put the mixture into a shaker can with many 1/4 inch holes drilled into the lid. It is difficult to judge which food the babies like most, the live brine shrimp or the ground krill. Both make for fast growth due to their high protein content.

Egg mixture weeks 2,3
Hard boil 6 eggs
Peel the egg and discard the egg whites
Place yolks plus 1/2 cup TetraMin flakes into blender
(Larval diet powder or spirulina powder can also be added)
Add de-chlorinated or bottled water to the 5 cup mark on the blender
Blend to liquefy
Pour into plastic squeeze bottles and refrigerate (old mustard containers will work)

Continue the egg mixture and shaker mix feedings until at least **day 20. After day 20** only use the shaker mix of flakes, koi food and krill. **About day 42** replace the brine shrimp with 1/2 inch cubes of frozen Daphnia (frozen brine shrimp and other frozen foods are still too large for the koi babies). To keep the cubes at the focus of the baby koi, I float them in a 4x4 " strawberry basket with a wine cork bonded with silicon to the top of two sides for buoyancy. The basket is tied to stay in one position. Each 7am,1pm,7pm feeding, place 10-20 cubes into the basket and watch the baby koi push the basket all over the place once they know what is in the basket. This is by far their second favorite food at $38/week for 550 cubes. This is starting to get expensive now. Baby koi favorite food source is their brothers because they are cannibalistic until about 1 inch in length. Try to separate the 1.5 inch koi (Toby's) from the ½ inch koi or most of the ½ inch koi will disappear. You can tell when the babies are 3/4 inch long that they are ready to eat cubes of larger frozen brine shrimp or blood worms. **By day 70,** you can start feeding sinking baby koi pellets for 2 feedings but keep the cubes for the other 3 feedings as long as possible to keep their

demand for protein satisfied. Stop the cubes only when you decide that the cost is prohibitive. In nature, live daphnia and bugs are abundant and baby koi grow 6 times faster and healthier as a result. The protein from the cubes will also minimize cannibalism and avoid whirling disease. You can recognize whirling disease symptoms when a koi is swimming around in small circles at the surface with their heads up and tails down, forming a cone shape in the water. The koi will soon die and others will follow if protein is not increased.

Water quality

With all of this food going into the system, how do you maintain water quality? Hopefully, your filter was up and running when you started breeding. The suction of the submersible pump should deposit most of the food (75% uneaten) into the filter once the foam block pump intake is replaced by a strainer. Use a dedicated, new plastic broom to sweep pulverized food from the bottom of the tank into the pump intake. Draining the reservoir at the bottom of your filter every day will help greatly to remove solids. Testing your water every 3 days will warn you of high nitrites which can only be corrected with 10% water changes that are required at least every week. However, a time when the above methods will not work is when the egg mixture is used. You end up with a rotting, egg layer on the bottom of the pond. The only way I have been able to remove this layer is with a 1/2 inch diameter siphon tube taped to a 36 inch stick for control. I fill the tube with water to create a siphon from the bottom of the breeding tank into a 20 gallon plastic, concrete mixing container next to the tank. Using the stick to guide the siphon tube, I sweep back and forth until the bottom of the breeding tank is free of the layer of debris. The baby koi will try to flow into the tube and many will succeed. Here is where the strong stomach is needed to bend over the filled, smelly container with a 4 inch net to catch the baby koi as they breach the water surface looking for clean water. Some babies will play hide and seek in the solid debris. This may take 10-15 minutes and visibility is best if you siphon the water just before dark and attract the baby koi to the surface with a flashlight. You may have to do this over 2 evenings to complete the tank bottom. For this reason, I only use the egg formula for 2 weeks to transition the food from liqued to solid food gradually. This smelly effluent may be used to fertilize your garden but I suggest disposal into the sewer for the sake of your neighbors.

Culling

By day 45, the baby koi should average 3/8 inch in length. If you started with 20,000 babies you are probably down to 5,000 by now. What happened to 15,000 koi, you ask. Some die due to starvation or to lack of oxygen but many have been food for the 30-40 larger babies in the tank. Remove any obviously larger koi because they are TOBYS who are eating their Grand Champion brothers and sisters. It is common to find a 2 inch koi in a group averaging 1/2 inch. These larger koi are usually discarded but you may move them into another tank or pond to keep them if you wish. I use a large koi net with 3/16 inch square spacing to filter out these larger koi which I move to a large doughboy pool. The smaller koi will escape through the holes in the net when it is held at the surface of the water. I continue this process every week until all of the baby koi are caught by this net and are in the doughboy **by day 84** when the koi should average 1" in length**.**

The following culling selection process is provided with the goal of only keeping potential show quality fish. **At day 30**, it has been the rule to cull SHOWA by keeping ONLY the black koi. However, with the advent of the modern Showa, with more white than black, I would suggest culling emphasis be on the red pattern which will not form this early. I myself have not bred Showa but would recommend culling at day 56-96**.** Dorsal fins that are totally black will form beautiful motogoro at the base of the fin when

older. It takes 1-3 years for the black to verify a good Showa so I hope you have plenty of room to grow the koi. Products of a Showa breeding include Tancho Showa and Utsuri Mono. **At day 56**, cull SANKE. Sanke are selected by discarding koi with too much black, koi with red in the fins or no red on the head, unbalanced red pattern or deformities. Keep Sanke with a balanced, wrapped red pattern, plus a red head pattern and white on the nose. Red will appear orange at this early age. Black markings are usually not up yet or look gray in color since they are below the surface of the skin. Don't be afraid of keeping a Sanke that is covered in light gray because this will emerge into small black spots later. Black may also take 1-3 years to come up completely depending on the breeding line. Bluish black that is on the white is more stable than carbon black on the red as characteristics of bloodline. Products of a Sanke breeding include Tancho Sanke, Kohaku and Bekko. **At day 84,** cull KOHAKU by discarding koi that are all white or all orange, koi with red in the fins or red below the eyes, unbalanced patterns or deformities. Look for the white at the tip of the nose but do not discard koi without it at this stage. Look for small red patterns for young show koi and for strong wrapping patterns with cuts up the sides for mature show koi. I do not find that a red pattern breaking apart leaves poor kiwa or edges all of the time so take a chance. Red is usually orange in color at this time but will take on the red color of the parents later. Knowing what the parents look like when young and how they changed as they grew helps a lot in culling criteria. Tancho are a product of a Kohaku breeding. I keep Tancho with any shape head pattern because the shape may change drastically as the koi grows. A larger tancho spot down to the eyes is best due to the tendency for the head pattern to shrink as the koi grows. I also keep Tancho with a minor secondary red spot because this secondary spot may disappear. 30% of the 12 week old baby Kohaku I keep lose their patterns by week 20. However, few of those with patterns at week 20 show further loss. This may be due to my inability to judge color thickness in 1" koi. Since I only breed every 2-3 years due to the cost and effort required, and since I change varieties each time I breed, I do not have the experienced culling eye that professional breeders get by repetition.

The process of culling is fun if you keep the right (hard hearted) attitude and don't start thinking of what will become of those culled out. The koi you keep will be far better off after their numbers are reduced. They will grow faster and will be healthier for the upcoming winter. I use nylon mosquito netting from a camping store to hold 100-200 babies at a time for culling. The net is strung between a length of 3/4 inch Scd. 40 sprinkler pipe across the breeding tank and the hooks on the side of the tank. A 3/4 inch PVC trapezoidal frame, filled with water, holds the bottom of the net down and creates the shape of the container submerged in 4 inches of water. Baby koi are netted with a 4 inch aquarium net and placed into the KEEP container or the DISCARD container. These temporary containers each hold about 100 gallons of de chlorinated water and have air stones for aeration. The process is repeated until all of the baby koi have been sorted. This process can take all day and be hard on the back. I usually skip the early culling for deformities and go directly to the culling for color and pattern between weeks 10-12 for the 1st culling. I stretch my imagination on what could be for the baby koi and keep as many as possible in this 1st culling. In the 2nd and 3rd culling before winter, I narrow the keepers down to the 50 I can grow in my main pond for the next year. Another option would be to keep the 3,000 gallon doughboy pool going to raise 150 baby koi for 1 year. However, since I am an amateur and not greedy, 30 baby koi provide more than enough odds to get the 5 good koi I want for my collection. Starting with 5000 baby koi, I keep no more than 30 in my 800 gallon breeding tank thru the first winter and feed them twice daily because the tank water is heated. This results in 1 year old koi 10-14 inches in length which is consistent with professional breeder mud pond koi growth. Since amateur standing is required in the US. to show or judge koi, the baby koi cannot be sold to recoup some of the investment because this may be interpreted as the actions of a dealer. You will have to work this problem out for yourself. Here is how I

have handled this sensitive issue over the years. Since I usually cull at 1 inch, the 2000-4000 unwanted babies are bagged with water and oxygen and **donated** to a local pet store to be sold as feeder goldfish at 50 cents each or KOI at $1-$5 each. In return for this generous donation I am given discounts on my purchase of frozen Daphnia cubes for the next 3-6 months. In October, the final culling reduces the last 300 baby koi to the 30 I want to keep. Fellow Koi Club members have first pick of the remaining baby koi at $1-$5 each donation to the club treasury. The remaining 200 pond and show quality baby koi at 2 inches are **traded** to a local koi dealer in return for koi food. After raising the 30 baby koi I kept for 12 months in my pond, I can take those I do not want to a club auction and receive 50% of the sale price.

Let's recap and put amateur, city koi breeding into perspective. From the investment of:

- Unestimatable cost for facilities, equipment and breeder koi
- $1500 for food and electricity
- Backbreaking, stomach-turning and heartbreaking, **continuous** effort for 6 months
- Risking damage to your breeder koi
- Risk being branded a dealer if not careful
- Lower quality koi in your main pond due to breeders and baby koi

You may obtain the results of:

- Perhaps $200 in koi food in trade for culls
- Perhaps $200 in donations to your club treasury for baby koi (much more if public sale)
- Maybe 5 GOSANKE koi with show potential (more for other show varieties and pond quality koi or NO show quality koi with bad breeders)
- Knowledge of how **some** koi change from 1 inch to 20 inches to help in selecting potential koi
- The rare possibility of breeding A MAJOR AWARD WINNER, perhaps GRAND CHAMPION

DO YOU STILL WANT TO BREED KOI? Some say I am a successful backyard breeder. However, from 5 GOSANKE and 2 other breedings over 7 years, my baby koi have won 1 Best in Class, 11 First Place, 4 Second Place and 1 Third Place awards, but NONE in GOSANKE categories. $1,500 times 7 breedings could have purchased a Grand Champion or several potential Grand Champion koi. When I step back and look at the data, Japanese show koi are a good deal and a lot less work.

Will I breed again? Depends on the results of this year's Kohaku breeding. I am always hopeful and besides, anyone can BUY a Grand Champion.

UPDATE SINCE ARTICLE WRITTEN IN 1996

In October, 2000, this 4 year old home bred Kohaku won Young Champion at a So. Calif. Show and has encouraged further breeding experiences. I guess anyone can get lucky.

SLIDE DESCRIPTION

Identifier	Description
B1	800 gallon breeding tank, 3000 gallon doughboy pond and shared filter
B2	6x6x18" foam block and drilled 3/4" pvc pipe submersible pump prefilter
B4	brine shrimp hatching area with fluorescent light out of photo above
B6	female with nose in hyacinth spawning media as male pushes from below
B9	female(r) re enters water after depositing eggs, male swishes tail to fertalize eggs
B10k	eggs deposited onto roots of water hyacinth
B12	(l to r) frozen daphnia cubes, dried krill, tin of brine shrimp eggs, Braun grinder, egg mixture in squeeze bottle, mini koi pellets, Liquifry red and green, larger koi pellets for grinding, Tetra flakes, shaker can, red and green powder food. (front l to r) strawberry basket missing buoyancy corks, brass and plastic strainers for Cal pump
B13b	aprox. 20,000 baby koi at 1/4" and 3 weeks old
B13c	at 8 weeks and 1/2" there are 1"- 2"Tobys present
B14	culling setup with nylon mesh, pvc support and bottom pvc frame
B16	Kohaku at 14 weeks and 1 1/2"-2" being culled next to 3/4" pvc frame
B17	Kohaku at 6 months and 4" with cut forming up right side of pattern
B19	Tancho Sanke and Kohaku at 6 months and 3"
B20	Hi Sanke at 6 months and 3"
B21	Sanke at 6 months and 3" and later at 2 years and 10 1/2"
B22	Sanke at 6 months and 5" and later at 5 years and 17 1/4", notice consolidation of sumi
B23	Bekko at 1 year and 5" and later at 2 years and 10", notice change in sumi
B24	Kohaku with Izumi pattern at 1 year and 3", notice red head pattern too far back
B25	Same Kohaku at 2 years and 10", notice red head pattern has moved forward to eyes
B26	Babies from 1996 breeding
B27	Tancho from 1996 breeding
B28	Kohaku from 1996 breeding
B29	Kohaku from 1996 breeding
B30	21” Kohaku Young Champion Oct, 2000
B31	female parent koi at 22” in 1995, bought from Grant Fujita in 1993 @ 20”
B32	male parent koi at 26” in 1999
B33	male parent koi at 8” in 1989, bought from Kaz Takeda @ Pacific Goldfish Farm