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Al Foster's
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Understanding Ammonia Test Kits

by Terry Cusick

It has been my experience that over the years, water parameter test kits have gotten better and easier to use. However, the one test kit that still gives aquarist problems is the one for ammonia. I'm not saying that you need to be a rocket scientist to use it, but it wouldn't hurt. The problem is not actually with the test kit as it is with interpreting the results of the test. By that I mean that you can't just say that if your test kit reads 2 mg/l (which is also the same as ppm) of ammonia that your fish are going to die. In some aquariums 2 ppm of ammonia will kill your fish and in others the same fish will be perfectly OK. You have to view the results in relation to other water parameters. As an example, during a recent general meeting of my local aquarium society, our presenter for the evening was talking about water quality. During his presentation, the presenter talked about going to a friend's place to help. His friend, let's call him Jack, was reading 6 ppm of ammonia and was concerned. The presenter observed when he arrived at Jack's home that his fish were acting normal and concluded that the ammonia test kit that Jack was using was defective. The presenter's point in telling this story was that observing your fish can tell you a lot and I couldn't agree more, but does this mean that the test kit was bad? Not necessarily. To understand why, you need to understand how ammonia test kits work. First ammonia test kits read what is called Total Ammonia. Total Ammonia is composed of the normal fish-toxic ammonia (NH_3) and the much less toxic ionized ammonia or ammonium (NH_4^+). So if you read 6 ppm of ammonia, it may not be all toxic ammonia, as a matter of fact, it maybe that none of it is. Actually you need a chart or table and two other readings, pH and temperature to determine that. For as the pH and the temperature drop, a larger and larger percentage of the Total Ammonia becomes the less toxic ammonium. The following table (see bottom of page) indicates at what level Total Ammonia, based on pH and temperature, becomes



toxic to most types of fresh water fish.

Using this table and assuming a couple of facts not in evidence, let's look at the case the presenter cited. Let's assume the water temperature was 72°F or 22°C and the pH was 6.5. That means, using a little interpolation, that anything Jack reads for Total Ammonia below about 13 ppm would be nontoxic. So when he only read 6 ppm ammonia, yes, his fish were doing fine, but he had 6 ppm of total ammonia and his test kit was working properly.

The presenter's friends are mostly Discus and Angel fish keepers, but if Jack was not keeping acidophilic fish, admittedly a highly unlikely condition, but one that we should consider because it helps my cause. Let's say the pH was 7.5, does that not mean that the test kit was bad? Again not necessarily, there are other things to consider. For example, if Jack was using an ammonia test kit based on the Nessler Reagents and he had used an ammonia binder to control the ammonia in his aquarium or if he did a large water change and used a water conditioning product contain-

Continued on page 19

pH	Water temperature				
	5°C	10°C	15°C	20°C	25°C
6.5	50	33.3	22.2	15.4	11.1
7.0	16.7	10.5	7.4	5.0	3.6
7.5	5.1	3.4	2.3	1.6	1.2
8.0	1.6	1.1	0.7	0.5	0.4
8.5	0.5	0.4	0.3	0.2	0.1
9.0	0.2	0.1	0.09	0.07	0.05



Member Profile: Al Foster

By Roma Radford

On March 6, 2004, Al Foster was kind enough to spend over half of an hour answering some of my questions. He shared a lot more information than I could possibly fit into one article. I have tried to condense our conversation into just a few pages, so it is probably terse. In any case, I hope that you enjoy reading it as much as I enjoyed my conversation with Al.



(left to right) Terry Cusick, Al Foster, and Simon Wong

How did you get started in the hobby?

I got started in college in the middle 1960s. Goldfish were really hard to come by back then. You just saw pictures in the books and magazines. Out here in the Midwest, we saw black moors, fantails, and feeder goldfish. Goldfish didn't really start showing up until Nixon went to China in 1972. I spawned my first goldfish in 1966. I have been keeping them since. I switched exclusively to goldfish around 1980. Before then, I had kept many varieties of Livebearers and Cichlids, including Angelfish. I found Goldfish to be more interesting, because the young fish do not all look like Mom and Dad.

What kinds have you kept and what kinds do you currently keep?

They come and go. I now mainly keep the rarer breeds. I keep Veiltails, because they are the only kind of goldfish that this country is given credit for coming up with. I keep British Shubunkins, because they are really hard to find and they look like they are becoming extinct.

When I started getting the Veils, I had been writing a column in the report for at least five years. We were all sure that they were extinct. One day an old guy from Cleveland sent 5 of the worst looking fish that I had ever seen. He told me that they were these rare Veiltails. One of the fish had a tail and a half and the other was single tail. The half tail looked like it had been crunched up and rolled up. I learned more about fish from those two fish. I thought that I knew all, because I had been in the hobby maybe 20 years. However, I had never tried to breed fish that weren't perfect before. I bred these two fish. From those 2000 fry, I got 5 or 6 fish that looked pretty dang good. That is where I got the strain back on its feet again, around 1985. I keep them around here because somebody has to keep them going. They are really tough to raise.

I started breeding goldfish years and years ago, because no one would sell me the ones that I wanted. Nowadays, they will sell you the ones you want, if you have the money. However, the best goldfish in the world are never sold, no matter where. If you want the best goldfish in the world, you have to breed them yourself. It might take you 10 years to figure out how to do that. You better enjoy it. It is going to be a lot of blood, sweat, and tears along the way.

Is there anything that you know now that you wish you knew when you were starting out?

I lurked for a while in the disease chat line. They were giving advice on what to do with fish that float upside down. They have pictures of these fish that have big heads and float upside down. They ask, "What can I do to cure it?"

There are a million different answers. Really the truth of the matter is some fish just have that tendency. If you come to my house, I can show you little fish, 2 months old, with a body the size of a pea that I can tell already are going to have that trouble with turning over. When they are short, fat fish and they grow big heads, they have even more trouble. In my column, I used to refer to it as these fish are "worn out". The Asians talk about these fish like they are flowers. This fish was blooming. Like any plant that blooms, it is just past bloom. There is nothing that you can do to fix this fish. The trick is to not buy those fish next time, no matter how big the head is. If it swims around the tank in the fish store with the tail higher



than the head after having not eaten anything in maybe two months, then it will likely float upside down for you.

Fish put outside in the pond will sometimes get over this pretty well. They have to forage all day long, swimming constantly. Unfortunately, that isn't an option for most people. Even so, when that fish comes back inside and you put him back in an aquarium, he is going to bob on the surface. It is nothing that you can fix. Experience teaches you that you just have to avoid these fish.

What is roughly your breeding setup? How many



Jikin (rear view)

breeders do you keep? How and when do you select them?

To keep a strain of fish, you should keep at least a couple of dozen fish all the time. These fish should be old enough to breed, 2 and 3 year old fish. Most people don't have enough water space to keep a strain going. Also, most are just too softhearted to do all the culling. If you don't cull, then you end up crowding the fish and they just don't develop.

It is fun. We encourage everyone to spawn all the goldfish that they can. For a novice, I would suggest the following. If you can get to a store that has adult fish in, you can usually pick out a pair by standing and watching the way that they act for a while. Once you have a pair, the breeding takes care of itself. If the water is clean, they will lay eggs by themselves. You can read in any book how to do it. Right on the Internet last night, some guy said, "Raising goldfish is easy. Ammonia kills them. Nitrite kills them. Nitrate kills them. That's it." There is volumes in that. That means changing water sometimes on a daily basis for the first couple of weeks.

How much water space do you have?

I could probably set up 150 aquariums. I have 2 fish rooms in the house. I have a building outside that

keeps fish over winter. I have maybe 20 ponds. You're calling the high end of the spectrum here. Almost every weekend in the summer, there are fish tours going on around here. Most people just walk around shaking their heads.

Do you sell fish to other members?

I don't really have a lot of fish for sale right now. However in the fall, I will have fish that I have culled three times and put outside for the summer. Out of those, I might have a hundred little red and white Ranchus. I'll decide that I am going to keep 10 of them. It will depend upon how good they are. Instead of trying to raise 100 nice fish, you are much better off just taking 10 or 12 of the really best ones. I sell a lot of fish. If nothing else, it helps to pay the electric bill. I have a 200 foot deep well. Most days of the week, that pump is running up to 10 hours a day. My electric bill is sometimes 350 dollars a month.

You talked about most people being soft-hearted



Jikin and Veil

when it comes to culling. How do you handle culling?

I recycle them. Most of the fish that I breed in the house are in 200 gallon tanks. There will be 10 or 12 adult fish in there. There will be several Ranchu in there, but usually a few small Ryukin in there, maybe even a few single tailed males. The big males, Veils especially, but Ranchu too, don't chase very well. The young males chase like crazy. When I walk into the fish room in the morning, I know immediately if any of the females have eggs, because the little males are chasing them all over. The big males are seeing if I will feed them.

When I see that there are fish with eggs, then I will take the female and the desired male and hand strip the eggs. I will hatch out the eggs and raise them for a month. I feed them all the brine shrimp that they can eat. I keep live brine shrimp in the tank with them



all the time. Regardless of whether this means feeding them 3 times a day or 2 times a day or whatever. Almost daily before I feed them, I will siphon out 2/3's of the water, including anything that they haven't eaten and any fish waste. I then fill it back up and feed them again. When they are about a month old, I cull them. I have big white porcelain bowls just like they have in China. I take the fish and put them in about a inch of water. I then take a 100 watt bulb with a little reflector and put this about a foot over the water. Then I pick out all the fish that have double tails that match. (These are fancies that I am talking about, anything



1 year old red veil

with a double tail.) You usually find out that this takes about 90% of the fish out of the batch right away, no matter what kind of fish. If you are breeding Veils, you only take the ones that have perfect matching tails. If you are breeding Ranchus, you get a lot of tripod tails. You get rid of all these fish. If you are raising a strain where color is real important, then sometimes you will raise some of these fish to make sure that you don't have any blood red, blue, green, or yellow fish. All the selected fish are put back in the same aquarium. There may have been 40 gallons of water with 2000 fish before. Now, after 10 minutes, there are 40 gallons of water with 200 fish. I feed the same amount that I was feeding the day before. You say, "How can I possibly do that?" Don't worry they eat it.

The fish that are left double in size almost twice a week. They grow so much faster. I will usually go through them again. Around here, no matter what kind of fish I raise, I usually raise only about 1% of the fry. People are under the illusion that I have thousands and thousands of Veils. I do, if you count all the ones that hatch out of the eggs. However, when you count the ones that people see pictures of in books, that is about 1%. I have found that even with all the water that I have, I end up with a lot of fish that no one wants. If

they don't want them, then I have to keep them. If I have to keep them, then they are screwing up all the other fish that I want to keep. I just learned to be real ruthless right away. If they don't have a double tail, then you don't want to raise them. It doesn't matter how good they look from the side. You've got fish that are just screwing up your whole system.

You asked what you do with the rest. The other 90% I dump right back in the big 200 gallon aquarium with all the adult fish. Within 10 minutes, they are gone. It is the best natural food. I figure by that time, I probably fed that tank about \$25 of newly hatched brine shrimp.

Unless you have more to add, I feel like I have plenty to do an article on. I really appreciate it.

We try to convince people that this is a journey. If you really get hooked by these fish and start meeting people around the world through the Internet, then you have something that you can do your whole life. You'll never go on vacation again without saying, "We are going to Cincinnati. I know Gary out there." I have received invitations to stay with guys in Hong Kong. I will probably never get there, but if I do, then I know I have some place to stay.

That is what we try to emphasize. It doesn't really matter what focus your fish are at any given moment. Or what terrible disaster you have had, where all your fish died. Just keep going. Everybody's fish dies. Everybody has terrible disasters. When we get together at the national meeting, we all of a sudden start to laugh, because we realize that we are all talking about neat fish that we had once rather than neat fish that we have now. "That is why I came this year. To get more fish! What have you got?" Things get traded around and passed around. The message to the beginners is to keep going and learn all you can. The Internet seems to be the best tool that goldfish have ever had. There is a lot of misinformation out there, but there always is in any subject.

Comments from the editor:

Al Foster resides in Sauk Rapids, Minnesota ("the frozen north"). Al has been instrumental in rescuing and maintaining the Philadelphia Veiltail variety. He is truly a goldfish Guru, and a genuinely nice guy.

Roma Radford has recently volunteered as a writer for the Goldfish Report. Roma will write several more installments of his "Member Profile" column this year, and has several other irons in the fire as well.



New Government Regulations on the Ornamental Fish Trade?

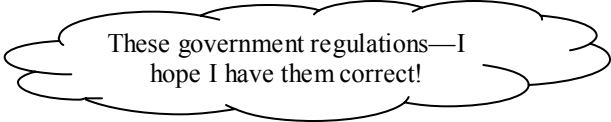
by Stephen Carney

The United States Department of Agriculture's (USDA) Animal and Plant Health Inspection Service (APHIS) fulfills several roles. It oversees disease and pest management, as well as the import and export of plants and animals, all that are used largely for human consumption. The service has been in the news much more than usual in the last weeks since a cow in Washington state was diagnosed with bovine spongiform encephalopathy, better known as Mad Cow Disease. APHIS is also in charge of the National Aquaculture Program, which focuses on the importation and exportation of all aquacultural products, including ornamental fish.

As part of their charter, it appears that APHIS will soon institute new policies that will affect the import of goldfish and koi, and possibly other ornamental fish as well. At the current time, there are no restrictions on trading aquarium fish. But, APHIS is in the process of writing regulations that will place restrictions on portions the international fish trade. These possible changes were prompted by America's first reported cases of spring viraemia of carp virus (SVC) in 2002. Cyprinid fishes, including koi and goldfish are all vulnerable to SVC. As you may remember from Matt Lyon's articles in the Goldfish Report last year, APHIS aided in the identification and eradication of two SVC outbreaks. Since that time, the two sites have tested SVC free and there is no evidence that the disease entered nearby waterways or otherwise spread. It is unknown how the SVC infection, which is caused by the virus Rhabdovirus carpio, was introduced into these populations. Initial reports seemed to suggest that the carriers were imported fish. Regardless of its origins, these outbreaks called the safety of U.S. koi and goldfish producers into question. In 2002, American farms were on pace to export some \$2.2 million worth of koi and its domestic market for koi, as well as feeder and fancy goldfish, was projected to top \$20 million. At that time, APHIS started to review health procedures to deal with additional epidemics. It also began drafting regulations that would govern the import, export, and even inter-state trade of any fish susceptible to SVC.

At present, APHIS has not introduced any public reports on how it will respond to future SVC outbreaks, primarily due to the fact that there have been no new cases identified. But, work has progressed on

changing import and export regulations. There are indications now that when the new regulations go into effect, they could include a range of ornamental fish, not just cyprinids. The potential scope of these changes (or exactly what fish might be regulated) is not yet known, nor is the possible timetable for implementing any new rules. Based on other APHIS regulations, however, it is likely that the exporting country will shoulder the responsibility for certifying all of the fish that they export. This could easily lead to an increase in shipment costs and a corresponding rise in the price of fish as well.



These government regulations—I hope I have them correct!



So, if you purchase any imported aquarium fish, whether or not they are susceptible to SVC, it certainly would be worth your while to pay attention to this developing story. The best resource for the time being is the APHIS National Aquaculture Program website, where you can also find information on SVC. It is available at:

<<http://www.aphis.usda.gov/vs/aqua/aquaphis.html>>



Understanding the Environmental and Hormonal Control of Goldfish Reproduction

by Robert Crosby

Most would-be goldfish breeders have probably experienced the frustration of not being able to breed their fish on a convenient schedule. Finding time to care for fry between family and work-obligations is difficult, and spawns occurring during business trips and vacations are often lost to cannibalism, poor water quality, or starvation. If hobbyists had the ability to control the timing of their spawns, they could greatly improve their potential for success.

Most reference materials describe the natural rhythms and environmental cues that trigger spawning, but it is nearly impossible to mimic so many variables in the confines of an aquarium. Goldfish breeders are not the only ones interested in understanding these mechanisms, in fact, there is an entire aquaculture industry founded on developing ways to control fish reproduction. Fortunately, the goldfish makes an excellent laboratory animal, and has been the subject of much research. It is now understood which hormones control oocyte maturation, ovulation and spawning. In fact, preparations of these substances are commercially available. While hormone injections are probably beyond the scope of most hobbyists, understanding the complex interaction between environmental cues and hormonal control is nonetheless helpful in planning your spawns.

The reproductive cycle of goldfish has developed in response to the natural seasonal changes in its native range. However, the goldfish has also proven to be very adaptable to new environments. In fact, it is the first known invasive fish species in North America, as well as much of the world. Goldfish have also adapted their breeding strategy to tropical climates, where they do not experience an annual dormant period. Thailand, for example, is a major producer and exporter of goldfish.

It is, of course, natural for goldfish to spawn, but in an environment that is constantly changing, timing is everything. The fish must wait for the appropriate environmental stimuli signaling that conditions are optimal for the survival of their eggs and fry. In a temperate climate, late spring through mid-summer is the most prolific spawning period. Fry born within this window have the advantage of a long, warm growing season, and abundant food sources. Environmental factors that have been shown to play a significant role in the reproductive cycle are:

- ✓ Photoperiod (day length)
- ✓ Water temperature

- ✓ Water quality (dissolved oxygen, pH)
- ✓ Flooding and water current
- ✓ Lunar cycles
- ✓ Weather cycles (changes in atmospheric pressure, rainfall, sunlight)
- ✓ Availability of spawning substrates
- ✓ Abundance of food
- ✓ Presence of other fish
- ✓ Presence of parasites

Fish are able to sense changes in these parameters that may serve as both positive and negative signals controlling reproduction. These signals do not function independently of each other, but are considered simultaneously. While some signals may stimulate reproduction, any unsuitable conditions may be overriding, and prevent spawning.

These environmental cues do not affect reproduction directly, but set off a chain reaction of internal processes that stimulate reproduction. The mechanism is complex, involving the brain, the hypothalamus, the pituitary and the gonads. Environmental stimuli are received by the brain, and are translated. Those stimuli of reproductive significance are transmitted to a portion of the brain called the hypothalamus. In response to these signals, the hypothalamus produces both gonadotropin releasing hormone (GnRH), and gonadotropin inhibiting factors. Studies suggest that dopamine inhibits the release of gonadotropin. Gonadotropin releasing hormone (GnRH) stimulates the pituitary to produce and release gonadotropin hormones (GtH). Gonadotropins then stimulate the ovaries and testes to produce various steroids, which lead to final maturation of egg and sperm cells.

The discovery that spawning can be artificially induced has led to major advances in the field of aquaculture. In this procedure, mature carp pituitaries are harvested and dried in acetone. The dried pituitaries are then ground into a powder and resuspended in saline solution. The pituitary solution is injected into the abdomen of both the male and female fish. Since this procedure only affects the final maturation and ovulation of eggs, it is important that the female fish be well conditioned. The exogenous introduction of the pituitary hormones effectively bypasses the brain-hypothalamus-pituitary chain, and affects the ovaries and testes directly. In addition to carp pituitary extracts, various synthetic hormone products such as Ovaprim™ are also available. Some references caution that this technique should not be used on valuable fish,



because over-stimulation of the ovaries may lead to infection.

Since the availability of mature eggs is the most limiting factor in reproduction, it is logical that the female should ultimately control when spawning will occur. While sperm are just as important to reproduction as ova, the male invests significantly less energy and time in the development of sperm than the female invests in the development of eggs. You have probably observed that whenever a female is ready to spawn, all of the males are also ready to spawn. The female is able to synchronize spawning readiness in the male by releasing a sex pheromone into the water. A pheromone is described as a substance that, when released, has a hormone-like effect on another individual. Studies in goldfish suggest that ovulating goldfish release the pheromone known as 17,20P into the water. This pheromone is detected by the olfactory epithelium of male goldfish, and causes a rapid (within 15 min.) elevation of blood gonadatropins, which causes an increase in milt volume. Experiments have shown that this effect can be abolished by removal of the olfactory tracts in male goldfish.



Figure 1—Chasing

While the pheromone effect of the female on the male has been proven, it is probably not the only spawning trigger for the male. From my own observations, it seems obvious that, at times, females send some signal to the males that they are ready to spawn, however, I believe there are also times when males exhibit spawning behavior in response to some other environmental stimuli. For example, while single males are sometimes slow to respond to an ovulating female, multiple males usually seem to pursue the ripe female together. This suggests that some males also rely on behavioral cues from other males to trigger their own spawning behavior. I recently separated a male and a female that were in breeding condition and were being kept together, but had not spawned. Both

fish seemed relaxed and content in their separate quarters, until one morning when I noticed the male acting very excited, darting around his tank with his pectoral fins erect. I decided to put him back in with the female, and he immediately pursued her, chasing her through the plants and pushing her to the surface. The female did not splash around as spawning females usually do, and despite being chased for several hours, she did not lay any eggs. Apparently, she was not ready to spawn. The next day, the male had calmed down, and besides the female's split tail fin, everything was back to normal. I later realized that the male's spawning behavior corresponded with the full moon. Within a day of the full moon of the next month, the same male exhibited this sort of behavior again. One breeder told me that his fish spawn whenever there is a clear day following a period of rain. Another breeder says he can induce his outdoor fish to spawn by doing 90% water changes on two consecutive days. It seems to be the case that absent any pheromone cues, environmental cues such as rising temperature, changing barometric pressure, or lunar cycles are also used to synchronize male and female readiness to spawn.



Figure 2—Male “Nudging” Female

While the final maturation of eggs, ovulation and spawning are closely controlled by environmental cues, the development of oocytes is a lengthy process and is ongoing. At the end of their natural breeding season, female goldfish will increase their food intake in preparation for hibernation, as well as the development of next year's eggs. Through the hibernation period, the eggs will undergo several stages of development before their final maturation. The first stage of development involves the development of the basic structure of the cells and subcellular organelles. At the end of this stage, there are two cell layers called the theca and granulosa, which are responsible for the production of reproductive hormones that will regulate the



successive stages of development. There is now a well-defined oocyte encased in a follicle. The second stage is known as vitellogenesis, where the uptake and synthesis of yolk proteins occurs. This is the longest phase of oocyte development and requires significant nutrient input. The yolk proteins are produced in the liver, secreted into the blood, and stored in the oocytes. If insufficient yolk proteins are produced, eggs will be small and fry mortality will be high. Stage three is called maturation, and is caused by the hormone progesterone. This step requires only 24-72 hours, and is the final stage. During this phase, the nucleus of the egg migrates to the periphery, the nuclear membrane disappears, and water uptake occurs. Once water uptake has occurred, the female's abdomen will swell and become soft. Finally, the eggs are ovulated, and are stored in the peritoneal cavity until spawning.

There are various strategies used by fish for the production of eggs and spawning. At one extreme are the salmon, which use synchronous spawning, where a single crop of eggs is produced at one time, and then the fish dies. At the other extreme are the danios, and killifish, which may produce a few eggs every day almost continuously. Goldfish are group synchronous spawners, producing groups of eggs several times throughout the spawning season. In temperate climates, the first spawn of the season will usually be the largest, followed by several smaller spawns throughout the season.

Allowing fish to undergo a hibernation of at least



Figure 3—Success

two months will definitely improve the likelihood of subsequent spawning. Since some deep-bodied, or long-finned varieties do not do well outdoors in the winter, a shorter hibernation might be less stressful on the fish, yet encourage spawning. Some breeders will bring their breeders indoors as early as December 1st, and will often have spawns by Christmas. This strategy may prove useful, since not all spawns will have

to occur in the spring, and for many people, late December through early January are the holidays, and might allow additional time at home to care for newly hatched fry.

Best of luck planning your own spawns, and please remember to share your tips with your fellow GFSA members!




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Goldfish Keeping 101 by Terry Cusick

I have received a few emails of late asking about the color of algae in an aquarium. The color of the algae in your aquarium is a great indicator as to just how well things are going. It is akin to the canary in the mine, it will tell you something is wrong, but not necessarily what.

Algae comes in essentially 3 colors:

- green, 
- blue/green, 
- Brown 

The only good color is green. Anything else and there is a problem. This is where the algae lets you down, for it doesn't tell you what of the hundreds of things could be wrong. It is now up to you to be a detective. I would start with the water parameters because these are the easiest to test for, you just have to have a bunch of test kits available at most pet shops. The following are what I think you should test for:

- pH—should be between 7.0 and 8.0,
- Ammonia—should be zero,
- Nitrite—should be zero,
- Nitrate—should be below 30 ppm,
- Total Alkalinity—should be between 50 and 200 with 100 ppm ideal.

If the water parameters checkout, try increasing the amount of aeration and the amount of light the tank gets. It is trial and error from this point on. Good luck!



Goldfish of the Month

The Black Moor

By Andrea Pecher

The black moor is a very popular goldfish breed, and can be found all over the world in millions of collectors tanks. He is easily available in most areas, and is not a too delicate fish.

Coloration

The black moor is only allowed in, well, black! And unlike most other goldfish breeds, he stays pretty true to his black color. He can change to orange over time, especially with old age, but most black moors stay black. Its one of the few breeds where it can be said that the black will most likely stay.



Photo by Fred Rosenzweig

Body features

The body depth should be greater than $\frac{2}{3}$ of the body length. The caudal fin should be double, and the lobes 90% or more forked, as well as nicely rounded. The black moor has a dorsal fin, which should be $\frac{1}{3}$ to $\frac{5}{8}$ of the body depth. Pectoral and pelvic fins are paired, and should be equal in length. Anal fins are paired as well. His most distinguished features however are his eyes - they are protruding, and should be of equal size and shape, well matched with each other. Unlike the Celestial, which has eyes going upwards, the eyes of

the black moor are going sideways. The color, as mentioned above, is always black, and it has a deep velvet look to it.

Variations

Besides the different kinds of caudal fins available, there are not that many variations to the black moor. The fish comes in broad tail, ribbon tail and butterfly, which is especially pretty when viewed from above. In earlier times, around the 1930s, there was a very gorgeous veiltail moor vastly appreciated in England, but unfortunately they are not available anymore to my knowledge.

Environmental needs

The black moor will not do as well in a pond, but will be a very happy fish in an aquarium. Due to his predominant eyes, he has a bit of a hard time seeing his food, and needs some extra time when it comes to feeding. Therefore it is recommended that he be kept with other eye handicapped fish like celestials, telescopes or bubble eyes. That way he has an equal chance to find food.

His eyes are also a big handicap when it comes to tank ornaments and some kinds of plastic plants, especially the ones that come with sharp edges or spiky leaves. His eyes can get damaged or even fall off, for that reason great care has to be taken when deciding what kind of tank decor goes into his tank. Silk plants are a much better choice, and tank ornaments in general should be much better off in tanks with other goldfish breeds.

Lunch time!

When it comes to feeding time, a black moor is just like any other goldfish - a pig! He eats almost anything and everything that's easily available on the market - pellets (sinking preferred), flakes, frozen foods like daphnia, shrimp, bloodworms, pre-cooked cocktail shrimp), freeze dried foods, fresh veggies like lettuce, cucumber, peas.... And again, because of his eye shape, he will have a harder time finding certain foods, especially the ones that tend to float around in the tank a while before they settle down - flakes and the frozen foods. He needs some extra time with those, and surely appreciates it if some faster oranda does not take away his dinner!



Why Cull Stats Don't Make the Cut

By Brian Rowe

A question facing all hobbyist breeders is “What is the breeding potential of a certain pair of goldfish?” Sure, the new fish you just imported pass the “look” test, but will they produce high-quality fish in decent numbers and form the cornerstone of your line for years to come? Since most American hobbyists have limited tank/pond resources we have limited numbers of adult fish from which to form a breeding group. Limited resources not only reduce the size of our breeding population, it also restricts the number of fry we can raise. This puts a premium on producing high quality fry as we don't want to spend the time, effort, and space on batches of fry that are eventual culls.

That's where cull stats should come into the picture. The premise is simple: take an adult breeding pair, hand strip them to control parentage, raise the fry, and track the physical characteristics of the progeny. Personally, I make a 5 by 5 matrix running tail characteristics along the right side and back characteristics along the top. Every time I cull a fry, I place a tick in one of the 25 possible cells that links both of its physical traits into one record. When you are done culling, in theory, the hobbyist should end up with a good representation of what future spawns from the same breeding pair should look like.

And that's about as far as the theory goes without showing fundamental problems. I do research for a living and go about my fish keeping in a very methodical fashion (as evidenced by the very fact that I take cull stats so seriously). I was shocked at what I discovered in my first summer of intensive spawning activity from my ranchu. I had three breeding pairs produce 15 spawns over four months of time. I kept cull stats on 14 of them - one is still growing out. What I found, using standard statistical assumptions, was amazing to me.

A deterministic genetic outcome for the development of the physical characteristics of the fry has to be rejected. Genetics alone can not explain the radical differences I experienced from one batch of fry to the next from the exact same breeding pair. The books most hobbyists use as reference sources do state that environmental influences have an effect, but I feel that this aspect is seriously under-reported. Below, I've simplified the findings of two batches of fry from the same parents. The sample size for each was large enough to ensure statistical significance at a high level

of confidence. I ran tests on each of the samples and in combination as well. I'm only reporting the culls here and the number of fish that failed to be culled by these conditions is about 10% of the total number of fry. Rounding explains sums that are greater than 100%.

	Batch A%	Batch B%
Tail Stats		
Single Tail	1%	22%
T to Tripod Tail	34%	73%
Good Tail	59%	4%
Bent Ventral Lobe Tail	9%	3%
Back Stats		
Good Back	32%	88%
Full Dorsal Fin	2%	0%
Partial Fin / Spike Fin	44%	5%
Bump on Back	14%	4%

The two batches of fry were polar opposites of each other in terms of back and tail traits. Batch A had almost 60% good tails while Batch B had only 4% good tails. Conversely, Batch A had only 32% good backs while Batch B had 88% good backs.

To find out what is going on, you've got to dig beneath the genes for the back story. In the case of Batch A, I placed the eggs almost immediately into a 20 gallon tank with a mature sponge filter, fresh water, and the water was the same temperature as that in which the bowl had been floating. Batch B had a much rougher time of it. It was placed into a bucket of fresh water a day after a 24 hour soak in a bucket of Methylblue'd water. It sat in the new bucket for two days and when I returned from a trip it had a very thin layer of foam around the edges. These fry were then dumped into a tank matching the description of Batch A's tank. The two batches received the same kind and amount of food throughout their grow-out stages.

During the fry's formative period of development - the first 48 hours or so before hatching - changes to their external environment had a tangible impact upon the expression of their traits. Batch B's tails turned out very poorly, yet its backs were markedly better. Batch A showed the opposite effects. As if the polyploidy nature of goldfish was not enough to ensure a



lifetime worth of work at breeding the perfect fish, the effect of the egg/fry environment adds further variables to the mix. Yes, we're doubly cursed!

So where does that leave me with my notes, matrixes, and lots and lots of culled fry? The first lesson I learned is to realize that cull stats are just a tool for selecting mating pairs. No one should try a pairing one time and judge whether or not the result is a success or failure. I suggest trying at least twice, three times if possible, and judge the results as a whole to determine the worth of the parents as a pair. Another lesson is to try to maximize the constancy in fry environmental conditions. That means keeping records on how you set up the environment for each spawn. Write down the temperature, water conditions (PH, salinity, nitrate levels, etc) and make sure they are kept constant through the entire egg development period. If the temperature in your bucket drops 15 degrees over night, or too many drops of Methylblue are used, you might not like the resulting outcome. Find out which constant environments produce the best results and then share this infor-

mation with the rest of us. Yes, this is getting technical and will take some amount of time to do, but imagine doubling the number of fish that are of high enough quality that you feel is worthwhile to raise them to adulthood. I know I'd rather have twice as many quality fish from which to choose in order to ascertain which 8 to 10 fish will be my future breeding stock. To me, at least, that makes the effort worthwhile. The last lesson I learned was that American hobbyists can not simply import their way to breeding a new generation of great fish. There is much we do not yet fully understand and it will take us time to ultimately do so. Unfortunately, we have to be much more concerned about every spawn simply because our entire combined hobbyist effort fails to produce as many fry in a year as does a single Chinese farm in a season. It will take a communal effort of trial, error, and information sharing to maximize our resources and eventually break our dependence on imported stock.

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Protecting Your Pond From Heron Attacks

By Robert Crosby

My outdoor pond was installed last spring, and shortly after completion, I moved my entire goldfish collection into the pond. The fish thrived and the lilies bloomed and I enjoyed my new landscape feature every day. The more valuable fish in my collection included some black ranchu, and tri colored demekins from Tommy Hui, and some Kroshinsky ranchu from Russ Taylor. Although I had read Russ's article about his visit from a Great Blue Heron, I had never seen one around my yard, and I was convinced that the open space around my pond and the noisy street in the background were enough to discourage the herons. By September, I had still not had any bird problems, and I didn't give it another thought. When I read that there was going to be a "Koi America Festival" in nearby Chantilly, Virginia, I excitedly extracted some cash from the ATM and drove myself to the Dulles Expo Center, hoping to find some great goldfish to buy. Sure enough, there were plenty of specimens to choose from, but I settled on five Red and White ranchu from Gunn Chusakul. With my new fish safely in the pond, I had high hopes for a ranchu spawn the next spring.

After returning from a weekend away at the beach, my neighbor casually mentioned that he had seen a "duck" in my pond, and that it sat in the nearby tree. I didn't argue with the information, but I couldn't remember ever seeing a duck in a tree, so I dismissed it as unimportant. The next day, I went out to the pond and noticed that a couple of fish were missing and some of the remaining ones looked beaten up. It finally dawned on me that the "duck" must have been hunting. Remembering that the duck had been seen in a tree, I figured it was some other species of fishing bird.

I read all my pond books, and decided I'd deter the bird by creating a trip wire from fishing line. Convinced that I had solved the problem, I went back inside the house. That evening, around dusk, I saw an ugly, long-necked bird crouched beside the pond, staring at the fish. I ran outside and shoed it away, but not before it had eaten a couple more fish. Desperate to find a solution to this problem, I tried tying fluttering ribbons and balloons to the trip wire, but each evening, like clockwork, the bird would return to the pond at 8:00 sharp. By this time, the formerly beautiful pond looked ridiculous with Christmas lights crisscrossed

across the surface and balloons lining the edge. My neighbors didn't say anything, but I'm sure they thought I was crazy. The bird must have had a good chuckle too, because he was still undeterred.

After some more research, and several dollars spent, I found a Great Blue Heron decoy, which was supposed to intimidate other herons from coming near the pond. Apparently, Herons prefer to eat alone. While the heron decoy looked much nicer than the Christmas lights, the visiting bird was not fooled. He didn't give the decoy a second glance. Finally, I got smart and purchased some bird netting that was meant to prevent birds from eating the fruit off of trees. This product was exactly the same stuff as what they sell to protect fish ponds, but at a third of the price. I cut a



Figure 1—Worthless Great Blue Heron decoy



Figure 2—Silicone caulk and lawnstake

piece of netting the size of my pond, and secured the edges with two eight foot 2x4's. The netting drooped over the water, and interfered with the waterlilies, and the 2X4's were very ugly. On the other hand, the bird returned only once more, but he must have given up, because I didn't see him again after that.

This spring I was determined to find a way to secure the bird netting that would not detract from the appearance of the pond, and would hold the netting high enough that it wouldn't touch the water plants. I decided that small stakes anchored around the edges of the pond would do the trick. I visited the local hardware store and found a bag of green plastic stakes that are used to tack down landscape fabric. A bag of these stakes was only a couple bucks. I did not want to ruin the stone edging around the pond by using some product like Liquid Nails, so I chose 100% clear silicone caulk. Because the flat heads of the plastic spikes were smooth, I rubbed them on some pavement to rough them up before gluing them to the rocks. After the



Figure 3—Befuddled Black Capped Night Heron

caulk had dried, the stakes were firmly attached. I stretched the netting across the pond and hooked it to the teeth in the stakes. I can say that I am very satisfied with the result. The netting and the stakes are barely visible and the netting does not interfere with the plants.

I am also pleased to report that this setup is heron proof! While I was mowing the lawn the other day, the heron returned. I got my camera and watched him closely as he walked all around the pond. Unable to get to the fish, he flew away, and hasn't returned.

Gus the Goldfish

by April Pederson



Editor's Note: Most of the cartoons that we use are by April and we've been recycling them for years, not always giving her credit. If someone knows how to contact her, please thank her. If we have someone that can draw and would like to try their hand at cartoons—we could sure use some new one.



Gary Hater's Breeders' Social 2003

It is almost time for another one of Gary Hater's Goldfish Breeders' Socials and Matt Lyon had all these photos leftover from last year that were going to go to waste. Gary will be having this years Breeders' Social September 10 thru 12. I'm not sure who took the photos, but Matt wrote all the captions. We'll have the photos from this years event for you to see soon.



"Gary Hater showing off his newly replumbed basement fish room. Gary has tanks and tubs tucked in every nook, enough to keep the curious observer occupied for days."



"A few of the younger attendees enjoying the wonders of a goldfish fanatic's backyard. Here, Simon Wong, Matt Lyon, and Ted Tai are shown 'deep diving'."



"Simon Wong, Terry Cusick, Larry Christensen, and Gary Hater receive a Rancho lesson from John Parker of the UK"



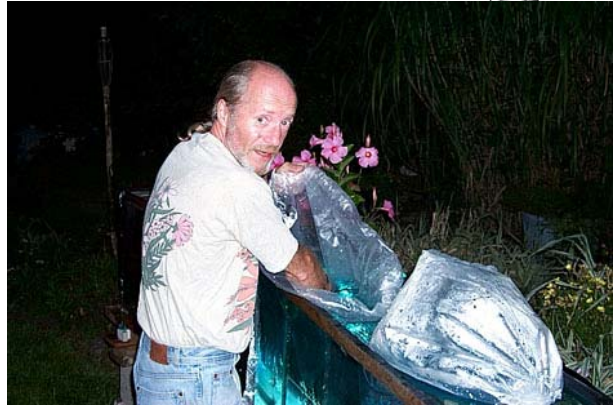
"Larry Christensen intently studying a tank full of Gunn's Fish. He only had so much space in his suitcase on the way home."



"Rancho trio waiting to be judged."



"Bristol Shubunkin and a Relatively New, Yellow Italian Variety in Gary's Fish Room."



"For the record, this is not a photo of Ken Terrill attempting to smuggle some show Rancho from Gary's backyard. Instead, here he is acclimating some of his own beautiful fish to a display tank."



"A rarely seen nacreous form of bubble eye, bred by Gunn Chusakul. Gary Hater reports he has thousands of young from fish he purchased from Gunn."



"Gary Hater's infamous Rancho X Orca outcrosses. Gary spent many hours carving and painting these highly prized Rancho figures, which were given as awards after the Rancho competition."



"Hater Rancho Frolic Freely Aware of Their Captors"

We can always use stuff for the Goldfish Report so if you attend a goldfish event don't forget your camera and send us copies of photos along with captions and a short blurb on what was going on.

Thanks,

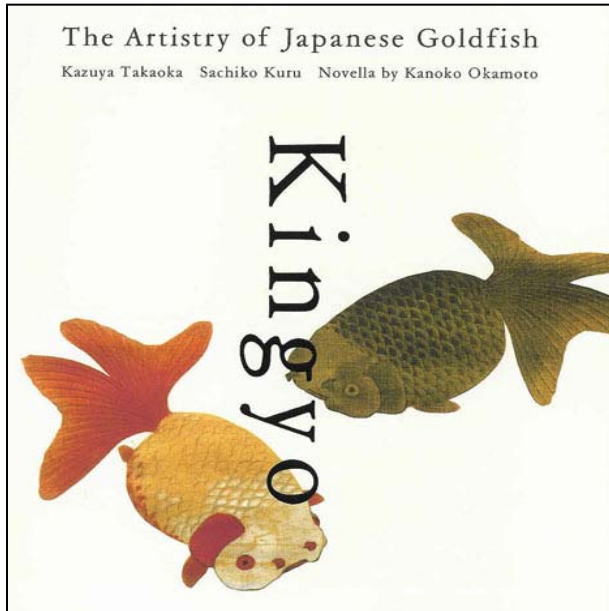
Terry



A Review of the Book

Kingyo: Artistry of the Japanese Goldfish

In Celebration of the Goldfish



Few Americans understand that the extraordinary grace embodied by even the most ordinary goldfish doesn't just happen. It is the result of thousands of years of meticulous cultivation. Each fish is unique and each fish carries with it a history and vision that began in China, spread to Japan, and ultimately reached a select group of fanciers around the world.

Kodansha International has just published a new book, *Kingyo: Artistry of the Japanese Goldfish*, that is at once a visual salute to the grace of these fish and an overview of the different ways that the Japanese have shown their appreciation for their beauty.

First brought to Japan in 1502, Goldfish were originally raised exclusively by the nobility as highly prized pets. In the 1800s, however, they became popular with the general public—street vendors carrying goldfish in oval tubs first appeared during those years and were common sites. It was at this point that the goldfish as an icon found its way into almost every aspect of daily and artistic life. *Kingyo* provides dozens of delightful examples, both ancient and contemporary, as seen in the graphic and decorative arts, extending to textiles, ceramics, paintings, ukiyo-e prints, lacquer ware, toys, and even

household items.

Most notable in this book are the contemporary photographs taken by Sachiko Kuru. Turning her focus from professional advertising and fashion photography to the goldfish, Kuru is able to capture the distinct features and personalities of each of her subjects. Several photographs of each of Japan's twenty-one different breeds are shown against an invisible backdrop so that they appear to float off the page. In addition, *Kingyo* has explanations of each of the breed names and distinguishing characteristics as well as a genealogical chart and an explanation of the distinguishing body part of the fish.

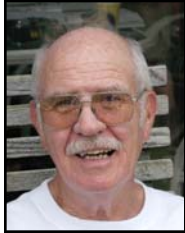
A short novella written in the 1930s entitled "A Riot of Goldfish" by Kanaoko Okamoto rounds out this survey. It tells a story of love and obsession as a breeder's son falls for the daughter of his wealthy patron and attempts to create a goldfish that will capture and reflect her beauty. The story charmingly evokes life in Japan in the early twentieth-century



during the height of their popularity and sheds light on the aesthetics of goldfish appreciation.

While *Kingyo: Artistry of the Japanese Goldfish* is sure to be an eye-opening introduction for Westerners to the unique culture that has grown up around the goldfish in Japan, the stunning photographs and charming collection of lore will also delight those already initiated into the "cult" of the goldfish.

Published by Kodansha International, PB \$37.50 Available at fine bookstores and on-line booksellers everywhere.



GFSA Club Corner
By Scott Taylor
GFSA Goodwill Am-
bassador



Four of our members at the Greater Louisville Koi and Goldfish Show. (Left to right) Art Lembke, Gaye Langley, Terry Cusick, and Les Berkow. The show had about 30 outstanding goldfish that were judged by Terry Cusick. In addition to the goldfish show there was a Koi and vendor show. Everything was held on the grounds of Charles and Caroline Phelps.

SHOW SCHEDULE

July 24-25 NWKGC Show at the World Forestry Center, Portland, OR Contact Dale Rohrer or Donna Mason—(503) 698-3379. Website: www.nwkg.org

Aug 20-22 Inland Empire Water Garden and Koi Society, Spokane, WA Show held at the Spokane Fair and Expo Center. Contact Gene Anderson (208) 762-5749 or koipondman@aol.com

Aug 21 Idaho Water Garden & Koi Society, Boise, ID. Contact Paul Samson (208) 467-7704 or Samson@iglide.net. Show held at Boise Depot

Aug 28-29 Midwest Pond & Koi Society. Chicago area, at the Dupage County Fairground. Contact Jim Castillo at (773) 612-0928. Website: www.mpks.org

If you want your goldfish club or event listed in the Goldfish Report please contact Scott Taylor at: (303) 693-8120 or stgoldfish@aol.com

Understanding Ammonia ... from page 3

ing an ammonia binder like Amquel then he could have got a 6 ppm reading of ammonia and the fish would be fine. For an ammonia-binder modifies the ammonia molecule to render it nontoxic. However, the ammonia is still present in the water and the Nessler Ammonia Test Kit can not discriminate between this rendered nontoxic ammonia and the regular toxic ammonia. You have to get an ammonia test kit that uses the Salicylate Reagents to get an accurate ammonia reading when you use ammonia binding products. Unfortunately, the manufacturers of these test kits do not identify them as Nessler or Salicylate. You have to do a little detective work. The Nessler has one bottle of reagent, is usually cheaper, and its color scale of the amount of ammonia goes from clear to blue. Salicylate has 2 or 3 bottles of reagents and has a color scale that runs from yellow to green to blue.

Finally, let's consider that Jack didn't keep acidophilic fish, put that the pH had dropped to 6.0 due to not enough alkalinity (buffers) in the water. What is called a "pH Crash". (A good topic for another occasion.) Knowing what we know now, that the pH is 6.0 and there is 6 ppm of total ammonia in the water, would we want to raise the pH without doing anything else? The answer is no because if you just raise the pH, the less toxic ammonium will be converted to the toxic ammonia. I would recommend the following procedure (assuming it is easier to correct the existing water then replace it with treated tap water):

- First, use an ammonia test kit to determine the amount of total ammonia (ammonia and ammonium) in the water.
- Based on this reading, determine from the ammonia binder product container how much product to add to the water to get rid of that much ammonia and then add twice that amount to the aquarium. This will provide a buffer for any additional ammonia produced during this procedure.
- Use a product you purchased to raise the pH or just using some baking soda (sodium bicarbonate) to adjust the pH upward. How fast you adjust the pH depends on the fish. If the fish look normal and are acclimated to the current pH then you want to raise the pH by 0.3 units per day. However, if the fish appear to be stressed at the lower pH then you may want to consider raising the pH more rapidly.
- Continue to monitor the ammonia throughout the process with a Salicylate test kit and add more ammonia binder as necessary.

So in conclusion, you need to have the big picture when determining whether you have toxic ammonia and good luck with that degree in Rocket Science.