



FINS & FRIENDS

The Official Newsletter of the North Carolina Koi & Watergarden Society

Upcoming Events

NCKWS Visit us at: www.nckws.com

July 12 NCKWS Koi Sale & Meeting
Lakeview Dailily Farm, Garner, NC

August 16 Meeting
George Lambie & Amy Bonis, Raleigh, NC

September 20 Meeting
George & Pat Wallace, Raleigh, NC

October 10-12
Carolina Classic Young Koi Show, Cary, NC
www.carolinaclassickoishow.com

USA/WORLD

July 17-22, 2008 IWGS Symposium
Richmond, VA, www.iwgs.org

September 12-14, MAKC 20th Annual
Koi Show & 4th Annual Goldfish Show
Westminster, MD, www.makc.com

September 12-14
ZNA Potomac's Annual Koi Show
Vienna, VA, jnorth@znapotomac.org

September 12-14
14th Annual Atlanta Koi Club Show
Tucker, GA, www.atlantakoiclub.org

President's Corner

The hot days of summer are upon us. Hopefully everybody made it thru the spring without any problems. This spring we had a few members who finished building a new pond. For some it's their first pond while for others it's a bigger and better second pond. We also have a few other members who are in the beginning stages of redoing their existing ponds. If you have any questions about your pond, your koi, a plant, or equipment, please visit our forum at nckws.com. We have some very knowledgeable members who are willing to help answer any questions you may have.

We will have several fundraisers through out the year. One of our club's main fundraising event is our Annual Cull Sale. This year it was held at The Garden Supply Center in Cary. I would like to thank chairman John Devlin for all the hard work he put in to making this event a success. I believe John has volunteered to be Chairman again next year.

We also have several items that have been donated by different vendors that we will raffle off or sell at our monthly meetings.

In October , we will be having our first koi show. Philip Bronikowski and Dan Phillips are the co chairs for the show. A lot of work goes into putting on a show. So I ask each member to volunteer to help out. There will be something for everyone to do.

Rich,

Rich Eitel, NCKWS President

Issue Highlights

NCKWS Person of the Year	2008 Koi Sale
KHA Corner	Filtration Systems
Bug Bites	Visit to Lotus Land



Message from the Editor

For better or worse summer is finally here. On one hand we can relax by the pond and enjoy our beautiful koi. On the other, we may be facing another year of drought and water restrictions. Remember though that in order to maintain healthy koi, we need to keep up with water changes and proper pond maintenance.

There are a lot of exciting things going on at NCKWS. We are preparing for our first Koi Show, which will take place this Fall (take a look at the ad on page 4.) We will also add another KHA to our roster, congratulations to Ed Walker!

In this edition, we introduce a new series of articles, Bug Bites by John Devlin, KHA. Each quarter John will focus on a different parasite. Read the articles, learn but if you suspect an infection, contact a Vet qualified to treat Koi.

Happy reading!

Rossy,
Rossy Garcia, NCKWS Editor



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Person of the Year

by: Roger Lias, Ph. D.

We are delighted to announce that NCKWS members have voted Bryan Connelly as the club's American Koi Club Association "Koi Person of the Year". Congratulations Bryan!

Every year members of AKCA affiliated clubs vote to recognize someone who embodies all that is best about being an AKCA club member by contributing to the hobby via participation in club activities, helping the club and assisting other club members.

Bryan has been a member of NCKWS for several years and is a popular, enthusiastic and active member of NCKWS. Bryan caught the koi bug and was introduced to the club via President Rich Eitel's wife Vicky who at the time was a work colleague. Bryan quickly jumped in with both feet and began construction of his beautiful pond in North Raleigh. It quickly became apparent that "McScratchit" (as he is very affectionately known) was not content to accept commercial filter design or inclined to pay the prices asked by the vendors. Bryan is the consummate do-it-yourselfer and started work on a variety of home made filter systems for his ponds. Fellow NCKWS members were quickly impressed not only with the quality of Bryan's workmanship (no thrown together jobs here!) but also with the level of his technical and engineering expertise, his quest for knowledge and his constant questioning of existing mechanical filtration systems and bioconverters and how they might be improved.

His projects have included a large fibreglassed vortex, numerous pressurized bead filters, his "Lexus Nexus Easy Breezy" Kaldness barrel systems and his "Black Dragon" foam fractionator. What has really endeared Bryan to NCKWS members is his willingness to build filters for club members, troubleshoot and fix existing systems, help with pond planning and construction and so on. He also happily helps non-members to improve their ponds and all while holding down a job that takes up a huge amount of his time! Bryan's "happy to help" attitude is appreciated by all.

Not content with being the club's filter expert and resident handyman, Bryan's knowledge of koi and fish husbandry has also grown considerably over the past few

years. He is now upgrading the quality of his fish collection and an active participant in the club mud pond growouts. In 2007 Bryan took the plunge and entered his first AKCA show in Charlotte and was rewarded with several prizes.

Finally, we must remember the saying that behind every great man there's a great(er) woman and also acknowledge Bryan's long-suffering wife and fellow club member Jessica, who puts up with Bryan's unbounded enthusiasm and regularly brings her cheerful countenance to bear at club meetings.

Congratulations Bryan!

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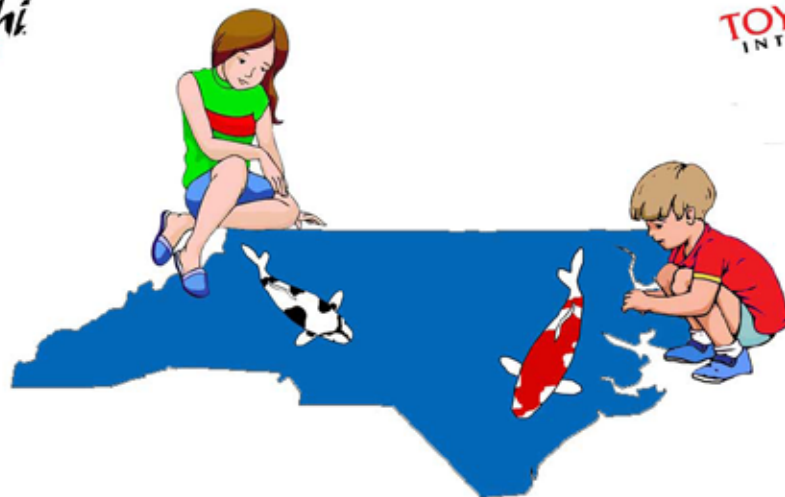
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KHA Corner: HOW MUCH SHOULD I BE FEEDING MY KOI?

by: Roger Lias, Ph. D.

When I first started keeping koi I was more than a little paranoid about over-feeding, damaging the health of the fish and ruining my water quality. But just how much should one be feeding and how? Hopefully this article will help novice and more experienced keeper alike take a disciplined approach to daily feedings based on the knowledge of some experienced koi keepers and a little science.

Firstly let me say that this article is not about what to feed your fish (although that may be a good topic for a follow-up article). Neither is it about how to start feeding in the spring and wind down in the fall, although it will certainly be mentioned. Rather it is about how to feed during the warmer months so as to get the best growth from your younger fish, maintain the health of the older fish and maintain your water quality and reduce filter maintenance by reducing the amount of waste food (either uneaten or eaten but undigested) entering the pond.

It is almost certain that most of us tend to over-feed our koi and our pond, although it is certainly also possible that we can be overly prudent. I was chatting to an NCKWS member recently who was concerned that his fish aren't growing much. No problem with stocking levels or water quality, but when we compared the amount we feed it was apparent that he has been feeding significantly less than me – could that be the problem?

There are plenty of rather subjective "rules" out there such as "feed as much as your fish will consume in three minutes" and "spread feeding over several smaller increments every day". These are well meaning and certainly send the message that over-feeding is bad, but do they have any basis?

This article draws largely from two previously published articles. Firstly "You Might Be Overfeeding Your Koi or Goldfish If....." by AKCA judge Ray Jordan of the Texas Koi and Fancy Goldfish Society – it's available on the club website at www.texaskoi.com/articles. It was this article that helped me considerably when I was starting-out and looking for information. More recently, Jasper Kuijper of Evolution Aqua in the United King-

dom has published an article "Lunch Time. Old Theories Tested" in the April/May 2008 edition of Koi Nations, pages 60 -63.

As already mentioned, this article is not intended to tell you what to feed. It is important, however, to ensure that you are providing proper nutrition by feeding a high quality food. For the purpose of this article I am assuming that a pelleted food such as those manufactured by Dainichi, Hikari, Evolution Aqua and others with a protein content in the range of 37% to 44% is being fed. This is important as I will be talking about the weight of food to be fed and some foods such as Tetra's pond foods are extremely dry and may not be applicable to the calculations that will be discussed.

So are there any tell tale signs that you are overfeeding? Absolutely! By observing your pond, the fish and their behavior carefully you may be able to pick up several clues.

- Are the fish keen to eat? There are numerous reasons why fish may choose not to eat or to eat more slowly than usual, but if they consistently show little interest in their food there's something wrong.
- Is your pond water green or cloudy? Those algae and bacterial species need food to thrive and if you're overfeeding they would be delighted to live on the leftovers!
- Do you see a lot of foam on the surface of your pond, especially around waterfalls/fountains? This is caused by excess Dissolved Organic Carbon (DOC) molecules, most of which are derived from proteins. Leftover/undigested food adds protein to your water which is bad not only because it feeds algae but because it gets broken down into toxic ammonia and puts additional burden on your bioconverter.
- Do you have trouble maintaining good water quality/chemistry?
- Do you see floating fish faeces?
- Do you find a lot of uneaten food in your skimmer?
- Does the white in your fish appear yellowish? Are the colors in your fish washed out?
- Put simply – are your fish too fat?

Continued on page 20

A Lotus for Every Garden by: Marilyn A. Grolitzer, Ph. D.



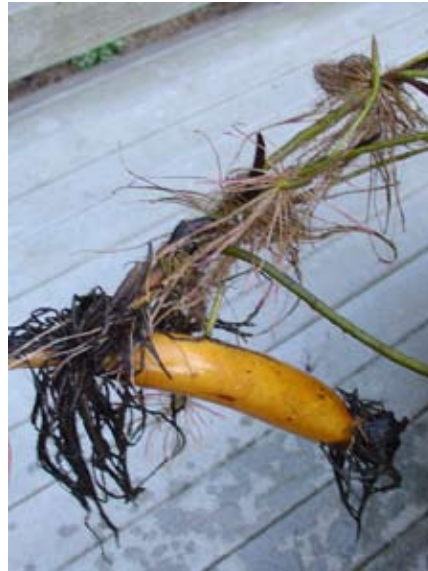
Until recently, I was under the misperception that lotuses were for experienced gardeners with large deep sunny ponds or water gardens. Older gardening books spoke of the short bloom season and blooms that only last 3 days and stay open only for a few hours each day. My thought was why bother, is it really worth it? This may have been true 10 years ago, but due to the lifelong work of a North Carolina resident and renowned hybridist, Perry Slocum, there are 30-40 cultivars now readily available in the US, with sizes, colors and fragrances to suit everyone and which bloom consistently for 3-4 months with blooms that stay open throughout the day.

Lotuses are among the most ancient of cultivated plants dating back well over 2000 years. They are considered by many to be a sacred plant and have been used for centuries in Buddhist ceremonies. There are two species; *Nelumbo lutea*, known as the American lotus, and *Nelumbo nucifera*, known as the Asian, giant or sacred lotus. The American *lutea* is the hardiest and grows to over 6 feet in height with large creamy yellow flowers. This is the lotus seen in the wild throughout NC in ponds, marshes and wetlands. The tubers propagate readily, sending out runners and can quickly take over a pond or wetland if uncontrolled. The Asian lotus may grow to over 8 feet in height. Slocum crossed *N. lutea* and *N. nucifera* to make new hybrids in rich colors, fragrances and many sizes, and some with flowers

that change colors over the bloom period. Most of the hybridization has been done with the Asian lotuses due to their attractive foliage. There are over 600 varieties recorded in China.

The lotus leaves extend high above the water on a thin stalk. Leaves are green and round. Flowers are now available which are single, semi-double or double petaled. The most common varieties available in local nurseries are 'Chowan Basu' and 'Momo Batan', which are both semi-dwarf varieties, growing to heights of 2-4 feet. Miniatures such as 'Chongshuihua' can be found which only grow to 4-10 inches high and are for table-top ponds and bowls. True dwarfs reach only 10-12 inches high.

Lotus are most readily propagated by tubers in March. To propagate, the tuber must have at least one viable green shoot. If the fragile shoot is broken, the tuber will die. The tuber should be delicately placed in a pot prepared with a layer of gravel at the bottom, then at least 6 inches of Carolina red clay. The tuber should be placed at the surface with only enough clay to cover the tuber, leaving the tender shoot above the soil surface. If desired, a layer of sand can be placed over the



clay. The pot should only be placed such that the top of the pot is 2 inches below the water line. The green shoot will readily put out leaves, the first resting on the surface, then the second set rising above the surface. As the lotus continues to grow, the pot can be moved to deeper and deeper water. 'Chowan Basu' and 'Momo Batan' varieties may be placed as deep as 3-4 feet in a pond or water garden when it has reached maturity.

Lotuses are ideal for our North Carolina climate. Al-

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though they are hardy plants and can readily tolerate cold temperatures, they thrive on warm soil and water, heat and humidity. They will remain dormant until 60 degrees and grow profusely as temperatures rise.



Lotus will do best in full sun, but will still grow and flower if receiving only morning sun. New varieties, such as 'Angel Wings' and 'Perry's Super Star', are now available which will grow and flower in partial shade. A blue variety 'Indigo' should be readily available this summer in our area.

Lotus will flower continually if kept well fed by fertilizing monthly with aquatic plant tablets. Some growers will actually use a few tablespoons of 10/10/10 fertilizer wrapped in a wad of newspaper as a makeshift slow release plant tablet. This approach should not be taken if the lotus is in a koi pond or with a lotus in a small pot.

Lotuses are generally free of pest problems. Aphids are the only commonly found insect pests and are readily removed and controlled by hosing down the plants. As the mature leaves are high above the water, they are generally inaccessible to hungry mischievous koi. Squirrels seem to find the leaves tasty as they hang off our deck railing to reach the tubs of lotus and have defoliated the lotus that are within reach of the railing.

We are fortunate to have two breeders and experts in our area:

- Frank LeBron - Stony Hill Farms:, 7301 Stony Hill Road, Wake Forest, NC
- Frank L. Schwartz -Water & Garden Creations;:, 4618 Jackson-King Rd. Raleigh, NC (Johnston county line)

An excellent reference book by Perry Slocum, "Waterlilies and Lotuses: Species, Cultivars, and New Hybrids" can be found in our local libraries.

If you have a koi pond, water garden or even just a bowl, tub, or bucket, you can experience the sacred wonderment of growing lotuses.

North Carolina Koi & Watergarden Society



July 12 Meeting and Fish Sale
Sale from 2-5pm, Meeting 5pm-till
Lakeview Daylily Farm, Garner, NC
see www.nckws.com for details

Trickle Tower Theory, and more... by: Dan Phillips, KHA

For the purpose of this article, I am going to group Protein Skimmers (PS), Foam Fractionators (FF) and Trickle Towers (TT) all in the same classification of filtration equipment, although there are some differences. While a TT primarily aids in degassing and bio-filtration, the PS & FF (and TTs) can all be used to remove dissolved organic carbon compounds (DOCs) as long as you have a way for the foam produced to be removed. Lower DOCs means less nitrogenous waste = lower nitrates. More on that later...

Even with the most effective settlement and entrapment system, many organic wastes, particularly fish feces, will start to decompose, producing various DOCs. TT, PS & FFs are to be located as last stage of filtration before returning to pond. One reason being because this is where nitrate levels are at their highest and mechanical particulates their lowest – the most efficient conditions in which these filter components operate.

A PS or FF is a device used mostly in saltwater aquaria to remove organic compounds from the water before they break down into nitrogenous waste. Protein skimming is the only form of filtration that physically removes organic compounds before they begin to decompose, lightening the load on the biological filter and improving the water's redox potential.

Skimming removes certain organic compounds, including proteins and amino acids, by using the polarity of the protein itself. Due to their intrinsic charge, water-borne proteins are either repelled or attracted by the air/water interface and these molecules can be described as hydrophobic (such as fats or oils) or hydrophilic (such as salt, sugar, ammonia, most amino acids, and most inorganic compounds). However, some larger organic molecules can have both hydrophobic and hydrophilic portions. These molecules are called amphipathic or amphiphilic.

Commercial protein skimmers work by generating a large air/water interface, specifically by injecting large numbers of bubbles into the water column. In general, the smaller the bubbles the more effective the protein skimming is because the surface area of small bubbles occupying the same volume is much greater than the

same volume of larger bubbles[1]. Large numbers of small bubbles present an enormous air/water interface for the organic molecules which are hydrophobic and those which are amphipathic to collect on the bubble surface (the air/water interface).

The diffusion of organic molecules is hastened by water movement, which effectively brings more organic molecules to the air/water interface and allows the organic molecules to accumulate on the surface of the air bubbles. This process will continue until the interface is saturated, unless the bubble is removed from the water or it bursts, in which case the accumulated molecules are released back into the water column. However, it is important to note that further exposure of a saturated air bubble to organic molecules may continue to result in changes as compounds that bind more strongly may replace those molecules with a weaker binding that have already accumulated on the interface.

Although some aquarists believe that increasing the contact time (or dwell time as it is sometimes called) is always good, it is incorrect to claim that it is always better to increase the contact time between bubbles and the aquarium water[2]. As the bubbles increase near the top of the protein skimmer water column, they become more dense and the water begins to drain and create the foam that will carry the organic molecules to the skimmate collection cup or to a separate skimmate waste collector and the organic molecules, and any inorganic molecules that may have become bound to the organic molecules, will be exported from the water system.

In addition to the proteins removed by skimming, there are a number of other organic and inorganic molecules that are typically removed. These include a variety of fats, fatty acids, carbohydrates, metals such as copper and trace elements such as iodine. Particulates and other detritus is also removed, along with phytoplankton and bacteria. There is at least one published study that provides a detailed list of the export products found in protein skimmer skimmate[3].

All skimmers have key features in common: water flows through a chamber and is brought into contact with a



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column of fine bubbles. The bubbles collect proteins and other substances and carry them to the top of the device where the foam, but not the water, collects in a cup. Here the foam condenses to a liquid, which can then be easily removed from the system. The material that collects in the cup can range from pale greenish-yellow, watery liquid to a thick black tar.

Consider this summary of optimal protein skimmer design by Randy Holmes-Farley[4]:

For a skimmer to function maximally, the following things must take place:

1. A large amount of air/water interface must be generated.
2. Organic molecules must be allowed to collect at the air/water interface.
3. The bubbles forming this air/water interface must come together to form a foam.
4. The water in the foam must partially drain without the bubbles popping prematurely.
5. The drained foam must be separated from the bulk water and discarded.

Protein skimmers can be classed in two ways depending on whether they operate by co-current flow or counter-current flow. In a co-current flow system, air is introduced at the bottom of the chamber and is in contact with the water as it rises upwards towards the collection chamber. In a counter-current system, air is forced into the system under pressure and moves against the flow of the water for a while before it rises up towards the collection cup. Because the air bubbles may be in contact with the water for a longer period in a counter-current flow system, protein skimmers of this type are considered by some to be more effective at removing organic wastes.[5]

As for TTs, one definition is they are “trickling bio-filters”, which are non-submerged bio-filters with huge amounts of surface O₂ on the bio-media as opposed to submerged bio-filters, and water “trickles” down over the media. Another term which I am going to group in with PS, FF and TTs is that of a Degassing Columns (DC). The function of a DC is to:

- Strip nitrogen, carbon dioxide, hydrogen sulfide, and other super-saturated gases from water,

- Increase dissolved oxygen in sub-saturated water,
- Oxidize ammonia (“Trickling Bio-filter”).

Most DCs are equipped with fan-type blowers that move air upward through the down-flowing water (sound familiar?). This “counter flow” design greatly increases gas transfer rates. Although Degassing Columns can also be used for ammonia removal (Trickling Bio-filters), hydraulic loading rates (gpm/sq.ft.) are an order of magnitude lower than for CO₂ degassing. The best place for degassing is after the bio-filter, where the CO₂ concentration is highest.

Here are but a few recommended types of media well suited for gas removal and fouling resistance in all four types of filtration components discussed in this article - PS, FF, TT and DCs:

Bio House - Bacteria House, www.enkoi.com



2” or 3” Bio Barrels www.aquaticeco.com



For reduction of remaining nitrates, the most common methods used are water changes and the use of plants.

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Although seldom used in koi ponds, but worth mentioning, a third method is thru anaerobic denitrification.

Water changes and plants: These two methods are the most common way in which koi hobbyists lower the level of nitrates in their ponds. The details of these two methods have been written about in many places and publications. I would like to focus on the less common method, anaerobic denitrification.

From author Stephen Spotte:

Denitrification - under anaerobic or anoxic (meaning without oxygen) conditions, several bacteria species can use nitrate in respiration instead of oxygen. Among these, bacteria from the Pseudomonas (this is one bacteria revered by koi keepers) group are predominant (Rheinheimer, 1980). In the process elementary nitrogen, N₂, is formed, which will escape as a gas. i.e. degassing under anaerobic conditions. Water should be aerated after denitrification filter unit before going back into a koi pond. Since the energy gain from nitrate-induced respiration is about 10% less than that of oxygen-induced respiration, the latter will have preference if oxygen is present (Mudrack and Kunst, 1986).

There is such an anaerobic filter in operation at the NCSU Fish Barn. They first ran water which came out of this filter thru an ozone system and then heavy aeration before returning into the fish pond. I have never seen a purpose built anaerobic bio-filter as part of a hobbyist koi pond filtration system, perhaps due to cost, complexity or the desire to keep Pseudomonas as far away as possible.

In summation – Using one of the filtration components discussed in this article will result in lower DOCs, which means less nitrogenous waste = lower nitrates = healthier environment for koi.

References:

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3. Shimak, Ronald L, Ph. D., "Down the Drain, Exports From Reef Aquaria, Reefkeeping, Dec. 2002, <http://www.reefkeeping.com/issues/2002-12/rs/feature/index.php>
4. Holmes-Farley, Randy, What is Skimming?, Reefkeeping, August 2006, <http://www.reefkeeping.com/issues/2006-08/rhf/index.php>
5. Escobal 2000

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Bug Bites by: John Devlin, KHA.

Bug Bites is a series of short educational articles on the common parasitic infections associated with Koi. Each quarterly NCKWS newsletter will feature an article on a different parasite, its impact on Koi, how to determine if the parasite is prevalent as well as commonly accepted treatment techniques. Please note - the author is not a veterinarian and makes no recommendations or claims on treatment or the success of any treatment. These articles are for educational purposes only and should not replace the advice of a licensed veterinarian.

Trichodina:



Trichodina are circular shaped parasites that are normally associated with an excess organic load in a pond, ex. mulm at the bottom or stagnant water volume. They are commonly found on the skin and/or gills of Koi and may cause the fish to flash repeatedly. Flashing to Koi is almost like itching to humans. Koi, who exhibit

flashing, will generally rub against pond surfaces and sometimes even leap above the water surface – all in an attempt to scratch. Although it is generally accepted that Trichodina do not directly cause ulcers in Koi, repeated flashing by the fish may break the surface of the skin and thus allow bacteria to enter – which in turn may result in a bacterial infection and ulcer.

As mentioned, Trichodina are small parasites (<0.1mm in diameter) in the shape of a disk. They have arrays of small cilia that they use to propel themselves as well interlocking teeth called Denticles in the form of a ring on the underside of the parasite – it is proposed that these cilia, or the denticles (or maybe both) are what 'itch' the fish and cause flashing. Using a microscope at 100x Trichodina are easily detected from a skin scrape or gill snip. They appear as flying saucers in the image field and sometime can move quite rapidly under magnification.

Generally accepted treatment techniques for Trichodina include salt, Potassium Permanganate and Formalin.

Trichodona reproduce by division, and although they live on the Koi, they can swim freely – thus treatment of the entire pond system is appropriate. Recommendations for treating by salt are to add approximately 0.3% NaCl (maximum 0.6%) to the pond by dissolving the salt in a bucket of pond water first and then adding back into the pond. (Note – correct volumetric measurement of the pond is an absolute necessity for this and any other pond treatment.) If flashing does not subside after 2 days, and microscopic analysis of skin scrapes/gill snipes still indicates the presence of Trichodina – an alternate treatment is recommended.

Remember any diagnosis or treatment should be under the direction of a licensed state veterinarian.

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2008 Koi Sale

by: John Devlin, KHA

Thanks to the help of all the volunteers (too many to name individually) the 2008 NCKWS Koi sale was a tremendous success. We netted well over \$2,000 (a club record)!

This year's Koi Sale was held at Garden Supply Company, in Cary, NC on Saturday the 19th of April. Planning had started months earlier and when the day finally arrived, we had big expectations. Intent was to sell as many Koi as possible, but we also wanted to fulfill our community charter of educating the public and providing a local resource for good koi husbandry advice. There were over 100 Koi and goldfish for sale, of all sizes and colors. We also had a generous information table, with plenty of hard goods for sale as well.



The location and the weather turned out to be perfect. The sun and warmth brought people out

to look for plants and fish, while the location Garden Supply was a great venue (thanks Keith) with plenty of foot traffic – all this combined to make quite a 'buzz' around the 4 tanks we had set up.

Along with selling quality nurtured koi and goldfish, we also had three educational talks available to the public...

- Koi Pond Building – Hal Brown & Bryan Connelly
- Water Quality – John Devlin, NCKWS KHA
- Water Gardening – Marilyn A. Grolitzer, Ph. D, Wake County Master Gardener Volunteer

...as well as a vet on site, Dr. Dan Johnson, Avian & Exotic to answer fish health related questions and provide advice.

Finally when the day was over, a tired but dedicated bunch of volunteers remained to help tear down and clean off the equipment. Again, thanks to all those that helped with this year's sale – it was a big success.

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DIY: Foam Fractionator/Trickle Tower

by: Bryan Connelly

This is a combination of a trickle tower and a protein skimmer. It has the best of both worlds. It removes DOC's (dissolved organic compounds) thru the creation and removal of foam. Secondly, it has the function of off-gassing as the water crashes over the bio barrels.

The best way to think about the concept of this filter is as an upside down protein skimmer filled with bio-barrels

Water is pumped into the top of the TT/FF, the water then crashes down thru the bio barrels which breaks up the water. As the water is broken up it is super saturated with oxygen, as well it is off-gassing harmful gases. When the water reaches the bottom of the column it forms foam. Many times you'll see yellow foam building up at the bottom of a waterfall out in nature. This is the same principle. That yellow foam is actually dissolved organic compounds. Organics removed via the TT/FF are waste products removed before they break down to ammonia and nitrites. This means less work for the biological filters.



This particular TT/FF is a 7' tall unit. The unit is capable of about 1,200 – 2,000 gallons/hour, and contains about 2 cu. ft. of bio barrels.



What makes this design so nice is its ability to capture the foam before the water returns back to the pond. Due to the large diameter of the tee (which is the collection chamber), water passes thru it at a slow rate which gives the bubbles the chance to rise to the top of the chamber before they have a chance to pass thru the outlet. What allows this is the level placement of the collection chamber in reference to the water level of the pond. As shown by the diagram the water level needs to be higher than the lateral run of the tee, but lower than the top of the vertical outlet of the tee. This is where the foam collects, and is forced out of the unit.

This unit is built by connecting one 6" elbow to the main column. A 6" tee is connected to the 6" elbow. The other two ends each have two reducers which downsize

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the outlets to 2". The top of the tee with the reducer is for the foam collection.



Here is a picture of the main body, which consists of a 6" elbow, 6" tee, and 2, 6"-4" & 2, 4"-2" reducers. I used a 6" irrigation grate to hold the bio barrels in the tower of the filter. In the top of the tower I drilled a 1" hole to put a short piece of 1" PVC pipe thru, and attached a 90 degree elbow on each side. The elbow on the inside of the 6" pipe would serve as the inlet (sprayer) of the filter. Due the high water flow, I found it to be more effective (less restrictive) to use the elbow with out a sprayer or end cap with holes for the discharge. Therefore, I left it open.



The production of foam greatly varies with the amount of DOC's (dissolved organic compounds) in a pond. The "dirtier" the pond, the more foam that will be produced. Here is what happened to a 5 gallon bucket after 8 hours of operation in the spring on my pond. You can't even see the bucket!!!



My TT/FF will fill the bucket about half way each day now. I imagine that the production will be even less as we get into the fall. Based on my observations, the benefit of this filter is seen the most during spring start up every year. Even when the pond is in the height of its filtration effectiveness, this TT/FF will still be beneficial in off-gassing, even if the production of foam is minimal. It would be best to bypass this filter during the winter, as it would act as a super chiller. I feel that since the winter carries the least load of bio. This filter's attributes shine right when a pond system is most in need of an extra kick!

I feel that a TT/FF offers unique attributes to a pond's total filtration system. Although this type of filter is not by all means a stand alone filter, it can definitely bring additional benefits to a koi pond system. The filter will show it greatest potential in the spring, and still give an impact thru out the summer and fall.

Mud Pond Update

by: Rich Eitel

It's a good thing we dug the mud pond deeper this year since we introduced 61 koi to the pond. We released the koi in mid-April and the plan is to seine the pond in late September just in time for our koi show!. Those member that wish to return their female koi to the mud pond for a 2 year period can do so after the appropriate quarantine time.

Over half the Koi were purchased by club members. The remaining Koi will be available for sale, at a higher

price, when we seine in the fall.

This year we are using sinking food in the automatic feeder. We also purchased an air pump to run the air stones in order to provide adequate aeration to the pond.

I would like to once again thank Noel and Molly Weston for the use of the mud pond and to everyone who's worked on the pond.



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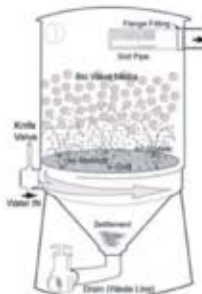
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Picking Grow-out Fish at Brady's by: Robert Mungo



The weather on this Saturday morning was lousy (cold, windy, overcast) but the fishing was exciting. There were ponds, tanks, and tubs everywhere. Each was filled with koi of all sizes and all colors (prices also). There seemed to be people everywhere; going from one group of koi to the next. Brady was trying to accommodate everyone although not at the same time. Some wanted to see small fry while others wanted to see a tub full of Kohaku tosia and still others wanted to see the two year olds. It was fun watching people make their selections and it was fun when Chris finally made his.

He goes over to this other tank and opens up a floating basket and said; I want this fish. It was a big 14" something. I didn't know what it was. Brady came by and said it was a Kin Ki Utsuri. It didn't turn me on but, he liked it and that's one of the wonderful things about this hobby. There are many different varieties and nobody gets to tell you what you like. Buy what you like and buy the best quality your budget will allow.

After we got home Chris and his mother begin having second thoughts about putting his fish in the mud pond. They wanted the fish here in our koi pond. I began to think that maybe putting his fish in the mud pond was not the best strategy. It was a male that was already 14". Generally you want to grow your male fish out slowly because they compete best under 20". They have better color at this size than the females and the confirmation doesn't play a big role. When they are greater than 20" the females have the advantage because they begin to bulk up and have great confirmation. The males will never have the great bodies.

My selection (7.25 inch Kohaku) will go into the mud pond. Along with a pick I hope to make when the other fish come in. I need a sanke real bad. I hope to grow them out and have them compete at our show. It's going to be exciting to see how they come out and how they do at the show. It's a wonderful opportunity to have a grow-out in a mud pond. It's a little different than most grow-out contest but there will be some wonderful fish coming out of the mud pond. The fish develop in a mud pond in a way that can't be duplicated in our closed end ponds. There is no price or size restrictions on the koi you can select so everyone can participate. I urge you to take advantage of this rare opportunity.



I made a bet with Chris; we would both pick out a koi and see which one did the best at the Raleigh Show. The loser would pay for both fish. I told Phillip about our bet and later I saw him telling Chris which fish to pick (ha ha). We picked out two tosia Kohaku. Later I noticed Chris was just not happy. I asked him about it and he said the Kohaku were boring. Just a bunch of red and white all over again. So I told him to forget our bet and pick out what he wanted as long as he was paying.



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KHA Corner continued...

OK. So there may be some clues that something's wrong, but how do I know if I'm doing it right?

The amount of the various nutrients provided in food that our fish require to grow and maintain good health will depend on numerous variables. Two of the key variables are the size and age of the fish and the water temperature. We can use a combination of these variables to make some calculations that will give us some guidance as to how much food we should feed our pond every day.

You may notice two things in the last sentence: firstly that we are looking for guidance here. There are no hard and fast rules and your careful observation is extremely important! I often measure out food based on the formulae below but either stop feeding because the fish seem less interested than normal (was a predator nearby? Are they more interested in spawning?) or feed a little extra because they devour the first course! Secondly you may notice that I specifically mentioned feeding the pond rather than the fish. This comes back to the importance of remembering that any food that you introduce to the pond that is either uneaten or eaten but not digested by your fish will become a food source for other organisms or will basically "rot" and negatively impact your water quality.

So the first thing we need to know is the quantity of fish biomass that we need to feed. This is not simply a case of counting your fish! There is an enormous difference in weight between an eight inch fish and a twenty eight inch fish. To complicate matters, the relationship between fish length and weight is not linear. A fish which is twice as long as another will be significantly more than twice as heavy. Luckily others have done the work necessary to study the relationship between koi length and weight and have published tables and charts to help us out. One of the more interesting charts I have seen is featured in Jasper Kuijper's Koi Nations article but unfortunately, at the time of writing this article, I have not received permission to reproduce it – If I get permission I will reproduce it in a future article. This graph plots weight vs. length for 120 koi over time and features over 1,000 data points. This data

set is especially interesting as it shows the variability in weight for koi of the same length – not all twenty inch koi weigh the same!

The chart below provides basically the same information, but doesn't show the variability (reproduced from www.evolutionaqua.com).

For those of you that prefer inches and ounces, Ray Jordan provides the following table:

Fish Length (inches) Approximate Weight (lbs)

6 – 7	0.15
8 – 9	0.23
10 – 11	0.5
12 – 13	0.8
14 – 15	1.3
16 - 17	2.0
18 – 19	3.0
20 – 21	4.2
22	5.3
23	6.6
24	7.9
25	9.4
26	11.5
27	13.8
28	15.3
29	18.8
30	21.6

Again, it is important to remember that these are estimates and for guidance only. If you have a particularly skinny or fat koi you will need to make allowances.

First use the chart or table to calculate the approximate total weight of fish in your pond, then use the information below to calculate what percentage of the fishes total body weight you should be feeding each day. Notice, of course, that the percentage will depend on the temperature of your water.

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Ray Jordan recommends:

- Below 50 °F: Do not feed
- 50 – 60 °F: Slowly build to 1% of total fish weight
- 60 – 70 °F: 1% to 2% of total fish weight
- 70 – 80 °F: 3% to 3.5% of total fish weight
- 80 – 90 °F: 2% to 1% of total fish weight
- Over 90 °F: <1% of total fish weight

Jasper Kuijper recommends:

- 5 – 12 °C (~40 – 54 °F): 0.25% of total fish weight
- 13 – 15 °C (~56 – 60 °F): 0.5% of total fish weight
- 16 – 20 °C (~62 – 70 °F): 1.0% of total fish weight
- 21 – 25 °C (~72 – 80 °F): 1 – 1.5% of total fish weight

We can see, of course, that our experts differ somewhat! I don't believe that there is reason to be concerned as this is all "for guidance" purposes. With a pond full of relatively young fish and looking for good growth, I have followed Ray Jordan's guidelines without incident for the past two years. I suspect, however, that if you have mature fish and want to emphasize the elimination of waste and maintenance of water quality, Jasper Kuijper's guidelines are good. Again – make your own observations and amend accordingly. Conventional wisdom certainly agrees with Ray's assertion that you shouldn't feed at temperatures under 50 °F. It is also generally accepted that you should start feeding less once water temperatures rise above ~80 °F. There are also those who believe that the amount of food being fed and associated growth rates vary based on whether the temperature is rising or falling, but that is outside the scope of this article.

In practice I feed by volume and not by weight. It is easy to weigh out your required daily amount and convert it into a suitable volumetric measurement system for use on a daily basis. I use inexpensive plastic kitchen measuring cups and feed a number of cups per day which is equivalent to the required weight of food. One advantage of this is that it's easy to instruct someone looking after your fish while you are away to feed exactly a certain number of cups and no more! (more on vacation feeding later).

Remember that you can make allowances for high vs. low protein foods and so on when calculating the

amount to feed. Also, if you feed different types/brands of food during the season remember that they may have different density and pellet size, so a cup of one type of pellet may weigh more than a cup of another type.

So now that we have an idea of what quantity we need to feed, how often should we feed and at what time of day? There is a lot of debate over this topic, but one thing that is agreed is that you shouldn't just dump the whole quantity into the pond as a single large feeding. Koi don't have stomachs and can only digest food and absorb the required nutrients as it passes through the gut. Too much food at one time and the digestive system can't keep up, resulting in the food being passed only partially digested back into the pond. We all seem to have busy lives but I would recommend that at a minimum the required quantity of food should be split into two feedings – perhaps before and after work? Conventional wisdom has been that if you can spread the food over even more small feedings during the course of a day you will get better digestion and conversion of food into growth. I am fortunate that when I'm not traveling on business I work from home and am able to feed five or six small "meals" a day. An added benefit of multiple feedings, of course, is that you get to spend more time observing your fish and enjoying the pond. Many koi keepers with busy schedules employ automatic feeders to spread small feedings over the course of a day. A wide range of models are available and may be powered by mains electricity, battery, clockwork or even solar power. Of course there is also a wide range of quality and the old adage about getting what you pay for tends to hold true. More experienced hobbyists tend not to overfill their automatic feeders and to refill regularly to keep the food fresh and to minimize problems if there's a malfunction and the entire content is dropped into the pond at once – this has been known to happen! Better quality feeders also tend to be more immune to raids by raccoons etc.

Interestingly, the conventional wisdom re: multiple smaller feedings has been challenged by Jasper Kuijper in his Koi Nations article. Experiments have been performed to examine the "digestibility" of protein, fats and starch at different water temperatures and feeding frequencies of 2x, 4x and 7x per day. Somewhat surprisingly the digestibility of all three was most efficient at 2x feedings per day and dropped as the frequency

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increased. The effect was most pronounced for proteins and was enhanced in higher fat foods. As would be expected, digestibility was reduced in colder water.

What about feeding at night? The Japanese National Research Institute for Aquaculture has data that demonstrates that food may be marginally better digested at night time, but the results aren't significant enough to actually recommend feeding at night. I enjoy watching my koi feed at night under the lights but would observe that they are "less enthusiastic" than when fed during daylight hours.

Finally – what do you do if you go on vacation? My first recommendation would be to get a club member who understands not to feed too much to feed the fish for you and keep an eye on things to make sure everything is functioning properly. Even then, I would cut down the quantity and frequency somewhat. Having some-

one come in every few days will be fine. I'm not a big fan of asking the neighbors to feed my fish. Almost invariably they will be tempted to feed too much (even if you measure the food for them!). If I'm not going to be away for more than a week or two, I would rather not feed at all than risk over feeding and a water quality nightmare. As a bonus - by not feeding for a week or two you will probably find out that your water has never looked better when you return from your trip!

Everyone's situation will be a little different and keen observation is extremely important in this and all other aspects of koi keeping. Hopefully though, these guidelines will have provided some food-for-thought and may help generate some confidence that you are feeding appropriately!

Thanks to Jasper Kuijper and Ray Jordan.

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NCKWS...Who We Are

NCKWS (North Carolina Koi & Watergardening Society) is an AKCA affiliated (www.akca.org) Koi & Watergardening club formed in 2001 to:

- Create, promote and enlarge the hobby of keeping, breeding, appreciating and exhibitingNishikigoi.... as well as water gardening
- To disseminate information about the hobby to the membership of this association and to the public
- To engage in educational social activities related to the hobby and to acquire and own such property as may be necessary for any or all of the foregoing purposes

NCKWS has 80 + members and growing stronger every month. We strive to meet our members needs in being successful in this great hobby. Monthly meetings provide us the opportunity to share with others our enjoyment of this hobby, to experience each others ponds & koi, to educate one another about all aspects of the hobby (pond building, koi health, water plants, filtration, etc...), to promote the experience of attending/participating in koi shows and as always great food!

So give us a chance to serve you in this great hobby. Check out our website (www.nckws.com) for details of monthly meetings, club activities & contact information. We look forward to hearing from you.

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North Carolina Koi & Watergarden Society (NCKWS) is a non-profit organization and an Associated Koi Clubs of America (AKCA) Affiliate Club. NCKWS membership dues are currently \$49 for the first year and \$24 for annual renewal per family. The initial \$49 dues include a name badge for each member. NCKWS corporate membership dues are currently \$49 per year. Corporate membership includes the addition of a link to the company website from the club website for that membership year. If you are interested in joining NCKWS, please complete the following form and mail, with your dues, to our Secretary or visit our website at www.nckws.com. All information will remain confidential – available only to club members.

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