



The Raleigh Aquarium Society

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April 3rd, 2008

Next Meeting: Thursday @7:30pm May 1, 2008.

Meetings are held on the first Thursday of each month at the [North Carolina State University College of Veterinary Medicine](#) located at [4700 Hillsborough Street in Raleigh](#). Visitors are welcome! Snacks and light refreshments are provided. A raffle of fish and fish related items follow the meeting. Due to Security Issues, NCSU has required that the doors going into the downstairs lobby remain locked. Please be on time, as we will have a designated person standing by the door to let you in. If you are late, you may try knocking or call Linda Twaddle at 919-880-3782 or John Patterson at 919-264-4011.

Meeting Agenda

Live Foods

From Amphipods to Zooplankton, live foods help to keep your fish happier, healthier and more productive. This month's program will show you how to grow your own, whether it's small or large. Daphnia is in constant demand among our members so if you want to try this food, you may want to get a bucket of dechlorinated water set out now. If you're lucky enough to go home with a starter culture, you'll be prepared. Also, if YOU have Daphnia to share, try to bring many small samples rather than a few large ones. I've had considerable interest in this particular food.

Monthly Feature

ARTICLE INFORMATION:

Author: Grant Gussie

Title: Fish Food, for Dummies

Summary: A comprehensive discussion of fish foods: flake foods (with recommended brands), freeze-dried foods, feeding (How much? Bottom feeders?), home made foods (beef heart/whole fish), vegetable diets (plecos, mbunas), commercial frozen foods, purchased live foods (feeders/tubifex/black worms), cultured live foods (compost worms/white worms/wingless fruit flies/brine shrimp/microworms/infusoria), collected live foods (mosquito larvae/fairy shrimps/daphnia/fresh-water shrimps. Hydra).

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Fish Food, For Dummies

by Grant Gussie, CAS

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Auarticles*

Fish need food. Otherwise they starve. Simple enough. But like you and me, fish also require that a necessary list of nutrients be in their food or they will slowly grow ill, and then will die. So how do you give your fish adequate nutrition?

Well, thankfully, it is not hard. We have so many very high quality flake foods and freeze-dried foods that fish can be adequately nourished with very little fuss and bother. You may read articles where it is stated categorically that flake foods do not make an adequate diet for any fish, but this assertion has long been disproved by the hordes of aquarists that feed flake foods exclusively, and still maintain colorful, breeding, vibrant fishes. So why not end this article here? Well, it's not that simple. Just because most aquarium fish will thrive on a good flake food, that doesn't mean they all will and it certainly doesn't mean that all flake foods are good. And of course, flake food is boring. Boring for you to feed, and probably boring for the fish to eat. Boring. This is a hobby right? It's supposed to be fun, right? Well why not get some fun out of meal times then? So I'll

talk about live and homemade foods too.

FLAKE FOODS

But first of all, the flake foods. Aquarian®, Tetra®, and Wardley® are all recommended brands. There are some other brands that are pretty good but these three are the most widely available. As a general rule of thumb, if a flake food is for sale in a reputable pet store, it will be pretty good. If you buy it at Walmart® however, you are taking your chances. Department store flake foods tend to have a small list of inexpensive ingredients and a lot of white wheat flour filler. One particularly bad brand that you should avoid has a red label and a name that starts with H and is a homonym for your primary circularity organ (hopefully that's sufficiently obscure that they won't sue us for defamation).

Wardley is the least expensive of the recommended brands and is also available in bulk, but the Wardley brand name lacks the range of "specialty flakes" that Aquarian and Tetra offer. As far as these specialty flakes go, the only one I have any use for are the "green" flakes that are high in vegetable matter. Most of these vegetable flakes contain *Spirulina*, which is a photosynthetic cyanobacterium (so *Spirulina* is not an alga as is generally assumed). *Spirulina* is quite high in protein and a great source of many amino acids that are otherwise difficult to acquire. Health food stores are full of the stuff. *Spirulina* flakes are just what you need for mollies and a host of other vegetarian fishes. Aquarian and Tetra also offer *Spirulina* enriched wafers that sink, which are very good for algae-eating bottom feeders like plecos.

The various other flake foods, like "carnivore flakes", "color flakes", etc. are in my humble opinion more useful as marketing strategies than as dietary supplements. Feel free to purchase a variety of flakes, but all good flake foods are heterogeneous mixtures of ingredients and supply complete nutrition on their own.

FREEZE-DRIED FOODS

Aquarium stores also sell freeze-dried foods. These differ from flake foods in that they usually have only a single animal-ingredient each (e.g. mosquito larvae, blood worms, tubifex worms etc.) and they are usually in the form of chunks or as individual organisms, rather than flakes. These foods are not in themselves complete diets, but they can be part a well-rounded diet consisting of a good basic flake food, a *Spirulina*-enriched flake food, and several types of freeze-dried foods.

Almost all of the organisms that are freeze-dried and sold for aquarium use can be found as either living or frozen foods as will be discussed below, but in the freeze-dried form they provide a convenience of storing and feeding that frozen or living foods can not match. Feel free to purchase freeze-dried foods if you are unwilling to devote freezer space to frozen foods or to go through the significant bother of dealing with live foods.

FEEDING

The next thing to know about dried foods is how much to feed. Unless you want your fish to spawn or are raising their babies, don't feed much at all. Fish are cold blooded, and therefore do not require food energy to maintain their body temperatures. They also are neutrally buoyant and

so they don't require any energy to stand up. As a result, fish can get by on remarkably little food.

The rule of thumb to feed all the fish can eat in five minutes twice a day is a good one, provided that all of the fish are actually getting some of the food. This isn't a problem with schooling fish, but a territorial fish like a cichlid can monopolize a food supply. Most aquarists therefore end up feeding a cichlid aquarium more than the recommended amount, and so they must deal with the high nitrate levels, algae growth, and unwanted breeding that comes with overfed fish. This is just part of the deal when you raise cichlids. But schooling fish can be fed quite sparingly because they will feed as a school rather than competitively. The concentration of their wastes can therefore be kept to a minimum, thus giving you a healthy, easily maintained, and more enjoyable tank.

Then there are the bottom feeders, like loaches and catfishes. What about them? If you feed according to the recommended five-minute rule, your bottom feeders won't get much to eat. Starvation is consequently one major cause of failure with catfishes, and over feeding in attempt to "make sure the catfish gets some" is another. In practice, however, things are not that bad and catfish can generally find enough to eat (remember fish need very little food). If you have a lot of catfish however, you should take advantage of the fact that most bottom dwellers are nocturnal and supply some sinking wafers when the lights go out. Make sure that this food is gone by morning. By feeding extra at night you are however walking a fine line between adequately feeding your fish and over feeding your fish. So be careful.

HOME MADE FOODS

As I mentioned before, you may eventually get bored of feeding your fish just flakes. Or the financial realities of purchasing flake foods (yes, you do pay for their convenience) may make you look for less expensive alternatives.

A less expensive alternative to flake food is homemade food. If you like to cook, this can also be fun, although to be honest I tend to think of making your own fish food as a bit of a smelly chore. Thankfully, it is easy to make and freeze enough to last you a good six months or more so you don't need to put yourself through it very often.

Before you start, get yourself a food processor. Then you can make any one of the various recipes that are kicking around. Most of these recipes have several things in common; namely they are bound together by unflavored gelatin and contain whole fish, vegetable matter, and beef heart. This is my recipe. I food-process several multivitamin tablets (with vitamin C) to dust, then process about ½ kilo of the red meat portion of a beef heart (cut away from all the fat and connective tissue). Then goes in a good handful of spinach leaves (no stems), one young whole zucchini, and a few raw carrots. Then the bulk of the food is added, which is whole fish. The fish I originally used were those minnows sold as bait, but I have since discovered Shun Fat, an Oriental supermarket in Forest Lawn (at 3215 17th Ave, SE). Here you can get a wide assortment of frozen sea foods. Nowadays I buy a kilo of frozen capelin since they are full of nutritious roe. I also get a frozen ½ kilo bag of something called "shrimp fry". I am not sure exactly what this is (some form of krill I think) but it's a lot cheaper than buying real shrimp, which I would have to do if this wonderful stuff weren't available. I also add ½ kilo of mosquito larvae and *Daphnia* that I had collected myself and froze previously (see below for a discussion on live food collecting). All the ingredients are processed to a thick paste. Then a liter of water is added and the mixture is brought to a low boil to congeal the blood. I then dissolve three large boxes (36 packets) of Knox

unflavored gelatin in a liter of cool water. I mix this liquid into the food (after it's cooled a bit) and let the mixture set overnight in the refrigerator. The next day I split the jelly into two or three-day feeding portions and freeze them separately in sandwich-sized freezer bags. I keep one freezer bag defrosted in the refrigerator at all times. My cichlids and turtles love this stuff. It sinks and doesn't cloud the water (too much).

VEGETABLE DIETS

Many fish either require vegetable diets or can benefit from them. Most notable for requiring vegetables are the plecos (South American algae eating catfishes), silver dollars (vegetarian relatives of the piranha), and mbuna (rock-dwelling cichlids from Lake Malawi, Africa). These fishes have extraordinarily long guts and will develop lower-digestive problems if they do not get enough roughage in their diets. These problems are usually followed by a lethal bacterial infection. Almost all other fish will also benefit from some vegetable matter as greens contain folic acid and the carotenes that are needed for the creation of red and yellow pigments. The vegetables in the gelatin food discussed above are adequate for almost all fish, but plecos and mbuna should really have some additional plant foods as well. Easiest to provide are slices of par-boiled young zucchini (par-boiling makes it sink). Romaine lettuce is also useful. Plecos also eat wood. I'm serious. All plecos should be provided with a nice piece of driftwood for them to slowly rasp away at and hide under.

COMMERCIAL FROZEN FOODS

Nowadays all good aquarium stores have freezers with frozen fish foods. These include various mollusks, fish, crustaceans, and aquatic insects. None of them are inexpensive. Most of them you can make yourself with a food processor and a trip to Shun Fat (see above), but frozen adult brine shrimp (discussed below) and blood worms (midge larvae) are more difficult to come by and could be considered for purchase at the pet store.

Blood worms are named because of their red color (it has nothing to do with blood) and can be collected from local ponds (see below) but never in quantity. They are an excellent food and highly recommended as a dietary supplement for all fishes.

PURCHASED LIVE FOODS

The live foods sold by local pet stores include feeder guppies and goldfish (discussed below), live adult brine shrimp (also discussed below), and black worms (*Lumbriculus variegatus*). Black worms are an annelid worm, related to both the earthworm and the tubifex worm (*Tubifex tubifex*). The tubifex worm is another worm that can be considered along with them since they are essentially identical in their aquarium characteristics. Both worms are aquatic but are found in very high nutrient bottoms. They are most often found in open sewers and therefore have a correspondingly bad reputation as disease carriers. Commercially sold black worms are however byproducts of the trout hatching industry, and so they are unlikely to give you something nasty like cholera. Black worms and tubifex worms were mentioned in the June 1998 issue of *The Calquarium*, where Steve Ward took a rather dim view on their use. I however have a less pessimistic opinion on them. I have in the past fed black worms to my cichlids about once every month or so, and have never seen any bacterial diseases as a result. They are also a very good food for bottom grubbing fish like Corydoras catfish and elephant noses (*Gnathonemus petersi*). In

fact, one is hard pressed to keep elephant noses alive at all without a sand bottom and a steady supply of black worms. Cautions are in order however as black worms are very high in protein and fat, and so they cause problems if fed too often. The worms must be stored in the refrigerator with daily changes of cold water.

CULTURED LIVE FOODS

Many live foods can be raised at home, and the culture of lived foods is a huge topic in its own right. I'll just mention a few foods and try to direct you to more information. A good place to start is in the CAS library, which has a book called the *Encyclopedia of Live Foods*. This book covers almost all the topics discussed below and several more.

Some fish (for example the *Chaca* catfish) are so highly predatory that they specialize in feeding only upon other fish. For these predatory fishes you have little choice but to either raise feeder fish yourself or buy them in bulk. Goldfish (*Carassius auratus*) are the traditional feeder fish to buy. However, goldfish, while inexpensive, are a bony fish with tough scales. Only very large fish can handle them. Most people who raise feeder fish raise guppies (*Poecilia reticulata*) or some other livebearer. These are smaller and softer than goldfish and thus more suitable for a wider range of predators. But guppies aren't very prolific, casting off only about 30 babies per month per female, so it's hard to keep enough guppies on hand. Egg scatters like the *Danio* species would provide many more offspring per female. Or a prolific cichlid like the convict (*Archocentrus nigrofasciatus*) would produce nearly as many babies as danios but (being larger at hatching) they would be a lot easier to raise to an eatable size. Always feed your feeder fish before their final swim so the predator gets extra nutrients from the food in its prey's stomach.

Compost worms (*Eisenia foetida*) are great for larger fishes and can be chopped up for smaller fishes or processed into a jelly food like that of the recipe given above. They will also get rid of your vegetable table scraps. Raise them in a compost bin. Learn more about worms on the Internet at <http://www.cityfarmer.org//wormcomp61.html> or in Dwayne Tiede's July 1998 *Calquarium* article . Compost worms are available locally from The Compost Queen (ph. 282-4765).

White worms (*Enchytraeus albidus*) can be grown along with your compost worms as well. These are smaller than compost worms and so are good for smaller fish. The classic technique to collect white worms is to place a milk-soaked slice of white bread on top of the compost and leave it overnight. The worms will gather under the bread and can be scraped off in the morning. More information on white worms is on the Internet at <http://www.badgerstate.com/JAWS/faqs/white.htm> White worm starter cultures are often auctioned at club meetings or they can be mail-ordered from

West Kootenay Tropical Fish Hatcheries PO Box 109, 705 Griffin Avenue Slocan, BC, V0G 2C0 Canada (250) 355 2592 jamstutz@netidea.com <http://www.netidea.com/tropical/index.htm>

Wingless fruit flies (*Drosophila* sp .) are another good food source for adult fish. They are especially suitable for top feeders like archerfish (*Toxotes jaculatrix*) and African butterfly fish (*Pantodon buchholzi*). Starter cultures can be mail-ordered (e.g. from Ward's Natural Science Establishment, Inc., at 1-800-387-7822, <http://www.wardsci.com/>). Raise fruit flies in mayonnaise jars stopped with a foam rubber plug or covered with a piece of cloth and a rubber band. Dissolve one teaspoon of molasses and a pinch of baker's yeast in five tablespoons of water,

then mix in three tablespoons of instant potato flakes. Put the resulting glop into the jar with ten or so adult flies, cover, and you'll get a few hundred flies within a couple of weeks. Learn more about fruit flies at <http://www.concentric.net/~worstell/FOOD1.HTM> or in the September 1997 issue of *The Calquarium* where you will find an article about them by Doug Forsyth.

Baby brine shrimp (*Artemia* spp.) are the perfect food for almost all baby fish, and small adult fish such as tetras as well. Very small fry (like those of most egg scatterers) can not eat brine shrimp immediately, but larger fry (such as livebearers' and most cichlids') can start out on brine shrimp. Brine shrimp are hatched in salt water from commercially available dry eggs. They are usually hatched in some sort of funnel with an airstone at the point of the funnel. An inverted plastic 2-liter pop bottle with the bottom cut off works well. Learn more about brine shrimp at <http://www.rtop.com/features/bs-faq.shtml> or check out the *Calquarium* articles by Ernie Inglis and Dan Grimby in the April 1993 and April 1994 issues (respectively). Brine shrimp eggs are available at local pet stores.

Microworms (nematodes) are another good food for fry, and can be fed to smaller fry than can brine shrimp. Microworms can be raised in plastic containers on a mixture of corn meal, water, and baker's yeast. Learn more at <http://www.access.avernus.com/~angels/microworms.htm> or in Paul Price's *Calquarium* article of March 1993. Microworms can be collected from their culture containers with a Q-tip as they will cling to the sides. Just dip the Q-tip in the aquarium with the baby fish to feed. Microworms can be acquired at club auctions or from the West Kootenay Tropical Fish Hatcheries.

Very small fry, like those of tetras and bettas, often have a hard time with even microworms. To these fry, "infusoria" is often fed (infusoria is an old word for Protozoa that aquarists still use). In the past raising infusoria was a hit or miss affair because the techniques all relied on the organisms finding their own way into the culture. Nowadays, pure *Paramecium* cultures are available by mail order (e.g. from Ward's Natural Science Establishment, Inc.) and these are much preferred ways to get a culture going. Grow the paramecia in boiled and cooled water to which a few boiled wheat seeds and a pinch of brewer's yeast is added. Small, sterilized plastic containers can be used to grow them, and a coffee filter can be used to filter them out of their culture water. A detailed description of *Paramecium* culture is in *The Calquarium's* June 1996 issue, thanks to Richard Pon, and also at http://www.zfish.uoregon.edu/zf_info/zfbook/chapt3/3.3.html

COLLECTED LIVE FOODS

It is possible to raise other live foods, but don't bother. Go out and find some. It's more fun. In fact, it can be a lot more fun, for now we are entering the realm of the bug hunter. For the bug hunt, you will need a large fine-mesh fish net. Preferably it has a long handle. Bring along a lidded bucket (to fill with pond water) so you can get your bugs home. A lot of people wear hip or chest waders when hunting, but heck, I just wear a pair of shorts and some old sneakers and get wet. So obviously this is a job for a warm day. And be prepared to pick leaches off of yourself afterward.

You also need a good place to hunt. Any of the ponds around Calgary will do, but you would like one that is accessible without crossing private land or having to scale a fence. If you must go on private land, always ask permission. Tell the landowner you are doing a mosquito larva count for

the university or something if you are embarrassed by your own eccentricity.

Local ponds are not supposed to be sprayed with insecticides anymore, but various farm chemicals might still cause problems. Do not choose a pond near a crop field, but instead just stick with cow pastures. And if a pond looks like it should have lots of bugs, but doesn't, assume something is amiss and rather than hunting hard and long for whatever bugs that are there, just go onto another pond. The bugs may not be there because of something in the water that won't do your fish any good either.

You want a pond with plant life in it, but not one that is so heavily overgrown that it is difficult to get to the water. Cattle in the neighborhood are a definite asset, because their droppings fertilize the water and this results in a much more abundant aquatic bug population.

Other subtleties should be considered when choosing a pond. For example, smaller ephemeral ponds or water-filled tire tracks (especially in cow pastures) are going to have lots of mosquito larvae and little else. Not that this is bad though, since mosquito larvae are one of the very best foods and feeding them to your fish is psychologically very satisfying. Mosquito ponds usually disappear by mid-summer but they can reappear any time if we get a good storm. Give the pond a few days after a storm to repopulate before collecting it. Mosquito larvae are air-breathers and can be easily seen rafting just under the surface with their tail-snorkels sticking out of the water.

Ephemeral ponds are also likely to have fairy shrimp (*Streptocephalus seali*). These look sort of like a larger version of an adult brine shrimp. They make a very good food but are relatively few and difficult to catch in bulk. Fairy shrimp can be reared in captivity but the lack of a commercial supply of eggs makes this much less convenient than rearing brine shrimp. Aquarists are forced to catch the adults and spawn them, which the adults readily do when their homes dry up. To collect eggs, put the shrimp in an aquarium and slowly lower the water, then allow the last centimeter or so to dry up on its own. Learn more about fairy shrimp at <http://www.badgerstate.com/JAWS/faqs/fshrimp.htm>

Larger, longer-lived ponds are likely to have *Daphnia pulex* in abundance. *Daphnia* are pinkish in color and look like small spheres a couple of millimeters across. Close inspection shows that they have large black eyes and feathery antennae on their heads. A pond's population of *Daphnia* can change dramatically even over a few days. When a pond is in a *Daphnia* bloom (often following the deposition of a fresh cow pie and a good solid rain), the density of *Daphnia* can be astounding. But after the population explodes it will inevitably drop again as the predator population increases, the water starts to dry up, and the oxygen levels decrease. *Daphnia* can be reared on a diet of yeast and finely ground spinach, but they are so easily caught that most people don't bother.

Another live food local aquarists can find in abundance is fresh-water shrimp (*Gammarus lacustris*). These are discussed at the web site <http://www.ualberta.ca/~fwilhelm/gammarus.htm>. *Gammarus* inhabit flowing water and larger lakes, and are generally found among the stones of a cobbled bottom. In rapidly flowing streams they can be collected by kicking and shuffling among the stones while holding a net downstream of your feet, so the shrimps get swept into the net by the current. They can also be collected by scraping the bottom with the net, but this wears out the equipment quickly. *Gammarus* make good food for larger fish like cichlids, but they are too large and tough-skinned for smaller fishes. They can also swim remarkably quickly. Dropping a

few *Gammarus* into a cichlid tank really livens things up.

Other bugs will also end up in your catch, but I never worry about parasites entering the aquarium with the bugs. The only real problem you are likely to introduce with the bugs are *Hydra*, which are a predator of very small fish fry. My tank does have a few *Hydra*, but I've never lost any fry to them and so I don't worry about it. But if you have very small fry or a lot of *Hydra*, a double dose of Aquari-sol given on two consecutive days will rid your tank of them, as was discussed in Birgit McKinnon's article in the April 1996 issue of *The Calquarium*. All the other fry predators (dragonfly nymphs etc.) will be eaten by larger adult fish. When feeding bugs to small fish, however, screen any large bugs out of the food carefully. This is most easily done by passing the catch through a wide-mesh fish net, and feeding the fish whatever passes through it. Pond snails and leaches should be stuck to the sides of your collecting bucket by the time you get home so they aren't likely to end up in your tank. But if you see any, pick them out.

Some of your bugs won't survive the trip home, depending on how many bugs are in the collecting bucket's water. But don't worry about any die-off. When I get home I dump the bucket's contents through the catch net to filter the bugs out of the pond water. I then quickly rinse the bugs in cold tap water before giving my fish one good feeding of live bugs. Then I freeze what's left. I never bother trying to keep a bug catch alive for more than one feeding.

As far as diseases go, I've never seen or heard of any being introduced in this way so I never worry about them.

So that's about all you need to know about foods. Have fun feeding!?



Fishy Reading

Live Foods

As most of you that keep fish (or even just inverts) know, the grail of having a great tank with your animals reproducing is live food. Unfortunately information on raising live food is often anecdotal or very limited in most aquarium literature. Most books just give a cursory introduction and instead emphasize good “prepared” foods because most casual hobbyists don’t want the “trouble or mess” of live foods.

Well if you can’t get enough information about live food, do I have a book for you. It was originally published by TFH in 1975 but is not your typical TFH book. It is Encyclopedia of Live Foods by Charles Master. This nearly 340 page hardback book was republished in 1986 but has unfortunately since gone out of print. If you can find it, buy it. You will be glad you did. Any and all types of live food culture for aquaria are discussed. Some of the information may be slightly dated but most of the “recipes” can be easily recreated. I was lucky enough to find a copy in a clearance bin in a chain book store about 15 years ago for less than \$5.

If you can’t find a copy of this book, a soon to be published book by Mike Hellweg called Culturing Live Foods: A Step-By-Step Guide to Producing Food for Your Home Aquarium is scheduled to be published later this year. Look for it.

Until next month, keep reading.

John Jankowski

Trading Post

I am doing spring cleaning on my pond and I have some nice giant val that I will bring to the RAS meeting. Please bring a plastic bag and let me know you want some. Bob Gillen: chiller919@aol.com

15 F1 Mpimbwe Frontosas 4" - 6" \$300
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Potomac Valley Aquarium Society in the Washington D.C. area <http://www.pvas.com/>

Atlanta Area Aquarium Association in Atlanta, Georgia <http://www.atlantaaquarium.com/>

Carolina Fish Talk <http://www.carolinafishtalk.com/>

Charlotte Area Aquarists Society <http://pvelasco.net/CAASBBS/index.php>

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North Carolina Koi & Watergarden Society <http://www.nckws.com/>

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Please contact John Jankowski at raleighaquariumsociety@yahoo.com if you are an active member of the Raleigh Aquarium Society and do not have an up to date membership card. Membership cards can be picked up at any meeting.

Raleigh Aquarium Society

Application for Membership

Membership privileges include:

- Ability to post items in trading post section of monthly newsletter
- A discount card good at participating local pet stores
- All club discounts on club functions
- Education from the most knowledgeable aquarium experts in NC
- Yearly Membership - \$15.00 (includes spouse and children)

(Membership dues run from March 1st each year. New members joining any other time will be pro-rated at \$3 + \$1 for each month remaining in the year.)

Name(s): _____

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New Membership

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