

# Aquarium Fish and the Veterinarian

(Or, I flushed them down the toilet, too)

Dr. Drury R. Reavill  
**Zoo/Exotic Pathology Service**  
2825 KOVR Drive  
West Sacramento, CA 95605

Lecture given at the U. C. Davis Avian/Exotic Animal Medicine Symposium 1993

Aquarium fish medicine is a challenging and exciting area of veterinary medicine. It is fortunate that as veterinarians, we are uniquely trained to work-up diseases and attempt therapies in many animal species. These skills serve us well in the watery realm of aquarium fish. The only additional skill needed will be understanding of the fish environment. Included in this presentation is an overview of the basic aquarium system, general fish behavior, common diagnostics, and fish therapeutics. For the intricacies of water quality, diverse fish anatomy, nutrition, and the multitude agents of disease, consult the many excellent information sources listed in the references.

## THE ENVIRONMENT

### THE HOME TANKS

The hobbyist aquarium tanks will be constructed of either glass or Plexiglass. **Glass** is free of substances that can leach into the water and it is inert to most disinfectants. Plexiglass is the most common clear plastic **acrylic** used in hobby tanks. It tends to yellow with age and scratches easily. Plexiglass interactions with drugs and chemicals are unknown.

### MATERIALS FOR LARGER SYSTEMS OR PONDS

**Fiberglass, polyethylene, and polypropylene** liners are all relatively inert materials. They do need to be carefully leached to remove toxic metals and plasticizers used during the manufacturing process. One leaching procedure is to soak the material in HCL (pH 3.0) for 24 hours, then at pH 11.0 with sodium hydroxide for 24 hours, repeat the pH 3.0 for 24 hours, and finally rinse with salt water.

**Concrete** is also a suitable material. It should be washed with dilute muriatic acid and coated with several layers of sodium silicate or similar sealant.

**Vinyl** is not suitable for housing fish. It requires 10 days of soaking and etching to remove the toxin dioctyl phthalate.

### THE FITTINGS

**SILICONE**--The low grade, inexpensive caulks contain heavy metals, cyanide, and organic toxins that can leach out into the water. Use a good quality silicone.

**METALS**--Do not use with salt water tanks. All metal fittings will eventually corrode. Galvanized fittings contain high levels of zinc that will dissolve out into the water. Another metal, bronze is also a source of zinc as well as copper.

**PLASTIC SPLASH GUARDS**--Used on top of the tank to protect metal lighting hoods and reduce evaporative water losses.

**AIR PUMP**--The power for any air-driven filtering systems. In electrical failures, the tank water can run into the pump line and damage the pump itself. To prevent this, either use one-way valves, put a loop in the line, or place the pump above the tank.

**THE STAND**--Should be able to support the weight of the tank! Each gallon of freshwater weighs about eight pounds, and saltwater weighs slightly more. Therefore, a 30 gallon tank will weigh 240 pounds with the water alone. It is also important not to move the tank with water in it.

## **LIGHTS**

**INCANDESCENT**--Provide spotty lighting, and generate more heat that can affect water temperature. Incandescent lights can cause sudden algae blooms which can be detrimental to tank inhabitants.

**FLUORESCENT**--Provide uniform lighting and less heat. In saltwater tanks, it is believed that the fluorescent, with more blue in its spectrum, promotes beneficial algae growth and enhances fish coloration. These lights are high-color temperature bulbs that have high degrees Kelvin.

**PLANTS** require 1.5 to 2.0 watts/gallon, with 8 to 12 hours light.

**PHOTOPERIOD**--Proper light/dark cycle (10 hours light and 14 hours dark) will provide normal feeding periods and normal reproductive cycles.

## **FILTRATION SYSTEMS**

Filters remove unwanted materials from the water. There are essentially three basic methods to accomplish this objective.

**MECHANICAL**--Simple entrapment of particulate matter. Examples are fibrous floss, sponges, and gravel or sand. The size of the filtering material determines the size particulate matter that is removed. It is important to clean the filters or they will become clogged and ineffective. The particulate matter is composed of the biological wastes of fish and invertebrates and living particles such as trematode larvae, protozoans, etc.

**BIOLOGICAL**--This involves the oxidation of toxic ammonia wastes to nitrites and nitrates by nitrifying bacteria. The bacteria will colonize any surfaces in contact with the water, including the mechanical filters. Another relatively new type of biological system involves the concentration of metals and certain toxic organics in algal scrubbers.

**CHEMICAL**--Includes a wide variety of methods to remove molecular contaminants from water. Activated carbon is the most commonly used chemical filter. It will remove various organic molecules, including those responsible for changes in water color. It may also remove chemical treatments. Ion exchangers can soften water or remove specific cations or anions. Ozone filtration is an oxidative system. Protein skimmers and UV lights also fall under chemical filtering. Protein skimmers or foam fractionators remove organic substances by means of interactions with rising bubbles. The organic materials accumulate on the surface of the water as a foamy froth that is then collected and removed. Ultraviolet sterilizers (UV lights) are effective at killing bacteria, fungus, algal spores, and some viruses. These sterilizers are not placed over the display tank, they are placed so water runs by the lights and is then returned to the tank. 30 watts/100gal/hour is recommended.

**WATER CHANGES**--Changing the water periodically keeps a tank healthy. It decreases the amount of dissolved organics and therefore bacterial counts, replenishes

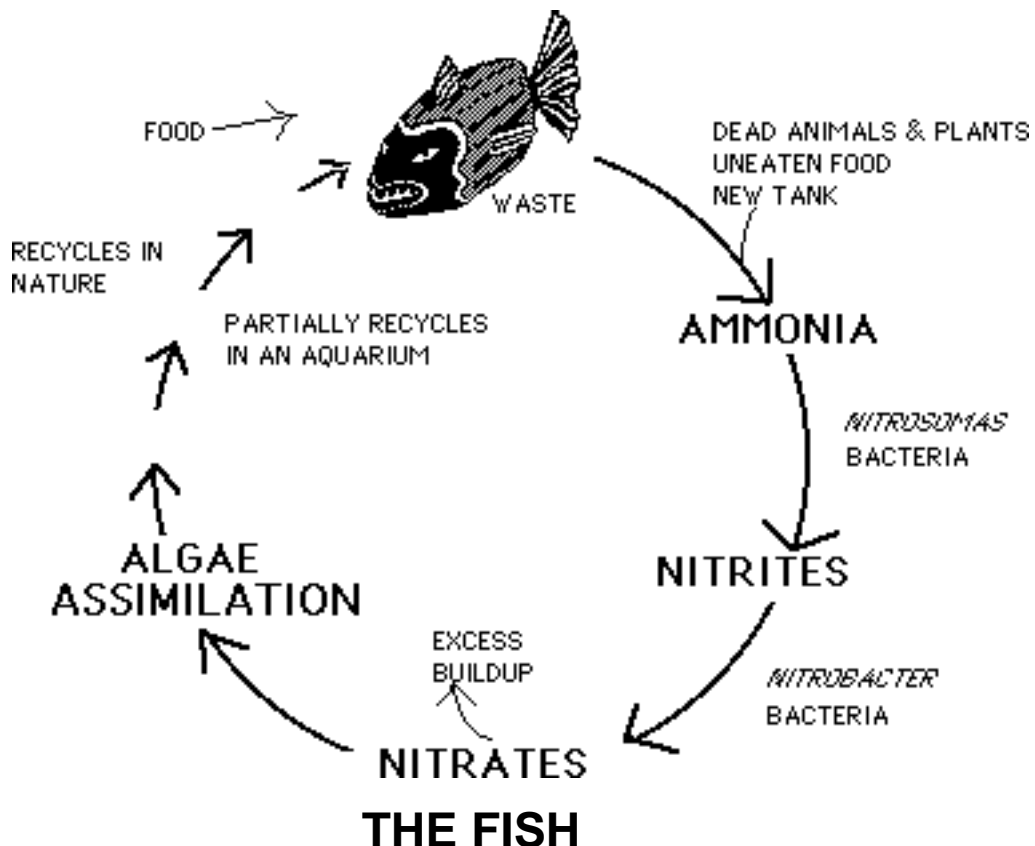
natural carbonates and bicarbonates which act as buffering agents, decreases ammonia and nitrite levels, and decreases nitrate and phosphate, so there is some control over algae growth. In general, the recommended frequency is 1/4 water volume every 3 to 6 weeks.

### WATER PARAMETERS

	Freshwater	Saltwater
Population density	1 inch (2.5cm)/gallon	1/2 inch/gallon
Temperature range	70-78 F	70-85 F
Water changes	1/4 q 3 to 4 weeks	1/4 q 3 to 6 weeks
pH	6.5-7.0	8.0-8.3
Ammonia (unionized)	<0.02 ppm	<0.01 ppm
Nitrites	<0.4 ppm	<0.1 ppm
Nitrates	<40 ppm	<20 ppm
Salinity	---	30-32 ppt
Specific Gravity	---	1.020 to 1.025

### NEW TANK SYNDROME

A new tank does not have the bacterial growth to oxidize the ammonia waste products. The peak ammonia levels occur about 7 to 10 days post-fish introduction, depending on the number of fish in the system. It will typically take about thirty days for the cycle to get established. This time can be shortened by seeding the new tank with gravel containing the nitrifying bacteria. In the meantime, it is important to do frequent water tests and water changes. The nitrification cycle is described in the diagram below.



Fish for the aquarium trade are gathered worldwide from the wild, cultured in outdoor ponds, and produced by indoor facilities or by the hobbyist. They come with their own parasites and diseases. If the hobbyist does not use the all-in/all-out method of tank set up, he/she should be encouraged to quarantine the new fish to avoid exposing the display tank's inhabitants to disease. The quarantine period should be about two weeks in a relatively bare aquarium (with a few hiding spots), with or without prophylactic treatments. If they treat, they should not use filters, since many therapeutics are removed by the filtering systems. To maintain water quality, change the water and use an airstone.

**UNPACKING THE FISH**--If they are not moving in the bag, it may be due to high carbon dioxide (CO<sub>2</sub>) levels; they are anesthetized. It is best to put the fish in water of the same or a slightly higher temperature. Do not float the bags or mix the water, as the pH of the water in the bag may be low, keeping the ammonia in the non-toxic form. Increasing the pH will shift the ammonia to the toxic form.

### **QUARANTINE**

For **freshwater tropical fish**, isolation should last two weeks. During the first four days, only observe the fish--do not treat. Prophylactic treatments are done on days 5, 10, and 15. Add formaldehyde/malachite green and metronidazole to the water. Do partial water changes 24 hours after the treatments.

For **saltwater fish**, prophylactic treatment is with copper for 10 days. On the last day, do a freshwater or acetic acid dip.

For **goldfish** or **Koi**, treat the same as for freshwater tropical fish. Salt is sometimes added to the water. It is reported to be anti-parasitic and helps maintain electrolyte balances in stressed fish. Use 1 tsp. Epsom salt and 3/8 cup table salt per ten gallons (114 gm NaCl, 1.4 gm KCL, 1.9 gm CaCl).

If the fish appear stressed during the treatments (fins clamped, lethargic, anorexic), change the water immediately.

### **BEHAVIOR**

It is important to be aware of normal fish behavior and interactions. This will make it easier to determine if the fish is ill. Many good books and magazines are available to help with the specifics of a particular fish's behaviors and interactions. The most common mistake is overcrowding the tank. The rule of thumb is 1 inch fish/gallon freshwater and 1/2 inch fish/gallon saltwater. This is roughly based on the carrying capacity of a bacterial filterbed. However, territorial aggressions will be more of a limiting factor than the volume of the tank. The following list will describe some normal behaviors.

**AGGRESSION**--This is a very common behavior. Prior residence and some specific circumstances (breeding, protecting young) will increase this behavior. To minimize aggression; provide hiding sites for timid fish and for the establishment of individual niches, add more of the same species if it is alone, rearrange the tank props before adding new fish so all will be without a territory, and finally, if it is a normally aggressive species, keep it in a species tank, not a community tank.

**BOTTOM SITTING**--Normal for sedentary and sleeping fish. It will be easy to determine if the fish are sleeping. Typically the lights will be dim, the room quiet, and if changed the fish will resume active behaviors. Check the references for species-specific behavior. If the fish are neither sedentary types nor sleeping, consider environmental contamination such as with carbon dioxide.

**COLOR CHANGES**--If either increased intensity or new colors are noticed, this could indicate reproductive status. For other changes, see **SIGNS OF DISEASE**.

**COUGHING**--This involves the fish suddenly flaring the opercular coverings and closing them forcibly. The function appears to be clearing the gills of accumulated debris. If the frequency increases, there may be gill disease.

**CHASING**--A rapid, short burst of swimming with one fish being actively driven away. If the behavior is excessive, reevaluate the social structure of the tank.

**DORSAL FIN ERECTION**--Aggression, courting.

**FANNING**--Of the pectoral fins indicates reproductive behavior associated with spawning.

**FIN NIPPING**--Aggression. Check the social structure of the tank. Other differential diagnoses for ragged fins; infectious disease, and in male Siamese fighting fish (*Betta splendens*) the long fins can suffer hydrostatic pressure damage due to excessive room to swim.

**HIDING**--Normal when associated with proper swimming orientation and movement, normal respiration, and healthy appearance. Consider whether the fish belongs to a shy or a sedentary species, is protecting eggs or young, or is newly introduced.

**HOVERING**--A normal swimming pattern in which the fish remains in one place. Species that commonly hover are angel fish (*Pterophyllum scalare*), hatchet fish (*Carnegiella sp.*), Siamese fighting fish (*Betta splendens*), and fancy goldfish.

**INVERTED SWIMMING**--Check for specific species behaviors. If associated with other signs such as whirling, circling, abnormal color changes, anorexia, or bloating, consider it abnormal. Check for gas accumulation in the abdomen or intestines.

**JUMPING**--Normal for some species and in predator-prey situations. Can also be a sign of environmental problems such as decreased oxygen, extremes in pH, or irritating chemicals.

**PIPING**--Gulping air at the water surface. Check the species. There are some air breathing fish such as the lungfish and some types of eels. Surface dwellers such as leaf fish may appear to pipe, and bubble nesters (fighting fish and some gouramis) use surface air to build their nests. Piping for prolonged periods of time may indicate severe hypoxia.

**SCHOOLING**--Some species of fish will swim together in large numbers as an aggregate unit.

**VORACITY**--The ravenous consumption of large amounts of food by goldfish is normal, although not necessarily desirable.

## **SIGNS OF DISEASE**

**ANOREXIA**--Nonspecific sign. Will see decreased activity, loss of condition, and muscle wasting. Guidelines: all fish in the tank--look for environmental problem or a general stress. All members of one species--check the husbandry (diet, tank mates, environment). Isolated fish--may be early sign of infectious disease.

ASCITES (dropsy)--Scales stand out from body. Systemic disease.

BOTTOM SITTING--See behavior.

CIRCLING--A controlled, purposeful swimming behavior. Differentials are unilateral blindness (good eye to outside) and unilateral fin damage.

COLOR CHANGE--With blindness, there will also be decreased aggressiveness, not schooling, sitting in a corner, anorexia, failure to find food, and a lack of response to threats. A general darkening is secondary to endocrine changes or stress. Darkening of the head sometimes indicates a gastrointestinal disease. Generalized blanching indicates bacterial or viral infections. A pale horizontal line on neon tetras (*Cheirodon sp.*) indicates a *Pleistiphora microsporidia* infection.

COUGHING--See Behavior.

CURLING--Head to tail. A grave sign.

DRIFTING--An aimless unpropelled motion. A grave sign.

EXOPHTHALMOS--Systemic bacterial or viral infections. Normal in some fancy goldfish.

FAVORING ONE SIDE--Showing only one side to an observer. Usually indicates a unilateral sensory deficit.

FIN CLAMPING--Analogous to a fluffed bird. General depression.

FIN ROT AND TAIL ROT--A bacterial infection.

FLASHING--Turning on one side, making a rapid semi-circular swimming motion and usually rubbing against objects in the tank. The most common cause is ectoparasites.

HEAD STANDING--Fish is in a head-down vertical position. There is a loss of equilibrium. This is a serious sign.

HEMORRHAGES--On surface of the body. Usually a sign of infection.

HURDLING--Falling in the water column, then suddenly spurting forward and gaining vertically. Differentials are ammonia toxicity, environmental toxin, or CNS disease.

INVERTED SWIMMING--See behavior.

LETHARGY--A nonspecific sign of illness.

PIPING--See behavior.

SECLUSION--A fish that avoids other fish, usually hiding, and swimming slowly at the tank periphery. A serious illness or blindness.

SPOTS OR BLUIISH FILM ON BODY--External protozoans, bacteria, fungus, or lymphocystis.

TAIL WALKING--An oblique position with the head toward the surface. Tetras with microsporidian infection.

WHIRLING--The frenzied, tail-chasing movement brought on by external stimulation as described in *Myxosoma cerebralis* infected salmonids.

## DIAGNOSTICS

Have the client bring the fish in one container and a sample of the tank water in another. If they do not bring in a tank sample, the water with the fish may be used if the fish has not been sitting in it for more than one hour. The water will not be suitable for analysis if the fish has been in it longer than an hour. There will be elevations in ammonia and pH changes due to the fish. For postmortem, use a sick and dying fish. A dead fish decomposes very rapidly even if refrigerated. Any external parasites will also be absent on a dead fish.

Obtain a thorough **history**.

Run the **water chemistry** tests; ammonia, nitrites, nitrates, pH, hardness, and if saltwater is used, copper and salinity. It may be diagnostic to submit the tank water for bacterial culture and sensitivity.

**Examine** the fish for external changes and behavior. Some external physical findings are exophthalmia, external growths, fin integrity, body swelling, and muscle mass.

**ANTEMORTEM TESTS**--Some of the following tests may require anesthesia or sedation. Handle the fish carefully and work quickly.

SKIN SCRAPING--With a dull blade, collect a sample of the surface mucus. Go head to tail to avoid descaling the fish. Do not traumatize the surface, as it will become a portal of entry for infection and can cause osmotic regulation problems. Place the sample on a slide with a drop of the tank water and a coverslip. Check under the scope immediately. Generally, the sample will have mucus, leukocytes, bacteria, and/or ciliates. Look for motion.

GILL SQUASH--Gently lift the opercula and cut a small sample of gill filaments with sharp scissors. Do not cut so deeply as to take the gill arch, just cut the tips of the primary lamellae. Place on slide as for a skin scrape.

FIN CUT--Cut a small section of fin and include any obvious lesions. Try to cut parallel to a fin ray, not through it. Place on a slide for examination. Fins do regrow with time.

FECAL--Collect a fecal sample with a net. The owner may need to bring in the sample if none are available at exam.

ASPIRATION OF COELOMIC CAVITY--Generally, collect fluid by syringe with a midline ventral tap. Examine any fluid (specific gravity, color, cellular components, bacteria) and submit for bacterial culture and sensitivity.

HEMATOLOGY--Use the tail vessels just ventral to the vertebral column for survival sampling on fish greater than 100 grams body weight. The sinus venosus or bulbus arteriosus punctures, as well as blood from a cut tail, should be reserved for

postmortems. The cells are very fragile and there is not a good method for consistent smears.

**RADIOLOGY**--To identify foreign bodies, masses, and skeletal lesions.

**CULTURE** or remove for **HISTOPATHOLOGY** any surface lesions. It is difficult to get good skin closure after sample biopsies.

**KIDNEY BIOPSY**--It is possible to collect a kidney biopsy on a live fish. The technique involves lifting the opercula and directing the needle dorsocaudally into the kidney, just caudal to the last branchial arch. The kidney is commonly used for isolating most microbial agents that affect fish.

**POSTMORTEM TESTS**--Many of the previous antemortem tests should be run.

**BACTERIAL AND FUNGAL CULTURE AND SENSITIVITY**--For frayed fins, cut off and put directly on culture media. Open lesions should be seared, a piece of the tissue excised and inoculated onto media. Some fish pathogens may require extended incubations (3 to 6 weeks).

**KIDNEY CULTURE TECHNIQUE**--Collect your sample **BEFORE** the abdomen is opened or you will contaminate the site.

>16 cm fish

- A. Cut off the dorsal fin
- B. Sear over fish where the fin was
- C. Cut perpendicular to spine
- D. Break spine
- E. Culture below spine, into the kidney.

<16 cm fish

- A. Drop fish into alcohol
- B. Pick up by head and flame
- C. Cut at level of kidneys
- D. Culture

**OPEN ABDOMEN**--Take samples for histopathology and for squash preparations. Cut a sample of muscle tissue for histopathology and squash preparations.

### **ANESTHETICS**

**BENZOCAINE**--A powder that must be dissolved in ethanol or other organic solvent. Dose 80 ppm. >100 ppm is lethal.

**METOMIDATE**--For longer procedures. Dose 10 ppm.

**MS222 (Tricaine methsulfonate)**--FDA approved for food fish. Twenty one (21) day withdrawal period for food fish. Solvent in aqueous solution but is acidic, so buffer the water. Dose 50-100 ppm to effect.

**EMERGENCY**--Club soda or alka seltzer. Increases CO<sub>2</sub> of the water.

To recover from anesthesia, place fish in well-aerated, non-medicated water. Stir, or gently swish the fish, forcing water over the gills.

**CAUTION--THE SCORPION FISH--**This fish is venomous. The venom is in the spines (dorsal, anal, and pelvic fins). The toxin is very painful and can cause severe swelling. It stays potent up to 48 hours after death. Other reactions: nausea, vomiting, chest pain, tissue sloughing, seizures, limb paralysis, fever, cardiac and respiratory arrest. If you are "stung" immediately wash with HOT (115°F) water for 30 to 90 minutes. The venom is heat-labile.

## THERAPEUTICS

The doses given in this handout are largely empirical. Review the pharmacokinetics of the agents and use COMMON SENSE. In general, keep the fish in their optimum environmental conditions to maintain immunocompetency and to prevent secondary disease problems. If the fish require handling to administer the drugs, use gentle techniques and for fractious fish, anesthetics may be required.

### METHODS OF ADMINISTRATION

**DIPS AND BATHS--**These require immersion of the fish into medicated water for varying lengths of time (dips less than 15 minutes and bath greater than 15 minutes). These are preferred to whole tank treatments, as the display tank is spared from the side effects of the treatments (see Indefinite/Tank treatment). Watch the fish carefully for signs of distress. After the treatment, place the fish in a clean holding tank for a thorough rinse before replacement in the display tank.

**INDEFINITE/TANK TREATMENT--**This involves medicating the whole display tank and all the inhabitants therein. This may be required in some disease conditions for effective treatment. Problems: some drugs tend to bind to the substrates and organic debris, or induce changes in biological filters, or can be toxic to plants and invertebrates. Due to binding, the drug may not reach therapeutic levels and can lead to increased bacterial resistances.

**INJECTIONS--**The most commonly employed ones are intraperitoneal (IP) and intramuscular (IM). It could be possible to use intravenous on very large, anesthetized specimens. IP can be used with drugs that are non-irritating and capable of crossing endothelial barriers. The technique involves inserting the needle under the scales of the caudal ventral abdomen, then directing it cranialdorsal. The bowel will be pushed away from the needle and the caudal area will prevent penetration of the liver, spleen, and kidney.

Intramuscular injections are still controversial, but recent studies indicate efficacy. Inject into the dorsal muscle mass, halfway between the lateral line and the dorsal fin. Direct the needle cranial under the scales. The volume is 1 to 2 µl/gm of body weight (BW).

**LOCALIZED--**For topical disinfection or cauterization of surface lesions. Treat, rinse fish, and replace in tank.

**ORAL--**This will be useful if the fish are eating. Medicated feed can be used to treat large numbers of fish. Some drawbacks: the fish may refuse to eat the medicated food, not all fish will successfully compete for their portion, and if normal feeding intervals are

greater than 24 hours, you may get satiated fish, which will end any effective treatment. Some medications can be given as an oral bolus.

## **ANTIBACTERIAL TREATMENTS**

There are only two antibiotics approved by the FDA for use in fish, Terramycin (Pfizer) an oxytetracycline, and Romet (Hoffmann-LaRoche) a potentiated sulfonamide. This is important if the fish will be used for human consumption. Most of your patients will not fall into that category, so you will be able to utilize a broader spectrum of antibiotics. Culture and sensitivity results will help with the selection.

**ACRIFLAVIN**-- An antiseptic dye used for external parasites and columnaris disease. It will also kill plants, color the water yellow, and many organisms are resistant. Dose 5-10 ppm as a prolonged bath.

**AMINOGLYCOSIDES**--Ineffective as a water treatment. Gentamicin 3-6 mg/kg BW IM q24-48 hours. Kanamycin 20 mg/kg BW IP or PO q24 hours. Amikacin 3-5 mg/kg BW IM q24-48 hours.

**CARBENICILLIN**--Fish tend not to eat food medicated with this drug. Treatment in the water results in a foul odor. Dose 200 mg/kg BW PO q24 hours.

**CHLORAMPHENICOL (CHPC)**--When used as a water treatment, it will stop the nitrification cycle and is not absorbed by freshwater fish. Dose 20-50 ppm q72 hours with water changes 24 hours after each treatment. Generally not effective as a bath. CHPC succinate 50 mg/kg BW IM or IP q24 hours. CHPC palmitate 40-100 mg/kg BW PO q24 hours.

**ERYTHROMYCIN**--During water treatment, very little is absorbed by freshwater fish, and it will stop the nitrification cycle in the tank. Dose 200 mg/5 gallons water q48 hours, with a water change 24 hours after each treatment. 100 mg/kg BW PO q24 hours: however, very unpalatable.

**ISONIAZID**--For mycobacteria. Dose 2 mg/kg PO q24 hours.

**NITROFURANS**--Used for *Pseudomonas*, *aeromonas*, and *flexibacter*. They are partially absorbed by freshwater fish when used as a water treatment. Furans are also potential carcinogens, deactivated by ultraviolet light, not effective in saltwater, and toxic to *Onchorhynchus spp.* Dose 1-3 ppm q72 hours with a partial water change 24 hours after each treatment. Nitrofurazone 50 mg/kg BW PO q24 hours. Nitrofurpuranol 2-4 mg/kg BW PO q24 hours. Furance (Furpyrinol) is approved for use in ornamental fish. Dose 0.2 ppm as a bath or 5 mg/kg BW PO.

**OXYTETRACYCLINE**--There is a 21-day withdrawal for food fish. It will be chelated in hard water and saltwater, so increase water dose one-third to one-half. Very little will be absorbed by freshwater fish. Dose 20-50 ppm q24 hours with a partial water change every 24 hours for 2-4 days. 50-75 mg/kg BW PO q24 hours. 10 mg/kg BW IM q24 hours.

**RIFAMPIN**--For mycobacteria. Dose 6 mg/100 gm food PO q24 hours or 10 mg/kg BW PO q24 hours.

**PIPERACILLIN**--100 mg/kg BW IM q24 hours.

## ANTIFUNGALS

Fungal infections are seldom the primary disease problem. Be sure to correct the underlying cause of illness.

FORMALDEHYDE--It will decrease the oxygen content of the water, so aerate the tank well. If exposed to temperatures below 40°F, a cloudy suspension or a white precipitate will form. This is paraformaldehyde, and it is very toxic-do not use. At concentrations greater than 15 ppm, the nitrification cycle may stop. For water treatment calculations, it is considered 100% active and it can be used on food fish. Dose: 15 ppm indefinite bath with water changes every 2-3 days. 25 ppm q 72 hours for three treatments with water changes 24 hours after each treatment. 75 ppm for 5-8 hours.

POVIDONE IODINE--Use with caution on smooth scaled or scaleless species. It may cause a chemical burn. Dose 1 to 10 dilution as a topical paint or rinse.

GRISEOFULVIN--Dose 50 mg/kg BW PO q24 hours.

MICONAZOLE--Dose 5-10 mg/kg BW IP, IM or PO q24 hours.

## ANTIPROTOZOAN

It is important to identify the organisms and understand their life cycles for effective treatments.

ACETIC ACID (Vinegar)--Dose 0.5 ml/l as a 30 second dip.

COPPER SULFATE--Use in saltwater tanks and **with great caution** in freshwater systems. It can be very toxic in soft water and inactivated in hard water. It is also immunosuppressive and toxic to invertebrates and plants. For water calculations, it is 100% active. Dose in saltwater 0.15 ppm (never above 0.3 ppm). Check water concentrations daily. 500 ppm for a one minute dip.

FORMALDEHYDE--See previous page.

FRESHWATER--For use on saltwater fish. 5 minute dip.

MALACHITE GREEN (Zinc-free)--Use in fresh water tanks. Will break down in ultraviolet light and is toxic to fry and neon tetras. Carcinogenic. Dose 0.1 ppm q48 hours for three treatments with water changes 24 hours after treatment. More effective if used with formaldehyde. Mix as a cocktail, 1.4 gm Malachite green to 380 ml formaldehyde, dose 1 ml/10 gallons water q48 hours for three treatments with water changes.

METHYLENE BLUE--Not as effective as malachite green/formaldehyde combination. Will kill the nitrifying bacteria. Dose 3-5 ppm q8-12 hours: change water after treatment.

POTASSIUM PERMANGANATE--Can use on food fish. Is 100% active for water calculations. Its effectiveness and toxicity depend on the organic content of the water. Dose at 2 ppm and watch water for color change and the duration. Maintain a pink color for four hours. Increase dose in 2 ppm increments. As a bath, use 50 to 70 mg per liter for 15 seconds.

METRONIDAZOLE--For flagellates. Dose 10 mg/gm food or 50 mg/kg BW PO q24 hours for five days.

### **ANTITREMATODES**

ACETIC ACID--See previous page.

COPPER SULFATE--See previous page.

FORMALDEHYDE--See antifungal treatments.

MASOTEN (Trichlorofon)--Inactivated by light, high pH, and high temperatures. Approved for use on ornamental fish, but handle with great care. It is very toxic to humans. Dose 0.25 ppm q14 days or as an indefinite bath.

PRAZIQUANTEL--Dose 100 mg/25 gm food q24 hours for seven days.

### **ANTINEMATODES**

ACETIC ACID--See previous page. For use on external nematodes.

MEBENDAZOLE--20 mg/kg BW PO q7 days repeat three times.

LEVAMISOLE--100 mg in 25 gm food q7 days repeat three times.

IVERMECTIN--0.7 ml of a one percent injectable solution per 76 liters of water, added gradually over a period of 4 days. (0.1 ml, 0.2 ml day 2, 0.2 ml day 3, 0.2 ml day 4). 100 µg/kg IM once. Toxicity can occur.

### **ANTICESTODES**

NICLOSAMIDE--200 mg/kg BW PO repeat in two weeks.

PRAZIQUANTEL--See previous page.

### **MISCELLANEOUS**

DEXAMETHASONE--Dose 10 mg/l as a one hour bath. 1-2 mg/kg BW IM or IP.

SODIUM THIOSULFATE--For chlorine contamination of the water. Dose 100 ppm as an indefinite bath.

METHYLENE BLUE--See previous page. For cyanide toxicity.

ATROPINE--For organophosphate toxicity. Dose 0.10 mg/kg BW IP or IM.

DOXAPRAM--Increases opercular efforts. Dose 5 mg/kg BW IP or IM.

SHOTGUN COCKTAIL (or What do I do in the meantime?)--For use in freshwater systems.

A. Formalin (25 ppm) or the Formalin-Malachite green mixture

B. Organophosphate (0.25 ppm)

C. Metronidazole (5 ppm)

On days 1, 3, and 5 use the cocktail. On days 2, 4, and 6 do a 50% water change. (I personally do not like this approach. You don't know what you are treating and you can kill some fish).

THYROXINE--Dose 20 µg/kg BW PO q24 hours.

VITAMIN A--Dose 500 units/kg BW PO q24 hours for 2 weeks.

VITAMIN B COMPLEX--Dose 0.2 cc/kg BW IM q24 hours.

#### DR. GRATZEK'S FISH FOOD MIXTURE FOR MEDICATIONS

This makes up 3 oz or 75 gm of fish food. Add the medications to a 0.25% to 0.5% concentration to minimize refusal of the food.

1 oz (25 gm) commercial flake or pelleted fish food.

1/2 tsp. (2.5 gm) cod liver oil

10 IU Vitamin E

125 mg Vitamin C

1/4 tsp. (1.5 gm) corn oil

1 TB (10 gm) plain gelatin

3 TB (50 ml) hot water

Mix together the gelatin and hot water. As it starts to cool and gel, mix in other the ingredients. Add the medications. Freeze the mixture. To use, just grate the food and drop the pieces in the tank.

## CALCULATIONS

$$\frac{\text{Length} \times \text{Width} \times \text{Depth (in inches)}}{231} = \text{gallons water}$$

## Sample History Questions

1. How long has the tank(s) been in operation?
2. Size of tank(s).
3. Number and type of fish per tank(s).
4. Type of lighting and the number of hours on per day.
5. Type of filtration system and how often cleaned.
6. Type of bottom substrate (i.e. commercial aquarium gravel, river sand) and how thick a layer.
7. List all tank decorations and types of plants. When were these introduced to the tank?
8. Is the tank located near an outside door or window? Is it in an area of heavy activity?
9. Water temperature, pH, hardness, ammonia, nitrite, salinity, and source.
10. How often is the water changed? How much?
11. Any current water treatment?
12. What food is offered? How much? How often? Source of live foods?
13. Type and number of fish affected.
14. Any recent fish or invertebrate introductions? Quarantine? How long? Any treatments?
15. Any previous problems?
16. Describe the problem(s).
17. Any deaths?

## REFERENCES

- 1) Aldridge FJ, Shireman JV. Introduction to fish parasites and diseases and their treatment. Florida Cooperative Extension Services, University of Florida, 1987.
- 2) Dixon BA, Issvoran GS. The activity of ceftiofur sodium for *Aeromonas* spp. isolated from ornamental fish. *J Wildlife Dis*, 28(3): 453-456, 1992.
- 3) Gratzek JB. An overview of the diseases of ornamental fishes. Proceedings of the 4th Kal Kan Symposium 1980.
- 4) Gratzek JB. Keeping Goldfish Healthy. *Tropical Fish Hobbyist* Feb. pg 10-29, 1987.
- 5) Gratzek JB. Fish Health Management. Lecture notes from the University of Georgia, 1985.
- 6) Gratzek JB, Reinert R. Physiological responses of experimental fish to stressful conditions. *National Cancer Institute Monograph*, 65: 187-193, 1984.
- 7) Groff J. Common diseases of tropical and ornamental fish. *Avian/Exotic Animal Symposium*, University of California-Davis, 1989, pg195-214.
- 8) Haley PJ. An introduction to fish diseases. Lecture notes from the Colorado State University 1984.
- 9) IAAAM (International Association of Aquatic Animal Medicine) Selected reports from the proceedings 1980, 1983, 1984, 1986, 1987, 1989, 1990, 1992.
- 10) Lewbart GA. Emergency care for the tropical fish patient. *J Sm Ex An Med*, 1(1):38-42, 1991.
- 11) Lewbart GA. Medical management of disorders of freshwater tropical fish. *Comp*, 13(6): 969-977, 1991.
- 12) Lewbart GA. Protozoal diseases of tropical fish. *J Sm Ex An Med* 1(3): 121-127, 1992.
- 13) Lewbart GA. Tropical fish medicine. *Avian and Exotic Animal Medicine Symposium*, University of California-Davis, 1992, pg 218-226.
- 14) Morales P. The detection and treatment of diseases in fish. *Avian/Exotic Animal Medicine Symposium*, University of California-Davis, 1990, pg 167-183.
- 15) Morales P. The pathology and therapeutics of fish. *Advances in Avian, Reptiles, and Nondomestic Medicine Symposium*, University of California-Davis, 1988, pg 78-120.
- 16) Noga EJ. Kidney Biopsy: A nonlethal method for diagnosing *Yersinia ruckeri* infection (enteric redmouth disease) in rainbow trout (*Salmo gairdneri*). *AJVR*, 49(3); 363-365, 1988.
- 17) Oestmann DJ. Environmental and Disease Problems in Ornamental Marine Aquariums. *Comp*. 7(8): 656-667, 1985.
- 18) Ralston T. Management of Tropical Fish. *Vet. Tech*, 8(9):448-456, 1987.
- 19) Roberts RJ. *Fish Pathology*, ed. 2. London, Bailliere Tindall, 1989.
- 20) Stoskopf MK, Citino S. Workshop on Marine Tropical Fish. Waikiki Aquarium Hawaii, Sept. 1987.
- 21) Stoskopf MK. Tropical Fish Medicine. *Vet Clinics of North America, Small Animal Practice*. 18(2) 474, 1988.
- 22) Stoskopf MK. *Fish Medicine*. W.B. Saunders, 1993.
- 23) Waltham Symposium #3. *The Diseases of Ornamental Fishes*, 1981.
- 24) Whitaker BR. Common disorders of marine fish. *Comp*, 13(6): 960-967, 1991.