TREATMENT OF FISH DISEASE

Once a diagnosis has been made, the diagnostic laboratory will contact the culturist and identify the disease as well as recommend an appropriate and approved treatment or action. In certain cases a change in management is necessary. In other cases it is necessary to add an antibiotic to the feed (for internal bacterial infections) or add a chemical to the water (usually for external parasite infestations). It is extremely important that the aquaculturist follow closely the recommendations of the diagnostic laboratory and take appropriate precautions prior to the application of any disease treatment.

Over the years four **cardinal rules of fish disease treatments** have evolved:

a. Know your fish

b. Know your water

c. Know your chemical

d. Know your disease

The culturist must know his/her fish. What is their normal behavior, what conditions are likely to stress them, and to what diseases are they most susceptible. Some chemicals are safe and legal to use on certain species and ages of fish, but they may not be appropriate or approved for your fish.

The quality of your water influences the condition of your fish. Each fish species has a preferred temperature. Some fish are more tolerant than others of reduced oxygen, high turbidity, and elevated levels of ammonia. Water chemistry in some systems remains relatively uniform (e.g., single-pass system, properly functioning recirculated system). In other systems, such as ponds, water chemistry can vary widely on a seasonal basis or even during a 24 hour period. Dissolved oxygen and temperature may change dramatically each day, but alkalinity and hardness vary little in ponds. In a properly functioning recirculated systems, dissolved oxygen and temperature remain relatively constant throughout the day and growing season, but alkalinity and hardness can change in a matter of days. In an improperly functioning or overstocked recirculated system, dramatic and rapid changes in dissolved oxygen, ammonia or nitrite can result in high mortality rates of cultured fish.

One of the most important aspects of knowing the chemical has become knowing which chemicals are approved for use by aquaculturists. Each chemical can be used to treat effectively and legally a few to several diseases. No one chemical is appropriate for all diseases or situations. For instance, an antibiotic can be very effective in the treatment of a bacterial infection, but is useless if the disease is caused by a protozoan parasite. All chemicals have precautions and considerations associated with their use. If an aquaculturist has no experience with a particular

chemical a small group of fish should be treated first, as a test before the entire lot is treated, to avoid potentially heavy losses due to toxicity associated with overtreatment. Extreme caution should be practiced when applying any chemical treatment. Water quality influences the toxicity of certain chemicals and is adversely affected by some chemicals. The culturist should be knowledgeable of the water quality in the culture facility. Of particular interest are dissolved oxygen, alkalinity, and the amount of organic material in the water.

Units

Units of measure used in this section and in this Fact Sheet are primarily metric system. Most discussions of chemical applications employ descriptions of concentrations of chemicals. Concentrations of chemicals are commonly expressed in terms of milligrams (mg) per liter (L) or parts per million (ppm). When making a chemical application to a freshwater system, these two terms are equivalent [one liter of water weighs 1 kilogram = 1000 grams = 1,000,000 milligrams]; therefore 1 mg/1,000,000 mg (or 1 L) = 1 ppm.

Antibacterial compounds added to the feed to treat systemic (internal) bacterial infections are applied as rates expressed as a weight of antibacterial compound per weight of fish per day for a specified number of days. This may be in terms of mg drug/kg fish weight/day. Historically, some antibacterial treatment rates have been expressed in terms of a combination of English and metric units. Such rates have been expressed in terms of gm drug/lb fish weight/day.

A list of conversion factors are provided in this Fact Sheet for reference in making any calculations.

Aquaculture Chemicals

Below are brief descriptions of some commonly used aquaculture chemicals and precautions/considerations associated with their use. It should again be emphasized that the aquaculturist must be aware of the legal status of using any chemical. A good practice is to maintain only those chemicals that do have specific approval for aquaculture uses at the production facility. The presence on non-approved chemicals at an aquaculture facility may imply their use to an inspector even if they are never used. Regulations concerning approved chemicals for use in aquaculture are continuously being updated. A good source of information is the publication *A Guide to Approved Chemicals in Fish Production and Fishery Resource Management* by R. A. Schnick, F. P. Meyer, and D. L. Gray (see references).

a) **Terramycin** -- Terramycin is an antibiotic used to treat systemic (internal) bacterial infections. It is **approved** by the U. S. Food and Drug Administration (FDA) for the treatment of sensitive bacteria of the genera *Aeromonas*, *Pseudomonas*, and *Hemophilus* in salmonids and catfish. It is used as a feed additive at a rate of 2.5 grams of drug (active ingredient)/100 pounds of fish weight/day for

10 days. A 21-day withdrawal period is required before the fish may be slaughtered and used for human consumption.

b) **Sulfamerazine** -- Sulfamerazine is an antibiotic compound for the treatment of furunculosis in salmonid fishes. It is used as a feed additive at 10 grams of drug (active ingredient)/100 pounds of fish weight/day for 14 days. A 21-day withdrawal period is required before the fish may be slaughtered and used for human consumption. (Note: Old fish health literature implies that Sulfamerazine is an approved compound for use on food fish, **this is no longer true**! Because many individuals were substituting a generic "sulfa drug" for sulfamerazine, the manufacturer decided to no longer manufacture Sulfamerazine, the product for which FDA granted a label. Since Sulfamerazine is no longer available, the use of any generic sulfa drug will be known to be in violation of the law.)

c) **Romet-30** -- Romet-30 is a combination of two antibacterial drugs that **has FDA approval** for the treatment of furunculosis in salmonids and enteric septicemia in channel catfish. It is used as a feed additive in both cases at a rate of 50 milligrams drug (active ingredient)/kilogram of fish weight/day for 5 days. A 42-day withdrawal period is required for salmonids and a 3-day withdrawal period is required for channel catfish before the fish may be slaughtered and used for human consumption.

d) **Copper Sulfate** -- Copper sulfate ($CuSO_4$) is used to treat a variety of external parasites of fish. It is also an effective algicide and piscicide, it can kill aquatic plants and fish and is approved for use as an algicide. The relationship between toxicity of copper sulfate and alkalinity of the water is very important. (Alkalinity is the total concentration of alkaline substances in the water expressed as equivalent calcium carbonate.) In water with an alkalinity less than 50 milligrams per liter (mg/L), copper sulfate can be toxic to fish and it should not be used unless a bioassay has been run in the water first with a limited number of the fish to be treated. The following general guidelines have been established for the use of copper sulfate:

Table 1. Treatment concentration of copper sulfate in water of various alkalinities(mg/L = ppm)

Copper Sulfate Treatments

Alkalinity of water (mg/L)	Permissible treatment (mg/L)
0 - 49	don't use without a prelim. bioassay
50 - 99	0.5 - 0.75
100 - 149	0.75 - 1.00
150 - 200	1.00 - 2.00
200+	ineffective; will ppt as $CuCO_3$

Since copper sulfate is an algicide, consideration must be given to dissolved oxygen in a pond to be treated. If a pond already has low dissolved oxygen, an alternate treatment should be used. Copper sulfate will only aggravate low dissolved oxygen problems by killing the primary source of oxygen (the algae) and by adding a large biological oxygen demand in the form of dead and decomposing algae.

e) **Formalin-F** -- Formalin-F (formalin) **is approved** for use in the treatment for a number of external parasites. It is commonly used as an indefinite pond treatment at 15 milligrams per liter (mg/L). Formalin will remove 1 mg/L dissolved oxygen for every 5 mg/L of formalin used as a treatment. Therefore, if dissolved oxygen concentration in a pond is low, aeration must be provided or a different treatment should be used. Formalin must not be stored at temperatures below 40 F because it will form very toxic paraformaldehyde at low temperatures.

f) **Potassium Permanganate** -- Potassium permanganate ($KMnO_4$) **is approved** for use in aquaculture as an oxidizer and detoxifier and has been used effectively against a number of external disease organisms of fish. The normal treatment is 2-8 milligrams per liter (mg/L), depending upon the amount of organic matter in the pond to be treated. Ideally, one would like to maintain a "wine red" color in the water for a 12 hour period to ensure an effective treatment. A preliminary bioassay can be performed with a small volume of culture water to determine the appropriate dose for the system.

g) **Sodium Chloride (Salt)** -- Sodium chloride (NaCl) **is approved** for aquaculture use as an "osmoregulatory enhancer." Salt can change the osmoregulatory balance (water balance) of aquatic organisms. It can sometimes be used effectively to control external parasitic protozoans by placing them in a condition of severe osmoregulatory shock. Care must be exercised to avoid overtreatment which will place the fish in the same condition of osmoregulatory shock. Sodium chloride is used as a 0.5% to 1.0% concentration in water as an indefinite (long-term) treatment or as a 3% concentration in water for 10-30 minutes (or stop the treatment earlier if the fish show signs of stress).