

## **WATER QUALITY FACTS**

(Source: Piper, Robert G., et. al. 1982. *Fish Hatchery Management*. US Department of the Interior, Fish and Wildlife Service, Washington D.C.)

Most schools conduct annual water quality analyses on their drinking water. This analysis can be used to assess the schools's water quality. All schools should conduct a water quality test before initiating the ASERP program. Utilize the table of acceptable water quality measures to determine if your school's water is suitable for incubating eggs. If measures exceed those recommended on the table, find an outside water source for your tank.

### **Temperature**

- \_ Impacts development of eggs and growth of fry - colder water slows down development and growth;
- \_ Extremes are stressful and can result in disease or poor survival;
- \_ Changes rapidly exceeding 10° F are very dangerous – which is why we try to match the tank temperature to the stream temperature prior to the stocking date;
- \_ Affects water quality – most chemical substances dissolve more readily in warmer water;

### **Dissolved Gases**

#### **Oxygen**

- \_ Dissolved Oxygen (D.O.) levels should be about 10-11 ppm
  - 5 ppm+: fish thrive
  - 3 ppm-5 ppm: expect decreased feeding & growth
  - 0 ppm-3 ppm: expect fish to die
- \_ Oxygen is less soluble in water at higher temperatures and altitudes;
- \_ Oxygen levels are depleted in fish tanks by live fish, and decay of feces, wasted feed, dead plants, & dead fish;
- \_ Oxygen levels can be increased by chemical addition of oxygen (air stone), mechanical aeration (flowing filter system), continuous fresh flow, photosynthesis by plants in daylight;

#### **Nitrogen**

- \_ Nitrogen levels must be less than 100% saturation;
- \_ Nitrogen greater than 100% saturation cause the “bends” in fish - the gas actually comes out of solution and bubbles lodge in the fins, behind the eyes, or in the gills; This can kill fish;
- \_ For example, snow melt sometimes results in supersaturation when the cold water is heated – this sometimes kills fish in ponds in the spring;

#### **pH**

- \_ pH is a measure of acidity in water;

- \_ pH <7 is acidic, pH >7 is alkaline; pH7 is neutral;
- \_ Fish can tolerate pH in a range from 6.5-8.0
- \_ Fish avoid alkaline waters that cause blindness, frayed fins & gills, and death;
- \_ Waters with low calcium/magnesium levels are poorly buffered, tend to be more acidic, pH may fluctuate widely;
- \_ The test kit measures pH in a limited range from 6.2-7.4;
- \_ If pH is outside the range of the test kit, you should bucket water out of the tank and replace with freshwater of the same temperature - this will also reduce ammonia levels;

## **TOXICS**

### **Heavy Metals – Avoid heavy metals especially in poorly buffered waters**

- \_ Zinc – 0.03 ppm - Source: galvanized pipes
- \_ Copper – 0.006 ppm - Source: plumbing, braces and fittings
- \_ Cadmium – 0.003 ppm in hard water
- \_ Lead – 0.03 ppm
- \_ Mercury – 0.002 ppm maximum

### **Pesticides**

- \_ One time exposure at 5-10 micrograms/liter may kill fish;
- \_ Prolonged exposure to lower concentrations may also kill fish or result in physiological damage;
- \_ Abundance of prey decreases after exposure & may be the reason growth rates of larger fish decline;
- \_ Fry & eggs may be killed on contact;

### **Ammonia –Upper limit = 0.0125 ppm (un-ionized)**

- \_ Fish excrete ammonia (NH<sub>3</sub>);
- \_ Un-ionized ammonia (NH<sub>3</sub>) and nitrite (NO<sub>2</sub>) are toxic to fish, causing brown blood, reduced growth, damaged gills, kidney & liver;
- \_ Un-ionized ammonia (NH<sub>3</sub>) levels increase at higher water temperatures and increased pH;
- \_ Un-ionized ammonia (NH<sub>3</sub>) can be broken down into toxic nitrite (NO<sub>2</sub>) and then harmless nitrate (NO<sub>3</sub>) biologically by nitrifying bacteria (on chips or oyster shells) or physically with zeolites like clinoptilolite – a material with high ion exchange capacity or chemically with chlorine (chlorine is toxic to fish & must be neutralized at levels greater than 0.03 ppm);

- Ammonia is not usually a concern until after the eggs are hatched and the fish are on feed - this is the time to test the quality of the water in your tank; Test water quality 1-2 times per week, or as needed;
- The ammonia test kit instructions recommend cleaning out excess feed, feces, and other decaying material, increasing aeration, and use of nitrogen chips at ammonia levels from 0.5+ ppm; or you may also choose to bucket water out of the tank and replace with freshwater of the same temperature;

\*Note: 1.0 ppm = 1.0 mg/l

\*\*Note: The *Adopt-A-Salmon Family* curriculum contains information on water quality with an activity for students in the *April* section.