

ly if electricity must be installed at the pond, but they can significantly improve the water quality of the pond.

### *Muddy Water (Turbidity)*

Muddy water is a common problem in ponds, and it is often caused by runoff from disturbed areas around the pond or the presence of waterfowl, muskrats, or bottom-dwelling fish. It interferes with recreational uses of the pond and, in severe cases, may reduce fish reproduction.

Muddy water will be minimized if the source is identified and fixed. This might include planting grass or other vegetation on exposed soil, placing a layer of rocks over exposed banks, discouraging geese and ducks, or removing muskrats or bottom-dwelling fish. Persistent muddy water problems can be treated with additions of ground limestone, gypsum, or alum. Muddy water is very common in new ponds and usually disappears as vegetation grows around the pond. In established ponds, muddy water can nearly always be traced to a preventable source. Chapter 2 includes information on pond maintenance and guidelines on clarifying pond water.

### *Nutrients*

Just as we fertilize plants to make them grow better, increases of nitrogen and phosphorus in a pond, usually inadvertent, will usually lead to overabundant growth of aquatic plants and algae. This was the most common problem reported by the surveyed pond owners in Pennsylvania, with more than 50 percent reporting excessive amounts of algae and/or aquatic plants. Thus, long-term control of plants and algae is best accomplished by identifying and limiting sources of both nitrogen and phosphorus in the pond.

Nitrogen can enter a pond as nitrate or ammonia from surrounding barnyards, crop fields, septic systems, lawns, golf courses, and waterfowl. Concentrations of nitrate-nitrogen above about 3 mg/L and any measurable amount of ammonia are indicative of pollution. Very high concentrations of nitrate-nitrogen can also be dangerous for drinking water. Humans should not drink water with nitrate-nitrogen above 10 mg/L, and animals should not drink water with nitrate-nitrogen concentrations in excess of 100 mg/L. Levels above 10 mg/L are not unusual in ponds, but concentrations

above 100 mg/L are rare. An ammonia concentration as low as 0.3 mg/L can be lethal to some fish species, but ammonia quickly oxidizes to nitrate in most pond environments. Inexpensive test kits for both nitrate and ammonia are readily available from most pet stores.

Phosphorus can occur in many forms in pond water, but phosphate is the most common form. It usually enters ponds attached to sediment runoff from fertilizer use or from resident waterfowl. Excess phosphorus usually accumulates in pond sediment, where it remains unless dissolved oxygen levels drop in the water above the sediment or it becomes re-suspended by bottom-feeding fish or animals. In most ponds, phosphorus is an influential nutrient for aquatic plant and algae growth, which means that less phosphorus leads to less weed growth. Inputs of this nutrient may cause rapid increases (or blooms) of algal growth. Phosphorus concentrations as low as 0.01 mg/L are sufficient to cause an increase in plant and algae growth. Test kits for phosphorus are sometimes available in pet stores; they can also be ordered through the on-line test kit suppliers mentioned earlier.

Long-term control of pond weeds is best accomplished by reducing or redirecting nutrient sources before they enter the pond. Approaches to limiting nutrient sources include reducing fertilizer use near the pond, improving septic systems, directing nutrient-laden runoff away from the pond, and maintaining buffer strips of unmown grass or brushy vegetation around the pond. Phosphorus control is best achieved by reducing sediment input to the pond and discouraging large numbers of waterfowl from congregating at the pond. If you do not address the underlying cause of aquatic plant growth, you must rely on continuous control of the plants using mechanical, biological, or chemical techniques.

### *Pesticides*

Pesticides are sometimes found in ponds if they are used on nearby land areas or if aquatic herbicides have been used to reduce plant and algae growth. Pesticides applied to the land surrounding a pond may occasionally reach the pond, especially on windy days or when heavy rain occurs shortly after application. Excessive concentrations are usually temporary, but they may result in fish kills, waterfowl deaths, animal sickness, or plant injury if the pond water is used for irrigation.