Pond Facts #12

Pond Fisheries Management

Discover some simple methods for fisheries management, including strategies to resolve common fish problems.

Fishing is an important use of private ponds throughout Pennsylvania. In fact, a recent survey of pond owners found that 56 percent use their pond primarily for recreational fishing. The widespread interest in pond fishing leads to many questions about proper management of pond fisheries.

Common Fish Populations

All fish have specific water temperature tolerances. Warm-water fish, like largemouth bass and sunfish, prefer water temperatures above 80°F in the summer while cold-water fish, like trout, cannot survive if the summer water temperature exceeds 75°F for a prolonged time. In between are cool-water fish, like smallmouth bass, that are adapted to both conditions. Proper stocking and management of fish in ponds requires knowledge of typical summer water temperature conditions in your pond.

Trout are a favored sport fish of many anglers in Pennsylvania, but few ponds remain cold enough during the summer to support trout throughout the year. In warm-water ponds, trout are often stocked in the fall or spring and then fished out of the pond before the water temperature reaches lethal levels in the summer (called “put-and-take”). In rare cases where a pond is fed by large amounts of cold groundwater from springs, trout may survive during the entire year. In this case, trout typically do not spawn and must be restocked every three to four years.

The most common fish population in ponds is a combination of warm-water fish like largemouth bass (Figure 1) and bluegill. This combination is generally successful in ponds with each fish species controlling the other. Slightly different combinations including other sunfish, catfish, and minnow species are sometimes used with varying success.

Figure 1. Largemouth bass are one of the most common and prized fish in Pennsylvania ponds.

For more specific information on the types of fish that are stocked in ponds, see the fact sheet titled Pond Facts #11: Fish for Pennsylvania Ponds, available on the Penn State Extension Water Quality website.

Measuring Your Fish Population

Approximately 15 percent of pond owners surveyed indicated that they had little or no knowledge of the current status of their pond fishery. The most accurate method for determining the fish population is to hire a professional fisheries biologist to sample the pond using a boat electrofishing unit (Figure 2).

Figure 2. A boat electrofisher operated by a professional fisheries biologist is the most accurate method to measure a pond fish population.

This method uses a small electrical current to stun (but not kill) fish, allowing them to be easily captured, identified, measured, and returned to the pond. Using data from an electrofishing survey, a professional fisheries biologist can provide a detailed assessment of the fish population along with stocking and harvest recommendations to reach the pond owner's goals (for a price of course). A list of professional pond consultants that may be able to provide an electrofishing survey is available on the Penn State Extension Water Quality website.

Proportional Stock Density (PSD) Method

A simple method of assessing the current status of a pond fishery is the use of proportional stock density (PSD). The PSD method is applicable to ponds dominated by a largemouth bass and bluegill combination. The method is less accurate for other combinations of bass and/or sunfish.

The method involves simple record keeping by anglers. The more data that are collected, the more accurate the final result will be. Pond owners can accomplish a good data set by keeping angling records during an entire summer for a few anglers or invite many anglers to fish over one or two weekends. Either approach would result in a significant number of angler hours (number of anglers times hours fished).

As anglers fish, they keep record of the following two categories of fish:

1. Number of largemouth bass caught that are over 8 inches and are also over 12 inches. Largemouth bass smaller than 8 inches are ignored. The resulting fraction multiplied by 100 is referred to as the bass PSD.

2. Number of bluegill caught that are over 3 inches and also over 6 inches. Bluegill smaller than 3 inches are ignored. The resulting fraction multiplied by 100 is referred to as the bluegill PSD.

In each case, the PSD can be thought of as the percent of adult fish that are large. As an example, Table 1 provides records of fish caught by two anglers in a one-acre pond in central Pennsylvania during one summer.

	Bass	**Bluegill**
Number > 3"	-	277
Number > 6"	-	177
Number > 8"	140	-
Number > 12"	10	-

Table 1. Bass and bluegill caught from a pond in central Pennsylvania by two anglers.

Using the data from Table 1, the corresponding PSD for bass and bluegill would be:

- Bass PSD = (10/140) X 100 = 7
- Bluegill PSD = (177/277) X 100 = 64

These results indicate that a low percentage of adult bass are large with many small adult bass and a high percentage of adult bluegill are large. The result can be compared with measurements from many ponds collected by Dr. Richard Soderberg at Mansfield University in northern Pennsylvania (Figure 3).

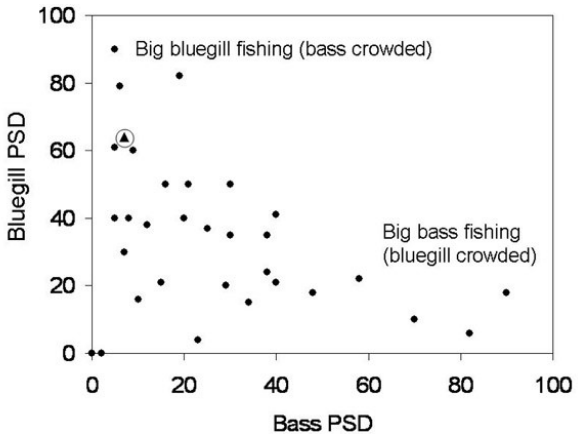

Figure 3. Plot of bluegill PSD versus bass PSD for many ponds in northern Pennsylvania. Each dot represents a separate pond. The circled triangle represents the example pond from Table 1.

Ponds that plot toward the center of Figure 3 (PSD of 20 to 50 for each species) are considered to be more balanced than those on the edges where one species has a high PSD and the other has a low PSD. Ponds that are "crowded" by one species or the other may be desirable to some pond owners, but most anglers prefer a more balanced population. Fortunately, remedies are available through harvest and/or stocking to shift pond fish populations toward desirable levels.

A Bass Crowded Pond

The example pond from Table 1, when plotted on Figure 3, is considered a “bass-crowded” pond characterized by numerous small bass and few but large bluegill. This condition occurs most frequently in ponds that are not consistently fished. If bass are not routinely harvested, they may overcrowd the pond and reduce the bluegill population. Over time, the amount of bass will continue to increase since fewer bluegill exist to feed on bass eggs and young. Although a great number of bass survive, they fail to grow large because they compete for a limited number of bluegill. The result is a pond with many bass that are 6 to 12 inches. The few bluegill that survive will often grow very large because they have little competition from other bluegill.

A bass-crowded pond can be adjusted toward a more balanced population by harvesting small bass while protecting the few large bass that are over 12 inches. Harvesting approximately 12 pounds of bass per pond acre (or about 16 fish per acre) will shift the pond away from a bass crowded condition. Other strategies that may be helpful include stocking a few large bass over 12 inches and/or stocking 100 to 200 adult bluegill (>4 inches) per acre to provide an added food base for bass.

Restoring a bass-crowded pond to a more normal condition will take time and patience. The result will be a steady change toward fewer, larger bass and more plentiful but smaller bluegill.

A Bluegill-Crowded Pond

A bluegill-crowded pond has many small bluegill and just a few large bass. This population structure often occurs in ponds that are regularly fished. Anglers tend to overharvest bass and underharvest bluegill. As a result, large bass are continually removed, allowing more bluegill to survive. The growing population of bluegill feed on bass eggs and fry, keeping the bass population low. A bluegill-crowded condition can be balanced over time by protecting all bass in the pond (no bass harvest). Stocking 50 to 100 bass fingerlings per acre may also be helpful but is not usually necessary if existing bass are protected. Recent research has also suggested that stocking a few very large bluegill can also provide a benefit in some cases by delaying the sexual maturity of the many smaller bluegill in the pond.

Angling Guidelines

The harvest guidelines presented above are useful to change a pond fish population, but what should be done once the desired fish population is achieved? Fish management is a continuous process that is necessary even to maintain a stable fish population. Here are some guidelines for anglers to keep the pond bass and bluegill population stable:

- Remove about 30 percent of bass biomass each year. Significantly exceeding this amount will lead to a bluegill-crowded condition while underharvesting bass will lead to a bass-crowded pond. This removal rate usually translates into the harvest of about 3 to 13 largemouth bass per acre of pond each year.
- Harvest about 15 bluegill for every bass harvested from the pond.
- Recent research favors a slot protection for bass. This involves protecting bass inside the slot size of 12 to 15 inches while harvesting bass smaller and larger than the slot. While preferred, this approach is notoriously violated by anglers. Most anglers release fish below the slot and keep many fish within the slot length. As a result, this approach may be difficult on a pond with many different anglers.

Miscellaneous Fish Management Issues

Fish Habitat

Creating optimum fish habitat is easiest done during the construction of the pond. Slightly undercut banks and rock ledges can be created during construction to provide great habitat for both bass and bluegill. Large trees cleared during construction can be placed on the bottom of the pond to provide additional habitat. Bushes and other brush can be piled in deeper locations to create reef habitat. Another common approach in the Midwest is to create log cribs by stacking logs into a square shape much like a log home is built. The inside of the log crib is filled with stones and brush. Properly constructed log cribs can last more than 20 years.

A variety of methods exist to improve fish habitat in existing ponds. Installation of diffuse aerators on the bottom of the pond can increase the vertical habitat in the pond by allowing fish to live in deeper parts of the pond that were previously low in dissolved oxygen. Underwater habitat can also be created by sinking brush or old Christmas trees by tying block or bricks to them. These sunken trees become excellent, albeit short-lived, habitat. By the same token, sunken piles of rocks, blocks, bricks, or other nontoxic materials provide excellent habitat. Finally, felled trees near shore are quickly colonized by fish taking advantage of the overhead cover they provide.

Excessive amounts of aquatic vegetation are a common complaint among pond owners, but moderate amounts of aquatic plants provide important habitat for fish. Submerged, rooted vegetation allows young fish to escape predation and improves spawning success. Floating plants, like water lily, provide overhead cover and encourage fish prey, like insects and frogs. Thus, while control of aquatic plants is often undertaken in ponds to improve aesthetics,

complete removal of plants is not desirable for the pond fishery.

Nuisance Grass Carp

Sterile grass carp are stocked in Pennsylvania ponds (with a permit) to control submerged aquatic plant growth. Although grass carp do not reproduce, they grow quickly and can strip the pond of all aquatic plants. Their wastes and feeding activities may discolor the water. In these cases, removal of some or all of the grass carp may be necessary. Removing grass carp by fishing is difficult because they eat plants and are reclusive. Some success has been achieved by chumming a small area of the pond with canned corn and then fishing that area with corn as bait. Other successes have involved luring the fish to the surface by chumming and then harvesting them with a bow and arrow (bow fishing) or a gun.

Fish Kills

An occasional dead fish in a pond is generally not of concern. Individual fish may succumb to wounds from predators or fishing hooks, parasites, diseases, or other causes. However, 25 percent of pond owners surveyed indicated that they have witnessed more significant fish kills at some time in their pond.

Large-scale or frequent fish kills can often be traced to low dissolved oxygen. These incidents are characterized by fish swimming near the water surface frequently gasping for air especially early in the morning. Problems with low oxygen usually occur in the summer due to the decay of aquatic plants that die naturally or from the use of an aquatic herbicides. Oxygen depletion may also occur if rain carries large amounts of animal waste into the pond or if a nearby septic system drains into the pond.

Fish kills can occur in winter if pond ice is covered by snow for an extended period, which prevents sunlight from reaching aquatic plants. Without sunlight, the plants expend oxygen as they die and decay. These kills are common in shallow ponds with extensive winter aquatic plant growth.

Fish kills due to oxygen depletion can usually be prevented with careful management such as the following:

- Never treat more than one-third of the pond at one time with an aquatic herbicide.
- Avoid using aquatic herbicides when water temperatures exceed 80°F since warm water naturally contains less dissolved oxygen.
- Do not store large amounts of animal waste or fertilizers near a pond.
- Divert runoff from barnyards and fields away from the pond.
- Clear long-lying snow from small patches or strips of ice to allow sunlight into the pond, especially in small, shallow ponds.

If oxygen depletion problems persist, consider installing an aeration unit in the pond. Aerators prevent ice formation on ponds, which makes them less susceptible to winter kill. Many types of relatively inexpensive aeration systems are available for ponds. Since oxygen-depletion problems are common in shallow ponds, deepening an existing pond will lessen its vulnerability.

Other less common causes of fish kills include water temperature, diseases, and pollution. Trout are most susceptible to high water temperatures and will begin to die if water temperatures exceed 75°F for extended periods. The first symptoms will be sluggish fish. Trout should not be stocked in ponds that routinely have warm water unless they are going to be harvested before the temperature reaches lethal levels.

Fish diseases are caused by a variety of bacteria, viruses, or parasites. Fish normally fall victim to diseases only when they are stressed by spawning activity or water quality problems. Diseases often affect only one species and rarely cause large-scale fish kills. In most cases, the population will recover. Little can be done to prevent or treat this problem.

Occasionally, fish kills can be traced to water pollutants such as runoff from pesticides or fertilizers applied near the pond. In this case, fish kills are usually observed within one or two days after a heavy rainstorm. Many pesticides, especially insecticides, used on crops or lawns are toxic to fish. Avoid applications immediately before heavy rainfall and direct surface runoff away from the pond. Aquatic herbicides that kill plants and algae may also kill fish. Some herbicides, like copper sulfate, are extremely toxic to fish if they are overapplied. Carefully follow the herbicide label to ensure that you don’t apply too much herbicide to the pond.

A Final Word

Pond fisheries can provide great sporting and aesthetic entertainment when properly managed. Problems with unbalanced populations, unwanted fish, or fish kills may occur but most can be solved with the ideas presented in this fact sheet. Once the source of the problem is identified, patient and careful management schemes will usually provide satisfactory results over time.

More Information

Penn State Extension has many fact sheets and publications related to pond management. For more detailed information on pond fisheries management, consult the publication titled Management of Fish Ponds in Pennsylvania. Publications are available from your local county extension office or online.

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