

Ornamental Fish Ponds, Waterfalls and Streams

An overview of ornamental fish pond location, design and construction.

By Stephen M. Meyer

By far, the dominant form of fishkeeping in the United States today is the home aquarium. A rectangular glass tank is a window to the aquatic world. Aquarists wishing to challenge their fishkeeping skills often turn to breeding fish or branch out from freshwater to saltwater aquariums. For a different perspective on the hobby, outdoor fishkeeping in artificial ponds and streams is yet another way to greatly expand your fishkeeping experience and enjoyment. In some ways, it is quite different from aquarium-related fishkeeping.

In the past, the installation of an ornamental pond meant massive construction (with reinforced concrete) and great expense. Today, the availability of rugged, long-lasting, inexpensive liner materials on the retail market allows anyone with a little spare time to move into the world of outdoor fishkeeping for little more than the cost of the average 55-gallon aquarium setup.

Under no circumstance should you use an ordinary swimming pool liner for a fish pond project. These liners are impregnated with chemicals to retard mildew and algae that will kill your fish. Use only fish-grade pond liners.

Because the focus of this article is on ornamental ponds and water features, not intensive fish-rearing ponds, no filtration system is required. What is required, of course, is a very low fish load. This could be two or three medium-sized goldfish (or the equivalent in other species) per 300 gallons of pond volume.

Ornamental water features — ponds, streams and waterfalls — place fishkeeping into the larger context of the surrounding environment. Landscaping and garden construction (e.g., decks and porches) are as much a part of the pond as a lighting hood or filter is part of an aquarium. Thus, as I discuss some of the basic principles involved in designing and building ornamental ponds, frequent reference is made to the surrounding environs.

Inspiration and Ideas

Ornamental pond designs tend to follow one of two traditions: European or Oriental. Anyone who has seen a French or Mediterranean garden is immediately struck by the formal geometry — a Euclidean fantasy. Plantings, pathways and water features are all cast in grand forms of triangles, pyramids, spheres and rectangles.

In contrast, the Oriental garden leans in the direction of nature. Plants and water features are cast in irregular and often distorted shapes to mimic the scenery of harsher environments. Japanese-style garden and ornamental pond designs are especially suited to small spaces, where informal composition and irregular shapes create the illusion of greater spaciousness.

Whichever tradition you intend to follow, you can save yourself considerable time and frustration with a little preliminary learning. Spend some time looking at established ornamental ponds. Local pond-oriented clubs can help to arrange pond visits in your area. Many clubs also have pond design and construction workshops, and the membership is a terrific reservoir of experience. Be aware, however, that some long-time pondkeepers are founts of misinformation and know little about the biology of ponds.

Books — especially large picture books — are an excellent source of ideas. As you find images that are especially appealing, try to determine which particular aspects and characteristics have sparked your interest. The idea is not to replicate something you see elsewhere, but rather to learn what you like and dislike and then combine the strong points in your own design.

If you are considering an Oriental-style pond, you will find it worthwhile to visit some natural water features — ponds and streams — in your area. Develop a sense of how these features fit into the local environment.

Ponds

Planning your pond involves several simple decisions. The most obvious are: Where to put the pond? How large should the pond be? What shape is best?

One can find many "rules" about where to put a pond, or where not to put one. Practical experience shows that, for the

most part, these rules can be ignored if you are prepared to accept some tradeoffs. For example, we are told never to place a pond under trees, especially oak trees. If you shudder at the notion of skimming leaves out of the pond during the fall and dredging the pond bottom for leaves in the spring, this is good advice. On the other hand, some heavily treed locations are among the most beautiful places to put a pond. The natural shade helps to limit solar heating of the water and inhibit algae growth that turns the water pea-soup green and reduces visibility.

Conversely, others advise against placing a pond in full sun because the intense summer sunlight can cause extreme water heating. If your pond is going to be plantless, and full of koi, this is good advice. But if you want to have a natural garden pond with many blooming water lilies, iris and submerged pond plants, then a location that receives more than six hours of direct sun daily is essential. In short, the more heavily you plant your pond, the greater the allowable exposure to sunlight.

As you look around for a suitable place for the pond, try to avoid areas where rainwater runoff might flow into the pond and cause contamination problems. For example, you would not want to locate the pond at the bottom edge of a grassy slope where insecticides or weed killers might be used during the year. Rain could wash these chemicals into the pond and kill the fish and plants. Similarly, placing the pond too close to the house raises the possibility that runoff from the roof will flow into the pond (it also makes house maintenance difficult!). Of course, there are many "engineering" tricks that you can use to negate these problems and place the pond where you like, but it always pays to think this through ahead of time.

How Large?

A pond in the ground always turns out to be smaller than the impression created by plans on paper. A 100-gallon pond may seem huge to someone used to a 20-gallon aquarium, but out in the backyard it will be a puddle. As is true with aquariums, the larger the pond, the more stable the water conditions over the long term. Being outdoors, environmental conditions — wind, rain, bugs, birds, blowing leaves and dirt — can really play havoc with water quality. The smallest practical pond, in my opinion, is one that is in the 150 to 200 gallon range. This is equivalent to an oval pond about 4 feet long, 3 feet wide and 2 feet deep.

Of course, land availability and aesthetics will dictate the practical pond size. Within those limits, more is better. Most of the successful ornamental ponds I have seen hold between 1000 and 2500 gallons.

What Shape?

An ornamental pond can have any shape, but keep in mind that its main purpose is to offer easy and enjoyable viewing of your fish. Viewing distances and angles are important in determining pond shape. If you design a circular pond that is 12 feet in diameter, do not be surprised if you rarely get a glimpse of your fish. They will instinctively stay in the middle, well out of sight.

I have found that irregularly shaped ornamental ponds where the maximum width is never greater than 8 feet offer the best fish-viewing opportunities. If you prefer a formal pool, perhaps a clean rectangular shape, I would still keep the width to 8 feet or less. Besides viewing considerations, basic pond management (e.g., leaf skimming and fish netting) will never be very strenuous if all sections of the pond are no more than 4 feet from the "shore."

No matter what shape you choose, the minimum pond depth should be at least 2 feet. This ensures that there will be at least 2 cubic feet of water (15 gallons) for every square foot of pond surface area. Experience shows that this offers more stable water conditions and makes control of suspended algae (the stuff that turns ponds pea-soup green and hinders fish viewing) somewhat easier. Once the pond dimensions are set, you can use this information to estimate the size liner you will need. (See sidebar entitled "Choosing the Correct Size Liner.")

Study the topography of the area where you are considering putting your pond. Try to imagine a shape that fits the natural contour. One way you can visualize the pond is to lay out a garden hose on the ground and outline alternative pond shapes. If you are considering incorporating a stream or waterfall into the pond, then you should look for features in the terrain that will help these new elements appear natural.

Give some thought to how you can use the soil that will be removed in digging the pond to create interesting relief around the it, such as to level the pond sides (on sloping land) or to support a waterfall or stream. In fact, people with very hilly or sloping yards might consider breaking the overall pond project into several smaller ponds, each at a different level in the yard. These can be set up as independent ponds, but a more interesting arrangement is to link them via a series of streams or water falls. Both visual and sound effects can be quite dramatic as water flows from pond to pond, cascading down small waterfalls and weaving around trees and bushes.

Pond Installation

Many books and pond club magazines, such as KOI USA, describe liner pond construction in great detail. Tetra supplies well-illustrated instructions with their pond liners. Therefore, I will only cover the rudiments here.

The most trying part of pond construction is digging the hole. Hiring a backhoe digger can save considerable time and energy, but final shaping will have to be done with a shovel. Inaccessible yards or courtyards demand hand digging. Whatever shape you choose for your pond, be sure to include a lip around the pond that is about 8 to 10 inches wide and 8 to 10 inches deep. Stones and plants will be placed along this lip to hide the liner where it extends above the water surface. Check and recheck the sides to make sure that the top of the pond is even all the way around.

The bottom of the pond should be sloped. If you use a filtration system or are including a waterfall or stream in the design, the deepest point along the bottom should be at the opposite end of the pond from where water enters the pond. This way, material that settles in the pond will tend to collect at one end, where it can easily be removed.

Once the basic pond excavation is completed, it is essential to remove any stones, tree roots or other objects that might puncture the liner under the heavy weight of the water. Smooth out the soil surface. Old carpet, carpet padding, an inch of wet sand or even newspapers can be used to line the hole to protect the liner.

Unfold the liner carefully in the hole and drape it loosely along the side. Place a few stones on the corners to hold the liner in place, and begin to fill the pond. As the water pulls the liner into place, adjust the liner material so that it sits flat against the sides. Some creative folding will allow the liner to bend around odd corners.

As the pond fills, check to make sure that the sides are roughly even. Make adjustments — adding or removing soil — where necessary. Once the pond is full, all that remains is to place the rockwork around the lip and then trim off the excess liner.

Choosing the Correct Size Liner

The size of liner you will need depends on the actual dimensions of the pond. The liner length should equal the sum of the pond length, plus twice the pond depth, plus an additional 2 feet. Similarly, the liner width should be the pond width, plus twice the pond depth, plus an additional 2 feet. For irregularly shaped ponds, be sure to measure the maximum length, width and depth. In all cases, the pond dimensions include the lip that runs around the pond to hide the liner.

Waterfalls

A waterfall plays two roles as a pond feature. One is, of course, aesthetic and the other is functional. Splashing water cascading over and around large stones can add wonderful visual effects to an ornamental pond. The area on either side of the falls can be planted to create a natural feeling, and the sounds will serve to draw attention to this focal point of the pond. The sound of flowing water will also attract a wide variety of birds to your garden.

The functional role is far more important to the fish: a waterfall aerates the pond water, driving out carbon dioxide and adding oxygen. I strongly advise you to include an aeration feature — a waterfall or stream — in any pond design.

The more steps the water drops over on its way to the pond, the greater the aerating effect. Thus, a gently sloping cascade where the water bounces from level to level is ideal. The sound from such falls also tends to be gentle and more pleasing. Conversely, high falls, where water drops great distances directly into the pond may look dramatic, but they are not very effective aerators and the roar of crashing water can be distracting rather than restful.

Building the Waterfall

Building a waterfall using pond liner material is a simple weekend project. All that is involved is some light digging and a little creative stone placing.

The height and length of the falls can be whatever seems to fit the site in a natural way. I suggest you consider a waterfall that has a "rise-to-run" ratio of no more than 1 to 1. The rise is the vertical distance from the pond surface to the top of the falls. The run is the horizontal distance along the waterfall course parallel to the ground. If space permits, rise-to-run ratios of 1:2 or more can produce wonderful effects. However, be careful to keep the waterfall in proportion to other features in the yard. A very high waterfall will look unnatural and contrived unless the local terrain is suitably rugged.

To start with, you might begin with a waterfall design that has a rise of about 18 inches above the pond surface and consists of five steps. The width of the falls should be kept in proportion to the rest of the project, but the volume of water

you plan to pump over the falls should also be considered. For example, 300 gallons per hour will produce a thin flow of water — about ¼-inch deep — over a 6-inch sill. This could still look quite natural in a waterfall that was 18 inches wide and punctuated with large stones to divert the water into narrow paths down the falls. This is something you will have to "eyeball." (Doubling the flow rate allows you to either double the sill width or double the water depth.)

The dirt from the pond excavation is used to build the supporting mound. Once you have decided on the waterfall size, lay out the waterfall course in the mound and cut in the steps. Remember, the greater the number of steps the better the aeration and the more gentle the sound. The waterfall course should be cut into the mound about 8 to 10 inches deep, and each step should slant back into the mound to provide a reservoir about 4 inches deep at the back.

The dimensions of the liner section are determined by the length and width of the waterfall. Place one end of a tape measure at the top of the falls and let it "flow" down along the course being careful to stay in contact with the waterfall bed. Measure all the way down to the pond surface. Next measure the width of the falls at the widest point. Add 2 feet to both the length and the width. This is the size liner material you will need.

Place the liner in the waterfall bed and use large stones to define the course along the edges. Do not trim the liner edge until the waterfall is completely finished! Stones are also placed along the outer edge of the waterfall to hide the liner edge. Slate, flat stone, rock and gravel can be placed all along the waterfall course to hide and protect the liner. Remove the existing stones on the pond lip where the waterfall connects. The waterfall liner should overlap the pond liner on the lip, and then the stones can be replaced.

The pump to drive the waterfall should be placed at the end of the pond opposite the waterfall to provide for the most effective circulation. If you are going to use a submersible pump in the pond, you will need to protect it from sucking in debris. You might consider placing the pump with a filter screen in a 5-gallon pail and then filling the pail with ½-inch stone. Submerge the bucket at the far end of the pond. (This will also act as a small biological filter, though that is not the real purpose here.) You can run the pump hose that delivers water to the falls along the bottom of the pond, or you can bury it along the side of the pond. The hose spout should wind up behind the falls and is hidden in the rockwork and plants at the top of the falls.

Once you have water flowing, you can "tune" the falls by strategically placing larger stones in the water course itself. This lets you create interesting twists and turns in the water flow as it makes its way down the falls to the pond. You will have to play with the waterfall for a while to get it the way you want it. Because the liner used in the waterfall will cost less than \$20, you may find yourself redesigning and improving the waterfall several times over the next few years.

Streams

An alternative to a waterfall, and one that I am becoming increasingly fond of, is a stream. A shallow stream feeding into a pond is a far more efficient aerator than a waterfall, and the sight and sound of a babbling brook is quite a contrast to a splashing waterfall. For that matter, a deep stream can be designed as an alternative to a pond!

A stream is an excellent place to plant iris and other bog plants. Anchored in the stream's gravel bed, these plants will provide vegetative filtration of the circulating water. Birds and other animals will come to drink and bathe.

From the design and construction point of view, a stream is just a very long but narrow pond. Using liner material, you can make your stream wind around trees, stones or other garden features. The width and length can be whatever you like. If the stream is intended primarily to aerate a pond, it should be just a few inches deep, with the water surface riding just above the stone bed. Streams intended as an alternative to a pond should be at least 18 inches deep and the water surface should be kept about 6 inches below ground level. (A stream 30 feet long, 2 feet wide and 1 foot deep will hold 450 gallons.) You should dig in a lip on both sides of the stream — as explained in the pond section — so that the liner edges can be hidden with rockwork.

After you dig out the stream bed, you should dig a narrow channel down the center in order to bury the return piping from the pump. Remove any stones and roots and smooth out the stream bed. Lay in the pipe, cover it with sand and then place the liner in the bed. Locate several rocks on the liner edge to hold it in place and then fill the stream with water. Allow the liner to adjust itself under water pressure and then begin to line the stream sides and lips with stones. Rock and gravel are then spread along the bottom to cover the liner on the stream bed.

The procedure for connecting a stream into a pond — if that is your plan — is the same as that used for the waterfall. In this case, the water surface of the stream will have to be slightly above the pond water surface when water is flowing through the stream.

Maintenance

There are four basic maintenance procedures to consider. The first is to skim off leaves and other debris that fall into the water on occasion. It is much easier to remove this material from the water surface than to attempt to snag it once it has sunk to the bottom.

Second, you should change 5 to 10 percent of the pond water each week. In areas that receive significant rainfall, this may not be necessary at all.

Third, feed your fish sparingly. Presumably, they are munching on pond insects, algae and plants. You will definitely notice that your fish grow larger and faster outdoors. This is because food sources in the pond allow the fish to feed continuously, but in small amounts.

Fourth, if you have a pump, check the filter screen any time you notice a reduction in waterfall or stream flow. I recommend you clean the pump filter screen, or the gravel in the pump bucket, weekly even if there is no apparent flow reduction.