Growing Trout in New Mexico Ponds

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INTRODUCTION

People have been raising trout in captivity for more than 150 years in the United States. Initially, trout were reared to replace wild stocks that were declining due to a variety of reasons. Today, trout are reared in captivity to supply stock for public and private lakes, ponds and streams. In addition, trout are cultured and sold as food items through restaurant and grocery markets. This guide provides prospective aquaculturalists with recommendations for culturing trout in ponds in New Mexico. Specifically, guidelines on site selection, pond size, species selection, stocking and feeding, and harvesting are given. While site-specific issues should be considered on a case-by-case basis, the following recommendations provide a general overview.

SITE SELECTION

When developing a pond for trout production, multiple factors must be considered to ensure success. The three most important factors to investigate are water quantity, water quality and the subsoil type found at the proposed site (Barrington, 1983).

Water Quantity

Before any plans are made to construct a recreational trout pond, a thorough study of the water supply should be completed. A natural spring with good quality water makes a perfect supply for a trout pond in New Mexico. Small streams and large ditches may be sufficient to supply a pond that has an impervious subsoil. Water from a drilled well can be a reliable water source in many cases. In most instances, water availability often dictates the size of the pond that can be constructed.

Water Quality

In addition to abundant quantity, high-quality water is essential for trout production in ponds. Dissolved oxygen, temperature, suspended solids, dissolved gasses, pH, mineral content, hardness and alkalinity of the water supply should be analyzed before any site plans are initiated to make sure that the proper environment for trout production exists.

Water temperature usually is the most critical water quality factor, because temperature affects survival, growth and egg production. Therefore, water temperature plays a critical role in the ability of a pond to produce trout (table 1). In general, trout can live in water temperatures of 33-78ºF, but they grow most rapidly in 50-55ºF water.

The list of water quality components given in table 2 is not complete. However, testing for

Table 1. Temperature ranges for trout survival and optimum growth (Shelton, 1994).

Species	Survival (ºF)	Optimum Growth (ºF)
Rainbow trout	33-78	50-55
Brook trout	33-72	45-55
Brown trout	33-78	48-55

these factors with a portable water quality test kit will give an initial indication of water quality for rearing trout. A complete analysis should be conducted to determine trace metal concentrations and other potential toxicants.

In addition to proper water temperatures and chemical components, appropriate dissolved oxygen and pH levels are essential to successfully produce trout in ponds (table 2). For example, fish most commonly die in New Mexico because of a lack of oxygen in the water, which often occurs on cloudy days with little wind or when water levels are low. If trout are coming to the surface in early morning and gasping for air, turn fresh water into the pond or aerate the pond immediately. Aerate by pumping water from the pond and returning it through sprinkler heads. Also, special aerators can be purchased for this purpose.

Table 2. Water quality criteria for trout (Cain and Garling, 1993; Shelton, 1994).

Parameter	Level
Dissolved oxygen	5-12 ppm*
Carbon dioxide	< 10 ppm
pH	6.5-8.5
Total alkalinity (as CaCo3)	10-400 ppm
Total hardness (as CaCo3)	> 20 ppm
Manganese	< 0.01 ppm
Iron	< 1.0 ppm
Nitrate	< 3 ppm
Zinc	< 0.05 ppm

*Parts per million.

Subsoil Type

Soil is an important factor to consider when constructing a trout pond. It is essential to test the subsoil of the proposed pond site using a soil test. If the soil samples have a clay content of 30 percent or more, conditions for building a pond are ideal (Barrington, 1983). If the clay content is considerably less than 30 percent, it becomes necessary to bring in clay from elsewhere. This adds to the initial cost of developing a recreational pond. If the subsoil is too well-drained and there is no readily available clay, a pond liner can be used on the pond's bottom. However, pond liners are expensive and may require specialized installations.

POND SIZE, DEPTH AND CONSTRUCTION

Trout can be raised successfully in a pond of almost any size. However, trout ponds smaller than one-third of a surface acre generally require supplemental feeding. A pond of 1 to 5 acres is an ideal size for recreational purposes (Marriage et al., 1971). Again, water supply often is the factor that limits pond size.

As a general rule, a depth of 3 to 4 feet is ideal for trout ponds supplied by a constant water flow. If the pond is filled only during rainy seasons, water should be at least 10 to 12 feet deep over one-quarter or more of the pond (Marriage et al., 1971). The pond's shore also should slope as abruptly as possible to a 3-foot water depth.

It is a good idea to have a drainage outlet in the pond. This allows removal of organically rich water from the pond's bottom. Additionally, water levels can be lowered to repair structures and control weeds. Also, water temperatures can be lowered and oxygen levels increased by increasing the inflow of fresh, cool water and releasing warm water through the drainage outlet.

SPECIES SELECTION

Trout are farmed both for sale to markets and for stocking recreational ponds. The rainbow trout (*Oncorhynchus mykiss*) is the most commonly raised species. Brown trout (*Salmo trutta*) and brook trout (*Salvelinus fontinalis*) also are stocked in recreational ponds (Shelton, 1994). However, recreational ponds primarily are stocked with brown trout or rainbow trout, which are more readily available from fish farms. The brown trout lives longer and grows larger in many recreational ponds, but it is more cannibalistic and harder to catch than rainbow trout. Also, the brown trout grows slower than the rainbow trout (Marriage et al., 1971). Therefore, brown trout generally are not recommended for stocking recreational ponds in the West.

Rainbow trout are stocked most commonly in New Mexico ponds, because they thrive under a wide range of conditions, grow faster than other

trout species and are more widely available from hatcheries. Occasionally, both rainbow and brook trout are stocked in the same pond for variety. Neither species is difficult to catch in the cooler months of the year, but brook trout can be "fished-out" much more readily (Marriage et al., 1971). If both rainbow and brook trout are stocked, they should be roughly the same size so that one species doesn't prey heavily on the other.

Rainbow trout

Description

The top of the rainbow trout's head, back and upper sides (*Oncorhynchus mykiss*) are bluish green to brownish with numerous small dark spots (fig. 1). The lower sides are silvery gray and sometimes have a pink to reddish stripe. Both dorsal and caudal fins have rows of dark spots and a black margin. In addition, the caudal fin is forked moderately.

Habitat

The rainbow trout is found in Pacific Coast drainages from Rio del Presidio in Durango, Mexico, north to Kuskokwim River in Alaska. Rainbow trout are found in cool, clear lakes and cool, swift streams. Overhanging vegetation on banks, deep pools, submerged vegetation, log jams and boulders are essential habitat components for escape and resting cover. Optimal dissolved oxygen levels appear to be at least 7 parts per million (ppm) at temperatures less than or equal to 59ºF and at least 9 ppm at temperatures greater than 59ºF. Low dissolved oxygen concentrations of 1.5-2.0 ppm are tolerated for short periods, although the incipient lethal level for adults and juveniles is approximately 3 ppm.

Food

Aquatic insects provide most of the rainbow trout's diet with the remainder including ants, grasshoppers, caterpillars, worms, other fish and other animals that fall into the water. In streams, the rainbow trout feeds primarily on drift organisms, while in lakes, bottom-dwelling invertebrates and zooplankton (tiny, floating or weakly swimming aquatic animals) are preferred. Larger rainbow trout, especially those that occupy lakes or other impounded waters, readily add smaller fish to their diet as well.

Reproduction

Rainbow trout usually migrate upstream in the spring to spawn when water temperatures are 41-59ºF. However, fall spawning also occurs. The female constructs a redd (nest) in gravel riffles (typically at a depth of 6 inches) and covers the reddish orange eggs with gravel.

Brown trout

Description

Brown trout (*Salmo trutta*) are olive to brown on the upper regions, transitioning to a light brownish yellow on their sides. Their abdomen is yellowish white, and there are large, dark spots located on the back fins (fig 2). Large, dark spots also occur on the head and body. These dark spots are confined primarily to the upper regions of the fish's body, although some black spots do occur below the midline. Smaller red spots, encircled by a white halo, occur along the midline. The reddish spots, together with large conspicuous dark spots on the sides and a lack of spotting on the tail fin, distinguish brown trout from other trout species.

Habitat

The brown trout, which is native to Europe and western Asia, was first introduced into the United States in 1883, and now occurs widely throughout much of the United States and Canada. Brown trout inhabit small to large cold water streams, ponds and lakes. They tend to occupy deeper, slower moving and warmer waters than other trout species. Optimal dissolved oxygen levels are thought to be at least 9 ppm at temperatures less than or equal to 50ºF and at least 12 ppm at temperatures greater than 50ºF. Lethal dissolved oxygen concentration for adults is approximately 3 ppm. Brown trout occur within a pH range of 5.0 to 9.5, although optimal growth occurs at a pH of 6.8 to 7.8.

Food

Young brown trout feed principally on aquatic and terrestrial invertebrates. Larger individuals (those at least 9.8 inches in total length) feed pri-

Figure 1. Rainbow trout (John Scarola, American Fisheries Society Collections).

Figure 2. Brown trout (Duane Raver, U.S. Fish and Wildlife Service).

Figure 3. Brook trout (John Scarola, American Fisheries Society Collections).

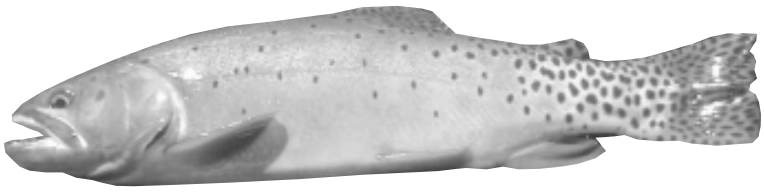

Figure 4. Rio Grande cutthroat trout (David Cowley, NMSU).

marily on bottom-dwelling aquatic invertebrates and small fish. Feeding is most intense during twilight hours but can occur anytime during the day or night.

Reproduction

Spawning typically occurs in streams or along rocky shoals in lakes during late fall and early winter. Homing instinct is highly developed, and spawning adults will return to the stream where they were spawned. Redds (nests) are excavated by the female, preferably in gravel at the head of riffle areas or the tail of pools. After the eggs are laid and covered with gravel, the nest is left unprotected.

Brook trout

Description

Brook trout (*Salvelinus fontinalis*) have light, wavy lines on their backs and dorsal fins. On their sides, blue halos around pink or red spots are evident (fig. 3). The caudal fin is lightly forked to nearly straight-edged with black lines. The brook trout also has red lower fins with a black line behind a white edge.

Habitat

The brook trout is native to eastern Canada and northeastern United States and has been introduced widely throughout much of the United States and Canada. The brook trout primarily is found in cold, clear headwater streams. But it also lives in cold lakes.

Food

Brook trout feed on a wide variety of food organisms and ingest whatever is readily available. Brook trout in streams rely heavily on insects and often supplement their diet with zooplankton. However, a variety of other foods are taken, including small fish. Most feeding occurs in the early morning and evening.

Reproduction

Spawning occurs in late fall to early winter in areas of current, either riffles or spring seepage areas. Redds (nests) are constructed in gravel by the female. The eggs are covered with gravel after they are laid.

STOCKING RECOMMENDATIONS

Once a new pond has been constructed and filled, there should be no hurry to stock it with fish. In about a month, the water will clear but the natural ecology may take a year to develop. This can be expedited by inoculating the pond with several gallons of water from a well-established pond. The number of trout a pond will support depends on its surface area and water quality, as well as fish size.

If the stocking number is slightly low, the fish will grow faster. If your pond is slightly overstocked, individual fish may not grow as fast, but nearly as many pounds will be produced in a given time. Either spring fingerlings (2 to 3 inches long, two or three months old) or fall fingerlings (5 to 6 inches long, seven or eight months old) can be used in stocking ponds (Harbell and Carkner, 1981). Both types reach catchable size during the spring following stocking. However, results with spring fingerlings are variable, sometimes leading to poor survival except in ponds fed by strong permanent springs. Therefore, usually it is wiser and more economical to stock the larger, fall fingerlings.

Stocking at the rate of 100 to 200, 5- to 6-inch fingerlings, or 200 to 400, 2- to 3-inch fingerlings per surface acre gives good results in most fertile ponds (Harbell and Carkner, 1981). Another alternative is to stock 300 to 400, 3- to 4-inch fingerlings in the spring, so that the trout grow to 8-10 inches by late summer or fall. With these stocking rates and favorable conditions, trout should grow about 1 inch a month until they are 9 to 10 inches long. Eating-size trout also can be stocked at about 100 to 200 per surface acre. This is a quick way to start fishing, but it is very expensive compared with stocking fish fingerlings (Harbell and Carkner, 1981).

Trout often are unable to compete successfully with most other types of fish in a pond, because they do not multiply as rapidly or compete well for the food and oxygen (Marriage et al., 1971). Therefore, do not stock other kinds of fish along with trout. If undesirable fish are already in the pond, drain it and remove them before stocking with trout (Harbell and Carkner, 1981).

HOW TO STOCK A POND

There are specific laws and regulations for stocking fish in private ponds in New Mexico. Contact the Fisheries Management Division of the New Mexico Department of Game and Fish at (505) 476-8055 prior to stocking trout in ponds. **An "Application to Import Fish into New Mexico" must be completed and approved by the department before stocking any pond. In addition, the department will provide a list of trout vendors certified for use in New Mexico.**

Because trout are sensitive to sudden changes in temperature, oxygen, carbon dioxide and pH, never put the fish directly into the pond from a shipping container (Marriage et al., 1971) and avoid stocking trout in water above 65ºF.

Pond water should be added slowly to the water in the shipping container until there is no greater than a 6ºF difference between the two. Temper the water in the shipping container in stages, taking about 15 to 20 minutes to complete the process. If the trout show signs of distress, such as turning on their sides, delay further mixing until they act normally.

After mixing, place the fingerlings carefully into the pond. Never throw fish into the pond, because this will cause shock and bruising. Choose a fairly deep part of the pond, previously cleared of weeds. Lower each container into the water, and allow the trout to swim out slowly. Any thick weeds nearby also must be checked to make sure no fish have become entangled in them. During the first week after stocking, the lake margins should be checked often and dead fish removed.

FEEDING TROUT

The trout's natural diet in ponds devoid of other fish is typically zooplankton, aquatic insects, other aquatic invertebrates and terrestrial insects. Allowing trout to feed only on natural forage generally yields approximately 90 pounds of fish per acre. Most private fee-fishing operations allow trout to feed solely on a natural diet. Feeding trout artificial feeds increases the carrying capacity of the trout pond. But it also increases the cost of raising fish. Feed costs have been estimated at 60 percent of the total cost of rearing fish (Sloane, 1994a).

By feeding trout, the expected yield can be increased 1,000 to 2,000 pounds per acre (Marriage et al., 1971) if water quality and oxygen levels are carefully controlled. However, this practice generally is used at state hatcheries and aquaculture facilities. Rainbow trout feeds have significantly higher protein levels than catfish feeds. Therefore, use feed specifically made for the species of fish being raised and follow the recommended feeding rate. It is important to note that no matter what the recommendation, feed should not exceed 20 lb/acre/day if aeration is not available. With aeration, the maximum rate should not exceed 100 lb/acre/day (Sloane, 1994b).

Fish feeds are available in two forms: sinking or floating. Although sinking feeds are less expensive than floating feeds, floating feeds are recommended and are used more commonly. Floating feeds allow pond owners to observe the feeding response and to monitor consumption. It takes about 2 pounds of feed to produce 1 pound of trout under favorable growing conditions. Feed only what the fish will eat and be sure not to overfeed. If any food remains 15 minutes after feeding, it probably will not be eaten and the decomposing food will use oxygen and may result in subsequent fish loss. Therefore, remove any floating feed not consumed.

HARVESTING RECOMMENDATIONS

To obtain the greatest return in numbers of pan-sized trout in trout ponds, start harvesting as soon as the trout are 6 to 8 inches long. This will be about 6 to 10 months after stocking the pond with fingerlings. During the second year, the trout should be 12 to 14 inches long. After this, growth will be slow and mortality will be high. Therefore, for maximum yield, pond owners should harvest as many trout as possible in the two years after initial stocking.

At the end of three years, just a few large trout will remain and their total weight will be far below the carrying capacity of the pond. Because trout survival in ponds is extremely low after two years, ponds should be restocked every other year to maintain adequate fishing. Fall fingerlings are

recommended for restocking. They are much less likely to be eaten by the large, holdover trout of the previous planting than are the small spring fingerlings.

POND STOCKING AND NATIVE SPECIES

New Mexico's game and fish department and other Western fish and game agencies have initiated extensive management programs for native trout species. Individuals with private trout ponds may be able to help protect state and private interests by raising native trout species.

Native trout have been the subject of petitions to list as threatened or endangered under the Endangered Species Act (ESA) of 1973. For example, the Rio Grande cutthroat trout, *Oncorhynchus clarki virginalis* (fig. 4) was petitioned for listing in 1998. Litigation following an initial ruling by the U.S. Fish and Wildlife Service (1998) resulted in a reopening of the review process (U.S. Fish and Wildlife Service, 2001). While listing was not warranted (U.S. Fish and Wildlife Service, 2002), the Rio Grande cutthroat trout and other native trout species remain the target of petitions and litigation, especially in relation to public lands use, such as national forests. Private landowners can help keep native species like cutthroat trout from being listed under the ESA by understanding how their private stocking program can affect native species management.

As part of the approval process for trout importation permits, private landowners can expect agencies to scrutinize the location of their ponds (or streams) relative to Rio Grande cutthroat trout populations to ensure that the stocked fish are unlikely to come in contact with native trout (Paroz et al., 2002). Protecting native trout populations from popular nonnative trout will help state agencies avoid ESA listings that transfer management control to the federal government. Federal management of listed species often initiates actions that ultimately can affect private landowners and impair their ability to use their property for personal gain.

LOOKING TO THE FUTURE

Private landowners seeking to stock trout in their ponds and streams may soon have native trout available for stocking. In response to private aquaculturists and Western fish and game agencies, the Western Regional Aquaculture Center solicited proposals in 2001 to develop procedures that will enable private hatcheries to commercially produce cutthroat trout. In New Mexico, the game and fish department is developing a Rio Grande cutthroat trout hatchery broodstock (Cowley, 1993), which may lead to stocks available for commercial production. Not only are native trout beautiful, they also can attain a large size; New Mexico's record cutthroat trout is 10 lb 2 oz from Latir Lakes.

CONCLUSIONS

Before starting a trout pond, make sure to assess the project's feasibility. Consider site selection, water quality, water quantity, species selection and stocking practices. Enlisting the advice and assistance of local experts greatly improves the likelihood of success. A good place to start is with the local Cooperative Extension Service office.

Also, check with the New Mexico Department of Game and Fish about specific laws and regulations for private trout ponds in New Mexico. Permits for effluent discharge, water rights and game fish propagation also may be required from the controlling state agencies. Depending on the facility and operational plans, additional permits may be necessary.

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