

# Winter Culture of Caged Rainbow Trout in the South.

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## INTRODUCTION

Southern ponds and lakes which are 0.5 acre in surface area or larger, and can not be seined, may be suitable for winter cage culture of rainbow trout. Caged trout culture offers an inexpensive, small scale method of fish production. The profitability of caged trout culture may be questionable and requires further investigation.

Most southern ponds and lakes are warm monomictic bodies of water. Warm monomictic describes ponds and lakes which have a water volume which mixes or circulates during the winter months, but does not normally freeze. These bodies of water are often deep and tend to stagnate during the summer. Summer stagnation is caused when cooler, more dense water settles to the pond bottom. This deep water is often deficient in dissolved oxygen. Large volumes of oxygen deficient water may cause fish kills during fall pond turnover. Warmer water remains at the lake's surface causing lake stratification,

To build a cage cut a 4 foot wide x 13 foot long piece of plastic mesh from the roll. The mesh should be sewn with 16 or 18 gauge plastic coated copper wire.

Cage hoops may be made of steel, fiberglass or flexible plastic pipe. The hoops should be spaced approximately 46 inches apart, or almost the width of the plastic mesh, and sewn to form an open cylinder. A third hoop may be

a layering effect created by different water densities. Water density is determined by temperature. A stable winter environment provides conditions which are appropriate for trout production. The growing season is approximately 120 - 150 days, from early to middle November to late March or early April. Trout survival depends

on water temperatures remaining at 68 degrees F (20 degrees C) or lower, throughout the growing season.

## CAGE DESIGN AND CONSTRUCTION

The most popular cage design is cylindrical in shape, and is constructed of plastic mesh. The cage has both a diameter and depth of 4 feet, and a volume of 50.26 cubic feet or 376 gallons. A roll of 0.5 inch plastic mesh, 50 feet in length and 4 feet wide should provide enough material to build two cages.

sewn into the center of the cylinder to provide added support. The cage bottom is constructed by cutting a 4 x 4 foot square of plastic mesh and sewing it to one end of the cylinder. Sewing the cage seam and bottom twice will help prevent fish from escaping if the cage must be lifted or moved. After the cage bottom is sewn into place, the corners of the plastic mesh can be trimmed to

extend a small distance from the outside of the hoop. Plastic coated wire should be used to fasten the entire cage together. A potato bag needle is suitable for sewing with either 16 or 18 gauge, plastic coated wire. The lid is made by cutting another 4 x 4 foot square of plastic mesh and sewing it to a separate hoop. Trim the corners of the lid in a manner similar to that done for the cage bottom.

Six inch long, rubber tie down straps with "S" hooks at each end, are useful for securing the lid to the top of the cage. These straps permit easy cage access. If the fish are to be fed a floating feed, a 1/8 inch plastic mesh feed ring should be used to contain the feed in the cage. Cut a 1 foot wide x 13 foot long piece of plastic mesh and sew it around the outside of the cage, approximately 3 inches down from the top hoop. This cage design would be suitable for both winter trout and summer catfish production. Contact your County Extension Agent or an Aquaculture Extension Specialist for a list of cage culture material suppliers.

## CAGE SITE SELECTION AND PLACEMENT

Fish cages should be placed in pond areas where winds create water

Trout cages should be stocked in early November after water temperatures have cooled and remain below 65 degrees F (18.3 degrees C). Four hundred, trout fingerlings 6 to 8 inches in length (11 to 4.5 fish per lb) should be stocked per cage if 0.5 to 0.75 lb fish are desired at the time of harvest. If fish 0.75 to 1.25 lbs are

movement. Moving water will flush fish wastes from the cage and improve water quality. Cages should be anchored to the pond bottom in at least 6 feet of water so waste material will not accumulate beneath the cage. The top of the cage should float about 6 inches above the water's surface. Cages can be supported in the water column by styrofoam floats, capped-plastic jugs, or suspended inside a floating frame of 3 or 4 inch PVC pipe. A PVC pipe frame is constructed by cutting four, 48 inch pipe lengths and using four, 90 degree pipe fittings to form a square frame. It is important to glue the frame joints together with PVC cement. A flotation frame which comes apart will sink along with the cage. The fish cages should be placed about 20 feet apart, depending on the pattern and amount of water movement in the pond.

The greatest security threat to caged fish is poachers. Placing cages a good distance from the shoreline (and removing boat oars at night), security lights, fences, and the presence of dogs may help to secure the pond area. A remote pond may not be a safe site for cage culture.

## CAGE STOCKING

wanted by spring, 400 advanced trout fingerlings, 8 to 10 inches in length (4.5 to 2.2 fish per lb) should be stocked. The maximum number of trout cages which can be raised per acre of pond requires further investigation. However, a conservative maximum production estimate of 4 cages or 1600 lbs per acre may be realistic for ponds without

aeration or devices which enhance water circulation.

## FEEDING CAGED TROUT

Trout should be fed a feed which consists of 38% protein, 20% fish meal and 12% fat. The feed must contain all the minerals, vitamins, and amino acids which trout require. Feed purchased in 50 lb bags is most convenient for small operations. Bagged feed should be stamped with a manufacture date. Fish feed should not be stored longer than 8 weeks to prevent vitamin loss, otherwise vitamins must be added to restore those lost during storage. Store feed in a cool, dry and rodent free building.

Either floating or sinking trout feed can be offered to caged trout. A floating diet is easier to feed, provided the cage has a feed ring. Floating feed may be more expensive than sinking feed. However, the difference in feed cost is likely to be small unless large quantities of feed are used. If a sinking diet is offered, lift the cage lid and feed the fish slowly until the smaller trout begin to spit out the feed or stop feeding. Fish are fed approximately 2 to 5% of their body weight daily. Trout food conversion ratios should range from 1.5:1 to 2.3:1 (lbs of food to produce 1 lb of fish) for caged fish. Caged fish food conversion may be less efficient when sinking feeds are used. Trout will feed less actively in the mid-winter months if water temperatures have dropped to 40 - 50 degrees F. It may be necessary to reduce the ration to prevent wasting feed. Late afternoon is the best time to feed trout during cold weather since water temperatures will be at their

warmest. If water temperature is between 50 - 65 degrees F, trout should be fed all they will eat. Mortalities and poor feeding response could both be indicators that fish are diseased or suffering from poor water quality. Contact an Aquaculture Extension Specialist as soon as possible if the trout are showing signs of poor health.

Weight samples of 30 - 50 randomly selected fish from each cage, should be weighed and recorded about every three weeks. The fish can be weighed in a 5 gallon bucket which contains 1 to 2 gallons of water. Subtract the weight of the bucket with water from the weight of the bucket containing water and fish. The difference in weight is the number of pounds of fish in the sample. Carefully count the number of fish in the sample while returning them to the cage. Divide the total weight of all fish by the number of fish in the sample to obtain the average fish weight.

A careful count of the fish stocked and mortalities which occur throughout the growing season will provide an accurate inventory of fish in the cage. Use the following example to determine an estimated ration.

In Example 1, the average weight of the fish sampled is multiplied by the number of fish in the cage to estimate the total weight of all trout in the cage. Next, the total weight is multiplied by 3-5% which will provide the ration of feed in pounds.

Example 1.

Weight sample of 37 trout weighing 11.1

lbs = 0.30 lbs per average fish.  
0.30 lbs weight of the average fish in the cage x 379 the number of trout in the cage = 113.7 lbs of fish in the cage

113.7 lbs weight of the fish in the cage x 3% feed rate = 3.4 lbs of feed to be fed per cage, per day.

## OPEN POND CULTURE OF TROUT

Trout may be reared in open ponds where seining is possible in late winter or early spring. Ponds of 4 feet maximum depth, may be too shallow for cage culture. Ponds and lakes may have obstructed basins, or may be too deep to seine. Most ponds and lakes do not have drains. The pond should be test seined to determine if seine harvest is practical. Seine the pond in the late winter or early spring when water levels are likely to be high. For open pond culture, fish should be stocked at 1000 - 1500 per acre. Trout fingerlings must be 10 inches in length or longer, if stocked into ponds which contain largemouth bass. Floating feed should be offered to trout at the same pond location and at the same time of day. Food conversion efficiency may be lower for trout raised in cages than for trout grown in open ponds where other fish are present.

## HARVESTING AND MARKETING CAGE CULTURED TROUT

The advantage to caged trout culture is that the caged fish are easy to feed and harvest. A sturdy, medium sized dipnet with a square or "D" shaped

frame, and a 0.5 inch mesh, knotless nylon bag is preferred for removing trout from cages. Harvested trout should be weighed in fish baskets or perforated buckets in units of approximately 25 lbs. A small platform or hanging scale is adequate for determining the weight of fish. The weight and number of trout harvested should be carefully recorded throughout the harvest process. It is critical that caged trout be harvested alive. Trout should be harvested in late March to early April before water temperatures reach 68 degrees F. The end of March is usually a safe time for harvest. Water temperatures should be monitored throughout the winter production season.

Marketing opportunities for caged trout would include local sales to individuals, small restaurants and fee fishing operations. Check with state fish and game agencies for permit information regarding the sale of aquaculture produced fish. County Health Departments may have additional requirements for operations which want to process fish. The sale of live fish may be more convenient and less expensive to establish than the facilities required to legally process fish. Fee fishing operations would likely stock 300 lbs of trout or more, each week on a Thursday or Friday, during the first few weeks of early spring. Small restaurants may express interest in serving locally grown trout as a special menu item. However, restaurants typically prefer processed fish which are uniform in size in order to maintain uniform portion size.

## ECONOMICS OF TROUT CAGE

The materials for constructing one or two fish cages with floating PVC frames, will cost about \$177.00 and \$252.00, respectively. Cage costs will vary with design, materials used, and the supplier of the material. Four hundred trout fingerlings, 6 - 10 inches in length should cost about \$260.00 or \$0.65 each, when bought in small quantities. Approximately, 500 lbs of feed would be required to grow 400, 6 - 8 inch trout fingerlings to harvest size fish which weigh 0.75 lb each (assuming a 2:1 food conversion ratio). Similarly, about 600 lbs of feed would be required to grow 400, 8 - 10 inch advanced trout fingerlings to harvest size which weigh approximately 1 lb. each (assuming a 2:1 feed conversion ratio). Retail trout feed costs can be as high as \$17.50 per 50 lb bag. Total feed costs for the 6 - 8 inch trout fingerlings, and for the 8 - 10 inch advanced fingerlings, would then be \$175.00 and \$210.00, respectively. Retail trout feed costs of \$12.00 - 13.00 per 50 lb bag are more reasonable. Typical prices paid to commercial trout growers by processors ranges from \$1.10 - \$1.30 per lb. As Example 2. demonstrates, caged trout growers must receive approximately \$2.00 per lb of fish sold in order to profit.

### Example 2.

Cost of the cage	\$177.00
Cost of 400 trout fingerlings	\$260.00
Cost of 600 lbs of trout feed	\$210.00
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TOTAL C OST	\$647.00

## CULTURE

Potential value of 400 lbs of trout sold at \$2.00 per lb.      \$800.00

NET RETURN FOR 1 CAGE      \$153.00

The simplified budget in the example above assumes there is no fish mortality, no labor costs and does not include costs for other equipment such as scales, dipnets and baskets. Cage culture of trout would likely yield minimal profit after the first season. However, the cost of the cage should be recovered after the first harvest of trout is sold. Cages should last about 3 or 4 years if used continuously, with raising catfish during the summer. Feed costs can also be reduced substantially if feed is purchased from the manufacturer. One cage of harvest sized trout sold at \$2.00 per lb could potentially generate \$100 - \$400.00 profit.