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Trout Farming

A Guide to Production and Inventory Management

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The carrying capacity of a trout rearing unit is dependent upon fish size, and on several water quality factors, principally oxygen content, temperature, water flow and volume. Rearing units most common to commercial trout farms in the South are a series of rectangular concrete tanks, sometimes called raceways. Carrying capacity is usually expressed in terms of pounds of fish per cubic foot of rearing space or water flow. A number of different formulas have been devised to calculate carrying capacities, taking into account oxygen consumption, rate of increase in fish length, water volume and temperature, feeding rates and other factors. As long as the appropriate limiting factors are monitored by the operator, the choice of a particular estimator is a matter of operator preference.

The easiest method for estimating maximum fish density for a rearing unit is to keep tank loadings within a level of 0.5 to 1 times the length of the fish (in inches) in pounds per cubic foot (for example, 2-inch fish at 1 to 2 lbs/ft^3, 4-inch fish at 2 to 4 lbs/ft^3). The multiplying factor is referred to as a **Density Index.** Many trout farmers simply stock all sizes of fish at 4.5 lbs/ft^3 as an upper limit for fish density, although with proper management, the density can be much higher.

The Density Index estimates only the appropriate density of fish without regard to water flow in the system. Water flow rate will determine how quickly other water quality characteristics become limiting in each unit. An estimate of the–appropriate capacities of trout relative to water flow is to keep loadings within a range of 0.5 to 1 times the fish's length in pounds per gallon per minute (gpm) of water flow (for example, 2-inch fish at 1 to 2 lbs/gpm, 4-inch fish at 2 to 4 lbs/gpm). This factor is referred to as a **Flow Index,** and works on the assumption that inflowing water is at or near saturation of dissolved oxygen. In a properly designed facility, the estimate of carrying capacity obtained from the Flow Index and the Density Index will be nearly equal.

Limiting factors

The trout culture industry in the South has developed mostly in the Southern Appalachian area, and depends primarily on diverted surface runoff for water supplies. Dissolved oxygen and ammonia (unionized) concentrations are the primary limiting factors in these culture systems, with oxygen normally the most critical. The surface waters typical of the areas where trout farming takes place are poorly buffered (total alkalinity <10 ppm), and have a pH averaging 6.5 to 7.0, which results in a high proportion (99 percent) of ionized ammonia, relatively non-toxic to fish. In areas where water supplies are more alkaline and have a higher pH (> 7.5), oxygen is normally the critical limiting factor for the first three to six uses of the water, after which the buildup of unionized ammonia will prevent further usc of the water for trout production.

Tank loadings should be decreased when oxygen levels at the outflow drop below 6 parts per million (ppm). Every trout farm should have a dissolved oxygen meter. Several models are available buy the best you can afford and know how to use it. Smaller farms may find a chemical oxygen test kit more economical, although somewhat more difficult to use. These kits are potentially very accurate, but arc relatively cumbersome and time-consuming to use with multiple individual rearing units.

Grading

During the production cycle, fish should be graded periodically to maintain size uniformity. Trout usually are graded four times during

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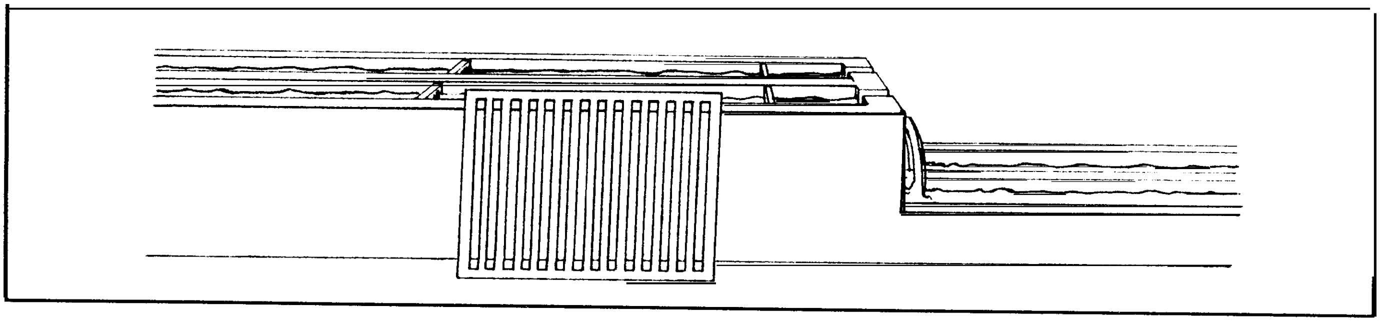

Figure 1. Bar grader for trout production.

the period from fingerling stocking (about 3 inches) until they reach a marketable size (12 to 16 inches). Frequency of grading will vary according to individual circumstances, but should routinely be done whenever loadings need to be decreased.

The simplest graders are made of wooden frames that are as long as the tank is wide, and slightly higher than the water is deep. Pieces of aluminum tubing, PVC pipe or smooth wood are spaced at regular intervals across the frame to perform the grading (Figure 1). The grader is put in the top of the tank and fish are crowded down toward the tailscreen. Fish too large to pass through the bars remain at the bottom of the tank, where they can be moved to another tank with fish of a similar size. The smaller fish swim through the bars and remain in the same tank, although 10 percent or more usually remain behind the grader. This method works best with fish larger than 2 to 3 inches long. Grading fish smaller than this is usually not necessary and will be stressful for the fish. Mechanized graders are available, and function by pumping the fish onto a series of grading bars. These systems are very effective when properly sized for the fish to be graded, but are difficult to justify economically for most smaller trout farms.

Inventory

Fish in each tank on the farm should be sample counted at least monthly to assure that the fish are growing as expected and to keep track of loading rates. Feeding according to a feeding rate chart allows you to check daily ration amounts and adjust them as necessary. When sample counting, the fish should be crowded starting from two-thirds of the way down the length of the tank and moving toward the head of the tank. The smallest, weakest fish, which will linger toward the tail of the tank are not representative of the general fish population and will be left behind. With the fish loosely crowded at the head end of the tank, a sample of fish is netted into a bucket of water suspended from a spring tension scale. The weight is recorded and the number of fish is determined as they are poured back into the tank. If fish are graded rather uniformly, three or four samples from different areas are sufficient. Fish size (expressed as number per pound) is calculated by dividing the number of fish in each sample by the total sample weight. The average for each tank is then used to estimate the weight of fish in the entire tank.

Remove mortalities from each tank on a daily basis and record the numbers. Dead fish left in tanks area potential source of disease and are indicative of poor farm hygiene. Analyzing mortality rates in each tank may indicate developing fish health problems before they become severe. Mortalities should be subtracted each month from estimated population totals to maintain an accurate inventory.

Earthen pond systems provide much more of a challenge in managing fish populations than do tank systems. Most often, fish are stocked into earthen pond systems at four fish per pound and are not graded until harvested for market. The carrying capacity of an earthen pond can be estimated similarly to a tank system if the water exchange rate is approximately 30 minutes or less. If turnover rate is longer than this, the capacity is a function of the ratio of surface area to water volume, inflow rate and oxygen demand of the sediments. The carrying capacities of earthen ponds are best determined by measuring the oxygen content of the pond and outflow waters, and maintaining good production records.

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