

## **RAINBOW TROUT PRODUCTION IN WATER RECIRCULATING SYSTEMS**

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Recirculating aquaculture systems (RAS) can provide control of water quality and temperature to optimize fish production and health, provide barriers that prevent fish escape and entry of pathogens, contain and remediate waste flows to curtail environmental impact, and minimize water use. RAS can also allow a fish farm to locate where power, feed, or oxygen are relatively inexpensive, where environmental impact can be minimized, where water is in short supply, and adjacent to their primary markets. With increasing environmental restrictions and decreasing groundwater and spring water supplies in most areas of the country, RAS are becoming production systems of choice for many new or renovated salmonid hatcheries and at some farms.

Rainbow trout have many attributes that make them an attractive species for farming. Domesticated strains are relatively inexpensive compared to other salmonids, and they are also commercially available as eyed-eggs year round. The availability of eggs can allow a farm to use continuous production strategies that help to maintain more culture tanks at near carrying capacity year round and allow fish production 52 weeks a year. In addition, some hatcheries can supply eyed eggs that are certified free of listed pathogens. Thus, when RAS are enclosed in a building to exclude birds and mammals and are supplied with a secure groundwater source, they can be operated in a biosecure manner, without obligate fish pathogens and without the use of chemotherapeutants beyond salt. Rainbow trout grow well in RAS. We typically achieve a 900-1400 g (2-3 lb) fish in 12 months post-hatch and a 4.5 kg fish in 22 months post-hatch (under optimum conditions). The RAS that we use to culture rainbow trout maintain a nearly ideal culture environment, i.e., water temperatures from 13-17°C, dissolved oxygen at saturation, dissolved CO<sub>2</sub> < 25 mg/L, nitrite nitrogen < 0.3 mg/L, alkaline water, and tank hydraulics that produce a self-cleaning tank and optimal swimming speeds of 0.5-2 fish body lengths per second. Note that few people kill fish in RAS from ammonia, but mortality and reduced growth can be caused by nitrite toxicity, low dissolved oxygen, and high CO<sub>2</sub> (plus factors such as nitrate and metals when water flushing is limited). Culture tank volumes are typically exchanged once every 15-30 minutes. We also provide constant 24-hour lighting and use timer-controlled mechanical feeders to feed fish equal portions during 8-24 feeding events daily, i.e., one feeding every 1-3 hours. Automatic feeding events are supplemented with regular hand feeding to observe feed response and satiate the fish. This feeding schedule produces nearly constant water quality in the RAS, because it produces a nearly constant biological respiration, oxygen demand, and waste production rate. Because rainbow trout are aggressive feeders, we use a slow sinking feed and distribute the feed using flingers, which work together to reduce competition for feed. We typically feed a standard trout diet (42:16 protein:fat) and achieve feed conversion rates of ≤ 1:1 for trout smaller than 100 g, 1:1 to 1.3:1 for 100-1000 g trout, and 1.3:1 to 1.5:1 for trout larger than 1000 g. Fin erosion can be a more serious problem with rainbow trout than with most other salmonids, which is another reason to thoroughly distribute feed and keep the fish well fed. Maintaining culture densities at or below 80 kg/m<sup>3</sup> also helps to reduce fin erosion.