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Managing a fish hatchery with oxygen injection

Aquaculture Department, Southeast Asian Fisheries Development Center

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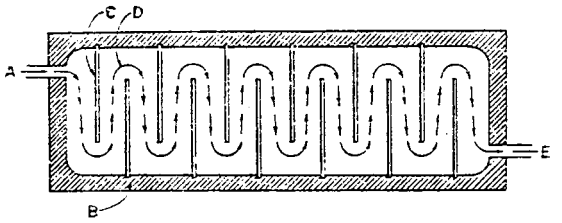

Top view of zigzag sedimentation tank: A, inlet; B, marine plywood; C, baffles; D, zigzag flow; E, outlet.

The recirculating systems can maintain BOD_5 values lower than 10 mg/l, dissolved oxygen values higher than 5 mg/l at all times, and tolerable levels of ammonia and nitrite. BOD_5 greater than 10 mg/l can adversely affect growth. The accumulated sediments can be flushed out periodically.

Reference: OM Millamena, CM Casalmir, PF Subosa. 1991. *Performance of recirculating systems for prawn hatchery and broodstock maturation tanks.* **Aquaculture Engineering** 10: 161-171.

Books on fish health published by SEAFDEC/AQD

- **Diseases of Penaeid Shrimps in the Philippines.** 1992. By MCL Baticados et al. Aquaculture Extension Manual No. 16. 46 pp.
  The manual costs ₱100 in the Philippines or US$20 for foreign orders.

- **Recommended Practices for Disease Prevention in Prawn and Shrimp Hatcheries.** 1992. By G. Lio-Po et al. Aquaculture Extension Pamphlet No. 3. 14 pp.
  The pamphlet costs ₱15 in the Philippines or US$14 for foreign orders.

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Carrying capacity is based on two assumptions: (1) it is limited by oxygen consumption and accumulation of metabolites; and (2) the amount of oxygen consumed and quantity of metabolites are proportional to the amount of food given. Carrying capacity can therefore be increased by improving water quality. Space then is not the factor that limits production in hatcheries. Managing a fish hatchery with oxygen injection can increase the space -- effective water volume -- by twice its usual amount.

Rainbow trout hatchery: an example

An oxygenation system that can supersaturate (about 100% O_2 saturation) a small portion of the water supply has been developed. The unit is fully automatic, including the control of low or high water level and low or high oxygen. It can automatically activate an auxiliary power system during power failures. The premise for such a system is that as high concentrations of oxygen are injected into the water, dissolved nitrogen, which can be lethal to fish, is stripped.

Growth of rainbow trout in raceways was compared in three levels of oxygen -- 5.15 ppm (natural spring water), 7.5 ppm (medium O_2), and 8.4 ppm (high O_2). After about 9 months, production parameters were as follows:

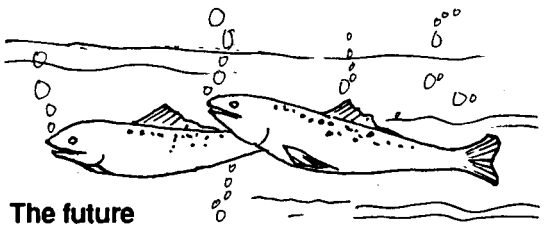
	Natural spring water	Medium O_2	High O_2
Mean daily length increase (cm/day)	0.38	0.58	0.58
Average weight per fish (kg)	10.0	24.0	23.5
Feed conversion	1.89	1.21	1.20
Fat index	2.9	2.95	3.00
Condition factor (K)	1.11	1.12	1.16

Under laboratory conditions, oxygen injection can improve growth of rainbow trout. The test in actual hatchery production yielded similar results:

Production parameters	Normal spring water	Oxygenated water
Dissolved oxygen (ppm)	6.2-5.0	8.6-5.0
Water flow (l/min)	2,000	2,000
Flow index	0.73	1.58
Fish produced:		
Total weight (kg)	1,050	2,300
Length (cm)	15	15
Mean length increase (cm/day)	0.5	0.6
Number of fish	27,800	60,300
Feed conversion	1.35	1.10

Both systems ended up with 5.0 ppm of dissolved oxygen at the end of the run. But the oxygenated water produced more fish.

If a hatchery has a raceway series, it is possible to supersaturate the water from the first series and deliver it to the next. A triple pass using oxygen saturated water is even possible.



The future

Managing a fish hatchery with oxygen injection is very challenging and the increased production potential astounding. There is no question that oxygen injection improves water quality and increases production capabilities. There are continuing efforts to reevaluate and to expand the oxygenation system to further increase production. Delivery channels between systems may be changed and additional injection sites selected.

Oxygen injection can help meet increased demands on our limited water resources.

Reference: RD Creer. *Managing a hatchery with oxygen injection.* **Aquaculture Magazine** Vol. 15. 1989.

Inexpensive hatchery alarm system

The main component of the alarm system is a commercial security alarm controller with an autodialer and siren. This device is connected to sensors that monitor water-recirculating systems for failure and to infrared and intruder-entry switches.

In the recirculation system, two uninsulated steel wires 2 mm in diameter, parallel and 20 cm apart, are installed throughout the length of the hatchery. At one end, the parallel wires are connected by two-core insulated wire to one sector of the security controller. The circuit to this sector of the controller is normally open, and the alarm is triggered when the circuit is completed.

A series of sensors monitors air supply, dissolved oxygen level, water level, and water flow. Each sensor contains a switch, which is also normally open, and is connected by a two-core wire across the parallel wires. A failure in the system closes the sensor switch, bridges the parallel wires, and triggers the security controller.

The sensors are connected to parallel wires via alligator clips so that each sensor can be easily removed without disrupting the rest of the system.

All sensors, except the dissolved oxygen sensor, are designed around a simple float-switch assembly. The switch assembly (see figure) is used to monitor water level, air supply, and water flow through the filter, and can also be used to operate water-valve solenoids or pumps through appropriately rated power relays.

The water-level sensor consists of a 300-mm length of tube with the float-switch assembly in the base. The sensor is hung over the side of the tank, and the height adjusted with the cord. The magnet float is retained inside the pipe by the suspension cord.

These sensors have proved to be more reliable than commercial float alarms. Commercial designs include a mercury switch which closes when the float is tipped. These mercury-switch sensors are triggered by fish movements as well as by falling water levels. The homemade water-

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