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DESCRIPTION AND PROPOSED TEST OF THE IMPROVED AUKE BAY INCUBATOR

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This is a description of a proposal to test biological ideas relating to the premature migration of fry in incubators and also to test improvements in the design of the original Auke Bay Incubator (Salter 1975).

BACKGROUND

The Auke Bay Incubator was first tested during the fall and winter of 1974-75 with 1974 brood fry at the Auke Creek hatchery (Bailey, Pella, and Taylor 1975). Survival of fry was very good (probably over 95%--Taylor, personal communication) even at the extremely high densities tested (74 eyed eggs per square inch). In addition, the fry from the Auke Bay Incubators were longer than fry from any of the other kinds of incubators tested as well as wild fry. The average weights of fry from the Auke Bay Incubator were greater than either natural fry or fry from any of the other incubators tested. Also, the weight of fry produced per gallon of water flowing through was far greater for the Auke Bay Incubator (Bailey et al. 1975).

A PROBLEM AND PROPOSED TESTS OF DEPTH OF SUBSTRATE

The only major problem encountered with the Auke Bay Incubator was premature migration of fry. In the early spring of 1975 at a special meeting of salmon investigation personnel at the Auke Bay Fisheries Laboratory, a proposal to try and solve the problem was submitted. The original Auke Bay incubator had only a single layer of AstroTurf[1] (1 inch deep) to accommodate the fry, and so it was proposed to test effects of different depths of AstroTurf placed vertically and horizontally and with a laminar and an upwelling flow.

Dr. William McNeil, Jack Bailey, and Sidney Taylor agreed to test in 1975-76 different depths of substrate in 40 small incubators (9 inches square) with substrate up to 18 inches deep. The small incubators were used as test units to save money in construction and time in operation.

ADDITIONAL TESTS NEEDED

In addition to the tests proposed by McNeil, Bailey, and Taylor, I propose to test five incubators designed to determine what factors cause early migration of fry. I have constructed five incubators for testing at the Auke Creek Hatchery. Four standard Auke Bay Incubators will test the effects of substrate depth and flow pattern: (1) 2-inch

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[1]Use of trade names does not imply endorsement by the National Marine Fisheries Service, NOAA.

deep substrate and laminar flow, (2) 3-inch deep substrate and laminar flow, (3) 3-inch deep substrate and upwelling flow, and (4) 6-inch deep substrate and upwelling flow. The fifth incubator to be tested will be the latest version of the Auke Bay Incubator.

All of the incubators will have eggs seeded on the trays above the turf with water flowing through them and then flowing over the dam as in the original Auke Bay Incubator design. The upwelling incubators have false bottoms with 3/32-inch perforations and have a cleanout rod and drain plug under the false bottoms.

The latest version of the Auke Bay incubator incorporates several features to permit simulation of natural changes in water level. During the winter the water level in streams is usually lowered, and sometimes the surface of the streambed is dry. I propose to control the level of the water in the incubators with an adjustable dam; the water in the incubators will be lowered as soon as the eggs have hatched and the alevins have fallen through the screen and entered the substrate below. The water can be lowered to the top surface of the substrate. I believe that restricting the alevins to intra-turf spaces will reduce their tendency to swim and expend energy, which causes rapid consumption of the yolk sac. Alevins almost float, and I believe that the water over the incubator substrate acts as a canal and the alevins float in the current and pass over the incubator dam. By lowering the water level, all of the water flows through the substrate and the alevins will be exposed to the water with maximum oxygen. With no water above the substrate, migrating alevins must work their way laterally through the turf all the way to the dam, reducing accidental departure. In the early spring, when creek waters normally rise, the dam can be raised so that the water covers the turf and the fry can easily migrate.

Incubators of the same dimensions should be run without lowering the water levels as controls to test the effect of water level on premature migration. Both laminar flow and upwelling flow in the incubators have been observed with dye, and the upwelling flow shows better distribution through the substrate. The first four incubators to be tested are modified Auke Bay Incubators but do not have the latest design features for blocking premature migration. They have been built just for testing. There will be no fry lock device in these four incubators; fry will be allowed to migrate voluntarily.

OPERATION OF THE LATEST VERSION OF THE AUKE BAY INCUBATOR

The following are significant operations involved in use of the latest version of the Auke Bay Incubator. Trays outside the incubator will be loaded with eggs and slid into the incubator from the front with the water level below the eggs--the water level will be raised after each tray is inserted in the incubator. After the eggs have hatched and the alevins

have fallen through the trays, the water level will be lowered and the trays removed. A rolling fry separator and lock-in device will be turned to the lock-in position. Before it is time for the migration of creek fry, the water will be raised over the substrate and the rolling fry separator and lock-in device will be turned to allow the fry to migrate. After all of the fry have left the incubator, the drain plug will be removed to drain the incubator. The front assembly will be removed so that the substrate cartridge unit and the false bottom can be removed and cleaned. The interior of the incubator can be easily scrubbed while the incubators are still stacked. After the false bottom, substrate, and front assembly are replaced, the incubator will be ready for operation.

The new features of the latest Auke Bay Incubator are:

1. The water level can be varied by raising or lowering the adjustable dam--the water level can be lowered to the top of the substrate.

2. Because the water level can be lowered, the trays can be loaded with water-hardened eggs outside the incubator and placed in the stacked incubators. The water can then be raised over the tray by adjusting the dam.

3. The vertically oriented AstroTurf is a cartridge unit, which makes removal, cleaning, and replacement simple and efficient.

4. The fry lock-in and separator is mounted in the top of the dam and is easily turned to either the lock-in or migration position.

5. The dam in each incubator can be leveled easily to attain an even flow of water over the dam.

6. The front assembly unit contains the adjustable dam (with the rolling lock-in and fry separator), the fry collection chamber, and the drain plug (with the attached false bottom cleaning rod) and is easily disconnected from the incubator by turning two screws. With the front assembly unit removed, the substrate unit and false bottom can be easily removed and the entire incubator can be cleaned without further disassembling it.

7. Salmonids can be raised from water-hardened eggs to fry in the same incubator, saving time and labor in picking dead eggs or transferring alevins to another unit.

8. Water is continually aerated as it enters and leaves each incubator unit.

The new version of the Auke Bay incubator retains the desirable features of re-aeration of water as it leaves and enters each unit,

efficient use of water, and compatibility with shelf or stacked use.

LITERATURE CITED

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