

GRAVEL SYSTEM HOLDS PROMISE FOR SALMON FRY INCUBATION

Robert M. Burnett

Fishery biologists think the female salmon may know what she's doing when she buries her eggs in gravel, so they're experimenting with the same method at the Auke Creek hatchery near Juneau, Alaska.

Designed to find ways of improving hatchery production, both in quantity and quality, the experiments at Auke Creek utilize a "back to nature" concept which departs considerably from traditional methods of rearing fish from eggs to fry. Instead of incubating eggs in flat trays in the usual manner, scientists at Auke Creek have mixed the eggs in gravel up to three feet deep. This provides a more natural environment and produces fry which are stronger than those reared in trays.

The Auke Creek hatchery was built and is being operated under a cooperative agreement involving the National Marine Fisheries Services (NMFS), the Alaska Department of Fish and Game and the Territorial Sportsmen.

"Cooperative agreements such as this can play an important role in the development of the fisheries of Alaska," said Robert Roys, director of the Division of Fisheries Rehabilitation, Enhancement and Development of the Department of Fish and Game. "By sharing funding and personnel, the agencies involved can achieve their common objectives at less cost and without duplication of efforts."

At Auke Creek, for example, the Territorial Sportsmen provided the land, the Department of Fish and Game purchased the equipment and provided technical assistance and the National Marine Fisheries Service renovated the building and is supplying the senior biological talent to operate the project.

The Auke Creek hatchery will be capable of producing at least one million fry annually when completed. Initial work is with pink

salmon because the two-year cycle of this species permits quick evaluation of results.

"Basically, we're trying to find a way to produce the most quality fry in the least space and with the minimum amount of water," says Jack E. Bailey, NMFS project leader at the hatchery.

"We have found that the tray-reared fry are not as strong as wild fry because they use large amounts of energy in movement and in efforts to remain upright. By burying the eggs in gravel, we duplicate as nearly as possible the natural egg nest and this produces stronger fry," Bailey notes.

He explains that the fry hatch in the small spaces between the pieces of gravel and remain there until fully incubated. The gravel supports them and they are thus less inclined to spend energy in movement. More of the yolk is utilized for growth and the result is a healthier, stronger fish which is better able to withstand the rigors of ocean life.

The concept of incubating salmon eggs in a carefully controlled gravel environment has been under study for several years by the National Marine Fisheries Service and the Fisheries Research Board of Canada. NMFS tests have shown that the gravel boxes can produce five to 10 times as many fry as could be expected from the same number of eggs in natural spawning beds.

Similar incubators developed by R. A. Bams in British Columbia have yielded a six-fold advantage over natural production of pink salmon.

The Auke Creek experiments is utilizing both NMFS boxes and Bams boxes, plus the normal hatchery tray method. Fish hatched in the three incubation systems will be compared with natural pink salmon fry from Auke Creek to determine which gives the best production.

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Evaluation of the incubator test results in the spring of 1972 will be on the basis of survival from eyed eggs to emergent fry, fork length of preserved fry, wet weight of preserved fry, timing of emergence, state of development at time of emergence and energy reserve of emergent fry.

While studies of fry quality and quantity are important, the final test will be the number of adults which return from eggs incubated at the hatchery. Such a study of adult returns will require the release of at least one million fry, but the natural run of pink salmon in Auke Creek will not provide enough eggs for such a study now. For this reason, present plans call for evaluation of the systems on the basis of fry quality only while the Auke Creek pink salmon run is being built up to the point that it will support a full-scale test.

"Our experiments began last fall when eggs were taken from 170 pink salmon which had entered Auke Creek to spawn. These eggs were fertilized with sperm from an equal number of males; and then incubated to the eyed stage in trays and baskets," Bailey said.

The eyed eggs were then placed in the incubation boxes between layers of gravel.

"The 170 females which supplied the eggs accounted for about one-sixth of the potential natural egg deposition in Auke Creek," Bailey said. "But if the gravel incubators function satisfactorily, the eggs from those 170 females could return as many fish to Auke Creek as will return from the other 926 females which spawned naturally in the stream."

The current test is utilizing two NMFS boxes and two Bams boxes, plus the standard hatchery incubator.

Both types of gravel incubators are four feet by four feet by three feet deep. The Bams boxes utilize a system of perforated pipes and layers of gravel to distribute the water while the NMFS box uses a space-saving perforated false bottom and a different configuration of gravel.

One Bams box is loaded with 112,163 eggs, the other with 53,650 eggs. The NMFS boxes contain 112,147 eggs and 56,074 eggs, respectively. Water flow to the high density boxes is 14.8 gallons per minute, while the low density boxes receive 7.4 gallons per minute.

Plans for the Auke Creek hatchery call for installation of 16 four by four by four foot incubators which will receive a total flow of 150 gallons per minute of filtered and sterilized water. This will enable the hatchery to produce up to one million fry per year for continued tests of the incubation system.

"If this system proves itself, it could be a valuable management tool for the production of fry for stocking Alaska's streams and rivers," says Roys.

"The system is simple, relatively inexpensive to construct and operate and can produce large numbers of high quality fry in limited space. We think it has a tremendous potential for a variety of projects," Roys said.

Although the initial tests at Auke Creek will be with pink salmon, the gravel box system could be used to build up runs of other salmon species elsewhere in the state.

