KLAMATH RIVER EXPERIMENTAL HATCHERY

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Introduction:

There has been an endless search throughout the State of California for suitable water for fish hatchery operations. Practically every natural flow within the State at some time has either been tested for a potential hatchery water supply or found unsuitable for various causes.

The development of the State's water resources through the building of dams and creating reservoirs is opening up an entirely new source of water for fish hatchery operations and is providing a potential source where none before existed. The purpose of this experiment was to test Klamath River water as a source of supply for a fish hatchery to rear king salmon, silver salmon and steelhead trout, in connection with the building of the Iron Gate Dam.

Method and Equipment:

An experimental hatchery was set up at a site on the Klamath River adjacent to the California-Oregon Power Company's No. 2 powerhouse, which is located about 16 miles east of Hornbrook, Siskiyou County.

The installation consisted of two 3' x 4' x 16' rectangular tanks and two standard California wooden hatchery troughs. The water supply was taken directly from the powerhouse penstock by tapping an existing six-inch irrigation line. The volume was controlled by individual gate valves which maintained a flow of approximately 8 to 15 g.p.m. for each hatchery trough and from 15 to 40 g.p.m. for the tanks.

IRON GATE SALMON & STEELHEAD HATCHERY

The hatchery was completed by Pacific Power and Light Company and formally turned over to the Department of Fish and Game on March 22, 1966. The fish trapping facilities were completed in February, 1962, and operated during the spring and fall of each year by the Department of Fish and Game under agreement with Pacific Power and Light Company.

Water for the trapping facilities and hatchery may be taken from the 16-foot or 74-foot depth from Iron Gate Reservoir or may be blended from these depths. In addition, water can be pumped into the water system from the powerhouse tailrace.

An aerator is located on a rock ledge near the powerhouse. Water enters the aerator through three pipes. Each pipe has three 12-inch jet-type openings which drive the water upward into cone energy dissipaters. After striking these cones, the water splashes down through three sets of baffles and into a sump from which it flows into the supply line or spills through the overflow pipe back to the river. Through a series of valves, water may be passed into the hatchery supply with or without aeration or with partial aeration.

The steel hatchery building is 40 x 120 feet. It is equipped with 136 stacks of Heath incubators (2,176 trays) which may be operated on a closed water system or continuous flow. The electric pump, which circulates water in the closed system, is backed up by a separate pump driven by a 19 HP air-cooled diesel engine. This diesel engine starts automatically when the water flow through the supply line stops. Water temperature in the closed system is controlled by space heaters.

In addition to the incubators, there are 12 fiberglass Heath troughs in the hatchery building. The troughs are not connected to the closed recirculating water system.

A laboratory is located in the hatchery building. It provides room for study of diseased fish, water analysis, and chemical storage.

A shop-office building is located between the hatchery and the residences. This building houses the dry and frozen feed storage room, workshop, office, truck storage room, and rest rooms.

There are 32 concrete ponds, 100-feet long, 10-feet wide, and 40-inches deep, arranged in paired raceways of four ponds long. Water is supplied through a 20-inch pipeline to a common head flume where it passes through a sloping screen to each raceway. A common tail flume at the end of the raceways drains them directly into the Klamath River. The crosswalks and screen supports are removable to allow an unobstructed area for seining and grading fish.

Four three-bedroom houses have been provided for permanent employees. Staffing includes 6 man months of Seasonal Aide time and a part-time hourly Clerk-typist. Water for domestic use is obtained from a drilled well behind the houses.

The fish ladder consists of 20 ten-foot pools which lead to a trapping pond. After fish enter this pond they are crowded toward the spawning house by a mechanical sweep which is driven by a gasoline engine. The fish are lifted through a hydraulic door sliding across a water-fish separator into a tranquilizing solution inside the spawning house. Here they are sorted and placed in flumes leading to ponds where they are held until ready to spawn. The circular holding ponds are 30-feet in diameter and 5-feet deep.

King salmon and steelhead trout eggs used in the experiment were taken from Klamath River fish at the Fall Creek Egg Collecting Station. The silver salmon eggs, due to the lack of a sufficient number of adults, had to be taken from the Trinity River at Lewiston (Trinity River is a large tributary stream flowing into the Klamath about 80 miles downstream from Copco #2 powerhouse). Hatchery equipment, technique and procedures were identical to those employed at the Mt. Shasta Hatchery and would be applicable at any other location in the State.

Operating Procedure:

The first king salmon eggs (39,500) were brought to the hatchery on October 12, 1959. These were green eggs taken at the Fall Creek Station that same day. The eggs were equally divided between two standard salmon hatching baskets and each basket placed in a separate trough. 1/ *Daily flushes of malachite green were administered to control the growth of fungus on the eggs during the incubation period which ran from October 12, 1959 to January 1, 1960, when the last eggs of this lot were hatched. After hatching, small white spots of coagulated yolk appeared in the yolk sacs of about 50 percent of the king salmon alevins.

According to available information white spot disease can be brought on by several different causes, such as over-ripe eggs, rough handling, low water temperatures, bacterial infection and malachite green treatments given in water temperatures over 55 degrees after the eggs are eyed. Heavy losses have been reported from white spot disease at other hatcheries after the affected fish swim up and start feeding. During the period from February 20 through March 26, 1960, most of the king salmon loss noted on the Fish Loss Record can be attributed to white spot disease. The adjusted loss

1/ *The flush method involved the use of a stock solution made of 1½ oz. malachite green dissolved in 1 gallon of water. Three ounces of this solution are poured into the head end of the trough. Water flow is regulated to 6 g.p.m. - Ref. Fish Bulletin No. 107 - Leitritz.

shown on May 20, when the fish were re-weighed and inventoried, was primarily due to this condition.

In order to be certain that a sufficient number of king salmon would be on hand to continue the experiment in case losses from white spot disease continued, another lot of 30,000 eyed Klamath River king salmon eggs were transferred from the Mt. Shasta Hatchery to the experimental station in January, 1960. As these eggs hatched a minor infection of white spot disease appeared, which caused negligible loss. (No white spots occurred on the king salmon eggs of the same lot held at the Mt. Shasta Hatchery).

The king salmon fry were fed a mixture of fifty percent beef liver and fifty percent ocean fish from swim up time until they reached a size of three per ounce on August 11, 1960. At this time, they were divided equally into two tanks, one group remaining on a liver fish diet as a control, and the other tank converted to a dry diet. As of this date, the control group are noticeably more vigorous and are growing more rapidly. Slightly higher losses have been taken in the control group. The dry feed group are 2.4 fish per ounce and the wet feed group are 1.7 fish per ounce.

Periodic prophylactic treatments of copper sulphate and salt were given the king salmon to control external protozoa and gill bacteria infections. Five microscopic examinations revealed extremely clean fish, except for a moderate quantity of gill bacteria occurring in June in all groups. This was readily controlled by copper sulphate treatment.

Survival in the king salmon from the egg to the fish was 45 percent, which is not good; however, taking into consideration the losses caused by white spot disease and the limited numbers of egg and fish involved, these losses are not excessive.

A lot of 20,200 silver salmon eggs taken from the Trinity River were eyed at Mt. Shasta Hatchery and transferred to Klamath River Experimental Hatchery on March 23, 1960. These eggs started hatching prematurely at Mt. Shasta due to a bacterial infection which perforated the outer membrane of the egg. Treatments with malachite green, salt, and sulfomerthiolate, failed to control this infection, with a resulting hatching success of only 45 percent and an 18% success from egg to fish. These fish were reluctant to start feeding on a dry diet and this loss, coupled with the premature hatch, made the survival rates very poor. A microscopic examination in September revealed that many of these fish were living on natural food in the water supply and were not taking dry feed. This resulted in uneven growth; however, the silver fingerlings are now averaging seven fish per ounce, which is an excellent rate of growth in any water.

The steelhead eggs were taken from two females trapped at Fall Creek Station near Copco #2 on 3-20-60, and totaled 6,100 eggs with a hatching success of 88 percent and followed with a 63 percent success from eggs to fish. These now weigh 7 fish per ounce.

Both the silver salmon and the steelhead fingerlings were switched to wet feed during June, 1960, due to a diet deficiency, and in July were switched back on dry feed. DuringAugust and September fish loss has remained normal and all groups of fish are feeding well and in excellent condition.

Water Suitability:

Water temperatures ranged from 50° F. to 56° F. through October and continued to drop during November and December, retarding egg development. Temperatures ranged from 35° F. to 39° F. during January and a portion of February. Spring temperatures increased in March, April and May to a low

of 40° F. and a high of 58° F. Summer water temperatures ranged from 59° F. to 72° F. through June, July and August, and dropping down to the low 60's in September. During periods of high water temperature, the fish showed no visible sign of distress.

Dissolved oxygen tests taken at the outlet of the experimental hatchery gave the following results:

Date	D.O.	Temp.
March 1, 1960	9.8 PPM	41°
May 4, 1960	9.3 PPM	53°
June 10, 1960	6.8 PPM	65°
July 6, 1960	6.7 PPM	70°
August 10, 1960	6.9 PPM	72°

Apparently the material discoloring Klamath River water during the winter months is in suspension as very little silt collected on the eggs. The only difficulty encountered was restricted visibility in the tanks. Fish were difficult to observe eight to twelve inches under the surface from October to March. The condition cleared during April to June and algae in the water during July and August made observation of the fish quite difficult again.

Conclusions:

This experiment ~~proved~~ showed that steelhead, silver salmon and king salmon ~~can be~~ could be raised under crowded hatchery conditions using a Klamath River water supply. ~~With the exception of~~ The small spots of coagulated yolk appearing in the king salmon alevins and the bacterial infection in the silver salmon eggs, disease and feeding problems were minor.

In the case of the first lot of king salmon eggs with white spot disease, this has appeared at other hatcheries and has been successfully controlled. It has appeared occasionally in king salmon alevins at Mt. Shasta Hatchery with minor losses and has been controlled at Nimbus Hatchery by regulating malachite green treatments. Extremely cold water temperatures have also been suspected of causing this disease at some hatcheries.