FEDERAL AID IN SPORT FISH RESTORATION

Volume 2, Number 5

Brood-Stock Development Center Fort Richardson Hatchery

by
Irv Brock

F-27-R

Alaska Department of Fish and Game
Division of Fisheries Rehabilitation,
Enhancement and Development

Robert D. Burkett, Chief
Technology and Development Branch

P. O. Box 3-2000
Juneau, Alaska 99802-2000

September 1987

TABLE OF CONTENTS

LIST OF TABLES

Volume 2, Number 5

RESEARCH PROJECT SEGMENT

State: Alaska

Name: Southcentral Sport Fisheries Enhancement

Project: F-27-R

Study: E-1, 2, and 3

Study Title: Brood-Stock Development Center, Fort Richardson Hatchery

Cooperator: Irvin Brock

Period Covered: 1 October 1986 to 30 June 1987

ABSTRACT

Rainbow trout, *Salmo gairdneri*, brood stock from the Swanson River and Big Lake have been maintained at the Brood-Stock Development Center (BDC). In the spring of 1987, approximately 7.2 million eggs were taken for the rainbow trout production program. For the Brood-Stock Selection Project, three traits were included in a performance index that was used to select 32 families of rainbow trout from a total of 64 families (1987 brood year). Final selection of 16 families will occur later.

The following research projects are also being conducted by the BDC: (1) oxygen generation, (2) rearing models, (3) female age versus egg quality, (4) rainbow trout egg survival: a male or female trait?, (5) rainbow trout egg fertilization, (6) rainbow trout diet comparison (production), (7) rainbow trout diet comparison (brood stock), and (8) rainbow trout brood-stock questionnaire.

KEY WORDS: Fort Richardson Hatchery, Brood-Stock Development Center, rainbow trout, *Salmo gairdneri*, brood-stock selection, genetics, brood-stock maintenance, fish-culture research.

INTRODUCTION

The rainbow trout, *Salmo gairdneri*, production program at Fort Richardson Hatchery supports the rainbow trout sport fishery enhancement programs for southcentral and interior Alaska. Maintenance of these programs requires a reliable source of viable eggs. Fry from these eggs must then be able to survive in both hatchery and wild environments. To date, however, performance of the existing strains of rainbow trout has not been good. Generally, wild brood stocks are used, and these stocks are notorious for poor survival within a hatchery system. Therefore, our goal is to develop a hatchery strain from the wild stocks that exhibits an improved in-hatchery performance, while retaining the desirable "wild" characteristics. In addition to its role of providing rainbow trout eggs for enhancing and developing a hatchery strain of brood stock, the BDC was envisioned as a small research facility to address other problems encountered in the production of rainbow trout.

To accomplish these goals, the BDC was established as a part of the Fort Richardson Hatchery. The physical structures include nine outdoor raceways (3.1 x 30.5 x 0.9 m) adjacent to a spawning shed. The spawning shed is attached to the BDC building, which houses a "wet laboratory" for incubation and rearing and a "dry laboratory" for water-quality analyses and basic fish health inspections. The water supply and other support facilities are provided by the Fort Richardson Hatchery.

Presently, two rainbow trout brood stocks are maintained: Swanson River and Big Lake. Random matings within these stocks produce all the eggs for the southcentral and interior Alaska rainbow trout sport fisheries enhancement programs. A genetic selection project was begun last year to develop a new strain of rainbow trout that spawns early, grows fast, and has high survival rates. This program is based on individual and family

selection within the Swanson River brood stock, and its design is similar to the program developed by Graham Gall for the State of California. Obviously, this is a long-term program, because the speed of genetic selection is a function of generation time.

OBJECTIVES

The following are primary objectives:

1. Maintain the rainbow trout brood stock needed to supply eggs for the stocking requirements of the enhancement program.

2. Collect adequate numbers of rainbow trout eggs annually to supply (a) the rainbow trout enhancement program, (b) brood-stock replacement, and (c) the brood-stock selection project.

3. Develop a strain of rainbow trout that survives and grows well in the hatchery and in the waters where they are planted.

Additionally, a secondary objective is to propose and carry out projects designed to make production of rainbow trout and other species more efficient. To achieve these objectives, the BDC program is divided into three primary objectives: (1) the brood-stock maintenance project, (2) the random-lot spawning project, and (3) the brood-stock selection project. These projects will continue until there is no longer a demand for rainbow trout production. The production improvement projects include any short-term secondary project that support the three primary projects or Fort Richardson Hatchery production.

PROJECT PERFORMANCE AND EVALUATION

Federal-Aid annual reports include detailed summaries of the three primary projects (brood-stock maintenance, random-lot spawning, and brood-stock selection), but the production improvement projects will be summarized and reported as soon as they are completed. These final reports will be attached to the appropriate Federal-Aid reports (annual or quarterly) as appendices. Brief descriptive reports, however, are included in this report.

The reporting period for this paper ends on 1 July 1987 and includes only three-quarters of a calendar year. Each year many of the project activities typically occur 1 or 2 months before and after 1 July, and most data summaries and interpretations occur after August. Consequently, many detailed analyses and discussions cannot be included in this report, but these will be included in the quarterly reports and in the FY-1988 Annual Report.

Brood-Stock Maintenance Project

General Information:

This project's goal is to maintain enough brood stock from both the Big Lake and Swanson River strains to meet the requirements of rainbow trout sport fishery enhancement programs for south-central and interior Alaska.

Methods and Materials:

Because the water supply is limited at Fort Richardson Hatchery, a three-pass water-reuse system was installed for the brood-stock's raceways. Mature fish from the Swanson River brood stock are held in first-pass water so that they can move up the fish ladder into the spawning shed as they become ripe. Brood stock

from the Big Lake and the Swanson River select strains are held in second-pass water, and replacement lots of brood stock are held in third-pass water. Replacement lots for both Big Lake and Swanson River strains are held in the production hatchery until transferred into the brood-stock raceways at 1 year of age. Fish from the replacement lots "replace" fish that either die during rearing or are discarded after spawning as 4-year-olds.

Results and Discussion:

Rainbow trout brood stock on hand at the BDC on 1 October 1986 included seven lots of fish from four brood years (BY) and two wild stocks (Table 1). These lots of fish were kept in the BDC's brood-stock raceways and indoor-rearing tanks throughout the year. In June 1987 individuals in remaining lots were counted and moved to their present raceways. Two lots of replacement brood stock (BY-1986 Swanson River and BY-1986 Big Lake random lots) that were to be transferred to the BDC in May 1987 were lost when an automatic valve in the production/incubation building failed. Loss of these replacement fish has resulted in an alteration of the number of fish originally planned to be held in other brood-stock lots. Table 2 summarizes the rainbow trout brood stock on hand at the BDC on 30 June 1987; Table 3 forecasts the numbers of brood stock and eggs that will potentially be available between 1988 and 1990. Each year the planning assumptions and the brood-stock and egg numbers will be updated.

Water in all of the brood-stock raceways was maintained at the same temperature. The average monthly water temperature ranged from 3.6°C in January and February 1986 to 9.6°C in May and June 1987 (Table 4).

A natural photoperiod was maintained as much as possible; artificial lighting was kept to a minimum. Fish were fed double

Table 1. Rainbow trout brood stock at Fort Richardson Hatchery, Brood-Stock Development Center, 1 October 1986.

Lot number	Description of lot	Number of fish
82RTSR	BY-82 Swanson River (wild)	2,308
82RTBL	BY-82 Big Lake (wild)	417
84RTSR	BY-84 Swanson River (wild)	4,229
84RTBL	BY-84 Big Lake (wild)	793
85RTSR	BY-85 Swanson River (random lot)	7,672
85RTBL	BY-85 Big Lake (random lot)	8,885
86RTSR(S)	BY-86 Swanson River (select lot)	5,985

Table 2. Rainbow trout brood stock at Fort Richardson Hatchery Brood-Stock Development Center, 30 June 1987.

Lot number	Description of lot	Number of fish
82RTSR	BY-82 Swanson River (wild)	317
82RTBL	BY-82 Big Lake (wild)	<20
84RTSR	BY-84 Swanson River (wild)	876
84RTBL	BY-84 Big Lake (wild)	<50
85RTSR	BY-85 Swanson River (random lot)	1,724
85RTBL	BY-85 Big Lake (random lot)	5,101
86RTSR(S)	BY-86 Swanson River (select lot)	5,640
87RTSR(S)	BY-87 Swanson River (select lot)	28,853

Table 3. Forecasted numbers of rainbow trout brood stock and potential numbers of eggs at the Brood-Stock Development Center, 1988-1990.

Lot number	Brood-stock origin	Brood year 1988 Number Brood stock	1988 Number Potential eggs	1989 Number Brood stock	1989 Number Potential eggs	1990 Number Brood stock	1990 Number Potential eggs
84RTSR	Swanson River	800	720,000	600	585,000	0	0
85RTSR	Swanson River	1,600	1,320,000	1,200	1,080,000	0	0
85RTBL	Big Lake	3,100	2,558,000	2,325	2,093,000	500	488,000
86RTST(S)	Swanson R. (select)	5,600	0	2,800	2,310,000	1,200	1,080,000
87RTSR	Swanson River	7,000	0	7,000	0	3,500	2,888,000
87RTBL	Big Lake	4,000	0	4,000	0	2,000	1,650,000
87RTSR(S)	Swanson R. (select)	3,200	0	3,200	0	1,600	1,320,000
Total	Swanson River		2,040,000		1,665,000		2,888,000
Total	Big Lake		2,558,000		2,093,000		2,138,000
Total	Swanson R. (select)		0		2,310,000		2,400,000
Total	All brood stocks		4,598,000		6,068,000		7,426,000

Assumptions:

1. Earliest female spawning age = 3 yr.
2. Mortality rates: Age 1 = 0%; Age 2 = 50%; Ages 3-5 = 25%.
3. Ratio of Males:Females = Age 2 - 1:1; Age 3 - 1:3.
4. Average fecundity: Age 3 - 1,100; Age 4 - 1,200; Age 5 - 1,300.

Table 4. Average monthly water temperatures in brood-stock raceways, Fort Richardson Hatchery, Brood-Stock Development Center.

Date		Water temperature (C)
1986	October	9.0
	November	4.5
	December	4.2
1987	January	3.6
	February	3.6
	March	5.4
	April	9.3
	May	9.6
	June	9.6

vitamin-pack Oregon Moist Pellet® (OMP), and they were fed only what they would eat. During the spawning season, the brood stockate little, but food was available for them. Dead fish were removed, counted, and recorded daily. Postspawning mortality was extremely high this year. To compensate for this loss, numbers of fish being held in various brood-stock replacement lots have been adjusted so as to minimize the effect on future rainbow trout production programs.

Random-Lot Spawning Project (Production)

General Information:

This project's goal is to operate the annual rainbow trout egg take and collect enough eggs for southcentral and interior Alaska rainbow trout production programs. Both the Big Lake and Swanson River brood stocks are included. The fertile eggs taken from these brood stocks are the result of random matings within each stock. The only artificial selection in this process is to achieve an earlier spawning time.

Methods and Materials:

Swanson River brood stock are spawned in the spawning shed. Fish are allowed to migrate out of the raceways, up the fish ladder, and into the shed. They are captured with nets, sorted, and dry-spawned using the oxygen-injection technique. After they have been spawned, fish are returned to a holding raceway via a polyvinyl-chloride (PVC) tube. Eggs from eight to 16 females (depending on fecundity) are pooled and immediately fertilized. The female-to-male ratio is kept at 4:1. After fertilization, fresh water is added, and the eggs are transported immediately to the incubation building. After approximately 5 temperature units

® Mention of commercial products and trade names does not constitute endorsement by ADF&G, FRED Division.

(12 hr at 10°C), randomly selected eggs are checked to determine the fertility rate.

Big Lake brood stock are spawned in their raceways. Fish are crowded to the upper end and held in place above a screen. Ripe fish are then spawned in the lower section of the raceway and released. Spawning techniques are the same as for the Swanson River strain.

Results and Discussion:

Random-lot spawning began on 9 April 1987. Water temperature, which had been a problem the previous year, was maintained between 9° and 10°C during the spawning season. Approximately 7.2 million eggs were taken during 14 days of egg takes (Table 5).

Females were 3 and 5 years old, and most males were 2 and 3 years old; however, a few 5-year-old males were included. Lots of eggs were separated by strain and female age for incubation. After hatching, they will be raised indoors until they average 2.0 g; then fish that will be reared for the catchable program will be moved into outdoor raceways.

Eggs for replacement brood stock were taken on 18 April 1987 for Swanson River and 9 April 1987 for Big Lake brood stocks. These lots are reared and handled as normal hatchery-production lots until they are moved to brood-stock raceways.

Brood-Stock Selection Project

General Information:

This project's goal is to develop a strain of rainbow trout that has high survival and fast growth in both hatchery and wild environments. Eventually, this strain should become the choice

Table 5. Summary of egg takes for BY 1987.

Brood stock	Date	Age	Number of females	Number of eggs	Percent fertility
Swanson River	4/18	3	279	274,335	94.4
		5	84	146,374	94.9
	4/20	3	194	199,388	87.6
		5	30	52,290	93.4
	4/21	3	160	112,592	87.6
		5	130	231,617	85.7
	4/22	3	110	97,848	92.5
		5	318	677,811	93.9
	4/23	3	765	787,134	96.5
		5	328	505,571	98.0
	4/24	3	315	300,881	96.7
		5	166	290,093	94.3
	4/25	3	675	668,731	92.9
		5	280	492,719	94.0
	4/28	3	270	236,491	95.3
		5	120	203,882	96.0
	4/29	3	300	278,770	92.6
		5	110	191,286	93.1
	4/30	3	240	233,520	93.0
		5	60	106,260	89.9
	5/1	3	300	291,900	-
Swanson River Total			5,234	6,379,493	
Big Lake	4/9	3	114	103,284	94.6
		5	109	213,545	93.1
	4/13	3	107	84,905	90.7
		5	77	131,692	75.9
	4/17	3	176	132,083	89.2
		5	56	87,992	89.0
	4/21	3	48	39,125	85.3
		5	21	29,565	85.7
Big Lake Total			708	822,191	
Grand Total			5,942	7,201,684	

domestic brood stock for rainbow trout hatcheries in southcentral Alaska. This project follows a 5-year genetic-selection program based on individual and family selection (Table 6).

Methods and Materials:

Lots of fish produced are referred to as "select lots", and replacement brood stock for select lots are chosen according to their "performance index." This value is a summation of weighted scores of traits that may result in better growth and survival. Because an earlier spawning time will benefit the rainbow trout production programs, the earliest spawning fish are selected (Wall and Olito 1986).

Adults from Swanson River brood stock (random lot) are used to supply eggs until the first generation of the select-lot brood stock mature; thereafter, only select-lot brood stock will be included. The data collected during egg take, incubation, and rearing provide a measure of the performance of each family lot for traits included in the selection program.

Two more fiberglass rearing tables designed to hold five 111-liter cylindrical tanks (66-cm diameter) have been installed in the BDC wet lab. There is now a total of 40 rearing tanks. This addition expands the number of select families that can be reared to 32 and provides another eight tanks for other research projects.

Results and Discussion:

The success of this selection program cannot be determined until the progeny are planted and harvested. All survival, growth, and production data collected will be used to compare the performance of fish from select lots (both in the hatchery and the wild) with fish from random lots. The random-lot brood stocks will be maintained until there is satisfaction that we have developed a

Table 6. Genetic selection program for annual select-lot broodstock production.

Year	Spawn				Progeny	
	Males		Females			
	Number	Brood year	Number	Brood year	Number of families	Lot designation
1986	64	1984	64	1982	64	1986-S
1987	64	1984	64	1984	64	1987-S
1988	64	1985	64	1985	64	1988-S
1989	64	1986	64	1986	64	1989-S
1990	64	1987	64	1987	64	1990-S
1991	64	1988	64	1988	64	1991-S

superiorly performing fish. At that time, the brood stock of choice will be the select-lot strain.

Select-lot families from BY-1986 were reared in the BDC wet lab until May 1987. Fish from each family (400 fish each) were differentially freeze-branded and pooled in an outdoor brood-stock raceway. First spawning will be in 1989 (Wall and Olito 1986).

On 16 April 1987 the eggs from 64 randomly selected females from the BY-1984 Swanson River brood stock were taken. As in the select program, all of these eggs were taken in one day from the first females to ripen. Sperm from 64 males randomly selected from the BY-1984 Swanson River brood stock were used to fertilize the eggs (1:1 ratio).

Fertilized, water-hardened eggs were then placed in one section of a compartmentalized Heath® tray and incubated using standard hatchery techniques. Antifungal treatments were administered three times a week. After the eyed-egg stage was reached, the eggs were shocked, picked by hand after 24 h, and returned to incubators. When the fish emerged, 32 selected families were transferred to individual family-rearing tanks. Excess fish were transferred to Fort Richardson Hatchery production lots.

During spawning, the following data were collected from each family pair: weight (g), egg size (eggs/g), and estimated fecundity (eggs/fish). During incubation, the following data were collected: actual fecundity (eggs/fish), green-egg to eyed-egg survival (%), and eyed-egg to hatching survival (%). After the fry were transferred to the rearing tanks, their growth rate (mg/TU/day) and survival were monitored. By 30 June 1987 final selection had not occurred; BY-1987 selection scores and final selections will be presented in the 1988 Federal-Aid report.

Production Improvement Projects

These projects are ancillary to the primary projects at the BDC, but they fulfill an extremely important function of solving problems that may limit rainbow trout production and brood-stock maintenance and development at the Fort Richardson Hatchery or the BDC. During FY 1987 a total of seven of these projects was begun. Most were initiated during or after this year's egg take and are not complete. Few of the data that have been collected have been analyzed. Consequently, few results and no conclusions are included in this report, but several projects will have been concluded, and these will be reported in the next annual report.

Oxygen-Generation Project

General Information:

Currently, Fort Richardson Hatchery's fish production is limited by lack of water. The cost of producing more ground water (if it can be found!) is quite high, and alternative measures are being evaluated so that fish production goals can be met. The oxygen-generation project was designed to determine if pure oxygen could be used to increase the carrying capacity of water in the hatchery. If this technique works, the required amount of water may be reduced by as much as 38% at 10°C. A reduction in water flow of this magnitude that still meets the metabolic requirements of the fish could reduce the cost of pumping water significantly and allow the hatchery to operate more efficiently. This technology is being used in European and State of Michigan hatcheries to strip nitrogen to below saturation while producing dissolved-oxygen levels above saturation. At these higher oxygen levels, raceways may be more heavily loaded than normal. The potential use for this technology at Fort Richardson Hatchery will be to increase dissolved-oxygen saturation so that more fish biomass can be reared with the available water. A by-product of the increased oxygen concentration is a reduction of dissolved

nitrogen to below saturation. Although the work will be carried out at Fort Richardson, the potential uses of this technology at other hatcheries are staggering!

Project Status:

Two raceways were prepared to test the efficiency of oxygen transfer into the influent water and to evaluate the effect of using oxygen-supersaturated water to rear fish. Gas tensiono-meters were installed on the test raceways to monitor influent and effluent gas concentrations in the oxygen/water contactors and influent and effluent rearing water. An oxygen generator was purchased and installed in the incubation building to produce a supply of oxygen for the experiment as well as for subsequent production. Digital flow meters were installed to monitor oxygen flow to each of the two oxygen/water contactors. To analyze data collected for each individual test of the contactors, test matrices were developed and computer programs[1] were written

Preliminary tests of oxygen-transfer efficiency were conducted on three different oxygen/water contactors at various contactor vacuums, water flows, water temperatures, and oxygen flows. With increased vacuum in the contactor, the oxygen-transfer efficiency was decreased; but with no oxygen flow, this increased vacuum alone reduces nitrogen- and oxygen-saturation levels.

Rainbow trout from BY-1987 are being reared in the test raceways of oxygen-saturation levels of 125%-130% and nitrogen levels between 90% and 95% saturation. Two control raceways are also being monitored, and there are no apparent differences in fish performance between test and control raceways; but the control raceways require a flow of approximately 650 liters/minute, while the test raceways use only approximately 320 liters/minute for

---

[1] One of the computer programs is already being used by several hatcheries to standardize gas-analysis and reporting procedures within state hatcheries.

approximately the same biomass of fish. Analysis of the data is not yet complete. A final report will be submitted upon completion of the project.

Rearing Models

General Information:

Various models have been used to design hatcheries in Alaska. In this region, the "Westers/Pratt" models have evolved into Alaskan models, and are now being used to plan production and rear fish. Recently, work by other leading investigators has been incorporated into our models. Using the computer to simplify calculations, these models have increasing use. There is a need, however, to test and refine our models so that a better understanding of how hatcheries function and subsequent optimization of each facility is attained.

Project Status:

During FY 1987 a computer model for storing and analyzing rearing data was written. Rearing data from both production and experimental lots of fish have been collected, but no statistical analysis has yet occurred. Interim status reports for this project will be submitted as tasks are completed.

Female Age vs. Egg Quality

General Information:

During 1986 eggs from the Big Lake strain brood stock survived very poorly, compared with eggs from the same class during the previous year; and we suspected that egg survival or quality may depend on the age of the female parent. In order to determine how long brood stocks should be held before they are discarded from the program, their contribution must be examined on a yearly

basis. Results of this project may suggest that only 3-year-old females should be used because of a significant reduction in egg quality among 4-year-olds. It is also possible, however, that eggs from 4- or 5-year-old fish have higher quality than eggs from younger females. Ultimately, this information will be applied to increase the efficiency of this program.

Project Status:

Each of the several production lots of eggs taken at the BDC this year were made up of eggs from a single strain and age class of females (3- or 5-year-old fish). There are six separate lots from the Big Lake strain (three from each age class) and 39 lots from the Swanson River strain (21 from 3-year-old and 18 from 5-year-old fish). Performance of each of these lots is being followed to release of the fish. A report will be submitted after all performance data have been collected and analyzed.

Rainbow Trout Egg Survival: a Male or Female Trait?

General Information:

During 1986 survival of rainbow trout eggs to the eyed stage was very poor. Survival in production lots ranged from 22% to 65% and averaged 48%, while survival of select-lot families ranged from 3.4% to 98.9% and averaged 76.7%. It was suspected that some physical condition of one or both of the parents caused poor survival or fertilization.

Project Status:

To determine if the problem was related to one sex, four replicates with three-female x three-male matrices were set up during the egg take. The eggs from one female were divided into three approximately equal lots, and each lot was fertilized with the sperm from a different male. Sperm from one male was diluted

with 8% saline, divided into three lots of approximately equal volume, and used to fertilize the eggs of three females. As each fish was spawned, its age and any obvious physical anomalies of the fish and/or its sex products were noted. The resultant lots of eggs were incubated in divided Heath incubator trays. Survival data to the eyed-egg stage and ponding were recorded.

At this time the data collected during egg take and the incubation period have not been statistically analyzed. A final report will be submitted during the next fiscal year.

Rainbow Trout Egg Fertilization

General Information:

During the 1986 rainbow trout production cycle, it was noted that most of the green- to eyed-egg mortality resulted from infertile eggs or eggs without visible embryos, which may have been because of the method of fertilization. According to the present procedure, eggs from each female are collected in a net, combined with eggs from several other females in a bucket, and fertilized with sperm from several males (one male at a time). This process takes 2-3 minutes to perform. After the last male is used, the eggs are gently mixed by hand, and water is added to activate the sperm. If sperm motility, however, lasts for less than a minute, the sperm from the first few males may be fertilizing only the eggs that it has come in contact with prior to mixing. The objectives of this study are to determine if the sperm is activated by the small amount of ovarian fluid present on the eggs and if sperm should be pooled in a dry beaker before being added to the eggs so that all the sperm added will be equally viable.

Project Status:

During spawning, sperm motility was checked under various conditions. Immediately after it was collected, one drop of sperm was combined with 0.25 ml water, and the motility of sperm in this mixture was observed with the aid of a microscope. Elapsed time between the addition of water and the cessation of sperm motility was noted. Next, ovarian fluid and 8% saline were added to portions of the sperm. Water was added to these mixtures at 1-min intervals for 10 min. The sperm mixture from each dilution was then inspected with the aid of a microscope, and percentages of motile sperm were estimated. Three replicates of this procedure were performed with sperm from one fish and with pooled sperm. These data have not yet been statistically analyzed. A final report will be submitted during the next fiscal year.

Rainbow Trout Diet Comparison (Production)

General Information:

During FY 1986 the mortality rate of rainbow trout fingerlings at Fort Richardson Hatchery was unexpectedly high. The ADF&G, FRED Division Pathology Section and many outside consultants were contacted for help. The fish appeared healthy, except for the livers of the involved fish. Mr. Charlie Smith[2] suggested that the liver problem probably resulted from inadequate nutrition similar to what he had previously observed among other first-generation "wild" fish. He suggested using a liver additive in the feed. He also stated that his nutrition laboratory would assist us, if possible, to solve the nutritional problems of these fish.

---

[2] U. S. Fish and Wildlife Service, Bozeman Fish Technology Center, personal communication.

The objectives of this study are to find the best food for the rainbow trout fingerlings and to reduce fish mortality and labor requirements during rearing.

Project Status:

Rainbow trout fingerlings were split into eight lots of approximately 1,500 fish each and placed in rearing tanks in the BDC wet lab. Two replicates of each of four diets are being tested: (1) Oregon Moist Pellet, (2) Alaska Dry Pellet, (3) Bio-Diet with 1.5% liver added, and (4) Bio-Diet. Data collected to date have not yet undergone statistical analysis. A final report will be submitted during the next fiscal year.

Rainbow Trout Brood-Stock Questionnaire

General Information:

Because of the geographical distance between the BDC and other rainbow trout brood-stock facilities in the United States and Canada, it has been difficult to compare hatchery techniques with those of other facilities. Consequently, a "brood-stock questionnaire" was designed and mailed to other production facilities. The questionnaire addresses key issues in hatchery brood-stock management.

Project Status:

Fifty-five questions to be answered with multiple choice, fill-in-the-blank, or essay responses were formulated. Questions requiring yes/no or multiple-choice answers were used as often as possible to simplify answering as well as data analysis. The questionnaire was sent to 359 public and private facilities in the United States and Canada in February 1987. Completed questionnaires were received from 50 respondents by 15 April 1987.

Data are currently being analyzed and the first draft of the completion report is complete. The final report will be completed during the next fiscal year and submitted for publication.

FACILITY DEVELOPMENT

The dry lab in the BDC is used for water-chemistry work, seawater-challenge testing, and first-line fish-health diagnostic work by both the BDC and the Fort Richardson production hatchery. Original construction allowed entry to the dry lab only after walking through the wet lab. Consequently, the fish that were in the wet lab potentially could have been contaminated while fish were taken to the dry lab for pathological examination. This potential was reduced by constructing a separate entry and restricting direct access between the labs.

A building exhaust fan was installed in the wet lab to vent potentially hazardous chemical fumes, such as formaldehyde, from the room; formalin treatments are used during egg incubation, and exposure to this gas is very harmful to humans and should be avoided at all costs. Two new rearing tables, each containing five tanks, were installed in the wet lab to increase rearing capacity and experimental opportunities. With these additional tables, 32 select families can be reared, and eight tanks can be utilized for other projects.

Oxygen/water contactors have been installed on all four headboxes in the wet lab to reduce nitrogen gas to below saturation. During FY 1986 tail rot apparently due to high nitrogen-gas concentrations was occasionally observed. Since the contactors were installed, tail rot has not been observed among the fish being reared in the wet lab.

SUMMARY

The objective of the Brood-Stock Development Center is to maintain and develop brood stock for rainbow trout enhancement programs in southcentral and interior Alaska. Presently we have the Swanson River and Big Lake stocks, from which a total of 7.2 million eggs were taken during spring 1987. The egg take went smoothly, and egg survivals surpassed stated goals. Unfortunately, postspawning mortality of the brood stock was higher than expected, and other replacement brood stock died when a valve failed to operate properly.

This is the second year of the genetic-selection program. The BY-1986 select lot was branded and is being reared outside. The BY-1987 select-log egg take went very smoothly, and the fry are being reared indoors until April 1988.

Oxygen contactors and monitoring equipment were installed on two production raceways for the oxygen-generation project. Preliminary tests were completed on three different contactors to evaluate the interaction of several variables and to test the efficiency of oxygen transfer. Fish in raceways are now being reared in water with 125% oxygen saturation.

Beginning with the FY-1987 egg take, several minor projects were begun to investigate some observations during the rainbow trout program failure at Fort Richardson in 1986. Although the same problems did not recur in 1987, some causes of that program failure (1986) are better understood. Data from these projects will be analyzed, and final reports will be submitted during the next fiscal year.

A rainbow trout questionnaire was sent out to other brood-stock facilities in the United States and Canada. A considerable

amount of information was gained on brood-stock culture techniques; some questions were answered, and some new questions were raised. This information will help improve our fish-culture techniques and cause some changes in our procedures.

ACKNOWLEDGMENTS

I would like to thank Bill Hauser and Ken Leon for their technical review of this paper and Sid Morgan for editorial assistance.

REFERENCES

Davis, Robert H. and Irvin Brock. 1985. Rainbow trout brood-stock development plan. Fort Richardson Hatchery.

Gall, Graham A. E. 1972. Rainbow trout brood-stock selection program with computerized scoring. Inland Fisheries Administrative Report No. 72-9.

Wall, Gary and Carmen Olito. 1986. Fort Richardson Hatchery. Federal Aid in Sport Fish Restoration. F-14. 1(4). 51 p.