Annual Report

FISCAL YEAR 1970

DWORSHAK NATIONAL FISH HATCHERY

(Hatchery)

Submitted
By: John R. Parvin Title Manager Date 8/28/70

Date Received
Regional Office _____ Reviewed
By: _____ Date _____

Date original forwarded
to Washington Office: _____

Date Received
Washington Office _____ Reviewed
By: _____ Date _____

DIVISION OF FISH HATCHERIES

Form 3-100
(Jan. 1964)

INTRODUCTION

This 1970 Report is the first complete report to be submitted by the Dworshak National Fish Hatchery. At the beginning of the 1970 fiscal year, construction had not been completed. On October 1, 1969 the hatchery was finally accepted by the U. S. Corps of Army Engineers from the contractor.

The Dworshak National Fish Hatchery was designed and built to replace the spawning area for the steelhead which will be lost by the construction of the Dworshak Dam. In addition to rearing of steelhead trout for release into the North Fork of the Clearwater, this hatchery also will participate in the management of the Dworshak pool. In this connection, it is expected that the station will rear catchable size rainbow trout, cutthroat trout, and kokanee salmon for stocking in the reservoir and lower tributaries of the reservoir.

The Dworshak National Fish Hatchery is located at the confluence of the North Fork of the Clearwater and the Middle Fork of the Clearwater River near the unincorporated town of Ahsahka, Idaho. The construction site is approximately three miles west of Orofino, Idaho on the north bank of the main stem of the Clearwater River. The hatchery is located approximately 8,000 feet downstream from the construction site of the Dworshak Dam. When completed, the Dworshak Dam will have a height of almost 700 feet. The depth of the pool behind the dam will be in excess of 600 feet.

The Dworshak National Fish Hatchery was engineered and planned to be built in two phases. The first phase was to care for an estimated 6,000 adult steelhead trout. The second phase was to include construction of an additional rearing facility to take care of a total of 12,000 adult steelhead. Construction of the first phase consisted of a total of 84 Burrows type recirculating ponds, 64 feeding tanks, and 128 Heath type incubators. The production to be expected from the first phase of construction is to be approximately 3,500,000 steelhead smolts. The second phase of construction was to be deferred until such a time as studies showed that the production envisioned in that construction would be needed to adequately maintain the runs of steelhead in the North Fork of the Clearwater River. Subsequend developments have shown that the additional 56 ponds which were envisioned in the second stage of construction may never be realized.

The first year's operation actually started with the collection of eggs from the 1969 brood year steelhead trout which had been hauled into the hatchery partly in October 1968 and the balance in the spring of 1969. These fish were trapped in temporary trapping facilities located at the lower end of the bypass tunnel at Dworshak Dam. Several very interesting departures from the expected norm were experienced. The design memo for the hatchery construction and operation anticipated that there would be approximately 4,000 eggs per female collected and that the run would be approximately 50 percent males and 50 percent females. During the first spawning season, 1969, it became apparent that the statistics anticipated in the design memorandum were in error. Approximately 70 percent of the fish delivered into holding ponds at the Dworshak National Fish Hatchery were females. In addition, the average number of eggs collected per female amounted to 6,200 eggs. A total of approximately 3,200 adult steelhead were handled. The balance of the fish were transported above the dam and allowed to spawn naturally during the 1969 spawning season. The design memorandum anticipated that a total of 9,600,000 eggs would be collected from approximately 6,000 adult steelhead. In actual practice, approximately 11,000,000 eggs were collected from the number of fish handled. The unexpected fecundity of this run of steelhead trout presents an added problem in the hatchery design. It can readily be seen that the construction standards deemed necessary for the handling of 6,000 adult steelhead would be highly inadequate.

The Dworshak National Fish Hatchery was the first large scale installation of an environmental control system. This consisted of the principle of recirculation of water with the addition of a small percentage of makeup water to the system. ~~Makeup water to the system.~~ Makeup water was filtered and heated or cooled as needed and entered the system and maintained the temperature at the desired level. The system incorporates a series of filters which in effect are biological filters which buffer the ph of the water and remove the ammonia. The water is then run through pumps and is aerated and returns to the system. At the present time, there are 25 ponds on this system which can be utilized. The rearing tanks are also in the system. Water may be routed throughthe incubators which have temperature control ability or directly into the system. This system operated so satisfactorily during the first year of operation that the station was able to release approximately 1.3 million smolts during April and May of 1970. This was slightly less than 12 months of rearing from the

time the eggs were collected.

The balance of the steelhead which at the end of the fiscal year 1970 numbered approximately 1.8 million must be held for two years in order to achieve smolting size. During the summer months it is anticipated that difficulties will be experienced from rearing these fish in the seasonally high water temperatures found in the North Fork of the Clearwater River. At the end of the fiscal year an infestation of glochidia which could prove serious was observed. In order to provide adequate rearing capacity for 100,000 pounds of trout for stocking the reservoir as well as the capacity for rearing to smolting size approximately 3.5 million steelhead, recommendations have been made to the U. S. Army Corps of Engineers that all of the pond system at the Dworshak National Fish Hatchery be placed in the reuse environmental control system. If this is done, adequate capacity will be provided for rearing 3.5 million steelhead trout to smolting size in a period of one year or less and will provide 14 ponds for the rearing of trout for the reservoir.

The Dworshak National Fish Hatchery has some of the most sophisticated equipment that has ever been installed in a fish hatchery. Various phases of these construction items will be described under appropriate headings at a latter point in this report. Because of the innovations that have been engineered into this hatchery, many construction people as well as fish and wildlife administrative people have shown considerable interest. Officials and engineering personnel from the Province of British Columbia, from the Province of Alberta, and from the Province of Nova Scotia have visited the hatchery with reference to construction of similar hatcheries in their own areas.

The first smolt releases were made on April 20, 1970. A ceremony was performed on this occasion involving Mr. Donald Basgen, the Resident Engineer for the Dworshak Dam Project, and the Manager of the hatchery, in which the gate was pulled from one of the ponds thus releasing fish into the North Fork of the Clearwater River. A relatively large number of these smolts moved downstream almost immediately. Subsequently, large numbers were counted downstream at Ice Harbor Dam near the mouth of the Snake River. There have been reports from the monitoring activity in the estuary of the Columbia River that a number of smolts arrived at that point. The smolt releases at Dworshak National Fish Hatchery were made during the early part of the spring snow runoff. As the flood conditions increased in the Snake River and in the Columbia River,

high concentrations of dissolved nitrogen were reported. This was a super-saturation of up to 140%. There were reports of considerable damage to downstream migrating smolts both of the steelhead and of the chinook salmon. At this time there is no way to evaluate the actual damage which was done to the downstream migrating smolts from the Dworshak National Fish Hatchery. Approximately 20% of the smolts released were marked by the removal of an adepose fin and freeze branding of a square U on the side above the lateral line.

On August 22, 1969 one of the highlights of the year occurred at this station. After a considerable amount of planning by committees which were set up, the hatchery was dedicated. The dedication ceremonies were under the sponsorship of the Idaho Wildlife Federation - Mr. Franklin Jones, President. Featured speaker for the day was Dr. Leslie Glasgow, Assistant Secretary for the Fish and Wildlife Service and Parks and Marine Resources, Washington, D. C. The attendance at the dedication was very gratifying -- an estimated 4,000 people visited this station at this time. The Master of Ceremonies for the event was Mr. Kimball, Executive Director, National Wildlife Federation, who did an excellent job. The Governor of the State of Idaho was represented by Mr. Cenarrusa, Secretary for the State of Idaho. The Nez Perce tribe was represented by Mr. Walter Moffett, Chairman of the Nez Perce Tribal Council, who gave a short speech which was very well taken. The Bureau of Sport Fisheries and Wildlife was represented by Mr. John Findlay, Regional Director, Region One, and by Mr. Harvey Willoughby, Chief, Division of Fish Hatcheries, Washington, D. C.; Mr. Russ Fielding, Bureau of Sport Fisheries and Wildlife; and by the Hatchery Manager. The U. S. Army Corps of Engineers was represented by Colonel Newman who represented the Chief of Engineers, Washington, D. C., by Colonel Giesen, District Engineer, Corps of Engineers, Walla Walla District, and by Mr. Donald Basgen, Resident Engineer for the Dworshak Dam Project. Entertainment was provided by the 438th U. S. Army Band, Ft. Lewis, Washington. Color Guard for the occasion was the Naval Reserve Unit from Clarkston, Washington.

In order to handle the large crowd expected, arrangements were made for parking space on the south side of the Clearwater River opposite the hatchery just off of U. S. 12. Travel by automobile amounted to approximately 8 miles to the hatchery site by road. However, the distance directly across the river was less than a quarter of a mile, and a floating foot bridge was installed by the 339th Combat Engineers, 18th Bridge Company, Ft. Lewis,

Washington for the occasion. In addition to the bridge across the Clearwater River for the use of the visiting public, shuttle busses were run from the same area and were unloaded immediately next to the dedication site. Mr. Leroy Altmiller, Sheriff of Clearwater County, headed the police detail which handled traffic and the pedestrian visitor load very nicely. The information booth at the station was manned by the conservation clubs of this area, the Orofino Chapter of the Northwest Steelheaders, and the Clearwater Conservation Club. The first aid station was manned by the Idaho State Department of Public Health. The local nurse for this agency was assigned to the task. In addition, the Orofino Chapter of the Order of Job's Daughters served as hostesses. These young ladies were dressed in very becoming gowns and served to direct the public and the guests to the various points of interest. They also seated the platform guests and helped out in many ways to make the event a success.

One of the interesting highlights of the ceremony was the presentation of a painting of the Dworshak National Fish Hatchery, painted by Mrs. Marty Johnson. Mrs. Johnson is a local artist who is a member of the Clearwater Art Association. She specializes in historical buildings. The painting was presented in behalf of the Te-Wap-Poo Art Gallery and the Clearwater Art Association by Mrs. A. B. Curtis who is the wife of the Mayor of Orofino. Te-Wap-Poo Art Gallery is a non-profit association located in Orofino, Idaho for the purpose of promoting the arts in Clearwater County, Idaho. A suitable glass case was constructed by personnel of this station to protect this painting. The painting now hangs in the lobby of the main building of the Dworshak National Fish Hatchery.

Due to the publicity which had been given to the public about the dedication and because of the very nature of this installation, public visitation was very heavy. The summer of 1969 was almost completely passed before the public was allowed to have free access to the installation. Until the contractor had removed his equipment from the area, visitors were discouraged from visiting the hatchery. During the dedication ceremonies and the open house which followed, there were approximately 2,000 recorded hatchery visitors. Full public access was not available until October 1, 1969. From that period until the end of the fiscal year which was the start of the 1970 tourist season, an estimated 25,000 visitors used the facility. During the spring of 1970, large numbers of group visitors toured the installation. Because of limited manpower, the staff of this hatchery was unable to program conducted tours for other than

organized groups. Organized groups were given thorough tours of the hatchery with complete explanations of the operation.

Public relations talks were given at many points. Because of the newness of the installation and the natural curiosity which the people of the general area showed, invitations to speak were extended to the Hatchery Manager from many operations.

At the beginning of the fiscal year, the arrangements were such that the Hatchery Manager and the Assistant Manager, Operations, were living in government rented trailers at a remote distance from the hatchery. During July of 1969, the residences were completed at the station, and the personnel began to occupy the quarters. Because of the need for 24 hour surveillance of the equipment, this was a considerable improvement over the previous arrangement.

The weather during the fiscal year would be considered normal. The winter had intermittent snow. Some snow removal problems were experienced but these were only incidental. Periods of snowfall during the winter were interspersed with thawing periods, and the weather was not anywhere near as severe as the previous winter. At the end of the fiscal year, it was apparent that the season was going to be warmer during the summer of 1970. Hotter weather had been experienced during this period than had been experienced in previous years.

During the fiscal year, two Division inspections were made by members of the Regional Office staff, and one Administrative inspection was made of the administrative actions of this office. Visits by Corps personnel which were in effect inspections were rather frequent. The Walla Walla District of the U. S. Corps of Army Engineers was very much interested in the operational problems and difficulties which were experienced, and many visits were made in order to check these conditions. In addition to the interest shown by the Corps in the operation of the station, checks were made of design criteria which could be used in the design of the Spring Creek facility and in other facilities to be built by the Corps.

FISH CULTURAL OPERATIONS

In an attempt to improve egg quality and survival, adult steelhead females were handled with less frequency this year than previously. The first spawning date was May 11, 1970, and the last was June 8, 1970. As the last take yielded only 18 ripe females and an egg survival to the eyed stage of less than 50%, this last take should have been eliminated as it was not economically practical.

Egg survival was still comparatively poor but the reason was probably not attributable to brood stock handling procedures. Egg losses were caused by fungus growth. Although the incubator water supply was run through the electric grid, sand filters, and ultraviolet banks, fungus spores were probably introduced with the eggs as they were not sterilized. Heavy rains increased the silt load in the water supply, and the cloudy water also inhibited the effectiveness of the ultraviolet light treatment. Mr. Einar Wold, the hatchery biologist, made observations on the effectiveness of formalin as a fungicide. Based on his findings, eggs and fry, if necessary, will be treated with formalin two or three times weekly, 1:400, for 15 minutes.

Steelhead eggs were all held in Heath vertical incubators at a constant water temperature, $48^{\circ} \pm 1^{\circ}F$. At this temperature, the range of temperature units required for eggs to reach the eyed stage was from 281 to 298 with the average being 288 units. Approximately 542 temperature units were required to hatching. When the fish were just "buttoning-up", they were transferred to the rearing tanks and/or production ponds.

During this production year, a rather futile attempt was made to keep many sub-lots of fish. Fish were designated as follows:

1. Falls - progeny from fall run fish over 27 inches, fork length.
2. Small Falls - progeny from fall run fish under 27 inches, fork length.
3. Springs - progeny from spring run fish over 27 inches, fork length.
4. Small Springs - progeny from spring run fish under 27 inches, fork length.
5. Sub-lot designations as above held in either the raw water system or the reuse system.
6. Some production lots were graded into small or large fish; a possible sublot description would have been

large, small, falls or small, small falls with another descriptive term added for the water system in which the fish were held.

Production records will be maintained as spring run and fall run progeny, each a designated lot, each with a designated water system.

Fish grading activities were accomplished using the Pacific fish pump. The pump has been used on fish up to seven inches long with excellent results. As the hatchery is not designed to use gravity in fish moving activities, it is anticipated that all future transfers on the station will be made via the fish pump and tubing rather than by handling fish in a portable tank.

Considerable operational difficulties were experienced with the Burrows circulatory ponds. The outlet screens as installed had insufficient open space, thus inhibiting the self-cleaning feature of the ponds. As a result, a six inch build up of silt occurred in raw water ponds, and normal production wastes caused screen stoppages and pond overflows. When the outlet gates were raised to stock the fish, the fish refused to swim out of the ponds unless they were manually crowded. With the current turning vanes in the pond, it is impossible to flush the fish straight out the stocking chute -- they just keep going around and around. This recirculating feature will also compound the severity of external parasite infestations as the fish will have to endure prolonged exposures.

Fish feeding trials were conducted with Abernathy, Silver Cup, PR-4 and Oregon Moist Pellet diets. A copy of the report is attached.

The first stock of fish reared in the reuse water was on April 20, 1970, and was completed on May 14, 1970. The average length of these fish was 7.8 inches compared to an average length of 4 inches of the fish of the same age group raised in raw water. It is evident that if the entire project was operated on reconditioned water that the entire smolt production and stocking cycle could be completed within one year.

Animal predation on the fingerling fish and human predation on the brood stock exists but has caused no large shortages. Kingfishers and minks have been seen fishing the ponds with some

success. The County Sheriff patrols the hatchery periodically as a deterrent to poaching.

The computerized fish feeding system was made operational in March, 1970. Since that time only pellet sizes of 3/32 and 1/8 have been used, but smaller feed will be tested as soon as the small fish on hand are large enough to utilize crumble particles. As was expected, programming and mechanical malfunctions occurred within the system. With the assistance of the Corps of Engineers and Wismer and Becker contractors, obstacles are being overcome and the efficiency of the system improved.

Regional Director
Bureau of Sport Fisheries and Wildlife

July 14, 1970

Fishery Biologist (Management)
Dworshak National Fish Hatchery

Diet Tests at Dworshak National Fish Hatchery

In two previous memos, the results of earlier diet tests were discussed. The first memo, August 18, 1969, explained the results obtained during the mash diet trials of July 10 to July 31, 1969. The second memo, January 26, 1970, explained the results obtained during the diet trial period of August 1, 1969 to December 1, 1969 (copies attached). This memo will discourse to some degree on two periods during which feed trials were held. The first period will overlap the period discussed in the second memo above and will cover the period from September 24, 1969 until the fish were graded. The second period concerned was after grading to the time the fish were released.

The fish in the O. M. P. control, the Silvercup, and the Abernathy diets were graded to three sizes on February 16, 1969. The fish on the PR-4 diet were graded on February 17, 1969. The main production group, which had a diet of 90% O. M. P., 5% PR-4 and 5% Abernathy, was graded during the period February 12 to 21, 1969. For informational purposes, grading results will be submitted on Chart C.

It may be desirable to point out some facts that were illuminated as a result of grading. More than 33% of the fish had reached the category of large (approximately 10 fish/lb.). If fish will be released early, the largest size possible at the earliest date would be a major consideration. Mr. Hemerick in his January 26, 1970 memo (Diet Tests at Dworshak National Fish Hatchery) stated, "the conversion factor isn't as important as is the factor of having the fish to the desired or largest size possible by the time of downstream migration." He made a very important point, but in comparing the attached charts, it appears that one diet performed well and produced large size fish. Silvercup Diet did have almost 38% of the fish to "large" size at grading time (February 16th), and the cost per pound of these fish was low.

July 14, 1970

SUBJECT: Diet Tests at Dworshak National Fish Hatchery

DIET PERIOD SEPTEMBER 24, 1969 to FEBRUARY 16±, 1970

Some observations made during this period are: The Silvercup and O. M. P. control fish handled well when sampled and/or crowded; the Abernathy diet fish appeared sluggish when handled but responded well under normal conditions; the PR-4 diet fish had the best gain in weight but when handled became stressed very quickly and appeared lethargic during sampling periods and when they were graded.

DIET PERIOD FEBRUARY 17±, 1970 to RELEASE APRIL 24±, 1970

This diet period showed the greatest growth in the fish as well as the quickest increase in mortality in the PR-4 diet. The greatest growth showed up in the main production (104% gain) fish; the O. M. P. control group followed (92% gain); with Silvercup fish (86% gain); PR-4 fish (78% gain); and Abernathy fish (60% gain) following.

During this period, losses increased drastically in the PR-4 diet fish. The PR-4 diet fish started dying on February 19th (400 fish dead), and the mortality increased until the diet was changed and they were split into two ponds on February 27th in order to place one pond on OM. P. to see if these fish might recover. A total of 1,796 fish died from February 19 to February 27 in that PR-4 diet group. Severe scoliosis developed. The fish were swimming in an undulative manner and were weak and lethargic. When the PR-4 group fish were split, they were fed O. M. P. at a reduced rate. On March 5th the mortality dropped off to a rate comparable to the other diet fed fish. The fish remained weakened and sluggish for about a month.

The other groups had average losses during this period as is shown on Chart B. The fish were fed eight times per day. One oddity is this: The fish would feed well when they were presented with ten pounds or less of feed per feeding - when the required pounds of feed per feeding reached about twelve pounds per pond, they would leave feed on the bottom. The number of feedings would then be increased to compensate for this.

These above comments concern the fish that were released. The fish presently on the station are now being fed via the computer controlled automated feeding system. The automated feeding system started

July 14, 1970

SUBJECT: Diet Tests at Dworshak National Fish Hatchery

operating on or about March 10, 1970, and the main production group were fed via this method. The Abernathy, PR-4, O. M. P. control and Silvercup were all hand fed.

Walter G. Harris

THRU: John R. Parvin, Manager

On July 9, 1970, all fish in the raw water system were started on TM 50 medicated Abernathy pellets. This medication was required for the marking program and was coincidental with an outbreak of Columnaris.

This terminates the feeding trials with no further comments.

John R. Parvin

cc: Murray Elevators
Burrows
Dworshak NFH Biologist

CHART A

EXPERIMENTAL DIETS

Period Sept. 24, 1969 to Grading Feb. 1970

	Abernathy	PR-4	Silver Cup	O. M. P. Control	Reuse Production
Weight Fish (in pounds) 9/24/69	408	449	390	390	3, 564
Weight (in pounds) when graded 2/16/70	4, 158	4, 585	4, 625	4, 034	85, 918
Population 9/24/69	62, 144	74, 296	62, 808	59, 909	1, 133, 228
Population 2/16/70	61, 758	73, 304	61, 434	59, 584	1, 122, 279
% Mortality	0. 6	1. 3	2. 2	0. 5	1. 0
Conversion	1. 64	1. 51	1. 51	1. 90	1. 91
Cost per pound of fish produced	. 1802	. 1385	. 1548	. 2744	. 2684

CHART B

DIET EXPERIMENTS

Period from grading Feb. 1970 to release April, 1970

	Abernathy	PR-4	Silver Cup	O. M. P. Control	Reuse Production Group
Weight of fish (in pounds) 2/17/70	3,025	3,189	2,729	2,675	57,307
Weight at release 4/24/70	4,840	5,680	5,068	5,130	117,003
Population 2/17/70	43,801	57,777	37,313	41,424	836,465
Population at release 4/24/70	43,615	55,041	37,115	41,294	829,805
% Mortality	0.4	4.7	0.5	0.3	0.8
Conversion	2.10	1.63	1.44	1.86	2.10
Cost per pound of fish produced	.2308	.2245	.1584	.2686	.2552

CHART C

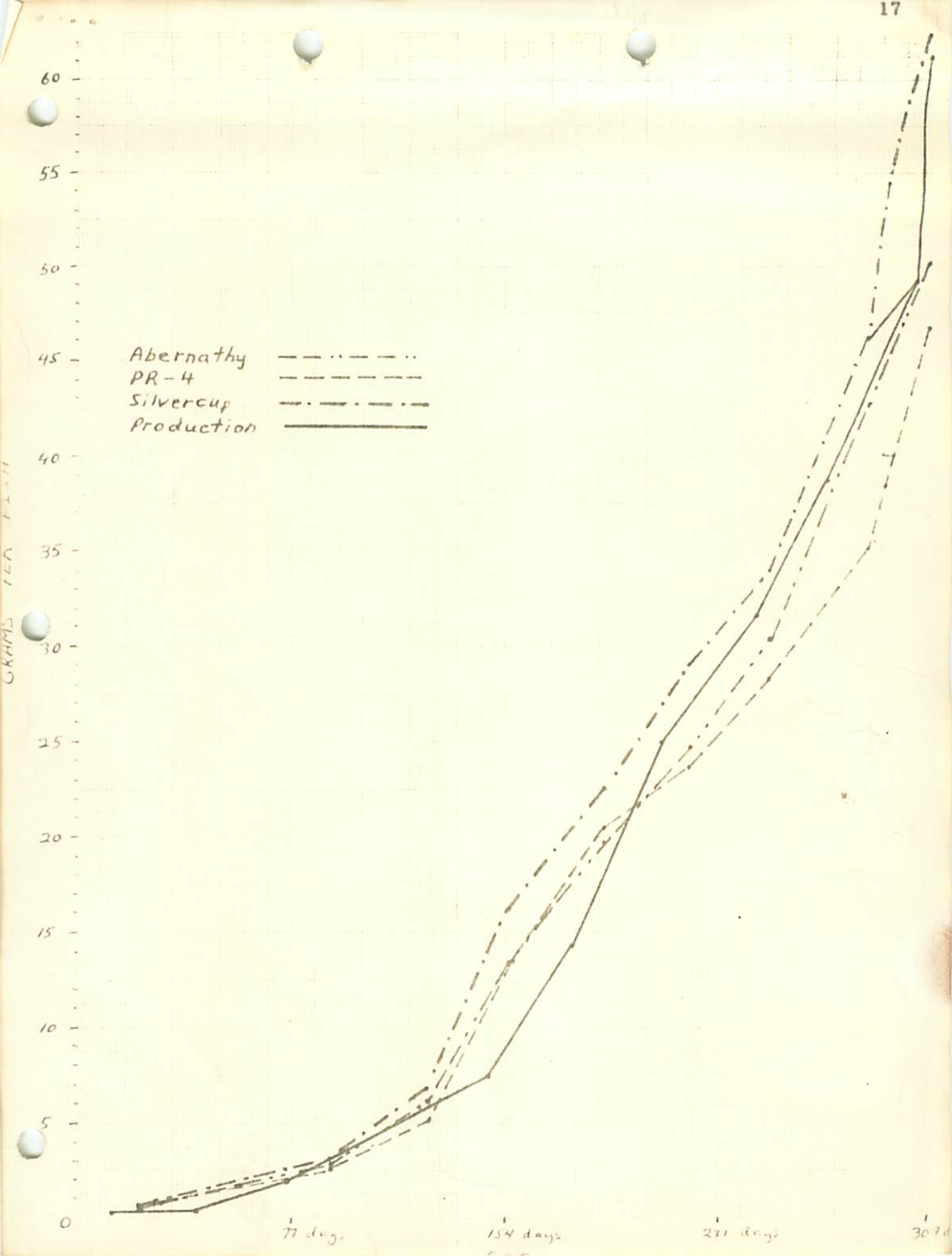
GRADING RESULTS - February 1970

	Total Lbs.	Total Nos. Fish	Nos. Small Fish Out	Nos. Med. Re-main.	Nos. Large Out	Lbs. Small	Lbs. Med. Re-main.	Nos. Large Out	Large Fish in Inches	% Large Fish
Silvercup 2/16/70	4,625	61,434	5,294	37,136	19,004	154	2,729	1,742	6.5	37.7
Abernathy 2/16/70	4,158	61,758	5,169	43,639	12,950	182	3,025	951	6.0	22.9
PR-4 2/17/70	4,585	73,304	2,463	55,364	15,477	175	3,189	1,221	6.1	26.6
O. M. P. Diet Control 2/16/70	4,034	59,584	4,690	41,342	13,552	134	2,675	1,225	6.4	30.4
Main Production	103,320	1,378,359	123,527	890,174	364,658	4,709	64,317	34,294	6.5	33.1

CHART D

SAMPLED WEIGHT IN GRAMS PER FISH

	12/1/69	1/19/70	Graded 2/16†/70	3/23/70	4/24/70
Silvercup	16.18	29.04	34.18	46.18	62.00
Abernathy	13.56	24.78	30.57	42.73	50.38
PR-4	13.55	23.81	28.40	35.12	46.85
O. M. P. Control	15.30	27.07	30.74	45.00	56.90
Main Production Group	14.28	27.58	34.03	46.20	63.93


60
55
50
45
40
35
30
25
20
15
10
5
0
Abernathy
PR-4
Silvercup
Production
77 days
154 days
231 days

HATCHERY BIOLOGIST ACTIVITIES

Description of Facilities

The hatchery biologist facility consists of a combination laboratory and office covering 250 square feet. Major equipment includes refrigerator, incubator, spectronic 20, pH meter, range, fluorescence microscope with fluorolume, microprojector for scale analysis, microscope with camera and a Van Slyke blood gas apparatus.

A wet lab of 200 square feet was constructed this year and equipped with six self-contained tanks with temperature controls.

Diagnostic Services

The hatchery biologist is responsible for disease diagnoses at three federal hatcheries--Dworshak, Kooskia and Hagerman. In addition to the federal hatcheries, assistance is provided to the Idaho Fish and Game Department and commercial hatcheries when requested.

The following list shows disease diagnosis made during the past year.

Dworshak National Fish Hatchery

Reclaimed Water System:

Disease	Species of Fish	Treatment	Results
Bacterial gill disease	Steelhead	Roccal and/or *Hyamine 3500 @ 2 ppm for 1 hour and increased flow thru ponds from 300 to 600 gpm	Good

*Hyamine - 3500 at 2 ppm for 1 hour is toxic to steelhead larger than 3.5 inches.

Raw Water System:

Disease	Species of Fish	Treatment	Results
Costia	Dace, Steelhead	None	
P. Fluorescens	Steelhead	None	
Scyphidia	Steelhead	None	
Epistylis	Steelhead	None	
Gyrodactylus	Steelhead	None	
glochidia	Steelhead	None	
Ichthyophthirius	Steelhead	Lowered water in pond and increased flow	Good
Trichodina	Steelhead	None	

Raw Water System (continued)

Disease	Species of Fish	Treatment	Results
Columnaris	Steelhead	TM 50 @ 3 gm level for 14 days followed in one week with 10 day treatment	Good
Sanguinicola	Steelhead	None	

Brood Stock:

Disease	Species of Fish	Treatment	Results
Ceratomyxa	Spring Chinook	None	
Nanophyetus salmincola	Steelhead	None	

Kooskia National Fish Hatchery

Disease	Species of Fish	Treatment	Results
Coagulated Yolk	Spring Chinook	None	
Ichthyophthirius	Spring Chinook	Formalin @ 1:6000 for 1 hour 5 days followed by 2x/week and lowered water to increase flow	* Good
Columnaris	Spring Chinook	TM 50 @ 3 gms/100 lbs. fish for 14 days	Good

*Fish at Kooskia were split into two equal groups and reared in standard raceways and rectangular circulating rearing ponds. Available water was split equally into the two groups. "Ich" was diagnosed and above treatment prescribed. Hatchery personnel were unable to lower water and increase flow in recirculating ponds and Formalin treatments did not curb the disease as all fish were lost. In the standard raceway the water was lowered and along with Formalin treatments, the epizootic was controlled.

Hagerman National Fish Hatchery

Disease	Species of Fish	Treatment	Results
Sanguinicola	Rainbow	None	
Gyrodactylus	Rainbow	None	

Idaho State Fish and Game Department

Hatchery	Disease	Species of Fish
Rapid River	Kidney Disease	Spring Chinook
Hayspur	Coagulated Yolk	Coho

Since the diagnosis of whirling disease at Lahontan National Fish Hatchery in the fall of 1969, the hatchery biologist at Dworshak has conducted examinations of fish from several areas that had been planted with fish from Lahontan. All examinations to date have been negative for Myxosoma cerebralis spores. The examinations have included:

1-20-70	Hagerman National Fish Hatchery	Negative
1-20-70	Idaho Fish and Game Hatchery - Hagerman	Negative
3-13-70	Western Fish Nutrition Lab. - Hagerman	Negative
3-13-70	Walker Lake, Nevada	Negative
3-13-70	Pyramid Lake, Nevada	Negative
5-07-70	Summit Lake, Nevada	Negative

Hatchery Certification

A national fish disease inspection-certification program was initiated this year. The following provisional classifications of the three federal hatcheries are based on disease examinations carried out this year. The Hagerman classification was made using this year's examinations and past records.

Hatchery	Classification
Dworshak National Fish Hatchery	A-2 (no disease diagnosis, but hatchery has open water supply)
Kooskia National Fish Hatchery	B-BK (eyed spring chinook eggs shipped in from hatcheries with known K. D. occurrences and infected brood stock)
Hagerman National Fish Hatchery	B-BR-BK

Hatchery Evaluation

Fish Marking:

A marking program was developed to evaluate the contribution of steelhead reared at Dworshak. A hatchery evaluation committee made of personnel from the Bureau of Commercial Fisheries, Corps of Engineers, Idaho Fish and Game Department, Division of Hatcheries - Portland, and Dworshak National Fish Hatchery collaborated to set up guidelines for the study. A basic plan was established to mark all smolts released each year with tetracycline and 20 percent of the release with a combination fin clip and freeze brand. The tetracycline will be fed at intervals to produce one or more bands to differentiate brood years. The fin

clip-brand combinations will be used to determine survival of different groups of fish such as fall run fish, spring run fish, fish reared in reclaimed water only, fish reared in raw water for two years, and time of release. The fin clip will identify Dworshak fish in the commercial and sport fishery and will facilitate recognition of brands.

Upon return to the hatchery all adults with fin clips and 10 percent of all unmarked adults will be checked for age (scale circuli), brood year (tetracycline marks), and groups (brands).

With the initiation of fin clipping this year, all equipment necessary for carrying out the program was constructed by hatchery personnel or purchased. Equipment obtained included 10 fiberglass tanks, overhead pull down lights, twelve nitrogen branding units, five dozen scissors, and two dozen tallies. Nets were fabricated by station personnel. The hiring of Nez Perce tribal members was coordinated through the local Community Action Program Director. The marking crew consisted of eleven women with no fish marking experience. The average fish per marker day ranged from 1,112 on the first day to 3,097 on the final day. A total of 264,285 steelhead were marked in 114 marker days.

Approximately 19 percent of the entire release of 1,371,543 steelhead were marked with a common adipose fin clip and a brand. A square letter "U" was used in four positions on the right side of the fish to identify four groups of fish. The groups are as follows:

(1) Progeny of spring run adults reared in reclaimed water entire rearing period - the fish were branded "U" on the right side forward of dorsal fin.
(2) Progeny of spring run adults reared in reclaimed water until two months prior to release and then maintained in raw river water until release - the fish were branded "∩" on the right side forward of dorsal fin.
(3) Progeny of fall run adults reared in reclaimed water entire rearing period - the fish were branded "U" on the right side behind the dorsal fin.
(4) Progeny of fall run adults reared in reclaimed water until two months prior to release and then maintained in raw river water until release - the fish were branded "∩" on the right side behind the dorsal fin.

In addition to the adipose fin clip and freeze brand, all the fish released from Dworshak were marked with one tetracycline band.

Downstream Migration

A study conducted by the Bureau of Commercial Fisheries at Ice Harbor Dam on the Lower Snake River, McNary and Bonneville Dams on the Columbia River, and in the estuary at Astoria, Oregon, contributed information regarding the success of downstream migration of Dworshak fish. As determined by selected sampling procedures, Bureau of Commercial Fisheries personnel have predicted that 85 percent of the fish planted at Dworshak passed Ice Harbor Dam and 30 percent made it to McNary Dam. Six marked fish were captured in the beach seine sampling at Astoria.

The fish loss to the downstream steelhead migrants was attributed to high (120-145% saturation) of nitrogen in the rivers from Ice Harbor to below Bonneville Dam. The high survival (85%) to Ice Harbor provides a good indicator that the fish from Dworshak were in excellent health and released at the correct time.

The table below lists the number of marked fish released at Dworshak and the number collected at Ice Harbor Dam for each mark.

Brand	Number Released	Number Captured Ice Harbor	% of Release	Times Factor Of 25*	Theoretical No. Fish to Ice Harbor
R. Ant. U	174,944	6,213	3.5514	88.785	155,324
R. Ant.	61,881	1,960	3.1673	79.183	48,999
R. Post. U	23,844	792	3.3216	83.040	19,800
R. Post.	2,551	80	3.1360	78.400	2,000
TOTALS	263,220				226,123

*The trapping facility had an average efficiency of 4%, therefore, the number captured is multiplied by 25 to obtain the theoretical number of marked fish pounted past Ice Harbor.

The average size of fish and the coefficient of condition was determined for each marked group of fish at time of release and at Ice Harbor Dam. The data are as follows:

	Dworshak Hatchery at release		Ice Harbor Dam	
Mark	Ave length (Total lg)	Ave CoF Cond	Ave length (total lg)	Ave CoF of Cond
Right anterior "U"	194 mm	.7600	186 mm	.6908
Right anterior "∩"	203 mm	.8100	180 mm	.7373
Right posterior "U"	195 mm	---	179 mm	.7201
Right posterior "∩"	192 mm	---	185 mm	.6342
Wild Steelhead	---	---	188 mm	.7958

The decrease in the average length from Dworshak to Ice Harbor may be due to several factors: (1) avoidance of trapping facilities by larger fish, (2) larger fish migrate past dam by different avenue and not through area with trapping facilities, (3) death of larger fish prior or during downstream migration, and (4) loss of migration urge with larger fish. The first or second hypothesis would be the more logical ones. In discussions with Bureau of Commercial Fisheries personnel at Ice Harbor, it was determined that no studies had been undertaken to find out if larger fish do avoid the trapping facilities. With this new information obtained from the hatchery released fish, a study will be initiated next year to determine the migration pattern around dams by the larger fingerline smolts.

Steelhead Adult Evaluation

Scales were obtained from 10 percent of all adults handled during the spawning season. In order to obtain scales that were not regenerated, all scales selected were scanned with use of a dissecting scope prior to final collection on scale cards. Scales from adults were obtained and will be analyzed for fresh water growth, age, and number of times fish had spawned previously.

All adults spawned were measured, weighed, and checked for marks and tags. The table below shows average size for 1970 brood males and females spawned.

Sex	Average Fork Length	Average Weight Before Spawning	Average Weight After Spawning
Female	32.07"	* 12.04 lbs.	9.99 lbs.
Male	32.80"	12.29 lbs.	

*All females were weighed after spawning. To determine weight of fish before spawning, a percent of body weight as eggs (17% as determined in 1969) factor was used.

Two tagged fish bearing Oregon Game Commission tags and three fin clipped (two adipose and one dorsal) were recovered.

Fish Cultural Management

Determination of Optimum Temperature for Incubating Steelhead Eggs:

A trial to determine the optimum temperature to incubate steelhead eggs was conducted. Six tanks with temperatures set at 38°, 43°, 48°, 53°, 50°, and 63°F. were tested using pooled samples of eggs from five females. Duplicate samples were incubated. From the results of the test, 48°F. is the recommended incubation

temperature. Temperatures above 59°F. are not recommended as a high incidence of coagulated yolk and cripples accompanied a low percent of eyed eggs.

The number of temperature units, using 32°F. as the base, required for eggs to eye and hatch was recorded for each temperature.

Temperature	Temperature Units To Eye	Temperature Units To Hatch
38°	380	--- *
43°	330	660
48°	300	585
53°	275	535
58°	260	500
63°	245	475

* Eggs are still developing at time of writing.

The amount of temperature units needed to hatch is increased about 5 percent when eggs are treated two times a week with Formalin.

Determination of Formalin Treatment Level with Incubating Steelhead Eggs:

It is the hatchery biologist's recommendation that all steelhead eggs incubated at Dworshak be treated twice a week with Formalin at 1:400 for 15 minutes. This recommendation is based on trials conducted during the past incubation period.

Establishment of Cutthroat Broodstock:

Westslope cutthroat eggs were obtained from Colville State Hatchery (Washington Game Commission) to establish a broodstock at Dworshak. The eyed eggs were incubated in quarantine until feeding was started. Virology tests were conducted with negative results and the fish are tentatively designated as being disease free. The fish will be kept in semi-quarantine until old enough for kidney disease.

Length-Weight Relationship of Fingerling Steelhead:

Length-weight data were recorded for fingerling steelhead during the rearing period. Originally the computer for feeding was programmed using Haskell's work with brook, brown, and rainbow trout. As the steelhead reared at Dworshak have dissimilar morphologies and physiological requirements than those species from which Haskell based his work, the establishment of the length-weight relationship of Dworshak steelhead was necessary. The following table shows the fish per pound calculated using a K value of 0.0003918 in the Formula $W=0.000398L^3$. W. is expressed as

the weight of 1,000 fish.

Total Length Inches	Fish Per Pound
1.0	2,552
1.5	755
2.0	319
2.5	163
3.0	94.5
3.5	59.5
4.0	39.8
4.5	28.0
5.0	20.4
5.5	15.3
6.0	11.8
6.5	9.29
7.0	7.44
7.5	6.04
8.0	4.98
8.5	4.15
9.0	3.50

Nutritional Disease:

During the last quarter, steelhead being fed the PR-4 diet developed diseased conditions. The fish became lethargic and developed scoliosis. The small amount of body fat and viscera were hemorrhaged. Fish were sent to the Western Fish Disease Laboratory for virus and histopathology examinations. No virus, bacteria, parasites, or indications of pesticide contamination were observed. Food samples were sent to the Fish-Pesticide Research Laboratory for pesticide analysis and to the Wisconsin Alumni Research Association for panthothenic acid assay. The following results were obtained: Analysis for pantothenic acid showed 80.0 micrograms per gram of pellets.

The Fish-Pesticide Research Laboratory supplied the following data regarding the food samples:

FPRL# S-45	Your Desig.	Pesticide and Metals ug/g (DDE	DDD	DDT	Diel-drin	En-drin	Al-drin	Hg	Cu	Zn
FF001	DNFH-1 PR-4 diet 3-18-70	0.15	0.05	0.10	0.03	----	----	1.0	0.2	0.006
FF002	DNFH-2 PR-4 diet 3-18-70	0.14	0.04	0.10	0.03	---	----	1.0	0.6	0.014
FF003	DNFH-3 PR-4 diet 3-18-70	0.26	0.08	0.09	0.04	---	----	1.0	0.05	0.010
FF004	DNFH-4 Abernathy Pellets 3-18-70	0.03	0.01	0.06	0.02	----	----	1.0	0.05	0.014
	LaCrosse diet	----	----	----	---	----	----	1.0	0.05	0.007

The pesticide levels are not significantly high, and they probably did not cause the symptoms described. Also, the pantothenic acid level is above the minimum amount required. A diet deficiency is suspected since a rapid recovery did occur when the fish were changed to Oregon Moist Pellet.

Water Chemistry

Routine water analyses were conducted throughout the year. Dissolved oxygen, ammonia, carbon dioxide, and pH were determined in the reclaimed water system. No problems developed in the system.

Weekly pH determinations were made for the Corps of Engineers of water used for construction of Dworshak Dam.

SAFETY

The Hatchery Manager assigned the responsibility of Safety Officer to the Assistant Manager in charge of operations who in turn assigned four staff employees as members of a Safety Committee. The Safety Committee drafted a station Safety Plan which was subsequently approved by the Regional Director.

During the year, fourteen staff safety meetings and six safety committee meetings were held. Subjects of the staff safety meetings included on-the-job and off-the-job safety practices. National Safety Council slides were the subject of most meetings and electrical safety were stressed.

Two lost time accidents occurred during the year: a lifting injury and a moving vehicle accident occurred.

There have been 88 days since the last lost time accident.

MAINTENANCE AND REPAIR

No major maintenance or repair work was necessary during the year. Charges to maintenance cost codes were for personnel costs, and for acquisition of materials andequipment necessary for the new installation and for conducting the maintenance program.

The maintenance program took three main directions: finding and correcting minor system faults, including trouble shooting and debugging the automatic fish feeding system; continuing a preventive maintenance program; development of maintenance employees' technical knowledge of the diverse systems and components that are vital to operation of the facility.

Minor system faults proving more of a nuisance than a real problem included: Faulty circuit breakers, improperly set sump alarms, overloaded sump pumps, faulty annunciator circuits, boiler flame-outs, chiller trip-outs, all of which activate the alarm circuits day or night. More serious problems included: failure of vital pumps to automatically restart following momentary power outages. This particular problem was corrected by installing time delay devices. Another potentially disastrous problem occurred when a fuse holder in the programmer circuit for the main pumps caused an unexplained shutdown of the main water supply system. This failure was repaired before system water supply completely stopped, and no loss of fish resulted.

A considerable amount of time was spent in maintenance of the automatic fish feeding system. This system has proven its usefulness, however, weaknesses in the system such as conveying, batching and pond selection are problems. Data to pinpoint faults is being collected and the system's reliability is expected to improve with operational experience.

The most important single factor in maintaining a high degree of reliability in the automated systems and components is a program of preventive maintenance by skilled technicians. This has been the first order of business in the maintenance program and will be expanded and improved upon in the next several years. Most of the periodic equipment maintenance and service work has been accomplished by staff mechanics and electricians. The monitoring system was an exception, and instrumentation maintenance was contracted to the Honeywell Corporation.

Success of the Dworshak facility depends to some extent on reliability of the automated equipment and support machinery. In turn, reliability of equipment components depends on the capability and knowledge of the servicing employees. On-the-job training has been continuing since the first piece of equipment went into operation. Factory training was obtained at the Chrysler Air Temp factory in Ohio and at the Mandrel Industries plant in Texas. It is anticipated that additional factory training of personnel will be accomplished in the coming year.

STATION HISTORY

The construction of the facility was authorized under Public Law 10-USC-2304(a) and constructed under appropriation 96x3122 Construction General Corps of Engineers, Civil, Dworshak Dam and Reservoir. The prime contract was awarded to M. Morrin and Sons of Ogden, Utah, effective September 16, 1967, for a contract price of $7,375,801.50.

There follows a summary of the facilities, including costs. These figures are the best available at the present time and reflect total costs of the various contracts and change orders. The figures may change slightly when all final change orders and adjustments are included.

BUILDINGS	Unit	Cost
Pump Station	1	$ 658,775
Pumps	5	49,760
Standby power plant 500 kw	1	48,233
Electric switchgear and controls	3	30,688
Fire and maintenance water pumphouse	1	34,889
Electric switchgear	1	1,475
Mechanical Building	1	708,662
Switchgear	2	29,642
Standby power plant	1	48,233
Hatchery Building	1	552,529
Instrumentation and recording system	1	97,300
Spawning equipment	1	25,400
Fish Food Facility	1	224,200
Automated fish feeding equipment with computer	1	651,469
Garage and Shop	1	83,804
Houses and Landscaping	4	134,365
Visitors' Toilet Building	1	20,245
Flammable Building	1	20,885
FISH PRODUCTION FACILITIES		
Water Treatment Facility	1	479,139
Switchgear	1	5,850
Water Reuse Facility	1	502,871
Fish Ladder and Attracting Channel	1	404,363
Holding Ponds and Channels	9	295,277
Pipelines, Water Supply and Drains		635,661
Rearing Tanks	64	97,750
Mechanical Feeders	64	17,328
Rearing Ponds	84	1,114,693

OTHER PHYSICAL FACILITIES	Unit	Cost
Underground Utilities		169,277
Railroad Overpass	1	56,583
Railroad bridge and pedestrian underpass	1	120,419
Incinerator	1	8,594
Sewage System and Treatment Plant	1	146,958
Storm Drainage System	1	116,751
Site Development and Landscaping	1	123,954
Concrete Curbs	6110 ft.	23,138
Concrete Sidewalk	1950 s.y.	11,700
Asphalt Concrete Pavement	33,800 s.y.	127,764
Guard Rails	1600 l.f.	4,600
Fill and Embankment	225,000 c.y.	529,200
Stream Riprap	28,000 c.y.	185,220
EQUIPMENT		
Fish Crowders with Transporter	3	46,650
	TOTAL -	$8,644,244

At the present time negotiations are still under way to settle certain claims of the contractor for additional compensation for change orders. Until final determination is made concerning these claims, we will be unable to give a complete detailed total cost of the project. There is also a contract to be issued which the Corps terms a "cleanup" contract. This will correct certain errors in design and add safety features which would appear to be required. At the present time it is expected this contract will be in effect possibly by September, 1970.

A description of the major buildings and related facilities of the hatchery and their cost follows:

Pump Station

The pump station is of course the water supply source for the entire project. Water is pumped from the North Fork of the Clearwater River into the water treatment facility which is a structure which will serve two or more purposes. The pump house is of reinforced concrete construction - 36' wide and 89' long. The exterior surface is finished in tan trowelled marble. The interior of the building is equipped with five pumps, one standby generator, three link belt traveling water screens, and the necessary switchgear and bus bars for the electrical equipment. In addition, there is a five ton bridge crane for handling the equipment within the building. There are three 200 H. P. pumps, one 100 H. P. pump, and one 2-speed pump which operates either at half speed or full

speed. These combinations of pumps will give sixteen different water flows from a minimum of 4,000 gallons per minute to a maximum of 64,000 gallons per minute in increments of 4,000 gallons per minute. When completed, the pumping controls will be automatic. There is incorporated into the system a sequential timer which receives impulses from the level indicators in the water treatment facility. The timer is energized to seek either additional combinations of pumping capacity or decreasing amounts of capacity depending upon the requirements of the system. The pumps are protected by three traveling water screens of link belt design. These water screens are automatic in that there are sensors which determine the differential head between the outside and the inside of the screen. When the head equals six inches, the screens are automatically turned on and backflushed. If the head should reach ten inches, the alarm system is activated and the alarm shows on the annunciator system at the pumphouse and is transmitted to the monitoring equipment. In addition, the pumphouse is equipped with a steam generator which will generate steam to remove ice from the traveling water screens as occasion arises.

Fire and Maintenance Pumphouse

The fire and maintenance pumphouse is of concrete block construction, 15'4" x 22'8". It has a painted tan finish. It contains the pumps necessary to supply the fire suppression system and the water necessary for general cleanup purposes as well as watering of shrubbery and lawns. This pumphouse is automatic in operation as the demand increases on the system, the pumps automatically cut in as needed.

Water Treatment Facility

The water treatment facility is of reinforced concrete design, 91'2" side and 113'6" long. At the present time it serves as an equalization reservoir and settling basin to maintain head upon the system. There are twelve gear cases mounted on the upper level of the facility. After the Dworshak Reservoir has filled, it is expected that the oxygen at times may be less than saturated in the water supply and that possibly the nitrogen concentration may be above acceptable levels. These gear cases have impellers which will be fastened to them. When completely assembled, these aerators will be used to stabilize the oxygen and nitrogen in the water supply.

Visitors' Parking Lot - Restroom Facility

This building is of concrete block design, 22' x 32', painted

yellow. The facility includes men's and women's restrooms and a service room for caring for the building.

Shop and Garage Building

This building contains eight stalls for vehicles plus two shop areas. At the west end of the building is located the carpenter's shop. At the east end of the building is located the welding shop and the maintenance shop for grounds. The building is of concrete construction and concrete block, 49'4" x 89'. The building is painted tan.

Water Reuse Pumping Plant

This building is of reinforced concrete design, 21' x 24'10", with tan trowelled marble exterior. It contains four pumps of varying sizes with a total pumping capacity of 15,000 gallons per minute. There is also included in the building a volume air compressor for backflushing the filter beds. Directly adjacent to this facility is the aeration chamber for the reuse system. This reuse aeration chamber is equipped with aspirator type aerators and has the capacity to aerate 15,000 gallons per minute of total pumping capacity of the reuse pumping plant. This system is equipped with oxygen sensors and with low and high level water alarms in the sump area.

Mechanical Building No. 1

This building is of reinforced concrete construction, 69' x 96', with tan trowelled marble exterior. The building houses the complete mechanical components necessary for the operation of the reuse system and the incubator supply system. Water for use in the reuse system and the incubator supply system enters this building and passes through an electric grid sterilizer. From this point, the water is pumped through pressure filters for the removal of foreign matter larger than 15 microns. It then passes through ultraviolet ray sterilizers and thence to heat exchangers before it enters the systems. The heat exchangers are connected to either two 450 H. P. oil fired boilers, or as the occasion arises, to four 350 H. P. chillers. The water is either heated or chilled as the season demands and enters the reuse system or enters the incubator supply system. In addition to the water conditioning facilities in the building, there are sufficient amounts of switchgear and electrical components to supply the demands of the units. Installed in a small room is a 795 H. P. diesel generator. This diesel generator is the same as that in the main pumphouse. Upon power failure,

this generator automatically starts and picks up the load which has been previously determined necessary by the setting of the proper control switches.

Fish Food Facility

A complete description of the automated fish feeding facilities is included in another section of this document. In addition to housing the computer room and the fish feeding equipment, the fish food facility includes storage for dry feed. Originally the plans called for the storage of Oregon Moist Pellets at 0 degrees temperature. The building was originally designed and constructed so that the storage rooms could be kept at low temperature. The building is of two story design constructed of reinforced concrete, 94'6" long x 52' wide. The external finish is of dark, greenish-gray trowelled mortar. The basement contains one room which houses the pneumatic equipment for the fish food conveying to the ponds and the cold storage machinery. An additional room in the basement is used and designed for the storage of fish food and other materials. The main floor houses two storage rooms which can be maintained at any temperature down to -10°F. The storage hoppers are in a separate room and the temperature may be maintained at any point. At the present time, this room is being maintained at 45°F. in order to assure that the mechanical, electrical equipment will be operating satisfactorily. The conveyors especially are very sensitive in their operation to varying temperatures. On the main floor is also housed the rest room plus a room temperature work area. Fish food may be unloaded from trucks by the use of a fork lift and pallets. Immediately in front of the truck unloading door is a truck leveling device for leveling the trucks to the level of the unloading dock.

Hatchery and Office Building

The main hatchery and office building houses many functions. This building is of three story design, 96' x 120'. The second story contains the administrative offices and part of the public lobby. These rooms are finished in glazed tile with accoustic tile ceilings. The main lobby upstairs contains several of the units of instrumentation. Also is included some public display material. The painting which was presented at the dedication of the hatchery is also displayed in the lobby in a glass enclosure.

The instrumentation which is located in the lobby area includes three recording devices in one cabinet, a summary cabinet for the annunciation system, and a display board which shows a

diagram of the hatchery and the waterflow systems including the handling of the fish. This display board serves as an informational source for the visiting public. However, its main purpose is to show the electrical equipment which is in operation on the project. Each of the electrical units are represented on this display by a two-light square module. All units that are in operation are then shown in red. The units which are operational but in standby status with the control power on are shown in green.

The recording devices as mentioned above, consist of three units. The top unit monitors five water flow meters. One meter is located in the main supply pipeline; the second meter is located in the reuse facility supply pipeline; an additional meter is located in the water supply pipeline to the reuse system; another meter monitors the incubator supply, and the fifth meter monitors the reuse pumping supply. The center recording device records temperatures. The incoming water, the supply water and return water from the reuse system, the waterflow to the incubators, and the water reuse facility supply are monitored. The lower recording device monitors six dissolved oxygen probes, one ph meter, and a turbidity meter. The ph meter is located in the reuse system in order to monitor the changes in ph in the enclosed system. The turbidity meter is located in the incoming water supply. This merely records turbidity. The dissolved oxygen sensors are set up to monitor the incoming water, the reuse supply and return water, and the water passing through the fish ladder and discharge channels to the river. All of these units will report to the annunciator if preset limits are exceeded as to temperature, dissolved oxygen, water flows, ph or turbidity.

Off the lobby, connected by glass swinging doors, is an observation balcony immediately over the spawning area. The public can observe the sorting of the fish and the spawning operations without being actually in the immediate area. Immediately below the balcony on the main floor, is the highly mechanized spawning equipment.

To the west of the hatchery building are located nine holding ponds. Across the end of these ponds and connected to them by air operated gates is located the transportation channel. Operating on rails on the tops of the walls of the transportation channel are two channel crowders. These are used to crowd the fish into the hatchery building at the time of spawning and

sorting. The crowders may be operated either at the site of the crowder or by remote control from inside the spawning area.

Immediately within the building at the end of the transportation channel is located a control gate which allows the fish to enter a basket which in operation is hoisted and dumped either into one or two baskets located in the anesthetic tanks in the basement of the building. From this point, the fish are hoisted to the sorting table which is of stainless steel. Immature steelhead are returned to the ponds through a fiberglass pipe system. In order to get the fish into this system, the controls are operated by foot, the fish drop through a trap door and into the tubes as selected by the foot pedals. The female steelhead which are sexually mature are passed through the "guillotine" in which the back bone and the dorsal aorta are severed. The fish then go down into the spawning area where the eggs are taken by the usual incision method.

Adjacent to the spawning area on the main floor is the incubator room. The incubator room has a capacity of approximately 15,000,000 steelhead trout eggs. The water supply to the incubators comes from the mechanical building after having been processed through the sterilization and heat exchanger units.

The portion of the main lobby which is located on the main floor contains fairly extensive public rest rooms, the guest register and four aquaria. These aquaria are stocked with small steelhead, large steelhead and trout of the Idaho area as available.

Behind the public area in the building is located a corridor or passageway which is accessible to mechanized equipment. Towards the rear of the building is located the crew's quarters which include lunchroom, shower and locker area and restrooms. Across the corridor from this unit is the diagnostic lab. Next to the diagnostic lab is the mechanical room for the building which includes heating and air conditioning systems.

Grounds and Other Facilities

The general layout of the Dworshak National Fish Hatchery is rather unique. Passing through the center of the property is the right of way for the Camas Prairie Railroad. This railroad links Lewiston with the towns upriver from the hatchery. The visitor parking lot is located on the north side of the track area. There is adequate parking for the number of visitors that have observed

the hatchery up to this time. The main pumping station and the water treatment facility are located on the north side of the tracks adjacent to the parking lot. For visitor use and connecting the parking lot to the main hatchery area is an underpass under the railroad track system. This is the only access to the public in reaching the hatchery system. Access by official personnel and vehicles as well as suppliers is an overpass over the railroad tracks at the eastern edge of the hatchery complex. To the east of the north approach of the overpass is located the housing area. There are four three-bedroom houses of a ranch style design with full basements. Key personnel are assigned to these housing units because of the standby requirements of the installation.

In the area east of the hatchery building are located the rearing tanks. These are covered by an aluminum roof and are equipped with automatic feeding devices controlled by timers in the hatchery building. The complex is well landscaped with attractive lawn areas, shrubbery and flower beds. At the present time, the lawns have established themselves and are in very attractive condition.

Automated Fish Feeding System

A complete description and evaluation of the automated fish feeding system follows.

DESCRIPTION

The Dworshak automated feeding system comprises several complex units. The heart of the system is an IBM 1800 computer complex including card reader/punch and disc drive. The computer uses a magnetic disc rather than tapes for recording the programs and operating data. The computer has a memory capacity of 8,000 words consisting of 16 bits per word. The total capacity of this unit is nearly all used for the feeding process.

The computer is programmed to actually control the feeding process as well as calculate the feed requirements pond by pond, taking into consideration the variables affecting fish feeding requirements such as temperature, fish size, and fish numbers. The computer will report on appropriate printouts a number of statistical reports depending on the requirements of the operator. The type of report is defined by the operator using fields which are also defined. This information is given to the computer through the keyboard. All commands are transmitted to the computer through the keyboard. The water temperature of the two systems, reuse and raw water are monitored automatically each hour.

The system is equipped with two modes, the manual mode and the automatic mode. The manual mode overrides the computer and can be used to feed the ponds, all or any one pond. Each pond is selected on the control panel, the amount of feed registered on a dial and the system actuated. The feed is then fed through the system. This process has to be repeated for each pond to be fed. During the time the system is in manual mode, the computer does not monitor the amount of feed being fed.

The automatic system is coupled to the feeding system through an interface piece of equipment. This is a complicated electronic complex which receives signals from the computer and transmits them to the feeding system and also receives signals from the equipment for transmittal to the computer. Most signals are analogical in nature. These must be converted to digital signals as the computer is a digital data processing unit.

In addition to the automatic feeding process, the computer continually scans 140 alarm points. These are equipment failures, environmental factors affecting the fish and feeding equipment problems. The alarm monitoring system is designed so that if

the local annunciator board alarms are not acknowledged, either in the lobby of the office or the building initiating the alarm, a tone will be transmitted by the computer through the public address system. If no one acknowledges this alarm, the computer closes a relay with dry contacts which energize the telephone equipment and an alarm rings in the houses.

The mechanical electrical feeding portion of the system consists of the hopper loading system, the hopper storage and batching system and the pond distribution system. The hopper loading system consists of the following assemblies. The debagging table consists of a hopper equipped with a bag breaker, a 24" x 48" vibrating scalping screen to break up and remove lumps, a 12" x 12" rotary feeder. The feed is elevated to the storage hoppers by pneumatic blower. The blower is equipped with inlet and outlet silencers and is located in the hopper room. There is a six way, manually controlled selector valve which can be used to select any of the six hoppers. Each bin or hopper is equipped with a low and high level alarm which is part of the alarm and annunciator system.

There are six hoppers for storage of pelletted fish food. Four are of 450 cubic foot capacity, and two will hold 225 cubic feet. These hoppers have high and low alarm switches and temperature alarm switches. The bottom of the hoppers are cone shaped and are equipped with adjustable shutoff switches. The feed is transported by vibratory conveyors. The speed of these conveyors is controlled by SCR devices. The computer selects full speed and dribble speed. The feed conveyors start automatically when food is requested, then slow down and stop when food quantity is obtained.

There are two batching and weighing assemblies. These assemblies consist of a weighing bucket, a load cell transducer, and a discharge gate. Each batching and weighing assembly is the initial distribution point for the north and south pond feeding system. Three vibratory conveyors from three hoppers feed into each assembly under control of the computer. The vibratory conveyor controls are interlocked so that only one conveyor will feed at a time, and then only if all equipment downstream is working. The weight of the feed fed into each bucket is weighed by a transducer. When the selected weight is reached, the door of the bucket opens and drops the entire batch of feed into the volumetric feeder. This entire process takes approximately ten seconds.

There are two volumetric feeders which allow the feed to enter the

blower system at a rate not to exceed 3/4 pounds per second. Three pond distribution blowers furnish the volume of air necessary to transport the feed to the ponds. One blower operates each end of the pond system and one is held in reserve as a spare. Both high and low pressure switches will shut down the blowers in case of equipment failure. An automatic-hand-off switch is located near each unit. When the local switch is in the automatic position, the blowers will start under control of the control panel either by the computer or the manual override.

Two rotary airlocks serve as the entry points of the feed from the batching system into the pneumatic pond distribution system. One each is provided for the north and south feed distribution systems. Hand-off-automatic switches are provided adjacent to each airlock for control.

In the automatic position, the airlocks are controlled by a pressure switch in the outlet to the blower; in case of blower failure, the entire system is shutdown.

Two six way tier valves are provided to select the pond tier to be fed. One valve controls the feed to the north side of the pond system and the other the south side. In the present configuration of ponds, only two tiers are provided, so the valves select which of the two tiers are to be fed. Two additional ports are provided to service additional tiers if these are ever built. Two pond diverter valves are furnished for each pond. One is for feeding from the north system and one from the south. Each is independently controlled. The control system is designed to notify the computer as to the valve position and the system will shut down if the valves fail.

HISTORY

The design and construction of an automated fish feeding system at the Dworshak National Fish Hatchery was a first in the application of a computer to fish feeding. The contract for this installation was both a development and a supply contract.

Originally, a solicitation for technical proposals was circularized to possible contractors. Request for technical proposals was issued on March 8, 1968 by the U. S. Corps of Engineers serial No. DACW68-68-B-0041 step 1. The technical proposals were received and evaluated by the Walla Walla office of the Corps of Engineers. Only those firms submitting satisfactory technical proposals were solicited for formal bids.

On September 10, 1968 a request for formal bids was issued as solicitation No. DACW68-68-B-0041 step 2. Bids were opened at 2:15 p.m. on October 31, 1968 and the bid was awarded to Wismer and Becker of Sacramento, California for a total of $651,469.00. The amount of the bid included two years maintenance of the equipment after acceptance by the Government. Subsequent change orders raised the total cost to $655,752.90.

The contract with Wismer and Becker, DACW68-69-C-0047, included a completion date of October 22, 1969 with actual feeding to start and instruction of personnel to be completed by November 22, 1969. Numerous construction delays ensued which resulted from the fact that this was a development contract. Periodic periods of feeding were interspersed with periods of construction and alteration. Finally, during the month of May, 1970 the operation became sufficiently stable to allow the U. S. Corps of Engineers to accept the installation subject to the terms of the contract maintenance clause.

The contractor is obligated to maintain the installation for a period of two years.

OPERATIONS

Several of the station employees have been trained to a greater or lesser degree in the operation of this system. A description of the operation of the computer including loading a disk and actual operation commands follows.

AUTOMATIC FISH FEEDING SYSTEM

SYSTEM GENERATION

SYSTEM GENERATION

INTRODUCTION

This section will be in outline form with comments as needed. The format will be the same as that used by IBM and certain sections are taken right from the IBM book: "IBM 1800 TIME-SHARING EXECUTIVE SYSTEM OPERATING PROCEDURES". For error recovery and a further explanation of any step refer to this manual.

The Dworshak Fish Feeding System has been created using binary cards for ease of operation and the shortening of loading time. Each step must be done in the order given. Please follow each step carefully. The system has been checked to be error free and will remain error free if the operator is very careful in removing the cards from their drawers and replacing them. If an error does occur which is not taken up in this manual, refer to the IBM manual: "IBM 1800 TIME-SHARING EXECUTIVE SYSTEM OPERATING PROCEDURES" which is in Volume II of IBM System Manuals.

Step 1: Load Task and Write Disk Addresses

1.0 Load the disk pack to be loaded into the 1810 disk drive and ready it by pressing "START" on the 1810 disk unit.

1.1 Zero core by executing the following steps:

1.1.0 Press "IMMEDIATE STOP" on the 1800 console.

1.1.1 Turn off all console switches (down position).

1.1.2 Set the "WRITE STOR PRT BITS" switch to yes (up) position.

1.1.3 Set the console mode switch to "RUN".

1.1.4 Press and hold the "CLEAR STOR" button.

1.1.5 While holding the "CLEAR STOR" button, press the console "START" button.

1.1.6 Release both buttons and press the "IMMEDIATE STOP" button.

1.2 Place the drawer marked "SYSTEM GENERATION 1/4" into the card read/punch hopper.

NOTE: Not all the cards will fit into the hopper so place only enough to 7/8 fill the hopper. As these cards are used, replace them with the cards remaining in the drawer. As the cards are used, they will fall into stacker 1. Take these cards and replace them in the drawer. From this time, until the completion of System Generation, the hopper should not become empty. As each drawer is used replace it with the following drawers:

System Generation 2/4

System Generation 3/4

Mainlines 1/4

Mainlines 2/4

Mainlines 3/4

Mainlines 4/4

A drawing showing what these drawers consist of and their order will follow system Generation. (Page 8)

1.3 Ready the reader by pressing "START" on the reader. Then press the console "Program LOAD" button.

1.4 Wait for the following 1800 TASK message to be printed. The message is as follows:

TASK 1800 TSK V3 M2

SEN SW0 ON FOR ABSOLUTE LOADER

SEN SW1 ON FOR NON PROCESS MONITOR

SEN SW2 ON FOR SKELETON BUILDER

1.5 Execute the task absolute loader function (sense switch 0 and data entry switch 15 on).

1.6 Press the console "START" button. When the routine is loaded, the following message is printed:

TASK DISK WRITE ADDRESSES PROGRAM

ENTER NO. TRIES ON DATA SW MAX 001F

NOTE: If any other message is printed out that is not listed, refer to the IBM Manual "OPERATING PROCEDURES".

1.7 Turn on data switches 14 and 15 and press console "START".

1.8 The following message is then printed:

DATA SWITCH EQUAL LOGICAL DRIVE

DRIVE CODES --- HEX 0000 0001 0002

1.9 Turn off all data switches and press console "START".

1.10 If the disk is acceptable, the following messages are printed:

THERE ARE NO DEFECTIVE CYLINDERS

SEN SW 0 ON GO TO TASK OFF REDO

NOTE: If any other messages occur refer to Pages 26, 26.1, and 27, steps 5-14 of the IBM Manual, "OPERATING PROCEDURES".

1.11 Set sense switch 0 on and press console "START". The following messages are printed out:

TASK 1800 TSX V3 M2

SEN SW 0 ON FOR ABSOLUTE LOADER

SEN SW 1 ON FOR NON PROCESS MONITOR

SEN SW 2 ON FOR SKELETON BUILDER

Step 2: Load the IBM System Decks

2.0 Set sense switch 0 on and data switch 15 on, and press console "START".

2.1 After a listing of the assignment cards and the loader assignments (about to 2-3 page of listing) is completed the following messages are printed:

THE SOURCE CORE-SIZE IS 08192

THE OBJECT CORE-SIZE IS 08192

END SYSTEM LOAD

2.2 Press "IMMEDIATE STOP" and console "START" the following messages will be printed:

TASK 1800 TSX V3 M2

SEN SW 0 ON FOR ABSOLUTE LOADER

SEN SW 1 ON FOR NON PROCESS MONITOR

2.3 Set all console switches off.

2.4 Set sense switch 1 on and press console "START".

NOTE: This will delete all not used IBM subroutines and give a listing of them and remove all 9-dummy positions in the let-table. Then it will load System Director, define the disk configuration, load on the skeleton subroutines, load on the W/B subroutines, and then give a let/flet dump.

If at any time the message:

// MOVE PAPER TO NEXT TEAR OFF

// PAUSE

occurs move paper to next tear off and press console "START". The last message that will be printed out is "// END - BUILD SKELETON NOW".

Step 3: Build the System Skeleton

3.0 Zero core (step 1.1) and then press "PROGRAM LOAD" and the following message will be printed:

TASK 1800 TSX V3 M2

SEN SW 0 ON FOR ABSOLUTE LOADER

SEN SW 1 ON FOR NON PROCESS MONITOR

SEN SW 2 ON FOR SKELETON BUILDER

3.1 Set sense switch 2 on and data switch 15 on all other console switches off and press console "START". The following message is printed.

PLACE TASK DECK IN CARD HOPPER

3.2 Press console "START".

3.3 The following message is then printed:

PUT SKL BUILD PROG IN CARD HOPPER

Press console "START" and wait for the following message:

DATA SW 0 ON TO ABORT SKEL

3.4 Make sure that data switch 0 is off and press console "START". The following message is then printed:

SKB, SYDIR LD XQ (System Director Loadable and Executable)

NOTE: If for any reason this message is not printed out and some other is printed, such as:

SKB, SYDIR, NL NX

The job must be started again from step 1.0.

3.5 The system will "WAIT" to allow the operator time to review the message. Press console "START" to return to TASK. The following messages will print out:

TASK 1800 TSX V3 M2

SEN SW 0 ON FOR ABSOLUTE LOADER

SEN SW 1 ON FOR NON PROCESS MONITOR

Step 4: Create Disk Files and Load Mainlines

4.0 Set sense switch 1 on and press console "START". The following messages are printed:

// JOB

// MOVE PAPER TO NEXT TEAR OFF

4.1 Do so and press console "START".

4.1.1 A listing of the files creation is printed.

4.2 Each mainline will load in and the build message is printed:

CLB LNAME

NOTE: LNAME is the program name being built.

4.3 Check each build to make sure that the following message is printed:

CLB, LNAME, LD XQ

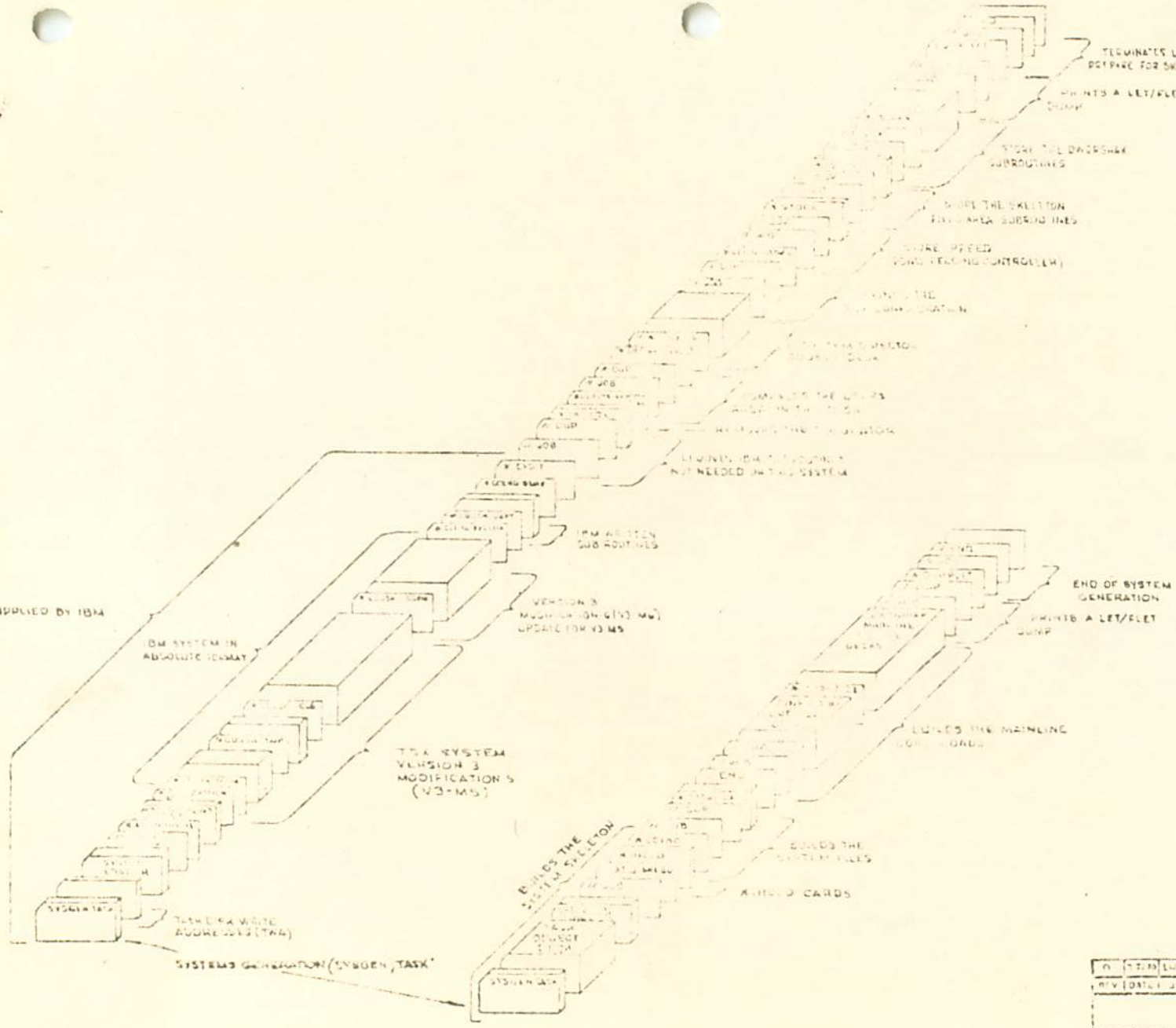
NOTE: If any other message is printed correct error and redo that program. Errors codes and correction procedures are found in Pages 90-110 of "OPERATING PROCEDURES".

4.4 Wait for the following messages to be printed:

// JOB

// END OF LOADING DISK

4.5 Return all cards to their proper places and go on to the next section which is "INITL COLD START".



NOTES

1. THIS DIAGRAM SHOWS THE CONTENTS AND STRUCTURE OF THE SYSTEM GENERATION DECK CONTAINED IN THE DRAWER CABINET BY THE READER IN THE COMPUTER ROOM.
2. THESE DECKS SHOULD BE STORED AFTER A SYSTEM [illegible]
3. PERFORM THE FOLLOWING:
   A. IBM SYSTEM GENERATION PROCEDURES, [illegible]
   B. DASHMAX PROGRAM LOGIC MANUAL
   C. COMPUTER OPERATIONS MANUAL
4. IF THE DECKS ARE OUT OF SEQUENCE AN ERROR MESSAGE WILL BE PRINTED. SEE M.S. FOR REFERENCE MANUAL

NO.	DATE	BY	APPROVED
REV	DATE	BY	DESCRIPTION

UNIVERSITY OF CALIFORNIA
CONTRACTING ENGINEERS
2320 PERCIVA BOULEVARD SACRAMENTO, CALIFORNIA 95825

COMPUTER-SYSTEM-GENERATION
OBJECT DECKS

DASHMAX AUTOMATIC FISH FEEDING SYSTEM

DESIGNED	DRAWN	CHECKED	APPROVED

SCALE: NONE

49

AUTOMATIC FISH FEEDING SYSTEM

OPERATORS COMMANDS

COMMAND DESCRIPTION INTRODUCTION

Control of the system by the operator is handled through commands which the operator enters. The operator has control of the complete system except for those commands issued by the computer.

There are 52 commands divided into five different categories. Each category has a call letter which indicates the type of operation the command will perform, and they are as follows:

1. Category "B"
   The "B" signifies back-up and these commands are primarily used to duplicate data stored in the computer memory, on punch cards and their related handling programs. These punch cards may then be stored for future analysis or may be used for a reload in the event a computer failure occurs.

2. Category "D"
   The "D" indicates data manipulation. New data or correction data is added to the computer files through the keyboard.

3. Category "F"
   The "F" indicates feeding control. The operator has the ability to modify the routine feeding by using these commands. These commands are primarily used for operator convenience and to instruct the computer to take alternate action in the event of a hardware failure.

4. Category "R"

The "R" indicates report. A number of reports are called with a "R" prefix. The "R" reports are primarily intended to allow the operator to generate special summary reports. Other printouts, like "F LOG ON", "B LIST", etc. are associated with other functions and are listed in their respective category.

5. Category "T"

The "T" commands are a set of diagnostic routines which allow the operator to test the operation of the hardware and also test the functioning of the software routines. Provision is made to obtain a running log of critical parameters in the event troubles are suspected.

All of these commands are entered through the keyboard. In order to get into the keyboard, the operator must first press the "RLST KBD" button, on the keyboard and then the "KBD RE" button. Both are located on the printer keyboard. If the computer is available, the "PROCEED" light will come on. This procedure is used for every keyboard entry and for simplicity sake is called "START".

NOTE: The keyboard entry mode is usually terminated if the operator keys in certain erroneous data or if the operator does not continue typing. The operator must "START" over again. After the "PROCEED" light is on, the

operator may then call in a particular command by typing the name of the command, beginning at the extreme left hand margin. After the command name or data has been entered, the operator must then press the EOF (END OF FIELD) key to indicate that the data was entered.

If the operator waits longer than 20 seconds to enter any data, the keyboard may be taken away by the other typewriter. If incorrect information is entered, the typer will print "*ERROR X XX" message. A definition of these "ERRORS" will be found on Pages A-1 thru A-4 of Appendix A together with their recovery procedures. If an "* INVALID" is typed by the computer after the entry of some data, the operator has typed in a number where an alpha character should have been typed, or the alpha word was misspelled or the number is outside of the field range. To recover from the error, find the reason for the error and re-enter the field. For further information refer to the detail description of the respective command.

The following is a summary of all keyboard entry commands followed by a detail description of every command.

B - BACKUP OR FILE LOADING

Command	Command No.	Description
B END OF DAY	B-1	Closes out daily records.
B END OF MONTH	B-2	Closes out monthly records.
B KEYPUNCH	B-3	Converts the computer to a keypunch.
B LOAD FIELD	B-4	This punches the field file into cards.
B LOAD PONDS	B-5	This loads the pond file from cards.
B REPRODUCE	B-6	Reproduces 2 for 1 - 149 cards at a time.
B LIST	B-7	Lists cards on the typewriter.
B RESET TIME	B-8	Resets the real time clock.
B SAVE FIELDS	B-9	This punches the field file into cards.
B SAVE PONDS	B-10	This punches the pond file into cards.

D - DATA ENTRY

Command	Command No.	Description
D CHANGE FEED	D-1	This changes the pond feeding data.
D CHANGE POND	D-2	This changes or corrects information on a pond.
D CNALA	D-3	Loads the alarm file from cards.
D CONVEYING TIME	D-4	Sets the conveying time.
D DELETE POND	D-5	This removes fish from the system by deleting a pond.
D FIELD	D-6	This adds, replaces, or deletes a print column including a heading.
D MANUAL FEEDING	D-7	This logs the amount of food fed by hand to any one pond or system.
D MORT	D-8	Adds mortality count to the pond records.
D NEW ALARM	D-9	This adds a new description of an alarm.
D NEW POND	D-10	Required to activate a new pond.
D POND CONFIG	D-11	This creates the order the ponds will be fed.
D REPORT	D-12	This adds, replaces, or deletes a report.
D RESET TEMP	D-13	Resets temperatures to any value at operator's option.
D TRANSFER FISH	D-14	This program is used when fishes are moved into different ponds.

F - CONTROL PROGRAMS

Command	Command No.	Description
F ABORT	F-1	Terminates feeding for the day.
F ALLOW NORTH	F-2	Restarts North system.
F ALLOW SOUTH	F-3	Restarts South system.
F CONTINUE	F-6	Continues feeding after pause.
F INHIBIT NORTH	F-7	Stops North system.
F INHIBIT SOUTH	F-8	Stops South system.
F LOG OFF	F-9	Turns off logging.
F LOG ON	F-10	Turns on logging.
F PAUSE	F-11	Makes a pause in feeding.
F RELEASE CONTROL	F-12	Releases the system from computer control.
F RESET ALARM	F-13	Resets programmed alarms.
F STOP STARTUP	F-14	Stops startup.
F SYSTEM STARTUP	F-15	Sets auto startup of the system.
F SYSTEM STATUS	F-16	Gives a complete status of the system.
F TEST LOG	F-17	Writes out a test log used in testing the feeding operation.
F VIBRATORY SPEEDS	F-18	Sets vibratory speeds for various weight settings.

R - REPORT GENERATION

Command	Command No.	Description
R XXXX	R-2	Typing the "R" activates the report generator. XXXX is the name of a desired report printout that has been defined earlier.
R FEED SCHEDULE	R-1	Gives operator a schedule of which hour each pond is to be fed.

T - TESTING

Command	Command No.	Description
T ALARM	T-1	Tests the alarm status.
T BATCH	T-2	Tests the batching cycle.
T CONVEY	T-3	Gives printout of one or all pond conveying times.
T FEED	T-4	This tests the feeding operation.
T FIELD NAMES	T-5	Lists all defined field names.
T HOPPER	T-6	Test hopper control and conveying speeds.
T POND	T-7	This tests the pond valves.
T REPORT NAMES	T-8	Lists all defined report names.
T TEMP	T-9	Prints the hot and cold temperature.
T UPDATE FEED	T-10	This simulates a feeding for updating records.

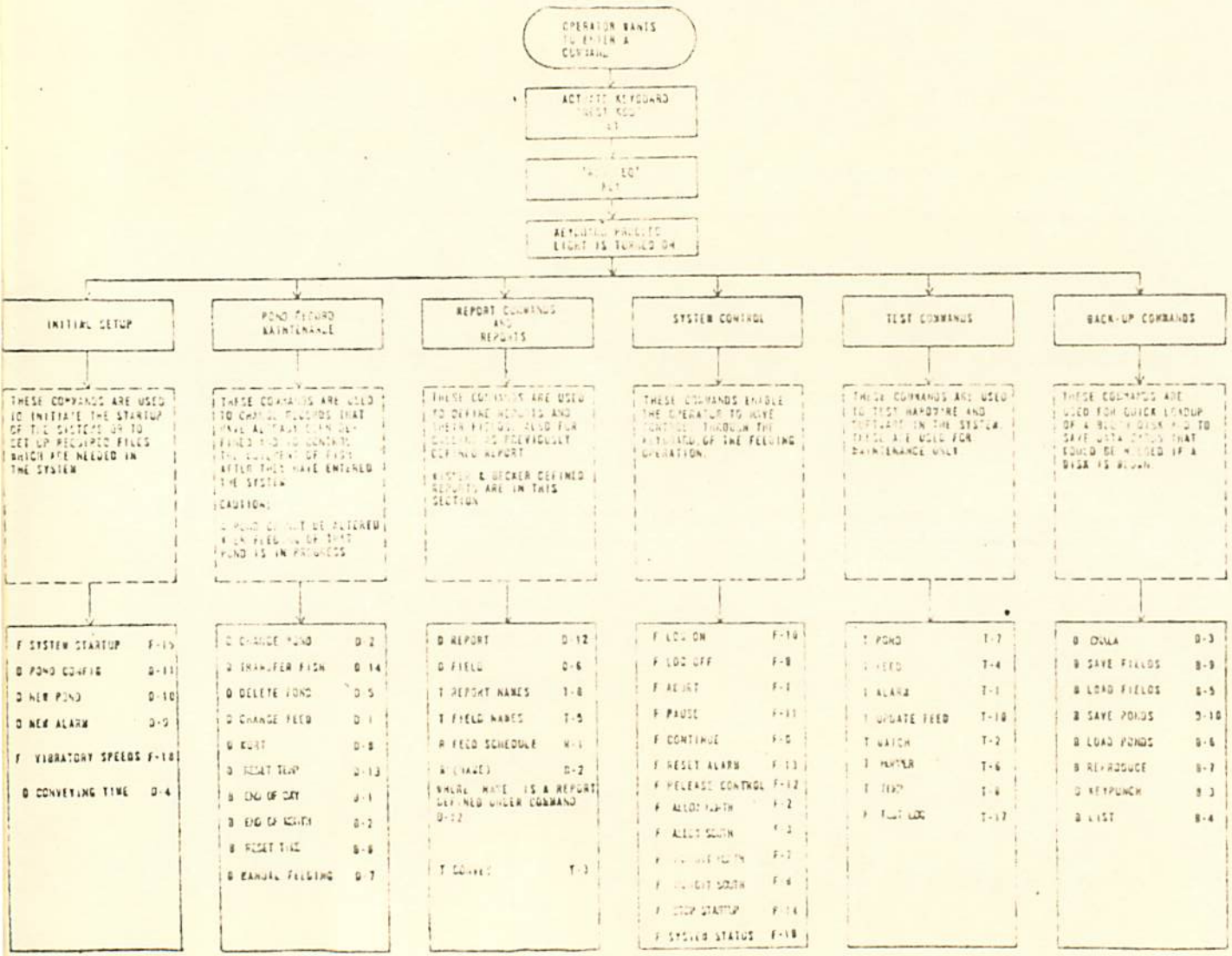
DWORSHAK KEYBOARD ENTRY
COMPUTER COMMANDS

COMMAND NO.	COMMAND FORMAT
B-1	B END OF DAY
B-2	B END OF MONTH
B-3	B KEYPUNCH
B-4	B LIST
B-5	B LOAD FIELDS
B-6	B LOAD PONDS
B-7	B REPRODUCE
B-8	B RESET TIME
B-9	B SAVE FIELDS
B-10	B SAVE PONDS
D-1	D CHANGE FEED
D-2	D CHANGE POND
D-3	D CNALA
D-4	D CONVEYING TIME
D-5	D DELETE POND
D-6	D FIELD
D-7	D MANUAL FEEDING
D-8	D MORT
D-9	D NEW ALARM
D-10	D NEW POND
D-11	D POND CONFIG
D-12	D REPORT
D-13	D RESET TEMP
D-14	D TRANSFER FISH
F-1	F ABORT
F-2	F ALLOW NORTH
F-3	F ALLOW SOUTH
F-4	F BLOWERS OFF (Future Command)
F-5	F BLOWERS ON (Future Command)
F-6	F CONTINUE
F-7	F INHIBIT NORTH
F-8	F INHIBIT SOUTH
F-9	F LOG OFF
F-10	F LOG ON
F-11	F PAUSE
F-12	F RELEASE CONTROL
F-13	F RESET ALARM
F-14	F STOP STARTUP
F-15	F SYSTEM STARTUP
F-16	F SYSTEM STATUS
F-17	F TEST LOG
F-18	F VIBRATORY SPEEDS

COMMAND NO.	COMMAND FORMAT
R-1	R FEED SCHEDULE
R-2	R "XXXXX" where "XXXXX" is the name of a report defined under the D REPORT (D-12) command.
T-1	T ALARM
T-2	T BATCH
T-3	T CONVEY
T-4	T FEED
T-5	T FIELD NAMES
T-6	T HOPPER
T-7	T POND
T-8	T REPORT NAMES
T-9	T TEMP
T-10	T UPDATE FEED

BILL OF MAT

QTY	PART	DESCRIPTION	MATERIAL	WT. EACH



NOTES:

EVERY COMMAND HAS A NUMBER AND IS LOCATED TO THE RIGHT OF THE COMMAND.

COMMANDS F-4 AND F-5 ARE NOT SHOWN. THEY ARE POSSIBLE FUTURE COMMANDS.

REV	DATE	BY	DESCRIPTION
2	5-27-74	EWS	AS BUILT
1	9-18-73	D.B.	ADDED NEW PROGRAMS TO BLOCKS

WISMER & BECKER
CONTRACTING ENGINEERS
7020 FOLSOM BOULEVARD SACRAMENTO, CALIFORNIA 95826

KEYBOARD ENTRY REFERENCE CHART
(SUMMARY OF KEYBOARD ENTRY COMMANDS)
DWORSHAK AUTOMATIC FISH FEEDING SYSTEM

DRAWN	DATE	DWG. NO.	SCALE	SIZE
R. BUTCHER	3-29-73	3-2333		C

In addition to the above computer operation methods, the system has a backup manual operation which allows bypassing the computer and feeding the fish in case of computer failure or interface equipment failure. The manual mode system operation closely approximates the computerized automatic control system without attempting the same finite degree of accuracy or data logging characteristics. Much of the same functional circuitry is shared by both systems including power application relays, relay decoders, and annunciation.

The system is started by placing the auto-manual mode switch on the manual control panel to the manual position and repressing the startup and shutdown switch which in the manual mode causes steppingup of the startup relay in the motor control centers and applies motor control power to the blowers. The blowers start up automatically causing a pressure buildup within several seconds, triggering operation of the balance of the system.

The quantity selection is accomplished by dialing in any amount between zero pounds and ten pounds on the selector dial. This selects the same quantity for both the north and south systems alike.

The operation of the manual feeding system is almost entirely automatic with the exception of the initiation of the starting of the system and the actual setting of the weights to be weighed on the batching system. The diversion of the valves and their homing and the actual weighing are done by the same system that is operated by the computer and in the same manner.

However, with this manual override, there is no logging of the feed. The feed has to be recorded manually through the keyboard of the computer or has to be maintained on a separate sheet.

The only thing that is accomplished by this manual mode is the emergency feeding of ponds if the computer or some of the attendant equipment would be disabled.

PROBLEMS

Problems involving the initial start up and shake down operation of this equipment were many and varied.

One of the most persistent problems during the test period was finally determined to be caused by voltage spikes in the control circuits. During the design and construction the control circuits to the diverter valves which are of 12 volt d. c. were placed in the same conduits with the 480 volt a. c. actuating circuits. The surge of current in the 480 volt circuits induced a voltage in the control circuits. These spikes of voltage would burn out the diodes in the control circuit and disable the system. After much testing and experimentation, capacitors were placed across the control circuits to bleed off the voltage spikes.

Problems were the result of faulty installation. During the initial start up of the system, all the diodes in the control circuits and signal circuits to the ponds were either burned out or damaged sufficiently that they later failed. This was caused by the connection of 480 volt a. c. current to the 12 volt d. c. control circuit. Each time a diode failed, the system ceased to function. Faulty diverter valve operation was also caused by mechanical difficulties including interference of the valve movement by the valve covers and poor fitting pins and actuators. In some cases, the electrical wiring was assembled incorrectly.

Many malfunctions could be attributed to human error involving the technician who was working on the system. Test jumpers would be left attached, switches left in the wrong position and many other oversights.

Toward the latter part of the test period, the computer began to give trouble. It would not operate satisfactorily at all times. A check was made and the disc was found to have two defective cylinders. It became mandatory that a new disc be loaded with the program. This process takes from 6 to 7 hours. Since the new disc has been loaded, very few problems have existed involving the computer.

There appears to be ghost problems. These are phantom alarms which alert the computer but which do not activate the annunciator system. It appears as if these are stray signals received by the computer. There are other signals of this type which activate or cause deviation of the computer action from established patterns.

One of the problems involving this system has to do not with the mechanical, electrical and electronic components but with the program. The computer was programmed using certain of Haskell's formulae:

$$F = \frac{3.00 \times C \times \Delta L}{L} \times \frac{W}{f},$$

$$\Delta L = \frac{t^{\circ}F - 38.6}{660}$$

The calculated growth per day is based on the assumption that metabolism starts at $38.6^{\circ}F$. This is an invalid assumption for this strain of steelhead trout. There is evidence that metabolism extends down to $32^{\circ}F$. The difficulty with the operation of the system, among others, is that the computer stops the system from feeding at $38.6^{\circ}F$. In practice, the programming is such that $40^{\circ}F$ is the practical minimum at which it will feed because of the minimum the system will batch. In addition, the length-weight relationship is incorrect. These fish have a condition factor which does not conform to the formula $N = \frac{2466}{L^3}$ with which the computer is programmed. The North Fork strain of steelhead are longer in relation to the weight than this formula. At the present time, the hardware portion of the system has been fairly well shook down with only occasional failures occurring. These are corrected so far by the electrician on duty at this station.

Before the system is completely satisfactory, changes in the program will have to be made to make it more realistic in relation to the biological requirements of the strain of fish being reared.

In addition to the above major difficulties, many minor items continue to appear. This type of situation is to be expected with a feeding system as complex as this.

EVALUATION

This computerized feeding system has great possibilities for the saving of manpower and the calculation and keeping of records. If and when the system, that is the computer, is programmed to the point where the data that is calculated will be factual, the function of record keeping will be entirely deleted from the manual operation of the personnel. The only necessary record keeping will be of mortalities and feeding where there is no actual feeding by the computer but by the manual override. This data must be placed in the computer and will become part of the records of the system and will be available for printouts as the need arises.

The past year has been spent almost entirely in the initial phases of the operation of this automated system, and there has not been sufficient time of actual satisfactory operation in order to evaluate the total efficiency of the system. There have been certain problems which have become apparent in certain types of feed. One of these is the fact that there is some dusting of the feed when the pelleting is not of the best. Steps have been taken to increase the efficiency of the pelleting making a harder and more durable pellet which can be operated more successfully in the system.

There were also certain situations which may or may not have been due to the automatic computerized feeding but may possibly have been due to other factors. This is the apparent differential in the range of sizes which are found in the ponds at the present time of fish which are being carried over the summer. However, this may have been due to certain feeding practices during the winter months when the temperature was down to 32 and 33 degrees. At that time feeding was discontinued, which I think was a mistake because of the fact that these fish do have a metabolic rate at very low temperatures. When the fact was discovered that these fish were becoming very thin and the body fat had been used up, feeding was started but by that time we were experiencing pinhead situation.

In order to use this reporting system which is inherent in the computerized installation, we must be willing to accept computer printouts as a part of the reporting procedures to both our regional office and to the Washington office in order to more efficiently use the system.

Possibly the difficulties that are being experienced at times with this system are due to its intrinsic complication. This system

was built as a development contract as well as a supply contract. It is actually being used for the development of the technical phases of fish feeding systems for use not only at this hatchery but at future hatcheries. Therefore, the problems of shakedown and development cannot necessarily be charged to this hatchery. The operation of this equipment changes the emphasis from hand feeding by many employees to the operation and monitoring of a mechanical, electrical, electronic system.

This system was originally installed of an adequate size to service the entire projected 140 Burrows type ponds which will be the ultimate development if these ponds are ever built. This will of course depend upon the evaluation of the returning runs from the present operation. At the present time we do not have sufficient data to properly evaluate the cost-benefit ratios of this system, taking into consideration the manual feeding costs that would accrue if the system were not in operation.

The entire fiscal year has been spent in attempting to get the system into operation and to remove the bugs from the system. Up to this point, any data that may have been accrued, concerning the advantages or disadvantages of feeding by the automated system cannot be considered completely valid. Feeding has been carried on in a more or less sporadic manner depending upon the operational condition of the system. Automatic feeding has been interspersed with hand feeding as well as with partial feeding at times, due to breakdown or malfunctioning of portions of the system. At times, only one end of the ponds has been fed for a day or two at a time and also the total calculated amount of feed has not been fed on certain days. Toward the end of the fiscal year, the feeding system had become stabilized to the point at which feedings were carried on on a regular basis with full amounts of feed being provided. The coming fiscal year, 1971, should provide considerably more valid data for evaluation of this system.

Bureau of Sport Fisheries and Wildlife

BROODSTOCK AND SPAWNING OPERATIONS

(See Fish Hatchery Manual Section 4438a for Instructions)

No.	ITEM	ANADROMOUS OR WILD TROUT - Indicate Species			DOMESTICATED TROUT - Indicate Species		
		Steelhead					
1.	NUMBER OF FEMALES STRIPPED	1,809					
2.	TOTAL WEIGHT OF FEMALES						
3.	NUMBER OF MALES STRIPPED	470					
4.	TOTAL WEIGHT OF MALES						
5.	NUMBER OF GREEN EGGS TAKEN	11,627,946					
6.	EGGS TAKEN PER POUND OF FEMALES						
7.	EGGS TAKEN PER FEMALE	6,428					
8.	NUMBER OF EYED EGGS PRODUCED	8,914,900					
9.	EGG SURVIVAL: PERCENT TO EYED STAGE *	77 %	%	%	%	%	%
	PERCENT TO HATCHING *	57 %	%	%	%	%	%
	PERCENT TO FEEDING *	45 %	%	%	%	%	%
10.	LABOR COST	$16,360.00					
11.	NON-LABOR COST	6,433.00					
12.	TOTAL COST	$22,793.00					
13.	CREDIT CURRENT YEAR WEIGHT GAIN OF LOT (lbs. @ $)						
14.	ADJUSTED TOTAL COST (Item 12 minus Item 13)						
15.	DEBIT CURRENT YEAR WEIGHT LOSS OF LOT (lbs. @ $)						
16.	ADJUSTED TOTAL COST (Item 12 plus Item 15)						
17.	COST PER THOUSAND EYED EGGS	$2.56					

Form 3-101
(Revised June 1968)

*SEE REVERSE

DISTRIBUTION DATA AND COSTS

(See Fish Hatchery Manual Section 4438b for Instructions)

PART 1 - COSTS

SPECIES	DISTRIBUTION COSTS			FISH DISTRIBUTED		AVERAGE COSTS
	Labor (1)	Non-Labor (2)	Total (3)	Pounds (4)	Number (5)	(6)
PONDFISH	-	-	-	-	-	Per M. -
TROUT	-	-	-	-	-	Per lb. -
ANADROMOUS	408.00	56.00	464.00	189,871	2,954,609	Per lb. .0025
TOTALS	408.00	56.00	464.00	189,871	2,954,609	

PART 2 - DISTRIBUTIONS

SPECIES	TRANSFERS TO OTHER NFH's		TRANSFERS TO STATES		OTHER DISTRIBUTION	
	Pounds (1)	Number (2)	Pounds (3)	Number (4)	Pounds (5)	Number (6)
PONDFISH	-	-	-	-	-	-
TROUT	-	-	-	-	-	-
ANADROMOUS	-	-	-	-	189,871	2,954,609
TOTALS	-	-	-	-	189,871	2,954,609

PART 3 - TRIP DATA

SPECIES	NUMBER OF TRIPS			POUNDS PER TRIP			NUMBER PER TRIP		
	Transfers (1)	Other (2)	Total (3)	Transfers (4)	Other (5)	Total (6)	Transfers (7)	Other (8)	Total (9)
PONDFISH	-	-	-	-	-	-	-	-	-
TROUT	-	-	-	-	-	-	-	-	-
ANADROMOUS	Not applicable: Fish stocked directly into North Fork of Clearwater River.								
TOTALS									
AVERAGE									

PART 4 - MILEAGE AND SPECIES DELIVERIES

ITEM	PONDFISH	TROUT	ANADROMOUS	TOTAL
MILES TRAVELED Not applicable.				
AVERAGE NUMBER OF MILES PER TRIP				
NUMBER APPLICATIONS (species delivered) THIS YEAR				
NUMBER FARM POND DELIVERIES				
NUMBER INDIVIDUAL FARM PONDS INVOLVED				

PONDFISH DISTRIBUTED, 6" and larger: _____ POUNDS _____ NUMBER

Bureau of Sport Fisheries and Wildlife

SALMONIDAE PRODUCTION

(Fish and Eggs)

(See Fish Hatchery Manual Section 4438c for Instructions)

(1)	(2)		(3)		(4)		(5)		(6)
Species	ON HAND JULY 1 1969		Received During Year		Total Distribution		ON HAND JUNE 30		Total Production in Pounds
	Number	Weight	Number	Weight	Number	Weight	Number	Weight	
Steelhead (9-D)	7,288,900	2,529	0	0	2,954,609	189,871	1,785,875	89,049	276,391
Steelhead (O-D)	0	0	11,627,946	-	2,795,500	931*	4,920,000	1,968	2,899
Sub-Total	7,288,900	2,529	11,627,946	0	5,750,109	190,802	6,705,875	91,017	279,290
Cutthroat	0	0	10,560	2	0	0	10,000	3	1
TOTALS	7,288,900	2,529	11,638,506	2	5,750,109	190,802	6,715,875	91,020	279,291

* Eyed Eggs

Form 3-103
(Jan. 1964)

Bureau of Sport Fisheries and Wildlife

ANADROMOUS DISTRIBUTION

Species: Steelhead Trout

Source (parent waters): North Fork of Clearwater River

(See Fish Hatchery Manual Section 4438d for Instructions)

BROOD YEAR	NUMBER OF EGGS		EGGS AND FISH SHIPPED to another Hatchery			FISH PLANTED				
	Collected	Received	Number	Number per pound	Weight	Date Mo./Yr.	Number	Number per pound	Weight	Waters
1970	11,627,946		2,295,500		Eggs	4/70	1,248,227	7.10	175,766	North Fork of Clear-
						5/70	123,316	9.15	13,472	water River
						7/69	1,583,066	2,500	633	

Form 3-104

70

EGG SHIPMENTS - SALMONIDAE

(See Fish Hatchery Manual Section 4438e for Instructions)

SPECIES	NAME AND ADDRESS OF APPLICANT	NUMBER SHIPPED (Also subtotal each species)	DATE SHIPPED
1. Steelhead	Idaho Fish and Game Lewiston, Idaho	827,500	6/14/70
2. Steelhead	Abernathy Salmon Culture Laboratory Longview, Washington	100,000	6/18/70
3. Steelhead	Cooperative Fishery Unit University of Idaho Moscow, Idaho	500,000	6/19/70
4. Steelhead	Idaho Fish and Game Lewiston, Idaho	1,118,000	6/22/70
5. Steelhead	Oregon Game Commission Enterprise, Oregon	200,000	6/26/70
6. Steelhead	Moscow, Russia	50,000	6/28/70
	TOTAL NUMBER SHIPPED	2,795,500	

Form 3-105
(Jan. 1964)

FISH FOOD

SPECIES
☐ Trout ☒ Anadromous
Steelhead ☐ Salmon ☐ Other

(See Fish Hatchery Manual Section 4438f for Instructions)

No	ITEM		POUNDS (a)	TOTAL COST or VALUE (b)
1.	FISH FOOD ON HAND JULY 1, 1969		2,600	529.88
2.	FISH FOOD RECEIVED BY DONATION		200	30.00
3.	FISH FOOD RECEIVED BY TRANSFER		--	--
4.	SUB-TOTAL RECEIVED AND ON HAND		2,800	559.88
5.	LIST TYPE PURCHASED DURING YEAR	Cost Per Pound		
	Silver Cup	.1297	41,100	5,330.00
	Oregon Moist Pellet	.1444	280,150	40,453.66
	Open Formula PR-4	.0917	143,050	13,117.68
	Clark	.1953	500	97.65
	Abernathy	.1153	177,500	20,462.00
6.	SUB-TOTAL PURCHASED	Average: .1237	642,300	79,460.99
7.	TOTAL RECEIVED AND PURCHASED (Item 4 + 6)		645,000	80,020.87
8.	LESS FISH FOOD TRANSFERRED TO OTHER HATCHERIES		--	--
9.	LESS FISH FOOD ON HAND JUNE 30		112,200	12,366.16
10.	**TOTAL FISH FOOD EXPENDED**		532,900	67,654.71
11.	COST PER POUND OF FISH FOOD EXPENDED (Line 10, col.(b) ÷ col.(a)			.127
12.	GAIN IN WEIGHT OF FEEDING FISH PRODUCED DURING YEAR			275,460
13.	FOOD CONVERSION (Line 10, col.(a) ÷ line 12)			1.94
14.	FOOD COST PER POUND OF FISH PRODUCED (Line 10, col.(b) ÷ line 12)			.246
15.	GIVE DETAILS ON REVERSE SIDE FOR ENTRIES ON LINES 2, 3, and 8			

Form 3-106
(Revised June 1968)

CHEMICAL CONTROL PROGRAM

See Fish Hatchery Manual Section 4938 for Instructions)

CONTROL CHEMICAL USED	ORGANISM TREATED	AMOUNT USED		No. Acres Treated (Indicate Land or Water)	TOTAL PURCHASE PRICE
		Lbs.	Gals.		
Malachite Green	Fungus	50		L W 0.3	(125 lbs.) 341.25
Formalin	External parasites of fish.		40	L W 0.1	(50 gals.) 51.84
				L W	
				L W	
				L W	
				L W	
				L W	
				L W	
				L W	
				L W	
				L W	
				L W	
				L W	
				L W	
				L W	
				L W	
TOTAL		50	40	L -- W 0.4	393.09

Form 3-109
(Jan. 1964)

Bureau of Sport Fisheries and Wildlife
Divisio Fish Hatcheries

OPERATIONS COST SUMMARY

(See Fish Hatchery Manual Section 4438j for instructions.)

	ITEM	Cost Code	LABOR EXPENDITURES * Warmwater (a)	Trout (b)	Anadromous (c)	Total (d)	NON-LABOR EXPENDITURES * Warmwater (e)	Trout (f)	Anadromous (g)	Total (h)	Total Expenditures (i)
1	Broodstock and spawning	01 06			16,360	~~16,360~~ 13,360			6,433	6,433	~~19,793~~ 22,793
2	Rearing	07 12			89,452	89,452			186,078	186,078	275,530
3	Distribution	13 18			408	408			56	56	464
4	PRODUCTION Sub-total				103,220	103,220			192,567	192,567	295,787
5	Fish production facilities	21 22				26,248				7,515	33,763
6	Buildings	23 24				17,544				23,164	40,708
7	Other physical facilities	25 26				10,102				38,606	48,708
8	MAINTENANCE Sub-total					53,894				69,285	123,179
9	Public use	27 28				1,412				--	1,412
10	Training	31 32				3,099				12	3,111
11	Hatchery Biologist Ops. ~~fish passage facilities~~	19 ~~41~~ 49				4,521				200.19	24540
12	OPERATIONS & MAINTENANCE TOTAL					161,625				261,864	423,489 451,069
13	Fish production facilities	51 52									
14	Buildings	53 54									
15	Other physical facilities	55 56									
16	Public use facilities	57 58									
17	REHABILITATION TOTAL										
18	GRAND TOTALS					284,845					451,069 * 505,529
19	O & M Expenditures - Percent for Fish Production		Column (d): Line 4 ÷ Line 12			64	Column (i): Line 4 ÷ Line 12				70
20	TOTAL EXPENDITURES - Percent for Fish Production		Column (d): Line 4 ÷ Line 18			64	Column (i): Line 4 ÷ Line 18				70

Form 3-110
(Revised August 1967)

*If any totals include contributed funds, show source and breakdown on reverse!

* See reverse of form.

PRODUCTION COSTS

(See Fish Hatchery Manual Section 4438k for Instructions)

PART 1 - PRODUCTION and EXPENDITURES

No.	ITEM	PONDFISH	TROUT	ANADROMOUS	TOTAL
1	Number Produced				
2	Pounds Produced			279,291	279,291
3	Labor Expenditures			103,220	103,220
4	Non-Labor Expenditures			192,567	192,567
5	TOTAL EXPENDITURES			295,787	295,787

PART 2 - ANALYSIS OF PRODUCTION COST

ITEM	COST	PERCENTAGE
PONDFISH		
PRODUCTION COST PER POUND		
LABOR COST PER POUND		
LABOR COST PERCENT OF PRODUCTION COST		
PRODUCTION COST PER THOUSAND FISH		
LABOR COST PER THOUSAND FISH		
TROUT		
PRODUCTION COST PER POUND		
LABOR COST PER POUND		
LABOR COST PERCENT OF PRODUCTION COST		
ANADROMOUS		
PRODUCTION COST PER POUND	1.06	
LABOR COST PER POUND	.37	
LABOR COST PERCENT OF PRODUCTION COST		35
AVERAGE PRODUCTION COST PER POUND OF ALL FISH PRODUCED	1.06	

Form 3-111
(Revised June 1968)

Bureau of Sport Fisheries and Wildl

REARING FACILITIES AND WATER SUPPLY

(See Fish Hatchery Manual Section 4438m for Instructions)

PART 1 REARING FACILITIES

1. TYPES OF FACILITIES IN USE	NUMBER IN USE	CAPACITY (Calculate at normal water level)	MONTHS IN USE	TOTAL (Months x Cu.Ft.)
TROUGHS		Cu.Ft.		
TANKS	64	5,120 Cu.Ft.	3	15,360
RACEWAYS Rectangular Circulating Ponds	* 40	12,200 Cu.Ft.	12	1,464,000
OTHER POOLS AND PONDS - Broodstock Concrete	5	2,840 Cu.Ft.	9	25,560
OTHER POOLS AND PONDS - Earthen		Cu.Ft.		
		TOTAL		1,504,920
TOTAL CUBIC FEET IN USE ON YEARLY BASIS (Divide Total by 12)				12,541

PART 2 - WATER SUPPLY

2. SOURCE OF SUPPLY	Check appropriate source for each supply: SPRING	WELL	LAKE	STREAM	OTHER (Explain on reverse)
Supply No. 1				X	
Supply No. 2					*reuse syst
Supply No. 3					

3. AVERAGE VOLUME WATER-g.p.m. (Give total flow if not all used) parenthesis, if	1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	ANNUAL AVERAGE
Supply No. 1	10,900	15,100	20,800	30,300	19,275
Supply No. 2	10,800	14,000	14,000	13,100	12,975
Supply No. 3					

4. AVERAGE WATER TEMPERATURE-F°	1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	ANNUAL AVERAGE
Supply No. 1	58.4	40.7	37.1	48.1	46.1
Supply No. 2	60.0	55.9	52.4	51.5	54.9
Supply No. 3					

5. TOTAL POUNDS OF TROUT OR ANADROMOUS SPECIES PRODUCED: 279,291

6. TOTAL POUNDS OF TROUT OR ANADROMOUS SPECIES PRODUCED per g.p.m. AVERAGE FLOW USED: 8.7

7. TOTAL POUNDS OF TROUT OR ANADROMOUS SPECIES PRODUCED per Cu. Ft. (annual) FLOW: 2.27

IS ANY WATER PUMPED FOR FISH PRODUCTION? YES [X] NO [ ] HEATED? YES [X] NO [ ] ***

(If YES in either case, give details as to flow involved, estimated cost, etc, on reverse.)

Form 3-112
(Revised June 1968)

Bureau of Sport Fisheries and Wildlife

SUMMARY OF LABOR EXPENDED AND UTILIZATION

(See Fish Hatchery Manual Section 4438n for Instructions)

PART 1 - STATION LABOR ANALYSIS

No.	ITEM	Man-Years of Labor
1	PERMANENT PERSONNEL	12.87
2	ALL OTHER LABOR	2.28
3	OVERTIME FOR WORK PERFORMED AT STATION BY ABOVE EMPLOYEES	.12
4	DETAIL OF PERSONNEL TO STATION	
5	OVERTIME OF DETAILED PERSONNEL AT STATION	
6	TOTAL LABOR - ALL PERSONNEL	15.27*

PART 2 - LABOR UTILIZATION

No.	ITEM	Permanent	Other
7	PRODUCTION	7.96	1.54
	POND FISH (Cost Codes 01, 07)		
	TROUT (Cost Codes 03, 09)		
	SALMON (Cost Codes 05, 11)	7.96	1.54
8	DISTRIBUTION (Cost Codes 13, 15, 17)		
9	MAINTENANCE		
	MAINTENANCE (Cost Codes 21, 23, 25)	4.71	.67
	REHABILITATION (Cost Codes 51, 53, 55, 57)		
10	PUBLIC USE (Cost Code 27)	.15	
11	TRAINING (Cost Code 31)	.16	.08
12	SUB TOTAL	12.98	2.29
13	TOTAL PERMANENT AND OTHER (Equals Item 6)		15.27

Form 3-113
(Revised June 1968)

* Does not include 1.44 man years spent by hatchery biologist and other personnel on Evaluation Programs not directly involved with the Dworshak National Fish Hatchery Production.

should be explained in where & how. Let them know.

Bureau of Sport Fisheries and Wildlife

REPORT OF PERMANENT PERSONNEL

(See Fish Hatchery Manual Section 4438o for Instructions)

PART 1 - STATION PERSONNEL

include Standby

NAME OF EMPLOYEE	Age	Grade	Marital Status	Children Under 18	Period Worked	COMPENSATION PAID: Total Regular Salary	Uniform Allowance	Paid Overtime	Total Compensation
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
William G. Ankney	36	WG	M	3	7/1/69-6/30/70	8,769 60	125.00	195 30	9,089 90
Lila N. Brainard	52	GS	M	1	7/1/69-6/30/70	7,062 00	--	--	7,062 00
Dwain A. Carlson	35	WG	M	5	7/27/69-6/30/70	7,363 20	125.00	352 84	7,841 04
Walter G. Harris	36	GS	M	3	7/1/69-6/30/70	12,218 88	125 00	230 27	12,574 15
Paul D. Hemerick	30	GS	M	2	7/1/69-2/21/70	7,300.80	125 00	295.65	7,721 45
Henry F. Hosking	32	GS	M	4	3/22/70-6/30/70	3,404.16	--	--	3,404.16
Gary A. Love	29	GS	S M	0 2	7/1 - 9/25/69	1,285.12	--	--	1,285 12
1. TOTAL - STATION PERSONNEL									

PART 2 - PERSONNEL DETAILED TO STATION

NAME OF EMPLOYEE	From Station	Period of Detail	COMPENSATION PAID: Regular Salary Costs	Per Diem and Expenses	Paid Overtime	Total Compensation
	(1)	(2)	(3)	(4)	(5)	(6)
2. TOTAL - DETAILED TO STATION						

3. TOTAL COMPENSATION PAID TO PERMANENT PERSONNEL ON DUTY AT STATION

Form 3-114
(Jan. 1964)

78

Bureau of Sport Fisheries and Wildlife

REPORT OF PERMANENT PERSONNEL

(See Fish Hatchery Manual Section 4438o for Instructions)

PART 1 - STATION PERSONNEL

NAME OF EMPLOYEE	Age	Grade	Marital Status	Children Under 18	Period Worked	COMPENSATION PAID: Total Regular Salary	Uniform Allowance	Paid Overtime	Total Compensation
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Frederick E. Olney	21	GS	S	0	6/15/70-6/30/70	224.80	--	-	224.80
John R. Parvin	56	GS	M	0	7/1/69-6/30/70	~~17,413.12~~ 18,796.57	125.00	--	~~17,538.12~~ 18,921.57
Jack E. W. Pittman	62	WG	M	0	7/1/69-6/30/70	6,285.28 1383.40	125.00	36.16	6,446.44
Boyce O. Sanders	54	GS	M	0	*	~~5,879.04~~ 6528.80	125.00	--	~~6,004.04~~ 6653.80
Rolf W. Simonsen	48	GS	M	1	10/05/69-6/30/70	7,029.12	---	14.00	7,043.12
Robert Z. Smith	22	GS	S	0	7/1/69-8/08/69	689.04	---	--	689.04
Thomas M. Taggart	37	WG	M	2	7/1/69-6/30/70	7,670.08	125.00	139.65	7,934.73
1. TOTAL - STATION PERSONNEL									

PART 2 - PERSONNEL DETAILED TO STATION

NAME OF EMPLOYEE	From Station	Period of Detail	COMPENSATION PAID: Regular Salary Costs	Per Diem and Expenses	Paid Overtime	Total Compensation
	(1)	(2)	(3)	(4)	(5)	(6)
2. TOTAL - DETAILED TO STATION						

3. TOTAL COMPENSATION PAID TO PERMANENT PERSONNEL ON DUTY AT STATION

Form 3-114 (Rev. 1964)

* Does not include period of time on detail to Kooskia National Fish Hatchery 10/19/69 to 4/5/70

Bureau of Sport Fisheries and Wildlife

REPORT OF PERMANENT PERSONNEL

(See Fish Hatchery Manual Section 4438o for Instructions)

PART 1 - STATION PERSONNEL

NAME OF EMPLOYEE	Age	Grade	Marital Status	Children Under 18	Period Worked	COMPENSATION PAID: Total Regular Salary	Uniform Allowance	Paid Overtime	Total Compensation
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Warren L. Thornton	41	WG	M	1	3/8/70-6/30/70	2689 60	---	104. 55	2, 794 15
George L. Williams	41	GS	M	3	7/1/69-6/30/70	~~12210. 72~~ 13594.12	125. 00	83. 70	~~12, 419. 42~~ 13,802.87
Einar Wold	38	GS	M	0	7/1/69-6/30/70	14090. 88	125 00	---	14, 215. 88
Richard L. Wurth	38	WG	M	2	7/1/69-6/30/70	8581. 68	125. 00	---	8, 706 68
1. TOTAL - STATION PERSONNEL	18					~~130,167. 12~~ 134,338.24	1, 375. 00	1, 452. 12	~~132, 994. 24~~ 137,165.36

PART 2 - PERSONNEL DETAILED TO STATION

NAME OF EMPLOYEE	From Station	Period of Detail	COMPENSATION PAID: Regular Salary Costs	Per Diem and Expenses	Paid Overtime	Total Compensation
	(1)	(2)	(3)	(4)	(5)	(6)
2. TOTAL - DETAILED TO STATION						

3. TOTAL COMPENSATION PAID TO PERMANENT PERSONNEL ON DUTY AT STATION **132. 994. 24**

Form 3-114
(Jan. 1964)

FIVE YEAR PRODUCTION AND DISTRIBUTION SUMMARY

(See Fish Hatchery Manual Section 4438p for Instructions)

PART 1 - PRODUCTION

YEAR	TOTAL POUNDS (All Species)	NUMBER of PONDFISH	PER TOTAL MAN YEARS		PER PRODUCTION MAN YEARS	
			Pounds (All Species)	Number (Pondfish)	Pounds (All Species)	Number (Pondfish)
(1)	(2)	(3)	(4)	(5)	(6)	(7)
1970	279,291	-	18,290	-	30,031	

PART 2 - COST ANALYSIS

YEAR	Percent Production Cost of Total	Percent Labor Cost of Total	Production Cost per Pound of Fish	Labor Cost per Pound of Fish	Food Cost per Pound of Fish	Food Conversion
(1)	(2)	(3)	(4)	(5)	(6)	(7)
1970	70	38	1.06	.37	.246	1.94

PART 3 - DISTRIBUTION

YEAR	TOTAL DISTRIBUTION		Number of Truck Trips	Miles Traveled in Fish Distribution	Average Miles per Trip	AVERAGE DISTRIBUTION PER TRIP		Average Cost per Trip	Dist. Cost per Pound of Fish
	Pounds	Number				Pounds	Number		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1970	189,871	2,954,609	-----	Not Applicable		---			

Form 3-115
(Jan. 1964)

Bureau of Sport Fisheries and Wildlife

ANALYSIS OF PROGRAM

(See Fish Hatchery Manual 4438r for instructions)

PART 1- PRODUCTION

Line Number	Species	PROGRAM SCHEDULE		ANNUAL REPORT		DIFFERENCE			
		Pounds	Numbers	Pounds	Numbers	Pounds	%	Numbers	%
		(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)
1	Trout								
2	Warmwater								
3	Anadromous	2[illegible],000	1,400,000	279,291	*5,750,109	15,709	5.3	4,350,109	310
4	TOTALS	2[illegible],000	1,400,000	279,291	5,750,109	15,709	5.3	4,350,109	310

* Includes e[illegible]ess eyed eggs.

PART 2 - COSTS

	Category	PROGRAM SCHEDULE		ANNUAL REPORT		DIFFERENCE			
		Dollars	Man Years	Dollars	Man Years	Dollars	%	Man Years	%
5	Production	2[illegible],000	7.3	295,323	9.30	15,323	5.5	+2.00	+27
6	Distribution	[illegible],700	.2	464	.20	11,236	96.0	--	--
7	Maintenance	1[illegible],500	6.0	123,179	5.38	44,321	16.3	- .62	-10
8	Rehabilitation								
9	Public Use	[illegible],000	.5	1,412	.15	6,588	82.4	- .35	-70
10	Training	[illegible],500	.5	3,111	24	389	11.1	- .26	-50
11	TOTALS	[illegible],700	14.5	423,489	15.27	47,211	10.0	+ .77	+5.3

PART 3 - INDEXES

	Costs Lb/M	PROGRAM SCHEDULE		ANNUAL REPORT		DIFFERENCE			
		Per. Lb.	Per M	Per. Lb.	Per M	Per. Lb.	%	Per M	%
12	Total Cost	[illegible].60	3.36	1.52	.74	.08	5.3	2.62	78.0
13	Production Cost	.95	2.00	1.06	.51	.11	11.6	1.49	25.5

	Pounds/Man Years	PROGRAM SCHEDULE	ANNUAL REPORT	DIFFERENCE	
14	Total Man Years	20,344	18,290	2,054	10.1
15	Prod. Man Years	40,412	30,031	10,381	25.7

Form 3-118
(June 1968)

PUBLIC RELATIONS

(See Fish Hatchery Manual section 4438q for instructions)

TOTAL PUBLIC VISITORS 1/ 35,070

A - INTERPRETATIVE PRESENTATIONS

TYPE OF GROUPS	ON HATCHERY		OFF HATCHERY	
	Number of Groups	Number in Group	Number of Groups	Number in Group
Sportsman Clubs	1	4	1	50
Schools	32	1692	3	100
Service Clubs	8	427	11	685
Professional-Scientific	9	40	1	85
Religious Groups	2	42	1	20
Camp Groups				
Youth Groups	13	254	1	8
State or Federal Government	20	235	--	--
Other	3	12		
TOTALS	88	2706	18	948

B - OTHER PUBLIC RELATIONS ACTIVITIES

TYPE OF ACTIVITY	NUMBER	TYPE OF ACTIVITY	NUMBER
Press Releases (field level)	*	Hatchery Exhibits	3
Number of newspapers (receiving releases)	*	Off Hatchery Exhibits	1
TV Presentations	*	Estimate number of exhibit viewers	10,000
Radio Presentations	*	Other (Explain in remarks - i.e., open house, participation in local events, etc.)	1**

REMARKS * Dworshak National Fish Hatchery received extensive publicity through all media at the time of the dedication; publicity was given also at the time of the release of smolts and during the fish sorting operation.

** Open house during dedication ceremonies.

Form 3-172
(May 1965)

1/ will not agree with totals below

Aerial Photograph of Dworshak National Fish Hatchery.

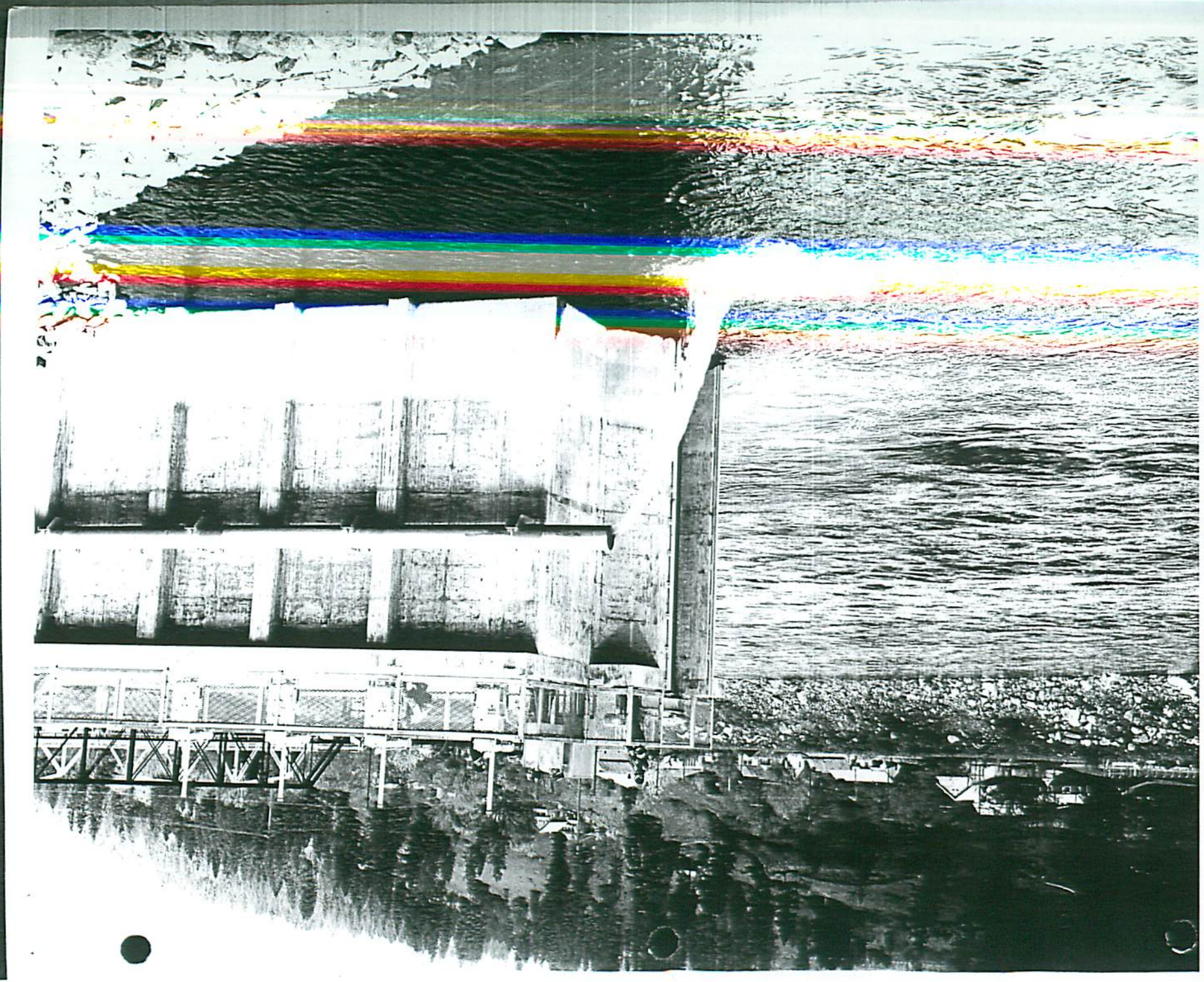
Note the clear water in the lower righthand tier of ponds. These are on the reuse system. The balance of the ponds are on single pass river water which is slightly turbid.

Releasing first smolts on April 20, 1970.

Right to left in picture: Donald Basgen, Resident Engineer
U. C. Corps of Engineers
Dworshak Dam and Reservoir Project

John R. Parvin
Hatchery Manager
Dworshak National Fish Hatchery

First smolt entering river from downstream transportation pipe. The steelhead trout is approximately one third of the distance from the water surface to the pipe in the stream of water leaving the pipe.



Crew marking Smolts for Rease in Spring of 1970.

The adipose fin was removed and a freeze brand applied.

Closeup of Freeze Brand Technique.

Liquid nitrogen was used as the cooling agent.

Dedication Ceremony.

Dr. Lonnie Glasgow speaking. He is Assistant Secretary for Fish and Wildlife and Parks. Dr. Glasgow was the principal speaker.

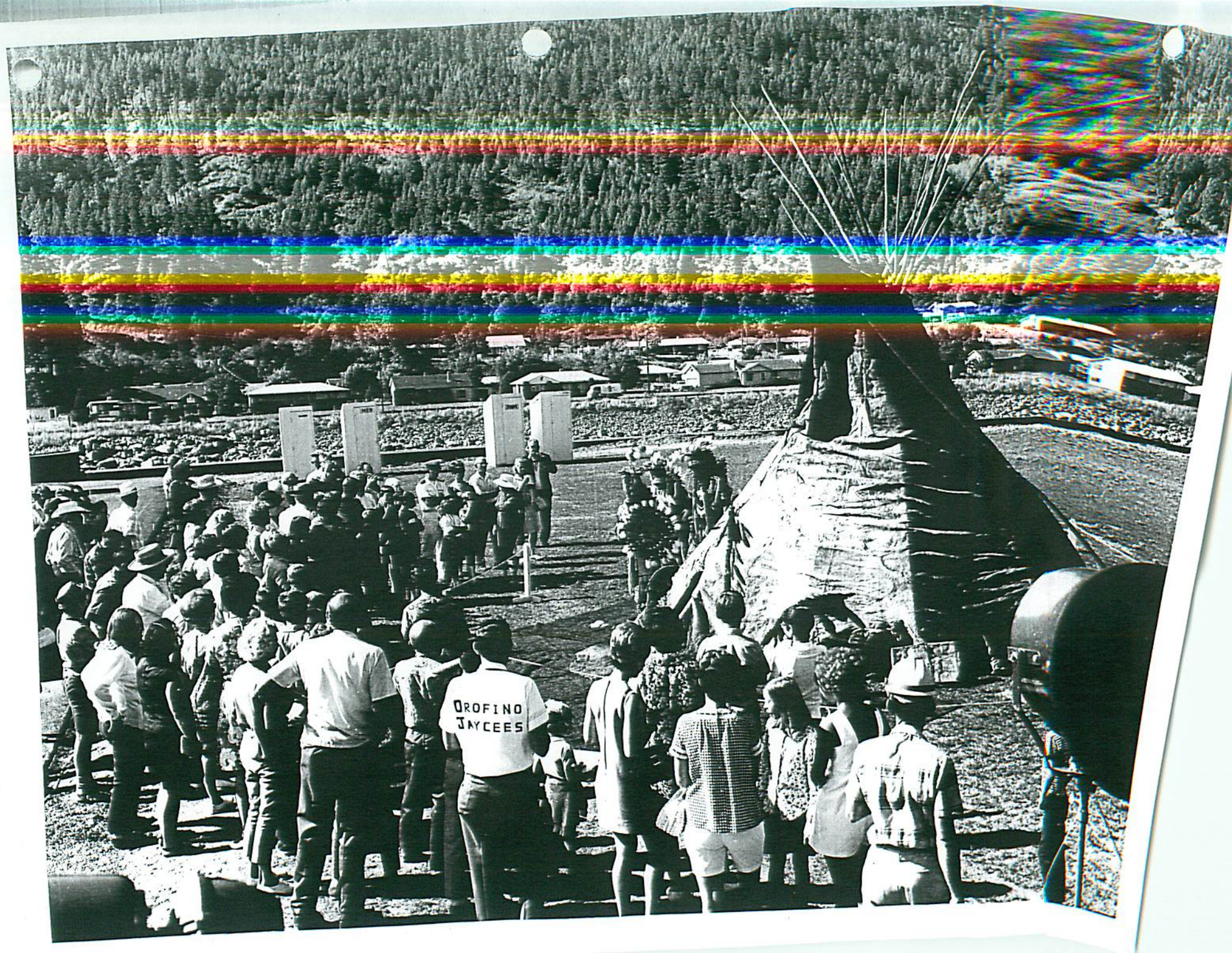
U.S. ARMY
FREE BROCHURES
TAKE ONE
PRESS
U-HAUL

Dedicati Ceremony.

Nez Per Tribal Artifacts and Dance.

The Indi Teepee was an original made of buffalo hides and used by e tribe during the period before and during the Nez Per wars.

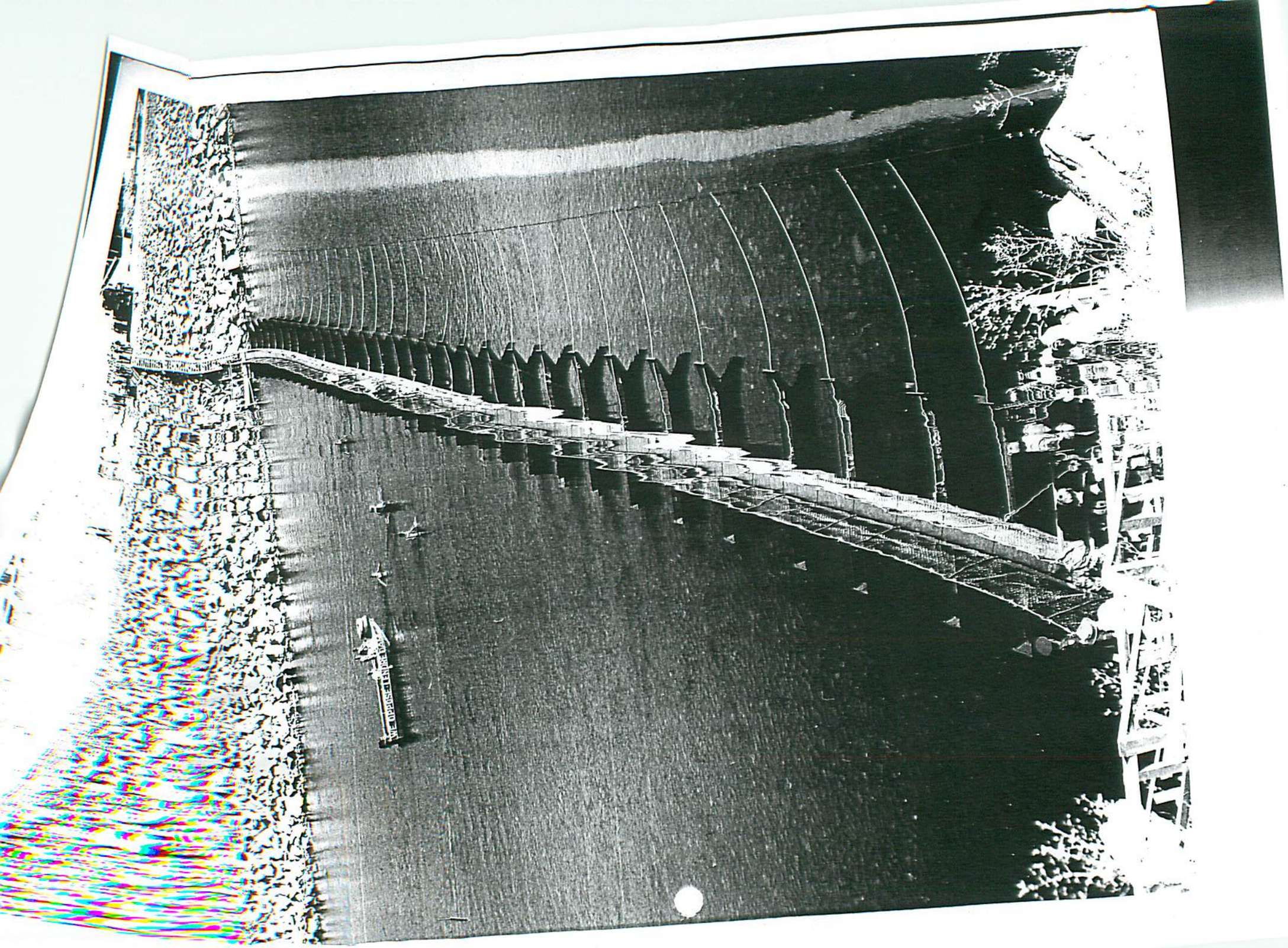
The trib dance was performed by young men of the tribe.


OROFINO
JAYCEES

Dedicat n Ceremony.

A parti view of the crowd attending the ceremony.

Floating Bridge installed by the Combat Engineers to provide access for the public from the parking area to the dedication site.



Dedication Ceremony.

Presentation of a painting by Mrs. Marty Johnson.

This painting was presented to the Dworshak National Fish Hatchery by the Clearwater Art Association and the Te-Wap-Poo Art Gallery.

From left to right - Master of Ceremonies -- Mr. Kimball, Executive Secretary of the National Wildlife Federation; Mrs. A. B. Curtis, wife of the Mayor of Orofino, who made the presentation in the name of the Clearwater Art Association and the Te-Wap-Poo Art Gallery; Mr. John R. Parvin, Manager of the Dworshak National Fish Hatchery, accepting the picture.