Annual Report

FISCAL YEAR 1978

Dworshak National Fish Hatchery
(Hatchery)

Submitted Wayne H Olson Title Hatchery Manager Date 1-12-79

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DIVISION OF FISH HATCHERIES

Form 3-100
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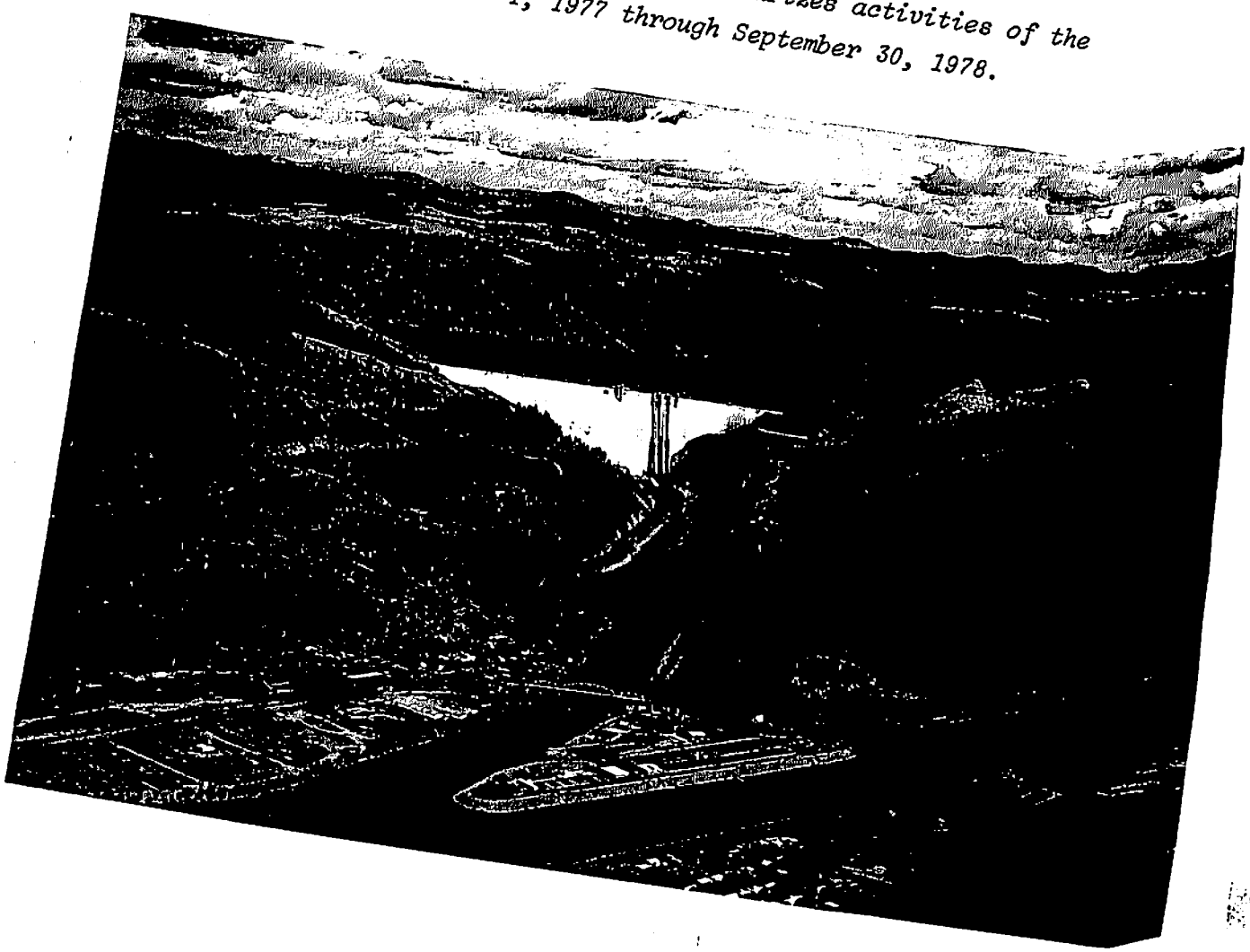
INDEX

I N T R O D U C T I O N

The Dworshak National Fish Hatchery, located at the confluence of the Clearwater River and North Fork of the Clearwater, near Orofino, Idaho, was designed and constructed by the Army Corps of Engineers in 1968 and is operated by U. S. Fish and Wildlife Service. The purpose of the hatchery is (1) to mitigate for spawning losses of the North Fork steelhead trout created by construction of Dworshak Dam and (2) to provide a resident species of trout for planting Dworshak Reservoir.

The Fiscal Year 1978 Annual Report summarizes activities of the hatchery from October 1, 1977 through September 30, 1978.



GENERAL

The Dworshak National Fish Hatchery formed a 'complex' with Kooskia NFH on April 9, 1978. Operations of Kooskia are directed by the Project Leader at Dworshak and all Administrative responsibilities for both hatcheries have been assigned to Dworshak. The complex has worked quite well; especially to the benefit of Kooskia in providing personnel, equipment and fish rearing from Dworshak.

One of the first FWS non-resident Young Adult Conservation Corps (YACC) was established at the hatchery on November 14 with hiring eight enrollees from the local community. Richard Nelson, Fishery Biologist, attended a YACC workshop, in Atlanta, for one week prior to assisting in the beginning of the program. Mr. Nelson continued to act as a coordinator between the hatchery complex and the enrollees. Lawrence Marchant, a fisheries graduate, was hired in January as a group leader. The hatchery has had as many as 13 enrollees down to eight working primarily on fish production. During the summer months, from June through August, the group was on loan to the Idaho Fish and Game and Army Corps of Engineers.

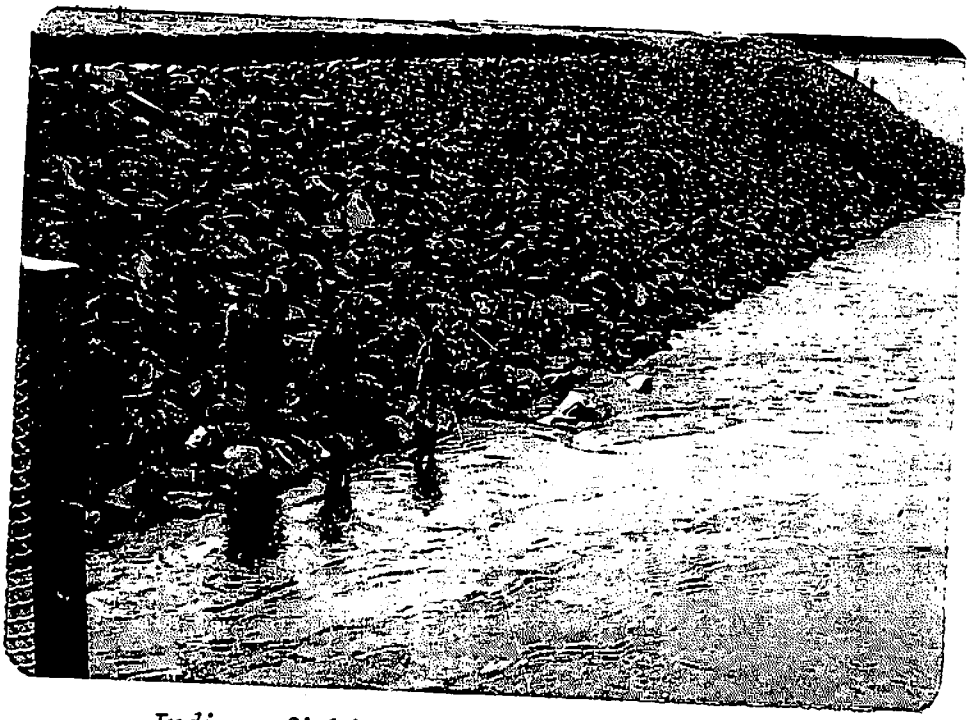
YACC enrollees Ginger McAllister, Yvonne Lowell and Chuck Billups completed 1 year employment in program. Shown with Rick Nelson, YACC coordinator for the hatchery.

YACC enrollees Cheryl Sanders and Donna Robertson transferring steelhead eggs to incubator trays.

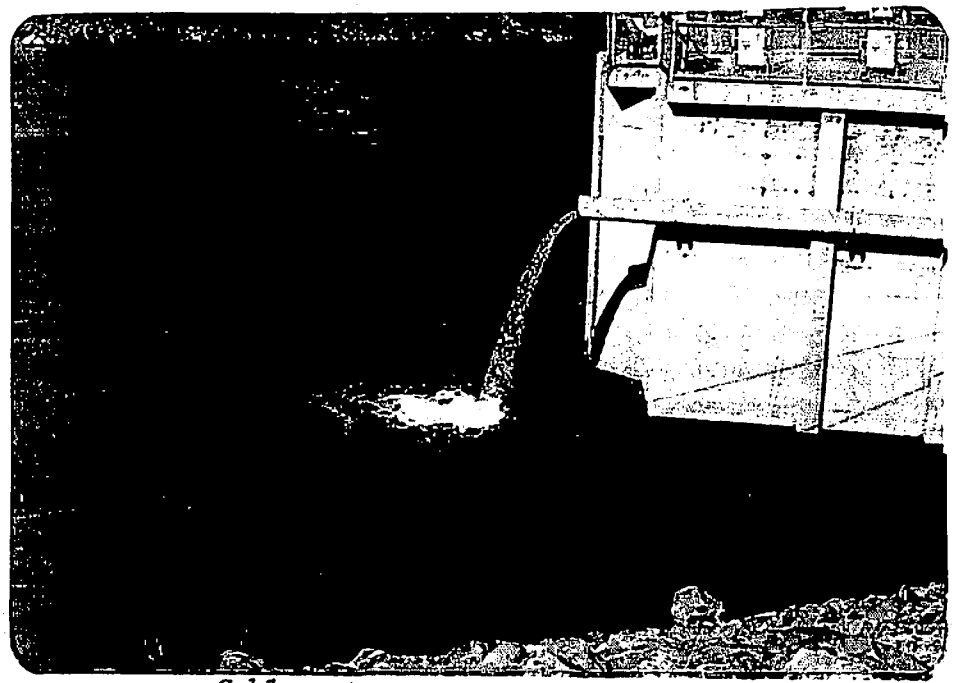
This year's fish production was designed around the removal of the rainbow program to Hagerman NFH during the interim period of construction and to place major emphasis on steelhead rearing. A total of $27,000 had been transferred from Dworshak's account for this program when IPN was discovered at Hagerman in March which prevented planting the rainbow in Dworshak Reservoir. Production at Dworshak was started again with shipments of rainbow eggs received in the spring for release the coming year as subcatchable and catchable trout.

A record number of 12,727 adult steelhead returned to the hatchery in the spring. Some 18 million eggs were taken. Excess unspawned adult fish were transported to waters in the upper Clearwater drainage.

Though the large number of returning fish resulted in a successful spawning season, it was not without problems. Indians illegally fished at the entrance to the fish ladder while the general fishing public was confined to a small area at the west end of the hatchery. We were forced to take action against fishing the ladder entrance by hanging a series of cables across the water. This prevented any taking of steelhead and resolved a potentially serious problem. Federal, State and local law enforcement personnel provided excellent assistance to the hatchery. Public fishing is no longer allowed on the hatchery and is so stated in the latest Fish and Game regulations. Numerous problems occurring with fishermen trespassing on the hatchery grounds resulted in the closing.



Indians fishing near entrance of fish ladder.



Cables strung near entrance of fish ladder to prevent taking of steelhead from within a 100-foot area of the facility.

A Columbia River Inter-Tribal Fish Commission training program was begun at the hatchery on July 17. Eight participants representing the Nez Perce, Yakima, Warm Spring and Umatilla Indian tribes took part in the 3-week session. All phases of fish culture, fish health, water reuse, and laboratory techniques were presented to the trainees.

Indian trainee Tim Green viewing fish sample under microscope

Indian trainees, under the Columbia River Inter-Tribal Fish Commission, are shown with Coordinator Dale Long and Counselor Diane Beverly. Enrollees participated in a 3-week, hatchery sponsored session involving fish culture and laboratory procedures.

Two Coordination Meetings were held with Idaho Fish and Game; one on October 18 and another on March 16. These meetings have been most beneficial in reviewing the hatchery program together with the fishery needs of the State. Cooperation has been excellent with the State, both on fishery related matters and law enforcement.

Two meetings were held at the hatchery with Dr. Tom Meade, University of Rhode Island, in conjunction with his contract study on water reuse and related parameters. Persons from University, research and development centers were in attendance at the meetings on November 29 and April 19.

Meetings attended by various hatchery personnel included:

Northwest Fish Cultural Conference - Olympia - December
Project Leaders Meeting - Boise - April
Regional Hatchery Workshop - Wemme, Oregon - April
Midwest Fish Disease Workshop - Kansas City - August
Pacific Northwest Biologist Meeting, Newport, Oregon - June

Talks and papers were given by different station personnel at several meeings including:

IDFG Conference - Boise - January 1978
"Operation of a Large Fish Hatchery"
"N_2 Gas Removal"

Chapter of American Foresters - Kamiah - February 1978
Rotary Club - Lewiston - February 1978
Junior Chamber of Commerce - Orofino - February 1978
Kiwanis Club - Orofino - March 1978

News releases were furnished the Lewiston Tribune, Clearwater Tribune, radio and television. The Idaho Farmer Stockman magazine and Denver Post featured articles on the hatchery. The hatchery received a number of news recognitions from the local media concerning the record steelhead return to Dworshak.

The visitor gallery over the spawning room was carpeted and three backlighted transparency boxes were installed in the room. The 8 x 10 color transparencies provide the viewer with a pictorial story of the spawning and rearing program.

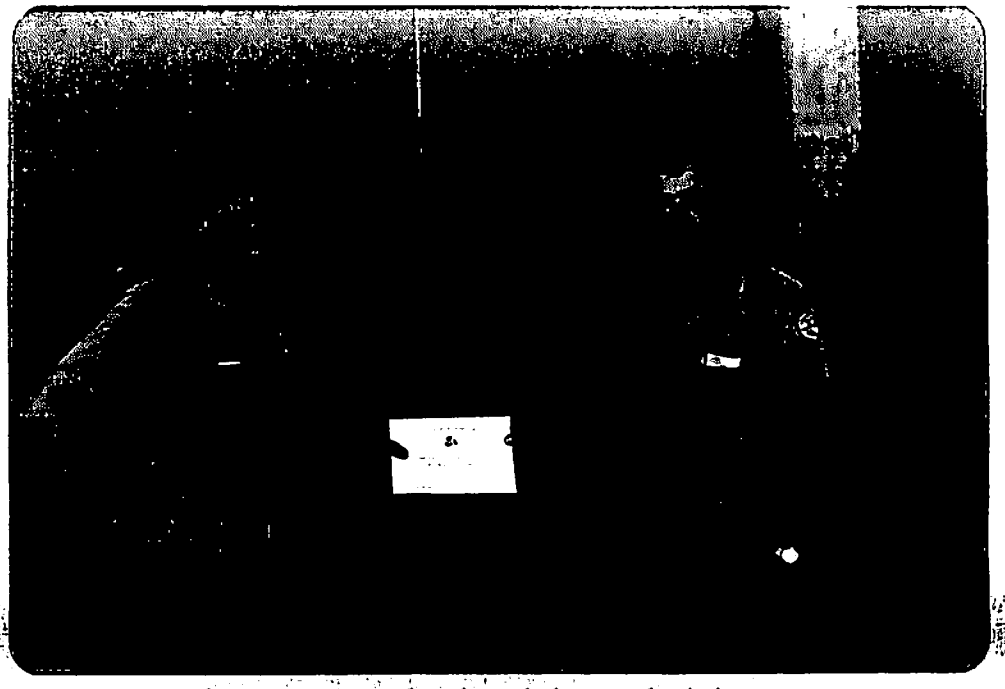
Two personnel changes took place during the year with Walt Harris, biologist, transferring to Hagerman NFH, in March 1978 and Jim Billi, biologist, resigning in July 1978 to accept a position with Alaska Fish and Game.

Manager Wayne Olson was detailed from the station for one month to assist in a Program Management evaluation. Travel took Mr. Olson to Washington, D.C., Denver, and Albuquerque.

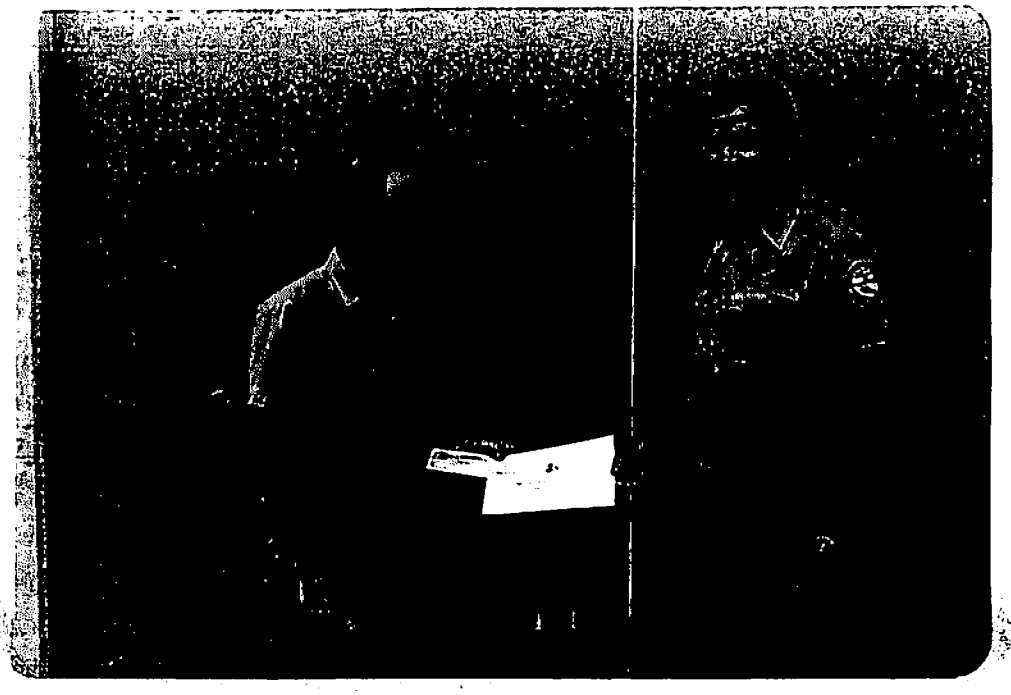
Training sessions during the year were attended by:

Gene Forest - Management By Objectives - Seattle
Joe Lientz - Management Functions - Seattle
Doug Lawson - Fish Health Management - Moscow

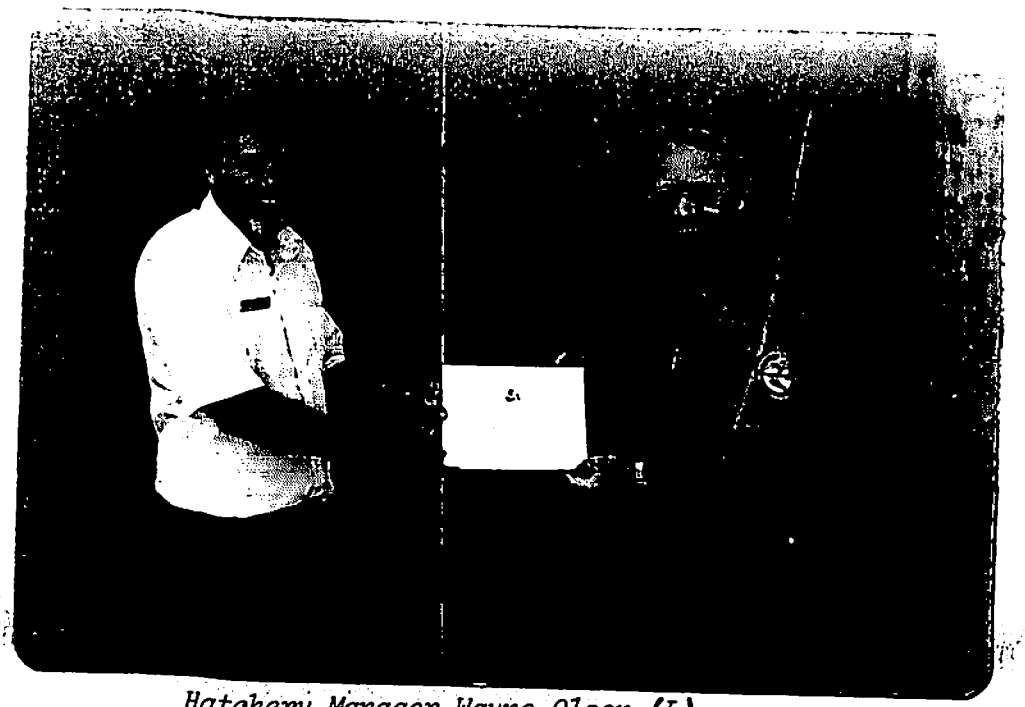
Two Special Achievement Awards and one Quality Increase Award were received by three station employees.



Maintenance Mechanic Dick Wurth (L) receiving a $75 Special Achievement Award from Assistant Manager George Williams (R).



Hatchery Biologist Joe Lientz (L) presenting $250 Special Achievement Award to Biologist Rick Nelson (R)



Hatchery Manager Wayne Olson (L) presenting a Quality Increase Award to Sanitary Engineer Dave Owsley (R)

DEVELOPMENT INVESTIGATIONS

Diet Testing

Abernathy Test Diet

The Abernathy test diet (A-16-28/77) using additional chelated minerals and dicalcium phosphate was used for production steelhead. The Abernathy diet was compared to the basic OMP formulation. Parameters used for evaluation were (1) fish growth, (2) fish health and performance, (3) basic hematological parameters and (4) mortalities.

Results: At the completion of the test the following observations were made:

1. The Abernathy fish grew less than the OMP fish.
2. Abernathy fish performed as well as the OMP fish.
3. Fish health, mortalities and hematological parameters of Abernathy fish were not significantly different from those of the OMP fish.

The Abernathy diet will perform as well as OMP considering it is less expensive and will feed more efficiently through the pneumatic feeder. Based on this study as well as past years' tests, steelhead will accept a dry diet and perform nearly as well as on OMP. Less cost and ease of handling make the use of dry diets feasible. It is important that a trained fish culturist maintain quality management techniques and the biologist monitor fish health regularly.

Mineral Enriched OMP

The Oregon Moist Pellet has proven to be a good production diet for the Dworshak steelhead. Due to the extreme soft water used for rearing, reused water systems and the sensitive steelhead species being reared, it is felt that more nutritional tests should be run. During this production season the basic OMP formulation was used as a test diet in the wet lab. Supplements were added to the OMP formulation:

1. Basic OMP -- control
2. OMP with chelated minerals added
3. OMP with additional calcium phosphate, $Ca_3(PO_4)_2$
4. OMP with double Vitamin C
5. OMP with the additions in 2, 3, and 4 above

The diets were fed in duplicate. Fish loadings, water flows, water source and the same lot of fish were used.

Results: The double vitamin C diet showed the best growth and conversions. The second best growth and conversions were the results of the diet with additional calcium phosphate. Mortalities, fish health, hematological parameters and parasite infestations have indicated no significant difference in the diets. The steelhead used in the diet trials were smaller than the steelhead used in the production program this year. Due to slower growth the smolting period was delayed. Observations of physiological and fish health differences were not noted. Size variation was noted in all trials. Although benefits were seen, the added diet costs are probably not warranted on a production basis. Additional costs would have been justified if beneficial changes would have been observed at smolting. At termination of the diet trials, no adverse smolting changes were noted. The double vitamin C diet outgrew the other test diets. Fish health exams noted no differences. If OMP is to be the production diet, double vitamin C would be economically justified.

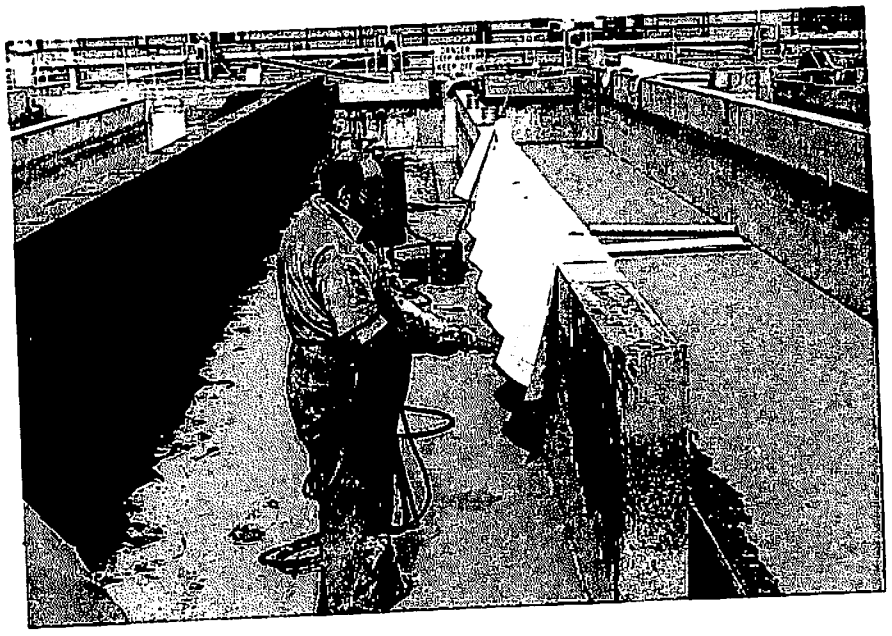
Pond Modifications

All the Burrows ponds converted to raceways have been changed back to the original design except one pond in System I. Although these ponds were converted to a raceway design, there was not sufficient flow to operate the ponds as such.

New screens were designed for the 84 Burrows ponds in System I, II and III. Screen have a 1-inch by 1/4-inch opening and are designed to have a minimum 1 fps outlet velocity to carry solids from the ponds. In conjunction with the new screens, one-third of the sump area was filled in to alleviate a dead space.

New headers have been tested for a double flow Burrows pond. Actual testing for loadings will be conducted in Broodyear 78-79. One problem encountered in using a double flow pond is that another pond is without water to maintain the total systems flow.

Two ponds in System III were fiberglassed by the Corps of Engineers to test for cleanliness and correct for concrete erosion. Fish culturists have complained about the problems of working within these ponds and no apparent benefit in cleaning has resulted.



Fiberglassing two rearing ponds in System II for evaluating pond cleaning effectiveness.

A new cleaning program is being used with the Burrows ponds. A 3000 gallons per minute suction pump attached to the pond effluent pipe is used to remove solids from the pond sump area. Covering the screens with solid plates gives greater suction and better cleaning action. An improvement in the pond environment has been observed. Time and manpower has been increased, however, as part of the YACC program, it appears to be a successful management tool.

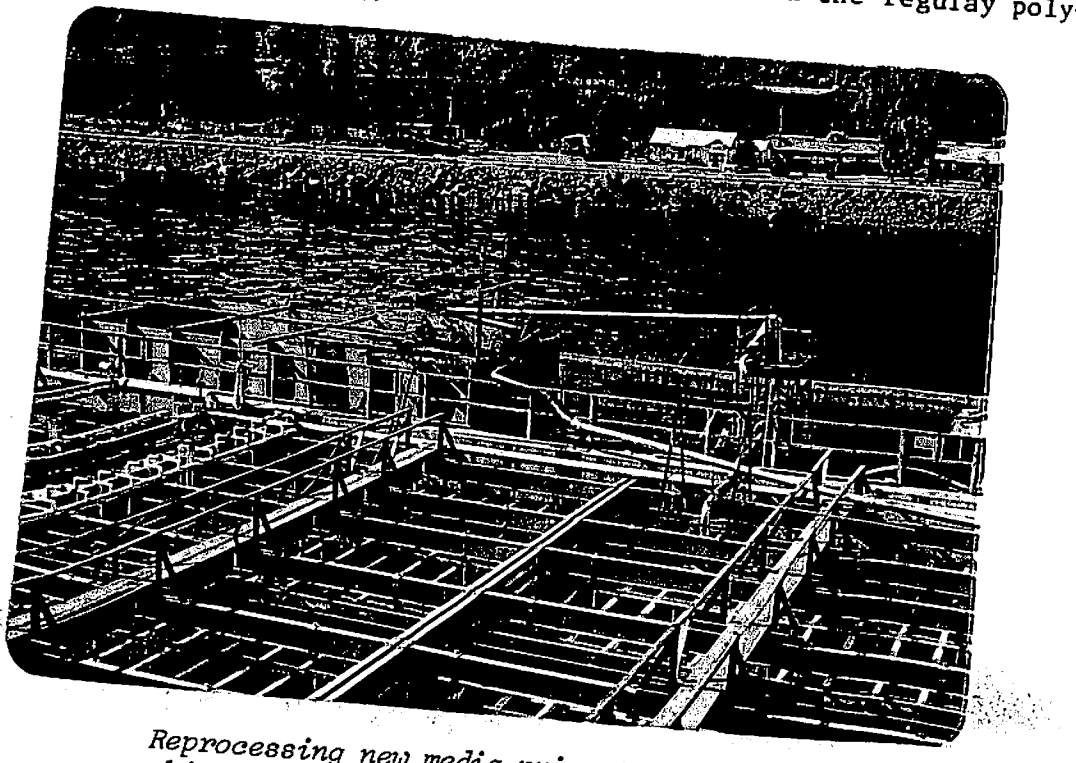
Overhead wires were added to System II in an attempt to reduce bird predation. Stainless steel, 1/16-inch, 600 lb. test salmon trolling wire spaced at 2-foot intervals was stretched 12 feet above the ponds. A netting will enclose three sides at a later date.

System III ponds have incorporated a water sprinkler system for reducing bird predation. The main drawback to this scheme is that it is limited to use only in above freezing weather.

Filter Beds

System II filter beds were converted to the new polyethylene bead plastic media. The filters were preactivated prior to placing them on line. Preactivation consisted of elevating the temperature and feeding ammonium hydroxide.

Due to a discrepancy in the size of the new polyethylene bead media, part of the media had to be reprocessed. This consisted of pumping, grading and drying of the media prior to shipping it back to the manufacturer for reprocessing. A new star-shaped polyethylene bead was the result of the reprocessing. This new media was added to filter bed no. 2. It is expected that the new star-shaped media will perform better than the regulay polyethylene bead media.



Reprocessing new media prior to shipping to manufacturer.

System II filter beds were seeded during Broodyear 77-78 with supernatant from the activated sludge basin. Nitrogen tests indicated that the supernatant was full of nitrifying bacteria.

The new media in System II filter beds has less void space and therefore traps more solids in the filtering process. Because of this, frequent washing had to be employed as fish loads became greater. It was noticed that it took a filter at least 10 days to become active after washing. Although longer runs on these filters was desired,haead lows would not permit more than 2 weeks during peak fish loading in the system.

Dry river sand has been used for nitrifying bacteria seed after washing of System II filter beds. The sand appears to be an excellent source of bacteria and is readily available and inexpensive.

System II continues to use the 3½-inch plastic Koch rings for the media in the filter beds. Higher makeup flows dilute the system and keep it operating in a marginal range.

Because of the EPA discharge limitations, System I filter beds cannot be used after March, 1978. The Corps of Engineers plans to modify this system for future reuse rearing purposes.

Chemical Addition

System II finished out Broodyear 77-78 on 5+ percent makeup water and chemical enrichment. Calcium chloride was added to increase hardness and the chloride ion level. Sodium bicarbonate was added to increase the pH.

System II started Broodyear 78-79 with 5 percent makeup water and chemical enrichment. Calcium chloride was added for hardness, alkalinity and chloride ions. Lime was used to maintain the pH above 8.

System III finished Broodyear 77-78 with sodium chloride being added several times to alleviate nitrite toxicity.

System III started Broodyear 78-79 with 16 percent makeup water and partial chemical enrichment. Sodium chloride was added continuously to prevent a nitrite problem.

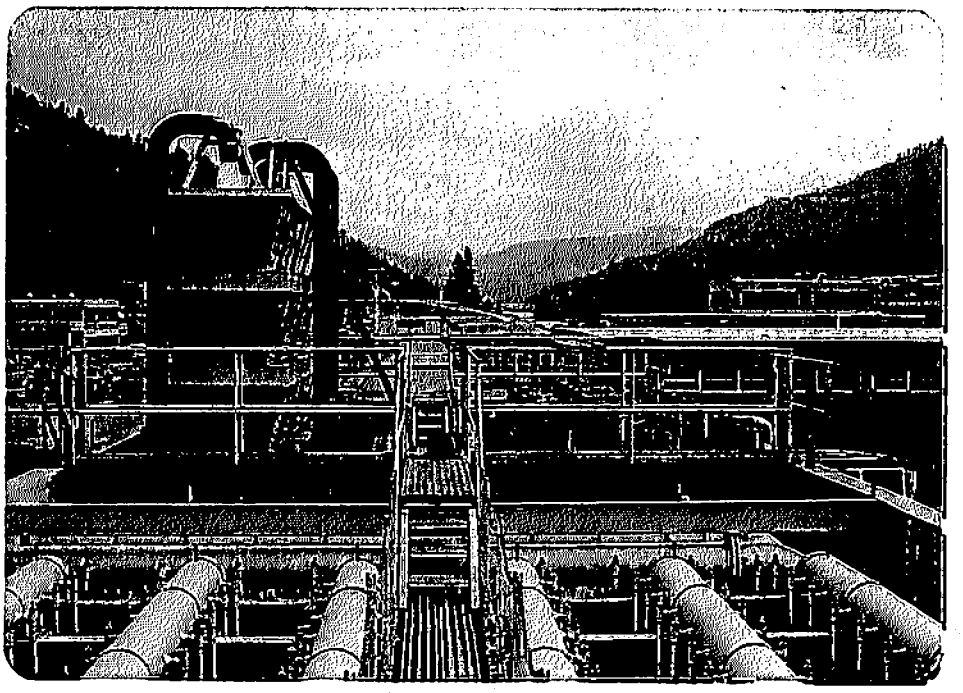
System I encountered nitrite problems during Broodyear 77-78 and sodium chloride had to be added at various times throughout the season.

Because no significant reduction in the white spot incidence was realized from chemical addition in the incubation water supply for Broodyear 77-78, chemicals were not added for Broodyear 78-79.

Nitrogen Gas

Five packed columns are presently being used for nitrogen gas removal in the incubation room. The packed columns are more efficient and less expensive than the Swedish degasser. The incubator packed columns have removed nitrogen gas in excess of 130 percent down to 100 percent.

A full scale "pagoda", furnished by the Corps, is being tested for nitrogen gas removal and aeration efficiency in the System II aeration basin. The pagoda appears to be very useful for large flows but needs improvement in the design.



A pagoda aeration system on System II.

Aspirators have been replaced in the System II aeration basin with packed columns. Along with removing nitrogen gas, the packed columns have showed a 10 percent increase in aeration efficiency over the aspirators.

The use of packed columns for removal of nitrogen gas in System II water supply.

Plans are being made to replace the aspirators in the System III aeration basin with packed columns. A decrease in nitrogen gas and an increase in aeration efficiency make the packed column a more favorable aeration device.

Various column and media sizes were tested for nitrogen gas removal. Plastic Koch rings varying in size from 3½-inch down to 5/8-inch diameter and the Koch flexipac media were tested. Column diameters varied from 2 to 12 inches and flows ranged from 5 to 200 gallons per minute.

Pilot Tests

Ozone was tested in a pilot study by the Corps of Engineers to determine the practicability and feasibility of using it in a hatchery situation. Tolerance and toxic levels of ozone were determined for steelhead trout. Bacteria counts were conducted and compared to ultraviolet light sterilization. Ozone proved to be a very good disinfectant but salmonids have a very low tolerance and toxic threshold for it.

A fluidized bed is beng tested by the Corps to determine if it can operate as a biological filter for hatchery rearing water. Initial tests support the strong potential for this type of filter to be used in place of the fixed media beds presently being employed. It is hopeful that this new filter will work well enough that it can be used in the new System IV.

A pilot study using styrofoam beads for media is being conducted by the Corps to determine the mechanical problems associated with this type of filter. Metabolite reduction, although documented, will be monitored along with the feasibility of using this type of media in a production situation.

Pilot tests by the Corps continue with the polyethylene plastic bead media. Removal efficiency of ammonia and nitrite as related to bed depth has been achieved. Media size as related to removal efficiency has been achieved. Various washing modes and techniques inidcate that an upflow air-backwash as the best way to wash the filter.

An iodinator was tested in the incubation room for fungus control on chinook salmon eggs. Although fungus control was good, the iodine apparently killed the enzyme which breaks the outer shell down and eventually releases the yolk-sac fry. Approximately 100 yolk-sac fry were surgically released from the shells. These fish will be monitored for growth and other fish health parameters for the next season.

Testing of hatching jars using various substrate for egg incubation has been completed. Six jars were tested, two with dolomite rock, two with glass marbles, one with crushed oyster shell and one with the screen only for a control. Several observations were made: a constant flow is a must, fry in jars appeared to be larger and more aggressive in feeding after hatching as the same fry in Heath trays, jars with media performed no better or worse than jars without media, jars with media require more labor after eggs hatch.

Smaller than normal steelhead eggs were taken and compared with normal sized eggs for hatching and growth. Although both size eggs hatched well, fish from the small eggs are only one-half the size of the normal fish. This test appears to relate to the time a fish might stay in the river prior to smolting and migration. Fish growth and health will continue to be monitored.

Column tests were conducted in conjunction with the pilot plant using polyethylene beads. Two columns were tested and varified that media depth is a critical parameter for metabolite removal rate.

A diurnal test was conducted over a 72-hour period to test the various water quality parameters within reuse Systems II, III and the pilot plants. Parameters measured include: ammonia, nitrite, nitrate, pH, alkalinity, hardness, chloride, oxygen, temperature, flow, biological oxygen demand, and feed rate. From this test it was determined that the highest metabolite levels occurred 3 to 8 hours after the day's last feeding.

Concentrated sludge by gravity separation using various chemicals and filter papers was tested to be used in conjunction with the aerated sludge basin. Dosage rates for floculants and paper porosities have been tested. A system should be working some time in the next year.

Pilot Pond Program

During the 1977-78 production year, 3-5 ponds from each system were designated as pilot ponds. Pilot ponds were selected as to loading (light, medium or heavy) and design changes (raceways in System I). Throughout the rearing season pond records, mortality records, feed fed, conversion, blood parameters and disease checks were recorded each month. Subtle observations were noted throughout the season. The use of the pilot pond program allowed us to monitor individual ponds for changes at a time when not every pond could be checked. The following observations were made:

1. Loadings did not directly relate to percent mortality.
2. Raceway design appeared to produce a better handling fish at times of stress and a little lower parasitic load over the entire rearing season.
3. Blood parameters did not vary withing the system but did vary from system to system.
4. Water and fish samples were sent to Dr. Gary Wedemeyer for heavy metal analysis.

Although no major differences were observed, we can say that the pilot pond monitoring method is a useful method for obtaining data on a monthly basis to compare production records with fish health exams.

Test for Saltwater Readiness and Nitrite Tolerance

Saltwater Readiness

The object was to determine the earliest size, age and time at which production smolt steelhead would become fully able to osmoregulate in sea water. Testing began on April 17, 1978 and was terminated on June 20, 1978. Data compiled indicates that smolt steelhead were able to tolerate 30 ppt salinity @ 10°C on April 17 but only at 160 mm+ size. There were no survivors below 160 mm after 14 hours. Survivors were only found in those fish tested from Systems I and III. All of System II fish and all the wet lab control fish died. The wet lab fish were all below 120 mm due to cold water rearing. The other tests conducted May 8, May 23 and June 20 killed 95 percent of the fish at 30 ppt salinity. The surviving fish were above 170 mm. It would appear that due to the temperature the steelhead were reared in, they were unable to osmoregulate this year. We did see that a 160+ mm steelhead is necessary and that the period around April 17 was better for osmoregulation.

Nitrite Tolerance

During the April to June period, the Dworshak steelhead were able to tolerate NO_2-N at 3.2 ppm if Cl was added to the water. Without the Cl addition approximately 95 percent of the smolts died regardless of size.

Conclusions

The salt water rediness test as well as the nitrite tolerance test are useful management tools for determining smoltification. These tests alone are good indicators. By monitoring sodium, chloride and potassium blood levels a more precise determination may be made. Steelhead should be larger than 160+ mm, held in cooler water during smoltification, and environmental stresses reduced. The two tests will be used each season prior to release and monitored from April-June each year. Mark return data this year, 1979, may support some of the observations made above.

Contract Studies

A number of studies were underway by the Army Corps of Engineers to assist them on future design work at the hatchery. The University of Idaho tested various reuse parameters under laboratory conditions using Dworshak water and Moscow water. Paul Cooley, graduate student, U of I, was employed by the Corps to pilot test the new media in System II bio filters.

The hatchery renewed a contract for the 3rd year with Dr. Tom Meade, University of Rhode Island at a cost of $18,000. Studies continue by the University to investigate environmental and physiological parameters associated with steelhead reared in a water reuse system.

HATCHERY BIOLOGIST ACTIVITIES

Cooperative Studies

Investigations were continued this year on the Dworshak steelhead concerning the environmental and physiological parameters affecting smoltification. Through workshops, communications and cooperative studies Dr. Tom Meade, University of Rhode Island, has offered considerable insight into the physiology of Dworshak steelhead.

Dr. Wedemeyer of the National Fisheries Research Center, Seattle, Washington, conducted a fish health assessment at Dworshak. Water samples and fish samples were sent to their lab for analysis.

Charlie Smith of the Bozeman Fish Cultural Development Center continued to support the Dworshak studies through histological examination, consultation and attendance at Dworshak workshops. Histological exams over the past 4 years have established yearly patterns of gill changes and kidney changes. This is an important part of the physiological studies now in progress. Support was also given to the pilot studies and other Regional hatchery problems.

Dr. Charles Knowles, University of Idaho Geology Department. Numerous water samples and fish tissue samples were analyzed for heavy metals and minerals. Support has been given to Dworshak studies through analysis of media, mineral and water samples.

Cooperation and communications were maintained with the following:

University of Idaho

Dr. Bjornn - marking programs, workshop participation, analysis of return data and downstream migration.

Dr. Klontz - Participation in workshops, bio filter studies consultation and support to laboratory for other area assignments concerning fish health.

Dr. Wallace - graduate student pilot studies at Dworshak for Army Corps of Engineers.

Dr. Lou Edwards - Pilot studies on pilot plant testing - ozone treatment.

Washington State University

Dr. Hindin - Consultation and graduate student studies when applicable.

Idaho Fish and Game Department

Participated in McCall hatchery design meeting.

Marking programs, return sampling, disease problems discussed and participation in workshops and coordination meetings.

Washington State Fish and Game

Cooperative studies with the Tucannon State hatchery rearing Dworshak steelhead.

National Marine Fisheries Service

Cooperative studies monitoring quality of downstream smolts and returning adults. Analysis of mark-return data and sampling. Considerable time was spent in recovering return data. Transportation studies and barging studies continued.

U. S. Fish and Wildlife Service

Abernathy FCDC - Diet trials and nutritional studies.

Dr. Zaugg - ATPase studies.

Fort Morgan Fish Disease Control Center - Continued cooperation agreement for implementing the National Fish Disease Inspection policy.

U.S. Army Corps of Engineers - Considerable time was spent discussing Dworshak problems, planning for future tests and analysis of pilot data and fish cultural observations. Mr. Croker and Mr. Hess have worked very close to the lab concerning fish health and disease problems as related to hatchery operation.

Extension Service

Attended meetings to discuss reuse and fish health with other agencies and private personnel. A seminar was given at WSU by Rick Nelson. A presentation was made to Idaho Fish and Game personnel at Boise.

Diagnostic Services

Disease inspection services was extended to a commercial fish hatchery and to a private fishing pond.

Fish health exams and inspections were conducted at six federal fish hatcheries. In April of 1978 an area biologist was assigned to Coleman NFH to handle the disease inspection program at Coleman and Lahonton, Nevada. More time was made available to the federal programs in Idaho and Dworshak studies.

Cooperation With Other Agencies

The Dworshak laboratory facilities were again made available to the Army Corps of Engineers, U.S. Forest Service, graduate student programs and other federal personnel.

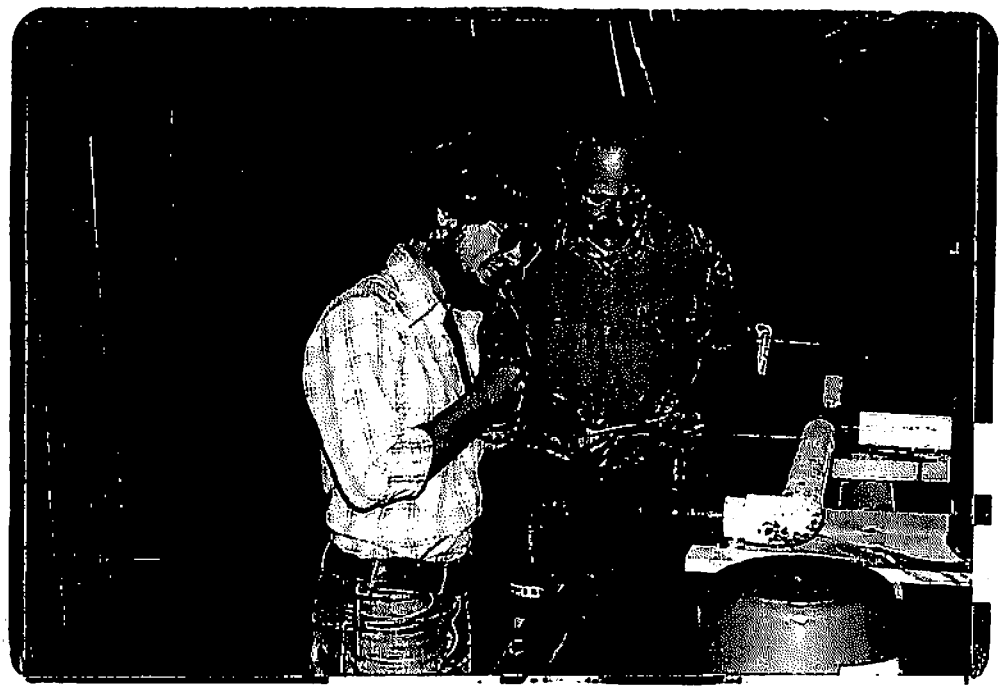
Meetings

Laboratory personnel participated in seminars, workshops, study team meetings, coordination meetings, training sessions, group discussions and scheduled American Fisheries Society meetings.

Major Contributions

1. Inoculation program for returning spring chinook salmon adults at Kooskia NFH against holding losses and kidney disease.
2. Monitoring of Dworshak steelhead reared at Hagerman NFH.
3. Testing of chemical treatments for steelhead.
4. Physiological studies and salt water challenge testing for steelhead and salmon.
5. Student trainee work/study program.

6. Columbia River Inter-Tribal Fish Commission training program.



Hatchery Biologist Joe Lientz with summer student trainee Chris Horsch

FISH CULTURAL OPERATIONS

Spawning Program

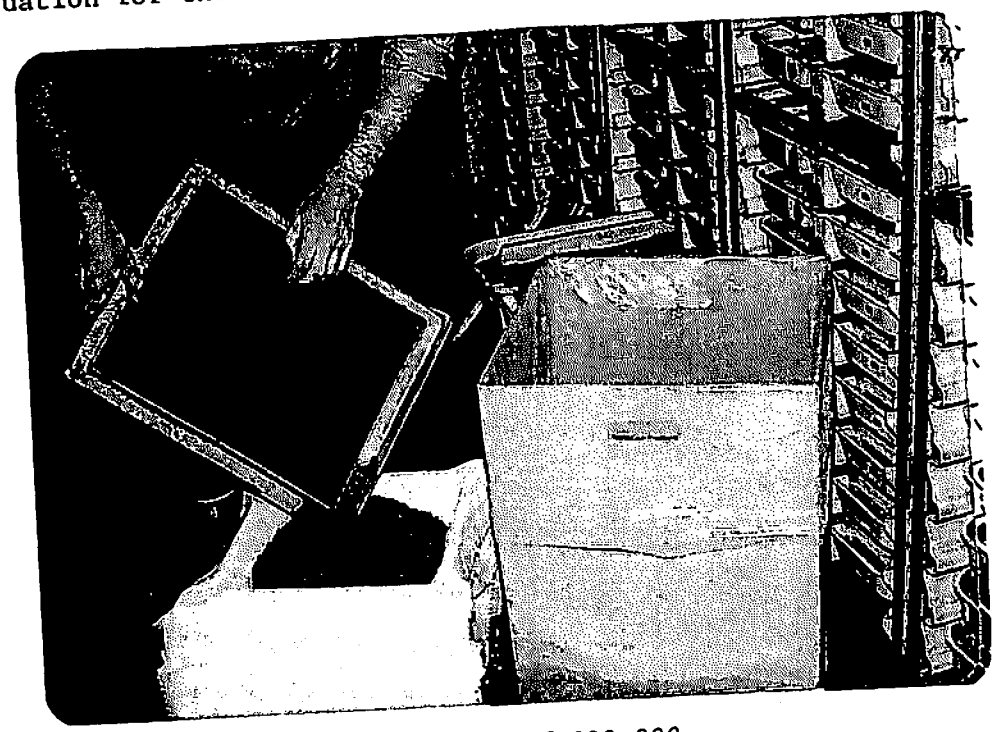
It was evident by early fall 1977 that the number of returning adult steelhead in the river were the highest in recent years. The hatchery could expect to see between 10,000 and 15,000 fish back; mostly from the 1975 smolt release. We opened the ladder on October 19 to check numbers and shut it down the following day when 66 fish were recorded. The ladder was again started in mid-January and remained open until May 9. By the end of January, 600 fish had been collected compared to 20 this same time one year ago. On February 22, the hatchery had 1,219 fish, with spawning begun on February 12; this date being the earliest in history. In one 10-day period in late March, 2,200 fish came up the ladder. On March 21, the hatchery counted 3,921 steelhead back, surpassing the total of 3,100 collected during the entire 1977 season. By April 19, 11,345 fish were on the station and 12,644,000 eggs collected. The total return was 12,727 steelhead, with 18,650,000 eggs collected. During the entire season, the trap at the dam was not operated. This was done to assure that fish remained in the river as long as possible to be caught by the angleers. Idaho Fish and Game maintained an open season on steelhead from September 15 to April 15.

Excess steelhead eggs, fry and unspawned adult fish from Dworshak were disposed of accordingly:

Adult Steelhead Distribution	Number
South Fork - Clearwater River	3,482
Lolo Creek	1,400
Potlatch Creek	480
Dworshak Reservoir	569
Green Steelhead Eggs	
Tucannon State Hatchery, Washington	537,000
Eyed Steelhead Eggs	
Idaho Dept. Fish & Game	4,465,000
Hagerman National Fish Hatchery	686,000
Steelhead Fry	
Idaho Dept. of Fish & Game	4,600,000
Dworshak Program	
Eggs	7,100,000

A total of 18,600,000 eggs were collected from returning steelhead to Dworshak. The Tucannon Hatchery received green eggs for hatching and planting of the Grande Ronde River in S.E. Washington.

The IDFG picked up eyed eggs for use at their rearing stations at Red River, Hayden Creek and Mackay. The resulting fish from these eggs will be returned to the Snake River drainage. Hagerman NFH received eggs for use in a steelhead rearing evaluation for the Snake River Compensation Plan.

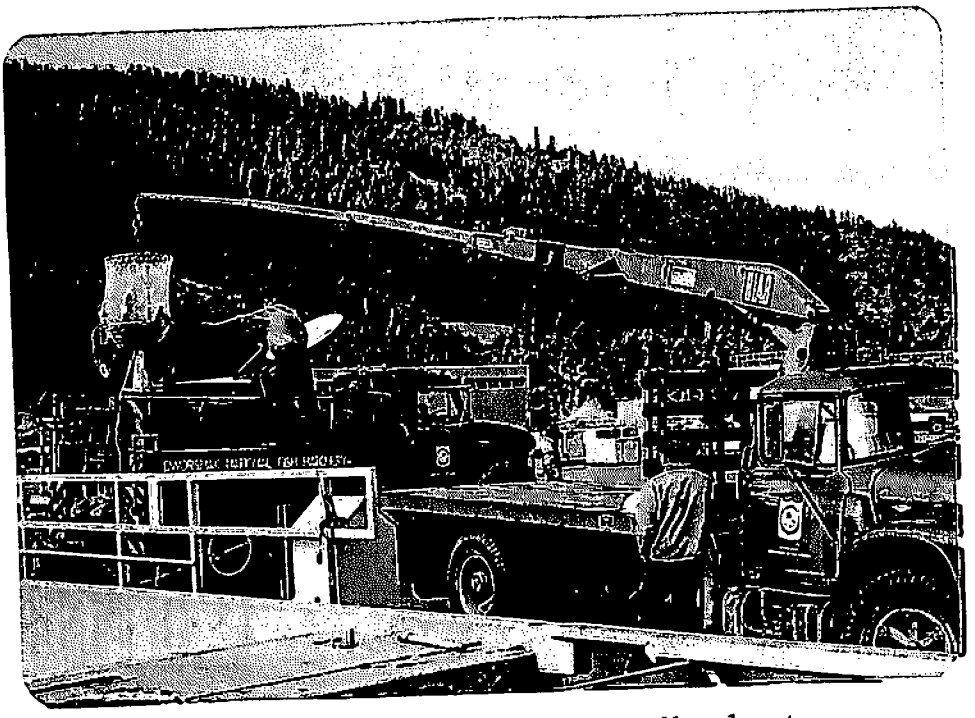


Preparing a shipment of 600,000 steelhead eggs to Hagerman NFH for evaluating rearing capabilities.

The disposition of steelhead fry to IDFG included some 3,000,000 to Dr. Ted Bjornn, U of Idaho, for planting in the Lochsa River. These small fry are a continuation of a 2nd year planting study to determine success of this program. The state planted a number of fry into various tributaries of the Clearwater, including Lolo Creek, S. Fork and Potlatch Creek.

The Dworshak program kept over 7 million eggs to meet a release of 2 million 1st year smolts in 1979 and some 1 million 2nd year smolts in 1980.

A total of 29 trips were made from the hatchery to distribute nearly 89,000 pounds of excess unspawned adult steelhead to tributaries of the Clearwater River. It was anticipated that many of these fish would spawn and contribute to some production in the wild. Sightings of redds have been observed by IDFG personnel.



Loading of surplus adult steelhead onto trucks for distribution into upper waters of the Clearwater drainage.

Allied Fisheries, Bellingham, Washington was on contract for the carcasses. A total of 5,402 fish, weighing 58,700 pounds, was purchased and removed.

Senior citizens assisting National Marine Fisheries Service in recovering nose tags from returning steelhead.

Steelhead Production

Broodyear 1977 (eggs collected Spring 1977) was set up in rearing ponds with lighter loadings. This was made possible by removal of the rainbow program. All three systems operated on reuse. Fish health problems were noticed at times in Systems I and III, however, at time of release in the spring, the fish appeared to have recovered and were generally in good condition. Reports from fishery people at the dams indicated that Dworshak's releases were some of the best seen in recent years. Very little fungusing occurred in the downriver migrants.

A breakdown of the steelhead release in Spring 1978 is as follows:

	Number	Weight (lbs)	Average Size
System I	391,089	43,244	180 mm
System II	677,547	80,929	175 mm
System III	478,059	52,014	175 mm
Subtotal	1,546,695	176,187	
2-year-old group	51,000	12,000	225 mm
Total release	1,597,695	188,187	177 mm

A fish marking program was completed in December 1977 by the National Marine Fisheries Service (NMFH) and Idaho Fish and Game. NMFS tagged 60,000 steelhead for a transportation evaluation study and the State marked 160,000 for a homing imprint study. Fish handled well and appeared in excellent condition upon completion of marking. Early marking is important to fish health and we must continually emphasize that any marking be completed prior to January 1. Another group of 300,000 steelhead smolts were released in April at the Kooskia hatchery to evaluate extending a steelhead return beyond Dworshak into Clear Creek. These fish were also marked to provide management with information on their return.

Transferring 300,000 steelhead via IDFG trucks for release at Kooskia NFH (Clear Creek). An evaluation study under the Lower Snake River Compensation Plan.

System I

System I had been operating the previous 2 years on raw water. It was placed on reuse for the Broodyear 1977 rearing program and remained on this water supply until fish were released in spring 1978. Problems within the system became evident in January with increases in fish mortality. No single cause could be found which contributed to the losses. The system went over to raw water (40°) for 10 days and losses decreased. It went back onto reuse at 56° and continued until ponds were released. Daily mortality in February was 0.7 percent but dropped during the months of March and April.

System I began operating in July on raw water to carry fish from Broodyear 1978 for a 2-year-old release in spring 1980. This will allow for modification by the Corps of the bio filters with anticipated operation again on reuse in summer 1980.

System II

System II was operated the entire rearing season of 1977-78 on reuse supplemented with mineral addition to increase total hardness, pH, alkalinity and chloride levels. A new media change was also made to the filter beds. From the standpoint of fish health, System II was highly successful in producing a healthy fish for release. Daily mortality remained less than 0.01 percent until near smoltification in April. At that time, losses increased to 0.15 percent at time of release.

The fish reared in System II appeared to have been in much better condition than those in Systems I and III. System II fish were not without parasite or bacterial problems but were more capable of resisting these infestations. The extremely weak fish or injured fish showed heavy parasite loads, but the healthy fish showed low parasite loads. It appears so far that under intensified fish culture conditions, using reuse water, that benefits concerning fish health are enhanced by mineral enrichment.

System II continued to produce healthy fish even during extended periods of extremely high metabolites for Dworshak. Nitrite and ammonia levels were much higher than desirable for rearing quality smolts, however, Dr. Meade's work has shown that the chloride protection against nitrite toxicity prevented high mortalities in System II this year. CO_2 levels remained low as compared to last year due to the increased pH level. Mineral enrichment provided us the capability of controlling pH, CO_2 and chloride levels.

There were definite benefits seen in operating System II on added minerals, but conclusions cannot be based on 1 year's operation. If the results can be repeated and loadings increased, only then will these results be more conclusive.

Mineral enrichment is not the answer to quality fish production in reuse systems. It is a part of the answer. Additional information and answers are needed in the following areas before the problem can be solved.

1. Reduction of nitrite levels
2. Reduction of ammonia (un-ionized) levels
3. Pond environment
   The ability to clean the pond adequately. Without this capability, we are limited as to what can be done.
4. Testing of ponds for best performance
5. Ability to remove solids before the biofilter. Without this capability little can be done to improve the biofilter operation.
6. Better means of cleaning and operating the biofilter. The new media appears to be doing a good job, but its performance is limited by the waste material collected in the media and capabilities to clean the media.
7. We have shown benefits of mineral enrichment but have not dented the surface concerning the pond environment.

Broodyear 1978 steelhead were moved to System II, in June, on reuse supplemented with minerals as in the previous year. An outbreak of *Ich* in early August resulted in a loss of 800,000 fish, 1-2 inches, over a 10-day period. Some 3 million steelhead located on a different water system were not affected. The system will continue, with fish being added from System III to operate on reuse using 5 percent makeup water and increasing total hardness to 150+ ppm, chloride at 50 ppm and pH at 8.0.

System III

The system continued on reuse through the entire rearing period of 1977-78. The 3½-inch Koch rings were in use, however, considerable lighter loads were being produced to offset the inefficienty of the filter media. Daily mortality went to 0.07 percent in February and approached 0.3 percent in April near release. Despite some of the higher losses in the later rearing period, the fish in general appeared to show some good signs of health.

The 1978-79 season will again see the system operating on reuse using rings in the bio filters. Sodium chloride is being added to assure protection from a nitrite hump with the chloride level maintained at 20 ppm. A makeup flow of 15 percent is also being used as further help to maintain fish health.

Rainbow Production

No rainbow were planted in Dworshak Reservoir in CY 1978 due to the disease, IPN, discovered in fish being reared at Hagerman NFH. These fish were to have been released in the Reservoir. Shipments of eggs were made in March to Dworshak to assure production was resumed and fish would be available in 1979. Fingerling plants will also be assured in spring 1979 from eggs received at the close of the fiscal year.

Kokanee Production

No kokanee plants were made from the hatchery as eggs were not available. Elk Creek was checked in fall 1977 for spawners resulting from previous years' plantings. No kokanee were found.

Chinook Production

The hatchery assisted Kooskia NFH in holding spring chinook salmon, both adults and fingerling. Dworshak was also used for spawning and incubating eggs. (Refer to Kooskia's Annual Report) The program for Kooskia could not have been met without the use of Dworshak's production facilities.

IMPROVEMENTS

Adult Holding Ponds

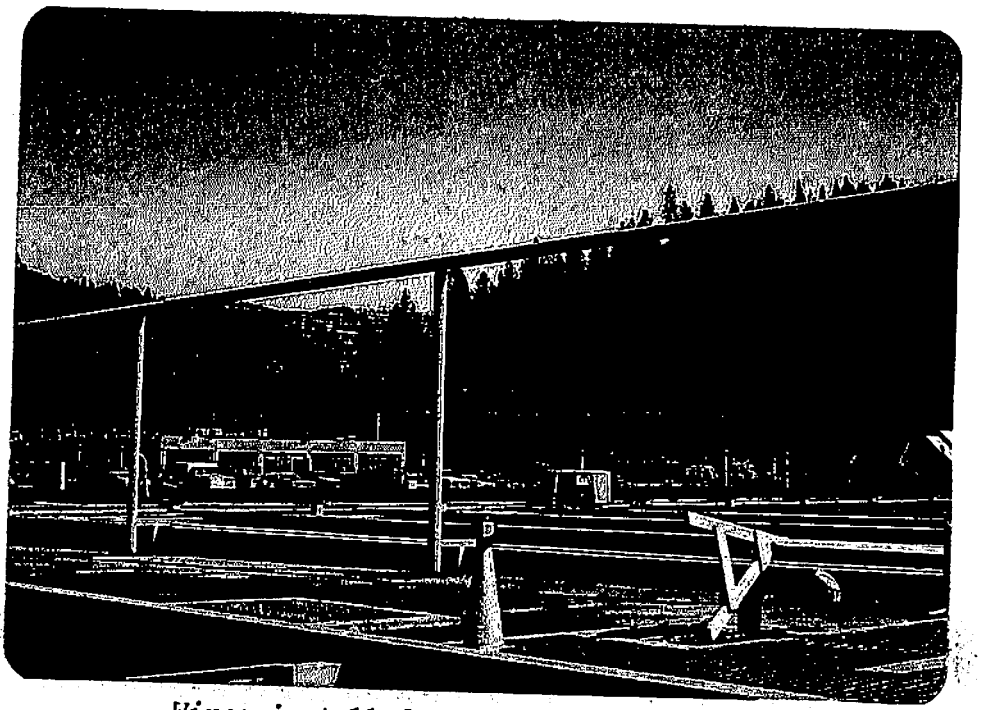
Four adult holding ponds were modified to accommodate the two-year rearing program for steelhead trout. A new water inlet and outlet distribution system was buildt with design similar to that of a raceway. Walkways with handrails were installed along one end and one side of the ponds for fish culture purposes.

Bird Depredation

Two methods of bird control were being compared to determine which will be the best method to reduce predation by sea gulls and ducks in the rearing ponds. The two methods consisted of overhead wire over 25 ponds of Reuse System II and an intermittent water jet system for 16 ponds in Reuse System III.

The overhead wires are 2 feet apart and span a distance of 450 feet by 75 feet between supports 12 feet above the pond walls. We will observe this setup as described to determine its effectiveness and make modifications as needed. One improvement would be to hang bird netting around the perimeters and fully enclose the ponds.

6" black iron pipe, 680 feet	$4.000
1/16" stainless steel wire, 19,000 feet	720
Miscellaneous hardware	1,250
Welding	2,500
Bird netting, 1,200 ' x 14'	150
Labor, 15 man-days	800
	$9,420

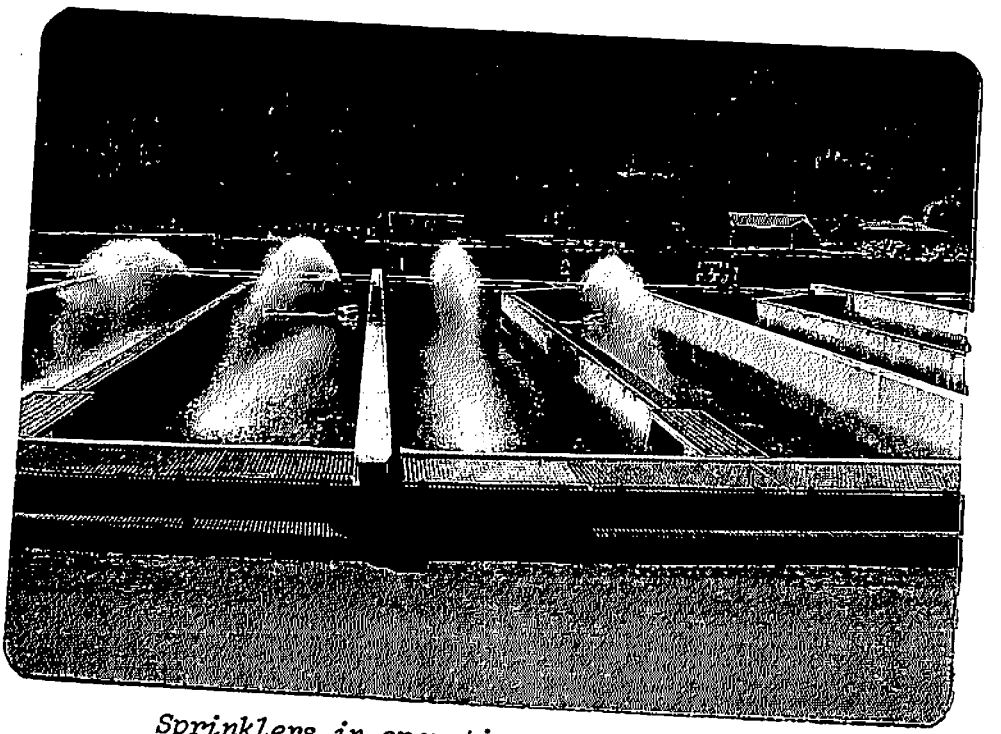


Wires installed on 2' spacing covering an area 75' x 450' over System II rearing ponds to reduce fish losses from seagulls and mallard ducks.

The water jet system provides a jet of water over the pond surface and thereby scares the birds away. Two jets are installed on each pond and two ponds are in operation at any one time. An irrigation control unit is used to turn the system on or off. Time of operation and interval between operations can be adjusted as needed.

Pump	$1,060
Electrical parts	575
Irrigation control	750
Pipe and fittings	745
Other materials	225
Labor, 20 man-days	920
	$4,275

Both systems were completed in early December and few birds were observed during the season to evaluate the two methods. Winter temperatures were warmer and kokanee escaping from the Dworshak Dam apparently provided abundant food for the gulls and ducks on the North Fork of the Clearwater River. Observations will continue in Fiscal Year 1979 to determine the effectiveness of the two systems in controlling bird predation on fish production.

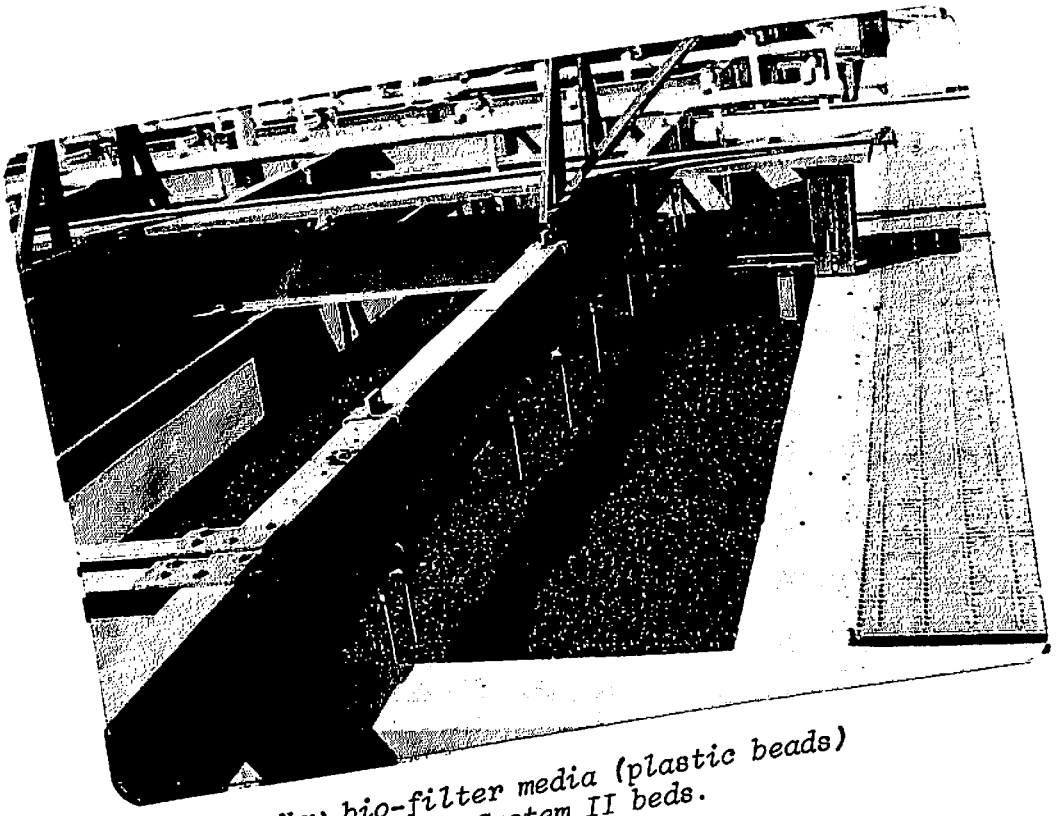


Sprinklers in operation on System II rearing ponds to reduce losses of fish to birds.

Filter Media

All four filter beds in System II have been converted by the Corps to the new plastic bead media. Two of the filter beds were preactivated prior to placing them on line. Ammonium hydroxide was added as an artificial ammonia source. The temperature was elevated and minerals were added to increase the pH and the alkalinity. The new media is more effective in removing ammonia but requires more maintenance because of frequent backwashing during the heavy fish loads. Perforated plastic well casing is being used for the outlet water distribution system. The filters are washed by means of the existing air lines within each bed.

Filter media change in System II showing workers removing the 3½-inch Koch rings.



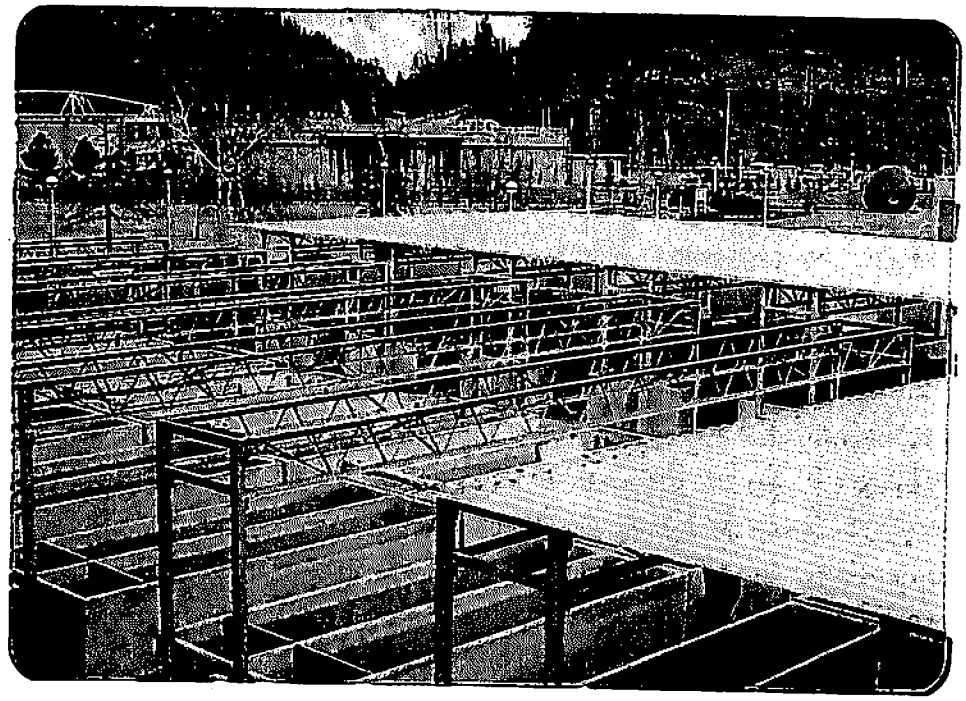
New bio-filter media (plastic beads) in place in System II beds.

Chemical Feed System

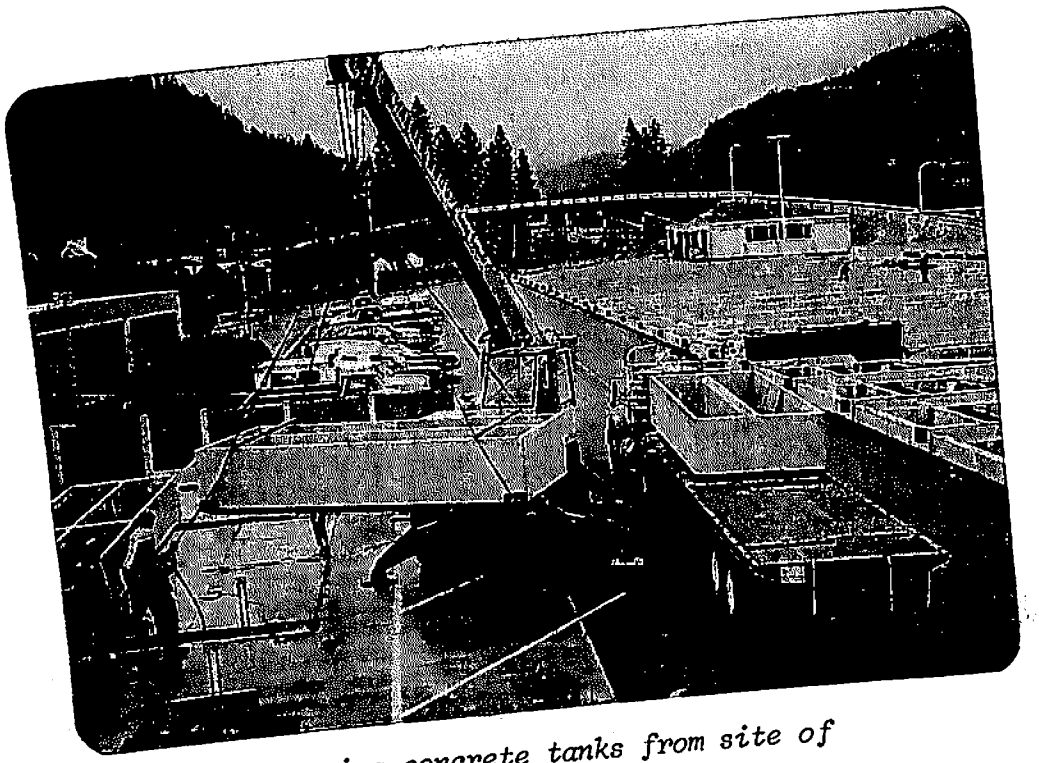
A temporary metal building was installed by the Corps at the south end of the Mechanical II Building. The new building contains chemical feed equipment for Systems II and III and storage for the dry chemicals. Chemicals that thave been added with this system include lime, calcium chloride, sodium bicarbonate and calcium carbonate. These chemicals were added to achieve an increase in pH, hardness, alkalinity and chloride ion concentration.

CONSTRUCTION

A contract was issued by the Army Corps of Engineers in spring 1978 for dismantling the sunshade cover and removing the 64 concrete nursery tanks prior to construction of the new nursery tank building. Tanks were relocated along the fish ladder and also at the west end of System III rearing ponds and placed on raw water single pass. The new building, with approximately 17,000 square feet of floor space, will house 128 tanks. A delay in awarding the contract has postponed construction to spring 1978, or one year later.



Removal of sunshade over tank area prior to constructing new nursery building.



Removing concrete tanks from site of new nursery building.

Some smaller contracts by the Corps were in progress during the year and included construction of a temporary metal building to contain chemical feed equipment and the change in System II bio filter media reported under IMPROVEMENTS.

A delay by the contractor in the installation and operation of Systems II and III drain channel pumps has resulted in pond cleaning problems. No action is anticipated until FY 1979.

Bure[illegible]f Sport Fisheries and Wildlife
Divis[illegible] of Fish Hatcheries

HATCHERY PRODUCTION SUMMARY

Station: DWORSHAK NATIONAL FISH HATCHERY
Period covered: October 1, 1977 through September 30, 1978

Density Index: 0.260 | Flow Index: 0.393 | Total Flow: 38,000

Species and Lot	FISH ON HAND END OF MONTH			FISH SHIPPED THIS F.Y.	GAIN THIS F.Y.	FISH FEED EXPENDED		Conversion	UNIT FEED COST		T.U. per Inch	T.U. to Date	Length Increase 30 day month
	Number	Weight	Length	Number	Weight	Pounds	Cost		Per Lb.	Per 1000			Inches
1	2	3	4	5	6	7	8	9	10	11	12	13	14
STT 6-DSX-61X	0	0	8.841	51.0	2,614	10,795	3,148.32	4.13	1.20	93.36	27.61	212.68	0.000
RBT 6-EWX-618	0	0	12.543	26.4	789	4,465	1,210.80	5.66	1.54	574.96	16.49	196.90	0.000
STT 7-DS-X 71X	50.4	3,107	6.385	1,615.9	161,680	343,450	101,205.40	2.12	0.63	33.23	34.32	181.90	0.000
STT 8-DS-5	3,244.7	36,119	3.198	0	33,119	73,560	20,735.43	2.22	0.63	6.68	28.60	59.90	0.889
RBT 8-UOR-X-6	495.6	10,139	3.695	0	9,802	19,060	5,378.31	1.95	0.55	11.09	20.08	57.10	0.603
TOTALS	3,790.7	49,365		1,693.3	208,004	451,330	131,678.26						
AVERAGES			3.305					2.17	0.63	24.01	25.42	141.70	0.497

Form 3-229
(Sept. 1971)