1984 Fish & Wildlife Annual Project Summary

BPA

U.S. Department of Energy
Bonneville Power Administration
Division of Fish & Wildlife

I-09

Mission Statement

BPA will act as a catalyst for defining and achieving the electric power and conservation objectives of the Pacific Northwest. We will work to assure the region an adequate, economical. reliable. efficient, and environmentally acceptable power supply. We will do so in an open and businesslike way, consistent with our responsibilities to fish and wildlife and with our obligations as a Federal agency. and responsivé to citizen's concerns for their well-being and the quality of their environment. BPA will provide leadership in the region, fulfilling our responsibilities with professional excellence.

Bonneville Power Administration
September 1983

This summary includes reports funded by the Bonneville Power Administration (BPA), U.S. Department of Energy in order to protect, mitigate. and enhance fish and wildlife resources affected by the development and operation of hydroelectric facilities on the Columbia River and its tributaries. Findings and recommendations offered in these reports are those of the project leaders or their respective agencies and do not necessarily represent the views of BPA.

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A MESSAGE FROM THE ADMINISTRATOR

ACCOMPLISHMENTS AND DIRECTIONS

By the end of FY 1984, BPA had reached an exciting new stage in its work to rebuild the Columbia River's valuable anadromous Fish runs. With the completion or near completion of numerous studies, program emphasis began shifting to implementation of construction plans and study findings.

BPA undertook its first fishery research projects in 1978 in response to the urgency of concerns about the region's declining fish runs. The program grew rapidly. escalating with the passage of the Pacific Northwest Power Act. The Act assigned to BPA major responsibility for funding the protection and enhancement of fish and wildlife resources harmed by hydroelectric development and operation. The Northwest Power Planning Council. created by the Act,. developed a comprehensive fish and wildlife program. BPA participated with other fish and wildlife interests and cooperated with the Council in its original and recently modified program. The Division of Fish and Wildlife was established in 1982 to implement that program.

During its first two years, BPA's Fish and Wildlife Division concentrated on developing the information needed to carry out an effective program of mitigation for losses to fish and wildlife caused by the development of the Federal Columbia River Power System (FCRPS). In 1984, nearly $12 million of $18 million expended on enhancement projects went for studies. Fishery managers have learned much from these studies about the difficulties that Fish encounter in their migration to and from the ocean. They applied their ideas to improve and expand productive habitat for wild fish runs. They have developed methods to increase both the health and productivity - and consequently. the adult returns - of both wild and hatchery fish.

In 1984, we also began to carry out the recommendations of some earlier studies. BPA spent approximately $6 million on construction and other enhancement activities. That included almost $1.5 million for the management of the Water Budget--a series of well-timed releases from a number of dams to supply river flows strong enough to move smolts quickly downstream in the spring. Through these efforts, we can look forward to seeing immediate improvement in protection for severely depleted runs. even as we continue to search for solutions to long-term problems.

Most projects funded by BPA relate directly to measures in the Northwest Power Planning Council's Fish and Wildlife Program. In this report. they are grouped according to the type of problem addressed and. for those involving anadromous fish. the stage in the life cycle that is affected. The listings give detailed. yet brief.

descriptions of each project's goals. accomplishments and continuing activities. Some projects will continue into the 1990's as returning adult migrants are observed and evaluated to determine the effectiveness of various mitigating and protective measures.

In FY 1985, BPA will move forward to streamline program implementation and begin evaluating completed projects. BPA's project managers will continue to consult and work in close cooperation with the region's fish and wildlife agencies and tribes. Fish and wildlife staff members will provide the special expertise needed to help plan BPA's marketing strategies and hydroelectric system activities as we continue to reach for BPA's goal of reconciling the region's economic demand for hydroelectric power with its cultural. recreational and economic demands for fish and wildlife.

Peter T. Johnson

BACKGROUND

In the 1930s, the hydroelectric potential of the Columbia River provided hope for the region's troubled economy. With the financial support of the Federal Government, Bonneville Dam was built. Grand Coulee soon followed. Within 40 years. there were 30 dams in the Federal Columbia River Power System.

From the beginning. most people knew that the salmon would need help getting past the dams. Anadromous Fish runs were already in trouble because of overfishing and withdrawals from riverflows for irrigation and municipal supplies and other water uses. So dam builders constructed fish ladders and hatcheries.

But Grand Coulee was too high, even for fish ladders. More than 1.200 miles of anadromous fish habitat were lost. Additional habitat was lost in the reservoirs behind the downstream dams. Mitigation hatcheries provided inadequate compensation.

Other problems were not even foreseen. Few had imagined that as many as IO to 20 percent of the juvenile fish migrating downstream to sea would be lost at each hydroelectric project to turbine blades or nitrogen saturation. No one thought that the impounded waters would severely delay the once rapid journey of those that survived the powerhouses. Or that such delay would cause mortality. The runs continued to decline. Some were lost altogether.

Now BPA is coordinating a long-term program intended to reverse that trend. BPA's program is strongly linked to the Northwest Power Planning Council's Fish and Wildlife Program.

The Pacific Northwest Power Act

The Northwest Power Planning Council (Council) was formed through the provisions of the Pacific Northwest Electric Power Planning and Conservation Act of 1980 (Act). The Act directed the Council to "promptly develop and adopt. .a program to protect, mitigate and enhance fish and wildlife, including related spawning grounds and habitat. on the Columbia River and its tributaries." The Council used recommendations from the region's Federal and State Fish and wildlife agencies. Indian tribes. and other public and private groups. incorporating their concerns to build its Columbia River Basin Fish and Wildlife Program (Program). BPA is carrying out a large part of that Program.

Programwide Projects

Two of BPA's projects address areas of wide concern. The projects will help BPA evaluate current hydroelectric operations and future hydroelectric development for fish and wildlife impacts. They will also assist BPA in integrating equitable treatment of Fish and wildlife into BPA plans and programs. They will provide BPA the information needed to develop policies that carry out its fish and wildlife responsibilities under the Pacific Northwest Power Act.

Development of Criteria and Methods for Assessing Potential Cumulative Effects of Hydroelectric Development of Fish and Wildlife (Project No. 84-41)

Past hydroelectric planning and development did not sufficiently consider fish and wildlife and the cumulative effects of individual projects in relation to the effects of other existing and proposed projects.

Hydroelectric development in some basins has resulted in large losses of fish and wildlife. Development and

operation of hydroelectric dams can have a synergistic effect, producing impacts above and beyond what would be expected from a given number of dams.

Through this study. researchers examined the literature for the effects Of hydroelectric development and operation. They analyzed existing techniques for assessment of hydroelectric development and recommended those to be included in a final methodology.

That methodology will be incorporated by the Northwest Power Planning Council into its Fish and Wildlife Program and Energy Plan. The objective is to minimize any conflicts from future development. The methodology will be field tested during FY 1985 and modified as appropriate. It will be offered for use by operators. planners, and others in the review of region.

Determination of the Extent of the Administrator's Obligation to Protect, Mitigate, and Enhance Fish and Wildlife (Project No. 84-49)

The extent of the responsibility of BPA ratepayers For impacts to fish and wildlife resulting from hydroelectric projects on the Columbia River or its tributaries must be quantified. The objective of this project is to develop methods to systematically quantify contemporaneous anadromous Fish losses that can be attributed to the system. This project will develop the information that BPA's Administrator will need to comment on methodology developed by the Council and provide the foundation for formulating a major administrative procedure to estimate loss and determine BPA's responsibilities. The procedure will also allow BPA to determine how to credit mitigation projects towards reduction of the outstanding obligation.

During FY 1985 existing procedures for estimating losses will be inventoried, evaluated. and tested. If necessary and appropriate. a new approach will be designed and tested during FY 1986. During FY 1987 and FY 1988 the selected method will be applied, extending the current methodology in order to integrate requirements for cost-effectiveness and accounting (crediting) into the general approach used to determine and account for the Administrator's obligation to fish and wildlife.

PROJECT HIGHLIGHTS

BPA funded 30 Fishery research projects in 1982. By 1983. that number had grown to 93 and addressed a wide variety of fish and wildlife needs. In 1984. BPA distributed funds to 45 entities, renewed 79 existing contracts and added 53 new ones. Total expenditures rose to $18 million, Of those funds. 86 percent were applied to research or direct improvements for the salmon and steelhead runs of Washington, Oregon, and Idaho. Nine percent went to projects investigating white sturgeon and upriver, non-migratory gamefish. Another five percent was used to identify the effects of hydroelectric operations on wildlife and to plan ways to alleviate those effects.

Anadromous fish projects aimed to develop improved fish diets and find cures for deadly diseases. The final goal of this research is to improve the resilience of hatchery fish and increase their chances of surviving migration both to and from the ocean.

Careful management of spring water flows-through the Water Budget—protected young fish as they travelled down from upstream rearing sites and past each of the Columbia River's dams. In all, 23 of BPA's 1984 projects addressed downstream migrant issues.

Projects rehabilitated spawning and rearing sites For wild Fish in many parts of the Columbia Basin. Access to undammed tributaries in eastern Oregon. to fertile spawning sites in Washington State's Yakima Basin. and on tribal lands in eastern Washington and Idaho will directly increase productivity and make up for habitat losses on the mainstem Columbia.

Hydroelectric operation and development also impacts the fish that reside in the reservoirs and downstream from the dams. In Montana and Idaho. biologists studied upriver game ("resident") fish and designed hatcheries. These Fish are of particular importance to the parts of the Columbia Basin that were cut off from or never had migratory fish runs.

Biologists studied the movements of radiocollared Canada geese and bighorn sheep near western Montana's Flathead Valley hydroelectric projects. Geese are followed throughout the nesting season to determine the effects of reservoir fluctuations on goslings and nesting success. Collared sheep help investigators evaluate the use of new habitat established to make up For that lost to reservoir inundation.

BPA's program is funded through revenues from the sale of power generated by the Federal Columbia River Power System. BPA also has the authority to borrow Treasury funds to finance major capital construction—facilities with a life expectancy of more than 15 years and costing more than $1 million to build. No support is derived from taxes or Congressional appropriations.

For further information and copies of specific project reports. contact:

Bonneville Power Administration

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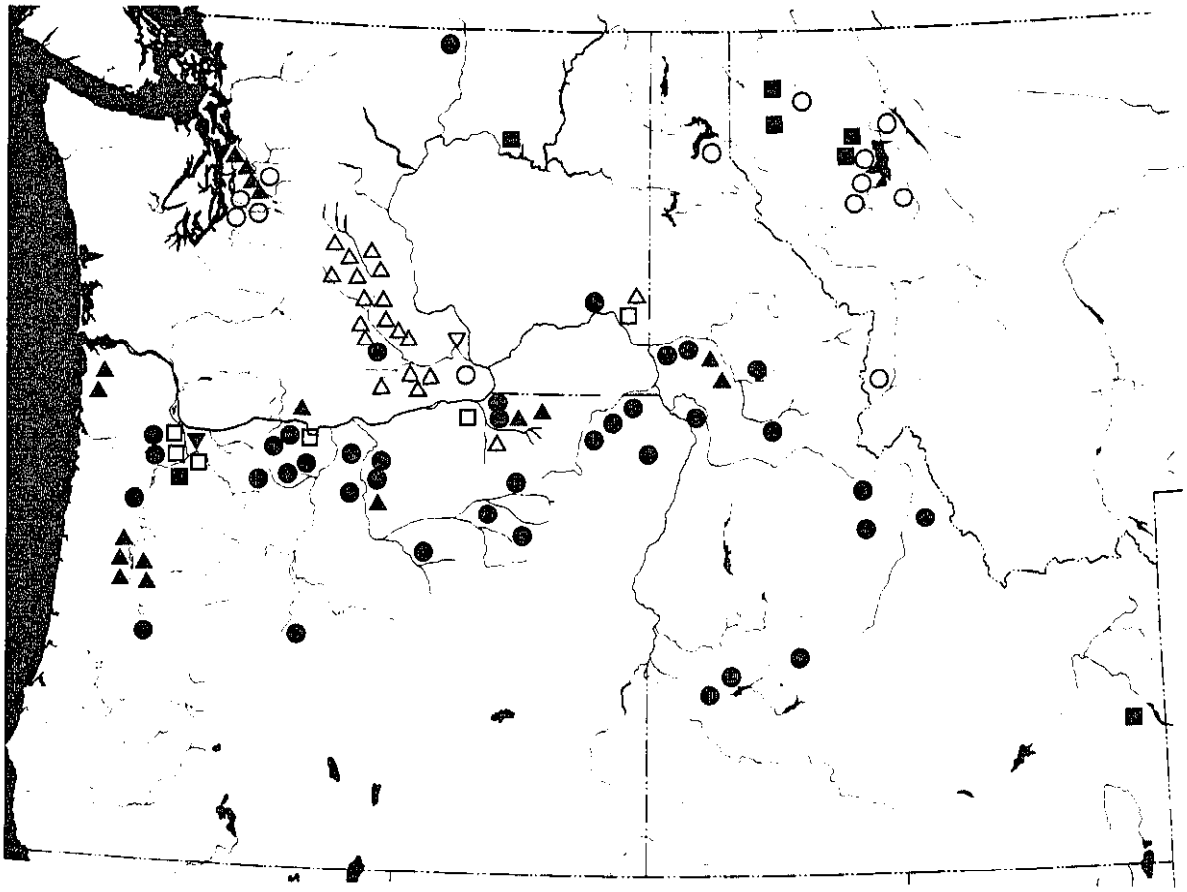
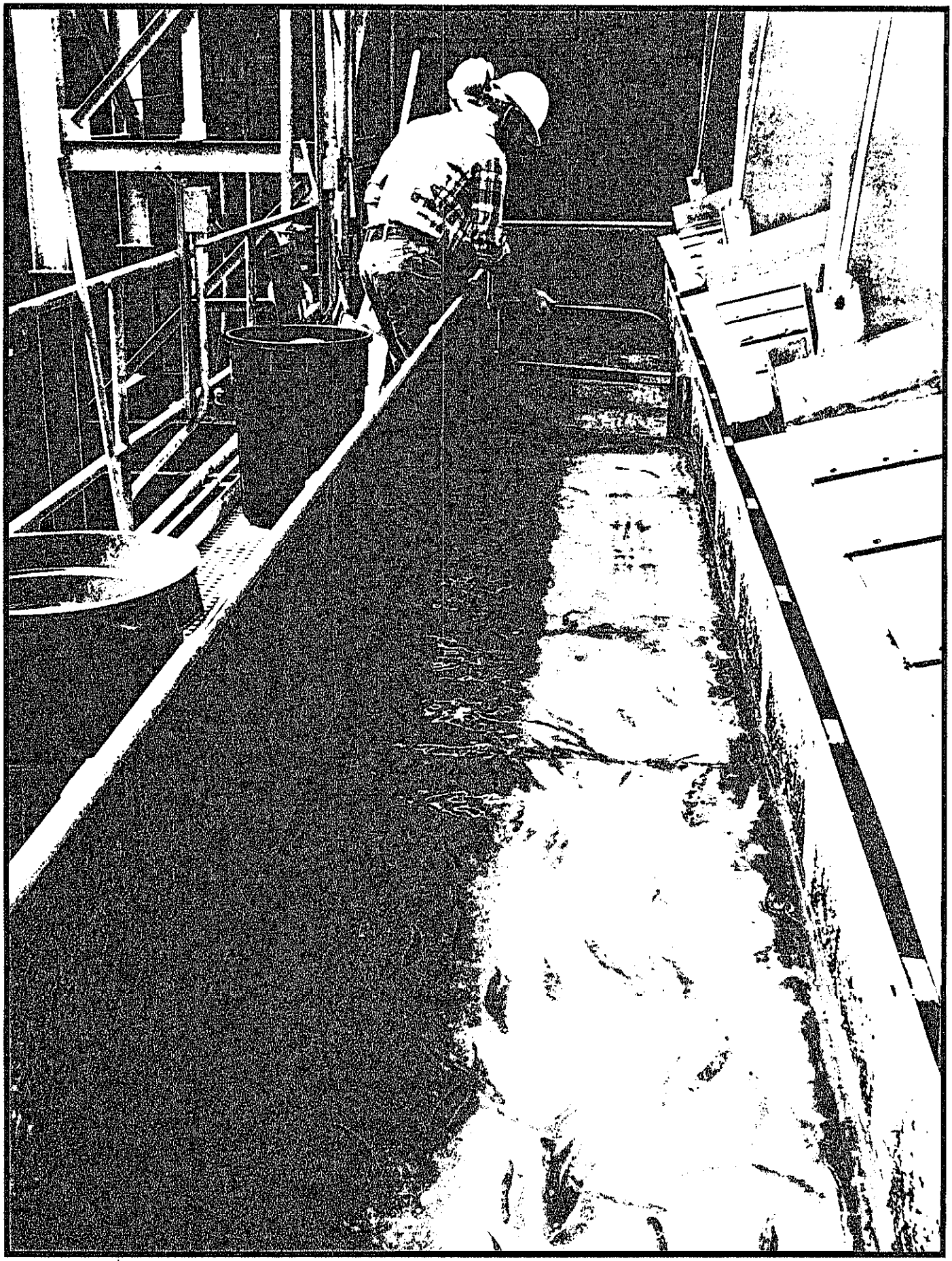
Fish & Wildlife Projects

(FY 1984)

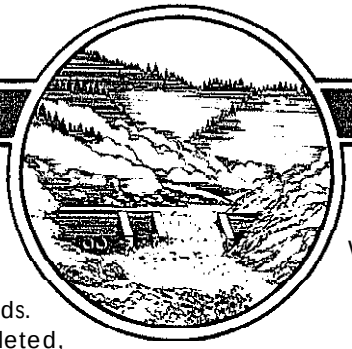


△ Upstream Migration and Yakima Basin Projects
○ Resident Fish Projects
■ Wildlife Projects
● Habitat Protection and Enhancement Projects
▲ Artificial Propogation & Fish Health Projects
□ Downstream Migration Projects



Barry Keesee, Chelan County PUD and Larry Basham, Water Budget Center, check brands on young fish trapped at Rock Island Dam in eastern Washington. Information from these fish will help plan water budget releases. BPA photo.

DOWNSTREAM MIGRATION



From the earliest days, the developers of the FCRPS knew that special structures would be needed For adult anadromous fish returning to their spawning grounds. The First Federal dam to be completed, Bonneville in 1938, was built with a fish ladder intended to permit the migrating salmon and steelhead to continue upstream. But it was not then understood that the dams would severely obstruct the passage of the juvenile Fish migrating downstream for their sojourn in the ocean.

When the runs began to decline, studies showed that many of the young fish were being drawn through the powerhouses where they could be killed or injured by the spinning turbine blades or the tremendous changes in pressure within the turbine housing. The stunned and disoriented survivors were easy prey for predators at the base of the dam.

Several large reservoirs also hampered downstream migration. Once the spring torrents. fed by the melting mountain snows, would have rushed the young fish to the sea. But these reservoirs captured the spring Freshet and changed the timing of the river's peak flow. Migration time for young salmon and steelhead lengthened by as much as three times. Delayed fish lose their urge to migrate. The process of smoltification-the physiological transformation which enables fish to survive in saltwater-stops or reverses.

In its efforts to alleviate these obstacles. BPA is funding a number of projects to determine the needs of the spring migrants and ensure that there will be adequate flows. properly timed under the guidance of the Water Budget Center.

Downstream Migration: Project Descriptions

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Water Budget (Project No. 83-491/536)

1984 was the first full year of operation of the Water Budget, the cornerstone of the Council's Fish and Wildlife Program. Seeking a balance between fishery and power needs, the Council proposed the budgeting of a volume of water to be used for enhancing waterflows during the critical migratory period of April I5 to June 15 thus accelerating the migration of young fish past the dams.

The Water Budget Center was established in April 1983 to manage the budget flows in cooperation with the power system operators. It is headed by two Water Budget Managers-one representing the State and Federal fish and wildlife agencies and the other representing the Columbia Basin Indian tribes. Using data on Fish movements supplied by the smolt monitoring programs. they request flows and spill over the dams to offer the best possible conditions for fish passage. This activity is expected to continue indefinitely.

As well as coordinating Water Budget usage and spill priorities with power production objectives. the Center:

- monitors actual runoff and smolt movement to achieve maximum benefit from Water Budget and spill usage:
- coordinates hatchery releases with Water Budget releases:
- evaluates the effectiveness of flow. spill. and the use of structural bypasses in improving downstream migrant survival by collecting, evaluating, and correlating data on flows. travel time, smolt survival. and subsequent adult returns, and eventually the number of returning adults.

The success of the Water Budget in increasing smolt survival is dependent upon other projects funded by BPA that monitor the progress and condition of the smolts.

Smolt Monitoring Programs (Project Nos. 80-l; 84-14; 84-15; 84-16; 84-17; and 84-54)

To most effectively use the water reserved for fish, the Water Budget Managers must have information on fish movements throughout the Columbia River Basin. The fish must be monitored both at dams operated by private utilities and by the public utility districts, as well as by the Federal agencies. The Smolt Monitoring Program supplies the data needed to evaluate the success of the Water Budget and to recommend changes for improving its efficiency. The program (80-l) is coordinated by the Water Budget Center. Field monitoring activities are conducted at system dams by the National Marine Fisheries Service (84-14), Biosonics (84-I 5), and Chelan County Public Utility District (84-54). Fish used in the analyses are tagged by freeze-branding of steelhead in the Yakima River (84-16) and of hatchery-reared chinook salmon and steelhead in Idaho (84-17).

Flow and Spill Requirements for juvenile Fall and Summer Chinook Salmon in John Day Reservoir (Project No. 81-l)

Knowing that yearling salmon and steelhead which migrate downstream during the spring months benefit from increased flows, fishery agencies have in past years requested similar summer fish flows. Research has shown. however, that even during high flow years large

numbers of juvenile summer and fall chinook have remained for extended periods in the John Day Reservoir.

Through this project. the National Marine Fisheries Service will relate instream flow and spill at John Day Dam to the passage time of summer and fall chinook salmon through the reservoir and will determine the effect of its duration on the survival of the smolts.

This project was initiated in 1981 and researchers completed the first phase dealing with the migration of juveniles in 1984. The second phase. monitoring adult fish to determine survival. is scheduled for completion in 1987.

Imprinting for Homing of Hatchery-Reared Salmon and Steelhead Trout (Project No. 78-i).

Use of a Fish Transportation Barge for Increasing Returns of Steelhead Trout Imprinted for Homing (Project No. 82-2)

Transporting downstream migrants around the hazards of powerplants and the predation and pollution in reservoirs greatly increases their survival. But questions remain about the ability of transported fish to home as adults. that is return to their hatchery of origin or other desired location.

Between 1978 and 1980, the National Marine Fisheries Service transported juvenile salmon and steelhead by barges and trucks. in 26 experiments using different methods of imprinting— providing biological clues to assist the fish in returning to particular sites. From 1980 to 1983. the returning adult fish were monitored at hatcheries and spawning grounds to determine the effectiveness of the homing mechanisms being tested.

At its completion in 1985, project 78-I is expected to provide needed information about methods and techniques of increasing the return of transported fish to desired locations and about the relationship of the physiological condition of the fish at the time of release to their ability to imprint.

In a supporting study (82.2) NMFS tags and imprints steelhead at the Dworshak National Fish Hatchery for transport by truck to nearby Lewiston. Idaho. There they are transferred to a barge to be carried downstream for release below Bonneville Dam. Investigators will find out if these Fish return in greater numbers to Dworshak Hatchery and the Idaho fishery than do fish released directly into the stream. They will also learn what proportion of fish in each release group have accepted a homing imprint and analyze the relationship between the physiological condition of the fish and their ability to accept an imprint. Project 82-2 will be completed in 1987.

Feeding Activity, Rate of Consumption, Daily Ration, and Prey Selection of Major Predators In the John Day Reservoir (Project No. 82-3)

Abundance and Growth Characteristics of Squawfish and Walleye in john Day Reservoir and Tailrace (Project No. 82-12)

These complementary studies were initiated to determine the extent of predation on juvenile salmonids in mainstem Columbia River Reservoirs by resident populations of native and introduced fish. The John Day Reservoir and tailrace were selected as the study areas.

The U.S. Fish and Wildlife Service is evaluating the importance of each of three major predators squawfish. walleye. and smallmouth bass. to the overall problem in study 82.3.

Using population estimates of each predator species, developed by Oregon Department of Fish and Wildlife in study 82-12, USFWS will determine the location. timing and species of resident fish that prey on salmonids. In 1985. the investigators will address the rate of consumption of each major predator and estimate the number of juvenile salmonids lost.

ODFW will continue to develop estimates of local populations of predators and their seasonal movements. Data from the two studies

will be combined to develop mechanical and/or biological alternatives for control of predation by 1988.

Development of an Effective Transport Media for juvenile Chinook Salmon (Project No. 82-4)

In this 2-year study completed in 1984, researchers at the U.S. Fish and Wildlife Service's National Fishery Research Center sought an improved liquid transporting medium for use in barging and trucking juvenile salmonids. They tested selected combinations of mineral salts and tranquilizing combinations of MS-222 for ability to ease stress and promote survival of smolts during hauling. Under Field conditions, they found that a 10 ppm MS222 was the most effective transport medium to reduce stress and improve survival of both single and mixed stocks of spring and fall chinook and steelhead.

Effects of Stress on the Viability of Chinook Salmon Smolts Transported from the Snake River to the Columbia Estuary (Project No. 82-5)

Smolts migrating naturally downstream through dams can suffer high mortality. But smolt transportation programs have not been as successful as expected in increasing their survival. The disappointing post-release survival of transported smolts may be related to the physiological effects of stress experienced during collection and transportation.

In this study, completed in 1984. researchers monitored various blood parameters during collection and transportation and established baseline responses for spring chinook salmon. They determined the effects of handling and of mitigative measures on seawater survival and on the vulnerability of smolts to predation.

Columbia River Salmonid Qutmigration: McNary Dam Passage and Enhanced Smolt Quality (Project No. 82-6)

Researchers at McNary Dam evaluated stress experienced by downstream migrants. Stress was evaluated for smolts descending through the bypass system as well as those that were collected and transported around the dam. The assessments included both the actual stress imposed by passage or collection, and the cumulative stress resulting from passage versus collection and transportation. The study also evaluated the effects of anesthetics, handling. and marking on smolt survival. Project leaders used that information to identify the severity of stress resulting from bypass, collection, handling. and transportation.

Smolt Passage Behavior and Flow-Net Relationships in the Forebay of john Day Dam (Project No. 82-8)

To enhance the survival of migrating juveniles at hydroelectric facilities, the National Marine Fisheries Service is studying the flow-net (water velocity vector) at John Day Dam under various flow and spill conditions. The researchers will relate the observed forebay flow-net patterns to the movements of the migrating salmon and steelhead smolts.

If they can find a correlation between the flow-net and efficient smolt passage. they will be able to define the operating conditions required for smolt survival and the project will be extended to the other Columbia River dams.

NMFS has completed initial investigations through flow-net monitoring, purse seine sampling and smolt radiotracking. They have also made substantial progress in developing a computer model that will assist in maximizing smolt passage conditions while minimizing adverse impacts on power production. This project will be completed in 1985.

Coded Wire Tag Recovery Program (Project No. 82-13)

Many of BPA's research activities use coded wire tagged fish to evaluate fish survival. timing of migrations. and contribution to fisheries. The tags are microscopic strands of wire coded to allow identification of the fish.

The studies depend upon data developed from recovery of these tags from ocean and freshwater sport and commercial catches. Other Federal and state Fish and wildlife agencies and tribal and fishery biologists, both in the United States and Canada, also tag fish and analyze recoveries.

The Pacific Marine Fisheries Commission coordinates the overall recovery effort and insures that all Fisheries are sampled and that duplicate sampling is avoided. Through this project BPA contributes an annual "fair share" to PMFC's recovery effort.

New Fish Tag System (Project No. 83-319)

Researchers are taking advantage of the latest in computer technology by implanting young Fish with computer chips-passive integrated transponders or PIT tags. Miniature antennae wrapping the chips send signals that help scientists identify the fish as they migrate to the ocean and back.

If this project is successful. automated receivers mounted in fishways and turbine bypass systems will be able to record data on every tagged Fish that moves through the system. This will be clone without. delay or harm to the fish. A functional tag should be available for use by FY 1986.

With data from tagging studies. researchers will be able to pinpoint sources of delay in migration or injury to Fish. Correction of site-specific problems will allow for more efficient use of water to meet hydroelectric and fishery needs.

Smolt Condition and Timing of Arrival at Lower Granite Reservoir (Project No. 83-323)

Idaho chinook and steelhead smolts migrate through a series of dams to reach the ocean. Their downstream migration can be inhibited by low river flows, especially in the reservoirs. Many smolts arriving at the Lower Granite bypass facility show substantial scale loss and other evidence of deteriorating health.

Knowledge of the timing of smolt arrival and condition at Lower Granite reservoir will aid Water Budget Managers in requesting appropriate flow increases to move smolts rapidly downstream.

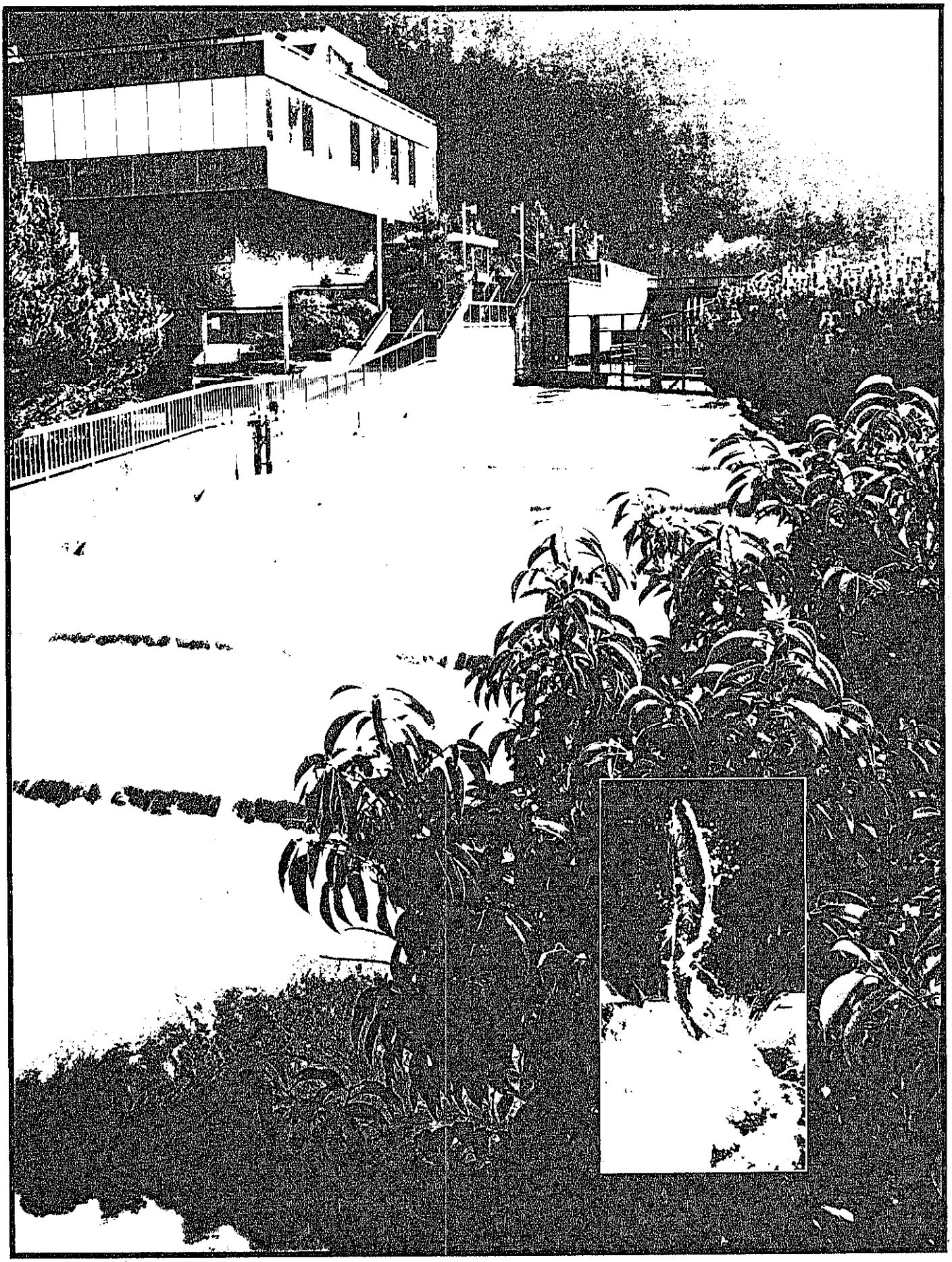
Through this project, BPA provides National Marine Fisheries Service with the funds to build and install traps to capture smolts to evaluate their condition and the timing of their arrival at Lower Granite reservoir. The Idaho Department of Fish and Game is studying downriver migration timing and the smolts' physical condition during the trip, The study is scheduled to run through FY 1990.

Investigation of the Process for Registration of Squoxin for Control of Squawfish (Project No. 83-428)

Squawfish thrive in the turbulent water of a dam tailrace. preying on smolts that are stunned or disoriented by their trip through the powerhouse. They are the primary resident fish predator of the young salmonids in the Columbia Basin.

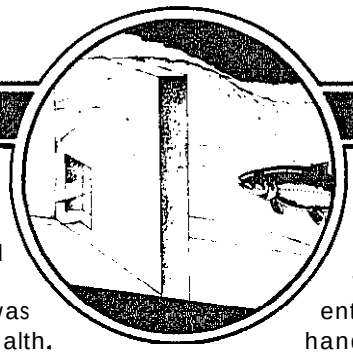
BPA has retained a private consulting firm. R. L. Rulifson. to study the use of squoxin. a pesticide specific to squawfish. Rulifson has compiled information on the chemistry and toxicology of squoxin. the Federal requirements for pesticide registration. and the process for registration of this pesticide with the Environmental Protection Agency.

The information may be used to determine the applicability and value of squoxin in protecting salmon and steelhead populations during early life stages. Results from the two predator-prey studies (82-3. 82-12) will help determine if the registraton of squoxin should be pursued.



Bonneville Dam fish ladder. Fish ladders at Columbia River dams help migrating adults return to their natal spawning grounds. COE photo./ WSU photo.

UPSTREAM MIGRATION



During the Depression, the government sought "to build an industrial empire from the wasted power of the Columbia." To that generation. the Columbia River was a source of boundless natural wealth. There was value, not just in the Fish living in the water. but in the moving energy of the water itself. Every free-flowing section was a potential generator of hydroelectric power.

As the population and economy of the Pacific Northwest grew, so did the number of dams. Within four decades. 55 Federal and private facilities dotted the Columbia Basin map. Dams controlled floods, turned rapids into navigable locks. provided water for irrigation and power for cities. But in the process. dams decimated upriver migratory fish runs.

One hundred forty miles from the mouth of the Columbia stands 70-foot high Bonneville Dam. The problem that dams would cause for adult fish migrating upstream was obvious from the time Bonneville came on line in 1938. The solution was not as simple. No one had ever tried to pass a fish over so high a barrier. The fish ladder the dam builders designed was an inclined channel with a series of steps or weirs. The weirs created successive pools. each higher than the last. By moving from pool to pool. salmon could work their way up and over the dam.

After Bonneville, builders included fish ladders at many Columbia and Snake River dams. But flows and spills at the base of some dams distracted fish away From the ladders. At some places on the lower Columbia. where the river is a half mile wide. fish may not find the ladder entrance. Other fishways could not handle seasonal variation in river flow. They became raging torrents in the spring and shallow trickles in the fall. In spite of the difficulties, many fish managed to ascend through these structures and reach spawning grounds. But. returns to many areas were poor and the runs declined. Four decades of experience have led to improved fish ladder design and operation. Problems were researched and some were corrected. Solutions For others must still be found.

Upstream Migration: Project Descriptions

Development of New Concepts in Fish ladder Design (Project No. 82-14)

The growing interest in small-scale hydroelectric facilities has brought a need for small-scale Fish passageways that are adequate and economical. In response. Washington State University has developed alternative Fish ladder

designs. Researchers began tests of chamber size. weirs, and baffles to dissipate water energy in passageways in 1983. They will prepare a manual of fishway design from test results. The manual will also present an analysis of the fluid mechanics of Fish passage.

Three Mile Fish Passage Facilities, Umatilla River (Project No. 83-436)

Three Mile Diversion Dam, at river mile 3 on the Umatilla River is a significant obstruction for salmon and steelhead migrating to spawning grounds in the upper Umatilla Basin. The spill flow pattern creates false attraction that draws the fish away From Fish ladder entrances.

In low water years, the resulting migration delay and stranding. along with poaching and poor water quality are seriously limiting to steelhead production in the basin. Mortality of downstream migrants, caused by improperly screened diversions. compounds the problem.

The Umatilla runs are important for offsite mitigation for the impacts of hydroelectric development on the mainstem of the Columbia River. So the U.S. Bureau of Reclamation. in coordination with appropriate fish and wildlife agencies and Indian tribes is developing preliminary designs for resolving the passage problems and for adult collection and counting facilities at the dam. Construction should begin early in FY 1986 and be completed by the end of FY 1987.

Tumwater Falls and Dryden Dam Fish Passage (Project No. 83-446)

Biologists are planning new fish passage structures at Tumwater Falls and Dryden Dams on the Wenatchee River to permit more salmon and steelhead to reach historic spawning areas. BPA contracted with Ott Water Engineers to develop alternatives and prepare a preliminary design. The contractor investigated flow conditions and turbulence in order to develop practical Fish passageway designs.

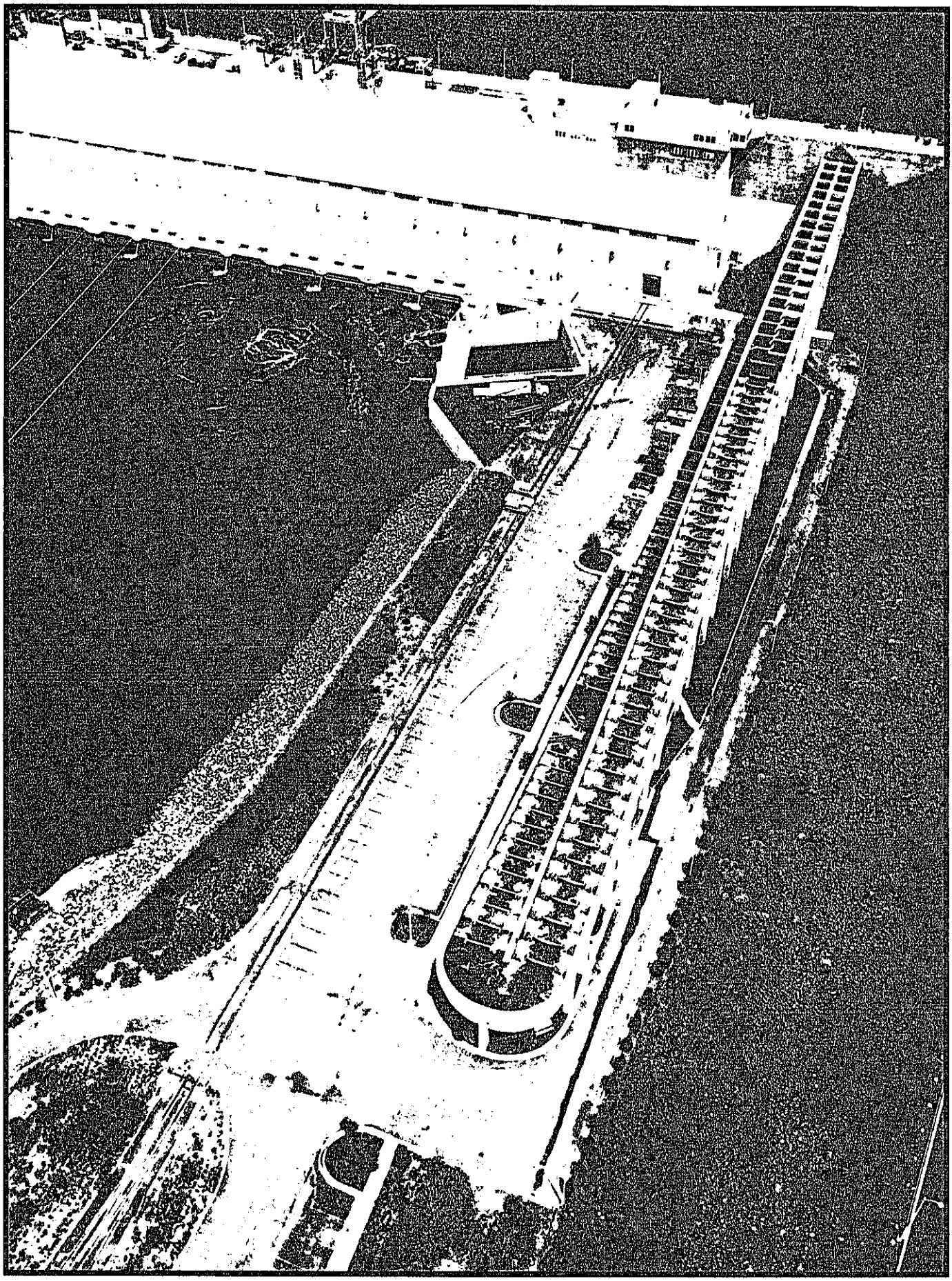
Their final report. prepared in 1984, described the passage method judged best for long-term success. The report also contained an assessment of the salmon and steelhead habitat above the dams and an estimate of the area's smolt production potential. Construction of the passageways is scheduled for FY 1986.

Accounting for Migrating Adult Salmon and Steelhead (Project No. 84-42)

Unaccountable losses of adult salmon and steelhead occur between hydroelectric facilities in the Columbia River. Possible causes of the discrepancy in the numbers of fish reported between dams are problems at the clams, biological or environmental conditions and harvesting. The fish also might enter tributaries or spawn in the reservoirs.

This project will evaluate procedures used to determine the numbers and distribution of migrating adults within the system. While describing accounting procedures. project leaders will estimate the precision and accuracy of those procedures. Researchers will collate dam counts at Lower Columbia and Snake River dams and gather existing data on fish losses between dams. Further, they will identify gaps in harvest, tributary turnoff. reservoir and dam mortality, and reservoir (mainstem) spawning counts.

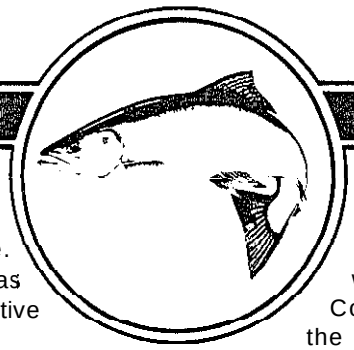
Through data analysis. they will determine the year and location of significant losses or discrepancies and evaluate the relationships between those losses and such factors as Flows, water temperatures, and accounting procedures. After identifying any remaining unexplained mortality, discrepancies, and losses they will recommend studies for species and locations that consistently exhibit such problems.



Ladders at Columbia River Dams allow salmon to reach upriver spawning grounds.
COE Photo.

Steve Folmar, contract worker for the Sunnyside Valley Irrigation District, makes final adjustments on the first of the Yakima's new fish screens. BPA photo.

YAKIMA BASIN



The Yakima Basin is arid. But irrigation waters have made its dry fertile soils highly productive. Over the last eight decades. it has become one of the most productive agricultural regions in the world. though not without cost to the fishery. The irrigation system has taken a toll on fish migrating both upstream and down.

Withdrawal of water for irrigation and other uses severely reduces river flows and causes significant deterioration of water quality. Below diversion dams, the river turns into a series of standing pools in low water years and may dry up completely. Water temperature in the pools can climb to 75 or 80 degrees—much too high for cold water fish species. Irrigation waters returning to the river channel also bring sediment and agricultural chemicals which further deteriorate water quality.

The harm to anadromous fish runs that results from the low flows and poor wafer quality is compounded by inadequate fish passage facilities. Some of the diversion structures were built without fishways. At others. they are poorly maintained or inoperable.

Fishery experts believe. however. that the Yakima Basin has excellent potential for increased anadromous fish production. Although fish passage has been obstructed. most of the streams and spawning gravels are undisturbed. They would still provide good habitat if they were accessible.

BPA's habitat improvement and passage projects serve as off-site mitigation. Their benefits will be charged against losses occurring at hydro sites on the mainstem Columbia.

To preserve and enhance the Yakima fish runs, existing fish passage facilities are being renovated and updated and new ones are being added where needed. BPA has joined with the Northwest Power Planning Council; the Bureau of Reclamation: the Yaltima Indian Nation: the Washington State Departments of Ecology, Fisheries, and Came: the U.S. Fish and Wildlife Service; the National Marine Fisheries Service; the Bureau of Indian Affairs: and Pacific Power & Light Co. to undertake this task. BPA is also coordinating the work of all the organizations and agencies involved.

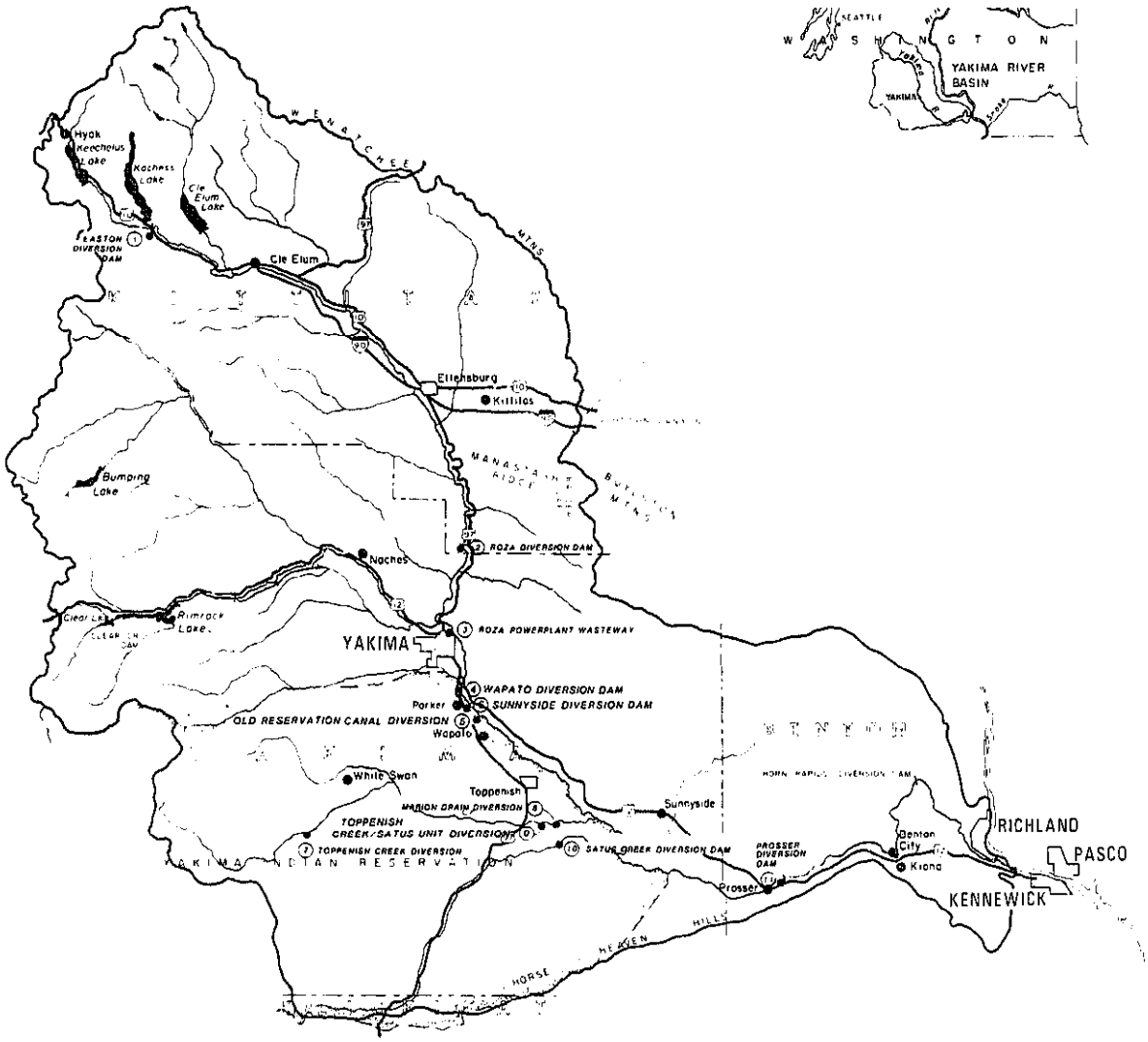
Yakima Basin Fish Passage Enhancement (Project No. 84-55, **84-56,** 84-57, 84-58, 84-61)

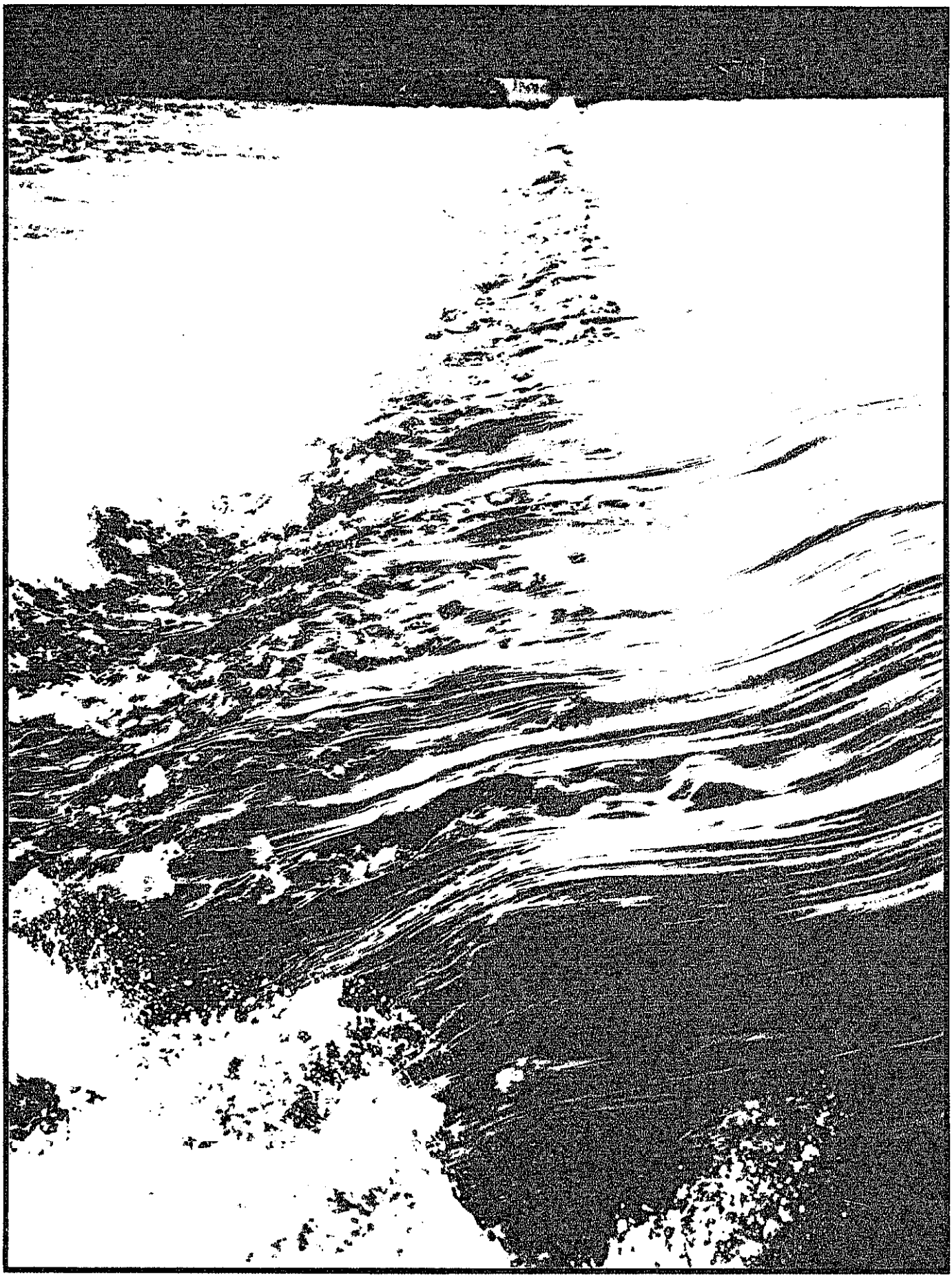
Fish passage facilities will be installed or renovated at 20 sites. Eight lower and mid-stream sites have been given priority, with work at the first five to be completed during 1985 and the spring of 1986. BPA is funding construction of fish screens at Sunnyside Canal (84-55), operated by the Sunnyside Valley Irrigation District, and at the Richland Canal at Horn Rapids Dam (84-56). The screens will direct downstream migrants. diverted from the Yaltima along with irrigation waters, back into the river channel. Construction of the screens began in 1984. Sunnyside is scheduled for completion by March 15, 1985: Richland Canal by June, 1985.

Screens will also be constructed on the main canals at Wapato Diversion Dam (84.57) and the Satus Unit Diversion Dam on Toppenish Creek (84-58). BPA is also funding the construction of fish ladders at both dams to enable adult salmon and steelhead to return to their spawning areas. Construction at both projects will begin in FY 1985 and is to be completed in FY 1986.

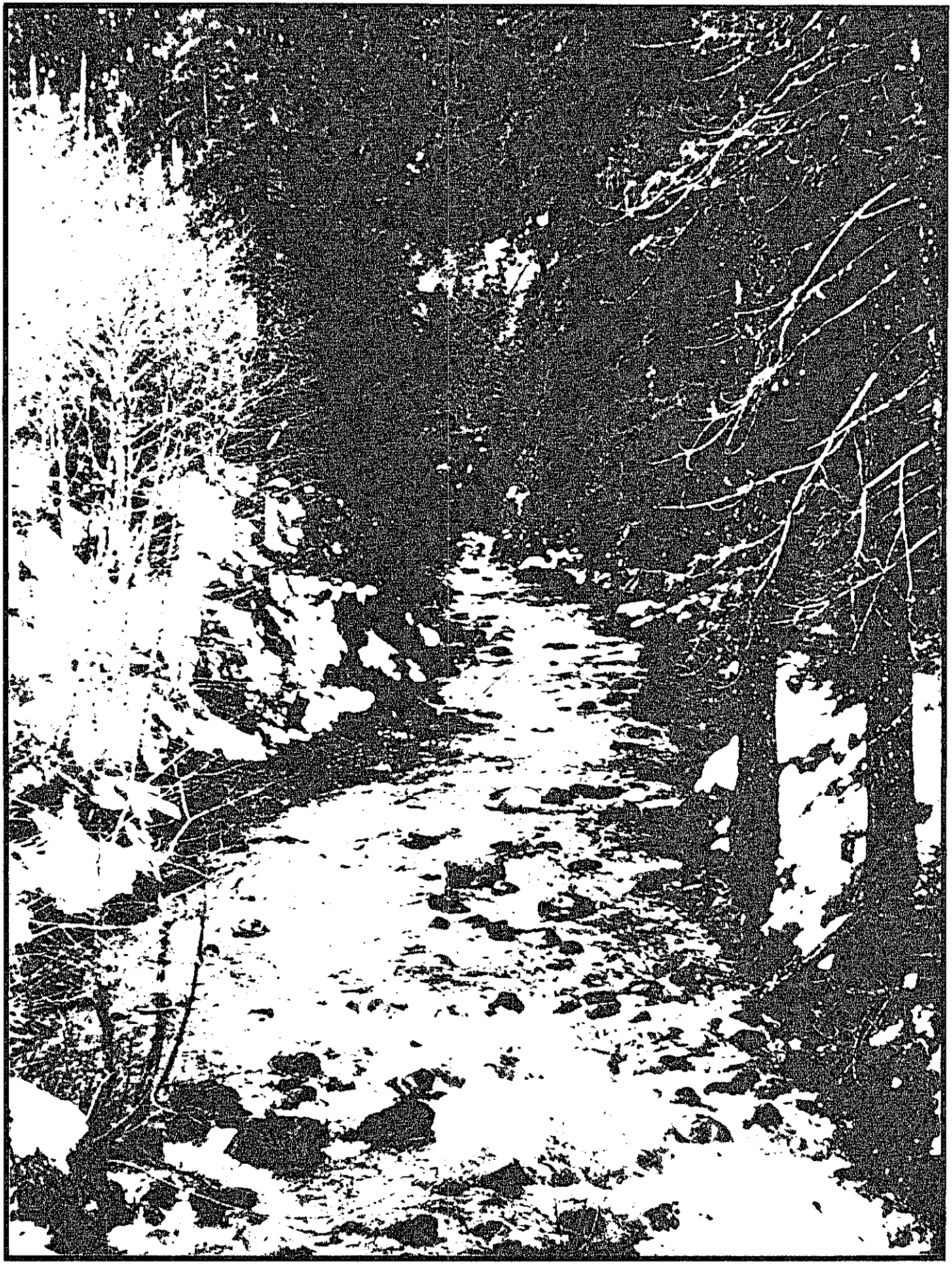
Through project 84-61, BPA will provide funds for fish passage facilities at the Sunnyside Dam and for screens on the Old Reservation Canal on the Yakima Indian Reservation. Sunnyside Dam has one ladder that is operating but inadequate. Three new ladders will be added in FY 1985. Old Reservation Canal, operated by BIA. has no screens and young fish are now easily trapped in the canal. Construction to correct this situation will be undertaken in FY 1985 or FY 1986.

Yakima River Basin





The Horn Rapids Dam blocks adult salmon migration. BPA Photo.



Fish Creek, a tributary of the Clackamas River, Oregon. BPA photo.

HABITAT PROTECTION AND ENHANCEMENT

Reestablishing wild fish populations and rebuilding their spawning and rearing habitat is a major element of the Council's Fish and Wildlife Program for mitigating losses resulting from hydroelectric development. Propagation of wild fish has also been an important part of BPA's program since 1978. when a study in the John Day River was initiated.

Fish that spawn naturally are subject to constant selective pressures and strong. resilient, diverse stocks evolve as a result. Maintaining this genetic diversity is essential to the vigor and even survival of a species.

Hydroelectric development has destroyed much of the spawning and rearing habitat in the Columbia and Snake rivers. Some areas such as the Hanford Reach of the Columbia and Hells Canyon on the Snake are still free-flowing. But water fluctuations from power-peaking operations at the dams can disrupt spawning activities and habitat.

Potential spawning and rearing habitat does exist in many tributary streams. In some it is inaccessible because of natural or manmade obstructions. as in the streams of the Yaltima Basin. In others, habitat improvements are needed to bring the sites up to their full propagation potential. BPA is funding projects to enhance spawning and rearing habitat and to design and construct passageways to the remaining undisturbed sites.

Habitat Protection and Enhancement: Project Descriptions

Study of Wild Spring Chinook in the john Day River (Project No. 79-4)

The John Day River system harbors one of the last completely wild spring chinook runs in the Columbia Basin. Hoping to learn much for use in bringing back other wild runs. National Marine Fisheries Service began a study of that run in 1978. under BPA contract. Oregon Department of Fish and Wildlife later took over the study with the objectives of:

- determining how many returning spring chinook will produce the largest number of Fish for harvest:
- recommending harvest regulations that will allow enough adults to return to spawn;
- determining the need for adjustment in fish passage operations to increase the survival of John Day migrants: and
- recommending methods for augmenting John Day spring chinook with hatchery stock.

This project is to be completed in FY 1985. The final report will present an analysis of the six years of data and conclusions. Studies of the timing of John Day migrations will continue. Harvests will be controlled using data from coded-wire tags implanted in smolts in earlier years. Life history data collection will also continue.

Establishment of Baseline Fishery Information for the Warm Springs Reservation (Project No. 81-108)

The Natural Resources Department of the Confederated Tribes of Warm Springs began a IO-year project in 1981 to improve habitat and passage for salmon and steelhead on the Warm Springs Reservation. Tribal biologists are evaluating potential spawning and rearing areas in reservation streams and working to determine the number of adults that must escape to Fully seed the habitat that is available.

They are completing a preliminary engineering survey for a Fish passage Facility and will implement habitat improvements on a channelized segment of Beaver Creek in 1985.

Researchers have finmarked several brood years of spring chinook fingerlings for release at the Warm Springs National Fish Hatchery and, in the Final years of the project when habitat and passage improvements are completed. they will evaluate the success of the project through analysis of returning adults from finmarked releases.

A Biological and Physical Inventory of the Streams within the Nez Perce Reservation (Project No. 82-I)

As a first step toward augmenting their declining salmon and steelhead fishery, the Nez Perce Tribes of Idaho are preparing an inventory of the physical habitat and biological community in reservation streams. During 1985, they will complete identification of factors that limit fish production, such as heavy sedimentation, high summer water temperatures. low flows and barriers to migration. They will use the information to select the most appropriate enhancement efforts for each stream on the reservation. The project will be completed in 1986.

Snake River Fall Chinook Brood Program (Project No. 82-7)

Snake River fall chinook populations have been reduced to critically low levels. To preserve the unique genetic traits of this upper river run, the National Marine Fisheries Service is producing some of the eggs needed by Snake River hatcheries on an experimental Fish Farm. Their goal is to produce 8.5 million eggs annually. Production will continue through the 1983 brood. Recently, a newly discovered disease has killed many of the fish reared by this study. Continuation of the project is under discussion. Meanwhile, project personnel are studying the diseases that occur in and nutritional requirements of chinook salmon brood stock held captive in seawater.

Habitat improvement: John Day River (Project No. 82-9)

To improve fishery habitat in the John Day River System, U.S. Forest Service and Bureau of Land Management workers installed log weirs and emplaced boulders to create the riffles and pools needed for spawning and rearing and fenced riparian zones. They made these improvements on Camp Creek on the Middle Fork of the John Day, Clear Creek on the North Fork, and Deer Creek on the South Fork. As a Final step, Oregon Department of Fish and Wildlife is evaluating the effectiveness of their efforts to augment natural salmon and steelhead production.

Yakima River Spring Chinook Enhancement Study (Project No. 82-16)

Yakima River spring chinook have also been reduced to extremely low levels. Researchers are beginning the restoration effort by trying to determine the numbers and distribution of naturally produced fry and smolts in the river. They will continue by evaluating different methods of introducing Fry and smolts into the natural rearing environment. After locating and defining areas of the watershed that are suitable for rearing spring chinook, they will develop strategies for enhancing the fishery and prepare guidelines for further offsite mitigation in the Yakima Basin. Their study is to be completed in early 1990.

Idaho Habitat Evaluation for Qffsite Mitigation (Project No. 83-7)

The Idaho Department of Fish and Game is evaluating the benefits to juvenile salmon and steelhead production resulting from habitat improvements, in order to produce an offsite mitigation record. Their biologists are measuring such parameters as smolt production and relating the figures to construction and operating costs per mile, for the life expectancy of each project. They are evaluating nine projects. all of which were built by the U.S. Forest Service and the Shoshone-Bannock Tribes in cooperation with Idaho Department of Fish and Game.

The Idaho offsite mitigation record will be prepared annually, although individual projects will be monitored only at intervals during FY 1984-1988.

Stock Assessment of Anadromous Salmonids of the Columbia River Basin (Project No. 83-335)

Anadromous salmonids are biologically driven to return as adults to their natural waters. For that reason, eggs are

often transferred from one hatchery to another so that adult fish can repopulate other stream systems.

Though a fairly common practice. this transfer of stocks can be counterproductive if they do not Fit the new environment. Fish selectively bred by nature to spawn in a large swift-flowing river close to the sea may not survive if their new home is a small secluded stream hundreds of miles from the ocean. Such unsuitable transfers could actually reduce fish populations rather than increase them.

This multiagency study assessed all Columbia Basin wild and hatchery salmon and steelhead stocks which may be used in mitigation programs. In the first year of the project, Oregon Department of Fish and Wildlife identified the stocks and substocks currently found in the Oregon portion of the basin and summarized available information about their individual characteristics and life histories. As subcontractors. the Washington Departments of Fisheries and Game and the Idaho Department of Fish and Game identified the salmon and steelhead stocks occurring in the basin in those states. The stock assessment will be completed during FY 1985.

Hood River Passage (Project No. 83-341)

Dams are not the only barriers to fish trying to migrate upstream. Nature can block the path to a potential spawning area just as effectively. A natural waterfall on the West Fork of the Hood River blocks the passage of adult salmon and steelhead to more than 23 miles of potential habitat. Construction of a fish passage facility could double the production potential of spring and fall chinook and summer steelhead in this river. Fishery benefits will be claimed as offsite mitigation or enhancement. Oregon Department of Fish and Wildlife engineers are now designing the facility. and construction should be completed in FY 1985.

Rehabilitate and Protect Critical Anadromous Salmonid Spawning and Rearing Habitat in Bear Valley Creek (Project No. 83-359)

Bear Valley Creek. a tributary of the upper Middle Fork of the Salmon River in central Idaho. is a valuable area for natural production of salmon and steelhead. Yet this area has been degraded by mining and dredging operations. The Shoshone-Bannock Tribes have formed a task force of tribal, State and Federal representatives to cooperate in enhancing the habitat for increased fish production.

The tribes will perform a habitat inventory and prepare design and cost estimates. They will also evaluate and select alternative enhancement measures, such as arresting lateral channel movement and sedimentation. while coordinating the work with Federal and private landowners. Since the enhancement is unrelated to hydroelectric development or operation, benefits will be considered to be offsite mitigation for mainstem losses from operation of the FCRPS. Between FY 1984 and FY 1988. the project will grow to encompass other measures in Section 704 ("Natural Propagation") of the Council's Program. These measures include Yankee Fork and Jordan Creek.

Deschutes River Spawning Gravel Degradation Study and Rehabilitation Plan (Project No. 83-373)

In this study, a consulting firm, J.W. Buell and Associates. Inc.. will examine the quantity, quality. and distribution of spawning gravel habitat in the Deschutes River and compare the results to those of a study conducted by Oregon Department of Fish and Wildlife in 1965. Study results will show relative spawning habitat changes and demonstrate trends of spawning and quality and quantity of gravel. They will be used to develop a substrate habitat enhancement plan and to recommend other habitat improvement measures for the Deschutes. The project constitutes offsite mitigation for the FCRPS. The project will draw to a close with the publication of a final report in FY 1985.

Forest Service Natural Propagation and Habitat Improvement Projects (Project No. 83-415, 84.5, 84-8, 84-11, 84-24)

Often potential spawning and rearing habitat can be found on Federal lands. If that habitat was originally damaged by hydroelectric development or is appropriate for offsite mitigation. BPA may contract with the agencies involved to make improvements. In 1984 BPA funded four new and one continuing project with the U.S. Forest Service.

The Sawtooth National Forest plans to augment instream flows below the Alturas Lake Creek diversion dam (83-415). The creek was historically a prime spawning site for salmon. Inadequate stream flows have cut into salmon production. Increasing these flows would not only allow fish to reach upstream spawning habitat but would also improve both the quality and quantity of spawning and rearing habitat below the dam. Through this project, USFS will find alternatives to insure adequate instream flow. It is considered offsite mitigation and is to be completed by 1986.

Nez Perce National Forest engineers are replacing a culvert so that salmon and steelhead can reach upstream spawning areas on the Crocked River (84-5). Production of juveniles could increase by 64 percent. Engineers are also improving habitat on the upper Crooked River. USFS is also cooperating with Idaho Department of Fish and Game and private landowners to improve Red River habitat by installing stream structures to protect the riverbanks and by planting trees and shrubs to stabilize the banks and shade the young fish. Fencing the riparian areas on private ranch land will encourage the growth of streamside plants and provide cover for juvenile fish. The project could increase production potential to three or four times the current levels. It is offsite mitigation. scheduled for completion in 1988.

Under project 84-8, the Umatilla National Forest is continuing the repair of historic mine dredging damage in Granite and Clear Creeks. Dredging disrupted riparian and instream habitat and displaced spawning gravel and. as a result, severely reduced salmon and steelhead populations. The dredging began in the 1920s and continued intermittently until 1954. U.S. Forest Service began the rehabilitation in 1979, concentrating on a 4-mile stretch of Clear Creek and adding 7100 cubic yards of gravel to the spawning areas. Foresters also installed log and boulder weirs to increase gravel-collecting pools, stabilized streambanks, and plugged the Blackjack Mine and diverted its seepage. They are planning to plant shrubs and relocate boulders on Clear Creek. expand habitat and stabilize banks on Granite Creek, and open blocked side channels for fish rearing in the North Fork, John Day River. Project results will be monitored by Oregon Department of Fish and Wildlife. It is considered offsite mitigation and scheduled for completion in 1985.

Mount Hood National Forest biologists are improving passage and habitat for coho salmon and winter and summer steelhead in several creeks in the Northern Cascades. At Fish and Wash creeks. they have reestablished an off-channel coho rearing pond and built I I instream structures to trap gravels. On Lake Branch Creek, crews are removing logjams and installing gravel-trapping structures with the expectation of doubling fish production. The project also includes plans for fish passageways at White River Falls to open 130 miles of stream habitat and Collawash Falls to give access to 8.4 miles of habitat in the upper Collawash River. These projects are scheduled for completion in 1987.

USFS and BPA are cooperating in the planning and will share the funding of habitat improvements in Marsh, Elk. and Bear Valley Creeks on the upper Salmon River in Idaho (84-24). Heavy livestock grazing. irrigation diversions, and natural sedimentation have depleted the salmon and steelhead habitat on those streams and degraded its quality. Biologists will measure potential habitat and quantify expected increases in fish habitat and fish standing crops, using fish population/standing crop surveys and applicable data from similar streams. They will recommend appropriate habitat improvement such as fencing, streambank stabilization. and instream structures. BPA and USFS will then develop a cost-sharing agreement to implement these recommendations. The work should be completed in FY 1988.CollawashCollawashvv

Trout Creek Riparinn Habitat (Project No. 83-423)

Salmon and steelhead are two of the most abundant and valuable Fish in Trout Creek, but the populations are limited by irrigation withdrawals and stream channelizationns that result in low summer flows. high water temperatures. unstable banks and few spawning pools. In addition vegetative cover has been lost to overgrazing. The project will develop habitat enhancement plans as offsite mitigation. Phases I and II include technical planning and rehabilitation recommendations. Phases III and IV, landowner coordination, implementation of recommendations, and NEPA compliance will be performed in FY 1985.

Developing a Brood Stock of Native Snake River Coho Salmon (Project No. 83-441)

Beginning in 1983, Oregon Department of Fish and Wildlife attempted to develop a native coho brood stock using parent fish for propagation with the aim to bolster depleted coho salmon populations in upriver basins. Results of the coho brood stock capture in 1984 were unsuccessful and the project was terminated.

White River Falls Passage (Project No. 83-440, 83-450)

White River Falls forms a natural barrier to migration and thus to increased production of salmon and steelhead production in the White River basin. Under phase I of this project. U.S. Forest Service, Oregon Department of Fish and Wildlife and Ott Waters Engineers are cooperatively investigating fish passage alternatives. They will include an evaluation of the potential upstream habitat in determining the Fish benefits and compare them to the costs of the differing passage methods.

In the project's second phase (83-450), Oregon Department of Fish and Wildlife biologists will select species that seem best suited for introduction into the area. They will also select the preferred passage alternative. If it is approved. BPA will fund project design and construction in FY 1986-1987.

Cottonwood Creek Summer Steelhead Habitat Improvement (Project No. 83-473)

Bureau of Land Management workers have constructed a series of log weirs to slow water velocities. scour pools. and capture spawning gravels. The weirs provide additional spawning habitat and added more instream cover for fish. Weirs and boulders were designed to encourage gravel recruitment and increase natural summer steelhead production in Cottonwood Creek, tributary to the John Day River.

Enloe Dam Passage (Project No. 83-477)

Biologists have inventoried habitat in 4 major tributaries and 59 stream reaches in the mainstem of the Similkameen River in northeastern Washington and southern British Columbia above Enloe Dam. They have also measured streamflows and analyzed water samples for contaminants. From the inventory, they will estimate the potential for production of steelhead trout and chinook salmon and devise a strategy for introducing those fish into the Similkameen basin.

Fish passage alternatives at Enloe Dam will be developed during FY 1984-1985. When the preferred passage alternative has been selected by agreement of Washington Department of Fisheries, British Columbia Fish and Wildlife. and Okanogan Public Utility District, BPA will implement construction. Work is scheduled to begin in 1987.

Lolo/Crooked Fork, El Dorado Creeks, Clearwater River (Project No. 84-6)

El Dorado Creek has a series of basalt falls naturally barring upstream spring chinook and steelhead passage. Migration through this area could be enhanced by blasting out barriers and building stairstep pools at the lowermost falls to open approximately IO miles of spawning and rearing habitat as offsite mitigation. Workers plan to complete the project in 1985.

joseph Creek, Grande Ronde River Oregon (Project No. 84-9, 84-25)

Optimum rearing habitat for summer steelhead is severely limited in large portions of the Joseph Creek drainage by a lack of streamside cover and the resulting high summer water temperatures. The objective of this project is to develop optimum habitat in 120.5 miles of stream.

The project will be carried out in three phases: prework survey and design: implementation, including protection of riparian vegetation, planting of vegetation to increase shade, and installation of instream structures to improve pool/riffle ratios: and postwork monitoring and maintenance.

It is estimated that, within 10 years of completion of the work. an annual increase of 4.000 spawning adults will result from the habitat improvements coupled with correction of downstream passage problems. The project is considered offsite mitigation and is scheduled for completion in 1988.

Main Stem, Middle Fork john Day River (Project No. 84-21)

The John Day's wild spring chinook run. along with hatchery-supplemented steelhead trout runs. has been depressed by losses of both adult and juvenile fish at mainstem Columbia River hydroelectric projects. Other water uses, unrelated to hydropower, have also affected these runs. If corrected. they present substantial opportunities for mitigation of mortalities at the mainstem dams.

This project will develop such enhancement opportunities on the Main Stem. Middle Fork, and North Fork of the John Day., Specific activities include: increasing the percentage of rearing pools: creating holding areas for adult fish: and rebuilding old stream channels that were damaged by mining operations in the 1940s. along with other habitat and riparian enhancement efforts. The project will run from FY 1984 through FY 1988.

Camas Creek, Idaho (Project No. 84-23)

Heavy livestock grazing has degraded the Camas Creek channel and riparian habitat. with detriment to the spawning and rearing of salmonids. A feasibility study and plan-including a detailed survey of instream habitat that could be enhanced by upgrading riparian zones-will be completed in 1985.

In 1986, BPA will initiate Phase II. Activities will include Fencing and reintroduction of riparian plant species to stabilize the streambanks and provide cover. Biologists will also quantify expected increases to Fish habitat and standing crops by using fish population and standing crop surveys and other applicable data from similar streams. The work should be completed in 1988.

Lemhi River Habitat Rehabilitation Study (Project No. 84-28)

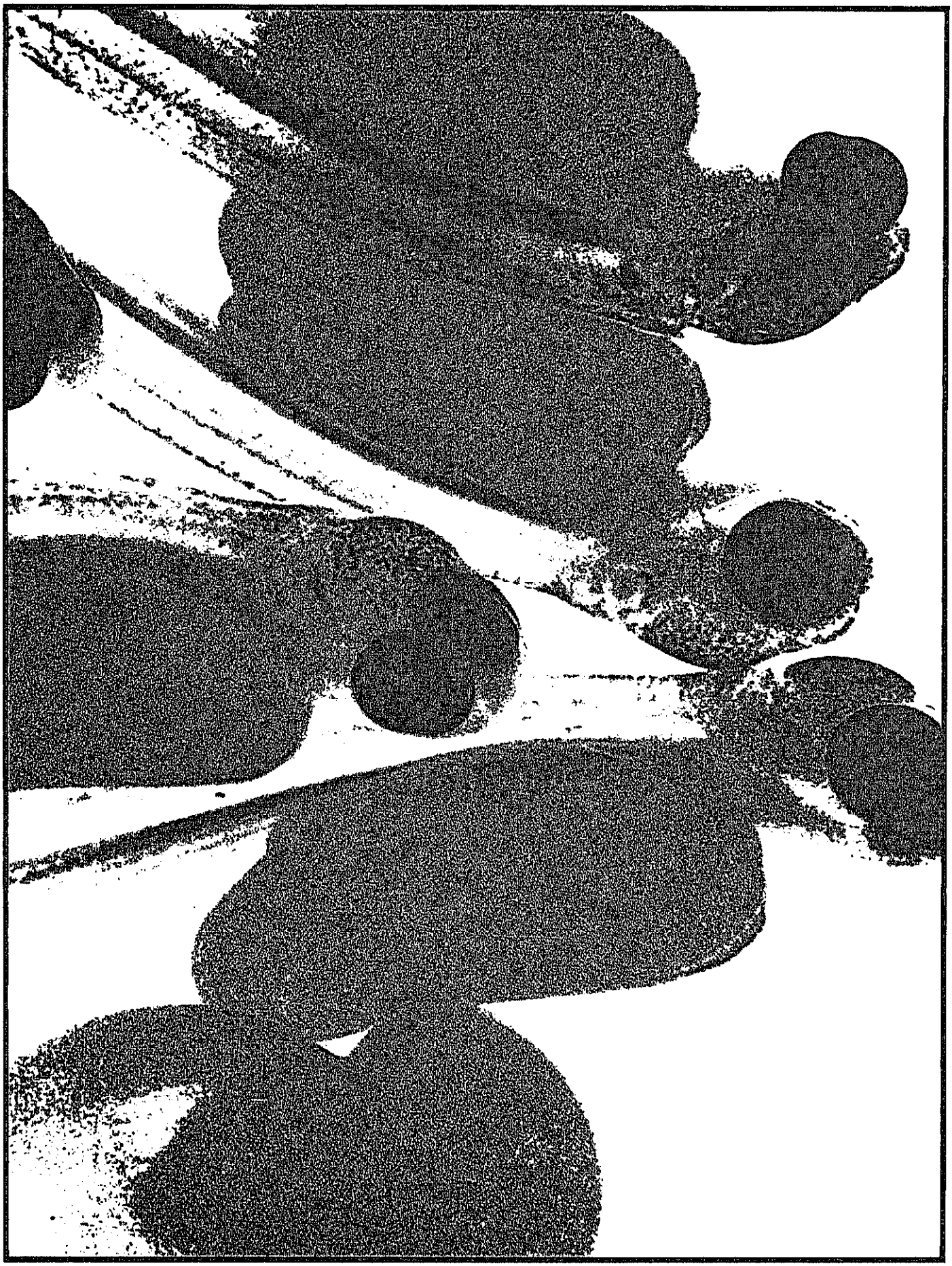
A large portion of the flows of the Lemhi River is diverted for irrigation, adversely affecting salmon and steelhead rearing and adult passage. Through this project. work will be done on private lands to identify problems. evaluate fishery potential, and develop recommendations for enhancing Fish production. A clam and reservoir may be needed in the headwaters to store water and sustain flows.

The Phase I feasibility plan and design of enhancement alternatives is to be completed in 1985. Work will begin in 1986. It should be completed by FY 1988 and the improvement in salmon and steelhead production will be claimed as offsite mitigation.

Panther Creek Habitat Rehabilitation Study (Project No. 84-29)

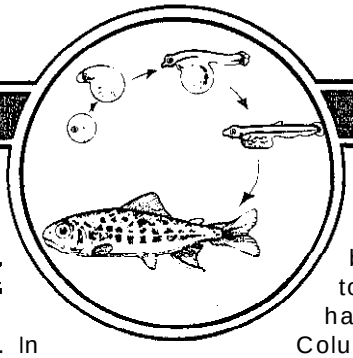
Deer and Blackbird Creeks carry toxic effluent from abandoned mines into Panther Creek, a tributary of the Middle Fork, Salmon River. Records from 1963 to the present show that spring chinook salmon and steelhead runs have declined to extremely low levels.

This study will evaluate the potential habitat that the streams offer and recommend alternatives for neutralizing the effluents below levels toxic to Fish, adding 100 miles of productive habitat for offsite mitigation. The feasibility study will be completed in 1985 and will present alternatives For mine reclamation and fisheries enhancement. The project should be completed in 1988



Just hatched young salmon with yolk sacs.
USFWS photo.

ARTIFICIAL PROPAGATION AND FISH HEALTH



Although rebuilding impaired or deteriorated habitat will help bring back anadromous fish runs,, artificial propagation now stands as the main source of juvenile salmon and steelhead production. In the wild. only 5 to 15 percent of the eggs reach the smolt stage. In hatcheries. that number can increase to 70 or 80 percent. The extra hatchery production can be used for renewing depleted runs and populating newly opened streams. Federal and State agencies have built fish hatcheries throughout the Pacific Northwest to compensate for the damage clone by dams. Returning salmon are guided into holding ponds where eggs are collected. incubated. and reared under conditions determined by man. Over the years. hatcheries have been successful in producing large numbers of fish, but not without serious problems. Hatcheries have altered the natural patterns of genetic selection and produced less genetic diversity than that found among wild salmon. Fish are paired and spawned regardless of their size or health. This practice often allows transmission of disease from parent to offspring. Thousands of young fish, all of the same age and genetic strain. are crowded into one rearing pond. Crowding causes stress and increases susceptability to disease. Disease spreads more rapidly. BPA has been funding studies since 1979 to improve the effectiveness of hatchery contributions to the Columbia Basin fish runs. Biologists are searching for ways to provide better nutrition, prevent disease and stress, and improve smolt quality. They are also examining the timing of smolt releases. They are concerned about the complications that can arise from the integration of hatchery releases and wild runs. both during rearing and harvest. If enough wild fish exist, the effect of hatchery fish might not pose a serious problem. But in many parts of the Columbia Basin. 80 percent of the salmon are now raised in hatcheries—and that percentage continues to rise.

Artificial Propagation and Fish Health: Project Descriptions

Evaluation of the Contribution of Chinook Salmon Reared at Columbia River Hatcheries to the Pacific Salmon Fisheries (Project No. 79-2)

A large part of the mitigation for hydroelectric development has been hatchery construction and operation. Some chinook hatcheries have consistently contributed significantly to ocean and inriver fisheries, with sufficient fish returning for continued production. Other facilities produce their quota of young fish, but for unknown reasons, contribute much less to fisheries and receive proportionally fewer returns. Hatchery production spans a range from satisfactory to unsatisfactory.

In this S-year project, coded-wire tags have been placed in three successive brood years of hatchery-raised fall chinook. for recovery throughout the lives of the fish. When all the data are in, the rate of contribution of releases from each hatchery will be compared by such variables as the disease history, smolt indices, length at release, diet. and time of release. The importance of each factor will be evaluated.

With this information, hatchery managers will be able to alter production techniques to improve results and the hatcheries will be better able to mitigate fish losses resulting from hydroelectric development. The project is scheduled for completion in FY 1986.

Bioenergetics of juvenile Salmon During the Spring Outmigration (Project No. 82-11)

The US. Fish and Wildlife Service is investigating the theory that juvenile salmonids now need to expend more energy in migrating downstream. and

that the physical drain results in lower survival rates. During their extended journey, the smolts, particularly those reared in hatcheries, have trouble finding food. Their stored energy (fat) can be critically important to their surviving to reach the ocean. Researchers are evaluating the effects that different water temperatures. river flow levels, and types of available food can have on the fitness of the young migrants. The project is to be completed in FY 1985.

Rapid Diagnosis of IHN Virus Infection in Salmon and Steelhead Trout (Project No. 82-20)

Since 1980, Infectious Hematopoietic Necrosis (IHN) viral infections have killed more than 14 million hatchery fish and undetermined numbers of wild fish in the Columbia Basin. All salmon and cutthroat, rainbow and steelhead trout are susceptible to this disease. Theoretically, the virus may be transmitted either through the reproductive process or directly through the water from infected to uninfected fish. An outbreak can virtually destroy the production of a hatchery in any year.

In this project. biologists characterized the different strains of IHN virus found within the Pacific Northwest and are beginning to identify the strains found in particular hatcheries and geographic areas. They also developed more sensitive methods that reduced diagnosis time from 40 to 5 clays.

Control of IHN by Broodstock Culling and Antiviral Drugs to Control IHN Virus in Sockeye and Chinook Salmon and Steelhead Trout (Project No. 82-21) Development of Rapid Seriodiagnostic Tests for the Detection, Surveillance, and Diagnosis of Five Important Pathogens of Fishes in the Columbia River Basin (Project No. 83-304)

As described in project 82-20, the IHN virus is seriously threatening the production of hatcheries intended to mitigate Columbia Basin hydroelectric clam construction. The US. Fish and Wildlife Service is testing broodstock culling, the removal of adults with high levels of virus from the breeding stock. as a means of controlling IHN. After two years of culling, the incidence of IHN has been substantially reduced at one test hatchery, but the cause and effect relationship is still uncertain. This is a promising approach, but unfortunately, it carries a risk of unwanted genetic selection and even the possible destruction of genetic strains of salmon and steelhead. Consequently, researchers are also testing drugs for their ability to block transmission of viral diseases. especially IHN. The project should be completed in 1985.

In a second study (83-304), USFWS biologists are attempting to improve methods for detecting and preventing the geographic spread of five fish diseases of major economic importance to salmonid culture in the Northwest: bacterial kidney disease (BKD); furunculosis: enteric redmouth disease (ERM): infectious hematopoietic necrosis (IHN): and infectious pancreatic necrosis (IPN). To accomplish this goal, they are using the enzyme-linked immunoassay (ELISA) test, which can rapidly diagnose infection of either viral or bacterial origin. FY 1985 activities include development of testing procedures and the field testing of the BKD ELISA test, and development of tests for the pathogens causing ERM, furunculosis. IPN, and IHN. Beginning in FY 1986. during the final phase of the project, project leaders will field test the assays. Subsequently, assays will be used to detect disease in hatcheries and wild populations.

Epidemiology and Control of Infectious Diseases of Salmonids in the Columbia River Basin (Project No. 83-312)

Since 1983, this project has examined several viral, protozoan. and bacterial fish pathogens with the goal of devising better means of control. The range and occurrence of these pathogens is being studied along with ways to estimate disease-induced mortality and morbidity

in hatcheries, rivers, and the Columbia River plume of the Pacific Ocean. Additionally, a basin-wide morbidity/mortality report is being generated with the cooperation of tribal. state and Federal hatchery operators.

Researchers have determined that one parasite. Ceratomyxosis, is spreading in the Columbia Basin and causes far more mortality than was previously suspected, yet no contol is currently possible. They are also studying bacterial kidney disease and the transmission of the IHN virus. emphasizing prevention and control rather than seeking a cure. The project is scheduled for completion in 1990.

Rearing and Imprinting of Fall Chinook Salmon (Project No. 83-313)

The objective of this 8-year study is to show that pen rearing and imprinting of salmon is a cost effective method of artificial propagation. Biologists rear juvenile fish in selected backwater areas so that, as adults. those fish will return to spawn naturally in those same areas. U.S. Fish and Wildlife Service biologists are evaluating backwater sites from John Day Dam to Priest Rapids Dam-an important fishery zone. They have already begun rearing fall chinook in pens and enclosures at Rock Creek and Social Security Pond, two potential rearing areas that have not been adversely affected by hydroelectric development. Should the methodology prove feasible--and adults return to the John Day reach-it could be applied throughout the Columbia River Basin. Returning adults will be available for harvest by the Indian fishery, for broodstock in subsequent off-station rearing projects, and for outplanting in nearby rivers and streams.

Low Technology Fisheries Facilities for the Enhancement of Anadromous Salmonid Stocks on the Nez Perce Reservation (Project No. 83-350)

The Nez Perce Reservation salmon and steelhead fishery was almost destroyed by the development and operation of the FCRPS. The tribe is now trying to reestablish the fishery by constructing ponds for spawning and rearing spring chinook and steelhead. Tribal biologists are evaluating potential artificial propagation sites on the reservation and will design. construct, and operate low capital, low technology facilities. They will coordinate their plans with the Lower Snake River Compensation Plan. Idaho Department of Fish and Game. and the Columbia River Inter-Tribal Fish Commission. If all goes according to plan, construction could begin in FY 1987 and be completed in 1988.

Low Cost Salmon and Steelhead Production for the Columbia Basin (Project No. 83-353)

A compendium of low cost production facilities and practices in the Columbia Basin was prepared. The compendium identifies a range of systems, equipment, and hatchery technology. The authors developed the compendium through discussions with tribes and fishery agencies who operate such facilities and by conducting site reviews.

The compendium will aid fishery managers in choosing appropriate production systems and in estimating the cost of constructing low technology systems. It contains illustrations and photographs, lists of estimated costs and vendors. all previous economic and biological evaluations. and limitations on permits.

Development of Diets for Enhanced Survival of Salmon (Project No. 83-363)

What a young salmon eats in its first months is believed to make a difference in its ability to survive during its long journey to the sea. The Oregon State University Seafood Laboratory and Oregon Department of Fish and Wildlife are cooperating in a 5-year study to develop a high-quality animal protein diet and to determine its effects on salmonid survival. Biologists have designed and conducted laboratory feeding trials to test the relative nutritional value of vacuum dried meals on chinook and coho fingerlings. The improved diet can be used in artificial production throughout the Columbia Basin.

ODFW is evaluating the effect of the new meal on the survival and return of coho and chinook salmon. They are tagging selected coho smolts with coded wires for their first release year. They will study three replicate release years of coho and chinook salmon. Diet development will continue through 1985. and coded-wire tag recoveries through 1987.

Evaluation of Low-Cost Salmon Production Facilities (Project No. 83-364)

Before the Clatsop Economic Development Committee (CEDC) began its Young's Bay salmon enhancement project in 1976, fishermen caught fewer than 100 fall chinook there each year. For the last three years. the catch has averaged 5,500. Now researchers, in an effort to determine how much the CEDC project contributed to that increase, are examining the effectiveness of various project components. They are rearing. tagging, and releasing coho and fall chinook not only to evaluate the project but to learn how to produce large numbers of salmon at low cost while maintaining genetic variability.

They are determining the best density level for juvenile fish reared in a hatchery and comparing the quality of fish produced in a natural pond environment with those reared in concrete hatchery troughs and ponds. They are also assessing the applicability of their methods to other low-cost salmon production facilities in the basin and exploring the potential of community involvement in such projects. By its completion in 1987. the study will determine the feasibility of establishing low-cost salmon production facilities as a means to offset Columbia Basin fish losses.

Estimation of Artificial Production Potential in the Columbia River Basin (Project No. 83-424) Survey of Artificial Production of Salmon in the Columbia River, Phase II (Project No. 84-51)

Investigators compiled data on existing salmon and steelhead hatcheries and on potential hatchery sites (83.424). They gathered pertinent facts about the number of facilities and their condition, the availability and quality of water. the number and species of fish reared. and current operational plans, costs, and potential for expansion. This data is being analyzed (84-51) for the reprogramming potential of the hatcheries and archived as a source for future selection of the best options in the artificial production of salmon and steelhead.

The survey will include more than 75 public fish culture facilities and may later be extended to private facilities. The data that is gathered will be compiled into a written summary report, written data appendices, and appendices recorded on computer disks for future collateral analyses. The project should be completed in 1985.

Stock Identification of Columbia River Chinook Salmon and Steelhead Trout (Project No. 83-451)

Researchers are characterizing each wild and hatchery stock-unique species, strain. or race of fish-by behavioral. physical, and biochemical traits, such as run timing, migration habits. fecundity, disease resistance, and multiple Forms of various enzymes. The results will be used in selecting donor stocks for hatchery programs and supplementation of wild populations. as well as protecting the genetic integrity of Columbia River chinook salmon and steelhead trout. Project evaluations are taking place in Oregon, Washington. and Idaho. The project is to be completed in FY 1986.

Protection of Wild Steelhead in the Upper Snake River and Evaluation of Effectiveness (Project No. 84-2)

Extensive hydroelectric development in the Snake River Basin has paradoxically depleted valuable wild steelhead runs in the midst of harvestable surpluses of hatchery fish. The wild fish could be protected if Fishing were prohibited or if harvesting only of surplus hatchery fish were permitted. Removal of the adipose fin of all hatchery-reared fish allows the

latter. but it can injure the fish and eliminate that fin's function. In this project, fins are removed from about 5 million fish annually and the results of that removal and its impact on the well-being of the fish is appraised.

Umatilla River Summer Steelhead Hatchery (Project No. 84-33)

The initial stage of this project involves siting and predesign studies for a hatchery to produce 200,000 summer steelhead smolts for annual release into the Umatilla River. The hatchery will increase the Umatilla River runs in mitigation for the effects of the FCRPS. Estimates of potential benefits from the hatchery's releases will be developed in a separate project. Present plans are to begin final designs in FY 1985 and construction in FY 1986.

Development of a Subunit Vaccine Against IHN (Project No. 84-43)

This project will investigate how to produce a previously developed subunit vaccine against IHN through genetic engineering. Project experiments will also determine the duration of induced immunity in laboratory-reared rainbow trout, steelhead trout, and sockeye salmon: evaluate various methods for immunizing fish against IHN: and develop protocols for vaccine production through evaluation of various cloning processes.

Etiology of Early Lifestage Diseases (Project No. 84-44)

Maternally transferred pathogens are particularly troublesome because their presence in the developing embryo tends to give its immune system the false impression that they are "self" or part of the fish. Consequently the host fish will not usually fight the disease.

Recent research has shown that bacterial kidney disease and IHN are transferred maternally to the egg yolk. Project data has revealed numerous gram-positive and gram-negative bacteria in the yolk of developing eggs and sac-fry. Enteric Red Mouth (ERM) disease has also been tentatively identified in the yolk material. These maternally transferred bacteria have been associated mostly with chinook salmon, but may account for significant mortality in other salmon species and steelhead. This project will isolate and identify additional pathogens in salmon eggs: characterize their induced pathology: determine levels of endotoxin (a bacterial product that is toxic to the fish host): and investigate remedial actions. The result will be a better understanding of which diseases are maternally transferred and the implications of shipping eggs to new locations.

Influence of Vitamin Nutrition on the Immunity Response of Hatchery-Reared Salmonids (Project No. 84-45)

Increased levels of certain vitamins help protect man and his domestic animals from infectious disease. Now, there is also evidence that this is true of fish. However, the amounts required for maximum disease protection have not been established. In this study, biologists are trying to determine the amounts of six vitamins-C, B6, E. folic acid. pantothenic acid, and riboflavin—required to protect Columbia Basin salmonids. They are also developing recommendations for the manufacture. storage, and handling of practical, economical, vitamin-enriched fish feeds to be used at hatcheries.

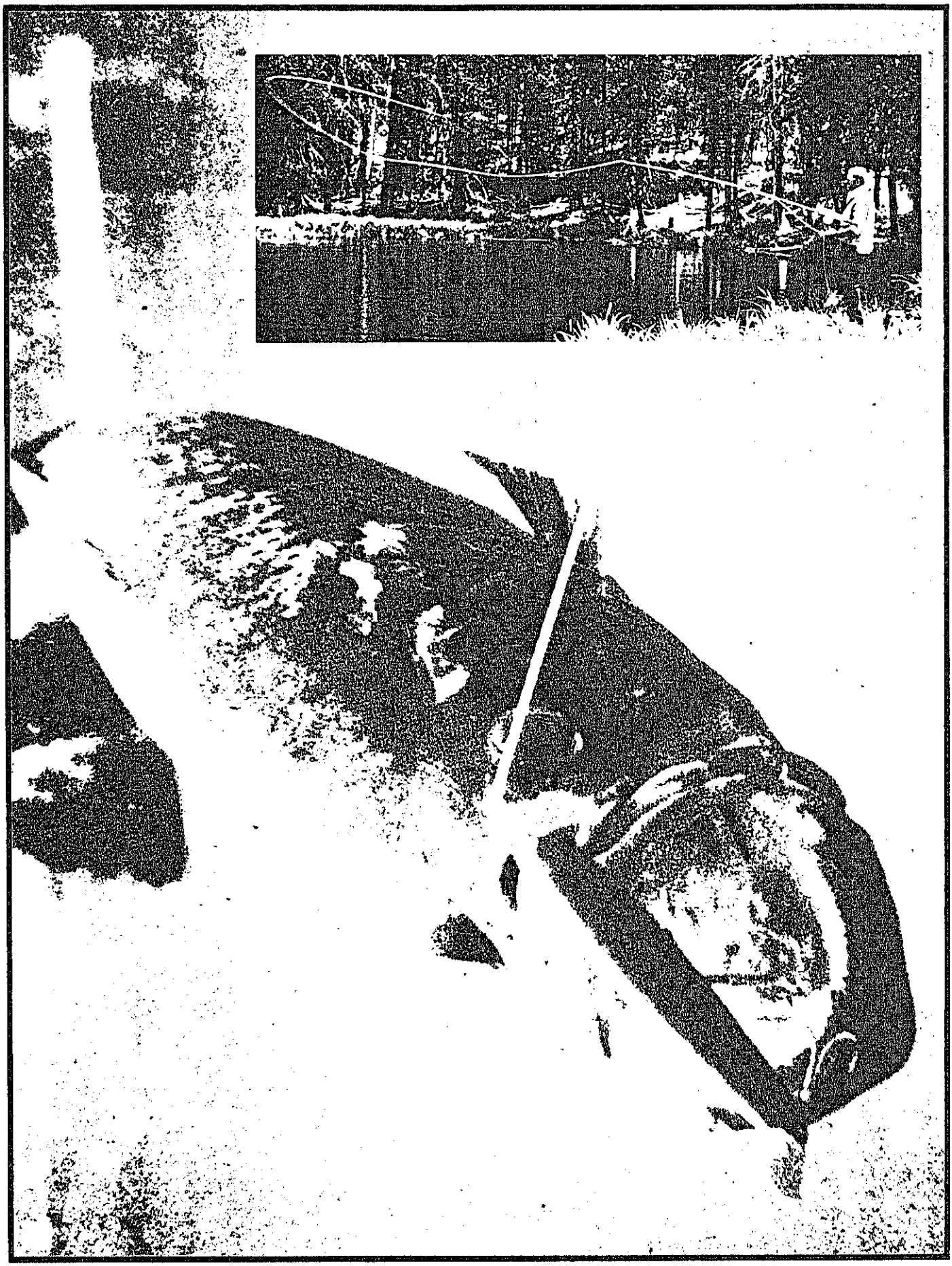
The outcome of their work, to be completed in 1989. should be a better, more economical salmon diet. more adult hatchery-reared salmon and more efficient mitigation for losses from hydroelectric development.

Evaluate Vaccines for Bacterial Kidney Disease in Salmon (Project No. 84-46)

Bacterial Kidney Disease (BKD) causes extensive infections and heavy mortality to hatchery-reared salmon and steelhead. With hopes of reducing this hazard. biologists are examining the components of the pathogen and evaluating their ability to induce immunity. They are assessing intercellular antigens in both natural

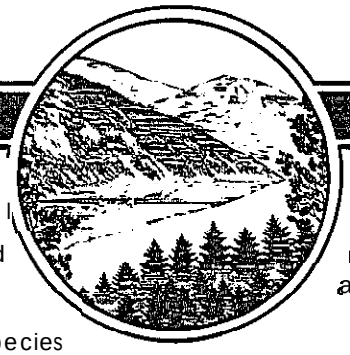
molecular form and in chemically modified forms, for their ability to induce effective immunity to Bacterial Kidney Disease, cellular immune responses to BKD, and resistance to challenge with live *Renibacterium salmoninarum*. They will rank the antigen preparations by effectiveness, cost of vaccine production, and any technical difficulties involved therein.

The final report, expected by FY 1986, will fully describe production protocols and give suggestions for large-scale vaccine production for each antigen researchers have determined is capable of inducing a significant degree of protection.



Smallmouth bass takes a lure in Brownlee Reservoir.
MFS photo./ BPA photo.

RESIDENT FISH



Unlike the anadromous fish that sojourn in the ocean. resident fish are freshwater fish that spend their lives within the Columbia Basin, developing. maturing. and reproducing there. At least 20 species of game fish are found in the basin. including kokanee (landlocked sockeye salmon). Dolly Varden (bull trout). and westslope cutthroat trout.

One species, the white sturgeon, is biologically an anadromous fish. Historically. sturgeon migrated upstream in fall and downstream in late winter or spring until the dams blocked their migration. Sturgeon do not use the fish ladders built for salmon. They have been restricted to stretches of the Columbia and Snake Rivers between the dams. Each reservoir pool primarily contains an isolated population. Little is known regarding sturgeon life history and behavior.

The hydroelectric facilities and their operations can affect other resident fish. High reservoir levels deposit silt on nesting gravels. smothering incubating eggs. Falling water levels may dewater nests. Low water disrupts spawning activities; trout and salmon are kept from entering shallow tributaries.

Sometimes fluctuating on a daily basis, the reservoir erodes its banks, and destroys streamside vegetation which provides food and shelter to young fry. Variable water levels may affect the production of the aquatic organisms. a major food supply for all age groups of fish. In most lakes, the edge where the water meets the land is the most productive zone. In some reservoirs, that edge has become a barren mudflat.

Resident fish are of considerable economic importance. particularly to areas no longer accessible to anadromous fish. BPA is funding studies of the resident fish populations. their food and habitat preference. reproductive success, and their response to conditions in rivers above and below dams.

Resident Fish: Project Descriptions

Effects of Operation of Kerr and Hungry Horse Dams on Reproductive Success of Kokanee in the Flathead System (Project No. 81-105)

This Montana Department of Fish, Wildlife, and Parks study will determine

what flows from Kerr and Hungry Horse Dams will optimize spawning. incubation. and rearing conditions for kokanee in the Upper Flathead River and lake, while having the least adverse impact on power production. The researchers are monitoring the timing and distribution of kokanee runs to learn the effects of controlled Flows on their reproduction and survival in the portions of the river above the lake. MDFWP will also examine the Kerr Dam discharges and how they affect kokanee spawning and incubation in Flathead Lake. They began the study in FY 1981 and plan to complete it in FY 1987.

Cumulative Impact Study of Microhydro Sites, Swan River (Project No. 82-19)

The Federal Energy Regulatory Commission has at least 400 applications pending and another 400 outstanding preliminary permits for small-scale hydroelectric projects in the four northwestern states. Many of the projects are proposed for tributaries to the Columbia and contain valuable fish habitat. Any one of these small projects might individually have little effect on a fish population, but the cumulative effect of several distributed over a river basin would be much greater. Until recently, Federal review has been limited to single projects. with no consideration given to the possibility of combined impacts.

The Montana Department of Fish. Wildlife. and Parks and the U.S. Forest Service examined the cumulative effects of 22 small hydroelectric projects proposed for the Swan River. The agencies developed a fisheries impact methodology that could be used to determine the levels of microhydro development that would be consistent with fishery needs and objectives in similar watersheds. Study results will be published in 1985.

Lower Flathead Fisheries Study (Project No. 83-I)

Researchers from the Confederated Salish and Kootenai Tribes of the Flathead Reservation are examining the condition of fish populations in the Lower Flathead River and the extent to which they are affected by the operation of Hungry Horse and Kerr Dams. They are studying trout, northern pike and largemouth bass populations, in particular. and interrelationships among these species. To protect the tribal fishery resource, they are preparing management alternatives for subsistence and recreational harvests and for the development and operation of new and existing hydroelectric facilities. They will also make recommendations for the level of mitigation that should be provided for impacts caused by these facilities. They have developed several options to offset those impacts and are considering. among other issues, the possibility of increasing quality aquatic habitat to increase game fish production. The tribes are also studying the potential effects of future hydroelectric development on these same fish species. The project is scheduled for completion in FY 1987.

Columbia River White Sturgeon Life History and Genetic Study (Project No. 83-316)

Once sturgeon migrated throughout the Columbia River Basin. Now their migratory routes are blocked by hydroelectric development and their environment is altered. Many speculate that the sturgeon's behavioral patterns have changed. but little is known about their behavior or needs.

This multiyear study is gathering life history information to be used in identifying the environmental changes by which sturgeon are most affected. It is investigating the responses of young sturgeon to changes in water temperature. flow and other variables. The study is also addressing the potential for artificial propagation and identifying genetic distinctions among populations. The information will be used as a basis for measures designed to mitigate for sturgeon population losses.

Managing Water Releases for Fainted Rocks Reservoir (Project No. 83-463)

Low water levels inhibit trout spawning and production on the Bitterroot River,

a tributary of the Clark's Fork of the Columbia. With the objective of improving the habitat. biologists with the Montana Department of Fish, Wildlife and Parks are conducting a feasibility study for a water management plan for releases from Painted Rocks Reservoir in western Montana. They are monitoring many aspects of the Bitterroot River, including water temperature and quality and stream discharge: analyzing the area's salmonid habitat: and monitoring brown and rainbow trout spawning activities in order to better estimate their populations and needs. The project is scheduled for completion in 1986 with the submission of a final water management plan for releases from the reservoir.

Quantification of Hungry Horse Reservoir Levels Needed to Maintain or Enhance Reservoir Fisheries (Project No. 83-465) Quantification of Libby Reservoir Levels Needed to Maintain or Enhance Reservoir Fisheries (Project No. 83-467)

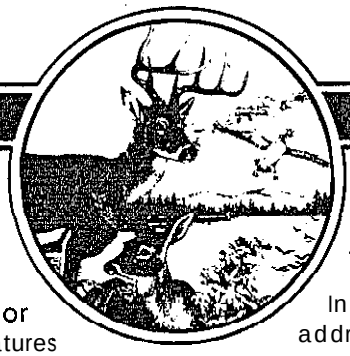
Montana Department of Fish, Wildlife and Parks biologists are exploring the effects of reservoir drawdowns—water releases for power generation. flood control or other water management activies-on game fish. MDFWP is evaluating the distribution of fish, their use of various reservoir zones, and the timing of the alterations of each zone's physical parameters as they relate to important life stages of the fish. From the data, they will be able to predict the effets of hydro operations on resident fisheries and recommend seasonal drawdown levels that are compatible with the needs of the fish. The two studies should be completed by FY 1988.

Cabinet Gorge Kokanee Hatchery (Project No. 84-19)

Construction and operation of the Albeni Falls and Cabinet Gorge hydroelectric projects has affected the kokanee population in Lake Pend Oreille in northern Idaho. This project calls for building of a fish hatchery on the Clark Fork River to mitigate for those facilities. Funding will be supplied through a three party cooperative agreement. BPA and Washington Water Power will each provide 50 percent of the cost of design and construction and Idaho Department of Fish and Game will fund the operation and maintenance. Work will begin in FY 1985 and the hatchery should be in operation in FY 1987.

BPA-funded studies will look at hydroelectric impacts on bighorn sheep and other big game species.
USFWS photo.

WILDLIFE



The impact of Pacific Northwest hydroelectric development reached beyond the rivers and streams into the surrounding hillsides. Habitat was diminished or altered not only for aquatic creatures but for wildlife as well.

Critical floodplain and riparian habitat was lost when reservoirs filled. Waterfowl in the Pacific flyway lost island nesting habitat. The rising and falling of reservoir water levels left streamside areas bare. exposing animals as they travel to the water. Wetland and riparian vegetation was changed. These changes to the habitat were severe enough, in some cases, to alter the composition of wildlife species and. in other cases. to render species more vulnerable to predators.

Big game wintering range was lost when rivers suddenly became lakes. Biologists report that wintering grounds are one of the more important factors limiting big game populations. The future of many species lies not only in the quantity but the quality of the winter range. Most animals spend their summers on high mountain slopes within the national parks and the wilderness areas of national forests. The deep crusty snows of winter force them from their luxurious mountain pastures to valleys. There, they may have to compete with domestic livestock for dry, dormant. overgrazed vegetation. low in nutrients. Often. the effects of winter on malnourished animals are felt long after the snow has melted.

South facing slopes in the valley bottoms are also the first to green-up in spring. It is there that the females give birth. Without fresh early spring grasses. lactating females continue feeding on low-protein forage. Lack of a high-protein diet is directly tied to offspring mortality. Yet, for much of the Columbia Basin's wildlife, wintering and spring green-up lands are now at the bottom of reservoirs.

In 1984. BPA funded 7 studies to address these wildlife concerns.

Wildlife: Project Descriptions

Impact of Water Levels on Canada Geese (Project No. 83-2) Evaluation of the Effects on Wildlife and Wildlife Habitat Associated with Development of Hydroelectric Projects in Montana (Project No. 83-464) Impacts of Water Levels on Productivity of Canada Geese in the Northern Flathead Valley (Project No. 83-498)

Biologists working for the Salish-Kootenai Tribes are studying Canada geese on Flathead Lake and the lower

Flathead River in Montana (83-Z). Their objective is to determine the effect on nesting success, gosling survival, and changes in riparian nesting habitat that has resulted from the operations of Kerr and Hungry Horse clams. They will recommend measures to mitigate for losses and to protect the geese populations from further degradation.

Through FY 1985 and FY 1986. they will concentrate on gathering data. Data analysis and recommendations for mitigation and enhancement activities for Canada geese will be ready in FY 1987.

Montana Department of Fish, Wildlife and Parks is conducting two related studies. In project 83-464. they are evaluating the effects of Hungry Horse, Libby and three Clark Fork clams on wildlife and wildlife habitat. In the first phase of the project. they estimated net losses of wildlife species, habitat types and habitat acreage. In the second phase they developed mitigation plans. The Council will consider these plans for further action in FY 1985.

In project 83-498. MDFWP is inventorying Canada goose nesting and brooding habitats and evaluating nesting success and gosling survival on the upper Flathead River. With study findings. biologists will develop strategies and determine how best to manage geese under given water level constraints. The focus of the study will be data collection in 1985. Recommendations will be prepared in FY 1986.

Willamette River Projects Wildlife Mitigation anti Enhancement Planning (Project No. 84-36) Palisades Dam Wildlife Mitigation and Enhancement Planning (Project No. 84-37)

Inundation and water level fluctuations at the Federal Willamette River hydroelectric facilities in Oregon and at the Palisades Dam on the South Fork of the Snake River in Idaho have also affected wildlife and wildlife habitat.

In the first phase of the studies, researchers are looking at the impacts of construction and operation of the facilities and will prepare estimates of losses to wildlife populations and wildlife habitat. In Phase II of the project. they will develop mitigation plans and identify wildlife and habitat mitigation and enhancement opportunities. Phase II is scheduled for completion in FY 1986. The mitigation plans will be submitted to the Council for adoption into the Program. Projects to enhance and mitigate for losses of affected species will be identified later.

Ural-Tweed Bighorn Sheep, Wildlife Mitigatlon Projects (Project No. 84-38) and (Project No. 84-39)

Important segments of the Ural-Tweed bighorn sheep spring and winter range have been lost to development and the impoundment of the Kootenai River by Libby Dam. The formation of Lake Koocanusa inundated approximately 4,350 acres of crucial range.

The U.S. Forest Service's Kootenai National Forest will work to improve existing habitat conditions by developing new grass stands and rejuvenating existing grass and shrub stands that are in poor condition. Subsequently, the Montana Department of Fish, Wildlife and Parks will monitor herd response to vegetation treatments. Approximately 1,500 acres of the critical spring and winter range should have a greater capacity to support bighorn sheep as a result of these efforts. The projects were initiated in FY 1984 and should be completed in FY 1988.

*GPO 596 - 035 (1985)

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