

DWORSHAK DAM IMPACTS ASSESSMENT

8709900

SHORT DESCRIPTION:

Optimize the resident fishery of the reservoir which is severely limited by entrainment losses. Limit losses to keep kokanee densities at 30 -50 adult fish/ha. Explore ways to avoid losses using selective water withdrawal and behavioral avoidance devices. Develop reservoir resident fish loss assessments due to the operation of Dworshak Dam.

SPONSOR/CONTRACTOR: IDFG

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SUB-CONTRACTORS:

na

GOALS

GENERAL:

Supports a healthy Columbia basin, Maintains biological diversity, Increases run sizes or populations, Provides needed habitat protection, Adaptive management (research or M&E)

RESIDENT FISH:

Research, M&E

NPPC PROGRAM MEASURE:

10.3C; 10.3C.1; 10.3C.2; 10.3C.3; 10.3C.5; 10.3C.6; 10.3C.7

RELATION TO MEASURE:

This research project conducts the activities specified in the above measures.

TARGET STOCK

Early spawning kokanee

LIFE STAGE

All

MGMT CODE (see below)

N, RSH

AFFECTED STOCK

Cutthroat trout

Rainbow trout

BENEFIT OR DETRIMENT

Beneficial

Beneficial

BACKGROUND

STREAM AREA AFFECTED

Stream name:

North Fork Clearwater River

Stream miles affected:

54

Hydro project mitigated:

Dworshak Dam

LAND AREA INFORMATION

Subbasin:

Clearwater River

Land ownership:

public

Acres affected:

16,000

Habitat types:

Reservoir

HISTORY:

An entire run of B strain steelhead and chinook were lost with the construction of Dworshak Dam in 1973. In 1987 to 1991 project identified entrainment losses as driving kokanee populations and destabilizing kokanee fishery. In 1991 to 1994 project reviewed options for the reservoir under the SOR. In 1993 and 1994 we used selective withdrawal to minimize kokanee losses in low water years. In 1995 selective withdrawal and changes in discharge timing were utilized and achieved record high numbers of kokanee in a normal water year. In 1996, winter flooding flushed most (>95%) of the kokanee out of the reservoir and the fishery nearly disappeared. This year the project will begin testing strobe lights to see if kokanee can be scared away from the

turbine intakes. In the future, project results will be used to develop biological and integrated rule curves. The project will also be instrumental in developing resident fish losses assessments.

BIOLOGICAL RESULTS ACHIEVED:

From 1981 to 1992 Dworshak kokanee abundance varied between 5 and 30 adult kokanee/ha. Utilizing selective withdrawal and changes in discharge timing resulted in record high numbers of kokanee; 70 kokanee/ha in 1994 and 80 kokanee/ha in 1995. Kokanee fishery increased markedly to a total harvest of 150,000 to 200,000 fish annually. In 1996 we documented the loss of over 1 million kokanee through the dam, which devastated the fishery. We learned when and how these entrainment events occur. This finding directed our study to its current course.

PROJECT REPORTS AND PAPERS:

Annual progress reports were published by BPA since 1987.

ADAPTIVE MANAGEMENT IMPLICATIONS:

Last year we learned that utilizing selective water withdrawal was not sufficient to prevent kokanee entrainment losses during winter floods. We therefore changed the direction of the project from fine tuning selective withdrawal to testing behavioral avoidance devices. Our objective is the same, but we learned we need to try an additional new approach. If entrainment losses can be minimized at Dworshak, it would have far reaching implications to how systems such as Lake Roosevelt and Libby Reservoir could be managed. Drawdowns for flood control, salmon flows, and power production could all be done with less of an impact on resident fisheries. This may allow more flexibility in a projects biological rule curves.

PURPOSE AND METHODS

SPECIFIC MEASUREABLE OBJECTIVES:

To reduce the entrainment losses of kokanee so that densities of 30-50 adult kokanee/ha can be maintained in the reservoir on an annual basis .

To optimize the kokanee fishery in the reservoir; provide catch rates of 0.7 fish/hr with a mean size of 12".

To design rule curves for dam operation which include methods to minimize entrainment losses.

To maintain reservoir productivity at its current level while utilizing selective water withdrawal to avoid kokanee losses.

CRITICAL UNCERTAINTIES:

How to prevent massive entrainment losses of year classes of kokanee.

BIOLOGICAL NEED:

Kokanee are potentially the best fish at providing a fishery in highly fluctuating reservoirs. Their one big weakness is that they are highly entrainable through dam structures. If this weakness could be solved, fisheries of over 200,000 fish in the harvest could be maintained on Dworshak Reservoir and other reservoirs in the Columbia drainage.

HYPOTHESIS TO BE TESTED:

The alternative hypothesis is that selective water withdrawal can be utilized to minimize kokanee entrainment losses and significantly increase kokanee densities in the reservoir. The null hypothesis is that kokanee will not be protected by the use of selective water withdrawal. The second alternative hypothesis is that strobe lights can be used to direct kokanee away from a given area. The null hypothesis is that strobe lights will have no effect on kokanee distribution.

ALTERNATIVE APPROACHES:

An alternate approach was to use sound to scare kokanee away from the dam. Tom Carlson, Battelle, conducted a literature review on sound and fish. Based on his results, it did not appear that sound was likely to work.

JUSTIFICATION FOR PLANNING:

na

METHODS:

- a. Depth distribution of kokanee in front of the dam will continue to be monitored during the day and at night using split-beam hydroacoustics. Recommendations will be made to the Army Corps on where to selectively withdraw water to avoid the depths utilized by kokanee. Population in the entire reservoir will be monitored for significant changes by Hauser type mid-water trawling. Trawling is conducted by a stratified random design. Normal statistics will be applied to determine significant changes in population estimates.
- b. A group of four large strobe lights will be lowered from a boat into the densest part of the kokanee layer during the night. Hydroacoustic surveys will be conducted to measure kokanee density in the vicinity of the lights while they are flashing, and while they are shut off. Pilot studies will be conducted to determine sample sizes and appropriate statistical procedures.

PLANNED ACTIVITIES

SCHEDULE:

Planning Phase	Start 7/1987	End 10/87	Subcontractor
Task Initial project planning set up a study design to monitor entrainment losses, test avoidance devices, monitoring the fishery, and examining reservoir productivity.			
Implementation Phase	Start 1993	End 1993	Subcontractor yes
Task Project planning reviewed. RASP planning methodology applied to project.			
O&M Phase	Start 1/1994	End 12/96	Subcontractor no
Task Test use of selective water discharge to determine if kokanee losses could be minimized.			
O&M Phase	Start 1/1997	End 10/1999	Subcontractor no
Task Test behavioral avoidance devices on kokanee and determine if suitable for installation on Dworshak Dam.			

PROJECT COMPLETION DATE:

2003

CONSTRAINTS OR FACTORS THAT MAY CAUSE SCHEDULE OR BUDGET CHANGES:

None known

OUTCOMES, MONITORING AND EVALUATION

SUMMARY OF EXPECTED OUTCOMES

Expected performance of target population or quality change in land area affected:

The following items will be achieved: A quality resident fishery for anglers will be provided. Harvests will exceed 200,000 kokanee /year. Knowledge of how kokanee losses through dams can be avoided. Knowledge of the distribution of kokanee in a reservoir and near dam structures. How to maintain resident fisheries in spite of withdrawals of water for anadromous fish. An improved kokanee population will provide forage for bull trout, large cutthroat trout, and smallmouth bass.

Present utilization and conservation potential of target population or area:

The present utilization potential of kokanee is very high. They have demonstrated that they can provide exceptional fisheries even when the reservoir is drawn down 80 feet during the year. However, in years when entrainment losses are high, the fishery may drop to > 20% of its previous level.

Assumed historic status of utilization and conservation potential:

Creel surveys were conducted in 1989, 1990, and 1991. They documented the harvest of kokanee.

Long term expected utilization and conservation potential for target population or habitat:

In the long term, we hope to establish kokanee as a major fishery, and have enough surplus to the population to sustain predation

by other species of fish. This will help to replace the lost angling due to construction of Dworshak Dam.

Contribution toward long-term goal:

If successful, the project will help to keep kokanee in the reservoir, thereby increasing their abundance.

Indirect biological or environmental changes:

With higher kokanee densities other non-target predators will have more feed. Also, kokanee carcasses will fertilized small tributaries as they spawn and die by the hundreds of thousands.

Physical products:

We have shown that kokanee abundance can be increased from a few hundred thousand fish to about 1.3 million fish.

Environmental attributes affected by the project:

Changing selector gate settings in the winter and early spring may cause discharged water to change temperature by a minor amount. Close consultation with Dworshak National Fish Hatchery (located below the dam) is needed before any changes can be made.

Changes assumed or expected for affected environmental attributes:

Changes due to this project will be minor: possibly a 1 to 2 degree temperature change in discharge water for one to two months each year.

Measure of attribute changes:

na

Assessment of effects on project outcomes of critical uncertainty:

The critical uncertainties are designed into the experimental tests within the project. Once testing is completed, the effect of the uncertainties will be known.

Information products:

Project provides annual progress reports, quarterly reports, and papers that are presented at American Fisheries Society and International Kokanee Workshop meetings.

Coordination outcomes:

Results of the project will be coordinated with the US Army Corps of Engineers, the Nez Perce Tribe, BPA, and other kokanee researchers in the region.

MONITORING APPROACH

This project can be monitored by the knowledge that we have gained. Do we now know the depth distribution of kokanee near the dam? Do we know what time of year is critical for entrainment losses? Do we know if strobe lights can be used to keep fish away from Dworshak Dam? Do we know how the dam's selector gates can be used to minimize kokanee losses?

Provisions to monitor population status or habitat quality:

We monitor the kokanee population annually by trawling and hydroacoustic surveys to density, abundance, and year class strength. Population estimates are accurate within +/-25%.

Data analysis and evaluation:

Data from trawling is analyzed using normal statistics for a stratified random sampling design. Strobe light testing will be analyzed by analysis of variance.

Information feed back to management decisions:

State fishery managers are briefed on project results as they occur. Annual project review meetings are also held.

Critical uncertainties affecting project's outcomes:

The critical uncertainties will be resolved by conducting the specified tests within the project.

EVALUATION

For this year: Winter depth distribution of kokanee near Dworshak Dam will be determined and a selector gate recommendation made. Population estimates of kokanee in the reservoir will be made and related to flow through the dam. Strobe lights will be tested and the kokanee reaction determined.

Incorporating new information regarding uncertainties:

Project study designs are reviewed and modified if needed each fall.

Increasing public awareness of F&W activities:

We submit news releases several times each year. We give presentations to local chambers of commerce. We have numerous contacts with anglers on the reservoir.

RELATIONSHIPS

RELATED BPA PROJECT

8740700 Project is related to one developed by the Nez Perce Tribe. Addresses item 10.3C.4 in the Council's program.

RELATIONSHIP

The Tribe is conducting separate studies on the reservoir to develop integrated rule curves.

OPPORTUNITIES FOR COOPERATION:

The project has been done with the cooperation of the Nez Perce Tribe.

COSTS AND FTE

1997 Planned: \$167,300

FUTURE FUNDING NEEDS:

PAST OBLIGATIONS (incl. 1997 if done):

<u>FY</u>	<u>\$ NEED</u>	<u>% PLAN</u>	<u>% IMPLEMENT</u>	<u>% O AND M</u>
1998	\$180,000	5%	70%	25%
1999	\$180,000	5%	70%	25%
2000	\$190,000	5%	70%	25%
2001	\$190,000	5%	70%	25%
2002	\$190,000	5%	70%	25%

<u>FY</u>	<u>OBLIGATED</u>
1987	\$111,100
1988	\$124,309
1989	\$147,816
1990	\$135,500
1992	\$123,660
1993	\$203,275
1994	\$266,830
1995	\$26,830
1996	\$169,020
1997	\$167,300

TOTAL: \$1,475,640

Note: Data are past obligations, or amounts committed by year, not amounts billed. Does not include data for related projects.

LONGER TERM COSTS: Estimated costs for operation and maintenance of \$100,000 / yr.

1997 OVERHEAD PERCENT: 24%

HOW DOES PERCENTAGE APPLY TO DIRECT COSTS:

Applies to the sum of personnel and operating costs. (Overhead does not apply to capitol outlay items.)

CONTRACTOR FTE:

Indicate how many people are directly employed on this project with the primary contractor (not including administrative support funded through overhead charges). 2 1/2

SUBCONTRACTOR FTE: 0

SUPPLEMENTAL RESIDENT FISH EVALUATION FACTORS:

Specific measurable objectives have been developed for this reservoir and project. They have been incorporated into Idaho Fish and Game's 5-year management plans. Dworshak Reservoir is drawn-down about 80 feet each fall to provide water for anadromous fish flows. Our project has demonstrated that this can be accomplished without impacting the reservoir's kokanee population. Biological rule curves for kokanee are being developed which incorporate the needed anadromous draw downs. The project therefore has some very direct benefits to anadromous fish. This reservoir is the largest resident fishery in the Clearwater Drainage of Idaho. About 80% of the fishing effort is for kokanee. To this Region it is a very important fishery.