

LAKE ROOSEVELT MONITORING / DATA COLLECTION PROGRAM

9404300

SHORT DESCRIPTION:

Monitor and evaluate the effects of mitigation activities and Columbia River Operations on the biota in Lake Roosevelt. Based on the information collected by this and other projects, develop biological / integrated rule curves.

SPONSOR/CONTRACTOR: Spokane Tribe
Spokane Tribe of Indians
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SUB-CONTRACTORS:
Washington Department of Fish and Wildlife (WDFW),
Colville Tribal Fisheries Department.

GOALS

GENERAL:

Supports a healthy Columbia basin, Maintains biological diversity, Maintains genetic integrity, Increases run sizes or populations, Provides needed habitat protection

RESIDENT FISH:

Research, M&E

NPPC PROGRAM MEASURE:

10.8B.5

RELATION TO MEASURE:

Collects necessary data to monitor and evaluate Lake Roosevelt biota and to construct required rule curves for Lake Roosevelt. Data will also be used to assess success and/or effectiveness of other program measures (10.8B.2 to 10.8B.4, 10.8B.9, 10.8B.11 and 10.3E3 to 10.3E.5).

BIOLOGICAL OPINION ID:

Task No. 2.1.d of proposed recovery plan for Snake River salmon; òConduct monitoring, evaluation and research to support flow augmentation effortsó.

TARGET STOCK

All other resident fishes in Lake Roosevelt
Walleye
Rainbow Trout
Kokanee Salmon

LIFE STAGE

MGMT CODE (see below)

N, RSH
N, RSH
S, W, A, RSH
S, W, A, RSH

BACKGROUND

STREAM AREA AFFECTED

Stream name:

Franklin D. Roosevelt Lake - Grand Coulee Dam Reservoir

Stream miles affected:

181 mi. - Includes Spokane and San Poil Rivers.

Hydro project mitigated:

Grand Coulee Dam - BOR

LAND AREA INFORMATION

Subbasin:

Upper Columbia River

Land ownership:

Public - Federal

Acres affected:

82,754

HISTORY:

The Lake Roosevelt Monitoring / Data Collection Program is the result of a merger between two projects, the Lake Roosevelt Mon

itoring Program (BPA No. 8806300) and the Lake Roosevelt Data Collection Project (BPA No. 9404300). These projects were merged because each required support staff and data from the other project to complete its deliverables.

The Lake Roosevelt Monitoring Program began July 1988. The intent of the project was to: (1) determine the status of fish stocks in Lake Roosevelt before construction of habitat improvement projects and hatcheries; (2) Evaluate contribution of habitat improvement projects and hatcheries to the Lake Roosevelt Fisheries, (3) provide recommendations to hatcheries for outplanting strategies which maximizes harvest of kokanee and rainbow trout and kokanee egg collection.

In 1991, the Lake Roosevelt Data Collection Project began operating under the Lake Roosevelt Monitoring Project Contract Number. The purpose of the Data Collection Project was to assist the resident fish workgroup of the System Operation Review with the development of the EIS. The Project collected data on biotic indices of Lake Roosevelt believed to be effected by the operations of Lake Roosevelt. Those indices included zooplankton density and biomass, water quality, fish growth and fish entrainment through Grand Coulee Dam. In 1994, the Data Collection Project was given its own contract and project number. The merged project, Lake Roosevelt Monitoring / Data Collection Program, combined efforts in 1996 to continue the work historically completed and identify data needs to develop a biological rule curve for Lake Roosevelt.

BIOLOGICAL RESULTS ACHIEVED:

This project is a research project and does not have a direct effect on the number or quality of fish, habitat or wildlife in Lake Roosevelt. However, recommendations from this project to mitigation projects and federal operators of Lake Roosevelt has had a positive effect on the fishery. The number of kokanee harvested and returning to egg collection facilities has increased over 4 fold over the past three years. The rainbow trout and walleye harvest has grown from 5 to 20% a year over the past five years.

PROJECT REPORTS AND PAPERS:

Lake Roosevelt Monitoring Project Annual Reports received by BPA are 1989, 1990, 1991, 1992, 1993, 1994 and 1995. The 1996 annual report is currently being assimilated. Monthly progress reports are available from May 1993 - December 1995. Quarterly progress reports are available from June 1996 through June 1997. Lake Roosevelt Data Collection Project annual reports received by BPA are 1991, 1992, 1993, 1994 and 1995. The 1996 annual report is currently being assimilated. Monthly progress reports are available from June 1991 through December 1995.

ADAPTIVE MANAGEMENT IMPLICATIONS:

This project has recommended changing the outplanting strategies of hatchery reared kokanee from age 0+ to age 1+. Kokanee outplanted as 0+ age fish were not readily observed in the creel. We believe the 0+ fish were being entrained out of Lake Roosevelt and predators were readily consuming fry. Kokanee released as 1+ fish are more plentiful in the creel and at egg collection facilities.

The rainbow trout raised in net pens are released later in the spring than in the past. Entrainment was believed to have a large effect on the number of rainbow trout available for harvest. Through Floy tag studies we were able to show that fish released later in the spring were more abundant in the harvest than early spring releases. As a result, a greater number of rainbow trout are now harvested due to the change in release times.

The release strategies recommendations are examples of adaptive management strategies of the fishery in Lake Roosevelt that resulted from this project.

Past results have provided an understanding of basic fishery dynamics in Lake Roosevelt which will be used in determining future research needs and direction.

PURPOSE AND METHODS

SPECIFIC MEASUREABLE OBJECTIVES:

Table 1. Biological Objectives for Lake Roosevelt.

Species/Stock/HarvestGoal (#)/Escapement Goal (#)//Total Adult Fish#/lbs//YearAchieved
kokanee/hatchery//290,000//10,000//300,000//2.0//2000
kokanee (adfluvial)/wild//120,000//60,000//180,000//1.5//*
rainbow trout/net pen//190,000//NA//190,000//2.0//1997
rainbow trout (interim-adfluvial)/wild//12,000//6,000//18,000//2.0//2000
rainbow trout (adfluvial)/wild//150,000//74,000//224,000//2.0//Finalt
walleye/wild//131,000//U//131,000//1.5//1996

NA = not applicable, U = unknown at the present time., * = target date will be determined upon completion of baseline

investigations, t = target date will be determined after interim goal is achieved. Other measurable objectives include construction of biological (2000) and integrated (2001) rule curves for Lake Roosevelt to help balance costs/benefits of reservoir operations to all stakeholders.

CRITICAL UNCERTAINTIES:

Uncertainties include the extent to which recommended hydro-operations can be implemented to balance benefits to the resident fishery and other stakeholders. No direct risks to other stocks/populations are thought to be associated with implementation of this project.

BIOLOGICAL NEED:

The natural production of kokanee and rainbow trout in Lake Roosevelt is limited due to a lack of habitat and prohibitive lake operations. Current operations of Lake Roosevelt impair or prohibit shore line spawning for most of the sport fish in the lake. Lake Roosevelt is a large body of water with relatively few tributaries. Tributaries could not produce the number of fish necessary to sustain a fishery in this size of lake even if fully seeded. Thus, the artificial production component is a key aspect of managing the fishery in the Lake.

This project also addresses questions concerning survival and spawning return potential of kokanee and rainbow trout in Lake Roosevelt. One of the objectives of this project is to enable hatchery facilities to establish and maintain self sustaining egg sources for these species.

Lake production is being affected by declines in nutrient loading that may result in declining fish growth and production rates. This project will examine water quality, including nutrient levels/availability, and relate reservoir operations to changes in both water quality and fish production.

Reservoir operations affect fish survival and spawning success in Lake Roosevelt. The study will define the affects of reservoir operations, and will develop biological and integrated rule curves in the combined interest of reservoir operation and resident fishery concerns.

HYPOTHESIS TO BE TESTED:

Based on the measurable objectives written above, the hypothesis is: Biological / integrated rule curves will be effective in developing meaningful recommendations for reservoir operations with respect to both a successful resident fishery and downstream water concerns.

ALTERNATIVE APPROACHES:

Maintenance of status quo has been rejected as a viable option to achieving project objectives as described in the following reports to BPA; Peone et al. (1990, Project No. 88-63), Griffith and Scholz (1991, Project No. 88-63), Griffith and McDowell (1993, Project No. 94-43), Thatcher et al.(1993, Project No. 88-63), and the current 1993-1995 annual reports of this project.

JUSTIFICATION FOR PLANNING:

This project should result in direct benefits to fishery resources in Lake Roosevelt. WDFW, Colville Tribe, Spokane Tribe, and other stakeholders will develop a model to predict effects of hydrologic management actions on various trophic levels in Lake Roosevelt.

METHODS:

A) Research

I. Collect habitat data

- a) Develop a bathymetric map of Lake Roosevelt in a GIS System
 - i) Fund BOR or other entity to complete a GIS map of the lake
 - ii) Collect bathymetric sounding of lake to verify accuracy of GIS Map
- b) Collect data and build map layer for vegetation (both shore and aquatic) and substrate type (seasonal, subsample reservoir)
- c) Vertical profile water quality data for nutrient levels and metal loads (monthly at nine sites)
- d) Vertical profile water quality by hydrolab (weekly at nine sites)

II. Collect primary productivity data

- a) Vertical profile chlorophyll a (twice a month at nine sites)
- b) Collect phytonlankton samples for identification and enumeration (twice a month at nine sites for first year then seasonally)

after that using chlorophyll a as surrogate)

- c) Conduct carbon 14 uptake experiment to estimate primary production rates (nine sites seasonally)

III. Collect secondary productivity data.

- a) Collect zooplankton via vertical pulls with Wisconsin styled plankton net (twice a month at nine sites)
- b) Place 202 micron mesh bags in situ with zooplankton (seasonally for a week)
 - i) collect zooplankton via Wisconsin net from both bag and lake (daily)
 - ii) develop zooplankton life history tables
- c) Collect zooplankton near shore and offshore to determine differences in density and species composition
- d) Collect macroinvertebrate samples via an Eckman Dredge

IV. Collect population dynamics data on target fish species

- a) Trawl and purse seine for pelagic species targeting all life history stages (Monthly or seasonally)
- b) Trap, gillnet and electrofish littoral fish species or fish in littoral zone.
- c) Conduct multiple mark - recapture studies to attain population estimates of target species, specifically walleye (year round)
- d) Plot fish distribution and estimate population density by mobile hydroacoustics (monthly or seasonally)

V. Collect angler use data

- a) Conduct a year round reservoir wide creel survey
- b) Conduct augmented creel surveys
- c) Reference fish guide journals
- d) Angler journal program

VI. Collect emigration / entrainment data

- a) Floy tag net pen rainbow trout and kokanee prior to release.
- b) Plot fish distribution and estimate population size at the forbay with mobile hydroacoustics
- c) Collect fish at dams below Grand Coulee (winter through fall, daily)
- d) Gill net at face of dam and conduct hydroacoustics at spill way, regulation tubes and turbines

VII. Collect return efficiency data on hatchery origin kokanee

- a) Tag kokanee with coded wire tags (fall)
- b) Adipose clip all hatchery origin fish (fall)
- c) Imprint fish with morpholine at swim-up (winter)
- d) Drip morpholine at release sites (fall)
- e) Intensively sample spawning adults to determine return rates for groups (trap and electrofish in fall)

VIII. Tributary data collection

- a) Measure habitat availability
- b) Trap spawning adults and fry emigrating from tributaries
- c) Estimate seasonal population density of tributaries

B) Model Development

I. Columbia River hydro-ops model and Lake Roosevelt detailed hydro-ops model (physical based model)

- a) Obtain CRITFC's beta version Columbia River hydro-Ops model
- b) Determine how to develop a hydro-ops model for Lake Roosevelt which will plug in to the CRITFC model
- c) Use bathymetric map to determine changes in lake volume, flow, littoral area with each foot of drawdown and change in inflow/outflow

II. Biological Model of Lake Roosevelt

- a) Build a plug-in for biological model to the hydro-ops model
- b) Model the effect of biotic and abiotic factors on each trophic level based on historic data and data collect over the next three years

III. Monitor and evaluate model once recommended operations are implemented

PLANNED ACTIVITIES

SCHEDULE:

Planning Phase **Start** 1997 **End** 2005 **Subcontractor** WDFW, EWU, CCT, and others

Task Develop a plan of operations for Lake Roosevelt that maximizes benefits to all stakeholders including (but not limited to) resident fisheries, power production, flood control, and downstream salmonid issues. Develop biological and integrated rule curves for Lake Roosevelt using past data and data to be collected during this study. A biological rule curve will be presented to the Council in 2000. An integrated rule curve will be presented in 2001. The rule curve will be evaluated through the year 2005.

Implementation Phase **Start** 2002 **End** 2005 **Subcontractor** WDFW, CCT

Task Implement integrated rule curve upon Council approval in 2002.

O&M Phase **Start** 2001 **End** 2005 **Subcontractor** WDFW, CCT

Task Continue this program at least through the year 2005 to effectively monitor and modify rule curves and assess benefits to all stakeholders resulting from their implementation.

PROJECT COMPLETION DATE:
2005

CONSTRAINTS OR FACTORS THAT MAY CAUSE SCHEDULE OR BUDGET CHANGES:

Unexpected changes in water demands resulting from (but not limited to) NMFS changes in salmonid recovery plans, regional flood control needs, etc...Unexpected hatchery catastrophe (i.e. disease) resulting in loss of fish study groups.

OUTCOMES, MONITORING AND EVALUATION

SUMMARY OF EXPECTED OUTCOMES

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

Each year meet or exceed the measurable objectives identified herein.

Present utilization and conservation potential of target population or area:

Utilization has been estimated at 231,202 angler trips to Lake Roosevelt in 1995 resulting in expenditures over 8.5 million dollars (see 1995 report). Important target species in the Lake Roosevelt fishery include kokanee, rainbow trout and walleye. Due to poor reproductive potential of kokanee and rainbow trout resulting from reservoir operations, conservation potential of these species is poor without supplementation activities. This project aims to maximize survival, harvest and spawner returns of hatchery and net-pen reared kokanee and rainbow trout in Lake Roosevelt.

Assumed historic status of utilization and conservation potential:

Historic utilization data indicates approximately 262,000 angler hours in 1989 resulting in an estimated value of 5.2 million dollars (Peone et al. 1990). Similar use was estimated for 1988 based on creel surveys conducted in fall, 1988. The sport fishery prior to 1988 consisted mainly of naturally reproducing walleye and net pen reared rainbow trout. Recommendations made in 1985 (Beckman et al 1985) suggested that more stringent management strategies were necessary to conserve the walleye population in Lake Roosevelt.

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

Goals are to maximize harvest and spawner returns of kokanee and rainbow trout in Lake Roosevelt under realistic reservoir operations (as defined by biological and integrated rule curves). Utilization would be expected to increase with increased harvest potential, and supplementation activities will obtain self sustaining egg sources from within the Lake Roosevelt fishery.

Contribution toward long-term goal:

This project will provide data necessary to model reservoir and fishery dynamics and will lead to construction of biological and integrated rule curves for Lake Roosevelt. In doing so, this project will directly allow for attainment of long term goals for Lake Roosevelt fisheries and operations.

Indirect biological or environmental changes:

Project may benefit downstream ecosystems through a more stable upstream ecosystem. Discharge from Lake Roosevelt affects water quality and production potential in downstream reservoirs.

Physical products:

Approximately 500,000 to 1 million tagged (coded wire tags) kokanee salmon annually. Approximately 20,000 tagged (floy tags) and 500,000 marked (adipose clipped) rainbow trout annually.

Environmental attributes affected by the project:

Implementation of biological and integrated rule curves are expected to stabilize seasonal fluctuations in water levels, water temperatures, flows, nutrient assimilation/production rates, zooplankton and fish growth rates, and fish survival in Lake Roosevelt. Impacts to human use are expected to be positive and result in increased opportunity for recreational fishing and increases in fish harvest rates.

Changes assumed or expected for affected environmental attributes:

Near term increases in harvest rates and fishing opportunities are expected as research continues to define improved release and rearing strategies for kokanee and rainbow trout. Long term improvements will be stabilization of the overall ecosystem and habitat in Lake Roosevelt. Long term increases in fishing opportunities and harvest rates are expected as the project continues and management recommendations are implemented.

Measure of attribute changes:

See Table 1 presented in Section 3 (specific measurable objectives).

Assessment of effects on project outcomes of critical uncertainty:

Biological and integrated rule curves to be developed will address uncertainties by addressing the water needs of all stakeholders involved with Lake Roosevelt system operations.

Information products:

The following will be presented in monthly and annual reports to the funding agency; Models of population and system dynamics in Lake Roosevelt, Biological and integrated rule curves for Lake Roosevelt to assist in systems operation decisions, Evaluation and monitoring of the effectiveness of rule curves in managing the Lake Roosevelt operations, and assessment of changes in Lake Roosevelt biota resulting from implementation of rule curves.

Coordination outcomes:

Assist with EIS on resident fish workgroup Systems Operation Review. Data collections necessary to fill informational gaps were incorporated into the study design. In addition, it assists in information gathering for project 88-063-00 (Lake Roosevelt Monitoring and Evaluation). Project will result in a fisheries management plan for Lake Roosevelt.

MONITORING APPROACH

Conduct creel surveys to determine changes in angler use, catch rates, and composition, fish growth and condition, and angler contribution to the local economy.

Conduct relative abundance surveys by electrofishing, hook and line, gill netting, and/or trawling to assess changes in the overall fishery. Evaluate success of hatchery release strategies and kokanee homing studies by reviewing data on tag returns including spawner return rates.

Monitor changes in zooplankton in Lake Roosevelt and Rufus Woods. Verify zooplankton population dynamics models using data on water quality, water retention time, water temperature, and fish predation in years other than those used to construct the

model(s).

Monitor numbers of kokanee and rainbow trout entrained through Grand Coulee Dam by creel surveys at Rufus Woods Reservoir and tagged fish collection at Rock Island Dam fish passage facility.

Monitor spawner return rates of kokanee and rainbow trout to assess variability in annual return rates and the effects (if any) of imprinting with synthetic chemicals.

Validate biological and integrated rule curves with continued monitoring of the effects on various stakeholders following implementation.

Provisions to monitor population status or habitat quality:

This project includes completion of biological rule curve in 1998, and of the integrated rule curve in 1999, with monitoring until 2005. Future monitoring included in the project scope will determine project effects on target species (kokanee, rainbow trout and walleye) as well as on the general hydrology and biota of Lake Roosevelt.

Data analysis and evaluation:

Data will be used to construct and test models predicting impacts of hydrologic management actions on various trophic levels.

Information feed back to management decisions:

The Spokane Tribe of Indians in cooperation with WDFW and CCT will utilize all data and information resulting from this project to update and advance their management goals, objectives, and activities on Lake Roosevelt. The fish managers will disseminate information from this project via BPA reports and general communication of results to and cooperation with other regional management authorities.

Critical uncertainties affecting project's outcomes:

Determine critical needs (not wants) of all significant stakeholders in terms of Lake Roosevelt water allocation, and utilize this information when constructing rule curves for water allocation. It may be necessary to have this procedure completed by a party that holds no stake in water allocation from Lake Roosevelt (i.e. an outside, unbiased party).

EVALUATION

Improvements to the Lake Roosevelt fishery; monitor long term changes and compare with project objectives listed in Section 3 (specific measurable objectives). Examine long term success of creating a self sustaining egg source for supplementation activities in Lake Roosevelt. Examine effects of integrated rule curve implementation on objectives of other stakeholders, and determine if using integrated rule curves effectively balances concerns of all stakeholders.

Incorporating new information regarding uncertainties:

Adaptive management strategies will be used to the greatest extent possible to allow incorporation of new information into both research and management activities throughout the duration of this project. Information will be evaluated and its effect on research and management objectives and results will be assessed as the information is made available. All relevant information will be addressed with modifications to modeling and data analysis procedures to ensure our reporting the most accurate results possible.

Increasing public awareness of F&W activities:

The Lake Roosevelt fishery is highly utilized by local recreationists and sportsman (See summary of expected outcomes, section B). Any measurable enhancements to the fishery will reflect favorably upon the regions protection, mitigation and enhancement efforts. Additionally, the performance of year round creel surveys creates an opportunity for creel clerks to inform the public of current research efforts and objectives, and for the public to ask any questions that they may have. Production of annual reports available to the public through the researching and funding agencies will also provide a source of public awareness and education.

RELATIONSHIPS

RELATED BPA PROJECT

NPPC No. 10.8B.26

RELATIONSHIP

The Native Fish Stock Status will provide information essential to the development of biological / integrated rule curves.

9502700	The Lake Roosevelt Sturgeon project will provide information essential to the development of biological / integrated rule curves.
9501100 Chief Joseph Kokanee Enhancement Project	The Chief Joseph Kokanee Enhancement Project will provide information essential to the development of biological / integrated rule curves.
9001800 Habitat Improvement - Lake Roosevelt	The Habitat Improvement Project will provide information essential to the development of biological / integrated rule curves.
9500900 Lake Roosevelt Rainbow Trout Net Pens	Kokanee salmon and rainbow trout outplanting into Lake Roosevelt by the Lake Roosevelt Net Pen Project
9104700 Sherman Creek Hatchery - O&M	Kokanee salmon and rainbow trout outplanting into Lake Roosevelt by the Sherman Creek Hatchery
9104600 Spokane Tribal (galbraith Sprgs) Hatchery - O&M	Kokanee salmon and rainbow trout outplanting into Lake Roosevelt by the Spokane Tribal Hatchery
8806300 The Lake Roosevelt Monitoring Program	The Lake Roosevelt Monitoring Program was incorporated into this program as of 1996. This program monitors and evaluates the effects of kokanee salmon and rainbow trout outplanting into Lake Roosevelt.

OPPORTUNITIES FOR COOPERATION:

The Spokane Tribe has provided \$220,000.00 dollars (FY'97 figure) for building an adult kokanee salmon collection facility on the southeastern boundary of the reservoir (Little Falls Dam). The facility will be constructed in the spring of 1997 and will enable the Tribe to collect kokanee salmon eggs from migrating adults. This in conjunction with the Sherman Creek Hatchery should provide enough kokanee salmon eggs to meet the biological objectives of the cooperative programs on Grand Coulee Reservoir. All related BPA projects listed above have the potential to and are currently sharing equipment and personnel to the extent possible as defined by project objectives, time schedules, and equipment needs.

COSTS AND FTE

1997 Planned: \$1,242,800
1996 Unobligated: \$400,000

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	\$1,300,000	20%	70%	10%
1999	\$1,400,000	10%	80%	10%
2000	\$1,400,000	10%	80%	10%
2001	\$700,000	10%	80%	10%
2002	\$700,000	10%	80%	10%

<u>FY</u>	<u>OBLIGATED</u>
1994	\$191,055
1995	\$10,000
1996	\$470,006
1997	\$240,533
TOTAL:	\$911,594

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

<u>FY</u>	<u>OTHER FUNDING SOURCE</u>
1998	Spokane Tribe of Indians

<u>AMOUNT</u>	<u>IN-KIND VALUE</u>
\$220,000	

OTHER NON-FINANCIAL SUPPORTERS:

Lake Roosevelt Forum

LONGER TERM COSTS: \$500,000 Monitoring and Evaluation.

1997 OVERHEAD PERCENT: 22%

HOW DOES PERCENTAGE APPLY TO DIRECT COSTS:

[Overhead % not provided so BPA appended older data.] Does not apply to capital equipment or subcontractors.

CONTRACTOR FTE: 12 FTE.

SUBCONTRACTOR FTE: 6 FTE.
