

**Bonneville Power Administration
Fish and Wildlife Program FY98 Watershed Proposal Form**

Section 1. General administrative information

Title **Mitigation For The Construction And Operation Of Libby Dam (Fy98)**

Bonneville project number, if an ongoing project 8346700

Business name of agency, institution or organization requesting funding
Montana Fish, Wildlife & Parks

Business acronym (if appropriate) MFWP

Proposal contact person or principal investigator:

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Subcontractors.

Organization	Mailing Address	City, ST Zip	Contact Name
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WestWater Consultants	1112 Catherine Ln.	Corvallis, MT 59828	Gary Decker

NPPC Program Measure Number(s) which this project addresses.

Program Measures 10.1B, 10.1C.1, 10.3B, 10.3B.2, 10.3B.3, 10.3B.5, 10.3B.6, 10.3B.7, 10.3B.10 and 10.3B.11.

NMFS Biological Opinion Number(s) which this project addresses.

NMFS Hydrosystem Operations for salmon recovery (56 FR 58619; 57 FR 14653)
 Bull Trout Proposed Listing (62 FR 32268)
 Westslope cutthroat trout and Interior redband trout recovery actions

Other planning document references.

Fisheries Mitigation and Implementation Plan for Losses Attributable to the Construction and Operation of Libby Dam. 1997. (Draft plan by MFWP, CSKT and KTOI is based on public comment from four public meetings in Libby and Eureka, Montana and agency review. The draft plan has been released for further public review prior to submission to NPPC for approval).

Kootenai Watershed Programmatic Habitat and Physical Parameter Review (Bibliography) Open File Report – MFWP-Libby, MT

Subbasin.

Kootenai Subbasin, Upper Columbia

Short description.

Execute watershed / habitat enhancement projects mitigating hydropower impacted native fish populations. Implement operational plan for Kootenai River and Libby Reservoir. Recover endangered Kootenai white sturgeon. Develop burbot recovery program.

Section 2. Key words

Mark	Programmatic Categories	Mark	Activities	Mark	Project Types
	Anadromous fish		Construction	+	Watershed
X	Resident fish		O & M	+	Biodiversity/genetics
	Wildlife		Production	+	Population dynamics
	Oceans/estuaries	+	Research	X	Ecosystems
	Climate	+	Monitoring/eval.	+	Flow/survival
	Other	X	Resource mgmt		Fish disease
		+	Planning/admin.	+	Supplementation
			Enforcement		Wildlife habitat en-
			Acquisitions		hancement/restoration

Other keywords.

Hydropower mitigation, habitat enhancement/restoration/evaluation, fish entrainment, fish passage, ecological interactions, reservoir modeling, IFIM river modeling, hydrosystem operation, lake rehabilitation, mDNA stock identification.

Section 3. Relationships to other Bonneville projects

Project #	Project title/description	Nature of relationship
9401000	MFWP- Lij Reservoir Excessive	Habitat Enhancement

	Drawdown	
9608702	MFWP- Focus Watershed	Native Species Recovery
8806500	IDFG-Kootenai River Fisheries Investigations	White Sturgeon Recovery
8806400	KTI – White Sturgeon Experimental Aquaculture	White Sturgeon Recovery
8346500	Libby and Hungry Horse Modeling Technical Analysis	Reservoir Modeling
9404900	Kootenai River Ecosystem Improvement Study	Ecosystem Function

Section 4. Objectives, tasks and schedules

Objectives and tasks

Obj 1,2,3	Objective	Task a,b,c	Task
1	Complete pilot mitigation projects in the Kootenai Watershed to determine the cost effectiveness of mitigation strategies and help guide future actions to compensate for fisheries losses incurred from the construction and operation of Libby Dam.	a	Complete pilot mitigation projects according to established timetables.
1		b	Establish site-specific project designs, budgets and timelines for completion of projects listed in the plan.
1		c	Identify projects not previously listed in the Mitigation Plan that will enhance native and gamefish species in the Kootenai Watershed
1		d	Conduct pre- and post-treatment data collection for comparison.

0			0.00%
			TOTAL 100.00%

Schedule constraints.

Pilot projects depend on public support, CBFWA prioritization, NPPC approval and permitting processes. Fieldwork should begin in early spring before spring melt.

Completion date.

This mitigation program was designed as a long-term commitment to mitigate for the loss statement. Estimated completion date 2055. This form pertains to the remainder of FY98.

Section 5. Budget

FY99 budget by line item

Item	Note	FY98
Personnel		
Fringe benefits		
Supplies, materials, non-expendable property		
Operations & maintenance		
Capital acquisitions or improvements (e.g. land, buildings, major equip.)		
PIT tags	# of tags:	
Travel		
Indirect costs		
Subcontracts		
Other	Watershed enhancement efforts (FY98)	141,996
TOTAL		\$141,996

Outyear costs

Outyear costs	FY99	FY00	FY01	FY02
Total budget	\$600,000	\$600,000	\$600,000	\$600,000
O&M as % of total	3.30%	3.30%	3.30%	3.30%

Section 6. Abstract

Libby Dam, completed in 1972, interrupted the second largest tributary to the Columbia River by creating the 90-mile Libby Reservoir. The primary benefits of this project are

power production (91.5%), flood control (8.3%) and other (0.2%). Reservoir surface elevation ranges from 2,287 feet msl to full pool 2,459 feet msl. Between 1974 and 1996, drawdowns averaged 112.44 feet, ranging as deep as 152 feet. Inundation of 109 miles of the mainstem Kootenai River and 40 miles of critical, low gradient tributary habitat occurred when Libby Reservoir filled. Annual drawdowns impact revegetation of the reservoir varial zone resulting in a littoral zone of nondescript cobble/mud/sand bottom with limited available structure and limited biological production. River operations for power production cause rapid flow fluctuations (as much as 400% change in daily discharge) which are inconsistent with the normative river concept. Primary objectives of this project are; 1) Correct impacts caused by hydropower operations and mitigate fisheries losses attributed to the construction and operation of Libby Dam using watershed-based, habitat enhancement, fish passage improvements and offsite measures; 2) Integrate computer models into a watershed framework using MFWP's quantitative reservoir model (LRMOD), Integrated Rule Curves (IRC), Instream Flow Incremental Methodology (IFIM) and Libby Dam fish entrainment model (ENTRAIN). Implement operational changes; 3) Recover native resident species including the endangered Kootenai River white sturgeon, bull trout, westslope cutthroat trout, interior redband rainbow trout, burbot. A loss statement, site-specific mitigation actions and monitoring strategies were compiled in the Libby Mitigation and Implementation Plan.

Section 7. Project description

a. Technical and/or scientific background.

Completion of Libby Dam in 1972 lead to profound biological and physicochemical changes in the Kootenai Subbasin, the second largest tributary to the Columbia River (Woods 1982; Chisholm et al. 1989; Skaar et al. 1996; Snyder and Minshall 1996). Libby dam terminated upstream fish migrations and caused a discontinuity between fish communities above and below the dam. Inundation of 109 miles of the mainstem Kootenai River and 40 miles of highly productive, low gradient tributary stream habitat occurred when Libby Dam filled (MFWP, CSKT and KTOI 1997). Annual reservoir operations resulted in extreme fluctuations in reservoir surface area and volume and river stage, effecting all biological trophic levels in the impoundment and river downstream (Marotz et al. 1996). Reservoir fluctuations impact revegetation of the reservoir varial zone resulting in a littoral zone of nondescript cobble/mud/sand bottom with limited available structure. River operations for power cause rapid flow fluctuations (as much as 400% change in daily discharge) which are inconsistant with the normative river concept (ISAB 1997) and create a wide varial zone that is biologically unproductive (Perry and Huston 1983; Cushman 1985; Hauer and Stanford 1997).

Fish populations throughout the Kootenai River Drainage have demonstrated responses indicitive of ecosystem collapse (Partridge 1983; Anders 1993; Anders 1994; Paragamian 1994; Williams 1961). Libby Dam has converted the Kootenai river from a lotic to lentic environment with species responses reflecting this manipulation. Westslope cutthroat and

rainbow trout captured during annual gillnetting on Libby Reservoir have declined significantly from early post-impoundment levels of 10% and 14% to current levels 0.2% and 0.3% of the total catch. Conversely, non-game species such as northern squawfish and peamouth chub (not abundant pre-impoundment) have increased significantly in gill net catches to comprise up to 87 percent of the total catch (Chisholm et al. 1989; Dalbey et al. 1997). Similar impacts have been observed in the tailwater below Libby Dam. Barriers have been deposited in critical spawning tributaries to the Kootenai River through the annual deposition of bedload materials (sand, gravel, and boulders) at their confluence with the river (Marotz et al. 1988). The Kootenai River (pre-impoundment) contained sufficient hydraulic energy to annually remove these deltas whereas sufficient hydraulic energy is lacking from the post-impoundment Kootenai River. Reversal of the Kootenai River hydrograph and alteration of the thermograph have caused impacts typical of tailwaters. Native fish populations that have been reduced due to impoundment include burbot, which are an estimated 10% of pre-impoundment levels with current hoopnet catches of 0.002-0.168-fish/hoopnet hour. Westslope cutthroat trout populations have been in decline based on 24 years of population estimates (Huston et al. 1984; Dalbey et al. 1997). In 1973, 44 percent of trout captured were westslope with angler catch rates recorded at 0.5 fish/hour, ranking the Kootenai River among other blue ribbon trout streams in Montana. Estimates in 1994 document significant population reductions with less than five percent of the trout captured being westslope cutthroat trout (MFWP data files). White Sturgeon populations were listed as endangered in the Kootenai River on October 6th, 1994 with very little recruitment since 1974 (U.S. Federal Register Vol 59, No. 171).

b. Proposal objectives.

GOAL: Rebuild weak, but recoverable, native fish populations of the Kootenai Basin injured by the hydropower system to sustainable levels.

- 1) Complete mitigation projects in the Kootenai Watershed to compensate for fisheries losses incurred from the construction and operation of Libby Dam. Specific projects that will be completed in 1999 include:
 - a) Rehabilitation of Carpenter Lake to remove illegally introduced non-native species that compete and prey on native species followed by reintroduction of native westslope cutthroat trout.
 - b) Reconstruction of stream channels in historic native westslope cutthroat, inland rainbow and bull trout watersheds that have been impacted by various land-use practices. GOAL is to reclaim linear stream habitats eliminated by inundation of Libby Dam. The following are priority projects to be completed in 1998.
 - * Bobtail Creek – Rehabilitate over 2,900 linear feet of channel to decrease width to depth ratio (W:D), reduce sediment loading caused by livestock use (project area will be fenced year-round), revegetation with native plants to provide soil stabilization and canopy cover, increase instream habitat

heterogeneity (boulders and large woody debris (LWD), provide spawning gravel entrapment conditions, increase juvenile rearing microhabitat. Project completion date = 10/98. Native species benefited = westslope cutthroat trout.

* Pipe Creek – Rehabilitate 780 linear feet of channel to decrease W:D, reduce sediment loading caused by riparian vegetation removal (urban development), revegetation with native plants to provide soil stabilization and canopy cover, increase instream habitat heterogeneity (boulders and large woody debris (LWD), provide spawning gravel entrapment conditions, increase juvenile rearing microhabitat. Project completion date = 10/98. Native species benefited = westslope cutthroat and inland rainbow trout.

* Libby Creek – Rehabilitate approximately 6000 linear feet of channel to decrease W:D, reduce sediment loading caused by riparian vegetation removal (urban development and livestock overutilization), revegetation with native plants to provide soil stabilization and canopy cover, increase instream habitat heterogeneity (boulders and large woody debris (LWD), provide spawning gravel entrapment conditions, increase juvenile rearing microhabitat. Phase I project completion date = 11/98. Native species benefited = westslope cutthroat and bull trout, burbot.

* Libby Field Station Spring Creek – Rehabilitate approximately 1320 linear feet of channel to decrease W:D, reduce sediment loading caused by bank sloughing, increase instream habitat heterogeneity (boulders and large woody debris (LWD), provide spawning gravel entrapment conditions, increase juvenile rearing microhabitat. Comprehensive project objective is to provide a wild captive brood stock for inland rainbow trout in the Kootenai Basin. Phase II will involve rehabilitation of small lakes connected to the Libby Field Station Spring Creek on Libby Field Station (MFWP property) and phase III will entail gamete collection for conservation aquaculture followed by outplanting to closed basin lakes and/or genetic swamping of stream populations. This will occur following successful establishment of genetically pure inland rainbow stock. Phase I project completion date = 11/98. Native species benefited = inland rainbow trout.

All pretreatment survey data (fish density and species assemblage, macroinvertebrate trophic guild composition, water temperature, stream dimension, pattern, profile and sediment loading) have been collected, entered and analyzed to determine cost effectiveness of various treatment options. Only projects projected to provide measurable improvement in the aforementioned biological indices will be implemented. Post-treatment evaluations of indices are established in rigorous data collection protocols followed by independent evaluation of project success criteria. Habitat enhancement project evaluations will be detailed in annually completed progress reports.

c. Rationale and significance to Regional Programs.

Hydropower related impacts on the Kootenai Watershed are well documented. The Libby Dam Fisheries Mitigation and Implementation Plan for Losses attributed to the Construction and Operation of Libby Dam details quantified fish losses above and below Libby Dam as called for by the FWP. Kootenai white sturgeon are endangered (USFWS 1997): less than 1500 individuals remain. Bull trout are proposed for listing. The bull trout population below Libby Dam has too few subpopulations to be considered a stable meta-population. However, the population in the Canadian headwaters of Libby Reservoir is believed to be the strongest meta-population in existence. Westslope cutthroat trout have been petitioned for listing under ESA. Losses and potential mitigation projects targeted at enhancement of native populations in the Kootenai Basin were compiled in the Libby Mitigation and Implementation Plan. This document was developed as a collaborative programmatic assessment with the Salish and Kootenai Tribes and the Kootenai Tribe of Idaho. Further coordination is conducted with Idaho Fish and Game and British Columbia Ministry of Environment. White Sturgeon Recovery efforts are consistent with the internationally developed White Sturgeon Recovery Plan (USFWS 1997). This program directly addresses the FWP mandate to enhance hydropower impacted fish stocks in the Kootenai Basin through on-the-ground habitat enhancement efforts that alleviate limiting factors to native species populations. Projects reclaiming critical spawning, rearing, overwintering habitats have been completed, or are ongoing, as pilot mitigation projects. These projects are being completed using grassroots watershed workgroups comprised of landowners, agency, sportsmen's groups and local, state and federal government coalitions.

The IFIM river model will be linked with the existing reservoir model LRMOD to complete the integrated watershed framework. The IFIM research is calibrating simulations of hydraulic conditions (stage/discharge and velocities) and fish habitat from Libby Dam to Kootenay Lake, British Columbia, Canada at various discharges from Libby Dam. An optimization program is scheduled for development to allow managers to assess tradeoffs between the requirements of reservoir and riverine biota, when conflicts occur between reservoir operation and river flow limits as per the FWP. This project provides data used to develop and refine operating protocols for Libby Dam (IRCs), including Tiered Flow augmentation for the recovery of the endangered Kootenai River white sturgeon. The IRC concept has been recognized by the ISG as a tool for restoring normative conditions in rivers below storage projects. The IRCs can be applied to other projects given the necessary data. A simplified version of the models was used during the Columbia Basin System Operation Review process on Dworshak, Grand Coulee and Pend Oreille. This screening model produces qualitative results that can be used to direct field sampling efforts which, in time, will provide the data for quantitative subroutines to construct a full scale quantitative evaluation model.

d. Project history

Work on Libby Reservoir began in 1982 to assess the effects of operation on fish populations and lower trophic levels. Results were used to develop the quantitative reservoir model LRMOD. The models and preliminary IRCs (called Biological Rule Curves) were first published in 1989 (Fraley et al. 1989). Monitoring of the reservoir biota continued to refine and validate the reservoir model. Development of Integrated Rule Curves and Tiered Flow Augmentation was completed on 1996. The project identified important spawning and rearing tributaries in the U.S. portion of the reservoir and began genetic inventories of species of special concern. Research on the entrainment of fish through the Libby Dam penstocks began in 1990 and was published in 1996. Research on the effects of operations on the river fishery using IFIM techniques was initiated in 1992. Assessment of the effects of river fluctuations on Kootenai River burbot fishery was examined in 1994 and 1995. IFIM studies were also completed in Kootenai River below Bonners Ferry to determine spawning area available to sturgeon at various river flows. Microhabitat data collection specific to species and life-stage of rainbow trout and mountain whitefish has been incorporated into suitability curves. River cross-sectional profiles, velocity patterns and other fisheries habitat attributes were completed in 1997. Hydraulic model calibrations and incorporation of suitability curves and modification of the model code will reach completion in 1998.

The following is a list of project reports and technical papers. A summary of accomplishments and implementation of adaptive management principals can be found in the abstract of each document. The annual budget of each project is attached as a table below.

Chisholm, I.M. and J.J. Fraley. 1986. Quantification of Libby Reservoir levels needed to maintain or enhance reservoir fisheries. Annual report. Prepared for Bonneville Power Administration by Montana Department of Fish, Wildlife and Parks. Kalispell, Montana. Project No. 83-467.

Chisholm, I.M. and P.D. Hamlin. 1987. 1985 Libby Reservoir angler census. Prepared for Bonneville Power Administration, by Montana Department of Fish, Wildlife and Parks. Kalispell, Montana. Project No. 83-467.

Chisholm, I.M., M.E. Hensler, B. Hansen, D. Skaar. 1989. Quantification of Libby Reservoir levels needed to maintain or enhance reservoir fisheries. Methods and Data Summary 1983-1987. Prepared for Bonneville Power Administration by Montana Department of Fish, Wildlife and Parks. Kalispell, Montana. Project No. 83-467.

Dalbey, S.R., J. DeShazer, L. Garrow, G. Hoffman, and T. Ostrowski. 1997. Quantification of Libby Reservoir levels needed to enhance reservoir fisheries. Methods and data summary, 1988-1996. Draft Report. Montana Department of Fish, Wildlife and Parks - Region 1. Prepared for Bonneville Power Administration. Project No. 83-467.

- Hauer, R. 1997. Kootenai river zoobenthos investigation. Kootenai River Fisheries Investigations - Montana. Montana Department of Fish, Wildlife and Parks Region 1. Annual Report to Bonneville Power Administration. Project No. 83-467.
- Marotz, B.L. and J.J. Fraley. 1986. Instream flows needed for successful migration, spawning and rearing of rainbow and westslope cutthroat trout in selected tributaries of the Kootenai River. Montana Department of Fish, Wildlife and Parks. Prepared for Bonneville Power Administration. Project Number 85-6.
- Marotz, B.L., and J. Fraley. 1986. Instream flows needed for successful migration, spawning and rearing of rainbow and westslope cutthroat trout in selected tributaries of the Kootenai River. Montana Department of Fish, Wildlife and Parks. Prepared for Bonneville Power Administration. Project Number 85-6.
- Marotz, B.L., B. Hansen, and S. Tralles. 1988. Instream flows needed for successful migration, spawning and rearing of rainbow and westslope cutthroat trout in selected tributaries of the Kootenai River. Montana Department of Fish, Wildlife and Parks. Prepared for Bonneville Power Administration. Project Number 85-6.
- Marotz, B.L., D. Gustafson, C. Althen and B. Lonen. 1996. Model development to establish integrated operational rule curves for Hungry Horse and Libby Reservoirs - Montana. Montana Department of Fish, Wildlife and Parks - Region 1. Prepared for U.S. Department of Energy - BPA. Project number 83-467
- MFWP, CSKT and KTOI. 1997. Fisheries mitigation and implementation plan for losses attributable to the construction and operation of Libby Dam. **Draft Report:** Montana Department of Fish, Wildlife and Parks, Confederated Salish and Kootenai Tribes and the Kootenai Tribe of Idaho. Prepared for Bonneville Power Administration. Project No. 83-467.
- Perry S. and J. Huston. 1983. Kootenai River Investigations Final Report 1972-1982. Section A. Aquatic Insect Study. Montana Fish, Wildlife & Parks in cooperation with the U.S. Army Corps of Engineers. 112p.
- Shepard, B.B. 1985. Quantification of Libby Reservoir levels needed to maintain or enhance reservoir fisheries. Annual Report. Prepared for Bonneville Power Administration by Montana Department of Fish, Wildlife and Parks. Kalispell, Montana.

Table of annual funding for Project 83-467.

Budget Period	Amt. Funded	Modification
5-83 - 5-84	\$156,305.	Original
10-83 - 10-84	\$371,311.	Mod 001000203
9-84 - 4-85	\$112,561.	4

5-85 - 5-86	\$292,106.	5
8-85 - 11-87	\$231,908.	6
9-86 - 3-88	\$472,871	76,550.8
10-87 - 9-88	\$49,696.	9
7-88 - 11-88	\$72,826.	10
11-88 - 12-88	0	11
12-88 - 12-87	\$248,844.	12
12-89 - 12-90	\$270,492.	13
12-90 - 12-92	\$282,142.	14
12-91 - 12-92	\$297,262.	15
1-93 - 12-93	\$275,000.	16
1-94 - 12-94	\$286,524.	17
"	\$6,939.	18
11-94 - 11-95	\$279,715.	19
"	\$4,500.	20
11-95 - 11-96	\$298,249.	21
11-96 - 11-97	\$310,700.	22

This project established relationship between reservoir operation and biological productivity, incorporated results in the computer model LRMOD. Developed Integrated Rule Curves (IRCs) adopted by NPPC in 1994 but not yet implemented. Developed tiered approach for white sturgeon spawning flows balanced with reservoir IRCs and Snake River salmon biological opinion. This strategy was unanimously supported by the White Sturgeon Recovery Team. A long-term database was established for monitoring populations of kokanee, bull trout, westslope cutthroat, rainbow and burbot and other native fish species. Long-term monitoring of zooplankton and trophic relationships was similarly established. A model was calibrated to estimate the entrainment of fish and zooplankton through Libby Dam as related to hydro-operations and use of the selective withdrawal structure. The effects of dam operation on benthic macroinvertebrates in the Kootenai River was also assessed (Hauer et al. 1997) for comparison with conditions measured in the past (Perry and Huston 1983) .

Documented successes of pilot mitigation projects include enhancement of westslope cutthroat and rainbow trout populations in Bobtail Creek (tributary to Kootenai River below Libby Dam). Eradication of illegally introduced predators in three Kootenai Basin lakes and reestablishment of native westslope cutthroat trout has been completed thus increasing the range and overall distribution of this species.

e. Methods.

Completion of the Kootenai River Instream Flow Methodology (IFIM) study will involve calibration of the HYDSIM, HABSIM subcomponents of the RHABSIM (River HABitat SIMulation) model framework developed under the overall framework of the IFIM and Physical Habitat Simulation (PHABSIM). PHABSIM consists of hydraulic simulation (in this case the IFG4 computer model using a single high flow data set for velocity calibration and two other stage-discharge rating measurements) and habitat simulation

with the HABTAT computer model. Calibration of HYDSIM involves utilization of the stream roughness worksheets, velocity graphs and Water Surface Elevation (WSL) with the objective of reproducing the measured velocities and limiting errors in velocity estimates when extrapolating over a range of simulated flows. Calculation of Weighted Usable Area (WUA) at each simulation flow and species life stage will be accomplished following calibration of Habitat Suitability curves or species criteria curves (stepwise polynomial regression). WUA values for Kootenai River rainbow trout and mountain whitefish (adult and juvenile stages), aquatic macroinvertebrates, bull trout and white sturgeon under different simulated discharges from Libby Dam will be evaluated seasonally to determine hydropower impacts. Subroutines from existing reservoir model LRMOD will be written by Dr. Craig Althen to link the two models allowing evaluation of tradeoffs and ecological impacts of operational schemes on the river and reservoir environments.

Investigations into limiting factors of native, resident, fluvial populations combine diverse field evaluation techniques. These include mark-recapture estimates in impaired reaches as well as relic reaches of the same or similar stream reach. Assumptions involved in this approach are that reaches are long enough to include all habitat types and that movement in and out of the reach is extremely limited or nonexistent (Ricker 1975). Also, reaches and associated fish parameters are representative of the entire stream. Parameters evaluated are population densities, species assemblages and composition, fish growth and age, condition factors, and biomass estimates. Historic data for the reach or a comparative reach is utilized (if available) and assessment of the reaches carrying capacity or biological potential is evaluated.

Stream habitat restoration projects involve collection of stream survey information to establish accurate dimension, pattern and profile of project reaches. These parameters include velocity, depth, slope, width, channel materials, discharge and sediment supply. Level III (Rosgen 1996) field evaluation of streams will be conducted which determine the state, stability, and "health" of the system.

Habitat manipulation activities are undertaken following critical evaluation of potential benefits to native species and identification of limiting factors. In general, the following criteria are used to evaluate success or failure of project: changes in standing stock, growth, proportional stock density, relative weight values, catch or harvest rates, angler satisfaction and permanency of improvements. This project offers a unique approach to enhance hydropower impacted fish stocks in the Kootenai Basin through on-the-ground habitat enhancement efforts and pre- and post-treatment data collection. Monitoring strategies have been established to determine a long-term success/failure criteria for evaluation of habitat enhancement efforts. Stream restoration and passage improvement are evaluated based on physical and biological changes. Physical parameters are evaluated using Rosgen stream typing (Rosgen 1996) to determine stream recovery potential and hydraulic heterogeneity of habitat structures, photopoints, and substrate analysis (sediment scoring and coreing) in treatment areas. Pre- and post-treatment measurements of fish community structure (standing stock and species relative abundance), age/growth

relationships (otoliths and scales) and condition factor (weight/size), and increased spawning utilization (redd/spawner counts) are used to assess fish recovery.

Lake restoration projects follow standard rehabilitation protocols (Greenback 1941). Historic fish and invertebrate data is thoroughly reviewed to determine species assemblage changes that have occurred. Parameters include population densities, species composition, fish growth and age, condition factors, and biomass estimates. Physical factors (geographic location, water exchange rate, eutrophication, seasonal oxygen and temperature profiles) are used to assess whether the lake has potential to expand the range of native species, create a genetic reserve or provide angling opportunity. Lakes are chemically rehabilitated using rotenone to remove nonnative (often illegally introduced) species that compete or prey on native populations. Following rehabilitation, native species from captive brood stock are planted back into the lake the spring following rehabilitation.

f. Facilities and equipment.

The Libby Field Station of MFWP has two office buildings containing office space, wet lab and computer equipment sufficient for project staff. Remnants of the old fish hatchery provide facilities for meeting experimental aquaculture objectives. A workshop and boatshed are situated near the office buildings on the state property. State vehicles and work boats are available for project use. Electrofishing equipment (boat-mounted, bank and backpack units), surveying and GPS equipment, SCUBA gear, lake and river sampling devices for sampling/monitoring all trophic levels are available at the site. A bobcat with apparatus designed for habitat enhancement work is time-shared with the Hungry Horse Mitigation Program. Minor tools and equipment are included in the project budget.

g. References.

Anders, P. J. 1993. Natural spawning of white sturgeon in the Kootenai River. Annual Hatchery Report FY1993, Report A. Kootenai Tribe of Idaho for Bonneville Power Administration, Portland, OR.

Anders, P. J. 1994. Kootenai River tributary kokanee spawning ground survey. Annual Hatchery Report FY1994, Report C. Kootenai Tribe of Idaho for Bonneville Power Administration, Portland, OR.

Chisholm, I.M. and J.J. Fraley. 1986. Quantification of Libby Reservoir levels needed to maintain or enhance reservoir fisheries. Annual report. Prepared for Bonneville Power Administration by Montana Department of Fish, Wildlife and Parks. Kalispell, Montana. Project No. 83-467.

Chisholm, I.M., M.E. Hensler, B. Hansen, D. Skaar. 1989. Quantification of Libby Reservoir levels needed to maintain or enhance reservoir fisheries. Methods and Data

Summary 1983-1987. Prepared for Bonneville Power Administration by Montana Department of Fish, Wildlife and Parks. Kalispell, Montana. Project No. 83-467.

Cushman, R.M. 1985. Review of ecological effects of rapidly varying flows downstream from hydroelectric facilities. *North American Journal of Fisheries Management*. 5:330-339

Dalbey, S.R., J. DeShazer, L. Garrow, G. Hoffman, and T. Ostrowski. 1997. Quantification of Libby Reservoir levels needed to enhance reservoir fisheries. Methods and data summary, 1988-1996. Draft Report. Montana Department of Fish, Wildlife and Parks - Region 1. Prepared for Bonneville Power Administration. Project No. 83-467.

Fraley J.J., B. Marotz, J. Decker-Hess, W. Beattie and R. Zubic. 1989. Mitigation, compensation and future protection for fish populations affected by hydropower development in the upper Columbia System, Montana, USA. *Regulated Rivers: Research and Management*. 3:3-18.

Greenback, J. 1941. Selective poisoning of fish. *Transactions of American Fisheries Society*. 70:80-86

Hauer, R. and J.A. Stanford 1997. Kootenai river zoobenthos investigation. Kootenai River Fisheries Investigations - Montana. Montana Department of Fish, Wildlife and Parks Region 1 (Open File Report). Annual Report to Bonneville Power Administration. Project No. 83-467.

Huston, J. E., P. Hamlin and B. May. 1984 Lake Koocanusa Investigations – Final Report 1972-1983. Montana Department of Fish, Wildlife and Parks – Region 1 in cooperation with Seattle District ACOE.

ISAB. 1997. The Normative River. Prepared by the Independent Scientific Advisory Board for the Northwest Power Planning Council. Portland, Oregon.

Leathe, S.A. and P.J. Graham. 1982. Flathead Lake fish food habits study. Final Report. Prepared for the Environmental Protection Agency by Montana Department of Fish, Wildlife and Parks. Kalispell, Montana.

Marotz, B.L., B. Hansen, and S. Tralles. 1988. Instream flows needed for successful migration, spawning and rearing of rainbow and westslope cutthroat trout in selected tributaries of the Kootenai River. Montana Department of Fish, Wildlife and Parks. Prepared for Bonneville Power Administration. Project Number 85-6.

Marotz, B.L., D. Gustafson, C. Althen and B. Lonen. 1996. Model development to establish integrated operational rule curves for Hungry Horse and Libby Reservoirs -

Montana. Montana Department of Fish, Wildlife and Parks - Region 1. Prepared for U.S. Department of Energy - BPA. Project number 83-467

MFWP, CSKT and KTOI. 1997. Fisheries mitigation and implementation plan for losses attributable to the construction and operation of Libby Dam. **Draft Report:** Montana Department of Fish, Wildlife and Parks, Confederated Salish and Kootenai Tribes and the Kootenai Tribe of Idaho. Prepared for Bonneville Power Administration. Project No. 83-467.

Paragamian, V. L. 1994. Kootenai River fisheries investigations: stock status of Burbot and Rainbow Trout, and fisheries inventory. 1994 annual work plan, draft. IDFG, Coeur d'Alene, ID.

Partridge, F. 1983. Sub project IV: River and stream investigations, Study IV: Kootenai River fisheries investigations., Idaho Department of Fish and Game, Boise, Idaho.

Perry S. and J. Huston. 1983. Kootenai River Investigations Final Report 1972-1982. Section A. Aquatic Insect Study. Montana Fish, Wildlife & Parks in cooperation with the U.S. Army Corps of Engineers. 112p.

Rosgen D.L. 1996. Applied fluvial morphology. Wildland Hydrology. Pagosa Springs, CO. Printed Media Companies, Mpls, MN.

Snyder, E. B. and G. W. Minshal. 1996. Ecosystem metabolism and nutrient dynamics in the Kootenai River in relation to impoundment and flow enhancement for fisheries management. Stream Ecology Center, Department of Biological Sciences, Idaho State University, Pocatello, Idaho.

USFWS. 1997. Draft White Sturgeon Recovery Plan. Prepared by the White Sturgeon Recovery Team for the U.S. Fish and Wildlife Service (Note: Draft Not Officially Signed by USFWS).

Woods, P. F. and C. M. Falter. 1982. Limnological investigations: Lake Koocanusa, Montan Part 4: factors controlling primary productivity [special report 82-15]. Prepared for: USACE, Seattle, WA.

Section 8. Relationships to other projects

As members of the Endangered Kootenai River White Sturgeon Recovery Team, this project conducts recovery actions and monitoring activities. These activities include benthic, mid-water and surface beam trawling. A Section 10 (ESA) permit was issued to MFWP researchers to extent larval and juvenile white sturgeon sampling in Montana

portions of the Kootenai River. IDFG and KTOI scientists sampling in Montana portions of the Kootenai river work under this section 10 permit. MFWP scientists working in Idaho portions of the Kootenai River are working under IDFG section 10 permit. These efforts are conducted with assistance from IDFG and KTOI biologists and technicians as marking, aging and radio tagging must be coordinated to ensure consistent data collection. Weekly/monthly meetings with IDFG and KTI guarantee a programmatic approach to sturgeon recovery throughout the Kootenai basin.

Collaborative habitat and native, resident species restoration in the Kootenai Watershed is carried out with the Focus Watershed Coordinator and the Libby Reservoir Excessive Drawdown Program. Specifically, facilitation of watershed based habitat restoration programs with pertinent agency and citizen groups are carried out by this project and the focus watershed project. Cost-share arrangements are promoted with public and private organizations. Implementation of pilot Libby Dam Mitigation habitat projects is carried out concurrently with this project and the Libby Reservoir Excessive Drawdown Program. Actions must comply with the Montana Environmental Protection Act, (consistent with NEPA requirements), Army Corps of Engineers 404 permits, state water quality 3A permits, streambank protection 124 and/or 310 and other applicable state, tribal or county regulations.

Section 9. Key personnel

BRIAN MAROTZ

Fisheries Program Officer (0.15 FTE)
490 North Meridian Road
Kalispell, Montana 59901
Phone (406) 751-4546
Fax (406) 257-0349
E-mail marotz@digisys

Education

Master of Science – Fisheries Management
Louisiana State University - Baton Rouge, Louisiana.
Estuarine Biology

15 Credits: Gulf Coast Research Institute
Ocean Springs, Mississippi.
Marine Science

Bachelor of Science – Biology (Aquatic Sciences)
University of Wisconsin - Stevens Point, Wisconsin.
Freshwater Biology

16 Credits: S.E.A. Semester at Sea, Boston University
Woods Hole, Massachusetts
Marine Biology

**Professional
experience**

1991-Present Fisheries Program Officer, Montana Fish, Wildlife & Parks
Kalispell, Montana
Duties: Supervise Special Projects Office, Hydropower Mitigation and Focus
Watershed Programs.

1989 – 1991 Fisheries Biologist, Montana Fish, Wildlife & Parks
Kalispell, Montana
Duties: Hungry Horse Reservoir Research, Develop Hungry Horse Mitigation
Program, Computer Modeling Flathead and Kootenai Drainages, Develop
Integrated Rule Curves (IRCs) for Montana Reservoirs.

1985 – 1989 Fisheries Biologist, Montana Fish, Wildlife & Parks
Libby, Montana
Duties: Libby Reservoir Research, Kootenai Instream Flow Project, Computer
Modeling Flathead and Kootenai Drainages, Develop Integrated Rule Curves
(IRCs) for Montana Reservoirs.

1984 – 1985 Research Associate, Louisiana State University - Baton
Rouge, Louisiana
Duties: Estuarine Research to control salt water encroachment to Estuarine
Marsh on the Sabine National Wildlife Refuge. Developed Operating Plan for
Water Control Structures to Allow Migration of Catadromous Fish and
Crustaceans

Publications

Pertinent Publications Listed in this Document

Awards

1994 Governor’s Award for Excellence in Performance as an Employee of the State of Montana

1994 Director’s Award for Excellence as an Employee of Montana Fish, Wildlife & Parks

1989 Certified Fisheries Scientist
American Fisheries Society

STEVE DALBEY

Fisheries Biologist (1.0 FTE)
475 Fish Hatchery Rd.
Libby, Montana 59923
Phone (406) 293-4161
Fax (406) 293-4163
E-mail sdalbey.fwp@libby.org

Education

1991 - 1994 Montana State University Bozeman, Montana
Master of Science – Fish and Wildlife Management

Professional experience

1983 - 1988 Montana State University-Billings, Montana
Bachelor of Science – Biology (Animal Physiology)

1995 – Current Montana Fish, Wildlife and Parks Libby, MT
Fisheries Biologist (Special Projects)

Duties: Habitat enhancement implementation, research coordinator, interagency liaison, and ambassador of good will.

1991 – 1994 Montana State University Bozeman, MT
Graduate Student (M.S.)

1993 – 1995 Montana Fish, Wildlife and Parks Billings, MT
Fisheries Technician

1989 – 1991 Montana Fish, Wildlife and Parks Billings, MT
Fisheries Technician

Publications

Dalbey, S.R., J. DeShazer, L.Garrow, G. Hoffman, and T. Ostrowski. 1997. Quantification of Libby Reservoir levels needed to enhance reservoir fisheries. Methods and data summary, 1988-1996. **Draft Report.** Montana Department of Fish, Wildlife and Parks - Region 1. Prepared for Bonneville Power Administration. Project No. 83-467.

MFWP, CSKT and KTOI. 1997. Fisheries mitigation and implementation plan for losses attributable to the construction and operation of Libby Dam. **Draft Report:** Montana Department of Fish, Wildlife and Parks, Confederated Salish and Kootenai Tribes and the Kootenai Tribe of Idaho. Prepared for Bonneville Power Administration. Project No. 83-467.

Dalbey, S.R., T.E. McMahon and W. Fredenberg. 1996. Effect of electrofishing pulse shape and electrofishing-induced spinal injury on long-term growth and survival of wild rainbow trout. *North American Journal of fisheries Management.* 16:560-569

McMahon, T.E., S.R. Dalbey, S.C. Ireland, J.P. Magee and P.A. Byorth. 1996. Field evaluation of visible implant tag retention by brook trout, cutthroat trout, rainbow trout and arctic grayling. *North American Journal of fisheries Management.* 16:921-925

American Fisheries Society Most Significant Paper Award 1997. *North American Journal of Fisheries Management.*

Awards

National Science Foundation Grant Recipient. 1985.

American Fisheries Society – Montana Chapter

American Fisheries Society – National Chapter

Montana Department of Fish, Wildlife and Parks – Electrofishing Committee

Professional memberships

GREGORY C. HOFFMAN

FISHERIES RESEARCH SPECIALIST

Montana Department of Fish, Wildlife and Parks

475 Fish Hatchery Road

Libby, MT 59923

DEGREES EARNED

University of Wisconsin - Stevens Point; Stevens Point, WI

Master of Science *in* Fisheries, August, 1994

South Dakota State University; Brookings, SD

Bachelor of Science *in* Wildlife and Fisheries Sciences, June, 1990

University of Minnesota - Crookston; Crookston, MN

Associate of Applied Science *in* Natural Resources Conservation, June, 1986

CURRENT RESPONSIBILITIES

Perform professional research, analysis and documentation to assess the biological effects of dam operation in the Columbia Basin. Operate the reservoir model (LRMOD) and the IFIM and AEA models. Under the guidance of the program officer and project biologist, evaluate Montana's Kootenai River White Sturgeon recovery efforts. Initiate and assist Libby Fisheries Mitigation project with field, office, and laboratory duties required to research, monitor and mitigate for the construction and operation of Libby Dam. (1.0 FTE)

RECENT EMPLOYMENT

Environmental Careers Organization Associate - Fisheries Biologist; E.C.O., Seattle, WA.; 05/94 - 12/95
@ Bureau of Land Management, Challis Resource Area; Salmon, ID; 05/94 to 05/95
@ Bureau of Land Management, Great Divide Resource Area; Rawlins, WY; 05/95 to 12/95

EXPERTISE

- Well-versed in fisheries theories, principles, and methods of research, management, and conservation.
- Fisheries statistics and population dynamics analysis.
- Scientific and technical literature preparation and use.
- Fisheries and other environmental sampling methods and data analysis.
- Stream habitat enhancement.
- Personal computers and application programs, computer habitat simulation models, and GPS/GIS applications.

1994: BLM "Proper Functioning Condition" Workshop - Casper, Wyoming
1995: USFS "R1/R4 Stream Inventory Methodology" - Salmon, Idaho
1995: USFS "R1/R4 FBase Stream Inventory Data Analysis" - Challis, Idaho
1996: AFS Public Outreach Symposium - Bozeman, Montana
1996: SCUBA Certification - Kalispell, Montana
1996: Inter-Fluve, Inc. "Design of Natural Stream Channels" - Bozeman, MT

RECENT PUBLICATIONS (RELEVANT)

Dalbey, S., J. DeShazer, L. Garrow, G. Hoffman, and T. Ostrowski. In press. Quantification of Libby Reservoir levels needed to maintain or enhance reservoir fisheries. Presented to the Bonneville Power Administration, Portland, Oregon.

U.S. Bureau of Land Management. 1995. Colorado River cutthroat trout reintroduction plan decision record and environmental assessment WY-037-05-028. Prepared by U.S. Department of Interior, Bureau of Land Management, G.C. Hoffman. 84pp.

Hoffman, G.C.. 1994. Creel survey and tournament assessment of Lake Winnebago, Wisconsin: 1989 - 1992. Master's thesis. University of Wisconsin, Stevens Point. 1,815 pp.

Larry F. Garrow
Fisheries Fieldworker III

Degree Earned

University of Montana - Missoula, MT
B.S. in Wildlife Biology with an emphasis in aquatic and fisheries management, December 1985

Current Employer

Montana Department of Fish, Wildlife and Parks
475 Fish Hatchery Road
Libby, MT 59923

(406) 293-4161

Current Responsibilities

Act as crew leader on the BPA funded Libby Reservoir Project supervising and scheduling, under the direction of the project biologist, one to three fisheries technicians. Primary duties include assisting project personnel in fisheries research, monitoring and enhancement of fish populations within the Kootenai Basin. Ensure that equipment is properly maintained and organized. Enter, proof and summarize data into statistical and graphical formats for completion of project reports. Locate, document and prioritize potential mitigation sites and prepare site plans, obtain permits and work with landowners and contractors. Following public scoping, implement projects that will provide the greatest benefit to the fisheries. (1.0 FTE)

Recent Employment

Fisheries Fieldworker III; Montana Department of Fish, Wildlife and Parks (MFWP); Libby, MT 02/92 to present

Interim Fisheries Biologist; MFWP; Libby, MT; 09/94 to 01/95

Fisheries Fieldworker II, I; MFWP; Libby, MT; 06/89 to 09/92

Fisheries Fieldworker I; MFWP; Superior, MT; 04/89 to 06/89

Fisheries Laborer I; MFWP; Fort Peck; MT; 04/88 to 07/88

Experimental Biology Aide I; Oregon Department of Fish and Wildlife; Charleston, OR; 10/87 to 01/88

Stream Surveyor; Oregon Department of Fish and Wildlife; Powers, OR; 07/87 to 09/87

Expertise

Field sampling and data collection using backpack, mobile and boom electrofishing methods, gill nets, hoop traps, fyke nets, Idaho weir traps, beam trawls, Schindler traps, Wisconsin nets, setlines, and draft tube nets.

Scheduling and coordinating the logistics of field operations.

Collection and enumeration of reservoir and lake zooplankton samples. Enter, proof and correct the resulting data.

Operation of outboard and I/O jet and prop boats safely and effectively.

Enter, proof and summarize data into statistical and graphical formats for completion of project reports.

Recent Publications

Dalbey, S., J. DeShazer, L. Garrow, and T. Ostrowski. In Press. Quantification of Libby Reservoir levels needed to maintain or enhance reservoir fisheries. Methods and data summary, 1988-1996. Presented to the Bonneville Power Administration, Portland, Oregon.

Skaar, D., J. DeShazer, L. Garrow, T. Ostrowski and B. Thornburg. 1996. Quantification of Libby Reservoir levels needed to maintain or enhance reservoir fisheries. Investigations of fish entrainment through Libby Dam, 1990-1994. Presented to the Bonneville Power Administration, Portland, Oregon. 80 pp, plus appendices.

JAY A. DE SHAZER
FISHERIES TECHNICIAN
Montana Fish, Wildlife and Parks
475 Fish Hatchery Road
Libby, MT 59923

EDUCATION

Montana State University; Bozeman, MT
Bachelor of Science *in* Fish and Wildlife Management, June 1989

CURRENT RESPONSIBILITIES

Research, monitor and document the effects on fisheries caused by the construction and operation of Libby Dam. Identify and implement mitigation projects to enhance fisheries within the Kootenai River Basin. Survey, design and coordinate the implementation of habitat enhancement projects.

RECENT EMPLOYMENT

Biological Technician; USFS; Rexford Ranger District; Eureka, MT; 06/89 to 04/91

EXPERTISE

- Well-versed in fisheries theories, principles, and methods of research, management, and conservation.
- Scientific and technical literature preparation and use.
- Fisheries and other environmental sampling methods and data analysis.
- Surveying, mapping and designing stream habitat enhancement.
- Personal computers and application programs, computer habitat simulation models, and GPS/GIS applications.
- Boat maintenance and operation
- Heavy equipment operation

1996: AFS Public Outreach Symposium - Bozeman, Montana

1996: Inter-Fluve, Inc. "Design of Natural Stream Channels" - Bozeman, MT

1995: Physical Habitat Simulation system - Logan, UT

1992: SCUBA Certification - Kalispell, Montana

RECENT PUBLICATIONS (RELEVANT)

Dalbey, S., J. DeShazer, L. Garrow, G. Hoffman, and T. Ostrowski. In press. Quantification of Libby Reservoir levels needed to maintain or enhance reservoir fisheries. Methods and data summary, 1988-1996. Presented to the Bonneville Power Administration, Portland, Oregon.

Skaar, D., J. DeShazer, L. Garrow, T. Ostrowski, B. Thornburg. 1996. Quantification of Libby Reservoir levels needed to maintain or enhance reservoir fisheries. Investigations of fish entrainment through Libby Dam, 1990-1994. Presented to the Bonneville Power Administration, Portland, Oregon. 80 pp, plus appendices.

Section 10. Information/technology transfer

Project results will be published in BPA reports and, where applicable, peer reviewed journal articles. monthly or quarterly reports to all agency and citizen groups. Electronically available via Kootenai Watershed web page (to be designed and available for access by spring 1998).