Bonneville Power Administration
Fish and Wildlife Program FY99 Proposal

Section 1. General administrative information

Improve The Kootenai River Ecosytem

Bonneville project number, if an ongoing project 9404900

Business name of agency, institution or organization requesting funding
Kootenai Tribe of Idaho

Business acronym (if appropriate) KTOI

Proposal contact person or principal investigator:

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Subcontractors.

Organization	Mailing Address	City, ST Zip	Contact Name
Ecometric Research Inc.	3320 W. 5th Ave.	Vancouver, B.C. V6R 1R7	Josh Korman

NPPC Program Measure Number(s) which this project addresses.
10.8B.22

NMFS Biological Opinion Number(s) which this project addresses.
Kootenai River White Sturgeon Biological Opinion (59 FR 45989)
ESA Section 10 Permit No. PRT-798744

Other planning document references.

U.S. Department of the Interior, Fish and Wildlife Service. 1996. White Sturgeon: Kootenai River Population Draft Recovery Plan. Region 1, USFWS, Portland, Oregon.

Resident Fish Manager's Caucus of the Columbia Basin Fish and Wildlife Athority (RFM-CBFWA). 1997. Multi-Year Implementation Plan for Resident Fish Protection, Enhancement and Mitigation in the Columbia River Basin. Final Draft, June 3, 1997. Columbia Basin Fish and Wildlife Authority, Portland, Oregon.

Subbasin.
Work will take place in all areas of the Kootenai River Basin

Short description.
Identify best management options in order to enhance the aquatic ecosystem and provide future harvest opportunities of white sturgeon, kokanee salmon and burbot in the Kootenai River system, historically fished by the Kootenai Tribe of Idaho.

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	X	Research	X	Ecosystems
	Climate	*	Monitoring/eval.		Flow/survival
	Other	*	Resource mgmt		Fish disease
			Planning/admin.		Supplementation
			Enforcement	*	Wildlife habitat en-
			Acquisitions		hancement/restoration

Other keywords.
Multi-agency cooperation

Section 3. Relationships to other Bonneville projects

Project #	Project title/description	Nature of relationship
8806500	Kootenai River Fisheries Investigation	Co-Investigator
8806400	Kootenai River White Sturgeon Studies and Conservation Aquaculture	Co-Investigator

Section 4. Objectives, tasks and schedules

Objectives and tasks

Obj 1,2,3	Objective	Task a,b,c	Task
1	Follow up on the Adaptive Environmental Assessment workshop	a	Decide on a Kootenai River management plan using the computer model developed in the workshop
		b	Complete and submit a final report
2	Continue evaluating biological and population parameter data for all fish species collected in the Kootenai River	a	Index electrofishing
		b	Determine relative abundance
		c	Determine habitat use
		d	Determine movement and migration
		e	Determine diet composition
		f	Determine annual growth
		g	Complete a biological and population parameter data evaluation report
3	Assess the habitat of the west-side Kootenai River tributaries	a	Determine habitat type and quality
		b	Determine fish species present
		c	Recommend tributary habitat enhancement measures
		d	Complete and submit assessment in a final report
4	Analyze contaminants in the lower Kootenai River (pesticides, PCB's, and metals)	a	Determine contaminant levels in river bottom sediments in the lower section of the Kootenai River (Idaho/Montana border to Kootenay lake)
		b	Determine contaminant levels in macroinvertebrates from the lower section of the Kootenai River (Idaho/Montana border to Kootenay Lake)
		c	Complete and submit a final report
5	Provide monthly, annual and project completion reports	a	Complete and submit monthly reports and research completion reports in a thorough and timely

			manner

Objective schedules and costs

Objective #	Start Date mm/yyyy	End Date mm/yyyy	Cost %
1	06/1999	12/1999	15.00%
2	07/1999	07/2000	25.00%
3	07/1999	07/2000	25.00%
4	06/2000	07/2000	20.00%
5	08/1999	07/2000	15.00%
			TOTAL 100.00%

Schedule constraints.
Funding for the analysis of contaminants in soil and invertebrates in the Lower Kootenai River (objective 4) may be provided through the Kootenai River Network Organization. If this happens, then objective 4 will be dropped from this project summary.

Completion date.
This is a continuing project.

Section 5. Budget

FY99 budget by line item

Item	Note	FY99
Personnel		$102,571
Fringe benefits		$33,849
Supplies, materials, non-expendable property		$5,000
Operations & maintenance		$2,000
Capital acquisitions or improvements (e.g. land, buildings, major equip.)		$0
PIT tags	# of tags:	$0
Travel		$3,000
Indirect costs		$78,578
Subcontracts	AEA workshop follow-up; analyitcal laboratory contracted for contaminant analyses	$20,000
Other	Shipping of sediment and ivertebrate samples to be analyzed	$600
TOTAL		$245,598

Outyear costs

Outyear costs	FY2000	FY01	FY02	FY03
Total budget	$250,000	$275,000	$300,000	$325,000
O&M as % of total	0.01%	0.01%	0.01%	0.01%

Section 6. Abstract

The Kootenai River ecosystem in Idaho, Montana and British Columbia (B.C) Canada has been degraded severely over the past 50 years. The aquatic ecosystem has changed from being nutrient-rich, to one that is lacking in nutrients. A few of the possible reasons for the degradation include separation of the river from its floodplain (channelization and diking), impoundment (construction and operation of Libby dam) and pollution abatement in the watershed. The interaction of these factors and the resulting trophic effects over a period of decades appear to be responsible for the collapse of the Kootenai River ecosystem, and the measurable symptoms of declining and endangered fish populations.

In the 1995 Columbia River Basin Fish and Wildlife Program (Section 10.8b.22), The NPPC calls on the Kootenai Tribe of Idaho to "Perform a five year Kootenai River ecosystem status determination and improvement study. The study should include elements that will: 1) provide a comprehensive ecosystem status report; 2) evaluate the biological feasibility of restoring system productivity; 3) identify effects of hydropower operations (Libby Dam) on aquatic biota and fish assemblages; and 4) develop, evaluate, test and analyze solutions to ecosystem problems caused by factors currently limiting system productivity, such as nutrient limitation and hydropower effects."

The overall objective for this continuing project is to identify best management options in order to enhance the aquatic ecosystem and provide future harvest opportunities of white sturgeon, kokanee salmon and burbot in the Kootenai River system, historically fished by the Kootenai Tribe of Idaho.

Section 7. Project description

a. Technical and/or scientific background.

The Kootenai River system is an aquatic ecosystem in the state of collapse. One possible reason for this collapse is the alteration of the natural hydrograph of the Kootenai River. Since Libby Dam began operating in the early 1970's, the Kootenai River hydrograph has been very unstable, unnatural, and virtually reversed from pre-impoundment conditions. Since impoundment, water has been retained during historical periods of high discharge, and released from Lake Koocanusa (impounded by Libby Dam) during historically low flow periods (Partridge 1983). Consequently, the last substantial naturally produced year class of white sturgeon to recruit to the Kootenai River population was produced in 1974. This white sturgeon population, endemic to the

Kootenai River system, was listed as endangered under the U.S. Endangered Species Act on September 6, 1994, in part due to this lack of recruitment (59 FR 45989).

Fish populations of other species in the Kootenai River system have also declined since 1974. Kokanee salmon runs (South Arm Kootenay Lake Stock), numbering thousands of fish as recently as the early 1980's (Partridge 1983), have declined to less than 85 fish in up to 8 historic spawning streams combined (Anders 1993). Catch rates of rainbow trout, and standing stock estimates and growth rates of mountain whitefish in the Kootenai River have declined since the early 1980's (Paragamian 1994). The burbot population in the Kootenai River has also declined during recent decades, as indicated by an ongoing burbot population study in which eight burbot were captured during 887 hours of sampling (Paragamian 1994).

Another potential reason for the decline in population densities of aquatic biota in the Kootenai River system appears to be nutrient retention in Lake Koocanusa. Woods (1982) reported that 63% of total phosphorus and 25% of nitrogen in the Kootenai River system never pass Libby Dam to provide biological benefit downstream. Lake Koocanusa (impounded by Libby Dam) is acting as a nutrient sink, trapping sediment with efficiencies exceeding 95%, and storing nutrients in the bottom substrates (Snyder and Minshall 1994, Woods 1982).

In the 1995 Columbia River Basin Fish and Wildlife Program (Section 10.8b.22), The NPPC calls on the Kootenai Tribe of Idaho to "Perform a five year Kootenai River ecosystem status determination and improvement study. The study should include elements that will: 1) provide a comprehensive ecosystem status report; 2) evaluate the biological feasibility of restoring system productivity; 3) identify effects of hydropower operations (Libby Dam) on aquatic biota and fish assemblages; and 4) develop, evaluate, test and analyze solutions to ecosystem problems caused by factors currently limiting system productivity, such as nutrient limitation and hydropower effects." (Northwest Power Planning Council Fish and Wildlife Program 1994 as amended in 1995).

The objective for this continuing project is to identify best management options in order to ultimately enhance the aquatic ecosystem and provide future harvest opportunities of white sturgeon, kokanee salmon and burbot in the Kootenai River system, historically fished by the Kootenai Tribe of Idaho. River and tributary habitat assessment, along with analysis of contaminants in soil and invertebrates, which is proposed for fiscal year 1999, is essential prior to developing management options for the Kootenai River ecosystem.

Fiscal year 1995 ended with the completion of the "Kootenai River Biological Baseline Status Report" (Richards 1997) which was produced through a combination of literature review and synthesis. From this compilation of data, it was determined that there was a considerable lack of data for the invertebrates in the Kootenai River, therefore an invertebrate study was initiated for the following year in order to develop a complete and thorough data-base for the Kootenai River.

A one-year macroinvertebrate investigation, which was implemented in order to complete a comprehensive inventory of the Kootenai River aquatic ecosystem was completed at the end of fiscal year 1996. Macroinvertebrates are one of the most important lower trophic organisms in river ecology because they are the link between nutrient supply and food availability for fish. The review on this project has not been

finalized yet. Upon completion of analysis, this investigation will provide valuable information about the productivity in the river and what affect this has on higher trophic levels. This information is essential prior to recommending and implementing ecosystem and fishery improvement measures for the Kootenai River.

A Kootenai River predictive model, incorporating empirical Kootenai River biological data, was also developed during fiscal year 1996, through a series of Adaptive Environmental Assessment (AEA) workshops. Throughout these workshops, international, federal, provincial, state, and tribal agencies cooperated in the exchange of data, ideas and concerns, in order to create a working computer simulation model of the Kootenai River system. The completed model provides a better understanding about the system, and will be used to make quantitative predictions about the response of the system to various management options. At this time, no enhancement measures have been initiated as a result of the model.

b. Proposal objectives.

The overall outcome for the continuing project (#94-49) is to identify best management options in order to enhance the aquatic ecosystem and provide future harvest opportunities of white sturgeon, kokanee salmon and burbot in the Kootenai River system, historically fished by the Kootenai Tribe of Idaho. The specific measurable objectives for this FY99 proposal which will play and important role in helping to achieve the outcome for the continuing project are:

1) Follow-up on the Adaptive Environmental Assessment workshop
2) Continue evaluating biological and population parameter data for all fish species collected in the Kootenai River
3) Assess the habitat of the west-side Kootenai River tributaries
4) Analyze contaminants in the lower Kootenai River
5) Provide monthly, annual and project completion reports

Hypotheses:

1) Contaminants such as pesticides, PCB's, and metals have a significant effect on the early life stages of Kootenai River white sturgeon
2) Kootenai River and tributary habitat is insufficient for spawning and rearing of white sturgeon, kokanee and burbot

Two final reports will be completed at the end of FY99. One report will present the data obtained on biological and population parameters for all fish species collected in the Kootenai River, along with a habitat assessment of the west-side Kootenai River tributaries. This report will also include suggestions for tributary habitat improvements. The second completion report will present the data collected on contaminants found in sediments and invertebrates in the lower Kootenai River.

c. Rationale and significance to Regional Programs.

This project's objectives and hypotheses are related to the Fish and Wildlife Plan (Northwest Power Planning Council 1994 as amended in 1995) objectives and measures because they are specifically directed toward evaluating and enhancing the Kootenai River aquatic ecosystem. In the 1995 Columbia River Basin Fish and Wildlife Program (Section 10.8b.22), The NPPC calls on the Kootenai Tribe of Idaho to "Perform a five year Kootenai River ecosystem status determination and improvement study. The study should include elements that will: 1) provide a comprehensive ecosystem status report; 2) evaluate the biological feasibility of restoring system productivity; 3) identify effects of hydropower operations (Libby Dam) on aquatic biota and fish assemblages; and 4) develop, evaluate, test and analyze solutions to ecosystem problems caused by factors currently limiting system productivity, such as nutrient limitation and hydropower effects." (Northwest Power Planning Council Fish and Wildlife Program 1994 as amended in 1995).

The objectives and hypotheses of this project are related to the Multi-Year Implementation Plan (MYIP) because they evaluate and "restore healthy ecosystems which preserve functional links among biota to ensure the continued persistence, health and diversity of all species including game fish species, nongame fish species, and other organisms" (RFM-CBFWA 1997).

The goals and objectives of this continuing Kootenai River ecosystem enhancement project are also closely related to the goals of the Kootenai River Network. The Kootenai River Network (KRN) is an alliance between various citizen's groups, individuals, business and industry, and tribal and government water resources management agencies in Montana, Idaho, and British Columbia. The KRN is working, through cooperative efforts, to improve resource management practices and to restore water quality and aquatic resources in the Kootenai River Basin.

During fiscal year 1999, the Kootenai Tribe, along with the Idaho Fish and Game, will be working with the Kootenai River Network to gather contaminant data on sediments and invertebrates so that a management plan can be developed that will preserve and enhance the aquatic resources of the Kootenai River.

d. Project history

Project number

same (9404900)

Project reports and technical papers

Kootenai River Biological Baseline Status Report (Richards 1997)

Implications of Ecosystem Collapse on White Sturgeon (*Acipenser transmontanus*) in the Kootenai River, Idaho, Montana and British Columbia (Anders and Richards, in press).

Summary of major results achieved

Fiscal year 1995 ended with the completion of the "Kootenai River Biological Baseline Status Report" (Richards 1997) which was produced through a combination of literature review and synthesis. From this compilation of data, it was determined that there was a considerable lack of data for the invertebrates in the Kootenai River,

therefore an invertebrate study was initiated for the following year in order to develop a complete and thorough data-base for the Kootenai River.

A one-year macroinvertebrate investigation which was implemented in order to complete a comprehensive inventory of the Kootenai River aquatic ecosystem was completed at the end of fiscal year 1996. Macroinvertebrates are one of the most important lower trophic organisms in river ecology because they are the link between nutrient supply and food availability for fish. The review on this project has not been finalized yet. Upon completion of analysis, this investigation will provide valuable information about the productivity in the river and what affect this has on higher trophic levels. This information is essential prior to recommending and implementing ecosystem and fishery improvement measures for the Kootenai River.

A Kootenai River predictive model, incorporating empirical Kootenai River biological data, was also developed during fiscal year 1996, through a series of Adaptive Environmental Assessment (AEA) workshops. Throughout these workshops, international, federal, provincial, state, and tribal agencies cooperated in the exchange of data, ideas and concerns, in order to create a working computer simulation model of the Kootenai River system. The completed model provides a better understanding about the system, and will be used to make quantitative predictions about the response of the system to various management options. At this time, no enhancement measures have been initiated as a result of the model.

Adaptive management implications

No management plans have been decided on at this time as a result of previous investigations.

Years underway

In the third year

Past costs

1995 - $175,000
1996 - $232,353
1997 - $223,858

e. Methods.

Objective 2: Evaluate biological and population parameter data for all fish species collected in the Kootenai River and adjacent tributaries.

Task 2.1 Index electrofishing

Bi-monthly index site electrofishing (April through October) will provide relative abundance, habitat use, movement and migration, diet composition, annual growth, recruitment, and mortality data for all fish species collected in the Kootenai River.

Task 2.2 Relative abundance

Relative abundance of all fish species collected will be determined, and expressed in terms of density (#/ha) and biomass (kg/ha). Catch data (CPUE) estimates will be expressed as catch/hr. After capture, each fish will be measured, weighed, sexed (when possible), and identified using taxonomic keys (Scott and Crossman 1973, Wydoski and Whitney 1979); a scale or appropriate bony structure will be removed from representative size classes for age determinations (Lux 1971; Jerald 1983).

Task 2.3 Habitat use

Depth, substrate, temperature, and current velocity will be recorded at each fish collection site until a sufficient number of sample points is obtained that will produce meaningful habitat use curves for the life stages of each collected species using procedures outlined in "Methods for evaluating stream, riparian and biotic conditions" (Platts et al. 1983). Each parameter will be categorized according to procedures outlined in the U.S. Fish and Wildlife Service's Instream Flow Incremental Methods manual (Bovee and Cochnauer 1977). Fish habitat use will be compared to availability using an IFIM model for the Kootenai River being developed by the Montana Department of Fish Wildlife and Parks. This will allow us to determine how alteration of river discharge effects habitat at different life stages of each species adequately represented in the catch.

Task 2.4 Movement and Migration

Index site electrofishing will provide home range, migratory and movement data for all fish species collected, thus providing information on the behavior and movement patterns of fish at different life stages. Fish movement will be assessed by recapturing marked fish at secondary recapture stations at different locations than where they were originally or previously collected.

Task 2.5 Diet composition

Diet composition and (preferred) prey availability for each target species will be determined in order to assess: (1) if standing crops of invertebrates and forage fish would allow for an increase in production potential for a particular species; and (2) the potential for competition with other species if the population is enhanced. Fish will be collected three times daily once a month from April to October to account for daily and seasonal fluctuations in diet. Fish collections for diet analysis will be separate from collections to determine relative abundance and other population parameter values. Sampling time will coincide with morning and evening peaks in feeding activity as well as mid-day reduction to account for diet changes is types of food items eaten and feeding intensity. The samples will include fish of all sizes to account for dietary differences between age classes of a species. These are standard practices recommended for an accurate assessment of the annual diet (Lagier 1956; Bowen 1983). Age, length, and weight data will be obtained on each fish collected for stomach analysis. Stomach contents will be collected by Lavage (i.e. stomach pump) methods, when possible, to minimize destructive sampling. Organisms contained in the stomach will be fixed in 10% formalin, transferred

to 70% alcohol, and later identified to family or lowest taxonomic level conveniently possible using the keying sources of Brooks (1957), Edmondson (1959), Ward and Whipple (1966), and Borrer and Delong (1971). The number of organisms in food categories will be enumerated.

Dry weights of each food category will be obtained by drying in an oven at 105°C for 24 hours and weighing on an analytical balance to the nearest 0.1 mg. Weights less than 0.1 will be considered as trace amounts.

For the purpose of comparing feeding habits, the mean and standard deviation of the number and weight of each category food organisms will be calculated for each age class and species of fish at each time interval and then converted into percentages of the total stomach contents. Since fish often exhibit seasonal fluctuations in diet (Bowen 1983), the monthly values will then be combined to provide an estimate of importance of each prey to the total annual diet.

The number and weight of each type of prey item in the stomach contents of individual fish will be entered into a computer file. A computer program will be used to calculate the mean number and weight, and standard deviation, of each prey type, age class, and species of fish in the sample for each time interval. The program will then calculate the frequency of occurrence, the numerical and weight percentage of each type of prey item in the diet of the population samples, and the relative importance index (Windell 1971; George and Hadley 1979; Bowen 1983), when compared against all the prey items found.

Stomach contents data will also be used to compute indices (Ivlev 1961; Strauss 1979) to demonstrate which prey organisms are contributors to the fish community. Diet overlap indices (Levins 1968; Keast 1978) will also be computed to assess the potential for competition between fish species.

Task 2.6 Annual Growth

Representative statistical samples of all collected species will be collected quarterly for analysis of growth. Fish will be sexed, weighed to the nearest gram, and measured to the nearest millimeter. Scales will be collected from each fish. Fish scale impressions will be mounted and ages interpreted. Fish ages will be determined according to procedures outlined by Lux (1971) and Jearld (1983). Fish will be grouped by species according to age class and mean length, weight, and condition factor (+S.D.) calculated. Composition of successive samples from the same cohort will provide seasonal growth rates. During the autumn sample, growth for individual fish in each cohort will be back calculated from scales to provide an estimate of the past annual growth rate for each cohort. Growth data will also be used to plot an age/length frequency distribution chart, so it will be possible to obtain the appropriate age of fish from length data. The annual growth increments for each cohort will be compared to assess the degree of variability in growth rates over time. Growth rates of target species collected from the Kootenai River will be compared to growth rates for those species reported for other rivers in the Upper Columbia Basin in order to interpret their significance.

Task 2.7 Complete a biological and population parameter data evaluation report.

Objective 3: Assess the habitat of the west-side Kootenai River tributaries

Numbers of kokanee and burbot using the west-side Kootenai River tributaries to spawn have significantly decreased over the years due to the loss of spawning areas from stream channelization and the increase in fine sediments in most of the west-side streams (Anders 1993). The use of the tributaries as a rearing habitat for kokanee and burbot, as well as white surgeon has also greatly decreased over the years due to habitat degradation. Assessment of the tributaries will allow for identification of best management options that will enhance tributary habitat so that there will be an increase in the fishery which will provide future harvest opportunities of kokanee, burbot and white sturgeon in the Kootenai River system, historically fished by the Kootenai Tribe of Idaho.

Task 3.1 Determine habitat type and quality

Stream order – Determination of stream order, as described in Nielsen and Johnson (1983), will be made. Stream order is a useful classification based on branching of streams (Strahler 1957). The smallest unbranched tributaries are designated order 1. Stream order can be used to estimate approximate stream size and fish population numbers and diversity (Platts 1979; Barila et al. 1981).
Channel morphology – Channel and stream bed shape will be determined using methods described in Plafkin et al. (1989).
Water quality - Water samples will be collected using methods described in APHA (1992) in order to determine bacteria, nutrients, alkalinity, and total solids. In addition, field measurements of pH, temperature, conductivity, turbidity and dissolved oxygen will be taken.
Cover/shelter - Types and quantity of cover and shelter will be measured. Cover types are based on the object providing cover such as boulder, log, root wad, brushpile, vegetation, undercut bank, and overhanging vegetation. In determining the quantity of cover, the surface area of the coverage is measured (Wright et al. 1981).
Instream vegetation – The distribution and abundance of aquatic macrophytes will be surveyed according to Nielsen and Johnson (1983).
Substrate composition – Substrate composition determines the quality of spawning habitat and cover for many fishes and also influences benthic invertebrate production. The percentage composition of various substrate classes in an entire area of the stream bottom will be measured. Substrate classes are determined by the particle sized of the substrate (Nielsen and Johnson 1983).
Stream gradient – Stream gradient determination will be measured between an upstream and downstream site. The difference in elevation between the two sites divided by the horizontal distance between them is the gradient (Nielsen and Johnson 1983).
Habitat types – Stream habitat will be typed by determining whether the stream is riffle/run or glide/pool according to Plafkin et al. (1989).

Task 3.2 Determine fish species present

Population estimates will be made with a backpack electrofisher in spring and late summer/autumn to determine utilization of tributaries by migrants from the river. Relative abundance of all fish species collected will be determined, and expressed in terms of density (#/ha) and biomass (kg/ha). Catch data (CPUE) estimates will be expressed as catch/hr. After capture, each fish will be measured, weighed, sexed (when possible), and identified using taxonomic keys (Scott and Crossman 1973, Wydoski and Whitney 1979); a scale or appropriate bony structure will be removed from representative size classes for age determinations (Lux 1971; Jerald 1983).

Task 3.3 Recommend tributary habitat enhancement measures

Stream enhancement measures will be recommended at the completion of the tributary assessment. Rehabilitation techniques may include cleaning, trapping, or emplacing gravels that improve spawning opportunities, installation of woody debris or other structures that increase the cover for young fish, or removing or surmounting barriers that impede access to habitats (Meehan 1991).

Task 3.3 Complete and submit assessment and recommendation of enhancement measures in a final report.

Objective 4: Analyze contaminants in the lower Kootenai River

Industrial operations in the Kootenai River Basin such as the cominco fertilizer plant and Sullivan lead and zinc mine in Kimberly B.C., the W.R. Grace Company vermiculite mine in Libby, Montana and the Crestbrook Forest Industries pulp mill in Skookumchuck, B.C. have added an unknown amount of contaminant load to the Kootenai River system for many years. Problems with the recruitment of kokanee, white sturgeon, rainbow trout and burbot have prompted studies to determine the effects of contaminants on the fishery of the Kootenai River.

Zaranko et al. (1997) suggested that contaminants that were ingested by fish were more likely to bioaccumulate in the tissues than simply the uptake of contaminants from the water column. Fish frequently ingest bioaccumulated contaminants, such as PCB's that are stored in the river bottom sediment and invertebrates. Therefore, it is important to assess the contaminant level in the sediment and food sources in order to determine the risk to fish populations.

Task 4.1 Determine contaminant levels in river bottom sediments

Sediment samples will be taken at eight selected locations along the lower Kootenai River at known white sturgeon spawning sites and where sturgeon are known to be present (Bonners Ferry, Deep Creek, Myrtle Creek, Fleming Creek, Rock Creek, Ferry Island, Porthill and the inlet to Kootenay Lake). Sampling will take place from early to mid summer, after the endangered white sturgeon spawning season has ended so that

deposited eggs will not be disturbed. One sediment sample will be taken at each location. Sample size was determined using methods described in Scheaffer et al. (1990).

Samples will be obtained with a core sediment sampler and collected in jars and then sent to an accredited analytical laboratory for determination of pesticides, PCB's and metals. Data will be analyzed for differences in contaminant levels at the sampling locations using Analysis of Variance (ANOVA). Data will also be statistically analyzed with contaminant data from the Kootenai River White Sturgeon egg samples (provided by the Idaho Department of Fish and Game) and water samples (provided by the Kootenai Tribe of Idaho) using Analysis of Covariance (ANCOVA).

Task 4.2 Determine contaminant levels in macroinvertebrates

Macroinvertebrate samples will be taken at the same eight selected locations as the sediment samples along the lower Kootenai River. Sampling will also take place from early to mid summer, after the endangered white sturgeon spawning season has ended so that deposited eggs will not be disturbed. One macroinvertebrate sample will be taken at each location. Sample size was determined using methods described in Scheaffer et al. (1990).

The bottom substrate of the lower Kootenai River consists mainly of sand, therefore, a Ponar dredge sampler, hooked onto the side of an aluminum sampling boat, will be used to obtain the samples. Samples will be placed in jars and sent to an accredited analytical laboratory for determination of pesticides, PCB's and metals. Data will be analyzed for differences in contaminant levels at the sampling locations using Analysis of Variance (ANOVA). Data will also be statistically analyzed with contaminant data from the Kootenai River White Sturgeon egg samples (provided by the Idaho Department of Fish and Game) and water samples (provided by the Kootenai Tribe of Idaho) using Analysis of Covariance (ANCOVA).

Task 4.3 Complete and submit a final report

All reasonable precautions will be taken during the sampling for this project, to not adversely affect the habitat and populations of native and resident fish.

f. Facilities and equipment.

Soil and invertebrate samples for contaminant analysis will be collected from the Kootenai River in Boundary County, Idaho. A Ponar dredge sampler will be used to collect macroinvertebrates and a core sediment sampler will be used to obtain soil samples from the river bottom. Both of these methods are EPA approved methods of collection. An accredited analytical laboratory will be contracted to analyze soil and invertebrate samples for contaminants (specific laboratory had not been determined at this time).

The Hydrolab Surveyor® 3 is a computerized data logger that will be used to obtain physical parameters such as temperature, pH, conductivity, dissolved oxygen and turbidity from tributary sites. A current meter will also be used for the tributary assessment in order to determine flow and discharge.

An electrofishing boat will be used to collect biological and population parameter data on fish species present in the Kootenai River, and a backpack electrofisher will be used to collect information on fish species present in the adjacent tributaries. The use of electrofishing equipment is suitable for the collection of fisheries data as described in Nielsen and Johnson (1983). A 1997 Chevy Taho 4X4 will be used to transport sampling boats to and from the sampling sites.

Fish stomach contents will be fixed in a 10% formalin solution and transported to the Kootenai Tribal Laboratory where they will be transferred to a 70% ethyl alcohol solution before analysis takes place. This procedure is a standard practice recommended for accurate fish diet analysis (Lagier 1956; Bowen 1983).

A Gateway 2000 IBM compatible computer will be used for statistical analyses, graphing and report writing.

g. References.

American Public Health Association. 1992. Standard methods for the examination of water, sewage, and wastewater, 18th edition. American Public Health Association, New York, New York, USA.

Anders, P.J. 1993. Kootenai River fisheries studies. Report C: Kootenai River tributary kokanee spawning ground survey. Prepared for U.S. Department of Energy, Bonneville Power Administration. Project No. 88-64. Portland, OR.

Anders, P.J. and D.L. Richards. 1996. Implications of ecosystem collapse on white sturgeon (*Acipenser transmontanus*) in the Kootenai River, Idaho, Montana, and British Columbia. American Fisheries Society. In press.

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Section 8. Relationships to other projects

This project's objectives and hypotheses are related to the Fish and Wildlife Plan (Northwest Power Planning Council 1994 as amended in 1995) objectives and measures because they are specifically directed toward evaluating and enhancing the Kootenai River aquatic ecosystem. In the 1995 Columbia River Basin Fish and Wildlife Program (Section 10.8b.22), The NPPC calls on the Kootenai Tribe of Idaho to "Perform a five year Kootenai River ecosystem status determination and improvement study. The study should include elements that will: 1) provide a comprehensive ecosystem status report; 2) evaluate the biological feasibility of restoring system productivity; 3) identify effects of hydropower operations (Libby Dam) on aquatic biota and fish assemblages; and 4) develop, evaluate, test and analyze solutions to ecosystem problems caused by factors currently limiting system productivity, such as nutrient limitation and hydropower effects." (Northwest Power Planning Council Fish and Wildlife Program 1994 as amended in 1995).

The objectives and hypotheses of this project are related to the Multi-Year Implementation Plan (MYIP) because they evaluate and "restore healthy ecosystems which preserve functional links among biota to ensure the continued persistence, health and diversity of all species including game fish species, nongame fish species, and other organisms" (RFM-CBFWA 1997).

The goals and objectives of this continuing Kootenai River ecosystem enhancement project are also closely related to the goals of the Kootenai River Network. The Kootenai River Network (KRN) is an alliance between various citizen's groups, individuals, business and industry, and tribal and government water resources management agencies in Montana, Idaho, and British Columbia. The KRN is working, through cooperative efforts, to improve resource management practices and to restore water quality and aquatic resources in the Kootenai River Basin.

During fiscal year 1999, the Kootenai Tribe, along with the Idaho Fish and Game, will be working with the Kootenai River Network to gather contaminant data on sediments and invertebrates so that a management plan can be developed that will preserve and enhance the aquatic resources of the Kootenai River.

Electrofishing the lower Kootenai River and its major west-side tributaries will require that a collection permit be obtained from the Idaho fish and Game.

Section 9. Key personnel

Chris Lewandowski
Fisheries Biologist/Limnologist Technician
40 hrs/wk
Duties: sample collection; identification and analysis of field samples (invertebrate and fish stomach contents); data entry into computer; statistical analysis and graphing of data; assist with study design.

Ralph Bahe
Fisheries Biologist/Limnologist Technician
40 hrs/wk
Duties: sample collection; identification and analysis of field samples (invertebrate and fish stomach contents); data entry into computer; statistical analysis and graphing of data; assist with study design.

Diana Richards
Master of Science, Biology - 1994
Eastern Washington University
Cheney WA 99004
Concentration: Limnology, Water Pollution Biology
Bachelor of Science, Biology - 1992
Eastern Washington University
Cheney WA 99004
Concentration: General Biology, Chemistry

Experience:
Nov. 1995 to Present — KOOTENAI TRIBE OF IDAHO
Fisheries Biologist/Limnologist – 40 hrs/wk
- Experience with annual contract responsibilities
- Develop annual budgets
- Coordinate aquatic ecosystem enhancement projects
- Make project purchases and expenditures within budgeted amounts
- Interview, recommend and train new full-time and temporary employees
- Assign work responsibilities and projects to employees
- Lead small field research crews through annual sampling regimes
- Supervise full-time and temporary employees
- Involved with interagency scientific, political and public correspondence
- Interact with staff from diverse backgrounds
- Organize, analyze and interpret data
- Formulate progress and annual reports according to contract obligations

July 1995 to Nov. 1995 — INLAND EMPIRE PAPER COMPANY
Laboratory Assistant – 40 hrs/wk
- Performed nutrient and turbidity tests on paper mill effluent
- Performed water quality tests on the river receiving mill effluent

- Performed brightness, strength, and fiber content tests on paper pulp
- Organized, analyzed and interpreted data
- Entered data into computer
- Summarized project results

Sept. 1992 to July 1995 EASTERN WASHINGTON UNIVERSITY
LIMNOLOGY LABORATORY

Research Associate – 40 hrs/wk

- Co-authored progress and annual research reports
- Operated various field and laboratory equipment
- Collected water quality samples
- Analyzed water samples in a laboratory
- Organized, analyzed and interpreted data
- Communicated test results and environmental issues to clients
- Practiced quality assurance and quality control measures
- Obtained knowledge of word processing and spreadsheet software

Sept. 1988 to Sept. 1992 UPPER COLUMBIA UNITED TRIBES
FISHERIES CENTER

Research Assistant – 30 hrs/wk

- Co-authored progress and annual research reports
- Supervised hourly employees
- Assessed fish populations through electrofishing
- Identified and analyzed aquatic invertebrates and zooplankton samples
- Analyzed fish scales
- Operated various field and laboratory equipment
- Acquired considerable knowledge of computer software
- Organized, analyzed and interpreted data
- Worked with Native Americans on environmental assessment projects

Technical Reports

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Section 10. Information/technology transfer

Technical information obtained from this project will be distributed through final project reports submitted to the Bonneville Power Administration. Some of the studies may also be published in various fisheries journals. The work done on the Kootenai River predictive model through the Adaptive Environmental Assessment workshop in 1997 can be downloaded off the University of British Columbia fisheries centre web server at http://fisheries.com.