Bonneville Power Administration
Fish and Wildlife Program FY99 Proposal Form

Section 1. General administrative information

Snake River Sockeye Salmon Habitat and Limnological Research

Bonneville project number, if an ongoing project 9107100

Business name of agency, institution or organization requesting funding
Shoshone-Bannock Tribes

Business acronym (if appropriate) SBT

Proposal contact person or principal investigator:

Name	Doug Taki
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Phone	208-238-3914
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Subcontractors.

Organization	Mailing Address	City, ST Zip	Contact Name
Biolines	HC-64 Box 9965	Stanley, ID 83278	Bob Griswold

NPPC Program Measure Number(s) which this project addresses.
2.2A, 7.5A, 7.5A.1, 7.6A.2

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

Other planning document references.

Proposed Recovery Plan for Snake River Salmon 1.3.a and 1.6.c

Subbasin.

Salmon River

Short description.

Increase carrying capacities of Snake River sockeye salmon *Oncorhynchus nerka* rearing lakes (Redfish, Pettit, and Alturas) by adding nutrients that stimulate production of sockeye forage. The high background kokanee biomass and the nature of existing forage necessitates nutrient additions to increase survival of sockeyes added to the lake from captive broodstock progeny. Continue limnological monitoring in order to estimate carrying capacities of each lake and document the effects of fertilization. Investigate fish community dynamics to better understand inter- and intra-specific interactions within those lakes and determine how they affect sockeye smolt production. We will use a smolt weir on the Pettit Lake outlet and a screw trap on Alturas Lake Creek to estimate smolt emigration from sockeye captive broodstock progeny released into those lakes in 1997 from the captive broodstock program.

Section 2. Key words

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

Other keywords.

Life history, sampling, modeling, nutrient dynamics, predation, ecological interactions

Section 3. Relationships to other Bonneville projects

Project #	Project title/description	Nature of relationship
9107200	Redfish Lake Sockeye Captive Broodstock	Results generated by this project (e.g., lake fertilization) help direct decisions about how many sockeye are produced from the captive broodstock programs and where they should be released.
9204000	Redfish Lake Sockeye Salmon Captive Broodstock Rearing	Results generated by this project (e.g., lake fertilization) help direct decisions about how many sockeye

		are produced from the captive broodstock programs and where they should be released.
9009300	Genetic Analyses of Oncorhynchus nerka	We assist in data collection to help stock analyses for *O. nerka* in Sawtooth Basin lakes.

Section 4. Objectives, tasks and schedules

Objectives and tasks

Obj 1,2,3	Objective	Task a,b,c	Task
1	Continue extensive limnological monitoring in Redfish, Alturas, and Pettit lakes. Continue monitoring limnological parameters in Stanley Lake with a less intensive schedule. The goal is to restore or increase, if necessary, sockeye salmon nursery lake fertility to levels conducive to optimum sockeye salmon survival in these nursery lake systems. Monitoring of these parameters is necessary to evaluate the effects of lake nutrient enhancement.	a	Conduct ongoing limnological studies in the Sawtooth Valley nursery lakes during 1998 and 1997 to provide continued information on physical, chemical, and biological characteristics relating to *O. nerka* production. This will also include a lake fertilization monitoring program.
		b	Complete winter limnology sampling to estimate sockeye salmon production opportunities and constraints during this season.
		c	Coordinate efforts with the USFS, IDFG, Idaho State Dept. of Water Resources.
2	Conduct lake fertilization in Redfish, Alturas, and Pettit lakes.	a	Apply pharmaceutical grade nitrogen and phosphorous by boat at weekly intervals. Rates of application had already been determined for 1997 and after evaluating 1997 limnological data and *O. nerka* population estimates those rates may change for 1998.
3	Enumerate sockeye smolt	a	Initiate collection of sockeye

	outmigration from Pettit and Alturas lakes. We will use a smolt collection weir and a screw trap at the outlet streams of Pettit and Alturas lakes, respectively.		smolts from Alturas Lake and continue collection of smolts from Pettit Lake. Enumeration and potential PIT tagging (pending TOC recommendation) will be undertaken at each location.
4	Continue monitoring *O. nerka* population characteristics and densities in the Sawtooth Valley lakes in conjunction with IDFG to determine inter-annual trends.	a	Estimate the emergent *O. nerka* fry population entering Redfish Lake. Estimate summer survival of age-0 fish by comparing population estimate to end of the summer trawl/hydroacoustic work.
		b	Estimate *O. nerka* stream spawner population size and sex ratio in Redfish (Fishhook Crk.), Alturas, and Stanley lakes using spawning ground surveys. Estimate spawner distribution and stream residency. Enumerate fecundity for each system by sacrificing 20 females from each system. If the escapement is small in Stanley Lake Creek we may choose not to enumerate fecundity. Survey Pettit Lake for shoal spawning *O. nerka* locations. Coordinate with IDFG.
		c	Estimate the total number of *O. nerka* in Sawtooth Valley lakes (Redfish, Alturas, Pettit, and Stanley) using hydroacoustics. Use vertical gillnets to assist in partitioning targets. Determine year class strength and mortality.
		d	Correlate hydroacoustic population estimates with IDFG's trawling estimates
5	Determine direct and potential piscivorous fish effects on *O. nerka* populations in the Sawtooth Valley Lakes in conjunction with IDFG.	a	Estimate potential predation and competition impacts to *O. nerka* by nursery lake fish community constituents by stomach content analysis of gill-net captured fish. Samples will come from different time periods and lake locations.
		b	Estimate overwinter survival of

			rainbow trout stocked in Pettit Lake, and monitor seasonal diet habits.
6	Assist IDFG with in-lake captive broodstock production activities of *O. nerka*.	a	Assist IDFG with developing *O. nerka* juvenile release strategy protocols and evaluation of fish performance.
		b	Assist IDFG with construction and maintenance of net pens used to rear *O. nerka* juveniles in the Sawtooth Valley nursery lakes.
		c	Assist IDFG with placement and retrieval of egg incubation boxes in Redfish Lake.
		d	Assist IDFG personnel, where needed, with PIT tagging of sockeye salmon destined for nursery lake re-introduction.
		e	Solicit and obtain written recommendations from other sockeye salmon experts on release and lake production strategies.
7	Technology Transfer	a	Provide written reports to Stanley Basin Technical Oversight Committee.
		b	Write Annual report for BPA. (Due date April 1998). Since most data is accumulated logically by a field season year (January through December) versus a fiscal year (August to August) we propose completing and presenting our draft annual report to BPA by April 20, followed with the final report on May 30 of the year following the end of the prior fiscal year. For example, our FY97 report would be presented in April of 1998. This will allow for adequate summary and analysis of a complete data year rather than fragmenting collected information.
		c	Attend appropriate conference(s) that relate to sockeye salmon

			production.

Objective schedules and costs

Objective #	Start Date mm/yyyy	End Date mm/yyyy	Cost %
1	09/1991	10/2024	21
2	06/1995	10/2010	27
3	04/1996	08/2025	16
4	09/1991	08/2025	11
5	09/1991	08/2025	8
6	09/1991	10/2010	4
7	09/1991	08/2025	12

Schedule constraints.

If a decision on mainstem operations is finalized in 1999 it may be five life cycles before our goals are reached.

Completion date.
2025

Section 5. Budget

FY99 budget by line item

Item	Note	FY99
Personnel		108046
Fringe benefits		36736
Supplies, materials, non-expendable property		5500
Operations & maintenance		32925
Capital acquisitions or improvements (e.g. land, buildings, major equip.)		12000
PIT tags	# of tags:	
Travel	includes per diem etc. for field work	29032
Indirect costs		41161
Subcontracts		139773
Other		
TOTAL		405173

Outyear costs

Outyear costs	FY2000	FY01	FY02	FY03
Total budget	425000	430000	435000	440000

O&M as % of total	50	45	45	45

Section 6. Abstract

The purpose of this project is to assess habitat limitations pertaining to Snake River sockeye salmon *O. nerka* preservation and recovery, and to implement activities necessary to increase or re-establish sockeye production in historic nursery lakes of the Sawtooth Valley, Idaho. To investigate fish community dynamics in lake nursery areas, including the relationships between resident and anadromous forms of *O. nerka* in present or potential Sawtooth Valley production areas. Assist IDFG in captive broodstock activities such as sockeye net pen production and assessment of fish performance while residing in nursery lakes through smolt emigration.

Limnological conditions and fish interactions (competition/predation) are used to estimate sockeye carrying capacity. Without this data, stocking at densities greater than existing carrying capacities could result in a zooplankton crash which would reduce available rearing habitats and impede recovery.

Our limnology and lake fertilization efforts directly address 7.5A.l and 7.6A.2 in the FWP. We also removed a passage barrier on the outlet of Pettit Lake Creek that is called for in both 7.5A.1 and 7.6A.2.

The methods we use for limnological monitoring and lake fertilization are standard methods used for decades in Alaskan and Canadian sockeye rearing lakes. We consulted with Dr. John Stockner, a Canadian researcher with more than two decades of sockeye research experience, to formulate a prescription for the quantities of fertilizer to apply to each lake that will increase forage resources for juvenile sockeyes without detrimental effects on the lake's ecosystem.

We expect to increase the number of returning adult sockeyes to the Sawtooth Valley, Idaho. The time frame for this to occur is unknown but early results should be seen in adult returns during 1998.

Section 7. Project description

a. Technical and/or scientific background.

Show how the proposed work is a logical component of an overall conceptual framework or model that integrated knowledge of the problem. The most significant previous work history related to the project, including work of key project personnel on any past or current work similar to the proposal, should be reviewed. All work should be adequately referenced and listed at the end of this field.

Although the Northwest Power Planning Act of 1980 was congressionally enacted to restore depleted salmon runs, the remnant Snake River sockeye salmon run to Redfish Lake near Stanley, Idaho has continued to decline throughout the 1980's and 1990's toward extinction (National Marine Fisheries Service 1995). From 1954 to 1966 there are records of adult sockeye salmon escaping to Redfish Lake to spawn (Bjornn et al. 1968). Adult escapement since 1954 has ranged from a high of 4,361 fish in 1955 to zero fish in

1990, 1995, and 1997. Escapement to the Redfish Lake weir during the 1990's was highest in 1993 when eight fish returned.

The last documented spawning of sockeyes in Alturas Lake was in 1964 (Bowler 1990). When a local rancher was requested to allow the passage of water through his diversion, forty-five sockeyes were counted in Alturas Lake inlet and outlet streams. Seven sockeyes were counted at the Sawtooth Hatchery during the 1980's (Bowler 1990). These fish were probably destined for Alturas Lake.

An inter-agency team of scientists with the expertise needed to accomplish the goal of recovering Snake River sockeye was formed at the onset of the project. Current members of the Stanley Basin Technical Oversight Committee (TOC) are the SBT, the National Marine Fisheries Service (NMFS), the University of Idaho (UI), the Idaho Department of Fish and Game (IDFG), the BPA, the Idaho Department of Environmental Quality (DEQ), and the U.S. Forest Service. All activities addressed in this project have been endorsed by the TOC.

Section 7.5A1 in the FWP identifies funding for lake fertilization. Nelson and Edmondson (1955) reported increased salmon production by adding fertilizer to an Alaskan lake decades ago. Since then lake fertilization has been used to increase production and survival of juvenile sockeyes in several Canadian lakes (LeBrasseur and Kennedy 1972; Robinson and Barraclough 1978; Hyatt and Stockner 1985).

At the inception of this project there was a paucity of information available about the limnological attributes, and consequently sockeye rearing capabilities of the Sawtooth Valley lakes. We began intensive limnological and fish community assessments of Redfish, Stanley, Pettit, and Alturas lakes in 1992 to provide baseline data. Since 1992 we have collected samples for the following variables: water temperature, dissolved oxygen, and conductivity profiles, water transparency, light, nutrient concentrations (TP, SRP, NO2+NO3-N, NH4-N, and TKN), chlorophyll *a*, primary productivity, and zooplankton density and biomass. Initial sampling was done monthly during ice-free months and then we began winter sampling in 1994. This information allows us to estimate *O. nerka* carrying capacities for each lake. After testing different levels of nutrient additions in limnocorrals during 1993 and 1994 we began a test fertilization of Redfish Lake in 1995. In 1996 we did an abbreviated fertilization and then in 1997 we fertilized Redfish, Pettit, and Alturas lakes. With no plans to introduce sockeyes into Stanley Lake we are still monitoring it as a control lake. We have also studied fish community dynamics in all four lakes.

We set gill nets in the lakes to capture fish for species composition and diet analysis. This is necessary to learn about interspecific competition and predation among the different species resident in each rearing lake. *O. nerka* populations are monitored in several ways. We do adult spawning surveys in the fall, lake hydroacoustic population surveys in the summer, and fry trapping in the spring to estimate egg to fry survival rates. We also monitor smolt outmigration from Pettit and Alturas lakes.

During 1995 and 1996 we removed the fish passage barrier at the outlet of Pettit Lake (7.5A.1) and installed a weir that enables us to quantify smolt outmigration and capture returning adults. We will utilize a screw trap on the outlet of Alturas Lake to estimate smolt outmigration from that system.

b. Proposal objectives.

1. Characterize limnologic attributes for Sawtooth Valley lakes to assess *O. nerka* production limitations and production potential. Continued monitoring will assist in predicting lake carrying capacities based on inter and intra-annual habitat fluctuations. Continue winter limnological evaluations to help determine sockeye salmon production opportunities and limitations. Monitoring is also required by the DEQ for evaluation of nutrient enhancement activities. Results may be distributed to independent consultants for obtaining fertilization rates.

2. Implement and evaluate lake nutrient enhancement of Redfish, Alturas, and Pettit lakes during 1998. This objective will follow protocols of a successful test fertilization of Redfish Lake in 1995. We are trying to achieve a goal of 20% survival of sockeyes reared in the lake until outmigration.

3. Operate a smolt weir on the outlet of Pettit Lake and a screw trap on the outlet stream of Alturas Lake. This will enable us to estimate overwinter survival and outmigration rates of the broodstock sockeye released into those lakes during 1997.

4. Investigate *O. nerka* population dynamics in Stanley Basin lakes. Estimate population parameters of potential fish predators (bull char, lake trout, rainbow trout, squawfish) and potential fish competitors (rainbow trout, brook char, and redside shiners) in Sawtooth Valley nursery lakes. We will not be the lead agency on any Redfish lake gill netting, but will cooperate with IDFG researchers in 1998 pending Endangered Species Act permitting.

5. Determine predator effects on *O. nerka* population dynamics in relation to different release strategies. We will continue Pettit Lake fish sampling per the NMFS request to intensify evaluation of hatchery rainbow trout/*O. nerka* interactions.

6. Assist IDFG with net pen construction and operation for the purpose of rearing progeny of captive broodstock sockeyes and monitoring subsequent survival and smolt production. Also, assist, as necessary, IDFG research biologist with field investigations related to sockeye salmon recovery.

c. Rationale and significance to Regional Programs.

Section 7 of the FWP (1994) calls for a coordination of salmon production and habitat. This project evaluates and enhances habitat for Snake River sockeye and is intimately involved with sockeye production from the captive broodstock programs (Project numbers 9107200 and 9204000). Lake fertilization and barrier removal are

identified as tasks 1.3.a and 1.6.c in the Proposed Recovery Plan for Snake River Salmon (NMFS 1995) and 7.5A.1 in the FWP (1994). The Snake River Salmon recovery team also recommended implementing these measures (1994) in chapter 5, section 6. As noted above in 7a., all Snake River sockeye recovery efforts are coordinated through the TOC and each individual project is dependant on each other.

The overall objective of this project is to increase sockeye populations in the Sawtooth Valley, Idaho which directly addresses Section 2.2A of the FWP (1994) that states "The program preference is to support and rebuild native species in native habitats, where feasible." In order to increase sockeye populations we need to increase survival during their freshwater life stage. The null hypothesis, H_o = adding nutrients to sockeye rearing lakes will not affect sockeye survival, was rejected during our first year of lake fertilization. Captive broodstock progeny released in Redfish Lake during 1994, when there was no lake fertilization, had an estimated survival from time of release to outmigration of 5.4%. Sockeyes released during 1995, the first year of fertilization, had an estimated survival from time of release until outmigration of 15.8%. Based on those results, we began fertilizing Alturas and Pettit lakes in 1997 to try to increase survival of sockeyes released into those lakes.

d. Project history

This project began in 1991 after Snake River sockeye salmon were listed as an endangered species. The seven year average expenditure for this project is $483,223. Since 1991 we have successfully fertilized Redfish Lake for 2 2 years and Pettit and Alturas lakes for one year. We removed the fish passage barrier from Pettit Lake Creek and installed a weir near that location. The barrier removal was the single greatest expenditure during this project.

Based on our annual evaluations of lake rearing conditions the TOC is able to recommend stocking rates for each lake. This has to be adaptive as conditions change annually. We are also in the process of evaluating the interactions of stocked hatchery rainbow trout with resident kokanees and stocked sockeyes.

Spaulding, S. 1993. Snake river sockeye salmon (*Oncorhynchus nerka*) habitat/limnologic research. U.S.Department of Energy, Bonneville Power Administration, Portland, OR. Project number 91-71.

Taki, D., and A. Mikkelsen. 1997. Snake river sockeye salmon habitat and limnological research. U.S.Department of Energy, Bonneville Power Administration, Portland, OR. Project number 91-71.

Teuscher, D., and D. Taki. 1994. Snake river sockeye salmon habitat and limnological research. U.S.Department of Energy, Bonneville Power Administration, Portland, OR. Project number 91-71.

Teuscher, D., and D. Taki. 1995. Snake river sockeye salmon habitat and limnological

research. U.S.Department of Energy, Bonneville Power Administration, Portland, OR. Project number 91-71.

Teuscher, D., and D. Taki. 1996. Snake river sockeye salmon habitat and limnological research. U.S.Department of Energy, Bonneville Power Administration, Portland, OR. Project number 91-71.

e. Methods.

Detailed methods for monitoring limnological parameters can be found in Taki and Mikkelsen (1997). Following is our proposed sampling schedule for the lakes.

Redfish, Pettit and Alturas Lakes
Sample once per month in October, November, January, March and May.
Sample twice per month , June through September or every two weeks during fertilization.

Stanley Lake - sample once per month in March, June, August and October.

1. Temperature and Dissolved Oxygen - every sample period
   Collect profile data using hydrolab or YSI for temperature (^{o}C) and dissolved oxygen.
   Record at one meter intervals to 10 m then record changes.
2. Secchi Transparency - every sample period
   Record depth at which secchi disappears, drop secchi and retrieve slowly, record depth secchi reappears. Secchi transparency is the mean of the two values.
3. Light Profile - every sample period
   Identify euphotic zone. Collect light profile using LiCorr at 2 m intervals to 2-4 meters below 1% light level. R = sea/deck at surf, record depth at 1% R.
4. Nutrients - once per month or every two weeks if fertilizing
   Collect water from the epilimnion, metalimnion and hypolimnion based on profile data. Integrate samples within each level (use churn splitter). Analyze for total phosphorous (TP) and nitrate (NO^{2}+NO^{3}-N).

June, August and October - add assays for ammonium (NH^{4}) and kjeldahl nitrogen (TKN) at each strata.

January, March and May - sample 3 discrete depths while lakes are isothermal, collect water at surface (6-0 m), mid-depth (RFL 55m, Pet and Alt 35m, Stan 12m), and 1 meter above bottom. Analyze for total phosphorous (TP) and nitrate (NO^{2}+NO^{3}-N).

5. Chlorophyll - every sample period

Collect water from the epilimnion, metalimnion and hypolimnion based on profile data. Integrate samples within each level (use churn splitter).

June, August and October - add 1% light level

January, March and May - sample water at surface (6-0 m) only

1. Zooplankton - every sample period

Lake and Station	Depth			
Redfish A	10-0 m	30-10 m	60-30 m	85-60 m
Redfish B and C	10-0 m	30-10 m	60-30 m	
Pettit A,B and C	10-0 m	30-10 m	45-30 m	
Alturas A,B and C	10-0 m	30-10 m	45-30 m	
Stanley A,B and C	10-0 m	23-10 m		

6. Phytoplankton

June, July, August, September, October at Redfish, Pettit and Alturas
June, August, October at Stanley
Integrated Epilimnion and Metalimnion
Focus on picoplankton (1-2 *u*m) and nanoplankton (2-20 *u*m)

Liquid fertilizer (28-0-0 and 10-34-0) will be added weekly to Redfish, Pettit, and Alturas lakes from June through October 1998. The N:P ratios (20:1 by weight, 45:1 molar) are skewed toward very high nitrogen loads to prevent any possible occurrence of colonial N-fixing Cyanophyta. Approximately 217 kg of TP and 4,208 kg of TN will be added to Redfish Lake, 78 kg of TP and 1,540 kg of TN for Alturas Lake, and 35 kg of TP and 694 kg of TN will be added to Petitt Lake. Applications follow a ramping schedule with different amounts added at different periods. Fertilizer will be applied by boat and will be directed by hose to the boat wake while traveling 4-8 knots. A set number of parallel transects will be used for each lake, and boat speed is controlled by the amount of fertilizer applied for each particular date.

We will operate a smolt weir on the outlet of Pettit Lake and a screw trap on the outlet stream of Alturas Lake. We are able to capture 100% of fish outmigrating from Pettit Lake. The screw trap on the outlet of Alturas Lake will capture approximately 25% of fish outmigrating from Alturas Lake (NMFS 1994). We will do a mark recapture study at four different intervals based on changes in discharge to estimate trap efficiency for different flow regimes. A detailed description of trap operations can be found in our Section 10 Permit #998 (NMFS 1996).

We will use horizontal and vertical gill nets to capture fish from Pettit and Alturas lakes to determine predation/competition among the fish communities. After capture, fish are measured and weighed, and then the stomachs removed and preserved in formalin for diet analysis. We will follow the procedures in Taki and Mikkelsen (1997) but anticipate curtailing our schedule to only sample four times a year.

f. Facilities and equipment.

The office and laboratory for this project are located in Fort Hall, Idaho, approximately 220 miles from the Sawtooth Valley. In addition to our lab we have the use of the Biolines laboratory which is located in the Sawtooth Valley. We utilize the Biolines lab for all limnological work and our lab for stomach analysis and otolith and scale readings. We also send nutrient samples to Cal State-Davis for processing, and phytoplankton and zooplankton samples are counted independently by the same individuals who have counted them since the inception of the project.

Our office is fully staffed and equipped to accomplish our work objectives for this project. Office equipment includes computers, facsimile machines, a copy machine, etc.. We use a Hydroacoustics Technology, Inc. echosounder system for our hydroacoustic surveys. This project uses two boats for collecting samples and applying nutrients and two pick-ups for transportation to and from the Sawtooth Valley. The only high-cost items we will request is the purchase of two snowmobiles. The ones we are using are four years old with high mileage. High repair costs and decreasing reliability make these machines a liability. Snowmobiles serve an important function on this project as they are needed to access the lakes and smolt sampling sites from late November through June.

g. References.

Bjornn, T. C., D. R. Craddock, and D. R. Corley. 1968. Migration and survival of Redfish Lake, Idaho, sockeye salmon, Oncorhynchus nerka. Transactions of the American Fisheries Society. 97 (4): 360-373.

Bowler, B. 1990. Additional information on the status of Snake River sockeye salmon. Idaho Department of Fish and Game and USDA Forest Service. P.O. No. 40-0267-4-127.

Hyatt, K. D., and J G. Stockner. 1985. Responses of sockeye salmon Oncorhynchus nerka to fertilization of British Columbia coastal lakes. Can. J. Fish. Aquat. Sci. 42: 320-331.

LeBrasseur, R. J., and O. D. Kennedy. 1972. The fertilization of Great Central Lake. II. Zooplankton standing stock. Fish. Bull., 70 (1): 25-36.

National Marine Fisheries Service. 1994. Biological Opinion. Trapping of Alturas Lake kokanee Oncorhynchus nerka outmigrants during the spring of 1994-1997. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Silver Springs, Maryland.

National Marine Fisheries Service. 1995. Proposed recovery plan for Snake River salmon. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Washington, D.C.

National Marine Fisheries Service. 1996. Section 10 permit to take endangered species. Permit number 998. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Silver Springs, Maryland.

Nelsen, P. R., and W. T. Edmondson. 1955. Limnological effects of fertilizing Bare Lake, Alaska. U.S. Fish and Wildlife Service, Fish Bulletin 56: 414-436.

Northwest Power Planning Council. 1994. 1994 Columbia River Basin fish and wildlife program. NPPC, Portland, Oregon.

Robinson, D. G., and W. E. Barraclough. 1978. Population estimates of sockeye salmon Oncorhynchus nerka in a fertilized oligotrophic lake. J. Fish. Res. Board Can. 35: 851-860.0

Section 8. Relationships to other projects

This project is one component of an inter-agency effort to restore Snake River sockeye salmon runs to the Sawtooth Valley, Idaho. As I mentioned in Section 7a, all activities involved in our recovery efforts are coordinated through the TOC. Shoshone-Bannock Tribes' fisheries personnel involved with this project work closely with their counterparts in the IDFG (Project Number 9107200) and the NMFS (Project Number 9204000). Mutual cooperation is evident by the coordination of field activities and the sharing of personnel between agencies.

Overall project goals are similar for all of the agencies involved - the immediate goal is to prevent extinction of the ESU, and the overall goal of having a viable population of Snake River sockeye is shared by all. The scope of this program dictates that each project is responsible for specific tasks involved to reach our mutual goal. Achievements by each agency have contributed to making informed decisions regarding management issues and future direction of our work.

Genetic analyses of the *O. nerka* populations in the Sawtooth Valley lakes by the NMFS and the University of Idaho have defined which stocks may be endemic and which ones are not. That information has allowed us to focus our efforts toward sustaining the ESU without expending energies on stocks that are not endemic. Improvements in culture techniques by the IDFG and the NMFS have made progeny from the sockeye broodstock program available in large enough numbers that we have been able to reintroduce sockeye to Pettit and Alturas lakes. Our work has enabled the TOC to decide upon release strategies for those fish, and has improved rearing habitat as they become available for release into the lakes. We have also increased available habitat by removing the fish passage barrier below Pettit Lake. This was done with in collaboration with the Forest Service, the DEQ, the BPA, and the IDFG.

Section 9. Key personnel

Doug Taki	Program Manager	(10 mo.)
Anders Mikkelsen	Project Biologist	(12 mo.)
Ken Ariwite	Senior Technician	(12 mo.)
Robert Trahant	Technician	(9 mo.)
Lillian Guardipee	Clerical	(6 mo.)

Doug Taki

Education:

Idaho State University, B.S. in Biology with emphasis on fish ecology

Current Employer and Responsibilities:

Sockeye Research Program Manager July 1993 - present
SHOSHONE-BANNOCK TRIBES
FORT HALL, ID 83203

I am responsible for every aspect of the Shoshone-Bannock Tribes (SBT) Snake River sockeye research project and are responsible for ensuring that all contractual obligations are met. This includes writing annual Statement's of Work and an itemized budget, tracking expenditures, ensuring all tasks are completed, monitoring subcontractor performance, and completing Annual Reports to the Bonneville Power Administration.

. I am the direct liaison between Tribal government and the IDFG, NMFS, BPA, IDEQ, and the USFS for all sockeye related management or research related issues. I represent the SBT on the Stanley Basin Technical Oversight Committee and share responsibility on the Fish Passage Advisory Committee and Anadromous Fish Managers forum.

I supervise one biologist, one full-time and one temporary technician, a limnology subcontractor, and coordinate field work with the IDFG whenever there is a need for help by either agency. In addition to supervising and working with everyone to assure all project goals are accomplished I conduct all hydroacoustic analyses and PIT tag evaluations.

StreamNet Steering Committee October 1996 - present

SHOSHONE-BANNOCK TRIBES
FORT HALL, ID 83203

My duties include evaluating proposed changes to our website, coordination of data transfers, integration of genetic data between researchers and StreamNet, and assisting others when needed.

Resident Fisheries Manager November 1991 - July 1993

SHOSHONE-BANNOCK TRIBES
FORT HALL, ID 83203

I was responsible for managing the fisheries resources on the 544,000 acre Fort Hall Indian Reservation.

Fisheries Field Biologist May 1990 - November 1991

SHOSHONE-BANNOCK TRIBES
FORT HALL, ID 83203

Expertise:

1) Techniques and methodologies for evaluating stream and riparian habitats, 2) Techniques and methodologies for evaluating lentic habitats, 3) experience with equipment necessary to sample fish (e.g. screw traps, weir operations, gill nets, electrofishers, etc.) and subsequent evaluations, 4) All phases of using PIT tags for evaluating migration performance of anadromous fish, 5) All phases of conducting and analyzing hydroacoustic surveys, 6) Sound background in statistics including a five day biometry workshop, 7) SCUBA certified

Publications:

six BPA annual reports
four BIA annual reports
two IDFG annual reports

Section 10. Information/technology transfer

Current results are provided at monthly TOC meetings. The minutes from TOC meetings are public and may be obtained from the BPA. Project activities and results are provided in an annual report to the BPA.