Bonneville Power Administration
Fish and Wildlife Program FY99 Proposal

Section 1. General administrative information

Imnaha River Smolt Monitoring Program Project

Bonneville project number, if an ongoing project 8712703

Business name of agency, institution or organization requesting funding
Nez Perce Tribe Department of Fisheries Resources Management

Business acronym (if appropriate) NPT

Proposal contact person or principal investigator:

Name	Paul Kucera
Mailing Address	P.O. Box 365
City, ST Zip	Lapwai, ID 83540
Phone	(208)843-7320, Ext. 2 (research)
Fax	(208)843-7322
Email address	paulk@nezperce.org

Subcontractors.

Organization	Mailing Address	City, ST Zip	Contact Name
IDFG		Lewiston, ID 83501	Ed Buettner/Steve Pettit
ODFW		Enterprise, OR/Clackamas, OR	Anne Setter/Kirk Beiningen
WDFW		Olympia, WA	Charlie Morrill
Chelan Co. PUD		Wenatchee, WA	Robert McDonald
USFWS		Vancouver, WA	Marv Yoshinaka/Walt Ambrogetti

NPPC Program Measure Number(s) which this project addresses.
5.1B,5.1B.1

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

ESA Section 10 permit 825.

Other planning document references.

NMFS draft recovery plan calls for monitoring, evaluation and research to support flow augmentation efforts; evaluating juvenile survival in relation to flow augmentation; improving fish passage efficiencies at the dams; reducing fish losses through increased spill; understanding salmonid biological requirements and variation in life history characteristics. These all directly or indirectly relate to ongoing smolt monitoring program efforts in the Imnha River.

Subbasin.

Imnaha River, Snake River

Short description.

Operate the Imnaha River smolt trap(s) to provide information (condition, performance and survival) on spring emigration of wild and hatchery chinook salmon and steelhead trout smolts from the Imnaha River. **provide indicators of the healh of emigrating smolts. PIT tagged smolts provide measures of smolt travel time and estimates of in-river survival through key index reaches. These tributary specific data are used for in-season operational decisions relative to flow and spill management, particularly during periods when spill is being provided to improve smolt passage and survival.**

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

Other keywords.

Survival estimation, chinook, steelhead,

Section 3. Relationships to other Bonneville projects

Project #	Project title/description	Nature of relationship
LSRCP Reim.Prg	Lower Snake River Comp. Plan Hatchery Prod. And Monitoring and Evaluation	Provides evaluation of production releases and survival estimates of wild salmon.

8805301	Northeast Oregon Hatchery	Will provide evaluation of production releases.
8712700	Smolt Monitoring by non-Federal Entities	Provides data necessary for flow and spill management and spill requests.

Section 4. Objectives, tasks and schedules

Objectives and tasks

Obj 1,2,3	Objective	Task a,b,c	Task
1	Determine the spring outmigration timing of chinook salmon and steelhead trout smolts at the Imnaha River trap from March 15 to June 5.	A	Operate the outmigrant trap daily (5 days/week) from March 15 to June 5 to determine the timing of anadromous salmonid smolt emigration.
		B	Subsample the fish catch to collect length, weight, species catch composition, and fish condition of hatchery and wild chinook salmon and steelhead trout smolts.
		C	Calculate fish condition factors for spring emigrating wild and hatchery chinook salmon and steelhead trout smolts and report general fish health.
		D	Determine the spring outmigration timing of wild and hatchery chinook salmon and steelhead trout smolts in the Imnaha River.
		E	Report outmigration information to the FPC two times per week by 1600 hours in a standard format determined by the FPC.
2	Determine the outmigration timing and travel time of previously PIT tagged wild and hatchery chinook salmon and hatchery steelhead trout smolts through interrogation at the lower Imnaha River trap from March 15 to June 5.	A	Obtain release time and tag information for previously PIT tagged wild and hatchery chinook salmon and steelhead trout smolts fom ODFW and the NPT.
		B	Interrogate all fish collected at the trap for the presence of PIT tags.
		C	Determine the outmigration timing

			and travel time o previously PIT tagged wild and hatchery chinook salmon smolts and hatchery steelhead trout smolts at the Imnaha River trap.
		D	Estimate the relative survival of PIT tagged hatchery chinook salmon smolts recaptured at the Imnaha River trap (SURPH model).
		E	Report all interrogation files to PTAGIS within 48 hours.
3	Determine the outmigration timing, travel time and recovery rate of wild and hatchery steelhead trout PIT tagged fom the Imnha River through the Snake River and other Columbia River dams.	A	PIT tag 1,400 actively outmigrating wild steelhead trout smolts (200 fish/week) over a seven week period.
		B	PIT tag 3,200 actively outmigrating hatchery reared steelhead trout smolts (60 fish/week) over a five week period; with 200 tags for one week tagging. PIT tag release groups of 600 fish are to be tagged over a one to three day period if possible.
		C	Edit and validate all PIT tag files using PITVAL before submission to PTAGIS.
		D	Upload PIT tagging files to PTAGIS within 48 hours.
		E	Retrieve PIT tag recovery and travel time data from PTAGIS for Snake River and other Columbia River dams.
		F	Calculate outmigration timing of PIT tagged wild and hatchery steelhead trout smolts from the Imnaha River to Snake River and Columbia River dams.
		G	Determine the travel time and recovery rates of PIT tagged wild and hatchery steelhead trout

			smolts to Lower Granite Dam.
		H	Estimate the survival of PIT tagged wild and hatchery stelhead trout smolts, to Lower Granite Dam and other dams as release group size allows.
4	Provide a final report summarizing results of Imnaha River smolt monitoring studies.	A	Prepare a final report of all spring smolt monitoring activities conducted in the Imnaha River during the monitoring period.
5	Manage and coordinate the PIT tag database for the Nez Perce Tribe.	A	Manage the PIT tag database for this project and provide reports for management review.
		B	Coordinate all NPT PIT tagging projects with appropriate state, Tribal and federal agencies.

Objective schedules and costs

Objective #	Start Date mm/yyyy	End Date mm/yyyy	Cost %
1,2,3 -Field data collection	3/99	1/2020	30%
1,2,3 - data analysis	6/99	1/2020	35%
4,5 - report prep.	9/99	1/2020	35%

Schedule constraints.

Constraints are associated with the ability to effectively fish traps during high water discharge and debris loads in the Imnaha River relative to safe smolt trap operations. Additional resources to modify the trap site into a permanent facility would allow greater effectiveness, reliability and ability to comprehensively monitor juvenile and smolt emigration, yield and survival of natural and hatchery chinook salmon and steelhead trout.

Completion date.

2020 - this is a long term monitoring tool for natural and hatchery fish in the Imnaha River subbasin.

Section 5. Budget

FY99 budget by line item

Item	Note	FY99
Personnel		82,733
Fringe benefits		15,275
Supplies, materials, non-expendable property		12,840
Operations & maintenance		
Capital acquisitions or improvements (e.g. land, buildings, major equip.)		
PIT tags	# of tags:4,600	13,340
Travel		11,864
Indirect costs		36,200
Subcontracts		0
Other		3,000
TOTAL		$175,252

Outyear costs

Outyear costs	FY2000	FY01	FY02	FY03
Total budget	$199,000	$188,000	$191,000	$193,000
O&M as % of total	100%	100%	100%	100%

Section 6. Abstract

The Imnaha River smolt monitoring program provides tributary specific in-season information on the spring outmigration timing, travel time, and relative survival of natural and hatchery chinook salmon and steelhead trout smolts from the Imnaha River to Sanke River and Columbia River dams. Salmon managers use this information to base in-season water budget and spill requests and management.

The smolt monioring program is mandated by the Northwest Power Planning Council's program for water budget and spill mangement and to evaluate future drawdown of Lower Granite Reservoir. It further directs the Fish Passage Center to: 1) plan and implement the annual SMP program, 2) develop and implement flow and spill requests, and 3) monitor and analyze smolt monitoring results to assist in water budget and spill planning and reporting. Data from the Imnaha River assists in these directives.

Expected outcome is providing information on the outmigration timing of smolts from the Imnaha River and dam arrival timing, daily fish condition and smolt performance

characteristics past the series of hydroelectric projects on the Snake and Columbia Rivers. Indices of migration strength and timing are provided for Imnaha River smolts at key monitoring sites. Fish quality and descaling information are also collected and provide indicators of the health of emigrating smolts. PIT tagged smolts provide measures of smolt travel time and estimates of in-river survival through key index reaches. These tributary specific data are used for in-season operational decisions relative to flow and spill management, particularly during periods when spill is being provided to improve smolt passage and survival.

Results of each years investigations are provided in an annual report format for review and dissemination.

Section 7. Project description

a. Technical and/or scientific background.

General Background:

The Northwest Power Planning Council's (NPPC) program includes measures for flow, spill, and drawdown to provide for partial mitigation for losses due to operation of mainstem dams on the Snake and Columbia Rivers. The Program establishes and directs the Fish Passage Center to manage fish mitigation measures on behalf of the fishery agencies and tribes represented on the Columbia Basin Fish and Wildlife Authority.

The Fish Passage Center plans the annual Smolt Monitoring Program which the fishery agencies and tribes implement at smolt monitoring sites. The Nez Perce Tribe proposes to continue implementation of the smolt monitoring and PIT tagging program on the Imnaha River in 1999. To accomplish this on a programmatic level, the Imnaha River smolt monitoring program project has been moved out of the Smolt Monitoring by Non-Federal Entities into an umbrella of direct-funded projects that Bonneville Power Administration funds the Nez Perce Tribe to conduct. Fish Passage Center staff will provide technical assistance and biometrician consultation for the project as needed.

Operation of the Imnaha River smolt trap provides the Fish Passage Center with information on spring emigration timing of wild and hatchery chinook salmon and steelhead trout smolts from the Imnaha River, daily fish condition and smolt performance characteristics past the series of hydroelectric projects on the Snake and Columbia River. Indices of migration strength and migration timing are provided for Imnaha River smolts and smolts from the run at large at key monitoring sites. PIT tagged smolts provide measures of smolt travel time and in-river survival through key index reaches. Fish quality and descaling information are collected at the Imnaha River trap site and provide indicators of the health of emigrating smolts. These data are useful for in-season operational decisions relative to flow and spill management, particularly during periods when spill is being provided to improve smolt passage.

The Imnaha River smolt monitoring project will monitor outmigration timing and PIT tag actively outmigrating wild and hatchery steelhead trout smolts in the Imnaha River to provide the Fish Passage Center with information needed to conduct the annual SMP. The SMP is mandated in the Northwest Power Planning Council's program for water budget and spill management and to evaluate future proposed drawdown of Lower Granite Reservoir. Smolt monitoring and PIT tagging will be conducted during the spring smolt outmigration period (March 15 - June 5) to provide in-season information on smolt movement out of the Imnaha River for water budget and other management decisions. We will PIT tag up to 4,600 total steelhead (hatchery and wild) to estimate the outmigration timing, travel time and recovery rate (as an index of survival) from the mouth of the Imnaha River to Snake River and other Columbia River dams. Wild chinook are also being marked over their outmigration period. Up to 9,600 spring emigrating wild and hatchery chinook salmon smolts are being PIT tagged as part of a separate NPT investigation. This information will be useful for evaluation of the effects of flow, smolt condition and other environmental factors on outmigration timing, travel time and relative survival of wild chinook salmon smolts and wild and hatchery steelhead trout smolts from the Imnaha River.

Northwest Power Planning Council program measure 5.1B directs activities that are to be conducted under the Fish Passage Center (FPC). Measure 5.1B.1 directs Bonneville Power Administration to fund and support the Fish Passage Manager in 1) planning and implementing the annual smolt monitoring program, 2) developing and implementing flow and spill requests, and 3) monitoring and analyzing research results to assist in implementing the water budget and spill planning and in preparing reports. The Imnaha River smolt monitoring program (SMP) project provides information vital to carrying out the FPC directive under the NPPC program.

The Imnaha River smolt monitoring program project has been rated as a high priority by state, federal and Tribal representatives through the Columbia Basin Fish and Wildlife Authority (CBFWA). This project has been ongoing since 1994 as part of the Smolt Monitoring by Non-Federal Entities (Project No. 8712700) and is coordinated with all salmon managers in the Columbia River basin. It is closely coordinated with ongoing Lower Snake River Compensation Plan (LSRCP) hatchery evaluation studies in the Imnaha River with the Oregon Department of Fish and Wildlife through annual operation plan meetings. The LSRCP program provides cost-share funds which are tightly coordinated to ensure collection of an essential and non-duplicative time series of information on fall and spring anadromous salmonid emigration from the Imnaha River. This project is consistent with the direction given by the Northwest Power Planning Council program measure 5.1B.

Various authors have identified that mortality of anadomous salmonid smolts that occurs in the mainstem Snake River and Columbia River hydrolectric projects may be a limiting factor for salmon recovery and mitigation efforts. Bell et al. (1981), as reported in Independent Scientific Group (1996), reported a range of 6-20% turbine mortality of juvenile chinook in the Columbia River up to 1967. Other authors have reported similar

ranges in mortality associated with passage through turbines (Iwamoto et al. 1994, Long et al. 1975, Long 1968, Muir et al. 1995a, Giorgi and Stuehrenberg 1988, and Weitkamp et al. 1981). The NPPC (1987) reported that a 15% per dam turbine mortality was a generally accepted figure. Other authors have reported that only 46.3-51.9% of Imnaha River hatchery chinook survive from the Imnaha River to Lower Monumental dam in the Snake River from 1993 to 1997 (Iwamoto et al. 1994, Muir et al. 1995, and Muir unpublished data).

State and Tribal salmon management agencies have advocated smolt bypass from turbine entrances and to maximize the use of spill for improved smolt passage and survival while keeping fish migrating in-river. To be able to bypass smolts past turbines and use spill to improve smolt survival one has to have specific knowledge of smolt outmigration timing at each hydroelectric facility. Providing tributary-specific information on wild and hatchery chinook and steelhead smolt outmigration timing at dams, travel time to dams, and survival in key stream reaches is the way we can attempt to provide protection to listed Pacific salmon smolts. This rational and objective information-based approach allows managers to make informed decisions for the wise use of the water budget, proposed spill and dam operation.

The objectives of this study were to:

1. Determine spring outmigration timing of chinook salmon and steelhead trout smolts collected at the Imnaha River trap.

2. Evaluate effects of flow, smolt condition and other environmental factors on outmigration timing.

3. Collect biological information on Imnaha River emigrants, such as length, weight, and condition factors.

4. Determine outmigration timing and/or travel time of PIT tagged hatchery chinook smolts released at the Imnaha Acclimation Pond.

5. Determine arrival timing, travel time and recovery rate (as an index of smolt survival) of hatchery chinook and wild and hatchery steelhead trout smolts PIT tagged from the mouth of the Imnaha River to Snake and Columbia river dams.

Ashe, B. L., A. C. Miller, P. A. Kucera, and M. L. Blenden. 1995. Spring outmigration of wild and hatchery chinook salmon and steelhead trout smolts from the Imnaha River, March 1 - June 15, 1994. Fish Passage Center Technical Report. Nez Perce Tribe Fisheries Management, Lapwai, Idaho. 76 pp.

Blenden, M. L., R. S. Osborne, and P. A. Kucera. 1996. Spring outmigration of wild and hatchery chinook salmon and steelhead trout smolts from the Imnaha River,

Oregon, February 6 - June 20, 1995. Fish Passage Center Technical Report. Nez Perce Tribe Department of Fisheries Resources Management, Lapwai, Idaho. 74 pp.

Blenden, M. L., S. Rocklage and P. A. Kucera. (In press). Spring outmigration of wild and hatchery chinook salmon and steelhead trout smolts from the Imnaha River, Oregon, February 23 - June 24, 1996. Fish Passage Center Technical Report. Nez Perce Tribe Department of Fisheries Resources Management, Lapwai, Idaho. 132 pp.

Blenden, M. L., E. Veach, and P. A. Kucera. (In press). Spring outmigration of wild and hatchery chinook salmon and steelhead trout smolts from the Imnaha River, Oregon, February ? - June , 1997. Fish Passage Center Technical Report. Nez Perce Tribe Department of Fisheries Resources Management, Lapwai, Idaho.

Carmichael, R.W., P.A. Kucera and B Ashe. 1998. Spring chinook in the Imnaha River subbasin. Oral presentation at the Lower Snake River Compensation Plan Status Review Symposium. Febr. 3-5, 1998, Boise, ID.

Blenden, M. L., P. A. Kucera and G. Alley. 1998. Post-release survival of hatchery chinook salmon smolts and migration characteristics of natural chinook salmon from the Imnaha River. Poster presentation at the Lower Snake River Compensation Plan Status Review Symposium. Febr. 3-5, 1998, Boise, ID.

Rocklage, S.J., M.L. Blenden, G. Alley and P. A. Kucera. 1998. Smolt performance characteristics of natural and hatchery steelhead trout smolts from the Imnaha River. Poster presentation at the Lower Snake River Compensation Plan Status Review Symposium. Febr. 3-5, 1998, Boise, ID.

b. Proposal objectives.

1. Determine the spring outmigration timing of chinook salmon and steelhead trout smolts from the Imnaha River, 2. Determine the outmigration timing and travel time of hatchery chinook salmon smolts PIT tagged at Lookingglass Hatchery and wild chinook PIT tagged in the upper Imnaha River through interrogation at the trap site, 3. Determine the outmigration timing travel time, recovery rate and relative survival of PIT tagged wild and hatchery steelhead trout smolts from the Imnaha River through the Snake River and Columbia River dams.

Products resulting from this project include the preparation of annual reports summarizing all information collected relative to study goals and objectives.

c. Rationale and significance to Regional Programs.

The rationale behind the Imnaha River smolt monitoring project is to provide managers

tributary specific in-season information on wild and hatchery chinook salmon and steelhead trout outmigration timing and magnitude of the run from the Imnaha, outmigration timing at the dams, travel time to dams, health of the migration, and estimated survival in relation to other environmental variables. Managers use this information to shape each respective years/water budget and spill requests to attempt to improve survival of emigrating smolts. **For example, when this study was initiated in 1994 90% of the natural Imnaha River smolts migrated past Lower Granite Dam (LGR) before spill was initiated to attempt to improve survival.** With specific outmigration timing information available, ranges in timing, median and 90% arrival timing dates at LGR were identified. The water budget could be shaped to provide improved survival conditions for Imnaha River chinook.

The Northwest Power Planning Council (1994) devotes an entire section (Section 5) of the Columbia River Basin Fish and Wildlife Program to addressing juvenile salmon migration. Section five addresses mainstem passage and experimental program, coordination of river operations, improvement of Snake River flow and velocity, Snake River drawdown strategy, improving Columbia River flow and velocity, conduct of additional research and monitoring, completing installation of bypass systems, reducing predation and competition, transportation and pursuing monitoring and dispute resolution. Almost all of these measures are intended to improve juvenile anadromous salmonid fish passage and survival past the eight major hydroelectric facilities on the Snake and Columbia River. Section 5.1B addresses the need and rationale for the Imnaha River smolt monitoring program.

Other Relevant Projects:
The Grande Ronde River smolt monitoring project conducted by ODFW provides tributary specific information on emigrating chinook salmon and steelhead trout smolts (Project 8712700). IDFG operates several traps, one at Whitebird on the Salmon River and the other on the Snake River, and provides somewhat similar information on groups of salmon and steelhead smolts from various tributary streams. Sampling at the dams also occurs as part of project 8712700 to assess smolt quality, descaling, species composition/hatchery and wild status and gas bubble trauma sampling. The Idaho Supplementation Studies conducts outmigrant trapping on treatment and control streams as part of their experimental design (Project No. 8909802, 8909800, 8909801 and 8909803). Nez Perce Tribal Hatchery conducts outmigrant trapping on several tributary streams under project 8335000. We have coordinated within the NPT conducted outmigration studies to attempt to collect similar type information from a number of tributaries so that general inferences could be drawn from study results on different tributary streams. We have tried to coordinate this same approach with ODFW on Grande Ronde River outmigration studies with limited success.

We believe the Imnaha River smolt monitoring program study has potential opportunities for research because of ongoing LSRCP supplementation programs for listed chinook and steelhead trout and their wild counterparts. We believe that opportunity exists to transform the existing outmigrant trapping facility to a more

permanent facility. This would allow a comprehensive monitoring approach to determining smolt yield, natural production and survival in-river and survival estimation to dams. It would allow a more complete analysis of the supplementation program and provide the region knowledge of a Snake River basin program. We believe this type of comprehensive monitoring would be useful in several select subbasins in the Snake River basin.

d. Project history

Project Number - was previously part of 8712700, Smolt Monitoring by non-federal Entities; new project number not yet assigned by BPA as of 1/21/98.

Project Reports include:

Ashe, B. L., A. C. Miller, P. A. Kucera, and M. L. Blenden. 1995. Spring outmigration of wild and hatchery chinook salmon and steelhead trout smolts from the Imnaha River, March 1 - June 15, 1994. Annual project report to the Bonneville Power Administration. Nez Perce Tribe Fisheries Management, Lapwai, Idaho. 76 pp.

Blenden, M. L., R. S. Osborne, and P. A. Kucera. 1996. Spring outmigration of wild and hatchery chinook salmon and steelhead trout smolts from the Imnaha River, Oregon, February 6 - June 20, 1995.Annual project report to the Bonneville Power Administration. Nez Perce Tribe Department of Fisheries Resources Management, Lapwai, Idaho. 74 pp.

Blenden, M. L., S. Rocklage and P. A. Kucera. (In press). Spring outmigration of wild and hatchery chinook salmon and steelhead trout smolts from the Imnaha River, Oregon, February ? - June , 1996.Annual project report to the Bonneville Power Administration. Nez Perce Tribe Department of Fisheries Resources Management, Lapwai, Idaho. pp.

Blenden, M. L., E. Veach, and P. A. Kucera. (In press). Spring outmigration of wild and hatchery chinook salmon and steelhead trout smolts from the Imnaha River, Oregon, February ? - June , 1997. Annual project report to the Bonneville Power Administration. Nez Perce Tribe Department of Fisheries Resources Management, Lapwai, Idaho.

Summary of Major Results: Above mentioned reports contain major project results from 1994 to 1997. Some major accomplishments include:

1. Identification of outmigration timing of listed wild and hatchery chinook salmon smolts from the Imnaha River.
2. Describing biological characteristics and general health of anadromous salmonid smolts from the Imnaha River
3. Estimation of smolt yield for wild and hatchery chinook and steelhead trout smolts during select years.
4. Providing tributary specific data through PIT tagging of wild and hatchery Imnaha

River chinook and steelhead trout smolts.
5. Documenting arrrival timing at Snake River dams and McNary Dam with ranges in timing, median and 90% arrival dates from 1994 to 1997.
6. Examining diel passage information of Imnaha River smolts at several Snake River dams.
7. Determining travel times of the various groups to Lower Granite dam.
8. Determining cumulative recovery rates at Lower Granite Dam as a minimum survival estimate.
9. Estimating survival of PIT tagged Imnaha River smolts to Snake River dams through use of the SURPH model in relation to other variables.

Adaptive Management Implications: The Imnaha River smolt monitoring program provides current information on the spring emigration timing of wild and hatchery chinook salmon and steelhead trout smolts from the Imnaha River and provides data on PIT tagged fish arrival timing at dams, travel time to the dams and relative survival to the dams. In that regard it provides managers in-season information on which to base water budget and water spill decisions relative to management of threatened chinook salmon juveniles.

Years Underway: This project has been providing a time series of anadromous salmonid emigration information from the Imnaha River since 1994.

Past Costs: 1994 - $72,985; 1995 - $103,516; 1996 - $142,213; 1997 - $143,726; 1998 - no contract as of 1/21/98.

e. Methods.

METHODS

Study Area Description

The Imnaha River subbasin is located in northeastern Oregon and encompasses an area of approximately 2,538 square kilometers. The mainstem Imnaha River flows in a northerly direction for 129 km from its headwaters in the Eagle Cap Wilderness Area (ECWA) to its confluence with the Snake River at river kilometer (rkm) 308.4 (James 1984; Kucera 1989). The river drains the eastern escarpment of the Wallowa mountains and part of an adjacent plateau located between the Wallowa River drainage to the west and Hells Canyon of the Snake River to the east (Kucera 1989). Elevations in the watershed vary from 3,048 m at the headwaters to about 260 m in lower elevations (Kucera 1989).

The 64 year (1929 - 1993) mean annual discharge of the Imnaha River is 172 cms (6,060 cfs) at Imnaha, Oregon, USGS gauge 13292000. Maximum river discharge generally occurs from April to June with minimum flows from August to February (Kucera 1989).

Equipment Description

Two floating rotary screw traps manufactured by E.G. Solutions Inc., Corvallis, Oregon, are used to capture outmigrating salmonid smolts for this study. Similar traps have been used to capture migrating salmonid species in New York and Alaska (Kennen et al. 1994; Thedinga et al. 1994) and throughout the Pacific Northwest. The trap consisted of a non-standard 2.1 m diameter trapping cone supported by a metal A-frame and two six meter pontoons that provided flotation. Fish entering the trapping cone move through to a custom oversize live box (1.68 m wide x 1.25 m long x 0.55 m deep). The live box was fitted with a removable baffle to dissipate water velocity during high flows.

Water temperature information for this study was collected using a constant recording Ryan TempMentor which was located approximately 150 m upstream from the trap.

Discharge information used in this report was provided by the U.S. Geological Survey, USGS gauge 13292000 at Imnaha, Oregon (rkm 32).

Trap Operations

The Imnaha River trap(s) are installed and operated as soon as ice-up leaves the river each year, usually sometime in mid-February. The Fish Passage Center directs when the project begins each year, which doesn't always coincide with fish emigration. The trap is operated to bracket the period of all anadromous salmonid emigration each year. The trap is operated 24 hours a day, five days a week during this period. Exceptions to this occur on occasions when trap repair is necessary or high flows or debris load in the river preclude safe trap operation.

The floating rotary screw trap was secured on the west bank of the Imnaha River, below the Cow Creek bridge, 6.6 kilometers from the confluence with the Snake River. The trap position in the river was adjusted by manipulating a cable suspension system which allowed side to side and upstream/downstream movement of the trap. This setup allowed the trap to be backed slightly out of the main current and fished during high flows. The trap was fished in one of three positions depending on daily readings from the staff gauge located approximately one kilometer upstream of the trap (Table 1).

Table 1. Position in which screw trap was fished dependent upon staff gauge reading.

Staff Gauge	Trap Position
< 0.9 m	Forward
0.9 - 1.0 m	Intermediate
> 1.0 m	Rear

The live box of the screw-trap is checked at 0800 every morning and several times

throughout each night and day. Non-target piscivorous fish and large numbers of other non-target fish were removed from the live box first. Non-target piscivorous fish were scanned for PIT tags and then released 30-50 meters downstream. Wild juvenile chinook salmon were processed first, followed by hatchery chinook salmon, wild steelhead trout and hatchery steelhead trout smolts, respectively.

Daily processing procedures were similar to those reported by Ashe et al. (1995) and were as follows: 1) Fish were anaesthetized in a MS-222 bath (3 mL MS-222 stock solution (100 g/L) per 19 L of water) buffered with propolyaqua (PRO-NOVAQUA), 2) Each fish was examined for existing marks (e.g. fin clips), and PIT tag insertion scars, 3) Fish with PIT tag scars were scanned with a PIT tag scanner, 4) Up to 100 hatchery chinook salmon smolts were selected for trap efficiency trials, 5) A specified number of each species were selected for PIT tag insertion, 6) All other fish were enumerated and released 30-50 m downstream from the trap, 7) All fish mortality was recorded.

Exceptions to this procedure occur after hatchery releases when potential exists for capture of large numbers of fish in one night. On these occasions netfulls of fish were removed from the live box and released through a remote PIT tag scanner (Biomark model RM-DC400-6) into the river. Subsampling occurred when tallying fish by hand could not keep up with the rate of fish accumulation into the live box of the trap. Daily catch estimates were made by subsampling 10% of the total number of netfulls for species number and composition. Fish were held in net pens until processed.

Trap Efficiency

Trap efficiency trials for hatchery chinook salmon were conducted as often as possible with the requirement that at least 25 healthy individuals were available. Special efforts were made to conduct trials when changes in stream discharge occurred. Hatchery chinook salmon selected for trap efficiency trials were measured (FL) to the nearest mm, weighed to the nearest 0.1 g, and marked by clipping the distal portion of one of seven possible fins (Table 2).

Table 2. Fin clip applied to hatchery chinook salmon smolts used in trap efficiency trials.

Day of the week	Fin clip applied
Sunday	Dorsal fin (DC)
Monday	Top caudal fin (TCC)
Tuesday	Lower caudal fin (LCC)
Wednesday	Left ventral fin (LVC)
Thursday	Right ventral fin (RVC)

Friday	Left pectoral fin (LPC)
Saturday	Right pectoral fin (RPC)

Fish marked for trap efficiency trials were held in covered live nets during daytime hours (approximately 12 h) and then transported upstream approximately one km to the release site during evening hours. Fish were released after dark on the day they were marked.

Trap efficiency was determined by: $E = R/M$

where E is estimated trap efficiency, R is number of marked fish recaptured, and M is number of fish marked and released.

Outmigration numbers were estimated by: $N = U/E$;

where N is estimate of total number of emigrants, and U is number of unmarked fish.

Smolt Yield

The hatchery chinook salmon smolt outmigration period is divided into flow periods based on discharge. Smolt yield was determined for each flow period using the bootstrap method (Efron and Tibshirani 1986; Murphy et al. in prep). Total smolt yield and 95% confidence intervals were calculated by summing flow period smolt yield estimates and variances.

Bootstrap period estimates (N_p) were calculated by: $N_p=U_p/E_p$

where U_p is the total number of unmarked fish captured during the period and E_p is the mean trap efficiency for the period. Variance for bootstrap estimates were calculated using a program developed by Murphy et al. (in prep).

Hatchery chinook smolt yield, during periods of trapping interruption of less than three days, was estimated by extrapolating daily catch using equal increments at an ascending or descending rate. Estimated numbers of daily outmigration and smolt yield was not estimated during trapping interruptions greater than three days. All hatchery chinook smolts were enumerated by hand (no netfulls of fish were released to the river).

Biological Characteristics

Length frequency distributions were created and condition factors calculated for each fish species and origin. Condition factor was calculated using Fulton's condition factor: $(W/L^3) \times 10^5$ (Bagenal and Tesch 1978). Wild steelhead less than 120 mm were believed not to be smolts and therefore were not used in smolt length, weight and condition factor calculations.

Student's t-test was used to test for significant differences in fork length between various groups of fish (i.e. wild versus hatchery steelhead trout smolts, previously PIT tagged

hatchery chinook salmon smolts versus those not previously PIT tagged, hatchery chinook marked and released for trap efficiency versus trap efficiency recaptures, etc.). Differences were considered significant at $p<0.05$.

PIT Tagging

Fish selected for passive integrated transponder (PIT) tagging were examined for previous PIT tagging, descaling and general health before being tagged, measured (FL-mm) and weighed (0.1 g). For chinook salmon, only healthy fish greater than 65 mm were selected for tagging. Steelhead were tagged irrespective of health. Fish were PIT tagged using hand injector units following the general methods described by Prentice et al. (1986, 1990b) and Matthews et al. (1990, 1992). Hypodermic injector units were sterilized after each use in ethanol alcohol for at least 10 minutes prior to tagging. PIT tags were also sterilized for 10 minutes and allowed to air-dry prior to their use. Tagging is discontinued when water temperatures exceeded $15^{\triangledown}$C.

Weekly steelhead smolt tagging goals are set by FPC. These goals are modified as the season progressed based upon catch and interruptions in trapping due to equipment repairs. Up to 200 additional wild and hatchery chinook salmon and 150 wild steelhead smolts were tagged each week as part of a separate Nez Perce Tribe (NPT) investigation. Steelhead trout smolts tagged for FPC and NPT investigations were held for a minimum of one hour after tagging until fully recovered and then released as a group. Chinook salmon smolts tagged for NPT investigations were held in net pens for a minimum of 12 hours and released as a group after dark. The latter methodology is a standard practice employed by the NPT aimed at allowing chinook smolts to recover from tagging stress and increasing predator avoidance. Mortality due to tagging was recorded.

Tagging data were proofed for mistakes using PITVAL software program. Tagging and interrogation files were submitted to the Pacific States Marine Fisheries Commission (PSMFC) PIT Tag Information System (PTAGIS) database via modem the day following collection. PIT tag interrogation data were downloaded from the PTAGIS database.

Travel Timing to Trap Site and Lower Snake River Dams

Outmigration timing of wild chinook salmon and steelhead trout smolts was determined by daily collection numbers at the rotary screw trap site. Arrival timing and travel time of PIT tagged hatchery chinook salmon smolts released at the Imnaha River Acclimation Facility and hatchery steelhead trout smolts released at the Little Sheep Creek Acclimation Facility was determined by daily collection numbers and PIT tag interrogation at the rotary screw trap site.

Arrival timing, travel time and cumulative interrogation percents to Lower Granite Dam, and diel passage at hydroelectric facilities through the Snake River to McNary Dam was determined for wild and hatchery chinook salmon and steelhead trout smolts. Single coil detections or negative travel time individual fish were deleted from all analysis. Release

groups of fish were pooled weekly to determine travel time to Lower Granite Dam. First time PIT tag observations, from all dams, were used to calculate and report the cumulative interrogation percents to Lower Granite Dam by species and origin. Cumulative interrogation percents of each species was determined by dividing the sum of first tag code observations by the total number of fish tagged and released. Fork lengths were compared between length at tagging and lengths, at tagging, detected at Lower Granite Dam for each species and origin.

Arrival timing at each dam during this report period are based on first-time observations of individual tag codes at each dam. Arrival timing estimates do not include subsequent detections of fish that were captured in the Snake River trap, held in sample rooms or raceways, had negative travel times or single coil detections.

Average weekly diel smolt passage at Lower Granite, Little Goose, Lower Monumental, and McNary dams were summarized by three passage periods (midnight to sunrise, sunrise to sunset, and sunset to midnight) provided that 30 or more fish were detected at a dam. Passage periods were delineated using a United States Naval Observatory sunrise and sunset table for Lewiston, Idaho. All times used were Pacific Standard Time. Weekly diel passage was further broken down into hourly passage frequencies. Fish detections not used in the analysis were those previously caught in the Snake River trap or those detected going to a raceway or sample room.

Travel time estimates to Lower Granite Dam do not include fish captured in the Snake River trap. Differences in mean travel time, from weekly PIT tag release groups, were analyzed by means of a t-test (Statgraphics Plus 1995). In some instances the distributions of travel time were skewed with some kurtosis. It was assumed with independent samples and a combined sample size $n_1+n_2 \geq 30$, that t-methods were reasonably accurate even with modest skewness in the two populations (Ott 1984). T-test values were calculated and reported from samples with unequal variance. Differences in means were tested and considered significant at the 0.05 level. When the assumption of normality was violated, the t-test was abandoned in favor of the Wilcoxon rank sum test statistic (Ott 1984). This test compared median travel times of hatchery and wild smolts.

Critical Assumptions: 1) the rotary screw trap collects a representative sample of wild and hatchery chinook salmon and steelhead trout smolts emigrating from the Imnaha River, 2) Trapping and handling does not adversely affect smolt behavior or survival, 3) PIT tagging does not affect smolt behavior or survival, and 4) PIT tagged smolts are representative of the population as a whole. provide answers in paragraph form)

f. Facilities and equipment.

We utilize the NPT's Enterprise, Oregon office which provides adequate administrative space and fenced compound storage and parking. The project uses two rotary screw traps with an additional trap available as backup. Two PIT tag stations are available and are used in tandem or with one serving as backup. Several trailers are parked near the trapping site on USFS property for quick access to the trap site.

g. References.

Ashe, B. L., A. C. Miller, P. A. Kucera, and M. L. Blenden. 1995. Spring outmigration of wild and hatchery chinook salmon and steelhead trout smolts from the Imnaha River, March 1 - June 15, 1994. Fish Passage Center Technical Report. Nez Perce Tribe Fisheries Management, Lapwai, Idaho. 76 pp.

Bagenal, T. B., and F. W. Tesch. 1978. Age and growth. Pages 101-136 *in* T.B.Bagenal, editor. Methods for assessment of fish production in fresh waters, 3rd edition. Blackwell Scientific Publications, Oxford, England.

Blenden, M. L., R. S. Osborne, and P. A. Kucera. 1996. Spring outmigration of wild and hatchery chinook salmon and steelhead trout smolts from the Imnaha River, Oregon, February 6 - June 20, 1995. Fish Passage Center Technical Report. Nez Perce Tribe Department of Fisheries Resources Management, Lapwai, Idaho. 74 pp.

Efron, B., and R. Tibshirani. 1986. Bootstrap methods for standard errors, confidence intervals, and other measures of statistical accuracy. Statistical Science 1:54-77.

Giorgi, A.E. and L. Stuehrenberg.. 1988. Lower granite pool and turbine survival study, 1987. Portland, Bonneville Power Administration. Oregon:30.

Independent Scientific Group. 1996. Return to the River. Restoration of salmonid fishes in the Columbia River ecosystem. Prepublication copy. Sept. 10, 1996. 584 pp.

Iwamoto, R.N., W.D. Muir,B.P. Sandford, K.W. McIntyre, D.A. Frost, J.G. Williams, S.G. Smith and J.R. Skalski. 1994. Survival estimates for the passage of juvenile salmonids through Snake River dams and reservoirs. 1994. Portland, Bonneville Power Adminmistration, Oregon.

James, G. 1984. Imnaha River basin recommended salmon and steelhead habitat improvement measures. Working paper. Confederated Tribes of the Umatilla Indian Reservation. 30 pp. plus appendices.

Kennen, J. G., S. J. Wisniewski, N. H. Ringler, and H. M. Hawkins. 1994. Application and modification of an auger trap to quantify emigrating fishes in Lake Ontario tributaries. North American Journal of Fisheries Management 14:828-836.

Kucera, P. A. 1989. Nez Perce Tribal review of the Imnaha River Lower Snake River Compensation Plan. Working paper. LSRCP Technical Report AFF1/LSR-89-08. Nez Perce tribe Fisheries Management, Lapwai, Idaho. 49 pp.

Long, C.W. 1968. Diel movement and vertical distribution of juvenile anadromous fish in turbine intakes. U.S. Fishery Bulletin 66:599-609.

Long, C.W., F.J. Ossiander, T.E. Ruehle and G.M. Mathews. 1975. Survival of coho salmon fingerlings passing through operating turbines with and without perforated bulkheads and of steelhead trout fingerlings passing through spillways with and without a flow detector, NMFS/NOAA Northwest Fisheries Science Center: 8.

Matthews, G. M., J. R. Harmon, S. Achord, O. W. Johnson, and L. A. Kubin. 1990. Evaluation of transportation of juvenile salmonids and related research on the Columbia and Snake Rivers, 1989. Report to the U.S. Army Corps of Engineers, Contract DACW68-84-H0034. National Marine Fisheries Service, Seattle.

Matthews, G. M., S. Accord, J. R. Harmon, O. W. Johnson, D. M. Marsh, B. P. Sandford, N. N. Paasch, K. W. McIntyre, and K. L. Thomas. 1992. Evaluation of transportation of juvenile salmonids and related research on the Columbia and Snake Rivers, 1990. Report the U.S. Army Corps of Engineers, Contract DACW68-84-H0034. National Marine Fisheries Service, Seattle.

Muir, W.D., S.G. Smith, R.N. Iwamoto, D.J. Kamikawa, K.W. McIntyre, E.E. Hockersmith, B.P. Sanford, P.A. Ocker, T.E. Ruehle and J.G. Williams. 1995. Survival estimates for the passage of juvenile salmonids through Snake River dams and reservoirs. 1994. Portland, Bonneville Power Administration, Oregon:187.

Murphy, M. L., J. F. Thedinga, and J. J. Pella. In Prep. A bootstrap method for obtaining confidence intervals for population estimates of migrating fish. National Marine Fisheries Service. Juneau, Alaska.

Northwest Power Planning Council. 1987. 1987 Columbia River Basin Fish and Wildlife Program. Portland, Northwest Power Planning Council. Oregon:246.

Ott, L. 1984. An introduction to statistical methods and data analysis. PWS Publishers. Boston, Massachusetts.

Prentice, E. F., D. L. Park, T. A. Flagg, and S. McCutcheon. 1986. A study to determine the biological feasibility of a new fish tagging system, 1985-1986. Report to the Bonneville Power Administration, Contract DE-A179-83BP11982, Project 83-119. National Marine Fisheries Service, Seattle.

Prentice, E. F., T. A. Flagg, C. S. McCutcheon, D. F. Brastow, and D. C. Cross. 1990b. Equipment, methods, and an automated data-entry station for PIT tagging. American Fisheries Society Symposium 7:335-340.

Statgraphics Plus. 1995. Statgraphics Plus Version 2. Manugistics, Inc. Rockville, Maryland.

Thedinga, J. F., M. L. Murphy, S. W. Johnson, J. M. Lorenz, and K. V. Koski. 1994.

Determination of salmonid smolt yield with rotary screw traps in the Situk River, Alaska, to predict effects of glacial flooding. North American Journal of Fisheries Management 14:837-851.

Weitkamp, D.W, D. McKenzie and T. Schadt. 1980. Survival of steelhead smolts - Wells Dam turbines and spillway, 1980. East Wenatchee, Public Utility District No. 1 of Douglass County. Washington:39. provide answers in paragraph form)

Section 8. Relationships to other projects

This project complements other tributary specific smolt monitoring projects conducted by state agencies by collecting and reporting information for in-season shaping of the water budget and for spill recommendations. In the past gill ATPase samples have been collected by the USFWS at the Imnaha River trap and steelhead smolts have been subsampled for radio telemetry studies. This study has coordinated with the UW in application of using the SURPH model for survival estimation.

This project is tightly coordinated with and cost-shares with monitoring and evaluation work being conducted for LSRCP hatchery evaluations program which began in 1992. This coordination ensures that no duplication of effort exists and that funding resources are utilized to the maximum benefit possible. The cost sharing allows a wild chinook smolt survival estimation project (under the LSRCP) to occur that is designed to PIT tag up to 10,000 spring emigrating smolts annually.

Section 10 permits are maintained for the conduct of the study. Permit 825 through the CRITFC by and through the BIA handles NMFS ESA permits.

Section 9. Key personnel

Project Leader - vacant; Biotechnician - Joe McCormick (9 mo.); Seasonals (2).

Jay A. Hesse, Research Coordinator, no ISS funding associated
Nez Perce Tribe Department of Fisheries Resources Management

Education: M.S. in Fisheries, Michigan State University, 1994
B.S. in Fisheries and Wildlife, Michigan State University, 1992

Duties: Technical direction and supervision of fisheries research projects, research coordination, Nez Perce Tribe LSRCP project implementation, report writing, monitoring and evaluation plan and proposal development, tribal fisheries research representation at federal and state meetings, budget preparation, personnel supervision.

Experience: Project Leader, Idaho Salmon Supplementation Study. Nez Perce Tribe. July 1994 - October 1997.

Skills:

Publications: Hesse, J. 1997. A-run steelhead status in tributaries of the lower Clearwater River, Idaho. In Interactions of hatchery and wild steelhead in the Clearwater River of Idaho. 1995 Progress Report, Fisheries Stewardship Project, USFWS Report. November 1997.

Hesse, J.A., P.J. Cleary, and B.D. Arnsberg. 1995. Salmon Supplementation Studies in Idaho Rivers. Annual Report - 1994. U.S. Department of Energy - Bonneville Power Administration. Portland, Oregon.

Hesse, J.A. and B.D. Arnsberg 1994. Salmon Supplementation Studies in Idaho Rivers. Annual Report - 1993. U.S. Department of Energy - Bonneville Power Administration. Portland, Oregon.

Hesse, J.A. 1994. Contribution of hatchery and natural chinook salmon to the eastern Lake Michigan fishery, 1992-1993. Masters Thesis, Michigan State University.

RESUME
Paul A. Kucera

WORK ADDRESS: Nez Perce Tribe Dept. of Fisheries Resources Management
P.O. Box 365
Lapwai, Idaho 83540
(208) 843-2253, extension #2435
CURRENT POSITION: Director of Biological Services

EDUCATION: Bachelor of Science. 1975.
Utah State University.
Major: Fisheries Management.

Completed MS studies at the University of Idaho 1990
Major: Fisheries Management.

PROFESSIONAL EXPERIENCE:

1991-present Director of Biological Services with the Nez Perce Tribe Department of Fisheries Resources Management. Responsible for technical program direction and administration of the Fisheries Research Division.

1988-1991 Senior Fisheries Biologist with the Nez Perce Tribe Fisheries Department.

1987-1988 Acting Fisheries Program Manager with the Nez Perce Tribe Fisheries Department. Responsible for fisheries program

management and direction.

1984-1986 Senior Fisheries Biologist with the Nez Perce Tribe Fisheries Department. Conducted research on juvenile steelhead trout life history characteristics and abundance in relation to physical habitat parameters on five streams.

1982-1983 Project fisheries biologist with the Nez Perce Tribe Fisheries Department. Responsible for conduct of a physical and biological inventory of streams on the reservation proper with emphasis on anadromous salmonids.

1978-1980 Fisheries biologist with the Colville Confederated Tribes Fish and Wildlife Department. Developed fishery management programs for the Colville Tribe on their 1.3 million acre reservation and the 1.7 million acre ceded area.

1975-1978 Fisheries research biologist with W.F. Sigler and Associates, Environmental Consulting Firm. Ecological and fish life history research on 110,000 acre Pyramid Lake, Nevada.

Unique Abilities:

Certified Fisheries Scientist - AFS
Experienced with Endangered Species Act and management of listed fish species.
Experience in program development and procuring project funding.
Research and management experience with resident and anadromous species.
Familiar with Tribal government and management approaches.
Trained in CPR and First Aid.
Certified SCUBA diver - NAUI

Publications

Kucera, P.A. and J.L. Kennedy. 1977. Evaluation of a sphere volume method for estimating fish fecundity. The Progressive Fish Culturist. 39(3)115-117.

Kucera, P.A. 1978. Reproductive biology of the tui chub, Gila bicolor, in Pyramid Lake, Nevada. Great Basin Naturalist. 38(2): 203-207.

Kennedy, J.L. and P.A. Kucera. 1978. The reproductive ecology of the Tahoe sucker, Catostomus tahoensis, in Pyramid Lake, Nevada. Great Basin Naturalist 38(2): 181-186.

Vigg, S., P. A. Kucera. 1981. Contributions to the life history of Sacramento

perch,
Archoplites interruptus, in Pyramid Lake, Nevada.Great Basin Naturalist 41(3): 278-289.

Sigler, W.F., W.T. Helm, P. A. Kucera, S. Vigg and G. W. Workman. 1983. Life history of the Lahontan cutthroat trout, Salmo clarki henshawi, in Pyramid Lake, Nevada. Great Basin Naturalist 43(1): 1-29.

Kucera, P.A., D.L. Koch and G.F. Marco. 1985. Introductions of Lahontan cutthroat trout into Omak Lake, Washington. North Amer. Jrnl. Of Fish. Mngt. 5(2): 296-301.

Johnson, J.H. and P.A. Kucera. 1985. Summer-autumn habitat utilization of subyearling steelhead trout in tributaries of the Clearwater River, Idaho. Can. Jrnl. Zool. Vol, 63:2283-2290.

Kucera, P.A. 1989. Nez Perce Tribal review of the Imnaha River Lower Snake River Compensation Plan. AFF1/LSR-89-08, Tech. Rep. 89-7. Annual project report to the U.S. Fish and Wildlife Service. Nez Perce Tribe Fisheries Dept., Lapwai, ID. 49 pp.

Kucera, P.A. and M.L. Blenden. 1996. Summary report of 1996 project activities relating to endangered chinook salmon populations listed under the Endangered Species Act. Nez Perce Tribe Department of Fisheries Resources Management, Lapwai, Idaho. 60 pp.

Section 10. Information/technology transfer

Annual reports are provided on this project. Annual report presentations are provided as requested by the BPA. Presentations are also provided at smolt seminars and state AFS chapter meetings as time allows.