PART I - ADMINISTRATIVE

Section 1. General administrative information

Title of project

Idaho Water Rental: Resident Fish And Wildlife Impacts. Phase Iii

BPA project number: 9106700
Contract renewal date (mm/yyyy): 9/1999 ☐ **Multiple actions?**

Business name of agency, institution or organization requesting funding
Idaho Department of Fish and Game

Business acronym (if appropriate) IDFG

Proposal contact person or principal investigator:

Name	Eric Leitzinger
Mailing Address	600 S. Walnut, P.O. Box 25
City, ST Zip	Boise, ID 83707
Phone	(208) 334-4888
Fax	(208) 334-2114
Email address	eleitzin@idfg.state.id.us

NPPC Program Measure Number(s) which this project addresses
2.2E.7; 5.5A.1

FWS/NMFS Biological Opinion Number(s) which this project addresses
NMFS Biological Opinion: Reinitiation of consultation on 1994-1998 operation of the Federal Columbia River power system and juvenile transportation program in 1995 and future years. Action # 1.

Other planning document references
IDFG Fish Managment Plan, 1996 - 2000 (sec.1); NPPC's Fish and Wildlife Program (sec. 2.2E.7, 5.5A.1); CBFWA Resident Fish Multi-Year Plan (sec 6.6.6, 6.8); USFWS Snake River Aquatic Species Recovery Plan (December 1995)

Short description
Quantify changes in resident fish habitat in the upper Snake River basin resulting from the release of 427,000 acre-feet of water for anadromous fish flow augmentation. Recommend release strategies to benefit weak, native resident fish populations.

Target species

white sturgeon, rainbow (redband) trout, yellowstone cutthroat trout, bull trout

Section 2. Sorting and evaluation

Subbasin
Boise River, Payette River, Upper Snake River, Snake Headwaters, Mid-Snake Boise, Mid Snake-Powder

Evaluation Process Sort

CBFWA caucus	Special evaluation process	ISRP project type
Mark one or more caucus	If your project fits either of these processes, mark one or both	Mark one or more categories
☐ Anadromous fish ☒ Resident fish ☐ Wildlife	☐ Multi-year (milestone-based evaluation) ☐ Watershed project evaluation	☐ Watershed councils/model watersheds ☐ Information dissemination ☐ Operation & maintenance ☐ New construction ☒ Research & monitoring ☒ Implementation & management ☐ Wildlife habitat acquisitions

Section 3. Relationships to other Bonneville projects

Umbrella / sub-proposal relationships. List umbrella project first.

Project #	Project title/description

Other dependent or critically-related projects

Project #	Project title/description	Nature of relationship

Section 4. Objectives, tasks and schedules

Past accomplishments

Year	Accomplishment	Met biological objectives?
1992	Completed Phase I: Summary of resident fish and wildlife issues, concerns; and needs in the Upper Snake Basin as well as potential impacts caused by flow augmentation. Recommendations to protect those resources.	
1994	Completed Phase II: Biological Assessment (IFIM study) of the Upper Snake R. near Blackfoot. Summarized flow augmentation releases since Phase I.	Yes, developed habitat versus flow relationships for rainbow and cutthroat trout, mountain whitefish, canada goose, mallard ducks, and beaver. Recommended a flow regime to protect and enhance these species.
1996	Developed a method to quantify changes in resident fish habitat resulting from the release of salmon flow augmentation water.	Yes, Quantified estimates in square feet of useable habitat for sturgeon and rainbow trout in the mainstem Snake R. 1994 release was able to quantify habitat changes for 4 sturgeon and 4 rainbow life stages. 1995 one sturgeon and 3 rainbow life stages
1997	In addition to the 1996 work, began a comparison of flows with and without the salmon augmentation releases to recommended and established instream flows, both in terms of volume of flow and frequency that flows were met and not met.	Yes, in addition to the quantified estimates as was done for the 1995 data, we now have the frequency that salmon flow releases help achieve recommended flows for resident fish. Developed a salmon flow release strategy that benefits resident fish.
1998	Same as 1997	Same as 1997. Estimates and recommendations have been refined. Flow recommendations are being expanded to include the entire upper Snake River Basin.

Objectives and tasks

Obj 1,2,3	Objective	Task a,b,c	Task
1	Determine impacts to resident fish	a	Gather all existing habitat versus

	habitat (in weighted usable area) in the upper Snake River for key native fish species resulting from salmon flow augmentation releases and make recommendations that will maximize benefits to native resident fish.		flow relationship data for the upper Snake River and analyze its utility for estimating resident fish habitat changes resulting from salmon flow augmentation releases. Identify areas where data is lacking.
		b	Annually, estimate the impacts to key native, resident fish species (in WUA) in the upper Snake River upstream of Brownlee Reservoir resulting from salmon flow augmentation releases.
		c	Annually, compare flows with and without the salmon flow augmentation component to recommended or established instream flow regimes to determine if salmon flow releases help meet the recommendations and determine the frequency they are met or not met.
		d	Based on the results of task 1b and 1c, recommend timing and volumes of salmon flow releases that maximize benefits to native resident fish species.
2	Coordinate with federal, state, and tribal agencies to ensure that duplication of work does not occur in local efforts to explore water management opportunities in the upper Snake River basin for salmon flow augmentation.	a	IDFG will continue to consult with the technical work group to refine the goals, objectives, and recommendations of the project. Agencies on the technical work group include the IDFG Shoshone-Bannock Tribes, BOR, USFWS, Idaho Power Co.
		b	Coordinate with sub-regional planning efforts, and act as a clearinghouse for water rental/flow information. This includes tracking and summarizing salmon flow augmentation releases.
		c	Assist in coordinating and integrating BPA funded IDFG resident fish and wildlife programs with other projects (BOR's SR3 project, snail

			recovery, etc.) in the upper Snake Basin into a cohesive ecosystem approach to water and fisheries managment.
3	Assist the BOR in developing a model that incorporates resident fish flow needs in water managment scenarios in the upper Snake Basin, and ultimately estimate changes in fish habitat resulting from various flow release strategies.	a	Work with the BOR and the technical work group to provide input for the model. Continue to meet quarterly with BOR contractors and SR3 staff for updates on model development and to insure the latest flow information is included.
4	Prepare an annual report.	a	Prepare a draft report and circulate for comments.
		b	Incorporate comments into final report.

Objective schedules and costs

Obj #	Start date mm/yyyy	End date mm/yyyy	Measureable biological objective(s)	Milestone	FY2000 Cost %
1	9/2000	8/2001			60.00%
2	9/2000	8/2001			15.00%
3	9/2000	8/2001			5.00%
4	1/2001	8/2001			20.00%
				Total	100.00%

Schedule constraints
Model development is dependent on cooperation from BOR and progress of BOR's Snake River Resources Review project. The lack of habitat vs flow data in the upper Snake Basin. Possible reluctance of the BOR or Idaho Power to implement flow recommendations.

Completion date
2005

Section 5. Budget

FY99 project budget (BPA obligated): $110,000

FY2000 budget by line item

Item	Note	% of total	FY2000
Personnel		%48	57,387
Fringe benefits		%15	18,146
Supplies, materials, non-expendable property		%5	7,000
Operations & maintenance		%4	5,500
Capital acquisitions or improvements (e.g. land, buildings, major equip.)		%4	5,500
NEPA costs			0
Construction-related support			0
PIT tags	# of tags: 0		0
Travel		%4	5,000
Indirect costs	22.5% of total except capital	%17	20,932
Subcontractor			0
Other			0
TOTAL BPA FY2000 BUDGET REQUEST			$119,465

Cost sharing

Organization	Item or service provided	% total project cost (incl. BPA)	Amount ($)
Total project cost (including BPA portion)			$119,465

Outyear costs

	FY2001	FY02	FY03	FY04
Total budget	$120,000	$125,000	$125,000	$125,000

Section 6. References

Watershed?	Reference
☐	Anglin, D. R., T. R. Cummings, and A. E. Ecklund. 1992. Swan Falls instream flow study. U. S. Depart. of the Interior, FWS, Lower Columbia Fisheries Resource Office. Vancouver, WA. A cooperative study by the

	USFWS and IPCo. Report # AFF1-FRO-92-14.
☐	Bureau of Reclamation. 1996. The upper Snake River Basin. A description of Bureau of Reclamation system operations above Milner Dam. January 1996, Boise Idaho.
☐	Bureau of Reclamation. 1996b. The Central Snake River Basin. A description of Bureau of Reclamation system operation of the Boise and Payette rivers. November 1996. Boise Idaho.
☐	Bureau of Reclamation. 1997. The Central Snake River Basin. A description of system operation of the Owyhee R, Malheur R, Weiser R (Mann Cr), Burnt R, and Powder R. April 1997. Boise Idaho.
☐	Columbia Basin Fish and Wildlife Authority. 1997. Draft multi-year implementation plan for resident fish protection, enhancement and mitigation in the Columbia River Basin. Technical Planning Document. June 3, 1997.
☐	Idaho Department of Fish and Game. 1996. Fisheries management plan 1996 - 2000. Boise, Idaho.
☐	Independent Scientific Group. 1996. Return to the river. Restoration of salmonid fishes in the Columbia River ecosystem. Prepublication copy. Report # 96 - 6.
☐	Leitzinger, E. J. 1996. Idaho water rental pilot project: Probability/coordination study - resident fish and wildlife impacts. Phase III. Idaho Department of Fish and Game Annual Report to BPA, Contract 93-BI02390, Project 91-067.
☐	Leitzinger, E. J. 1997. Idaho water rental pilot project: Probability/coordination study - resident fish and wildlife impacts. Phase III. Idaho Department of Fish and Game Annual Report to BPA, Contract 93-BI02390, Project 91-067.
☐	Leitzinger, E. J. In Press. Idaho water rental pilot project: Probability/coordination study - resident fish and wildlife impacts. Phase III. Idaho Department of Fish and Game Annual Report to BPA, Contract 93-BI02390, Project 91-067.
☐	National Marine Fisheries Service. 1995. Endangered Species Act -Section 7 Consultation, Biological Opinion. Reinitiation of consultation on 1994-1998 operation of the FCRPS and juvenile transportation program in 1995 and future years. NW Region.
☐	Northwest Power Planning Council. 1982. Columbia River Basin Fish and Wildlife Program. Portland, Oregon.
☐	Northwest Power Planning Council. 1992. Strategy for salmon. Volume II. Columbia River Basin Fish and Wildlife Program. Portland, Oregon.
☐	Northwest Power Planning Council. 1994, amended 1995. Columbia River Basin Fish and Wildlife Program. As amended in 1995. Portland Oregon.
☐	Palmer T. 1991. The Snake River: Window to the west. Island Press. Washington DC.
☐	Riggin, S. H. and H. J. Hansen. 1992. Phase 1 water rental pilot project: Snake River resident fish and wildlife resources and management

	recommendations. IDFG report BPA, Contract DE-BI79-91BP21416, Project 91-067. Boise.
☐	Stovall, S. H. 1994. Phase II water rental pilot project: Snake River resident fish and wildlife resources and management recommendations. IDFG Annual Report to BPA, Contract DE-BI79-91BP21416, Project 91-067. Boise.
☐	USDA FS, and USDI BLM. 1997. An assessment of ecosystem components in the interior Columbia Basin and portions of the Klamath and Great Basins: Vol III. Gen Tech Rpt PNW-GTR-405. T.M. Quigley and S. J. Arbelbide, tech.eds. PNW Research Sta. Portland
☐	USFWS. 1995. Snake River aquatic species recovery plan. December 1995. Snake River Basin Office, Ecological Services. Boise, Idaho.
☐	

PART II - NARRATIVE

Section 7. Abstract

Section 2.2E.7 of the FWP asks the fish managers to address the trade-offs between resident fish and wildlife affected by upriver reservoir releases and anadromous fish affected by flow augmentation releases. Section 5.5A.1 calls on the states and tribes to review, compile, and submit information on impacts of anadromous flow augmentation on resident fish and wildlife. This project will submit that information. The overall goal of the project is to quantify the impacts of the salmon flow augmentation releases on resident fish habitat (expressed in weighted usable area - WUA) in the Snake River upstream of Brownlee Reservoir and implement recommendations that result in improved resident fish habitat. The focus is on weak native stocks (white sturgeon, rainbow trout, bull trout, and cutthroat trout).

Evaluation of the impacts is done by using existing habitat versus flow relationships from previous IFIM studies. Changes in WUA due to increased flows from salmon flow releases are estimated. Timing of releases and WUA changes are compared to known critical time periods for fish. Also, flows with and without the salmon flow releases are compared to recommended minimum flows to determine if the salmon flow releases help meet or exceed these recommended minimums.

The expected outcomes include an accurate history of the salmon flow releases, estimates of changes in fish habitat, recommended release strategies to improve resident fish habitat, implementation of these recommendations, and a model that can simulate the salmon flow releases and can be used to evaluate the trade-offs of different release strategies.

Section 8. Project description

a. Technical and/or scientific background

It is well known that the Snake River Basin has been significantly altered by human development since the late 1880's when the first major irrigation diversion was built. Development in the upper Snake River Basin has drastically changed the flow regime of the basin much to the detriment of

the native fishes (BOR 1997; Palmer 1991; USFS and BLM 1997). The natural hydrograph no longer resembles the historic condition due to impoundments, diversions for irrigation, municipal, and industrial uses, hydropower, channelization, development, and a variety of land management activities. Often the timing of flows and volumes are insufficient for the maintenance of fisheries, other aquatic resources, and water quality. Generally, the Snake River upstream of Milner Dam (a privately owned irrigation dam upstream of Twin Falls, ~ river mile 640) and major tributaries like the Boise and Payette rivers are characterized by reduced spring runoff, higher summer flows and dramatically reduced late fall and winter flows compared to historic flows. Downstream from Milner, the flow regime is characterized by a lack of a spring runoff, drastically reduced summer flows (down to 200 cfs), and lower than historic winter flows. The lower Boise River (downstream from Lucky Peak Dam), lower Payette River (downstream from Black Canyon Dam), and much of the mainstem Snake River has been designated as "water quality limited" by the Environmental Protection Agency (EPA) (D. Zaroban, Idaho Division of Environmental Quality, personal communication).

It is clear that changes are needed if water management in the Snake River Basin is to take into account the needs of the fishery resources. If water quality is to be improved and fish populations are to be recovered to a healthy, viable, harvestable level, then a more natural hydrograph is needed. This will benefit all native aquatic species in the Basin. Specific changes include increased winter flows in the tributaries (e.g. Boise, Payette, Henrys Fork) and the Snake River above Milner and increased spring and summer flows for spawning sturgeon, larval sturgeon development, to improve water quality, and prevent fish kills below Milner. Salmon flow releases are not sufficient to do it alone. But, modification of existing flow augmentation releases in the tributaries could go a long way to improving conditions for fish.

The long term goal of the Idaho Department of Fish and Game (IDFG) is to restore the native fish species still present in the system to healthy, harvestable levels. The approach IDFG is taking is to reestablish "normative conditions" (ISG 1996) in the Basin, beginning with a more natural hydrograph. Salmon flow augmentation releases from the upper Snake River basin is one way to help achieve normative flows.

The use of stored Snake River water to aid anadromous fish migration in the Snake River downstream of Lewiston, Idaho, and in the Columbia River began in 1982 with the adoption of the first Columbia Basin Fish and Wildlife Program (FWP) by the Northwest Power Planning Council (NPPC). The Program called for a total of 1.19 million acre-feet (af) of water from the Snake River Basin to be delivered to Lower Granite Dam between April 15 and June 15 each year to aid spring outmigrating anadromous fish (NPPC 1982).

The NPPC's Strategy for Salmon (NPPC 1992) called for a total of 427,000 af of water to come from the Snake River upstream of Brownlee Reservoir, up to 900,000 af from Dworshak Reservoir to aid spring migrants, and up to 200,000 af from Dworshak Reservoir to aid fall migrants. Then with the listing of Snake River salmon stocks on the endangered species list, the National Marine Fisheries Service (NMFS) in its Biological Opinion (NMFS 1995) on endangered Snake River salmon, replaced this with flow targets for the Snake and Columbia rivers while maintaining the requirement to use at least 427,000 af of upper Snake River Basin water for flow augmentation. In 1996, the Idaho Legislature approved the use of the 427,000 af on an experimental basis through the year 2000.

The Idaho Water Rental Pilot Project began in 1991 as part of the 1990 Non-Treaty Storage Fish and Wildlife Agreement (NTSFWA) between Bonneville Power Administration (BPA) and the Columbia Basin Fish and Wildlife Authority (CBFWA). The NTSFWA contained several provisions designed to ensure the NTSA did not adversely impact fish and wildlife. One of the provisions called for identifying conditions needed for resident fish and wildlife and to protect those needs. Prior to this agreement, the impacts (both positive and negative) to resident fish from salmon flow augmentation were largely unknown and not adequately addressed.

The timing, volumes, duration, and locations of the water released is critical to the health and stability of the Snake River watershed. Releasing water at the wrong time, or at the wrong volume, or for the wrong length of time could have very serious detrimental impacts to the resident fish in the upper Snake River and tributaries. On the other hand careful, planned releases taking into consideration fish and wildlife impacts could greatly benefit the fish and wildlife in the Snake River basin. This project will determine what is the best way to release the water to maximize the benefits to resident fish upstream of the Hell's Canyon Dam complex.

The study area encompasses the Snake River upstream of Brownlee Pool to the Wyoming border, the Henrys Fork, Boise River, and Payette River drainages. The flow augmentation water has been physically moved from these Bureau of Reclamation (BOR) facilities within the study area: American Falls, Lucky Peak, Cascade, and Deadwood reservoirs. It is possible that other federal reservoirs in the basin (such as Palisades, Island Park, Ririe, and Anderson Ranch) could also be used in the future. It depends on the water supply each year. It will also depend on which salmon recovery option NMFS chooses in 1999.

This project is attempting to mitigate for losses in place, in kind by modifying water release strategies to a more "normative condition" for the benefit of native resident fish. We believe that a return to a more natural hydrograph will significantly improve conditions for all native aquatic species, especially native resident fish and endangered snails.

b. Rationale and significance to Regional Programs

The overall goal of this project mirrors the overall goal of the NPPC's FWP, IDFG's fish management plan, and CBFWA's draft Multi-year Plan (MYP). All these plans want a healthy Columbia Basin and to protect and restore native fish in native habitats. By evaluating the impacts of salmon flow augmentation releases on resident fish, we can make recommendations on how and when to release that water so that it maximizes benefits resident fish. The primary species of concern have been white sturgeon and native rainbow trout. As more information becomes available in the future (i.e. IFIM study results though FERC relicensing, Snake River Basin water rights adjudication, BOR funded research etc.) we hope to include more of the Basin in the analyses and include more species, namely bull trout and yellowstone cutthroat trout.

This project is closely related to several planning documents. The system-wide goal in the NPPC's FWP is "a healthy Columbia Basin, one that supports both human settlement and the long-term sustainability of native fish and wildlife species in native habitats...". The resident fish goal mirrors the system-wide goal by emphasizing the "long-term sustainability of native species in native habitats where possible..." (NPPC 1994 as amended 1995). The goal of the CBFWA draft resident fish MYP is to promote the long-term viability of native species in native habitats (CBFWA 1997). IDFG's fish management plan (IDFG 1996) states that wild, native, self

sustaining fish populations are a management priority as is protection and restoration of habitats and water quality. One of the goals of the plan is to maintain and restore wild, native fish populations. It is our belief that the salmon flow augmentation water can be released in such a manner to improve habitat conditions for weak native species. These include sturgeon and rainbow trout in the Snake River below Shoshone Falls, rainbow trout and bull trout in the Boise and Payette rivers, and native cutthroat trout upstream of Shoshone Falls. By recreating a more natural hydrograph, we will help restore natural ecosystem functions and this will go a long way toward restoring the ecological health of the upper Snake River Basin.

This project complements the plans for recovery of the five species of ESA listed snails residing in the Snake River (USFWS 1995; Snake River Aquatic Species Recovery Plan). This plan calls for using flow augmentation programs in a way that benefits listed snails such as using the water to provide adequate year-round flows downstream of Milner Dam.

This project provides direct benefits to both anadromous fish and wildlife. The water that is being moved through the upper Snake River basin is ultimately used to aid juvenile salmon and steelhead outmigration in the lower Snake River. Phase I and Phase II water rental reports showed through modeling as did a 1992 USFWS study (Anglin et al. 1992) that increased spring and summer flows in the Snake River help maintain or preserve island integrity, thus preventing predators from reaching the islands and destroying waterfowl nests, eggs, and young. There are many islands in the Snake River that are historic waterfowl nesting areas, many of which are included in the Deer Flat National Wildlife Refuge. In the past low flows (due to impoundments, hydropower, irrigation withdrawal etc.) have left the islands exposed to predators and human disturbance. These are serious threats to waterfowl and other wildlife (Anglin et al. 1992; Riggin and Hansen 1992).

Although this project has biological objectives (i.e. flow augmentation releases that result in an increase in habitat - expressed as WUA for sturgeon, rainbow trout, bull trout, and cutthroat trout), they have not been submitted to the NPPC for adoption into the program. They are continually being refined. Once final, they will be submitted to the NPPC.

This project does support important fisheries. The catch-and-release sturgeon fishery is very important. It provides a very unique fishing opportunity. The chance for people, especially those in inland states, to catch 6 - 10ft long fish is extremely rare. It is also a popular sport fishery that is gaining in popularity. There was a mandatory sturgeon permit program from 1989 through 1996. This program provided important information about the fishery, such as its popularity, and size and spatial distribution of the sturgeon caught. In 1989, 2800 tags were issued. In 1994, over 6,000 tags were issued. There are important recreational fisheries in the Boise River through Boise, and in the Payette River that will benefit from this project.

c. Relationships to other projects

This project is related to other projects in the subregion. The water rental project will provide useful, quantified information concerning habitat versus flow requirements for native salmonids in several of the upper Snake subbasins. This information will be very useful in identifying and implementing protection and restoration actions and will be incorporated into the Snake River Native Salmonid Assessment project (BPA # 9800200).

The water rental project is most closely tied to the BOR's Snake River Resources Review (SR3) project. This BOR project is building a decision support system (DSS) to improve the overall management of the upper Snake River subregion. The DSS will allow managers to make better informed decisions on water management in the Upper Snake. They will be able to see and analyze the trade-offs (benefits and risks) of different management (or water release) strategies. Information from the water rental project (e.g. flow recommendations) is being incorporated directly into the DSS so that impacts to fisheries from various flow scenarios can be evaluated. It is through the coordination of these projects that the modeling aspect of the water rental project is being accomplished. The Water Rental project is dependent on the BOR's SR3 project to accomplish that objective.

The project is also related to the BOR's ongoing feasibility study of the use of an additional one million af of water from the upper Snake River Basin for salmon flow augmentation (MAF study). Recommendations from this project are being modeled by the MAF study to estimate potential impacts to resident fish resources resulting from the release of an additional one million af of water.

This project is also tied to an Idaho Department of Water Resources (IDWR) aquifer recharge feasibility study. IDWR is presently conducting a study to determine the feasibility of a large scale recharge program for the eastern Snake Plain Aquifer. Flow recommendations generated from this project are being used as the basis for determining water availability and estimating impacts to fish and wildlife resulting from the recharge efforts.

The project is being coordinated with USFWS to insure that recommendations are compatible with snail recovery.

This project will complement a proposed BOR research project scheduled to start in FY 2000 or 2001 and is designed to conduct IFIM studies downstream of BOR dams in the basin as well as develop methods to determine requirements for fish and wildlife in BOR reservoirs. This is similar to the biological and integrated rule curve concept developed in Montana. This project would allow for a much expanded and more detailed analysis of flow augmentation impacts to both riverine and reservoir fish populations.

d. **Project history** (for ongoing projects)

The Idaho Water Rental Pilot Project began in 1991 as part of the 1990 Non-Treaty Storage Fish and Wildlife Agreement (NTSFWA) between Bonneville Power Administration (BPA) and the Columbia Basin Fish and Wildlife Authority (CBFWA). The NTSFWA contained several provisions designed to ensure the NTSA did not adversely impact fish and wildlife. One of the provisions called for identifying conditions needed for resident fish and wildlife and to protect those needs. After the initial three years of the project, it was integrated into the NPPC's Fish and Wildlife Program. The project number has not changed. The project has three phases.

Phase I of the project was completed in October 1992 and included the identification of existing resident fish and wildlife resources in the upper Snake River basin, habitat conditions, management recommendations, and water release strategies designed to protect or enhance resident fish and wildlife and their habitats. It identified lack of flows during the nonirrigation season as a limiting factor for fish populations in much of the study area, especially in the major tributaries (Boise,

Payette, Henrys Fork, and South Fork) and the upper mainstem and recommended releasing salmon flow water to meet nonirrigation season fish needs. It also recognized the need for summer flow enhancement below Milner Dam and recommended release strategies to help alleviate that problem.

Phase II began in February 1993 and focused on an IFIM study of resident fish and wildlife habitat in the upper Snake River between American Falls Reservoir and the city of Blackfoot. The purpose was to gather fish and wildlife habitat data on a portion of the Snake River that had been dewatered in 1992 due to irrigation diversions. The study mapped fish and wildlife habitat, developed habitat versus flow curves for several species of fish (rainbow trout, cutthroat trout, and whitefish) and wildlife (Canada goose, mallard duck, beaver), and validated the findings of an earlier Shoshone-Bannock flow study. It recommended a minimum flow for that reach of the river of 2,000 cfs to protect resident salmonids (cutthroat trout, rainbow trout, and whitefish) as well as Mallard Duck, Canada Goose, and Beaver, with "high spring flows" (5,000 - 10,000 cfs) from March - June for rainbow and cutthroat spawning, waterfowl nest establishment and brood rearing, and island integrity.

Phase III is currently underway. This phase is monitoring and evaluating the impacts of salmon flow augmentation releases on resident fish in the upper Snake River basin with a focus on quantifying changes in resident fish habitat resulting from the salmon flow augmentation releases. We are trying to insure that these releases benefit resident fish. Changes in WUA for white sturgeon and rainbow trout resulting from the salmon flow releases have been summarized for the 1994 - 1997 water releases (Leitzinger 1996; 1997; in press). The flow releases resulted in a short-term increase in available habitat for most life stages. The 1994 releases were made in the spring, thus we were able to estimate habitat changes for four life stages of both sturgeon (adult/juvenile, spawning, incubation, larvae) and rainbow trout (adult, juvenile, spawning, fry) in the five reaches of the Snake River between C.J. Strike Dam and Brownlee Pool defined in the Swan Falls Instream Flow Study (SFIFS) (Anglin et al. 1992). WUA for sturgeon increased for all life stages except larvae. Rainbow trout WUA increased for adults and spawning while it decreased for fry and juveniles. From 1995 - 1997, the flow releases were made during the summer when only one sturgeon life stage (adult/juvenile) and three rainbow trout life stages (adult, juvenile, fry) are present in the river. Adult/juvenile sturgeon WUA increased each year. Rainbow trout WUA increased for adults, but decreased for fry and juveniles each year. The decrease in WUA for larval sturgeon is more an artifact of the difficulty in sampling habitat and larval sturgeon at high flows and may not accurately reflect larval sturgeon habitat needs (D. Anglin USFWS personal communication). The reductions in rainbow trout fry and juvenile WUA are not significant because historically the rainbow trout fry and juveniles did not use the Snake River extensively. The rainbows exhibited a fluvial life history pattern, meaning adults used the Snake River at various times of the year but moved into tributaries to spawn. Fry and juveniles reared in the tributaries and migrated to the Snake River as adults.

Despite increases in flow and WUA, the minimum flow recommendations were not met for the mainstem Snake River in most months. The mean monthly flow recommendations at the Murphy gage (below Swan Falls Dam) were met only one month out of the 15 months of flow augmentation from 1994 - 1997. The flows were still well below what is needed to sustain viable healthy fish populations as defined in the SFIFS (Anglin et al. 1992).

The enhanced flows in the Boise River met or exceeded mean monthly minimum flow recommendations all the time from 1994 - 1997 at the Middleton gage (lower Boise River). The

recommended monthly flows would have been met 63% of the time without the flow augmentation releases. Although the flow augmentation releases helped meet minimum flows some of the time, it needs to be pointed out that those are minimum flows, not preferred. Plus, the Boise River contribution is released during the summer when flows are not limiting. The timing of the releases should be changed to the nonirrigation season to maximize the benefit to resident fish (Leitzinger 1997; in press).

The summer releases in the Payette River drainage (1994, 1996, 1997) met mean monthly minimum flows at the Letha gage (lower Payette River) only 50% of the time. These minimums would not have been met if the flow augmentation water was not released. These releases appear to have some benefit to the lower Payette River. The winter releases (1995/96, 1996/97, 1997/98) in the Payette met mean monthly minimum flows all the time at the Letha gage and the Cascade gage (upper Payette River). But, the minimum flows would have been met only half the time without the flow augmentation releases.

Clearly, the flow augmentation provides some benefits to resident fish habitat but it is not enough to solve all the flow related problems all the time. Other factors are also influencing flows such as precipitation, snow pack ,and irrigation and hydropower demand.

The following recommendations have been presented in an effort to refine the salmon flow augmentation releases to maximize benefits to resident fish. Evaluation of these new flow regimes is needed.

1) Release the salmon flow augmentation water out of Lucky Peak Reservoir on the Boise River during the nonirrigation season (mid-October - mid-April) in addition to the stream channel maintenance flows presently being released. The BOR releases 400 cfs for salmon flow augmentation during July and August each year. Flows are not a limiting factor during the summer, however, they are during the winter. Current nonirrigation season releases range from 150 - 240 cfs. Preimpoundment monthly minimum flows for these months averaged approximately 600 cfs, while monthly means were between 1100 and 1200 cfs. Releasing the salmon flow augmentation water during the nonirrigation season will keep significantly more fry and juvenile trout habitat under water and available during the nonirrigation season. The resulting flows would approach the historic minimum monthly flows observed prior to any dam construction.

2) Continue the 50/50 summer/winter release in the Payette River Basin. This strategy may have benefits to resident fish, but no clear trend is evident. Again nonirrigation season flows have been identified as a limiting factor to salmonid populations in the Payette system (Riggin and Hansen 1992). The nonirrigation season release would increase habitat for salmonids in the river and help keep Cascade Reservoir as full as possible during the summer to protect the fishery and improve its water quality (the reservoir has been designated water quality limited by the EPA). The summer releases would come mostly from Deadwood Reservoir and would help improve water quality in the lower Payette River downstream of Black Canyon Dam.

3) The BOR and IDWR should monitor flow augmentation releases from Cascade and Deadwood reservoirs separately. This would allow a much more detailed evaluation of the impact of these flows in the Deadwood, South Fork and North Fork Payette rivers.

4) Discontinue the splitting of the salmon flow releases in the upper Snake River at Milner Dam. Keep the entire 1,500 cfs in the river channel. Current operation is to only send 200 cfs down the river, while the remaining water (approximately 1,300 cfs) gets sent down an irrigation canal for a little over a mile so that it can be sent through turbines before returning to the river. This splitting of the water may negate any water quality benefits this extra water could provide. The 200 cfs left in the river is subject to intense solar radiation and thus excessive warming. The remaining water is also subject to warming as well as additional nutrient loading from agricultural fields the canals irrigate.

5) Conduct IFIM studies to obtain habitat versus flow relationships in other areas of the basin so a more accurate and detailed evaluation can occur. This will also allow the evaluation to expand to include other species (bull trout and cutthroat trout) and other reaches. We anticipate some additional data becoming available (through FERC relicensing, Snake River water rights adjudication, BOR funded research etc.) by the year 2000 and beyond.

6) In dry years, release the salmon flow augmentation water from American Falls Reservoir in the spring (April - June) to aid sturgeon spawning and larval development as well as outmigrating anadromous smolts downstream of Hells Canyon Dam. In normal to wet years, begin releasing the water in June to keep water temperatures cooler to protect larval sturgeon and to improve water quality.

In addition to these recommendations, a preferred flow scenario for the release of the salmon augmentation water has been developed. This scenario includes recommendations 1, 4, and 6 above. Also, IDFG would prefer that all flow augmentation releases from the Payette system be shifted to the upper Snake. Proper release of the water would benefit the ecological functioning of the entire upper Snake River mainstem, provide about 155,000 af more water per year to reestablish a natural hydrograph and benefit the entire native biological community, especially sturgeon, native salmonids, and ESA listed snails. If this shift is impossible, maintain the Payette release as described in recommendation 2 above.

The adaptive management implications are that fish managers can assess and quantify impacts to resident fish habitat resulting from salmon flow augmentation releases. Once these impacts are known, the timing and volume of flows can be shaped to maximize benefits to resident fish. As more data becomes available in the future, the evaluation came expand into other river reaches, subbasins, include more species and become more detailed.

Project costs: 1991 - $85,123; 1992 - $0; 1993 - $145,470; 1994 - $119,770; 1995 - $46,381; 1996 - $98,776; 1997 - $91,905; 1998 - $112,928; 1999 - $110,000 (est.)

Project Reports:

Riggin, S. H. and H. J. Hansen. 1992. Phase 1 water rental pilot project: Snake River resident fish and wildlife resources and management recommendations. Idaho Department of Fish and Game, Report to BPA, Contract DE-BI79-91BP21416, Project 91-067. Boise.

Stovall, S. H. 1994. Phase II water rental pilot project: Snake River resident fish and wildlife resources and management recommendations. Idaho Department of Fish and Game Annual Report to BPA, Contract DE-BI79-91BP21416, Project 91-067. Boise.

Leitzinger, E. J. 1996. Idaho water rental pilot project: Probability/coordination study - resident fish and wildlife impacts. Phase III. Idaho Department of Fish and Game Annual Report to BPA, Contract 93-BI-02390, Project 91-067. Boise.

Leitzinger, E. J. 1997. Idaho water rental pilot project: Probability/coordination study - resident fish and wildlife impacts. Phase III. Idaho Department of Fish and Game Annual Report to BPA, Contract 93-BI-02390, Project 91-067. Boise.

Leitzinger, E. J. In Press. Idaho water rental pilot project: Probability/coordination study - resident fish and wildlife impacts. Phase III. Idaho Department of Fish and Game Annual Report to BPA, Contract 93-BI-02390, Project 91-067. Boise.

e. Proposal objectives

Objective 1) Determine impacts to resident fish habitat (in weighted usable area - WUA) in the upper Snake River for key native fish species (sturgeon, rainbow trout, bull trout, yellowstone cutthroat trout) resulting from salmon flow augmentation releases and make recommendations that will maximize benefits to resident native fish.

Objective 2) Coordinate with federal, state and tribal agencies to ensure that duplication of work does not occur in local efforts explore water management opportunities in the upper Snake River basin for salmon flow augmentation.

Objective 3) Assist the BOR in developing a model that incorporates resident fish flow needs in water management scenarios in the upper Snake Basin upstream of Brownlee Reservoir, and ultimately estimates changes in fish habitat resulting from various flow release strategies.

Objective 4) Prepare an annual report.

The main products will be annual reports summarizing the previous years flow augmentation releases, estimates in changes in WUA resulting from those releases, a comparison of the augmented flows to recommended and established instream flow regimes, and new flow recommendations for the 427,000 af and the Basin as a whole. These recommendations will be used in the BOR's SR3 project and IDWR's aquifer recharge study. Recommendations will be refined as new information becomes available. Implementation of flow recommendations. A model that can assess the impacts to resident fish from different flow scenarios.

f. Methods

The methods being used in phase III are described in Leitzinger (1996; 1997; in press). A Lotus spreadsheet was developed that calculated the change in WUA expressed in millions of square feet for these four age classes of sturgeon in each reach: adult/juvenile, larvae, spawning, and incubation. The age classes for rainbow trout were adult, juvenile, spawning, and fry. The spreadsheet took United States Geological Survey (USGS) daily stream gauge data and subtracted the daily flow augmentation releases supplied by IDWR and BOR. The resulting values represented what the flow in the river would have been without the flow augmentation releases.

The stream gauge data represents the flow in the river with the flow augmentation water. Then using habitat versus flow relationships from the SFIFS (Anglin et al. 1992), WUA was calculated for each flow (with and without the flow augmentation water). These values were subtracted to get the change in WUA resulting from the flow augmentation releases. The SFIFS habitat versus flow curves were developed using flows from 3,000 to 22,000 cubic feet per second (cfs) in 1,000 cfs increments (5,000, 6,000, 7,000, etc.). Actual flows were somewhere between these points, so WUA for the actual flows were estimated by linear interpolation between the two closest increments. If the actual flow was 6,500 cfs, the WUA was calculated to be half-way between the WUA at 6,000 and 7,000 cfs. If the actual flow was 8,900 cfs, the WUA was estimated to be 90% of the difference between the WUA at 8,000 and 9,000 cfs. Habitat changes were summarized for each month the flow augmentation water was released.

Flows in the Boise River, Payette River, and Snake River were compared, with and without the flow augmentation water, to flow recommendations from the literature and established instream flows to see if flows were being met and if the augmentation water helped achieve those flows.

The following are the tasks associated with the objectives listed in section 8e above.

Task 1.1: Gather all existing habitat versus flow relationship data for the upper Snake River and analyze its utility for estimating resident fish habitat changes resulting from salmon flow augmentation releases. Identify areas where data is lacking. This task will continue for the life of the project as periodically new data becomes available.

Task 1.2 Annually, estimate the impacts to key native, resident fish species in WUA (primarily white sturgeon, rainbow trout, bull trout, yellowstone cutthroat trout) in the upper Snake River upstream of Brownlee Reservoir resulting from salmon flow augmentation releases.

Task 1.3 Annually, compare flows with and without the salmon flow augmentation component to recommended or established instream flow regimes to determine if salmon flow releases help meet the recommendations and determine the frequency they are met or not met.

Task 1.4 Based on the results of tasks 1.2 and 1.3, recommend timing and volumes of salmon flow releases that maximize benefits to native resident fish species. Refine these recommendations as new information becomes available.

Task 2.1 IDFG will continue to consult with the technical work group (TWG) to further refine goals, objectives, and recommendations of the project. Agencies on the technical work group include IDFG, Shoshone-Bannock Tribes, BOR, USFWS, and Idaho Power Company (IPC). The TWG meets regularly to discuss fish needs and flow recommendations.

Task 2.2 Coordinate with sub-regional planning efforts, and act as a clearinghouse for water rental/flow information. This includes tracking and summarizing salmon flow augmentation releases. Continue to meet with BOR and IDWR staff to obtain the flow augmentation data and to understand water management in the Basin.

Task 2.3 Assist in coordinating and integrating BPA funded IDFG resident fish and wildlife programs (e.g. Water Rental and Snake River Native Salmonid Assessment) with other projects (e.g. the BOR's SR3 project, snail recovery etc.) in the upper Snake Basin into a cohesive ecosystem approach to water and fisheries management.

Task 3.1 Work with the BOR and technical work group to develop and test the models used in their Decision Support System for SR3. This will include models that incorporate resident fish and wildlife needs so that the impacts to fish and wildlife and other resources can be determined from various flow scenarios. Continue to meet quarterly with BOR contractors and SR3 staff for updates on DSS development and to insure the latest flow information is included.

Task 4.1 Prepare a draft report and circulate for comments.

Task 4.2 Incorporate comments into final report.

The major assumptions associated with this project are that the flow versus habitat (WUA) relationships are reasonably accurate and that changes in WUA will result in changes in the fish population over the long-term. Another assumption is that the salmon flow releases make it through the system intact to benefit resident fish and ultimately anadromous fish downstream of the study area. A critical uncertainty for this project is the role flow augmentation will play in salmon recovery after 1999. Depending on which recovery option the NMFS chooses in its upcoming 1999 decision, flow augmentation could expand, stay the same, or be phased out. If it expands (i.e. NMFS requires an additional one million af of water from the upper Snake Basin), this project would also expand and it would be more critical to determine when, where, and how that water should be delivered to minimize negative impacts or benefit resident fish.

The expected results from this project are quantified estimates of changes in fish habitat resulting from the salmon flow augmentation releases, implementation of a release strategy that maximizes the potential benefits to resident fish, and a model that can ultimately be used to evaluate the impacts of various flow release strategies in the upper Snake River Basin on resident fish. This model is being developed by the BOR with input from this project through coordination with the BOR's SR3 project.

g. Facilities and equipment

Facilities are adequate for the project. No major capital expenditures are planned. The project computer is adequate for the job (Micron 486 with Windows95, network and internet access). All needed software is available. The computer and software will be upgraded during FY99. Upgrades include but are not limited to pentium processing, increased memory and speed, increased storage space, Windows97 and the newest versions of all software. Storage is also provided for equipment. Vehicles are available from the motor pool. There is other equipment and manpower available from the Department if needed (e.g. volunteers, administrative and computer help, expertise on many subjects).

h. Budget

Personnel on this project include the project biologist and six months of clerical help to assist in data summary, analysis, and report preparation. Supplies include things like field gear, computer software, and miscellaneous office supplies etc.. Maintenance includes maintaining and repairing a boat and outboard motor previously purchased by the project, utilities, phone/fax, computer and printer repairs etc. Travel is primarily instate to meet with IDFG regional personnel, BOR and IDWR staff on SR3 and aquifer recharge. It also includes travel to Portland or Spokane to CBFWA meetings to defend this project proposal. Capital includes upgrades on computer and printer hardware, and replacement of field gear etc. The budget is adequate to achieve the goals and objectives of the project. The budget has been fairly stable over the past several years and the objectives have been met. Continued funding for monitoring and evaluation will be required. There is the possibility that the NMFS will require the BOR to release and additional one million af of water from the upper Snake River (for a total of 1.427 million af) annually for salmon flow augmentation as a result of NMFS's upcoming 1999 decision. It will be extremely important to be able to monitor and evaluate the impacts this additional water may have on resident so that we can work to have this water released in a manner that will minimize negative impacts and maximize benefits.

Section 9. Key personnel

The principal investigator on the project is Eric Leitzinger, Fisheries Staff Biologist. He has been working for the Idaho Department of Fish and Game as a permanent biologist since December 1989. His first five years were spent in fish research as a research biologist and a senior research biologist. He worked on the Idaho Supplementation Studies research project (BPA # 89-098) and the Idaho Habitat/Natural Production Monitoring project (BPA project # 91-73). He has spent the last four years as a staff biologist working on the Water Rental project (BPA # 91-067).

He received a B. S. in Fisheries Biology from Colorado State University in 1983 and an M. S. in Fisheries Science from Oregon State University in 1992.

Publications:

Leitzinger, E. J. In Press. Idaho water rental pilot project: Probability/coordination study - resident fish and wildlife impacts. Phase III. Idaho Department of Fish and Game Annual Report to BPA, Contract 93-BI-02390, Project 91-067.

Leitzinger, E. J. 1997. Idaho water rental pilot project: Probability/coordination study - resident fish and wildlife impacts. Phase III. Idaho Department of Fish and Game Annual Report to BPA, Contract 93-BI-02390, Project 91-067.

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Hall-Griswold, J., E. J. Leitzinger, and C. E. Petrosky. 1995. Idaho habitat/natural production monitoring, Part I. Annual Report for 1994. Idaho Department of Fish and Game Annual Report to BPA, Contract DE-BI79-91BP21182, Project 91-73.

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monitoring. Part I. Annual report 1993. Idaho Department of Fish and Game Annual Report to BPA, Contract DE-BI79-91BP21182, Project 91-73.

Leitzinger, E. J., K. Plaster, P Hassemer, and P. Sankovich. 1996. Idaho supplementation studies. Annual progress report. Period covered: January 1, 1993 to December 31, 1993. Idaho Department of Fish and Game Annual Report to BPA, Contract DE-BI79-89BP01466, Project 89-098.

Leitzinger, E. J., K. Plaster, and E. Bowles. 1993. Idaho supplementation studies. Annual report 1991-1992. Idaho Department of Fish and Game Annual Report to BPA, Contract DE-BI79-89BP01466, Project 89-098.

Bowles, E. And E. Leitzinger. 1991. Salmon supplementation studies in Idaho rivers (Idaho supplementation studies). Experimental Design. Idaho Department of Fish and Game Report to BPA, Contract DE-BI79-89BP01466, Project 89-098.

Section 10. Information/technology transfer

Information from this project will be shared primarily through the coordination with the BOR through their SR3 project. They have a large public outreach program associated with SR3. This information will also be directly incorporated into the Decision Support System being developed by SR3. Applicable data generated from the project will be made available to the Stream Net project and all Stream Net users. Findings are presented at project review meetings held by BPA, when they occur. All data will become part of IDFG's common databases. Information will also be shared through quarterly and annual reports, and presentations at professional society meetings. Information may also be put on IDFG's home page on the internet. Data and reports are available to anyone who wants them.

Congratulations!