PART I - ADMINISTRATIVE

Section 1. General administrative information

Title of project **Monitoring Smolt Migrations of Wild Snake River Sp/Sum Chinook**	
BPA project number	**9102800**
Contract renewal date (mm/yyyy)	**12/2001**
Multiple actions? (indicate Yes or No)	**Yes**
Business name of agency, institution or organization requesting funding **National Marine Fisheries Service**	
Business acronym (if appropriate)	**NMFS**
Proposal contact person or principal investigator:	
Name **Mailing address** **City, ST Zip** **Phone** **Fax** **Email address**	**Stephen Achord/Gene Matthews** **2725 Montlake Blvd. East** **Seattle, Wa. 98112-2097** **509-547-7518/206-860-3270** **509-547-4181/206-860-3267** **Steve.Achord@noaa.gov or Gene.Matthews@noaa.gov**
NPPC Program Measure Number(s) which this project addresses **5.9A.1; and 5.8A.8 (partially)**	
FWS/NMFS Biological Opinion Number(s) which this project addresses **NMFS BO RPA 13a and 13f**	
Other planning document references **2.1.d.5 of NMFS Snake River Salmon Recovery Plan.**	
Short description **Collect time series information to examine migrational characteristics of wild ESA-listed Snake River spring/summer chinook salmon stocks. Mark wild spring/summer chinook salmon parr with PIT-tags annually; intercept and decode tagged smolts as they pass traps in tributary streams and Snake and Columbia River dams annually. Monitor environmental conditions within natal streams and determine how they effect wild parr and smolt movements and migrations. Provide real-time wild smolt timing data annually for making operational decisions to maximize survival of wild smolts as they migrate through the hydropower system.**	
Target species **Snake River spring/summer chinook salmon.**	

Section 2. Sorting and evaluation

Subbasin Salmon of the Lower Snake Subregion.

Evaluation Process Sort

CBFWA caucus	CBFWA eval. process	ISRP project type
X one or more caucus	If your project fits either of these processes, X one or both	X one or more categories

X	Anadromous fish	X	Multi-year (milestone-based evaluation)		Watershed councils/model watersheds
	Resident Fish		Watershed project eval.		Information dissemination
	Wildlife				Operation & maintenance
					New construction
				X	Research & monitoring
				X	Implementation & mgmt
					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
8909800	Idaho Supplementation Studies	Screw Trap operations in 9102800 study streams critical for assessing relationships between fish movement and environmental factors.
9202604	Spring Chinook Salmon Early Life History/ODFW	9102800 timing information includes fish from some Oregon streams.
8909802	Salmon Supplementation Studies in Idaho Rivers	Screw Trap operations in Secesh/Lake Creeks critical for assessing relationships between fish movement and environmental factors
9105100	Evaluation of the predictions of the run-timing of wild migrant spring/summer yearling chinook in the Snake River Basin using program Realtime.	This project uses fish tagged for project 9102800.

Section 4. Objectives, tasks and schedules

Past accomplishments

Year	Accomplishment	Met biological objectives?
1992 1993 1994 1995 1996 1997	Documented migrational timings of individual and combined populations of wild Snake River sp/sum. chinook salmon smolts at dams.	Yes.
1992 1993 1994 1995 1996	Migrational timings of these wild fish populations at traps and dams were used for real-time management of the hydropower system operations and water budget usage.	Yes

1997 1998		
1995 1996 1997	Documented environmental conditions within some streams where PIT-tagged wild parr reside.	Yes.

Objectives and tasks

Obj 1,2,3	Objective	Task a,b,c	Task
1	Gather data related to smolt migrational timings of individual and combined populations of wild sp/sum. chinook salmon.	a	Collect and PIT tag wild Snake River sp/sum. chinook salmon parr during summer each year. Download/analyze PIT tag detection info. on these fish from PSMFC database each spring and summer.
2	Gather data on environmental conditions within streams where PIT-tagged wild parr reside	b	Service and download/analyze data from environmental monitors every 4 months. Post analyzed data on Internet.
3	Provide timing information on a yearly basis and determine differences between years related to seasonal climatic and environmental conditions within the streams.	c	Analyze all collected data and provide quarterly and annual reports.
4*	Provide emigration, genetic, and survival information on salmon (primary) and steelhead (ancillary) juvenile populations from the Big Creek drainage of the Middle Fork of the Salmon River in Idaho, and relate movement info.to seasonal climatic and environmental conditions within this drainage.	d*	Install and operate a rotary screw trap in the lower portion of Big Creek at Taylor Ranch from March through November yearly to monitor salmonid emigrants. In-stream environmental monitor and weather station are in place for collecting data at this University of Idaho Wilderness Research Center.

* This objective and task have been added to the original proposal and are contingent upon Permits etc.

Objective schedules and costs

Obj #	Start date mm/yyyy	End date mm/yyyy	Measurable biological objective(s)	Milestone	FY2000 Cost %
1	06/1991	12/2005			35%
2	06/1996	12/2005			25%
3	06/1991	12/2005			25%
4	06/1999	12/2005			15%
				Total	100%

Schedule constraints
Acquisition of State of Idaho Collectors Permits and/or ESA-Permits may effect schedules.
Completion date
2005

Section 5. Budget

FY99 project budget (BPA obligated):	$457,500 ($275,000 recommended by CBFWA, carry

	forward will make up the reduction).

FY2000 budget by line item

Item	Note	% of total	FY2000 ($)
Personnel		29.7	114.3
Fringe benefits		6.2	23.7
Supplies, materials, non-expendable property		14.2	54.7
Operations & maintenance		6.7	26.0
Capital acquisitions or improvements (e.g. land, buildings, major equip.)		0.0	0.0
NEPA costs		0.0	0.0
Construction-related support		0.0	0.0
PIT tags	# of tags:15,000	11.3	43.5
Travel		5.8	22.4
Indirect costs		13.1	50.6
Subcontractor	PSMFC	13.0	50.0
Other		0.0	0.0
		TOTAL BPA REQUESTED BUDGET	385.2

Cost sharing

Organization	Item or service provided	% total project cost (incl. BPA)	Amount ($)
N/A			
		Total project cost (including BPA portion)	

Outyear costs

	FY2001	FY02	FY03	FY04
Total budget	325.0K	350.0K	350.0K	350.0K

Section 6. References

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PART II - NARRATIVE

Section 7. Abstract

The overall project goals are to: 1) characterize the migration timing of different wild stocks of Snake River spring/summer chinook salmon smolts at dams on the Snake and Columbia Rivers, 2) determine if consistent migration patterns are apparent, and 3) determine what environmental factors influence migration timing. The FWP states that a monitoring program will provide information on the migrational characteristics of various stocks of salmon and steelhead within the Columbia Basin and further urges conservation of genetic diversity, which will only be possible if wild stocks are preserved. Wild chinook salmon parr are PIT tagged in their natal streams in late summer, then subsequently monitored at downstream traps and dams the following fall, spring, and summer as they migrate downstream. Migration timing patterns of stocks and combined populations will be mapped over time and examined for relationships with various environmental and climatic conditions.

Section 8. Project description

a. Technical and/or scientific background

The Snake River drainage once produced a relatively stable and viable population of spring and summer chinook salmon. Raymond (1988) estimated that prior to 1970, combined populations of wild spring and summer chinook salmon smolts arriving annually at Ice Harbor Dam ranged from 1.3 to 2.0 million. With virtually no programs in place for their protection during dam passages, these wild populations produced adult returns ranging from 50,000 to 79,000 fish, with an average return rate of 4.4%.

However, major problems developed during the 1970s that severely impacted these wild populations during their migrations through the hydroelectric complex. In the early 1970s, three additional dams were completed on the lower Snake River. Concomitantly, gas supersaturation caused by spilling excess water during average-to-high flows was identified as a major cause of mortality affecting both adult and juvenile migrants (Ebel et al. 1975). The opposite extreme also occurred during this period. Severe droughts in the Snake River during 1973 and 1977 were associated with catastrophic losses of smolts, although the losses were probably related more to poor passage conditions at dams than to low flows. Moreover, during the latter part of the decade, mortalities and injuries associated with certain components of newly installed collection and bypass facilities at Lower Granite, Little Goose, and McNary Dams likely decreased survival.

The spawning escapement trends from 1960 through the early 1980s chronicle the rapid decline in wild population (White and Cochnauer, in press). During 1960-70, redd counts in the Middle Fork of the Salmon River index areas averaged 1,603 redds (1,026-2,180), but from 1971 to 1978, the counts dropped to an average of 683 redds (221-1,348). During the next 6 years (1979-84), counts plummeted to an average of 142 redds (38-195). A once-viable population of wild fish appeared to be nearing extinction. However, the severely reduced spawning escapements in the early 1980s produced substantial increases in spawning indices in recent years. From 1985 through 1988, redd counts in the Middle Fork of the Salmon River averaged 533 redds (350-972): a four-fold increase over the previous 6-year period. Wild stocks are clearly showing a high resiliency and potential for recovery.

To some extent, downstream movements of wild juvenile spring and summer chinook salmon from natal areas occur during most of the year except mid-winter (Edmundson et al. 1968, Durkin et al. 1970, Krcma and Raleigh 1970, Bjornn 1971, Everest and Chapman 1972, Raymond 1979, Sekulich 1980, Lindsay et al. 1986). By far the largest downstream displacements occur in fall (0 age) and spring (1+ age). The magnitude of the fall migrations vary annually by stream and are influenced by prevailing environmental conditions and cover availability (Bjornn 1971, Raymond 1979, Sekulich 1980).

The fall migrations do not include all individuals of a particular stream population and are limited to movements into larger downstream tributaries probably for overwintering purposes. The spring movements are associated with smoltification and downstream migration to the sea. Regardless of location in fresh water, all yearling chinook salmon follow this life history pattern except for small numbers of precocious males (Bjornn 1971). If flows are adequate, these migrations culminate in all fish moving into the sea.

Before 1989, data on the timing of individual populations of wild fish as they passed through the lower Snake River on their way to the sea were limited. Raymond (1979) reported on the timing of wild smolts arriving at Ice Harbor Dam from 1964 through 1969. In that study, the composite population (mostly wild) arrived at the dam in early April and was usually present until mid-June. Peak movements varied annually, occurring as early as 20 April and as late as 20 May. In addition, the timing of a few individual populations were reported for only two years, 1966 and 1967. In 1966, Raymond found the earliest arriving fish were from Eagle Creek and the Imnaha River in Oregon, with a median passage date of 16 April for both streams. The latest arriving fish were from the Grande Ronde and Wallowa Rivers in Oregon with median passage on 3 June for both streams. In 1967, the earliest arriving fish were from the Lemhi River in Idaho, with a median passage date of 21 April, while fish from a nearby stream, the East Fork of the Salmon River, arrived last, with a median passage date of 19 May. Lindsay et al. (1986) found that wild smolts from the John Day River moved past John Day Dam on the Columbia River between mid-April and early June from 1979 through 1984. However, sample rates were extremely low at the dam, averaging 0 to 6 fish annually.

A detailed review of Raymond's unpublished field notes and data reveals that his results do not provide the scope or precision that is currently required for making decisions on behalf of these fish during their smolt migrations through the hydroelectric complex. For logistical reasons, the timing of populations from individual streams or reaches received little attention. Moreover, by today's standards, the methods used were primitive. Various forms of thermal marks including hot brands, alcohol and dry ice, and liquid nitrogen were used to mark very small parr in fall. Nearly all of these marks would have been virtually unnoticeable, much less identifiable, the following spring.

Marked fish were not representative of the entire population in any particular stream, as nearly all marking was on parr caught in box traps in fall, and marking of fish not migrating at this time was limited to a few individuals in a few streams. Only fish greater than 70-mm fork length were marked. This likely would have excluded from the study nearly half of the fish sampled in all streams. In many cases, release numbers were low. In all cases, recoveries of marked fish at Ice Harbor Dam were low, usually in the range of 0-10 fish.

Before 1992, fisheries management relied on branded hatchery fish, index counts at traps and dams, and flow patterns for information to guide decisions on dam operation and when to use water set aside for fish. In 1992, a more complete approach integrated PIT-tag information on passage of several wild spring and summer chinook salmon stocks through Lower Granite Dam. We are now moving closer to some specific goals of the Columbia River Basin Fish and Wildlife Program of the Pacific Northwest Electric Power Planning Council and Conservation Act (1980). Section 304(d) of this program states that: "The monitoring program will provide information on the migrational characteristics of the various stocks of salmon and steelhead within the Columbia Basin." Further, Section 201(b) urges conservation of genetic diversity. This will only occur if wild stocks are preserved. In addition, Section 5.9A.1 of the 1994 Fish and Wildlife Program states that field monitoring of smolt movement will be used to determine the best timing for water storage releases and Section 5.8A.8 states that continued research is needed on survival of juvenile wild fish before they reach the first dam with special attention to water quantity, quality, and several other factors. Clearly, the advent of PIT-tag technology has provided the opportunity to precisely track the smolt migrations of many stocks as they pass through river traps and the hydroelectric complex on their way to the ocean.

The National Marine Fisheries Service (NMFS) began a cooperative study with the U.S. Army Corps of Engineers (COE) in 1988 to PIT tag wild spring and summer chinook salmon parr for transportation research. This project continued through mid-1991, with outmigrating smolts monitored during spring and summer 1989-91 as they passed Lower Granite, Little Goose, and McNary Dams (Matthews et al. 1990, 1992; Achord et al. 1992, 1996b). Information from this study demonstrated that timing of various wild stocks through Lower Granite Dam differed among streams and also differed from patterns for hatchery-reared fish. Generally, the outmigrations of wild spring chinook salmon were later and more protracted than for their hatchery-reared counterparts, and they also exhibited variable outmigration timing patterns over the 3 years. Conversely, the outmigrations of wild summer chinook salmon were earlier and more protracted than for their hatchery counterparts.

*The Middle Fork of the Salmon drainage is the major area for our wild fish monitoring project (9102800), with nine streams where wild chinook salmon parr are PIT tagged for monitoring. Big Creek is the largest tributary stream of the Middle Fork of the Salmon River. We PIT tag wild chinook salmon parr in upper Big Creek and lower

Big Creek/Rush Creek. The migrational timing of smolts at Lower Granite Dam from these two areas is very different. Upper Big Creek fish are one of the latest outmigrating stocks at Lower Granite Dam, while fish from lower Big Creek, 30 miles downstream, have the earliest migration of any stock of fish measured at the dam, with timing 2 to 3 weeks earlier than upper Big Creek fish (Achord et al 1995a, 1995b, and 1996a). In addition, over the years from 1992 to 1994, lower Big Creek chinook salmon parr averaged 6 to 13 mm larger than upper Big Creek parr and in the subsequent migration years from 1993 to 1995, lower Big Creek fish had detection rates 2 to 4 fold higher than that of upper Big Creek fish at Lower Granite Dam. The obvious question is--Are the chinook salmon parr that we are PIT tagging in lower Big Creek, progeny from spawners in that area or are they progeny from spawners in upper Big Creek or Monumental Creek that moved downstream as fry or young parr?

Historically, the Idaho Department of Fish and Game (IDFG) classified spawning salmon in lower Big Creek as summer chinook salmon and upper Big Creek as spring chinook salmon. This was because of later spawning in a separate area in lower Big Creek. From 1960 to 1971, an average of 126 redds (range 21-332) were observed in lower Big Creek from the mouth to Crooked Creek, while an average of 123 redds (range 32-377) were observed in upper Big Creek from Logan Creek to Jacobs Ladder Creek over the same years. From 1972 to 1988, there were only 5 years; 1977, 1980, 1982, 1985, and 1987, when redd counts were conducted in both lower and upper Big Creek. During these years, the average redd count was 15 (range 0 to 32) for lower Big Creek and 25 (range 4 to 70) for upper Big Creek. From 1989 to 1997, the average redd counts were 5 (range 2 to 10) for lower Big Creek, and 20 (range 1 to 56) for upper Big Creek (IDFG redd count database).

In recent years, the IDFG and the Nez Perce Tribe (NPT) have installed rotary screw traps in some streams of the Salmon River drainage for monitoring movements of juvenile chinook salmon and steelhead for various projects. This has provided an excellent opportunity, with the use of water quality environmental monitors, to accomplish an important goal for this study. To date, there are four screw traps in the South Fork of the Salmon River drainage and only one in the upper Middle Fork of the Salmon River in Marsh Creek.

We propose doing additional work in Big Creek to 1) characterize the migrational behavior of stocks of wild chinook salmon (primary) and steelhead (ancillary) juveniles in Big Creek and relate migrational characteristics to climatic conditions and environmental conditions in the stream, 2) estimate population abundances and survival of juveniles emigrating from Big Creek, and 3) identify genetic characteristics of populations of chinook salmon and steelhead in upper and lower Big Creek. We propose installing and operating a rotary screw trap in lower Big Creek at Taylor Ranch Wilderness Research Facility. This facility is owned and operated by the University of Idaho (UofI). Caretakers Jim and Holly Akenson and Jim Peek of UofI Wilderness Research Center express a high level of support for this research. The ranch is located in lower Big Creek below where most of the historical chinook salmon spawning occurred. Caretakers live at the ranch year-round, lodging is available, and there is year-round access (by air). The ranch has power, phone, and email, along with an on-site weather station that makes it an ideal location to do such a study.

Field work would be from March 1 to November 30, yearly. The screw trap would be operated most of the time during this time period. An environmental monitor was installed in November, 1998. Summer collection and PIT tagging would occur as usual with some additional tagging in Monumental Creek and at the trap. The Wilderness Research Center at the UofI is highly supportive of this type of fisheries monitoring at the ranch. This is a wonderful opportunity to do some important research on these populations of listed chinook and steelhead in a large stream system that lies almost wholly within a pristine wilderness.

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*This section addresses additional work proposed for project 9102800.

b. Rationale and significance to Regional Programs

Before 1992, fisheries management relied on branded hatchery fish, index counts at traps and dams, and flow patterns for information to guide decisions on dam operations and when to use water set aside for fish. Since 1992, a more complete approach integrated PIT-tag information on passage of several wild spring/summer chinook salmon stocks, from project 9102800, through Lower Granite Dam. Clearly, project 9102800 has directly addressed stated goals of the Columbia River Basin Fish and Wildlife Program of the Pacific Northwest Electric Power Planning Council and Conservation Act (1980). Section 304(d) of this program states that: "The monitoring program will provide information on the migrational characteristics of the various stocks of salmon and steelhead within the Columbia Basin." Further, Section 201(b) urges conservation of genetic diversity. This will only occur if wild stocks are preserved. In addition, Section 5.9A.1 of the 1994 Fish and Wildlife Program states that field monitoring of smolt movement will be used to determine the best timing for water storage releases and Section 5.8A.8 states that continued research is needed on survival of juvenile wild fish before they reach the first dam with special attention to water quantity, quality, and several other factors. Thus, this project mitigates (reduces) losses in place, in kind, by supplying information on wild stock migrations in real-time, to best determine timing of water storage releases to benefit survival of these wild stocks. In addition, the expanded project proposal to include a more intense study of the Big Creek drainage in Idaho, as presented in the above Section 8a*, directly addresses 5.8A.8 (as stated above) of the 1994 FWP.

We see project 9102800 as complementing and fitting well with the other associated studies on wild fish in this Subbasin. This project provides the most accurate timing information for each stock at Lower Granite Dam, since timing is based on summer-tagged parr collected from their natal rearing areas. Other BPA projects by IDFG, NPT, Shoshone-Bannock Tribe (SBT), and ODFW rely on traps to monitor wild fish movements (and magnitudes) out of rearing areas in some 9102800 study streams. Our environmental monitors located near some of these traps make possible reciprocal exchange of important information to further narrow the gaps in knowledge in this system.

c. Relationships to other projects

Idaho Department of Fish and Game (IDFG) project 8909800, uses timing information from several wild stocks for background information on continued supplementation studies. This and several other existing BPA projects by IDFG(8909800, 9107300), NPT(8712700, 8909802), and SBT(8909803) monitor wild fish movements in Lake Creek, Secesh River, South Fork Salmon River, Marsh Creek, Imnaha River in northeast Oregon, and the upper Salmon River by fish traps. Many of these streams are project 9102800 study streams and we work closely with each agency on summer tagging schedule coordination, data exchange, and environmental monitoring in conjunction with several traps. Together we hope to be able to map detailed movements of these wild fish from parr-to-smolt in several different streams and possibly relate environmental conditions within the streams where the wild parr reside to subsequent movements and survival of these fish to the first dam. With recent additions of some tributary (and river) traps that enable multiple detection probabilities for summer-tagged parr prior to arrival at Lower Granite Dam the following spring, we can now expand the current “Survival Study”, Project 9302900 (NMFS), to include survival estimations for some stocks prior to arrival at the dam. As this project expands in this area, the new PIT tag flat-plate detector technology will be utilized, by placing these monitors in small streams to monitor fish movement.

With agreement from ODFW(Project 8712700), we continue to include and report timing of wild spring/summer chinook salmon from some northeast Oregon streams (where NMFS PIT tagged fish in the past) at Lower Granite Dam. Environmental monitoring may be established in some of these streams in the future.

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

The present study began with the 1992 migration of wild chinook salmon smolts (Achord et al. 1994). Warm weather and high water temperatures in late winter and spring appeared to elicit an early migration timing for all wild smolts in 1992. The migration timing of wild spring chinook salmon smolts was earlier in 1992 than in the previous 3 years. Also, most wild summer chinook salmon smolts migrated earlier than wild spring chinook salmon smolts. However, as was observed during previous years, all wild stocks exhibited protracted and variable migration timing at Lower Granite Dam.

In 1993, cold weather and low water temperatures from late winter to early summer appeared to elicit a late migration timing; however, high flows during the third week of May moved a large portion of wild spring/summer chinook salmon through the dams (Achord et al. 1995a). As observed in previous years, wild stocks exhibited variable migration timing at Lower Granite Dam; however, the middle 80% passage time of wild fish stocks at the dam was more compressed in 1993 than in earlier years.

In 1994, migration timing of wild spring/summer chinook salmon smolts at Lower Granite Dam was similar to timing in 1990 and 1992, with peak passage in all 3 years occurring in April; however, peak detections of fish from individual streams in 1994 occurred from late April to late May (Achord et al. 1995b). As observed in 1990 and 1992, 1994 was also warm during late winter and spring.

Before 1995, we observed a 2-week shift in timing of wild fish at Lower Granite Dam between relatively warm and relatively cold years. In the cold years of 1989, 1991, and 1993, 50% of all wild fish passed the dam by mid-May, while 90% passed by mid-June (except in 1993, when high flows moved 90% through the dam by the end of May). In the warm years of 1990, 1992, and 1994, 50% of all wild fish passed this dam from 29 April to 4 May, and 90% passed by the end of May. In 1995, we experienced intermediate weather conditions in late winter and early spring (compared to the previous 6 years) and observed intermediate passage timing at the dam, with 50 and

90% passage occurring on 9 May and 5 June, respectively (Achord et al. 1996a). Sustained high flows from mid-May to early June in that year moved the later half of the wild fish migration through the dam at a more uniform rate than in previous years, and over 90% passed by the time peak flows occurred at the dam on 6 June.

In 1996 and 1997, as observed in all previous migration years from 1989 to 1995, peak detections of wild spring/summer chinook salmon smolts at Lower Granite Dam were highly variable and generally independent of river flows before about 9 May; however, in all years, peak detections of wild fish coincided with peak flows at the dam from 9 May to the end of May. In 1995 and 1996, well over 90% of the wild fish had migrated passed Lower Granite Dam by the time peak flows occurred in June. In 1997, close to 90% of the wild fish had passed Lower Granite Dam by the time flows peaked in the third week of May. In 1989, we observed a period of peak detections of wild fish that coincided with peak flows at the dam in June (Achord et al. 1996b). These data suggests that water reserved for fish during the out-migration may benefit more wild spring/summer chinook salmon smolts if it is initiated around 9 May in most years and may be especially important in drought years.

In 1996, 50 and 90% passage dates of PIT-tagged fish from wild stocks combined (Idaho and Oregon streams) at Lower Granite Dam occurred on 3 and 22 May, respectively. However, unlike previous years, few wild fish were marked as parr in 1995 from Idaho streams; therefore, the 1996 detections at Lower Granite Dam were composed of 91% fish from Oregon streams. Therefore, we caution against comparing migration timing in 1996 to previous years, since in all previous years less than 50% of wild fish detections were from Oregon streams.

In 1997, 50 and 90% passage dates of PIT-tagged fish from wild stocks combined (Idaho and Oregon streams) at Lower Granite Dam occurred on 24 April and 21 May, respectively. However, 1997 detections at Lower Granite Dam were composed of 73.5% fish from Oregon streams. Therefore again, we caution against comparing migration timing in 1996 and 1997 to previous years, for the aforementioned reason.

In addition to the important information gained in this study that supplies managers with in-season information for management decisions related to flow augmentations, dam operations including spill, and transportation; it appears that overall annual climatic variation is emerging as an important factor controlling the overall migrational timing of wild spring/summer chinook salmon smolts at Lower Granite Dam. Environmental monitoring in streams and climate monitoring is continuing and relationships to parr and smolt movement will be developed in the future.

Project 9102800 started June 1, 1991 and continues to present (11/98); $1,388,200 (estimated) has been spent over the years and has produced 6 annual and numerous progress reports.

More detailed information and results from this project can be found in the following list of reports and publication:

Reports:

Annual Report 1992 DOE/BP-18800-1 September 1994
Annual Report 1993 DOE/BP-18800-2 January 1995
Annual Report 1994 DOE/BP-18800-3 September 1995
Annual Report 1995 DOE/BP-18800-4 September, 1996
Annual Report 1996 DOE/BP-18800-5 July, 1997
Annual Report 1997 DOE/BP-18800-6 May, 1998 (available on Internet)

Publication:

Achord, S, G. M. Matthews, O. W. Johnson, and D. M. Marsh. 1996. Use of passive integrated transponder (PIT) tags to monitor migration timing of Snake River chinook salmon smolts. N. Amer. J. Fish. Manage. 16:302-313, 1996.

e. Proposal objectives

Overall Study Objective: Characterize the outmigration timing of wild Snake River spring/summer chinook salmon smolts at Lower Granite Dam over a period of years.

For objectives 1-3 from Section 4:

1) Null Hypothesis (Ho): Run-time distributions at Lower Granite Dam are not significantly different within years among wild smolt populations in the Snake River drainage.
Corollary: If null hypothesis is rejected, it is highly likely that run-timing to Lower Granite dam is different among wild populations within years in the Snake River and that these differences may be influenced by several environmental factors and/or genetics.

Criteria for rejecting Ho: The null hypothesis will be rejected if run-timing is significantly different among populations by re-sampling methods. Significance will be set at ($P<0.05$).
2) Null Hypothesis (Ho): Run-time distributions for fish from individual streams or tributaries at Lower Granite Dam are not significantly different among years.
Corollary: If the null hypothesis is rejected, it is highly likely that run-timing of fish from individual streams or tributaries is different among years and that these differences may be influenced by other factors such as temperature or flow.
Criteria for rejecting Ho: The null hypothesis will be rejected if run-timing of fish from individual streams is different among years by re-sampling methods. Significance will be set at ($p<0.05$).

After at least 5 years of data, we will analyze arrival timing distributions at Lower Granite Dam for fish from individual streams as well as combined streams between years. We will also continue to analyze arrival timing distributions for fish from individual streams within years. One method used for statistically comparing these distributions is the Student-Newmann-Keuls multiple comparison method. If timing differences are found, we will attempt to relate environmental conditions within the streams, as well as annual climatic conditions to observed timing differences.

For objective 4 in Section 4:

Analyses of arrival timing distributions at Lower Granite Dam would also be performed for fish from within the Big Creek drainage. Screw trapping efficiencies and survival to the first dam may be determined using the single-release, multiple recapture (detection) model. Other analyses may be deemed necessary for population estimates, etc.

f. Methods

SCOPE:

In 2000, as in previous years, we plan to continue monitoring the timing of the migrations of wild Snake River spring/summer chinook salmon smolts from individual and combined streams through traps and dams. We will also continue to monitor environmental conditions within natal streams along with recording weather data in the same areas. Timing of these fish through traps and dams will be examined for relationships to various environmental conditions within the streams and weather data.

For objectives 1-3 in Section 4:
APPROACH:

Chinook salmon parr will be collected in 17 streams of the Salmon River drainage of Idaho in July and August of each year using backpack electrofishers and seines. All special precautions will be used during electrofishing and all personnel are highly trained. Wild spring/summer chinook salmon are used in this study. The minimum number of wild fish PIT-tagged per stream is about 1,000, the maximum about 3,000. This produces about 30-300 smolts detected at Lower Granite Dam for timing purposes.

METHODOLOGY:

Portable PIT-tagging stations are used for tagging fish and are designed specifically for use beside streams in the field. Station components, setup, and PIT-tagging techniques have been described by Prentice et al. 1990a and 1990b. Fish are dipped from live cages with sanctuary dip nets and poured into plastic pans containing anesthetic; after anesthetization, chinook salmon parr greater than 54 mm in fork length are PIT tagged. Fish are allowed to recover after tagging for a minimum of 0.5 hours before release into the stream at the same location where they were collected. About 10% are held in live cages for 24-h for delayed mortality and tag loss information. All collection and tagging activities are terminated if the stream water temperature reaches 16 degrees C. More detailed information on methodology can be found in Achord et al. 1994, 1995a. Surviving PIT-tagged wild chinook salmon smolts are subsequently detected at downstream dams the following spring and summer.

The following statistical analyses have been used in annual reports:
1) length distributions (at tagging) vs. length distributions for detected fish (at tagging)--Chi-square, 2) mean length at tagging vs. length of detected fish (at tagging), overall and during segments of the outmigration--one and two-sample Z-tests, 3) diel timing at dam fish facilities--Chi-square, 4) comparison of detection rates at dams for fish PIT tagged and released under different water temperature scenarios--two-sample Z-tests, and 5) comparison of

arrival timing distributions for fish from individual streams at Lower Granite Dam--Student-Newmann-Keuls multiple comparison method.

For objective 4 in Section 4:

Install and operate a rotary screw trap in lower Big Creek at Taylor Ranch from about March 1 to November 30, yearly. The trap would be checked daily or more often. Fish would be anesthetized, sorted, enumerated by species, and scanned for PIT tags. A predetermined number of salmon and steelhead juveniles would receive a PIT tag for monitoring downstream, as to the proportion of out-migration. Total chinook salmon and steelhead PIT tagged yearly at this trap would range from 300 to 750, for each specie. Project 9102800 would work closely with project 8909600, another NMFS project that monitors and evaluates the genetic program for salmon and steelhead, to identify genetic characteristics of salmon and steelhead in this drainage. The goals of this objective (4) would be: 1) to characterize the migrational behavior of stocks of wild chinook salmon and steelhead juveniles in Big Creek and relate (or not) migrational characteristics to annual climatic conditions and environmental condition in the stream, 2) to estimate population abundances and survival of juveniles emigrating from Big Creek, and 3) to identify genetic characteristics of populations of chinook salmon and steelhead in upper and lower Big Creek.

The following statistical analyses would be used in the evaluation of objective 4: 1) comparison of arrival timings within this drainage at Lower Granite Dam--Student-Newmann-Keuls multiple comparison method, 2) mark-recapture method for determining trapping efficiencies under different flow and temperature regimes (may also use, or compare with using, summer-tagged parr and subsequent detections and the trap and Lower Granite Dam to determine trapping efficiencies), 3) single-release, multiple recapture (detection) model to determine survival to Lower Granite Dam, and 4) other analyses as deemed necessary.

Continued collection of detection information on these wild fish will continue as long as the State of Idaho continues issuance of the yearly Collectors Permit, PIT-tag monitor systems continue at the dams, and adequate numbers of parr can be PIT-tagged each year.

This project is directly related to the overall Smolt Monitoring Program as well as numerous BPA projects conducted by IDFG, ODFW, NPT, SBT, PSMFC, and other NMFS projects. Virtually, every project that relies on PIT-tag monitoring of juvenile salmonids at dams and traps are somehow related.

g. Facilities and equipment

No special facilities are needed for this project. Existing equipment used on the project include field vehicles, electrofishers, seines, generators, tagging stations (including all electronic components), live cages, and other misc. gear.

h. Budget

We propose to describe the migrational characteristics of wild Snake River spring/summer chinook salmon smolts. The study requires PIT tagging of parr from a variety of wild streams located throughout remote regions in the Salmon River in Idaho during summer. Capturing and tagging large numbers of parr in their native habitats is labor-intensive and time-consuming and requires considerable field travel for personnel. A study that is this field and equipment intensive will require the amount requested to accomplish the proposed objectives. The budget is our best estimate of the costs to complete this study; actual amounts will depend on several factors, most notably the abundance of salmon parr in any given year.

Section 9. Key personnel

Gene Matthews, Project Manager, 0.1 FTE on project per year

Project Duties: yearly project updates for contract renewal, Progress and Annual Report Editor.

Work Experience

1987-present: Supervisory Fisheries Research Biologist, GM-13. National Marine Fisheries Service. Responsible for managing the Columbia and Snake River collection and transportation research project.

1973-1986: Fisheries Research Biologist, GS-5, 7, 9, 11, 12. Involved in the design and conduct of many mark/recapture studies at dams on the Columbia and Snake Rivers. Designed and conducted many studies/experiments related to disease and stress. All work conducted for National Marine Fisheries Service.

Education:
1966-1970: Washington State University, B.S. 1970.
Publications/reports
Authored or co-authored 14 publications in professional journals; authored or co-authored numerous research proposals and roughly 30 processed research reports or issue papers.
Publications (5):
Matthews, G. M. 1979. Exposure of fingerling spring chinook salmon to mixtures of Furanace-10, Quinaldine, and MS-222. The Prog. Fish. Cult., 41(2):85-86.

Matthews, G. M., N. N. Paasch, S. Achord, K. W. McIntyre, and J. R. Harmon. 1997. A technique to minimize the adverse effects associated with handling and marking salmonid smolts. Prog. Fis. Cult. 59(4):307-309.

Matthews, G. M., D. L. Park, S. Achord, and T. E. Ruehle. 1986. Static seawater challenge test to measure relative stress levels in spring chinook salmon smolts. Trans. Am. Fish. Soc. 115(2):236-244

Matthews, G. M., G. A. Swan, and J. R. Smith. 1977. Improved bypass and collection system for protection of juvenile salmon and steelhead trout at Lower Granite Dam. Mar. Fish. Rev. 39(7):10-14.

Matthews, G. M., and R. S. Waples. 1991. Status review for Snake River spring and summer chinook salmon. U. S. Dep. Commer., NOAA Tech. Memo. NMFS F/NWC-200, 75 p.

Stephen Achord, Principle Investigator, full-time on project (1.0 FTE)
Project Duties: field work, data collection and analysis, State and ESA Reports, BPA Progress and Annual Reports.

Work Experience
1976-present: Fisheries Research Biologist, GS-5,7,9,11,12. National Marine Fisheries Service. Involved in the conduct or supervision of many mark/recapture studies at dams on the Columbia and Snake Rivers. Highly experienced in all types of fish tagging methodologies including coded-wire-tagging, freeze branding, fin clipping, and PIT-tagging.

1970-1976: Biological Aide. Idaho Department of Fish and Game. Conducted creel censuses, spawning ground surveys, and sampled fish in lakes and streams.

Education
1968-1971: Boise State University.

1971-1973: University of Idaho, B.S. 1973.

Publications/reports
Authored or co-authored 5 publications in professional journals; authored or co-authored 19 processed research reports.

Publications:
Achord, S., G. M. Matthews, O. W. Johnson, and D. M. Marsh. 1996. Use of passive integrated transponder (PIT) tags to monitor migration timing of Snake River chinook salmon smolts. N. Am. J. Fish. Manag. 16:302-313.

Achord, S., J. R. Smith, and G. M. Matthews. 1984. Experimental tanker used to study transportation of juvenile salmonids. Prog. Fish. Cult. 46(3):206-208.

Matthews, G. M., N. N. Paasch, S. Achord, K. W. McIntyre, and J. R. Harmon. 1997. A technique to minimize the adverse effects associated with handling and marking salmonid smolts. Prog. Fis. Cult. 59(4):307-309.

Matthews, G. M., D. L. Park, S. Achord, and T. E. Ruehle. 1986.
Static seawater challenge test to measure relative stress levels in spring chinook salmon smolts. Trans. of Amer. Fish. Society. 115(2):236-244.

Pascho, R. J., D. G. Elliott, and S. Achord. 1993. Monitoring of the in-river migration of smolts from two groups of spring chinook salmon, Oncorhynchus tshawytscha, (Walbaum), with different profiles of Renibacterium salmoninarum infection. Aqua. and Fish. Mgmt. 24, pp 163- 169.

M. Brad Eppard, Co-investigator, 0.5 FTE on project per year
Project Duties: field work, environmental monitoring database maintenance, assists in report preparation.

Work Experience

1996 - present: Research Fisheries Biologist, GS-9, National Marine Fisheries Service. Project Leader for a spill efficiency study at Ice Harbor Dam using radio telemetry. Assist other project leaders in collecting and tagging juvenile salmonids, data collection and analysis, and preparing scientific reports and presentations.

1995 - 1996: Research Fisheries Biologist, Pacific States Marine Fisheries Commission. Assist project leaders of the National Marine Fisheries Service in collecting and tagging juvenile salmonids, data collection and analysis, and preparing scientific reports and presentations.

1993 - 1995: Research Fisheries Biologist, GS-5, National Marine Fisheries Service. Assist project leaders in collecting and tagging juvenile salmonids, data collection and analysis, and preparing scientific reports and presentations.

Education

1986 - 1992: Central Washington University, B. S. Biology, 1992

Publications

Co-authored 13 contract reports of research and 3 research proposals.

ERIC E. HOCKERSMITH, Co-investigator, 0.5 FTE on project per year
Project Duties: field work, assists in report preparation.

Work Experience

1994-present: Research Fisheries Biologist, GS-11. National Marine Fisheries Service. Conduct research which includes juvenile salmonid survival studies, radio telemetry research, and environmental monitoring. Responsibilities include project design, project operations, analyzing data, and preparing scientific reports and presentations..

1991-1994: Research Fisheries Biologist, GS-9. National Marine Fisheries Service. Assistant project leader for adult salmonid radio telemetry studies within the Yakima River Basin. Responsibilities included conducting research, analyzing data, and preparing scientific reports and presentations.

1990: Fisheries Biologist, GS-7. US Forest Service. Conducted watershed and stream surveys within the Mount Hood National Forest.

1989: Fisheries Biologist, GS-7. National Marine Fisheries Service. Conducted research on juvenile salmonid smolt migrations and rearing habitat utilization within the Taku River Basin in S.E. Alaska and Canada.

1988: Fisheries Biologist, GS-5. US Bureau of Land Management. Conducted watershed and stream surveys for the Prineville Resource Office.

1983-1986: Fisheries Biologist. Normandeau Associates, RMC Environmental Services Division. Conducted fisheries life history studies in association with the FERC relicensing requirements for Conowingo Hydroelectric Project in Pennsylvania and Maryland .

Education

1978-82: University of New Hampshire, B.S. 1982.

Publications/reports

Authored 1 publication in a professional journal; authored or co-authored numerous research proposals and 13 processed research reports.
Publications:
Hockersmith, E. E., and B. W. Peterson. 1997. Use of the global positioning system for locating radio-tagged fish from aircraft. N. Am. J. Fish. Mgt.17:457-460.

Other field personnel: Biological Technicians and Fishery Biologists, 2.2 FTE per year on project.
Duties: Fish collection, PIT tagging, and trap operation.

Section 10. Information/technology transfer

Information transfer will be (and is) through annual and progress reports to BPA, publications in scientific journals, and articles in newspapers and magazines including the National Geographic Magazine--July 1990. In addition, information transfer has been through oral presentations at AFS meetings, COE annual reviews of research, BPA reviews of research, and PSMFC workshops.

Congratulations!