IDAHO NATURAL PRODUCTION MONITORING AND EVALUATION 83-7(ESA) 9107300

SHORT DESCRIPTION:
Evaluate and monitor chinook salmon and steelhead trout smolt production from 6-8 important indicator streams in Idaho. Developed models to estimate the number of wild/natural chinook salmon and steelhead trout smolts that will arrive at Lower Granite Dam the following spring. Compile and compare smolt/female production and SAR's from indicator streams within the Columbia River Basin. Estimate current Snake River Basin SAR's, and SAR's necessary for recover of wild/natural chinook salmon and steelhead trout. Measure productivity responses to changes in migration corridor recovery efforts.

SPONSOR/CONTRACTOR: IDFG
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SUB-CONTRACTORS:
N/A

GOALS

GENERAL:
Supports a healthy Columbia basin, Adaptive management (research or M&E)

ANADROMOUS FISH:
Hydro ops, mainstem passage, construction, Research, M&E

NPPC PROGRAM MEASURE:
7.3B.1; 4.3C.1; 5.9A.1; 7.1C.3

TARGET STOCK	LIFE STAGE	MGMT CODE (see below)
Fish Creek/ steelhead	Fry, parr, pre-smolts, smolts, adults	(P), N
Selway River/ spring chinook, steelhead	Fry, parr, pre-smolts, smolts, adults	(P), N
Rapid River/ summer chinook, steelhead	Fry, parr, pre-smolts, smolts, adults	(L), (P), N
Chamberlain Creek/ spring chinook, steelhead	Parr, adults	(L), (P), N
Crooked River/ spring chinook, steelhead	Fry, parr, pre-smolts, smolts, adults	(P), S, W
Upper Salmon River/ spring chinook, steelhead	Fry, parr, pre-smolts, smolts, adults	(L), (P), S, W
Middle Fork Salmon River/ s/s chinook salmon, steelhead trout	Fry, parr, pre-smolts, smolts, adults	(L), (P), S
Snake River/chinook, steelhead	Smolts, adults	(L), (P), N, S, W

AFFECTED STOCK	BENEFIT OR DETRIMENT
Crooked River/ Bull Trout, Cutthroat Trout	Beneficial
Upper Salmon River/ Bull Trout, Cutthroat Trout	Beneficial
Rapid River/ Bull Trout	Beneficial

BACKGROUND

Subbasin:
Snake River above Lower Granite Dam

Hydro project mitigated:
N/A not a wildlife project

Habitat types:
N/A Not a wildlife project.

HISTORY:

In 1984, Idaho Department of Fish and Game undertook a comprehensive evaluation and monitoring project for Snake River anadromous fish. This project to date has reported the following conclusionss.

1.•What proportion of sand or finer materials in spawning areas results in reduced egg-to-parr survivals.

2.•Arrival timing at Lower Granite Dam of wild/natural chinook salmon smolts occurs over a much longer time frame than the more numerous hatchery chinook salmon smolts.

3. Survival of wild/natural chinook salmon parr PIT tagged in August and returned to their natural rearing habitat is not significantly different than their un-handled cohorts in the same habitat over a two-month period.

4. Anglers can have a significant impact on wild/natural steelhead trout smolt production in streams with high angler use, no gear restrictions, and a six fish limit.

5. Once a chinook salmon or steelhead trout parr has been successfully PIT tagged, there is no significant difference in survival to smolts reaching Lower Granite Reservoir.

6. In streams degraded by dredge mining, connecting off-channel ponds to the stream can increase the carrying capacity for chinook salmon parr and complex instream structures can increse the carrying capacity for steelhead trout parr.

BIOLOGICAL RESULTS ACHIEVED:

Project efforts have resulted in the production of an additional 15,000 spring chinook salmon and 6,000 summer steelhead trout naturally produced smolts. Project results have directed habitat rehabilitation projects in streams degraded by dredge mining towards connecting off-channel ponds over instream structures. Determined that holding hatchery chinook salmon adults until close to ripening and then releasing them to vacant high quality spawning areas is more successful at supplementing natural production than just passing the adults above a trapping weir as they come in.

PROJECT REPORTS AND PAPERS:

Annual project reports have been completed 1984-1993. Emigration characteristics of spring chinook from Crooked River and Upper Salmon River, Idaho. American Fisheries Society Chinook Salmon Smolt Migration Symposium, Moscow, Idaho. February 26 to 28, 1992.

ADAPTIVE MANAGEMENT IMPLICATIONS:

Project has estimated what proportion of sand or finer materials in spawning gravels results in reduced egg-parr survival.

Project found that most hatchery adult chinook salmon released above Sawtooth Hatchery to supplement natural production were spawning in areas where egg-to-parr survival was half that of the areas where wild adults were spawning. This project has outplanted 341 (155 female) hatchery adult chinook salmon to vacate high quality spawning areas in the Upper Salmon River that resulted in approximately 15,000 more naturally produced smolts.•

Arrival timing at Lower Granite Dam of PIT tagged wild/natural chinook salmon and sockeye salmon smolts from this project has helped managers decide to extend the period for smolt passage improvement measures in the Lower Snake River hydroelectric system.

Outplants of hatchery adult steelhead trout in Crooked River to estimate carrying capacity have resulted in an estimated 6,000 naturally produced smolts.

Showed that naturally produced chinook salmon smolt production can be increased by outplanting hatchery adults directly into vacant spawning habitat close to spawning time, instead of just releasing them above the trapping weir when captured.

Showed that complex and boulder instream structures can increase steelhead trout juvenile carrying capacity, and that connecting off-channel ponds can increase chinook salmon juvenile carrying capacity.

Beginning in fall 1995 project has and will continue to estimate the number of chinook salmon and steelhead trout smolts that can be expected to arrive at Lower Granite Dam the following spring.

Project will estimate smolt-to-adult survival rates necessary to recover wild/natural Snake River chinook salmon and steelhead trout populations.

Project is evolving into part of a system wide monitoring and evaluation program that will be able to measure the effectiveness os Snake River recovery efforts.

Project will estimate the number of wild/natural adults and hatchery adults that will return to particular drainages for broodstock and weir management decisions.

As populations recover, this project is designed to estimate the number of spawners necessary to fully seed rearing habitat.

Project will be capable of measuring responses in productivity of wild/natural s/s chinook and steelhead to changes in migration corridor recovery efforts.

PURPOSE AND METHODS

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SPECIFIC MEASUREABLE OBJECTIVES:

1. Accurately estimate wild/natural smolt production for chinook salmon and steelhead trout from indicator streams and the entire Snake River Basin.
2. Estimates of smolt-to-adult survival rates necessary to recover wild/natural Snake River s/s chinook salmon and steelhead trout stocks.
3. Determine current smolt-to-adult survival rate for wild/natural s/s chinook salmon and steelhead trout on a Snake River Basin wide scale.
4. Estimate wild/natural and hatchery adult returns to indicator drainages.
5. As population recovers, determine number of spawners necessary to fully seed available rearing habitat.
6. Compile and compare wild/natural s/s chinook salmon and summer steelhead trout rearing stream productivity in the Columbia River Basin.

CRITICAL UNCERTAINTIES:

1. Will more effective juvenile migration survival measures be implemented in the next 2 to 5 years?
2. Will the genetic integrity of these highly evolved upriver stocks be sustained until migrant survival can be improved?

BIOLOGICAL NEED:

1. Clearly identify responses of important indicator naturally reproducing stocks in Idaho to Fish and Wildlife Program recovery measures.
2. Identify limiting factors to recovery of naturally reproducing stocks in the Snake River Basin.
3. Provide an accurate estimate of the numbers of naturally produced smolts that can be expected to arrive at Lower Granite Dam the following spring.
4. Provide accurate return estimates for both naturally produced and hatchery adults to those drainages where both production occurs.
5. Accurately estimate the smolt-to-adult return rates necessary for recovery of Snake River naturally reproducing stocks to occur, and how close current efforts are to meeting these rates.

HYPOTHESIS TO BE TESTED:

1. Ho: Rearing stream parr abundance cannot be predicted from adult escapement numbers and environmental factors (water temperature and flow). Corollary: Rejection of the null hypothesis will allow us to use adult escapement levels and environmental factors to indicate abundance of subsequent parr populations, or parr population and environmental factors to indicate adult escapement to a rearing stream.
2. Ho: Rearing stream smolt production to Snake and Clearwater rivers confluence cannot be predicted from parr abundance and environmental factors. Corollary: Rejection of the null hypothesis will allow us to use parr abundance to estimate smolt production from rearing streams.
3. Ho: Snake River wild/natural smolt production cannot be predicted from adult escapement numbers and egg-to-parr survival estimates from study streams. Corollary: Rejection of the null hypothesis will allow us to use adult escapement numbers and egg-to-parr survival estimates from indicator streams to estimate Snake River Basin wild/natural smolt production.
4. Ho: Adult returns to study streams and hatcheries cannot be predicted from smolt production estimates and Snake River Basin-wide PIT tag smolt-to-adult return rates. Corollary: Rejection of the null hypotheses will allow us to use smolt production estimates and Snake River Basin-wide PIT tag smolt-to-adult return rates to predict adult returns to wild/natural indicator streams and hatcheries.

ALTERNATIVE APPROACHES:

N/A The objective of this project is to monitor and evaluate; wild/natural s/s chinook and steelhead producion from indicator streams within and the entire Snake River Basin, the effectivness of current recovery efforts, and the effectivness of future recovery efforts.

JUSTIFICATION FOR PLANNING:

N/A The focus is not primarily on planning, assessment, or coordination.

METHODS:

1.
A. Study streams:
Adult escapement will be estimated using adult trapping weirs and/or redd counts. Snorkel counts will be used to estimate parr abundance and egg-to-parr survival. Summer parr will be PIT tagged and subsequent detections will be used to estimate parr-to-smolt survival and smolt production. Juvenile outmigrant traps and PIT tags will be used to determine emigration characteristics and to provide a more accurate estimate of smolt production when we are able to operate the traps throughout the emigration seasons.

B. Basin-Wide
Use adult escapement estimates at Lower Granite Dam, Snake River Basin hatchery records, and harvest records to estimate adults available for natural reproduction in the basin. Use egg-to-parr survival estimates from study streams as an adjusting variable in model. Use model to estimate the number of naturally produced smolts/female that will arrive at Lower Granite Dam the following spring.

2. Methods described in Hankin and Reeves 1988, will be used to estimate parr abundance in study streams and calculate egg-to-parr survival. The Snake River Basin smolt production model will be evaluated and adjusted annually. The goal is for the predicted smolt production estimate to be within 33% of the actual production for naturally produced chinook salmon and 50% for naturally produced steelhead trout.

3. The majority of fish handled will be juveniles (parr, pre-smolts, and smolts)., in a few study streams adults will be handled to remove from traps, measure, and release upstream. Juveniles will be captured, anesthetized, PIT-tagged, and released with proven methodologies that have resulted in less than 5% mortalities in all years of the project history. Up to 10,000 juveniles could be marked in a year with good production. We will not tag at all in a given stream if we do not believe we can capture a representative sample.

PLANNED ACTIVITIES

SCHEDULE:

Planning Phase **Start** 7/97 **End** 7/98 **Subcontractor** None

Task Project developed to evaluate habitat rehabilitation project and to monitor parr densities in key production streams Project modified to the estimation of carrying capacity, optimal smolt production, and adult escapement necessary to fully seed rearing habitat. Project modified to include estimation of smolt production, smolts/female, SAR's necessary for recovery, and current SAR's for the entire Snake River Basin above Lower Granite Dam. Coordinate the collection, compilation, and reporting of compatible production data from production streams throughout the Columbia River Basin. Add weir and rotary screw trap to South Fork Salmon River tributary suitable for monitoring productivity of wild/natural steelhead.

Implementation Phase **Start** 7/84 **End** ongoing **Subcontractor** none

Task Continue general Parr monitoring program in priority one monitoring locations. Assess annual adult escapement and juvenile production in 7 to 9 key production streams in Idaho. PIT tag representative groups of juveniles from key production streams annually. Update and apply models annually to estimate adults available for natural reproduction, smolts produced, smolts/female, and SAR's for the Snake River Drainage above Lower Ganite Dam.

CONSTRAINTS OR FACTORS THAT MAY CAUSE SCHEDULE OR BUDGET CHANGES:
Without improvements in smolt-to-adult survival, stock productivity will remain low and the monitoring system this project is becoming part of would not yield intended results.Extreme runoff conditions could jeopardize adult weirs and juvenile traps and the production data for that year class.

OUTCOMES, MONITORING AND EVALUATION

SUMMARY OF EXPECTED OUTCOMES

Expected performance of target population or quality change in land area affected:
1. Project will be able to define the effect and adequacy of program measures and management changes on the productivity of naturally reproducing stocks in the Snake River Basin

2. Project will develop predictive models that will estimate natural smolt production basin-wide, adult returns, and smolt-to-adult return rates necessary for recovery of naturally reproducing stocks to occur.

Present utilization and convservation potential of target population or area:
Wild/natural s/s chinook salmon and steelhead trout in the Snake River Basin are at historic low population levels with cohort collapse occurring in several stocks in brood years 95 and/or 96. With improvements in mainstem migration survival these populations still have the potential to recovery to healthy fishable numbers.

Assumed historic status of utilization and conservation potential:
These stocks provided fisheries into the 1970's. The USFS Intermountain Research Station has recently estimated that 70% of the wild/natural s/s chinook salmon production potential left in the Columbia Basin is in the Snake River Drainage above Lower Granite Dam.

Long term expected utilization and conservation potential for target population or habitat:
To recover these stocks to healthy populations that support fisheries and supply wild/natural genetics to maintain the productivity of hatchery stocks.

Contribution toward long-term goal:
Project will be able to define the effect and adequacy of recovery measures nad management on the productivity of naturally reproducing s/s chinook salmon and steelhead trout stocks in the Snake River Basin.Project is developing predictive models that will estimate natural smolt production basin-wide, adult returns, and SAR's necessary to recovery Snake River wild/natural s/s chinook and steelhead.

Indirect biological or environmental changes:
N/A None that we can identify.

Physical products:
The project study design calls for PIT tagging up to 15,000 juveniles in years with adequate juvenile production. The project installs and operates four adult trapping weirs and five juvenile outmigrant traps.

Environmental attributes affected by the project:
N/A The project does not affect environmental attributes.

Changes assumed or expected for affected environmental attributes:
N/A The project does not affect environmental attributes.

Measure of attribute changes:
N/A The project evaluates habitat projects, not implements them.

Assessment of effects on project outcomes of critical uncertainty:
If mainstem survival does not occur soon the populations being studied will become extinct and the project will not be necessary. Extreme runoff conditions could cost the loss of critical project data for a giving year and destroy juvenile and/or adult traps that would need to be replaced sooner than scheduled.

Information products:
Provides monitoring and evaluation (stock and basin productivity) to help managers determine if recovery efforts are adequate for recovery of wild/natural Snake River s/s chinook and summer steelhead.
Provides managers estimates of the number of wild/natural s/s chinook and steelhead smolts that will arrive at Lower Granite Dam the following spring.
Provides managers with estimates of SAR’s necessary to recory these wild/natural stocks.
Developing methodology to estimate the ocean age components of the wild/natural adult returns passing Lower Granite Dam

without having to handle any adults at the dam.
Developing methodology to determine how accurately PIT tags estimate SAR's for Snake River w/n stocks.

Coordination outcomes:
Part of cooperative group in Idaho collection production data on naturally reproducing anadromous fish. This group includes other IDFG research projects, the Nez Perce Tribe, Shosone-Bannock tribes, USFWS, NMFS, and the University of Idaho. Project is collecting, compiling, and comparing natural production data from other researchers in the Columbia River Basin. Project plans include becoming part of a broad based group of researchers to estimate the proportion of PIT tagged smolts passing Lower Granite Dam that migrate through the system without being detected, and the SAR's for these smolts.

MONITORING APPROACH
This project provides monitoring and evaluation of recovery efforts, and develops data to assist managers in making recovery decisions.

Provisions to monitor population status or habitat quality:
Project is part of the monitoring and evaluation process for wild/natural stock productivity, habitat rehabilitation projects, hatchery supplementation efforts, and mainstem migration corridor recovery efforts.

Data analysis and evaluation:
Annual snorkel count surveys are used to estimate densities (#/100m2) in core stream section throughout the range of each anadromous fish class in Idaho. This project updates and maintains the database used to store and analyze this long term trend data.
Adult escapement to indicator streams will be estimated using adult trapping weirs and/or redd counts.
Snorkel counts using a multistage sampling design as described in Hankin and Reeves 1988, are used to estimate parr abundance in study streams and calculate egg-to-parr survival.
Summer parr are PIT tagged and subsequent detections are used to estimate parr-to-smolt survival and smolt production. To estimate smolt production from our summer parr PIT tagging, we multiply the snorkel count parr abundance by the ratio of the PIT tag detection rates at the Snake and Columbia rivers' smolt collecting facilities of (PIT tagged summer parr / PIT tagged spring smolts). We assume that both groups suffer the same post tagging mortality and that smolts from both groups that survive to the collection facilities are detected at the same rate.
Juvenile outmigrant traps and PIT tags are used to determine emigration characteristics, collect outmigrating smolts for PIT tagging, and to provide a more accurate estimate of smolt production when we are able operate the traps throughout the emigration seasons. Methods developed at the 1993 Idaho Chapter of the American Fisheries Society meeting are used to estimate the number of emigrants.
A spreadsheet using adult escapement estimates at Lower Granite Dam, Snake River Basin hatchery records, and harvest records, estimates adults available for natural reproduction in the basin. Egg-to-parr survival estimates from study streams are used as an adjusting variable in a model that estimates the number of smolts/female will be produced for naturally spawning adults in the Snake River Basin. The Snake River Basin smolt production model will be evaluated and adjusted annually. The goal is for the predicted smolt production estimate to be within 33% of the actual production for naturally produced chinook salmon and 50% for naturally produced steelhead trout.

Information feed back to management decisions:
The main management decisions related to this project are how to ensure that the project provides natural production information critical to management needs, and how to disseminate project information. Personnel contacts, meetings, symposia, research briefs, journal articles, and annual reports are all part of the information feed back system.

Critical uncertainties affecting project's outcomes:
The main critical uncertainty of this project is whether Snake River smolt-to-adult return rates will be adequate for wild/natural s/s chinook and summer steelhead to recover. If not, then these stock will become extinct and the project will no longer be necessary.

EVALUATION
Trend parr density data correlates with adult escapement numbers.

Models developed predict Snake River Basin smolt production within the goals stated above.
Project develops methodologies to accurately estimate the ocean age of wild/natural adult returns at Lower Granite Dam without having to handle any of the adults at the dams.
Project collects, compiles, and provides in a useful format, natural production data from study streams throughout the Columbia River Basin.
Project personnel are part of a group of researchers from a broad spectrum of agencies and tribes that estimates the proportion of smolts passing Lower Granite Dam that are not collected and their SAR's.
Project's estimates of SAR's necessary for recovery are included in determining effectiveness of mainstem migration corridor recovery options.

Incorporating new information regarding uncertainties:

Project holds project planning meetings and develops work plans annually to ensure that the project adapts to the current needs of managers.

Increasing public awareness of F&W activities:

Regularly holds project field tours for schools and interested groups.
Occasional newspaper articles.
Public contact during field operations.
Presentations to sportsmens and other interested groups.
Presentations at professional workshops and symposiums.

RELATIONSHIPS

RELATED BPA PROJECT	RELATIONSHIP
8909800 Idaho Supplementation Studies	Work cooperatively in field . Each projects uses other project's data in their analysis.
NMFS & FPC--Smolt survival and transportation studies	Their projects use the smolts that we have PIT tagged as part of their data sets.
8909600 NMFS Genetic Monitoring	We collect samples for this project in rearing areas we study.
8332300 Smolt monitoring	We use their PIT tag data to estimate smolt migration survival to the head of Lower Granite Pool.
Sockeye	Work cooperatively with this project and ISS in a Stanley Basin smolt trapping and PIT tagging team.
9005500 ISS	Work cooperatively in field . Each projects uses other project's data in their analysis.

RELATED NON-BPA PROJECT	RELATIONSHIP
USFS Intermountain Research Station / Taxpayers	Work cooperatively in Field. Provide information on bull trout
IDFG Regional Fisheries Management / License Sales	Work cooperatively in Field. Provide information on resident trout
Sawtooth and Clearwater Hatcheries / LSRCP: Rapid River / Idaho Power	Assist each other with activities that require additional manpower. Cost share temporary employees.

OPPORTUNITIES FOR COOPERATION:

Cooperative field work, equipment sharing, data sharing, and temporary employee sharing occurs between this project and other BPA funded research projects, anadromous fish hatcheries, Indian Tribes, IDFG resident fisheries researchers, IDFG regional fisheries management, USFS, and USFWS.Basin-wide production models require accurate estimates of smolt and adult passage at Lower Granite Dam for naturally produced fish. This project's information becomes more powerful if compatible adult-to-smolt and smolt-to-adult production data is collected from other basins in the Columbia River system.

COSTS AND FTE

1997 Planned: $550,000

FUTURE FUNDING NEEDS:

FY	$ NEED	% PLAN	% IMPLEMENT	% O AND M
1998	$550,000			
1999	$550,000			
2000	$500,000			
2001	$420,000			

PAST OBLIGATIONS (incl. 1997 if done):

FY	OBLIGATED
1991	$498,456
1992	$558,447
1993	$547,921
1994	$1,191,526
1996	$649,821
TOTAL:	$3,446,171

Note: Data are past obligations, or amounts committed by year, not amounts billed. Does not include data for related projects.

OTHER NON-FINANCIAL SUPPORTERS:

All Idaho Supplementation Studies (90-055) Cooperators, LSRCP and Idaho Power Hatcheries, USFS, IDFG regional fisheries management, IDFG resident fish research.

LONGER TERM COSTS:

The continued funding need for this evaluation and monitoring project are very uncertain. If the fish become extinct then there will be no need for this project. If recovery occurs then the level of evaluation and monitoring the Region needs will only be known at that time.
O&M

1997 OVERHEAD PERCENT: 24.6%

HOW DOES PERCENTAGE APPLY TO DIRECT COSTS:

Overhead applies to Personnel and Operating, but not Equipment.