RESEARCH PROPOSAL (FY05)

TITLE: Estimating migration and survival rates among transported and in-river-migrating Snake River fall chinook

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I. PROJECT SUMMARY

A. Introduction

Transportation and project operations strategies intended to achieve recovery of ESA-listed fall chinook stocks in the Snake River require evaluation in terms of overall life-cycle survival. However, previous efforts to evaluate life-cycle survival and migration rates for Snake River fall chinook have been limited and insufficient for obtaining the precision necessary for properly informing the decision-making process. Because it is extremely difficult to measure differences in overall life-cycle survival among the various management options, surrogates of overall life-cycle survival, such as smolt-to-adult return rates (SAR), in-river survival, migration rates and delays at projects, need to be measured to assess existing and alternative transportation and project operations strategies.

Overall Northwest Power and Conservation Council (NPCC) and regional goals are to protect, recover, and rebuild fish populations. Project evaluations that compare only juvenile survival rates at-or-between dams are incomplete because they only estimate direct mortality (i.e., they fail to include a measure of indirect effects on life-cycle survival). These indirect effects need to be incorporated into the evaluation because hydropower system configuration and actions likely result in delayed mortality due to combinations of reduced fish condition (e.g., reduced energy stores, increased stress) and behavioral changes (e.g., altered timing into seawater, reduced predator avoidance). Thus, studies that measure survival to adults, along with in-river survival and migration rates, are needed.

To address these regional concerns and needs, this proposal outlines a long-term passive integrated transponder (PIT) tagging program that would provide the information necessary for assessing the existing and future alternative transportation and project operations strategies affecting Snake River fall chinook. In a joint effort with the Nez Perce Tribe, subyearling fall chinook will be marked at the acclimation ponds in the Snake and Clearwater Rivers to provide a direct links to hydrosystem passage impacts on the basin's hatchery production. In addition, wild fall chinook will be collected through beach seining and trapping, and PIT tagged to provide comparisons with their hatchery counterparts. Using hatchery production fall chinook will eliminate the problem of insufficient number of fish available for PIT tagging for study purposes that has hindered prior research conducted by NOAA Fisheries. They focused their marking effort at Lyon Ferry Hatchery on fish set aside for research purposes only after production quotas were satisfied. This approach caused these researchers to move the PIT tagging effort to Lower Granite Dam in 2004 due to no research fish available at the hatchery that year. In addition to utilizing a stable base of subyearling fall chinook to PIT tag, this study also proposes to significantly increase the total number of marked fish released over NOAA Fisheries quota levels in order to generate survival rate estimates with a higher precision level in order to better inform the decision-making process.

B. Research Goal

The goal of this research project is to assess transportation versus in-river migration strategies that may maximize overall life-cycle survival in an attempt to achieve recovery targets for Snake and Clearwater River fall chinook.

C. Study Objectives

1. Develop annual smolt-to-adult survival rates (SARs) for transported and in-river hatchery and wild fall chinook plus an annual transport to in-river (T/I) survival rate ratio.

2. For Snake and Clearwater River hatcheries/acclimation ponds, develop a long-term index of survival rates from release to return of adults to hatcheries.

3. Determine annual reach survival rates for hatchery and wild fall chinook.

4. Determine migration rates, passage distribution, and passage timing for hatchery and wild fall chinook at Snake River and Lower Columbia River projects.

II. PROJECT DESCRIPTION

A. Background and Justification

The National Marine Fisheries Service (NOAA Fisheries) 2000 Biological Opinion (BIOP) for the Federal Columbia River Power System (FCRPS) establishes a suite of measures to provide protection for and ensure recovery of 12 species of listed salmon and steelhead stocks in the Columbia Basin. The Northwest Power and Conservation Council (NPCC) has adopted, in its Columbia Basin Fish and Wildlife Program, a suite of mainstem measures including spill for fish passage. Both the 2000 Biological Opinion and the mainstem program include measures for evaluation of management actions.

The present BIOP and Fish and Wildlife Program measures for summer-migrating Snake River fall chinook include: maximizing collection and transportation of juveniles in the Snake and Columbia rivers; spill for fish passage at Ice Harbor, John Day, The Dalles, and Bonneville dams; flow targets in the Snake and Columbia rivers; drafts from federal storage reservoirs; and cool water releases from Dworshak Reservoir. Each of the plans establishes a series of actions to evaluate the benefits of implementing the various protection, mitigation, and recovery measures. The NPCC mainstem program (2003, page 18-19) specifically states:

> *"When making long-term, annual and in-season decisions for when, and to what extent, to spill water for fish passage, priority should be given to 1) minimizing impacts on returning adults and 2) optimizing passage survival benefits for populations that are important to the biological objectives of this program, and that cannot be transported, or are ineffectively transported. This includes spring chinook from the John Day River; wild naturally spawning and key hatchery populations of spring chinook from other tributaries above Bonneville Dam but below the transport projects (or where only a small proportion are collected at McNary), such as from the Deschutes, Hood, Umatilla, Wind, Klickitat and Yakima rivers; listed mid-Columbia steelhead; Hanford Reach fall chinook and Snake River chinook, to the extent that transportation should be determined to be ineffective……federal agencies, state fish and wildlife agencies and tribes*

should determine an optimal passage strategy at each dam and for each passage route. The Council seeks to maximize improvements in life cycle survival. This requires determining the cumulative effects on fish survival of passing multiple dams and taking that information into account."

The BIOP establishes similar evaluation requirements in Actions 45 and 46 (pages 9-78 through 9-79). These actions require the evaluation of the present transportation of juvenile fall chinook versus in-river and other passage routes. The BIOP action requires the determination of smolt-to-adult survival of listed sub-yearling fall chinook transported at McNary and Lower Granite Dams relative to marked fish traveling in-river. The BIOP requires the provision of spill at Snake River collector projects to reduce turbine mortality, and alternative water management strategies to enhance flow and reduce water temperature. Spill at collector and non-collector projects to enhance river conditions is planned annually as a test condition on an alternating basis.

A limitation associated with the present electrical power transmission system precludes the implementation of the full transportation-inriver survival evaluation for fall chinook under the enhanced spill conditions required by the BIOP. This constraint should be resolved by completion of the necessary transmission system upgrades within the next two years. Accordingly, since adoption of the BIOP the region has implemented a "baseline" evaluation of maximum collection and transportation of fall chinook until the transmission system is upgraded to allow the evaluation of transportation under enhanced spill conditions in the Snake River including benefits provided by RSWs being planned at all Snake River projects.

The following study proposal evaluates the contribution of BIOP transportation and project operation measures to the achievement of overall life-cycle survival and recovery goals for listed Snake River fall chinook. A component of the proposed study is measurement of the baseline effects under the existing BIOP transportation and project operation conditions compared to the effects of simply bypassing collected fish rather than transporting them. Once the enhanced spill operations are permitted, this proposed study will be able to compare smolt-to-adult survival rates (SARs) of subyearling chinook transported from a collector dam, bypassed at collector dams, and passing all four collector dams to the tailrace of McNary dam through non-bypass routes (i.e., combination of spill and turbine passage). The marking program outlined in this proposal provides the framework for examining existing as well as future management strategies aimed at achieving recovery of Snake River fall chinook. While conducting this study presents challenges associated with logistics, costs, numbers of marked fish, and changes to operations necessary to carry out the experimental design, there is a critical need to determine if these improvements are adequate to meet the BIOP's performance and recovery standards.

Design Considerations

There are two approaches for studying changes to the BIOP transportation and project operations program: management strategies can be evaluated in terms of fish performance within years or among years. For a valid implementation of either approach, establishment of baseline survival estimates and juvenile migration characteristics is necessary. Precise baseline information has not been collected for fall chinook to date. This proposed study design collects the baseline information necessary

for assessing the current BIOP transportation and project operations strategies for Snake River fall chinook populations. The first step is to mark fish and detect marks at sufficient levels to estimate in-river survival, migration rates and patterns, and overall survival under the implementation of the BIOP recovery strategies. In addition, comparison with fall chinook bypassed at the collector dams instead of transported will provide insight into the strength of transportation as a recovery strategy.

Evaluating survival under the baseline BIOP strategies will generate a basis for comparing the effects of future enhanced in-river passage conditions on fish survival. This is consistent with and will support NOAA Fisheries' approach to evaluating fall chinook transportation. Fall chinook survival data collected to date indicate that with adequate PIT tag mark groups an annual reach survival estimate is possible. Annual indices of survival will support the evaluation of spill implementation among years. Data from the initial study years will provide the basis for a determination of whether or not it is feasible to evaluate fish passage enhancements to the BIOP program within a year in terms of reach survival and smolt to adult returns. The results of the initial study years will also provide the information necessary to determine whether an annual experimental approach or in-season blocked design is feasible.

The proposed study is a multi-year approach designed to meet the stated requirements of the Fish and Wildlife Program's mainstem amendments for evaluation of spill for fish passage and of the BIOP for evaluation of transportation. The foundation of this approach is:

- It is designed to utilize and build upon the fall chinook studies that are currently in place and generating results.
- It compliments on-going research and monitoring efforts.
- It generates data that has multiple applications to long and short-term management questions.
- It is consistent with the present approach to evaluating the fall chinook transportation program and the baseline benefits of the BIOP spill measures.
- It will, as part of its transportation evaluation, provide the necessary empirical information to help define the long- term transportation strategy to be implemented in the Snake and Columbia Rivers, and thus will help determine the number of fish to be left to migrate in river through the lower Snake and Columbia River.
- By using production fish, it will provide data necessary to Nez Perce hatchery managers evaluating the successes of their fall chinook supplimentation program.

Fisheries agencies and tribes have developed a similar multi-year program for spring migrating fish, the Comparative Survival Study (CSS), for the purpose of monitoring and evaluating the impacts of the mitigation measures and actions (e.g., flow augmentation, spill, and transportation) under the National Marine Fisheries Service (NMFS) Biological Opinion to recover listed stocks (Berggren et al. 2003). The CSS design is founded upon marking large numbers of fish with a passive integrated transponder (PIT) tag implanted in the body cavity during the smolt life stage and retained through their return as adults. These tagged fish can then be detected as juvenile and adults at several locations of the Snake and Columbia Rivers. Tag release/recapture probability models assess the pattern of reductions in the number of individuals detected as the tagged fish migrate through the system to effectively provide estimates of survival.

This allows comparisons of survival over different life stages between fish with different experiences in the hydrosystem (e.g. different routes of dam passage, transportation vs. in-river migrants, and migration through various numbers of dams). These types of studies have generated some of the most useful data for informing management decisions and improving understanding of chinook life-history to date (Berggren et al. 2003, Connor et al. 2003, Smith et al. 2003).

The CSS has PIT tagged large numbers of hatchery spring/summer chinook to obtain adequate sample sizes for these different comparisons. In addition, PIT tagged wild spring/summer chinook from other regional studies have also been used for survival estimation. By comparing the various survival and migration rate estimates for hatchery and wild subyearling fall chinook, it will be possible to determine if hatchery fall chinook are a reasonable surrogate for wild fall chinook in aspects of hydrosystem passage survival and survival to adult. Although the current CSS program has shown that there exist more differences between the wild and hatchery stocks of spring/summer chinook than is desirable to consider the hatchery fish as a surrogate for wild fish, these may not be the case with fall chinook. The hatchery fall chinook released in the Nez Perce acclimation ponds and at the new Nez Perce Hatchery are from Lyons Ferry Hatchery stock, which was initially derived from wild fall chinook from the Snake River basin. Therefore, we may find that the hatchery fall chinook make adequate surrogates for the wild fall chinook. If so, hatchery fish, which are plentiful, may be used to track wild stocks which are currently present in numbers too few to provide precise SAR estimates alone. However, without tagging large numbers of both hatchery and wild fish, it would be impossible to make this determination. The objectives and tasks of this study are as follows:

B. Objectives and Tasks

1. Develop annual smolt-to-adult survival rates (SARs) for transported and in-river hatchery and wild fall chinook plus an annual transport to in-river (T/I) survival rate ratio.

   Task 1(a): Compute annual SARs for transported fish from the four collector dams, SARs for in-river fish not detected at a collector dam, and SARs for in-river fish collected and bypassed back to the river at collector dams (measured at LGR-to-LGR) and associated confidence intervals.

   Task 1(b): Compute the ratio of transport SAR to in-river SAR (T/I ratio) and test if this annual T/I ratio (measured at LGR-to-LGR) is greater than 1.

   Task 1(c): Although SARs computed for wild fall chinook will have low precision due to relatively low numbers of PIT tagged wild chinook available annually, compare point estimate SARs of wild stocks to those of hatchery stocks to determine if hatchery fall chinook are reasonable surrogates for wild fall chinook.

2. For Snake and Clearwater River hatcheries/acclimation ponds, develop a long-term index of survival rates from release to return of adults to hatcheries.

Task 2(a): Partition survival rates (*i*) from hatchery (smolts) to LGR (smolts), (*ii*) from LGR (smolts) to back to LGR (adults), and (*iii*) from LGR (adults) to the hatchery (adults). Because returning adults can be detected at BON and MCN, adult survival from BON to MCN and MCN to LGR will also be generated within partition (*ii*).

Task 2(b): Compute the annual survival rate of smolts transported at LGR and returning as adults to the hatcheries.

Task 2(c): Compute the annual survival rate of smolts migrating in-river and returning as adults to the hatcheries.

3. Determine annual reach survival rates for hatchery and wild fall chinook.

4. Determine migration rates, passage distribution, and passage timing for hatchery and wild fall chinook at Snake River and lower Columbia River projects.

C. Methodology

Subyearling fall chinook originating in the Snake River basin above Lower Granite Dam will be marked using PIT tags. The marked populations will consists of wild fall chinook PIT tagged in the mainstem Snake and Clearwater river above Lewiston and hatchery fall chinook PIT tagged for the supplementation releases made at and near the Pittsburg Landing, Captain Johns Rapids, and Big Canyon Creek acclimation ponds, plus the production releases made from the new Nez Perce Hatchery complex.

The goal is to have the PIT tagged fish in each study category (defined later) be representative of a non-tagged counterparts for each management strategy that may be used in the future. PIT tagged fish passing through the hydro system should mimic the experience of non-tagged fish. Over the next couple of years of baseline (no spill) data collection, the management strategy is maximum transportation at collector dams. So it is imperative to have a group of PIT tagged fish that directly mimics this maximum transportation mode. Plus it is critical to have another group of PIT tags directly mimic what would have occurred if the management strategy had been maximum bypass at collector dams. It is possible to have both groups of PIT tagged fall chinook created by using one of two methods of releasing the smolts from the hatchery/acclimation pond locations to guarantee good mimicking of the untagged population.

The first method utilizes a single, large release and uses the electronics at the dams to divert smolts to reaceways (or sample room) for transportation or back to the river. This method is currently used in the ongoing CSS program with yearling spring/summer chinook. The second method, developed by the Nez Perce Tribe, aims to simplify the handling of fish to be routed to transport and those to be returned to the river. Their approach keeps two separate pools of PIT tagged fish at the hatchery. Upon release together, one pool of fish is destined to 100% mimic the untagged run-at-large. If fish from this pool of PIT tags are collected at a dam where all fish are being transported, then these PIT tagged fish will all be transported. PIT tagged fish from this pool of tags that are not detected at any collector dam will directly mimic the non-collected untagged fish directly in proportion to what occurred for the run-at-large. This is the pool of PIT tags that is of greatest interest to hatchery managers in the evaluations of fall chinook supplementation studies. The second pool of fish is used to obtain the in-river survival

components from release to Lower Granite Dam and between dams within the hydrosystem. These survival estimates will allow the partition of the hatchery-to-hatchery SAR into the release to Lower Granite Dam survival rate, Lower Granite (smolt) to Bonneville Dam (adult) SAR, and Bonneville Dam-to-Lower Granite Dam adult survival rate, and Lower Granite Dam to hatchery survival rate. Harvest information will be utilized to adjust detection numbers to arrive at the appropriate survival rates for adult between Bonneville Dam and the hatchery rack. Because of the large commitment required of the Nez Perce Tribe in providing of PIT tagged fish for the study, it is imperative that the best release approach be chosen to meet the needs of both cooperating entities Nez Perce Tribe and USFWS. Therefore, this proposal plans to use the Nez Perce Tribe approach to releasing PIT tagged fall chinook from their facilities. Total numbers to be release are:

- Non-spill years – 240,000 PIT tagged fall chinook
- Spill years – 360,000 PIT tagged fall chinook

Breakdown of number of PIT tagged smolts in each study category for a single hatchery/ acclimation pond release is presented in Table 1.

Table 1. Number of subyearling fall chinook required to calculate SARS for an individual hatchery/acclimation pond group using Nez Perce tribe's release approach.

	Release	**Category T_0**	**Category C_1**	**Category C_0**
Non-spill years[1]				
Mimic transport	30,000	11,900	None	400
Mimic bypass	30,000	none	11,900	400
Spill years[2]				
Mimic transport	45,000	13,250	none	5,200
Mimic bypass	45,000	none	13,250	5,200

[1]Assumes FGE (no spill) : 0.60 at lgr & lgs, 0.48 at lmn, and 0.62 at mcn
[2]Assumes CE with BIOP spill: 0.265 at lgr & lgs; 0.245 at lmn; 0.310 at mcn
[3]Assumes survival: 0.41 to rel-lgr; 0.75 lgr-lgs; 0.78 lgs-lmn; 0.75 lmn-mcn

As long as the minimum sample size of PIT tags within any study category remains above 10,250 fish, which occurs for T_0, C_1, and pooled C_0, there is an 80% power with 5% error of detecting a difference of 50% between pairs of study groups when the smallest SAR for a group is 0.6% (LGR-to-LGR survival rate). Due to uncertainty in collection efficiencies and survivals that may occur under the BIOP spill program when implement, these sample sizes are considered only a guide for planning purposes and not as a projection of future results.

D. Methods

Study scenarios and PIT tagged fish study categories

One major objective of this study is to compute and compare overall smolt-to-adult survival rates for smolts transported through the hydro system versus smolts

migrating in-river. Since 1995, the standard hydro system operation was to transport all smolts collected at LGR, LGS, LMN, and MCN throughout the summer season. But in the future, there may be benefits from modifications of this approach to one where only a portion of the collected fish are transported and the remainder returned in order to implement a spread-the-risk approach in face of uncertainty. Likewise, there may be benefits provided by adding spill at the collector dams as occurs during the springtime migration. These various future management scenarios would be investigated during the course of this study. To accomplish this, the population of PIT tagged study fish arriving at Lower Granite Dam will be estimated and assigned to categories related to the manner of subsequent passage through the hydro system (i.e., their capture histories).

There are at least four possible operational scenarios that could be implemented in the future. Scenarios where collected fish have a portion transported and the remainder returned to the river is considered an unlikely scenario for the future. The four scenarios to be evaluated in this study include:

(1) No spill at collector dams and transportation of all collected smolts –current operation in place

(2) No spill at collector dams and all collected smolts are returned-to-river

(3) Spill at collector dams and transportation of all collected smolts

(4) Spill at collector dams and all collected smolts are returned to the river

Placing these four operational scenarios in a 2 by 3 grid shows that there are basically three different test combinations that are common regardless of whether spill or no spill is being provided in any given year. In a no spill year with well over 90% of subyearling fall chinook arriving Lower Granite Dam "destined" to be collected at a collector dam, there is not enough fish in Category C_0 to conduct any tests.

	Transport only	**Bypass only**	**Transport vs Bypass**
No spill	T_0	C_1	T_0 vs C_1
Spill	T_0 vs C_0	C_1 vs C_0	T_0 vs C_1

Each test combination is made up of a set of 2 to 3 categories of fall chinook that are defined as follows:

(1) Category T_0: Transported fish that are first-time detected at one of the 4 collector dams (this PIT tag group mimicks the run-at-large in the current maximum transportation mode).

(2) Category C_0: Fish remaining in-river below McNary Dam with no detection at a collector dam (this PIT tag group mimicks the run-at-lage in the current maximum transportation mode).

(3) Category C_1: Fish remaining in-river below McNary Dam with one or more detections at a collector dam (this PIT tag group would mimick the run-at-

large whenever the management scenario was to bypass a portion of the collected run-at-large)

The three study categories T_0, C_0, and C_1 to be used in this study are also being used in the on-going Comparative Survival Study for spring/summer chinook (Berggren et al. 2003). In that study the SARs for fish in categories T_0 and C_0 are the most critical for management since purposes since there is no management scenario looking at bypass instead of transport as a management option. So Category C_1 fish are used primarily in the reach survival estimation process. But for subyearling fall chinook there is more uncertainty about transportation and whether or not bypass would be a better option than transport whenever improved in-river conditions are provided through provision of BIOP spill at collector dams. Therefore, releases of PIT tagged fish from the hatchery/acclimation ponds will be made in such a manner as to provide similar numbers of study fish in categories T_0 and C_1. With the absence of spill currently over 90% of the subyearling fall chinook arriving Lower Granite Dam will end up transported from one of the collector dams. Once spill is provided, then the release strategy will be modified so as to obtain approximately similar numbers of study fish in categories T_0, C_0, and C_1.

Since we are computing a LGR-LGR smolt-to-adult survival rate as a key parameter for comparison across transportation and in-river study categories, we must estimate the population of PIT tagged smolts arriving Lower Granite Dam that are "destined" to end up in each of study category of interest. Thus, LGR-LGR SARs must be estimated for all groups even if a smolt was not detected at LGR. For example, smolts destined for transport at the lower projects include a larger group than actually transported at the lower projects, due to mortality from migrating in-river from LGR to the lower projects. Therefore, an estimated survival rate is needed to convert actual transport numbers at LGS, LMN, and MCN into their LGR starting number (i.e., LGR equivalents). These survival estimates are obtained by using the Cormack-Jolly-Seber (CJS) (Cormack 1964, Jolly 1965, Seber 1965) methodology. Overall, survival will be estimated from hatchery release site to Lower Granite Dam tailrace and then downstream for up to five reaches between Lower Granite Dam tailrace and Bonneville Dam tailrace.

Likewise, the estimated number of PIT tagged smolts that migrate past the collector dams undetected (C_0 fish) and those that migrate passed the collector dams with one or more detections (C_1 fish) to the tailrace of MCN, the last transportation site in the summer season, are also expanded to LGR equivalents using the appropriate in-river survival estimates.

Estimation of SARs, T/I ratio, and D for Study Categories

Dividing the estimated number of smolts in each study category at Lower Granite Dam into the detected number of returning adults at Lower Granite Dam will produce the SARs for categories C_0, C_1, and T_0. The adult count is the sum of all 1-, 2-, 3-, and 4-salt returning chinook for each category of interest. All mini-jacks (0-salt) are excluded from the adult count.

The ratio of $SAR(T_0)/SAR(C_0)$ will form the typical T/I ratio typically presented in transportation studies under the current management scenario. Ratios of $SAR(C_1)/SAR(C_0)$ and $SAR(T_0)/SAR(C_1)$ will also be useful for addressing the other management scenarios covered in the study evaluation.

The estimation of D (i.e., delay mortality of transported fish below the hydrosystem) for fall chinook subyearlings will be more more susceptible to estimation

errors than occurs for the spring migrants. D is defined as the ratio of post-Bonneville Dam to Lower Granite Dam SAR of transported fish to in-river fish. Under current project operations, it is estimated (T/I)*(Vc/Vt) where the T/I ratio is multiplied by the ratio of in-river estimated survival from Lower Granite Dam tailrace to Bonneville Dam tailrace (Vc) to transportation survival from collector dams to Bonneville Dam tailrace (the latter using an adjustment to account for differential survival rates from Lower Granite Dam to each of the the dam being considered and proportion of total transported fish coming from each of the four collector dams). The component Vc requires an estimate of in-river survival to Bonneville Dam. However, due to lower FGE for subyearling chinook at John Day and Bonneville dams than occurs for there yearling chinook counterparts and moderate BIOP spill levels at these two dams during the summer months, the ability to directly estimate in-river survival in the lower Columbia River below McNary Dam with adequate precision may be limited. In these situations, we apply a "per mile" expansion of the survival rate from Lower Granite Dam tailrace to McNary Dam tailrace to the reach below McNary Dam. In years of no spill at collector dams, the fall chinook in-river survival rate from Lower Granite Dam tailrace to McNary Dam tailrace on a "per mile" basis is expected to be lower than that occurring in the lower Columbia River with spill occurring at John Day, The Dalles, and Bonneville dams. In this situation, the estimated expanded in-river survival is expected to be lower than what actually occurs, which will make the in-river survival to Bonneville Dam appear lower than actual. Therefore, the circumstances under which the "per mile" expansions are required will be investigated on a case-by-case basis to help reduce the impacts of potential bias in the computation of D.

To improve upon the direct estimation of D would require PIT tag detection capability below Bonneville Dam for migrating smolts. In the springtime NOAA Fisheries operates a trawl equipped with PIT tag detection capability in the lower Columbia River near Jones Beach (site name TWX). Although not currently deployed during the summer months, Dr. Richard Ledgerwood stated at the June 24, 2004, AFEP planning session for fall chinook transportation studies that this trawling operation for PIT tag detections could be implemented in the summer months if funds were provided.

Program for Parameter Estimation and Confidence Intervals

A computer program has been written in the on-going CSS to compute the in-river survivals, SARs, ratios of selected SARs, and D indices along with associated bootstrapped confidence intervals for yearling chinook. This program will be modified to handle fall chinook subyearlings with the Nez Perce Tribe approach. During a bootstrapped iteration, the computer program obtains a random sample of PIT tags with replacement from the full set of PIT tags in the particular group of interest. During each iteration, all relevant study parameters are computed, while retaining the raw data used in the computations. From a set of iterations (typically 1,000 runs), non-parametric 95% confidence intervals will be computed for each parameter of interest.

III. PROJECT IMPACTS, FACILITIES, AND EQUIPMENT

No PIT tagging operations will be conducted at the Snake River dams. Under the Nez Perce Method there will be two groups of study fish arriving at the dams. The first group will follow the untagged population, which is normally routed to the raceways.

These fish will be added to the list of fish in the Separation-by-Code database with disposition of "raceways". The second group will follow the default for PIT tagged fish, which is return-to-river. For the transported fish, the first group will have self-weighting across four collector dams and this will simplify the computation of the SAR for the total number of fish transported from the four dams in LGR equivalents. Because of concerns about winter movements of fall chinook that holdover, there is strong interest in pursuing lengthened facility detection seasons.

IV. COLLABORATIVE ARRAGNEMENTS AND/OR SUB-CONTRACTS

As currently proposed, this study will be led by the U.S. Fish and Wildlife Service (USFWS) Columbia River Fisheries Program Office and performed in collaboration with NOAA Fisheries, Nez Perce Tribe, Idaho Department of Fish and Game (IDFG), and Fish Passage Center (FPC). However, due to the large commitment required by the Nez Perce Tribe in providing the hatchery fall chinook to PIT tag, the framework of the co-leadership between the Nez Perce and USFWS needs to be worked out during future coordination meetings between the two entities.

V. LIST OF KEY PERSONNEL

Dr. Steven L. Haeseker- Principal Investigator
Steve Rocklage – Nez Perce research biologist in charge of NPT fall chinook studies
Dr. William P. Connor- USFWS research biologist in charge of wild fish marking
Tom Berggren- FPC biometrician
Dr. Charlie Petrosky- IDFG research biologist
Dr. Howard Schaller- USFWS

VI. TECHNOLOGY TRANSFER

Information acquired during the proposed work will be transferred in the form of written and oral research reports. A presentation will be made at the Corps' annual Anadromous Fish Evaluation Program Review. A draft report will be provided to the COE by December 15, 2005 and the final report will be completed after appropriate review. Technology transfer activities may also include presentation of research results at regional or national fisheries symposia, or publication of results in scientific journals.

VII. BUDGET

A detailed budget will be provided if a full proposal is requested.

VIII. REFERENCES CITED

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