

**Project ID: 35011****Title:** The Floating Net Pen Transportation System Pilot Project**Sponsor:** Columbia Basin Fishery Restoration L.L.C.**ISRP Preliminary Comments:**

The experimental design is not technically sufficient. The proposal does not specify what benefits might be expected from use of net pens relative to existing methods of transportation of juvenile salmon, nor how any such benefits would be obtained or measured. Neither the need for transfer nor the method to be used for transfer of fish from hatchery raceways or other sources to the net pens is discussed in the proposal.

The reviewers are aware of an experiment on gas bubble trauma conducted by Earl Dawley that employed net pens in the Columbia River. Dawley couldn't keep the net pens together.

**Action Agency/NMFS RME Group Comments:**

OCEAN AND ESTUARY SUBGROUP---Potential action items addressed-187; 195. The artificial transportation aspect of this proposal is not in concert with the habitat restoration efforts and proposed research on ecosystem function of the lower river and estuary currently being conducted by LCREP, NMFS, and others.

**Response to ISRP and RME Comments:**

This study addresses the use of floating net pens to transport juvenile salmonids downstream in the Columbia River. Principal goals are to assess survival and straying at adulthood.

Net pens are proposed as a low cost alternative to the present system of transporting smolts in the Columbia River. The present system encloses smolts in steel barges receiving water pumped from the river. Transport of smolts in enclosed steel tanks raises questions about response of transported smolts to olfactory and magnetic cues, which may be critical for homing, and survival to adulthood. Also unanswered are questions concerning relative survival of transported smolts released at various locations. To our knowledge no previous studies have evaluated relative survival of smolts released in fresh water, the estuary, and the Nearshore Ocean.

Experimental groups of known numbers of spring Chinook will be tagged, raised at Ringold Hatchery, and released into the Columbia River. Smolts will be transferred from hatchery raceways to net pens by gravity flow or Aqua pump. Fish surviving to adulthood will be recaptured at the hatchery and upstream of the hatchery to evaluate survival and straying.

Proposed juvenile release locations are Ringold Hatchery (location of rearing juveniles), Bonneville dam (downstream side), Jones Beach (location of approximate mixing of fresh and salt water), Astoria vicinity, and offshore of the Columbia River.

The planned evaluation will estimate survival ratios between adults from control and treatment groups of tagged juveniles returning to Ringold Hatchery on the mid Columbia River upstream from McNary Reservoir. Ringold Hatchery is in Washington State and will be used as a source of stream type spring Chinook juveniles and a release location for control groups of coded wire tagged juveniles.

This multi-year program will involve the release of four brood years of tagged spring Chinook smolts. The marked smolts will have coded wire tags implanted in their snouts. The Washington Department of Fish and Wildlife Ringold Hatchery will provide up to 250,000 tagged smolts per brood year for this program. Although certain details of the research plan remain to be developed, there is likelihood that ten groups of the 25,000 smolts per group will be tagged with separate codes.

Net pens are 18 feet deep. This is the maximum depth that can be accommodated in order to avoid contact with the streambed in reservoir navigation channels.

A boat will be tethered to the floating net pens to assist downstream passage through reservoirs, navigation locks at dams, and the Columbia River below Bonneville Dam. Time in transit from Ringold Hatchery to Astoria is predicted to be about 10 days.

Loading fish at Ringold Hatchery will require that net pens be partially submerged at the hatchery which is located on the Hanford Reach of the free flowing river. Partial submergence is necessary at the hatchery because water depth is less than 18 feet.

Implementation of the program will require installation of ten raceways at Ringold Hatchery to hold the ten individually tagged groups of treatment plus control fish for each of the four brood years. Each raceway will contain about 2,000 cubic feet of water and flow of at least 0.5 cubic feet per second. Juvenile spring Chinook will be tagged in late summer/early autumn for release in April and May at an average weight of approximately 40 to 50 grams.

The release of tagged control and treatment groups will follow the same protocol in each of the four release years. A hypothetical protocol presented here is a first step to initiation of a detailed plan.

The total number of tagged fish per treatment or control group is 25,000 providing eight treatment and two control groups per year. On each of two release dates for control groups per year ( $2 \times 4 = 8$  control groups over four years), the net pen barge will be configured to accommodate four treatment groups per release date. This allows an option to release treatment groups at four locations downstream from Ringold Hatchery. The release plan could, for example, include the release of treatment groups at:

1. A location near that currently used by the Corps of Engineers for release of barged juveniles below Bonneville Dam.
2. A location near the upriver intrusion of the saltwater wedge (Jones Beach).
3. A location near Astoria, and
4. A seaward location offshore of the jetty.

Inclusion of a release site below Bonneville would provide information on survival parallel to that collected for the existing barging program. Inclusion of a release site near Jones Beach would provide comparative estimates of survival for the essentially fresh water and estuarine segments of the lower Columbia River.

Survival rates of tagged spring Chinook juveniles from Ringold Hatchery have in the past compared favorably with spring Chinook from other Columbia Basin hatcheries (Fuss et al., 1994). Three brood years from Ringold (1975, 1976, and 1977) averaged 2.0 percent (range 1.5 to 2.6 percent) survival. Survival of hatchery spring Chinook has generally declined in recent years, and an expectation of between 0.2 and 0.5 percent is likely to be more realistic for control groups. Treatment groups, especially those released near Astoria and offshore, are projected to have a much higher survival than control groups. We are projecting recovery numbers of about 50 to 100 tagged adults for control groups and as many as four times this number for treatment groups.

The analysis of ratios is amenable to the use of parametrics as well as non-parametric statistical techniques. Parametric tests are more powerful than non-parametric tests, but must satisfy a number of assumptions that are described in general statistical textbooks. It is premature to predict the specific statistical analysis (or analyses) to be performed until sufficient data become available to determine how well assumptions underlying parametric tests (including analysis of variance) are satisfied.

The research plan will incorporate assessments of:

1. Survival of returning adults.
2. Homing of returning adults,
3. Health and condition of juveniles at release (including incidence of infection by selected disease agents),
4. Physiological condition (stress, immune response to disease, smoltification, etc), and
5. Juvenile behavior (post-release feeding behavior, migration, etc).

Detailed plans to address the above issues will be developed as we proceed with development and implementation of the operation plan.

Initial adult returns from the first brood year could become available as early as second year jacks. It is more likely, however, that returning 3-year-old adults will be the first to provide sufficient numbers of adults for simple Chi-square analysis of return ratios. Return ratios can be expressed as the weighted number of adults per unit number of test groups of smolts divided by the number of adults per unit number of control smolts. Return ratio greater than unity support a hypothesis that survival is higher for test groups than control groups.

## **SCHEDULE**

- Year 1                    Implementation of the operations plan will receive initial priority for The first fiscal year. Ten hatchery race ways will be constructed and placed on operation by October. The net pen barge will be constructed And placed in operation by April. Release of control and transportation of treatment groups will occur on or about April 15 (first release) and May 15 (second release).
- Year 2                    Tagging of control and treatment groups will occur in October. Release and transportation schedules remain April 15 and May 15. Specific study plans which address fish health, physiology, and behavior will be implemented along with release schedules.
- Year 3                    Repeat second year with regard to operations and research. Plan And implement evaluation of homing response of control and and treatment groups.
- Year 4                    Same as year 3.
- Year 5,6,7 and 8        Will see a continuation of evaluation of adult return and adult and adult homing.

## **REFERENCE CITED**

Fuss. H.J et al. 1994. Annual coded wire tag program (Washington). Missing production Groups. Bonneville Power Admin. Portland, OR. Proj. 89-66.

We cannot respond to the reviewer's comments on the Earl Dawley experiment. The reason being they did not supply us with the name and year of the experiment. Consequently, NMFS is unable to find that study without that information. We will make our response if the necessary documentation is provided to us.

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