

Operation of the Adult Trap at Lower Granite Dam, 2010

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Report of research by

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EXECUTIVE SUMMARY

During 2010, we operated the adult salmonid trap at Lower Granite Dam from 1 March through 18 November. Trap operation was continuous, except during a short period when water temperatures were above 21°C, which was too high to handle fish safely. We collected and handled a total of 22,642 steelhead *Oncorhynchus mykiss*, and of those fish, we PIT tagged 4,305 wild steelhead. We took scale samples from 1,421 spring/summer Chinook salmon *O. tshawytscha* for age and genetic analysis. We collected 15 PIT tagged Lemhi River adult spring Chinook using the separation-by-code system within the trap, and we radio-tagged these fish for the Idaho Department of Fish and Game.

We collected and handled a total of 9,886 fall Chinook. Of these fish, 2,343 adults and 446 jacks were transported to Lyons Ferry Hatchery on the Snake River in Washington. In addition, 1,026 adults and 14 jacks were transported to the Nez Perce Tribal Hatchery on the Clearwater River in Idaho. The remaining 6,057 fall Chinook salmon were passed upstream to continue their adult migration. Scale samples were taken from 2,837 PIT-tagged fall Chinook that were collected by the separation-by-code system. Five spring/summer Chinook were collected by the separation-by-code system and examined for the presence of marine mammal marks. One hundred American shad *Alosa sapidissima* were collected during random sample. Nineteen sockeye *O. nerka* were collected and transported to the Eagle Fish Hatchery in Idaho.

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INTRODUCTION

Lower Granite Dam, located 695 river kilometers from the mouth of the Columbia River, is the farthest upstream dam on the Snake River with adult fish passage facilities. Since the completion of Lower Granite Dam in 1975, adult salmonids have been collected and sampled using an off-ladder trap built into the fish ladder, and these collections have been an integral part of many studies (Harmon 2003). Trap operations have been conducted primarily by National Marine Fisheries Service (NMFS/NOAA Fisheries) personnel in cooperation with other agencies. Demands on use of the Lower Granite Dam adult trap have increased in recent years and are expected to continue to increase. To meet this increased demand, the adult trapping facility was revised during winter 1995-1996, and completely remodeled during winter 2006-2007. The most recent modification of the facility was used for the first time during the 2007 adult migration.

Current collections using the Lower Granite Dam adult trap include fall Chinook salmon *Oncorhynchus tshawytscha* for a captive broodstock program, multiple species samples for run-reconstruction monitoring, fish tagged with passive integrate transponder (PIT) tags for transportation and life history studies, steelhead *O. mykiss* for adult PIT-tag studies, and adults for radio telemetry studies (with both tagging and tag removal conducted at the adult trap).

Operation of the Lower Granite Dam adult trap provides the following benefits to listed stocks:

- 1) Reduces risk to the fall Chinook salmon ESU by improving hatchery practices (i.e., provides hatcheries with the ability to collect and use natural-origin fish for broodstock).
- 2) Jump-starts fall Chinook salmon production in underutilized areas of the Clearwater Basin by providing natural-origin fish.
- 3) Reduces risks to ESUs from atypical straying of hatchery-origin fish from areas outside the Snake River Basin by facilitating the removal of unusually high numbers of stray fish.
- 4) Provides information on age-class distribution and hatchery/wild composition of spring/summer Chinook salmon and steelhead returns to improve understanding of ESU status, and provides critical information needed for run-reconstructions of these stocks.

- 5) Provides critical life history information for fall Chinook salmon (from scale samples) to better manage this stock.

The adult trap at Lower Granite Dam has been operated by the National Marine Fisheries Service and maintained by the U.S. Army Corps of Engineers since its origin in 1975; however, the Bonneville Power Administration (BPA) began funding trap operations in mid-2005 (Harmon 2006, 2007, 2008, 2009; Ogden in press). Here we report on adult trap operations during 2010.

METHODS

The adult salmonid trap is located adjacent to the south shore adult fish ladder at Lower Granite Dam on the Snake River. A complete description of the adult trap and its operation was reported by Harmon (2003). When the adult trap is in operation, a diversion gate is rotated across the fish ladder to divert upstream-migrating fish. Diverted fish then enter an attraction pool and pass through pipes fitted with coded-wire-tag (CWT) and PIT-tag detectors. Tagged fish are then diverted from the pool to a holding area (for PIT tagged fish, only those selected by tag code are diverted to holding), while non-tagged adults continue through the pipes to the exit ladder, where they re-enter the main fish ladder to continue their upstream migration. Diversion gates are also set to sample the run-at-large at a predetermined rate..

The trap has a gravity-flow dewatering system that reduces stress on fish by allowing them to pass directly from the holding area to an anesthetic tank without being handled. Fish are sedated with eugenol (99.9% pure) and inspected, and sample data are collected and recorded. Fish are then placed either in a freshwater recovery tank for release back to the fish ladder, or into holding tanks for eventual transfer to trucks to be hauled from the facility to various hatcheries.

The adult trap is generally operated 7 d/week, 24 h/d during the adult migration period, from early March through November each year, except during short periods in the summer when water temperatures reach 70°F and are too high to handle fish safely.

RESULTS AND DISCUSSION

The Lower Granite Dam adult trap was remodeled during winter 2006-2007. Work was contracted through the U.S. Army Corps of Engineers (USACE), with funding provided by BPA. Modifications to the trap addressed the need for increased holding capacity for fall Chinook salmon broodstock collection. Holding capacity was increased by adding four additional holding tanks, which are approximately one and one-half times larger than the original two tanks. The original holding tanks were also modified, but their capacity was not increased. Anesthetic capacity was also increased, with an increase in size of the main anesthetic and recovery tanks, and installation of two additional anesthetic tanks.

The modifications also provided substantial expansion of the work area. These modifications now make it feasible to handle a larger proportion of the adult steelhead and Chinook salmon migrations. However, when the Lower Granite forebay is at minimum operating level, as it is during early September, there is only enough water available to use three of the four new holding tanks. The adult trap was designed to operate with a gravity flow water system that will supply enough water pressure to operate the adult trap when the forebay is at minimum operating level. USACE personnel that designed the water supply system believed that there was something wrong. Throughout the 2009 season, the USACE worked to increase the water supply so that all tanks could be used in the future.

In mid-August 2009 while the trap was shut down due to high water temperatures, a remote operated camera was run through the water supply pipes to check for debris blockage. Nothing was found in the water supply pipes that would obstruct flow. The next step taken was to replace a faulty butterfly valve on the water supply pipe. This operation was performed at the end of the 2009 season in mid-November on the day after the trap was shut down. The following day, a test was performed on the water supply pipe. During this test, we were able to run the adult trap at full capacity, with all six holding tanks operating. Further testing was done throughout the 2010 season to verify the improvement in water supply during normal trap operations. The trap was able to run at full capacity during the 2010 season without any problems with water supply.

During 2010, we operated the adult trap from 1 March to 18 November, except during the period of 13 August to 22 August, when it was shut down due to high water temperatures. Samples of the run at large were taken automatically four times an hour, 24 h/d for the entire trapping period, using different sample rates depending upon the migration period and species (Table 1).

Table 1. Sampling schedule during adult trap operations at Lower Granite Dam, 2010.

Species	Period	Sample rate (%)
Steelhead (spring)	1 March-17 April	15
	18 April-13 August	4
Spring/summer Chinook	4-17 April	15
	18 April-13 August	4
Fall Chinook	22 August-21 September	12
	22 September-17 November	10
Steelhead (fall)	22 August-21 September	12
	22 September-17 November	10

In addition to periodic samples of the run at large, we also used the PIT-tag separation-by-code system at the trap to collect spring, summer, and fall Chinook salmon that had been PIT-tagged as juveniles. Sampled fish were inspected for species, length, injuries, brands, visible implant tags, PIT tags, and fin clips. Scale and tissue samples were also taken from some spring, summer, and fall Chinook, as well as some steelhead. Fall Chinook salmon collected at the trap and transported to hatcheries were inoculated with erythromycin and oxytetracycline, and their operculi were hole-punched for identification.

The following data is preliminary and will be further analyzed by researchers from the respective agencies for which the data were collected. A total of 22,642 steelhead were collected and handled during the sampling period (Table 2). Of these fish, 1,596 were sampled during spring and 21,046 during fall. Of the 1,596 steelhead sampled during the spring, 243 were of wild origin and received a PIT tag, and 11 were recaptured fish that had been previously PIT tagged. Of the 21,046 steelhead sampled during fall, 4,162 were of wild origin and received a PIT tag, and 157 were recaptured that had been previously PIT tagged.

Table 2. Number of adult salmonids collected and handled at the Lower Granite Adult trap during 2010.

Species	Number collected	Number PIT tagged	Number previously PIT tagged
Spring Chinook	4,196	712	185
Summer Chinook	1,618	419	108
Fall Chinook	9,886		
Steelhead	22,642	4,305	168

Data taken from these fish will be analyzed to evaluate the A- and B-run segments, as well as the hatchery/wild composition of the steelhead run. These data will be analyzed and reported by the Idaho Department of Fish and Game (Bill Schrader, IDFG, personal communication) and Quantitative Consultants Inc. (Jody White, QCI, personal communication). No freeze-brands were observed during 2010 adult collections.

We also collected and handled a total of 4,196 spring Chinook salmon and 1,618 summer Chinook salmon (Table 1). Of the 4,196 spring Chinook salmon sampled, 712 were of wild origin and received a PIT tag, and 185 were recaptured that had been previously PIT tagged. Of the 1,618 summer Chinook salmon sampled, 419 were of wild origin and received a PIT tag, and 108 were recaptured that had been previously PIT tagged. Adult spring Chinook salmon from the Lower Granite Trap were used for the following investigations during 2010:

1. Scale and genetic samples were taken from all fish that were PIT tagged and will be analyzed by IDFG and QCI. Age structure and genetic analysis will be determined from these samples, and results from these analyses will be available from IDFG (Bill Schrader, IDFG, personal communication) and QCI (Jody White, QCI, personal communication).
2. We collected 15 PIT-tagged adult spring Chinook salmon that were of Lemhi River origin using the separation-by-code system in the adult trap. We radio-tagged these fish for IDFG as part of the BPA-funded Integrated Status Effectiveness Monitoring Project. This project has the following objectives:
 - a) Determine the timing of adult Chinook salmon from Lower Granite Dam to spawning grounds in the Lemhi River watershed

- b) Identify stream flow and instream migration barriers in the Lemhi River watershed to prioritize future habitat actions
- c) Determine the effectiveness of habitat restoration actions taken to reduce fish migration barriers in the Lemhi River watershed
- d) Identify staging area habitat in the Lemhi River watershed to prioritize future habitat restoration actions
- e) Determine adult Chinook salmon distribution in the Lemhi River watershed

Further information about this study is available from IDFG (Mike Biggs, IDFG, personal communication) and on the ISEMP web pages (www.nwfsc.noaa.gov/research/divisions/cbd/mathbio/isemp/index.cfm).

3. We collected five spring Chinook using the separation-by-code system for a study of adult survival of Chinook salmon from the mouth of the Columbia River to Bonneville Dam. A picture of each fish was taken to document any marine mammal marks that may have been present. Detailed information on this study is available from the Northwest Fisheries Science Center (Michelle Wargo-Rub, NMFS, personal communication).

We collected and handled a total of 9,886 fall Chinook salmon (Table 1). Of those fish, 2,343 adults and 446 jacks were transported to Lyons Ferry Hatchery on the Snake River in Washington. In addition, 1,026 adults and 14 jacks were transported to the Nez Perce Tribal Hatchery on the Clearwater River in Idaho. The remaining 6,057 fall Chinook salmon were passed upstream to continue their migration. Adult fall Chinook salmon from the Lower Granite Trap were used for the following investigations during 2010:

1. From the Fall Chinook salmon transported to the Lyons Ferry and Nez Perce Tribal Hatcheries, run reconstruction and hatchery data are being analyzed and will be available from the Washington Department of Wildlife when these analyses are complete (Debbie Milks, WDFW, personal communication).
2. Scale samples were taken from 2,837 PIT-tagged fall Chinook that were collected using the separation-by-code system. Data from these scales will be used for a study of fall Chinook salmon early life history. Information on this study is available from the Northwest Fisheries Science Center, Seattle (Doug Marsh, NMFS, personal communication).

3. Nineteen Sockeye salmon were trapped and hauled to Eagle Fish Hatchery in Idaho as part of a trap and haul feasibility study. Information on this study is available from IDFG (Mike Peterson, IDFG, personal communication).

During the spring and summer months, 100 American shad *Alosa sapidissima* were collected during random samples. Information on this study is available from the University of Washington School of Aquatic and Fishery Sciences (Daniel J. Hasselman, University of Washington, personal communication).

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REFERENCES

- Harmon, J. R. 2003. A trap for handling adult anadromous salmonids at Lower Granite Dam on the Snake River Washington. *North American Journal of Fisheries Management* 23:989-992.
- Harmon, J. R. 2006. Operation of the Lower Granite Dam Adult Trap, 2005. Report of the National Marine Fisheries Service to the U.S. Department of Energy, Bonneville Power Administration, Division of Fish and Wildlife, Project 200500200.
- Harmon, J. R. 2007. Operation of the Lower Granite Dam Adult Trap, 2006. Report of the National Marine Fisheries Service to the U.S. Department of Energy, Bonneville Power Administration, Division of Fish and Wildlife, Project 200500200.
- Harmon, J. R. 2008. Operation of the Lower Granite Dam Adult Trap, 2007. Report of the National Marine Fisheries Service to the U.S. Department of Energy, Bonneville Power Administration, Division of Fish and Wildlife, Project 200500200.
- Harmon, J. R. 2009. Operation of the Lower Granite Dam Adult Trap, 2008. Report of the National Marine Fisheries Service to the U.S. Department of Energy, Bonneville Power Administration, Division of Fish and Wildlife, Project 200500200.
- Ogden, D. A. In press. Operation of the Lower Granite Dam Adult Trap, 2009. Report of the National Marine Fisheries Service to the U.S. Department of Energy, Bonneville Power Administration, Division of Fish and Wildlife, Project 200500200.