

Continuing Research Preliminary Proposal

**Evaluating Methods to Estimate True Escapement of Adult Pacific Lamprey
Migrants at Bonneville and The Dalles Dams - 2008**

Study Code: ADS-P-00-8

Project Leader

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Study Summary

A. Goal

The goal of this study is to use nighttime counts, day counts and other data related to lamprey passage research to develop an accurate method to estimate adult Pacific lamprey *Lampetra tridentata* passage at Bonneville and The Dalles dams.

B. Objectives - 2008

1. Use analysis of video at fish counting stations to more accurately estimate nighttime passage of adult Pacific lampreys at Bonneville and The Dalles Dams.
2. Combine nighttime, daytime, LPS counts and detections from radio and HD PIT sites to determine the best methods to estimate true passage of adult Pacific lamprey at Bonneville and The Dalles dams.

C. Methods

We propose to use digital video at fish counting stations to determine nighttime passage of adult Pacific lamprey at Bonneville and The Dalles dams. To estimate the true numbers of lamprey passing at each dam, nighttime counts will be combined with day counts and with numbers of lamprey counted past lamprey passage structures (LPS) (Bonneville Dam only). Records from ongoing studies using radiotelemetry and half-duplex passive integrated transponder (HD PIT) monitoring will also be used to evaluate passage timing and use of other passage routes (i.e. closed Cascades Island fishway exit). These data sources will be combined and analyzed to determine the best method to estimate true escapement at these two dams.

D. Relevance

A petition to list Pacific lamprey as a federally-endangered or threatened species was submitted in 2002 to the U.S. Fish and Wildlife Service. Although not approved at that time, current downward trends in numbers returning to the Pacific Northwest, especially for interior populations, suggest aggressive management is needed to prevent a population collapse. So far in 2007, adult lamprey abundance counted at Columbia River dams have been the lowest recorded in recent time. Improving lamprey passage at Columbia River hydropower dams was identified as the highest priority for lamprey recovery by the Columbia Basin Pacific Lamprey Technical Workgroup (a subgroup of the CBFWA Anadromous Fish Committee). However, a true estimate of lamprey escapement to the Columbia River and through the Federal Columbia River Power System (FCRPS) is critical to understanding current status of these populations and in developing and assessing effective management actions. This project will address concerns raised by tribal agencies (Close et al. 2002), the U. S. Army Corps of Engineers, and the Northwest Power Planning Council in section 7.5F of the 1994 Columbia River Basin Fish and Wildlife Program, related to effects of FCRPS projects on passage of Pacific lamprey in the Columbia and Snake rivers.

Project Description

A. Background

Pacific lampreys are anadromous and some adults must pass up to eight or nine dams and reservoirs to reach spawning areas historically used by the species: up to four dams in the lower Columbia, five in the mid Columbia, and four in the Snake (Close et al. 1995). While much is not known about the ecology and status of Pacific lamprey in the Columbia River, it is believed that populations are in decline. Declines may be most dramatic for interior populations such as in the middle Snake River where only 38 adult lamprey were counted at Lower Granite Dam in 2006 (See Figure 1). Evidence for declining lamprey numbers comes from several sources including anecdotal information of low numbers of adult and juvenile salmon observed at various locations (dams, spawning streams, weirs and irrigation screens, and the like) and counts of adults at dams. The latter is possibly the most relied on source as it provides a quantitative estimate of escapement that can be tracked among dams through the FCRPS. However, early radiotelemetry studies in the lower Columbia River confirmed that adult lamprey were primarily nocturnal in nature while in and near fishways (Moser et al. 2002a; 2002b). This makes it difficult to interpret count data when attempting to assess population status, which is a critical piece of information to determine when populations are at risk and need protection and when trying to evaluate the efficacy of management actions. The situation is confounded because there is evidence that counts may inconsistent between

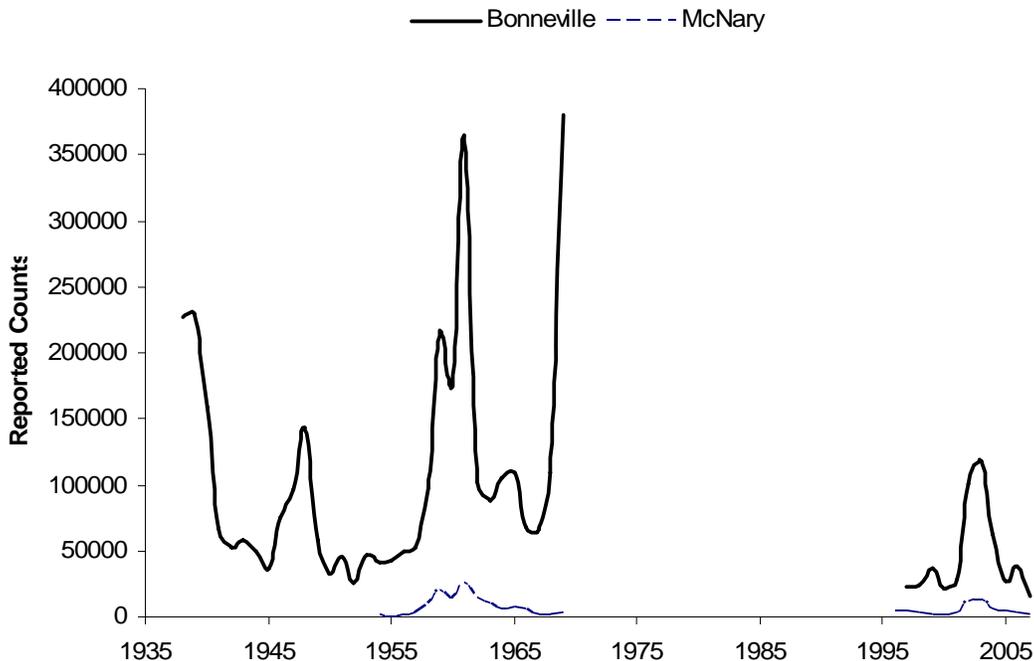


Figure 1. Counts of Pacific lamprey reported for Bonneville and McNary dams. Counts were not made 1970 to 1995. Source: USACE Annual Fish Passage Reports.

dams. For example for the past ten years, conversion of annual lamprey counts (upstream count divided by downstream count) averaged 0.28 between Bonneville and The Dalles, 0.95 between The Dalles and John Day dams, and 0.38 between John Day and McNary dams (Figure 2). These conversions may be misleading however, since annual counts reported for John Day Dam can be higher than those at The Dalles Dam during some years. During 2006, using an HD PIT system for the first time, conversion of lamprey between the lower Columbia River dams was estimated to be about 68% between Bonneville and The Dalles dams and between The Dalles and John Day dams, but only 21% between John Day and McNary projects (Daigle et al. *Draft*).

Development of this proposal was prompted by requests for preliminary proposals issued by the COE in June of 1994 and subsequent years, and it addresses concerns raised by the USACE, the Northwest Power and Conservation Council in section 7.5F of the 1994 Columbia River Basin Fish and Wildlife Program, and Native American Tribes in this region. This proposal was developed in consultation with the USACE, and in response to the high priority assigned to research on adult passage in the Columbia and Snake rivers by the former Fish Research Needs and Priorities subcommittee of the Fish Passage Development and Evaluation Program, and the current Anadromous Fish Evaluation Program.

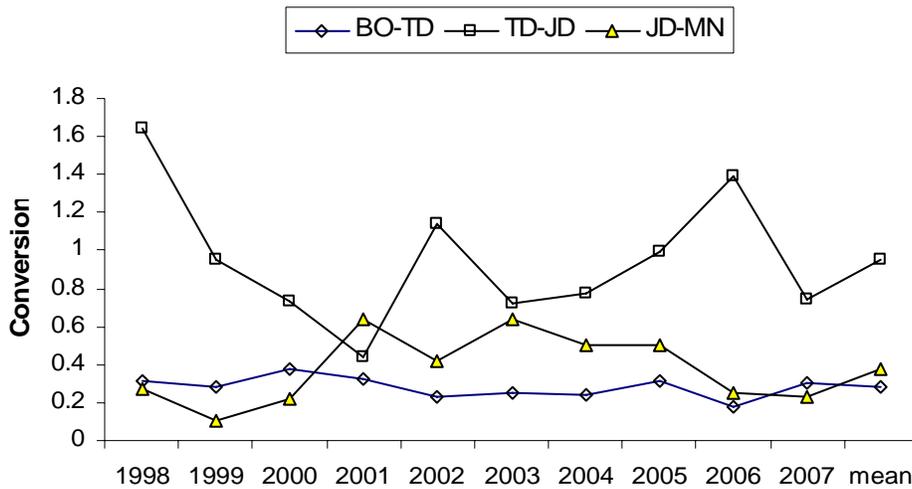


Figure 2. Annual and mean conversions of adult Pacific lamprey between dams of the lower Columbia River, based on day time counts, for past ten years. Source: DART.

For this study we propose to use digital video to determine behavior and net movement for lamprey at the fish count windows at Bonneville and The Dalles dams at night. Nighttime counts will be combined with day counts currently reported at these sites and with the count of lamprey that are passed to the forebay at Bonneville Dam from auxiliary water channels by the lamprey passage structures (LPS) (e.g. Moser et al. 2005, 2006). We will also use estimates of passage that occurs via other routes at the dams, as

observed from past and ongoing radiotelemetry and HD PIT monitoring efforts, to modify passage numbers when appropriate.

B. Objectives - 2008

1. Use analysis of video at fish counting stations to determine nighttime passage of adult Pacific lamprey at Bonneville and The Dalles Dams.
2. Combine nighttime, daytime, LPS counts and detections from radio and HD PIT sites to determine the best methods to estimate true passage of adult Pacific lamprey at Bonneville and The Dalles dams.

C. Methods

Objective 1. Use analysis of video at fish counting stations to determine nighttime passage of adult Pacific lamprey at Bonneville and The Dalles Dams.

In 2007, digital video techniques were compared to identify how to best capture images of lamprey movements past count windows at night. Factors we considered were camera placement, lighting, image quality and frame speed. Filming settings for 2008 will be similar to those we used in 2007. We will explore the availability of newer video recording, archiving, and lighting equipment to determine if improvements can be made in image quality or storage capabilities. For example, newer recorders may have improved video compression techniques that would aide data storage and transferal.

Video recording would occur for 8 hrs per night (2100 to 0500 hrs) 7 days per at the four fishway ladders (two at Bonneville Dam, two at The Dalles Dam). The lamprey migrate from late May until about mid-September in the lower Columbia River (Figure 3). Manual counters will record lamprey movements the remaining 16 hrs of each day. Each video digital recorder (VDR) stores images directly to changeable hard drives that can operate for two to three weeks before filling. VDR's will be checked by UI staff at regular intervals to assure that equipment is functioning properly, and switch out hard drives when needed. We will also work with fish counting staff to alert us if they observe problems with VDR equipment and operation.

Filled hard drives will be shipped to the UI campus where staff will transfer the data to our server and burn files to DVD discs. Discs will be viewed to record hourly up- and downstream counts per night so that net nightly counts can be calculated.

Objective 2. Combine nighttime, daytime, LPS counts and detections from radio and HD PIT sites to determine the best methods to estimate true passage of adult Pacific lamprey at Bonneville and The Dalles dams.

Nighttime counts from Objective 1 will be combined with daytime counts and LPS counts (Bonneville only) to determine actual numbers of fish exiting ladders. Data from HD PIT- and radiotelemetry-monitored fish will also be used to estimate the

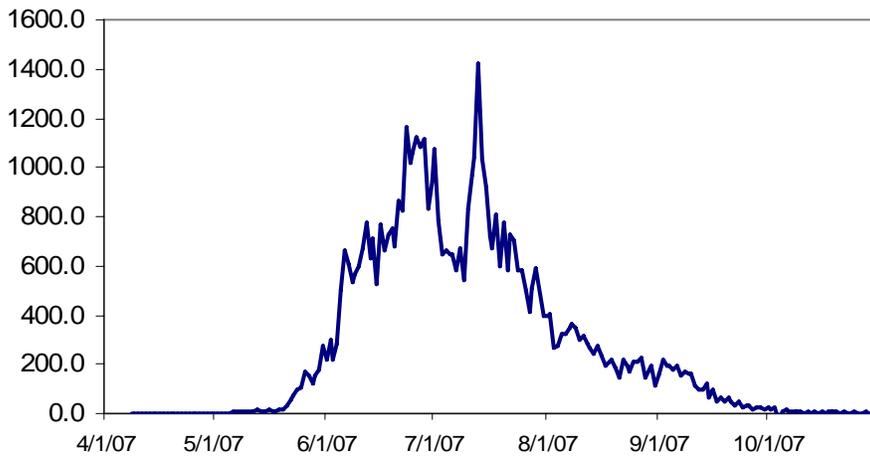


Figure 3. Mean numbers of adult Pacific lamprey counted at Bonneville Dam during 2000 to 2006.

proportion of fish that may pass dams using other routes. For example, some lampreys have been observed in the now-closed Cascade Island fishway exit. Some lamprey may also use navigational locks to pass dams. The HD PIT and telemetry data will be used to determine if a correction factor is needed to adjust passage numbers. We will analyze all data to determine if some index of lamprey passage can be used to estimate actual passage. For example, if it is found that daytime counts are consistently a fixed proportion of overall passage, a simple expansion factor could be used in the future to estimate actual escapement at a dam. Within- and among-year variation will be used to develop confidence intervals on estimators.

D. Facilities and Equipment

Similar video recording equipment used in 2007 will be used for proposed work in 2008. All other equipment (vehicles, computers, etc.) needed for the proposed work will be provided by research agencies on a rental basis.

E. Impacts of study on Corps projects and other activities

Division or district Corps personnel will be needed to provide technical review of research proposed for 2008. We will coordinate video recording placement and operations so as to minimize any potential conflicts with fish counting operations.

Assistance from project personnel will be required as follows:

1. Provide access to fishways at count stations during dewatering periods to potentially modify lighting and structural shape of the count window floors and walls to eliminate blind spots where lamprey could pass without being viewed.
2. Provide access to count stations at Bonneville and The Dalles Dams to install and test video equipment and regularly change out hard drives.
3. Provide power at count stations to operate video recording equipment.

Biological Effects

Work outlined here should have not biological impacts to fish at Bonneville and The Dalles dams.

Key Personnel

Project planning, administration, work plan preparation, study protocols:

Project leaders, C. Peery

Equipment specifications and purchase and software:

D. Joosten, E. Johnson, U of I

Data processing, data analysis and reporting:

C. Peery, E. Johnson, D. Joosten, U of I

Technology Transfer

Information and analyses from this study will be provided regularly to managers via reports and verbal presentations. Information that is appropriate will be published in technical journals. Special efforts will be made to provide information for managers as needed.

References

Close, D. A., M. Fitzpatrick, and H. Li. 2002. The ecological and cultural importance of a species at risk of extinction, Pacific Lamprey. *Fisheries* 27:19-25.

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