



## Independent Scientific Review Panel

for the Northwest Power & Conservation Council  
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**Memorandum (ISRP 2011-15)**

**June 23, 2011**

**To:** Tony Grover, Fish and Wildlife Division Director, Northwest Power and Conservation Council

**From:** Eric Loudenslager, ISRP Chair

**Subject:** Review of CRITFC Accord Project, Tribal Pacific Lamprey Restoration Plan Implementation (2008-524-00) - Tasks under Objectives 2, 3, and 5

### Background

At the Northwest Power and Conservation Council's May 14, 2011 request, the ISRP reviewed a response containing four sub-proposals from the Columbia River Inter-Tribal Fish Commission for the Accord project titled, *Tribal Pacific Lamprey Restoration Plan Implementation (2008-524-00)*. This multi-faceted project has undergone several ISRP reviews. In the ISRP's 2010 review of the full proposal, the ISRP provided specific recommendations on each proposal objective ([ISRP 2010-16](#)). The ISRP recently reviewed and requested a response for Objective 3, Task 3B, Subtask (i) to plan prioritize and implement mainstem juvenile lamprey habitat inventories ([ISRP 2011-12](#)). The review presented here concerns proposal Objective 2 (Action 2.1, Task 2.1D and Subtask (i)), Objective 3 (Action 3.3, Tasks 3.3A and 3.3 B), and Objective 5 (Action 5.1, Task 5.1B). In 2010, the ISRP requested responses on each of these objectives.

The review below is organized by the objectives, tasks, and subtasks used by the proponents in their initial 2010 proposal for the full project. A recommendation and comments are provided for each of the four proposal elements submitted to the ISRP on May 14, 2011. Although the overall proposal has had several reviews and responses, this review is the first time that the ISRP has reviewed these sub-proposals. Consequently, as with any new proposal, response requests are a normal part of the ISRP review.

### **I. Objective 2. Assess and improve mainstem and tributary lamprey passage efficiency and survival.**

**Task 2.1D. Develop juvenile lamprey passage designs to expedite safe, timely and effective juvenile passage through mainstem and tributary barriers.**

**Subtask(i) In collaboration with regional partners and CRITFC Tribes, design new tributary screens for juvenile and adult lamprey.**

***Proposal for research and experimental design of tributary diversion screens for juvenile lampreys in the Columbia River Basin***

In ISRP 2010-16, we commented, “The design and tests of structures and methods should be reviewed by the ISRP before a costly commitment to installation and implementation is approved. In general the objectives would be improved by addition of detailed information, including specific objectives, clear research design, detailed methods, and means for data analysis.” In response, CRITFC provided a proposal for Research and Experimental Design of Tributary Diversion screens for Juvenile lampreys in the Columbia River Basin.

**Recommendation:** Meets Scientific Review Criteria (Qualified)

Qualifications:

1. The final design of many elements of the investigation remains to be determined, in part based on field evaluation and testing during early phases of the research. In year three of this research a progress report summarizing the initial findings and updated design of the remaining research objectives should be prepared and reviewed by the ISRP.

While in general the proponents have provided an improved proposal, uncertainties remain with the proposed work, especially on details of several aspects of methodology and experimental design. The three-year progress report should provide information on:

- Specific methods proposed to estimate entrainment of lamprey;
- Identification of specific screen sites to measure entrainment in the field;
- Types of screens to be tested in the field and laboratory;
- Whether scaled-down versions of screens used in the laboratory adequately represent field screens;
- Sample sizes and associated power tests for the field and laboratory experiments;
- Information on the experimental streams and their similarity to natural streams;
- Methods to detect “delayed mortality” after lamprey have passed through the screens in experiments;
- A follow-up study to determine if altered screen properties intended to protect lamprey migrants are suitable for protection of downstream migrating salmon.

2. This proposal is nearly the same as Objective 7 in project 1994-026-00 (Objective 7), Pacific Lamprey Research and Restoration, reviewed in the RME/Artificial Production Categorical Review. The relationship between this proposal and Objective 7 of 1994-026-00 should be clarified during contracting to ensure cooperation, integration, and avoid unnecessary duplication.

General Comments:

The proposed research is well targeted – screens on irrigation systems could be a factor in the decline of lamprey in the Columbia River Basin, although passage mortality at major dams and

ocean survival are likely important agents as well ([ISAB 2009](#)<sup>1</sup>). The rationale for the work is sound and the project could be worthwhile. The proponents have provided useful additional information about objectives and their research plan. The background information is fairly comprehensive although reference could have been made to the experiments that led to screening criteria for juvenile salmonids (see McMichael *et al.* 2004<sup>2</sup>). The objectives and procedures for both salmon and lamprey share some common elements.

The proponents are to be complimented for accurately acknowledging that modifications to the protocols may be necessary and will be facilitated by working with other interested parties. It appears to the ISRP, however, that more planning and collaboration prior to initiating fieldwork would be beneficial. Significant uncertainties remain with the proposed work, especially for several aspects of methodology and experimental design. Specific methods to estimate entrainment of lamprey, identification of specific screen sites to measure entrainment in the field, types of screens to be tested in the field and laboratory (the proponents propose criteria for selecting screen types), and details of the experimental design for the laboratory experiments are not yet settled upon. The proponents indicate designs will be developed through “discussions with colleagues and review of the literature,” to consider whether scaled-down versions of screens used in the laboratory experiment adequately represent characteristics of screens in the field, and whether devices intended to assess behavior and entrainment of juvenile lampreys will be adequate to accurately estimate these factors. Almost all the statistical tests need more information on how sample sizes were chosen as well as power tests. The proponents propose to resolve these uncertainties and work out more detailed methods and design as part of the research.

The proponents attached an executive summary of a draft manuscript or report outlining results from previous tests of lamprey entrainment that seem similar to those being proposed. It was not clear in the proposal which work elements and objectives in the current proposal are new or whether past experiments will be repeated.

#### Comments on Sub-proposal Objectives:

A. Sub-proposal Objective 1. Document the general passage characteristics of juvenile lampreys over selected screen types in the laboratory.

##### Objective 1, Task 1.1, 1.2 and 1.3

The ISRP requests information to verify that the dimensions of the flume, and that the artificial stream creates/simulates currents and flows similar to those in a natural stream.

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<sup>1</sup> ISAB, 2009. Comments on the draft Tribal Pacific Lamprey Restoration Plan for the Columbia River Basin. ISAB 2009-3. 20 p.

<sup>2</sup> McMichael, G.A., Vucelick, J.A., Abernethy, C.S. and D. A. Neitzel. 2004. Comparing Fish Screen Performance to Physical Design Criteria. *Fisheries* 29:10-16

B. Sub-proposal Objective 2. Estimate the rate of entrainment of juvenile lampreys at various screen sites in the field.

(also Task 1.4) – The proponents propose to use “artificial” lampreys as part of their experiment to assess entrainment. The development of artificial lamprey and their use in field experiments is insufficiently justified in the proposal. No references to the use of artificial lampreys or artificial fish of any type are given. Although ammocoetes are poor swimmers, they could exhibit avoidance behavior, and results from a totally passive artificial fish could be unrealistic. While the proponents propose to design artificial lamprey based on behavior and morphology of live fish, it is unclear if the “behavior” and entrainment of artificial lampreys will actually be compared to that of ammocoetes to demonstrate that they are indeed an adequate model of live fish.

Devices are not yet designed for the screen system entrances to detect lamprey entrainment. While this approach may be necessary for practical reasons it may result in difficulty analyzing the data and drawing appropriate conclusions if different evaluation systems are used with different screen types. Details are not adequate to evaluate the “suite of laboratory experiments” that will be conducted “to help design relevant field experiments.” Nor are the details adequate to evaluate the methods that will be developed to estimate the rate of entrainment in the field. For example, statements such as, “We will release large groups of ammocoetes and macrophthalmia upstream of the stream site ...” do not provide enough detail to allow a critical assessment of the task. Later in the proposal 14 groups (7 control, 7 treatment) of 10 fish each are identified in the protocol without justification for this sample size. An evaluation of whether this may be too many or too few fish for the purposes of this task is necessary. Preliminary experiments may need to be carried out at least once before determining if the sampling design is appropriate.

McMichael et al (2004) used a video system to observe salmonid behavior near screens. This technique should be considered for evaluating lamprey behavior near fish screens.

C. Sub-proposal Objective 3. Document the general passage characteristics of juvenile lampreys experimentally released over screens in the field.

The proponents indicate that they “may” assess post-passage or delayed mortality of lamprey after they have passed the screens. It seems that these measurements would be essential. Twenty-four hours may not be sufficiently long to determine post passage survival. A test should be designed with time as a variable with some fish being held at least a week. A control group that had not been electroshocked should be part of the experiment’s protocols (assuming fish can be caught with alternate methods, e.g. carefully extracting them from the substrate if they are sufficiently abundant for this method).

For the field tests, fish that do not move downstream into the screens will be “gently prodded” to move downstream. The proponents should consider whether reluctance to move downstream into the screens is an important behavioral characteristic that may reduce entrainment.

The Fluorescein protocol used to assess injury incurred while passing screens was developed and tested on teleosts that were descaled and there is the possibility it might not work for lampreys which have a different type of skin. A back-up method might be needed.

D. Sub-proposal Objective 4. Develop velocity and operational criteria for the safe and effective passage of juvenile lampreys at different types of diversion screens in the Columbia River Basin.

The proponents state under this objective: “Based on the results of the work described above, we will develop—if necessary—velocity, design, and operational criteria for the safe and effective passage of juvenile lampreys at a variety of different screen types. We say ‘if necessary’ because part of this project involves testing how well current NOAA-Fisheries criteria for teleosts work for juvenile lampreys. If the current NOAA-Fisheries criteria offer safe and effective passage for juvenile lampreys, then there would be no need to change them.”

These statements suggest a staged approach might be taken by running experiments using the NOAA-Fisheries criteria for teleosts (presumably salmonids) as a starting point rather than a final task. A conflict in goals may exist, however, if hydraulic and operational characteristics of currently employed screens are significant sources of mortality for lamprey. Alterations of screens to prevent lamprey mortality may be inadequate for protection of downstream migrating salmon and steelhead. It seems that a follow-up study may be needed to determine if altered screen properties intended to protect lamprey migrants are suitable for protection of downstream migrating salmon.

## **II. Objective 3. Monitor and evaluate, collect and disseminate information on lamprey population status, life histories and mainstem habitat.**

**Task 3.3A. Fund analysis of existing juvenile and adult genetic samples to optimize suite of DNA and AFLP markers**

**Subtask(i) Analyze existing samples to assist in establishing gene flow trends and temporal vs geographical/spatial differences.**

### ***Assessment of Gene Flow in Pacific lamprey using Microsatellite Markers***

**Recommendation:** Response Requested.

The ISRP requests a final sample design and a more detailed description of how data will be applied to characterize and differentiate Columbia River and West Pacific coast lamprey aggregations.

There are two objectives for this proposal. The ISRP requires a response to clarify elements of both objectives.

For objective 1, “Isolate polymorphic microsatellite markers using Fast Isolation by AFLP Sequences Containing repeats (FIASCO),” the ISRP requests a summary of why this method of identifying microsatellites is being proposed versus others, including having sequences and primers developed by laboratories such as the Savannah River Ecology Lab ([www.srel.edu/microsat/Microsat\\_DNA\\_Development.html](http://www.srel.edu/microsat/Microsat_DNA_Development.html)). The choice of microsatellite development approach should be demonstrated to be efficient and cost effective.

If continuing with the FIASCO work that appears to be in progress is the logical choice, provide a more detailed time frame for developing the 130 candidate sequences identified in the proposal.

For objective 2, estimate levels of genetic diversity and degree of spatial genetic differentiation, and explain in more detail the sample design to assess spatial and temporal genetic differentiation.

The title of the proposal is “Assessment of Gene Flow in Pacific lamprey” and the CRITFC proposal objective 3, task 3.3a, subtask (i) calls for analyzing existing samples to establish gene flow trends. The analysis outlined on page 3 does not include a discussion of estimating gene flow. Additional detail is also needed on the scope of the temporal and spatial analysis that will be possible with the samples available.

### **III. Objective 3. Monitor and evaluate, collect and disseminate information on lamprey population status, life histories and mainstem habitat.**

**Task 3.3A. Fund analysis of existing juvenile and adult genetic samples to optimize suite of DNA and AFLP markers**

**Subtask(ii) Analyze potential for subpopulation gene flow in the Willamette subbasin.**

#### ***Microsatellite analysis on Pacific lamprey from the Willamette Basin proposal for funding***

**Recommendation:** Response Requested

The proposal lacks detail and requires further development. An explanation is required on the status of lamprey microsatellites and the expression and amplification of *Lampetra richardsoni* microsatellites in Pacific lamprey. An explanation is needed of how genetic structure of lamprey can be analyzed to provide insight into distinct migration behaviors and especially location of spawning. The May 4, 2010 version of the CRITFC proposal states: “we propose to contract with M. Docker from University of Manitoba to investigate for the potential relatedness for adults returning to a single subbasin within the Columbia River.” No mention of this goal is provided in the proposal.

The proponent proposes to conduct genetic analysis of adult Willamette lamprey tagged in 2009 and 2010. More detail is needed. How many fish were tagged? Where in the Basin were

the fish tagged? Will the results be compared to other basins within or outside the Columbia Basin? Is the intent to compare genetic structure between tributaries of the Willamette River?

This proposal should demonstrate integration with the proposal “Monitoring the relative abundance of ammocoetes in the Willamette River Basin” submitted by Dr. Carl Schreck. An objective of Dr. Schreck’s proposal is to compare microsatellites from ammocoetes collected from the Willamette with microsatellites collected from adults in 2009 and 2010, presumably the same adult sample that will be analyzed by *Microsatellite analysis on Pacific lamprey from the Willamette Basin proposal for funding*.

Comments for both *Assessment of Gene Flow in Pacific lamprey using Microsatellite Markers* and *Microsatellite analysis on Pacific lamprey from the Willamette Basin proposal for funding*:

In ISRP 2010-16, we requested a separate proposal for Task 3.3A. In response, CRITFC provided two documents: *Assessment of Gene Flow in Pacific lamprey using Microsatellite Markers* (Close proposal) and *Microsatellite Analysis on Pacific Lamprey from the Willamette Basin* (Docker proposal).

The ISRP requires further information on the relationships between the two proposals, and both proposals should demonstrate how they are integrated. There seems to be considerable overlap in methods and samples to be analyzed.

The purpose of the proposed work in both proposals lacks detail concerning study design and benefits to management. The proponents need to provide a more complete justification for this work by explaining more comprehensively how their results will be used in lamprey management. For example, what are the implications of the work for supplementation and reintroduction of lamprey? How will alternate states of the genetic structure of lamprey inform choices in lamprey restoration activities? The proposals should provide updated summaries on what has recently been learned about lamprey genetics, stock structure, and discreteness that is applicable to management.

Some of the rivers where samples are being taken are large (e.g., Willamette, Deschutes, and Yakima). There may be genetic differentiation within these basins and this possibility needs to be incorporated into the sampling and data analysis design. Morphological data such as length of adult lamprey should be obtained from the sampled lamprey to determine if phenotypic differences exist between basins and whether they are correlated with genetic data.

The proponents state “Our goal is to determine whether any genetic variation in microsatellites coincides with distinct migration behaviors and especially location of spawning. Microsatellite analysis will help to clarify the population structure of Pacific lampreys and inform any future management decisions.” The proposal should explain how genetic variation will be used to assess migration behavior and how location of spawning will be determined. Does “location” pertain to the entire river system or to specific locations, such as tributaries, within the system?

The status of microsatellite loci for analysis with Pacific lamprey needs to be clarified. Dr. Close proposes to isolate and develop polymorphic microsatellite markers for lamprey, but Dr. Docker

indicates that her lab has already developed markers (recently published, but not cited in either the Close or Docker proposals: Luzier, C. W., M. F. Docker, and T.A. Whitesel. 2010. Characterization of ten microsatellite loci for western brook lamprey, *Lampetra richardsoni*. Conservation Genetic Resources 2:71-74). Dr. Docker also intends to analyze samples from the Willamette River. It is unclear why Willamette lamprey genetic analysis should be performed simultaneously by two concurrent projects. There appear to be inconsistencies or contradictions between these two proposals, with a seeming lack of close communication between the investigators. These apparent inconsistencies need to be resolved or explained. Both proposals need to demonstrate that they are complementary and without duplication.

#### **IV. Objective 5. Evaluate contaminant accumulation and other water quality impacts on lamprey**

**Task 5.1B. Through funding partnerships with USGS, EPA and others, evaluate juvenile contaminants in 2-3 tributaries in 2010 and expand in future years.**

#### ***Emerging and Legacy Contaminants in Juvenile Pacific Lamprey in the Columbia River Basin***

**Recommendation:** Response Requested

The description of the potential contaminants problems for lampreys is convincing, and the justification for the study is well done. The ISRP was pleased to see more formal partnerships established and proposed sampling of lampreys for contaminants analysis.

The proponents have described a reconnaissance-level activity, writing a report documenting their findings, and planning for future collaboration as parts of this three year project. However, it is not clear that the intensity of work as described and the resulting products should take three years to complete. The series of activities over the two to three-year period should be better described. As well, the original ISRP request for more detail is still needed including: study design, sampling procedures, specific locations for collections, number of samples from each river, application of data, and statistical design for data analysis. It may be important to sample enough individuals to get a statistically valid relationship between contaminant load and body size. As mapped out (Figure 1) this study seems to only deal with the Upper Columbia Basin, and then only in general terms with regard to sampling locations and sample numbers.

With regard to PBDEs, pharmaceuticals and personal care products, it would seem logical to evaluate “some” worst case situations (e.g., downstream of wastewater treatment plants) in this initial evaluation. To include some potentially worst case sampling locations may require additional project-specific sampling conducted by the proponents or their cooperators. Quality assurance aspects and compositing of samples seems to be covered adequately. The list of contaminants to be analyzed should be made available.

The introduction states adult lampreys have high PCBs based upon a personal communication, but that is a relative statement and it is not clear what comparison is being made—high compared to what? This study deals with juvenile lamprey, and depending upon locations where samples are collected (e.g., agricultural areas), it could also involve possible exposure to



modern pesticides. Pesticide use data and Wastewater Treatment Plant discharge data, along with river flow, from the Columbia Basin is available based upon USGS information and should be considered in the design and evaluation.

The proponents suggest that the greatest effect of contaminants will be on migrating and reproducing adults that are metabolizing lipid stores where contaminants are most likely to accumulate, rather than acquiring contaminants through actively eating. However, the project description indicates that sampling adult migrants will not be done because of their low abundance in the Columbia Basin. If the proposed work is a pilot effort to determine if contaminants bioaccumulate in lamprey, it would seem reasonable to sample several life stages (different size juveniles and the adults) with the higher contaminants likely to be detected in adults. However, the ISRP believes that it would not be totally unexpected if the older juveniles from freshwater were more contaminated than the adults returning from the ocean. Are adult numbers really so low that some samples cannot be taken? Would it be possible to obtain tissue samples from the lamprey fishery at Willamette Falls? Also, can effects be forecast from body burdens? Perhaps a more balanced approach with bioassays or laboratory work might be appropriate at this stage. These concepts could be better developed/described for a 2- to 3-year effort.

In objective 2 the proponents propose to prepare an “interpretive product” that will aid in understanding the potential threat of contaminants to lamprey. It is unclear what is meant by an “interpretive product.” Is this a report providing data analyses and interpretation of the findings?