August 21, 2002

DON'T SAY IT…WRITE IT !!!!

To: ISRP Review Team
From: Dennis Dauble-PNNL

The purpose of this DSI is to respond to comments of the Independent Scientific Review Panel (ISRP) on project 35006, Use of mainstem habitats by juvenile Pacific lamprey, (*Lampetra tridentata*). This project received a designation of "fundable" during the recent Mainstem and Systemwide Preliminary Review process.

The focus of the ISRP comments was for more methodological detail. To address these comments, I list each question and provide a response.

• **What specific habitat criteria will be used to classify habitats as having high, medium, and low potential for lamprey rearing and spawning?**
We will use substrate size data from studies in the Umatilla River by the CTUIR and from our observations in the Hanford Reach and Lower Granite Dam tailrace as a starting point in our sampling design. In brief, rearing habitats are characterized as porous bed material, typically with dominate substrate <5 cm diameter. Low potential habitat are considered to be armored shorelines (e.g., basalt) and Ringold formation or other impermeable bed material. Medium potential is considered to be dominant substrate from 5-30 cm in diameter.

• **How will spawning habitat and its use by adult lamprey be quantified?**
The focus of our study as stated in the proposal is to identify use of mainstem habitats by juvenile lamprey for rearing. Thus, we will look for locations where ammocoetes have settled in the substrate prior to metamorphosis and emergence. The assumption is that adults used nearby habitat for spawning. Searching for and quantifying spawning habitat is beyond the scope of this proposal.

• **How large of an area will be sampled at each sampling site?**
We will assume a sampling site means Hanford Reach for Year 1 and the three tailrace areas for Year 2. The Hanford Reach contains about 350 km of shoreline habitat (includes islands). Based on what we know about mainstem habitat used by juvenile lamprey for rearing, we estimate ~20% of this area or 70 km might be high potential for rearing. Thus, 14 km would be surveyed if we subsampled 20% of the habitat. We plan to sample a lower proportion of low and medium potential habitat (e.g., up,to10% of available). This area would be a minimum effort with the actual amount to be based on number of fish collected during initial surveys and amount of medium and low habitat present at each site. Proceeding along the same train of thought, each of the three tailrace areas contains about 30 km of shoreline habitat. The amount of high potential rearing habitat is expected to be somewhat higher for these areas, possibly up to 50% or 45 km

total. Thus, the total amount of shoreline sampled would be similar between years if we subsampled at the same rate for Year 2 as for Year 1.

• **To what water depth will sampling occur?**
Sampling by the backpack shocker will be limited to <1 m depth. We also intend to use a boat shocker to sample depths to approximately 3 m.

• How will abundance be quantified?
Juvenile lamprey abundance will be expressed as both numbers of fish per unit area and number per unit time.sampled within defined habitats.

• **Describe in more detail how ANOVA will be used to assess relationships between habitat and abundance?**
Assuming this study discovers lamprey at a reasonable percentage of sites, a generalized ANOVA/ANCOVA will be used to determine if individual habitat variables, or combinations of variables, have a statistically significant relationship with lamprey abundance. A random-model ANOVA/ANCOVA was selected because many of the habitat variables are qualitative rather than quantitative (e.g., presence/absence of vegetation, bottom type, shoreline configuration). Quantitative independent variables will be entered as quantitative variables in the analysis. This method is typical with ANCOVA, but the regressor is typically not a variable of interest in the usual applications of ANCOVA. The analytical method we will use is functionally equivalent to a regression analysis using dummy variables, and is a simple case of analysis using general linear models.

• **Is a multiple regression approach suitable for defining these relationships**?
We will explore the use of other statistical methods, including multiple regression techniques, for defining these relationships when data becomes available. As noted above, the analytical method we propose to use is functionally equivalent to multiple regression using quantitative independent variables and coding qualitative independent variables as dummy variables. If our assumption regarding finding lamprey at many sites is not met, we will use logistic regression of the habitat variables on the presence or absence of lamprey.

• **Will stratified random sampling be incorporated into the study and, if so, what will be the sampling design?**
Yes, we will incorporate stratified random sampling into the study. We will first categorize the shoreline area as high, medium, and low probability of use for rearing. This will establish the total area to be sampled by habitat type. We will then use aerial photographs and bathymetric data to further segregate each 500 m segment into 50 m units for surveying by electroshocker. Each segment will be given a unique number and surveyed selected randomly with respect to time (two seasons) and space using a random numbers table. The spatial dimensions will then be further divided into 50 m units to obtain greater homogeneity.

• **How will the site-specific information gathered in this work be scaled up or linked to the channel and reach level characteristics such as channel form, gradient, and discharge?**

The first step in our analysis will be to categorize 500 m segments of the four study sites (i.e., Hanford Reach and three tailrace areas) into potential rearing habitat using criteria developed for fall chinook salmon spawning (Battelle and USGS 2000). In brief, the segments must contain >50% unconsolidated sediment, contain channel bars/islands, and have < 0.0005 units in longitudinal gradient. This will result in an initial reach-level classification of potential habitats. We will then use data from both historic-and present-use locations (i.e., those habitat data collected during our surveys of 50 m units) to confirm that the coarse-level classification correctly identifies known rearing locations and adjust the classification scheme, if necessary. The sampling design for individual sampling units will be based on substrate size. This will allow us to "scale up" to the geologic features classication, but with some loss of precision since our measurement scales obviously differ at each level of classification

• **What are the "geologic features" that will be used in the landscape-scale extrapolation?**

Geological attributes to be used include geologic formation, rock type, age, major lithology, and bedrock/unconsolidated classification of the nearest right bank and left bank geologic unit for each 500 m segment (after Battelle and USGS 2000).

• **How will historical habitats be identified?**

Known historical habitats will be identified from additional literature reviews. "Potential" historical use areas will be identified using the habitat categorization approach developed in Year 3 of the study.