Evaluation of potential habitat breaks (PHBs) for use in delineating the upstream extent of fish habitat in forested landscapes in Washington State

Answers to Prospective Six Questions from the CMER / Policy Interaction Framework Document

October 17, 2023

Approved by CMER on: October 24, 2023
Presented by the: Instream Scientific Advisory Group
SAG Co-chair: Jason Walter

Brief Project Description: The purpose of this study is to develop criteria for accurately identifying PHBs and to evaluate the utility of PHB criteria for use in the Fish Habitat Assessment Methodology (FHAM) as part of a water typing rule. The study is designed to assess which combinations of gradient, channel width, barriers to migration, and other physical habitat and geomorphic conditions are associated with uppermost detected fish locations. This will 1) inform which Board-identified PHB criteria most accurately identify the upstream extent of fish habitat in an objective and repeatable manner as applied in the FHAM and 2) evaluate whether an alternative set or combination of empirically derived criteria more accurately achieves this goal (CMER 2020). Additionally, this study is intended to provide insight into how uppermost detected fish points, upstream extent of fish habitat based on FHAM, and PHBs proposed by the Washington Forest Practice Board may vary across geography, seasons, and years. The Board is expected to use the study findings to inform which PHB criteria to use in FHAM.

1. **Will the study inform a rule, numeric target, Performance Target, or Resource Objective?**
   Yes, this study will inform WAC 222-16 Water Typing Rules.

2. **Will the study inform the Forest Practices Rules, the Forest Practices Board Manual guidelines, or Schedules L-1 or L-2?**

   Yes, this study will inform WAC 222-16 Water Typing Rules and related Forest Practices Board Manual 23 guidelines but will not directly inform Schedules L-1 or L-2 (Appendix N, FP HCP 2006).

   The study will also address the following water typing critical questions from the CMER Work Plan:
   - CQ 1. How can the line demarcating fish- and non-fish habitat waters be accurately identified?
   - CQ 2. To what extent does the current water typing survey window capture seasonal and annual variability in fish distribution considering potential geographic differences?
   - CQ 3. How do different fish species use seasonal habitats (timing, frequency, duration)?
   - CQ 4. How does the upstream extent of fish use at individual sites vary seasonally and

annually?

- CQ 5. How does the delineation of the upstream extent of fish habitat change seasonally?

The study addresses one of the two CMER Work Plan resource objectives related to water typing (not in Schedules L-1 or L-2):

- "Streams and their associated wetlands should be typed to include fish habitat. Fish habitat is defined in the forest practices rules to mean 'habitat, which is used by fish at any life stage at any time of the year, including potential habitat likely to be used by fish, which could be recovered by restoration or management, and including off-channel habitat.'"
- The second resource objective and the performance target listed in the CMER Work Plan are related only to the modeling and mapping and are outside of the scope of this project.

3. Will the study be carried out pursuant to CMER scientific protocols (i.e., study design, peer review)?

Yes. At the request of CMER, the task of developing the study design was assigned to ISAG. The study design was then developed by a project team within ISAG. The study design was approved by CMER and through the Independent Scientific Peer Review process of the Adaptive Management Program (AMP). The final report will go through the same review and approval process as specified by the AMP.

4a. What will the study tell us?

As a stand-alone project, and in conjunction with the companion DPC study, the PHBs study will provide answers to several CMER Workplan critical questions and to more detailed research questions.

This PHB study will 1) inform which Board-identified PHB criteria most accurately identify the upstream extent of fish habitat in an objective and repeatable manner as applied in the Fish Habitat Assessment Methodology (FHAM) and 2) evaluate whether an alternative set or combination of empirically derived criteria more accurately achieves this goal (CMER 2020). Additionally, this study is intended to provide insight into how uppermost detected fish points, upstream extent of fish habitat based on FHAM, and PHBs proposed by the Washington Forest Practice Board may vary across geography, seasons, and years. The Board is expected to use the study findings to inform which PHB criteria to use in FHAM. The FHAM will utilize PHBs that reflect a measurable change in the physical stream characteristics at or upstream from a detected fish point, above which a protocol electrofishing survey would be undertaken. The first PHB located at or upstream from the uppermost detected fish would serve as the end of fish habitat (F/N Break) when no fish are detected above this PHB.

The study is designed to address the water typing critical questions listed in our response to Question 2 above, in addition to the following project research questions:

UPSTREAM-MOST FISH LOCATIONS

1. How do the locations of the last (uppermost) detected fish vary interannually?

2. How do the locations of the last (uppermost) detected fish vary seasonally?
3. How do the locations of last (uppermost) detected fish vary geographically across the state of Washington?

HABITAT ASSOCIATED WITH UPSTREAM-MOST FISH LOCATIONS

4. How do the physical channel and basin characteristics (e.g., bankfull width; average gradient, basin size) associated with the identified end (upstream extent) of fish habitat vary geographically across the state of Washington?
5. Where the location of the last (uppermost) detected fish changes (seasonally or interannually), how does that influence which PHB would be associated with the F/N break and how frequently does that occur?
6. How do the physical channel features at the locations initially identified as PHBs change over the course of the study?
7. How often do similar features appear to limit upstream fish distributions in some contexts but not others (e.g., further into the headwaters vs. downstream; different flow levels)?

PHB PERFORMANCE ANALYSES

8. Which combinations of physical channel features and basin characteristics (for example, gradient, channel width, barriers to migration) best identify the end of fish habitat relative to the location of the last (uppermost) detected fish?
9. Can protocols used to describe PHBs be consistently applied among survey crews and be expected to provide similar results in practice?
10. How well do the PHB criteria provided by the Washington Forest Practices Board accurately identify the EOF habitat when applied in the Fish Habitat Assessment Methodology (FHAM)?

4b. What will the study not tell us?

This study is not intended to evaluate the current water typing system or the FHAM; nor is it intended to describe how the regulatory Type F/N break should be determined. PHBs are defined in FHAM as permanent, distinct, and measurable changes to in-channel physical characteristics. Other factors such as temperature, flow, water quality, population dynamics, anthropogenic and natural disturbance, and biological interactions are important covariates that might influence the distribution of fishes but do not affect PHBs. Therefore, they are not being evaluated in this study.

This study does not address longer-term changes (>3 years) in small streams that may render them unsuitable for fish occupancy, or conversely, may render previously unsuitable streams habitable for fish. At any point in time, some headwater streams are not used by fish during any season of the year due to a blockage, to invasion, or to unfavorable physical conditions (e.g., gradient) in the channel itself. Factors that determine whether small streams can be used by fish are typically related to disturbances such as exceptionally high discharge, landslides, debris flows, and windstorms. Such episodic disturbances are erratic and can be widely spaced in time (decades to centuries), but their overall effect in drainage systems is to create a mosaic of streams suitable for fish occupancy that changes over long intervals (often hundreds of years) in response to local disturbance regimes (Kershner et al. 2018; Penaluna et al. 2018). An

important implication of the notion that the potential use of small tributaries by fish can change over time is that while some stream segments are not now occupied by fish, there is no guarantee that they may not become suitable in the future, or that those which are currently habitable will always remain so. This study, however, does not address the expansion and contraction of fish habitat over long time intervals, because the sample time is limited to three years and the methods cannot predict with certainty where and in what form large disturbances capable of transforming a stream segment's ability to support fish will occur.

While there are likely to be differences among ecoregions in where the fish and barriers to movement occur on the landscape – identifying those spatial patterns of occurrence is not the purpose of the PHB study.

The PHB study is not intended to evaluate the Anadromous Fish Floor (AFF) or Default Physical Characteristics (DPC). These components of the AMP Water Typing Strategy will be addressed in separate studies.

5. What is the relationship between this study and any others that may be planned, underway, or recently completed?

The PHB Study is part of the AMP Water Typing Strategy (CMER 2020), which also includes DPC, LiDAR-based modeling and mapping, and eDNA (see first four bullets below). As of August 2023, AFF was also assigned to CMER/ISAG (final bullet below).

- Implementation of the PHB study will occur simultaneously with that of the DPC study in order to take advantage of their shared elements (e.g., sample sites, upstream extent of fish distribution information). The PHB and DPC studies will maintain separate and focused analyses designed to accomplish discrete study objectives and answer project-related critical questions in the CMER work plan.

- Implementation of the LiDAR model study has been postponed until after completion of the DPC and PHB studies and the development of a statewide LiDAR derived stream network.

- The data from the PHB and DPC studies would likely be used in the development of the map-based LiDAR model.

- The PHB project team explored ways to include further eDNA components into this study design. The team determined that the best option would be to recommend that an additional complementary study is developed by the AMP that utilizes the sample sites and the fish location data that are collected in this study.

- While not included in the current AMP Water Typing Strategy, the AFF is a potentially complementary study for which CMER approved the Policy recommendation to the Board to delegate the study to ISAG on the science track, consistent with the AMP process. CMER approved Policy's recommendation to forward to the Board to add this project to the AMP Water Typing Strategy and the Master Project Schedule.

6. What is the scientific basis that underlies the rule, numeric target, performance target, or resource objective that the study will inform? How much of an incremental gain in understanding will the study results represent?

The current water typing rule was based on a general understanding in the mid-1990s founded on strong empirical evidence that the water type definitions and rules in effect at that time were not resulting in accurate identification or adequate protection of a satisfactory fraction of known fish use areas. Concerns were further substantiated by a large assemblage of field data gathered, contributed, and analyzed by TFW stakeholders including WA DNR, WDFW, tribes from both sides of the Cascades, industrial forest landowners, and Washington Trout, with some of this work conducted under state and/or federal grants (see for example, Light 1997). In response to those concerns illuminated by that new information, the Forest Practices Board adopted emergency rules in 1996 that included revisions to the default definition of Type 3 (now Type F, i.e., fish bearing) waters. Provisions were made in rule allowing protocol electrofishing surveys as an alternative to use of the default physical criteria.

Current water typing protocol surveys depend in part on guidance provided by Board Manual Section 13. The Board Manual guidance for delineating the end of fish habitat relies to some degree on best professional judgement, which is subjective. PHBs would provide measurable a priori decision criteria for establishing end of fish habitat relative to the location of last fish in a way that would be implementable, repeatable, and enforceable.

While the dataset used in development of the emergency rules was extensive, not all the data were gathered consistently using the same methods or standards. This PHB study, in conjunction with the companion Default Physical Criteria (DPC) study, will use standardized methods to generate a data set that is significantly more robust and statistically powerful by using a spatially balanced random sample of adequate size and superior geographic coverage to that afforded by the earlier efforts. Careful and rigorous analysis of the data and the resulting reports will offer substantial insights on relationships of fish with the geophysical template of their habitats, including factors limiting their upstream movements and upstream limits of their distribution. Those factors include the constituent metrics used to construct both the potential habitat breaks (PHBs) and the default physical criteria (DPC).

The findings of this study will result in a substantial gain in understanding and the reduction in uncertainty about our knowledge of fish-habitat relationships. The sample frame and sampling scheme to be used (all FFR lands statewide) will improve the scope of inference for the results of this study relative to earlier data collection and analysis efforts that led to the current rule.

References

CMER. 2020. CMER Strategy for completing Water Typing Study Designs. Memo to the Forest Practices Board, May 1, 2020. Delivered to and approved by the Washington Forest Practices Board May 13, 2020. File "bc_fpb_wtstrategy_20200513.pdf" in Board meeting materials for May 13, 2020 meeting.

Kershner, J. L., P. A. Bisson, P. C. Trotter, P. Roni, R. K. Timm, J. Maroney, K. Ross, H. Berge. 2018. A review of the role of small tributary streams as salmonid habitat. Report prepared for the Washington Forest Practices Board. Olympia, Washington.

Light, J. 1997. Use of Drainage Area and Channel Gradient to Determine the Upper Limit of Salmonid Fish Distribution. Plum Creek Timber Company, L.P.

Penaluna, B. E., G. H. Reeves, C. Z. Barnett, P. A. Bisson, J. M. Buffington, C. A. Dolloff, R. L. Flitcroft, C. H. Luce, K. H. Nislow, J. D. Rothlisberger, M. L. Warren. 2018. Using natural disturbance and portfolio concepts to guide aquatic–riparian ecosystem management. Fisheries 43(9):406-422.