
MEMORANDUM

Date: February 23, 2017

To: Hans Berge, Adaptive Management Program Administrator, Forest Practices Division
Washington Department of Natural Resources

From: Phil Roni, Principal Scientist; Ray Timm, Senior Scientist, Watershed Sciences Lab,
Cramer Fish Sciences; and Pete Bisson, Aquatic Biologist, Bisson Aquatic Consulting LLC

Subject: Review of Fish Habitat Assessment Water Typing Proposals

Per your request, a team of scientists was convened to review the four fish habitat assessment water typing proposals. This included proposals from Conservation Caucus, Eastside Tribal Caucus, Weyerhaeuser (Weyco), and Washington Department of Fish and Wildlife (WDFW). As requested, we also reviewed the guidance document provide by the Fish Habitat Assessment Technical Working Group (TWG) (memo dated 5 October 2016). The review team consisted of Drs. Peter Bisson, Raymond Timm and Philip Roni (Chair). All of the reviewers have more than 25 years of experience as scientists working on fish habitat and forestry issues.

The goals of our review were to:

- review and score proposals to determine if they were adequate address objectives of Fish Habitat in 222-16-10 to identify break between Type F and N waters;
- provide recommendations for improving the proposals or the top proposal; or
- if appropriate, propose another alternative method.

Our initial approach included four components:

- 1) reviewing proposals,
- 2) developing criteria to objectively compare them,
- 3) providing a specific summary of strengths and weaknesses of each proposal, and
- 4) providing overall recommendations.

1. Review of proposals

Upon initial review of the proposals, it became clear that these were not traditional proposals that included an introduction, background, objectives, methodologies, and consistent supporting documentation. While all the proposals presented potentially useful approaches, they varied greatly in format, detail, and justification. This made objective review, comparison, and ranking of them difficult. Unfortunately, none of them provided enough detail to determine if they were feasible or could be easily operationalized. Thus, the review team unanimously agreed that all of the proposals were incomplete, could not be scored or ranked based on information provided, and

were not ready for a formal review. Therefore, the team focused on outlining the major components that each proposal needs to facilitate an objective review in the near future.

2. *Criteria for review*

Because the proposals were incomplete, we focused on outlining general and specific components each proposal must contain to be complete and ready for a formal and objective review. In general, all proposals need to be written more like traditional proposals with background, problem statement, approach and methods. Moreover, they should outline objective, measurable, and practical protocols. By objective, we mean the protocol should rely on data where available and avoid opinion-based metrics that rely on subjective judgment wherever possible. Inferences about the effects of a site attribute on fish presence or absence should be based on available science and associated with a specified level of certainty. The protocol should use criteria that are clearly measurable and reproducible to the greatest extent possible. Criteria should be practical in that they rely on measurements and assessments that are reasonably obtained without numerous site visits and/or very expensive measurement techniques.

After reviewing both the background information and documents (e.g., 222-016-10, interim rule (WAC222-16-031), Board Manual Section 13, and TWG Memo), we created a list of the key factors that each proposal should address (Table 1). That is not to say that each proposal needs to include criteria for each of these, but that they discuss how they will address or considered each of these.

Table 1. List of key components and issues that each proposal should address. Some issues (e.g., water quality, other biotic factors) may or may not be part of protocol, but proposal should describe how they were incorporated or why they are not part of protocol.

Proposals Should Include or Describe	Explanatory Notes
Background, problem statement and supporting info	Adequate background and supporting information is needed to assess the appropriateness and feasibility of the proposed protocol.
Decision tree/matrix/step-wise process	A decision tree, matrix or similar figure diagraming the approach should be provided. This can be achieved with a decision tree or structured matrix, but the steps should be logical with clearly defined outcomes.
Clear protocol and methods	This can be achieved in part with a decision tree or structured matrix, but the steps should be logical with clearly defined outcomes and the methods described
Repeatability	Address the repeatability of the protocol. Has it been tested or does it need to be tested?
Permanent natural barrier	Criteria for determining a complete barrier (e.g., vertical drop, water velocity at low flow) should be specified and related to species of interest. This should include any permanent landscape feature where a vertical water drop or water velocity will preclude upstream fish passage at any stage of the life cycle.

Deformable and manmade barriers	Proposal should describe how manmade barriers and deformable natural barriers will be addressed. (Both log jams and culverts should be considered transitory from a fish passage standpoint).
Habitat disturbance	How would any obvious signs in the stream channel or riparian zone of recent natural or anthropogenic disturbances influence the protocol? This could include debris flows, wildfire, windstorms, grazing, drought, etc.
Drought	How would a formally recognize drought affect the type F or N determination?
Flow, dry reaches, ephemeral streams	How will flow be incorporated? This includes a determination of whether continuous surface flow exists at the site, or if there are documented instances of the channel becoming intermittent or dry in the past.
Incorporates gradient	Incorporates gradient and describes distance over which it is measured.
Morphology	How is channel morphology addressed? This includes bankfull width, depth, channel type, pool frequency, confinement etc.
Other biotic factors	Does it consider other ecological factors (e.g., amphibians, invertebrates, wetland plants, etc.) or species that might indicate suitable habitat for fish? An explanation of how or why or why not should be included.
Water quality (including Temperature)	Does it incorporate any water quality issues that might influence fish distribution or fish habitat? Why or why not?
Season	How does it incorporate seasonality of fish use or potential fish habitat?
Ecoregion (East W. vs West. WA etc.)	Will the method change depending upon region? How will it differ based on East vs. West side, Omernik or other ecoregions?
Recoverable fish habitat	How does methodology consider habitat that could become suitable in future?
Depressed fish stocks	How will depressed fish stocks/critical habitat be considered in determining break between Type F and N waters?
Considers Climate Change?	How does the proposed protocol address future changes in Type F/N due to climate-driven weather?

3. *Specific Strengths and Weaknesses of Proposals*

To assist with developing complete proposals and facilitate review and selection of an appropriate protocol to replace the interim rule, we provided specific comments on the strengths and weaknesses of each proposal. These are a compilation of individual comments by the three reviewers for each of the four proposals. We did not consider the recent TWG Memo as a proposal, but rather as background that helps clarify what each proposal should address and describe.

Conservation Caucus (Physicals Plus)

Strengths

- Starts with concept that if it's not impossible for a fish to get to a place, or persist in it, then it is habitat.
- Explicitly highlights efforts to decrease electrofishing.
- Extensive background and well-developed rationale.
- Protocol follows criteria that are familiar and already adopted in the rule.
- The approach is clearly spelled out. The Figure 2 decision pathway provides branching points that are objective, measurable, and for the most part not based on subjective judgment. I felt this one was the most straightforward of the proposals we reviewed in terms of following the decision pathway of the approach.
- The protocol is relatively simple and should be able to be implemented without extensive additional training of survey crews, although the criteria for what constitutes a permanent natural barrier need to be precisely defined to avoid confusion in the field.
- The protocol does allow for ID team assistance in the event an F/N break is in dispute.
- By relying solely on the default physical criteria to define potential or recoverable fish habitat, this protocol likely provides the most conservative approach to establishing the F/N break, i.e., the F/N break is likely to extend further upstream using these criteria than it would in the other proposals. This may be considered a strength or weakness depending on the level of risk of placing the break point in an incorrect location relative to the actual position of the last fish. In some cases the approach will overestimate the upstream extent of fish occupancy

Weaknesses

- The approach takes a very simple one-size-fits-all approach to defining habitat. If a stream meets the default physical criteria [2' channel width and 16% grade over 500ft (<50 acre basin area); or 2' BFW x 20% grade over 500ft (>50 acre basin area)] the channel is considered potentially inhabitable by fish. A number of other site attributes such as flow regime, disturbance history, and the number and type of transitory barriers in or near the site are excluded from consideration.
- They make the claim that training and certification make the protocol repeatable, accurate, balanced, cost-effective, and immediately implementable – there is no discussion of how they will demonstrate that.
- The protocol does not consider the possibility that the interim F/N break could be above an unknown permanent natural barrier and therefore is currently inaccurate. This could result

in identifying an incorrect F/N break and possibly even extending the Type F boundary upstream from where the actual F/N break is located.

- Under “Rationale, Item 1.b.” it is stated that there is low confidence in the existing water typing process and a more complicated FHAM would worsen the problem. Without additional data and information, it is not clear what this means. Is the current rule already too complex to be usable? What is the evidence that the existing approach leads to a systematic bias for either over- or underestimating the F/N break? As it stands, the statement implies that any new protocol that adds more considerations to determining the F/N break would result in decreased accuracy (“worsen the problem”), but there is little evidence presented to support this suggestion.
- Surface flow should not be ignored in the “physicals” criteria. Some Washington streams have well defined channels but have no surface flow part of the hydrologic year, but otherwise meet the gradient and width criteria for Type F. These streams may just be too dry to support fish, and when surface flow does occur fish may not have access to them. The only exception is when there are springs, small ponds, or significant seeps upstream that can harbor fish year-round and act as refugia from which fish can move into ephemeral channels when wet.
- Environmental DNA (eDNA) is mentioned as a potential method for determining upstream presence or absence. While this method holds great promise in the future, it should not yet become a formal part of the protocol until the genetic catalog upon which it is based is further expanded and the risk of eDNA detection error in streams with very few fish is better understood.
- The concept of permanent natural barrier (PNB) has not yet been established with sufficient accuracy and precision by WDFW to be completely workable in the field. The current criteria for PNB were developed in the 1990s and have not to our knowledge been published in peer-reviewed literature. The jumping ability and burst swimming speeds of salmonids vary by species and fish size. Even for a common species like cutthroat trout, we are not aware of any study that has systematically controlled both vertical waterfall height and water velocity in a way that enables prediction with 95% certainty that a waterfall or chute with a certain set of properties is a barrier, while another waterfall or chute with similar but slightly different properties is not. Until a scientific consensus forms around what specific attributes a PNB should have, there will be a potential for differences in interpretation when conducting field work. However, if CMER is able to reach agreement on what properties constitute a valid PNB backed by scientific review, then this concern disappears. We urge the TWG to continue working toward a mutually agreeable, scientifically-based PNB definition.
- Does not clearly define a stepwise approach that could be implemented.
- States that the approach addresses many key issues (e.g., drought, electrofishing, man-made barriers, seasonality of fish use, survey timing, recoverable habitat, depressed stocks), but provides no clear description of how it will do this.

Eastside Tribal Caucus

Strengths

- Does not deviate greatly from existing interim methods, so will not require extensive re-training.
- Contains “concessions”, although it is not completely clear what is being compromised or what the effects on determining the F/N break will be. On one hand, a concession might increase the likely of a protocol being acceptable to all sides, but on the other hand a concession might not get us any closer to determining the best method of establishing real F/N break.
- Good background paragraph. Simple step-wise approach.
- Both Step 2 and Step 3 are clear and provide measurable targets that can easily be replicated in the field. If it were fleshed out more completely, it would lend itself nicely to a decision tree type of graphic.

Weaknesses

- Protocol is simple, not clearly defined, and little or no justification provided. Not written like a proposal.
- Inadequately supported from a scientific standpoint.
- Utilizes a one-size-fits-all approach with no clear methods for tailoring the F/N determination to a local setting. Although it was developed by a caucus from eastern Washington the proposal could be taken to imply that the protocol is applicable to both sides of the state.
- Does not mention the use of ID teams.
- Appears to rely solely on physical channel properties – bankfull width and gradient – for determining potential fish habitat and ignores other categories of factors that could be important.
- No longitudinal boundaries (length of channel) are given for parameters such as channel width. Does this proposal suggest that the F/N break will occur wherever the channel width is less than 2 ft. or does the 2 ft. width threshold apply to an average width over a given channel distance?
- “Table 9” (only figure in the proposal) gives WDFW fish passage thresholds for large anadromous adult salmonids and is not applicable to resident trout in very small headwater

streams. The SSHEAR report and Milo Bell’s work cited in the proposal focused on adult salmon and steelhead migration barriers.

- Units are inconsistent (ft. and m).

Weyco (Industry Caucus)

Strengths

- Helpful Objectives and Background sections explaining the need to establish a more accurate F/N break and improve the accuracy of the Type F and Type N maps.
- The proposal does a reasonably good job of spelling out assumptions.
- Extensive use of data to justify the approach and quantify error
- The proposed protocol (pages 9-10) is clearly outlined, as long as the operational definition of habitat “node” is accepted by all parties. This approach seems promising and repeatable. However, if the operational definition of node is not widely accepted, there could be differences in survey result interpretation.

Weaknesses

- Suggests habitat data alone are not good indicators.
- Methodology is only briefly outlined – stepwise approach needs more detail.
- What is a node? It is a very specific thing in spatial data. Not clear what they mean by it.
- There are a lot of words in this proposal and it’s still not clear to me what they are proposing. The whole thing seems long on literature review and discussion and short on methods. Where they do present methods (page 9), important detail is lacking. This is important because it potentially impacts transferability of the approach among practitioners (i.e. some of the GIS methods need more detail).
- With reference to the 1,408 surveys, it is not clear why “the model-based F/N break points were not adopted in a rule as was anticipated in 2005” and why “the FPB elected to continue using the interim fish use-based rule (WAC 222-16-031), relying on electrofishing surveys or default physical criteria to determine the extent of Type-F water while work on a permanent model-based solution continued.” What were the deficiencies in the early 2000s surveys that prevented the model from being incorporated into the rules? It was not clear to us why CMER turned away from its own data. Was the overlap between fish bearing and non-fish bearing streams with respect to gradient and stream size (Fig. 1) too great to provide confidence in the model?

- The statement that “a protocol field survey conducted in a manner consistent with the WAC fish habitat definition will never yield an outcome where the F/N break is downstream from the location of the uppermost detected fish. In contrast, this outcome is not only possible with a model based system, it is an expected and accepted outcome” needs clarification. What is the *acceptable level of risk* of the true F/N break being located upstream from the model’s prediction? Quite often this is a policy, not scientific, question, i.e., how much risk regulatory organizations are willing to accept that an F/N break will be underestimated. Nevertheless, if an argument for a model is to be made, the risk of being wrong (in this case, classifying a stream as Type N when it is a Type F) should be made very clear and specified in quantitative terms, e.g., the model is correct 90% of the time. Actually, a similar comment could be made about the other proposals as well.
- Page 7 – It is not clear what “temporal variability in the upstream extent of fish use typically occurs in a predictable sub-set of streams” means. Does this mean that, on average, a relatively fixed percentage of F/N breaks move up- or downstream each year? If so, what is the evidence for this? There are other confusing statements on this page as well. Some of them may stem from trying to reconcile statements like “...significant gains in accuracy...” with the enormous variability presented in Figure 1.
- Page 8 – The statement that “fish presence/absence above potential barriers can only be verified by field sampling” is true, but potential or recoverable fish habitat can be identified in theory without field surveys if established criteria for potential or recoverable are met, correct?
- Page 11 – It is stated that “an upstream change in the location of the last detected fish greater than 500 feet is rarely observed”. This conclusion was reached after surveys of only two consecutive years and may not hold over much longer periods (multiple decades).
- Page 15 – It is claimed that “Consistent with current practice and guidance, the upper extent of “recoverable” fish habitat may be estimated through interpretation of physical characteristics of stream channels and the potential extent of fish use likely in the absence of anthropogenic or disturbance influences [our emphasis]”. We do not believe this statement is ecologically realistic. Natural disturbances are quite likely over the time period of a commercial forest rotation and anthropogenic disturbances may also happen if the forest is thinned, fertilized, or if forestry-related sedimentation occurs. It seems probable that the extent of potential fish habitat will change over time using the node approach.
- Page 16 – The statement that “Success or failure of the proposed system can then be evaluated by examining the alignment of Type-F habitat extension decisions made at the time of survey against a baseline of measured frequency and extent of temporal variability in fish use” essentially calls for a scientific database we do not currently have. It is not clear how such a baseline database will be developed, or how long it would take. The temporal variability in fish use question will not be easy to solve in practice without well designed long-term studies.

- Page 18 – One year re-surveys aren't enough to answer the question, in our opinion, especially in the highly variable climate in Washington.
- Page 20 – The statement that “Further analysis of available data along with a focused research effort to collect paired fish movement and habitat extension data can support refinement and evaluation of guidance criteria to meet Policy objectives” is another example of the “we need additional research” argument. While this may be quite true it does suggest that the proposed protocol cannot be applied with confidence until such studies are completed.
- Their data suggest not much variability in upstream extent of fish. The Cole et al. (2006) study referenced only compared upper extent of fish distribution in summer between two years.

WDFW

Strengths

- Five-step approach is clearly defined, including quantitative channel properties that form the basis for determining the F/N break. Of the proposals being reviewed, this one contained the most specifics and from a practical standpoint could be applied most consistently across the landscape.
- Sections 6-10 include additional criteria that aren't included in the other protocol proposals, as well as specifying instances where ID team assistance is needed (although some of the factors identified for ID team involvement may not be easily addressed).
- Addresses many of issues outlined in Table 1 and the 18 items in the TWG memo.
- They acknowledged “Other Factors to Consider” – but see weaknesses below,

Weaknesses

- Not written like a proposal, no background or justification for approach provided
- Proposal is insufficiently referenced. Not enough scientific supporting information (papers, reports, etc.) is given.
- The physical criteria in this protocol appear to differ somewhat from the criteria given in some of the other proposals, for example with respect to stream width and permanent natural barrier dimensions on the F/N break. Because there are no references cited for many of the assumptions in the protocol it is difficult to determine the scientific basis for them.

- The critical threshold values for some channel attributes, especially stream gradient, do not specify a length of stream over which they are determined. For example, does the 20% gradient threshold apply to a single point along the channel or does it apply to an average gradient over a certain length of stream? This is an important question in terms of how the F/N determination will be made.
- The determination of channel type (included in Step 1 and Step 4) isn't that easy for small, relatively steep streams without training in channel geomorphology. For example, determining where a step-pool channel becomes a cascade channel is often prone to observer interpretation. There are inconsistencies in the proposal itself: step-pool channels never average 20% gradient (see Step 1) and even cascades rarely occur at 20% gradient or greater. Quantitative definitions for different channel types and their gradients can be found in Chapter 2 in *Methods in Stream Ecology, 2nd edition* (Hauer and Lamberti, editors).
- Section 6.c. – It is very difficult, sometimes impossible, to distinguish a natural disturbance from an anthropogenic disturbance. ID teams could be convened even when a disturbance is related to natural causes.
- Section 6.e. – It is unclear how the statement “Is there adequate substrate for spawning, considering the fish species likely to be there? Note: This may be more an indication of optimal habitat, rather than availability of habitat.” relates to the determination of the F/N break.
- Section 6.h.i. – The statement is made that permanent changes in map status should not occur in streams in drought status: “These permanent map changes will not be made unless last detected fish are determined during a season when flows are “normal”. What if a stream is experiencing a multi-year drought? Does this preclude making permanent map changes until “normal” conditions are experienced?

4. *General Recommendations/Next Steps*

While all four of the fish habitat assessment proposals for delineating Type F and N waters have merit, none of them provided enough detail to determine if they were accurate, based on best available science, implementable, reproducible, and cost-effective and other review criteria. From a purely technical standpoint, the proposals need to be further developed and fleshed out so that they can be adequately reviewed and evaluated. Thus we recommend the following next steps:

- Provide feedback to proponents (caucuses) on what is missing from each proposal so that they can revise them
- Provide a list of criteria that revised proposals should include and by which they will be reevaluated
- Provide revised proposals to contractor review team for review and scoring

- Allow caucuses to present the proposals to the contractor review team including a question and answer session
- Contractor review team provides final recommendations and review to Policy

These steps are in line with more traditional review of scientific proposals. They will not only help assure that the best proposal is selected, but that the selected protocol will be measurable, repeatable, practical and defensible.