



# United States Department of the Interior

U.S. GEOLOGICAL SURVEY  
COLUMBIA RIVER RESEARCH LABORATORY  
5501A Cook-Underwood Road  
Cook, WA 98605 USA  
(509) 538-2299

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Bruce Suzumoto  
Assistant Regional Administrator  
Hydropower Division  
National Marine Fisheries Service  
1201 Lloyd Blvd., Suite 1100  
Portland, OR 97232-1274

Dear Mr. Suzumoto:

In a recent letter (dated 3 September 2009) to Les Perkins and the Farmers Conservation Alliance (FCA), your office commented on various issues with the FCA screens and on some research we did for the FCA evaluating the efficacy of the screen at Herman Creek. In this letter, I'd like to respond to the comments on our research because there are some issues that need clarification. Please consider the following:

## **NMFS comment:**

1) Use of fluouroscein dye injury detection method as a metric for screen injury is not consistent with other screen evaluations done in the Northwest Region. It does not look at overall screen performance. This is because the magnitude of individual fish injury was recorded with the fluouroscein dye method, as opposed a more conventional release and recapture evaluation, which provides migration rates, mortality rates and injury rates of the population at large. The fluouroscein dye method revealed that nearly all fish were injured to some extent on the FCA screens, although some injuries were minor and probably negligible. However, this evaluation did not associate the degree of injury of an individual fish with its long-term survival. For example, a 1 percent injury of an individual fish could be negligible if it is a scale or two, but could cause eventual death if the injury was a distorted operculum.

## **USGS response:**

The use of fluorescein dye is an effective and established method for evaluating injuries to the integument of fishes (Noga and Udomkusonsri 2002; Colotelo et al. 2009; Davis and Ottmar 2006). It does focus on individual fish and removes the subjectivity in evaluating injuries. However, because we tested large samples of fish under a variety of conditions at the Herman Creek screen, we can also evaluate our data from an overall screen performance and population

perspective, as mentioned in your comment above. In fact, we have done so in our final report, using NMFS-established criteria for injury in fish. This analysis revealed that *no* fish were injured as a result of passing over the screen under a variety of hydraulic conditions—even very shallow water over the screen surface. Now granted, the NMFS injury criteria are rather severe, for example performance standards include less than 0.5% mortality and  $\leq 2\%$  injury rate (i.e., the percent of a sample that is injured) for salmonid smolts. The agency defines injury as visual trauma (including but not limited to hemorrhaging, open wounds without fungus growth, gill damage, bruising greater than 0.5 cm in diameter, etc.), loss of equilibrium, or greater than 20% descaling on one side (Bryan Nordlund, NMFS, personal communication). We are not aware of how or when NMFS came up with these criteria (we can't find anything substantive in the literature), but we nevertheless compared our fish to these criteria and found no injury. Please note that *all* of the injuries we saw in our fish, not *some* of them (as stated above), were minor—particularly when compared to the NMFS criteria just mentioned. We think these results should be seriously considered by NMFS when evaluating the efficacy of the FCA screen designs. Although our work was focused on the Herman Creek screen, we are confident that our results would extend to other FCA screens of similar size and under similar operating conditions. Finally, we did evaluate short-term (48 h) survival of fish after they passed over the Herman Creek screen under all conditions and found that no fish died.

As an aside, we have searched the literature quite extensively for information that led to the development of current NMFS criteria for the operation of passive and active screens, but we can't find anything substantial. There are papers and grey literature reports here and there, but nothing that unequivocally points to the methods and logic underlying NMFS fish screening criteria. In other words, where did the current injury and mortality criteria come from? It would be helpful to have some peer-reviewed citations upon which criteria are based. Along the same lines, how were sweeping velocity and approach velocity criteria developed? Did this come exclusively from swimming performance studies? If so, we may want to discuss re-visiting these criteria since recent research has shown that the performance of fish in swim tunnels can dramatically underestimate their true capabilities (Peake 2004, 2008). As far as we know, current fish screening criteria are in “draft format” only and they have been that way for several years. Nothing has ever been finalized. As more and newer designs of fish screens are installed, it would help to have established, defensible criteria available to evaluate the efficacy of such devices.

**NMFS comment:**

2) The fluouroscein dye method probably could have utility in detecting de-scaling of smolts. Unfortunately, smolted fish were not tested.

**USGS response:**

We did not test smolts and agree that they would be a good test animal for screen tests. However, we know that truly smolting fish are very difficult to hold in captivity and are difficult to work with.

**NMFS comment:**

3) There was no attempt to measure screen egress time. For this type of test, marked test fish (smolted) should be released well upstream of the screen and captured or detected downstream of the screen. Egress from the release point to the capture point should be through relatively uniform hydraulic conditions. To determine the extent of delay, egress time through the screen site should be compared with egress time through an equal length of flow conveyance just above

the screen site. Flat-plate Passive Integrated Transponder (PIT) tag arrays could be used to perform this test with PIT tagged fish. Radio telemetry or acoustic telemetry methods could also be employed. Mark and recapture techniques could also be used, but may present problems if recapture of the majority of the test fish does not occur.

#### **USGS response:**

Although we understand this comment, we think its underlying context stems from work evaluating the efficacy of screens at large hydropower dams. Such “egress time” work is typically done at dams in the Columbia River Basin. However, we don’t think it’s valid to compare evaluations of large, vertically-oriented traveling screens at dams to those done at small, off-channel, horizontal flat plate irrigation diversions. At dams, fish have to pass the concrete structure and egress time studies can be informative. At small, off-channel diversions such as the one at Herman Creek, fish do not have to pass over the screen. In fact, we don’t want fish to enter the screen site—we’d rather have them migrate in the creek or river. Thus, we think the scale and context of such studies are simply not comparable. For example, if we were to release hundreds of PIT-tagged juvenile salmonids upstream of the Herman Creek screen, how many, or what percentage of them, would become entrained? We discussed this at our office and concluded that a very small percentage would likely become entrained. This is a completely different context than evaluating large screens at a hydropower facility. This isn’t to say that evaluating and understanding the rate of entrainment at irrigation diversions wouldn’t be useful—it would. A PIT tag study as described above could provide information on this. For egress time, however, we recommend simply releasing fish at the intake of the screen (which we did not do) and monitoring the time it takes for them to pass. We remain unconvinced that a comparison of passage rates between a screened portion of a conveyance (i.e., the screen itself) and an equivalent length of unscreened conveyance (i.e., the stream) is particularly relevant to the overall evaluation of diversions like the FCA screens. Perhaps more discussion is warranted here.

We know that your agency is currently reviewing our final report on this research and we look forward to receiving your comments. We also look forward to cooperating with you on documenting the effects of flat plate fish screens on fish injury and mortality. Please feel free to call me if you have any questions.

Sincerely,

Matthew G. Mesa, Ph.D.  
Research Fishery Biologist

#### **References**

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