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Here are the EPA comments on the ISAB/ISRP Critical Uncertainties Report.

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Dear Lorenzen, Vice Chair Booth and Members of the Northwest Power and Conservation Council,

On behalf of the U.S. Environmental Protection Agency (EPA), I am providing comments on the Northwest Power and Conservation Council, 2006 Research Plan and Independent Science Advisory Board/Independent Scientific Review Panel (ISAB/ISRP) 2016 Critical Uncertainties Report for the Columbia River Basin Fish and Wildlife Program. The U. S. Environmental Protection Agency (EPA) has long advocated the importance of a healthy Columbia River Basin ecosystem to support the recovery of fish and wildlife in the Basin. EPA has also emphasized that a focus on a healthy ecosystem will bring accountability to the Northwest Power and Conservation Council's Fish and Wildlife Program. EPA recommends that two critical uncertainties be addressed in near term research: toxic contaminants and water temperature.

EPA is providing comments to place a high priority on near term research to further understand the location and ecosystem impact of toxics contaminants, identified as an uncertainty in the Research Plan and ISAB/ISRP 2016 Critical Uncertainties Report. Fish, wildlife, and even human populations in the Columbia River Basin have been, and are currently being, exposed to an ever-growing variety of pollutants and chemicals as a result of increasing urbanization, industrialization and agricultural development in the basin. As a result of this exposure, toxics are bioaccumulating in the ecosystem and showing up in food webs.

For toxics, EPA recommends high priority on the following research actions:

- Research is needed to measure and map the spatial and temporal patterns of their use, transfer, accumulation and persistence in the Columbia River Basin.

- Research is needed to measure how contaminants affect fish production and survival. Aquatic communities in the estuary and coastal ocean are considered especially vulnerable to the accumulation of contaminants because of their spatial positions in the watershed. Studies of contaminants in invertebrate species, many of which comprise the base of the food web, indicate they can accumulate contaminants. Such studies are extremely rare in the Basin.
- Research is needed to further understand whether restoring or reconnecting tributary habitat to expand productive capacity can increase resilience enough to buffer fish populations against the effects of toxic contaminants. A key issue to be resolved is the extent to which population responses are determined by various stressors, including exposure to toxic contaminants.
- Research is needed on specific factors impacting the growth, migration, maturation, and survival of focal fish species in the estuary, plume, and ocean. Some factors (e.g., avian predation on Chinook and steelhead smolts in the estuary) have been studied much more than others (e.g., toxic contaminants). More research needs to be done in this area.

The second uncertainty identified in the Research Plan and ISAB Critical Uncertainties Report is water temperature. Specific research is needed on water temperature impacts on fish survival, the use and location of thermal refugia, and research on the viability of potential actions in the Columbia and Snake river. The ISAB/ISRP report specifically identifies these three critical uncertainties related to water temperature, which EPA supports. Increased research on water temperature becomes increasingly significant with future climate change and the devastating fish mortalities that we all saw in 2015 due to high water temperatures.

For water temperature, EPA recommends high priority on the following research actions:

- Research is needed on salmon/steelhead use in cold water refugia areas (e.g., Drano Lake) through the installation and analysis of additional PIT tag detectors
- Research is needed to better understand temperature exposure and temperature effects including survival, egg viability, and behavioral patterns through additional PIT tag studies.
- Research is needed to better understand additional actions that can be done in the Columbia and Snake Rivers to cool summer mainstem temperatures and

model the temperature benefits of those actions. This becomes especially critical with increasing effects of climate change.

Thanks for the opportunity to provide our research priorities, we look forward to working with you as we continue to improve the Region's understanding of the complex factors affecting fish and wildlife recovery in the future. This improved understanding will help us all as we work together in collaboration to implement actions to restore and protect the Columbia River ecosystem.

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