UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
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WATER
DIVISION

Michael P. Tehan
Assistant Regional Administrator
NOAA Fisheries, Interior Columbia Basin Office
West Coast Region
1201 NE Lloyd Boulevard, Suite 1100
Portland, Oregon 97232-1274

JAN 02 2020

Re: Request for Completion of Endangered Species Act Section 7 Consultation for the Agency's Proposed Action to Promulgate Aquatic Life Criteria for Aluminum Applicable to Oregon Freshwaters

Dear Mr. Tehan:

Please find the enclosed revised Biological Evaluation (BE) for the *Proposed Oregon Water Quality Standards – Aluminum Criteria to Protect Aquatic Life in Oregon Freshwaters, December 20, 2019* (Enclosure 1). The revised BE includes the additional information responsive to NMFS's prior comments and recommendations. By this transmittal of the revised BE, the Environmental Protection Agency requests completion of formal Endangered Species Act consultation with the National Marine Fisheries Service.

Pursuant to a consent decree, the EPA must sign the final aquatic life criteria for aluminum for freshwaters in Oregon by March 27, 2020. In light of this deadline, we would appreciate all reasonable efforts by your staff to work with us to complete the ESA section 7 consultation by February 2, 2020. The EPA anticipates receiving a biological opinion from the U.S. Fish and Wildlife Service within a similar timeframe.

The EPA's effects determinations for the species under NMFS's purview are summarized in Table 7-1 of the enclosed BE and excerpted in Enclosure 2. The EPA has also developed a table in Enclosure 3 summarizing the list of comments and information requested by NMFS and the EPA's responses that are reflected in the revised BE.

We appreciate the technical support from your staff, including the ongoing coordination to discuss NMFS's information needs. If you require additional information, please contact Mark Jankowski, the EPA Ecotoxicologist, at (206) 553-1476 or jankowski.mark@epa.gov, or Rochelle Labiosa, the Water Quality Standards staff lead at (206) 553-1172 or labiosa.rochelle@epa.gov.

Sincerely,

Hanh Shaw, Manager
Standards and Assessment Section

Enclosures: (1) *Biological Evaluation: Proposed Action to Promulgate Oregon Water Quality Standards – Aluminum Criteria to Protect Aquatic Life in Oregon Freshwaters, December 20, 2019 (redline and clean versions)*
(2) Summary of Effects Determinations
(3) The EPA's responses to NMFS's comments and information requests

cc (via electronic transmission):
Anne Mullan, NMFS
Johnna Sandow, NMFS
Jeffrey Dillon, USFWS
Jeremy Buck, USFWS

Enclosure 2
BE Table 7-1. Summary of Effects Determinations

B. NMFS Species Purview

Species Name	DPS/ESU	Status (T=threatened; E=endangered)	Designated Critical Habitat in Action Area?	Species Effects Determination	Critical Habitat Effects Determination
Green Sturgeon (*Acipenser medirostris*)	Southern DPS	T	Y	**LAA**[1]	**LAA**
Eulachon (*Thaleichthys pacificus*)	Southern DPS	T	Y	**LAA**[2]	**LAA**
Southern Resident Killer Whales (*Orcinus Orca*)	Puget Sound	E	N (Y)[3]	**LAA**[2]	**LAA**
Coho Salmon (*Oncorhynchus kisutch*)	Lower Columbia River	T	Y	**LAA**[2]	**LAA**
	Oregon Coast	T	Y	**LAA**[2]	**LAA**
	Southern Oregon/Northern California Coast	T	Y	**LAA**[2]	**LAA**
Chum Salmon (*Oncorhynchus keta*)	Columbia River	T	Y	**LAA**[2]	**LAA**
Chinook Salmon (*Oncorhynchus tshawytscha*)	Upper Columbia River, spring-run	E	Y	**LAA**[2]	**LAA**
	Snake River spring/summer-run	T	Y	**LAA**[2]	**LAA**
	Snake River Fall-run	T	Y	**LAA**[2]	**LAA**
	Upper Willamette River	T	Y	**LAA**[2]	**LAA**
	Lower Columbia	T	Y	**LAA**[2]	**LAA**
Sockeye Salmon (*Oncorhynchus nerka*)	Snake River	E	Y	**LAA**[2]	**LAA**
	Upper Columbia River	T	Y	**LAA**[2]	**LAA**

Species Name	DPS/ESU	Status (T=threatened; E=endangered)	Designated Critical Habitat in Action Area?	Species Effects Determination	Critical Habitat Effects Determination
Steelhead (*Oncorhynchus mykiss*)	Snake River Basin	T	Y	**LAA**[2]	**LAA**
	Middle Columbia River	T	Y	**LAA**[2]	**LAA**
	Upper Willamette River	T	Y	**LAA**[2]	**LAA**
	Lower Columbia River	T	Y	**LAA**[2]	**LAA**

Notes: 1, Based on CMC analyses; 2, Based on CCC analyses; 3, Relevant to the Conference Opinion
LAA – Likely to Adversely Affect

Enclosure 3: Responses to NMFS's Comments

Comment Identifier	Summary of NMFS Comment	Summary of EPA Response	BE Location
Proposed action 1	Methods to characterize and identify most toxic conditions at a site should be a part of the proposed action	EPA added the relevant preamble section to the BE Proposed Action. The added material provides the suggested options for interpretation of protection of conditions at a site that EPA provided in the proposed rule. The need to protect the most toxic conditions is stated in rule.	Section 2.3, Page 2-6
Action area 1	Where do the criteria apply? NMFS assumed criteria apply to freshwaters in which aquatic life are designated, headwaters to mouth of all rivers and streams, with the exception of rivers influenced by tidal waters.	EPA has added the requested information including ODEQ's rule language (OAR 340-041-0022(22)) for its delineation of saltwater (salinity ≥10 parts per thousand, ppt), estuarine waters (salinity of 0.5-9 ppt), and freshwaters (salinity of <0.5 ppt) and how the Al freshwater criteria may apply to estuarine waters but not marine waters. A map of estuarine waters was also included; and, the associated data were provided to NMFS on 12/2/19 and 12/11/19.	Section 2.5, Pages 2-9 to 2-10
Action area 2	Provide specific terms in which the freshwater criteria will apply (will it be applied in any saltwater?)	Addressed above in comment Action Area 1	Section 2.5, Page 2-9
Action area 3	Boundaries of Indian Country (provide a map)	Map added to BE and sent to NMFS on 11/13/19. Data provided to NMFS 12/16/19. The map includes estuarine water boundaries as well.	Section 2.5, Page 2-10, Figure 2-1
Effects analysis 1	The LC05 is an inappropriate threshold for effects determinations, as 5% mortality is not a tenable target because mortality of one individual is a basis for an adverse effect determination. Suggest a probability of mortality approach.	Added information describing the statistical nature of the LC05 estimate and that it is not possible to distinguish between LC05 and LC00, the latter estimate not being quantifiable. Thus, EPA has decided to base its effects determinations on what is	Section 5.1.2.1.1

		measurable, and therefore not insignificant or discountable (50 CFR 402.13(a)).	
Effects analysis 2	Adjust the approach of the Indirect Effects analysis. Suggest EPA normalize prey-based SSDs (and thus HC5s) to water chemistry across the range of conditions instead of analyzing indirect effects only for reference conditions.	Analysis conducted as suggested and new effects determinations (Section 6) were made based on the revised results. This revision caused EPA to change the way the information was integrated into the Weight of Evidence process as well as thresholds for effects determinations. These changes can be found in the revised BE (Sections 5.1.1.2 and 5.5).	Section 5.5; Section 5.1.1.2; Section 6.2; Section 7
Effects analysis 3	What does the exceedance of a toxicity value mean, biologically? More information regarding the Weight of Evidence (WOE) ranking scheme and how it relates to biological effects. The final effects determinations (LAA/NLAA) should not include the qualitative WOE rank.	Completed as requested.	Section 6.2; Section 7
Effects analysis 4	Spatial scale of the effects needs more description. Criteria concentrations across the range is the BE's current assumption. Provide explanation of why duration of exposure was not evaluated in the effects analysis.	EPA's analysis proceeded from a screening level to refined level to address spatial, duration, and frequency effects. The screening level analysis of direct effects (Tier 1/Line of Evidence 1) assumed criteria concentrations across a species range in Oregon. If that assessment found a potential for adverse effects, two more analytical steps were taken. (1) A hypothetical discharger assessment based on two permitted locations in Oregon was used to describe the low frequency at which a species would experience toxicity (i.e., species specific toxicity value < concentration of Al at edge of mixing zone) downstream of current Al dischargers (See Appendix F). (2) A refined exposure assessment (Line of Evidence 2) was conducted in which Al was found to be present at locations across the state (Section 4). This was not surprising given that Al is one of the most common	Sections 4, 5.2, 5.3, & 6.4.1; Appendix F

		elements in the earth's crust. EPA further demonstrated weak correlations between land uses and Al concentration but does not recommend basing quantitative conclusions on that work. Rather, the data suggest that the percent of agricultural and forested lands was associated with Al concentrations in surface water. To address duration of exposure, EPA provided information in a new Section (6.4.1) to address conservative assumptions inherent in EPA's analysis and that duration of Al exposure did not appear to be as important as concentration based on the available data.	
Effects analysis 4	Spatial scale of the effects. Provide explanation of how frequency of exposure may affect the analysis. Perhaps EPA could compare frequency of exposure literature for other cationic metals to understand of frequency of exposure may impact the manifestation of Al toxicity. Might EPA estimate the number of potential facilities that could discharge Al?	Please see above response in Effects Analysis 3. Although there were no available data to evaluate the effect of frequency of exposure on Al toxicity, the potential frequency of exposure downstream from an Al discharge is discussed in Appendix F. Al criteria at a site cannot be exceeded more than once in three years. Fish exposed to Al criteria concentrations just once may experience effects based on the data summarized in the BE and EPA used that information for its analysis. Lastly, it is worthwhile to keep in mind that water quality criteria are designed with a no more than once in three-year frequency component to allow vulnerable ecosystems to recover rather than to protect individual species. The number of facilities with a potential for discharging Al was analyzed in the Economic Analysis. EPA has provided this information in Section 4 of the BE as Table 4-2	Table 4-2

Effects analysis 7	Enhance the analysis of effects to SRKW. Reduction in prey is not a sufficient basis for an LAA determination. Make the connection clearer between salmonid presence and the diet of SRKW that may be affected by the action. Clarify % effect on whale diet	In coordination with NMFS, EPA conducted a revised analysis of indirect effects to SRKW that estimates the percent lost prey mass relevant to SRKW that feed on Columbia River Chinook salmon. NMFS may be able to estimate a number of lost individuals by multiplying the estimated lost prey mass (provided by EPA as a percentage) by the number of individuals they estimate to be in each ESU. EPA views the latter exercise to be beyond the scope of its expertise.	Section 5.5.18
Relevant information 2	Use of mixing zones should be addressed to know to what extent the criteria will be exceeded.	ODEQ mixing zone rule language was added to the BE. EPA will provide to NMFS (at the time of BE submission) the permits and fact sheets for the two facilities in Oregon that have Al permit limits (Northwest Aluminum Specialties and Fujimi Corporation). A new permit was found in December of 2019 for Georgia-Pacific Wauna Mill and is also provided to NMFS.	Section 4.7
Effects analysis 6	Use relevant and reliable studies described in Appendix H and J of the 304(a) criteria document.	A new table was created using information from Appendix H of the criteria document. EPA provides this information so that NMFS is able to determine that the criteria and the toxicity values in the table generally indicate that the criteria are protective. Due to limited information in Appendix H studies, these were not useful for the derivation of lower effects concentrations than what can be found in Table 5-6. Studies found in Appendices A and C of the criteria document were more completely documented and thus used for the analysis in the BE.	Table 5-6

Relevant information 1	Implementation of criteria by states is interrelated/interdependent to the proposed action.	EPA disagrees. As discussed on the 11/13/19 call, the EPA has provided additional baseline information on MZ implementation, including Oregon MZ rule language and guidance, however, the EPA has not included MZ as interrelated/interdependent actions per the 11/13/19 discussion and as summarized in the BE.	
Best available science 1	Please provide electronic copies of Appendices A, C, G, H, and J from the 2018 304(a) criteria document	There were 339 studies. ECOTOX technical support provided EPA the PDFs that EPA transmitted to NOAA and FWS on 12/19/19.	NA
Effects analysis 5	Include an assessment of mixtures toxicity or provide a review of studies on aluminum mixtures or aluminum exposures in the field.	Described or cited ODEQ policies and procedures for the implementation of mixing zones and the use of WET testing in the context of environmental mixtures and the implementation of the Al criteria. The following information is also included in this letter to assist NMFS with it's understanding of Al toxicity in the context of mixtures based on the available literature. EPA assessed Appendix H of USEPA (2018) for mixture studies conducted on salmonids. Appendix H contains "Other Data on Effects of Aluminum to Freshwater Aquatic Organisms," which are typically used in a qualitative manner. Based on the "Reason Other Data" column of Appendix H of USEPA (2018), no freshwater salmonid acute or chronic toxicity studies were considered qualitatively acceptable data as a result of mixture toxicity. EPA also assessed Appendix J of USEPA (2018). Appendix J contains the "List of Aluminum Studies Not Used in (the 2018 Al) Document Along With Reasons." Appendix J contains data not acceptable for criteria derivation because of data quality issues,	Section 4.7 and 5.6

		data reporting issues, unacceptable test parameters, and/or irrelevancy to evaluating chemical effects to aquatic biota. Within Appendix J, EPA specifically targeted studies conducted on salmonids that also contained "mixture" in the "Reason Unused" column of Appendix J. Together, these search criteria produced 28 individual tests/studies on salmonid species that were considered unacceptable as a result of, but not limited to, mixture toxicity. Twenty-five of these 28 were considered irrelevant for considering mixture toxicity for one or more reasons, such as the mixture water being natural/uncharacterized waters or the mixture assessed Al effects at low pH (e.g., < 4.5). Specific reasons why these twenty-five studies were unused are described below: • "Mixture; dilution water is river water" (n = 4) • "Mixture; low pH and Al" (n = 4) • "Mixture; dilution water us lake water" (n = 3) • "Mixture; dilution water not characterized" • "Mixture; dilution water is stream water" • "Mixture; runoff" • "Mixture; Al, NH_3, NH_4" • "Mixture; field experiment-dosed stream" • "Mixture; fluctuating Catskill Mountain stream chemical exposure" • "Mixture; Al and organic acids" (*note: test was designed to evaluate Al bioavailability*) • "Only one exposure concentration; Mixture; Al and acid pulses" • "Mixture; Exposure concentration varied over time; dilution water is lake water" • "Mixture; Al and Si" (*note: test chemical was hydroxyaluminosilicates, not a true factorial design to evaluate mixture toxicity*)	

		• "Mixture; exposure concentration varied over time; dilution water is river water" • "Mixture; Al and citrate" • "Mixture; dilution water is breakwater" • "Mixture" (*note: Article is titled "Effect of pH on Speciation and Toxicity of Aluminum to Rainbow Trout [Salmo gairderi]," indicating an Al and pH mixture study*) The remaining the three studies that appeared to provide a reasonable study design for assessing Al/mixture toxicity included: • Sayer (1991) that was unused because "Only one exposure concentration; mixture; low pH and Al" • Sayer et al. (1991b) that was unused because "Only two concentrations; mixture" • Sayer et al. (1991c) that was unused because "Only two exposure concentrations; mixture" Briefly, the results of these three studies, as they pertain to Al/mixture toxicity, are summarized below: Sayer et al. 1991: This study was designed to assess Cu, Al, and a Cu+Al mixture, all in conjunction with acid pulses over the course of ~300 days (i.e., hatch to swim up; see Figure 1 of Sayer [1991]). The acid pulses lowered the test waters to a pH of 4.5, which is the limit of pH acceptability used in the derivation of the chronic Al criterion (USEPA 2018). Moreover, because the Al x acid pulse treatment was the only Al treatment without copper, this study lacks a true Al-only control treatment. Only one concentration	

		of Al and only one concentration of Cu were tested. Sayer (1991) states, “In the chambers with a[cid]Al, aCu, or aAl/Cu, low levels of mortality were recorded (5, 2, and 0%, respectively).” A lack of exposure concentrations and a lack of a true factorial design limit the ability to formulate broad conclusions about toxicity of Al and Cu mixtures. Sayer (1991) observed limited effects of acid+Al and acid+Cu, and no effects of acid+Al+Cu. Sayer et al. 1991b: Sayer et al. (1991b) conducted two mixture experiments. The first experiment exposed fertilized brown trout eggs to every possible combination of Al, Cu, Pb, and Zn for 700 days and evaluated embryonic survival and success and subsequent effects to fry mineral content, skeletal development, and survival. The second experiment assessed effects of Al, Al+Fe, Al+Mn, Al+Ni, and Al+Cd on fry survival over 300 days. In the first experiment, there was high egg mortality with nearly half of all eggs not becoming eyed. Of the hatched fry, there was 100% survival 300 days post hatch (dph) in the control and Al only treatments. There was also high survival in the Al+Pb, Al+Zn, and the Al+Pb+Zn treatments. Mixtures containing Al and Cu (i.e., Al+Cu, Al+Cu+Pb, and Al+Cu+Zn) produced relatively greater mortality. Al+Cu was the most toxic mixture and produced 73% mortality relative to Al only treatments. In the second experiment, there was high survival in all Al mixtures. There was no true Al only treatment in the second experiment because of an equipment error. Sayer et	

		al. (1991b) states results "should be considered with some caution" because treatment were not replicated. Sayer et al. 1991c: Sayer et al. 1991c did not assess any mixtures containing Al. **References** Sayer, M.D.J. 1991. Survival and subsequent development of brown trout, Salmo trutta L., subjected to episodic exposures of acid, aluminium and copper in soft water during embryonic and larval stages. J. Fish Biol. 38: 969-972. Sayer, M.D.J., J.P. Reader and R. Morris. 1991b. Embryonic and larval development of brown trout, Salmo trutta L.: exposure to trace metal mixtures in soft water. J. Fish Biol. 38: 773-787. Sayer, M.D.J., J.P. Reader and R. Morris. 1991c. Effects of six trace metals on calcium fluxes in brown trout (Salmo trutta L.) in soft water. J. Comp. Physiol. B.: 537-542. S USEPA. (2018). *Final Aquatic Life Ambient Water Quality Criteria for Aluminum - 2018* (EPA-822-R-18-001). Retrieved from Washington, DC:	
EC10 analysis	Per NMFS letter (Oct 15), please provide a supplemental analysis based on EC10 criteria. Consider revising rule using this revised criteria.	EPA acknowledges the letter sent on October 15th by NOAA. However, EPA will not be providing the requested analysis as communicated to NMFS (and FWS) on 12/2/2019.	