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U.S. Army Corps of Engineers  
Attn: CRSO EIS  
1201 NE Lloyd Blvd.  
Portland, OR 97232

*Submitted via online portal at: [comments.crso.info](https://comments.crso.info)*

**Re: Columbia Riverkeeper Comments on FCRPS DEIS**

Dear Army Corps of Engineers, Bonneville Power Administration, and Bureau of Reclamation:

Columbia Riverkeeper (Riverkeeper) submits the following comments and exhibits regarding the Draft Environmental Impact Statement (DEIS) for federal Columbia and Snake river dams (hereinafter “FCRPS” or “hydrosystem”). **To help prevent the extinction of Snake River salmon, Southern Resident orcas, and Northwest salmon cultures, breaching the four Lower Snake River dams must become part of the final preferred alternative.**

Riverkeeper works to protect and restore the water quality of the Columbia River and all life connected to it, from the headwaters to the Pacific Ocean. Riverkeeper was founded to establish one consistent voice working to protect the Columbia River from a “whole river” perspective—in recognition that poor water quality or degraded habitat anywhere in the Columbia River basin affect salmon and steelhead populations and fisheries both upriver and downriver. Riverkeeper’s staff and members are connected by a common interest and concern for salmon and steelhead, which use the Columbia and Snake rivers throughout their lifecycles. Salmon—and subsistence, recreational, and commercial salmon fishing—are integral parts of these rivers, their history, and the communities and lives of local residents. Many of Riverkeeper’s staff and members regularly fish for, catch, eat, and serve our families and friends salmon and steelhead caught in the Columbia River and its tributaries. We enjoy and value the ability to consume healthy, delicious salmon and steelhead that are locally and sustainably harvested.

Riverkeeper’s staff and members are working to protect and restore strong salmon runs in the Columbia and Snake, with a focus on protecting salmon from warm water caused by the dams and climate change. Riverkeeper staff and volunteers have devoted thousands of hours to researching the causes of, and advocating for solutions to, high water temperatures in the Columbia and Snake rivers. These continuing efforts have included extensive document review; legal, scientific, and factual research; public records requests; meetings and discussions with tribal, federal, and state agencies and scientists; expert scientific and technical research related to

the temperature of the Columbia and Snake rivers; and litigation to compel the preparation of a temperature Total Maximum Daily Load (TMDL) for the Columbia and Snake rivers.

Riverkeeper has also facilitated several community meetings and training sessions to empower and educate Riverkeeper members and the public about temperature problems in the Columbia and Snake rivers and the impacts to salmon and steelhead.

Riverkeeper's comments<sup>1</sup> on the DEIS will focus largely on water temperature, dams and dam removal, climate change, and the implications for fish survival and recovery.<sup>2</sup> High summer and fall water temperatures already limit the survival of some salmon runs and significantly threaten the future of many Columbia and Snake river salmon fisheries. In 2015, for instance, more than 250,000 adult sockeye died in the Columbia and Snake rivers because warm water prevented them from successfully migrating upstream, trapping them in lethal conditions. In response to temperature-driven fish kills, the Environmental Protection Agency (EPA) noted that "[t]he need to lower water temperatures becomes more critical as the Pacific Northwest Region continues to address and mitigate climate change."<sup>3</sup> The Fish Passage Center similarly concluded that "under a climate change scenario, the long-recognized and largely unaddressed problem of high water temperatures in the [Columbia and Snake rivers] becomes an ever-increasing threat to the survival of salmon . . ."<sup>4</sup> Unfortunately, the DEIS' overall narrative about water temperature, dams and dam removal, and climate change is incomplete, occasionally misleading, and—perhaps worst of all—largely divorced from the context of salmon migration, survival, and recovery.

Despite its many defects, the DEIS does admit that dam removal would significantly improve the water temperature regime and migration conditions for salmon and steelhead in the Lower Snake River. For instance, the DEIS states that **dam breaching "would have moderate to major beneficial effects on water quality in [the Lower Snake River]** through the restoration of natural, river, and water quality processes; a substantial cooling effect in the fall; greater nighttime cooling[;] and respite from warm water temperature conditions in the summer."<sup>5</sup> As explained below, this and similar admissions are greatly overshadowed by the DEIS's general narrative implying that Lower Snake dam removal would not significantly influence water temperatures.

Based on the events of the past twenty years and the tone of this DEIS, the Army Corps of Engineers (Corps), the Bureau of Reclamation, and the Bonneville Power Administration (BPA) (collectively, "the action agencies") lack the will or the vision to modify the hydrosystem

<sup>1</sup> Riverkeeper also incorporates by this reference comments and exhibits submitted by Earthjustice; Defenders of Wildlife and the Center for Biological Diversity; the State of Oregon; and the Columbia River Inter-tribal Fish Commission.

<sup>2</sup> See also Exhibit 1, Paul Pickett, *Technical comments on the CRSO DEIS' modeling and discussion of water temperature prepared for Columbia Riverkeeper* (2020).

<sup>3</sup> Exhibit 2, EPA, *Comments on NMFS' 2015 Adult Sockeye Salmon Passage Draft Report* (2016).

<sup>4</sup> Exhibit 3, Fish Passage Center, *Review of Draft of NMFS' 2015 Sockeye Salmon Passage Report* (2016).

<sup>5</sup> DEIS, p. 3-275; see also *id.* at pp. 3-270, 4-38.

to meet the Pacific Northwest’s needs in 2020 and beyond. Therefore, **Riverkeeper supports ongoing federal legislative efforts to unite Northwest sovereigns, communities, and stakeholders around solutions to remove Lower Snake River dams and re-invest in regional transportation, irrigation, and energy infrastructure.** Working together, we can have a future that includes salmon, agriculture, and clean energy. If the action agencies significantly revised the final EIS, it could inform this legislative effort and lead to real-world improvements. In its current form, however, the DEIS is merely a fig leaf for the untenable status quo; it will only lead to extinction and another court decision that federal agencies violated federal laws.

## **I. Breaching the Four Lower Snake River Dams Should be Part of the Final Preferred Alternative in the DEIS.**

Riverkeeper joins the Nez Perce Tribe, Shoshone Bannock Tribe, the Upper Snake River Tribes (USRT), Oregon’s Governor Kate Brown, and hundreds of thousands of people and organizations from across the Pacific Northwest and the United States in calling for the restoration of the Lower Snake River. Snake River sockeye and steelhead are perilously close to extinction now, and it is widely acknowledged that Snake River Chinook are unlikely to survive coming decades without significant changes to the status quo.<sup>6</sup> With these risks in mind, the “small, incremental improvements”<sup>7</sup> touted by the action agencies are legally,<sup>8</sup> ecologically, and morally untenable. After twenty years of failed incrementalism, the action agencies should do what they have long resisted: recommend the removal of the Lower Snake River dams.

Even the DEIS shows that Lower Snake River dam removal is the best way to avoid extinction and recover Snake River salmon and steelhead—although a combination of the DEIS alternatives 3 (dam removal) and 4 (increased spill) would be even more effective. The Fish Passage Center’s modeling of Snake River steelhead and spring/summer Chinook survival shows that the action agencies’ preferred alternative would not meet the criteria for recovery—but dam removal will.<sup>9</sup> NMFS’ own survival model also shows that dam removal would have the most significant benefit to Snake River salmon and steelhead.<sup>10, 11</sup> Setting aside disagreements

<sup>6</sup> See New York Times, [How Long Before These Salmon Are Gone? ‘Maybe 20 Years’](#) (September 16, 2019) (quoting U.S. Forest Service fisheries research scientist Russ Thurow as saying that wild Snake River Chinook may go extinct in four generations or 20 years); see also The Lewiston Tribune, [Simpson offers critical remarks on river study](#) (March 12, 2020) (quoting Idaho Congressman Mike Simpson as saying “in the next 15 years, if something isn’t done, [Snake River salmon] will be extinct. There is no doubt about that, they will be extinct.”).

<sup>7</sup> DEIS, p. 7-89.

<sup>8</sup> Riverkeeper reiterates, and incorporates by reference, Earthjustice’s comment that mere “improvement” or “benefit” to salmon and steelhead is a legally insufficient “purpose and need” statement under the National Environmental Policy Act (NEPA).

<sup>9</sup> See Fish Passage Center, [Comparative Survival Study of PIT-tagged Spring/Summer/Fall Chinook, Summer Steelhead, and Sockeye: 2019 Annual Report](#), Chapter 2 (December 2019).

<sup>10</sup> DEIS, Executive Summary, p. 25.

<sup>11</sup> Importantly, neither survival model appears to account for the benefits of decreased exposure to warm water and increased adult survival that would likely result from Lower Snake River dam removal. *Pers. Comm. with Margaret Filardo, ret. Fish Passage Center staff* (March 26, 2019). Accordingly, these models are likely underestimating the improvements to SARs that could result from Lower Snake River dam removal.

between (and about) the models, the difference in survival between stocks that traverse the Lower Snake, and the mid-Columbia stocks that do not, strongly suggests that the Lower Snake River dams are preventing the recovery of Snake River salmon and steelhead. As the Columbia River Inter-tribal Fish Commission (CRITFC) pointed out, salmon and steelhead in the John Day, Deschutes, Yakima, and Umatilla rivers consistently survive the hydrosystem well enough to meet recovery goals. Snake River stocks consistently fail to meet these same goals. From a fish's perspective, the difference is four dams and 140 miles of warm, slack water in the Lower Snake. The DEIS does not seriously dispute this conclusion.

The action agencies' fundamental mistake is believing—despite nearly 100 years of evidence to the contrary—that engineered solutions can replace or improve upon the productivity of the Columbia basin's natural conditions. This preference for engineered solutions over ecological systems is central to the culture and identity of the Army Corps and BOR. But this paradigm for managing our river has failed; it defies common sense, over a century of Euro-American experience, the Traditional Ecological Knowledge of cultures that sustainably managed these fisheries since time immemorial,<sup>12</sup> and scientific findings prepared for the Northwest Power and Conservation Council.<sup>13</sup> As Idaho Congressman Mike Simpson succinctly stated, “Salmon need one thing—they need a river.”<sup>14</sup> The preferred alternative in the final EIS should depart from action agencies' failed paradigm and recommend the measure most likely to restore healthy runs of salmon to the Snake River basin.

## **II. The Alternatives Analysis Violates NEPA.**

NEPA requires that every EIS analyze a reasonable range of alternatives and take a hard look at the environmental consequences of each alternative so that decision-makers and the public can readily understand the implications of the choices before the agency. For the following reasons, the DEIS does not meet these requirements.

### **A. Maintaining the status quo means extinction for Snake River sockeye and steelhead.**

The DEIS fails to take a hard look at the consequences of the No Action Alternative (NAA) by failing to explain that maintaining the current status quo will likely lead to the extinction of Snake River sockeye and steelhead in the near term. The DEIS describes the measures included in the NAA and models their implications for fish survival. These models indicate that the smolt-to-adult return rates expected under the NAA will not lead to recovery.<sup>15</sup>

<sup>12</sup> See, e.g., Shoshone-Bannock Tribes, *CRSO Tribal Perspectives Document*, p. 10 (DEIS, Appendix P).

<sup>13</sup> See generally, The Independent Scientific Group, *Return to the River: Restoration of Salmonid Fishes in the Columbia River Ecosystem*, [Chapter 2](#) (September 10, 1996).

<sup>14</sup> The Lewiston Tribune, [Simpson offers critical remarks on river study](#) (March 12, 2020).

<sup>15</sup> See DEIS, pp. 3-387, 3-384 (using Snake River spring/summer Chinook survival rates as a proxy for Snake River sockeye survival rates), 7-100, 7-102.

**What the DEIS does not explain is that Snake River sockeye and steelhead stocks are in a state of collapse and that failure to substantially recover in the near term will very likely lead to extinction.** This critical omission obscures the consequences of the NAA, especially when accounting for intensify climate change, and does not constitute the hard look that NEPA requires.

**B. The DEIS’ “multiple objectives” approach to fails to present a reasonable range of alternatives.**

The alternatives presented in the DEIS violate NEPA because they are not distinct enough to present decision-makers and the public with realistic and intelligible choices. The point of NEPA’s alternatives requirement is to describe the range of options before the agency and the corresponding range of environmental consequences that could flow from the decision. Unfortunately, the action agencies’ use of so-called “multiple objective” alternatives makes this impossible. The DEIS should have presented a suite of true alternatives that reflect a reasonable range of potential FCRPS operations and the consequences. Instead, the DEIS proposed five “multiple objective” alternatives that are, with the exception of Lower Snake River dam removal, so similar as to prevent meaningful comparison. Further, the “multiple objective” alternatives contain competing or contradictory measures that often obscure the potential environmental benefit of measures disfavored by the action agencies, such as Lower Snake River dam removal or increased spill. To address this problem, the final EIS should abandon the “multiple objectives” approach and analyze alternatives focused on maximizing different benefits of hydrosystem operations, including fish survival. This approach will allow decision-makers and the public to understand the true range of outcomes that could be achieved.

**C. The EIS should consider profound changes to the status quo.**

The DEIS should have analyzed removing the lower four Columbia River dams. The Yakama and Lummi Nations, Columbia Riverkeeper, and many others have called for the removal of these dams to restore Columbia River fisheries and Southern Resident orcas, honor treaty commitments, and improve ecosystem function to mitigate for the negative impacts of climate change. Additionally, analyzing lower Columbia dam removal would give DEIS readers a better sense of the benefits of a more natural river system, which the action agencies’ illegal and myopic focus on dam operations obscures. Lower Columbia dam removal (like Snake River dam removal) is not beyond the action agencies’ existing authority and, even if it were, that would not preclude its consideration in a NEPA analysis. These dams were not built to last forever; one is approaching 90 years old. The four lower Columbia dams may be part of the action agencies’ cultures and identities but they have significantly disrupted the culture, identity, and economy of many others throughout the Northwest. In the mid-term, their electricity is not irreplaceable, or even particularly significant, given the energy revolution necessary to achieve deep decarbonization goals in the Pacific Northwest. This EIS process is a rare opportunity to

weigh real changes to the status quo. As we enter the 21st century, the action agencies should reconsider the value and trade-offs of their 19th century technology.

The DEIS should also have analyzed of the impacts of summertime reservoir draw-downs on temperature and salmonid survival in the Lower Snake River as well as at McNary and John Day dams. As explained below, these reservoirs significantly increase water temperatures and impair fish migration and survival. Drawing down these reservoirs to the spillway crest during certain times has the potential to decrease water temperature due to smaller reservoir surface area and decreased water residence times. While this level of draw-down could require modification to fishways and other dam structures, the cost of such modifications should be compared to other measures under contemplation to improve fish survival—including dam removal and the concurrent permanent loss of electric generating capacity. Given the ongoing search for regional solutions to the fish passage problems caused by these dams and reservoirs, the action agencies should have modeled the water temperature impacts of reservoir draw-downs and discussed the implications for salmon and steelhead migration survival and recovery.

**D. The DEIS discussion of dam removal in MOA3 is arbitrary and capricious.**

First and most importantly, Riverkeeper is appalled—but not surprised—by BPA’s continued attempts to leverage fish mitigation in the Snake River basin against Lower Snake River dam removal. The DEIS implies that Snake River dam removal would necessarily result in the immediate termination of the LSRCP, soon followed by significant reductions in fisheries mitigation work throughout the Snake basin.<sup>16</sup> Given ongoing legislative efforts to resolve the deep-seated problems with the FCRPS, and the action agencies’ own assertions that dam removal would require additional legislation, BPA’s attempt to couch its threat as an unavoidable legal consequence of lower Snake dam removal does not hold water. After decimating the fisheries resources of the Snake River basin, BPA blithely proposes to bulldoze holes in the four Lower Snake dams and walk away from the mess it created—leaving states, tribes, and stakeholders to rebuild what the action agencies destroyed. Moreover, the DEIS’ overtly transactional tone is a wholly inappropriate when addressing the tribal and state sovereigns whose fisheries resources have been degraded or eliminated and who effectuate BPA’s mitigation obligations on the ground. The Northwest Power Act and the Endangered Species Act obligate BPA to mitigate some of the damage caused by the FCRPS. The discretion afforded BPA in deciding how to carry out this mitigation should never be used as a carrot or wedge to influence regional policy choices.

Similarly, it is duplicitous and unscientific for the action agencies to repeatedly reference pre-dam water temperature observation in the Lower Snake River when describing the consequences of Lower Snake River dam removal and Alternative 3. Even if those measurements were reliable or representative, once-daily surface temperature samples are not

<sup>16</sup> DEIS, pp. 1-45, 3-250, 3-548.

particularly helpful for understanding how the Lower Snake River’s water temperature regime influenced fish passage and survival<sup>17</sup> (a mistake perpetuated by the DEIS’ singular focus on current daily maximum water temperatures). Furthermore, the DEIS steadfastly ignores *other* pre-dam conditions—especially conditions that show the dams’ deleterious impact or undermine the action agencies’ long-held policy preferences. For instance, the DEIS does not present pre-dam water temperature or flow data for the main-stem Columbia or the estuary. And the DEIS fails to mention that Snake River coho were historically abundant, went extinct after the construction of the Lower Snake River dams, and were only recently re-introduced by the Nez Perce Tribe. Presenting questionably relevant data on pre-dam conditions only where it appears to support a long-established policy preference is arbitrary and capricious and only serves to highlight the action agencies’ bias.

Finally, the DEIS’ discussion of Alternative 3 should explain that Lower Snake River dam removal could enhance the benefit of cold-water releases from Dworshak Reservoir.<sup>18</sup> The DEIS concedes that, with the Lower Snake dams in place, the cooling effect of Dworshak’s water diminishes significantly downstream of Lower Granite dam. However, **the DEIS does a poor job of explaining that, without the four dams, the cold water from Dworshak could meaningfully and quickly decrease water temperatures throughout entire the Lower Snake River.** Both HEC-RAS and RBM-10 models predict that daily average temperatures in a free-flowing Lower Snake River at Ice Harbor Dam would have significantly declined following a major increase in Dworshak water releases in late June 2015—and significantly increased just after Dworshak releases were curtailed at the beginning of August 2015. The two figures below

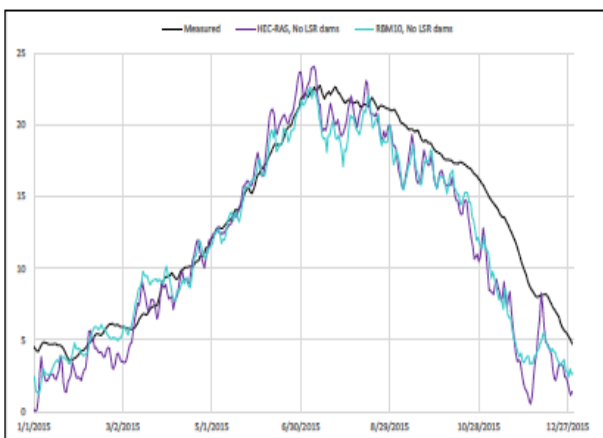


Figure 1-22. Ice Harbor tailrace, Comparison of 2015 Daily Average Temperature Prediction with No Lower Snake River Dams

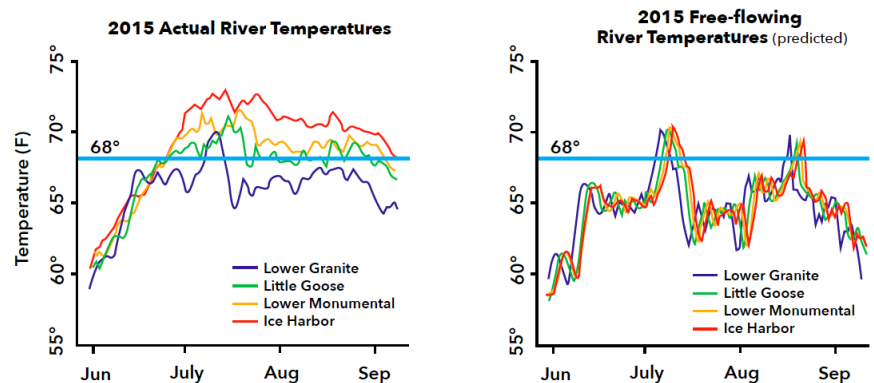


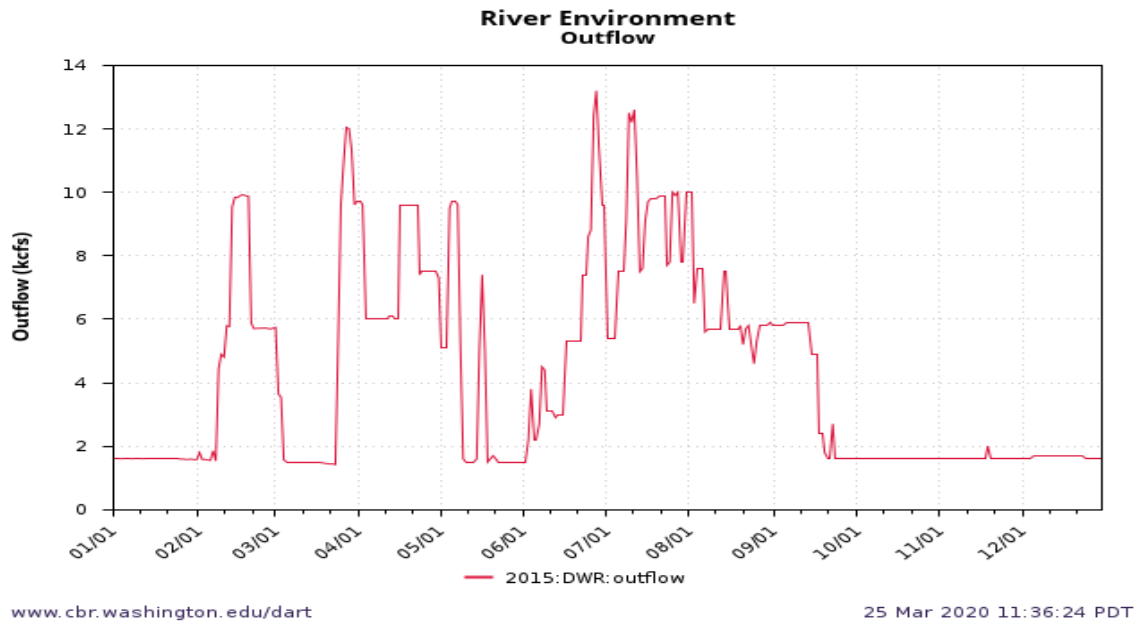
Figure 1. Comparison of 2015 summer water temperatures between the actual, dammed Lower Snake River (left) and a modeled, free-flowing Lower Snake River (right).

describe the daily average temperatures in the Lower Snake at Ice Harbor in 2015, both as observed temperatures and temperatures predicted without the dams. Both figures predict that the

<sup>17</sup> See Exhibit 4. Margaret Filardo *et al.*, *Letter to Gene Spangrude re: historic Snake River water temperature observations* (November 13, 2019).

<sup>18</sup> See Exhibit 5, EPA, *Draft Assessment of Impacts to Columbia and Snake River Temperatures using the RBM10 Model*, pp. 39–40 (December 19, 2018) (predicting lower monthly average temperatures in July, August, and September in the Lower Snake River if the dams were breached and Dworshak releases continued.)

average temperature of the free-flowing Snake River at Ice Harbor would have declined sharply in early July and risen sharply again in early August of 2015. What could explain these significant changes in temperature? The next figure shows water releases from Dworshak Dam over the same period.



The hydrograph above shows that cold water releases from Dworshak more than doubled in late June of 2015—just before the Corps and Riverkeeper’s modeling both predicted a significant decline in the free-flowing river’s temperature at Ice Harbor. Similarly, the hydrograph shows that Dworshak water releases decreased sharply at the beginning of August 2015—and the models predicted significant temperature increases at Ice Harbor shortly thereafter. In contrast, the temperatures observed in the dammed river at Ice Harbor in 2015 showed no noticeable reaction to Dworshak operations. This anecdotal evidence supports the commons-sense conclusion that breaching the Lower Snake River dams would allow Dworshak releases to significantly and quickly influence water temperatures—and improve fish migration—throughout the *entire* Lower Snake River.

Instead of ignoring and obscuring<sup>19</sup> this important point, **the DEIS should have investigated how to optimize Dworshak releases to regulate water temperature and improve fish survival in a free-flowing Lower Snake.** For instance, Alternative 1 proposes releasing more Dworshak water in June/July, less in August, and more again in September/October. This schedule would release cold water during the peak of the sockeye and spring/summer Chinook migrations in June/July and again during the peak of fall Chinook and

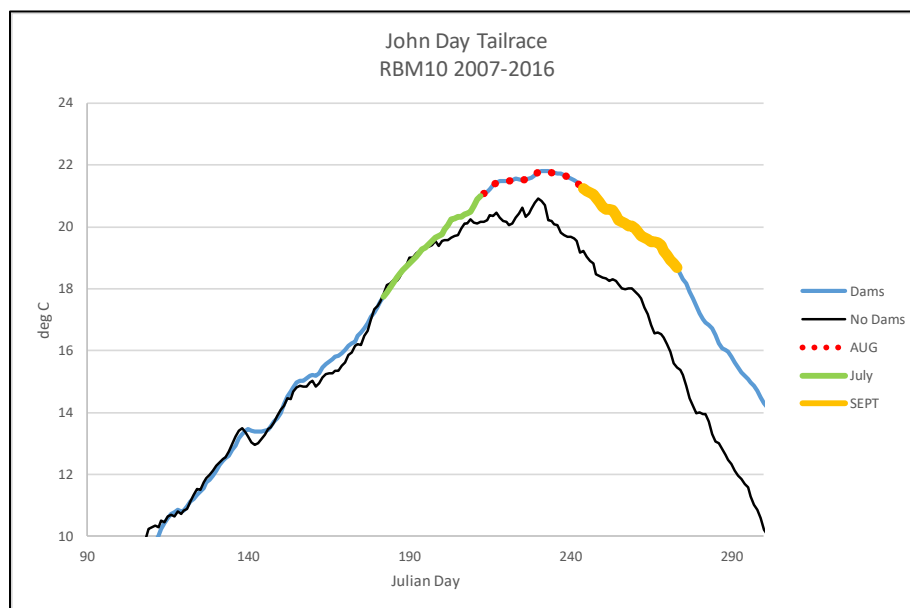
<sup>19</sup> As explained in Section IV and V, below, focusing exclusively on daily maximum temperatures obscures important information about how dam removal would affect water temperatures and fish survival.



steelhead migrations in September/October. Because Alternative 1 does not include Lower Snake dam removal, temperature modeling of this alternative showed (unsurprisingly) that an early summer/early fall Dworshak release schedule would have little to no impact on water temperatures or fish survival in the Lower Snake River. A much more interesting and revealing question would be: how would the Alternative 1 (or other) Dworshak release schedule influence temperature and fish migration in a free-flowing Snake River? The DEIS should have investigated how the combination of Snake River dam removal and different Dworshak dam release patterns could provide the most benefit for fish survival.

### III. The DEIS Ignores Water Temperature Problems, and the Lack of Solutions, in the Lower Columbia.

The DEIS conceals the hydrosystem's significant impact on water temperature in the lower Columbia River. Recent modeling by EPA (below) shows that the summer water temperatures at John Day dam are significantly warmer because of the John Day pool and upstream reservoirs.<sup>20</sup>



EPA modeling also shows that John Day and McNary dams together raise the temperature of the Columbia an average of 0.5 and 0.6 degrees C in August and September, respectively.<sup>21</sup> While these results show significant temperature increases due to the dams, Riverkeeper notes that EPA's modeling only examines river temperature with and without dams under *current* flow conditions. Modeling temperature under a natural (*i.e.* pre-FCRPS and Columbia River Treaty) hydrograph where the freshet was more pronounced and lasted longer into the summer would

<sup>20</sup> Exhibit 6, EPA, *Columbia River Temperature TMDL: State and Tribal Meetings PowerPoint Presentation*, Slide 33 (January 2020).

<sup>21</sup> See Exhibit 5, pp. 28–29.

show the true extent of the FCRPS' temperature impacts. The action agencies' refusal to discuss pre-dam conditions or consider alternatives that meaningfully depart from the status quo results in a DEIS that conceals the hydrosystem's significant impact on water temperature in the lower Columbia River and its implications for salmon survival.

Furthermore, the DEIS's reliance on EPA's unpublished temperature refuges study and temperature TMDL is misplaced, cynical, and incorrectly implies that the action agencies can foist the main-stem Columbia water temperature problems onto EPA. First, temperature refuges will not address many of the temperature-related fish passage problems in the lower Columbia because temperature refuges do not:

- address the cause of, or solutions to, high water temperatures;
- address temperature barriers at fishways;
- benefit adult sockeye or spring/summer Chinook;
- benefit out-migrating juvenile salmonids experiencing high water temperatures, or;
- exist in the mainstem Columbia or Snake rivers upstream of John Day dam.<sup>22</sup>

Second, the action agencies and federal government should not pretend to rely on a currently non-existent temperature TMDL that they have actively, and successfully, resisted for the last 20 years. A temperature TMDL *could* provide a meaningful plan to reduce water temperature in the Columbia and the Lower Snake. Unfortunately, the action agencies have worked to prevent and undermine the development of such a plan for the past two decades. When EPA put forth a draft temperature TMDL in 2002, the action agencies convinced the Bush administration to shelve that plan. When it appeared the TMDL might go forward anyway, the action agencies pressured EPA to ignore the impacts of the dams on temperature and pressured Oregon and Washington to exempt the dams from the Clean Water Act using a process called a Use Attainability Analysis. After the Ninth Circuit recently ordered EPA to produce the TMDL, the federal government took the extraordinary measure of asking that court to re-consider its opinion *en banc*—but not a single Ninth Circuit judge thought the case worthy of rehearing. It is cynical in the extreme for the federal government to imply that a currently non-existent temperature TMDL will help address water temperature problems. Regardless of the status of EPA's TMDL and thermal refuges work, the DEIS should realistically and clearly analyze whether the hydrosystem is causing or contributing to compliance with the water quality standards.<sup>23</sup>

#### **IV. The DEIS' Overall Narrative About Temperature in a Free-flowing Snake River is Misleading and Incorrect.**

Overall, the DEIS gives the incorrect impression that dam removal would cause the Lower Snake River to warm earlier in the spring, have no effect on temperature in the summer, and cool earlier in the fall—and that the spring and fall effects are equivalent in magnitude and

<sup>22</sup> See, generally, Exhibit 7, Northwest Environmental Advocates, *Comments on Draft Columbia River Cold Water Refuges Plan* (November 19, 2019).

<sup>23</sup> See Exhibit 1, pp. 2–3.

counterbalance each other in terms of benefits to fish. For instance, the DEIS says that dam breaching:

“. . . is expected to result in warmer water temperature in the spring, similar water temperatures in the summer, and cooler water temperatures in the fall . . .”<sup>24</sup>

This oft-repeated narrative leaves readers with the impression that Lower Snake River dam removal would not substantially improve water temperatures or fish migration conditions. This is untrue.

**A. The free-flowing Lower Snake would not be meaningfully warmer in the spring.**

Contrary to the DEIS’ general narrative, the DEIS’ data show that the free-flowing Lower Snake would not be meaningfully warmer in the spring (*e.g.* March, April, and May) than the dammed river. When ranges of uncertainty were incorporated into the models’ results, springtime temperatures in the free-flowing river almost never exceed the dammed river.<sup>25</sup> In March and April, the DEIS’ modeling does predicts that the monthly average temperature at Ice Harbor could be one or two degrees F warmer in the free-flowing river.<sup>26</sup> But in March and April, the free-flowing Lower Snake River would almost never be warmer that 56 degrees F<sup>27</sup> and therefore would remain well below the temperature thresholds known to impair salmon and steelhead migration.<sup>28</sup> The small temperature difference resulting from Lower Snake dam removal in March and April is, therefore, not relevant to the fisheries resource. **And in May, the DEIS actually predicts that snowmelt runoff would cause the free-flowing Lower Snake to be colder than the dammed river.**<sup>29</sup> Accordingly, the federal agencies’ long-time narrative that the free-flowing Lower Snake would be warmer in the spring is not scientifically viable; irrelevant and misleading (with respect to March and April); and untrue (with respect to May).

**B. The summer water temperature regime in the free-flowing Lower Snake River would not be “similar” to that of reservoirs.**

The DEIS’ oft-repeated claim that water temperatures in June, July, and August would be “similar”<sup>30</sup> with or without the dams is misleading and incorrect, even assuming that the Corps’ modeling of temperature in the free-flowing Lower Snake river is reliable. This claim appears to

<sup>24</sup> DEIS, p. 4-32; *see also id.* at 1-45, 3-551, 6-42, 7-19, D-6-25, D-6-71.

<sup>25</sup> DEIS Appendix D, Annex A, p. A-2-5.

<sup>26</sup> DEIS Appendix D, p. D-6-31; *see also id.* at D-A-1-28 (showing even smaller differences when comparing monthly averages of daily average water temperatures).

<sup>27</sup> DEIS Appendix D, p. D-6-36.

<sup>28</sup> *See, generally*, Exhibit 8, EPA, *Issue Paper 1: Salmonid Behavior and Water Temperature* (2001).

<sup>29</sup> DEIS Appendix D, p. D-6-25 (Explaining that “During [May], total river flows are highest due to snowmelt (i.e. spring freshet), resulting in overall cooler water temperatures throughout the [free-flowing] lower Snake River as compared to the No Action Alternative.”); *see also id.* at D-6-31.

<sup>30</sup> DEIS, p. 4-32; *see also id.* at 1-45, 3-551, 6-42, 7-19, D-6-25, D-6-71.

be based exclusively on the Corps' projections of *daily maximum* temperatures in the dammed and free-flowing Lower Snake River. Daily maximum temperature is just one of several water temperature parameters that influence how well adult salmon and steelhead migrate and survive. As detailed in Section V, below, other temperature parameters and metrics—including average temperature, diel cooling, and inter-day variability—would all be different, and more favorable to salmon and steelhead, in the free-flowing river. Accordingly, dam removal would meaningfully improve the temperature profile of the Lower Snake in the summertime in ways that benefit salmon and steelhead. The DEIS' blanket assertion that summer temperatures in the Lower Snake would be “similar” after dam removal is therefore misleading and incorrect.

Furthermore, **the temperature model used to assess dam breaching appears to over-estimate summer temperatures in the Lower Snake River**.<sup>31</sup> Problems and uncertainty with the Corps' modeling further undercut the DEIS' central narrative [*e.g.* that summer water temperatures would be the same with and without the Lower Snake dams] because the DEIS appears to over-estimate how hot the Lower Snake would be without the dams. The HEC-RAS model habitually over-predicts summer temperatures in the Lower Snake.<sup>32</sup> But the Corps nevertheless asserts, without any real justification, that it expects HEC-RAS to accurately predict water temperatures without the dams.<sup>33</sup> This makes no logical sense, and some important sources of modeling uncertainty contradict the Corps' hope that HEC-RAS will somehow begin accurately predicting summer water temperatures under a dam-breach scenario. For instance, wind- and temperate-driven evaporative cooling is an important source of heat loss from the river, but the HEC-RAS model has no way to adjust the wind-sheltering coefficients or change evaporation rates seasonally.<sup>34</sup> These limitations on the HEC-RAS model would likely still cause this model overpredict summer water temperatures in the free-flowing Lower Snake.<sup>35</sup> Another indication that the Corps may be over-estimating summer temperatures in the free-flowing Lower Snake is that the Corps' HEC-RAS model over-predicts summer water temperatures in the Lower Snake when compared to EPA's RBM-10 model.<sup>36</sup> Accordingly, summer daily maximum temperatures in the free-flowing Lower Snake may actually be lower than the DEIS predicts.

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<sup>31</sup> See Exhibit 1, pp. 1–2.

<sup>32</sup> DEIS Appendix D, Annex A, p. A-1-16 (“the HEC-RAS representation of the current [*i.e.* dammed] system overpredicts mid-summer temperatures”); *id.* at p. A-1-18 (explaining that HEC-RAS “underpredicts [reservoir] water temperature consistently throughout the year except during the summer, at which time the temperature is overpredicted”).

<sup>33</sup> DEIS Appendix D, Annex A, p. A-1-18. (“The WQ team believes these results corroborate the 360 HEC-RAS heat balance routines and the parameter set for a one-dimensional representation of 361 dam breach of the lower Snake River.”); *id.* at p. A-1-16.

<sup>34</sup> Exhibit 1, p. 1.

<sup>35</sup> *Id.*

<sup>36</sup> DEIS Appendix D, Annex A, p. A-1-28 (comparing results of HEC-RAS and RBM-10 modeling on free-flowing Lower Snake water temperatures).

**C. Fall cooling in the free-flowing Snake River would be far more significant than spring warming, both in terms of absolute temperature differences and benefits to fish survival.**

The DEIS' narrative incorrectly implies that predicted fall cooling in the free-flowing Snake River would roughly mirror, and offset, spring warming. This is misleading. The magnitude, duration, and ecological impact of predicted cooling in September, October, and November is far greater than the impact of any warming that might occur in March or April. In contrast to the spring months, when ranges of uncertainty are incorporated into the models' results, fall temperatures in the free-flowing river are almost always lower than the dammed river.<sup>37</sup> Furthermore, in contrast to the minor differences between the dammed and free-flowing Lower Snake predicted for March and April, the significant differences in water temperature predicted in September and October would occur when the dammed river would be warm enough to cause migrating salmon and steelhead thermal stress. Steelhead and fall Chinook attempt to migrate through the Lower Snake mostly in September and October. According to EPA, migration temperatures for adult steelhead and fall Chinook are 10–13 C and 10.6–19.4 C, respectively.<sup>38</sup> Temperatures in the dammed Lower Snake are often above, or at the high end, of these ranges in September and October. Therefore, significant temperature reductions in September and October provided by dam removal would meaningfully improve migration conditions for steelhead and fall Chinook. Dam removal would also improve spawning temperatures, and success, for fall Chinook in the Lower Snake, especially in October and early November when the dammed river is often significantly warmer than the 10 C optimum spawning temperature or even the 15 C level considered “stressful” for spawning.<sup>39</sup> In sum, the fall cooling predicted in a free-flowing Lower Snake River significantly exceeds the magnitude, and benefit to salmonids, of any spring warming that might occur due to dam removal; the EIS—and, more broadly, the action agencies and NMFS—should stop implying that these two effects are equivalent and counterbalancing.

**V. The DEIS Does Not Take a Hard Look at the Impacts of Lower Snake River Dam Removal on Water Temperature, Fish Migration, and Salmon Recovery.**

The DEIS' blanket assertion that “Adult upstream passage through the CRS projects on the lower Columbia and lower Snake Rivers is generally safe and effective”<sup>40</sup> is incorrect and deeply irresponsible. Columbia and Snake river dams routinely and significantly impair the upstream migration of adult salmon and steelhead, in large part due to the dams' impacts on water temperatures in fishways and reservoirs.

<sup>37</sup> DEIS Appendix D, Annex A, p. A-2-5.

<sup>38</sup> Exhibit 9, EPA, *Summary of Temperature Preference Ranges and Effects for Life Stages of Seven Species of Salmon and Trout*, pp. A-3, A-4 (1998).

<sup>39</sup> Exhibit 8, p. 17.

<sup>40</sup> DEIS, p. 3-301 (note that the pagination of the DEIS erroneously jumps from 3-304 to 3-285 and then repeats upward, meaning that duplicate page numbers exist in that range).

The eight dams on the lower Columbia and Snake rivers have caused significant mortality of returning adult endangered Snake River sockeye<sup>41</sup> in four of the past five years. The catastrophic and well-known fish kill in 2015 destroyed an estimated 96% of the endangered Snake River sockeye before they passed Lower Granite Dam, and EPA admitted that the death of these fish was “attributable primarily to warm water.”<sup>42</sup> Unfortunately, subsequent years have shown that adult Snake River sockeye frequently die in significant numbers in the hydrosystem. In 2017, NMFS estimated that passage through the hydrosystem killed 43% of returning adult endangered Snake River sockeye.<sup>43</sup> In 2018, NMFS estimated that 15% of adult Snake River sockeye died between the Bonneville and McNary dams;<sup>44</sup> and ladder counts suggested that 28% of the remaining fish died in the Lower Snake.<sup>45</sup> **In 2019, ladder counts suggested 75% mortality for sockeye in the Lower Snake:** 320 sockeye were observed at Ice Harbor Dam ladder, but only 81 were observed in the ladder at Lower Granite Dam.<sup>46</sup> Unhelpfully, the DEIS only presents information on adult Snake River sockeye survival from 2012 through 2016<sup>47</sup>—even though the current BiOp requires the action agencies to collect and report such reach mortality data every year.<sup>48</sup> The overwhelming evidence suggests that the hydrosystem has caused very significant mortality on endangered Snake River sockeye in recent years—particularly in the Lower Snake River.

Adult Snake River steelhead and Chinook also suffer significant mortality from the hydrosystem. The DEIS suggests that (when eliminating other sources of mortality) only 85% of these fish survive their journey past the 8 dams.<sup>49</sup> The DEIS does not explain why the action agencies believe that killing 15% of all pre-spawn adult fish from populations that are not meeting recovery objectives is “safe” and “effective,” or whether this level of mortality is acceptable, sustainable, or likely to lead to extinction. As explained below, these estimates of out-right fish mortality in hydrosystem do not capture the effects of chronic or cumulative thermal stress that may contribute to additional mortality or reproductive failure upstream of Lower Granite dam.

The DEIS’ explicit dismissal of the impacts of the dams, and water temperatures, on adult salmon and steelhead survival and recovery constitutes a failure to take a hard look at an important problem. The following subsections provide a more thorough review of why the DEIS’ discussion of water temperature and salmonid migration is inadequate.

<sup>41</sup> The DEIS uses the modeled SAR for Snake River spring/summer Chinook as a proxy for Snake River sockeye survival. This is inappropriate given the differences in return timing, temperature sensitivity, and conversion rates between adults of these two species.

<sup>42</sup> *Columbia Riverkeeper v. Pruitt*, Case No. 2:17-cv-00289-RSM, Defendants’ Answer, ¶ 3 (May 15, 2017).

<sup>43</sup> Exhibit 10, NMFS, “2019 adult survival estimates for distribution” spreadsheet; “SR Sockeye” tab (2019) (excerpted from original).

<sup>44</sup> *Id.*

<sup>45</sup> Fish Passage Center, *Adult Returns for Columbia & Snake River Dams Webpage* (queried April 5, 2020).

<sup>46</sup> *Id.*

<sup>47</sup> DEIS, Table 3-113 on p. 3-302 (this table is mis-labeled).

<sup>48</sup> NMFS, *2019 CRS Biological Opinion*, p. 877 (March 29, 2019).

<sup>49</sup> DEIS, p. 3-302.

**A. The DEIS' singular focus on daily maximum temperature, and 68 F, ignores many important, and complex, relationships between salmonids and water temperature.**

Although the DEIS' focus on daily maximum water temperature, and particularly on the 68 F (20 C) mark, is appropriate for evaluating the water quality standards, it oversimplifies a multifaceted relationship between fish migration, fish health, and water temperature. Because the DEIS' water quality modeling only predicted daily maximum temperatures, the DEIS's analysis and discussion of those modeling results overlooks many of the differences in the temperature regimes that would occur in a dammed and free-flowing Lower Snake River. While instantaneous daily maximum temperature is relevant to salmonid survival (and can be controlling if, temperatures are extreme), the daily maximum is just one of several important temperature metrics that influence how well salmonids can migrate through the Lower Snake River.<sup>50</sup> Furthermore, focusing on days above and below 68 F oversimplifies the state water quality criteria that the DEIS is purporting to address.<sup>51</sup> The DEIS' focus on daily maximum temperature obscures important consequences of Lower Snake River dam removal and does not constitute the hard look that NEPA requires.

The DEIS' singular focus on 68 F daily maximum temperatures is inappropriate because many negative impacts to salmonids occur at temperatures well below 68 F. These chronic temperature impacts can, and often do, lead to migration failure and premature mortality. As EPA explained with regard to sockeye, "migration blockages, susceptibility to disease, impaired maturation, increases to stress parameters, reduced efficiency of energy use, and reduced swimming performance are all more common as daily mean temperatures exceed 62.6 °F (17°C)."<sup>52</sup> Similarly, NMFS noted that, "At water temperatures above 64.4 °F, [Snake River] sockeye salmon display increases in fallback and straying, and decreases in survival."<sup>53</sup> In laboratory tests, all sockeye held at 68 F died after 12 days; but even sockeye held at 61 F showed significant thermal stress (weight loss, absence of fat reserves, enlarged liver, and reduced egg size) when compared to fish held at lower temperatures.<sup>54</sup> Temperature impacts below 68 F are not limited to sockeye. Adult Chinook survive better when water temperatures remain below 57.2 F,<sup>55</sup> and EPA found 66.9 F to be the upper "feasible" limit for fall Chinook

<sup>50</sup> See Exhibit 11, EPA, *Issue Paper 5: Summary of Technical Literature Examining the Physiological Effects of Temperature on Salmonids*, p. 74 (2001) ("Even if a free-flowing river experienced a maximum daily temperature that impeded upstream migration, it would not have continuous temperatures beyond the migration threshold, nor would they be present for many consecutive days.")

<sup>51</sup> See Exhibit 1, pp. 2–3 (explaining how the DEIS' approach to addressing state water quality criteria for temperature ignores the states' natural conditions criteria, which limit additional thermal loads from anthropogenic sources, including dams, when waterways exceed the numeric temperature criteria).

<sup>52</sup> See Exhibit 11, p. 74.

<sup>53</sup> NMFS, *2019 CRS Biological Opinion*, p. 600 (March 29, 2019).

<sup>54</sup> See Exhibit 11, p. 78; see also Crossin, *et al.*, *Exposure to high temperature influences the behaviour, physiology, and survival of sockeye salmon during spawning migration*, *Canadian J. of Zoology*, 86:127–40 (2008) (explaining that wild adult sockeye collected and held for 24 days at 18 C were roughly twice as likely to die both during holding and during their subsequent spawning migration as sockeye held at 10 C).

<sup>55</sup> See Exhibit 11, p. 76.

migration.<sup>56</sup> Accordingly, the DEIS' singular focus on 68 F as a proxy for adult salmonid migration success ignores the well-documented negative impacts of water temperature below this threshold and therefore does not constitute a hard look at an important problem.

The DEIS' singular focus on 68 F daily maximum temperature is also inappropriate because it does not address the negative impacts to reproductive success from warm water that occur well below 68 F. Even for salmon and steelhead that survive their migration through the hydrosystem, the extended exposure to elevated temperatures can compromise their ability to reproduce successfully for a wide variety of reasons, from pre-spawning mortality to poor fry condition in the next generation. As EPA explained regarding sockeye, “[e]levated but sublethal temperatures are known to negatively affect secretion of the hormones controlling sexual maturation . . . [and t]he likely physiological consequences of these reduced hormone levels are poor spawning success, poor egg quality and viability, and senescent death prior to spawning.”<sup>57</sup> Hatchery observations of *O. mykiss* and Chinook also showed a variety of negative impacts on reproductive success (*e.g.* increased pre-spawn mortality; decreased sperm volume and viability; decreased egg size, fertility, and survival; and decreased embryo and juvenile survival) that generally intensified as pre-spawning water temperatures increased from 50 to 68 F.<sup>58</sup> Observations of wild coho salmon also showed decreased egg viability and hatching rates for fish that encountered water above 59 F during their spawning migration.<sup>59</sup> By focusing almost exclusively on the 68 F mark, the DEIS fails to explain, much less attempt to quantify, how the combination of sustained warmer water and increased migration time in the Lower Snake River reservoirs likely harms the reproductive success of all stocks of Snake River salmon and steelhead.

The DEIS' singular focus on 68 F daily maximum temperature also obscures the importance—to adult salmonid migration and, ultimately, reproduction—of the increased daily temperature fluctuations that would occur in a free-flowing lower Snake River. The DEIS does admit that summertime daily temperature fluctuations would be roughly two to six times greater in a free-flowing Lower Snake River: modeling predicts that daily low temperatures in the free-flowing Lower Snake would be 2.5 to 3.5 F less than daily maxima, whereas daily cooling in the reservoirs would be just 0.5 to 1.0 F.<sup>60</sup> However, the DEIS does not really describe the implications of this admission—namely that, assuming similar daily maxima, **the free-flowing Lower Snake would, throughout much of each summer day, be significantly cooler than dammed river.** This severely undercuts the DEIS' central narrative that summer water temperatures in the Lower Snake would be “similar”<sup>61</sup> with or without the four dams. At most, the *daily maximum* summer temperatures in the Lower Snake with and without dams might be

<sup>56</sup> See *id.*

<sup>57</sup> *Id.*

<sup>58</sup> See, generally, *id.* at pp. 76–77.

<sup>59</sup> See *id.* at p. 77 (May 2001).

<sup>60</sup> DEIS, p. 3-270; see also *id.* at D-6-37 (Figure 6-29, showing modeled daily temperature fluctuations that would occur without the four Lower Snake Reservoirs).

<sup>61</sup> DEIS, p. 4-32; see also *id.* at 1-45, 3-551, 6-42, 7-19, D-6-25, D-6-71.



similar. But the temperature regime that fish experience throughout each day in the dammed versus free-flowing Lower Snake would be quite different, and more favorable to migration, because the undammed river would often cool 2 to 3 F throughout each 24-hour period.<sup>62</sup> As EPA noted, even if the “free-flowing [Lower Snake] river experienced a maximum daily temperature that impeded upstream migration, it would not have continuous temperatures beyond the migration threshold, nor would they be present for many consecutive days.”<sup>63</sup> By over-emphasizing daily maximum temperatures and largely ignoring the much greater daily cooling that would occur in the free-flowing Lower Snake, the DEIS incorrectly concludes that summer temperatures, and salmon migration conditions, would be “similar” in the dammed and free-flowing rivers.

The DEIS’ singular focus on daily maximum temperature also obscures the significant differences between *average* summer water temperatures in the dammed and free-flowing Lower Snake. Contrary to the DEIS’ repeated assertion that summer temperatures in the Lower Snake would be “similar”<sup>64</sup> with or without the four dams, modeling by Columbia Riverkeeper using the EPA’s RBM-10 temperature model (below) shows that daily average temperatures in the Lower Snake River during the summer of 2015 would have actually been significantly lower

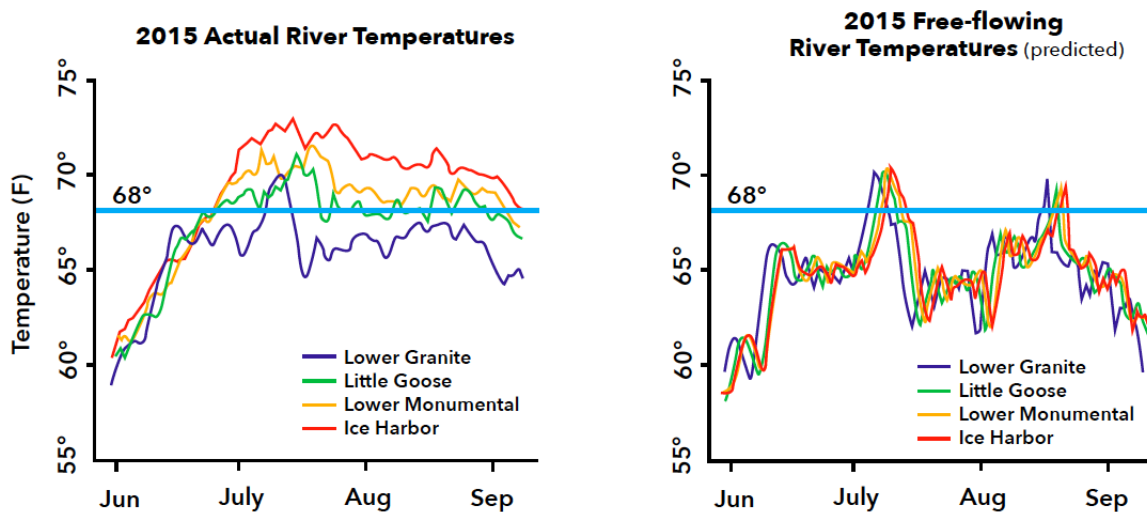


Figure 1. Comparison of 2015 summer water temperatures between the actual, dammed Lower Snake River (left) and a modeled, free-flowing Lower Snake River (right).

than daily average temperatures in the dammed river.<sup>65</sup> The Corps’ HEC-RAS model produced similar results for summer 2015.<sup>66</sup> The Corps could and should have used HEC-RAS, which uses an hourly timestep, to comprehensively model the daily minimum and daily average temperatures that would result from dam removal—alongside the daily maxima. The results of such a modeling effort would have given readers of the DEIS a much more robust and

<sup>62</sup> DEIS, pp. 3-270, D-6-37.

<sup>63</sup> See Exhibit 11, p. 74.

<sup>64</sup> DEIS, p. 4-32; see also *id.* at 1-45, 3-551, 6-42, 7-19, D-6-25, D-6-71.

<sup>65</sup> Exhibit 12, Columbia Riverkeeper, *White Paper: Computer modeling shows that Lower Snake River dams caused dangerously hot water for salmon in 2015*, p. 4 (2017).

<sup>66</sup> DEIS, Appendix D, Annex A, p. A-1-28.

meaningful picture of how dam removal would impact temperature and salmonid migration. Instead, the Corps focused its modeling effort exclusively on daily maximum temperatures, an oversight that led directly to the DEIS' misleading narrative that summer water temperatures would be "similar" in the dammed and free-flowing Lower Snake. Compounding this error, the DEIS provides almost no explanation of how the lower average and minimum daily temperatures that would occur in the free-flowing Lower Snake would benefit survival and reproductive success of summer-migrating adult salmonids. Altogether, the Corps' singular focus on modeling daily maximum temperatures results in a DEIS that gives the incorrect impression that Lower Snake Dam removal would not improve summer water temperatures or migrating conditions for adult salmonids.

**B. Lower Snake River dam removal could decrease cumulative thermal stress on adult salmon and steelhead by shortening migration times.**

The DEIS should have examined how removing impediments to migration in the Lower Snake River could decrease *cumulative* thermal stress and improve adult salmon migration, survival, and reproduction. Even if the DEIS' narrative that summer water temperatures would be similar with and without the Snake River dams was true (and it is not), salmon and steelhead migrating through the dammed and undammed rivers would likely experience significantly different amounts of thermal stress. This is because migrating adult salmon and steelhead experience thermal stress cumulatively,<sup>67</sup> and the dams, fishways, and reservoirs create migration blockages that likely cause adult fish to spend more days lingering in warm water.<sup>68</sup> Fish forced to hold in warm water expend significantly more metabolic energy just to survive, and, because migrating adult salmon do not feed and have a finite amount of "stored body energy,"<sup>69</sup> increasing the *duration* of exposure to warm water can drain energy stores and lead to negative outcomes for survival and reproduction.<sup>70</sup> Accordingly, the DEIS should have compared adult fish passage times through the dammed Lower Snake River to projected passage times through the free-flowing river and discussed the implications for migration, latent mortality, and reproductive success. The discussion of temperature is incomplete without an acknowledgement

<sup>67</sup> See Exhibit 13, Lisa Crozier, *Impacts of Climate Change on Salmon of the Pacific Northwest*, p. 18 (2015) (explaining that cumulative thermal stress is "the primary predictor of migration survival in endangered Snake River sockeye adults").

<sup>68</sup> See Exhibit 11, p. 78 (Explaining that "[f]orced delays in spawning, such as are frequently caused by difficulties in passing dams, can cause decreases in reproductive success."); see also NMFS, *2019 CRS Biological Opinion*, p. 601 (noting high rates of sockeye fall back and consequent migration delays at Lower Granite, The Dalles, and Bonneville dams); see also Exhibit 14, David Cannamela *et al.*, *Letter to Northwest Policymakers re: Science-based solutions are needed to address increasingly lethal water temperatures in the lower Snake River* (October 22, 2019).

<sup>69</sup> See, Exhibit 11, p. 75.

<sup>70</sup> Exhibit 15, Keefer, *et al.*, *Thermal exposure of adult Chinook salmon and steelhead: Diverse behavioral strategies in a large and warming river system*, PLoS ONE 13(9), pp. 16–17 (2018) ("Warm conditions more rapidly exhaust finite energetic reserves, which salmon and steelhead are simultaneously re-allocating to sexual maturation and depleting during migration, holding, and spawning. At the same time, stress hormone production surges, organs atrophy, and immune function is substantially reduced. These co-occurring processes allow the proliferation of parasites and pathogens, many of which become more virulent as temperatures rise, significantly increasing the likelihood of premature mortality.").

that the dams and fishways create migration delays that likely subject migrating adults to more cumulative thermal stress than they would experience in a free-flowing river. This is another example of how the DEIS' singular focus on daily maximum water temperature obscures and minimizes the benefits of Lower Snake River dam removal for water temperature and salmon recovery.

## **VI. The DEIS does not take a hard look at the implications of climate change for water temperatures and salmonid survival.**

The DEIS does not take a hard look at how impending climate change will impact river temperatures.<sup>71</sup> Climate change has led to increased water temperatures throughout the hydrosystem;<sup>72</sup> various studies show that the monthly average August temperature of the Columbia at Bonneville Dam is increasing at .2 to .4 C per decade<sup>73</sup> and could warm by a cumulative 1.7 to 2 C by the end of the century.<sup>74</sup> Despite this significant threat to water quality and fisheries, the DEIS does not take the logical step of modeling how climate change will impact river temperatures at various points throughout the hydrosystem in coming decades. Indeed, the RMJOC model that the DEIS uses to discuss climate change could have produced the necessary inputs (*i.e.* predicted air temperature, precipitation, streamflow, etc.) to run the water temperature models under predicted climate conditions for the coming decades.<sup>75</sup> The failure to model potential future water temperatures throughout the hydrosystem not only prevents the DEIS from taking a hard look at a looming problem, it cuts short any discussion of what measures might be necessary to ensure that salmon and steelhead can still endure their migration through the warming rivers in coming decades.

The DEIS should have considered new strategies to mitigate the effects of climate change on river temperatures. Not only is new temperature mitigation necessary to ensure that salmon and steelhead can safely migrate through the hydrosystem as climate change intensifies, it is appropriate because the reservoirs actually intensify the water temperature increases caused by changing climate.<sup>76</sup> In other words, the impacts of climate change on water temperature (and, by extension, fish survival<sup>77</sup>) in the current hydrosystem are worse than they would be in a free-flowing river. Nevertheless, the DEIS does not explore or recommend strategies to deal with increasing water temperatures under climate change. An appropriate exploration of temperature mitigation actions would have included, at least, studying: increased summer flow from Canadian storage reservoirs; increased and/or variable-depth releases from Grand Coulee dam;

<sup>71</sup> See, *e.g.*, DEIS, p. 4-31; see also Exhibit 1, pp. 3-4.

<sup>72</sup> See generally Exhibit 16, EPA, *Draft Assessment of Climate Change Impacts on Temperatures of the Columbia and Snake Rivers* (2018).

<sup>73</sup> Exhibit 17. EPA, *Columbia & Snake River Temperature TMDL: Preliminary Technical Information PowerPoint Presentation*, Slide 28 (August 29, 2018).

<sup>74</sup> Exhibit 6, Slide 53.

<sup>75</sup> See Exhibit 1, pp. 3-4.

<sup>76</sup> Exhibit 17, Slide 31 (showing that average August temperatures at John Day dam are increasing faster in the dammed river than they would without the dams).

<sup>77</sup> See, generally, Exhibit 13.

summer-time drawdown of McNary and John Day pools or the removal of these dams; and the draw-down or removal of Snake River dams coupled with optimizing Dworshak cold water releases to enhance fish migration. The failure to contemplate, much less recommend, any mitigation for the intensifying water temperature problems caused by the dams and climate change (especially in the main-stem Columbia River) is inexcusable and short-sighted.

## Conclusion

To help prevent the extinction of Snake River salmon, Southern Resident orcas, and Northwest salmon cultures, breaching the four Lower Snake River dams must become part of the final preferred alternative. The EIS' narrative should also be corrected to tell a more accurate, and complex, story about how dam removal would significantly improve the water temperature regime in the Lower Snake River to the benefit of critically endangered salmon and steelhead.

Sincerely,



Miles Johnson  
Senior Attorney  
Columbia Riverkeeper

## Exhibits:

1. Paul Pickett, *Technical comments on the CRSO DEIS' modeling and discussion of water temperature prepared for Columbia Riverkeeper* (2020).
2. EPA, *Comments on NMFS' 2015 Adult Sockeye Salmon Passage Draft Report* (2016).
3. Fish Passage Center, *Review of Draft of NMFS' 2015 Sockeye Salmon Passage Report* (2016).
4. Margaret Filardo *et al.*, *Letter to Gene Spangrude re: historic Snake River water temperature observations* (November 13, 2019).
5. EPA, *Draft Assessment of Impacts to Columbia and Snake River Temperatures using the RBM10 Model*, pp. 39–40 (December 19, 2018).
6. EPA, *Columbia River Temperature TMDL: State and Tribal Meetings PowerPoint Presentation* (January 2020).
7. Northwest Environmental Advocates, *Comments on Draft Columbia River Cold Water Refuges Plan* (November 19, 2019).
8. EPA, *Issue Paper 1: Salmonid Behavior and Water Temperature* (2001).
9. EPA, *Summary of Temperature Preference Ranges and Effects for Life Stages of Seven Species of Salmon and Trout* (1998).
10. NMFS, "2019 adult survival estimates for distribution" spreadsheet; "SR Sockeye" tab (2019).
11. EPA, *Issue Paper 5: Summary of Technical Literature Examining the Physiological Effects of Temperature on Salmonids* (2001).

12. Columbia Riverkeeper, *White Paper: Computer modeling shows that Lower Snake River dams caused dangerously hot water for salmon in 2015* (2017).
13. Lisa Crozier, *Impacts of Climate Change on Salmon of the Pacific Northwest* (2015).
14. David Cannamela *et al.*, *Letter to Northwest Policymakers re: Science-based solutions are needed to address increasingly lethal water temperatures in the lower Snake River* (October 22, 2019).
15. Keefer, *et al.*, *Thermal exposure of adult Chinook salmon and steelhead: Diverse behavioral strategies in a large and warming river system*, PLoS ONE 13(9) (2018).
16. EPA, *Draft Assessment of Climate Change Impacts on Temperatures of the Columbia and Snake Rivers* (2018).
17. EPA, *Columbia & Snake River Temperature TMDL: Preliminary Technical Information PowerPoint Presentation* (August 29, 2018).

cc'd via email:

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