Barry Thom, Regional Administrator
NOAA Fisheries
1201 NE Lloyd Blvd.
Suite 1100
Portland, OR 97232

Scott Spellmon, Northwest Division Commander
Army Corps of Engineers
PO Box 2870
Portland, OR 97208-2870

Dear Administrator Thom and Major General Spellmon,

We write to request you take immediate action to help Idaho's endangered Snake River sockeye salmon.

In the summer 2015, 95 percent of Idaho's returning adult Snake River sockeye salmon were killed before reaching Idaho by two unbroken months of hot water in the Columbia and Snake rivers. Chronic hot water now occurs in both the Columbia and Snake Rivers nearly every summer and catastrophic, lethal hot water, like that which occurred in 2015, is becoming more frequent. Water temperatures are steadily rising.

Many scientists consider Snake River sockeye to be the salmon species at most immediate risk from ongoing climate change. They migrate home when water is hottest, in the summer. And they are already endangered. The catastrophe in 2015 makes plain that sockeye need every edge we can provide them, starting now.

NOAA Fisheries, and the Army Corps of Engineers can take a practical step that will help right away. **The undersigned organizations ask NOAA and the Army Corps to establish a biological objective to reduce artificial transportation of endangered Snake River juvenile sockeye to as close to zero as possible, beginning this spring of 2017.** Artificial transport in barges harms the sockeye that are subjected to it, making them even more vulnerable to hot water when they return as adults. The less they are barged as juveniles, the greater their capacity to survive hot water as adults.

On the attached pages, we make the scientific case for our request, relying mainly on NOAA science. Once the objective is established, we suggest that federal, state and tribal fish managers be charged to implement it to assure consistency with management for other species and uses.

Due to above average Snake Basin snowpack this year, high flows and large volumes of uncontrolled spill are likely at the four lower Snake River dams this spring. This by itself will reduce barging of sockeye. Judge Simon's new ruling directing an increase in salmon spill beginning in 2018 is likely to reduce it some as well. Active management should be used to reduce it further, starting this year.

We know your agencies are conducting multi-year legal processes under the Endangered Species Act and National Environmental Policy Act to determine longer-term actions for all endangered Columbia Basin salmon. But Idaho's sockeye need help now. We hope you will seriously consider our request. Thank you.

Sincerely,

Kevin Lewis
Executive Director
Idaho Rivers United
PO Box 633
Boise, ID 83701

Justin Hayes
Program Director
Idaho Conservation League
PO Box 844
Boise, ID 83701

Zack Waterman
Chapter Director
Idaho Sierra Club
503 W. Franklin St.
Boise, ID 83702

Brian Brooks
Executive Director
Idaho Wildlife Federation
PO Box 6426
Boise, ID 83707

Buck Ryan
Executive Director
Snake River Waterkeeper
2123 N. 16th St.
Boise, ID 83702

Gary Macfarlane
Ecosystem Defense Director
Friends of the Clearwater
PO Box 9241
Moscow, ID 83843

Michael Wells
President
Clearwater-Snake Rivers
Chapter #935
Trout Unlimited
PO Box 9958
Moscow, ID 83843-9953

Scientific background

in support of a biological objective to reduce artificial transportation of endangered Snake River juvenile sockeye as close to zero as possible, beginning spring 2017

Ocean-bound juvenile Snake River sockeye salmon have been routinely subjected to artificial transportation, commonly called juvenile fish barging, since the 1980s. There has never been an explicit scientific basis for barging Snake River sockeye, even after the species was declared endangered by extinction in 1992. Instead, barging of sockeye has been a by-product of the program to barge chinook salmon. The collection and barging system does not separate the juveniles of these two different species.

The percentage of Snake River sockeye juveniles barged varies annually with water conditions. It was highest in the 1990s and through 2005. Since 2006, court-ordered salmon spill has reduced it somewhat. But an average half of sockeye juveniles are still being barged. In its 2015 Annual Report, the Fish Passage Center estimated the proportion of ocean-bound Snake River sockeye juveniles that were collected and barged from 2007 through 2015. Across these nine years, an average 49 percent were barged. In 2013, when most of the sockeye that returned as adults in 2015's killing hot water migrated to the ocean, 58 percent of Snake River sockeye were artificially transported.[1]

NOAA Fisheries' post-mortem on the catastrophic sockeye migration of 2015 documents that some 95 percent of endangered adult Snake River sockeye died in the hot water of the Columbia and Snake Rivers before reaching Idaho. It also documents that those 2015 adult sockeye that had out-migrated in the river two years earlier as juveniles had significantly higher survival during 2015's extreme heat than those that were collected at a lower Snake dam and barged to below Bonneville Dam. It documents that the same was true the two previous years: sockeye that migrated in-river as juveniles in 2011 and 2012 enjoyed higher survival when returning as adults in 2013 and 2014 than sockeye that were collected and barged.[2]

Figure 10, on page 26 of the report, shows survival of 2015 adult Snake River sockeye, between Bonneville and McNary dams, was **five times higher** for fish that migrated in-river as juveniles than those that were artificially transported. Table 4 on page 30 shows that 2015 adult survival, between Bonneville and Lower Granite Dams, was **zero** for sockeye that had been artificially transported as juveniles, and 8 percent for those that had migrated in-river as juveniles.[3]

The report notes on page 24 that "[t]ransported fish have higher straying, wandering, and fallback rates as adults than those that are not transported (Keefer and Caudill 2012). Fish that exhibited any of these behaviors moved upstream more slowly and therefore were more likely to experience mainstem temperatures above 20°C [68F] during 2015." It states on page 25 that "…it appears that Snake River sockeye salmon that had been transported as juveniles had an impaired homing ability, which delayed their upstream progress and increased their exposure to elevated mainstem temperatures."

The harmful effects upon sockeye of artificial transportation are ratified in two other recent reports: a 59-page October 2015 Fish Passage Center memorandum,[4] which is also cited in NOAA's post-mortem, and the draft 2016 report from the Comparative Survival Study (CSS).[5] Both contain additional evidence that out-migrating sockeye juveniles that are transported have lower survival than juveniles that migrate in-river. An earlier study by Chapman et al (1997) reached the same conclusion.

---

[1] *2015 Annual Report.* Fish Passage Center, August 2016. Appendix G, Page G-5.

[2] *2015 Adult Sockeye Salmon Passage Report*, NOAA Fisheries, September 2016.

[3] Due to extreme hot water in 2015, survival for <u>all</u> sockeye was very low. But some in-river migrants survived, whereas no transported migrants did.

[4] "Requested data summaries and actions regarding sockeye adult fish passage and water temperature issues in the Columbia and Snake rivers." October 28, 2015. Fish Passage Center. Memorandum 159-15.

[5] "Comparative Survival Study of PIT-tagged Spring/Summer/Fall Chinook, Summer Steelhead, and Sockeye," Draft 2016 Annual Report. Columbia Basin Fishery Agencies and Tribes, December 2016. See especially pages A81-83 in Appendix A.

The poor results from barging salmon also make ecological sense. The long-running CSS studies are showing that, in general, the more human and mechanical handling that juvenile salmon of all species are exposed to during dam passage, the lower are their adult survival rates. This agrees with the ecological paradigm of *Return to the River*, and many of NOAA's own studies, that habitat conditions (whether in spawning, rearing, migratory, or estuary habitats) that most closely mimic natural conditions and processes within which salmon evolved will be most successful at restoring imperiled salmon.[6]

For the last nine years, half of endangered Snake River sockeye juveniles have been subjected to a practice that NOAA and others have concluded harms their fitness and homing ability. In 2013, when most of the sockeye that returned as adults in 2015 migrated to the ocean, 58 percent of Snake River sockeye were artificially transported. It is thus likely that, had no Snake River sockeye been transported in 2013, 2015's terrible adult returns would have been higher, perhaps even doubled.

A converging strain of science documents the steady increase in Columbia and Snake River water temperatures, the role of climate change in it, its harmful effects on salmon, and the high likelihood of further near-term increases. NOAA scientists are leaders in this work. Among its findings:

1. Columbia and Snake River main-stem summer temperatures have risen steadily, and stayed higher longer, since the 1950s (Quinn and Adams 1996; Crozier et al 2007). In 1993, 24 years ago, Dauble and Mueller reported that exceedances of 68 degrees F (20 C) had become routine in both rivers. 68F is NOAA's established upper temperature standard for salmon.

2. Temperatures in the main-stem Columbia and Snake have regularly approached lethal levels since at least 2000 (Hodgson and Quinn 2002; Hyatt et al 2003; Crozier et al 2007).

3. Hot water is now chronic in both rivers each summer. Over the period 2006-2015, average water temperature at Bonneville Dam on the Columbia exceeded 68 F for 45 straight days starting July 19. For the same 10 years, average water temperature at Ice Harbor Dam on the Snake exceeded 68 F for 45 straight days starting July 16 (FPC 2016a).

4. Climate change has been a factor in these rising temperatures, so they are likely to rise further in the near future (Crozier et al 2011; ISAB 2016). Beechie et al (2013) project a 1-4 degree C increase in Northwest stream temperatures by the 2030-2069 period, and Wu et al (2012) project a 1.88 degree C temperature rise at the Columbia River mouth in the 2020s. While such estimates are subject to uncertainties, the key finding for purposes of this request is that water temperatures will continue to rise in the near term.

5. Temperatures above 68 degrees F harm adult salmon in many ways, from direct

[6] *Return to the River*, 2006. Richard N. Williams, editor. Elsevier Academic Press.

lethality to drip-by-drip sapping of energy stores and fitness. The harm increases as temperature goes up and exposure is prolonged (McCullough et al 2001; Richter and Colmes 2005; Crozier et al 2007; Crozier et al 2014).[7]

6. While all salmon are at risk from current and rising water temperatures, Snake River sockeye salmon are likely at greatest risk due to the summer timing of their adult migration, coupled with their already-endangered status. Keefer et al (2008) and Crozier et al (2014) both found that survival of Snake River sockeye drops sharply at higher temperatures. The mass death of sockeye in 2015's hot water confirms it. Summer Chinook and summer steelhead were also harmed, but sockeye fared the worst (NOAA 2016; Fish Passage Center 2016b).

7. Catastrophic hot water, like that in 2015, is likely to occur more often, and the extent and severity of salmon kills is likely to increase (Mantua et al 2009; ISAB 2016).

8. The unbroken 300-mile string of dams and reservoirs from Bonneville Dam on the Columbia to Lower Granite Dam on the Snake, contributes to the total warming and exacerbates its effects on salmon (Crozier et al 2007; Crozier et al 2011; Fish Passage Center 2016c). Reducing barging of sockeye will help counteract dam-related harmful effects as well as effects of climate change.

9. Actions and measures to help salmon withstand climate change should protect, restore or mimic the natural processes within which salmon evolved their exceptional fitness. Salmon will do most of the work; our job is to provide them better conditions in which to do it. This approach prioritizes protecting and restoring connected habitats, conserving functioning natural ecosystems that allow evolutionary processes to develop, increasing habitat diversity and resilience, restoring floodplains and their connectivity, and keeping waters cool. This approach generally does not prioritize mechanical, non-ecological measures such as juvenile salmon barging (Williams ed., 2006; Waples et al 2009; Beechie et al 2010; Beechie et al 2013; Bottom et al. 2009; Crozier et al 2007; Crozier and McClure 2015; Lackey et al. 2006; Lichatowich 1999; Lichatowich 2013; Lichatowich and Williams 2015; Schindler et al 2010; Stanford et al 1996; Wade et al 2013; Williams (ed.), 2006.

Conclusion. A preponderance of science and empirical data, from NOAA and many others, documents that barging juvenile Snake River sockeye harms their adult fitness, and reduces their resilience to the summer hot water that is now common and getting worse. Reducing such barging as close to zero as possible, within a management context that considers other species and uses, will help this endangered fish withstand the effects of climate change within their already badly-degraded Columbia and Snake migratory habitat.

In its post-mortem on the 2015 Snake River sockeye disaster, NOAA recommends more study and evaluation of juvenile sockeye barging. This is an insufficient response to the

[7] These and other studies show this statement is conservative – that is, substantial evidence exists that harm to salmon species occur at temperatures well below 20 C.

preponderance of NOAA's own data. Waiting for additional data, rather than acting to help endangered sockeye now, violates any reasonable application of the precautionary principle under the Endangered Species Act. NOAA should immediately establish a biological objective to reduce barging of sockeye juveniles as close to zero as possible, and empower federal, state and tribal fish managers to implement the objective to assure consistency with other species.

Bibliography

Beechie TJ, Sear D, Olden J, Pess GR, Buffington J, Moir H, Roni P, Pollock MM. 2010. Process-based principles for restoring river ecosystems. BioScience 60: 209–222.

Beechie T, Imaki H, Greene J, Wade A, Wu H, Pess G, Roni P, Kimball J, Stanford J, Kiffney P, and Mantua N. 2013. Restoring Salmon Habitat for a Changing Climate. River Research and Applications, 29:939-960. wileyonlinelibrary.com, DOI: 10.1002/rra.2590

Bottom, D. L., K. K. Jones, C. A. Simenstad, and C. L. Smith. 2009. Reconnecting social and ecological resilience in salmon ecosystems. Ecology and Society 14(1): 5. [online] URL: http://www.ecologyandsociety.org/vol14/iss1/art5/

Chapman, D., C. Carlson, D. Weitkamp, G. Matthews, J. Stevenson, and M. Miller. 1997. Homing in sockeye and Chinook salmon transported around part of the smolt migration route in the Columbia River. North American Journal of Fisheries Management 17:101

Comparative Survival Study of PIT-tagged Spring/Summer/Fall Chinook, Summer Steelhead, and Sockeye. 2016. Draft 2016 Annual Report. Columbia Basin Fishery Agencies and Tribes.

Crozier LG, Hendry AP, Lawson PW, Quinn TP, Mantua NJ, Battin J, Shaw RG, Huey RB. 2007. Potential responses to climate in organisms with complex life histories: evolution and plasticity in Pacific salmon. Evolutionary Applications 1: 252–270.

Crozier LG, Scheuerell MD, and Zabel RW. 2011. Using Time Series Analysis to Characterize Evolutionary and Plastic Responses to Environmental Change: A Case Study of a Shift toward Earlier Migration Date in Sockeye Salmon. The American Naturalist. Volume 178. No. 6, December 2011.

Crozier, L., B. J. Burke, B. P. Sandford, G. A. Axel, and B. L. Sanderson. 2014. Passage and survival of adult Snake River sockeye salmon within and upstream from the Federal Columbia River Power System. Northwest Fisheries Science Center, National Marine Fisheries Service, Seattle, Washington.

Crozier, Lisa and McClure, Michelle. 2015. Steelhead Persistence and Adaptation in a Warming World. *Osprey*, May 2015, Issue No. 81.

Dauble, DD and Mueller, RP. 1993. Factors Affecting the Survival of Upstream Migrant Adult Salmonids in the Columbia River Basin. Recovery Issues for Threatened and Endangered Snake River Salmon, Technical Report 9 of 11, Bonneville Power Administration.

Fish Passage Center. *2015 Annual Report.*

Fish Passage Center 2016a. “Water Temperature Data” query to FPC website.

Fish Passage Center 2016b. “Requested data summaries regarding summer Chinook adult fish passage and water temperature in the Columbia and Snake Rivers.” January 29, 2016, memo 15-16.

Fish Passage Center 2016c. “Review of April 2016 Draft of NOAA Fisheries report, *2015 Sockeye Salmon Passage Report*, May 4, 2016, memo 35-16.

Fish Passage Center 2016d. “The effect of water temperature on steelhead upstream passage.” October 31, 2016, memo 56-16.

Hodgson, Sayre and Quinn, Thomas, 2002. The timing of adult sockeye salmon migration into fresh water: adaptations by populations to prevailing thermal regimes. Canadian Journal of Zoology, 2002. 80(3): 542-555

Hyatt, K. D., M. M. Stockwell, and D. P. Rankin. 2003. Impact and adaptation responses of Okanagan River sockeye salmon (Oncorhynchus nerka) to climate variation and change effects during freshwater migration: stock restoration and fisheries management implications. Canadian Water Resources Journal 28:689–713.

ISAB and ISRP (Independent Scientific Review Panel. 2016. Critical Uncertainties for the Columbia River Basin Fish and Wildlife Program. ISAB/ISRP 2016-1. Pages 35-38, 118-121.

Keefer ML, Caudill CC, Peery CA, and Lee SR, 2008. Transporting Juvenile Salmonids Around Dams Impairs Adult Migration. Ecological Applications, 18(8), 2008.

Keefer, M. L., and C. C. Caudill. 2012. A review of adult salmon and steelhead straying with an emphasis on Columbia River populations. Technical Report 2012-6. Prepared for U.S. Army Corps of Engineers, Walla Walla District, Walla Walla, WA.

Lackey RT, Lach D, Duncan S. 2006. Salmon 2100: The Future of Wild Pacific Salmon. American Fisheries Society: Bethesda MD.

Lichatowich, Jim. 1999. Salmon Without Rivers. Island Press.

Lichatowich, Jim. 2013. Salmon, People and Place. Oregon State University Press.

Lichatowich and Williams. 2015. Faith in Nature: The Missing Element in Salmon Management and Mitigation Programs. Osprey, Issue No. 81.

Mantua, Nathan; Tohver, Ingrid; and Hamlet, Alan. 2009. Impacts of Climate Change on Key Aspects of Freshwater Salmon Habitat in Washington State. Chapter 6 in *The Washington Climate Change Impacts Assessment: Evaluating Washington's Future in a Changing Climate*, Climate Impacts Group, University of Washington, Seattle, Washington.

McCullough, D.A., S. Spalding, D. Sturdevant, and M. Hicks. 2001. Summary of technical literature examining the physiological effects of temperature on salmonids. Region 10 Temperature Water Criteria Guidance Development Project Issue Paper 5. U.S. EPA Report 910-D-005. Seattle, WA.

NOAA Fisheries. 2016. 2015 Adult Sockeye Salmon Passage Report. September 2016.

Quinn, T. P., and D. J. Adams. 1996. Environmental changes affecting the migratory timing of American shad and sockeye salmon. Ecology 77:1151–1162.

Richter, A., and S.A. Kolmes. 2005. Maximum temperature limits for Chinook, coho, and chum salmon, and steelhead trout in the Pacific Northwest. Reviews in Fisheries Science 13:23-49.

Schindler DE, Hilborn R, Chasco B, Boatright CP, Quinn TP, Rogers LA, Webster MS. 2010. Population diversity and the portfolio effect in an exploited species. Nature 465: 609–612.

Stanford JA, Ward JV, Liss WJ, Frissell CA, Williams RN, Lichatowich JA, Coutant CC. 1996. A general protocol for restoration of regulated rivers. Regulated Rivers: Research & Management, 12: 391–413.

Wade, A. A., T. J. Beechie, E. Fleishman, N. J. Mantua, H. Wu, J. S. Kimball, D. M. Stoms, and J. A. Stanford. 2013. Steelhead vulnerability to climate change in the Pacific Northwest. Journal of Applied Ecology 50:1093-1104

Waples RS, Beechie TJ, Pess GR. 2009. Evolutionary history, habitat disturbance regimes, and anthropogenic changes: what do these mean for resilience of Pacific salmon populations? Ecology and Society 14: 3. http://www.ecologyandsociety.org/vol14/iss1/art3/.

Williams, Richard, editor. *Return to the River.* Elsevier Academic Press, 2006.

Wu H, Kimball JS, Elsner MM, Mantua N, Adler RF, Stanford J. 2012. Projected climate change impacts on the hydrology and temperature of Pacific Northwest rivers. Water Resources Research, Vol 48, W11530, doi:10.1029/2012WR012082.

###