Mining's effect on fish warrants better science-based policies

July 1 2022

Migrating sockeye salmon approach their spawning grounds on a tributary of the Copper River. Credit: University of Alaska Fairbanks

A new paper published in *Science Advances* synthesizes the impact of metal and coal mines on salmon and trout in northwestern North

America, and highlights the need for more complete and transparent science to inform mining policy.

It is the first comprehensive effort by an interdisciplinary group of experts that explicitly links mining policy to our current understanding of watershed ecology and salmonid biology.

"Our paper is not for or against mining, but it does describe current environmental challenges and gaps in the application of science to mining governance. We believe it will provide critically needed scientific clarity for this controversial topic," said lead author Chris Sergeant, a graduate student at the University of Alaska Fairbanks College of Fisheries and Ocean Sciences and a research scientist at the University of Montana.

For the study, experts integrated and reviewed information on hydrology, river ecology, aquatic toxicology, biology and mining policy. Their robust assessment maps more than 3,600 mines throughout Montana, Washington, British Columbia, the Yukon and Alaska. The size of the mines ranges from family-run placer sites to massive open-pit projects.

The study shows that, despite impact assessments intended to evaluate risk and inform mitigation, mines continue to harm salmonid-bearing watersheds through contaminants, stream channel burial and streamflow alteration. Silt suffocates eggs, and embryos may not survive contaminated groundwater. Heavy metals compromise a salmon's sense of smell, which affects their ability to react to predators and find their way back from the ocean to spawn.

"Not all mines pose the same level of risk, but our review revealed that harm from mining can be severe and long-lasting. The extent of mining pressures on these watersheds underscores the importance of accurately

assessing risk to water, fish and communities," said Sergeant.

The paper also describes how some mining policies do not account for the breadth and length of mining impacts on the environment, or the increasing effects of climate change.

"The crux of the issue is that salmon use so much of the watershed during their life cycle. They move throughout watersheds, whereas the impact assessments of mining projects tend to be very locally focused, and they don't sufficiently consider all of the compounding and downstream effects of mining," said salmon biologist and CFOS faculty member Megan McPhee.

She explained that some impact assessments don't fully assess the infrastructure required to operate a mine, such as roads, electricity generation and water removal.

"Another thing is that most mines, after closure, have to be mitigated in perpetuity. That's a problem because most corporations aren't structured that way. Also, most mitigation strategies don't take into account environmental change, including permafrost melting, and climate change-induced flooding," said McPhee.

Moving forward, the authors highlighted four key issues that will be foundational to modern, science-based risk assessment and mitigation, beginning with understanding stressor complexity and uncertainty. Stressors include impacts such as altered hydrology and temperature, habitat modification and loss, and pollutants.

Other key issues are accounting for cumulative effects of mining activities across a mine's life cycle, developing realistic mitigation strategies and recognizing the potential for climate change to magnify risk.

More information: Christopher Sergeant, Risks of mining to salmonid-bearing watersheds, *Science Advances* (2022). DOI: 10.1126/sciadv.abn0929. www.science.org/doi/10.1126/sciadv.abn0929