Stormwater biofiltration increases coho salmon hatchling survival

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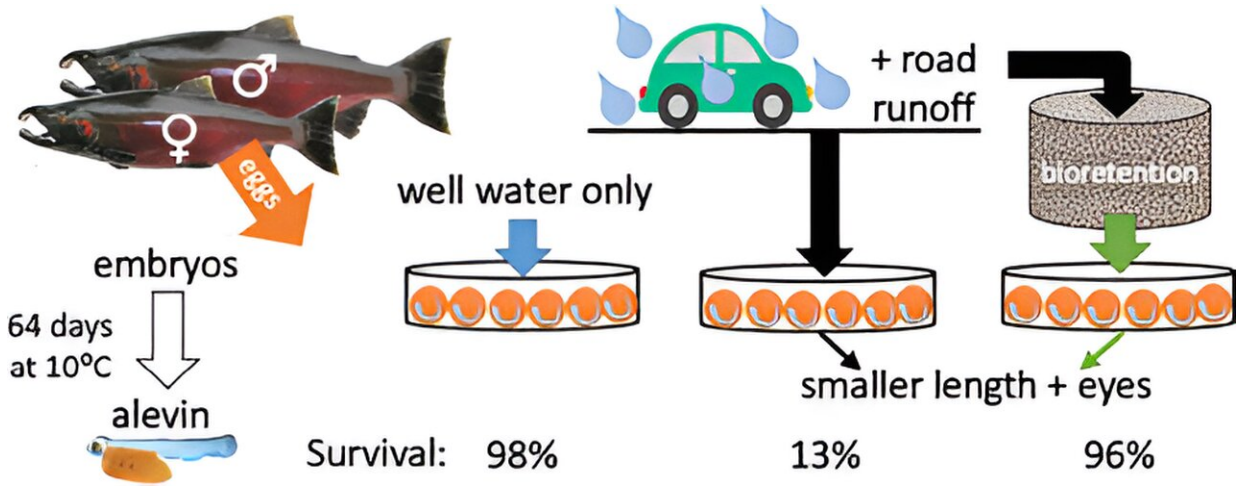

Credit: *Science of The Total Environment* (2023). DOI: 10.1016/j.scitotenv.2023.165759

A relatively simple, inexpensive method of filtering urban stormwater runoff dramatically boosted survival of newly hatched coho salmon in an experimental study. That's the good news for the threatened species from the Washington State University-led research. The bad news: unfiltered stormwater killed almost all of them.

The findings, published in the journal *Science of the Total Environment*, are consistent with previous research on adult and juvenile coho that found exposure to untreated roadway runoff that typically winds up in

waterways during storms resulted in mortality of 60% or more. For the coho hatchlings in this study, mortality from runoff exposure was even higher at 87%.

When the stormwater was run through a biofiltration method—essentially layers of mulch, compost, sand and gravel—nearly all the coho hatchlings survived, though many of resulting fish had smaller eyes and body sizes than a control group.

"This study highlights how vulnerable the fish are as soon as they hatch to the toxic impacts of stormwater runoff," said lead author Jen McIntyre, an associate professor in WSU's School of the Environment. "Biofiltration appears to be very effective at preventing that acute lethal toxicity. We also found that it prevented some of the sub-lethal effects but not all of them."

To understand runoff impacts and possible interventions, researchers set up experiments with about 8,400 fertilized coho eggs, placing a subset under direct exposure to runoff produced by 15 storms in the Seattle area. That water contained a host of contaminants including dissolved metals and polycyclic aromatic hydrocarbons, a class of chemicals associated with fossil fuels.

Coho eggs have a thick shell and all the embryos survived under the different treatments, but once they hatched, most of young fish, called alevins, in the set exposed to the runoff died.

This high mortality, at various freshwater coho life stages might help explain why coho have disappeared from some streams completely, McIntyre said.

These experiments were done prior to the identification of the tire-related compound 6PPD-quinone that is particularly lethal to coho

salmon. The authors noted that the mortality seen in the runoff-exposed alevins in this study is consistent with other research that directly exposed fish just to that chemical.

In this study, the researchers also exposed another set of alevins to runoff that first had gone through biofiltration. The method was able to remove most contaminants and those fish survived at similar rates to a control group raised in just clean water.

While relatively inexpensive, implementing biofiltration does face some hurdles—primarily because it requires setting aside land for these engineered soil systems. Such green infrastructure is now required for all new developments in Washington state, but the vast majority of already established built environments do not have them.

Implementing more biofiltration would help coho as well as other fish sensitive to urban runoff like steelhead, but it is only part of the solution, McIntyre said.

"We also need to pay more attention to source control, finding out which are the worst chemicals," she said. "Rather than just rely on filtering them at the end, we can do more to prevent them getting into the runoff in the first place."

More information: Jenifer K. McIntyre et al, Bioretention filtration prevents acute mortality and reduces chronic toxicity for early life stage coho salmon (Oncorhynchus kisutch) episodically exposed to urban stormwater runoff, *Science of The Total Environment* (2023). DOI: 10.1016/j.scitotenv.2023.165759

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