Even at sublethal levels, pesticides may slow the recovery of wild salmon populations

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Biologists determined that short-term, seasonal exposure to pesticides in rivers and basins may limit the growth and size of wild salmon populations. In addition to the widespread deterioration of salmon habitats, these findings suggest that exposure to commonly used pesticides may further inhibit the recovery of threatened or endangered populations.

"Major efforts are currently underway to restore Pacific salmon habitats in an effort to recover depressed populations," says David Baldwin of the National Oceanic and Atmospheric Administration (NOAA), who co-authored the study with NOAA colleagues in the December issue of the ESA journal Ecological Applications. "However, not much research has been done to determine the importance of pollution as a limiting factor of ESA-listed species."

The researchers studied the impact of pesticides, such as diazinon and malathion, on individual salmon using pre-existing data, and then devised a model to calculate the productivity and growth rate of the population. They used several exposure scenarios to reflect realistic pesticide use across various landscapes and over time.

Pesticides include insecticides, herbicides and fungicides that are usually applied to agricultural and urban landscapes. They primarily enter waterways in spray drift, surface runoff and irrigation return flows.

"An important aim of the work was to link known sublethal effects for

individual salmon to impacts on the productivity of salmon populations," explains Baldwin.

The biologists found in previous studies that, on an individual level, the pesticides directly affected the activity of acetylcholinesterase, an important enzyme in the salmon brain. As a result, the salmon experienced reductions in feeding behavior. The reductions in food were then extended using the model to calculate reductions in the growth, size, and subsequent survival at ocean migration. In one scenario, the model predicted that, within a span of 20 years, returning spawners would have an increase of 68 percent abundance compared to a 523 percent projected increase in an unexposed chinook population.

"The model showed that a pesticide exposure lasting only four days can change the freshwater growth and, by extension, the subsequent survival of subyearling animals," says Baldwin. "In addition, the seasonal transport of pesticides to salmon habitats over successive years might slow the recovery of depressed populations."

The researchers argue that improving water quality conditions by reducing common pollutants could potentially increase the rate of recovery. Looking to the bigger picture, "This should help resource managers consider pesticides at the same biological scale as physical and biological stressors when prioritizing habitat restoration activities," says Baldwin.

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