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# Study: Pyridine is 'highly toxic' to crabs and caused 2021 die-off

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By Responsible Seafood Advocate

## Pyridine quickly travels the coastline and can kill off roughly 50 percent of the crab population in 24 hours

Newcastle University researchers have identified the chemical responsible for the crab and lobster mass mortalities on the Northeast and North Yorkshire coasts in the United Kingdom.

A series of mass mortalities of crabs and lobsters were recorded along the Northeast and North Yorkshire coasts during the autumn and winter of 2021. The cause of the die-offs was unknown, with suggestions ranging from toxic algae bloom to the release of poisons from intensive dredging of the Tees estuary.

Early research in the lab revealed high levels of pyridine – a chemical with a long history of release into the River Tees – in the tissues of the dead crabs. However, there were no data on whether pyridine is toxic to crabs. The Fishmongers' Company commissioned Newcastle University to undertake research to fill this knowledge gap.

In this research, edible crabs (*Cancer pagurus*) were exposed to a range of pyridine solutions, while their behavior, indicators of cellular stress and survival over periods of up to three days were recorded. At the upper range of tested concentration which was comfortably within the pyridine levels found in the dead



Early research revealed that high levels of pyridine are highly toxic to crabs, and responsible for the 2021 crab and lobster mass die-offs in the UK. Photo courtesy of Newcastle University.

crabs, pyridine caused convulsive behaviors, paralysis and death within six hours. The onset of paralysis took longer as the pyridine concentrations were lowered, but mortalities remained high even at lower concentrations.



(<http://penverproducts.com>).

“Our research has shown that there is no doubt that pyridine is highly toxic to crabs,” said Dr. Gary Caldwell, Senior Lecturer in Applied Marine Biology. “The levels of pyridine we tested were below the levels recorded by the Environment Agency from the bodies of the dead crabs, and yet we saw it caused death in the edible crabs.”

The next step was to explain the scale of the deaths over such a large stretch of the coastline. To evaluate the scale of the deaths, Dr. Miguel-Angel Morales, a physical oceanographer in the School of Natural and Environmental Sciences at Newcastle University, combined the toxicity data with computer simulations of the North Sea currents and tides during and after the autumn dredging activity.

The modeling showed that pyridine would be quickly transported along the coastline, with areas around Hartlepool and Redcar worst affected, with the potential to kill approximately half of the crab population after only 24 hours of exposure. Levels of pyridine sufficient to kill approximately 10 percent

of the population within three days were predicted to reach as far south as Whitby and Robin Hood's Bay. The timeline of the transport of pyridine along the coast closely matched the timeline of mortalities reported by the fishing community and the general public.

With the experiment and analysis complete, the next step is to publish the findings in an academic journal.

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