European eels found to suffer muscle damage due to cocaine in the water

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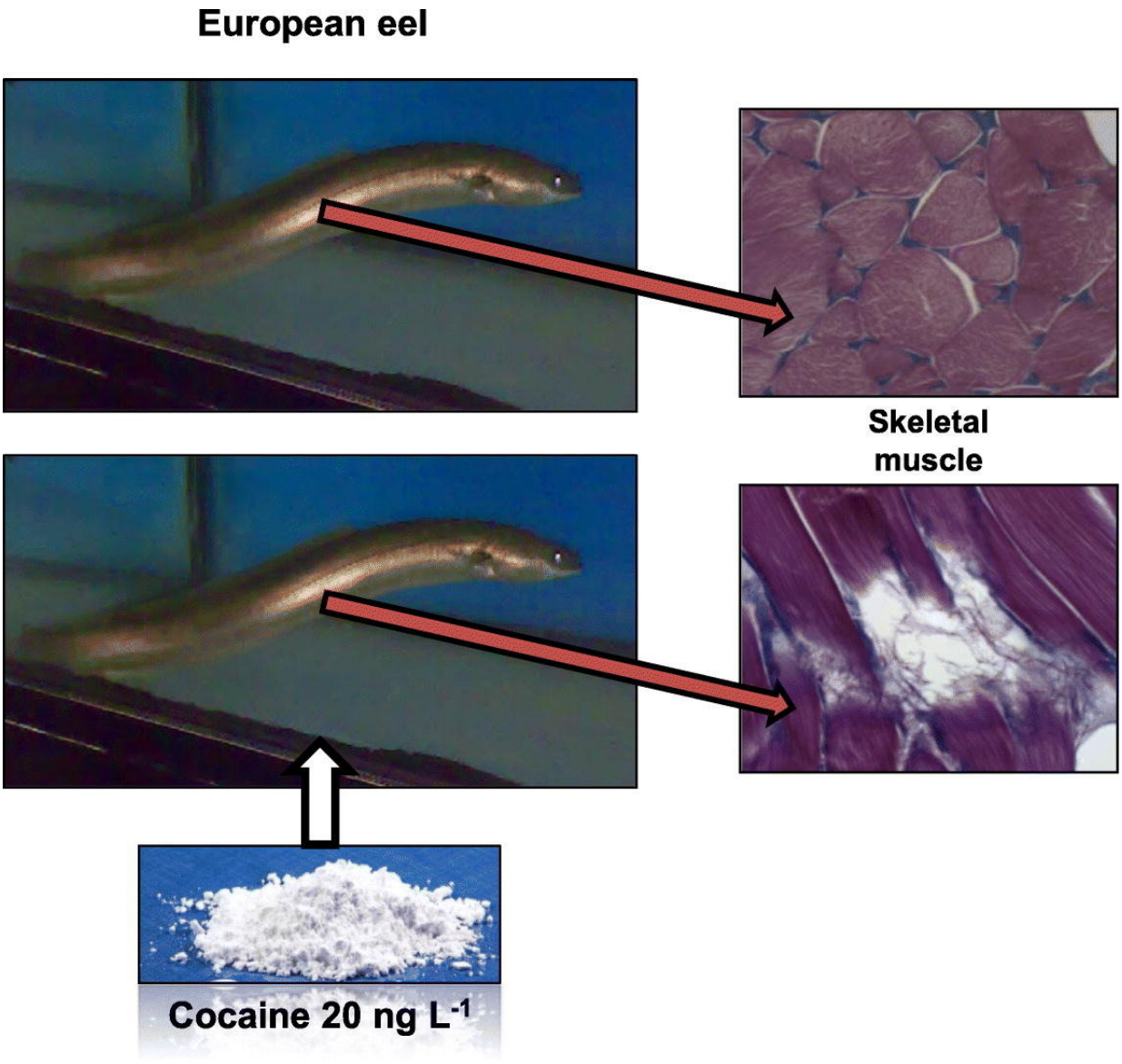

Credit: *Science of The Total Environment* (2018). DOI:

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A team of researchers from the University of Naples Federico II and the University of Salerno has found that eels exposed to very small amounts of cocaine in the water suffer health problems. In their paper published in *Science of The Total Environment*, the group describes their study of the eels and what they found.

As the researchers note, several studies have shown in recent years that a host of drugs, illicit or otherwise, make their way into rivers and streams. Such drugs, they note, have been found to cause a variety of health problems for the creatures that inhabit those waterways. In this new effort, the researchers focused on just one species and one drug—eels and cocaine.

Cocaine is, of course, a banned drug in most parts of the world, but that has not prevented widespread use. It can make its way into waterways via the urine of users, or direct dumping into toilets. Either way, it winds up in sewage systems that eventually drain into natural waterways. Prior research has found that the water in which European eels reside (off the coast of Europe) typically contains approximately 20 billionths of a gram of cocaine per liter. To find out what that might be doing to the eels, the researchers obtained 150 of them from an eel farm and put them in tanks in their lab. Some of the eels were given clean water from a tap, while others had tap water with cocaine added to match their natural environment. All of the eels were observed for 50 days.

The researchers report that the eels in the tanks with cocaine were noticeably more active than those in the clean tanks, but appeared otherwise healthy. After the 50-day trial period, most of the eels were dissected to see if they looked healthy inside, as well. The researchers

report that they did not. They found instances of muscle damage around the skeletons of cocaine-exposed eels, which could inhibit swimming. The researchers observed swollen muscles, and in some cases broken muscle fibers. They note that the damage did not appear to be life-threatening, but could prevent the eels from successfully migrating—they normally cross the Atlantic to spawn. They also reported that several of the eels exposed to cocaine were transferred to clean tanks after the 50-day period for three to five days. None of them were able to recover in that short time span.

More information: Anna Capaldo et al. Effects of environmental cocaine concentrations on the skeletal muscle of the European eel (Anguilla anguilla), *Science of The Total Environment* (2018). DOI: 10.1016/j.scitotenv.2018.05.357

Abstract

The presence of illicit drugs in the aquatic environment represents a new potential risk for aquatic organisms, due to their constant exposure to substances with strong pharmacological activity. Currently, little is known about the ecological effects of illicit drugs. The aim of this study was to evaluate the influence of environmental concentrations of cocaine, an illicit drug widespread in surface waters, on the skeletal muscle of the European eel (Anguilla anguilla). The skeletal muscle of silver eels exposed to 20 ng L−1 of cocaine for 50 days were compared to control, vehicle control and two post-exposure recovery groups (3 and 10 days after interruption of cocaine). The eels general health, the morphology of the skeletal muscle and several parameters indicative of the skeletal muscle physiology were evaluated, namely the muscle whole protein profile, marker of the expression levels of the main muscle proteins; cytochrome oxidase activity, markers of oxidative metabolism; caspase-3, marker of apoptosis activation; serum levels of creatine kinase, lactate dehydrogenase and aspartate aminotransferase, markers of skeletal muscle damages. Cocaine-exposed eels appeared hyperactive

but they showed the same general health status as the other groups. In contrast, their skeletal muscle showed evidence of serious injury, including muscle breakdown and swelling, similar to that typical of rhabdomyolysis. These changes were still present 10 days after the interruption of cocaine exposure. In fact, with the exception of the expression levels of the main muscle proteins, which remained unchanged, all the other parameters examined showed alterations that persisted for at least 10 days after the interruption of cocaine exposure. This study shows that even low environmental concentrations of cocaine cause severe damage to the morphology and physiology of the skeletal muscle of the silver eel, confirming the harmful impact of cocaine in the environment that potentially affects the survival of this species.