Fish exposed to SSRIs exhibit abnormal behavior, study finds

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Fish exhibit abnormal behavior and lower levels of anxiety when exposed to Selective Serotonin Reuptake Inhibitors (SSRI), which are common drugs used to treat depression, among other disorders. The study, by Baylor University researchers and online in the journal *Environmental Science & Technology*, also found that human data for drug activity can be used to predict surface water concentrations of these substances that negatively impact fish behavior.

The Baylor research, which builds on their previous study of pharmaceuticals found in fish downstream of a wastewater treatment plant, has implications not only for the environment but for communities planning to begin wastewater reuse programs.

"This research is an important step in determining the long-term consequences of drugs taken up by fish in the environment and has direct implications for both survival and fitness of fish," said Bryan Brooks, Ph.D., professor of environmental science and biomedical studies and director of environmental health science in Baylor's College of Arts & Sciences. He and former Baylor student Theodore W. Valenti, Jr., Ph.D., now a National Research Council post-doctoral fellow with the Environmental Protection Agency in Duluth, Minn., co-authored the article as part of Valenti's dissertation research.

"This helps our understanding of the potential impact of pharmaceuticals in the environment which are accumulating in fish," Brooks said.

In the current study, the shelter-seeking behavior of fathead minnows was monitored under laboratory conditions for 28 days using digital tracking software to diagnose abnormal behavior while they were exposed to the SSRI sertraline, which is used to treat depression, panic attacks and other disorders. Sertraline concentrations and lighting conditions significantly affected the time that the minnows spent in a sheltered area.

During dark conditions, sertraline-exposed fish spent approximately 67 to 78 percent of the time that control fish spent in the shelter. During light intervals, fish exposed to sertraline spent between 18 and 42 percent less time in the shelters.

"The shelter was the only dark area during light conditions in the observation tanks; therefore, control fish apparently retreated to the shelter to reduce anxiety, whereas fish exposed to sertraline appeared to display reduced anxiety and did not exhibit this behavior," Brooks said.

"Based on our observations, we hypothesize that fish exposed to sertraline displayed reduced levels of anxiety and consequently were more willing to explore outside of their shelters during both light and dark conditions. Fish willing to spend more time away from shelters face greater predation risk, and their overall survival rate may be reduced," he said.

Valenti noted that another very interesting aspect of the study was the accuracy of a quantitative model the Baylor researchers used to predict internal fish plasma concentrations when pH of the water was considered. These findings emphasize the importance of accounting for the pH of rivers and lakes during surface water quality assessments of pharmaceuticals and other weak acid and weak base contaminants.

"Improving our understanding of these relationships is paramount for

reducing uncertainty during ecological risk assessments and is vital to addressing potential hazards associated with human population growth and urbanization in the future," Valenti said.

"Conservation and water reuse strategies will become paramount to meet water resource needs of future generations. Understanding emerging risks to water quality, from pharmaceuticals and other contaminants present at trace levels, is equally important to support responsible management decisions and meet environmental protection goals," Brooks added.

A previous study by Baylor researchers in the journal *Environmental Toxicology and Chemistry*, initially found residues of sertraline and fluoxetine, another SSRI, and their metabolites in three different types of fish living in the Pecan Creek in North Texas. A follow-up study by Baylor researchers in Pecan Creek, which appeared in the journal *Analytical Chemistry*, observed three additional human medications in fish. They were diphenhydramine, an over-the-counter antihistamine also commonly used as a sedative in non-prescription sleep aids and motion sickness; diltiazem, a drug for high blood pressure; and carbamazepine, a treatment for epilepsy and bipolar disorder.

More information: Read the study using this link: http://bit.ly/xtbhi8

Provided by Baylor University

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