

Cocktail of drugs from sewage taint bonefish in Biscayne Bay and Keys, study finds

February 7 2022, by David Goodhue



Credit: Unsplash/CC0 Public Domain

A cocktail of prescription drugs—from blood pressure medications to opioids—has found its way into the flesh of South Florida's population of bonefish, one of the state's most sought-after game fish, according to

a study released this week.

The culprit is a sewage system designed to filter out fecal matter and other pollution, but not pharmaceuticals, researchers at Florida International University and the Bonefish and Tarpon Trust say.

"The source of this contamination is human waste and a wastewater infrastructure that has been pressed beyond its technological capability and capacity, at least to meet the demands of today," Jim McDuffie, president and CEO of the Bonefish and Tarpon Trust, said while introducing the study at Florida State University in Tallahassee Wednesday.

The [conservation group](#) and FIU released their collective research this week. They found 93 of the bonefish sampled in Biscayne Bay and on the flats surrounding the Keys since their investigation launched in 2018 had traces of an average of seven prescription drugs in their systems. And, researchers found an alarming 17 medications in just one single bonefish.

"Pharmaceuticals are an invisible threat, unlike algae blooms or turbid waters," Jennifer Schopf Rehage, principal investigator and associate professor of Earth and the environment at FIU, said in a statement. "Yet, these results tell us that they are a formidable threat to our fisheries and highlight the pressing need to address our longstanding wastewater infrastructure issues."

The list of 58 drugs found in the fish includes blood pressure, antidepressant and prostate treatment medications, along with antibiotics and pain relievers, including opioids.

"These findings are troubling on many fronts," McDuffie said.

"Pharmaceutical contamination was detected at levels high enough to

have biological effects on the fish, thus posing a risk or a threat to our fishery. And, second, the contamination is not limited to bonefish, but also likely present in other fish—crab, lobster and other nearshore marine life."

Aaron Adams, director for science and conservation for the Bonefish and Tarpon Trust, told the Miami Herald Thursday that that amount of drugs would be considered a "cocktail" of medication for a human, and a patient's physician would typically prescribe them only after determining how they would interact with one another. So, the next step is trying to figure out how these drugs could be impacting the bonefish's behavior, from reproduction, migration and feeding patterns.

"There are a lot of unknowns," Adams said.

The researchers also want to know what other flats fish species are similarly impacted, not only for the benefit of the environment, but also because of the potential impact it could have on Florida's recreational saltwater fishery, which is a \$9.2-billion-a-year industry that directly supports close to 90,000 jobs, according to the study.

Keys wastewater treatment

In 2015, county and municipal governments in the Florida Keys fulfilled their state mandate by building a centralized sewage system throughout the island chain to prevent further untreated wastewater from leaking out of old septic systems into the nearshore waters.

The massive effort cost close to \$70 million to complete and made significant progress in preventing [human waste](#) from seeping into the ocean, Florida Bay and the Gulf of Mexico, all of which surround the Keys. Recent research also points to the project contributing to the improvement of the health of the Keys' reef system—North America's

only coral barrier reef.

However, the study suggests that the engineers who designed the system did not predict, nor prevent, prescription pharmaceutical medication from escaping the treated discharged wastewater. And, traces of the drugs have found their way into the local population of at least one of South Florida's most prized game fish.

While the centralized sewage system in the Keys has been successful in keeping many contaminants from nearshore waters, it wasn't designed with pharmaceuticals in mind, the researchers said. Very few in Florida or worldwide are, Rehage said, because they don't use technology like reverse osmosis and carbon filters to trap micro pollutants.

And, compounding the problem is that several areas of the Keys inject treated wastewater into shallow water wells instead of deep water wells. In the Upper Keys, Key Largo, which has its own wastewater treatment special taxing district, and the Village of Islamorada, use deep wells. But, the small city of Layton, Key Colony Beach, the city of Marathon and Duck Key, use shallow wells.

A group of Middle Keys citizens filed a lawsuit in federal court last month under both the Clean Water Act and the Endangered Species Act seeking to stop Marathon from continuing to use its shallow well injection system.

Big Pine Key has deep well injection, as does the city of Key West, but Stock Island, just north of Key West, does not.

"It's kind of a hodgepodge," Rehage said.

Surprising discovery

The origins of the study came from researching the decline of the bonefish fishery in the 1990s, which did not begin to rebound until around 2014, Rehage said.

"There was a very severe decline," Rehage said in an interview. "They were almost gone."

Bonefish, or "gray ghosts of the flats," are a fast-moving, silver game fish highly sought after by anglers looking for a challenge on rod and reel.

"South Florida is one of the few places in the United States where anglers have the unique opportunity to fish for bonefish, and the shallow saltwater flats of the Florida Keys and Biscayne Bay are considered a world-class destination for catching large, trophy-sized bonefish," the Florida Fish and Wildlife Conservation Commission says on its website.

FWC commissioners designated bonefish as a catch-and-release-only species in 2013.

The Bonefish and Tarpon Trust and FIU researchers began working with scientists at Umeå University and the University of Agricultural Sciences in Sweden to study the health of the South Florida bonefish fishery in 2018.

They sent blood and tissue samples from bonefish that died in the process of being caught to their Swedish counterparts to be analyzed.

They were not necessarily looking for pharmaceuticals, but that's what the lab results from Sweden showed.

Rehage and her team then set out for the next three years to catch more bonefish to be tested to see if the initial sample was an anomaly. Not

only was it not, the problem was much bigger than they originally suspected. Samples of [bonefish](#) caught and released from Key Biscayne to Key West were found to have multiple prescription drugs in their systems.

"What struck us the most is how we found them everywhere," Rehage told the Herald. "We didn't have any zeros."

The scientists fished for their subjects with the help of volunteer Florida Keys backcountry guides—a segment of the professional angling community known for its commitment to conservation—including one who is in the process of getting his doctorate from FIU, Rehage said.

"It was fantastic to have the support of the guide community," Rehage said.

While the U.S. is a heavily medicated society, there are no regulations on the levels of [prescription drugs](#) allowed in treated wastewater. According to the study, the average American consumes 18 prescriptions annually, and 4 billion drugs are prescribed nationally every year, with Florida ranking fourth in consumption.

"The rate of production and release of these pharmaceuticals into the environment is far outpacing our ability to assess their safety once they're entering the environment," Rehage said.

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Citation: Cocktail of drugs from sewage taint bonefish in Biscayne Bay and Keys, study finds (2022, February 7) retrieved 23 June 2024 from <https://phys.org/news/2022-02-cocktail-drugs-sewage-taint-bonefish.html>

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