Grad student finds PFAS in seabirds from Narragansett Bay, Massachusetts Bay, Cape Fear

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URI graduate student Anna Robuck dissects a seabird as part of her PFAS research. Credit: Anna Robuck

Evidence continues to accumulate about human and wildlife exposure to chemical compounds called per- and polyfluoroalkyl substances, collectively referred to as PFAS, and their deleterious effects on the environment. The latest study, by a University of Rhode Island graduate student, found high levels of the compounds in seabirds from offshore Massachusetts and coastal Rhode Island and North Carolina.

Chief among the findings was the discovery that one type of PFAS, perfluorooctanesulfonic acid or PFOS, which has not been produced since the early 2000s, is the most dominant PFAS compound in the birds from all three sites, further illustrating how these chemicals do not breakdown in the environment and can remain in animal tissues for many years.

"Wildlife is being inundated with PFAS," said Anna Robuck, a doctoral student at the URI Graduate School of Oceanography, who has been studying PFAS with Professor Rainer Lohmann since 2016. "We don't really understand what that means for wildlife health overall, since scientists are just catching up with what PFAS means for human health. What we do know is that we're seeing significant concentrations that laboratory studies tell us are concerning."

Her research was published this month in the journal *Environmental Science and Technology*.

The concentrations of PFAS Robuck found in seabird livers are comparable to levels found in other bird studies that suggested that the compounds may be causing negative reproductive health outcomes.

"This speaks to the incredible persistence of these compounds," she said. "Once in the environment, it's there in perpetuity for it to be accumulated by wildlife. And even though we no longer produce PFOS, we still produce a series of related compounds that, once in the

environment, readily transform into PFOS."

Robuck, a native of Chadds Ford, Pennsylvania, measured the levels of PFAS in the livers of herring gulls from Narragansett Bay, Rhode Island, great shearwaters in the offshore waters of Massachusetts Bay, and royal and sandwich terns from Cape Fear, North Carolina. All of the birds were juveniles found dead near their breeding or feeding grounds. The three sites were chosen to represent birds from an urban area where PFAS exposure is common (Narragansett Bay), an offshore area of birds that seldom approach land (Massachusetts Bay), and an area downstream of a major PFAS producer (Cape Fear).

"We studied their livers because there is a specific protein in the liver that PFAS love to bind to," Robuck said. "We also know that in humans, PFAS exposure leads to liver damage and impairment of function."

Among her other findings, Robuck discovered that the North Carolina birds that hatched downstream from a PFAS production site contained several novel PFAS compounds that have been created in recent years to replace those that have been phased out.

"The nesting colonies where we got the Cape Fear birds from are 90 miles from the production facility," she said. "This is the first detection of these compounds in liver tissue and the furthest distance from the known industrial source.

"Surprisingly, we also found those same novel PFAS in birds that have no connection to Cape Fear—in one gull from Narragansett Bay and two shearwaters in Massachusetts Bay," she added. "It suggests that these replacement compounds are highly persistent and capable of migrating further in the environment than we were aware of. There also may be more sources of the compounds than we know about."

Of particular note, Robuck also found that as PFAS levels increased in the birds, the phospholipid levels in their liver decreased, a finding that is especially concerning.

"That's a really big deal because fats are important for reproductive health, migration, raising their young successfully, and other elements of their life cycle," Robuck said. "The fact that there is an observable relationship between PFAS and fats deserves a lot more investigation to see what it could be doing to wildlife populations."

In addition, Robuck detected the same PFAS levels in the offshore birds as those from inshore Rhode Island.

"They didn't have the same kind of PFAS, but they had the same total level," she said. "I expected offshore birds to be a lot lower, since those birds never come to land. It suggests that even our most remote and most pristine habitats are facing exposure to these compounds."

Robuck's next study will analyze the PFAS concentrations in other tissues from the same birds. She hopes the resulting data will be included in future government assessments of the impact of PFAS in wildlife and the environment.

More information: Anna Robuck et al, Legacy and Novel Per- and Polyfluoroalkyl Substances (PFAS) in Juvenile Seabirds from the US Atlantic Coast, *Environmental Science & Technology* (2020). DOI: 10.1021/acs.est.0c01951

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