

You May Miss These Parasites When They're Gone

Warming temperatures in one part of the world seem to have driven down the parasite population, suggesting another unexpected way that climate change harms ecosystems.

By Rachel Nuwer

Jan. 9, 2023, 3:00 p.m. ET

4 MIN READ

Sign up for Science Times Get stories that capture the wonders of nature, the cosmos and the human body. [Get it sent to your inbox.](#)

Most people assume that a warmer planet will be a bugger, more parasite- and disease-ridden place. There are plenty of examples to justify this fear. Climate change is already expanding the range of ticks that spread Lyme disease; mosquitoes that transmit malaria and Zika; and nocturnal, biting kissing bugs that drive Chagas' disease infections.

But while some parasitic species are getting a boost from climate change, they may be the exception rather than the rule. According to a groundbreaking study published Monday in the Proceedings of the National Academy of Sciences that analyzed 85 parasitic species, the majority suffered population declines over 140 years, on par with some of the most threatened wildlife species — or worse.

"It's the kind of decline that triggers conservation action for mammals and birds, and that gets people riled," said Chelsea Wood, a parasite ecologist at the University of Washington and an author of the study.

It might sound counterintuitive, but this is not good news. Forty to 50 percent of all animal species on Earth are parasites, or organisms that live in or on a host and depend on it for survival, at that host's expense. That figure does not even count certain bacteria, viruses, fungi and protozoans that are also considered to be parasitic. Yet very little is known about these wildly abundant, diverse life-forms. Most discussion of parasites involves species that negatively affect us, our pets, our livestock or our children. But these malignant species are in the extreme minority.

As scientists learn more about the hundreds of thousands of other parasitic species that do not harm humans, a picture of animal groups that play key roles in maintaining healthy ecosystems is emerging. For instance, parasites keep species populations in check just like predators do.

Climate Forward There's an ongoing crisis — and tons of news. Our newsletter keeps you up to date. [Get it in your inbox.](#)

Parasites also help to push energy up the food web, by making prey species behave more recklessly and become easier for predators to catch. California killifish infected with a trematode flatworm, for example, are 10 times to 30 times more likely to become meals for birds than uninfected fish. In Japan, nematomorph worms goad their cricket hosts into jumping into streams, providing up to 60 percent of total calories for endangered Japanese char. "Predators are getting an assist from parasites," Dr. Wood said.



Monogenean worms (*Microcotyle sebastis*) that were dissected from the gills of a preserved copper rockfish from the Burke Museum specimen collection. Katie Leslie/University of Washington

Until now, scientists were mostly left to guess how climate change and other anthropogenic pressures were affecting parasites. To answer this question, Dr. Wood and her colleagues turned to 699 fish specimens, most of which were kept in the basement of the Burke Museum of Natural History and Culture in Seattle. The fish, which were collected between 1880 and 2019 in the Puget Sound of Washington State, were “parasite time capsules,” Dr. Wood said. The formalin and ethanol that suspended the fish in time at the moments of their death also preserved the worms and other organisms attached to their gills and skin or burrowed into their muscles and innards.

Meticulous dissection of these specimens revealed 17,702 parasites that were members of 85 different species, allowing Dr. Wood and her colleagues to infer how population abundance has changed over time.

“There is no data set like this in the world,” said Skylar Hopkins, a parasite ecologist at North Carolina State University, who was not involved in the research. “Just imagine how long it took them to dissect all those stinky, ancient fish.”

Controlling for other factors like pollution and fluctuating fish populations, the team found that across all species, parasites declined by 38 percent for every degree Celsius of temperature increase. Some species were harmed more than others. Parasites with complex life cycles — the 52 percent of species in the study that require three, four or even five hosts to make it from egg to adult — declined by almost 11 percent every decade, a finding that was significantly associated with sea surface temperature. “The hotter it got, the fewer of those parasites we found,” Dr. Wood said.



A copper rockfish collected from Puget Sound in 1964 from the study. Natalie Mastick/University of Washington

The “remarkable” data set gathered by Dr. Wood and colleagues showed “that losses in parasite diversity can be measured and are substantial,” said Armand Kuris, a parasite ecologist at the University of California, Santa Barbara, who was not involved in the research. “This is disturbing news.”

Kevin Lafferty, a disease ecologist at the U.S. Geological Survey, who also was not involved in the research, said it makes sense that parasites with complex life cycles are “the first to go,” because they have evolved to exploit complex ecosystems. Around the world, climate change, pollution, overfishing and other human-caused stressors are steadily chipping away at nature’s complexity, leading to simpler systems that no longer seem to be able to support the careful choreography of a multihost lifestyle. As Dr. Lafferty said, such parasites are, “to use a tired phrase, canaries in the coal mine.”

Scientists cannot say yet if the findings from the Puget Sound generalize to other ecosystems. Dr. Wood and her colleagues have already started analyzing fish specimens from the Gulf of Alaska as well as the Rio Grande, the Pearl River in Louisiana and Mississippi and the Alabama River. She also hopes to see other ecologists making use of “the treasure trove” of museum specimens that exist around the world. “It’s a lot of effort to dissect fish preserved with chemicals — and it’s not the most glamorous work — but it’s not rocket science,” Dr. Wood said.

What the findings do say for sure, she added, is that parasites are in need of conservation, just like any other species. “Parasites are playing these vital roles in ecosystems that will disappear when they do, and that’s when we’ll notice how important they are.”