Scientists predict extinction risk for hard-to-track species

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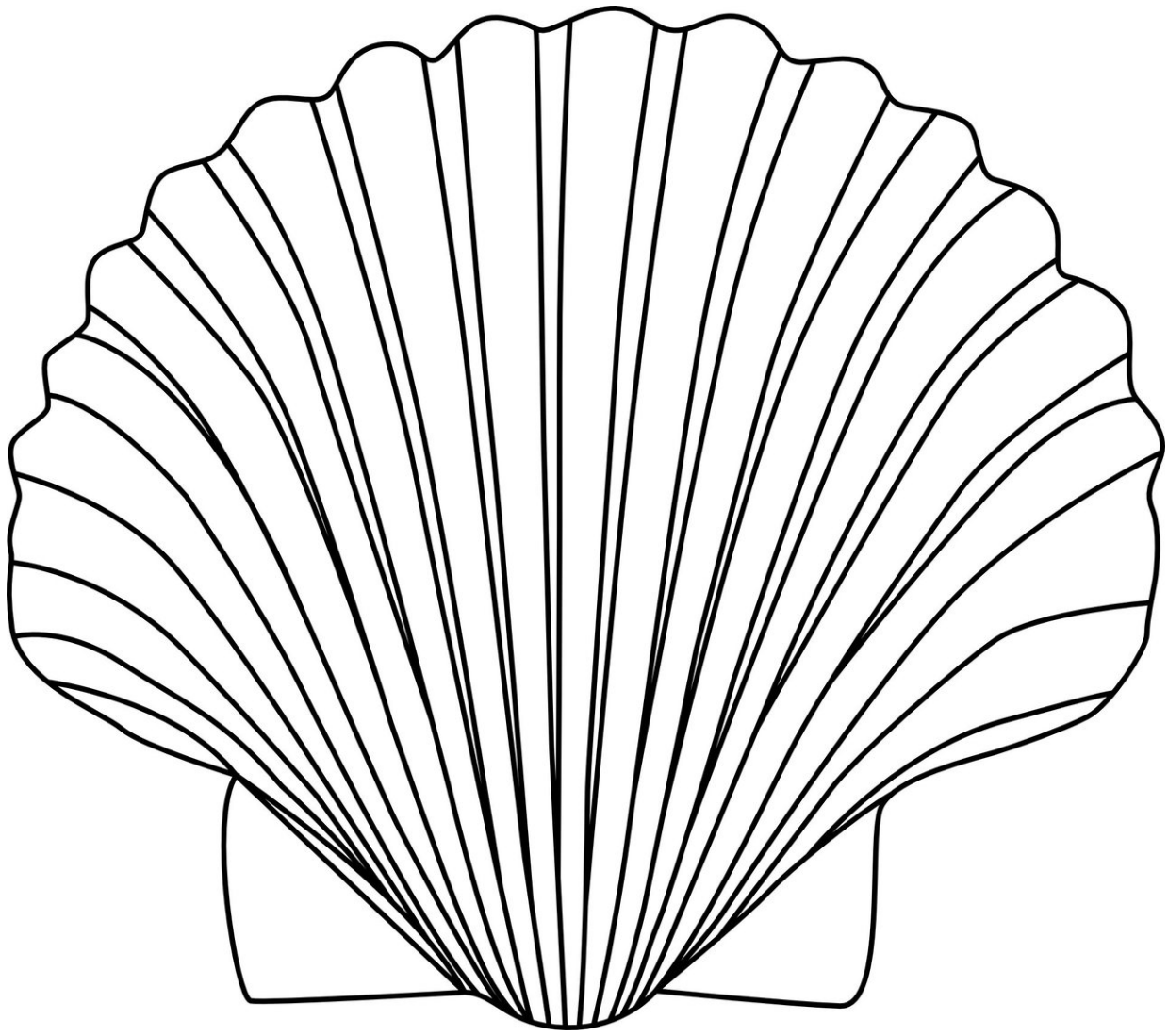

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Species are going extinct all over the world: Scientists believe that Earth is losing between 200 and 2,000 species every year. That number is squishy, partly because there are so many species for which they lack good data—particularly those living in the oceans, which are difficult to track but still critically important to ecosystems and livelihoods. Even the most comprehensive evaluation of extinction risk—the international Red List of Threatened Species—has only spotty data for many species around the globe.

A new study from University of Chicago scientists offers a tool to predict extinctions for hard-to-count species. Their method takes advantage of the fact that while some species are hard to monitor while alive, many of them leave extensive fossil records.

"Today's extinction work tends to focus on animals like us—mammals and other vertebrates that live on land," said Katie Collins, a postdoctoral researcher at the University of Chicago and first author on the paper. "But most things that live on the planet don't have a backbone, and a huge part of the world's biodiversity lives in the sea, where our picture is really incomplete. It's much harder to get a handle on extinction there."

Collins and David Jablonski, the William R. Kenan Jr. Distinguished Service Professor of Geophysical Sciences, along with a team of researchers at UChicago, the Smithsonian and the University of California, San Diego, wanted a way to estimate extinction risk for species that are short of directly measured data.

A key part of the puzzle came when they realized that the fossil record could help. Jablonski has been building a database of fossils of marine bivalves—creatures like scallops, mussels and oysters—for many years. That database allowed them to review the history of extinctions and develop a set of predictors about which species are most likely to go extinct.

"Fossils give you a bird's-eye view of lineages. You can see the first and last occurrences for different species, and it can also tell you how often these lineages split into new species, how often they go extinct, and where they were when they did," Collins said.

How likely a species is to go extinct depends on a lot of factors, but there are a few key predictors. One is range size. If the species can only live in a small part of the Gulf of Mexico, a single oil spill could wipe out the entire population. Temperature tolerance matters too: If it can survive under a wider range of temperatures and conditions, its chances are better. "Some widespread species can also handle wide temperature changes, but a huge number of warm-water species are actually tracking a narrow band of temperatures," Jablonski said. "That means that a geographically widespread species can still get clobbered if the temperature changes beyond its ability to cope."

They built these predictors into a metric they called PERIL, or Paleontological Extinction Risk In Lineages. The first step was to test it, by winding the clock back two and a half million years, to the end of the Pliocene epoch. They had the tool "predict" the fates of species living in two widely separated ecosystems: off the coasts of California and New Zealand. The result: "It does a very good job of predicting who's going to live and who's going to die out," Collins said.

From there, they applied the metric to the present day, mapping out the oceans on a scale from high to low risk of extinction.

"This gives us a new, global picture of extinction risk in this economically important marine group, far beyond what's available from the Red List," said Jablonski. For example, Collins said, "There's nearly 6,000 species of bivalves in the ocean; the Red List has only been able to assess 29 of them, and of those, 15 are marked 'data-deficient.'"

A couple of hot zones jumped out immediately, the scientists said: The coast of Southeast Asia is precarious; so are areas in the Antarctic, the Caribbean and New Zealand. "There are some scary situations where key foodstock species live in very fragile areas," Jablonski said.

Though they tried it with marine bivalves, the process could be repeated with any group of living things with a reasonable fossil record, the scientists said.

"Our goal is to produce a method that can be used alongside the Red List, and provide assistance for conservationists dividing up limited resources—where to get the biggest bang for your conservational buck, so to speak," Jablonski said. "The PERIL metric is a new tool for pinpointing species and places that would benefit most from protection and management."

More information: K. S. Collins et al. Extinction risk in extant marine species integrating palaeontological and biodistributional data, *Proceedings of the Royal Society B: Biological Sciences* (2018). DOI: 10.1098/rspb.2018.1698

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