that claims with *P* values between 0.05 and 0.005 should be treated merely as "suggestive evidence" instead of established knowledge.

Other co-authors include two heavyweights in reproducibility: John Ioannidis, who studies scientific robustness at Stanford University in California, and Brian Nosek, executive director of the Center for Open Science in Charlottesville, Virginia.

One problem with reducing *P*-value thresholds is that it may increase the odds of a false negative — stating that effects do not exist when in fact they do — says Casper Albers, a researcher in psychometrics and statistics at the University of Groningen in the Netherlands. To counter that, Benjamin and his colleagues suggest that researchers increase sample sizes by 70%; they say this would avoid increasing rates of false negatives, while still dramatically reducing rates of false positives. But Albers thinks that, in practice, only well-funded scientists would have the means to do this.

Shlomo Argamon, a computer scientist at the Illinois Institute of Technology in Chicago, says there is no simple answer to the problem, because "no matter what confidence level you choose, if there are enough different ways to design your experiment, it becomes highly likely that at least one of them will give a statistically significant result just by chance". More-radical changes, such as new methodological standards and research incentives, are needed, he says.

Lowering *P*-value thresholds may also exacerbate the 'file-drawer problem', in which studies with negative results are left unpublished, says Tom Johnstone, a cognitive neuroscientist at the University of Reading, UK. But Benjamin says that all research should be published, regardless of *P* value.

Other scientific fields have already cracked down on *P* values — and in 2015, the journal *Basic and Applied Social Psychology* banned them. Particle physicists, who collect reams of data from accelerator experiments, have long demanded a *P*-value threshold below 0.0000003 (or 3×10^{-7}) because of concerns that a lower threshold could lead to mistaken claims, notes Valen Johnson, a statistician at Texas A&M University in College Station and a co-lead author of the paper. More than a decade ago, geneticists took similar steps to establish a threshold of 5×10^{-8} for genome-wide association studies, which look for differences between people with a disease and those without across hundreds of thousands of DNA-letter variants.

Yet other scientists have abandoned *P* values in favour of more-sophisticated statistical tools, such as Bayesian tests, which require researchers to define and test two alternative hypotheses. But not all researchers will have the technical expertise to carry out Bayesian tests, says Johnson, who thinks that *P* values can still be useful for gauging whether a hypothesis is supported by evidence. "*P* value by itself is not necessarily evil." ■

CHRISTOPHE LEPETIT/HEMIS/ALAMY

A tiny island in the Tetiaroa atoll near Tahiti is now nearly mosquito-free.

PEST CONTROL

Mosquitoes meet their match in Tahiti

Bacteria-laden insects deployed on South Pacific islands in effort to rid the region of the pests.

BY EMMA MARRIS, PAPEETE, TAHITI

The South Pacific islands have long drawn sailors and tourists seeking paradise on Earth, but biologists are now trying to make the region even more alluring. A biomedical lab in Tahiti has succeeded in nearly eradicating mosquitoes from a tiny nearby island, and researchers are gearing up to eliminate the pests from a larger island that is permanently inhabited by people.

The eventual goal is to cut off transmission routes for mosquito-borne diseases such as dengue, chikungunya and Zika, which plague the Pacific. Researchers also hope that reducing the mosquito burden will help populations of local birds. On other islands, such as Hawaii, avian malaria spread by mosquitoes can devastate bird populations.

The mosquito problem could be solved in the Society Islands — a part of French Polynesia that includes Tahiti, Moorea, Bora Bora, Huahine and Raiatea — within ten years, says Hervé Bossin, an entomologist at the mosquito lab of the Louis Malardé Institute in Paea, Tahiti, and the project's lead scientist.

He and his team plan to do this using a technique that infects mosquitoes with a specific strain of a bacterium called *Wolbachia*. About 65% of insects around the world carry *Wolbachia*, but the strains vary. If mosquitoes with different strains mate, the resulting eggs develop incorrectly and don't hatch. If there are enough of these doomed pairings, an area's mosquito population usually dies out.

But first, scientists must sort the males from the females. In a small, tidy lab on Tahiti's east coast, nestled among coconut palms and fragrant white tiare blossoms, senior technician Michel Cheong Sang pours water between two glass plates set at an angle, washing several dozen larvae of *Aedes polynesiensis* mosquitoes down between them. The larger females get stuck about halfway down. The smaller males descend a bit farther, forming a dark, wriggling band behind the glass. The low-tech method sorts more than 99% of the larvae correctly, says Bossin.

All the larvae are infected with a particular strain of *Wolbachia* — taken from a related mosquito species, *Aedes reversi* — that is not naturally present in French Polynesia. Only the males will be released in target areas to mate with wild female mosquitoes. Researchers are working at a total of five sites, most located at luxury hotel properties around ▶

the Society Islands (see 'The *Wolbachia* approach').

Right now, the *Wolbachia* method is the gold standard for ridding islands of mosquitoes, says Zhiyong Xi, a medical entomologist at Michigan State University in East Lansing. His group has used the technique to nearly eliminate *Aedes albopictus* mosquitoes from two small, inhabited islands in Guangzhou, China. "I predict that the technology will be used in large scale in five years and we will see large tropical countries free of mosquitoes in less than ten years," Xi says. Researchers have run similar trials in Brazil and in the United States, where three states saw populations of wild *A. albopictus* reduce by 70% over three years.

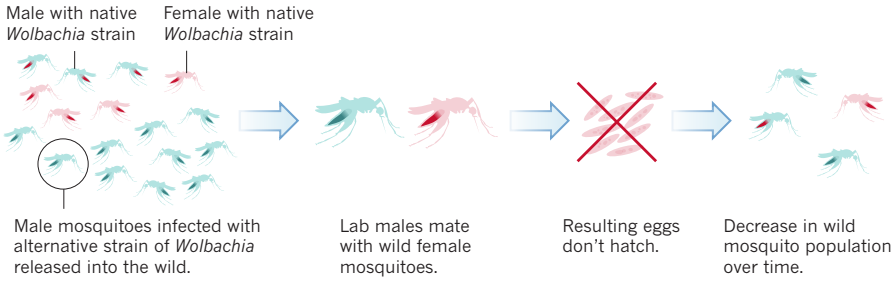
The *Wolbachia* approach is based on a naturally occurring bacterium, and has drawn less opposition than experimental methods that use genetically modified mosquitoes. Still, Bossin and other researchers are following the progress of genome-based techniques, because they could eventually become faster and cheaper to use than the bacterial method.

Bossin and his team started their first large-scale study in 2015, on a tiny island in the atoll of Tetiaroa. The atoll, once owned by film star Marlon Brando, is a 20-minute flight from Tahiti. The researchers' monitoring efforts currently find about one female per trap per week. Last year, earlier in the project, they found one per trap per day.

The Tetiaroa pilot study had funding from the governments of French Polynesia and France, and logistical support from the small resort on the atoll. The hotels where Bossin is running trials this year are also funding his work.

THE *WOLBACHIA* APPROACH

Use of this bacterium could result in mosquito-free islands in the South Pacific in ten years.



NO LIMITS

The researchers are ramping up preparations to eradicate mosquitoes from an entire permanently inhabited island. They plan to announce the exact location soon, and hope to release *Wolbachia*-infected male mosquitoes in two years. They already have the funds to expand their lab to handle the necessary increase in larvae production. If the team is successful, the island could become the first in the South Pacific to be cleared of mosquitoes.

Bossin thinks the incompatibility technique could be scaled up to eradicate the biting insects from islands across the Pacific — perhaps even from continents. "The only limit is the size of your production facility," he says.

Giovanni Benelli, an entomologist at the University of Pisa in Italy, is less sanguine about the prospect of continental eradication. And he wouldn't want to see all mosquitoes disappear in any case. "The mosquito's ecological role is still important," he says. Some aquatic animals eat mosquito larvae, and adult mosquitoes help to regulate mammal and bird populations by transmitting diseases among them, Benelli says.

Bossin says he's happy to see mosquitoes thrive — just not where people live. ■