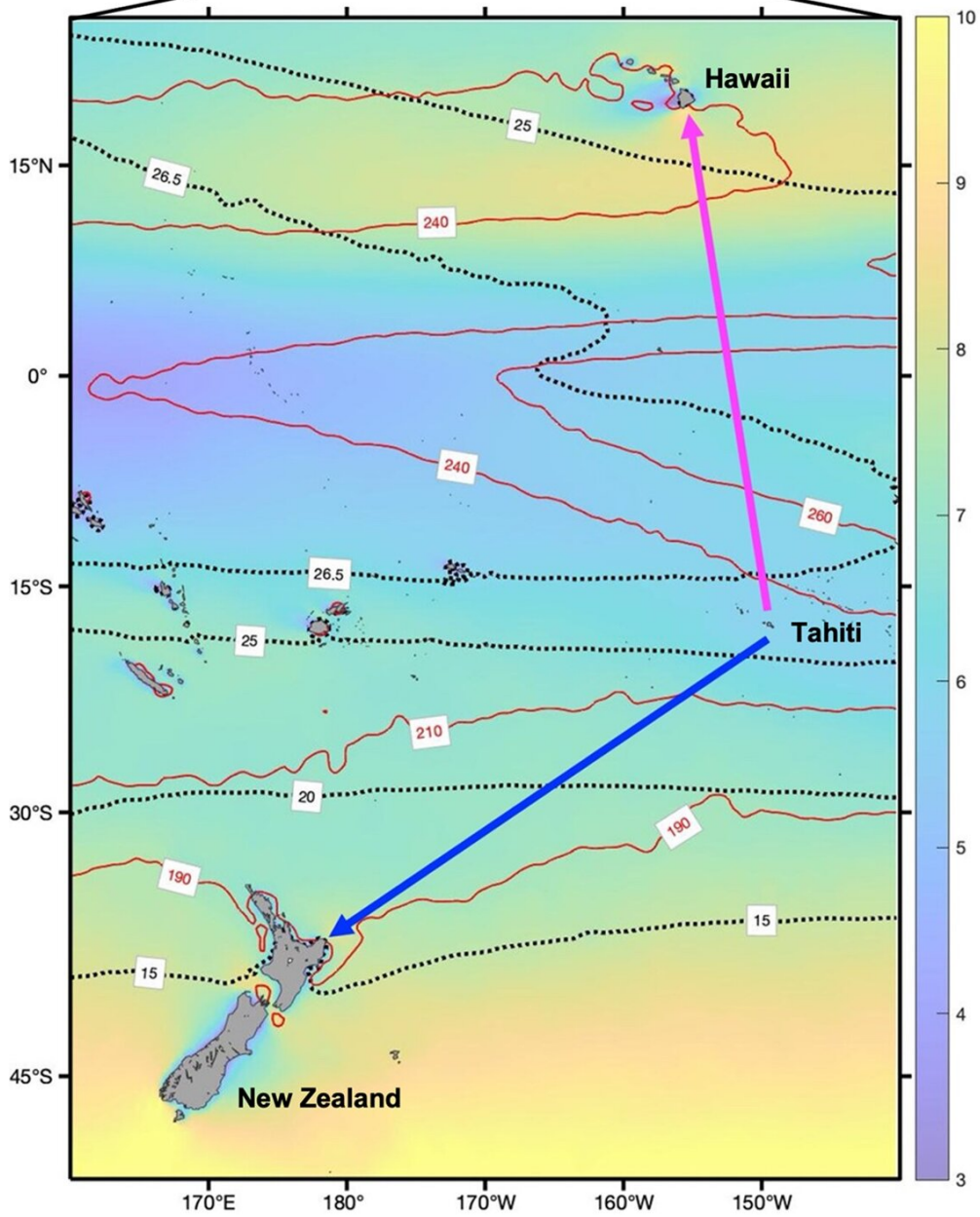
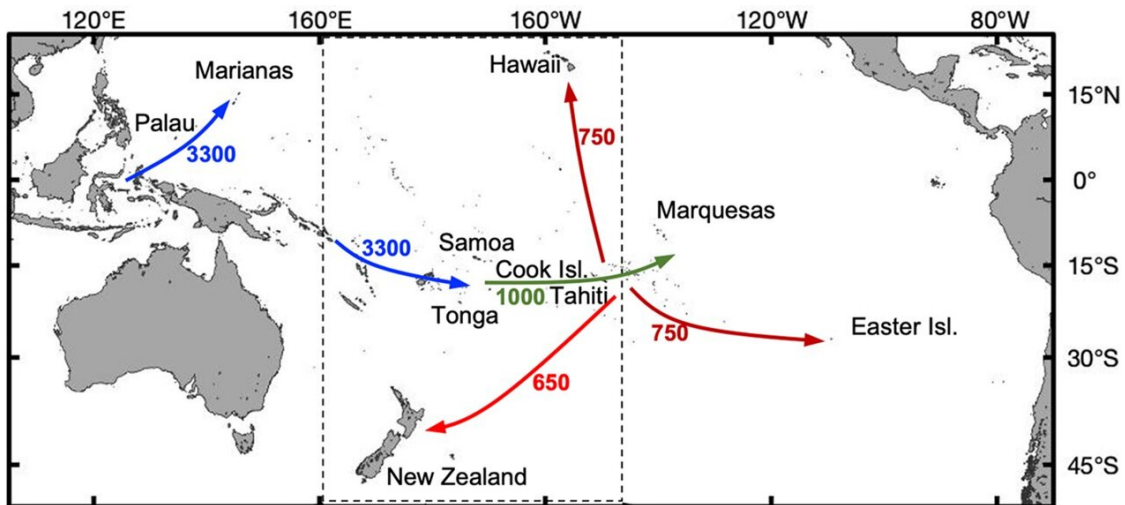


# How larger body sizes helped the colonizers of New Zealand

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Estimated energetic demands of thermoregulation during ancient canoe passages from Tahiti to Hawaii and New Zealand, a simulation analysis. Credit: *PLOS ONE* (2023). DOI: 10.1371/journal.pone.0287290

For the first time, researchers have developed a model to estimate how much energy the original colonizers of New Zealand expended to maintain their body temperatures on the cold, harrowing ocean journey from Southeast Asia.

Results showed that people making the first voyages from Tahiti to New Zealand in sailing canoes would expend 3.3 to 4.8 times more energy on thermoregulation—the technical term for maintaining body temperature—than those making a trip of similar length to Hawaii.

The ocean route to New Zealand required much more energy for thermoregulation because it went through harsher and colder conditions than the one to Hawaii, said Alvaro Montenegro, lead author of the study and associate professor of geography at The Ohio State University.

The findings help provide additional evidence supporting the long-standing theory of why Polynesians of today have a distinctive body type—relatively larger, heavier, bulkier—that is more often found in populations that live in [higher latitudes](#) with colder climates.

"It has been long hypothesized that the first trips to New Zealand were much harder on the body of settlers than trips of similar lengths to places like Hawaii," Montenegro said.

"We were able to put together a model to actually measure how much

more energy for thermoregulation it would take for people to get there—and show why larger, heavier people would have been more likely to survive the trip. That's one reason why their descendants today may have the body types they do."

The study was published today in the journal *PLOS ONE*.

Although much of East Polynesia is tropical, the southern third, including New Zealand, ranges from a warm- to cool-temperate climate. Researchers say that may be one of the reasons it was one of the last places on Earth to become inhabited. The first people arrived in New Zealand about the 14th century.

"The basic question is how difficult would it be on [human physiology](#) to sail out of the tropics on these long-distance colonizing voyages through much harsher environmental conditions than they were used to?" Montenegro said.

Researchers believe that these original settlers used double-hulled sailing canoes that probably each had at most a few dozen voyagers on board.

Montenegro and colleagues had previously developed a voyage simulation model that estimates how far these boats would travel each day based on winds and currents. In this study, the researchers used that model combined with likely environmental conditions that voyagers would encounter, including air temperatures and wind.

To evaluate how [body size](#) would affect [energy use](#) for thermoregulation on these voyages, the researchers used female and male bodies of three different types. One body type resembled Polynesians of today, a second one was of a higher weight, and the third type had higher body weight and additional subcutaneous fat layer thickness.

The researchers estimated how much energy it would take travelers to maintain their body temperature sailing from Tahiti to New Zealand and compared that to travelers going to Hawaii, which they estimated would take about 23 days, similar to the 25-day trip to New Zealand.

The model the researchers used did not account for energy used by physical activity, which of course would be an additional need for the voyagers.

Results showed that the trip to New Zealand would take significantly more energy than the trip to Hawaii, Montenegro said.

Based on a summer trip (which would require less energy than a winter trip), each traveler to New Zealand would require an average of an extra 965 calories a day compared to those going to Hawaii to maintain their body temperature.

If this deficit was completely made up by burning fat, those going to New Zealand would lose an average of an extra 5.9 pounds at the end of a 25-day trip. If the difference was compensated just by use of muscle mass, the whole trip extra weight loss would be about 13.3 pounds.

Model calculations showed that travelers with a larger body size experienced lower heat loss, and so had an [energy](#) advantage compared to those of smaller body sizes. The advantage was greater for females.

"The trip would be difficult under any circumstances, but our results showed that people of larger body size would have had an advantage under the harsh conditions they faced," Montenegro said.

These findings line up with the larger bodies of Polynesian populations today, including the fact that females are about 31% heavier, and males 24% heavier, than populations to their west.

"Our analysis can't definitively prove that the size differences we see in Polynesia today are the result of larger people being more likely to survive the original trips and colonizing the region, but it certainly is consistent with that fact," he said.

Other authors on the study were Alexandra Niclou of the Pennington Biomedical Research Center and University of Notre Dame; Atholl Anderson of Australian National University and University of Canterbury; Scott Fitzpatrick of the University of Oregon; and Cara Ocobock of the University of Notre Dame.

**More information:** Alvaro Montenegro et al, Estimated energetic demands of thermoregulation during ancient canoe passages from Tahiti to Hawaii and New Zealand, a simulation analysis, *PLOS ONE* (2023). [DOI: 10.1371/journal.pone.0287290](https://doi.org/10.1371/journal.pone.0287290)

Provided by The Ohio State University

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