

# Critically endangered Singapore freshwater crab lives in genetically isolated populations

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Singapore freshwater crab (*Johora singaporensis*), a critically endangered species unique to Singapore. Credit: Daniel NG Jia Jun

Researchers from NUS and National Parks Board (NParks) have established that the critically endangered Singapore freshwater crab (*Johora singaporensis*) does not mix or breed between different populations, and has overall low genetic diversity.

The International Union for Conservation of Nature (IUCN) considers the Singapore freshwater crab to be one of the 100 most endangered species worldwide. It is uniquely from Singapore and not found anywhere else in the world. Only a few hundred mature individuals of this pebble-sized freshwater crab are known to exist. They live in a few isolated populations in very small areas (less than 0.01 km<sup>2</sup>) within Singapore that are vital to the survival of the species. As part of the national conservation strategy formulated in 2015, one immediate concern was to establish if these [crabs](#) are experiencing inbreeding within their own isolated populations, which may cause them to lose [genetic diversity](#).

A research team led by Prof Rudolf MEIER from the Department of Biological Sciences and Lee Kong Chian Natural History Museum, NUS, partnering the NParks has found that the Singapore freshwater crabs from the remaining populations are indeed physically isolated and unlikely to move and breed between populations.

Presently, levels of genetic diversity are low. Cutting-edge genomic tools were used to analyse the genetic variation of the crabs for this study. The genetic information, together with their migration patterns, were compared with a more widespread and common species, the lowland freshwater crab (*Parathelphusa maculata*) that often lives in the same places as the Singapore freshwater crab. The researchers used 2,617 and 2,470 genome-wide SNPs (Single Nucleotide Polymorphisms, a common type of genetic variation) from the two groups of about 90 individuals each, with each group belonging to either of the two crab species mentioned above. The study also showed that the dispersal of individuals between populations for both crab species has been hampered by urbanisation, with the amount of genetic diversity being similar in both species despite the Singapore freshwater crab being much rarer.

This study is among the recommended actions described in the Singapore freshwater crab Conservation Strategy that was published in 2015 by the Freshwater Crab Conservation Working Group (FCCWG). The FCCWG includes members from NUS, NParks, and Wildlife Reserves Singapore. The FCCWG continues to meet regularly to discuss the various conservation efforts, and the results of this genetic study will contribute to how the populations are managed.

"The low levels of genetic diversity may reduce the adaptive potential and resilience of the Singapore freshwater crab, and render the species more vulnerable to extinction in the event of disease outbreaks or environmental changes. Coupled with poor mobility and restricted habitat range, their risk of extinction in this era of rapid and erratic climatic changes is even higher, as they are not able to retreat from sites that have become inhospitable to them," explained Dr. TAY Ywee Chieh, who is the first author of the study.

Prof Meier said, "This study found that the crab populations for both species are strongly isolated with low genetic diversity. The most genetically isolated populations for both crab species are separated from other populations by the Upper Bukit Timah Road, one of the oldest roads in Singapore. This suggests that urbanisation may have impacted stream-dwelling crab species in the same manner, regardless of ubiquity, habitat preference or the way they move between streams. Fortunately, signs of inbreeding were not detected for the critically endangered species. However, the genetic distinctiveness and low diversity of the separate populations call for genetic rescue and connecting corridors between the remaining fragments of their natural habitat."

**More information:** Ywee Chieh Tay et al. Roads to isolation: Similar genomic history patterns in two species of freshwater crabs with contrasting environmental tolerances and range sizes, *Ecology and Evolution* (2018). [DOI: 10.1002/ece3.4017](https://doi.org/10.1002/ece3.4017)

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