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Marine biologist Huang Danwei (far right) and his doctoral student Marc Chang, both from the National University of Singapore's (NUS) Department of Biological Sciences, holding samples of oceanic skaters at the Lee Kong Chian Natural History Museum. A new study by researchers from NUS and the University of California San Diego's Scripps Institution of Oceanography has found that the population growth of three oceanic skater species in the eastern Pacific Ocean coincided with changes in the climate there.
ST PHOTO: TIMOTHY DAVID

Tiny clue to climate change

Study shows population growth of 3 insect species reflects shifts in ocean temperatures

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Environment Correspondent

The rich bounty in the depths of the ocean often diverts attention from what lies on its surface.

But an enigmatic insect, which lives on the skin of the ocean, has helped an international team of scientists peel back the layers of how environmental changes can affect wildlife.

A new study has found that the population growth of three oceanic skater species in the eastern Pacific Ocean coincided with changes in the climate there.

The research paper by researchers from the National University of Singapore (NUS) and University of California San Diego's Scripps Institution of Oceanography was published today in scientific journal Marine Biology.

Their findings show that oceanic skaters can function as a canary in the coal mine in a warming ocean, with population trends serving as indicators of how open oceans – a challenging habitat to monitor with sensors due to their inaccessibility – are changing.

The study could also help scientists better understand how climate change can impact insects and marine organisms.

NUS marine biologist Huang Danwei, one of the authors of the study, said: "Bugs could include parasitic and even disease-carrying insects, so we might understand whether their populations would overlap substantially with human-dominated areas to become a problem for our health."

Oceanic skaters are not easy insects to study.

Their preference for the open ocean means specimens can be obtained only through expensive oceanic expeditions that could cost tens of thousands of dollars a day.

In 2006, Dr Lanna Cheng, sea skater scientist from Scripps Oceanography, learnt that her contacts at the United States' National Oceanic and Atmospheric Administration were planning to go on an oceanic expedition to monitor sea bird, whale and dolphin activity in the eastern Pacific ocean, from California to South America.

"One of the chief scientists on board was interested in flying fish. So I said, if you are collecting flying fish and shining a light on the surface of the water, you must be able to attract my insects too," said Dr Cheng, who has been studying these creatures for over five decades.

"And he said, 'Oh yeah, sure, no problem'."

That expedition yielded almost 400 oceanic skater specimens from three species.

Dr Cheng, who did her bachelor's degree at NUS, maintained close contacts with scientists at her alma mater.

In 2017, she sent the skater samples to a laboratory in NUS where Dr Wendy Wang was working.

At that time, Dr Wang was working on a project to see if species could be differentiated just by a fragment of their genome – similar to how barcodes can indicate the type of product on sale.

Dr Wang found that the barcoding worked – but also noticed there were population-wide differences in the barcodes of the three different species. These genetic variations among the species illustrate different stories of population growth and development during ancient times.

Dr Cheng then roped in Professor Richard Norris – her colleague at Scripps Oceanography who specialises in paleoceanography – and other NUS genomic experts, including Dr Huang and his doctoral student Marc Chang.

By matching the genetic data with the fossil record, the researchers found that the oldest of the three species, *Halobates splendens*, went through a population expansion nearly a million years ago.

This species is now found in the Peru Current – the rich, productive waters originating off the coast of South America. Climatological data showed that this physical feature of cold surface water came into existence a million years ago.

The two younger species, *Halobates micans* and *Halobates sobrinus* – now found in the warm, relatively unproductive waters off Central America – increased in abundance 100,000 to 120,000 years ago.

The populations of both species expanded when El Nino climate events caused warm ocean water to move into the eastern Pacific Ocean.

El Nino events were especially strong in this region about 100,000 years ago, which coincides with the time these species developed their modern genetic patterns and population sizes.

Said Prof Norris: "The genetics show that the three species we studied each had periods of population growth that fit eerily well with geological evidence for when the current systems they live in came into existence."

The researchers now plan to study more closely the genetic make-up of the oceanic skaters, which are hardy creatures exposed to intense sunshine and gusty winds.

"The abilities of their body covering or cuticle to protect their internal organs from heat and ultraviolet damage, and to survive violent storms and find food in this unique habitat where no other insect could, demonstrate their unique ecological roles in the ocean," said Dr Wang.

"These characteristics make them fascinating subjects of study for materials science and extreme biological adaptations."

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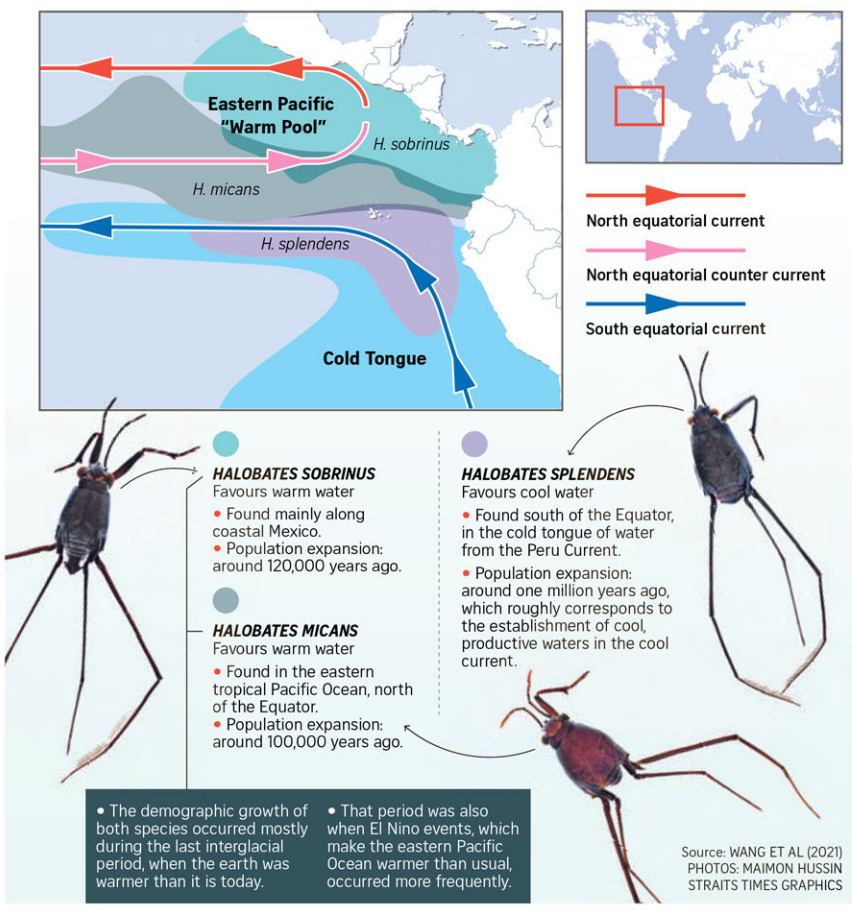
When climate change drives population change

Scientists in Singapore and the United States have, in a new study, found that the populations of three ocean-dwelling insect species in the eastern Pacific Ocean changed when their environments did. The findings contribute to the growing body of knowledge on how climate change could affect wildlife species, and also show how these understudied insects could act like canaries in a coal mine in a warming ocean.

KEY FINDINGS:

- Oceanic skaters are insects that live in one of the harshest environments on the planet: the skin of the open ocean, where they are affected by winds, tides and strong sunshine.
- But there are five oceanic skater species that have found a way to thrive against the odds. Three of them are found in different parts of the eastern Pacific Ocean — *Halobates micans, H. sobrinus* and *H. splendens.*
- The new study, which involved researchers from the National University of Singapore and the Scripps Institution of Oceanography, found that though the three are closely related, each one came to occupy the different parts of the ocean at different points of history when their environments changed.



Source: WANG ET AL (2021)
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