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INSIDE JEB

Small-spotted catsharks cope with marine heatwaves, for now

A small-spotted catshark. Photo credit: Maria Rita Pegado and Catarina Pereira Santos, Laboratório Marítimo da Guia, Portugal.

Every year, the United Nations Conference of the Parties (COP), reminds us of the perils of climate change. However, ectothermic (cold blooded) creatures are constantly on the front line and scientists suspect that the main danger faced by these animals is sudden and dramatic heatwaves, which warm ectotherms quickly passed the highest temperatures they can endure as their metabolic rates rocket. Sandra Martins (University of Lisbon, Portugal) and colleagues from across Portugal explain that small-spotted catsharks (*Scyliorhinus canicula*) could be particularly vulnerable to heatwaves, placing coastal ecosystems at risk. The immune system is one of the most metabolically costly biological networks that the animals maintain, but no one had investigated the impact of high temperatures on the diminutive shark's health and ability to fight infections. So, Martins and colleagues raised the water temperature in the tanks of recently caught wild male small-spotted catsharks at the Laboratório Marítimo da Guia, Portugal, from 16 to 19°C for 30 days to find out how the sharks were affected by a month-long marine heatwave.

After months of extensive investigation, the team decided that the small sharks seemed to have coped with the heat. The amount of protein, fat, salts and urea in the blood were no different after the heatwave and the immune cells circulating around the body seemed as healthy as if the fish had remained cool. But the team did notice that the males had larger gonads for their size – which should increase their fertility in the hope of producing more offspring – and their blood glucose levels had risen from ∼24 to ∼26 mg dl^{-1}, suggesting that the sharks were successfully mobilising energy to meet their increased energy demands as the warm fish's metabolic rates increased.

The team also checked the number of infection-fighting white blood cells in the fish's blood (including lymphocytes, granulocytes and monocytes) and found that the catsharks had fewer monocytes, which destroy the bacteria and viruses that cause infections. In addition, the fish had reduced the expression of two key genes that are usually activated when the fish are dealing with an infection, suggesting that the overheated sharks were compromising some components of their immunity to deal with the heatwave.

Adult male small-spotted catsharks seem to cope reasonably well during a month-long heatwave, they have physiological strategies – including releasing more glucose into their blood – which keep them healthy. However, Martins and colleagues suspect that the fish pare down their ability to fight infection to increase their fertility when temperatures are high and they are also concerned that the fish's energy-mobilizing strategy, which allows them to deal with higher temperatures over a short period, could have detrimental effects as marine heatwaves are predicted to become more intense and longer in the coming decades.

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