How temperature influences the fitness of fish and their tapeworm parasites

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Video Abstract

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Abstract

Climate change may negatively impact cold-water fish while benefiting their parasites. That is the finding of a new study conducted by researchers at the University of Münster. An important biological question regarding climate change is how ecological and evolutionary dynamics will be altered in the face of temperature shifts. Climate change is expected to impact many species – and parasites are no exception. But few studies have conducted empirical tests to determine precisely how environmental changes will affect host-parasite dynamics. To provide insights into this, a team of researchers conducted an experiment involving three-spined sticklebacks, a tapeworm parasite, and varying water temperatures. Sticklebacks – and the tapeworms that infect them – occupy a wide environmental range, making this an ideal system for studying such interactions. Sampling warm and cold-water sites across an Icelandic lake, fish and tapeworms were collected and transferred to a laboratory where various host-parasite combinations were subjected to warm and cold conditions in a fully crossed experimental design. The research team found that warm temperatures promoted growth and, therefore, the evolutionary fitness of the tapeworm. Warm water conditions also reduced the stickleback's immune response to parasite infection. Looking a little closer, they noted that the tapeworms were able to exploit their hosts more efficiently when they were in water of the same temperature as originally collected from. This study provides a rare, empirical test of the consequences of climate change for host-macroparasite dynamics in the freshwater environment. By demonstrating that tapeworms benefit from warmer temperatures while the fitness and immunity of their stickleback hosts suffer, the results of the experiment suggest that temperature variation interferes with host-parasite interactions and affects the fitness of both participants. As climate change progresses and global temperatures rise, this parasite may get a leg-up in the evolutionary arms race.