Warming temperatures cause aquatic animals to shrink the most

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Warmer temperatures cause greater reduction in the adult sizes of aquatic animals than in land-dwellers in a new study by scientists from Queen Mary, University of London and the University of Liverpool.

The research published today (Mon 5 Nov) in Proceedings of the National Academy of Sciences (*PNAS*) shows that the body size of marine and freshwater species are affected disproportionately by warmer temperatures. This could have implications for aquatic food webs and the production of food by aquaculture.

The researchers compared the extent to which the adult size of 169 terrestrial, freshwater, and marine species responded to different non-harmful temperatures, in the largest study of its kind.

Summarising the results, co-author Dr Andrew Hirst from Queen Mary's School of Biological and Chemical Sciences, said:

"Aquatic animals shrink 10 times more than land-dwellers in species the size of large insects or small fish. While animals in water decrease in size by 5 percent for every degree Celsius of warming, similarly sized species on land shrink, on average, by just half a percent."

The research also demonstrates that the most likely cause of this difference in size is due to the much lower availability of oxygen in water than in air. Warming increases the need for oxygen by organisms on land and in water, however aquatic species have a much harder job

meeting this increased demand.

Co-author Dr David Atkinson of the University of Liverpool explains:

"To satisfy increased demands for oxygen at higher temperatures, aquatic species have fewer options. Reducing the size at which they mature is their way of balancing oxygen supply and demand."

Lead author Dr Jack Forster also from Queen Mary's School of Biological and Chemical Sciences adds: "Given that fish and other aquatic organisms provide 3 billion people with at least 15 percent of their animal protein intake, our work highlights the importance of understanding how warming in the future will affect ocean, lake and river dwelling species."

Provided by Queen Mary, University of London