Study: Sea stars bulk up to beat the heat

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A new study finds that a species of sea star stays cool using a strategy never before seen in the animal kingdom. The sea stars soak up cold sea water into their bodies during high tide as buffer against potentially damaging temperatures brought about by direct sunlight at low tide.

"Sea stars were assumed to be at the mercy of the sun during low tide," said the study's lead author, Sylvain Pincebourde of François Rabelais University in Tours, France. "This work shows that some sea stars have an unexpected back-up strategy."

The researcher is published in the December issue of The American Naturalist.

Sea stars need to endure rapid changes in temperature. During high tide, they are fully submerged in cool sea water. But when tides receded, the stars are often left on rocky shorelines, baking in the sun.

Clearly the stars had some way of beating the heat, but scientists were unsure how they did it. Pincebourde and his team thought it might have something to do with fluid-filled cavities found in the arms of sea stars. So he set up an experiment to test it.

The researchers placed sea stars in aquariums and varied the water level to simulate tidal patterns. Heat lamps were used to control temperature, with some stars experiencing hotter temperatures than others. The researchers found that stars exposed to higher temperatures at low tide had higher body mass after the high tide that followed. Since the stars

were not allowed to eat, the increased mass must be from soaking up water.

"This reservoir of cool water keeps the sea star from overheating when the tide recedes again the next day, a process called 'thermal inertia,'" Pincebourde said.

What appears to be happening, the researchers say, is that a hot low tide serves as a cue telling the star to soak up more water during the next high tide. And the amount of water the stars can hold is remarkable.

"It would be as if humans were able to look at a weather forecast, decide it was going to be hot tomorrow, and then in preparation suck up 15 or more pounds of water into our bodies," said co-author Brian Helmuth of the University of South Carolina in Columbia.

The researchers are concerned, however, that climate change may put this novel cooling strategy in peril.

"This strategy only works when the sea water is colder than the air," said co-author Eric Sanford of the University if California, Davis. "Ocean warming might therefore break down this buffering mechanism, making this sea star susceptible to global warming. There are likely limits to how much this mechanism can buffer this animal against global change."

More information: Sylvain Pincebourde, Eric Sanford, and Brian Helmuth, "An Intertidal Sea Star Adjusts Thermal Inertia to Avoid Extreme Body Temperatures." *The American Naturalist* 174:6 (December 2009).

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