Emperor Penguins breeding on ice shelves

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A new study of four Antarctic emperor penguin colonies suggest that unexpected breeding behaviour may be a sign that the birds are adapting to environmental change.

Analysis of satellite observations reveals that penguin colonies moved from their traditional breeding grounds during years when the thin layer of ice (sea ice) formed later than usual to the much thicker floating ice shelves that surround the continent.

Reporting this week in the online journal, *PLOS ONE*, a team of scientists from British Antarctic Survey (BAS), the Australian Antarctic Division and the Scripps Institution of Oceanography at UC San Diego in California, describe this extraordinary change in behaviour.

Lead author, Peter Fretwell of BAS said, "These charismatic birds tend to breed on the sea ice because it gives them relatively easy access to waters where they hunt for food. Satellite observations captured of one colony in 2008, 2009 and 2010 show that the concentration of annual sea ice was dense enough to sustain a colony. But this was not the case in 2011 and 2012 when the sea ice did not form until a month after the breeding season began. During those years the birds moved up onto the neighbouring floating ice shelf to raise their young.

"What's particularly surprising is that climbing up the sides of a floating ice shelf – which at this site can be up to 30 metres high – is a very difficult manoeuvre for emperor penguins. Whilst they are very agile swimmers they have often been thought of as clumsy out of the water."

The emperor penguins' reliance on sea ice as a breeding platform coupled with recent concern about changing patterns of sea ice has led to the species being designated as 'near threatened' by the IUCN red list. The discovery suggests the species may be capable of adapting their behaviour.

In recent years satellite technology has significantly enhanced the scientists' ability to locate and monitor emperor penguin populations.

Barbara Wienecke of the Australian Antarctic Division said, "These new findings are an important step forward in helping us understand what the future may hold for these animals, however, we cannot assume that this behaviour is widespread in other penguin populations. The ability of these four colonies to relocate to a different environment – from sea ice to ice shelf - in order to cope with local circumstances, was totally unexpected. We have yet to discover whether or not other species may also be adapting to changing environmental conditions."

Gerald Kooyman, of the Scripps Institution added: "Without satellite imagery these moves onto shelf ice would not have been detected. It is likely that there are other nuances of the emperor penguin environment that will be detected sooner through their behaviour than by more conventional means of measuring environmental changes."

Whereas sea-ice is frozen salt water, ice shelves are made up of glacial ice that has flowed from the land onto the sea. At the outer edge of an ice shelf ice cliffs can form and these can be anything up to 60 metres high.

More information: Emperor Penguins Breeding on Ice Shelves by Peter T Fretwell, Phil N Trathan, Barbara Wienecke and Gerald L Kooyman is published in *PLOS ONE* on Wednesday 08 January 2014. dx.plos.org/10.1371/journal.pone.0085285

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