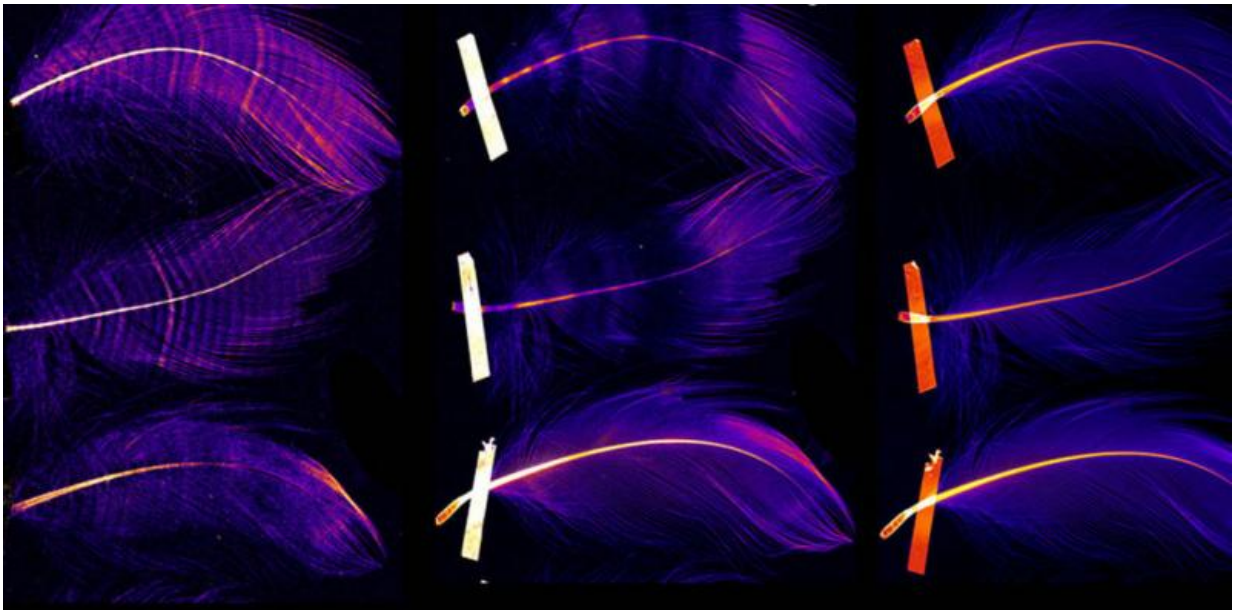
Hidden feather patterns tell the story of birds

June 5 2017, by Richard Banati



Shown as bright orange and pink highlights under X-ray fluorescent light, birds incorporate metals like zinc and bromine into feathers as they grow. Credit: Nature Scientific Reports , CC BY-SA

Shearwaters are migratory marine birds that travel in a figure-of-eight pattern between the coasts of Siberia and Japan to Tasmania.

Placing one of the undistinguished grey feathers from a shearwater into the brilliant light of the X-ray fluorescence microscopy beam reveals something unexpected. We see intricately patterned deposits of chemical elements that tell the story of how a feather grows.

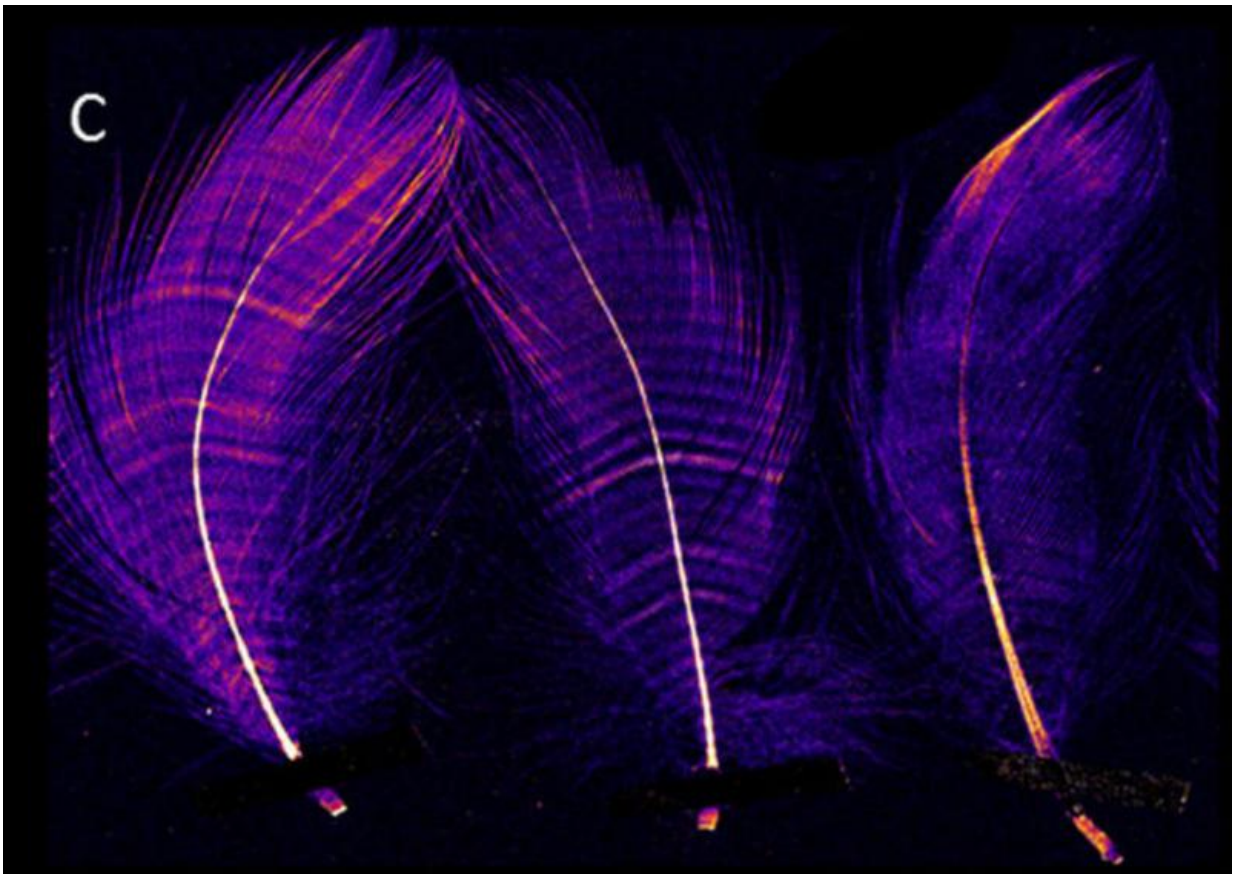
Among other findings, the images show strikingly regular bands containing zinc. There are roughly the same number of bands as the estimated number of days of feather growth.

Different from simple feather growth bars, these patterns were not known before our study, published this month.

Like the annual growth rings of trees, birds' feathers lay down growth bars during their moult. (Moulting is the process of shedding old feathers, making way for new ones to grow.)

While bars simply show growth, the patterns of chemical elements tell us about the bird's life during the growth period of the feather. They can indicate environmental exposures in a bird population, perhaps before impacts such as illness and death are clear.

We think the zinc banding may be a natural diurnal (daily) time stamp locked up within the feather. If confirmed, it's a finding that may be applicable for retrospective dating of the occurrence of stressful events – for example, the temporary exposure to environmental contaminants such as heavy metals – during the period when birds grow new feathers.



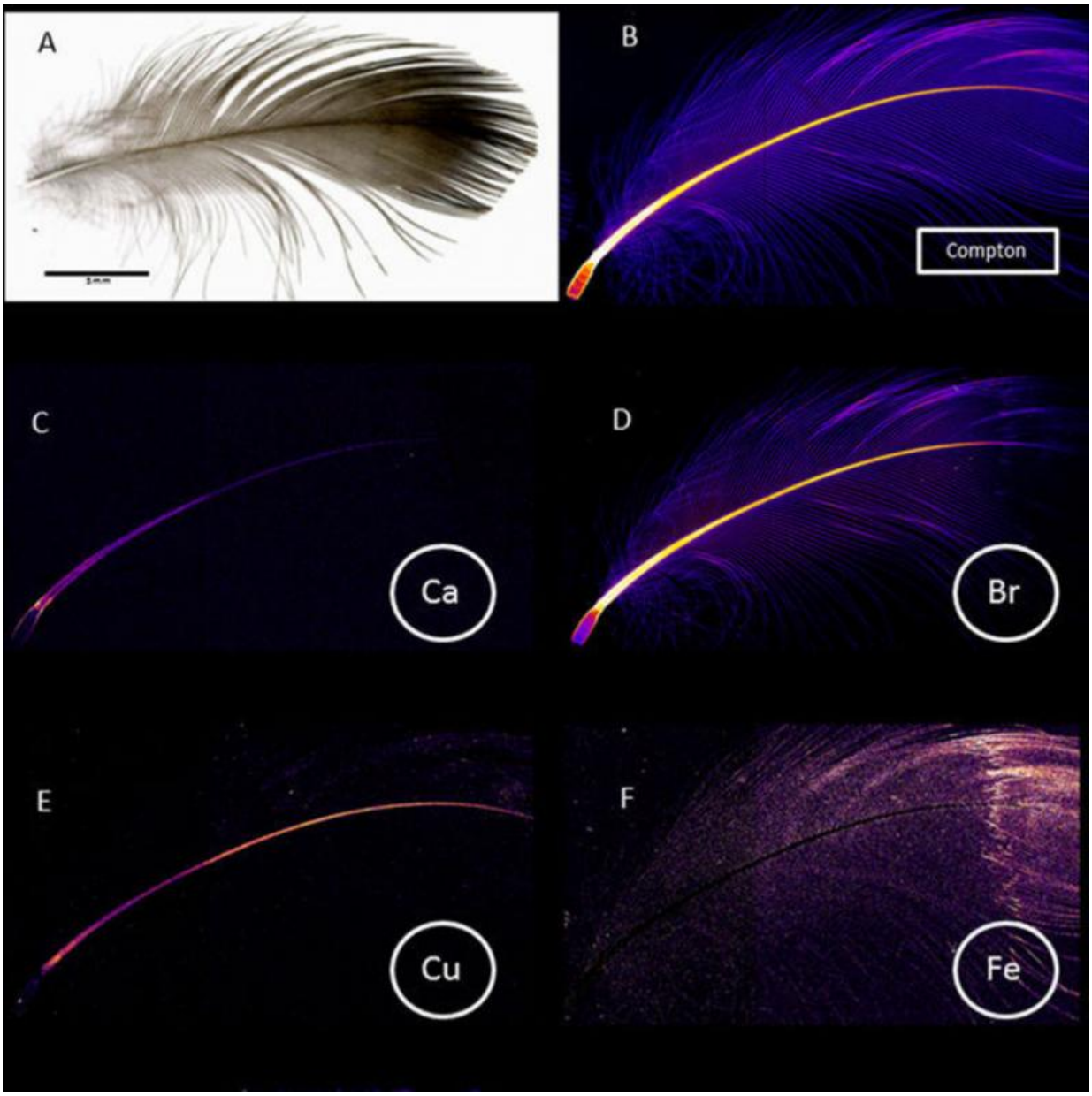
Three breast feathers from three individual Streaked Shearwater birds (Calonectris leucomelas), scanned simultaneously in high resolution X-ray fluorescence microscopy. Regular banding of the element zinc can be seen along the length of the feathers. Credit: Nature Scientific Reports, CC BY

In addition to zinc, other elements detected in feathers include calcium, bromine, copper and iron, each with its own unique pattern of distribution.

The team, including field researcher Jennifer Lavers, analysed feathers painstakingly sampled from remote locations in Japan, as well as Lord Howe Island and New South Wales, and complemented by feathers from the Australia Museum collection in Sydney.

The bulk of the work investigated feathers from three species of shearwaters who migrate more than 60,000km over open ocean each year, to and from their breeding areas.

Foraging across huge areas, shearwaters are important indicators of environmental health. As described by Nobel Laureate and author Peter Doherty in his book Sentinel Chickens:

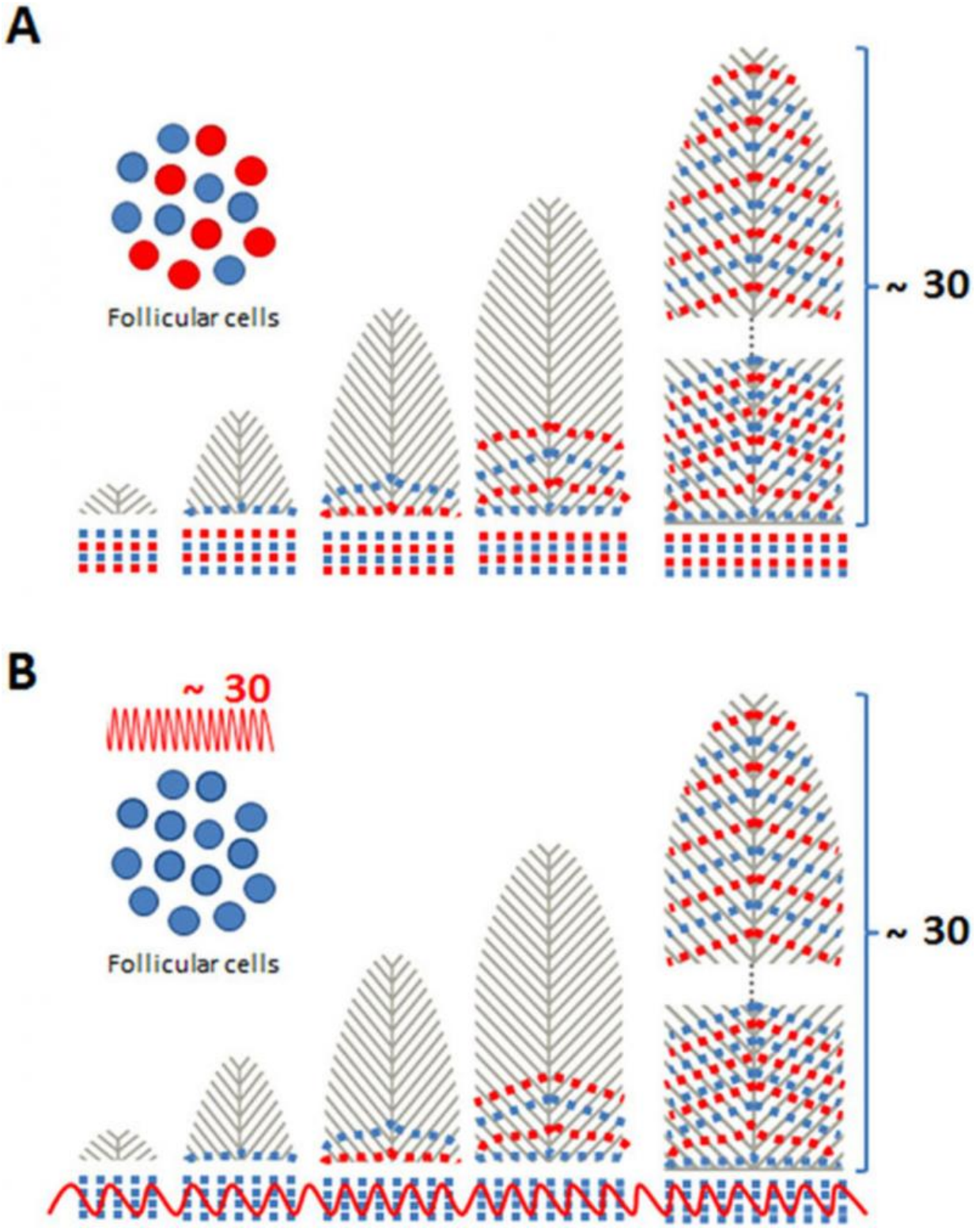


Photographic image [A] and high resolution X-ray fluorescence microscopy images [B-F] in a breast feather from a Flesh-footed Shearwater (Ardenna carneipes); [B] reconstructed Compton scatter (as a density measure) ; [C] calcium distribution; [D] bromium distribution; [E] copper distribution; [F] iron distribution; . Credit: Nature Scientific Reports, CC BY

"Birds of all kinds are recruited by humans to help us interpret changes in our increasingly challenged and unpredictable world. These wonderful creatures continually sample the atmosphere, oceans, fields and forests, signalling toxic and environmental dangers that threaten all vertebrates."

Studying the population health of our feathered fellow creatures might be translatable into early warning signs for humans.

Observed patterns of chemical elements are also useful in a more fundamental scientific sense, as they open a window onto the dynamics of how feathers grow. It's an example of "topobiology", a term that describes the complex growth and regulation processes that take place as a few stem cells develop into an organ or structure such as a feather.



Models of pattern formation in feathers. The bands of zinc may be due to mixed stem cells known as 'follicular cells' growing feathers over a period of around 30

days [A], or regular systemic pulses of changed zinc concentration [B]. Credit: Nature Scientific Reports, CC BY

Developmental biology is usually studied under the highly controlled conditions of a laboratory experiment. However, the current study shows that sensitive markers of development and health can also be applied to samples collected in field studies.

The chemistry of feathers might become a tool for watching our environment.

This article was originally published on The Conversation. Read the original article.

Provided by The Conversation

Citation: Hidden feather patterns tell the story of birds (2017, June 5) retrieved 6 July 2024 from https://phys.org/news/2017-06-hidden-feather-patterns-story-birds.html