

## ECOLOGY

# Iceberg unveils secret ecosystem

Biologists rush to study life exposed under Antarctica's Larsen C ice shelf before it changes.

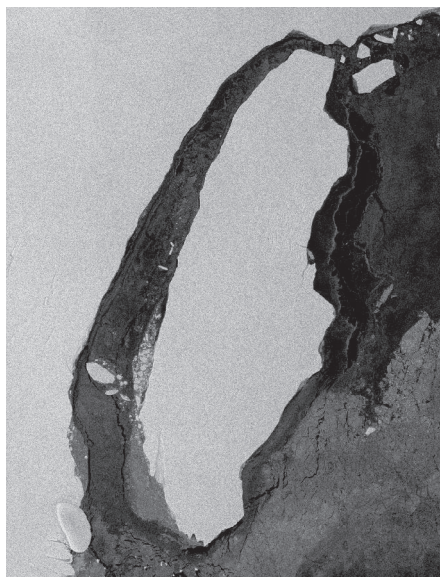
BY JO MARCHANT

Biologists are racing to secure a visit to a newly revealed region of the Southern Ocean as soon as it is safe to sail there. One of the largest icebergs ever recorded broke free from the Larsen C ice shelf on the Antarctic Peninsula in July. As it moves away into the Weddell Sea, it will expose 5,800 square kilometres of sea floor that have been shielded by ice for up to 120,000 years. If researchers can get to the area quickly enough, they'll have the chance to study the ecosystem beneath before the loss of the ice causes it to change.

"I cannot imagine a more dramatic shift in environmental conditions in any ecosystem on Earth," says Julian Gutt, a marine ecologist at the Alfred Wegener Institute for Polar and Marine Research in Bremerhaven, Germany.

It is difficult for Antarctic scientists to respond quickly to sudden events, because polar-research vessels are usually booked months, if not years, in advance. A German research mission led by Boris Dorschel, head of bathymetry at the Alfred Wegener Institute, was already scheduled to visit the Larsen area and will now include a biodiversity survey of the exposed region in March 2019.

Hopes for reaching the region this Antarctic summer lie with the British Antarctic Survey (BAS) in Cambridge. The agency has a fast-track proposal sparked by the calving event, led by BAS senior biodiversity scientist Katrin Linse, to send a research vessel in early 2018. The proposal is now being considered



The calved iceberg is about the size of Delaware.

by a British funding council. South Korean researchers are also considering whether to divert a mission currently planned for the South Shetland Islands, says Hyoung Chul Shin, a biological oceanographer at the Korea Polar Research Institute in Incheon.

If the BAS proposal is successful, it will be the first time marine biologists have been able to explore such an ecosystem so soon after the break-up of the ice. Nearby sections of ice shelf, at Larsen A and Larsen B, broke away in 1995 and 2002, respectively. But it was several years

before the ocean cleared of sea ice and biologists could safely visit the area. Gutt was first in with a detailed survey, leading a team of about 50 scientists on the German research vessel *Polarstern* in 2007. The group sampled hundreds of species in areas exposed by the break-ups at Larsen A and B, and saw signs of a unique ecosystem with more deep-sea species than elsewhere on the Antarctic continental shelf (J. Gutt *et al. Deep-Sea Res. II* 58, 74–83; 2011). But other species were already moving in, including fast-growing sea squirts, krill and minke whales. "By then, a lot had happened," says Linse.

Video footage taken by geophysicists on a US Antarctic Program cruise at the Larsen B site in March 2005 had unexpectedly showed most of the sea floor covered with a white mat, which the team interpreted as a layer of sulfur-eating microbes, as well as large clams, which were also chemotrophic — that is, living on energy sources other than the Sun. It was the first report of a chemotrophic ecosystem in the Antarctic. But when the *Polarstern* arrived two years later, Gutt's team saw only dead clamshells and a layer of decaying plant matter and sediment.

Biologists will discuss research priorities for Larsen C and future exposed regions at a meeting at Florida State University's Coastal and Marine Laboratory in St Teresa on 18–19 November. Meanwhile, Linse's team is waiting to learn whether the BAS mission proposal will be approved, and monitoring the iceberg in satellite images. "We need the wind to blow the iceberg out a bit more and to blow the sea ice out of there," says BAS spokesperson Athena Dinar. ■

COPERNICUS SENTINEL-1 VIA BAS

## BIOLOGY

# Competition shapes ducks' penis size

When forced to vie for mates, some birds develop longer penises and others only nubs.

BY AMY MAXMEN

Some male ducks respond to sexual competition by growing an extra-long penis, whereas others develop a nub of flesh, a study finds. The unusual phenomena occurred in two species studied: the lesser scaup (*Aythya affinis*) and the ruddy duck (*Oxyura jamaicensis*). They suggest that penis size — in line with many traits and behaviours meant to impress or allow impregnation of the opposite sex — involves a trade-off between

the potential to reproduce and to survive.

Patricia Brennan, an evolutionary biologist at Mount Holyoke College in South Hadley, Massachusetts, compared the penises of ducks kept in male–female pairs to those housed with multiple males per female (P. L. R. Brennan *et al. Auk Ornithol. Adv.* 134, 882–893; 2017).

"If they were alone with a female, the males just grew a normal-sized penis, but if there were other males around, they had the ability to change dramatically," Brennan says. "So evolution must be acting on the ability to be

plastic — the ability to invest only in what is needed in your current circumstance."

Because evolutionary success relies on reproduction, genitals are adapted to meet the varied circumstances that every animal faces. Some male ducks, for example, have penises in the shape of corkscrews to navigate the labyrinth-like vaginas of their female counterparts. An earlier study by Brennan found that females' anatomy evolved to prevent access to undesirable males who try to force copulation (P. L. R. Brennan *et al. Proc. R. Soc. B* 277, ▶

► 1309-1314; 2010). To mate successfully with their chosen partners, Brennan says, female ducks assume a posture that allows males to enter them fully and deposit sperm near the eggs.

### CLOSE COMPETITION

However, evolutionary changes in the size and shape of body parts are generally thought to happen over generations, not within an individual's lifetime. Brennan wondered whether ducks might buck this trend, because some species' penises emerge anew every breeding season and degenerate afterwards.

Brennan and her colleagues fenced off habitats so that ducks would live either in pairs or in groups with almost twice as many males as females for two breeding seasons over the course of two years. The lesser scaups grew longer penises when they were forced to compete for females than when they were coupled up. A larger reproductive organ is thought to improve their chances of fertilizing an egg.

But the results of the social environment on ruddy ducks were more complicated. During the first year, only the largest males grew long penises (about 18 centimetres each), whereas smaller males developed half-centimetre stubs. In the second year, smaller males grew normal-sized penises, but they lasted for just five weeks, whereas the largest males kept their

penises for three months.

Clues may lie in the drama of ruddy-duck life. The birds have some of the largest penis-to-body ratios found in nature — with penises that can be longer than their bodies. “I can't imagine they could grow any longer,” Brennan says. The birds fight to the death at times, which suggests that smaller ones might be too stressed to develop penises normally. “Bullying may increase stress hormones, and those

**“There is a cost to having a large penis because individuals are investing according to the competition.”**

could counteract the effects of androgen hormones” that control penis growth, Brennan says. This response to stress could be adaptive. The same androgen hormones that trigger penis growth every season in birds also underlie colouration. They cause the duck's feathers to turn from dull brown to chestnut when it's time to breed, and their bills to go from grey to bright blue. To females, the wardrobe change signals a male's readiness. To neighbouring males, it foreshadows a fight. “I think the small ones go through it quickly so that there's less danger of getting beaten up,” Brennan says.

The study is “really interesting”, says Charlie Cornwallis, an evolutionary biologist at Lund

University in Sweden. “This suggests there is a cost to having a large penis because individuals are investing according to the competition they face from other males.” Cornwallis says that few studies have investigated the effect of environmental and social conditions on penis size, and that these evolutionary trade-offs could be more common than imagined.

Visitors to the Livingston Ripley Waterfowl Conservancy in Litchfield, Connecticut, where the study was conducted, overlook the birds' bargains as well. “People watch the ducks on the weekends, but they have no idea what's really going on,” Brennan says. “I now have a love-hate relationship with ducks.” ■

### CORRECTIONS

The News story ‘Researchers unite in quest for ‘standard model’ of the brain’ (*Nature* **549**, 319–320; 2017) incorrectly located the Simons Foundation in Washington DC. It is in New York City.

Both the News story ‘Researchers riled by lack of detail in Brexit science plans’ (*Nature* **549**, 140–141; 2017) and the Seven Days item ‘Brexit plans’ (*Nature* **549**, 137; 2017) erroneously stated that the United Kingdom would leave the European Union next year. In fact, it is expected to leave in 2019.