

With their dinner-suit plumage and waddling gait, penguins are among the most unusual and endearing members of the bird kingdom. A new fossil find, however, has revealed that one of their ancestors was a far more fearsome beast.

The fossils, which were found in Peru and are described in detail today by scientists, reveal a creature that was over 1.5 metres tall and weighed as much as a person. The 36 million-year-old tropical bird's intimidating appearance was topped off with powerful arms, a chunky neck and a potentially vicious 18-centimetre beak.

The discovery of the giant bird has shaken scientists' understanding of penguin evolution. The find indicates that penguins made the journey to equatorial regions much earlier in their evolutionary history than researchers had realised.

And because the penguins lived during a period when the Earth was experiencing a "greenhouse" climate the pair of species are challenging what researchers thought they knew about how species adapt to hotter temperatures.

"It's a monster," said Julia Clarke at North Carolina State University, who described the fossils with her team in Proceedings of the National Academy of Sciences today. The two main finds are remarkably complete and well preserved. "The bone preservation is extremely good," she said. "We have so few relatively complete penguins from that period of penguin evolution." The detail is so good that the researchers were able to see fine patterning on the beak of the giant penguin left by a sheet of keratin - the material that makes up feathers.

The giant species has been named *Icadyptes salasi*. If it were alive today, *Icadyptes* would tower over the largest penguins on the planet - the 1.2-metre emperors, whose epic migration across the Antarctic wilderness to bring food to their chicks was celebrated in the film *March of the Penguins*.

The team do not have any direct evidence for the new discovery's diet, but the wings were adapted for swimming and found in sediments laid down just off shore. *Icadyptes'* elongated beak would have been capable of snaring large fish, but its shape is so unusual that the team believe it used a previously unknown technique for catching prey. "It is distinct from anything we have in living penguins," said Prof Clarke. Attachment points

for neck muscles are also very large suggesting that it had a powerful neck, perhaps for spearing prey.

The discovery goes against the general rule that as climatic conditions get warmer, species tend to evolve into a smaller body size.

The theory is that large size is useful in the cold because it reduces the ratio of surface area to volume, making it easier to conserve heat. But *Idadyptes* was found in a region that resembled the modern day Atacama desert at a time when the Earth was experiencing an extremely warm period in its history.

The researchers speculate that there may have been an increase in ocean upwelling at the time around what is now the Peruvian coast. This would have fertilised the food chain, leading to an abundance of fish and so giving easy pickings for the mammoth birds.

The find also contradicts the idea that penguins did not reach equatorial regions until between four and eight million years ago, well after a cooling period had set in that began to swell the polar ice caps. Today, only one species - the Humboldt penguin - is found on the coast of Peru.

The team are keen to point out that although these species were adapted to the tropics, it does not mean that current penguin species will be able to adapt quickly to climate change. "Current global warming is occurring on a significantly shorter timescale. The data from these new fossil species cannot be used to argue that warming wouldn't negatively impact living penguins," said Prof Clarke.

The *Idadyptes* fossil is the most complete of any giant penguin yet discovered. But it may be smaller than the largest giant known. *Anthropornis nordenskjoeldi*, Nordenskjoeld's giant penguin, which is thought to have lived up to six million years ago and whose fossils were found in New Zealand, could have been up to 2 metres high and weighed 100kg.