

HOW WE FOUND THREE NEW SPECIES OF PENGUINS

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YOUNG REVIEWERS:



JULIA

AGE: 12



THEO

AGE: 12



VEDANT

AGE: 9

SPECIES

A group of closely related organisms that can reproduce with each other and produce offspring that can reproduce with other similar individuals.

Usually, it is easy to tell species apart by what they look like, for example, a blue whale and a horse. Chinstrap and Adelie penguins are closely related species, but we can still tell them apart by their unique color patterns. However, sometimes different species look incredibly similar, and we must use special methods to tell them apart. These are called cryptic species. Gentoo penguins live across a large area, including Antarctica and many sub-Antarctic Islands. It has been suspected that gentoos might really be more than one species. To test this, we looked at their DNA and measured their flippers, legs, and beaks to compare gentoos living in four locations. We found differences that told us that there are at least four species of gentoo penguins, not just one species as previously thought.

WHAT IS A SPECIES?

The world around us is full of life. In biology, we use the word **species** to categorize living creatures. In the past, scientists mostly told species apart based on how they looked. It is easy to tell species apart when

CRYPTIC SPECIES

Groups of organisms that look nearly identical but are actually different species that cannot reproduce with each other.

DNA

The material inside cells that provides instructions on what an organism will look like and how parts of the body will work.

Figure 1

ARABIC 1Gentoo penguins in museum collections in the UK (A), in the grassy areas of South Georgia (B) and on ice in Antarctica (C). We use metal rulers to measure Gentoo penguins as are sturdy and can be taken on fieldwork.

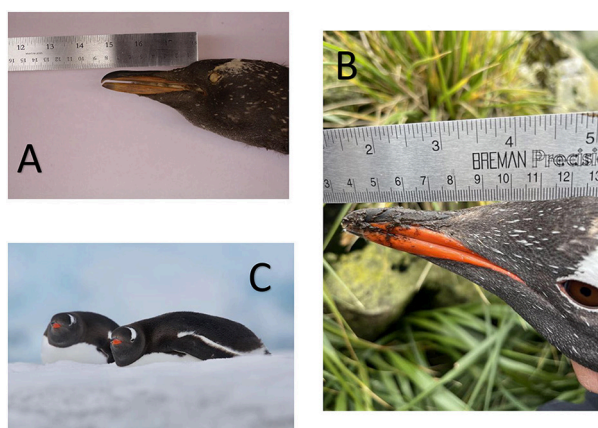


Figure 1

they look very different, like a blue whale and a horse, for example. When species are closely related, it can be more challenging to tell them apart, like horses and zebras, turtles and tortoise, frogs and toads, butterflies and moths, or even types of tigers. Sometimes, species look so similar that we cannot tell them apart based just on how they look. These are called **cryptic species**, and we must use special scientific methods to tell them apart, like taking very precise measurements of their bodies or by comparing their **DNA** [1, 2]. Recognizing species is very important for protecting wildlife, because scientists, governments, charities, and the public are all focused on saving species [3].

GENTOO PENGUINS

Gentoo penguins are one type of penguin that lives in the Southern Ocean, which is the body of water surrounding Antarctica.

You can recognize a gentoo penguin from its bright red bill, black head, and striking white patches on its face (Figure 1). They live across the whole Southern Ocean, from South Georgia and the Falkland Islands in the north, all the way down to Antarctica. The environment on the islands is quite different than that of Antarctica. On the islands there is less ice and more plant life, while in Antarctica there is far more ice and snow.

CONSERVATION

The act of protecting species from extinction and actively maintaining or restoring habitats.

We know from other scientific studies that the number of gentoo penguins in Antarctica is growing every year. But that is not the case in other areas, like the sub-Antarctic islands, where the number of gentoo penguins is falling. This means that individual populations vary in their levels of success at getting food and increasing their populations. Eventually, some of those populations might go extinct if **conservation** efforts are not increased. Conservation usually applies at the species level, and we do not usually protect specific populations of the same species. Therefore, if the gentoo penguin is more than one species,

we would be better able to protect them. Other scientists have already looked at gentoo penguins and found that groups were more distinct than they expected. We wanted to go a step further and use the latest science to find out if the differences meant gentoo penguins were actually more than one species.

In this study, we looked at gentoo penguins from four areas in the Southern Ocean, to see if they might be more than one species: the island of South Georgia, the Falkland Islands, Kerguelen Island, and the Antarctic Peninsula.

EVIDENCE FROM GENTOO DNA

DNA is the material inside the cells of all living creatures (including you!) that carries all the information about how that creature will look and function. You can think of DNA as a tiny blueprint for making a living thing. By comparing their DNA, we can tell how similar or different creatures are, as well as how closely related they are. Your DNA is very similar to the DNA of your siblings, quite similar to the DNA of other humans that are not in your family, and very different from the DNA of a tree frog or a penguin.

In our study, we compared the DNA of gentoo penguins living in the four areas of the Southern Ocean using a small drop of their blood. We found that the penguins that live together in the same area have DNA that is very similar to each other, but between areas, we found that the penguins' DNA is very different [4].

EVIDENCE FROM GENTOO MEASUREMENTS

Because the DNA of the gentoo penguins is different between locations, we also looked closely at their bodies to see if there are any differences in how they look. If you were on a boat in the Southern Ocean and a gentoo penguin jumped out of the water and landed at your feet, it would be extremely difficult to know which area it came from just by looking at it. That is because penguins from separate areas have very similar colors and overall shapes. However, it is possible that there are smaller differences that we do not notice at first glance.

We visited **museum collections** that have lots of preserved gentoo penguins and used a pair of **calipers** and a ruler to carefully measure their bodies. By measuring the heads, legs, and flippers and comparing measurements between penguins in the four areas, we found that penguins from each area have slightly different sizes. Gentoo penguins from Antarctica are the smallest, followed by Kerguelen, then South Georgia, and the gentoos from the Falkland Islands were the biggest.

MUSEUM COLLECTIONS

Collections found in museums that contain many specimens (bones, teeth, stuffed skins, etc.) of various species. Scientists use these collections to study species without having to find them in nature.

CALIPERS

Used to measure lengths like a ruler, Calipers allow scientists to get exact measurements of objects that are often odd shapes.

NEW SPECIES ALERT

All the evidence points to gentoo penguins being four separate species: *Pygoscelis papua* for the Falklands Islands gentoo, *Pygoscelis taeniata* for the Kerguelen Island gentoo, *Pygoscelis ellsworthi* for the gentoo from Antarctica, and finally *Pygoscelis poncetii* from South Georgia. One of the most exciting things about finding new species is that we get to name them. *Pygoscelis poncetii* is named after Sally Poncet, a marine biologist who works in South Georgia where the new species is found. Figure 2 shows where each of the four species live and Figure 3 shows each of the new species in their habitats.

Figure 2

Map of new gentoo penguin species across the Southern Ocean. Colored triangles show the colonies we used in this study, while the gray areas are other gentoo colonies in the Southern Ocean.

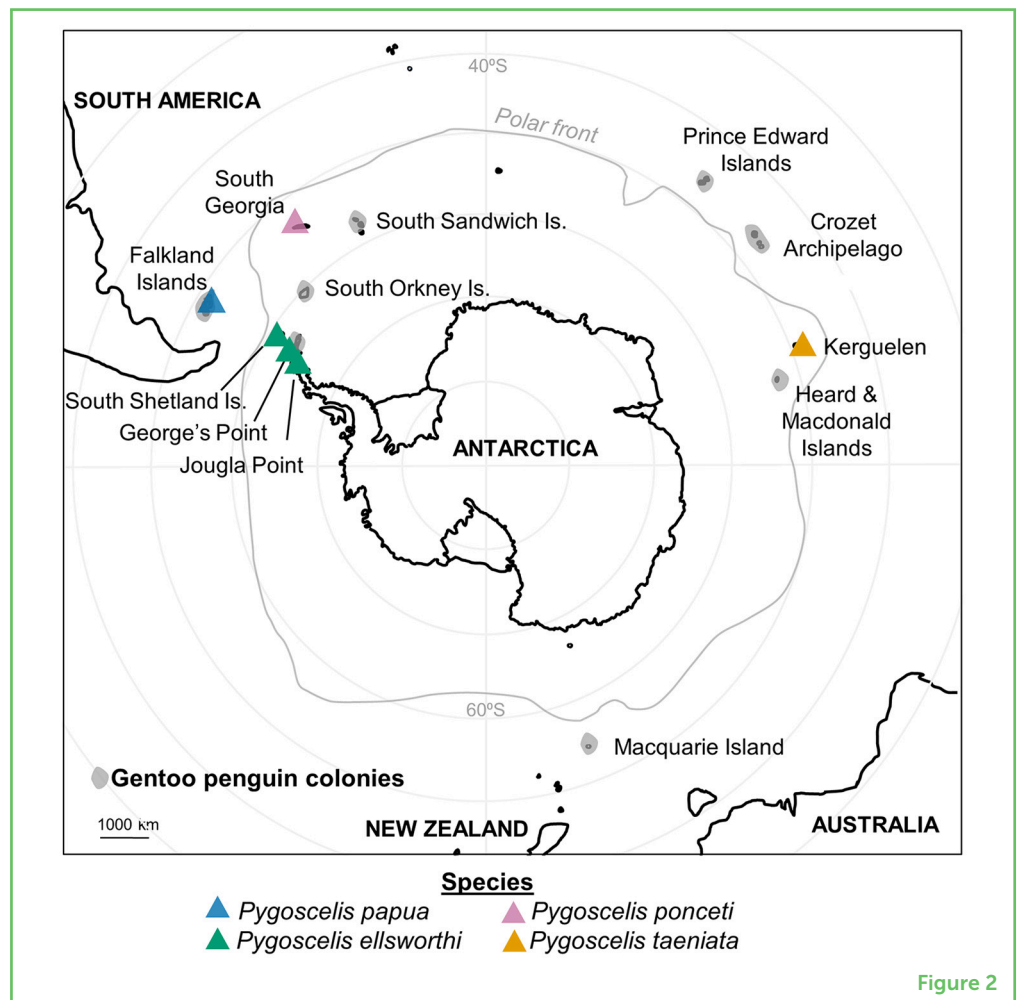


Figure 2

CONCLUSION

Discovering new species is an incredibly exciting part of biology. In our study, we used DNA and body measurements of gentoo penguins to look for cryptic species, and we found that gentoo penguins are actually four separate species. By using the latest tools in biology, we can find new diversity in the most surprising of places, including in very well-known animals like penguins. There are many other penguin

Figure 3

The four gentoo species we identified. While they all have the same colors patterns, the main difference is their size. *Pygoscelis ellsworthi* are the smallest, followed by *Pygoscelis taeniata*, then *Pygoscelis poncetii*, and *Pygoscelis papua* are the biggest. The differences are small that they cannot be seen without taking measurements. The colored triangles match the map in Figure 2 (Photos from Jane Younger & Gemma Clucas, used with permission).



species beyond the gentoo penguin, each facing challenges in the face of climate change. By understanding their biology and how many species there are, we can learn how to best protect penguins—as well as many other types of creatures—so that generations of people can enjoy them.

ORIGINAL SOURCE ARTICLE

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REFERENCES

1. Barrowclough, G. F., Cracraft, J., Klicka, J., and Zink, R. M. 2016. How many kinds of birds are there and why does it matter? *PLoS ONE* 11:e0166307. doi: 10.1371/journal.pone.0166307
2. Cracraft, J. 1983. Species concepts and speciation analysis. *Curr. Ornithol.* 1:159–87. doi: 10.1007/978-1-4615-6781-3_6
3. BirdLife International. 2018. *State of the World's Birds: taking the Pulse of the Planet*. Cambridge, MA: BirdLife International.
4. Clucas, G. V., Younger, J. L., Kao, D., Emmerson, L., Southwell, C., Wienecke, B., et al. 2018. Comparative population genomics reveals key barriers to dispersal in Southern Ocean penguins. *Mol. Ecol.* 27:4680–97. doi: 10.1111/mec.14896

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YOUNG REVIEWERS



JULIA, AGE: 12

Julia is a 6th grader student. She is passionate about music and science. Julia plays the drums, the piano and the bass. She plays in the orchestra and in the jazz band and recently she and her band wrote a song. Julia loves science class and would like to become an F1 engineer.



THEO, AGE: 12

Theo is a 6th grader. His favorite class is science and he would like to be a photographer for National Geographic. Theo plays in a band with his friends and they have recently wrote a song. Theo has played a variety of sports and basketball is his favorite.



VEDANT, AGE: 9

I love playing Minecraft and I enjoy creating different worlds in it. I am very curious. I am a chatterbox and also, I love asking questions.

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