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Flipper Bands Hinder King Penguins

A team of researchers headed by Yvon Le Maho, CNRS researcher at the Institut Pluridisciplinaire Hubert Curien (CNRS / Université de Strasbourg) and member of the Académie des Sciences, has demonstrated that, over a ten year period, flipper-banded penguins have a 16% lower survival rate and produce 39% fewer chicks than non-banded birds. These results were obtained through electronic monitoring of one hundred king penguins on Possession Island in the southern hemisphere. As a precautionary measure, French researchers have stopped banding penguins since the 1990s.

Supported (1) by the Institut Polaire Français Paul-Émile Victor, this work was carried out in collaboration with Oslo and Tromsø universities in Norway, the Tour du Valat biological station and the Muséum National d'Histoire Naturelle and has been published on 13 January in *Nature*, also featuring on the cover of the journal.

Penguins are excellent indicators of the state of health of marine ecosystems and thus make it possible to better understand the impact of climate change on biodiversity. As a matter of fact, these top predators of the Southern Ocean are at the summit of the marine food chain. Their population dynamics is thus conditioned by the evolution of marine resources; any modifications arising in their survival and breeding success reflect to a large extent the impact of climate on lower links in the food chain (fish, zooplankton, etc.). Until now, most of the available data has been obtained by banding the animals being monitored. However, unlike other birds, it is impossible for anatomical reasons to fit bands to penguins' feet. Researchers therefore fit them to their flippers. These metal bands can be read at a distance, thus avoiding any stress involved in recapturing the penguins. The use of such flipper bands however raises serious questions as they can have deleterious effects on the animal. These effects include injuring flipper tissues or increasing energy expenditure while swimming or fishing due to the hydrodynamic drag effect on the flippers that the penguins use to propel themselves. Short-term studies (maximum one year) have concluded that banding has no impact. As a precaution, certain researchers, including French teams, have abandoned it but it is still used throughout the world. In

addition, some scientists continue to rely on data from banded birds.

For the first time, a French-Norwegian team has conducted a long-term study, the objective of which was to monitor, over a ten year period, one hundred king penguins with electronic tags implanted under their skin, half of which were also fitted with a flipper band. The penguins were identified individually by radiofrequency using antennas buried along their passageways, between the colony and the sea. This electronic monitoring system was developed in 1998 by Le Maho's team at the Institut Pluridisciplinaire Hubert Curien (CNRS / Université de Strasbourg). The researchers focused on two key parameters for monitoring the evolution of this penguin population: their mortality rate and their breeding success. Their results unequivocally prove the significant impact of flipper banding, which affects both the survival and breeding of these animals, in the medium and long term. The banded population's growth rate is a fortiori also affected. In fact, over the last decade, the 50 banded penguins produced 39% fewer chicks (from laying until the chicks can feed for themselves). In addition, their mortality was 16% higher than that of non-banded birds.

The banded birds arrive later at their reproduction sites and, after having been banded for 10 years, they continue to have a delayed breeding cycle on account of their longer foraging trips. This study thus refutes the theory that penguins get used to such bands after a certain time. Another very important result is that banded penguins do not react in the same manner as non-banded penguins to

climatic variability (mainly sea temperature). This is why, depending on the year and the environmental conditions, the effect of banding is more or less perceptible. "In favorable periods, when the sea temperature is low and food resources are abundant, there is virtually no difference between banded and non-banded animals," explains Claire Saraux, the leading author of this article. "On the other hand, when the sea temperature is higher, the penguins need to forage further to find their food and banded birds then stay longer at sea." These results thus demonstrate the need for long-term studies to test the possible effects of methods used to monitor animal populations.

From an ethical point of view, this study calls into question the numerous banding campaigns that are still ongoing.

These results are obviously specific to penguins and cannot be generalized to foot-banded flying birds. Furthermore, since banded and non-banded penguins do not react in the same way to changes in sea temperature, this study demonstrates that flipper banding introduces an important bias in the study of climatic effect on the dynamics of penguin populations. Since current knowledge of this effect is based to a large extent on data from banded birds, such information must therefore be considered with caution.

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