Impact of RPAS (drone) use on emperor penguins

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***Introduction***

Due to the increasing application of Remotely Piloted Aircraft Systems (RPAS[[1]](#footnote-1)) in Antarctica, an intersessional ICG which was convened by Germany in 2017/2018 developed Environmental Guidelines for RPAS (see ATCM XL IP38 *Use of UAVs in Antarctica - A competent authority’s perspective and lessons learned*, ATCM XLI WP29 *Report of the CEP Intersessional Contact Group to develop guidelines on the environmental aspects of the use of Unmanned Aerial Vehicles (UAVs) / Remotely Piloted Aircraft Systems (RPAS) in Antarctica*, ATCM XLIII IP18 *Operationalizing the use of Unmanned Aerial Vehicles (UAV) for assessing Antarctic wildlife populations*, Harris et al 2019). With Resolution 4 (2018) the *Environmental Guidelines for operation of Remotely Piloted Aircraft Systems (RPAS) in Antarctica (v 1.1)* were adopted. The current version of the guidelines does not include distinct minimal distances from animals, mainly because the scientific basis for such restrictions is not fully established yet. Information on sensitivity to RPAS is incomplete, preliminary or completely missing for many Antarctic species. The iconic emperor penguin (*Aptenodytes forsteri*) is one of those species for which there is no knowledge about RPAS sensitivity. The data presented here aim to close this gap. It becomes particularly important in light of the predicted strong population changes the species faces with ongoing climate change, where RPAS present a promising tool to observe and monitor penguin colonies for a better understanding of their development.

***Abstract***

During experiments carried out in November and December 2019 at the emperor penguin colony at Atka Bay (Weddell Sea, Dronning Maud Land) near the German research station Neumayer III, emperor penguin chicks and adults on the sea ice / fast ice were video recorded from a distant position on the ice shelf to observe behavioural reactions to two different drone models or human approaches (Rümmler et al. 2021a,b). In general, only moderate responses to drone overflights with distinct reactions were observed in fewer than 20% of individuals. There was no observation of severe reactions like escape behaviour, panic, or large group movements. The behavioural reaction also only lasted for a fairly short time, with individuals returning to their previous behaviour in less than one minute. In chicks, the greatest reaction was observed during vertical approaches of a multirotor drone, while adults showed only an intermediate reaction. During horizontal flights, increased vigilance behaviour was observed in chicks, but very few reactions in adults. Contrastingly, adult emperor penguins showed a stronger reaction to human approaches than chicks and stronger than to any drone activity (see Figure 1).

The comparison of two different RPAS models revealed only slight differences, with a fixed-wing drone causing fewer individuals to react than a multirotor drone.

For adult emperor penguins, a flight height above 70 m was shown to not induce significantly different behaviour for the multirotor drone than observed during controls. For chicks or fixed-wing drones, no such height could be derived.

The reaction towards the multirotor drone was stronger later in the season when chicks were in fledge phase than in the earlier crèche phase, though it cannot be concluded with certainty if this effect is caused by the timing in season or by daily factors such as daily patterns or weather conditions.

Gráfico, Gráfico de cajas y bigotes

Descripción generada automáticamente

Figure 1: Comparison of observed behavioural reactions (percentage of individuals showing vigilance & flipper-flapping) to different disturbance sources. Displayed are the mean ± standard error during the class of the highest observed disturbance (i.e. 11-20 s after the drone was directly overhead in horizontal flights at 20 m flight height, <5 m in human approaches, 15–20 m for vertical approach).

***Concluding remarks***

In general, there seems to be no strong reaction of emperor penguins to drones. There was very little influence on adults, particularly in comparison to a human approach. In chicks, stronger reactions have been observed, comparable or even slightly stronger than to a human approach. Especially vertical movements above chicks should be avoided. In all cases, the reaction towards the drone is very short in time.

Thus, it can be concluded that RPAS flights for monitoring purposes (mainly horizontal) over emperor penguins, where the drone only passes over the colony for short moments, can be regarded as reasonable, particularly if done above 70 m. Repeated activities, particularly with reoccurring changes of direction (as for example often used for recreational or journalistic purposes) should be avoided. Where applicable, fixed-wing drones should be preferred.

***References***

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1. A Remotely Piloted Aircraft System (RPAS) is defined by the International Civil Aviation Authority (ICAO) (2015) as “A remotely piloted aircraft, its associated remote pilot station(s), the required command and control links and any other components as specified in the type design”. A Remotely Piloted Aircraft (RPA) is “An unmanned aircraft which is piloted from a remote pilot station”. RPAS are one class of Unmanned Aerial System (UAS), and they are often referred to as Unmanned Aerial Vehicles (UAVs), Unmanned Aircraft Systems (UAS) or ‘drones’. In this context RPAS is used for all types of remotely piloted drone systems, the term which has also been adopted by COMNAP, SCAR and a number of national authorities, and RPA is used to refer specifically to the aircraft itself. [↑](#footnote-ref-1)