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Risks of COVID-19 to Antarctic Wildlife

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Information Paper submitted by SCAR

Summary

In 2020, the Antarctic Wildlife Health Monitoring Working Group of the SCAR Expert Group on Birds and Marine Mammals (EG-BAMM) assessed the risk of a SARS-CoV-2 outbreak to Antarctic wildlife. Based on the scientific literature about the structure and function of SARS-CoV-2 as well as its stability in different environmental conditions, and taking into consideration information available on other viruses in Antarctic wildlife, a risk assessment was conducted to examine whether SARS-CoV-2 could survive in the Antarctic environment and be transmitted from humans to wildlife (and vice-versa) and if so, whether Antarctic wildlife could be susceptible to the virus.

The findings from this study were published in the journal *Science of the Total Environment*[1] and followed up by two publications in the outreach platform *The Conversation*[2,3]. This Information Paper highlights the vulnerability of Antarctic wildlife to novel viruses, our limited knowledge and understanding of infectious diseases in Antarctic wildlife, and the potential risks posed by human activity on the Antarctic continent.

Background

Human activity and human-wildlife interactions in Antarctica are on the rise[5,6], increasing the risk of introducing novel infectious diseases to the Antarctic continent and to Antarctic wildlife. Both direct (activities within or close proximity to wildlife and wildlife colonies (<10m)) and indirect (fisheries, animals near stations) human-wildlife interactions pose a significant risk for the introduction and transmission of pathogens to wildlife. Currently, information on pathogens of Antarctic wildlife and their susceptibility to different microbes and viruses is limited, with little research being conducted on the presence of pathogens and their impacts on wildlife.

In late 2019, a novel disease, COVID-19, emerged – most probably – from the Hubei Province of China and began to spread rapidly throughout the world, with the World Health Organization declaring a pandemic in early 2020. The COVID-19 pandemic is caused by the Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2), which is a novel species of coronavirus closely related to other coronaviruses found in bats and pangolins. The virus is suspected to have originated in a yet-to-be determined animal and spread to humans via an unknown intermediate host.

Recent research has shown that the viruses have the potential for cross-species transmission from humans to wildlife and vice versa, with animals such as felids, canids and mustelids and other mammals known to have been recently infected with the virus. However, little is known about the susceptibility of wildlife to the virus. In early 2020, Damas et al.[4] predicted the risk to wildlife of SARS-CoV-2 based on a comparative and structural analysis of the ACE2 receptor, which is the main receptor used by the virus to infect its hosts. This raises the question, is Antarctic wildlife susceptible to the virus? To address this, the Antarctic Wildlife Health Monitoring Working Group of the SCAR Expert Group on Birds and Marine Mammals (EG-BAMM) conducted a risk assessment on the risk of a SARS-CoV-2 outbreak to Antarctic wildlife in 2020. Their findings were synthesized in an article whose key findings are presented below[1].

Key Findings

Given the relative stability of SARS-CoV-2 at low temperatures and its ability to remain viable on a variety of materials, this study found that the Antarctic continent provided a suitable environment for the survival and transmission of the virus to wildlife.

Based on the predictive modelling by Damas et al.[4] in early 2020, it is predicted that Antarctic wildlife species such as pinnipeds and seabirds will have a low susceptibility to the virus, whilst cetaceans are

considered to be highly susceptible, but the actual risk of transmission to cetaceans is lower in comparison to pinnipeds and seabirds due to their lower probability of contact with humans. However, it appears that the ACE2 receptor is not the only factor in determining a species' susceptibility to the virus as species such as minks that were also predicted to have a low susceptibility to the virus have recently contracted the virus from humans on farms[7]. As such, further research is required to understand the risks to Antarctic wildlife.

Barbosa et al.[1] also identified a number of key potential transmission routes of the virus to wildlife. Contact with wildlife via direct handling for research purposes, human-wildlife interactions via tourist activities and transmission via migratory species were deemed to pose the greatest risk for transmitting the virus (Fig. 1). Indirect routes, such as via faecal transmission from raw sewage, contaminated equipment and interactions between fisheries and wildlife, are also important to consider.

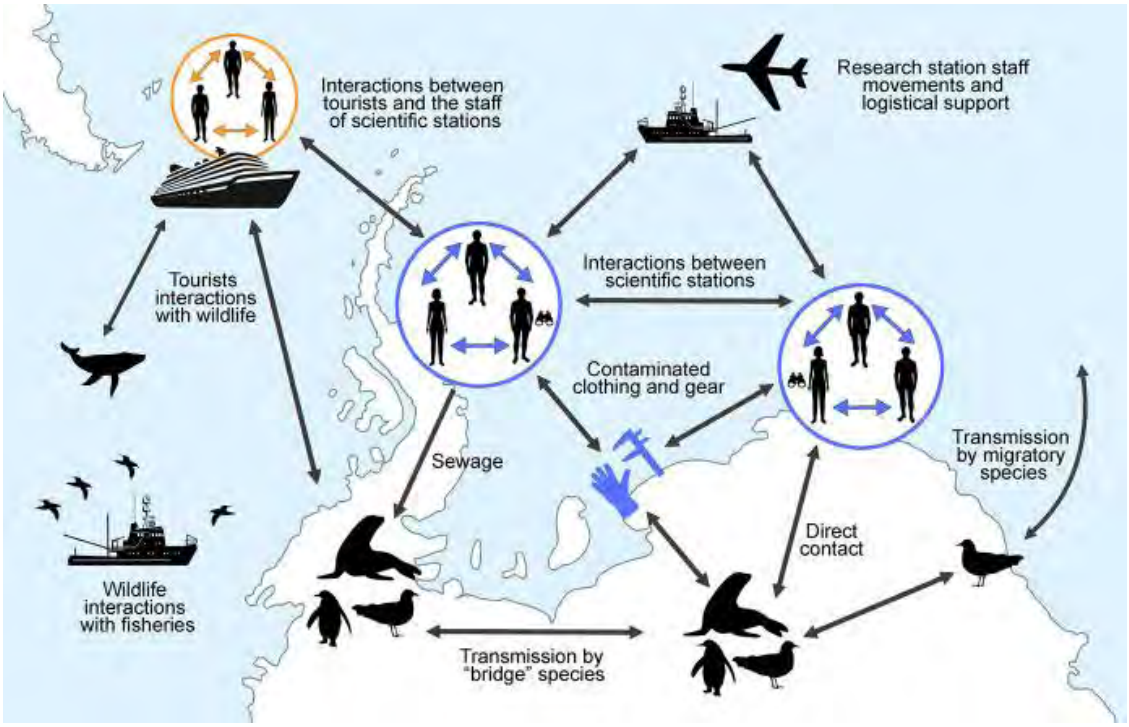

Figure 1. Potential transmission routes of virus to wildlife in Antarctica[1]. Species and human activities shown in the map do not refer to actual locations (Barbosa et al 2021).

The study also found that the areas that posed the greatest risk of introduction and transmission of the virus are areas where human activities and numbers of research stations are the highest including the Antarctic Peninsula, South Shetland Islands and Victoria Land (Figure 2).

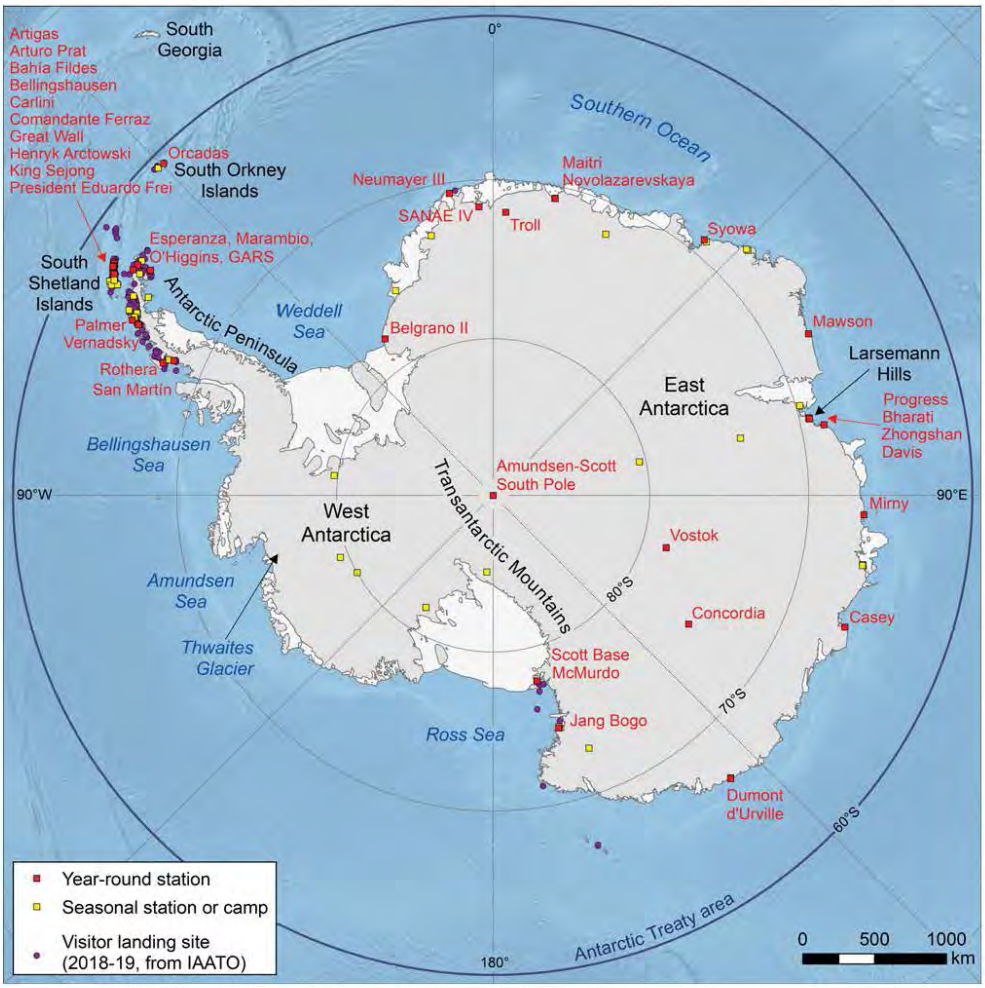

Figure 2. Map of Antarctica displaying Antarctic Research stations and key tourist landing sites[8].

Conclusions

Human-wildlife interactions in Antarctica are on the rise, increasing the risk of introducing novel infectious disease to the Antarctic continent and to Antarctic wildlife. The recent COVID-19 pandemic highlights the need for further research into the microbial ecology and pathogens of Antarctic wildlife and assessment of current biosecurity measures to understand how novel pathogens can spread from humans to wildlife. Additional mitigation measures may also be required to minimise the risk of SARS-CoV-2 and other infectious pathogens being introduced to Antarctic fauna (see Barbosa et al. 2021), recognising that biosecurity measures and regulations aimed at limiting animal disturbance are already in place, in addition to COVID-19 prevention guidance and mitigation protocols developed by COMNAP and national Antarctic programmes, that will significantly reduce transmission pathways (see WP047).

Although the work by Damas et al.[4] highlights that most bird and mammal species in the Antarctic are not susceptible to the virus, further research and general monitoring of pathogen presence in Antarctic wildlife is needed. To address the knowledge gaps in wildlife health and disease, the Antarctic Wildlife Health Monitoring Group has established a disease surveillance network to coordinate research and surveillance programs on the impacts of current and emerging infectious diseases on Antarctic wildlife. The aim of the network is to:

1) Coordinate the collection and analysis of data and biological samples for ongoing disease surveillance in Antarctic and Southern Ocean wildlife.
2) Using historical collections of biological samples:
    a. Examine changes in the spatial and temporal variations in presence/absence of pathogens/infectious diseases;

b. Examine the influence of human activity and climate change on the prevalence of pathogens/infectious agents in the Southern Ocean region.

3) Assist in the investigation of "Unusual mass mortality events" and suspected disease outbreaks.

4) Identify routes of introduction and transmission to assist in biosecurity and management of Antarctica.

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