**Potential for zoonotic transmission of SARS-CoV-2 from humans to Antarctic wildlife**

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Information Paper presented by Chile

Background

The global SARS-CoV-2 pandemic continues to advance in the world and the number of infections goes on a growing curve. Although vaccination programs are beginning to show the first positive results, the global health situation is still critical. This situation has not been the exception for the Antarctic continent as the first cases of Covid-19 were reported in December 2020.

The scientific community has expressed its concern about the possible human introduction of this virus in the continent through research activities, logistical support or tourism, also focusing the discussion on how to avoid the serious effects of SARS-CoV-2 on human health, which would increased its risks due to limitations in the medical infrastructure in said territory.

It is common for other species to transfer viruses. Bats are good examples of transfers of these types of coronaviruses to other species. Coronaviruses belong to the order Nidovirales, a group of viruses that are rapidly expanding our knowledge as a result of an increase in high-throughput sequencing studies.

In the case of Antarctic fauna, the risk of reverse zoonotic transmission can be complex and dangerous, due to the fact that environmental conditions in Antarctica appear to be favorable for the stability of the virus. In the case of Chile, positive cases of Covid-19 were detected in closed spaces such as ships and permanent stations, which are favorable environments for the transmission of the virus, even taking the measures of social distancing and use of a mask recommended by the WHO. Recent work by Antarctic researchers suggests that cetaceans are at increased risk of infection, while seals and birds appear to be at low risk of infection.

Since 2013, our scientific program has developed field research on the effects of pathogens such as bacteria and viruses that can affect populations of marine organisms. Projects have been carried out about the penguin virome to understand the ecological diversity of Antarctic microorganisms and the potential origin of emerging diseases, or evaluating the role of the Snowy Sheathbill (Chionis albus) as a reservoir or transport of viruses with zoonotic risk. The environmental aspects of the presence of viruses in the marine environment has also been evaluated.

In May 2020, measures were taken to be implement in the future Antarctic expeditions to be carried out during the austral summer 2020/2021 both at the bases and in the field. Those measures consisted in: reducing the number of activities and, therefore, the number of personnel in the field; treating the cargo and scientific instruments sent to Antarctica with sanitizers (such as quaternary ammonium) in Punta Arenas, to later use only 70% alcohol and other types of environmentally friendly detergents in Antarctica (the excessive use of quaternary ammonium can increase bacterial resistance and affect the proper functioning of sewage treatment plant. A fieldwork protocol for researchers who handle animals was also implemented, since they pose the highest risk of transmission to animals (Barbosa et al. "Risk assessment of SARS-CoV-2 in Antarctic wildlife", 2020).

Presence of SARS-CoV-2 in wastewater after detected sprouts of Covid-19 is predictable because SARS-CoV-2 can infect the gastrointestinal tract and break off through the feces. For the most part, investigations occurrence and persistence of viruses in the aquatic environment have focused on enteric non-enveloped viruses, given that these viruses are characterized by high resistance to a variety of environmental conditions. However, the number of studies on the occurrence of enveloped viruses in aquatic compartments, as in the case of SARS-CoV-2, is rather limited, because enveloped viruses are predisposed to inactivation in water. The persistence of viruses can be affected by both the environment (for example, the surface water, wastewater) and by the physical and chemical properties of the environment (for example, temperature, pH, humidity, exposure to sunlight and the type of surface). Coronaviruses are not quantitatively significant components of marine virioplankton. Members of the Nidovirales infect marine mammals, fish, and possibly invertebrates, and human coronaviruses can persist in marine plankton that receives sewage effluents. However, virions are likely to experience significant decreases in particle number and infectivity rate in seawater, similar to other enveloped RNA viruses.

The decay rates of viral infectivity of enveloped RNA viruses can be similar to those of virioplankton. The high decline and dilution rates in seawater suggest that coronaviruses may not persist for long periods in natural waters, which would help minimizing the risk of infecting any potential susceptible hosts in the marine environment that could act as animal reservoirs for the virus.

However, it is important to note that surviving virions can potentially infect marine mammals, since cetaceans and land mammals share receptor-binding domains similar to the ACE2 protein, which in humans is the receptor that interacts with the virus and allows entry into tissues.

**Conclusion**

Since 2013, Chile has constantly monitored Antarctic bird populations in the South Shetland Islands and the Antarctic Peninsula, looking for pathogens and viruses as part of its Scientific Program. Based on that experience along with what happened during the pandemic, Chilean scientists will continue working on these priority lines of research.

Chile agrees with the importance expressed by COMNAP through WP 47 and supports its suggestions to strengthen monitoring, control and education on this issue.

In addition, also suggests the following measures:

Based on the different bibliographic reviews and scientific evidence developed to date, it is important to optimize the systems of sewage treatment plant to make them more efficient and perhaps to incorporate new technologies. The possibility of adding a final disinfection step prior to discharge of wastewater to the sea, for instance the ozonation of wastewater, may further reduce the risk posed by viral pathogens such as SARS-CoV-2,.

On the other hand, the implementation of monitoring programs is recommended, particularly regarding the presence of SARS-CoV-2 in sewage treatment plant (by means of PCR techniques or technologies based on biosensors that has been widely used for the detection of viruses), and the corresponding affected Antarctic ecosystem and food chain levels.