Climate Change: A Threat to Biodiversity of Emperor Penguins

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May 2023, UiB, Faculty of Mathematics and Natural Sciences

Introduction

Climate change is inherently known as a global issue, affecting our planet in many ways, the consequences however will not be felt equally. The magnitude and rate of change will differ throughout the world. One way is through loss of biodiversity. This paper focuses on the significant loss of the Emperor Penguin in the Antarctic region adhering to the reduction in the Antarctic Peninsula by over 60% in the last 30 years.

Catalysed through human activity, climate change has intensified through the burning of fossil fuels and deforestation, often for economic gain. The increase in greenhouse gas emissions has resulted in a process known as global warming with temperatures increasing by 1,1°C in the last 150 years suggested by Tollefson 2021. The rapid warming has resulted in the melting of glaciers in the poles, habitats to the Emperor Penguin and many others. Emperor Penguins are a uniquely adapted species to extreme climates of up to -50 degrees Celsius. Emperor Penguins are a key aspect of Antarctic biodiversity, which describes the variety of life in a particular or collection of habitats. However, large scale activities as discussed above are causing rapid changes in this variation. One way to track this impact in relation to damage to ecosystems is through the use of Indicator species. This is a single (or group) of species which are used as a proxy when evaluating biodiversity or environmental conditions in a particular area, which in turn aids guiding conservation management. By stating its presence, absence, or loss it can represent the state of the ecological community (Simberloff 1998). Seabirds, like Emperor penguins, are suitable for being used as indicator species in marine ecosystems because they are well visible and easily numerated. They are usually colonial and gather in order to reproduce, so their reproduction rate can be easily monitored. (Piatt, Sydeman et al. 2007) On average around 25% of species are threatened, with around 1 million species already facing extinction within decades. The global rate of species extinction is already at least tens to hundreds of times higher than it has averaged over the past 10 million years. (IPBES 2019). Penguins in particular are a highly threatened group. According to the International Union for Conservation of Nature, the world authority on the status of threatened species: 11 of 18 penguin species are declining and considered an extinction risk, two species are considered stable, the population status of the remaining five is unknown. (Shaye Wolf 2019)

Challenge Discussion

Biologically, penguins are a slow-evolving species, making them more vulnerable to extreme changes in environment brought about by climate change. As a species their inability to adapt to changes in the environment at the same rate is taking place, meaning eventually one will displace the other, which may result in its extinction. Their life cycle sees a balance between life on water and land, both aspects being

affected by climate change. One key morphological process is moulting, necessary for maintaining its waterproofing abilities while in the water, insulation during the time on land. Moulting season ties in with the increase of body fat needed to supply the penguin when they burrow for catastrophic moulting (Phillip Island Nature Parks 2022) If environments continue to increase in temperature, penguins could undergo heat shock and could even see fatalities.

Moreover, Emperor Penguins are affected by climate change in relation to their breeding patterns, where the use of land is significant. The stability of the breeding population declined by 50% during the 1970's according to Barbraud and Weimerskirch (2001). Their life on land sees the protection of eggs from the males. This is necessary until hatching, usually taking up to 75 days. Feeding also requires the presence of stable sea ice. Little sea ice from melting could see vulnerable chicks dying before they reach adulthood, the transition from chicks to adulthood allows the waterproofing of feathers, essential for their life at sea. Sea temperature also proved to be the dominating factor influencing the survival of adults and fledglings. Without guaranteed survival of future generations of penguins through changing reproduction conditions, the species' continuation is limited. Population dynamic models pre-cut if we do not curve greenhouse emissions, Emperor penguin populations will decline by 4/5ths by 2060, becoming virtually extinct by the end of this century.
Penguins are affected by changes on land and in the ocean. The marine ecosystems are controlled by bottom-up processes, so populations of species in higher trophy levels are regulated by the lower trophy level species. Penguin populations or their diet can indicate the state of the marine ecosystem and inform us about the effects of fishing or climate change on the life below water. Seabirds could also be used as monitors of pollutants that accumulate at high trophic levels. (Furness and Camphuysen 1997)
In this case, the loss of this species could impact the Antarctic food chain. They consume smaller fish like squid, but they are eaten by things like leopard seals and large sharks. Further protection of their habitat is needed to ensure oceans remain habitable, along with the wildlife that depends on them.
Climate change will bring changes in more extreme weather globally. Changes to regional climates affect local ecosystems. Current areas have the potential to become inhabitable, interactions, biological transitions and food webs could also face irreversible consequences.
In addition, protecting endangered penguin species can also help to preserve the biodiversity of the entire ecosystem, as penguins play an important role in the food chain and nutrient cycling. (Huang, Sun et al. 2014)

SDG's & Other goals

Seventeen Sustainable Development Goals were agreed in 2015 as a part of the 2030 Agenda for Sustainable Development. SDG Number 15: Life on Land is in particular focused on protecting and restoring terrestrial ecosystems, promoting biodiversity, and combating desertification, land degradation, and the loss of habitats. Endangered penguins, such as the Emperor Penguin, can directly relate to SDG 15 as they are an indicator of the health of marine ecosystems and the impact of climate change on the biodiversity of these ecosystems.
This paper highlights how Penguins are also affected by SDG13: Climate Action and SDG14: Life below Water. Climate action particularly focuses on combating climate change which is essential to prevent

the further melting of Penguin habitats. Life below Water's focus is to conserve and sustainable use of oceans, in this case reduce overfishing and ocean pollution.
When you combine these 3 sustainable development goals and really focus on them, we have the potential to prevent this species from becoming extinct.

Conclusion

Penguins have also the potential to be used as flagship species. These are often charismatic and favourable species that anchor the conservation campaign and help enforce regulations or raise the money needed for conservation management. (Simberloff 1998)
These animals that people are easy to recognise due to their distinctive features, and their familiarity raises their awareness with regard to symbols of conservation. They are key indicator species of climate and ocean change.
Focus on the conservation of endangered Penguin species, we can also work towards achieving SDG15 as a whole. This can be done by promoting sustainable fishing practices that minimise the impact on penguin habitats and food sources, reducing pollution that can harm penguin populations, and conserving important breeding grounds for penguins. Conservation can only take us so far, combined effort in relation to climate policy is needed. Limiting global warming to a certain level requires major reductions in greenhouse gas and net zero CO2 emissions. The melting ice in Antarctica is considered as irreversible in the next centuries. Oil, gas operations and agriculture sectors are major sources of methane emissions, (nations, 2023) these bring major economic benefits to the world. The combined effect of these two solutions in future policies should enable us to see significant changes to penguin habitat and their environments.
Therefore, efforts to conserve penguin populations can contribute to achieving the larger goals of SDG15 in promoting the sustainable use and protection of terrestrial and marine ecosystems. Perhaps this can be done via indirect protection through legal frameworks to facilitate conservation actions that in turn should help mitigate climate change impacts.

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