From Penguins to Polar Bears

The Impacts of Climate Change

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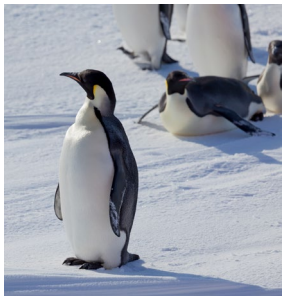
A March Into the Unknown for Antarctic Penguins

Adélie penguins with eggs



Emperor penguins

Chinstrap penguin

Gentoo penguin with egg

Beloved across the world, the Emperor penguin, and its fellow penguin species, are Antarctica's largest, most charismatic, and distinctive seabirds. Penguins are an icon of Antarctica. Yet, their survival is in peril due to global climate change.

Mysterious, beautiful, and extraordinary, Antartica is home to four penguin species: Emperor, Adélie, Gentoo, and Chinstrap penguins. They breed in large colonies on sea ice or on land.

"*When I first arrived on Ross Island and came face-to-bill with a mountainside of penguins, I was a bit intimidated. How can I possibly capture the immensity of the colony and the thousands of details that make these penguins so fascinating?"* said photographer Chris Linder. *"The research teams at Cape Royds and Crozier were my guides to the colony. They could, quite literally, 'speak penguin,' interpreting the subtle gestures communicated through the widening of a white eye ring or puffed feathers and head bobs. Under their expert tutelage, I learned the ways of the Adélie penguin and consequently, the right place and time to capture the most interesting behaviors with my camera.*"

Antarctic penguins' ability to breed and thrive is dependent upon ice formation, and the most southerly of all penguins, the Emperor penguin, is threatened by the loss of this sea ice habitat and food availability.

Researchers at Woods Hole Oceanographic Institution (WHOI) are studying the effects of climate change in Antarctica and thus the ability for penguins, to continue to survive and prosper. According to WHOI biologist Dr. Stéphanie Jenouvrier, as global temperatures continue to increase, colonies of Emperor penguins in Antarctica will severely decline by the end of this century. Her research models are based upon data collected over several decades by French scientists studying Emperor penguin colonies in Terre Adélie, Antarctica.

"*In Terre Adélie today, there are about 3,000 breeding pairs of Emperor penguins. But by the year 2100, there will be about 500 to 600 breeding pairs remaining, according to our best projections*," said Jenouvrier.

Dr. Jenouvrier, who has been researching Emperor penguins for more than a decade, has developed mathematical models to determine the growth and decline of Emperor penguin populations by observing mortality and birth rates as well as mating and breeding behaviors. She is currently working on

predicting the effects of sea ice change across Antarctic penguin species, and projections suggest dramatic changes by the year 2100 if Antarctic sea ice continues to decline at the projected rate.

Artist Aurélie Lebrun Du Puytison illustrates this peril in the painting, *Emperor Penguins March Toward Extinction?*

Analyses across Antarctica are critical because sea ice varies among regions as well as the penguin populations in each region. For example, in the Antarctic Peninsula, sea ice extent is decreasing and populations of Adélie penguins are also decreasing. However, in the eastern Antarctic region, sea ice extent is expanding and Adélie penguin populations are also increasing.

"Adélie penguins are adapted to cold, Antarctic conditions with more sea ice where they forage for krill," said Dr. Michael Polito, a WHOI post-doctoral scholar who studies penguins.

Conversely, Gentoo penguins are adapted to warmer sub-Antarctic conditions with less sea ice, where they forage on a wide variety of prey.

"Therefore, in general, Gentoo penguins have not been as impacted as Adélie penguins by the changes in climate that we are seeing today," said Polito.

Du Puytison portrays these different species' responses in three paintings, *Discordance, Another World,* and *The Space of One Life*. Penguins endangered by sea ice declines are envisioned in fading imagery.

The challenges they face are further complicated by broader global issues such as fisheries.

Emperor, Adélie, and Gentoo penguins feed on Antarctic krill, the largest and most abundant shrimp-like crustacean in the Southern Ocean. Krill are an important link in the Antarctic food web. They are vital to sustaining the polar ecosystem as small fish, whales, seals, and penguins consume krill. However when sea ice decreases, the amount of krill declines. Krill commercially harvested for aquaculture feed and nutritional supplements also contributes to declines.

Researchers and the Pew Environment Group are working to create the world's largest Marine Protected Area in Antarctica's Southern Ocean in order to protect Antarctic krill, and thus all marine life that inhabits this remarkable continent.

In addition sea ice loss and krill commercial fisheries, penguins also endure a multitude of other threats including tourism, pollution, and disease.

Researchers and policymakers are working towards adding the Emperor penguin to the Endangered Species List due to the effects of climate change. Currently seven penguin species are protected by the U.S. Fish and Wildlife Service under the Endangered Species Act. New scientific data submitted by the Center for Biological Diversity as well as on-going research by WHOI scientists will inform this conservation decision.

Author Neila Columbo is a freelance journalist and editor who writes about climate science as well as an array of subjects related to environmental and international global development. Originally from Boston, Massachusetts, she completed graduate studies in international political economy at Institut Barcelona d'EstudisInternacionals in Barcelona, Spain in 2009. The following year, she received a journalism fellowship with United Nations Environment Programme Ambassador Yann ArthusBertrand in Paris, France. She continues to work between the U.S. and Europe as a journalist dedicated to covering the science of climate change.