

How does the climate crisis affect the Antarctic fur seal?

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The Antarctic fur seal (*Arctocephalus gazella*) is a marine mammal that only lives in the Southern Ocean. Credit: Lluís Cardona (UB-IRBio)

The climate crisis is limiting the availability of krill—small crustaceans that are vital in the marine food chain—during summer in some areas of

the Antarctica. This involves a decrease in the food abundance for female Antarctic fur seals in summer and a decrease in their reproductive success. Moreover, the predation of pups by the leopard seal has also increased due to a lower abundance of penguins, the main prey of this voracious Antarctic predator. However, the impact of the climate crisis on the Antarctic fur seal in winter has been ignored to date, when the cold, wind and ice make it harder to study the Antarctic ecosystems.

Thanks to satellite tracking, we know how this marine mammal is distributed over the winter months in the Antarctica, as well as its relationship with [krill](#) and the Antarctic icefield during this period, according to an article published in the journal *Scientific Reports* by the experts Lluís Cardona, Manel Gazo, David March, Massimiliano Drago and Diego Rita, from the Faculty of Biology and the Biodiversity Research Institute of the UB (IRBio), and Mariluz Parga, from the SUBMON association.

How does the Antarctic fur seal adapt to global change?

The Antarctic [fur seal](#) (*Arctocephalus gazelle*)—a marine mammal that only lives in the Southern Ocean—was intensively exploited by the fur industry during the first half of the 19th century. After a notable recovery, the populations of these pinnipeds are now regressing since 2003.

This predator feeds mainly from krill—the Antarctic crustacean *Euphasia superba*—and fish. Most of their breeding colonies are close to the Antarctic Polar Front, but the South Shetland Islands—surrounded by the polar icefield in winter—host the most southern population of the species and the only Antarctic one. Now, the study provides answers to many doubts about the importance of environmental factors that regulate the distribution of this population in winter and their link to the ice cycle

and krill.

The team conducted the research during the austral summer season of 2019 in the Antarctic research station Gabriel de Castilla, in Deception Island within the archipelago of the Southern Shetland Islands. In the study, the scientific monitoring via [satellite tracking](#) focused on juvenile and sub-adult males since they represent more than the 80% of the seals that remain in Antarctic waters during winter, while females leave the Antarctica during this period.

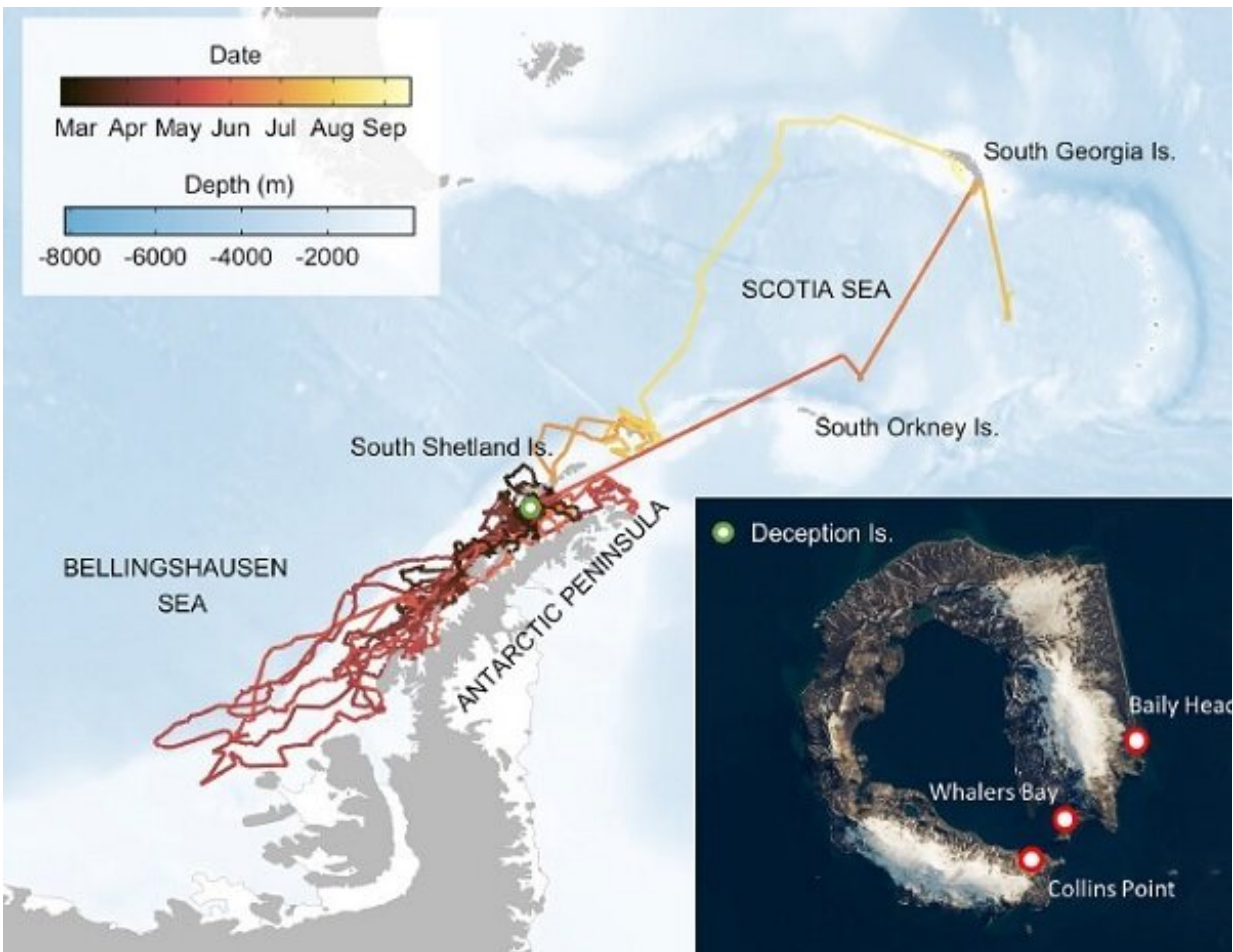
This occurs because during winter, when the breeding season is over, females leave the Southern Shetland Islands and move to warmer areas, near Southern Georgia islands and the South American continent. However, males remain in the Antarctic continent.

Juvenile and sub-adult individuals are those predominating the male populations, as stated in the study. In this species, the relatively late sexual maturity—after seven years—and high mortality in adults caused by the cost of defending a breeding area makes male adults live only for a few years, and therefore the male population is skewed towards younger individuals. Female individuals reach sexual maturity when aged three, and they undergo a lower adult mortality, so female adults are the most abundant ones.

"Males spend most of the winter time in the Antarctic Ocean, without going to the mainland, and they preferentially select areas of less than 1000 meters deep, located about 200 kilometers from the ice borders and with high levels of chlorophyll and a surface temperature below 2° C," notes Lluís Cardona, lecturer at the Department of Evolutionary Biology, Ecology and Environmental Sciences and IRBio. "

This coincides with the favorite habitat of the Antarctic krill, the main prey of these otariids. Due to the seasonal dynamics of ice, the krill-

friendly habitat moves north during winter and so do the fur seals. As winter progresses, krill migrate deeper into the water and males dive deeper to eat, sometimes up to 180 meters deep," continues Cardona, director of the Antarctic research project Flexseal within the study.



Thanks to satellite tracking, we know how this marine mammal is distributed over the winter months in the Antarctica. Credit: Lluís Cardona (UB-IRBio)

Males and females: An unequal fight for food

These different habitats occupied by males and females during the austral winter could be related to the sexual dimorphism of the species: Adult females can reach 20-50 kg and adult males 140 kg. Juvenile and sub-adult males are even bulkier than females. This difference is a major determinant of their thermoregulatory skills and diving performance when adapting a new extreme environment and feed successfully.

"An increased body mass involves more capacity to store oxygen, which allows adult males to dive deeper when searching for [food](#)," notes Cardona.

The most important reproductive population of the Antarctic fur seal is in the South Georgia islands, the area that has shown the greatest abundance of krill in the summer during the last two decades. "When this food source decreases, fur seals increase their fish intake but the reproductive success decreases. Therefore, the species can survive without krill but the population of the Antarctic fur seal is less abundant, like in the Kerguelen Islands," says the expert.

Climate change and polar fauna: Changes in the horizon

The climate crisis is altering the ecosystems of the Antarctic peninsula and the Southern Ocean. Surviving the global change successfully involves changes in the distribution, abundance and ecology of many species in polar latitudes.

In the context of global change, fur seal males and females are exposed to the environmental changes that affect the Antarctica during the austral summer. However, unlike males, females are also affected by the changes in those areas at latitude 40-50° in subantarctic latitudes.

In some colonies, the climate crisis causes a higher predation of pups by the leopard seal. "To adapt to the external changes, the colonies of the

Antarctic fur seal should move south across the Antarctic peninsula, but this is an extremely slow process," notes Cardona.

Regarding the conservation of the Antarctic fur seal, "In the future, we will need to manage properly the krill fishing activities in these areas, and this will require to consider not only the female consumption during summer but also the consumption associated with males of all ages during the four seasons of the year," concludes the researcher.

More information: David March et al, Winter distribution of juvenile and sub-adult male Antarctic fur seals (*Arctocephalus gazella*) along the western Antarctic Peninsula, *Scientific Reports* (2021). [DOI: 10.1038/s41598-021-01700-w](https://doi.org/10.1038/s41598-021-01700-w)

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