

Flippers over Flight: Adaptations of Adélie Penguins

By Kenlynn Volz

Out of all the species of penguins, Adélie penguins are the most well-studied, and for a good reason! Adélies are 2 feet of confident, charismatic, yet seemingly-clumsy birds. Despite their charming personalities, the real reason that Adélies are studied is that they are Southern Ocean ecosystem indicators, giving us insight into ocean health.

Adélie penguins are one of five species of penguins that live on Antarctica, the world's largest desert. You may be wondering, "Antarctica is surrounded by water and covered by ice and snow, so how is it a desert?" Despite its proximity to water, Antarctica receives about 6.5 inches of precipitation per year. Living in a desert surrounded by saltwater, Adélies have adapted methods for osmoregulation to ensure they don't dehydrate. Adélies get their water from their prey. Special glands located behind their eyes remove excess salt from their bodies.

Adélie penguins spend most of their time at sea, only returning to land each spring to breed. As colonial nesters, Adélies form penguin "neighborhoods." Adélies build their nests with pebbles on bare ground. Antarctica is primarily covered in ice, limiting pebble availability. To deal with this, many Adélies turn to a life of crime, stealing pebbles from other penguins!

Pebbles are more than just a construction material. Like us, Adélies gift their mate a fancy rock to express their commitment. Adélie penguins exhibit biparental care, so parents take shifts incubating the egg and foraging. When the parents switch roles, the departing penguin brings their partner more pebbles, promising they will return. Once the chicks fledge in the summer, the penguins will return to sea to forage more bountiful waters.

Adélie penguins feed on krill, followed by squid, fish, jellyfish, amphipods, and pteropods. To capture their prey, Adélies must dive deep into the Southern Ocean. Diving is costly. Penguins have specialized adaptations to make the most out of each dive. Collapsible ribcages and lungs allow penguins to empty all the air from their lungs, preventing excess nitrogen from being absorbed into the blood (what divers call "the bends").

Penguins store high quantities of oxygen in their blood and muscle so that they can dive longer per breath. Their streamlined bodies and flipper-formed wings allow them to soar through the water. Their black and white "tuxedo" acts as camouflage from predators and prey. The low surface area to volume ratio and downy feathers coated in a waterproof wax allow Adélies to stay warm. With all these adaptations, Adélies are well-equipped for Southern Ocean life.

The specialization of Adélie penguins to the Southern Ocean makes them sensitive to its changes. Scientists have collected long-term data on the response of penguins to changing factors such as sea ice extent, ocean acidification, prey abundance and distribution, and sea surface temperature. By comparing current penguin population trends to long-term data, scientists can understand the state of the Southern Ocean.

Photo: Adélie penguin by Dylan Shaw