

Adélie Penguin Diet



Did You Know ?

1. Adélie Penguins eat the most readily available, high-energy food they can find and easily swallow.
2. The diet of Adélie Penguins changes when whales are present because the whales eat the same thing, and they eat much more than penguins do.
3. Adélie Penguin diet differs depending on the habitat where they are foraging. For example they eat different fish in shallow water compared to deep water.

Why we want to know.

Knowing what a bird eats helps us understand how they live and where they go to find food. This is important because if we want to protect a species like Adélie penguins we need to conserve and protect its food source.

How we know.

We know what penguin eats, at least during the summer, from watching what passes from a parent to its chick, or what the parent regurgitates onto the ground. At other times of the year, we have to capture penguins and cause them to regurgitate into a bucket. During most of the year the Adélie's diet is composed mainly of small fish. When fish are not easily available or require extra effort to find, they eat krill and squid.

This is not the usual way that Adélie Penguins eat fish, but this fish was too large to be easily swallowed while the penguin was swimming. In fact, this penguin had to drag the fish onto the ice flow, but it could not eat it before a Skua (large predatory bird) swooped down and swiped it away.



Figure 1 Penguin with fish



Figure 2 Lantern fish

Fig 2 shows some lantern fish, which live in deep water. Adélie Penguins eat a lot of these during the winter.

In Fig 3 you see Antarctic silverfish. Adélie Penguins eat lots of these during the summer. It is the most abundant small fish in shallow coastal waters around Antarctica. Its shape makes it easy for Adélie's to swallow, head first.



Figure 4 Penguin regurgitating into a bucket



Figure 3 Antarctic Silverfish

In Fig 4, a penguin is regurgitating into a bucket. Water was pumped down its throat until the penguin began to feel so full that it was becoming sick to its stomach. The penguin was turned over, pointed into the bucket, and out came its food. The penguin then felt much better. It was released and walked away back to its nest although, rightly so, it was growling at us as it went.



Figure 5 Penguin food

This is what came out of a penguin, which had just had its stomach pumped. The pink shrimp are called krill; the gray stuff is partly digested fish. Fish gets digested much, much faster than krill, because the krill has a protective shell but the fish does not. We freeze this sample for later analysis. Back in the laboratory, once this sample is thawed, we have to pick through the goop to find fish otoliths (ear bones) to identify the fish. We measure the otoliths and also the krill.



Figure 6 Fish otoliths

One way to determine what kind of fish penguins eat, is to put a tray where they will build their nests. Over the season, they will poop into the tray. At the end, we wash what is in the tray to find the otoliths. Kind of like panning for gold. Otoliths are a part of fish that take the longest to digest.

Here are some fish otoliths, or ear bones, from the two main fish prey of Adélie Penguins. The small, rounded ones are from silverfish and the larger, flat ones are from lantern fish. Every fish species has a distinctively-shaped otolith. Otoliths also grow as the fish grows. We can tell the species by the shape and the length of the fish by how big the bone is. These ear bones are very small, we use a microscope to find them. These have been magnified by about 3 times.



Figure 7 Otolith box under the penguin nests



Figure 8 Spilled krill



Figure 9 Adélie parent feeding krill to its chick

Sometimes parents catch so much food that some spills on the ground while feeding it's very small chick (the chick's mouth was too small!!!). Fig 8 shows another way we can see what the penguins are eating. It's pink, so it's krill. Sometimes the parents

regurgitate partly digested fish onto the ground as well. The parent in Fig 9. is feeding its chick some pink stuff, which we know, by its color, is krill. The dark spots in this pink mass passing from the parent into the chick's mouth are the krill's eyes (which are black).



Figure 10 Research ship



Figure 11 Trawling for penguin food

To understand where the penguins' prey is located requires a very expensive but exciting study. We need a ship (Fig 10) that can move in the pack ice, and one that can pull nets through the water or sense the occurrence of fish or crustaceans by sound waves. The trawling (catching fish with a net) needs to occur where we know the penguins are feeding. The large white structure at the back end of this vessel is a frame for pulling a large net through the water.

In Fig 11. a scientific net is being pulled from an ice-covered sea, using the frame at the stern of the ship. This net is put into the ocean and then, using an electronic signal, is opened only when it reaches the depth at which the scientists want to catch fish. (Photo courtesy Jose Torres).



Figure 12 Minke whales

These are Minke whales, the smallest baleen whale (only about 25 feet long!). Like the Adélie Penguin they occur in pack-ice covered waters, and they eat the same food as do Adélies, both fish and krill. However, one whale in a day eats about 2000 times more food than one penguin.

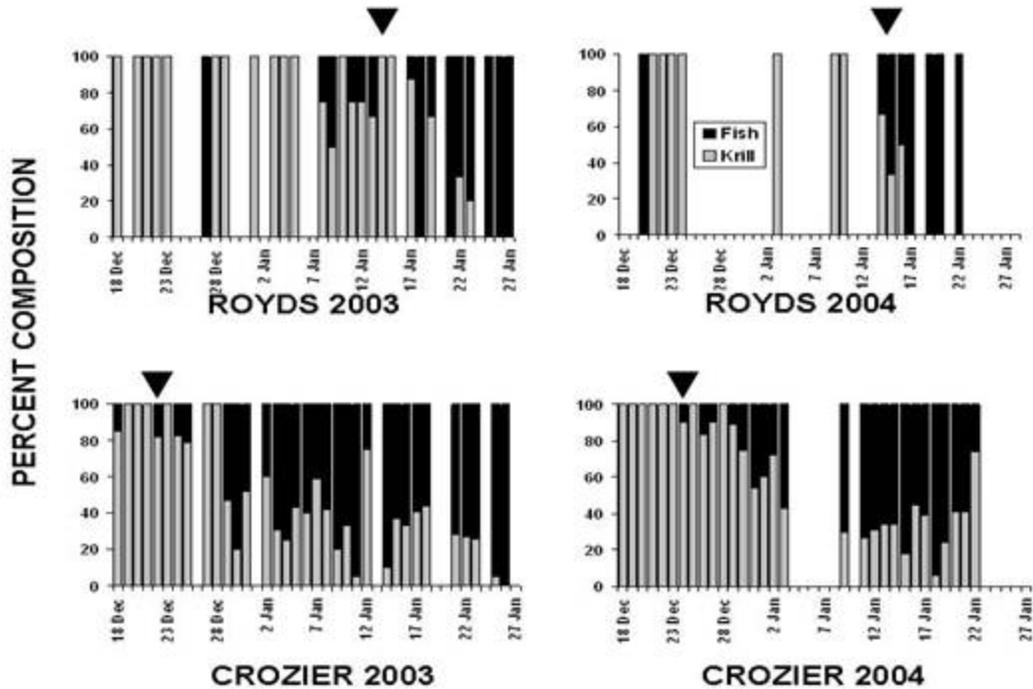


Figure 13 Diet graph

Here's an example of how whales can change what the penguins are eating. In both years at Royds and Crozier penguin colonies, the penguins' diet switched from mostly krill to mostly fish when lots of Minke whales appeared in the penguins' foraging area. Such a diet switch is ok, as the penguins and whales have been living together for 3 million years.

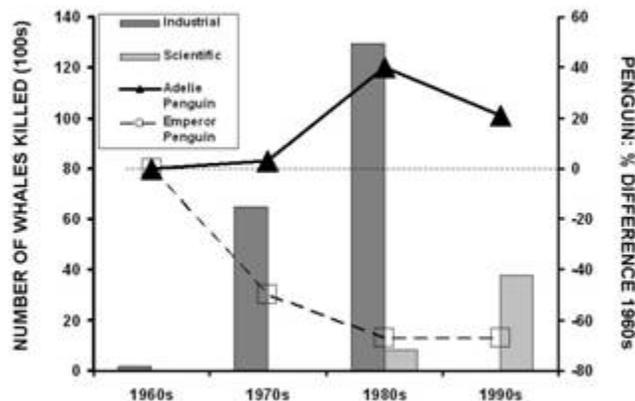


Figure 14 Change in penguin numbers during whale harvest

Here is what happened in the Ross Sea sector when people from Japanese fishermen killed many thousands of Minke whales during the 1970s and 1980s (see bars, and labeling on the left). The whales compete with Adélie Penguins for food. As the whale population decreased the penguin population increased because there was more food (lines, and labeling on the right). When the whaling stopped, the number of Adélie Penguins declined as the whales began to recover and once again were competing for the food. In the case of Emperor Penguins, whose numbers steadily declined, we're not so sure, but maybe the removal of lots of minke whales led to killer whales eating Emperor Penguins, because no longer were there enough Minke whales to eat. It's all very complex, but knowing what penguins eat helps us to understand such things.

As a population, Adélie penguins depend on the ocean to provide large amounts of food. So far in the history of Adélie Penguins the ocean has been able to provide enough food to feed the penguins, the whales and the rest of the ocean-going creatures. Now that man has entered the system, this balance has been interrupted and Adélie penguins in some areas may have trouble finding enough food to raise their chicks. In other areas, if whales are killed, they will have an easier task.