

## Did You Know?

1. Adelie Penguins can dive 150 m deep.
2. Adelie Penguins can hold their breath 6 min.
3. Adelie Penguins can swim, for many hours without stopping, at 8 km/hr.
4. On foraging trips, Adelie Penguins can travel up to 250 km from the colony and be gone for 6 days.
5. The usual foraging trip of an Adelie Penguin is less than 2 days, or even just a few hours, long.
6. Adelie Penguins, during winter, remain in the pack ice but in areas where there is still daylight; they do not stay with their mates.
7. Adelie Penguins are changing their migration as a result of climate change.

## Tracking Penguins

Electronic tags are commonly used to track animals as they migrate, or simply move around looking for food. From elephants to fish, only in the last 15 years or so, these handy instruments have helped to understand the range of an animal's habitat. Large animals, like bears, can carry a tag that is similar to the computers in newer cars (airplanes or cruise missiles) that tell you your exact location; these tags use information from Global Positioning Satellites (GPS) to record where it is at any given moment. These instruments, which continually 'talk' back and forth with a satellite, require a very large battery and are way too large for an Adélie Penguin to carry. However, a much smaller one can simply store data to be retrieved later. The battery needed is much, much smaller and, therefore, the instrument can be worn safely by a penguin. The memory chip in the instrument also records the time and date. When this information is downloaded into our computer, a map can be drawn to show where the penguin has been or a chart can be created showing how deep it has been diving. Two different kinds of tracking tags are used on Adelie Penguins. We track them both horizontally, over the surface of Earth to see where they

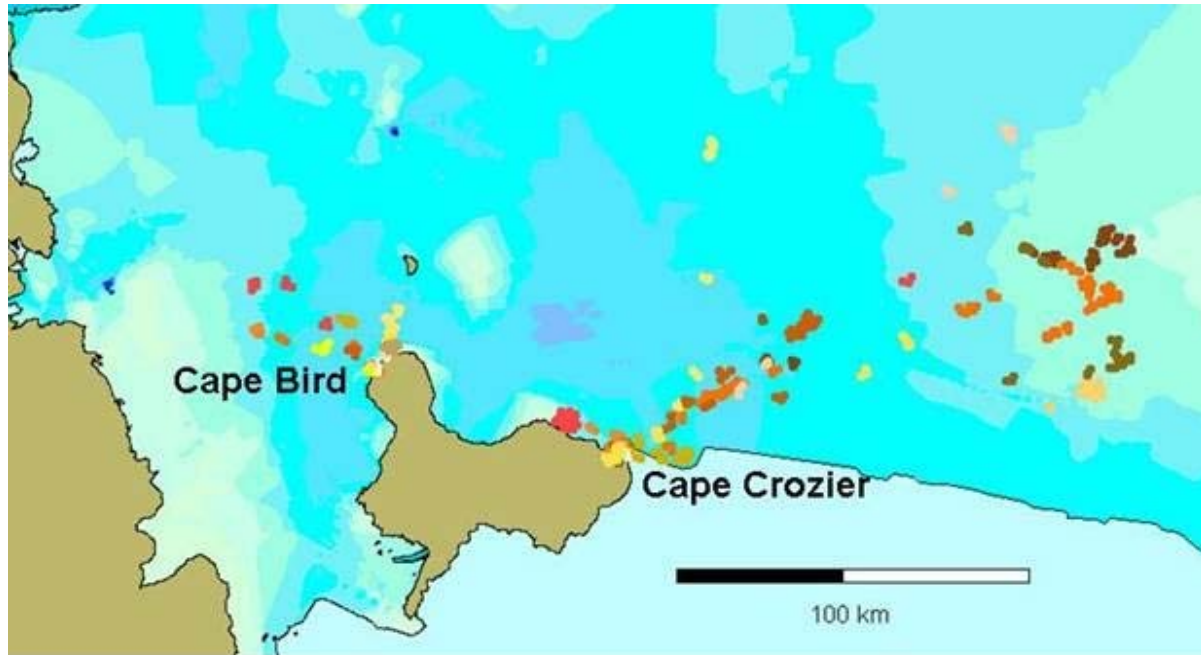
go, and vertically, to see how deep they dive in the ocean.



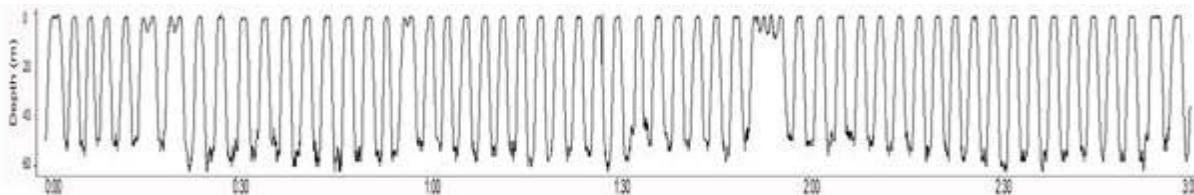
1. Splash Tags. These are medium-sized tags that we attach to the back of Adelie Penguins. The tag is attached with tape to the bird's feathers so it neither hurts nor interferes with the bird's movements. We select birds from nests with young chicks to feed, because we know that bird is committed to return to the same place and we can retrieve the tag. The tags are on the bird only a few days.

*Here is a satellite tag, taped to the back of a penguin. The wire is an antenna. This antenna sends information to a satellite, which then determines the penguins' location, every time it passes over the Ross Sea, which is several times each day. The satellite then stores the information and later sends it to us as an email message. This system is called ARGOS and is operated by a French and US company.*

Once attached, and once it becomes wet, the tag starts to send messages to a satellite recording its positions, which determines the movement of the bird. It only sends a signal when the penguin, and the tag, is at the surface of the ocean. The satellite tag that we use, manufactured by Wildlife Computers, also records the diving behavior of the penguins. Every second, the tag records its depth, using a pressure sensor (water pressure increases with depth). This is called a time-depth-recorder. It does not record depth information when the tag is dry. Two minutes after the penguin jumps from the sea onto an ice floe, the tag dries, and no longer records any information. This saves the batteries, which are only good for about a month of continual operation. Using these tags we know where and at what depth the penguin is finding its prey. Below is a map we created using the location data that these tags provide. It shows where birds from two different colonies went looking for food.



*A map of positions of penguins from two different breeding colonies for 6 different days. Each color is for a different day and for a different bird. Three penguins from Cape Crozier went about 150 km away in order to find food.*



*This is a trace from a time-depth-recorder showing the dives, maximum to 60 m, that a penguin made over a period of three hours. Pretty amazing creatures, aren't they?*

2. GLS tags. These tags are very small, with only a very tiny battery (same size as in a hearing aid), and do not send a signal to a satellite. They are made by British Antarctic Survey. They are so small that they do not interfere at all with the penguin. They can comfortably wear this tag, attached to a plastic leg

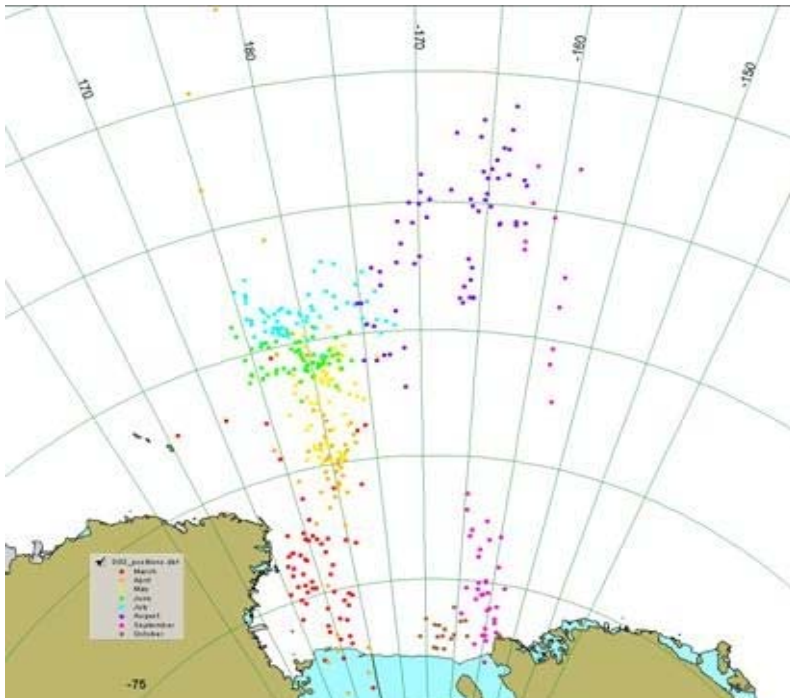
band, for many months. We put them on the penguins at the end of the season to find out where they go during the winter.



Here, on the left leg of this penguin, is the tag it will wear for the entire winter. It will tell us where the penguin was every day once we retrieve the tag a year later.

These tags store information about where it is located twice a day for the entire time that the penguin is away from the colony, for 9 months!! We have to find and then capture the penguin the next year, remove the tag, and download the information into a computer. Every few minutes it senses the amount of light where the penguin is. From light level data, position can be determined in the same way used by sailing ships for centuries before the age of computers and satellites. If one knows the date and the

length of the day, then one can know the latitude. Day length changes with season at a known rate for each latitude. Knowing the clock time for the mid point of daylight we can determine longitude.



The positions determined from the light data recorded by a GLS tag, after an entire winter's journey, look like this. This penguin traveled in a circular route, reaching 2500 km away from Cape Crozier during its winter. Its journey spanned 15 degrees of latitude and 15 degrees of longitude. Each color of dot represents a different month, red being March and brown being October.

This information is important for understanding the extent and range of an Adelie Penguin's habitat or how much space they need to live and where they need to go to find food. As global warming changes the amount of sea ice in Antarctica, the migration patterns of Adelie Penguins are changing.