

## Activity #2

# Penguin Feeding Habits Change with the Season

### Activity Introduction:

Adelie penguin's diet consists mainly of krill, squid, and fish. As the Antarctic summer approaches, adult krill form large swarms with up to 10000 krill per cubic meter of ocean water. This makes them an easy target. However penguins are not the only Antarctic animal that depends on krill as a food source. Seals, fish and baleen whales also exploit these huge swarms of tiny crustaceans. The same is true of schools of fish, especially the Antarctic silverfish.

Based on the information you gathered in Activity 1 (see **Fig 1**), scientists asked the questions, "Why do the Ross Sea penguins change their eating habits during the summer season of Nov to Feb?" It is during this time that the Adelies are raising their chicks.

1. In your group, formulate some reasons why you think these penguins would change from krill to fish. Make a list in your journal of your ideas and share your group's list with the class

Scientists who study these penguins wanted to know the answer to the question and wondered if the population of krill in the area decreased so the penguins were forced to eat the fish instead. Look at **Fig 2** which shows the seasonal krill populations around Antarctica. They record the population levels of southern ocean krill throughout the season.

2. Make a statement in your journal regarding this new data and what the scientist learned. Make any revisions about the causes for the changes in diet from Part 1.

Scientists wondered if all Antarctic penguins change their eating habits as the season progresses because of a change in the nutritional need of raising chicks. The rearing of chicks requires parents to supply much food and nutrients, and maybe the fish provided some nutrients that were needed later in the growth of the chicks. Maybe the penguins made a choice to stop eating the krill and begin eating the fish in order to provide the nutrients their chicks needed. They decided to examine the seasonal eating habits of Adelie penguins in other areas around Antarctica that are also rearing healthy chicks. Examine **Fig 3**.

3. Make a statement about the eating habits of Adelie penguins in other areas of Antarctica compared to the Adelie in the Ross Sea Area. Make any revisions about the causes for the changes in diet from Part 1.

As the scientists were studying the Adelie penguins, they noticed the presence of baleen whales in the area starting about Dec. Baleen whales filter their food through baleen sieves in their mouth. They eat several hundred lbs of krill a day. The scientists decided to track the presence of whales in the feeding area of the penguins. Look at **Fig 4**.

4. Make a statement about the presence of the whales and the change in the eating patterns of the penguins in the Ross Sea. Make any revisions about the causes for the changes in diet.

5. Revisit your list of ideas from Part 1. Take one of the ideas that you have not discarded and determine what data you would need to gather in order to support or discard this idea. If time allows, search the internet to see if such data exists.

## Teachers notes

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Teacher note: If you did not do Activity 1, then give students copies of Fig 1 before you start this activity.

#### **Student Goals:**

##### ***Students will***

- Understand the southern ocean food web and the importance of krill and fish.
- Understand the competition for food between whales and penguins.
- Gain practice in reading and interpreting graphs and data tables.
- Practice scientific inquiry to solve problems.

#### **Key Concepts:**

The upper level predators, such as whales, seals, birds and large fish, in the southern ocean food web depend on having densely packed schools of bite-sized organisms, such as krill and fish. Penguins and whales compete for the same food source.

#### **Background for the Teachers**

Ice Krill (*Euphausia crystallorophias*) are found in waters overlying the continental shelves of Antarctica (relatively shallow, compared to the deep ocean beyond the shelf). Between 3-4 centimeters in length, these creatures are an important component of the southern ocean food web. They are a major consumer of phytoplankton and breed under the ice from the end of December to February. Female krill lay thousands of eggs several times a season. The eggs sink hundreds of feet below the ocean surface where they develop and hatch. Immature krill then work their way to the surface in search of their main food source, phytoplankton, which requires the sunlight to grow. It takes about two years for krill to mature and like other crustaceans molt their outer shell as they grow. In the winter krill live under the ice feeding off the reservoirs of algae which accumulate on the ice undersurface, as well as feeding on phytoplankton that sank to the ocean floor following the summer bloom. In the summer, adult krill gather in swarms of up to 10 000 per cubic meter and become easy targets for baleen whales, seals, penguins and fish which rely on their abundance for survival. The same is true for the Antarctic silverfish, which occur in large schools. The silverfish prey on the krill as well. Silverfish, however, are orders of magnitude larger than a krill, i.e. reaching 10-20 cm in length when as younger life stages they are swimming at mid depths to the surface; as adults silverfish live near the bottom.

1. Students can work in small groups or this can be done as a class. Make a list on the board of the student's ideas. Here are some possible responses

- The krill population decreases: dies off, migrates, so is no longer available for the penguins.
- The fish population increases: breeding cycle, migration into the area, which make it easier for the penguins to catch.

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- The nutrition demands of the penguins change as the breeding season progresses, and the fish meet that demand
- There is competition for the krill, and the fish become easier to catch.

2. Pass out Fig 2 Krill Population cycles, to all the groups. Offer some assistance to groups that may have trouble understanding the graphs. Have students make a conclusion about the population cycles of the krill being a factor in the change in eating habits of the penguins. The krill populations do not change very much during this period of time. Have students revise their list from Part 1, adding or deleting ideas.

3. **Fig 4** shows the eating habits of Adelie in other areas than the Ross Sea. Other populations of these penguins seem to feed only on krill for the entire season and still are very successfully raise their chicks. Switching to fish in the Ross Sea population does not seem to be for reasons of nutritional need. Have students revisit their list from Part 1 and make revisions.

4. Have students look at **Fig1 and 2**. Have students look at the table and make a statement in their journals about what this table tells us. You may need to help some students. Shortly after the whales appear the penguins change their diet from krill to fish. Shortly after the whales disappear the penguins go back to krill. Baleen whales are large consumers of krill and their presence in the Ross Sea creates competition with the penguins for the krill. At this time the penguins find it easier to find and catch fish.

5. Return the class to the list of ideas they made in Part 1 about why the penguins switched their food source. Which ones are left? Are there any new ones which can be added? Help the students come up with the kinds of data they would need to support or discard ideas.

Here are some ideas.

Satellite images of ice cover

Satellite images of krill population blooms

Silver fish population counts season to season and year to year.

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Fig 1. Adelie Penguins diets in the Ross Sea area.

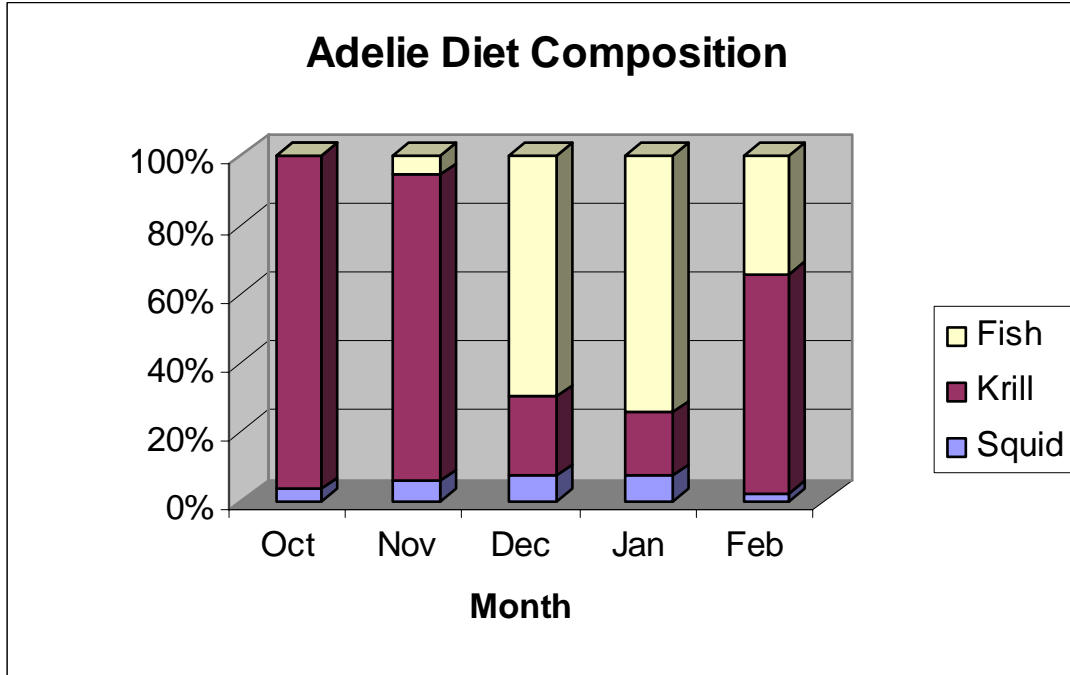


Fig 2. Krill populations during the summer season.

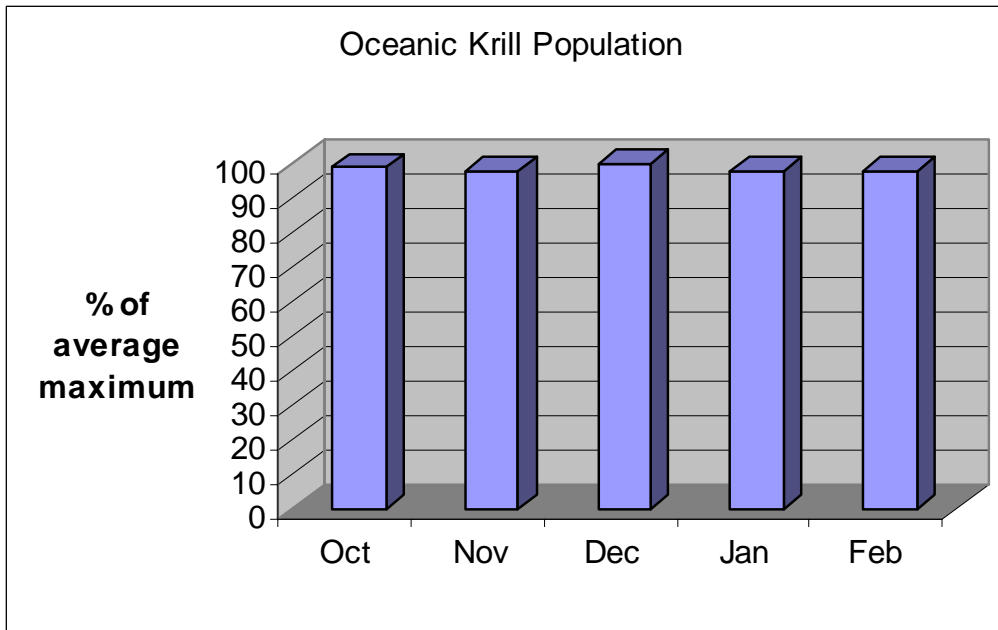


Fig 3 The seasonal eating habitat of Adelie Penguins in other areas of Antarctica.

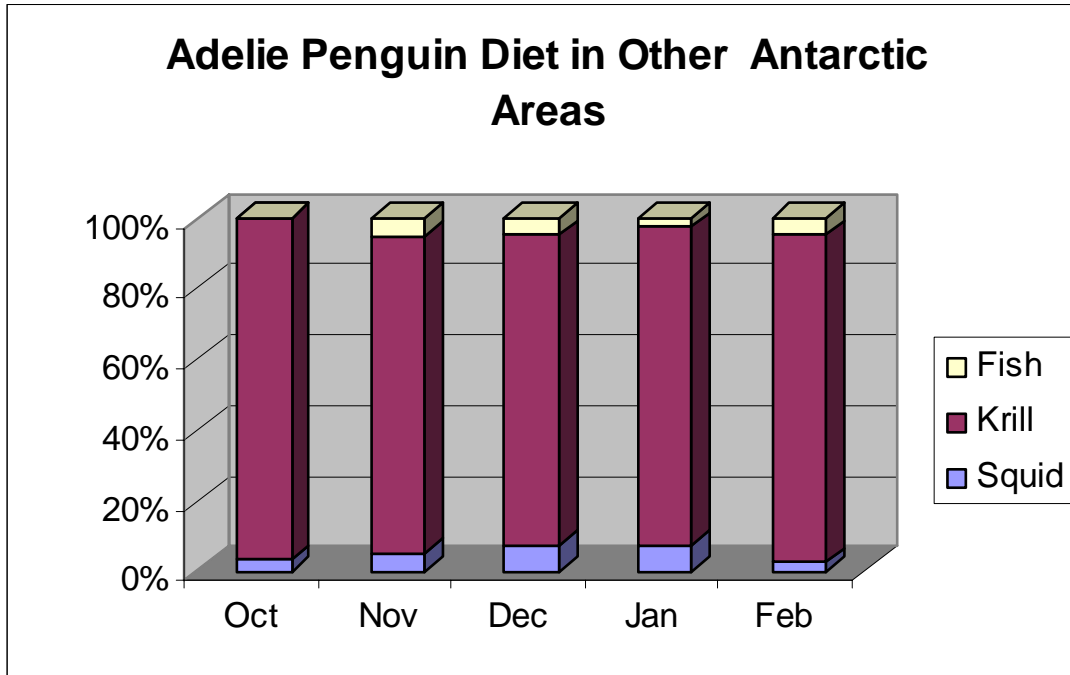


Fig 4. Whales sited in the Ross Sea Area.

