

Key Stage 4 – Penguin populations

Notes for teachers

At a glance

Penguins integrate a long life-span with shorter-term foraging needs. This means their breeding success is usually a reflection of the quality of the environment in any given year. Penguinologists at The University of Oxford are collecting data about penguin populations to provide early warning of ecosystem change and future population trends of Antarctic organisms.

In this activity, students plot data that shows the change in population of two penguin species living on the same Antarctic island. They then use different sources of information, including a food web, to decide possible hypotheses for the changes in each species' population and use this to write recommendations to policy makers on what they should be doing to protect the Antarctic.

The activity can easily be adjusted to be an at-home activity or homework.



Learning Outcomes

- Students plot a line graph to show population change.
- Students analyse sources of information to invent hypotheses about the causes of population change.

Each student will need

- Copy of student worksheet pages 1 and 3
- One copy of the population data cut from student worksheet page 2
- Graph paper



Possible Lesson Activities

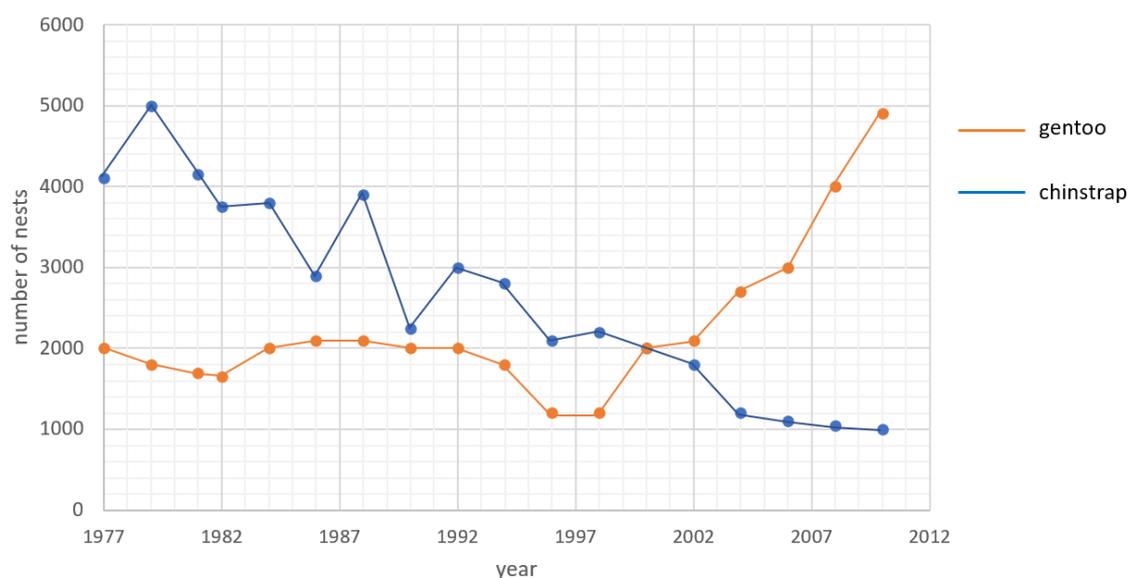
1. Starter activity

- Show the class the Oxford Sparks animation 'Seabird Monitoring: Witnesses in the Wild' (see weblinks), which outlines the work of penguinologists working at The University of Oxford.
- Ask the students to write down one or two sentences that outlines why scientists want to monitor penguin populations.
- You may like to show them the Penguin Watch website and discuss how they can help with the project.

2. Main activity: Drawing a population graph

- Give each student a copy of page 1 and 2 of the student worksheet.
- Ask them to read through page 1 and carry out task 1 (plotting the population graph) using the data cut from page 2.
- Check their answers.

Answer



The populations of both species fluctuated over time. However, the gentoo population increased between 1977 and 2010 (from 2000 to 4900 nests, an increase of 2900), with a greater rate of increase after 1998. The population of chinstraps decreased steadily (from 4100 to 1000, a decrease of 3100 nests).

3. Main activity: Invent possible hypotheses

- Give each student a copy of page 3 of the student worksheet (the Antarctic food web).
- You may wish to ask a series of questions to remind students how to interpret food webs e.g.:
 - Name the producer (*phytoplankton*)
 - Why are both zoo plankton and krill primary consumers? (*because they eat the producer*)
 - Which organisms are predators of penguins? (*orca and leopard seal*)
 - How would a decrease in squid affect the sperm whale population? (*It would decrease, because sperm whales eat squid*)
- Ask students to complete task 3 on page 1 of the student sheet.



Answer

During the 1970s-1990s whaling stopped and krill fishing began.

This caused a decrease in the krill population.

Also, during this time there was rapid sea ice loss due to climate change. This would have also caused a decrease in the krill population.

Krill makes up the vast majority (95%) of Chinstrap penguins' diet. So, the decrease in krill meant they had less food, so their population decreased.

Gentoo penguins eat krill, fish and squid. This variation in their diet means that a lack of krill has less impact on their population, so their numbers did not decrease. Also, with more gentoos living on the island, more krill will be eaten, further causing a decrease in chinstrap population.

After 1990, whale populations recover. Blue whales eat enormous amounts of krill, so an increase in their population will further reduce the krill population, reducing chinstrap population. This may be what caused the sudden increase in gentoo population after 1998.

4. Plenary

- Ask students to answer task 4 on the student sheet.
- Discuss their ideas as a class. Chinstrap penguins are at risk from extinction because of krill fishing and climate change. However, because of krill's vital position in the food web, other species must also be at risk. Suitable ideas include: Local policies to reduce the amount of krill fishing, stop it during the season when penguins are hunting krill, put in place no take zones around the island to stop any kind of fishing. Global policies to reduce climate change e.g. emissions targets.
- Ask some volunteers to share their ideas and discuss as a class if they will work.

Weblinks

Oxford Sparks animation – Monitoring Seabirds: Witnesses in the Wild

www.oxfordsparks.ox.ac.uk/content/seabird-monitoring-witnesses-wild

Penguin Watch website

<http://penguinwatch.org>