Key Stage 4 – Penguin counting

Notes for teachers

At a glance

Penguin Watch is a project led by University of Oxford scientists that relies on members of the public to count the number of penguins present in images taken by remote cameras monitoring over 30 colonies in Antarctica.

These data about penguin populations are used to provide early warning of ecosystem change and future population trends of Antarctic organisms.

In this activity, students take part in a simulated version of the project by studying images taken by the cameras to learn about why we repeat measurements in science, and what calculating uncertainty can tell us about data quality.
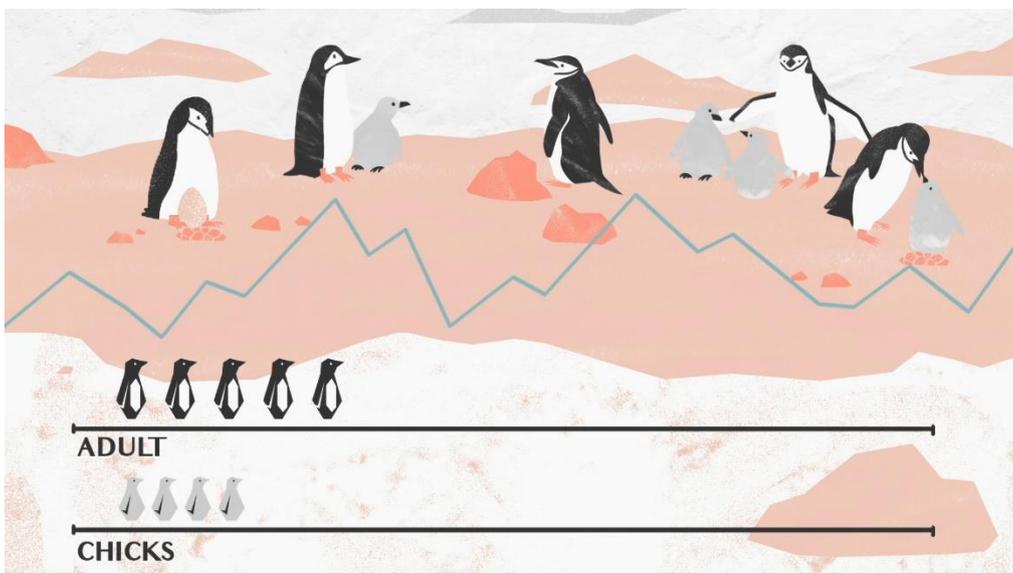
Learning Outcomes

- Students calculate mean and uncertainty from a data set.
- Students explain why repeats are made when collecting data.
- Students explain what uncertainty reveals about data.

Each student will need

- Copy of student worksheet.
- Access to penguin images. Either upload the 'Penguin Counting' PowerPoint onto a shared area that students can access or direct them to the Google slides document (see weblinks below).
- Access to 'counting penguins' pdf, either projected onto a whiteboard or you can convert into a google sheet and give students the link that allows them access to edit.
- Calculator.

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

Possible Lesson Activities

1. **Starter activity**
   - Show the class the Oxford Sparks animation 'Monitoring Seabirds: 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.
   - Show the students the Penguin Watch website.

2. **Main activity: Collecting data**
   - Give each student a copy of the student sheet and ask them to read through the information.
   - Each student will need access to a computer – pairs can share one computer - and should view the penguin images (1-10).
   - Tell the students to look out for the extra nuggets of penguin information in the speaker's notes at the bottom of some of the slides.
   - Individuals/pairs count the number of adult penguins on each image and write their results into the 'counting penguins' results table.

3. **Main activity: Analysing the data**
   - When all the data have been collected explain that this is like the data collected by the website – each image is seen by several people.
   - First, remove image 3 (as this contains no penguins - you might like to discuss whether anyone marked any penguins in this image (there is a different bird species), to introduce the idea of false positives). Then assign each student one image (1-10, excluding 3). This will result in several students studying each image. Ask students to calculate the mean number of penguins for their image.
   - Ask students to say what the mean is for their image, check they agree, and then record it on the table.
   - Now, ask students to calculate the range and uncertainty for their image. Range is the highest number counted minus the lowest number counted. Uncertainty is half the range.
   - Again, collect in the results and show the class how to present the results as mean ± uncertainty.
   - Ask students to discuss in pairs:
     - Which image had the highest uncertainty and why?
     - Why does Penguin Watch get many people (~10) to count the penguins on each image?
     - Why do you repeat results when you collect data?

4. **Plenary**
   - Discuss their responses as a class.
     Possible answers:
     - *Highly likely to be one of the images that had the highest number of penguins, as it is more difficult to be accurate when counting – some dispute over which penguins to include in the count, may miss out penguins or count them twice.*
     - *To reduce uncertainty (increase accuracy) of the number counted.*

- *For the same reason – the higher the number of repeats you make the less the impact of any random errors, so the more accurate the results. Also, it helps you to check how close your repeats are (how precise they are) and so spot any anomalous results, that should not be included in the mean.*

- Ask students to visit the Penguin Watch website and have a go at penguin counting for real to help out the researchers (click on the 'classify' tab in the top right corner). This can be done as a homework task.

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

Penguin counting Google Slides document

bit.ly/2BHP4DJ