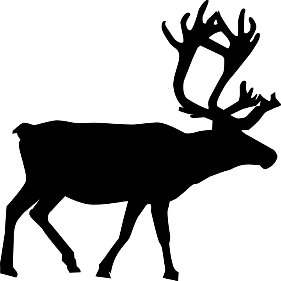
**Reindeer on Saint Paul Island**



Saint Paul Island is a small island near Alaska. In 1911 scientists released 25 reindeer on the island. The reindeer had no predator on the island. Each year, from 1911 until 1984 the scientists counted the number of reindeer. The data is shown in the table below.

|  |  |
| --- | --- |
| Year | Approximate number of reindeer on Saint Paul Island |
| 1911 | 11 |
| 1920 | 300 |
| 1930 | 410 |
| 1938 | 2046 |
| 1940 | 1180 |
| 1948 | 8 |

**To do**

Study the data above.

1. Plot a line graph of the data.

**To answer**

1. Describe in detail what happens to the reindeer population from 1911 to 1948.

**2.** What could be the cause of the changes observed in the reindeer population.

*Biology > Big idea BOE: Organisms and their environments > Topic BOE2: Organisms in their environments > Key concept BOE2.1: Ecosystem components and dynamics*

|  |
| --- |
| **Response activity** |
| **Reindeer on Saint Paul Island** |

**Overview**

|  |  |
| --- | --- |
| Learning focus: | The environmental conditions in different ecosystems, and in different parts of an ecosystem, affect and are affected by the organisms that live there. |
| Observable learning outcome: | Describe how changes in environmental conditions may lead to population change in ecosystems. |
| Activity type: | Application and practice |
| Key words: | Population, community, food chain |

This activity can help develop students’ understanding by addressing the sticking-points revealed by the following diagnostic question:

* Diagnostic question: Reasons why

**What does the research say?**

Research has shown that when students are asked to predict possible effects of a change in a population within a food web, they tend to focus only on single food chains within the web, struggle to trace changes through more than one chain, struggle to think about the impact of a change in a population more than one trophic level away, and are more able to trace changes upwards through a chain than downwards (Webb and Boltt, 1990; Leach et al., 1992; Gotwals and Songer, 2010; Griffiths and Grant, 1985; Barman, Griffiths and Okebukola, 1995). These authors and others have identified specific misunderstandings about changes in food webs that are commonly held by school children, including that:

* a change in the size of a population will only affect another population if they are related as predator-prey;
* a change in the size of a population will only affect other populations in the same food chain within a food web (and will not affect populations in other food chains within the food web);
* if the size of one population changes, all other populations in the food web will change in the same way (e.g. a decrease in one population means all other populations will also decrease).

Research therefore suggests that students may not see indirect or distant connections and Hogan’s (2000) investigation into how students used systems thinking to reason about food web perturbations also found that they rarely recognised feedback loops and indirect relations in ecosystems.

An ecology concept test used in a study of elementary students revealed several misconceptions about population change in ecosystems. It found students thought that ‘a change in one population will only affect another population if the two populations were related as predator and prey’ and that ‘ if the size of one population in a food web is altered, all other populations in the web will be altered in the same way’ (Ozkan, Tekkaya and Geban, 2004). Students appeared to have difficulty determining the effect of change on population numbers when the effect was transmitted along more than one route, pupils reasoned that the populations were too far apart or not closely linked.

A study by Jin et al. (2019)investigated student ability to explain the interdependent relationships in ecosystems. Students were presented with real world phenomena about relations in ecosystems and their responses were graded based on the content within their explanations. Jin et al. found that only 3% of the students were able to discuss mechanisms in their answers and the majority of students were unable to “use systems thinking concepts to construct a causal mechanism that explains phenomena about interactions in ecosystems”. 33% of students were able to identify distant relations and interactions in ecosystems but were not able to construct explanations, whilst most students (57%), simply explained the relationships in terms of individual organism needs.

**Ways to use this activity**

Students should complete this activity in pairs to plot the data on graph paper and then answer the questions about the changes observed in the reindeer population over time.

**Expected answers**

1. The reindeers are introduced in 1911. From 1911 to1938 the population increases, initially the increase is small, but between 1930 and 1938 there is a significant increase. After 1938 the population decreases, within two years it has nearly halved, it continues to fall and in 1948 is lower than it was in 1911.
2. The large increase in reindeer is a result of an abundance of food and no predators on the island. The decrease is a result of a lack of food which lead to the death of the reindeer.

**Acknowledgments**

Developed by Elizabeth Lupton (UYSEG), from an idea by Hui Jin et al.

Images: pixabay.com/ Clker-Free\_Vector-Images (48519)

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