PREPARING FOR EXAMS

NCEA L2 BIOLOGY QUESTIONS: POPULATION GENETICS

L2 Biology 91157 usually gives one of the three questions in the exam on a particular NZ species. Look at the species chosen over the last 8 years. The questions usually relate to Natural Selection, Genetic Drift, Founding Populations, Bottlenecks, Migration, Gene Pools and Conservation. What NZ Species have not been examined.

1. 2020 - Kākāpo

Since the arrival of humans (700 years ago) and other mammalian predators, the population numbers of most native species found in Aotearoa, New Zealand have decreased significantly.

In 1977 the last wild population of kākāpō was discovered on Stewart Island / Rakiura. The birds' main predators there were thought to have been feral cats.

2. 2019 - Kārearea Falcon

Kārearea, *Falco novaeseelandiae*, live throughout Aotearoa. They are predators that use flight to hunt their prey. Research shows that males tend to remain in a particular area, while females migrate to new areas.

Birds found in the North and South Islands have two distinct phenotypes.
Population size is estimated at 7000. Genetic analysis has found that gene flow occurs between North and South Island populations, and the population has low genetic diversity

3. 2018 – Hector and Māui Dolphin

Hector's and Māui dolphins are endemic to New Zealand (found only in New Zealand). They are considered separate subspecies; however, they are so closely related that they are able to interbreed.

Hector's dolphin population is estimated to be 7 270 individuals and is classified as 'Endangered'. Māui dolphin population is estimated to be 80 individuals and is classified as 'Critically Endangered'.

4. 2017 – South island saddleback

The South Island saddleback's gene pool has been affected by both the founder effect and the bottleneck effect at different points in history. The South Island saddleback was originally widespread over the mainland and also had established populations on some of the offshore islands, such as Big South Cape
Island, because they were within flying distance from the mainland. The graph below compares the genetic diversity of historic saddleback populations on the offshore island of Big South Cape Island and the South Island mainland inthe 1800s with the current population (in 2005) on Kaimohu Island.

After Māori and European settlers arrived, the South Island saddleback eventually became extinct, with the exception of the population on Big South Cape Island. In 1964 all South Island saddlebacks were removed from Big South Cape Island and taken to pest-free island sanctuaries such as Kaimohu Island. Safe
from rats and other predators, the South Island saddleback population on Kaimohu Island is increasing, and is being used to establish other populations around the South Island.

5. 2016 – Takahe and Moa

- Takahe

Many of New Zealand's native species have suffered population bottlenecks due to hunting, introduced predators, and habitat destruction. The Department of Conservation has successfully saved some of these species from extinction by moving several breeding pairs from mainland populations to predator-free islands. However, maintaining genetic diversity on island populations can be difficult for many species of flightless birds, such as the takahe, *Porphyrio hochstetteri*

- Moa

A large body mass is an advantage in cooler climates because its low surface area to volume ratio helps animals to retain heat. Many examples of this, such as polar bears, walrus and large polar sea mammals, are seen today.

Fossil evidence shows that during the last ice age, the population of heavy-footed moa, *Pachyornis elephantopus*, contained much larger individuals than the same species of moa that existed during warmer times. As the ice age ended and temperatures warmed, the fossil evidence shows that the heavy-footed moa's body mass became smaller again.

6. 2015 - Black Robins

Female black robins usually lay eggs inside their nests. However, conservationists found some birds laid eggs on the rims of nests, where the eggs could not survive. So, they pushed the eggs back into the nests where they could be incubated and hatch successfully. However, this selection pressure from humans caused the rim laying allele to increase to 50% in the black robin population. They decided to stop pushing eggs back into the nests to prevent the behaviour from spreading throughout the population. In 2011 only 9% of the population laid eggs on the rims of nests.

7. 2014 Galaxis (Fish)

The lowland longjaw galaxias (*Galaxias cobitinis*) is New Zealand's rarest freshwater fish. It has been isolated from other galaxias species for millions of years and now is found only in a six kilometre stretch of the Kauru River, in North Otago.

Lowland longjaw galaxias.

www.niwa.co.nz/freshwater-and-estuaries/nzffd/NIWA-fish-atlas/fish-species/lowland_longjaw_galaxias

A change

8. 2012 – Chatham Island Black Robin.

Changes occur in the gene pool of populations over time. Examples in New Zealand include tussock grasses and the Chatham Island black robin.

Discuss how genetic drift, natural selection and migration can contribute to these changes.

You should refer to the examples given, or any other New Zealand examples to help to clarify your