Q1.

(a) A weed is a plant growing where it is not wanted. Fat hen is a weed which grows in some crop fields.

Describe how you could estimate the **number** of fat hen plants in a field.

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(5)

(b) In potato plant fields, fat hen plants can grow up to a height of 2 m and absorb large quantities of nutrients from the soil.

Fat hen has a negative effect on the growth of potato plants.

Use the information provided to explain why.

In your answer, name the type of competition occurring between fat hen plants and potato plants.

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(3)

(c)   The table below gives some features of fat hen seeds.

Feature of seed	
Mean mass / mg	0.77
Maximum number produced per fat hen plant during a growing season	20 000
Percentage viable (able to develop) after a growing season	79

During a growing season, it was estimated that a total number of 550 fat hen plants grew on the fields of a farm.

Calculate the maximum mass, in kg, of viable fat hen seeds on this farm after a growing season.

Show your working.

Assume that all the seeds produced during the growing season remain on the farm.
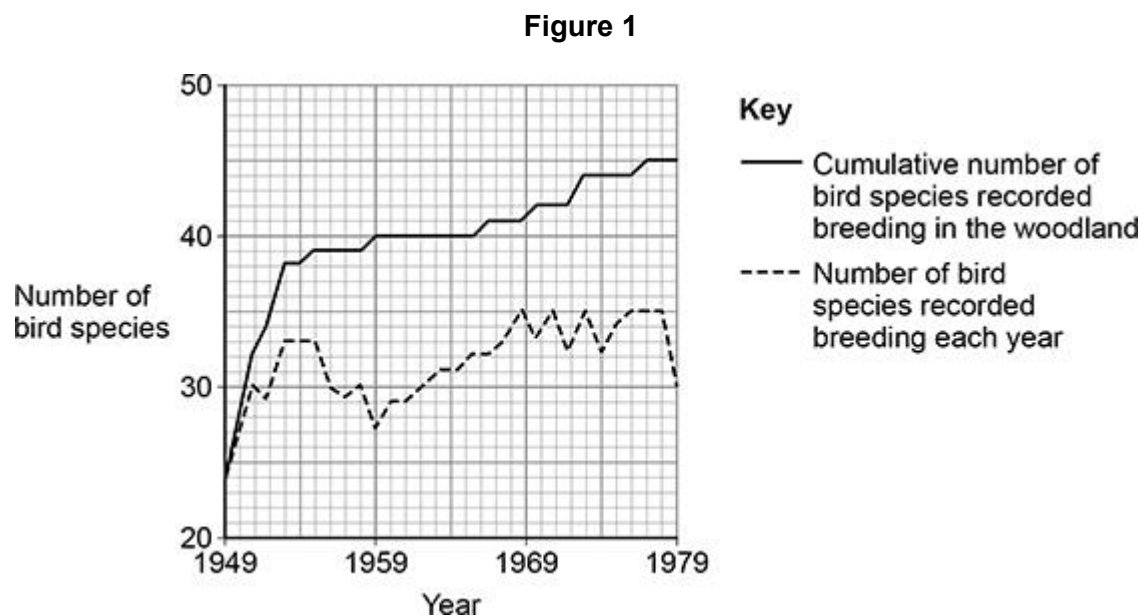
Answer _____ kg

(2)

(Total 10 marks)

Q2.

(a)   Define the biological term **population**.

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(2)

Ecologists monitored the biodiversity of birds in a protected woodland.

They recorded the number of bird species breeding in the woodland on the same day, every year for a 30-year period.

Figure 1 shows their results.

Figure 1

(b)   Which statement correctly represents the species richness of the woodland?

Tick (✓) **one** box.

The number of all species present in the woodland ☐

The number of all species present in the woodland and their habitats ☐

The number of animal and plant species present in the woodland ☐

The number of bird species present in the woodland ☐

(1)

(c)   A student studying the information in this question concluded that all woodlands should be protected to increase the biodiversity of birds.

Evaluate the student's conclusion.

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(4)

(d)   It is **not** possible to extrapolate the data for the number of bird species recorded breeding each year beyond 1979.
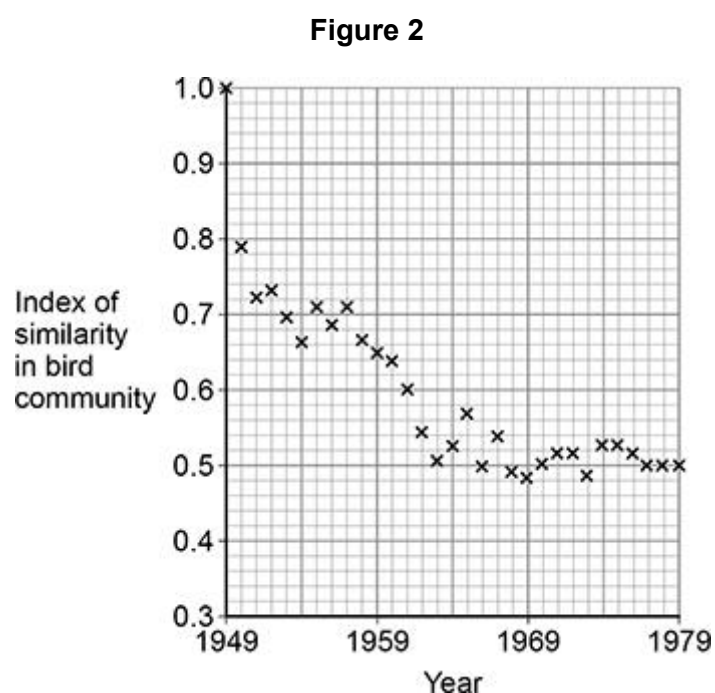
Explain why.

_____

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(1)

In this woodland, the ecologists measured the similarity in the bird community by comparing each year to 1949 using an index of similarity.

This index ranges from 1.0 for total similarity to 0.0 for total dissimilarity.

Figure 2 shows their results.

Figure 2

(e)   Suggest how the changes in the index of similarity in the bird community provide evidence for the process of succession.

_____

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(2)

(f)   In **Figure 2**, the index of similarity for the last 10 years remains fairly constant.

Name the stage of a succession this represents.

Suggest **one** reason why the index of similarity is **not** absolutely constant.

Stage of succession _____

Reason why the index of similarity is not absolutely constant _____

_____

_____

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_____

(2)

The Living Planet Index (LPI) is an index designed to monitor the state of the world's biodiversity.

The LPI is arbitrarily scaled to be 1.0 in 1970, the baseline year.

Figure 3 shows the LPI from the Living Planet Report, 2008. The dotted lines represent ± 2 standard deviations from the mean, which includes over 95% of the data.

Figure 4 shows an alternative version of **Figure 3** published on a news website.
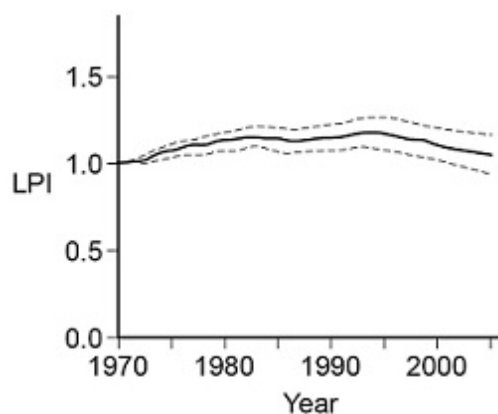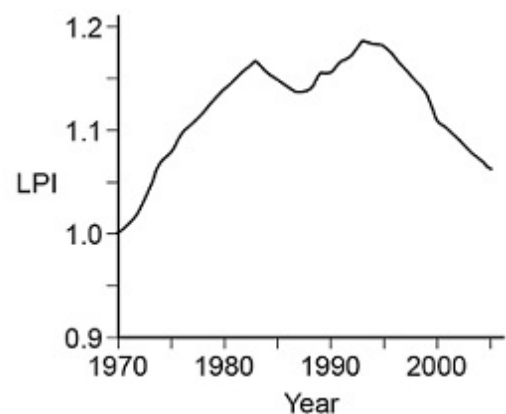

Figure 3

Figure 4

(g)   The news website published the headline:

The LPI shows human activities cause significant decrease in biodiversity.

Suggest **three** reasons why this headline is **not** valid.

Use all the information provided.

1   _____

_____

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2   _____

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3   _____

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(3)
(Total 15 marks)

Q3.

(a)   In the following passage, the numbered spaces can be filled with biological terms.

An ecosystem supports a certain size of population of a species, called the __(1)__ capacity. There are often numerous habitats within an ecosystem. Within a habitat, a species occupies a __(2)__ governed by an adaption to both __(3)__ and biotic conditions. Populations of different species form a __(4)__.

Write the correct biological term beside each number below that matches the space in the passage.

1 _____

2 _____

3 _____

4 _____

(2)

(b)   Suggest **two** reasons for conserving rainforests.

1 _____

_____

2 _____

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(2)

(c)   Give **three** reasons for the low efficiency of energy transfer from secondary consumers to tertiary consumers in an ecosystem.

1 _____

_____

2 _____

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3 _____

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(3)
(Total 7 marks)

Q4.

Lemurs are small mammals. Lemurs live in trees and feed on leaves and fruit.
Scientists used a computer program to predict the expected distribution of two
species of lemur, *Eulemur rufus* and *Eulemur rufifrons,* on the island of
Madagascar. These predictions were based on the environmental needs of each
species.
Then, the scientists determined the actual distribution of these two species of
lemur on the island of Madagascar.

The diagram below shows the scientists' results.
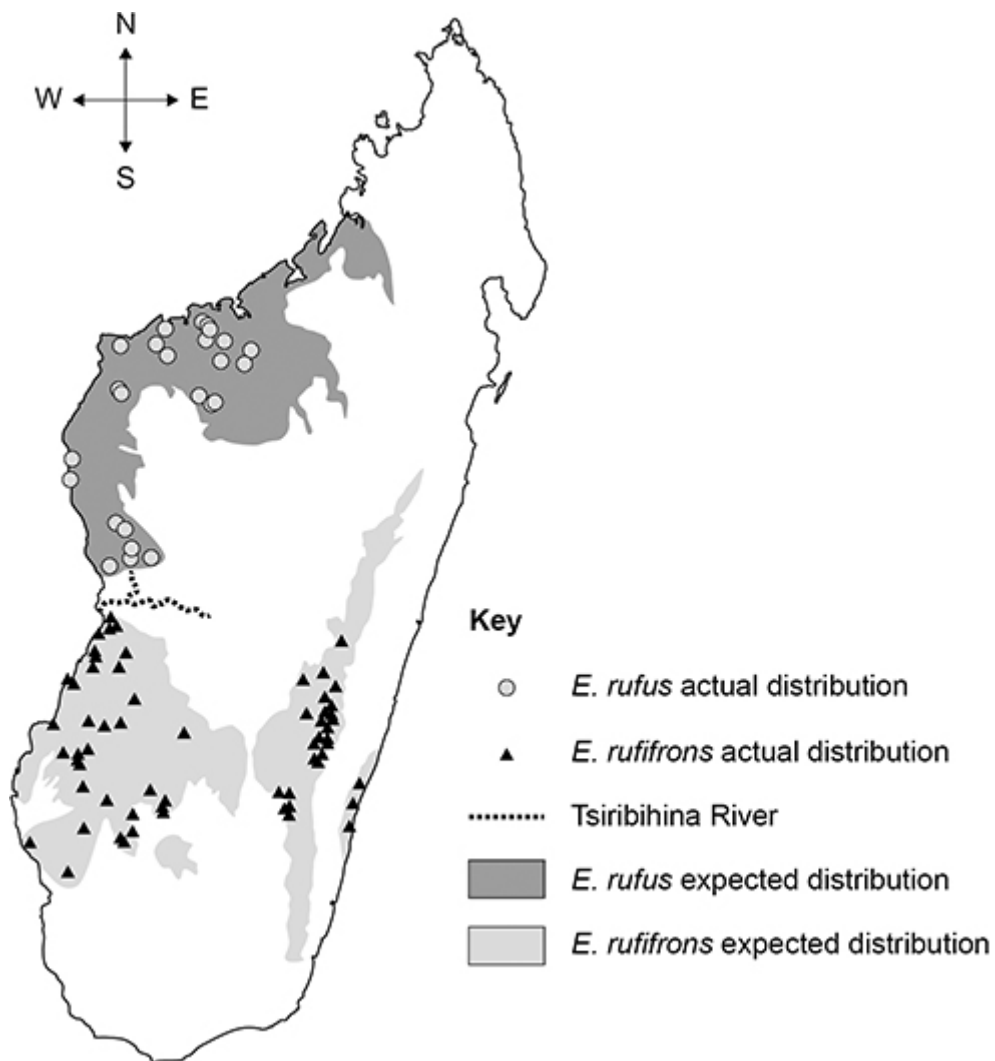
(a)   Using the diagram above, give **three** conclusions you can make about the distribution of these lemur species.

1   _____

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2   _____

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3   _____

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(3)

(b)   Using all the information, suggest how speciation happened to produce two species of lemur.

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(5)

The scientists used the mark-release-recapture method to determine the number of lemurs in one area of forest. They captured, marked and released a first sample of 30 lemurs. A week later, they captured a second sample of 25 lemurs from the same area of forest. The scientists calculated that there were 250 lemurs in that area of forest.

(c)   Suggest **one** precaution needed when marking the lemurs to make sure the estimate of the number of lemurs is valid.

_____

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_____

(1)

(d)   Using the information provided, calculate how many lemurs in the second sample were marked.

Answer _____

(1)

(Total 10 marks)