
SL Paper 3

- a. Define the terms fundamental *niche* and *realized niche*. [2]

Fundamental niche:

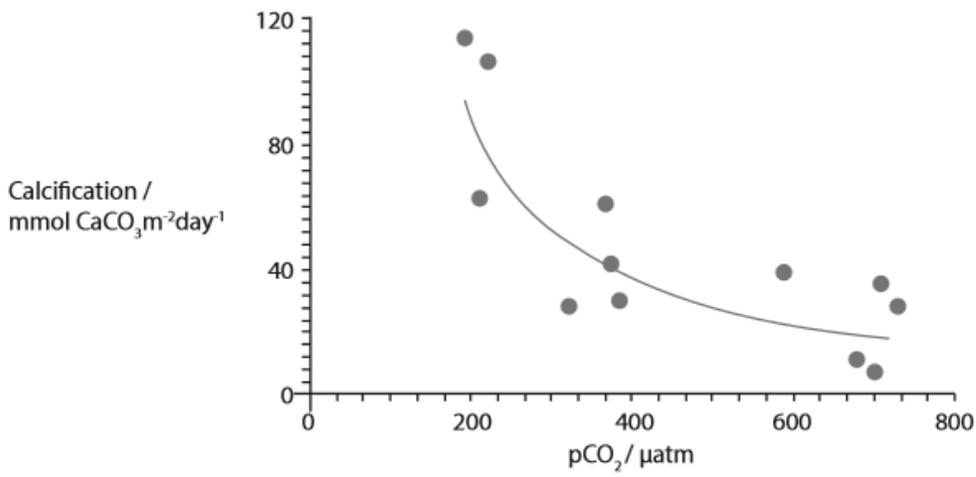
Realized niche:

- b. Explain why the carnivores in an ecosystem tend to be fewer in number and have a smaller biomass than the herbivores in the same ecosystem. [2]
- c. Explain why carnivores tend to be more affected by biomagnification than organisms lower down the food chain. [3]

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- b. Outline the role of saprotrophic bacteria in the treatment of sewage. [2]
- c. Explain the formation of methane from biomass. [3]

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- b. Explain the principles involved in the generation of methane from biomass. [3]
- c (i) State the role of *Rhizobium* in the nitrogen cycle. [1]

Increasing carbon dioxide concentration in the atmosphere leads to acidification of the ocean. This in turn reduces the amount of dissolved calcium carbonate. A study was undertaken to investigate the effect of increasing the concentration of atmospheric carbon dioxide on the calcification rate of marine organisms. Calcification is the uptake of calcium into the bodies and shells of marine organisms. The study was undertaken inside Biosphere-2, a large-scale closed mesocosm. The graph shows the results of the data collection.

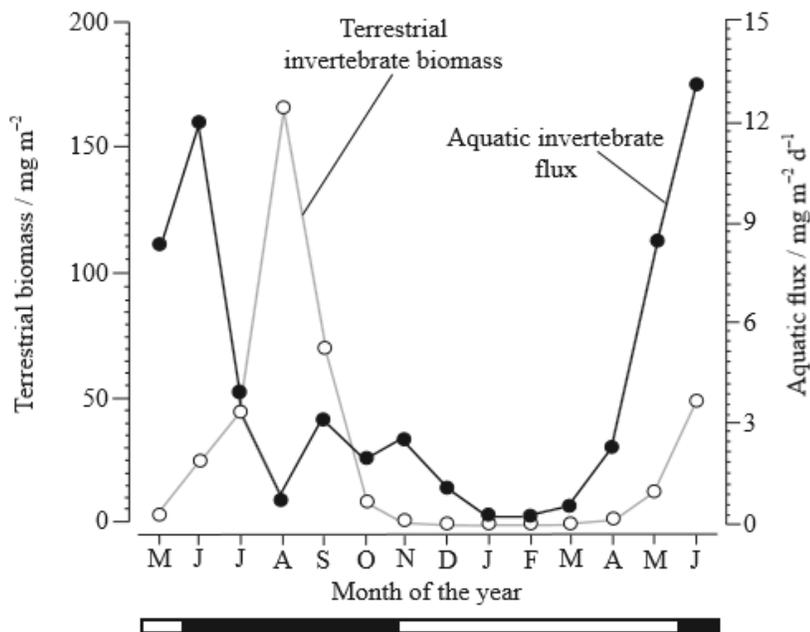


[Source: © International Baccalaureate Organization 2016]

- a. State the relationship between atmospheric carbon dioxide and calcification rates. [1]
- b. Distinguish between the exchange of matter and energy with the surroundings in a closed mesocosm. [1]

Discuss the definition of the term species.

The graph below shows the monthly mean values of terrestrial invertebrates from May 1997 to June 1998 in the northern hemisphere. The light line shows the biomass of invertebrates which are prey to forest birds (terrestrial invertebrate biomass). The darker line shows the invertebrates which lived in the stream and have moved to the forest (aquatic invertebrate flux or movement). The black bars on the horizontal line at the bottom show periods when trees have leaves and the white bars show periods of defoliation.

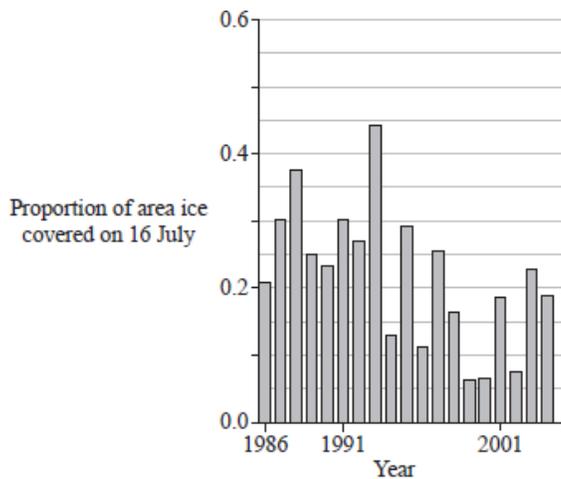


S. Nakano and M. Murakami, 'Reciprocal subsidies: Dynamic interdependence between terrestrial and aquatic food webs'. *PNAS*, 98 (1) pp. 166-170. Figure 1C. Copyright (2001) National Academy of Sciences, U.S.A.

- a. State the mean terrestrial invertebrate biomass measured in August. [1]
- b. Describe the trend in the aquatic invertebrate flux. [2]
- c. Suggest the relationship between defoliation and the amount of terrestrial invertebrates in the forest. [2]
- d. Suggest a possible explanation for the pattern in aquatic invertebrate flux to the forest seen between the months of June and December. [2]

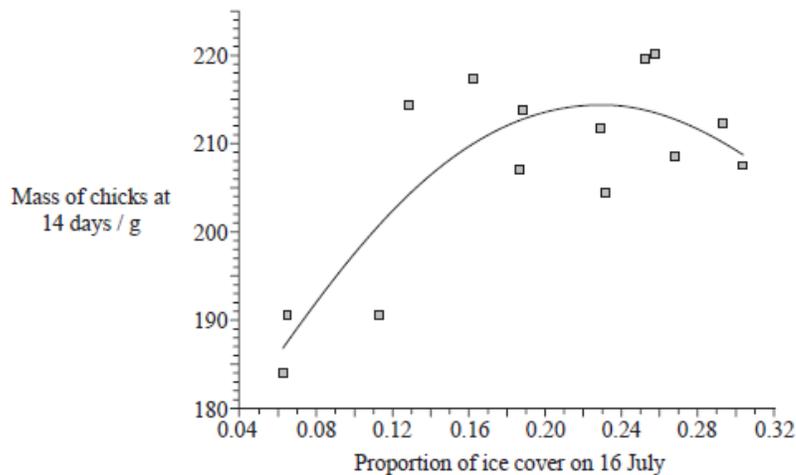
A colony of a marine diving bird, Brunnich's guillemot (*Uria lomvia*), lives on the southern limits of the Arctic on Coats Island. Brunnich's guillemots feed principally on Arctic cod (*Arctogadus glacialis*) which are characteristic of Arctic waters.

The graph shows the changes in ice cover on Coats Island over a period of 19 years.



[Source: adapted from A. Gaston, et al., (2005), *Journal of Animal Ecology*, 74, pages 832-841]

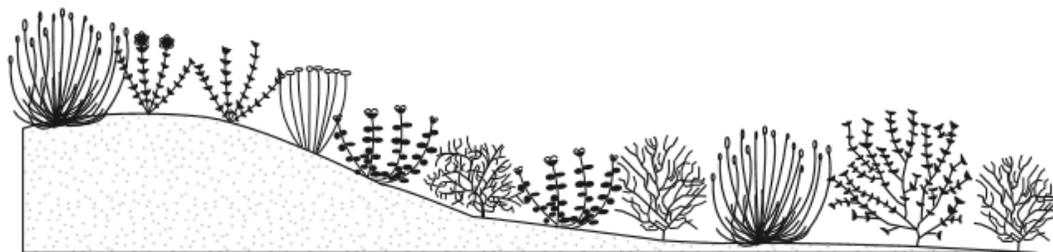
At Coats Island, chick mass at 14 days was measured in most years between 1988 and 2002. The scattergraph below shows the results, plotted against proportion of ice cover.



[Source: adapted from A Gaston, *et al.*, (2005), *Journal of Animal Ecology*, 74, pages 832–841]

- a(i). Outline the changes in ice cover shown in the data above. [2]
- a(ii). Suggest **one** reason for the changes in ice cover. [1]
- b(i). Outline the relationship between ice cover and the mass of 14-day-old chicks on Coats Island. [2]
- b(ii). Suggest reasons for the relationship. [2]
- c. Predict, with a reason, the change in the mass of chicks in the years ahead. [1]

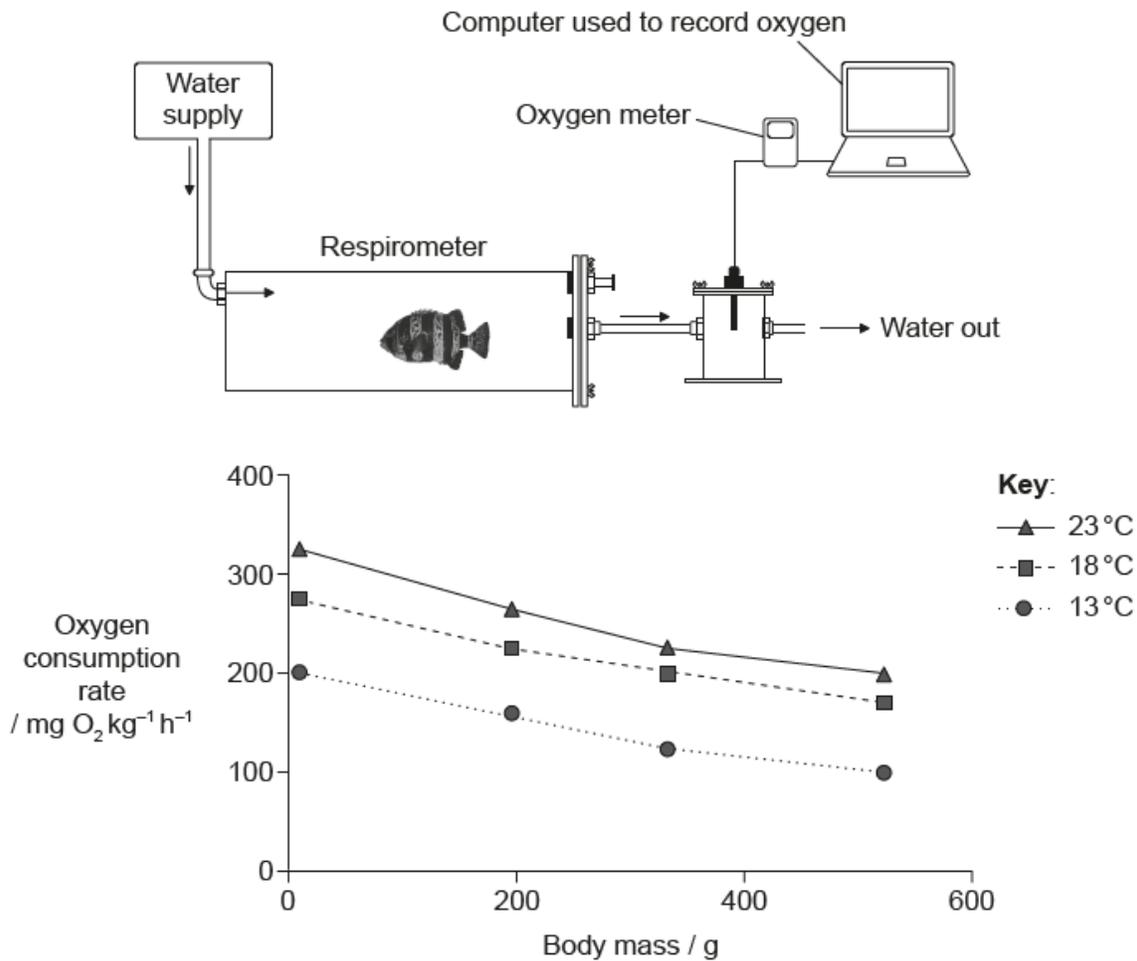
The diagram below shows changing vegetation along a slope in a terrestrial ecosystem.



[Source: © International Baccalaureate Organization 2015]

- a. Describe how a transect can be used to investigate the distribution of plant species in this ecosystem. [2]
- b. The vegetation shown here has developed as a result of primary succession. Outline the changes that take place in the abiotic environment during primary succession. [2]
- c. Outline the abiotic factors that affect the distribution of plant species in an ecosystem. [2]

The oxygen consumption rate of the fish *Oplegnathus insignis* was examined in a respirometer at three different water temperatures and at four different body masses.



[Source: adapted from E Segovia, et al., (2012), *Latin American Journal of Aquatic Research*, **40** (3), pages 766–773]

- a. Suggest how the oxygen consumption rate is determined using this apparatus. [2]
- b. State the relationship between body mass and the oxygen consumption of fish. [1]
- c. Predict the effects of global warming on aerobic respiration in fish. [2]