



FACULTY	AGRICULTURE, ENGINEERING & NATURAL SCIENCE		
DEPARTMENT	ENVIRONMENTAL SCIENCE		
SUBJECT	POPULATION ECOLOGY		
SUBJECT CODE	EBL3871		
DATE	FEBRUARY 2023		
DURATION	3 HOURS	MARKS	100

PROMOTIONAL EXAMINATION

Examiner: PROF. I. MAPAURE (University of Namibia)

External examiner: PROF. C. T. DOWNS (University of KwaZulu-Natal)

This Question Paper consists of **four (4) pages** including the cover page

Instructions

- Candidates must answer **ALL** questions in Section A and any **TWO** questions from Section B.
- Section A carries 50 marks and Section B carries 50 marks.
- Candidates are allowed to use Scientific Calculators.

UNIVERSITY OF NAMIBIA EXAMINATIONS

SECTION A

Answer ALL questions in this Section.

QUESTION 1 (8 marks)

Briefly summarize the following Models of diet selection:

- (a) Euphagia (4)
- (b) Hedyphagia (4)

QUESTION 2 (4 marks)

The human population of a certain Region is growing at an exponential rate of 3.4% per annum. If the population was 150 000 in 2010, what was the population in 2022?

QUESTION 3 (7 marks)

Read the passage below (from Zuk, 2016) and answer the questions which follow.

Abstract

Sexual cannibalism, in which one member of a mating pair consumes the other, has riveted people's attention for centuries, despite its being confined to spiders and other arthropods that tend not to be particularly charismatic. It seems intuitive that the consumed party — usually, though not always, the male — loses in such interactions, and sexual cannibalism is often viewed as the ultimate form of sexual conflict. But a recent paper by Schwartz *et al.* (2016) examining the practice in the dark fishing spider, *Dolomedes tenebrosus*, supports the notion that, at least in some species, males themselves benefit from their sacrifice. What is more, females are not merely obtaining a meal; female *D. tenebrosus* that eat their mates lay more and larger eggs that hatch into better-surviving offspring than those that do not consume their mates. Importantly, females given a similar-sized cricket to eat showed no such benefit, suggesting a very particular evolutionary function for sexual cannibalism in these spiders. In other words, it's not just about the calories. The same benefits to either males or females do not always hold for other taxa, however, underscoring the fact that sexual cannibalism describes several different phenomena with different costs and benefits depending on the ecological and evolutionary contexts. The effect of sexual cannibalism on sexual selection can also vary, with males in some cannibalistic species showing enhanced choosiness, whereas in other species females may use sexual cannibalism as a way to dispose of rejected mates while obtaining a meal in the process, tidily eliminating the disturbance caused by a courting male in the web. The frequency of sexual cannibalism is also variable within species and populations, with relatively few taxa being cannibalistic all the time.

- (a) Use evidence from this passage to argue that cannibalized male *Dolomedes tenebrosus* increased their fitness despite dying. (4)
- (b) Justify why females also cannibalized males with which they had not mated. (3)

QUESTION 4 (3 marks)

The Lotka-Volterra equation below indicates the rate of growth of a population of Species 1 experiencing competition from Species 2 (subscript 1 refers to Species 1 and subscript 2 refers to Species 2).

$$\frac{dN_1}{dt} = r_1 N_1 \left(\frac{K_1 - N_1 - \alpha N_2}{K_1} \right)$$

Explain how α (alpha) is interpreted with respect to the effects of intra- and inter-specific competition on the population growth of Species 1.

QUESTION 5 (9 marks)

Briefly describe any three challenges faced by ruminants in their foraging activities in savanna ecosystems. Use appropriate examples in your answer.

QUESTION 6 (9 marks)

Construct an expected cyclical pattern of the relationship between a predator and a prey (assuming that no other factors influence the relationship). Your well-labelled sketch graph must be accompanied by explanatory text.

QUESTION 7 (6 marks)

Explain the concept of *Optimal foraging efficiency*.

QUESTION 8 (4 marks)

Outline any 4 disadvantages that parasitic organisms may face compared to a free-living lifestyle.

Sub-total marks (Section A) = 50

SECTION B

Answer **ANY TWO** questions from this Section. Where appropriate, structure your answer **using clear subheadings**, including an Introduction at the beginning and a Conclusion at the end. Failure to do so will result in loss of marks.

QUESTION 9 (25 marks)

Read the Abstract below (from Hayward & Kerley, 2005) and answer the question which follows.

Abstract

Lions *Panthera leo* are generally thought to prey on medium to large ungulates. Knowledge of which species are actually preferred and which are avoided is lacking, however, as is an understanding of why such preference or avoidance may arise. An analysis of 32 studies over 48 different spatial locations or temporal periods throughout the distribution of the lion shows that it preferentially preys upon species within a weight range of 190–550 kg. The most preferred weight of lion prey is 350 kg. The mean mass of significantly preferred prey species is 290 kg and of all preferred species is 201 kg. Gemsbok, buffalo, wildebeest, giraffe and zebra are significantly preferred. Species outside the preferred weight range are generally avoided. Species within the preferred weight range that are not significantly preferred (such as roan, sable and eland) generally have features that reduce predation either morphologically (e.g. sable horns), ecologically (e.g. roan and sable occurring at low density), or behaviourally (e.g. the large herd size and increased vigilance of eland). Warthog are below the preferred weight range yet are taken in accordance with their availability and this is probably due to their sympatry with lion, their relatively slow evasion speed and their lower level of vigilance. Plots of prey preference against prey body mass follows a bell curve with a right skew that, we argue, is caused by collective hunting by lions of larger-bodied prey. Our methods can be used on all

large predators and are likely to be useful in assessing competition in sympatric communities of predators, cooperative hunting and predicting predator diets. This will allow us to move beyond descriptive dietary studies to improve our predictive understanding of the mechanisms underlying predator-prey interactions.

Question: Discuss the determinants of lion predatory behaviour. Use the information from this Abstract as well as from your general understanding of the concept of classical predation.

QUESTION 10 (25 marks)

Evaluate the importance of character displacement and resource partitioning in minimizing or even eliminating interspecific competition among animal species. Use appropriate examples in your answer.

QUESTION 11 (25 marks)

How do energy requirements, habitat specialisation and home range size scale with body size in African savanna mammals?

Sub-total marks (Section B) = 50
Grand Total Marks = 100

END OF EXAMINATION