



NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY

FACULTY OF ENVIRONMENTAL SCIENCE

DEPARTMENT OF FOREST RESOURCES AND WILDLIFE MANAGEMENT

VERTEBRATE POPULATION DYNAMICS (EFW 2205)

Main Examination Paper

March 2025

This examination paper consists of 4 pages

Time Allowed: 3 hours
Total Marks: 100
Special Requirements: Nil
Examiner's Name: Prof Allan Sebata
External Examiner: Prof. E. Chivandi

INSTRUCTIONS

1. Answer **QUESTION ONE** and any **THREE** others.
2. Each question carries 25 marks
3. Use of calculators is permissible

MARK ALLOCATION

QUESTION	MARKS
1.	25
2.	25
3.	25
4.	25
5.	25
6.	25
TOTAL	100

1. Table 1.1 is an incomplete life table for a population of female African buffalo (*Syncerus caffer*) in the Gonarezhou National Park.

Table 1.1

Age (years) (x)	#. alive at start of age interval (n_x)	Proportion surviving at start of age interval (l_x)	# dying within age interval x to x + 1 (d_x)	Finite rate of mortality (q_x)	Finite rate of survival (p_x)
0	1000				
1	670				
2	576				
3	565				
4	553				
5	532				
6	516				
7	487				
8	467				
9	432				
10	380				
11	336				
12	263				
13	196				
14	140				
15	91				
16	48				
17	22				
18	7				
19	0				

- (a) Copy and complete Table 1.1 by calculating the values of l_x , d_x , q_x and p_x . [12 marks]
- (b) Use the completed life table to calculate the mean expectation of life (e_x) for individuals alive at start of age x. [8 marks]
- (c) Explain how data obtained from recording age at death can be used to construct a life table. [5 marks]

2. Briefly, describe the following wildlife census techniques:

- (a) catch per unit effort (CPUE). [6 marks]
- (b) 24-hour water observational counts. [6 marks]
- (c) mark-recapture methods. [7 marks]

- (d) camera traps. [6 marks]
3. (a) Use an appropriate model to explain the population changes of wildebeest (*Connochaetes taurinus*) introduced into a newly created game reserve. [15 marks]
- (b) Distinguish between absolute density and relative density. [10 marks]
4. (a) Explain how you would manage a small or declining population of a named large herbivore to raise its density. [13 marks]
- (b) Describe the measures you would employ to deal with an excessive increase in the population of a named large ungulate. [12 marks]
5. Figure 5.1 is widely used to explain predator-prey relationships. The figure shows the Canadian lynx and snowshoe hare pelt-trading records of the Hudson Bay Company over almost a century.

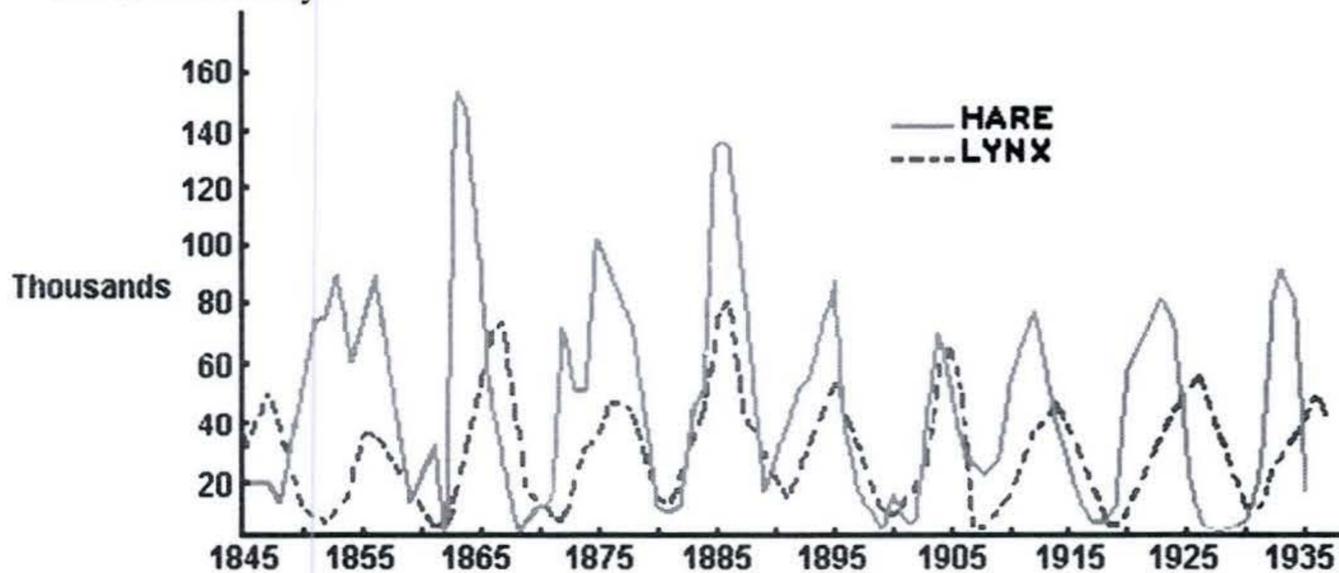


Figure 5.1 The Lynx and snowshoe hare graph (source: *Fundamentals of Ecology*, Saunders, 1953)

- (a) Describe the lynx-hare relationship using the Lotka and Volterra model principles. [10 marks]
- (b) Discuss the criticism of using the Canadian lynx and snowshoe hare pelt-trading records to explain predator-prey relationships. [15 marks]
6. (a) Plains zebra (*Equus quagga*) were counted on 12 transects of unequal length in a census area. The area of the census zone was 2829 km². There were 126 possible transects, of which 12 were selected at random without replacement. The census data are summarized in Table 6.1 below.

Table 6.1

Transect no.	Area of transect (km ²)	No. of plains zebra counted
1	8.2	2
2	13.7	26
3	25.8	110
4	25.2	82
5	21.9	89
6	20.8	75
7	23.0	42
8	19.2	50
9	21.4	47
10	17.5	23
11	19.2	30
12	20.8	54

Use the data in Table 6.1 to calculate:

- (i) the total population of the plains zebra. **[5 marks]**
(ii) 95% confidence limits on total population. **[5 marks]**
[Given the following: $t_{0.025}$ for 11 d.f. = 2.201; standard error = 218.14]
- (b) Distinguish between total and sample counts in censusing wildlife. **[10 marks]**
- (c) Explain why ecologists aim at making repeatable rather than accurate counts of game when conducting a census. **[5 marks]**