RAJARATA UNIVERSITY OF SRI LANKA
FACULTY OF APPLIED SCIENCES

B.Sc. in Applied Biology
Third Year – Semester II Examination – January/February 2023

BDC 3204 – WILDLIFE CONSERVATION AND MANAGEMENT

Time: Two (02) hours

Answer ANY FOUR (04) questions.

1) Below are the genotypes at three loci from a sample of ten individuals of *Elephas maximus* from Minneriya National Park. This elephant population consists of 1500 individuals with adult male to female sex ratio of 1:2.1.

Individual	Locus		
	1	2	3
1	aa	BB	CC
2	aa	Bb	CC
3	Aa	BB	CC
4	aa	Bb	CC
5	Aa	BB	CC
6	AA	BB	CC
7	aa	BB	CC
8	AA	BB	CC
9	AA	BB	CC
10	Aa	BB	CC

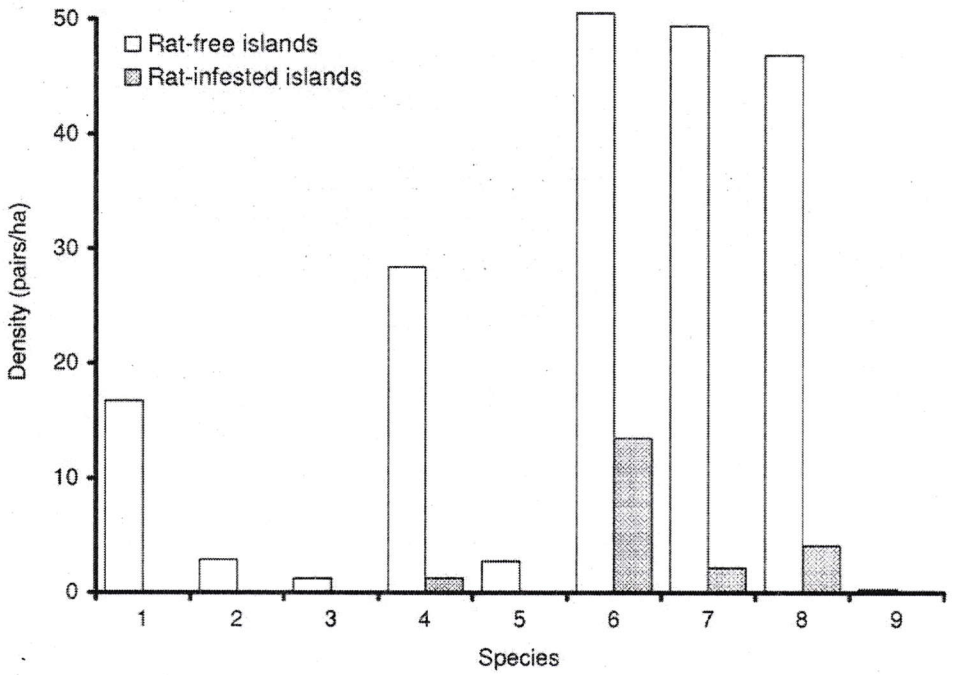
a) What are the frequencies of alleles and genotypes at each locus? **(20 marks)**

b) What is the polymorphism using the 95% criterion (the frequency of the most common allele <95%) and heterozygosity for this population? **(10 marks)**

c) Briefly discuss the factors that may minimize the level of genetic diversity in a population with special emphasis on their relative effect on the alleles listed above. **(30 marks)**

d) Another study conducted on the elephant population at Yala National Park revealed that the allele frequencies at loci 1, 2, and 3 were identical to Minneriya. However, the population consists of 300 individuals, with an adult male to female sex ratio of 1:8. Comment on how differences in the population demographics of these two populations may impact their long-term persistence. **(40 marks)**

2) A group of six islands has nesting populations of nine seabird species. At the beginning of the 20th century, all nine seabird species nested on all six islands. In the 1970s, rats were accidentally introduced to three of the islands; rats are well known to prey on seabirds and their eggs. The figure (modified from Hilton & Cuthbert, 2010) shows the current density of the nine seabird species in the island group in relation to the presence of rats.



a) What does this figure suggest about the role of rat predation on the island group?
(10 marks)

b) The pattern in the figure could be due to a cause other than predation. Explain what this other cause might be.
(20 marks)

c) What factor other than predation may play a major role in regulating seabird populations on this island group?
(20 marks)

d) Where mammalian predators, such as rats, have reached an island group, it is possible that the total number or biomass of seabirds remains relatively constant. Explain how this might occur.
(50 marks)

3) The conservation organization managing a rare bird species endemic to an island is considering the possibility of carrying out a control operation to exterminate exotic mammalian predators (rats and cats) that are preying on the bird and thus causing its decline.

a) Describe the kinds of evidence needed to ensure that such a control operation is justified/appropriate and how and when such evidence should be collected. **(25 marks)**

b) What would be the objective of the control operation? **(05 marks)**

c) Which of two methods, direct killing or biological control, might be more effective in controlling the rat and cat populations? Justify your answer. **(20 marks)**

d) Describe three measures that might be used to assess if the control operation has been successful or not and state when data on these measures should be collected. **(50 marks)**

4) Discuss the concepts of structural and functional biodiversity and their role in conservation planning. **(100 marks)**

5) Longevity data were collected from an undisturbed sea snake population. This sea snake species matures at age 2 and breeds approximately for 2 years. The tables 01 and 02 below show the longevity data collected from a cohort of 50 individuals, and the fecundity data from a sample of 25 females at a breeding colony respectively. By using the data, construct the life table for the above sea snake population and answer the following questions.

R_0 – Net reproductive Rate = $\sum l_x m_x$ when $l_0=1$
G – Mean Generation Time = $\sum x l_x m_x / R_0$
E_x - The life expectancy for an individual of age x = T_x/n_x
$T_x = \sum_{x=1}^{\infty} (L_x)$
$L_x = (n_x+n_{x+1})/2$

a) What is the net reproductive rate? **(20 marks)**
b) What is the mean generation time? **(20 marks)**
c) Calculate the maximum sustainable yield. **(20 marks)**
d) Estimate the life expectancy. **(20 marks)**
e) Comment on the trend of the life expectancy with the age. **(20 marks)**

Table 01: Longevity data for sea snake population

# 1 dead at 0.2 years	# 2 dead at 0.7 years	#47 dead at 3.2 years
# 50 dead at 3.2 years	# 5 dead at 0.2 years	#42 dead at 4.5 years
# 25 dead at 3.1 years	# 9 dead at 1.0 years	#36 dead at 4.5 years
# 14 dead at 1.1 years	# 31 dead at 2.3 years	#49 dead at 3.1 years
# 3 dead at 0.5 years	#28 dead at 3.5 years	#38 dead at 4.8 years
# 6 dead at 0.4 years	# 22 dead at 2.1 years	#44 dead at 4.9 years
# 12 dead at 1.4 years	#30 dead at 2.2 years	#27 dead at 3.4 years
# 10 dead at 1.1 years	#23 dead at 3.0 years	#15 dead at 1.0 years
# 8 dead at 1.2 years	#29 dead at 2.1 years	#21 dead at 1.4 years
# 16 dead at 0.6 years	# 32 dead at 2.1 years	#26 dead at 3.0 years
# 17 dead at 0.7 years	#19 dead at 0.9 years	#11 dead at 1.3 years
#4 dead at 1.2 years	#20 dead at 1.5 years	#33 dead at 4.1 years
#7 dead at 0.6 years	#18 dead at 0.8 years	#48 dead at 3.5 years
#13 dead at 1.2 years	#24 dead at 3.1 years	#34 dead at 4.2 years
#35 dead at 4.1 years	#41 dead at 4.6 years	#37 dead at 4.7 years
#46 dead at 4.3 years	#45 dead at 4.2 years	#43 dead at 4.8 years
#39 dead at 4.6 years	#40 dead at 4.7 years	

Table 02: Maternity Rates in the sea snake population

2 offprings at 2 years	0 offprings at 2 years
0 offprings at 3 years	1 offprings at 3 years
1 offprings at 2 years	2 offprings at 2 years
1 offprings at 4 years	2 offprings at 2 years
1 offprings at 2 years	3 offprings at 2 years
2 offprings at 2 years	3 offprings at 3 years
3 offprings at 3 years	3 offprings at 2 years
4 offprings at 2 years	4 offprings at 3 years
4 offprings at 2 years	4 offprings at 3 years
3 offprings at 4 years	3 offprings at 2 years
3 offprings at 2 years	
3 offprings at 3 years	
6 offprings at 3 years	
0 offprings at 3 years	
2 offprings at 2 years	

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