UNIVERSITY
OF SKÖVDE

School of Bioscience

WRITTEN EXAMINATION

Course Molecular Ecology in Conservation

Examination Written final examination

Course code BV715A

Credits for written examination 3.5 hp

Date 2026-03-13

Examination time 14.15-18.30h

Examination responsible Sonja Leidenberger

Teachers concerned Sonja Leidenberger, Tomas Jonsson, Niclas Norrström

Aid at the exam/appendices - No

Other - No

Instructions

- ☐ Take a new sheet of paper for each teacher.
- ☐ Take a new sheet of paper when starting a new question.
- ☒ Write only on one side of the paper.
- ☒ Write your name and personal ID No. on all pages you hand in.
- ☒ Use page numbering.
- ☒ Don´t use a red pen.
- ☒ Mark answered questions with a cross on the cover sheet.

Grade points **40 in total. The written exam will determine the grade of the course. You have to reach at least 50-59% = E, 60-69% = D, 70-79% = C, 80-89% = B, and more than 90% = A in the entire exam.**

Examination results should be made public within 18 working days

Good luck!

Total number of pages 3

Molecular Ecology in Conservation, BV715A, VT 2026

Final examination 13th of March 2026 **In total: 40 points**

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Goal 1: *In detail explain theories, applications and scientific methods within the field of molecular ecology.*

Goal 2: *Critically evaluate results from molecular ecological methods/analyses.*

Background - Ecology and 'Molecular' (6.5 points)

1. Define an ecosystem in ecology? (1 point)

2. Explain 'phenotypic plasticity'? (1 point)

3. Name a commonly used molecular marker in plants (0.5 point) and list at least four characteristics that distinguish it from nuclear DNA markers (each correct answer 0.5 point) (maximum 2.5 points).

4. Briefly describe the main steps of the process of PCR. (2 p)

Species and phylogeography (6.5 points)

5. What is meant by the 'Biological Species Concept' (BSC) proposed by Mayr? (1.5 p)

6. In the coalescent theory, we trace alleles backward in time to know when they share a most recent common ancestor (MRCA). Consider two mtDNA lineages sampled from a population of constant effective size N_e under radom mating. Calculate the probability that the two lineages remain distinct (do not coalesce) after t generations. Show your reasoning and explain each step. (3 p)

7. How can chromosome structure influence the ability of a species to adapt to environmental changes? (2)

Population genetics, dispersal and gene flow (10 points)

8. What are the requirements/conditions that need to be in place for a particular locus in a population to be in a Hardy-Weinberg equilibrium? (2.5 p)

9. A small population size can have significant genetic consequences for a population and produce phenomena such as 'population bottle necks' and 'founder effects'. Explain what 'population bottle necks' and 'founder effects' refer to. (3p)

10. 'Adaptive' and 'neutral' genes have different use in molecular ecology. Describe whether adaptive or neutral genetic data should be used when (1 p)

(a) quantifying dispersal and gene flow between populations, and estimates of genetic differentiation among populations, and

(b) studying local adaptations in landscape genomics.

11. The following data was obtained for the distribution of number of individuals in three genotypes in two small population:

Genotype	A_1A_1	A_1A_2	A_2A_2
No. ind. Pop. 1	60	20	20
No. ind. Pop. 2	50	40	10

Which one of the two populations appear to be more inbred than the other?

Motivate your answer. (4p)

Behavioral ecology (8 points)

12. Describe two adaptive hypotheses and one non-adaptive hypothesis proposed to explain why females engage in extra-pair fertilizations. Briefly explain how molecular genetic data are used to test these hypotheses. (4 p)

13. Hamilton's equation of kin selection:

a) Describe and briefly explain Hamilton's equation of kin selection (1 p)
b) What is the purpose of the equation and give an example of a phenomenon that has been analyzed and better understood using Hamilton's equation (2 p)

14. Explain what eusociality is. (1 p)

Conservation & Genetics (9 points)

15. What is the Holocene extinction? (2 points)

16. What is meant by 'Extent of Occurrence (EOO)' in the red list assessment process? (1 point)

17. Explain DNA barcoding and its advantages and disatvatages for identifying organisms at the species level. (3 points)

18. Explain with help of an concrete example how **environmental DNA (eDNA)** can be used for monitoring biodiversity. What is the advantage of this technique – what is still the most challenging part? (3 p)