



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 2026-02-12

Examination time 8.15-12.30h

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 2025

Final examination 12th of February 2025

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. How has Ernst Haeckel (1869) defined 'ecology'? (1 point)
2. What is mean by the karyotype of a species? (1 point)
3. Explain the difference between Microsatellites and SNPs (Single Nuclotide Polymorphisms)? (1 point)
4. Name the main differences between mitochondrial DNA(mtDNA) and nuclear DNA (nDNA) (2.5 points).
5. What is the main difference between Illumina sequencing (2nd generation) and Nanopore sequencing (3rd generation)? (1p)

Species and phylogeography (6.5 points)

6. Explain the differences between the morphological (MSC) and and phylogenetic/diagnostic species concept (PSC) and name a problem for each of the concepts. (1.5 p)
7. Hybridization occurred in history, but also now. Describe hybridization effects by explaining
 - a) what 'sympatric' and 'allopatric' means? (1 point)
 - b) why it can lead to introgression and what happens genetically? (1 point)
 - c) what is the main difference when you looking at mtDNA or nDNA? (1 point)

You can use the example of the toads *Bufo bufo* and *Bufo spinosus* to explain hybridization, if you want.

8. What is a haplotype network? (1 point)

Population genetics, dispersal and gene flow (10 points)

9. What is the Hardy-Weinberg theorem? (2 points)

10. Genetic diversity was studied in a population where 10 loci were examined in 100 individuals. The number of alternative alleles found among the examined individuals distributed over the 10 loci was 2, 3, 2, 1, 1, 1, 5, 1, 1, 2. The number of individuals who were heterozygous for the respective loci was 20, 40, 10, 0, 0, 0, 60, 0, 0, 10. (3 points)

- a) Calculate the proportion of *polymorphic loci* (P)
- b) Calculate the degree of (observed) *heterozygosity* (H_o) across all analysed loci
- c) Calculate the *allelic diversity* (A)

11. Explain what genetic drift is, what affects it and what its consequences are. (2 points)

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

<i>Genotype</i>	A_1A_1	A_1A_2	A_2A_2
No. ind.	112	43	31

Calculate the inbreeding coefficient (F) at this locus for this population. (3 points)

Behavioral ecology (8 points)

13. Given that we have genotypic data from offspring and its potential parents but we have many males that can't be excluded:

- a. what type of parentage analysis would be suitable in such a case? (1 p)
- b. briefly explain how this type of parentage analysis works. (3 p)

14. Compare microsatellites and SNPs for use in parentage analysis. Discuss one advantage and one limitation of each marker type, and explain why modern parentage studies increasingly rely on SNP data. (3 points)

15. Explain how monogamy can be a result of evolution. (1 p)

Conservation & Genetics (9 points)

16. Biodiversity is important. One threat is habitat fragmentation that can lead to small populations. Explain what

- a) is mean with the extinction vortex? (1 point)
- b) means Minimum Viable Population (MVP)? (1 point)
- c) is the 50/500 rule? (1 point)

17. Explain DNA barcoding and its application in conservation (e.g., for evolutionary significant units). (3 points)

18. Explain with a concrete example what biological invasion is and how environmental DNA (eDNA) can be used in this context. What is the advantage of this technique – what is currently the most challenging part? (3 points)