

**Doctoral thesis**

For the degree of Doctor of Philosophy

**Ecological genetics of inbreeding,  
outbreeding and immunocompetence  
in *Rana* frogs**

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**AKADEMISK AVHANDLING**

som för avläggande av filosofie doktorsexamen i ekologisk zoologi, enligt Naturvetenskapliga Fakultetens beslut, kommer att offentligens försvaras fredagen den 12 december 2008, kl 10.00 i föreläsningssalen, Zoologiska institutionen, Medicinargatan 18, Göteborg.

Avhandlingen försvaras på engelska. Examinator är Professor Charlotta Kvarnemo. Fakultetsopponent är Professor Johan Elmberg, Högskolan Kristianstad.



**UNIVERSITY OF GOTHENBURG**

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**Abstract** Using artificial fertilization, I crossed frogs from different populations to evaluate fitness consequences for the offspring from an inbreeding-outbreeding perspective, and to evaluate quantitative genetic effects on immunocompetence against a fungal pathogen (*Saprolegnia*). Crosses between closely situated populations of different sizes generated contrasting results for the effects of outbreeding on offspring traits between populations and life history stages, emphasizing the importance of epistatic effects and the difficulties of relying on generalizations when making conservation decisions (e.g., regarding translocations). Experimental infection of frog eggs from six populations with *Saprolegnia* fungus showed a significant family effect on the degree of infection of eggs and embryos, in particular at lower fertilization success and with a significant temperature  $\times$  population interaction effect. A paternal genetic effect on fungus resistance was found using a half-sib split design. Furthermore, relatively more eggs were infected when fertilized by sperm from the same, in contrast with a different population. However, there was no evidence for a stronger effect in isolated island populations. Although the mechanistic underpinnings remain unknown, these results suggest substantial levels of genetic variation in resistance to *Saprolegnia* in natural populations within and among populations. We also found that pre-hatching exposure to *Saprolegnia* dramatically reduced the size at metamorphosis in the absence of further exposure to the fungus, possible as a delayed effect of impaired embryonic development. However, in contrast to some other amphibians, induced hatching in response to *Saprolegnia* could not be confirmed. In conclusion, the results suggest that frog populations are genetically diverse even at small geographic scale with frequently strong and unpredictable consequences of in- and outbreeding for the response to stressors.

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