Mathematical modeling of the mechanism of a reproductive strategies differentiation in natural populations (on an example of arctic fox, *Alopex lagopus)*

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This paper considers a complex approach for modeling the natural evolution of a population in terms of population number and dynamics of the genetic structure. A set of dynamic models that considers various types of natural selection was applied to describe possible mechanisms underlying the formation of existing genetic variations in litter sizes in coastal, inland, and farmed arctic fox populations (*Alopex lagopus*, family Canidae, order Carnivora).

Natural populations of arctic fox inhabit coastal and inland areas considerably differ in their reproductive strategy. Coastal foxes produce litters of moderate size yearly. In years with low food supply, inland fox population demonstrates a very low rate of reproduction. By contrast, in years when prey species are abundant, female inland foxes can produce up to 16â“18 offsprings. The average mean litter size and coefficient of variation are 1.5-fold higher in inland populations.

The most interesting results are obtained by using the model of population with two development stages. This model allows getting a monomorphism in considered gene for coastal populations of arctic fox, where food resources are nearly constant. Also the model produces a polymorphism with cyclic fluctuations in the number and gene frequency for the continental populations due to regular fluctuating rodent number, the major component of its food. In farmed populations this gene becomes a pleiotropic one (i.e., determining the survival rate of individuals during both early and late stages of their life cycle) due to selective selection carried out by farmers to increase the reproductive success. So an application of appropriate model (with the selection on pleiotropic gene) allows to get an adequate elimination rate of small litters allele.

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