WEITZMAN´S APPROACH AND CONSERVATION OF BREED DIVERSITY: FIRST APPLICATION TO GERMAN CHICKEN BREEDS

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Summary
The Weitzman method is used to derive conservation priorities for 20 non-commercial chicken breeds of German origin, using genetic distances estimated from microsatellite data. It is shown that conservation priorities change, when data on related commercial breeds, which are not at risk, are included. This finding can be generalised to the case of national vs. international conservation concepts, where the former case may lead to sub-optimal conservation decisions.

Keywords
Chicken breeds, conservation program, microsatellites, Weitzman's approach

Countries having subscribed the Convention on Biological Diversity [2] have to develop strategies for the conservation of biological diversity of farm animals. Available funds for conservation, however, do not cover the costs for preserving the great variety of breeds. To date, Germany lacks a conservation and promotion concept for poultry, although there is a very high number of different breeds and lines, especially in chicken. German fancy breeders keep nearly 200 breeds, half of them being large breeds and the other half bantam, of which some may display in 30 different colour variants and body shapes. In order to develop a conservation concept, it is necessary to identify the breeds that should receive funding and the appropriate amount of financial support allocated to each breed in the selected pool, respectively.

For this purpose, we make use of an econometric model suggested by Weitzman [11,12]. This approach has proven helpful before in several studies in different species [10, 3]. Our group used this model in research projects on African cattle breeds [4,5,6,8], where it could be shown that the efficiency of the conservation scheme could be enhanced by up to 60% [8].

In the current project on German chicken breeds, we chose 20 non-commercial breeds representing European lineages. The European ancestries of these breeds were evaluated with the help of both, the breed groups defined in the fancy breeders club BDRG by historical knowledge [9] and microsatellite data. Both methods result in groups that broadly coincide. For each breed the degree of endangerment was derived from the total population size of the breed in Germany and was quantified as extinction probability assuming a time horizon of 50 years, ranging from 0.76 for the breed Bergische Schlotterkaemme to 0.15 for the breed Italiener rebhuhnfarbig.

In addition to this set of endangered breeds, we added 8 commercial lines: one white layer, three brown layer, and four broiler lines. Those breeds were considered to be not endangered, so their extinction probability was set to zero.

The goal of this study was to develop a cost efficient conservation program for the diversity of those breeds. For the 28 populations, Reynolds distances were estimated based on 29 microsatellite genotypes available for on average 30 individuals per line. We then calculated a maximum likelihood tree using Weitzman´s recursive algorithm [11]. Additionally, the marginal diversity was calculated that reflects the change of diversity in the whole population in case of an increase in the extinction probability of one breed [5]. Its value depends on the position of the breed in the maximum likelihood tree and on the extinction probabilities of the neighbouring breeds in the tree, but is independent of the extinction probability of the breed itself. Finally the conservation potential, which is the product of extinction probability and marginal diversity, was calculated, which is a good indicator for the priority of a breed for conservation [8,12].
These calculations were done in two versions:

1. For the subset of 20 endangered non-commercial breeds alone;
2. For all breeds, including the non-endangered commercial breeds.

Marginal diversities and conservation potentials in both cases were only calculated for the 20 non-commercial breeds. The results show, that conservation priorities change, if a reference population of save breeds is taken into account. In this case, endangered breeds which are genetically similar to a save breed are downgraded with respect to their conservation priority.
This result can be extended to the problem of national vs. international conservation schemes. If a conservation scheme is only optimised on the national scale, ignoring the fact that there may be closely related and relatively save breeds in other countries, allocation of funds and conservation efficiency are expected to be sub-optimal [7]. The presented method is a most helpful tool to cope with the difficult task of choosing particular breeds that should be conserved by obtaining financial support.

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