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Conservation of Farm Animal Genetic Resources: implementation guidance

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Background to the Guidance

Sustainable use of farm animal genetic resources (FAnGR) requires the conservation of the breeds themselves, and of the genetic variation within them. The UK continues to be successful in the former, but success in the latter is less clear. No breeds have been lost since 1970 and many breeds which at that time were only still in existence because of the dedication of small numbers of owners have now reached numbers where they can be considered for practical purposes secure. This has been achieved by promotion of numerical growth and spread of ownership of the breeds, with the breed societies and the Rare Breeds Survival Trust having been key in the process.

However, new issues have been emerging which mean that conservation of FAnGR has become in many ways more complex. These have related to mainstream breeds rather than to those which were, certainly during the first half of the 20th century, relatively rare. A focus of this report is the pair of questions; whether the UK government can claim that breeding plans and conservation strategies as they operate in the UK actually meet these obligations, and if they do not, what can be done to rectify the situation.

Some of these mainstream breeds are themselves very local in distribution (many of them are associated strongly with a particular county) or have segments within the breed of particular conservation significance. Today a county-wide distribution does not guarantee the survival of a breed under a disease control regime which countenances the stamping out of "dangerous contacts"; due to modern patterns of livestock movement, such contacts may be geographically far more widespread than in the past.

There is also the issue of commercial breeds losing their (usually highly specialized) roles, and declining in numbers. How this situation is managed depends on the breed society.

This project records, analyses and evaluates the effectiveness of current programmes relating to the conservation and sustainable use of FAnGR in the UK. The information which breed societies currently place in the public domain is reviewed in terms of its suitability for monitoring national FAnGR. Drawing on new methodologies that may facilitate both the management and monitoring of FAnGR, the project offers guidance for breeders and their breed societies, and for policy makers and advisers.

This report complements the other elements of the project, which have focused on background policy and specific issues of animal identification and traceability. Its aims are

- To review current activities in UK FAnGR breeding and conservation;
- To generate a best practice document for stakeholders and policy makers.

<u>The approaches used to tackle these aims, and the key findings, are summarized as follows</u>

<u>Breeding plans</u>

"The selective breeding of livestock in order to meet commercial requirements"

1. Breeding plans operate within political, economic and scientific-technical contexts and these are reviewed;

2. UK livestock are in the private sector and while decisions are made by individual breeders, who also own the information necessary to assess the genetic consequences, but the UK Government is responsible internationally for the effects of these decisions on FAnGR;
3. Breeding plans that fail to take account of genetic conservation can lead to genetic improvement in the traits under selection being accompanied by the avoidable loss of genetic variation in other traits which may be of value either now or in the future, as has been observed in the breeding of commercial dairy cattle;
4. A practical investigation of native mainstream and at-risk breeds, using new data and methods, has shown how breeding plans and conservation strategies coexist;
5. Methodologies developed for the planning and monitoring of breeding plans can readily be adapted to perform the same functions in conservation strategies.

Conservation strategies

"The planned mating of livestock in order to retain breed genetic variation"

1. The contexts of FAnGR conservation, and the relevant stakeholders, are reviewed, with the role of breed societies being considered in detail;
2. Conservation strategies must take account of the desire of many owners of at-risk breeds to develop their breeds along commercial lines;
3. New research is reported showing that while genetic variation is, in general, being conserved, there are important areas where particular attention is needed;
4. Ex situ conservation (principally, the storage of frozen semen) is reviewed and found to compare favourably with what is practised elsewhere in Europe, except in the case of poultry;
5. Emergent issues are highlighted, notably the conservation of traditional segments within commercial breeds and of poultry in general;
6. New research is reported on the monitoring of genetic variation by means of demographic variables, for breeds where computational approaches cannot be applied.

The complete report is available on the Defra website.

Guidance for breeders

1. Guidance on the practical husbandry, welfare and management of breeding animals is readily available from college courses, networks and societies, veterinary surgeons, published books and periodicals;
2. All breeders should join their breed society. If one already exists, do not form a new one, even if you believe your animals are a distinct type within a currently accepted breed. If in doubt, consult the Rare Breeds Survival Trust, Rare Poultry Society or other umbrella organizations;
3. If intending to practise selection, consider joining a centralized scheme;
4. If breeding mainly for conservation, consider lengthening generation intervals or using a wider spread of males;

5. If keeping poultry, note the recent guidance from the Animal Health and Veterinary Laboratories Agency on the advantages of documented membership of a breed society and of unique individual identification of your birds[1].

Guidance for breed societies

(i) In the case of breeds at particular risk, the priority should be on building up numbers and minimizing overall risk. Once progress has been made in this direction, breeding schemes that manage effective population size should be implemented;

(ii) Particularly in the case of numerically strong breeds, traditional or original lines within the breed should be inventoried and electronic databases reviewed to ensure pedigrees are accurately documented;

(iii) For breeds where there has been upgrading or breed development by introgression, there should be a clear designation to be applied to animals that have no ancestry from outside the UK population. This must be established rigorously, if necessary by tracing animals back beyond electronic records and into hard copy volumes;

(iv) For pedigreed breeds, if one is not already in existence, establish a breed conservation committee which will, every year, report on retention of genetic variation within the registered portion of the breed. Recommended mode of operation of the committee is presented below;

(v) All breed societies should make their herd/flock/stud books as informative as possible. Comparison with those published by other breeds (with particular reference to breeds that are recognized under the Zootechnical Regulations) may be a useful first step. For example:
   a) Herd or flock returns should be included in as much detail as possible;
   b) Sires should be easily identifiable as home-bred or bought-in;
   c) Periodic surveys of breed numerical status should be made and trends identified.

(vi) Poultry breed societies that do not currently register individual birds should consider options for pedigree recording and operation of breeder and animal databases; these must be electronic.

Guidance for the UK Government, Devolved Administrations and public bodies

1. Continue supporting and where possible improve the current enabling environment for breed societies and breeders;
2. Implement urgently research on identifying significant flocks/herds, in all breeds but with special emphasis on those which are geographically localized;
3. Continue working with other government agencies and bodies to ensure that such flocks/herds receive special protection when needed, for example from culling during disease outbreaks;
4. Review all proposed regulatory requirements which may be particularly financially burdensome on keepers of breeds of conservation significance;
5. Monitor effective population sizes of breeds;
6. Implement urgently research and development relating to the conservation of poultry breeds;
7. Establish a cost-effective national database of electronic breed registration and census data including development of software for monitoring and periodic review and for facilitating routine activities of breed societies.

[1] This is to be published on the Defra FAnGR website.

Recommended mode of operation for a breed conservation committee

First steps

Encourage all breeders to adopt an overall breeding policy and to see it as a group activity.

Arrange for the exchange of information so there can be breed-wide networks for exchanging parent stock. Remember that many breeders will not be confident internet users.

Avoid having overly exclusive rules for registration of animals.

If there are genetic faults in the breed, deal with them openly[2].

If there are problems, find out how these have been dealt with in other breeds, and seek advice.

The key- have as many active sires as practicable, all siring much the same number of young.

This is how you can calculate a minimum number of sires for your breed.

If this calculation is not possible, then a rule of thumb is to have at least 25 sires active in each generation, each siring similar numbers of offspring. This is broadly true for all species.

1. How many dams are there on average for each sire? This will probably be 5 or more for cattle, 5 for sheep and goats, 3 for horses and poultry, 2 for pigs. There is no need to try and change this.
2. Deduce how many breeding offspring (sexes combined) the average female produces during her lifetime. For all species, this will probably be between 4 and 12.
3. Are there <u>at least</u> the following numbers of males siring registered stock in the current year:
    a. For a lifetime production of 4, 21 bulls, rams or bucks; 24 stallions or male birds; 25 boars
    b. For a lifetime production of 12, 25 bulls, rams or bucks; 28 stallions or male birds; 43 boars
4. If your breed uses EBVs, specialist advice is needed to confirm the above numbers.
5. Discuss with your database manager ways of keeping the mating structure of your breed, and its consequences for increase of inbreeding, under review.

The target is to have at least the number of sires given in (3) above for your species.

[2] http://www.signetfbc.co.uk/documents/content/sheepbreeder/ridgene_manual_digital.pdf

Possible ways of achieving this number of sires – also, ask your membership for ideas

1. Possible incentives to breeders might include:
    a. With advice from your database manager, provide a list of recommended sires
    b. Make available stored semen; have a rationing/archiving scheme so stocks never become exhausted; encourage purchasers of semen to contribute to restocking
2. Manipulate registration fees perhaps as follows:
    a. Free registration for first son/daughter registered from a given sire that year
    b. Increased registration fee for subsequent progeny, maybe on a sliding scale
    c. Funds raised from (b) could be used to subsidize (a) or for some other conservation purpose for example collection of semen or funding periodic external review of breed conservation activities

And here are some things your committee should do every year or every two years:

1. Calculate effective population size by whatever method your database manager can offer (preferably by at least 2 methods). Ensure exactly the same methods are used each year and that the calculations are documented. Compare with previous years, add new methods should they become available

If you are unable to do this, then report the number of sires that have been in use, which should be at least 25. If you can also illustrate that numbers of offspring per sire are getting more even, so much the better – this is easy to do with spreadsheets

2. Review whether there are specific sires that are being heavily used
3. If not operating a semen bank, consider doing so
4. If your breed uses computerized evaluation including the recording of performance data for pedigreed animals, ask your service provider whether optimum contribution methodology can be applied and consider how to implement it

Further information

This guidance has arisen from a report on how breeding and conservation operate and interact in the UK's native breeds of cattle, sheep, goats, pigs, equines and poultry – our national farm animal genetic resources.

Those interested in the guidance will want to know more about the background to it and how it might apply specifically to a particular breed. The report provides this background.

Naturally the author would prefer the report to be read as a complete entity but this will not be possible for everyone. As it is being published electronically, key word search could be a first step, and there is a glossary of technical terms. Inevitably it has not been possible to examine every UK breed in the detail it deserves, but an issue relating to one breed will probably have been discussed in relation to some other breed of similar function or background.

Electronic publication means that updates are possible, and it is intended to develop some aspects of the study for publication in the scientific literature, subject to approval. The author will welcome advice on enhancements or corrections.

The findings of the study are summarized at two points within the report. Another component of the project has been the production of documents on the policy background to conservation of farm animal genetic resources and on specific issues of individual animal identification and traceability and these are also available electronically.

Finally, opinions and the choice of examples and the overall coverage are the responsibility of the author alone and must not be taken as reflecting the views of Defra or any other individual or organization.