SPANISH CRITERIA FOR CONSIDERING A BREED AT RISK OF ENDANGERMENT IN THE OFFICIAL CATALOGUE OF LIVESTOCK

INTRODUCTION

The Official Catalogue of Spain Livestock breeds listed in Annex I of Royal Decree 2129/2008, established by the national Programme for the conservation, improvement and promotion of livestock breeds contains the official record and classification of all the recognised livestock breeds in Spain of economic, productive or social value. Amongst the different categories, the aforementioned Royal Decree defines, in its article 2, the Native Spanish breeds as those which have its origin in Spain. Those which, in terms of population and organisation, are expanding, are classified as Breeds in Development; while those which are in serious decline or in the process of disappearing are classified as Breeds in Danger of Extinction, in accordance with criteria established at national or international level.

In the framework of the National Coordinating Commission for the conservation, improvement and promotion of livestock breeds is necessary to clarify the criteria for updating the categories of the Catalogue with a technical basis and consistent with policies that exist to support livestock breeds, in such a way that each breed is classified into the appropriate category and taking into account that the aim should be that in a gradually way breeds classified as endangered were fewer, which is a good indicator of the effectiveness of the measures and support provided by the Administration and their associations.

This document aims to define the national criteria for categorizing native breeds as development breeds or endangered breeds based on a series of technical criteria.

In addition to the census, other criteria must be taken into consideration: sex ratio, historical development, number and characteristics of farms, area of distribution, operating system, existence of breeders association, existence of improvement program, marketing and market demand factors, social and demographic factors (age of farmers, etc.), even aspects related to the CAP and the decoupling of aid, which can affect livestock in general and breeds in particular.

The goal is to establish criteria for judging if a population which is under the management of a particular association, and under the worst scenario of reproductive isolation requires the establishment of conditions that ensure their long term survival without significant loss of diversity.

Thus, the following basic information will be obtained from the National System of Livestock Breeds (ARCA: http://www.magrama.gob.es/es/ganaderia/temas/zootecnia/razas-ganaderas/):

- Census of breeding females and males registered in the herd book.
- Number and geographical distribution of farms
- Additional technical parameters, productive, social and economic development.

This information and the conclusions will be reviewed by National Coordinating Commission to analyze the situation of the official Catalogue with the objective of updating it and to classify each breed in the appropriate category, under the RD 2129/2008.

PROPOSAL

Consequently, the following criteria are made to review and update as necessary, the status of endangered breeds in the Official Catalogue:

1) Census criteria: The following limits are considered to classify a breed as at risk of endargement, both with a margin of 15%.

a) Number of pure-bred breeding females available for purebred reproduction over the last year, understood as those females registered in the herd book whose parents and grandparents are also registered (the limits correspond to the thresholds for breeds at risk of endargement established for agri-environmental measures under Rural Development Policy, set out in Annex IV of EC Regulation No. 1974/2006).
Breed societies shall provide the National Information System (ARCA) the exact number of females that have been reproduced in purity until December 31 of the previous year. Supposing that this data cannot be provided by the association accurately, the number of females that breed in purity will be calculated from the number of new animals entered in the register of births in the calendar year. In case of Bovine and Equine the calculation will be made directly, in the case of sheep, goats and pigs, prolificacy of the breed or specie will be considered when calculating the number of females that breed in purity from the number of animals entered in the register of births.

SPECIES	Equidae	Cattle	Sheep-Goat	Pigs	Avian
Nº breeding females	5.000	7.500	10.000	15.000	25.000

b) Number of breeding males, understood as those registered as such in the herd books.

SPECIES	Equidae	Cattle	Sheep-Goat	Pigs	Avian
Nº breeding males	100	150	200	300	500

c) Number of female replacements: Annual average of purebred females registered in herd book that became breeding animals in the past three years, which would allow to establish several risk levels, as below:

SPECIES		Equidae	Cattle	Sheep-Goat	Pigs	Avian
Annual average of purebred females registered in herd book in past 3 years *	Crítical	45	75	90	105	200
	High risk	150	225	300	345	600
	Moderate risk	450	700	900	1000	2000
	Low risk	1500	2300	3000	3300	6600

* Following a similar approach than the one proposed by Alderson (2003).

If the average of purebred females registered in herd book that became breeding animals in the past three years is below the limits set in the "low risk" category, the breed would be considered as endangered. ([1]

Census data to determine these parameters will be collected from ARCA at 31 December.

In the case that the census of breeding females or breeding males or the average replacement females is below the established limits, the breed will be considered as BREEDS AT RISK OF ENDANGERMENT.

When the limits established for the census criteria are exceeded in less than 15%, the genetic criteria and other criteria modulation described in paragraph 3 will be assessed. In this way, breeds that slightly exceed the census criteria could be still considered at risk taking into account the others criteria.

2) Genetic Criteria: Rate of inbreeding

The population size is an important factor to determine the endargerment of a breed, however, it does not provide a complete overview of the degree of endangerment.
Mating between animals with common ancestors tend to reduce the genetic variation in the next generation. Hence, the importance of taking into account

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[1] In process of spanish review for changing: According to the studies it would be preferable to change this paragraph and to take as reference the "moderate risk" figures for the replacement indicator (average of females registered) instead of "low risk".

this second genetic criteria related to the **rate of inbreeding ((ΔF)[2] that is directly connected to the effective population size (N_e).**

CATEGORY	ΔF
NOT AT RISK	**<1%**
ENDANGERED	**1-3%**
CRITICAL	**>3%**

According to FAO and Alderson (2003) criteria

If the rate of inbreeding is greater than 1%, the breed will be considered is as in danger of extinction.

If considering the census criteria, the breed was already in danger of extinction, this parameter will allow us to grade the risk.

If considering the census criteria the breed was not at risk and in spite of that, the rate of inbreeding is greater than 1%, the breed analyzed would be considered endangered.

3) **Other parameters or factors of modulation** [3]:

Some easily measurable variables are proposed, they are divided into three levels and each level is scored with 0, 1 or 2 if it is favorable, neutral or unfavorable.

Thus, the higher score obtained for a breed, the higher risk of endangerment. Those factors would allow to consider a breed in the Catalogue as endangered even if the threshold for the census criteria is slightly exceeded, but the resulting overall score is higher than 4.
Otherwise, if the score is less than or equal to 4 and the census of breeding animals is slightly over the threshold, the breed category in the Catalogue would change from breed in danger of extinction to breed in development.

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[2] $N_e=[4 \ast N_M \ast N_F / (N_M + N_F)] \ast 0.7$ and $\Delta F=1/(2xNe)$ where N_M =n°breeding males, N_F=n°breeding females. To obtain the annual inbreeding rate: $\Delta F/t$ [*t* average in years of the generation length by species (horses, asses: 8 years; cattle: 6 years; sheep and goats: 4 years; pigs: 2 years; fowl: 1year)]
[3] The existence of favourable trend will be estimated in periods of five years and shall be reflected in one or more factors of modulation.

Geographical distribution (km)[*]	>50	0	Nº of farms	>50	0
	12.5-50	1		10-50	1
	<12.5	2		<10	2
Population trend[**]	Expansion	0	Gene banking[***]	Complete	0
	Maintenance	1		Medium	1
	Recession	2		None	2

[*] In kilometres, more than 75% of the population within a radius of less than 12.5 km, between 12.5 and 50 km over 50km (GIS)

[**] According to criteria established by the FAO, it will be defined in terms of growth rate "r" [4]
- Expansion: growth rate>1;
- Maintenance: growth rate=1;
- Recession: growth rate <-1.

[***] According to criteria established by the FAO in "Guidelines for the Cryoconservation of Animal Genetics Resources":

	SEMEN	SEMEN and OOCITES	EMBRYOS
Complete	≥10.000 samples from 25 different donors	≥100 samples from 25 different male donors and 100 oocytes from 25 different female donors	≥200 embryos from 25 different donors
medium	<10.000 samples from 25 different donors	<100 samples from 25 different male donors and 100 oocytes from 25 different female donors	<200 embryos from 25 different donors
None	Gene banking non-existent		

SUMMARY

To determine if a breed is in danger of extinction, firstly the demographic or census criteria will be taken into account, either the census of breeding female or census of breeding male or the number of female replacements. If any of these 3 data would be below the limit, the breed would be considered AT RISK OF ENDANGERMENT.

Secondly, the effective population size will be examined through the rate of inbreeding. If the studied breed exceeds the limit sets for the rate of inbreeding, the breed will be considered AT RISK OF ENDANGERMENT.

Finally, if the breeding census exceed the limit in less than 15%, others modulation factors will be used to analyze the risk. If these factors are

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[4] Growth rate: r =anti-log[(log10(C1) - log10(C2)/ t], where C1and C2 are respectively the first and the second census of each breed and t the time interval in years between the two censuses, the generation length varies according to the species (horses, asses: 8 years; cattle: 6 years; sheep and goats: 4 years; pigs: 2 years; fowl: 1year)

unfavorable, it may still be considered as a breed AT RISK OF ENDANGERMENT.