

# ASSESSMENT OF THE POPULATION EFFECTIVE SIZE AND THREATS TO THE ORIGINAL BREED CATTLE IN ORDER TO PROTECT AND UTILIZE GENETIC RESOURCES IN CROATIA

P. Mijić<sup>1</sup>, T. Bobić<sup>1</sup>, V. Bulić<sup>2</sup>, I. Klarić<sup>1</sup>, M. Baban<sup>1</sup>, M. Sakač<sup>1</sup>, V. Bogdanović<sup>3</sup>

<sup>1</sup>University of J. J. Strossmayer in Osijek, Faculty of Agriculture in Osijek, Trg Sv. Trojstva 3, CRO-31000 Osijek, Croatia

<sup>2</sup>Croatian Livestock Center, Ilica 101, 10000, Zagreb, Croatia

<sup>3</sup>University of Beograd, Faculty of Agriculture, Nemanjina 6, 11080, Belgrade-Zemun, Republic of Serbia

Corresponding author: [Pero.Mijic@pfos.hr](mailto:Pero.Mijic@pfos.hr)

Original scientific paper

**Abstract:** Because of the economic, scientific and cultural interest it is necessary to protect biological diversity of indigenous breeds of animals. In Croatia there are three original cattle breeds: Istrian cattle, Slavonsko-srijemski podolac breed and Busha breed. The aim of the research was to estimate the effective size of the populations and threats to the original cattle breeds, considering that the competent authorities of the Republic of Croatia had started certain programs for their protection. The research results have shown certain positive trends that are mostly expressed in the population of the Istrian cattle. During the last few years, certain negative trends in the populations of Slavonsko-srijemski podolac breed and Busha breed have been transformed into the mild positive population trends.

**Key words:** original breed, cattle, protection, preservation, genetic resources, Croatia

## Introduction

Genetic value of indigenous breeds' cattle in Croatia was identified during the late nineteenth century when the leading experts (Povše, Adametz, Frangeš) had recognized their strengths, especially endurance, modesty and resistance. Subsequent researches (*Ogrizek, 1957; Rako, 1958*) had confirmed the advantages of indigenous cattle breeds and the need for improvements in the purebred of their production characteristics. Interest in the indigenous cattle breeds is evident through the studies in which they had been characterized by exterior appearance, genetically and by their productivity. According to *Caput and Ivanković (2006)*,

the first record about Istrian cattle was given by the Povše in year 1894, and then *Mišon and Jardas (1950)*, and later some other authors. Supporting the preservation of the genetic purity of the Busha breed *Ogrizek (1930)* states: "On the basis of data on absolute acquiescence we make conclusions about the value of our cattle. If we place these acquiescence's in relation to the costs of supporting the cattle we can see our domestic despised breed in quite another, much more favorable light". He concludes its consideration with the following words: "We should therefore discover, preserve, and improve our primitive domestic breeds". The level of threat for the population indicates the level of extinction danger of the breeds and primarily depends on the number of individuals and reproductive performance of the breed. However, apart from the number of individuals, the degree of breed threat is significantly affected by the level of similarity of reproductive effective individuals and genetic material that has been stored in liquid nitrogen (sperm, embryos, eggs, tissue). Increasing levels of rearing publication can greatly endanger self, particularly smaller population (*Alderson, 2003*). With today's galloping urbanization and less pronounced industrialization, there is a growing abandonment of rural space in Croatia. The main problem is the depopulation of wider rural area and the termination of the existing landscape due to failure of traditional agriculture and the accompanying landscape values, such as the aesthetics of space, habitats, biodiversity, ethnological heritage, and more. The most obvious indicator is the disappearance of livestock, which is far stronger than depopulation of inhabitants and represents an eco-genocide. As an example we can highlight the area of the Biokovo where in year 1926 there were over 23.000 of livestock, while today there are only a few hundred of them (*Ozimec, 2007*). Therefore, the specific protective projects should ensure the protection of all the conditions for sustainable development of original breed and increase their market value. In order to accomplish that entire one can take advantage of the touristical, educational, recreational and cultural potentials of certain natural habitats (*Franić, 2006*). According to the statements (*HSC, 2003*) in the Republic of Croatia there are three original cattle breeds: the Istrian cattle, Slavonsko-srijemski podolac breed and Busha breed.

The aim of this research was to make an effective assessment of the size of the population and determine the level of threat to the original cattle breeds in Croatia in order to protect them from their total disappearance. For such demanding operations for this cattle breed it is necessary to design effective economic programs of self-preservation and utilization.

## Material and Methods

The study included lineage indicators of the bred justly piece pf cattle pertaining to the Istrian cattle breed, Slavonsko-srijemski podolac breed and Busha

breed registered in the central register at the Croatian Livestock Center. Data analysis was performed by the use of the statistical program STATISTICS 7 (*StatSoft, Inc., 2009*). For the calculation of the effective population size ( $N_e$ ) the following formula has been used (*Falconer, 1989*):

$$N_e = 4x \frac{Nm \times Nf}{Nm + Nf}$$

Where:

Nm = number of male breed justly piece pf cattle

NF = number of female breed justly piece pf cattle

Calculation of the threat level of studied breeds was made by the international classification (FAO) that was cited by the *Alderson (2003)*. Categories are organized in that way that one breed is endangered if the number of cows falls below 3.000, and in critical condition if the number of cows is less than 100 (Table 1).

**Table 1. Numeric criteria for the category of cattle threat (expressed as the number of registered young animals per year)**

Threats and category	Number of cows in the population	Primiparous cows
Critically endangered - Category 1 (K1)	< 100	25
Endangered - Category 2 (K2)	< 300	75
Endangered - Category 3 (K3)	< 1000	250
Endangered - Category 4 (K4)	< 3000	750

## Results and Discussion

Action programs for the protection of the original cattle breed that have been initiated by the competent authorities of the Republic of Croatia had started first on the Istrian cattle in year 1994, then on the Slavonsko-srijemski podolac breed in year 1997 while the last was Busha breed protection program, which was launched in year 2003.

Istrian cattle, was formed as a working-meat breed, with modest milk yield and excellent adaptation and endurance. During the early nineties of the last century in the rearing area there were only little more than a hundred animals, mostly older and with worse propagation performances. The enthusiasms of breeders, the public consensus on the need for its preservation and considerable economic resources have restarted the negative population trend in a positive

direction. The relevant professional institutions and services (Croatia Livestock Center, Center for the reproduction of livestock in the Republic of Croatia) have been helping the breeding work especially in the sense of keeping a breeding books, collecting and distributing seeds from breeding bulls.

Results of the survey (Table 2) show that the breeding work and systematic care for this population of cattle have resulted in the shift of the Istrian cattle breed population from the group “Endangered (K2)” into the group “Endangered (K3)”. The union of breeders of the Istrian cattle breed (Savez uzgajivača Istarskog govoda - S.U.I.G., in Croatian) with headquarters in Višnjan is constantly working on preservation and protection of this breed. In year 2003 the Agency for Rural Development of Istria Ltd. was established that as a part of the livestock program has been dealing with the permanent protection of the Istrian cattle by taking advantage of the rural development of Istria. The headquarter of the organization is located in the town of Pazin (*Caput and Ivanković, 2006*).

**Table 2. View of the effective population size and threat categories of the Istrian cattle breed**

Year	Number of breeders	Number of males (Nm)	Number of females (Nf)	Effective population size (Ne)	Endangered category (FAO)
1994.		8	103	29.69	Endangered (K2)
1995.		10	124	37.01	Endangered (K2)
1996.		16	116	56.24	Endangered (K2)
1997.		22	118	74.17	Endangered (K2)
1998.	61	24	114	79.30	Endangered (K2)
1999.	65	29	133	95.23	Endangered (K2)
2000.	76	21	167	74.62	Endangered (K2)
2001.	76	19	192	69.16	Endangered (K2)
2002.	91	34	236	118.87	Endangered (K2)
2003.	94	48	277	163.64	Endangered (K2)
2004.	102	28	272	101.55	Endangered (K3)
2005.	103	18	350	68.48	Endangered (K3)
2006.	103	18	343	68.41	Endangered (K3)
2007.	109	23	414	87.14	Endangered (K3)
2008.	111	21	460	80.33	Endangered (K3)

Slavonsko-srijemski podolac is in a most adverse situation considering sustainability. Although the breed protection program was launched simultaneously with the running of the Istrian cattle protection program, maintaining of this population in a flock and on a narrower site has limited its growth and this breed is consequently still in a status of “Critically Endangered (K1)” breed (Table 3). During the last few years the establishment of the new flocks of the Slavonsko-srijemski podolac breed was started, and as a result of changes in breeding strategies in year 2005 a significant increase in the number of animals was noted. New breeding considerations include separating the population of animals in more

flocks, and continuation of the developmental programs dealing with the commercialization of this cattle breed.

According to data of *HSC (2009)* this breed is today reduced to a hundred of piece of cattle, which are owned by the Center for the reproduction of livestock in the Republic of Croatia (Centar za reprodukciju u stočarstvu Hrvatske – CZRSH, in Croatian) in Križevci (Cret economy). It is reasonable to expect a positive change in increasing numbers of this cattle breed in the area of Slavonski Brod, where in year 2007 the cooperative named “Eco Gajna” was established. The objective of this cooperative is to encourage the preservation and improvement of protected grasslands Gajna, which would be appropriate for the breeding of Slavonsko-srijemski podolac cattle breed in the system of cow-calf (*Bulić et al, 2007*).

**Table 3. View of the effective population size and threat categories of the Slavonsko-srijemski podolac breed**

Year	Number of breeders	Number of males (Nm)	Number of females (Nf)	Effective population size (Ne)	Endangered category (FAO)
1997.	1	1	17	3.78	Critic. endangered (K1)
1998.	1	2	17	7.16	Critic. endangered (K1)
1999.	1	2	27	7.45	Critic. endangered (K1)
2000.	1	2	29	7.48	Critic. endangered (K1)
2001.	1	1	37	3.89	Critic. endangered (K1)
2002.	1	1	41	3.90	Critic. endangered (K1)
2003.	1	1	49	3.92	Critic. endangered (K1)
2004.	1	1	36	3.89	Critic. endangered (K1)
2005.	4	4	64	15.06	Critic. endangered (K1)
2006.	4	3	74	11.53	Critic. endangered (K1)
2007.	4	4	98	15.37	Critic. endangered (K1)
2008.	9	9	107	33,21	Endangered (K2)

Research results for the Busha breed cows also show a large degree of threat of this breed based on its size and number (Table 4). Exterior features of the Busha breed cattle, as stated by *Ivanković et al. (2006)*, generally do not differ

significantly in relation to earlier research, but their high variability has been noted. This fact is in part significantly caused by the non-consolation of this cattle breed, non existence of the breeding guidelines during the past decades and the lack of care of the wider professional and public publicity for its being. Smaller frame, modesty and endurance are some of the fundamental attributes that make the Busha breed economically attractive in the current environment. One color, short horns, dry head and a little udder are some of the characteristic of the current Busha breed population. Modest dairy is an assumption that has yet to be confirmed. During the year 2005 the Association of the Busha breed breeders was founded in Gospić with the main goal to preserve and protect this breed from extinction. Due to this a positive shift in increasing the effective size of Busha breed population can still be expected.

**Table 4. View of the effective population size and threat categories of the Buša breed**

Year	Number of breeders	Number of males (Nm)	Number of females (Nf)	Effective population size (Ne)	Endangered category (FAO)
2003.	2	3	5	7.50	Critic. endangered (K1)
2004.	17	6	49	21.38	Critic. endangered (K1)
2005.	32	11	105	39.83	Endangered (K2)
2006.	36	11	100	39.64	Endangered (K2)
2007.	31	16	125	56.74	Endangered (K2)
2008.	45	16	172	58.55	Endangered (K2)

## Conclusion

During the early nineties of the twentieth century Croatian autochthonous breed cattle were involved in preservation programs. Farming promotion funds given to the breeders of the autochthonous breed cattle have produced some positive impacts. A systematic inventory of the state breeds respect to the population size, exterior and genetic profile was made. We can observe positive trends in the size and structure of populations, although the attained values were not sufficient for their long-term survival. Population of the Slavonsko-srijemski podolac breed and Busha breed are critically endangered. It is necessary to model the breeding strategy with granting the more clear guidelines to the mating scheme, opening the possibility of emergency “immigration” of the related genomes in order to avoid the consequences of breeding in cognation. It is necessary to urgently develop *in vitro* program (Gene bank) as a support to more active *in vivo* protection programs. It is useful to develop the programs of economical reaffirmation in order to increase the income from breeding these cattle breeds and reducing dependence on farming promotion funds. It is necessary to stimulate the

interest for the increasing of the effective number of animals by breeds with the height of financial incentives stated in the legal provisions.

## Acknowledgment

Present research was result of the international bilateral research project named "Conservation, improvement and utilization of animal genetic resources in Serbia and Croatia", financed by the Government of the Republic of Croatia and the Government of the Republic of Serbia for the period from 2008 to 2010.

## Ocena efektivne veličine populacije i opasnosti za originalnu rasu goveda u cilju očuvanja i korišćenja genetskih resursa u Hrvatskoj

*P. Mijić, T. Bobić, V. Bulić, I. Klarić, M. Baban, M. Sakač, V. Bogdanović*

## Rezime

Zbog ekonomskog, naučnog i kulturološkog značaja neophodno je zaštititi biološki diverzitet autohtonih, nativnih rasa životinja. U Hrvatskoj postoje tri originalne rase goveda: istarsko goveče, slavonsko-srijemski podolac i buša. Cilj ovog istraživanja je bio da se proceni efikasna veličina populacije i opasnosti za originalne rase goveda, uzimajući u obzir da su nadležni organi Republike Hrvatske inicirali program njihove zaštite. Rezultati istraživanja su pokazali izvesne pozitivne trendove koji su u najvećoj meri izraženi u populaciji istarskih goveda. Tokom poslednjih godina, određeni negativni trendovi u populaciji slavonsko-srijemskog podolca i buše su pretvoreni u blago pozitivne trendove.

## References

- ALDERSON L. (2003): Criteria for the recognition and prioritisation of breeds of special genetic importance. *AGRI*, 33, 1-9.
- BULIĆ V., IVANKOVIĆ A., IVKIĆ Z., ŠPEHAR M., KELAVA N., KONJAČIĆ M. (2007): Stanje i odlike izvornih pasmina goveda u Hrvatskoj. Konferencija o izvornim pasminama i sortama kao dijelu prirodne i kulturne baštine. - Šibenik, 13. - 16. studenog 2007. Knjiga sažetaka, 41-42.
- FALCONER D.S. (1989): *Introduction to Quantitative Genetics*, Ed. 3. Longmans Green/John Wiley & Sons, Harlow, Essex, UK/New York.

- CAPUT P., IVANKOVIĆ A. (2006): Trajna zaštita istarskog goveda gospodarskim iskorištavanjem u sustavu ruralnog razvitka Istre. *Stočarstvo*, 60, 3, 203-226.
- FRANIĆ R. (2006): Rural development policy – new opportunity for Croatia. *Agronomski glasnik*, 3, 221-235.
- HSC (2003): Hrvatske izvorne i zaštićene pasmine domaćih životinja. Hrvatski stočarski centar, CD medij, Ur. M. Dražić, Zagreb.
- HSC (2009): Godišnje izvješće. Hrvatski stočarski centar, Zagreb.
- IVANKOVIĆ A., ORBANIĆ S., CAPUT P., MIJIĆ P., KONJAČIĆ M., BULIĆ V. (2006): Genetska struktura i održivost populacija autohtonih pasmina goveda u Hrvatskoj. *Stočarstvo*, 60, 1, 47-51.
- JARDAS F. (1957): Prinos poznavanju spolnog života i plodnosti istarskog goveda. Prinos poznavanju spolnog života i plodnosti istarskog goveda. *Veterinaria*, 3, 109-121.
- MIŠON J., JARDAS F. (1950): Istarsko govedo. *Stočarstvo*, 4, 345.
- OGRIZEK A. (1930): Ein Rassenbild der jugoslavischen Tierzucht. Göttingen, Deutschen Gesellschaft für Zuchtungskunde.
- OGRIZEK A. (1957): Prilog poznavanju istarskog primigenog goveda. JAZU, I dio. *Acta Biologica*, I, 155-186.
- OZIMEC R. (2007): Upravljanje okolišem korištenjem izvornih pasmina i sorti. Konferencija o izvornim pasminama i sortama kao dijelu prirodne i kulturne baštine. Šibenik, 13.-16. studenog 2007. Knjiga sažetaka, 201-204.
- RAKO A. (1958): Gojdbene, toвне i kvalitete domaćeg oplemenjenog kratkorožnog goveda i istarskog goveda. *Stočarstvo*, 12, 3-4, 175-179.
- ŠIĆ R., RAKOŠ F., PUTINJA F. (1973): Sadašnje stanje reprodukcije goveda Istre s posebnim osvrtom na istarsko govedo. *Stočarstvo*, 27, 279-286.