

The distribution and inbreeding level in Dalmatian Pelican population (*Pelecanus crispus*, Bruch, 1832)

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Abstract: Although, as it already mentioned, Dalmatian Pelicans have been kept in zoological gardens over many decades, since the 80's of twenty century an intensive breeding and protection of the species began. Unfortunately, the population is relatively small. To our knowledge, no results on inbreeding rate in Dalmatian pelicans have been available in literature. The objective of this contribution was to estimate an inbreeding level in Dalmatian Pelican population in context its distribution around the world. Records of 889 Dalmatian Pelicans (extracted from SPARKS computer programme of the Dalmatian Pelican EEP studbook by Piotr Ćwiertnia - edition of 01.06.2005) were analysed. The birds studied hatched (in zoological gardens) or caught from wild between the years 1957-2005. Two approaches have been employed to estimate inbreeding coefficients (with and without pedigree information). Only 26 registered as inbred birds were hatched in three zoos (Vienna, Prague and Poznan). By far the largest share in captive population have birds kept in just two French collections. The individuals in both zoos were not pedigreed. The hypothetical inbreeding for these birds, yielded 0.13 for Villars and 0.39 for Mullhause.

Key words: Dalmatian pelican, inbreeding rate, captive breeding, population distribution

Introduction

The Dalmatian pelican distribution covers parts of southern Europe and vast expanses of Asia (Crivelli *et al.* 1991, 1997). During the XIX and XX century the numbers of these birds begin to fall drastically, mostly due to uncontrolled hunting and habitat alternation (Crivelli, 1987 after Reiser and Fuhrer, 1896; Crivelli i Vizi, 1981; Crivelli, 1984). In captivity first breeding was recorded at 1961 year at Tierpark Berlin (Grummt, 1984) regular breeding results have been obtained in the middle 80's. In the view of potential importance of captive population to conservation of this

species the European Endangered Species Program (EEP) had been initiated. Although, as it already mentioned, Dalmatian Pelicans have been kept in zoological gardens over many decades, Since the 80's of twenty century an intensive breeding at captivity (Ćwiertnia 2001). Unfortunately, the population is relatively small. Therefore, an inbreeding rate has been registered. A number of investigations was conducted on inbreeding rate and its effects in animal populations (Princee, 1998; Szwaczkowski *et al.*, 2004). To our knowledge, no results on inbreeding rate in Dalmatian pelicans have been available in literature.

The objective of this contribution was to estimate an inbreeding level in Dalmatian Pelican population in context its distribution around the world.

Material and methods

Records of 889 Dalmatian Pelicans (extracted from the Dalmatian Pelican EEP studbook by Piotr Ćwiertnia - edition of 31.12.2004) were analysed. The birds studied hatched (in zoological gardens) or caught from wild between the years 1957-2004. More details on number of individuals studied over time are given in Fig. 1. Sex structure of the population in chosen zoological gardens is listed in Fig. 2. Sex of relative large number of individuals (57% of total population) is known.

Majority of birds (73%) has unknown both parents whereas only 25% individuals have known both parents. Only one parent is unknown for 2% birds. Length of life were recorded for 370 birds. It mainly influenced by large longevity of pelicans kept in captive breeding. Lifespan of some individuals achieves 40 years. In consequences, some unrecorded individuals are likely still living. Hence, the classical analysis of relationship between inbreeding rate and longevity seems to rather difficult in the population studied.

For above mentioned reasons, two approaches have been employed to estimate inbreeding coefficients. First one is based on pedigree data, according to classical formulae given by Wright

$$F_X = \frac{1}{2} \sum_{ij} \left(\frac{1}{2}\right)^{n_{ij}} (1 + F_{M_i})$$

(1921):

where: F_X – inbreeding coefficient of individual X ; F_{M_i} – inbreeding coefficient of common ancestor M_i ; n – number of generations between parents of individual X via common ancestor. The computation was performed for 222 individuals with complete pedigree data.

Average hypothetical inbreeding coefficient was estimated based on formulae described by Wright (1931):

$$\Delta F = \frac{1}{8N_s} + \frac{1}{8N_d}$$

where: N_s – number of sires, N_d – number of dams.

This formulae was used within generations for two data sets: */ all males and females, and **/ only sires and dams. These computations were performed for four zoological gardens (Villars les Dombes, Mulhouse, Poznan and Prague).

Results and discussion

At the moment, Dalmatian pelicans are kept in 22 (?) zoological gardens. Generally, the subpopulations are considerably diversified. It resulted from management systems and genetic variability. Distribution of Dalmatian Pelican subpopulation (number of males and females) in five more important zoos is presented on Fig. 3. The greatest population of hatched birds were in Villars les Dombes and Mullhouse. It should be noted that Mulhouse's pelicans are progeny (generation F1) of Dombes' birds.

Estimated inbreeding coefficients by Wright's method included pedigree data are listed in Table 1.

Table 1. Average inbreeding level for Dalmatian pelicans in three zoological gardens

Zoo	Number of inbred birds	Average inbreeding coefficient
Poznan	9	0.250
Prague	16	0.275
Vienna	1	0.250

Only 26 inbred birds kept in three zoos (Vienna, Prague and Poznan) were registered. The individuals (8 females, 8 males and 10 individuals with unknown sex) were hatched in 1999-2000. As it already mentioned the reported number of inbred individuals was determined by limited pedigree information. Average inbreeding coefficient of total population is 0.77. However, the value is underestimated due to incomplete pedigree data.

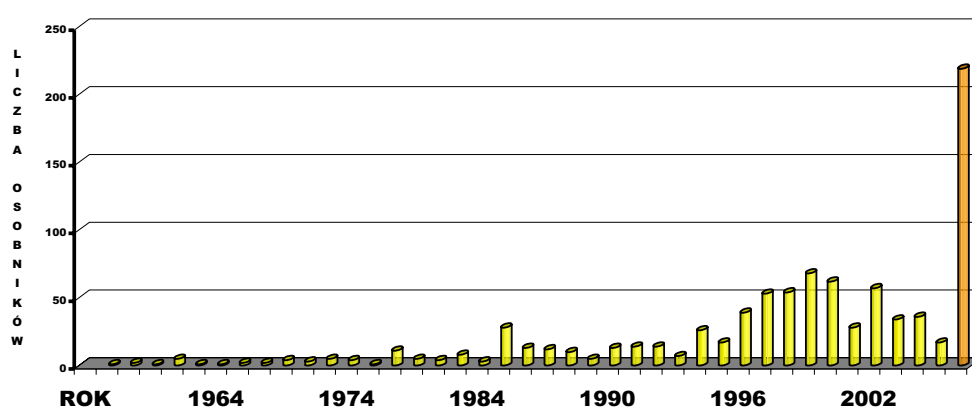


Figure 1. Number of individuals hatched in consecutive years

By contrast to above approach, second method based only on number of males and females were also employed to estimate inbreeding level. The hypothetical levels of

inbreeding over generations within four zoos were given on Figure 3. Variability of inbreeding rate was observed among both zoos and generations. The estimates of inbreeding level obtained for parents are considerably higher than ones computed for all individuals. It should be recall that the formulae omitted pedigree information.

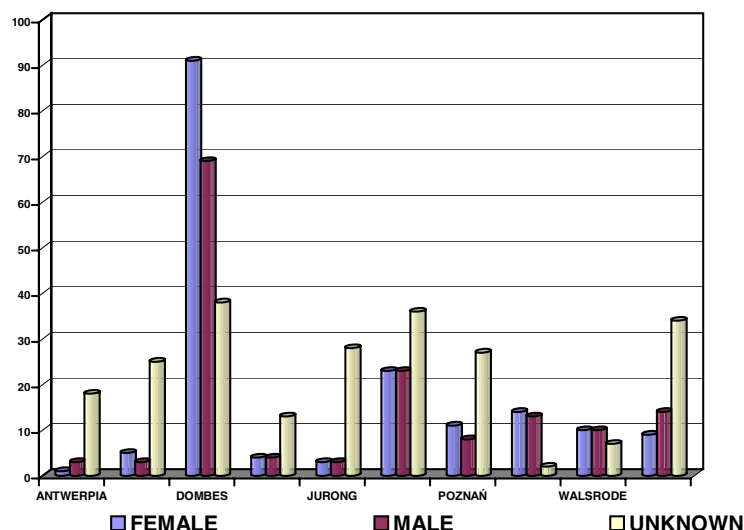


Figure 2. Number of males and females in chosen zoological gardens
(może most important?? Albo cos w tym stylu?)

As it already mentioned , by far the largest share in captive population have birds kept in just two French collections. The individuals in both zoos were not pedigreed. The hypothetical inbreeding for these birds, yielded 0.13 for Villars and 0.39 for Mullhouse. This comparatively high values may not be very worrying because due to high philopatry of the species (Catsadorakis and Crivelli, 2001). In general, there are

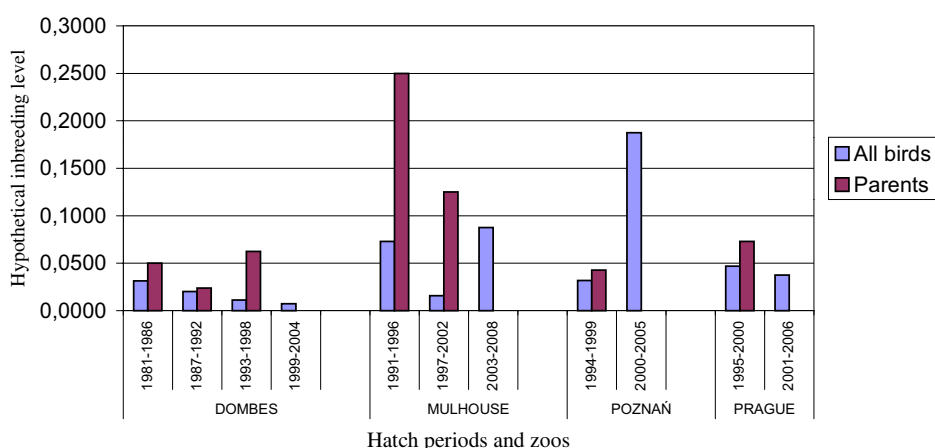


Figure 3. Hypothetical inbreeding level in of chosen zoological gardens

prominent differences in size of different subpopulations. This factor undoubtedly reflects the level of inbreeding within different groups.

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