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LIFE EXPECTANCY IN ZOO MAMMALS: WHAT A ZOO VETERINARIAN SHOULD KNOW

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Abstract

Recently several scientific publications have appeared related to the topic of longevity in mammals with a special focus on zoo animals. This presentation summarizes the findings and highlights facts which are of importance for a scientific discussion, especially when data from zoo animals are compared with data from free-ranging conspecifics. Special emphasis is given to the definition of parameters used to quantify longevity, such as survivorship, maximum longevity and mean or relative life expectancy.

An above-average life expectancy is considered a sign of successful management of zoo animals, a goal that every modern zoo strives for. Zoos enjoy a public perception that animals in their care have a "good life" free of predators, supported by veterinary care and living longer than their free-living counterparts. This assumption is supported by the fact that longevity records are most often held by zoo animals[1], which has ironically led to criticism resulting from the problems inherent in an increasing number of geriatric animals.[4]

However, scientific analyses of life expectancy in zoo animals, and whether species in zoos generally live longer than their wild counterparts have been sporadic. In several species, it has become apparent that current life expectancies in captivity may indeed be less than those of free-ranging populations. Species investigated include African and Asian elephants (*Loxodonta africana* and *Elephas maximus*), roe deer (*Capreolus capreolus*), moose (*Alces alces*), orca (*Orcinus orca*) and walrus (*Odobenus rosmarus*)[3,5-7].

Zoo veterinarians are perceived as experts by the general public in evaluating the management of zoo animals and will therefore be answering questions regarding life expectancy in captivity, as well as comparisons to free-ranging conspecifics. It is therefore important that zoo veterinarians are be able to give objective answers regarding life expectancy.

It has been hypothesized for several species that reduced longevity is influenced by the captive diet. For Asian elephants, obesity appears to be a problem, and browsing ruminants such as roe deer and moose may not receive adequate fiber sources in captivity. Müller et al.[6] found that the life expectancy of captive female non-domestic ruminants in general correlated with the percentage of grass in a species' natural diet, suggesting that the needs of species adapted to

grass can be more easily accommodated than those adapted to browse. Another impact on life expectancy is related to reproductive physiology, where captive male non-domestic ruminants of monogamous species demonstrate higher life expectancy than polygamous males, which matches observed differences of sexual bias in life expectancy in free-living populations and thus supports the ecological theory that the mating system influences life expectancy. But it should also be emphasized that Müller et al.[6] found life expectancy to be higher in non-domestic ruminants managed by international studbooks when compared with species not managed in this way.

Results on longevity cannot always be easily compared because different parameters are used. Table 1 summarizes the main parameters that are measured.

Studbook data and the International Species Information System (ISIS) represent excellent compilations of data that can be used to investigate longevities for captive animals. Data for wild populations are less available, as many fewer species have been studied in the wild for the long time spans necessary to assemble comprehensive demographic data.

In conclusion, there is no doubt that the general assumption that zoo animals live longer than their conspecifics in the wild is not entirely valid, even though studies have involved a limited number of species. It is to be expected that this pattern will continue as additional taxa are analyzed. Certain species represent a challenge for captive management and further research is required. Differences between species may be related to biological adaptations that may directly influence husbandry (such as adaptations to the natural diet), or to biological adaptations in terms of life history, which will not change in captive specimens. These differences are of importance since they emphasize different directions for further investigation.

Finally, it should be recognized that longevity is only one of many parameters by which husbandry success can be quantified.[5] High longevities are a side-effect of good husbandry coupled with sufficiently available space for maintaining geriatric animals. A long life as such may, strategically, not be as desirable in itself as a healthy population (and meta-population) with a pyramidal age-structure. However, reduced longevity can serve as an important warning parameter.

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Table 1. Commonly used parameters used to define population management success in zoo animals (modified from Clubb et al., 2008 and Clauss et al., 2010).

	Unit	Definition	Comment
Survivorship	%	1. Mortality: proportion of cohort that is alive at a defined point in time.	Allows comparison within species; comparisons between species must take differences in longevity into account.
Mortality	%	1. Survivorship: proportion of cohort that has died at a defined point in time.	Allows comparison within species; comparisons between species must take differences in longevity into account.
Maximum longevity	years	Published age record.	Data for a single animal, not representative for a population.
Life expectancy or mean life expectancy	years	Number of years an individual is expected to live; can be determined for different age classes.	Allows comparison between populations of same species.
Relative life expectancy	%	Life expectancy of a population as a proportion of the longevity record of the species.	Excludes allometric influences and allows comparison between populations of different species.