Species Survival Statistics

Summary

The Association of Zoos and Aquariums (AZA) and its member institutions (AZA-accredited institutions, Certified Related Facilities, and Conservation Partners) must frequently answer the question "How long does this species live?" Until the creation of the Species Survival Statistics Library (previously behind AZA member paywall), no science-based reference source has existed to allow the zoo community to consistently and easily communicate appropriate survival-related information on zoo and aquarium animals to the public. Using consistent language and scientific facts when discussing this topic will reduce uncertainty and eliminate contradictions. Scientists at Lincoln Park Zoo and the AZA Population Management Center (PMC), with support from the Columbus Zoo and Aquarium, have created a reference library of scientifically-valid median life expectancies based on studbook datasets for many species in AZA-accredited zoos and aquariums. **AZA recommends all members utilize the Median Life Expectancy as the primary referenced statistic for a species' typical lifespan, and use this Library as the primary reference for those median life expectancies.** These statistics will be updated quarterly and the most up-to-date data will be available at www.aza.org/species-survival-statistics.

Median life expectancy is the appropriate way to communicate about how long a typical individual of a given species lives. For context, the median life expectancy from age one for humans in the U.S. is 77.5 years and the maximum longevity (documented worldwide) is 122 years. This means that assuming that we live to our first birthday, about half of the human population will die before 77 and half will die after. Very few people can expect to reach 122. If we discuss the age of a particular individual in relation to the maximum longevity, it could cause confusion because very few individuals live that long. For example, a person that lived to age 82, well exceeding the median life expectancy, should not be characterized as having died young for failing to reach 122, the maximum longevity.

Please read the Frequently Asked Questions/How To Guide for more details on how to interpret the table of median life expectancies, which is available below, and the full Survival Statistic reports, 4-5 page reports that give more details on the statistics calculated for each species. AZA-accredited institutions may request these reports by e-mailing animalprograms@aza.org. If this is an emergency outside of normal business hours, contact Rob Vernon (rvernon@aza.org), Senior Vice President, Communications and Marketing. If there are any questions, please submit them to animalprograms@aza.org.

SPECIES SURVIVAL STATISTICS LIBRARY – FREQUENTLY ASKED QUESTIONS AND HOW TO GUIDE

8. **How to use this information in a press release**
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Why is there a need for standardized statistics on survival?

The Association of Zoos & Aquariums (AZA) and its member institutions continue to develop a clearer way to answer the question "How long does this species live?" Although death is inevitable for all animals, there can be uncertainty about how to appropriately communicate survival-related information to the public. It is particularly difficult to place an individual death in the context of what is typical for the species. Assessments of whether an individual animal was young, middle-aged, or old often vary greatly depending on perceptions and the data source used. Moreover, imprecise and inconsistent use of common terminology such as life expectancy, life span, and longevity can lead to a confusing, and sometimes contradictory, range of 'answers.' The survival statistics provided in this library can assist in reducing uncertainty, eliminating contradictions, and supporting AZA members' knowledge and expertise in animal care.

What are the most appropriate survival statistics to use?

The Survival Statistics Report focuses on the **Median Life Expectancy (MLE);** half the individuals in a population die before reaching the MLE, and half live longer than the MLE. The MLE in the report is calculated excluding the first year of life, which, for many species, often involves high risk of mortality (both in zoos/aquariums and in the wild). **AZA recommends that members utilize the MLE as the primary referenced statistic for species longevity.** The Library table contains each species' MLE, when it can be calculated.

The more detailed full report also provides, for context, the **Maximum Longevity**, which is based on the maximum age of an individual in the dataset – an outlier. In any population, both in zoos/aquariums and in the wild, very few individuals will live as long as the maximum longevity. For context, the median life expectancy from age one for humans in the U.S. is 77.5 years and the maximum longevity for humans (documented worldwide) is 122 years[1].

The full report includes example language for how to understand and interpret these statistics.

Are the statistics in the report are accurate?

The statistics in these reports are specific to animals in zoo and aquarium populations and are based on either a species studbook or a subset of data from Species360 (formerly ISIS) if no studbook exists. Even though these datasets are very high quality, following individual animals from birth to death, they are often still small in the context of analyzing survival patterns. High quality estimates of median life expectancy can require at least hundreds of animals followed from birth to death. To ensure that the estimates given are based on reliable datasets, the analysis includes data quality checks to determine

[1] Median life expectancy for people is estimated, excluding 1st year mortality so that methods are parallel with those used in the Libarry, from: Xu, Jiaquan, Kochanek KD, Murphy SL, and Tejada-Vera B. 2007. Deaths: Final Data for 2007. National vital statistics reports; vol 58 no 19. Hyattsville, MD: National Center for Health Statistics. Jeanne Calment of France was the oldest documented and fully validated human and died at 122 years and 164 days; from: http://www.grg.org/Adams/Tables.htm. Accessed August 9, 2007.

whether data are robust enough to make reliable estimates of the survival parameters above. If a dataset does not pass the data quality tests, the report reflects there are not enough data to report reliable statistics. Also note that the statistics are specific to animals held in zoos and aquariums in the geographic region referenced in the report (typically either AZA or North America); different regional populations or different subsets of data may display different patterns in survival data.

How to use the median life expectancy at a zoo or aquarium

Use the median life expectancy when:

1) Planning ahead for communicating about animal deaths – if ages of the animals in a zoo or aquarium are greater than the 25% survival rate (i.e. only 25% of individuals live past that age) that is typically included in the full report, they can be viewed as elderly or geriatric (although it may not mean that, health-wise or behaviorally, the animals is necessarily experiencing problems).
2) Preparing to talk with the media about a death of an animal, to put that animals' death in context of what is typical for the species. It is also recommended to have the full report for your reference in this instance.
3) Determining what statistics to use on signage, on website species fact sheets, in education programs, and in response to visitor questions.

How to use the table of median life expectancies provided on this website

The table available on this website summarizes the MLE for all populations that have been analyzed. For each species, it reports either

1) sex-specific MLEs - male and female statistics are reported separately if there are very different survival patterns between the sexes,
2) a single MLE – if male and female survival patterns are not different, data are pooled to increase sample size and a single value is reported, or
3) "data deficient" – if an entire dataset (both sexes) or a subset of data (one sex only) fails a set of data quality tests, there is not an accurate MLE and this is indicated.

Note: Once data for a species becomes available or as updated data are received, results will always be uploaded to http://www.aza.org/species-survival-statistics. Always check there for the most up-to-date statistics.

See the full Survival Statistics Reports for more details for each species.

How to use a species' full Survival Statistics Report. What is included?

For species of interest listed in the table, you can request a full Survival Statistics Report by submitting your request to animalprograms@aza.org. If this is an emergency outside of normal business hours, contact Rob Vernon (rvernon@aza.org), Senior Vice President, Communications and Marketing.

The full report includes:

1) MLE, Maximum Longevity, First-year (infant) survival, 25% survival (age which only 25% of individuals live past), if these statistics can be calculated/reported
2) Results of the data quality tests – the report includes five data quality tests. If one or more of these tests are failed, MLE and other statistics cannot be reported and the species is considered data deficient; in this case, the report will list the oldest individuals in the studbook for general reference
3) Background and context for how to interpret the statistics
4) Details on the dataset, including sample size, timeframe of data included, and data quality evaluations
5) Details on the data source (studbook name, studbook keeper, people who completed the analysis and reviewed the report)

Due to the complex, technical nature of these reports they are intended for internal use by professionals in the zoo and aquarium community to assist in the preparation of press releases, signage, program scripts, etc. If members have any question during this preparation, please contact animalprograms@aza.org, who can put you in contact with the scientist who completed the analysis.

How to properly cite a single report or the entire library

Single Survival Statistics Report:
SSP Coordinator Name, Studbook Keeper Name, Advisor Name, Report Year. Descriptive Survival Statistics Report for Species Common Name (*Species Scientific Name*). Chicago (IL): Lincoln Park Zoo.

Example:
Torregrosa, K., Litton, M., Andrews, J. 2016. Descriptive Survival Statistics Report for Chinese Alligator (Alligator sinensis). Chicago (IL): Lincoln Park Zoo.

Entire Survival Statistics Library:
Survival Statistics Library [Internet]. Chicago (IL): Lincoln Park Zoo/AZA Population Management Center; 2008 - [accessed September 1, 2017 Sept 1]. Available from https://www.aza.org/species-survival-statistics

How to use this information in a press release

This information can be used in press materials when announcing the loss of an animal in the institution's collection. For example, here is a sample press release issued by a zoo after making the difficult decision to euthanize its male African lion:

Zoo Bids Farewell to King of Urban Jungle
African lion euthanized today

The Zoo is saddened to report that animal care staff made the difficult decision to euthanize a geriatric male African lion due to progressively deteriorating health and quality of life.

The lion was 18 years old and lived at the zoo since 1995. The median life expectancy for African lions is approximately 16 years.

Over the years he sired six cubs. Guests of the zoo often remarked that seeing him was a highlight of their visit….

The lion was one of many geriatric animals living at the Zoo. With advances in veterinary medicine, nutrition, and husbandry techniques, animals are living longer in zoos and aquariums around the nation. As a result, managers and care takers develop new ways to address the unique needs of geriatric animals.

When to use the maximum longevity

AZA recommends only using the maximum longevity in a follow-up question after providing the median life expectancy. This can be challenging, as the maximum value often seems to be the one that is easiest to recall, and often when zoos and aquariums have talked about species longevity in the past phrases such as "this species **can** live as long as X years," have been used. Remember that if someone asked how long a human lived and the answer was "as long as 122 years," most people would recognize that it is very rare to live that long. If someone follows up about the median life expectancy with a question about the oldest age that an individual of that species has lived to, it may be appropriate to use the maximum longevity. Because the maximum longevity can change quickly, especially if it is based on a living individual, it is good practice to double-check with the AZA Studbook Keeper before reporting it formally.

An example press release statement for this type of circumstance:

SNOW LEOPARD statement

The Zoo is saddened to report on July 2, 2008 animal care staff made the difficult, but humane decision to euthanize a geriatric female snow leopard. The leopard had chronic renal failure and severe degenerative joint disease which recently resulted in lameness in her hindquarters.

The leopard was 19 years old and lived at the Zoo nearly her entire life. Of the 136 snow leopards living in AZA-accredited zoological facilities, she was the oldest living leopard in any AZA-accredited zoo in the United States, which is a testament to the exceptional care she received her entire life here at the Zoo.

Snow leopards are a rare and endangered big cat native to high, rugged mountains in Central Asia. The median life expectancy of snow leopards in zoos is approximately 11 years and only 25% live to the age of 17.

The leopard was one of many geriatric animals living here. With advances in zoo medicine, nutrition, husbandry techniques and exhibitory, animals are living longer in zoos and aquariums around the nation posing new challenges for zoo managers and care takers. Although she lived a long, full life here, it recently became apparent that disease and pain were severely diminishing her quality of life and euthanasia was a difficult, but appropriate decision.

The Zoo family is saddened by her loss.

How to talk about a species where the report indicates there are not enough data (data deficient)

As MLE is not calculated in the library for any data deficient species, in a press release MLE would not be able to be included. If asked, suggested language includes:

"Because this species' population size in zoos and aquariums is small and they have not been in zoos long

enough, there is not enough information right now to give an accurate statement about how long this species typically lives in AZA-accredited zoos and aquariums. As zoos and aquaria continue to work collaboratively and gather data, we will likely be able to determine this for this species in the future. "

Estimates that are given on other websites, even other potentially credible sources, are often based on maximum longevities (e.g. this species can live "as long as" X years) or more general estimates, rather on statistical analysis of datasets that follow animals from birth to death.

How accurate will these reports be over time?

More data will accumulate in species' studbooks over time and the results in these reports will likely change if the analyses is repeated 10 years from now (or sooner for some species). Specific parameters are affected differently:

1) Median Life Expectancy: this should be fairly stable for populations that have been maintained in zoos and aquariums for a long time, and should be especially stable for species with short maximum longevities (data accumulate more quickly for such species). For species that are long-lived and have not been bred in human care for very long, the MLE might change slowly over time as more adults have the opportunity to live through the oldest age classes.
2) Maximum Longevity: this may increase over time. If the maximum longevity is based on a living individual, this parameter will be "out of date" as soon as it is generated and until that individual dies. This value will be likely to change if the animal is a long-lived species that has only recently been kept in AZA zoos and aquariums. If you have an animal that is at or greater than the maximum longevity in the report and would like to know where it falls within the current population's oldest animals, contact the species' Studbook Keeper to check the oldest individuals.

The Survival Statistics Library is updated quarterly, with new species added and existing species updated as the AZA Population Management Center plans for each species (but note that all species are not updated at each quarterly update). The most up-to-date library is available at http://www.aza.org/species-survival-statistics.

How does this compare to how long animals live in the wild?

It is very difficult to study wild populations with the level of detail needed to generate survival curves or estimate accurate median life expectancies for the wild population. To do this, field researchers have to find individuals at birth or at known ages, and then study those individuals over the course of their entire lives. The researcher would also have to follow a large enough sample of individuals (hundreds to thousands) to make the estimate statistically accurate. This is especially challenging for long-lived species, whose life spans would easily surpass the career of a scientist studying the species. For most species, the best opportunities to estimate longevity are with data from zoos and aquariums.

There are only a few peer-reviewed studies that illustrate examples comparing wild and zoo/aquarium datasets for a handful of species, including:

Lynch, H, S Zeigler, L Wells, J Ballou, and W Fagan. 2010. "Survivorship Patterns in Captive Mammalian

Populations: Implications for Estimating Population Growth Rates." Ecological Applications: 20(8): 2334-2345.

- This analysis found that adult survivorship (from the age at sexual maturity) was higher for zoo-based populations than wild populations in seven species of mammals. Juvenile survivorship (defined as birth until sexual maturity) showed no clear trend, with some zoo populations having higher, lower, or indistinguishable rates compared to those of wild populations.

Müller, D. W. H., J.M. Gaillard, L. B. Lackey, J.-M. Hatt, and M. Clauss . 2009. "Comparing Life Expectancy of Three Deer Species Between Captive and Wild Populations." European Journal of Wildlife Research 56, no. 2: 205–208.

- This analysis compared data from red deer, roe deer, and reindeer between world-wide data in the ISIS dataset and long-running field studies of the three species. The authors found that life expectancy from the age at female sexual maturity was higher in zoo-based reindeer and red deer populations, but roe deer had lower life expectancy.

Tidiere, M. et al. Comparative analyses of longevity and senescence reveal variable survival benefits of living in zoos across mammals. Sci. Rep. 6, 36361; doi: 10.1038/srep36361 (2016).

- This analysis compared life table data from zoo and aquarium mammal populations (data from Species360) and data from wild populations (published in the peer-reviewed literature). The authors using metrics of longevity, baseline mortality, onset of senescence, and rate of senescence for 59 mammalian species in zoos and in the wild. The authors found that in 84% of the species analyzed, zoo animals of both sexes lived longer than wild animals of the same species.

Each of these types of analyses uses slightly different metrics, and there are complex statistical properties of the databases used that mean AZA can't make comprehensive statements about whether all animals in zoos and aquariums live longer than their wild counterparts. Zoos and aquariums do, however, reduce or eliminate predation and human/wildlife conflict, provide optimal food resources, and have excellent veterinary care. As predation, human/wildlife conflict, disease, and food limitation are often causes of mortality in wild populations, populations in zoos and aquariums likely have reduced selective pressures compared to the wild, and can hypothesize that for many species they may live as long as or longer than their wild counterparts.

How did these reports come about? Who generates them, and what data are they based on?

Through an AZA Conservation Endowment Fund grant to Lincoln Park Zoo in collaboration with Minnesota Zoo, AZA supported the development of a scientific framework for 'how long animals live.' This framework is built into analytical routines in PopLink software (www.lpzoo.org/poplink).

The survival statistics in the report are based on the same data that are used to manage AZA's Species Survival Plans® (i.e. studbooks) when those exist. For species without studbooks that have reports in the

library, a representative sample of data from International Species Information Systems (at the time data were extracted; now Species360) for the species utilized. The reports include details of the data source.

Completion of reports for an initial set of approximately 100 species was part of a joint project between Lincoln Park Zoo and Columbus Zoo and Aquarium. The Library is currently maintained and updated by Lincoln Park Zoo and the AZA Population Management Center. The PMC Population Biologists, as well as PMC Adjunct Population Biologists, generate updated reports as they go through the planning process for Species Survival Plan Programs.

What if a species isn't in the library?

Funding to generate reports for an initial set of species was generously provided by the Columbus Zoo and Aquarium and Lincoln Park Zoo. Now, there are several hundred species included in the Survival Statistics Library. Some species are not in the library because they do not currently have appropriate demographic data to accurately analyze and produce a Survival Statistics Report; more data may need to accumulate before they can be assessed. If you are interested in a report for a species not currently in the library, please email a request for that species (with scientific name) to conservation@aza.org.