Vision document for the EAZA Biobank

Towards EAZA-wide DNA biobanking for population management

Vision

The EAZA membership will establish dedicated biobanking facilities for the European zoo community. This biobank aims to be a primary resource for genetically supporting population management and conservation research.

Introduction

The success of EAZA ex situ programmes relies on intensive demographic and genetic management of animal populations. Currently, the majority of genetic management in zoos is individual, pedigree-based management. This often causes problems because for many populations pedigree records are incomplete and relatedness of founders is built on assumptions. Furthermore, many species still have taxonomic uncertainties and for others, their natural history does not lend itself to individual pedigree based management (e.g. group living species). DNA-analysis is a key tool to improve knowledge of a population's genetic make-up and furthermore ensure that, as far as possible, captive populations represent the genetic diversity of the wild counterparts. Thus, DNA-analysis holds great impact on animal health and welfare. In recent years, molecular genetic techniques and tools have become readily available to the zoo and the conservation communities alike. The ongoing technological advances coupled with decreasing prices will create additional opportunities in the near future. But only if genetic samples are available can we make use of these opportunities and open up for a huge range of possibilities for the use of molecular genetics to help improve future management of EAZA ex situ programmes. Adding a genetic layer to a studbook will provide information such as origin and relatedness of founders, which was previously built on assumptions, and help resolve paternity issues. Genetically identifying the origin of individuals can help set up the correct breeding groups and reviewing the programme genetically using PMx will increase its chance of success.

However, before we can start using molecular genetic tools for population management it is pivotal to establish a centralized Europe-wide DNA repository. This bio-bank will aim to hold DNA/tissue/genetic material from all animals in EAZA, and be designed such that samples are stored properly, securely, and are available for genetic analyses to benefit intensively managed populations. We are aware that such a biobank does create interesting research opportunities ranging from being relevant for population management (e.g. veterinary molecular diagnostics and/or adaptive processes) towards more scientifically fundamental research questions.

Why do we need a centralized Biobank?

Biobanks are well-organized resources comprising biological samples such as blood, serum, tissue, whole specimens or simply DNA, in association with information regarding the sampled individual. Globally, already millions of samples with related data are held in different types of collections that are accessible to scientific investigation. Within the zoo community, initiatives like the Frozen Zoo and the Frozen Ark collect genetic material from various zoos, and some individual zoos have established collections of samples that have potential to be more widely accessible. Given the expanding needs

and possibilities for the use of molecular tools in population management it is advisable to move away from an ad hoc and DIY tissue collection, to a more professional service ensuring optimal and long term storage of high quality material that will significantly impact on future population management and conservation research.

Towards 2020, the aim is to have four banking hubs for the EAZA community in Antwerp Zoo, Royal Zoological Society of Scotland (RZSS), Institute for Zoo and Wildlife Research (IZW) and Copenhagen Zoo, each of whom currently have adequate facilities and staff available to initiate a centralized EAZA biobank. The general principle will be that these hubs will keep, curate and register samples of all individuals sampled. This network of hubs will exist currently and zoos are encouraged to send samples to Antwerp Zoo, RZSS, IZW or Copenhagen Zoo, dependent on country:

Antwerp hub: Belgium, France, Greece, Israel, Italy, Luxembourg, The Netherlands, Turkey

Contact: Dr. Philippe Helsen (Philippe.Helsen@kmda.org),
Centre for Research and Conservation
Royal Zoological Society of Antwerp
Koningin Astridplein 20-26
2018 Antwerp, Belgium

Edinburgh hub: Ireland, Kuwait, Qatar, UAE, UK

Contact: Dr. Helen Senn (HSenn@rzss.org.uk)
Royal Zoological Society of Scotland
WildGenes Laboratory
134 Corstorphine Road
Edinburgh EH12 6TS, UK

Berlin hub: Austria, Croatia, Czech Republic, Germany, Hungary, Poland, Russia, Slovakia, Slovenia, Switzerland, Ukraine

Contact: Dr. Jörns Fickel (FICKEL@izw-berlin.de)
Department of Evolutionary Genetics
Leibniz Institute for Zoo and Wildlife Research (IZW)
Alfred-Kowalke Strasse 17
10315 Berlin, Germany

Copenhagen hub: Denmark, Estonia, Finland, Latvia, Lithuania, Norway, Portugal, Spain, Sweden

Contact: Dr. Christina Hvilsom (ch@zoo.dk)
Copenhagen Zoo
Roskildevej 38, PO.Box 7
2000 Frederiksberg, Denmark

Once a year in January the four hubs will split samples in duplicates and transfer samples between them for storage safety reasons.

Type of samples needed

Ultimately the aim is to collect samples from all individuals of EEP populations and species which are under consideration for a programme in the biobank. Samples must be of sufficient quality and quantity to allow a wide range of genetic analysis techniques to be employed over the long-term. Ideally every animal is sampled at least once during routine veterinary practices (or during autopsy) for the purpose of DNA biobanking -See sample document in Appendix I. Currently, only a very small fraction of animals are sampled upon death (<10%). The remainder are disposed of without sampling. The number one priority is to increase the proportion of sampling, as they will be valuable sources of information for the management of the extant populations, e.g. to estimate founder relatedness. Specific protocols for sampling during veterinary procedures or upon death, details of transportation, etc. are developed and made available to the zoo community.

Teaching people to sample

Informing the zoo community about the importance of DNA-analysis for the management, health and welfare of their animals will have to be given priority, in order to increase the sampling. Most veterinarians take EDTA blood, but after counting leukocytes to help set a diagnose they throw out the remaining material containing the DNA. Instead of perceiving EDTA blood as useless, attention needs to be given to inform about the usefulness of EDTA blood for genetic purposes. Furthermore, if serum samples are linked to a genetic sample, it will enable medical/ epidemiological research of interest for the veterinarians, which hopefully will encourage more veterinarians to take genetic samples.
Remarkably often, the wrong collection tubes are used, not labelled properly and samples are stored and shipped improperly. In order to overcome these challenges, we need to present good projects illustrating the importance of genetics at e.g. International Zoo veterinarian conferences, write articles to EAZWV newsletter and ensure proper sampling protocols.

Transfer of samples

Protocols for the transfer of samples to the biobanking hubs will be provided (Appendix I) as well as information on permits, documents etc. The shipping costs will need to be covered by the sending institutions.

Funding

Initial storage facilities, consumables and curator time will be provided by Antwerp Zoo, RZSS, IZW and Copenhagen Zoo. Towards 2020, the infrastructure itself does not pose additional costs as it is already available in these institutions, and is thus considered as zero in economic terms. When the EAZA Biobank exceeds existing capacities, additional funding will be applied for to provide long-term storage facilities with dedicated curator(s) who will be responsible for the collection and archiving, database organisation, and for shipping costs.

Database development

Antwerp Zoo, RZSS, IZW and Copenhagen Zoo have existing database systems which are both compatible and easily accessible. We envision using ZIMS as the future registration database for the Biobank enabling EAZA members to easily gain an overview of samples deposited in the EAZA biobank and get notified of sample usage and extract reports of samples on request. This will require a re-design of the existing Sample Storage option in ZIMS, which will be developed in collaboration with Species360 and other biobanking stakeholders. The information collated in the existing databases will also be transferred to this Biobank registration module in ZIMS. Recording of samples by individual institutions needs to be possible within the Biobank registration module in ZIMS, which should allow an immediate

link with individual data collected within ZIMS. Non-ZIMS user will provide information to the hub they send their samples to and they will then ensure to register the sample in ZIMS. Furthermore we envision linking the Biobank samples to information on assays performed on the samples and links to where data is stored (NCBI; sequencing archive etc).

Biobank Working Group

A Working Group has been established with representation from EPMAG/ EAZA Research Committee / EEP committee and others. The Working Group will be responsible for and providing advice on:

- species prioritization for banking and defining criteria for species sampling
- development of Standard Operating Procedures, and identifying best applicable protocols and methodology
- conditions for storage and ownership
- evaluation of sample usage (e.g. based on urgency for management / relevance of proposals)
- expanding the network of collaborators
- funding opportunities

EAZA Biobanking Working Group members as of 2016:

- Christina Hvilsom (Copenhagen Zoo) – chair
- Zjef Pereboom (RZSA Antwerp Zoo, Centre for Research and Conservation / chair EAZA Research Committee, liason to EEP committee)
- Helen Senn (RZSS Wildgenes)
- Danny de Man (EAZA Executive Office liaison)
- Tania Gilbert (user group)
- Phillipe Helsen (RZSA Antwerp Zoo, Centre for Research and Conservation)
- Jörns Fickel (IZW)
- Andrew Kitchener (National Museums of Scotland)
- Imke Lüders (liaison to EAZA Vet Committee and EAZWV)
- Baptiste Mulot (liaison to EAZWV)

Collaborators

Collaboration with AZA and ZAA is being discussed; both regional associations already have equivalent initiatives, but those are not specifically aimed at collecting genetic materials for population management purposes. Additional collaboration and/or networking (e.g. with the Global Genome Biodiversity Network, Frozen Ark/Frozen Zoo, local universities/museums) are being discussed.

EAZA Biobank documents

1) Protocols for sampling, storage and shipping
2) Guidelines for curation, record management and institutional storage (small scale) – records, spare freezer (draft pending..)