

Ex Situ Population Management Tools Working Group UPDATE

2008 CBSG Annual Meeting, Adelaide, Australia

Working Group Update: July 2009

Several recent assessments of the status and sustainability of mammalian and avian *ex situ* populations managed through studbooks and cooperative programs such as the AZA Species Survival Plans[®], EAZA European Endangered Species Programmes, and ARAZPA Australasian Species Management Plans have drawn attention to the inability of many programs to be able to achieve their population goals. The likely causes are multi-fold, and may include technical limitations as well as biological, logistic and socioeconomic factors. With the increasing pressures of climate change, habitat loss, disease and other pressures on wildlife populations, the need for effective *ex situ* management will likely increase. Now is the time to re-evaluate current methods, tools and data, and develop a strategy for addressing the challenges of *ex situ* population management.

To address these issues, a wide range of individuals with varying perspectives on *ex situ* population management were invited to participate in a working group at the 2008 CBSG annual meeting in Adelaide; those who were not able to attend were invited to contribute their thoughts and relevant briefing materials for consideration at the working group sessions. The working group used this information as a basis to develop a more complete list of issues on the complexities, constraints and challenges of *ex situ* population management (PM). A list of current PM tools and those under construction (primarily ZIMS and PMx) was generated to identify which tools might be able to address some of the PM issues. The working group discussed some initial action steps to address a few of these issues. Below is a summary of these issues (grouped into conceptual, technical and people issues) and recommended actions along with a brief update on activities documented since October (see complete working group report for more details on issues and tools).

Conceptual Issues

These issues address four major concerns:

1. Impact of changing environment on *ex situ* programs
2. Need for prioritization given increasing demand and limited resources for *ex situ* programs
3. Linking *in situ* and *ex situ* conservation activities to benefit both
4. Increasing the effectiveness of *ex situ* population management

The specific issues identified prior to and during the working group meeting are:

- Plasticity – the need to reevaluate management units in the face of a changing environment
- Increasing need for population management
- Need to manage more species as sustainable captive populations (for exhibition or as insurance populations)
- Scale of problems of captive propagation. – targeting flagship species for best outcomes
- Tools needed for linking *in situ* and *ex situ* conservation efforts
- Recognition of expertise outside of the zoo industry
- Optimizing relationships between conservation partners for best outcomes in the wild
- Limited funding for *ex situ* management and for support of *in situ* conservation
- Lack of communication/insufficient accessibility of data between zoo and field
- Lack of awareness by visitors and public on role of *ex situ* management
- Euthanasia as a management tool

- Exhibit design/size/capacity – not optimal for reproductive success
- Differences in husbandry standards/practices within programs
- Insufficient founders / founder availability
- Inadequate population growth rates
- Insufficient *ex situ* carrying capacity

Progress: The issue of sustainability of current ex situ managed populations is of concern and is being explored by several regional zoo associations, including ARAZPA, EAZA and AZA. AZA recently established a Task Force specifically to address this issue.

Tools: Existing modeling tools available to aid in assessing population sustainability/viability and the relevant impact of various management strategies include PM2000/PMx (for deterministic projections) as well as stochastic models that can incorporate specific pedigree and age-sex structure information (Vortex and ZooRisk).

Technical Issues

These issues primarily address factors affecting the effectiveness of population management, including aspects of data collection and analysis, tools for collection and analysis, and the development of new or modified management strategies to improve population viability and promote the achievement of program goals. Issues identified by the working group primarily fall into the general categories of:

1. Group management
2. Unknown or inaccurate data
3. Mate choice implications
4. Reproductive / health issues (including inbreeding, sustainability, breeding success)
5. Metapopulation management

Specific identified technical issues (and associated tools / actions) are:

- Group management issues:
 - a. Collecting the right data

Tool: To be addressed by ZIMS release 1

Action: ZIMS data specifications are needed so we can start to collect data now. ZIMS – Excel import interface hopefully will be possible. The guidelines for amphibian population management (AArk guidelines) can be tweaked to create general group management guidelines (CBSG to facilitate).

Progress: Discussions have occurred with the EAZA Aquarium committee and EPMAG to think about the design of a simple Excel or Access database that could be used as a trial for group pedigree data entry pending the release of ZIMS. The test database has not yet been built, as we are looking for someone with the programming skills and time to do it. To our knowledge, no progress has been made on using the AArk guidelines to create general group management guidelines.

- b. Dealing with unknown pedigree

Tool: PMx will provide multiple tools and options for dealing with gaps and uncertain parentage data in group pedigrees.

c. Genetic management of groups

Tool: PMx will provide the ability to do simple genetic calculations on group pedigrees, but incorporating into PMx the more sophisticated analyses of the sort that are in the Zoological Society of London (ZSL) software is still only a wish for the future. Also, at this time we do not yet have a database that can provide group pedigree data to PMx. ZIMS will provide this, and discussions are underway with ZSL colleagues to develop exports of group pedigree information from their software to PMx.

d. Incorporating known data into genetic management

Tool: PMx will provide the capability to use information on possible source populations.

e. Better management guidelines and supporting tools for increasing gene diversity and decreasing the rate of inbreeding

Tool: To be addressed by PMx

Progress: Some tool development is being conducted by Paul Pearce Kelly and colleagues at the London Zoo. Several other groups of individuals are also dealing with group management issues. EAZA fish specialists are working with Bob Lacy and Kristin Leus to developing a simple spreadsheet or database that will feed into PMx and ZIMS group management (see above).

- Dealing with unknown pedigree

Tool: PMx will provide multiple tools and options for dealing with gaps and uncertain parentage data in pedigrees.

- Incorporating molecular genetic data (interpretation of data is not clear cut)

Tool: Data collection to be addressed by ZIMS release 2

- No guidance in relative importance of molecular data vs studbook data

Tool: PMx might create a tool that does this (probably will not be available in PMx version 1, but is planned to be incorporated in future upgrades).

- Incorporating genetic history of population into management strategy

- Unknown inaccuracies in pedigrees

- Hybrids discovered too late – how to handle, how to prevent situation (currently do not check for hybrids early).

Tool: ZIMS will trace back taxonomy in the pedigree.

Action (CBSG): Develop a process to determine this before too late. Think about guidelines for insurance populations or rescue populations. Guidelines for confirming taxonomy (ask Heribert Hofer) and for breeding management. Amphibian ARK could be approached for a model for this and develop guidelines for starting a new captive population of a taxon, including taxonomic assessment, reference issues, and databank. Population-specific and species-specific. Guidelines on what to do have not been developed.

- Implications of mate choice on population management, including:

- a. Mate choice as a different management strategy for genetic management

- b. Mate choice interference with breeding pair success

- c. Effect of population management on altering mate choice

Action: It would be valuable to bring together the many colleagues who are interested in mate choice – could be a working/discussion group within CBSG or organized by CBSG. CBSG

could promote mate choice issues as a trial for using the mass collaborative tool to find out what people are working on (maybe as an electronic forum on mate choice issues). Liaison with Onnie Byers re: development of mass collaboration tools for this issue. Caroline Lees will initiate this and will talk to Cheryl Asa and Heribert Hoffer.

Progress: An IMLS grant proposal has been submitted by Cheri Asa and colleagues (from the Saint Louis Zoo, Chicago Zoological Society, CBSG) to conduct a series of three workshops focusing on mate choice within the context of managed breeding programs. The purpose is to compile relevant information and research on mate choice, identify representative taxonomic models, and design research projects to assess the impact of mate choice on reproductive success in those taxa. The first workshop will be held in Saint Louis on 4 October, immediately following the 2009 CBSG annual meeting. Interested individuals may contact C. Asa (Saint Louis Zoo).

Tool: Once the CBSG MySite tool is established, the CBSG Member Site on the ISIS portal may provide a forum for continued collaboration.

- Mating system issues providing challenges for genetic management – sperm competition, parthenogenesis (e.g., Komodo monitors), extra pair copulations (differential parentage within litter), chimeras – mosaic genetic cells (e.g., tamarins).

Tool: Information on genetic mechanisms other than standard sexual reproduction (e.g., cloning, parthenogenesis, haplodiploidy) is not currently collected within most studbooks. ZIMS data standards for sex and parents are complete enough to handle these situations; thus, if the mating system is known, there will be mechanism for recording it in ZIMS. The Partula snail program, which handles groups, does take into account selfing or sexual reproduction. PMx will be able to use information on parthenogenesis, clones, selfing, and other mating systems, and will complete all of the standard genetic analyses for these cases. Even chimeras can be handled by assigning multiple parents to an animal.

- Problems related to aggression, temperament
- Measuring breeding success – inadequate records

Tool: To be addressed by ZIMS

Action: Need to compile information on who is doing this (including which regions) and disseminate this information. Good route would be to go through the regional conservation management committees – ARAZPA put together a body of text on tracking breeding success within ASMP programs (Roz). Also need to find out how ZIMS will be doing this. CBSG (KTH) to approach the WAZA Committee on Population Management (former CIRCC) for interest in coordination of this project.

Progress: CPM is not interested in formally coordinating the compilation of this information and suggested that K. Traylor-Holzer handle it. Below is a summary of the information collected thus far:

1. ARAZPA has been tracking breeding success for every ASMP program since 1999-2000. Data are currently maintained in Word, with anticipation that this will eventually be tracked in ZIMS. There are minimum annual reporting requirements, although some programs track additional information. Each recommendation is assessed in terms of whether it was attempted and whether it was been achieved, along with relevant comments. Analysis of the first 5 years of results in 2004 was used to refine the process. Each year ARAZPA zoo directors receive a report on how their institution performed with respect to recommendation implementation.

2. Lincoln Park Zoo has received a three-year IMLS grant to design a database to track AZA recommendation implementation, analyze retrospective data on AZA SSP and PMP programs, and begin implementation of a process to routinely record this information and to incorporate the results into program management

3. Individual species managers or advisors in several regions also track information on reproductive success using a variety of data collection and analysis methods. For example, Sarah Christie has tracked breeding recommendation success for the EEP tiger programs since 1994 using an Access database that includes pairing attempts and causes of failure; K. Traylor-Holzer similarly tracks breeding recommendation success for SSP tiger programs (since 1992) in an Excel spreadsheet to evaluate biological and management factors impacting breeding success and recommendation implementation.

The compilation, analysis and application of information on factors impacting breeding success and breeding recommendation implementation may help guide managers in improving breeding success and in more accurately estimating the number of pairings to recommend to meet population size goals.

- Veterinary/health issues relevant to mortality and reproduction
Tool: Data collection to be addressed by ZIMS release 2
- Problems associated with age and reproduction (long-term limits on reproduction, consequences of delaying reproduction)
Progress: Some people are looking into this individually for specific species.
- Contraception (problems)
- Lack of husbandry knowledge/experience
- Relative concern with inbreeding and outbreeding in “naturally” inbred species or populations
- Analysis of inbreeding depression for certain species or populations
Progress: Some people are looking into this individually for specific species.
- Limited founder availability due to small wild population
- Need to understand the consequences of incorporating founders over time
- Tradeoffs of demographic growth and genetic management
- Cumulative long-term effects of less than optimal genetic management
Tool: PMx will provide a tool that projects the consequences of optimal genetic management. This can then be used both to steer us toward that optimum and as a standard against which to compare our actual trajectory. This tool will be presented in a paper to be presented at the WAZA conference (B. Lacy).
Progress: Past stochastic simulations using SIMPOP investigated the long-term impact of sub-optimal pairings for the Amur Tiger SSP population; further investigations are being explored with Vortex (K. Traylor-Holzer).
- Relative genetic contributions of siblings
- Metapopulation management tools for dealing with global programs, wild-wild, captive-wild
Tool: Tools to assist with this are being built into PMx.
- Genetic adaptation to captivity
- Behavioral adaptation to captivity
- Need to optimize preparation of animals for life in the wild (reintroduction or re-release)

People Issues

People-related issues that impact the effectiveness of population management can be generalized into the following categories:

1. Lack of sufficient number of trained and effective species managers
2. Lack of information sharing (on many levels)
3. Lack of common goal / buy-in on both sides (i.e., lack of acceptance/compliance with population management strategies by institutions; lack of sufficient consideration of institutional needs by species coordinators)
4. Lack of interregional / global coordination (including obstacles such as language, politics, permit requirements, disease issues, etc.)

Specific identified people-related issues (and associated tools / actions) are:

- Too few professional coordinators
- Tradeoff between the need for more programs/managers and the expertise to deal with biological and sociopolitical complexities of program management
- Inadequately trained coordinators (need project management skills and capacity to deliver)
- Unreasonable or misguided recommendations from population managers (untrained)
- Differences in training opportunities and status of current programs among regions
- Lack of monitoring, measuring and reporting to the right people (should be initiated at the beginning of the program)
- Lack of communication and sharing and analysis of information among institutional records (registrars), studbooks (studbook keepers), and management programs (species coordinators and TAG chairs).

Tool: ZIMS will address this, as all records will be in one database.

- Insufficient use of ISIS Studbook Reconciliation and other data validation tools – data quality and integrity between institutional data and studbook data is deficient.

Action: K. Traylor-Holzer and Bart Hiddinga will take this issue to WAZA CPM. CPM has the authority to require clean-up for inclusion in the WAZA/ISIS studbook library. This issue also can be highlighted in records and population management training programs. Karin Schwartz will find out about other regional records-keeping courses and open a collaborative discussion on course content.

Progress: The issue was discussed at the 2008 WAZA CPM meeting, where it was agreed that data validation should be promoted on the regional level. CPM may follow up with a letter to encourage international studbook keepers to use data validation tools.

- Lack of understanding or acceptance of population management principles
- Non-compliance with breeding management program recommendations
- Lack of buy-in from zoo administrative staff that records-keeping is important
- Wavering commitment to collection plans
- Inappropriate species prioritization
- Inappropriate/inadequate institutional plans (poor exhibit design/inadequate capacity/lack of flexibility)
- Program managers not communicating with or listening to institution's problems/needs
- Euthanasia as a management tool (also under Conceptual Issues)
- Atypical social groupings (compared to natural system in the wild), related to management
- Barriers to international/inter-state transfers
- Quarantine/disease risk management measures limiting movements

- Lack of global programs/global coordination
Action: WAZA CPM will be taking this on via its Global Species Management Programs (GSMPs).
- Language communication problems (e.g., EAZA countries, globally).
Tool: ZIMS will help to address this, as it will be available in different languages.

Development of New Tools

New tools that are under development include PMx (to replace PM2000) and ZIMS (to replace the various ISIS software programs).

PMx

Under development by Bob Lacy, Jon Ballou and J.P. Pollak. Release of PMx version 1.0 is scheduled for late 2009. PMx will have enhanced demographic analysis, genetic analyses, reporting and graphing tools. Some of the new features include: probabilistic/multiple parents; list of optimal breeding pairs; error estimates for demographic rates and projections; projection of lifetime breedings; group management; metapopulation management; and incorporation of MateRx.

Zoological Information Management System (ZIMS)

ISIS integrated web-based database software system that combines institutional, veterinary and studbook records currently managed with ARKS, MedARKS and SPARKS software programs. Planned for staged releases, beginning with Release 1 (Animal Management) in March 2010, followed by Release 2 (Animal Health Care), Release 3 (Population Management), and Release 4 (Information Management System).

Future Plans

The working group will reconvene at the 2009 CBSG annual meeting in St. Louis to continue discussion of these issues, share current projects and updates, and outline additional recommended actions, projects and collaborations.