Saudi Wildlife Authority

هيئة البيئة - أبوظبي
Environment Agency - ABU DHABI

الأمانة العامة لصون المها العربي
General Secretariat for the Conservation of the ARABIAN ORYX

Proceedings of the Regional Workshop on Genetic Management of Arabian Oryx (*Oryx leucoryx)* populations in the range states

13-14 March 2018, Taif, Saudi Arabia

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The General Secretariat for the Conservation of the Arabian Oryx (GSCAO) is a regional initiative with a key role of supporting all efforts to protect and conserve the Arabian Oryx, to agree regional criteria and standards, and to coordinate efforts between range states. GSCAO is hosted by the Environment Agency-Abu Dhabi.

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P.O Box 45553 Abu Dhabi, UAE
E-mail: info@arabianoryx.org; yalkharusi@ead.ae
Website: www.arabianoryx.org
Tel: 009712 693 4 664

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Executive summary

A two-day technical workshop (13-14 March 2018) focusing on genetic management of Arabian Oryx, *Oryx leucoryx*, populations in the range states was held in Taif, Saudi Arabia. The workshop was organized by the Saudi Wildlife Authority (SWA), Environment Agency-Abu Dhabi (EAD) and the General Secretariat for the Conservation of the Arabian Oryx (GSCAO), with the generous sponsorship of the SWA. The key objective of the workshop was to provide collections and experts with the opportunity to present actual daily management practices and provide them with information on best measures and approaches to improve the genetic health of Arabian Oryx populations in the Arabian Peninsula. The workshop was attended by 57 wildlife biologists, geneticists and conservation managers of Arabian Oryx collections from UAE, Saudi Arabia, Kuwait, Jordan and the United Kingdom (Appendix I). Participants discussed challenges in the application of best practices in genetic management and how to overcome these challenges. At the end of the workshop, participants recommended to have more capacity building courses in genetic management with particular focus on planning, sampling, storage and transfer. Workshop participants also urged GSCAO, in collaboration with local facilities, to develop a regional breeding population that implements optimal standards of herd management for the long-term sustainable conservation of oryx in the range states.

1 Introduction

At the 5th Meeting of the Coordinating Commitee for the Conservation of the Arabian Oryx (CCCAO) in May 2015 (GSCAO, 2015), range states agreed on the need to address genetic management in Arabian Oryx conservation and the importance of adopting a management policy that is based on "herd quality" rather than "herd quantity". Genetic information for many Oryx populations in the region is scarce and many collections in the range states do not prioritize genetic considerations in daily management practices. This has negative consequences on Oryx health and diversity particularly for those individuals planned for reintroductions, as they need to maintain physical fitness and adaptive potential to sustain harsh climatic conditions (e.g. prolonged drought). The regional workshop on genetic management of Arabian Oryx populations in the range states is aligned with the five year strategic work plan (2015-2019) of the General Secretariat for the Conservation of the Arabian Oryx (GSCAO, 2015). The workshop covered key topics in small population management including the importance of genetics for conserving ungulate populations, possible ways for enhancing genetic management practices of Arabian Oryx collections, studbook development and group management.

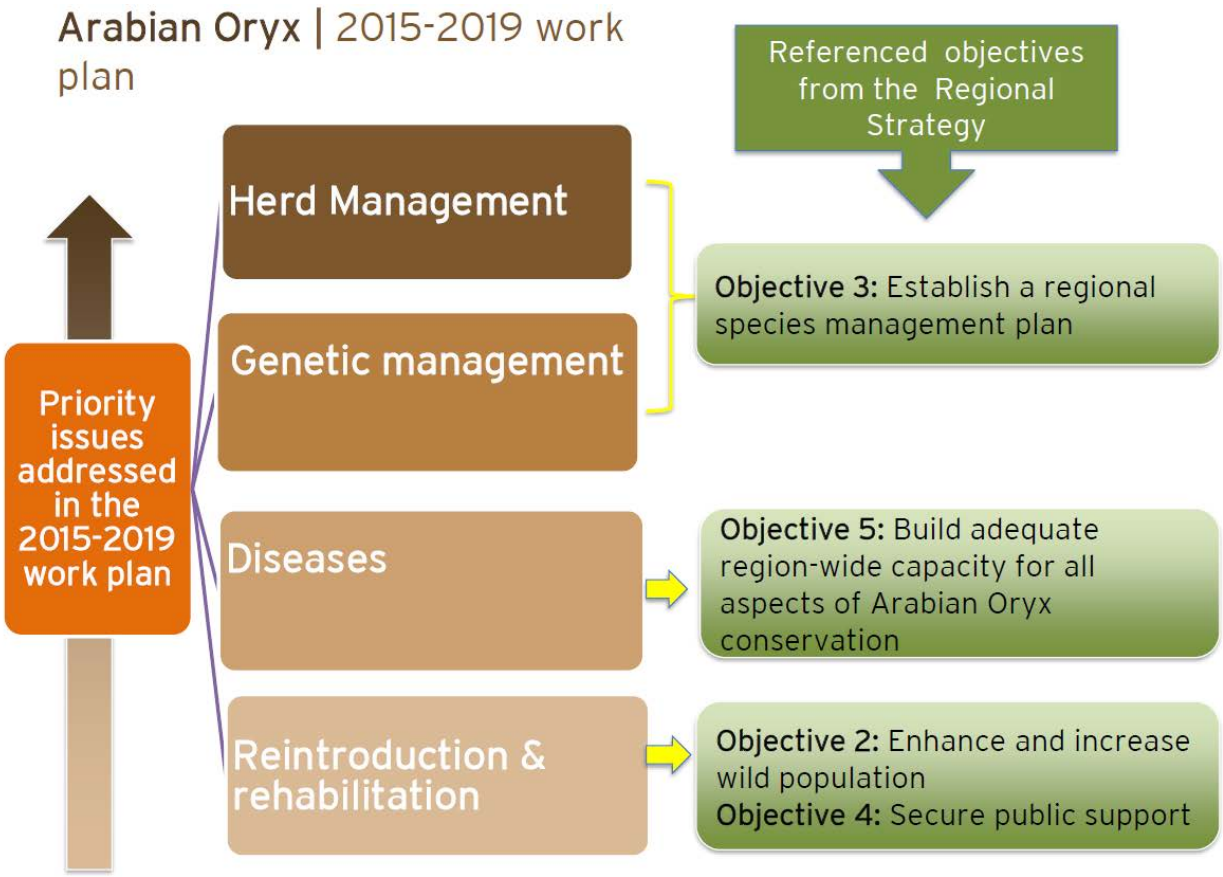

Figure 1. GSCAO's Five year strategic workplan (2015-2019), which was developed in consultation with Arabian Oryx collections in the range states (GSCAO, 2015).

Image 5. An Arabian Oryx herd at Mahazat As-Sayed reserve, Taif, Saudi Arabia

2 Workshop agenda

The workshop was opened with keynote speeches from H.E. Dr. Hany Tatwany, Vice Chairman of the Saudi Wildlife Authority and Mr. Omar Al Hameli, Ecologist, Ecologist, Environment Agency of Abu Dhabi (EAD) (Appendix II).

Table 1. Day 1 Workshop Agenda

Day 1 Agenda	Time
Registration	**09:00-09:30**
Welcome speeches His Excellency Dr. Hany Tatwany (Vice Chairman of the Saudi Wildlife Authority) Mr. Omar Al Hameli (Environment Agency- Abu Dhabi)	09:30-09:45
Overview talk about the workshop: objectives, discussions and expected outputs Dr. Rob Ogden, Head of Conservation Genetics, Royal (Dick) School of Veterinary Studies, University of Edinburgh	09:45-10:00
Coffee Break	**10:00-10:15**
Oral presentations Do genetics matter for managing ungulate populations? (Dr. Rob Ogden)	10:15-10:30
Genetic management of Arabian Oryx in the Kingdom of Saudi Arabia (M.Zafar-ul Islam, Saudi Wildlife Authority)	10:30-10:45
Genetic management of Arabian Oryx in the Environment Agency - Abu Dhabi (EAD) (Mohammed Al Romeithi, EAD)	10:45-11:00
Genetic management of Arabian Oryx at Shumari Wildlife Reserve, Jordan Ashraf El Halah, Royal Society for the Conservation of Nature	11:00-11:15
Conservation and genetic management of Arabian Oryx in captive collections, Al Ain Zoo, UAE	11:15-11:30
Genetic management of Arabian Oryx at Al Bustan Zoological Centre, UAE	11:30-11:45
Arabian Oryx population records at the Al Wadi Nature Reserve, UAE	11:45-12:00
Driving Arabian Oryx conservation forward: best practices in genetic management for ungulate populations (Dr. Rob Ogden)	12:00-12:15
Lunch and Prayer Break	**12:15-13:15**

The General Secretariat for the Conservation of the Arabian Oryx (GSCAO): Driving conservation work forward (Yassir Hamdan Al Kharusi, EAD)	13:15-13:25
Group discussions Why is genetic management not prioritized and how can we improve this? (facilitated by Yassir Hamdan Al Kharusi, EAD) Are regional collections ready for population genetic management? (facilitated by Dr. Rob Ogden, University of Edinburgh) How can we enhance regional coordination? (facilitated by M.Zafar- Ul Islam, Saudi Wildlife Authority)	13:25-14:20
Reporting and closing remarks of the day (Dr. Rob Ogden)	14:20-15:00

Table 2. Day 2 Workshop Agenda

Day 2 Agenda	**Time**
Reception and film presentation at the Prince Saud Al Faisal Wildlife Research Centre, Taif	**08:00-08:30**
Tour at the Prince Saud Al Faisal Wildlife Research Centre	08:30-10:00
Participants head to Mahazat As-Sayd Reserve to see wild Arabian Oryx	10:00-12:00
Reception and PowerPoint presentation at the ranger centre of the Mahazat As-Sayd (Ahmed Boug, Director General of Prince Saud Al Faisal Wildlife Research Centre)	12:00-13:00
Lunch and Prayer Break	**13:00-14:30**
Watch wild Arabian Oryx herds in the Mahazat As-Sayd Reserve	14:30-18:00
Return to the Awaliv International Hotel, Taif	18:00

3 Workshop objectives

The workshop was attended by 57 wildlife experts, geneticians, conservation managers from UAE, Saudi Arabia, Kuwait, Jordan and UK (Appendix I). The objectives of the two-day workshop were to:

- Provide collections and experts with the opportunity to present actual daily practices in relation to small population management in the Arabian Oryx conservation programmes in the range states.
- Discuss studbook and group management approaches, their uses in small ungulate populations and key requirements to develop such approaches in the range states.

4 Abstracts of oral presentations by participating institutions

Genetic management of Arabian Oryx in Saudi Arabia

M. Zafar-ul Islam, Ahmed Boug, Khairi Ismail and Saud Anajariyya

Prince Saud al Faisal Wildlife Research Center, PO Box 1086, Taif, Saudi Arabia; mzafarul.islam@gmail.com

Genetic diversity plays an important role in the survival of wildlife species including Arabian Oryx. The Saudi Wildlife Authority (SWA) manages Arabian Oryx populations considering three key parameters including (1) long-term survival of individuals (2) species recovery in its historic range and (3) the species' ability to adapt to its new release sites. In April 1986, 57 Oryx were moved to Prince Saud Al Faisal Wildlife Research Centre (PSFWRC) from the collection of the late King Khalid in Thumamah. By September 1989, 16 (28) had died of *tuberculosis* but the outbreak of *tuberculosis* was controlled and additional founders from United states, Europe and elsewhere in the Middle East were also added to the herd. Consequently, the PSFWRC herd is genetically diverse. Due to the TB outbreak in the first generation, the founder herd was kept in isolation to avoid any transmission of disease and the herd classified into three different generations: A = Animals imported to the PSFWRC known as founders; B = Hand-reared offspring of founders & C = Mother-reared offspring of disease-free B generation animals. Only the C generation animals were considered totally disease free and used for reintroduction. The PSFWRC captive herd is maintained with strict health management and annual prophylaxis policies. Currently, there are 600 oryx in Mahazat As-Sayd reserve, 150 in Uruq Bani Ma'arid, 85 at PSFWRC in Taif and 80 in King Khalid Wildlife Research Center in Thumamah in Saudi Arabia. The PSFWRC oryx captive-breeding programme is capable of providing suitable animals for reintroductions throughout the Arabian Peninsula.

Genetic and herd management of Arabian Oryx (*Oryx leucoryx*) in Abu Dhabi, UAE

Mohammed AL Remeithi, Environment Agency – Abu Dhabi; Mohammed.alremeithi@ead.ae

The Environment Agency – Abu Dhabi (EAD) manages a total of 156 Arabian Oryx in the Deleika wildlife conservation center. The Arabian Oryx within the center originate from Sir Bani Yas Island, several private collections from Abu Dhabi and some imported from the United States. The purpose of having Arabian Oryx collections in EAD is to maintain a genetically diverse conservation breeding population suitable for possible future reintroduction. On the herd management side, ear tags and microchips are used for identification and tracking individuals. For record keeping, we use Excel to keep all the information for the Arabian Oryx and in future we are planning to use ZIMS (Zoo Information Management System). However there are several challenges associated with the use of ZIMS at Al Deleika field centre. For example, the identity of many animals in the center is unknown, staffing is inadequate for ZIMS implementation and there is no reliable internet connection yet. To increase the genetic diversity within the population for long term sustainability, 40 Arabian Oryx were imported from the United States.

Genetic management of Arabian Oryx at Shaumari Wildlife Reserve, Jordan

Ashraf Elhalah, the Royal Society for the Conservation of Nature (RSCN), Jordan

Ashraf.elhalah@rscn.org.jo

The Shaumari Wildlife Reserve was the first reserve to be established in Jordan. It was created by the RSCN in 1975 as a captive breeding and release site for the endangered Arabian Oryx. From a nucleus herd of 8 animals flown in from Phoenix zoo in Arizona, the herd reached a peak of over 200 animals during the 1980s. Based on the site rangeland carrying capacity recommendation, the Oryx herd number decreased to nearly 100 individuals. After more than 40 years of breeding Arabian Oryx, a new vision and objective has been formulated, in order to maintain the genetic diversity and population viability. A matrix of interventions and practices have been designed in order to achieve the new objective. These intervention measures included constructing new breeding enclosures that have the optimum requirements such as good vegetation cover, fresh water points, shades and anti-predation measures. Equally, genetic profiling for Shaumari's Oryx showcased the need to import new individuals from neighboring countries.

Conservation genetic management of Arabian Oryx in captive collections of Al Ain Zoo, United Arab Emirates

Myyas Al Qarqaz Myyas.alqarqaz@alainzoo.ae; Mohammad Faqeer mohammed.alfaqeer@alainzoo.ae

Al Ain Zoo was first established in 1968 primarily to house its extensive population of Arabian Oryx. It now has a total of 199 Oryx. To maintain and enhance, wherever possible, the genetic resources of this population, a set of sound management practices have been adopted and implemented aiming to increase the genetic diversity and quality. Key practices and inbreeding avoidance measures have been implemented to improve the population management methodologies and ultimately the quality of genetic resources that includes systematic and structured herd management, management of breeding groups, introduction of new blood lines and the selection/ rotation of breeding males. Collectively, these actions have increased the linage diversity of the Arabian Oryx genetic pool, significantly improving the survival rates, body condition and general health. Establishing the genetic baseline data and continuous assessment are critical to understanding and measuring success and progress.

The Genetic Management of the Arabian Oryx on Al Bustan Zoological Centre, United Arab Emirates;

Meyer E. de Kock; meyer@albustanzoo.ae

Al Bustan Zoological Centre's Arabian Oryx (*Oryx leucoryx*) population is managed as part of the Arabian Oryx international studbook. The conservation breeding of this population does not focus on the quantity, rather it focuses on the population quality. The population breeding management strategies consist of the combination of known pedigree information, and the exchange and import of individuals from other institutions to ensure the best possible genetic composition of the herds. Although the genetics are unknown, at this point, a form of general risk management strategy applies. The strategy focuses on the best decisions with the limited information available, to minimise the risk of inbreeding depression after the population bottleneck that was experienced after the last individuals were transferred from the region, in 1962. The future plan for ABZC Arabian Oryx collection includes the genetical barcoding of the population and supporting a mitochondrial DNA study in the UAE collection to provide a baseline and assist in population management decisions that can guide the collections for the best-suited transfers of genes between the collections. ABZC offers support in the region to store DNA samples of the Arabian Oryx, if needed.

Arabian Oryx management at Al Wadi Nature Reserve, Ras Al Khaimah, United Arab Emirates

Gabriel Gutsa and Ciprian Giurgiu, gutsagabriel@gmail.com, ciprian.giurgiu@ritzcarlton.com

The Ritz-Carlton Ras Al Khaimah, Al Wadi Desert, is a 500 hectare protected nature reserve that focuses on wildlife conservation and hospitality. It is also a site for Arabian Oryx (*Oryx leucoryx*) amongst other ungulate species. The Al Wadi Nature Reserve's Oryx herd started with four females and one male in 2009. Food is provided on daily basis and one watering hole has been dedicated for the herd. Visitors at the reserve have an opportunity to learn about the Arabian Oryx as the resort offers nature-based activities. The herd's genetic management is yet to be explored and investigated. The management of the reserve invites researchers to study the genetic health of the Oryx population as to imporove its physical adapation to the desert environment.

5 Discussions

Following the formal presentations by range state participants, the workshop progressed into a series of group discussions, each addressing a different aspect of Arabian Oryx genetic management. Three groups were formed by the participants who were asked to consider the following questions:

A) Why is genetic management not prioritized and how can we improve this?

B) Are regional collections ready for population genetic management?

C) How can we enhance regional coordination?

The following section describes the outcomes of discussions held in each group.

Group A) Why is genetic management not prioritised and how can we improve this?

Chair: Yassir Hamdan Al Kharusi

Why is genetic management not prioritised?

A number of factors were recognised as limiting the prioritisation of genetic management; some of these are historic, others still relevant in today's management environment.

Initially, the focus of Arabian Oryx conservation was on increasing the number of individuals in a herd and this was prioritised ahead of all other factors.

From a conservation perspective, this is standard practice, however since Oryx numbers have increased throughout the region, the subsequent transition to considering the long-term genetic health of the herds has not yet occurred. This is probably due in part to the fact that most Oryx remain in private collections where management success is viewed solely in terms of herd size. Another factor is the lack of awareness of, or access to, good genetic management practice. It was noted that wildlife genetics is still a fairly new concept in Arabian wildlife management and there are relatively few practitioners in the region with the appropriate expertise. The underlying population genetic theory is perceived as being technically challenging to master and relatively expensive to apply.

Is there sufficient awareness of genetic management?

Despite the lack of technical capacity, it was generally felt that at an institutional and senior management level, the importance of genetic management is now widely recognised throughout the region. However, the lack of easily accessible, well-communicated case-studies limits the prioritisation and application of genetic management at a collection level, where individual animals managers may not yet be sufficiently aware of genetic management principles and procedures.

Constraints on the uptake of genetic management

Currently, a number of issues are thought to constrain more widespread use of genetic management. These issues include:

- Difficulty in implementing genetic management in wild / semi-captive populations
    - Limited opportunities for sampling animals for DNA analysis
    - Limited capacity for implementing subsequent breeding recommendations
- Insufficient institutional support for genetic management
    - This may occur at any point in the management system and reduces the chances of successful uptake
    - This issue suggests that all Arabian oryx stakeholders, from CEOs to animal handlers, need to understand the importance of genetic management within their breeding programmes
- Lack of services for DNA analysis
    - There is almost no wildlife genetic management expertise available at a national level

- Various barriers to engaging international service providers exist, ranging from sample movement restrictions, national political will, insufficient confidence to commission appropriate service work and inappropriate provision of services by international third parties

In addition, the subjects of service cost, funding models and the potential to develop commercial genetic management services were briefly discussed.

Group B) Are regional collections ready for population genetic management?

Chair: Dr. Rob Ogden

Pre-requisites

Prior to initiating a region-wide programme of genetic management it is important to consider the various pre-requisites that need to be met to enable the successful implementation of such a strategy. Considerations include the need for mutual understanding and agreement on the scale, scope and objectives of a strategy, and of the respective capacities and capabilities in place across the region for its delivery. The following points were considered with this overall context:

Type of breeding programme to implement

The use of genetic theory or analytical data to support conservation management must be targeted towards informing the breeding programme in place. At the present time, there is no consistent regional breeding programme for Arabian oryx, therefore before genetic management options could be considered, it was first necessary to decide upon the most appropriate type of breeding programme to implement. A discussion was held on whether the aim should be to implement an individual studbook-based management system, such as those employed by international zoo association breeding programmes, or rather to focus on population-level or group management, in which animal movement and breeding decisions were made at the level of the herd.

Given the lack of established pedigrees in any existing regional herd, the number of captive animals in Arabia and the need for all countries to engage in a common management strategy, it was agreed that in the first instance any regional breeding programme should concentrate on group-management, not studbook management. This decision, while not precluding the development of individual or pedigree-based management programmes over time or in specific collections, does have a number of implications for the design of a genetic management strategy for the region.

Inter-regional coordination

It was noted that any regional population management system should be compatible with existing systems in Europe and with the International Arabian Oryx studbook. This does not necessarily mean that systems should be identical, but that data management and DNA analysis follow standards and conventions established within the international community.

Regional coordination

Any regional breeding programme and associated genetic management plan should be applicable in all participating range states and help to support the conservation management of Arabian Oryx at both national and regional levels. Where possible, individual nations should have broadly equal involvement in the breeding programme in terms of investments and benefit sharing.

Considerations for the design of a regional Arabian oryx breeding programme

Based on these pre-requisites, discussions turned to the possible design of a regional breeding programme incorporating appropriate elements of good genetic management practice. The following section summarises the topics considered and key points that were agreed by the group.

Development of a regional breeding population

In practice, it was agreed that any regional breeding programme should focus on a subset of all the Arabian Oryx in the region, with representatives from each participating nation. Establishing such a regional breeding population would be a priority for the programme and would consist of a number of phases:

- First phase – rapid population genetic assessment of samples from each collection in each country. Potentially focusing on mitochondrial DNA haplotype data generation. This would provide an approximate baseline of genetic variation across all herds.
- Second phase – selection of 500-600 animals across all countries to form a core captive breeding programme herd. This would incorporate genetic selection criteria but would also be driven by considerations of veterinary health, age structure, sex ratios and ultimately the availability of individual animals for inclusion in the population. This population would remain physically partitioned across participating countries and collections, with agreement that emigration, immigration and exchange of animals would be managed centrally on a collective basis.
- Third phase – detailed genetic analysis of individuals within this core breeding population to enable the implementation of fine scale population management (group management, with the option for individual studbook management).

Management of a regional breeding population

Following creation of the breeding population, management at the herd level would need to be controlled through a single population manager, a regional role that would be the responsibility of the Secretariat. Information regarding the status of each constituent herd would be communicated from the herd managers to the population manager through a system of national coordinators, who would be responsible for the collation of all demographic and genetic data available within each country for submission to the central population manager. Conversely, the national coordinators would also be responsible for communicating and overseeing the implementation of management recommendations from the regional population manager.

Regional standardised protocols requirements

It was recognised that in order to manage a breeding population in a consistent manner, a series of protocols would need to be developed and agreed to ensure that all constituent herds were managed effectively as a single population. Examples of required standardised procedures include:

- An individual and group record keeping system (e.g. ZIMS)
- Sample collection, storage and transfer protocols for genetic materials
- Genetic analysis methods

Practical requirements/opportunities in the region

The development of an Arabian Oryx conservation breeding programme will have many facets and challenges that were beyond the scope of the group discussions. However, a number of points were made concerning the requirements and opportunities that such an initiative would encounter:

- Capacity building and training
    - Building on this genetic management workshop and other held under the current action plan, further training needs will need to be met to enable a regional breeding programme to succeed
    - This was viewed as an extremely valuable opportunity to enhance regional expertise and transfer knowledge and skills into Arabian wildlife management
- Learning lessons from other programmes

A great deal of expertise has been gained within the region through the development of management programmes for other wildlife species, for example the reintroduction of the Scimitar-horned Oryx. The Arabian Oryx breeding programme

should seek to capitalise on and adapt resources from existing programmes, specifically in relation to:

- Strategies for genetic management and selection
- Protocols (for genetic management and husbandry)
- International agreements (for cooperative management and international transfers)

- Regional coordination approach

It was felt that there would need to be a strong role for the GSAOC to drive coordination and enable implementation. Mutually agreed mandate to act across all participant countries was considered very important for the long-term success of the Arabian oryx conservation breeding programme.

Group C) How can we enhance regional coordination?

Chair: M. Zafar-ul Islam

Building on the need for cooperative activities operating across the region, the third discussion group examined some of the issues concerned with enhancing coordination processes. It was recognised that historically there have been difficulties in creating the necessary conditions for a regional approach and that these would need to be addressed as part of any regional breeding programme design.

Information sharing

One of the key factors currently preventing any coordinated management of Arabian Oryx is a lack of knowledge concerning the exact numbers and locations of herds across the region. This was considered to be largely due to a historic reluctance to share information within and among countries regarding the existence and make-up of Arabian oryx collections. In this regard a number of points were made:

- Greater information sharing regarding collections is required. The creation of a breeding population would not require involvement of all oryx in the region but would be considerably strengthened by comprehensive knowledge of their demographic and genetic status.
- To begin a process of information sharing and to reassure collection owners concerning the use of any data collected, a needs analysis of essential information required about each herd should be conducted
- A central database will be required to hold regional information. This database should be based on the use of ZIMS
- Common protocols / guidance for genetic sampling and analysis would need to be developed and shared so that all participants understood what analysis will be undertaken and how the resulting data will be used to support the breeding programme.

Regional programme development scope

In addition to agreements regarding the type of information to share and how this should be achieved, the group considered what other factors would require a regional approach in the development of a regional conservation breeding programme. Key areas identified as requiring common regional approaches included:

- Sample collection and DNA analysis
- Data analysis and the creation of a genetic baseline for the population
- Identification of key collections and sampling design (i.e. numbers of oryx per herd to sample)
- Specific protocols for managing animal exchanges:
    - Animal selection
    - Physical transfer
    - Disease management
    - Welfare considerations

6 Workshop Recommendations

Based on a synthesis of the group discussions at the workshop, a series of recommendations concerning the genetic management of Arabian Oryx has been prepared. These recommendations cover both technical activities related to genetic analysis and management practices, and activities related to the wider Arabian Oryx management framework that would be required for their successful implementation. The recommendations provided here summarise the key findings of the workshop.

Arabian Oryx regional management recommendations:

- The genetic management of Arabian Oryx should form part of a broader regional conservation breeding programme for the species.
- A regional conservation breeding programme should focus on the development of a breeding population. This would consist of a subset of the total Arabian Oryx population in the region, representing both the participation of individual countries and the available genetic diversity found within them.
- The breeding population may be distributed across multiple countries, but constituent herds should be managed according to agreed standard operating practices, coordinated by a single regional population manager.
- Given the absence of pedigree data, the high number of animals in the region and the desire to maximise participation in the breeding programme, the breeding population should be genetically managed according to a system of group management, rather than individual studbook-based management. This should not prevent individual collections from implementing studbook-based management if desired.
- The establishment and maintenance of an Arabian Oryx conservation breeding programme would require regional agreement regarding information sharing and management protocols, animal ownership and a commitment to adhere to centralised population management decisions. This is likely to be best achieved through the existing GSCAO structure.
- The design and management of a conservation breeding programme should reflect established practice and experience from Arabian Oryx captive management programmes outside the region, and other wildlife management programmes within Arabia. This includes the need for data collection and storage systems to be compatible with those used in the wider international community.
- The development of a breeding programme should be used by the GSCAO and its national partners as an opportunity to support increased awareness and

technical capacity for good wildlife management practice, including genetic management, across the region.

Specific genetic management recommendations

- A series of standardised protocols should be established for the collection, storage, transfer and analysis of genetic material. These protocols should be accompanied by appropriate technical training courses delivered in the region to animal managers.
- As part of the creation of a breeding population, all oryx collections in the region should be sampled and screened using mitochondrial DNA sequencing as an initial examination of population genetic diversity. The results of this screening should be used alongside non-genetic criteria to inform the selection of animals and herds for the breeding population.
- Once the core breeding population is established, a second phase of more detailed genetic analysis using nuclear DNA markers should be performed to investigate individual-level diversity within each herd comprising the overall breeding population.
- The results of genetic analysis should be transferred to the GSCAO and interpreted to help inform the breeding management recommendations issued by the population manager. This process should be accompanied by appropriate training to develop capacity in applied conservation genetic management.

7 Next steps

Within an agreed timeframe and in-line with its five-year strategic workplan, GSCAO, in collaboration with other Oryx collections in the region, will follow up the recommendations of this Genetic Management Workshop to conduct a short training course in genetic management practices. Specifically, the hands-on training course will focus on how to appropriately take genetic samples from Arabian Oryx, store and transfer them. In this context, GSCAO urges local Oryx institutions in the range states to host this training. As far as establishing a regional breeding Oryx population that has key standards of herd and genetic management practices, GSCAO will consult local conservation managers and geneticians to formulate specific goal, objectives, outcomes, while considering practical requirements such as financial resources needed for implementation.

Appendix I: List of workshop participants

Appendix I: List of workshop participants

	Name	Institution	E-mail
1	Dr. Hany Tatwany	Saudi Wildlife Authority	hany.tatwany@gmail.com
2	Ahmed Boug	Saudi Wildlife Authority	boug2010@gmail.com
3	Dr. Jamal Dashti	Kuwait Institute for Scientific Research	Bahhar20@yahoo.com
4	Maen Al Samadi	Royal Society Conservation of Nature (RSCN)_Jordan	maen@rscn.org.jo
5	Dr. Al Walid Shaaban	Emirates Zoo	waleed@emiratespark.ae
6	Dr. Mohammed Shobrak	Taif University	shobrak@saudibirds.org
7	Majid Al Qurashi	Saudi Wildlife Authority	Majed.q@outlook.com
8	Gabriel Gutsa	Al Wadi Nature Reserve	gutsagabriel@gmail.com
9	Omar Al Hameli	Environment Agency – Abu Dhabi	Omar.AlHameli@ead.ae
10	Meyer De Kock	Al Bustan Zoological Centre	meyer@albustanzoo.ae
11	Mohammed Al Remethi	Environment Agency – Abu Dhabi	Mohammed.AlRemeithi@ead.ae
12	Rabah Jafnan Al Harbi	Saudi Wildlife Authority	
13	Fawaz Mohammed Al - Baroudi	Saudi Wildlife Authority	
14	Jaber Salman Heresy	Saudi Wildlife Authority	
15	Ashraf Al Halah	Royal Society Conservation of Nature (RSCN)_Jordan	Ashraf.elhalah@rscn.org.jo
16	Mohammed Al Faqeer	Al Ain Zoo_UAE	Mohammed.alfaqeer@alainzoo.ae
17	Myyas Al Qarqaz	Al Ain Zoo_UAE	Myyas.alqarqaz@alainzoo.ae
18	Raed Hamoud Al Qathami	Saudi Wildlife Authority	
19	Saad Dasman Al - Subaie	Saudi Wildlife Authority	
20	Mohammed Zafar-ul Islam	Saudi Wildlife Authority	mzafarul.islam@gmail.com
21	Saud Mohammed Anajariya	Saudi Wildlife Authority	

22	Parveen Khan	Saudi Wildlife Authority	parveen@nwrc-sa.org
23	Ahmed Al Qahtany	Saudi Wildlife Authority	
24	Mobarek Al Dosari	Saudi Wildlife Authority	
25	Mosleh Al-Juead	Saudi Wildlife Authority	
26	Bader Al Malki	Saudi Wildlife Authority	
27	Hajed Al Subai	Saudi Wildlife Authority	
28	Khari Hashem	Saudi Wildlife Authority	
29	Moyed Sha	Saudi Wildlife Authority	
30	Ibrahim Mrouei Sharhi	Saudi Wildlife Authority	
31	Khaled Ali Al-Humaidan	Saudi Wildlife Authority	
32	Greg Simkins	Dubai Desert Conservation Reserve	Greg.simkins@emirates.com
33	Sultan Jubran Khubrani	Saudi Wildlife Authority	
34	Abdullah Omar Al Sheikhi	Saudi Wildlife Authority	
35	Tarek Yousef Saif	Taif University	
36	Rashid Rzeeq Al Otaibi	Saudi Wildlife Authority	
37	Yassir Al Kharusi	Environment Agency – Abu Dhabi	yalkharusi@ead.ae
38	Dr. Mohammed Saeed Al-Mutairi	King Khalid Center	
39	Dr. Mohammed Fahad Al Bisher	King Saud University	
40	Dr. Munib Al-Rashidi	Hael University	
41	Abdullah Al Shetawi	King Khalid Center	
42	Abdullah Al-Mutairi	Saudi Wildlife Authority	
43	Omar Mesfer Al Otaibi	Saudi Wildlife Authority	
44	Aqil Al Shareef	Waas newspaper	

45	Bandar Al Otaibi	Waas newspaper	
46	Majed Al - Qurashi	King Khalid Center	
47	Sami Jarallah al - Maliki	almajmah university	
48	Ahmed Hamid Al - Qurashi	Saudi Wildlife Authority	
49	Hamad Mohammed Al Ajmi	Saudi Wildlife Authority	
50	AbdelElah Al Arab	Saudi Wildlife Authority	
51	Ali Al Zahrani	Saudi Wildlife Authority	
52	Hatem Al Yami	Saudi Wildlife Authority	
53	Majed Al Juaed	Saudi Wildlife Authority	
54	Mohammed Al Sofyani	Saudi Wildlife Authority	
55	Ali Al Faqeeh	Saudi Wildlife Authority	
56	Mohammed Shokan	Saudi Wildlife Authority	
57	Mustafa Mirqani	Saudi Wildlife Authority	

APPENDIX II: WELCOME SPEECH

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Delivered by Omar Al Hameli (Ecologist, Terrestrial and Marine Biodiversity Sector, EAD)

Good Morning,

It is my pleasure and honor to welcome you today to the Regional Workshop on Genetic Management of Arabian Oryx Populations in the Range States in this beautiful city of Taif in Saudi Arabia. On Behalf of the Environment Agency- Abu Dhabi (EAD), I would like to thank our host, the Saudi Wildlife Authority for their generous support and for hosting this workshop. I would like also to thank you all for joining us today. The Environment Agency- Abu Dhabi (EAD) in the United Arab Emirates is honored to host and support the General Secretariat for the Conservation of the Arabian Oryx (GSCAO), which is a regional initiative that aims to facilitate the sharing of information on Arabian Oryx conservation and support capacity building in the range states. The Secretariat, supported and guided by its national and regional partners has successfully implemented several initiatives focusing on information sharing and capacity building of conservation mangers in the region. Examples of these initiatives include carrying out regional disease surveys, establishing the Secretariat website www.arabianoryx.org *and developing a regional position paper on the issues of Arabian Oryx wilderness and overpopulation. Today's workshop comes in line with the Secretariat's Five Year Strategic Plan (2015-2019) which focuses on priority actions for the management of Arabian Oryx populations in the region. Genetic assessment is an important aspect in herd management to maintain the long-term population viability of wildlife species. Our meeting today specifically aims to address local and regional challenges associated with genetics as well as explore possible solutions and actions for Arabian Oryx collections to invest more in prioritizing herd quality in conservation management. Once again, I would like to thank the Saudi Wildlife Authority for hosting and funding this regional workshop and thanks also go to Dr. Rob Ogden, from the Royal School of Veterinary studies at the University of Edinburgh, for generously donating his time to facilitate our workshop today.*

I hope you will enjoy, benefit and continue to be active participants in the Secretariat, helping achieve our common conservation goals for this flagship species.

Thank you