



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

MIDDLE EAST
**ARABIAN ORYX
DISEASE SURVEY**

4th Edition





Authors: Maria Elena Pesci, Jon Llona Miguez, Yassir Hamdan Al Kharusi & Nessrine Al Zahlawi

The General Secretariat for the Conservation of the Arabian oryx was established in 2000 as 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.

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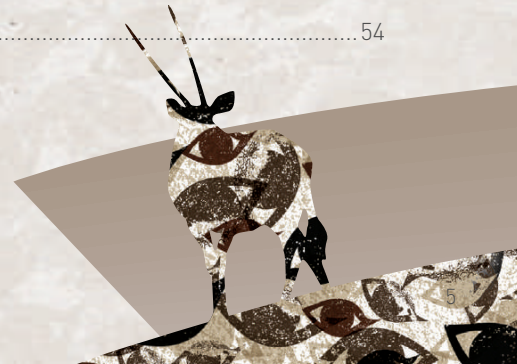
4th Edition

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ABBREVIATIONS

BTV	:	Blue Tongue Virus
CCPP	:	Contagious Caprine Pleuro Pneumonia
EAD	:	Environment Agency – Abu Dhabi
EHDV	:	Epizootic Hemorrhagic Disease Virus
FMD	:	Foot and Mouth Disease
GSCAO	:	General Secretariat for the Conservation of the Arabian Oryx
MOCCA	:	Ministry of Climate Change and Environment
MP	:	Managed population
NWRC	:	National Wildlife Research Center
OIE	:	Office International des Epizooties = World Organisation for Animal Health
PDD	:	Purified Protein Derivate
PPR	:	Peste des Petits Ruminants
RH	:	Reintroduced Herd
TB	:	Tuberculosis
UAE	:	United Arab Emirates

DEFINITIONS

The below definitions were developed and included to serve the purposes of the questionnaire.

Reintroduced herd into the wild

- The herd is free-ranging.
- The herd lives on natural resources and does not require supplementation.
- The herd's diet is not supplemented with food artificially.
- It occurs in its natural habitat within the historical distribution range of the particular species.
- The particular species' social requirements are met at all times.

Managed population

- It is free ranging (managed wild population) or semi free ranging.
- It lives on food from natural resources which may require supplementation.
- It occurs in its natural habitat within the historical distribution range of the particular species, and
- The particular species' social requirements are met at all times.

Captive-bred population

A population bred under controlled unnatural conditions is considered to be captive bred.

Dystocia

Dystocia is a pathologic or difficult labor, which may be caused by an obstruction or constriction of the birth passage or abnormal size, shape, position, or condition of the fetus. This condition usually requires human intervention.

Stillbirth

Stillbirth is a delivery of a fully formed dead neonate.

Abortion

Abortion is a premature expulsion from the uterus of the products of conception; termination of pregnancy before the fetus is viable. Most of the time, an early abortion will not be noticed at all. When an abortion occurs during the last stage of pregnancy it can be confused with a stillbirth. Some abortions can also cause dystocia, for instance when the fetus is decaying within the uterus and becomes swollen.



SUMMARY OF KEY FINDINGS

- The response rate for this fourth edition of the Middle East Arabian Oryx Disease questionnaire was 91%, with a total of 22 collections participating in the survey, accounting for 46 different sites. This represents a 15 % decrease in the number of participating collections compared to the last edition of the survey.
- A total of 9654 Arabian Oryx across the range states were covered in this disease survey. This represents a decrease of 25 % in the number of Oryx individuals included in the previous survey in 2015 (12879 Oryx). This is due to the fact that some collections with large numbers of Arabian Oryx did not participate in the 2018 disease survey. The numbers of Arabian Oryx recorded in the UAE represented 78% of the total numbers of Arabian Oryx covered in this survey.
- Fifty nine percent (59%) of the recorded Arabian Oryx in the survey are categorized as captive-bred populations, while 30% are considered managed populations and 11% as released into the wild.
- Excel is the most common system used by conservation managers of Arabian Oryx collections (46% of respondents use excel).
- The most common cause of death of Arabian Oryx in the reporting period (2018) was old age (60 cases), followed by Traumatic injuries (44 cases) and FMD (33 cases).
- Collections are encouraged to rely on a permanent veterinary support, instead of an occasional one. The cost will be compensated by a better epidemiological control, an implementation of the biosecurity measures and a permanent monitoring of the health status of the entire population. This will lead to a better control and eradication of the infectious diseases and outbreak events.
- Veterinarians and collection managers are encouraged to share information, and help increase the understanding and knowledge of those diseases affecting wild animal collections whenever possible.
- The adoption of the ZIMS record keeping is strongly encouraged, when possible, so that the Arabian Oryx data are handled by a sophisticated software, which can ensure the sustainability of the records as well as guide conservationists towards sound management decisions.
- A poor efficacy of some CCPP commercial vaccines to stimulate the immune system of wild ungulates is signaled in this report. This is based on a specific scientific trial done on sand gazelles (*Gazzella marica*) . (Lignereux et all, 2018)

1. INTRODUCTION

The General Secretariat for the Conservation of the Arabian Oryx (GSCAO) supported by the Environment Agency- Abu Dhabi (EAD) conducted this regional disease survey of the Arabian Oryx populations for the year 2018. Previous editions of this survey can be downloaded at www.arabianoryx.org

Epidemiological challenges require a multidisciplinary holistic approach. This regional disease survey supports information sharing and promotes veterinary communication amongst Arabian Oryx

collections in the Arabian Peninsula to control and manage common conditions and diseases to ensure effective welfare and health practices.

All the information in this report is based on responses submitted by participating Arabian Oryx collections in this survey. The responses were compiled, tabulated, analysed and reviewed by wildlife and veterinarian experts working with and supporting the GSCAO. This report would not have been possible without the support and contribution from the participating collections across the range states. We hope that veterinarians and wildlife conservation specialists will find this report beneficial to promote best practices in veterinary management of Arabian Oryx in the Arabian Peninsula.





2. SURVEY METHOD

The survey questionnaire was designed to collect as much information as possible about the Arabian Oryx diseases for the period from January to December 2018. It consisted of three key sections that included demographic information on the Arabian Oryx population in the facility, information on infectious and non-infectious diseases as well as prophylactic procedures.

The questionnaire was e-mailed as a Word and PDF format in January 2019 to 24 collections in the range states through GSCAO's national focal points and conservation managers of wildlife collections to have a representative sample of the surveyed populations, we attempted to reach as many collections in the region as possible. The last response was received in April 2019. This report is based on the direct answers from veterinarians and conservation managers of the participating Arabian Oryx facilities.

Obtaining an up-to-date full list of Arabian Oryx collections in the range states continues to be a key challenge for various reasons including lack of contact details of the collections and their locations.

Throughout the previous years (2011, 2013, 2015 onwards), GSCAO has successfully managed to obtain a good database of Arabian Oryx collections in the Arabian Peninsula. This has been

mainly achieved through the disease survey as well as GSCAO annual events such as workshops and meetings. The GSCAO still faces difficulties in obtaining a regularly updated list of contact and management details of Oryx collections in each range states. To address this, the Secretariat continuously enhancing communication with its stakeholders to identify new collections irrespective of the herd size and location in the region. This has been one of the GSCAOs' pillars to enhance information sharing across member states, expand the conservation network and identify all collections of Arabian Oryx in the Arabian Peninsula. In this context, we encourage veterinarians and conservation managers in the range states to report to GSCAO any new private or public collections, so that we can contact and invite them to join the next editions of the disease survey.

As in the previous editions, this report refers to "collections" and "sites". "Collection" is a series of sites with a common management, while "sites" refer to geographically separated herds, under the same management.

Whenever the answers to the questionnaire were referring to enclosures belonging to the same site, they were merged together and considered as one site. Some collections with several sites did not specify whether they had different health

plans for different sites therefore, it was considered that all sites under that collections are following the same procedures.

In the present survey, site level information was provided as much as possible, considering each site as an independent management unit. . Where details were lacking, information was analysed instead at the collection level (covering the total number of Oryx).The following document is based only on raw data provided by collection managers through the official questionnaire. The data is verified as much as possible, however in the case of one data set the reliability of the information provided could not be verified.

For this reason, this data set was excluded from the overall statistical analysis and was mentioned separately.

To avoid misunderstanding of the questionnaire, the definition for different population categories was clarified to the respondents in the survey forms. These definitions are as listed at page 7 of this reports:

- Reintroduced herd into the wild.
- Managed population.
- Captive bred population.

DISCLAIMER: In order to respect the anonymity of the participating collections, the location of some reported infections will not always be disclosed.



3. SURVEY OBJECTIVES

The fourth edition of the regional Arabian Oryx disease survey was reinitiated upon recommendations of the Arabian Oryx workshops held throughout 2015-2018, following requests from collection managers and veterinarians confirming the benefit and utility of sharing information on common conditions and diseases and recommended screening and treatment protocols.

The key objectives of this regional disease survey are to:

- Exchange information on the prevalence of diseases related to Arabian Oryx in their collections, their management and mitigation.
- Limit the risks associated with zoonotic diseases and other infectious diseases affecting this species, by helping and supporting the establishment of guidelines and protocols.
- Conduct a gap-analysis on the veterinarian aspects of Arabian Oryx management.
- Assess the risks that could compromise the long-term sustainability and conservation of this emblematic species.
- Review the literature to provide updated information on the topic.
- Maintain a network of people involved in the conservation of this species and draw up an exhaustive list of the Arabian Oryx collections in the Middle East.
- Obtain an updated and accurate total number of Arabian Oryx throughout the Arabian Peninsula, along with demographic parameters.
- Help to improve the genetic diversity of captive or semi-captive populations by promoting and facilitating animal exchange.





4. RESPONSE RATE

Twenty four collections were contacted across the Middle East and twenty two collections responded to the survey. The response rate was 91%. The 2018 survey covers 6 countries (Bahrain, Jordan, Oman, Saudi Arabia, United Arab Emirates and Kuwait), with 22 collections and 46 sites (Table 1). Two collections, one from Syria and one from UAE that were surveyed in 2015 did not return the questionnaire. Unfortunately, the difficult geopolitical situation in Syria and other areas made it difficult to collect data from some previously recorded collections.

Table 1. List of collections and sites which participated in this 4th edition of the Arabian oryx Disease Survey (2018 data).

*Not surveyed in 2015 edition.

COUNTRY	COLLECTION	SITE
UAE		
Abu Dhabi Emirate	Mawarid (Management for Nature Conservation)	Seith Al Miyah*
		Al Rowda Al Ain
		Al Wathba
		Abu Al Abyad
	Al Ain Zoo	Al Ain Zoo
	Environment Agency - Abu Dhabi (EAD) - Protected Areas Department	AOPA Umm Al Zomoul
	EAD -Ex Situ Conservation	Al Faya
		Deleikha
	Barari	Al Qjair Forest
		Al Wadehi Forest
		Al Kabshya
		Eastern Al Rowdh Palace
		Bu Hiran Forest
	Arabian oryx collection of HH Sheikh Mansour bin Zayed - Al Khatim	Bu Deeb
	Bani Yas Island - Barari/TDIC	SBY 1 (Arabian WL Park)
		SBY 1 (camp 26-)
SBY 1 (camp 22)		

COUNTRY	COLLECTION	SITE
UAE		
Abu Dhabi Emirate	Al Ajban Desert Safaris - Sweihan	Al Ajban
		Al Khazna
	Al Reef	Al Reef
	Wrsan Wildlife Division - Ajban	Cage 77
		Cage 70
		Cage 61
		Cage 63 A
Cage 63 B		
Dubai Emirate	Dubai Desert Conservation Reserve	DDCR
	Wadi Al Safa Wildlife Centre- Dubai	Wadi Al Safa (WAS)/MF
		Al Awir (AA)/G1
		MUG-DP
Ras Al Khaimah	The Ritz-Carlton Ras Al Khaimah	Al Wadi desert *
Sharjah Emirate	Breeding Center for Endangered Arabian Wildlife- Sharjah	BCEAW
		ADP
		Al Dhuleiman
	Al-Bustan Zoological Centre - Sharjah	Zoo

COUNTRY	COLLECTION	SITE
BAHRAIN		
	Supreme Council for Environment	Al Areen Wildlife Park 1
		Al Areen Wildlife Park 2
		Hawar Island
OMAN		
	Office for Conservation of Environment. Diwan of Royal Court - Al Wusta Wildlife Reserve (WWR)	WWR Jaaluni
		WWR Jaaluni
	Omani Wild Animals Breeding Center - Royal Court Affairs	Open Site
SAUDI ARABIA		
	Prince Saud Al Faisal Wildlife Research Centre	Prince Saud Al-Faisal Wildlife Research Center (PSFWR) - Taif
		Mahazat as- Sayd Protected Area
		Uruq Bani Ma'arid Protected Area
JORDAN		
	Aqaba	Wadi Rum*
	Royal Society for the Conservation of Nature	Shaumari Wildlife Reserve
KUWAIT		
	Kuwait Zoo	Kuwait Zoo*



5. SURVEY RESULTS

5.1 Total Number of Arabian Oryx Surveyed

The number of Arabian Oryx surveyed in the range states in 2018 was 9654 in total (Table 2).

The number of animals recorded decreased by 25%, compared with the previous 2015 edition where 12,879 Oryx were recorded (Lignereux et al., 2018) (Fig 1). This is due to the fact that some collections with large numbers of Arabian Oryx did not participate in the 2018 disease survey. As per Table 2, UAE hosts 7485 Arabian Oryx which represents approximately 78 % of the surveyed Arabian Oryx in 2018.

Table 2. Total population sizes of Arabian Oryx collections in the range states surveyed in 2018.

Country	Number of Arabian Oryx
UAE	7485
Oman	1038
Saudi Arabia	849
Bahrain	153
Jordan	120
Kuwait	9
Total in the range states	9654

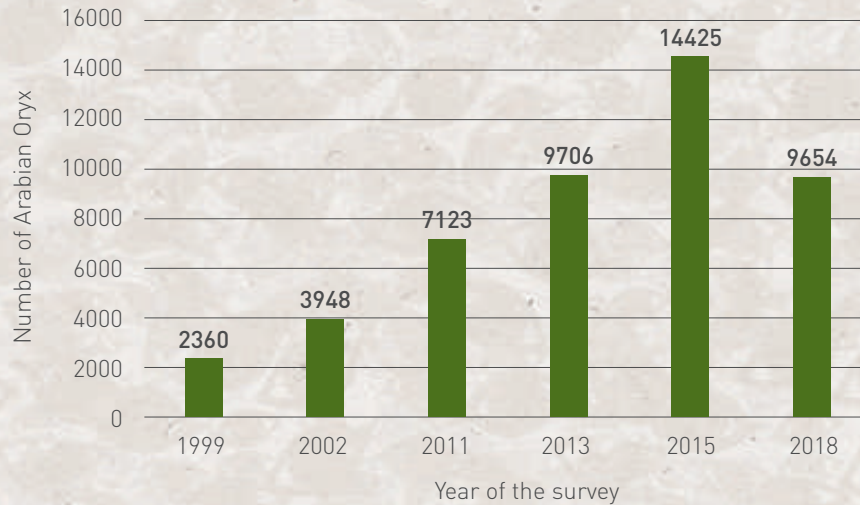


Figure 1. Numbers of Arabian oryx recorded in the different editions (1999-2018) of the disease survey.

Half (50%) of the surveyed collections are owned by Governmental institutions (Fig 2). The other surveyed Arabian Oryx collections are privately-owned (27%) or semi-governmental (23%). As per the responses of the survey, the total surface area for Arabian Oryx surveyed sites is 23148.2 square Kilometer (Table 3).



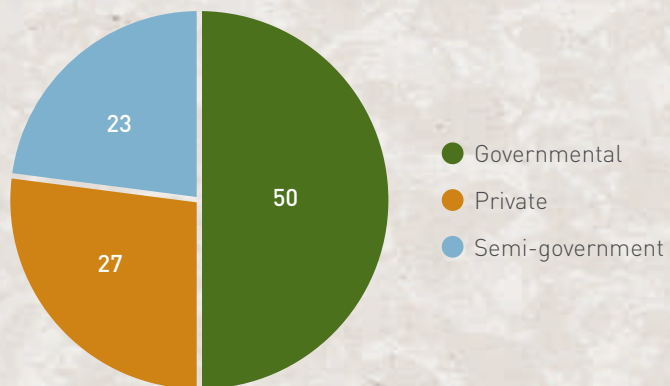


Figure 2. Percentage of ownership type of the surveyed Arabian Oryx collections in the range states.

5.2 Population Categories in the sites surveyed

Reintroduced Herd into the wild

As per the most recent update of Arabian Oryx assessment by the IUCN Red List (IUCN SSC Antelope Specialist Group, 2017), the populations of following sites were considered as “wild”:

Table 3. Total surface area reported by Arabian Oryx collections for the disease survey in 2018.

Country	Surface area [Km ²]
Bahrain	2*
Jordan	72
Kuwait	0.18
Oman	2826
Saudi Arabia	14248
UAE	6000
Total	23148.2

* This is the area for Al Areen Wildlife Park

- Arabian Oryx Protected Area in Umm Al Zamoul of Abu Dhabi, UAE
- Al Wusta Wildlife Reserve- the Released herd, Oman
- Mahazat As Sayed Reserve in Taif, Saudi Arabia
- Uruq Bani Ma’arid Reserve, Saudi Arabia
- Wadi Rum Reserve, Jordan

The Oryx in these reserve have been released in natural range for the purpose of establishing viable populations. Although some of these sites are entirely fenced in large areas (e.g. Mahazat As Sayed), the Oryx population is managed with zero intervention.

Only feed and water are provided during extreme drought. The above sites represent 11% of the total management sites of Arabian Oryx (Fig 3). As per the reporting period, these five sites had a total of 1564 Arabian Oryx (Table 4).

Table 4. Numbers of reintroduced Oryx in the range states as per 2018 data.

Protected area	Country	Number of Arabian Oryx recorded in 2018
Arabian Oryx Protected Area in Umm Al Zamoul, Abu Dhabi	UAE	835
Al Wusta Wildlife Reserve	Oman	31
Mahazat As Sayed Reserve, Taif	Saudi Arabia	500
Uruq Bani Ma'arid	Saudi Arabia	145
Wadi Rum Reserve	Jordan	53

Managed Population

A total of 2057 Oryx from the total recorded in this edition of the survey are classified into this population category and are managed by 14 sites (30% of the total sites). These collections include The size of the populations ranges from 2 to 686 Arabian Oryx.

Captive-bred population

The captive bred population of Arabian Oryx in the range states represents the largest management category with a total of 6033 (59% of the surveyed sites) Arabian Oryx (Fig 3). These individuals are a very important genetic reservoir for this species.

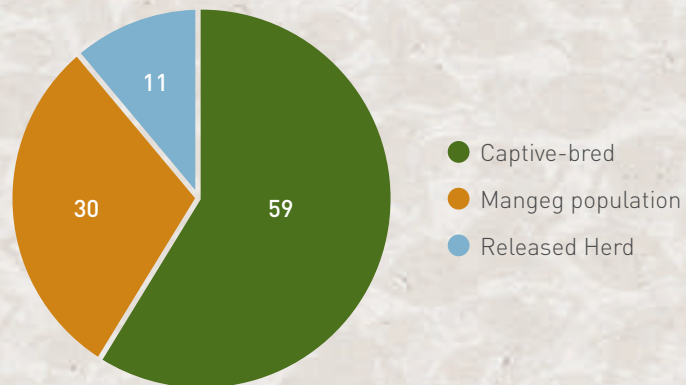


Figure 3. Percentage of Arabian Oryx in each management category. Population categories in the range states expressed as percentage of recorded sites.

5.3 Sex and age ratio

The sex ratio was 79 adult males for 100 adult females. The juvenile population of Arabian Oryx in the surveyed sites represents approximately 18% of the population of known age (Fig 4).

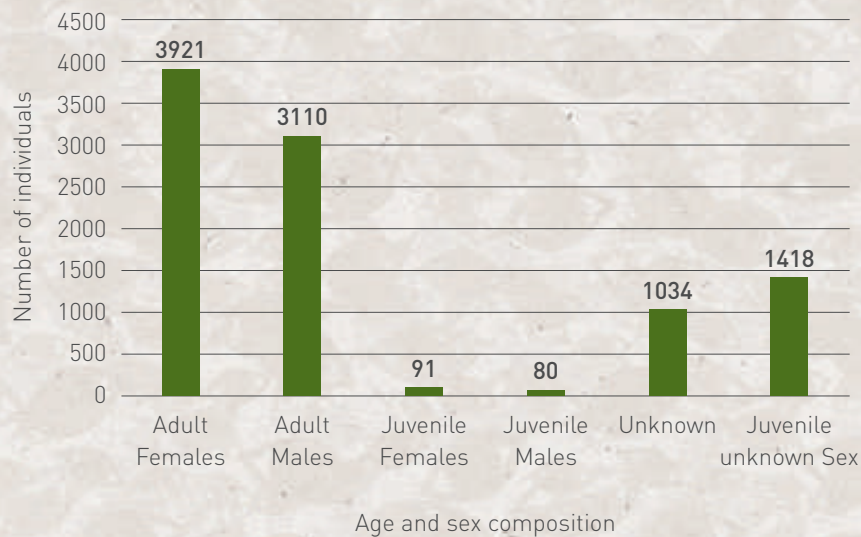


Figure 4. Distribution of male to female and adult to juvenile Arabian Oryx in the 2018 population.

5.4 Record Keeping

Several collections chose to use not one but multiple recording systems (e.g. Excel and hard copy). Excel is the most used programme, with 46% of the collections using Excel for recording Oryx data, followed by ZIMS (23%) (Fig 5). The number of collections that use ZIMS in reporting period increased by approximately 5% compared to the previous disease survey in 2015.

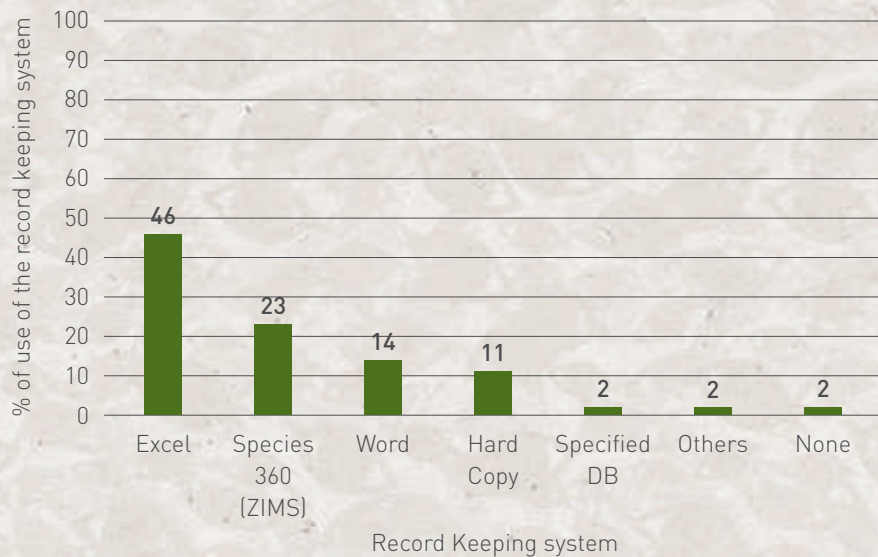


Figure 5. Percentage of use of the different recording systems during the reporting period of 2018.

5.5 Identification Systems

Many collections use more than one identification system for each animal (Fig 6). Ear tag and microchip are the two most common marking systems for identifying individual Arabian Oryx in the surveyed sites.

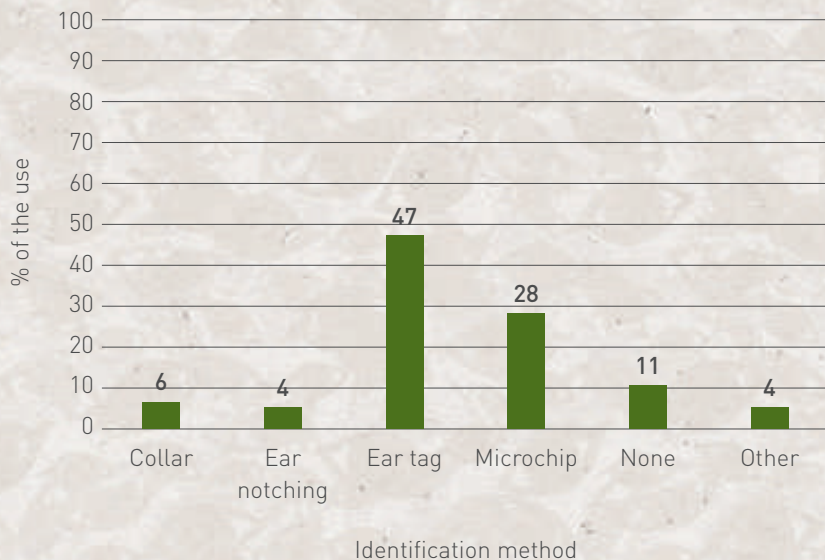


Figure 6. Percentage of the use of identification systems used by Arabian Oryx sites during 2018.

6. REPORTED PATHOLOGIES IN 2018

6.1 Bacterial Diseases

Subcutaneous Abscess

The subcutaneous abscesses are one of the most commonly reported diseases in Arabian Oryx and in antelopes in general. In 2018, the survey responses indicate 60 cases with 5 casualties. Two collections cultured the lesions and isolated respectively *Arcanobacter pyogenes* and *Staphylococcus* spp associated with *Streptococcus* spp. In both cases the bacteria was identified by API (Analytical Profile Index) identification. The main cause of the development of an abscess is intraspecific fighting. Males competing for breeding are very commonly observed, especially during the postpartum oestrus. Fighting is also frequently seen in bachelor groups for dominance reasons. Separating the bachelors group from the breeding females usually helps in reducing aggressive fighting amongst males.

Anaplasmosis

Only one collection in the UAE reported one case of suspected anaplasmosis, based on blood smear examination. No casualty is reported. The pathogenicity of *Rickettsia* in wild ungulates is still unclear. In the past, some collections reported few casualties, while other collections reported high prevalence without symptoms. The control of the vectors, the ticks, will help

to reduce the possibility of transmission. The ticks usually seen in some collections are *Hyalomma* genus.

Malignant Oedema

One case of suspected malignant edema was signaled in UAE, on the basis of post mortem findings. However, the culture did not succeed in isolating the agent of the infection. Malignant edema is a disease caused by *Cl. septicum*, and it can cause disease in cattle at any age. Some other *Clostridium* species could be involved as well (e.g. *C. chauvoei*). *Cl. septicum* is found in the feces of most domestic animals and in large numbers in the soil where livestock populations are high. The organism gains entrance to the body through deep wounds, like a horn stab or in uterine wounds in cows following a difficult calving. The swelling or edema is often localized in the lower portions of the body. Postmortem lesions seen are those of necrotic, dark and smelling areas under the skin, often extending into muscle. Very little gas is associated with the swelling. The disease shows similarity to Blackleg disease and can be distinguished only by isolation of the agent. The disease can be prevented by the use of a vaccine containing *Clostridium septicum* bacterins, and it is often commercialized in association with other *Clostridium* bacterins (*C. chauvoei*, *C. sordellii*, *Cl. Novyi* and *Cl. perfringens*).



Brucellosis

Brucellosis is a zoonosis that might infect humans and cause serious health issues. The most common way for humans to get infected is with birthing products and milk from an infected animal. Between animals the infection is also transmitted by sexual contact. Brucellosis is a OIE (World Organization for Animal Health) listed zoonosis and the notification is mandatory.

The disease was officially reported in the past as affecting the Arabian Oryx in Saudi Arabia (Ostrowski et al., 2002)

A collection in the region reported a confirmed case of Brucellosis during this survey period. The animal was tested with RBT (Rose Bengal Test) and PCR (Polymerase Chain Reaction). The finding was *Brucella* spp. The animal is reported as dead, so we assume it might have been euthanized. One collection in Oman reported 2 suspected cases on the basis of abortion. No other countries reported cases of the disease.

It seems to be a common practice in the region to test Arabian Oryx populations for Brucellosis. Eight collections screened their animals for Brucellosis. ELISA and RBT are the most used tests. One collection associated RBT with the Skin test, as a tool to reduce the false positive and false negative cases. The Skin test has a very high specificity. Some collections do not mention which test was used.

OIE reference test for the animal trade is RBT. It is easy to

operate in house, not very expensive and available mostly all over the Middle East. Although this test is suitable for a large size population, it can give false positive cases due to cross reactions with other bacteria sharing the same LPS (Lipo Poly Saccharide) on their membrane, such as: *Yersinia* sp, certain *E.coli*, and certain *Salmonella* sp (Díaz et al., 2011). Therefore, as was recommended in the last edition of the disease survey in 2015, a confirmatory test should be performed. Skin test, Fixation of the Complement and PCR are other available tests. Culture is, hypothetically, the best confirmation measure, but not always available.

In endemic areas with elevated brucellosis prevalence, sexually immature animals could test negative to RBT. Young animals in endemic areas should be tested regularly, especially when approaching puberty. Some countries apply the "Test and Euthanize strategy of control. A concern could be raised for the application of the test and euthanize strategy to endangered species. In several countries, when the prevalence is higher than 2%, the "Control strategy" through vaccination, applied on several generations, is preferred. All animals being imported, exported or reintroduced into the wild should be tested for Brucellosis.

Chlamidophyla abortus

One collection found 6 animals positives to *Chlamidophyla abortus* during serosurvey. No proven correlation with abortion could be established.

Enterotoxaemia

Four collections in the UAE reported a total 6 cases of enterotoxaemia of which 5 were fatal. Four cases were confirmed with the isolation of *Clostridium perfringens*. Type A is commonly found in soil and in the intestines of healthy animals, but under certain circumstances it can produce potent exotoxins. Therefore, the interpretation of the culture results should be correlated with the post mortem findings and the clinical signs. *C. perfringens* type A enterotoxin (CPE) is the main toxin involved in *C. perfringens* foodborne illness, and sometimes, with nonfood borne diarrheal disease in different animals. *C. perfringens* also produces a necrotizing toxin associated with necrotic enteritis in several species. Types B and C *Clostridium perfringens* both produce the highly necrotizing and lethal beta toxin responsible for severe intestinal damage.

The efficiency of the vaccines to protect the Arabian Oryx is still not clearly established. In cattle, some studies found that calves' immunity can be enhanced if dams are vaccinated approximately 4 months before calving; moreover, 120 days between clostridial vaccinations seems to be too long for adequate protection. (Troxel T R & All, 1997).

Bovine Tuberculosis

Bovine tuberculosis is an OIE-listed disease and it is a zoonosis. Five collections in the region tested their Arabian Oryx for Tuberculosis. Two collections in the UAE applied the TB Skin test, 2 applied the Elisa test and one did not specify the test used.

Only one collection reported 4 doubtful cases. The collection used the Comparative Skin test (one site injecting *M. bovis* PPD and one site injecting *M. avium* PDD) (PDD: purified protein derivate). The collection tested 80 animals, and the 4 doubtful animals correspond to 5% of the group. The animals were isolated and they will be re-tested after 6 months or more. The TB skin test cannot be repeated closer than 3 months (preferably 6 months) because it can cause desensitization; the animals could test negative even if they carry the bacteria.

All tests available up to now are not validated for Arabian Oryx, they are validated mainly for domestic species.

Skin test is supposed to be very sensitive and able to detect the very early stage of the infection. ELISA test, on the other hand, is not suitable to detect the early stage, but it works well in the late stage of the infection. This is because early *Mycobacteria* infection stimulates cellular immunity (phagocyte, macrophages, T cells and so on), rather than humoral immunity (Antibodies production) which is stimulated only at the late stage. Vaccination for *Mycobacterium avium* paratuberculosis can interfere with tests results and their interpretation.

Historically, Arabian Oryx are reported as susceptible to Bovine TB (Greth et al., 1994) and the most relevant confirmed cases were found in Saudi Arabia at the early stage of the captive breeding programme.



Mycoplasmosis

A collection reported 10 Arabian Oryx clinically affected by Contagious Pleuropneumonia, of which nine died. The disease was confirmed by Elisa test. Culture was still pending at the time of the survey. It was not specified whether it was Bovine or Caprine Contagious Pleuropneumonia.

No other collections reported clinical cases in 2018

CCPP was clearly documented in 2014 in one Arabian Oryx (Chaber et al.2014) who got infected after an outbreak of CCPP in a close gazelle collection.

Available vaccines in the Middle East were found incapable of stimulating the immune system against CCPP (Lignereux et al 2018). A vaccine trial, performed on Sand gazelles (gazella marica) on naïve animals, showed that only a reference CCPP vaccine produced according to OIE standards induced a sero-conversion by CCPP competition ELISA, while the commercially available vaccines did not.

The serosurvey (see data in specific chapter) of some collections showed quite high prevalence of seropositive animals, from 4% to 66%, in some collections.

CCPP is an OIE listed disease

Pasteurellosis

Two fatal cases of Pasteurellosis were reported from one collection in the UAE. The finding was confirmed by the culture of *Pasteurella multocida*. One more fatal case was reported by another collection, but the culture failed to isolate the bacteria. False negative is a common problem due to rapid death of *P. multocida* in dead animals, and serology cannot differentiate between current infection and previous exposure, so the diagnosis could be challenging. Culture using fresh lung tissue is preferable to that of a culture via swab sample.

Pasteurella can be easily isolated from tonsils and throats of healthy animals. However, under stress, the immune system becomes suppressed and these bacteria can multiply. The ability of pathogenic bacteria to cause infection is also greatly influenced by certain endogenous factors, like endotoxin, leukotoxin, fimbriae and cell capsule, which can enhance the pathogenicity of the organism and facilitate rapid invasion and destruction of target tissues of the susceptible host. They invade the lungs and from there, can either set up a pneumonia or septicemia. The disease is very contagious and often fatal. There are 5 serotypes of *Pasteurella multocida* (A,B,D,E,F). Knowing the serotype most prevalent in the area will help to select the right vaccine. The Asian serotype B:2 and the African serotype E:2 are mainly responsible for the disease. Serotypes, A:1, A:3, have been associated with a HS-like condition in cattle and buffaloes in India with mainly pneumonia leading to death.

The B:2 serotype has been seen in southern Europe, the Middle East, Southeast Asia, Egypt, and the Sudan.

The E:2 serotype has been reported in Egypt, the Sudan, the Republic of South Africa, and several other African countries (OIE data).

Other Bacterial Diseases

Nephritis

One fatal case of nephritis was signaled. An Alpha hemolytic *Streptococci* was isolated.

Infant sepsis:

One case involving *Vibrio cholera* was signaled in in the region.



6.2 Viral Diseases

Foot and Mouth Disease (FMD)

One collection declared an outbreak in a forestation area, involving 113 animals, of which 33 Arabian Oryx died. The case was confirmed by PCR and the strain isolated was "O" strain, the most common strain of FMD isolated in Middle East. Other strains reported to OIE from the Middle East are "A", "Asia 1" and "SAT2". The application of an effective vaccination protocol is challenging when involving animals released in open areas. The vaccination, in order to be efficient, should be done at 4 weeks of interval and then every 6 months. In the previous editions of the Arabian Oryx disease survey, there is ample evidence that Arabian Oryx are quite sensitive to FMD and the mortality might vary a lot, but is generally reported to be up to 65%. FMD is an OIE listed disease and must be declared to the competent authorities.

Rabies

The disease was reported in one collection, affecting and killing 3 Arabian Oryx. There is no further information or details about the species of biting animal that infected the Oryx. Arabian Oryx, as all mammals, are sensitive to the rabies virus, but the possibility of transmission is usually remote. Rabies is not yet eradicated in the Middle East. The most common reservoirs are stray dogs, foxes and bats. Rabies was not reported in the last 3 Arabian Oryx disease reports (2011, 2013, 2015). Rabies is a zoonosis and an OIE-listed disease.

6.3 Parasitic Diseases

Helminthiasis

In the UAE, one collection reported finding a low burden of *Nematodirus* sp, during a pooled fecal test. No symptoms were reported. Another collection in UAE reported 15% of animals infested by *Strongyloides* with no symptoms or casualty reported. A third collection declared 100% positivity for *Trichostrongylus* spp, they also declared 3 deaths related to the infestation. One last collection, also in the UAE, declared a dead Arabian Oryx positive for *Trichostrongylus*, without specifying if it was an occasional finding.

Coccidiosis and cryptosporidiosis

In the UAE, one collection reported 10-12% of their population positive for an unidentified coccidian. Another collection reported



3 casualties due to coccidia spp. One more collection reported 4 cases; no deaths were reported and there was no mention about the species of coccidia involved. There were no other reports of parasites infestation from other countries.

Tapeworm

One collection in the UAE identified 3 cases of infestation by *Moniezia expansa*. *M. expansa* infestation is generally harmless and asymptomatic, even when the tapeworms are present in large numbers. However, heavy infection may cause intestinal obstruction, diarrhea and weight loss.

Warble fly or hypodermosis

In the UAE, Hypodermosis was reported in only one collection affecting 30% of the animals. In Oman there was a report involving 25 Oryx.

Mange

One collection in Kuwait declared 80 % of the animals getting affected by mange. In the UAE one collection reported one suspected case.

Ticks

Several collections reported ticks on their animals in the UAE, but the prevalence varies a lot. One collection reported the

presence of ticks, while another calculated that about 5% of their animals carried ticks. One more collection reported observation of ticks on most animals. One collection identified one tick as *Hyalomma* genus.

We also have reports of ticks found in 2% of the animals of one collection in Bahrain.

In the UAE the genus of ticks reported are: *Hyalomma*, *Phypicephalus*, *Boophilus*, *Amblyomma* and *Argas* (Dubai Municipality Pest control section). The most common species signaled seems to be *Hyalomma* *dromedarii*.

Ticks are globally significant vectors of virus, bacteria and protozoa, causing several animal diseases. A high number of ticks could also cause anemia, paralysis, immunosuppression and infections at the bite wound area. It is very important to keep the load of ticks inside the collection under control by implementing preventative measures on both the animals and on the environment too. Any new Arabian Oryx entering the collection should be treated before transportation.

Other Ectoparasites

One collection in UAE found some unidentified parasites on the tails of the Arabian Oryx.

6.4 Fungal Diseases

Two cases of ringworm were reported from UAE. One case was so severe that it led to euthanasia. In Oman, one collection reported 5 % of the population having fungal lesions on the rump area.

6.5 Other Pathologies

Dental diseases

One collection in UAE reported three cases of tooth abscess, of which one was fatal and was confirmed by X-ray.

Metabolic diseases

There are 5 suspected cases of metabolic acidosis in the UAE, with the loss of one Oryx. Another collection had three non-fatal cases of suspected metabolic disorder. One additional collection described 5 cases of nonspecific "indigestion" on the basis of field observation. In Oman three Oryx died for "bloating" and two more got sick.

Nutritional Disorder

Only two cases of nutritional disorder were reported in this survey.

Stress myopathy

Four collections in the UAE reported a total of 10 cases and 6 fatalities related to stress myopathy.

Trauma

A total of 114 cases of trauma were reported in the participating Middle East collections with a mortality rate of 38.6% out of the total number of cases. Fighting is still the most common source of trauma for the Arabian Oryx, especially between males.

One car accident was reported as fatal in a MP collection, while 4 cases of Hemothorax and 4 cases of broken legs were also reported.

Foreign Bodies

Four fatal cases of foreign body ingestion were reported in the UAE. All cases were confirmed by postmortem examination. The foreign bodies found were mainly plastics and ropes. In Oman, one case was reported and confirmed by X-ray. It was not a fatal case.

Old Age

A total of 60 animals are reported dead for old age, out of which 35 were from UAE, 3 from Bahrain, 18 from Oman, 3 from Saudi Arabia and one from Jordan. Fifty three additional animals are reported as old on the basis of observation but they were still alive at the time of the survey.

Others

One collection in the UAE reported 13 cases of mortality due to a combination of old age, fighting and traumas.

6.6 Pathologies not reported in 2018

- Actinomycosis
- Anthrax
- Babesiosis
- Blue tongue (no clinical cases but some seropositive)
- Botulism
- Caseous Lymphadenitis (Pseudotuberculosis)
- Chlamydiosis (no clinical cases but some seropositive)
- Hydatidosis
- Leptospirosis
- Listeriosis
- Lyme disease
- Leptospirosis
- Paratuberculosis (No clinical cases, no positive serology)
- Q fever (no clinical cases, but some seropositive)
- PPR
- RVF
- Tetanus



7. REPRODUCTIVE PERFORMANCE

The survey gathered some information concerning the breeding management system applied by collections.

Twenty-two [22] collection sites apply the free breeding system, letting the animals breed freely, while the other 24 sites manage the breeding of their Oryx populations (Fig 7).

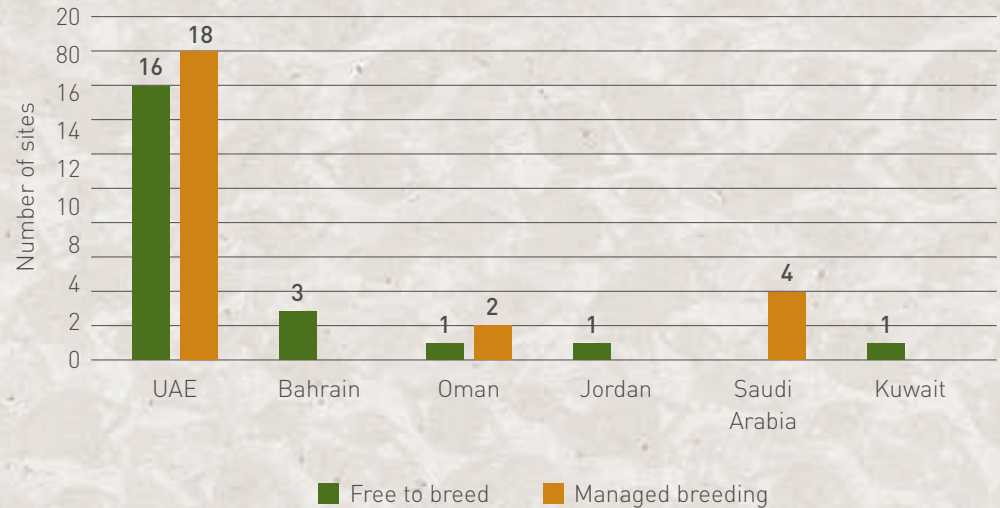


Figure 7. Breeding system applied by surveyed sites in the range states during the reporting period of 2018.

Table 5 shows the reported breeding intervals between 2 consecutive pregnancies of female Oryx in the surveyed collections.

Table 5. Observed breeding interval between 2 consecutive pregnancies of female Arabian Oryx

Time frame	% of collections
About 10-12 months	43
About 13-18 months	49
More than 2 years	8

7.1 Reproductive tract disorders recorded in 2018

Balanoprophitis

In UAE, one collection reported one case of balanoprophitis. Balanoprophitis is a condition that affects the penis causing inflammation of foreskin and glans.

Cesarean

Oman: 2 cases with one fatality were reported from old females. One case was reported in UAE.

Dystocia

In Oman 3 cases were reported with no casualties on the dams; the dams were reported as old animals. Jordan reported 2

fatal cases and the UAE reported 7 cases of dystocia of which 5 were fatal. In 4 cases the cause was an abnormal position or a narrow vagina. One collection tested the dams for Q fever and Brucellosis and the results were negative.

Abortion

One abortion during the 1st trimester was suspected in the UAE, but the fetus was not found. No further investigation was done. Two cases of abortions were observed in Oman, but there was no report of the possible causes.

Three cases of abortion during the 3rd trimester due to *Toxoplasma gondii* were diagnosed by PCR in a collection in UAE. One more case of abortion during the 3rd trimester was declared in a collection, without a precise diagnosis.

Retained Placenta

No cases were reported during 2018, but one case was signaled in 2017 in one collection in UAE.

Uterus Prolapse

One case was documented in the UAE. The animal was euthanized for humanitarian reasons.

Mismothering

Five cases of mismothering were reported in the UAE. Two cases were confirmed with postmortem examination finding only starvation signs in the dead calves.

8. MORTALITY CAUSES: SYNTHESIS

In 2018, the majority of the deaths were due to old age (60 cases). Trauma is also a major cause of losses (44 cases). A serious loss of 33 animals was recorded in one collection due to FMD (Fig 8).

Reproductive disorders caused the loss of 15 animals. A relevant event was the loss of 9 animals due to Mycoplasmosis (CCPP).

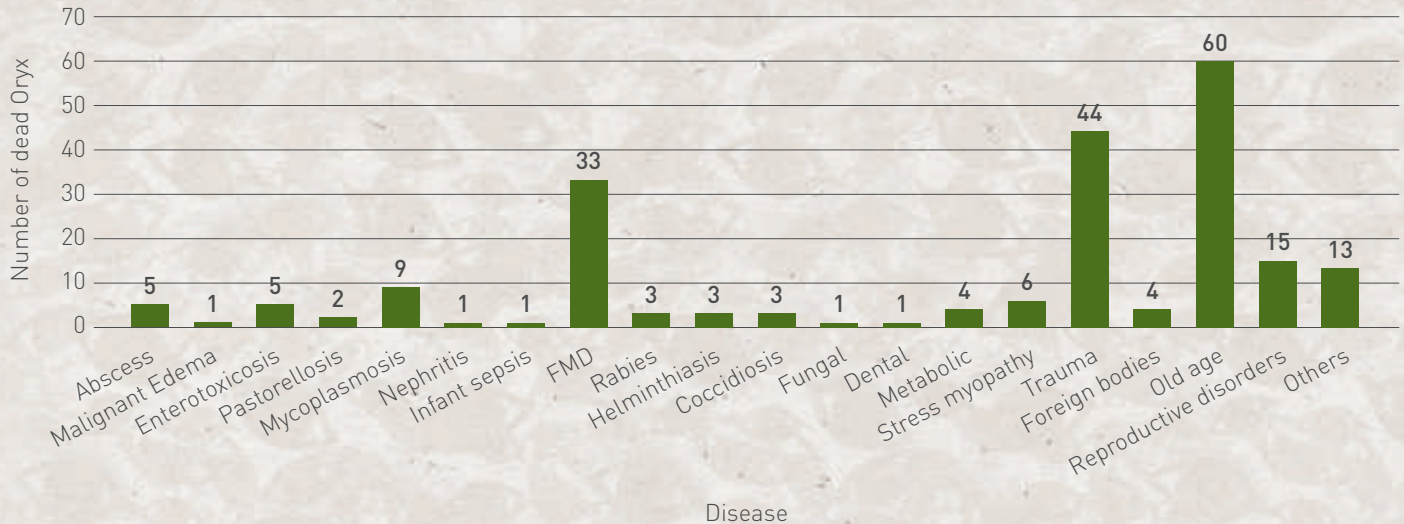


Figure 8. Mortality cases of Arabian Oryx populations in the surveyed sites in the range states during 2018.





9. ANAESTHESIA

The surveyed collections were asked to share their experience with anesthetic drugs, route of administration, effects and adverse effect (Table 6). The dose was not always expressed in mg/kg, so all given data was homogenized to mg/kg in order to easily compare the data. Some data mentioning only the concentration of the solution could not be used [e.g. 0.007mg/ml, instead of the actual dose used in mg/kg or in mg total]. For each combination of drugs all the protocols used are listed. Most collections mentioned the use of IM darting as the way to administer anesthesia, others did not specify the details.

The supply of the anesthetics drugs suitable for darting might be challenging.

Table 6. Records of anesthetic drugs and their uses in the surveyed Arabian Oryx collections during 2018.

Drugs	Doses 1	Doses 2	Doses 3	Doses 4	Comments
Ketamine HCl/ Xylazine	1.2mg/kg (K) + 1 mg/kg(X)	2mg/kg (K) + 0.05 mg/kg(X)	1.5mg/kg (K) + 1.5 mg/kg(X)	11 mg/kg (K) + 1.5 mg/kg(X)	The collection using Dose 4 described it as good.
Medetomidine/ Etorphine	N/A (M) + 0.4mg/ kg (Et)	0.07 mg/kg (M) + 0.03 mg/kg (Et)			One collection did not specify the dose of Medetomidine used, but they described a good anesthesia and smooth recovery
Xylazine/ Etorphine	N/A (X) + 0.4mg/ kg (Et)	0.37 mg/kg (X) + 0.03 mg/kg (Et)			One collection did not specify the dose of Xylazine used, but they described excessive salivation and smooth recovery
Medetomidine / Ketamine HCl	0.04 mg/kg (M) + 10-11 mg/kg (K)	0.2 mg/kg (M) + 1 mg/kg (K)	0.05mg/kg (M)+ 2-3 mg/kg (K)	0.08 mg/kg (M) + 10-11 mg/kg (K)	It is described as a good combination but with unpredictable induction time.
Medetomidine/ Butorphanol/ Zoletil	0.05mg/kg (M) + 0.2mg/kg(B)+ 1.2mg/kg (Z)				Good induction, down at 8-10 min post darting, gives about 60 min immobilization. If top up required-1mg/kg ketamine. Head holding within 12-15 mins from Atipamezole, standing soon after. Full recovery about 60 min.
Etorphine	0.02 mg/kg				Only one collection mentioned the use of Etorphine alone

K= Ketamine, X= Xylazine, Et= Etorphine, M=Medetomidine, B=Butorphanol, Z=Zoletil

10. SEROSURVEYS AND ROUTINE TESTS

One collection reported to have tested 2 of their animals for all the 15 diseases listed in the survey questionnaire. All results were negative. As the data could not be verified, it was excluded from the analysis. . Therefore, the total number of sites considered in the below chart is 45 and not 46 (Fig 9).

Tests for Brucellosis are the most common; more than half of the sites reported conducting these tests. The second most

common test is the Routine Fecal test, done by a little bit more than 1/3 of the sites. Paratuberculosis is also a commonly tested disease.

Eleven sites regularly run a full CBC and Chemistry panel. All other tests are done by a minority of sites. Most MP (managed population) and RH (reintroduced herd) populations are not getting regular veterinary testing for obvious practical reasons.

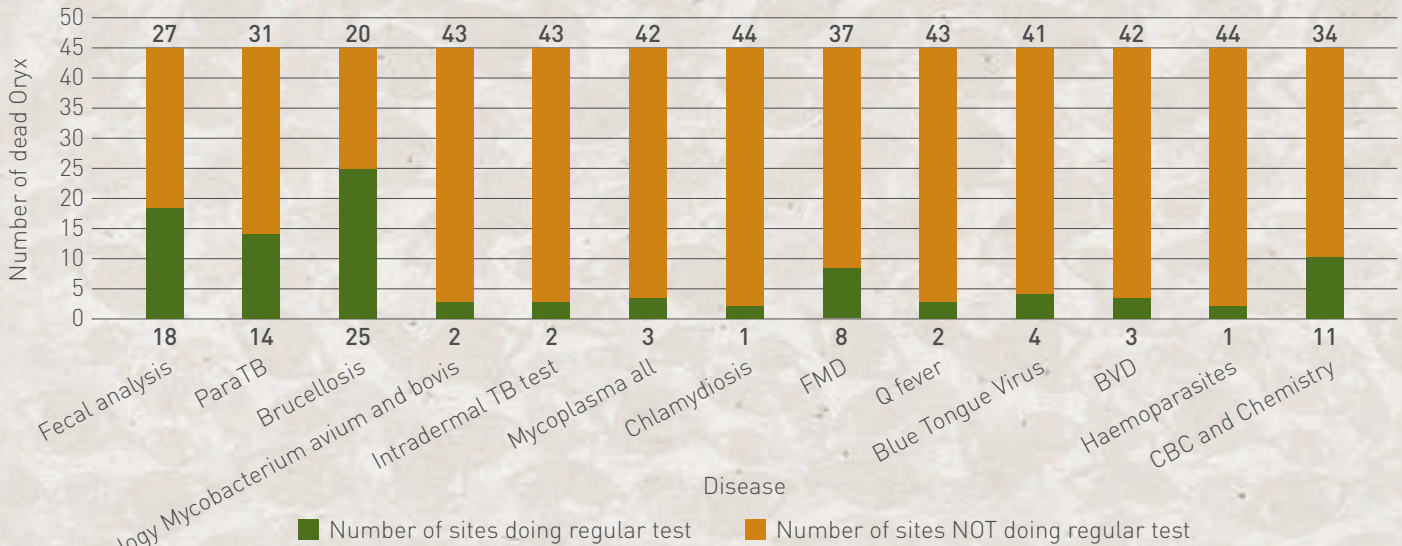


Figure 9. Number of Arabian Oryx sites that conduct veterinary screening (2018 data)

Bovine TB

Bovine TB tests were performed, yearly or biannually, by only 4 collections in the UAE. Two collections used ELISA serology with negative results. One collection in the UAE reported having tested 80 Arabian Oryx with Skin test (comparative skin test) and finding 4 doubtful cases.

Another collection also tested 9 animals using skin test and all animals were negative. The numbers of collections testing is still too low to be able to give us an idea of the prevalence of Bovine Tuberculosis in the Arabian Oryx.

Paratuberculosis

Five collections consisting of 14 sites tested a group of their Arabian Oryx for Paratuberculosis using ELISA kits. Some collections did it randomly on the population, while others tested all animals. All collections that conduct screening for this pathogen do it annually. A total number of 361 animals were tested and all results were negative. The data is not sufficient to evaluate the statistical significance of the results.

Brucellosis

Brucellosis test was the most common routine test done on Arabian Oryx during 2018. Six collections (24 sites) routinely tested their animals for Brucellosis, yearly or biannually. The tests used were RBT and ELISA. In the reporting year, a total of 552 Oryx were tested and only one was found positive.

Despite the overall positive results in this last Arabian Oryx brucellosis surveys, brucellosis remains endemic in several countries in Middle East. The attention around this disease should remain high.

Chlamydiosis

Only one collection tested some Arabian Oryx for Chlamydia abortus, although not on a routine basis. Eleven percent of the animals tested positive. The impact of this disease on the Arabian Oryx breeding performance is not yet clear.

Mycoplasmosis

One collection tests routinely (annually) their animals for Mycoplasmosis. Two more collections tested only in 2018, but not as a routine. In total data was received from three collections (9 sites), of which 2 collections specified that they tested for CCPP (*Mycoplasma capricolum* sub *capripneumoniae*). One collection tested also for CBPP (*Mycoplasma mycoides*). A total of 58 Arabian Oryx were tested for CCPP and 18 were found positive, accounting for 31% of the tested animals. Concerning CBPP, the data received indicated a 26% positivity on the total number of animals tested (one collection only). Once positive, animals will, most probably, remain carriers throughout their life.

CCPP is a very severe disease causing tremendous economic loss in domestic farms; and thus should get more attention from government authorities.

Arabian Oryx could act as reservoir of the infection. Special attention should be placed on the movement and exchange of the animals. There is a clear evidence of the lack of efficiency of the commercial vaccines on stimulating the immune system response on Sand Gazelle (*Gazella marica*) (Lignereux et al., 2018). CCPP is an OIE listed disease.

Q Fever

Two collections were tested for Q fever (ELISA). One collection screens all of its animals yearly, while the other did a random check. The prevalence of positive animals was quite high in both collections (19% and 17%). The result fits with a previous survey finding (Chaber et. al, 2012) that indicates that a wide range of ungulates has been exposed to *C. burnettii* in the region.

Q fever is caused by a bacterium that is quite resistant in the environment, and can be transmitted easily, not only sexually, but also by ticks and dust. The lack of vaccines available prevents a control plan from being set up and the only control possible is thus to test and remove the positive animals from breeding. Q fever is a zoonosis and it is an OIE listed disease.

FMD

Two collections (8 sites) in the region tested a total of 24 animals for FMD. Five sites test routinely using a rapid test. All samples tested negative. Most collections vaccinate their animals against FMD, when possible, so the routine test cannot be done.

FMD is an OIE listed disease and it has a severe economic impact on the farming industry.

Blue Tongue

In the region 2 collections (4 sites) conducted a serosurvey on a total number of 62 animals, although not on a routine basis. Only one Oryx was positive. BTV is a non-contagious viral disease, affecting domestic and wild ruminants, that is transmitted by biting midges. BTV does not cause severe disease on bovidae (except possible fertility/abortion issues), but the infected animals are to be considered carrier up to 90 days (OIE data), therefore they could act as temporary reservoirs for the biting midges (Culicoides) responsible of transmitting the disease. The disease causes high morbidity and mortality in sheep, therefore, a carrier is considered a threat for the farming industry.



BVD

Only one collection tested nine of their animals for BVD virus and the results were negative.

CBC/Chemistry analysis

This diagnostic tool is used as a yearly routine by 4 collections (10 sites). One collection uses it only when needed.

Fecal Test

Fecal test is the second most common routine test. It is performed all over the range states in 18 sites.

Some collections do regular tests (monthly), others every 4 or 6 months and some yearly. Most collections conduct the fecal test when needed.

Nematodirus (Trichostrongylidae family) were the most common finding. Nematodirus are parasites of the cranial small intestine of ruminants. The life cycle is direct. Nematodirus spp. do not generally cause disease except in association with other parasites or if the load is very high. Lambs and calves with high load of Nematodirus may develop severe dark-green diarrhea, anorexia and wasting.



11. PROPHYLAXIS

The possibilities of vaccinating the Arabian Oryx depend on the management of the collection. As expected, reintroduced and managed populations are frequently left unvaccinated. With a total number of 9654 Arabian Oryx in the reporting period, 3608,

(37% of the total recorded Oryx population) of Oryx are vaccinated against FMD (Figure 10). About 42% are vaccinated against PPR and 35% are vaccinated for Clostridium spp. For all other diseases, the percentage of covered animals falls below 20%.

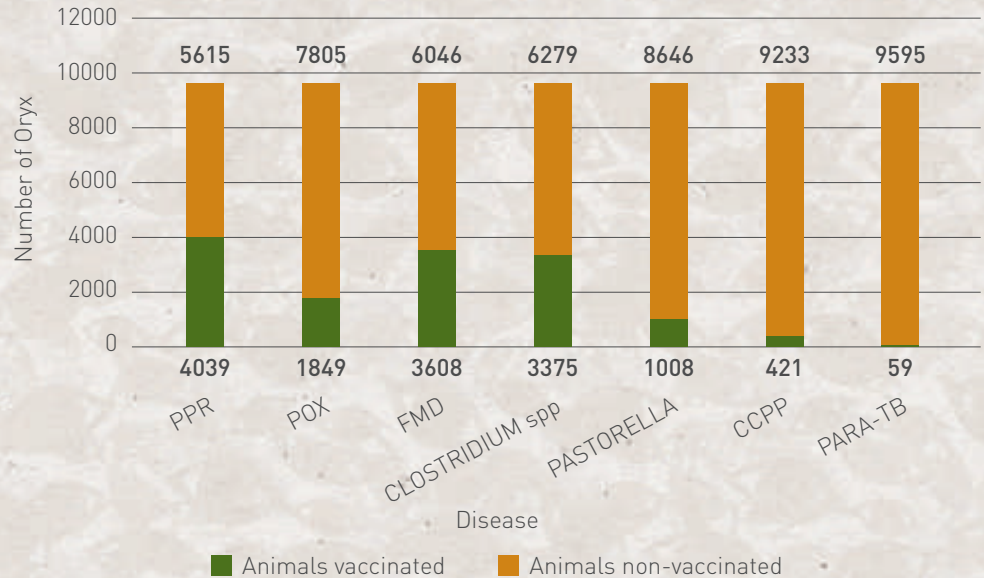


Figure 10. Number of vaccinated oryx in 2018, and vaccines used, on surveyed population.

Fifty nine percent (59%) of all sites hold captive breed populations, but not all of those animals are vaccinated.

Most vaccinations protocols applied to Arabian Oryx are carried out on the basis of the risks they are believed to be exposed to. The protocol applied will depend on the nature of the vaccine. Inactivated vaccines will need a more intensive protocol, usually involving 2 injections at 1 month intervals, followed by a yearly booster. A live attenuated vaccine might be done yearly or every 2 years. The vaccination results depend on several factors:

- Vaccine quality (they should be manufactured according to OIE recommendations) ,
- Maintenance of an appropriate cool chain,
- Response of the target species immunity system
- Protocol followed for inactive or attenuated vaccines.
- Use of the Serotype (if applicable) present in the region.

Most of the vaccines used for Arabian Oryx are validated on domestic species only.

PPR vaccine

An assessment of seroconversion was carried out in a collection in the UAE and published in 2013 (Sa et.al., 2013). A live attenuated vaccine produced in Jordan was used for the assessment. The results strongly suggested that vaccination of Arabian Oryx with a single dose of a homologous live attenuated

PPRV vaccine produces antibodies levels comparable to those known to be protective in small domestic ungulates (Singh et. al., 2004; OIE 2012).

No confirmed case of PPR has ever been reported in Arabian Oryx, but the vaccination is strongly recommended, at least every 2 years.

FMD vaccine

There is plenty of evidence that the FMD virus can severely affect the Arabian Oryx (see previous Arabian Oryx disease reports). When possible, all Arabian Oryx should receive vaccination for the circulating strains. In the Middle East, the vaccine should include strain A and O, but also Asia1 and Sat2. It is very important to use a vaccine manufactured according to OIE guidelines. The commercially available vaccines are inactivated and therefore the correct protocol would be to administer 2 doses 4 weeks apart, and then every 6 months. This demanding vaccination protocol is challenging for most collections, and it is virtually impossible in managed and reintroduced populations.

FMD vaccines strain O and A, and their ability to stimulate the seroconversion, were assessed in a study conducted in 2008 (Kilgallon et al., 2008). The conclusion was that one dose of a standard commercial FMD vaccine is not capable to elicit a sufficient antibody response in Arabian Oryx to confer lasting protection. A booster dose is needed, as is the case for domestic species.



In some countries the FMD vaccination is mandatory in all domestic ruminants.

Capripox vaccine

Greta et. al, (1992) documented the sensitivity of the Arabian Oryx to the Capripox virus. A commercial attenuated vaccine is available in the market, nevertheless, only 20 % of the animals listed in this survey are vaccinated for Pox virus.

The vaccine is supposed to protect the animal for life.

Clostridium vaccine

Thirty-seven percent (37%) of the surveyed Arabian Oryx were vaccinated in 2018 against Clostridium. The commercially available vaccine is inactivated and usually multivalent.

A single vaccination with most Clostridial vaccines does not provide adequate levels of protection and must be followed within a period of 3 to 6 weeks by a booster dose, and then annually or , preferably, biannually. Young calf vaccination does not yield adequate protective immunity for at least 1 to 2 months, so most vaccination strategies target the pregnant mother so that maximum immunity is imparted to the calf in the colostrum.

Pasteurellosis

Pastorellosis is recognized, together with Mannheimia Haemolytica, as a serious threat for ungulates. It causes severe hemorrhagic pneumonia. Pasteurella is commonly living in

the high respiratory organs of healthy animals, but it might be activated by any kind of stress. The vaccine might help to preserve the health of the animals undertaking stressful events like transportation. Most commercial vaccines are multi-strains and associate *Pasteurella multocida* with *Mannheimia hemolytica*. It is important to use the vaccine containing the strains circulating in the region (see reported pathologies section for OIE references).

CCPP

Only one collection (5 sites) vaccinates all of its animals for CCPP. Arabian Oryx are proven to be sensitive to CCPP (Chaber et al., 2014), but, as mentioned in the diseases section, some commercial vaccines are proven to be unable to stimulate an adequate response of the immune system (Lignereux et al., 2018).

Paratuberculosis

The Paratuberculosis vaccine can reduce clinical disease and fecal shedding of *Mycobacterium avium* subsp. *paratuberculosis* (MAP) but it does not protect against infection. The vaccine is indicated for use in herds with a high MAP infection prevalence or herds with limited resources for implementing paratuberculosis control measures. In heavily infected herds, a combination of vaccination and disease control measures can help protect susceptible young stock while reducing environmental burdens and limiting MAP transmission.

There is insufficient data from all collections to evaluate the prevalence of MAP in Arabian Oryx, but the 2018 serosurvey results that were received, did not document any positive case. The use of this vaccine might interfere with the TB testing results. Vaccinated animals become sensitive to the Tuberculin skin test, and they produce antibodies interfering with serodiagnostic tests.

Medications

Several collections mentioned the use of deworming medicine administered yearly during checkup and vaccination procedures, or as evidence based treatment. Ivermectine is the most common deworming drug used. Some collections prefer different drugs with similar effects on endoparasites, like Doramectin, Fenbendazole or Cydectine. Praziquantel was used only by one collection yearly to treat 100% of the population against tapeworms.

The use of an external anti parasitic (Fipronil) is mentioned by one collection and it is used in evidence based cases.

Most collections use some form of vitamin supplementation. Several inject Vitamin E and Selenium or multivitamins solutions yearly or more frequently. Very few collections administer the supplements in water. The permanent use of mineral block is mentioned by 11 sites only. The usage of other drugs was not mentioned.

12. EPIDEMIOLOGICAL RISKS

About 70% of the sites surveyed in 2018 are not open to the public. Whereas the 30% of the sites that are open to the public.

public accommodate a total of 1460 Arabian Oryx. Of those sites open to the public, 7 are CB (captive bred) and 8 are MP (managed population).

Presence of other wild ungulate species in Arabian Oryx collections

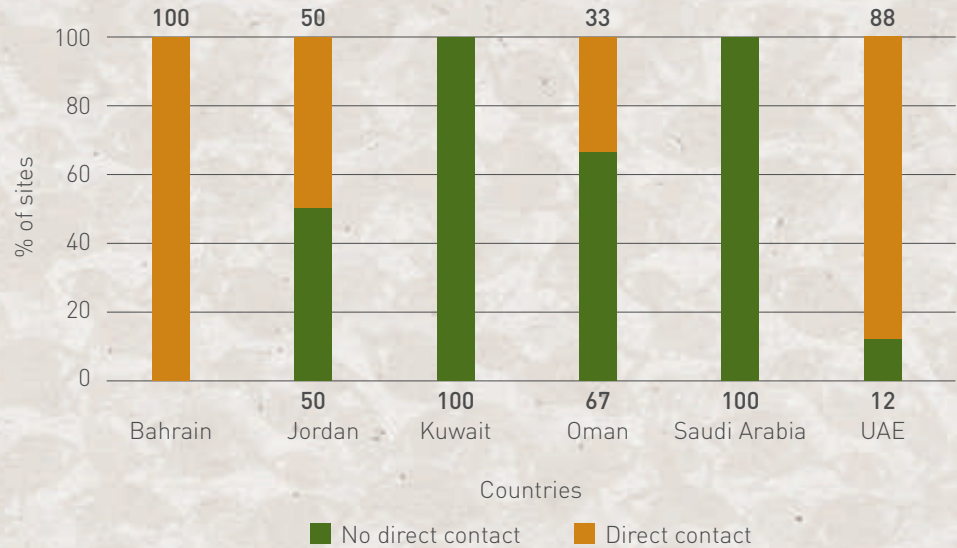


Figure 11. Percentages of Oryx sites in contact with other ungulates.

One site in UAE did not answer the question, about the direct contact of the Arabian Oryx with other ungulates.

As per Figure 11, 88% (6587 individuals) of the Arabian Oryx populations in UAE are housed in the presence of other wild ungulate species.

The two most common ungulates in direct contact with the Arabian Oryx are Sand gazelles (*Gazella marica*) in 30 sites, and Mountain gazelles (*Gazella gazella*) in 18 sites. Plenty of other species of ungulates are recorded, but in lesser numbers.

Although the sensitivity to disease might vary from species to species, the presence of other ungulates in close proximity obviously increases the possibility of disease transmission through symptomatic or even asymptomatic animals (e.g. Urial Sheep as possible healthy carrier of malignant catarrhal fever).



Distance between Arabian oryx collections and domestic hoof stock species

Twenty-five Oryx sites in the range states were reported to be located within 1 to 15 km away from domestic livestock (Figure 12). Four sites are located between 500 and 1000 meters from farms.

Five sites are located at less than 500 meters and only one site is in a direct contact with farming ungulates. It is unclear how those distances were calculated and reported as we witnessed

Arabian Oryx separated from livestock by one single fence, making direct contact possible, without any fenced buffer zone. Most likely, the distance was measured between the place where herds are most usually seen (usually around feeders and water troughs), without considering that Oryx might move in all parts of the provided area, especially when patrolling the perimeter fence.

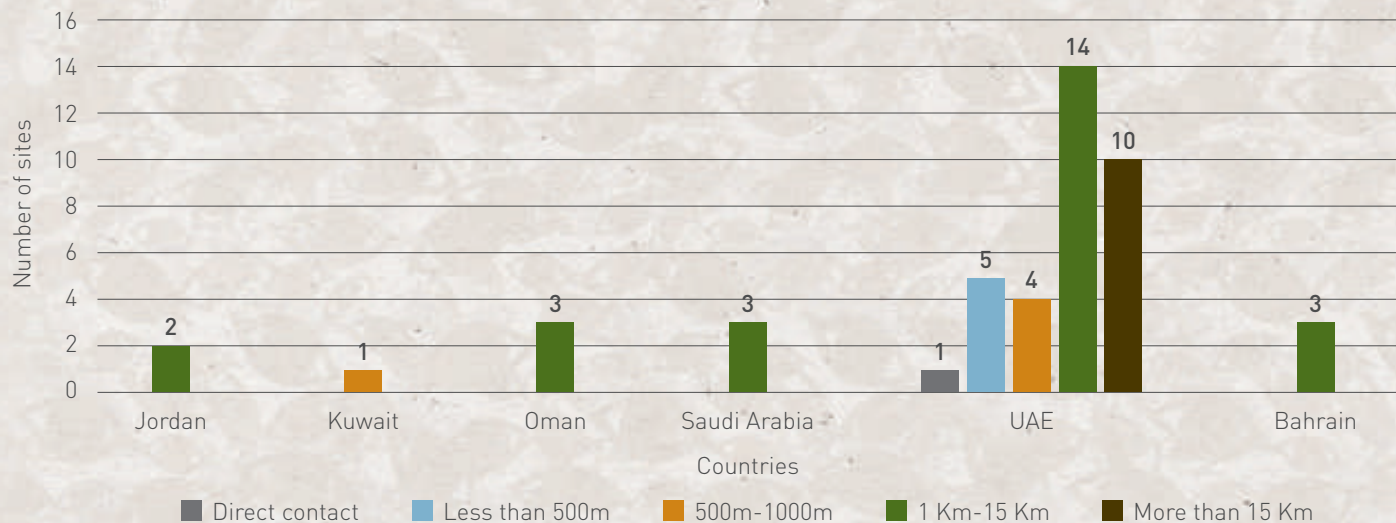


Figure 12. Number of Oryx sites according to distance to domestic livestock in 2018.

13. RECOMMENDATIONS

Exchanging information between the collections is an excellent way to improve our knowledge on the Arabian Oryx. Limited published research is available for this species; therefore information sharing and reporting on case studies and disease prevention and screening protocols are of the utmost importance.

Veterinary Support

All collections are encouraged to rely on a fix veterinary support, rather than on an occasional one. The cost will be compensated by better epidemiological control, implementation of biosecurity measures and a permanent monitoring of health status. This will lead to better control and eradication of the infectious diseases still widely circulating in the region.

Record Keeping

The adoption of the ZIMS record keeping system is strongly encouraged, when possible. Up to now only a little bit more than 20% of the sites adopt this internationally recognized system.

Health Assessment Before Transportation

As a measure to control prevalence of infectious diseases, it is important to check all animals before exchanges, export and import. The status of the collection concerning Tuberculosis,

Brucellosis, CCPP, Q fever, FMD and Paratuberculosis should be assessed regularly.

Vaccines

When possible, we recommend to vaccinate all animals in the collections for at least FMD, PPR and Capripox. Concerning the CCPP vaccines available in the region, as we already mentioned before, there is evidence of lack of efficacy on wild ungulates. (Lignereux et al. 2018) We welcome specific studies and trials on that issue. We also recommend, when possible, to use only vaccines manufactured following OIE guidelines.



ACKNOWLEDGEMENTS

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We would like also to thank all the Arabian Oryx collections across the range states listed below for their participation in this survey. Without their valuable input and information sharing this edition of the disease report would not have been possible:

- Bahrain: Supreme Council of Environment.
- Jordan: Aqaba Special Economic Zone (Wadi Rum Protected Area).
- Royal Society of Nature Conservation (Shumari Wildlife Reserve).
- Oman: Diwan of Royal Court (Office for Conservation of the Environment); Royal Court Affairs (Omani Wild Animals Breeding Center).
- Saudi Arabia: Saudi Wildlife Authority.
- Kuwait: Kuwait Zoo.
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