Dama Gazelle *Nanger dama*

Conservation Strategy 2019-2028: 5-year Review and Update

SECONDARK FOUNDATION

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Dama gazelle (*Nanger dama*) Conservation Strategy 2019-2028: 5-year Review and Update

Supporters

Participants

Dama Gazelle (*Nanger dama*) Conservation Strategy 2019-2028: 5-year Review and Update

Produced following the workshop held at Kerrville, Texas,
17-19 September 2024

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Front cover photo: addra gazelle male in display at Kyle Wildlife, workshop ranch field trip location (photo by Elizabeth Cary Mungall).

Rear cover photo: addra gazelle female with young, one of which is hers, at Kyle Wildlife, workshop ranch field trip location (photo by Christian Mungall).

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The designation of geographical entities in this report does not imply the expression of any opinion on the part of any participating organization concerning the legal status of any country, territory or area, or concerning the delimitation of any frontiers or boundaries.

Contents

List of Abbreviations

AAZ Al Ain Zoo (UAE)
ANEF Agence Nationale des Eaux et Forêts (Morocco)
ATNNR Aïr and Ténéré National Nature Reserve
AZA American Zoo Association (USA)
C2S2 Conservation Centers for Species Survival (USA)
CSIC Spanish National Research Council (Spain)
DFAP Directorate of Wildlife and Protected Areas (Chad)
DFCAP Directorate of Wildlife, Hunting, and Protected Areas (Niger)
DGF General Directorate of Forests (Algeria)
DPN Directorate of National Parks (Senegal)
EAD Environment Agency – Abu Dhabi (UAE)
EAZA European Association of Zoos and Aquaria
EEZA Experimental Station of Arid Zones (Spain)
EEP EAZA Ex-situ Programme
ENCR Ennedi Natural and Cultural Reserve
EWA Exotic Wildlife Association (USA)
GBR Gadabéji Biosphere Reserve
IUCN International Union for the Conservation of Nature
MW Marwell Wildlife (UK)
OROAFR Ouadi Rimé–Ouadi Achim Faunal Reserve (Chad)
PVA Population Viability Analysis
RZSS Royal Zoological Society Scotland (UK)
SAF Second Ark Foundation (USA) (soon to be restructured as Exotic Wildlife Association Conservation Foundation)
SCBI Smithsonian Conservation Biology Institute (USA)
SC Sahara Conservation
SPA Source Population Alliance (USA)
SSC Species Survival Commission
SSP Species Survival Plan (AZA)
TTNNR Termit and Tin Toumma National Nature Reserve
UAE United Arab Emirates
ZAA Zoological Association of America
ZIMS Zoological Information Management System

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1. Introduction

A dama gazelle conservation planning workshop was held in Edinburgh, Scotland, December 2013 to develop a conservation review, including a long-term vision and a set of objectives and actions, published in English and French versions (RZSS and ASG 2014). In December 2018 a second conservation review and planning workshop took place in Al Ain, UAE, organized by Al Ain Zoo, the Royal Zoological Society Scotland and the IUCN Antelope Specialist Group. This workshop brought together all major dama gazelle stakeholders for the first time, including NGOs, representatives of current and former range countries, international experts, veterinarians, and ex-situ population managers. Following the December 2018 workshop, a conservation strategy for the species was published (Al Ain Zoo, IUCN Antelope Specialist Group and Royal Zoological Society Scotland, 2019). In July 2021, an online review of progress was conducted to (i) review progress made after 2.5 years; (ii) highlight major developments since 2018; (iii) review, amend and update the actions as appropriate; add new required actions that had arisen since 2018; and (iv) outline the monitoring and evaluation plan for the strategy going forward.

A third dama gazelle conservation planning workshop was held in Kerrville, Texas, on 17-19 September 2024, hosted by the Exotic Wildlife Association and the Second Ark Foundation. Appendix 1 lists the participants and invitees. The aims of this workshop were to: (i) review progress made by the halfway (5-year) point in the conservation strategy; (ii) assess progress, amend and update the actions as appropriate and add new actions; (iii) increase contact and collaboration between the Texas rancher community and international dama conservation practitioners.

The workshop program consisted of an introduction, presentations, a status update, review of the actions table, plus discussions on three topics: taxonomy, inclusion and networking, fundraising (the full agenda is in Appendix 2).

2. Status update

A summary of progress since 2021 was drafted, circulated to all participants before the workshop, and revised to include comments. Further information presented during the workshop has been included in this version.

2.1. Historic range

Recent research by Arnd Schreiber (2021) revealed 19th century records of dama gazelle in the south and southeast parts of the Lake Chad Basin, situated within contemporary Cameroon. This country has now been added to the list of historic range states. A review of dama gazelle depictions in rock paintings at sites across the Sahara, combined with some published 19th century travelers' reports, also confirmed the historical occurrence of dama gazelle in Libya (Schreiber & Striedter 2022).

2.2. Niger

Air & Ténéré National Nature Reserve (ATNNR)

The reserve covers 77,360 km^2. Data was collected from 1979 to 1990 by John Newby and from 2017 to 2023 collected by Sahara Conservation. On a field survey in November 2023, 18 dama gazelles were observed, the highest total yet. Based on the latest field observations and photos from camera traps, the population is estimated to be 20-30 individuals and concentrated on the area of Mount Takolokouzet. The site lies within the range of *Nanger dama dama* and this population contains unique and irreplaceable genetic value. The SC team returned in November 2024; no dama were observed but several tracks were detected.

The main threats are poaching, gold panning, political instability, competition with livestock, habitat degradation and loss, and lack of resources for conservation action. In April 2024, evidence of poaching of two individuals (skins) was found for the first time in the area, highlighting the prevalence of threats. SC supports surveillance and patrols, engagement of local communities, and ecological monitoring. So far, 17 officers have been trained and equipped, 4 community guards were appointed, one of whom is still employed, 7 health missions were conducted, benefiting 1121 people; 23 families were directly supported in goat farming. Patrols have taken place in most months since January 2022 on Mount Takolokouzet.

Following a participatory process, an action plan for dama gazelle in the ATNNR has been developed and received government approval in early January 2025. The next steps include promoting the area, identifying new partners to support the implementation of the road map, and continuing work to safeguard one of the last wild dama gazelle populations.

Termit & Tin Toumma National Nature Reserve

Most conservation activities within the reserve have been reduced by the significant withdrawal of support and financial sanctions imposed by the international community after the change in government in July 2023. Only anti-poaching activities, community conservation and governance are maintained to preserve the dama gazelles. Some dama gazelles were present 2.5 years ago, living in marginal habitat with minimal opportunity to expand. There is no recent estimate of the dama population size. John Newby's best guess for current numbers would be around 20. There is no change in relations with the companies managing the oil concessions.

Tamesna (western Niger)

No recent information and it is highly unlikely that any dama are present. The habitat is sparsely wooded grassland without a mountain refuge.

Gadabedji Biosphere Reserve

A feasibility study on the reintroduction of dama gazelles was produced in 2022, but no action has been taken so far.

2.3. Chad

Ouadi Rimé-Ouadi Achim Faunal Reserve (OROAFR)

A series of aerial surveys has been carried out by Wings for Conservation. High-definition photos were taken of all herds to analyze the sex and age structure of all groups seen. A summary presented by Tim Wacher at the SSIG meeting in May 2024 reported that:

- In December 2023, 64 dama were counted on the aerial survey comprising 23 females, 25 breeding age males and 16 individuals less than one year of age. Seven females are judged to be 1-2 years old and 16 are older.
- Estimates from sample ground counts during the same period are highly variable due to very low encounter rates, but indicated broadly similar results, e.g., 54 dama (95% confidence interval 13-229) in December 2021. OROA probably holds at least 50% of the remaining animals in the wild.
- Recruitment was showing a slowly increasing trend, then as a result of exceptionally harsh conditions and high temperatures during the hot season (April-June) of 2024, high mortality rates were experienced by all ungulates in OROA, wild and domestic. These included the discovery of 5 wild dama carcasses and 3 of the 6 dama involved in the pilot release. The area is not fenced and there is a lot of suitable habitat, but the dama are sensitive to human pressure. Staff are in the field every day, monitoring habitat use, seasonality, group sizes, and flight behavior.

In October 2023 a single flight to the Ouadi Hawach area in the north of OROA, where dama were last confirmed in 2014, found no evidence of dama presence.

Poaching pressure in OROA is low and the main issue is competition from livestock and pastoral issues. Sahara Conservation is in contact with the government regarding management of these issues.

OROAFR captive breeding population

There were 32 dama gazelles at the end of December 20243, in two breeding groups. The animals originate from (i) the Manga region of Chad, (ii) the wild population in OROAFR, and (iii) the EAD herd in Abu Dhabi. Records indicating the identity and origin of all individuals are maintained. Six animals of 100% OROA origin were released into the reserve from the captive group on 23 January 2024, taking the group from 27 to 21. Captive breeding restored the numbers, despite the very harsh conditions experienced in 2024. A management plan for the breeding population has been developed and a population viability assessment (PVA) is being carried out to identify optimal breeding and release strategies. The dama gazelle is integrated into the scimitar-horned oryx program funded by EAD. The current Phase 3 extends until 2029. Some of the funding will be used to support dama gazelle conservation.

Manga/Eguey

In November 2023, a five-day aerial survey by Wings for Conservation and Sahara Conservation did not record any dama gazelles (the last record of presence was in January 2020). Issues with border between Chad and Niger restricted flying in certain areas. The area is unprotected and there are believed to be few, if any, animals remaining. It is unlikely that further resources will be invested in monitoring this area.

Ati

No recent information.

2.4. Morocco

There are currently approximately 160 dama gazelles in R'Mila Royal Reserve (100; mhorr), the M'Cissi Reserve in eastern Morocco (26; mhorr), and Safia Reserve in the south (27; mhorr), Rabat Zoo (unknown), and the private Al Maha Farm (unknown). Ten dama have recently been transferred to another breeding center in the lower Draa Valley as part of a planned reintroduction project. In 2015, 24 dama were released from Safia, 10 of them with GPS collars, 3 of which worked for an extended period (Abaigar et al. 2019). In the first week after release, dogs killed 7 gazelles. Poachers scattered the remaining group 5 months later, and eventually all the surviving gazelles moved out of monitoring range.

A revised national Action Plan for the Conservation and Restoration of Wild Ungulates for the period 2023-2035 has been developed by the government agency (ANEF 2024). ANEF and EEZA-CSIC are currently carrying out an assessment of the most suitable habitats for reintroduction of the species.

In 2008, 18 gazelles were transferred from R'Mila to M'Cissi and 16 to Safia. M'Cissi currently has two breeding groups and one bachelor group and Safia has one male in a large breeding group. Births are higher in Safia, possibly due to higher vegetation cover which contributes to two breeding seasons a year, compared to one in M'Cissi (Abaigar et al. 2024).

2.5. Senegal
In Senegal, dama gazelle populations reintroduced since 1984 have suffered a sharp decline under the effect of several factors, including management issues and predation of the young by jackals. In 2012, 11 (2.3.6) were observed (Jebali 2012). In the Guembeul Special Faunal Reserve, the residual population is 4 individuals in semi-captivity. Two births were recorded in 2018. Unfortunately, these two individuals were later killed by jackals. In the Ferlo Nord Faunal Reserve, a total inventory is needed to assess the exact number of dama gazelles present on the site. However, the latest sightings are made up of two individuals. In 2012, following the first extension of the Katané enclosure, about 20 individuals were estimated, based on official counts (Jebali 2012). In the field, the species was encountered on three occasions only, twice as single individuals and the third time in a group of 4 (1.2.1). A document on the national strategy for the restoration of wildlife is being prepared to give greater coherence to the current wildlife reintroduction programmes, along with public policies on environmental preservation and biodiversity conservation.

2.6. Mali
No information since 2005-2006.

2.7. Algeria
The last known observation was in the 1970s. Koen de Smet photographed rock paintings of dama gazelles at several new sites in 2021-2024.

2.8. Sudan
No new information.

2.9. Ex situ

2.9.1. Global
On 8 July 2024, the Zoological Information Management System (ZIMS) listed a total of 856 dama gazelles at 52 institutions worldwide. The total may be a little higher because not all institutions are registered with ZIMS and not all institutions update their information regularly. In addition, there are almost 500 in North Africa and the Middle East and over 1500 on Texas ranches (Table 1). Almost all dama are managed separately as 'mhorr' (*N. d. mhorr*) or 'addra' (*N. d. ruficollis*). There is a small mixed population at Al Ain Zoo, UAE (see below).

The 'mhorr' breeding program began in 1971 with 4 founders coming from the western Sahara that remained in various military barracks in the former Spanish colony (Abaigar 2018). All "mhorr" in captivity and reintroduced are descended from these founders. All 'addra' *N.d. ruficollis* in captivity are descended from 33 animals captured in Ouadi Haouach (Wadi Hawash) in northeastern Chad by Frans van den Brink in 1967 (van den Brink 2018). The gazelles were captured from a vehicle using a pole with a noose at the end. If the pursuit continued for more than 3 minutes, it was stopped to avoid overheating the animals. 35 Dama gazelles were caught and flown to Bremen in West Germany for quarantine. Only 2 were lost and the remaining 33 animals were transferred as follows (males.females): 2.8 to Munich Zoo, West Germany, 1.2 to Leipzig Zoo, East Germany, 2.6 to Catskill Game Farm, New York State, 3.9 to San Antonio Zoo, Texas (split into 3 breeding groups).

2.9.2. Europe

All ‘mhorr’ in Europe are included in the EAZA EEP which holds 270 animals in 31 institutions. Space is a problem but there is a waiting list of new holders that want to join the EEP. The pedigree is >95% complete. A pedigree analysis of the captive population was recently published (Domínguez et al. 2024). The mating strategies applied are helping to increase the effective population size and balance the genetic contributions of the founders. Inbreeding is high, but no further bottlenecks or large subdivisions in the EU population have been detected. The population is in the queue for a Long-Term Management Plan by the EAZA Population Management Group. The animals breed well in good indoor facilities. A husbandry manual is being developed and may be of interest to captive holders outside the EEP. Dama are held in some mixed exhibits with roan, lesser kudu, Nile lechwe, giraffe, dorcas gazelle, oryx, ostriches.

2.9.3. North Africa and the Middle East

There are about 160 ‘mhorr’ in Morocco and around 25 in Qatar. In the UAE there are 30 addra at EAD’s Deleika breeding center, 210 dama at Al Ain Zoo (93 addra, 94 mhorr and 23 cross-bred), 3 addra at Sharjah Safari, and 68 (35 addra, 33 mhorr) in a collection managed by a private company.

2.9.4. USA

Dama gazelles are held in zoos and on private ranches in Texas. Almost all dama in the USA are ‘addra’, the eastern form *N.d. ruficollis*. There are possibly 10 ‘mhorr’, all privately owned.

The American Zoo Association (AZA) Species Survival Plan (SSP) for ‘addra’ includes 201 animals (109 males and 92 females) in 15 AZA and a few private institutions. 98% of the pedigree is known. The animals are breeding well, space is not an issue, and every female is given a breeding recommendation (this was not the case previously). The goal is to have every female breeding. Institutions that hold dama are committed to their conservation. There are some hoof issues in moist environments.

Many Texas ranches have native and exotic animals. The ranches are privately owned, receive no government funding, and the owners are individually responsible for fencing, feeding and watering, but the owners have to follow various government regulations.

The last census of about 1510 dama held mainly on Texan ranches dates from 2015. A new census, in collaboration with the Texas State Statistical Department and EWA, would be useful. An organization called Wildlife Partners presently has 200 dama at three sites.

The motivation for owning dama is often conservation or aesthetic, not only hunting (it is estimated that 30% of ranches conduct hunting). Ranching operations can sometimes be written off against tax. The financial value of one dama was estimated to be $4000-$9000 in 2018. Based on gazelle sales at 4 EWA auctions in 2023 to 2024, 1 male dama gazelle = about $3500 ($2500-$8000), 1 female dama gazelle = about $15000 ($8000-$30,000). By comparison, one head of cattle costs about $2000. Feed cost for one head of cattle can feed approximately eight dama gazelles.

Exotic animals including dama have died during severe winter weather, snow and ice, and subsequent power cuts (especially in 2020 and 2021). Extreme drought has also been an issue recently and historically (a 7-year drought in the 1950s influenced ranches to stock certain exotic species, although dama gazelles were not in the USA then). The EWA is educating people on requirements for feed and water for different exotic species. There are no known free-living (escaped) dama, as any non-native species can be hunted. Research opportunities for EWA rancher members to help dama research are summarized in Appendix 3.

2.9.5. Uses of the ex-situ population

In total, there are about 2900 dama gazelles in all ex-situ situations, compared to 100-150 in the wild. Genetic and pedigree information is known for many of the animals. Cooperative breeding programs in AZA and EAZA help to maximize genetic diversity in those populations. Veterinary regulations in Europe and the USA impose import restrictions, especially from Africa, which often hinder exchanges of animals.

The ex-situ population represents an important insurance against extinction, a repository of genetic material and, especially in Texas, a resource for research on behavior and ecology. Animals on public exhibit in zoos serve as 'ambassadors' for the species, raising awareness of the species and, in some cases, funds.

Most significant is the **potential** role of the ex-situ population in providing stock for reintroduction, reinforcing wild populations, or establishing ex situ breeding programs in the range countries. The breeding and semi-captive populations in Morocco all originated from EAZA and some of these animals are being prepared for release. The breeding dama group in OROA has been augmented by animals from EAD which were originally sourced from the USA.

Restoration of the dama gazelle to a wider part of its historic range will inevitably rely on releases of animals into new sites. The most likely scenario is that dama sourced from Europe or the USA would not be released directly into the wild, but would be transferred to breeding facilities in the range states or the Middle East, and their offspring or descendants released later at the appropriate time. The EAD facility at Deleika in the UAE already fulfils this function. There is considerable potential for captive holders in the USA and Europe to make meaningful links to the conservation efforts in Africa through funding field surveys, supporting the development of captive holding facilities in country and a wide range of training, travel and translation needs to support African professionals working with dama gazelle (see also below).

It should be noted that any animals sought for conservation breeding for release operations would be subject to veterinary and genetic screening, national regulations, full agreement of the owners, and appropriate funding.

Some issues that could be investigated are response to predators and habitat use (with GPS collaring) and research into a wide range of husbandry methods including fence design, hand-rearing, captive nutrition, etc.

2.10. Research on ecology and biology

In Texas, Dr Elizabeth Cary Mungall has conducted a long-established observation and collaring study to research movement patterns, group dynamics, and habitat use.

In Morocco, EEZA is carrying out comparative studies at the Safia and M'Cissi Reserves to evaluate the effects of different ecological and management conditions and social group composition using camera traps, direct observations and vegetation studies. The next steps are to develop a habitat suitability map for the dama gazelle in Morocco:

Table 1. Dama gazelle numbers in all situations (data updated, September 2024)

Site	Number	Total by situation
Wild		
Mali		
Tamesna plains	?	
Chad		
Ouadi Rimé-Ouadi Achim Faunal Reserve (OROAFR)	64*	
Manga	?	
Alifa (Ati)	?	
Niger		
Aïr-Ténéré National Nature Reserve	20-30	
Termit Tin Toumma National Nature Reserve	20	
Total wild (minimum)		**104-114**
Semi-captive and captive in Africa		
Chad		
OROAFR	32	
Morocco		
R'Mila Royal Conservation Reserve	160	
M'Cissi Reserve		
Safia Reserve		
Rabat Zoo		
Al Maha Farm		
Tunisia		
Bou Hedma NP / Haddej NP	?	
Senegal		
Guembeul Special Faunal Reserve	-	
Ferlo Nord Faunal Reserve (Katané)	2	
Total semi-captive/captive in Africa		**194**
Outside Africa		
American Zoo Association	201	
Zoological Association of America	33	
Exotic Wildlife Association	**1510	
European Association of Zoos and Aquaria	270	
Arabian Peninsula	336	
Total outside Africa		**2350**
Overall total		**2648-2658**
* Probably reduced by mid-2024 due to harsh weather; ** = 2015 figure		

3. Genetics

3.1. Genetic and genomic research

Analyses of mtDNA show no correspondence between genetic structure and the three named subspecies (Senn et al. 2014, 2016). Dama gazelles have three different chromosome numbers (n=38, 39, 40) which also do not align with the three 'subspecies'. The current division into three subspecies is based on phenotype information and geographic location only.

Nuclear genetic data (hundreds of SNPs using hybrid capture) has been obtained from both museum specimens and wild fecal samples. The analysis is in progress at RZSS and is due to be reported at the SSIG meeting in May 2025. Genetic analysis of most of the founders of the breeding population in OROAFR has also been conducted by RZSS, under contract to the Environment Department Abu Dhabi.

Six genomes plus optical genome mapping data for analysis of structural variation have been produced by the Smithsonian Conservation Biology Institute and DNA Zoo (a consortium focused on facilitating conservation efforts through the rapid generation and release of high-quality genomics resources). A paper is due to be published early 2025. The genomic data indicates recent divergence of addra and mhorr. There are plans for further dama genomes (Smithsonian) and a wild dama gazelle genome has been submitted by RZSS to Org.1. A study by Gooley et al. (2022) used genomic data on the US 'addra' dama population to highlight the importance and value of metapopulation management.

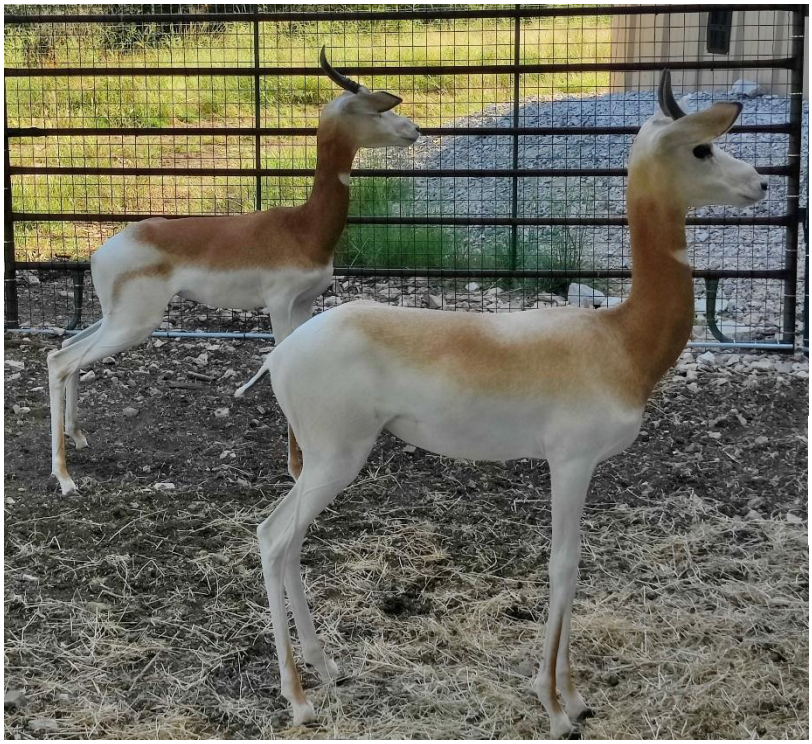
Additionally, RZSS has maintained a pedigree of the OROAFR ex-situ population, which has been used to inform population management and breeding recommendations. The plan is now to input this information into the Zoological Information Management System (ZIMS) (Species 360) with the help of the SSP coordinator and form a small group to ensure that management decisions take account of founder representation of the three 'lines' (Manga, OROA, EAD/UAE) (see actions).

Genetic sampling protocols are included in Appendix 4.

3.2. Mixing addra and mhorr

In 2014, a decision was made by all stakeholders, based on genetic data (insufficient evidence that the two subspecies are completely different), to begin an experiment on crossbreeding the mhorr and addra at Al Ain Zoo. The experiment has continued and AAZ currently manages 23 mixed dama as a fully segregated group. Comprehensive breeding records have been kept.

In Texas, the question of mixing the 10 mhorr with some 'addra' has been raised, but this did not happen because of a perception that the mhorr would not add additional genetic diversity, as they have lower genetic diversity than the 'addra'. This is, however, an erroneous assumption and the 'mhorr' would still constitute additional (and potentially highly valuable) genetic diversity. Jim Hale (Cross Bar C Ranch) has reported that after three generations of breeding pale 'addra' gazelles some animals showed darker coloration and a haunch stripe, typical of *N. d. dama* style markings. Nevertheless, the darker coloration as shown in his figure used here is unlike mhorr. The haunch stripe is not expanded over the haunch and there is no black eye stripe. Additionally, the haunch stripe on his darker individual shows only a tenuous connection with the body color and does not seem to reach the hock as is typical of *N. d. dama*. For detailed discussions of color development and variation among mhorr, central dama gazelles, and addra, see Cano (1991) and Mungall (2018).



Dama gazelles on Cross Bar C Ranch showing two different phenotypes (© Jim Hale)

The future of the mixed group of dama at Al Ain Zoo and the advantages and disadvantages of managing addra and mhorr together more widely was discussed. Some opinions were in favor of mixing the two forms to maximize genetic diversity while others preferred to keep them separate.

The Texas meeting in 2024 made two recommendations: 1) that ASG should convene a taxonomic taskforce to consider all the latest evidence and the potential genetic implications of mixing and not mixing addra and mhorr. A summary of questions and concerns to feed into that review was gathered at the meeting; 2) that the mixed-breeding experiment at Al Ain is continued until at least the outcome of this review.

4. Network and resources

A central repository of dama gazelle resources has been updated and can be found here https://sites.google.com/site/damagazellenetwork/home. Those wishing to contribute resources or news items, or to be added to an email alert list please contact hsenn@rzss.org.uk
The IUCN Antelope Specialist Group is collating new records of dama gazelle. A dama identification card has been produced in French and Arabic and was distributed at the meeting and is available on request from the Antelope Specialist Group asgpo@marwell.org.uk. Observations and any other new information on dama gazelle can be submitted to the same email address, or online at https://sites.google.com/site/damagazellenetwork/home

A discussion was held about ***improving access and Inclusion***. Despite best intentions, effort and fundraising, it was not possible to obtain visas for delegates from Chad and Niger to attend the September 2024 meeting. The recommendation is to hold future in-person meetings in Africa, with Morocco potentially being a good choice for delegates from the broadest range of countries, and many international flight options. A dama meeting could be added onto SSIG meetings and/or use online meetings.

Organizations wishing to support increased access and inclusion can consider a number of funding actions (section 5, below).

There is a wide range of options to increase the profile of dama gazelle within diverse networks and it was recommended that action should be taken to communicate updates from this meeting to EWA, SAF, C2S2, SPA, EEP, SSP, ASG, and other membership stakeholders through communications in members magazines. ASG will include a summary in *Gnusletter* in November 2024.

There is a potential opportunity to engage with the Zoological Association of America (ZAA) on dama gazelle conservation.

The first International day for scimitar-horned oryx will be held on August 16th 2025. There is the potential to develop awareness raising and fundraising actions for dama gazelle in association with this.

5. Fundraising

There was a long discussion about the ways that ex-situ programmes contribute to conservation in range countries. Currently, the amount of funding being contributed is not thought to be significant. There are many opportunities for raising funds – for example, after an initial donation, the cost of workshop expenses for the September 2024 meeting was provided by the auction of animals, including dama.

There is an ongoing need to fund field work and ex-situ activities in range countries. There are also smaller items that are extremely important such as:
- Bringing range state participants to the SSIG and other meetings (air tickets and accommodation: approx. $4000 per person).
- Sponsorship of translation into French of written material and simultaneous translation of meetings.
- Developing educational materials and payment for design and printing hard copies.
- English classes and English exchange visits for range state conservationists.
- Developing a funding ladder for smaller items may help to facilitate easy giving.
- There would be considerable opportunities for ranch and zoo communities to build long-term training and mentorship programmes and provide support for the establishment of ex-situ facilities in range countries. Developing a concrete plan to build on the success in Chad should be a priority.
- There is also an ongoing need to fund and conduct scientific research activities (e.g. genetic studies, reproductive research, population dynamics, behavior patterns and husbandry) to support implementation of the Action Plan.
- There should be an audit of funding sources and needs conducted in advance of the next action plan.

Sahara Conservation presented a major proposal to fund the next phase of captive breeding for release in Chad 'Bringing Dama Gazelles Back from the Brink'. In summary:
The areas of intervention: ATNNR and OROAFR, which account for at least half of the remaining dama gazelles in the wild. Sahara Conservation and local governments have been active in these areas for over 20 years.
Threat analysis: overgrazing, competition with livestock, lack of knowledge of species, fragmented small populations, and political problems make it difficult to find partners willing to work in the area.
Vision and approach: improvement of the overall status of the species, saving it from imminent extinction. Secure and stabilize the decline.

1) Increase knowledge and understanding of the wild populations

2) Safeguard wild populations of dama gazelle
3) Significantly grow the current population in OROAFR, Chad

Activities: monitor the population by remote and field-based methods and aerial support and increase the amount of suitable and secure habitat, reduce disturbances and human pressure in designated zones, produce and release captive-bred dama into the species natural range in OROAFR and study the effectiveness of reinforcement through post-release monitoring.

The estimated cost for this 5-year conservation action program is estimated at $1.5 million (monitoring $340,000, safeguarding $385,000, captive breeding and release $775,000), 12% of the initiative's budget has been committed by the EAD.

Appendix 1. List of participants

Amber BOY	Wildlife Partners	USA
Pierre COMIZZOLI	Smithsonian Conservation Biology Institute	USA
Melannie DIMITROFF	San Antonio Zoo	USA
Sonia DOMÍNGUEZ	Spanish National Research Council (EEZA-CSIC)	Spain
Adam EYRES	Fossil Rim Wildlife Center	USA
Brian GILROY	Wildlife Partners	USA
Cori GILROY	Wildlife Partners	USA
Jim HALE	Crossbar C Ranch	USA
Neil HUSKEY	Exotic Wildlife Association	USA
Abdelkader JEBALI	University of Sciences-Tunis	Tunisia
Larry JOHNSON	Safari Enterprises	USA
Vick JONES	Exotic Wildlife Association	USA
Hayden KELLY	Exotic Wildlife Association	USA
Susan KLEVEN	Frank Buck Zoo	USA
Rebekah Gregory KOEHLY	Austin Savanna	USA
Klaus-Peter KOEPFLI	George Mason University	USA
Pete MOORE	Exotic Wildlife Association	USA
Abdoul Razack MOUSSA ZABEIROU (online)	Sahara Conservation	Niger
Christian MUNGALL	Second Ark Foundation	USA
Elizabeth Cary MUNGALL	Second Ark Foundation	USA
John NEWBY	Sahara Conservation	France
Cloé POURCHIER	Sahara Conservation	France
Budhan PUKAZHENTHI	Smithsonian National Zoological Park	USA
Levi SCHERER	Wildlife Partners	USA
Lewis SCHERER	Exotic Wildlife Association	USA
Helen SENN	Royal Zoological Society Scotland	UK
Douglas E. SMITH	Bear Creek Exotics	USA
Eric SMITH	Williams Creek Wildlife Ranch	USA
Bobbie TARPEY	Second Ark Foundation	USA
Don TARPEY	Exotic Wildlife Association	USA
Matt TOY	White Oak Conservation	USA
Ricardo VILLAFUERTE	White Oak Conservation	USA
Ken YANCEY	Exotic Wildlife Association	USA

Appendix 2. Workshop Agenda

September 16.
Arrivals and evening visit to the Second Ark Foundation museum.

September 17. Session 1.
9:00 AM - 12 noon - Registration continues at hotel (Vick Jones from Exotic Wildlife Association and Lauren Connaly from Kerrville Convention & Visitors Bureau volunteer).
9:00 AM - Opening by Elizabeth Cary Mungall for the Second Ark Foundation
9:15 - 11:00 AM - Dama gazelle status - Texas and range states.
9:15 AM - talk 1 - US exotics situation today - Elizabeth Cary Mungall
9:30 AM - talk 2 - Another kind of organization - Brian Gilroy and Wildlife Partners group
9:45 AM - talk 3 - How dama gazelles came to the US - Elizabeth Cary Mungall
10:00 AM - talk 4 - Monitoring mhorr gazelle populations in fenced-protected areas of Morocco and future perspectives - Sonia Dominguez, Marta Ayala, Latifa Sikli, Zouhair Amhaouch, Teresa Abáigar
10:15 AM - talk 5 - Niger research - Abdoul Razack Moussa Zabeirou (Zoom presentation from Niger)
10:30 - 11:00 AM - Coffee and tea break
11:00 AM-12 noon - Reproduction, DNA, and diversity.
11:00 AM -talk 6 - Chad perspectives - John Newby
11:15 AM - talk 7 - A new proposal - Cloé Pouchier
11:30 AM - talk 8 - DNA in eastern vs. western dama gazelles - Klaus-Peter Koepfli
11:45 AM - talk 9 - Estrus vs. anestrus - Budhan Pukazhenthi
12 noon - 1:00 PM - Lunch at hotel.
1:30 - 7:30 PM - Field trip and BBQ to see dama gazelles in Texas ranch setting (Kyle Wildlife near Bandera), Texas.

September 18. Session 2.
9:00 AM Remaining presentations - Moderator Elizabeth Cary Mungall
Comments from EEP and SSP coordinators – Sonia Domínguez and Matt Toy
Special insights on mhorr gazelles in Senegal (with video) – Abdelkader Jebali
Crossbreeding experiments at Al Ain – material sent by Mohammed Yousef Al Faqeer
10:30 - 11:00 AM - Coffee and tea break
11:00- 12 noon Project actions review - Moderator Helen Senn
12 noon – 1:00 PM – Lunch at conference hotel.
1:00 – 5:00 PM -Continue actions review
5:00 – 5.15 PM - Conclude actions review
6:00 PM Banquet at hotel
6:30 PM - Introduction on behalf of Second Ark Foundation
6:35 PM - First dinner speaker, Source Population Alliance and partnership for species - Adam Eyres from Fossil Rim Wildlife Center
7:10 PM - Second dinner speaker, What has been happening in Chad (with 16 min. video) and proposal of new possibilities for dama gazelles, - John Newby from Sahara Conservation

September 19. Session 3.
9:00 AM - Orientation by moderator for further review discussion - Moderator Helen Senn
10:30 - 11:00 AM - Coffee and tea break
11:00 – 12 noon: Discussion concluding with fundraising options and thanks to participants.
12 noon - 1:00 PM - Lunch at conference hotel
1:00 - 4:00 PM – Time for individual networking.
6:00 PM - Dinner at conference hotel for the participants still at the hotel

Appendix 3. Research opportunities in Texas

- Analyse causes of dama mortality, e.g. causes on one Texas ranch from 2009 presentation by Elizabeth Cary Mungall:
  predators 35%, weather 22%, hit fence 17%, aggression 9%, accident 9%, toxic plants 4%, stillborn 4%.
- How 'best' to deal with coyotes, feral hogs, etc.
- Share information regarding how to 'condition' dama to seek shelter in times of freezing weather (and how to outfit such shelters).
- Share information on design of fence/post combinations to reduce impact mortality. (Note: this is capable of computer analysis and suitably planned dynamic testing).
- Assess the need for more information on dama behaviour (rancher knowledge vs "academic" knowledge).
- Collect information on optimum diet in various situations.
- Collect information on techniques for rotation between fenced pastures (also regarding associated 'weed' control).
- Collate collaring data on movement patterns and habitat use.
- Contribute to /funding genetic studies conducted through C2S2.
- Test reproductive methodologies, especially on hand reared individuals.
- Participate/assist with any census of the Texas Agricultural Statistics Service.

Appendix 4. Genetic sampling protocols

<u>For Europe</u> the EAZA genetic sampling protocols can be downloaded in English and French versions at the following links:

https://strapi.eaza.net/uploads/EAZA_Biobank_sampling_protocol_English_2023_cdca60fb10.pdf
https://strapi.eaza.net/uploads/EAZA_Biobank_sampling_protocol_French_5740ccb40e.pdf

<u>For the USA:</u>

Protocol Template for Collection, Storage, and US Domestic Shipping*

(*modified from the document prepared by the AZA Molecular Data for Population Management Scientific Advisory Group)

Notes:

- Below are general guidelines for the collection of non-infectious biomaterials that are suitable for most mammal, reptile, and avian DNA sequencing projects.
- Always check with the sequencing facility prior to sample collection to ensure these guidelines are in line with their requirements. For example, some biological materials are not appropriate for some sequencing methods. The acceptable minimum amount of whole blood, in particular, may vary. The protocol is intended to be modified as needed.

<u>Brief Description of Project (Optional)</u>

Example: Samples are being requested for molecular work to refine estimates of kinships among cooperatively managed individuals, which will improve breeding recommendations for this species. Although the breeding program's priority is to sample all living animals, samples collected at necropsy are still valuable if it is impossible to sample an animal prior to its death. This project is sponsored by the AZA's Species Survival Plan and has also been given a letter of recommendation by the USFWS. The following contact can complete institutional paperwork necessary for project approval: [ADD CONTACT]

<u>Types of Samples</u>

Whole Blood:

- Approximately 1.0 to 5.0 mL of whole blood is requested from adult mammals. An absolute minimum of 0.5 mL from a mammal is acceptable if collecting from a younger animal or during a neonatal exam. For taxa with nucleated blood such as birds and reptiles, 0.25 - 0.5 mL of whole blood is requested.
- Collect blood in a vacutainer tube containing an anti-coagulant; EDTA (purple top) vacutainers are preferred. Use vacutainer tubes of appropriate size depending on the amount of whole blood to be collected. Heparin tubes (green top) should **not** be used.
- Invert vacutainer 5 times to make sure blood and anti-coagulant are thoroughly mixed.
    - **If shipping fresh blood**: Blood samples should be stored in the refrigerator (4° Celsius) and must be shipped within 1 - 2 days of collection.

- **If shipping frozen blood**: Blood samples should be frozen at -20° Celsius, preferentially 80° Celsius, within 2 days of collection. Try to minimize the number of freeze-thaw cycles of frozen blood, as it can degrade DNA.

Tissues:

- Preferred tissues include ear notches of living mammals (typically hoofstock), and post-mortem tissue collected prior to or during necropsy of heart muscle (alternate tissue types include liver, spleen, skeletal muscle, or a skin biopsy).
- Collect one or two pencil eraser sized tissue samples (approximately 0.5 grams each). If possible, perforate tissue with scalpel, razor blade, or knife edge to allow ethanol or buffer to penetrate. Clean blades carefully with soap and water before processing a sample from another animal or use new blades for each individual.
    - **Using Ethanol**: Place samples into a sterile 1.5 – 2.0 mL (or larger volume size) collection tube with 80% - 95% ethanol. Multiple tissue samples from a single individual can be stored in a single tube, as long as the samples are well-submerged in the ethanol. Do not use formalin or methylated alcohol. Samples can be stored for several months at room temperature or in the refrigerator (4° Celsius) until shipped.
    - **Using Lysis Storage Buffer**: Place samples into a sterile 1.5 – 2.0 mL (or larger volume size) collection tube with lysis storage buffer (Longmire's, Queen's, e.g.). Multiple tissue samples from a single individual can be stored in a single tube, as long as the samples are well-submerged in the buffer. Samples can be stored for several months at room temperature or in the refrigerator (4° Celsius) until shipped. A white precipitate may form in lysis buffer tubes when cold but should disappear when at room temperature. Lysis buffers with soapy consistency are particularly prone to leakage and should be stored upright using screw cap tubes and sealed with parafilm.
    - **Using DNA/RNA Zymo Shield**: Place samples into a 1.5 – 2.0 mL (or larger volume size) sterile collection tube with DNA/RNA Zymo shield solution at 10% weight/volume ratio. Multiple tissue samples from a single individual can be stored in a single tube, as long as the samples are well-submerged in the buffer. Samples can be stored at room temperature (4°C - 25°C) for up to 2 years.

Cheek Swab:

- Before collecting the sample, make sure the mouth is relatively clear of debris, but do not rinse/wash mouth prior to collecting the sample. If possible, do not feed or water the animal within 30 minutes of collecting the sample (or up to 3 hours depending on the species' husbandry/welfare requirements).
- Using a sterile cheek swab or brush and wearing fresh gloves for each animal, place the swab head against the inside of the cheek and gums, not towards the back of the mouth, and swirl/rub vigorously. The objective is to collect loose cheek cells, not saliva.
- Collect 3 swabs per individual. Place swabs in the labeled sterile 50 mL collection/centrifuge tube and cut base of swabs with scissors to fit inside the tube.
- Let the swabs air dry *without* the collection tube caps. The samples should **air dry completely** to avoid condensation resulting in bacterial growth. Once swabs are dry, cap the tubes and wrap with parafilm making sure to seal the attachment area.

- Storage conditions include a cool dry place or freezer (-20° Celsius) until shipped. Avoiding condensation in the tube is **critical**, therefore it is recommended to ship dried cheek swabs within 1 - 2 days of collection.

Shipping

Sample Labeling:

- Please ensure each sample tube is *legibly* labeled with the institution's name, the individual's local ID number, species, and the sampling date. Waterproof labels are preferred over directly labeling tubes with markers.

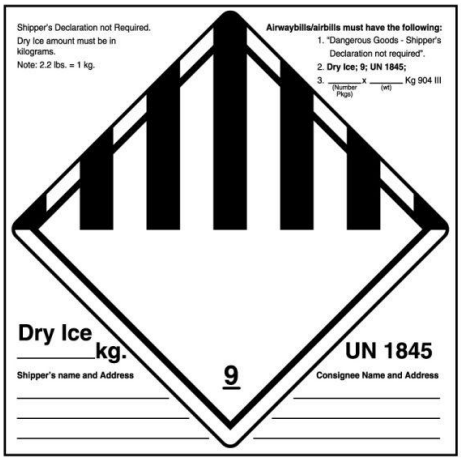
Packaging:

- Sample collection tubes should not leak, and it's recommended to wrap a small piece of parafilm around the cap and top of the tube prior to shipping. Alternatively, transfer samples to a clearly labeled, sterile, screw-top cryovial.
- Wrap tubes or containers in bubble wrap and paper towels (or absorbent materials) and place within a sealable plastic bag. Alternatively, use a cardboard cryovial storage box with the lid taped shut within a sealable plastic bag.
- Package the bag containing sample tubes in a styrofoam container with cold packs or dry ice for fresh blood samples. Frozen blood samples should be shipped overnight on dry ice (~5 - 10 lbs.). Cheek swabs, pin feathers, and tissue in ethanol or storage buffer can be shipped at room temperature.
- Place styrofoam container into a sturdy outer cardboard box as required by US regulations. If using dry ice, the styrofoam box and cardboard box should not be airtight to allow venting of CO_2.

Package Labeling:

- All samples should be sent via **overnight courier** to [ADD LOCATION]
- Please write, "Exempt Animal Specimen", on the outside of the box to indicate the samples have a minimal likelihood of infectious pathogens.
- If using dry ice, follow shippers guidelines for domestic air shipments (e.g. FedEx, UPS), and ensure personnel packaging and shipping the samples are trained to do so in compliance with federal law. Include a completed UN1845 Class 9 Dry Ice label on the outside of the shipping box as necessary (see example below).
- Please DO NOT ship packages on FRIDAYS.
- Once package has shipped, please email [ADD NAME, EMAIL] the list of samples sent and the package tracking number.

Example of a UN1845 Class 9 Dry Ice label.



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Dama Gazelle Conservation Strategy - Actions table update, September 2024

The Dama Gazelle Conservation Strategy 2019-2028 was reviewed, and the Actions Table updated, in 2021. The Table was updated again at the Dama Gazelle Conservation Workshop III in Kerrville, Texas, USA, September 2024.

Updated Objectives and Actions for Dama Gazelle Conservation (2021-2028)

Vision: Sustainable and free-living populations of dama gazelle in indigenous range, supported by well-managed populations elsewhere.

Action	Timeline/Urgency	Indicator	Responsibility	Update	Notes / Comments	Updated by Institution (Individual)
WILD						
Objective 1: Monitor wild populations effectively						
1.1. OROA	Ongoing	Survey results	DFAP, SC	Ongoing	• Systematic population monitoring ongoing. • Local opportunistic record keeping ongoing. • Monthly aerial surveys conducted by Wings for Conservation until December 2023. • Latest population estimate: 50, stable for some time. Extreme rainfall preceded by heat wave hit the population in summer 2024. At least 5 animals died of heat related factors. • Captive breeding going well (see later action). • OROA contains 50-75% of remaining wild animals globally and is the most well protected area, and most representative habitat. • Increased protection needed and more releases to increase numbers. • Poaching pressure is present, but the biggest issue is competition with livestock. Human dimensions is key to the future. • Dama are particularly sensitive to human pressure and tend to be in highly localized areas of rougher ground with limited impact of livestock grazing. • Possible new management mandate for the reserve led by SC. • Many opportunities for new partnerships. • Conservation profile has increased significantly over past years due to the presence of the scimitar-horned oryx project and support of EAD, but the budget will be reduced.	SC / DFAP (VB, JN, MHH)

New | Ongoing/In progress | Amended | Achieved/Partially Achieved | Dropped

Action	Timeline/Urgency	Indicator	Responsibility	Update	Notes / Comments	Updated by Institution (Individual)
1.2. Manga	2019-2020	Survey results	Noé, DFAP, SC	Achieved over the period 2019 – 2020. No more funding from 2021.	• Last survey 2023 by Wings for Conservation. No animals found but security concerns meant a lot of area was not covered. • Population in serious decline with very little likelihood of any action being possible due to security concerns. • Latest estimate less than 12 individuals. • Highlights critical importance of OROA.	SC and Wings for Conservation and SHO project
1.3. Alifa-Ati	L	Survey results	DFAP, SC	Dropped	• No activity since 2021 review. • Not a priority site, better to put resources into OROA.	SC / DFAP (VB, JN, MHH)
1.4. Aïr & Ténéré NNR	H	Survey results	DFCAP, SC	Ongoing	• Dama seen in all recent surveys. • Latest sighting of 18 animals in December 2023. • Monitoring ongoing and camera survey results under analysis - updates due . • Two instances of poaching in April 2024. • Field mission conducted in November 2024. • Local conservation road map has been developed for the area with the local stakeholders.	SC (VB, JN, AR, CP)
1.5. Termit & Tin-Toumma NNR	H	Survey results	Noé Conservation, DFCAP	Ongoing	• Following change of government in 2023, EU funding withdrawn and NGO activities suspended. • Noé have legal mandate but no resources. • Very little recent information. • Last SC info from the aerial survey to locate addax (January 2022), during which a small number of dama were located. • Population small and fragmented, living in atypical habitat with low carrying capacity for population growth. • Maybe 20 dama remaining • 19 salaried staff in September 2024.	SC (JN)
1.6. Tamesna plains (western Niger)					No information and doubtful that any dama are present.	
1.6.1. Establish local contacts	L-M	Contacts established.	DFCAP		• Region too insecure. • No update since 2021 review.	

New | Ongoing/In progress | Amended | Achieved/Partially Achieved | Dropped

Action	Timeline/Urgency	Indicator	Responsibility	Update	Notes / Comments	Updated by Institution (Individual)
		Local reporting system.				
1.7. Tamesna (Mali)						
1.7.1. Establish local contacts	M	Contacts established. Local reporting system.	Government agency, NGO		• Region too insecure. • No mountain refugia available at this site, so chance of finding animals unlikely. • No update since 2021 review.	
1.8. Algeria: follow-up local reports	L-M	Results available	ANN, DGF		• No update since 2021 review.	
1.9. Sudan: follow-up local reports and survey former range when feasible	L	Results available	SWS, ASG, Government agency		• No update since 2021 review.	
1.10. Provide training in survey and monitoring methods for all range states	M	Training courses conducted	Government agencies, NGOs	Ongoing (Morocco)	No detailed information.	ANEF (LS, ZA)
1.11. Produce ID card for local use	M	ID card produced and distributed	ASG	Achieved	Produced and distributed to SC and delegates of the September 2024 meeting (further copies available on request to DM/HS).	ASG & RZSS (DM /HS)
Objective 2: Secure and expand key wild populations						
2.1. Aïr and Ténéré NNR: follow recommendations in Regional AP	H	Recommendations implemented	DFCAP		• Action plan developed 2023 awaiting government endorsement. • Patrols supported for last two years (2022-2024) as part of a funding programme which has just ended. • Training delivered with ZSL in 2022. Entire management unit was trained but many staff rotated away.	SC (JN, CP, AR)
2.2. Termit and Tin-Toumma NNR: follow recommendations in Regional AP (cont.)	H	Recommendations implemented	Noé Conservation, DFCAP	Ongoing	• See also section 1.5. Most NGO activities suspended.	SC (JN)
2.3. OROA: follow recommendations in Regional AP	H	Recommendations implemented	DFCAP, EAD, SC	Ongoing	• Current contract with EAD on phase 3 of the project to 2029 includes dama but budget has been reduced. • New $1.5 million funding initiative to for action on dama is 12% matched funded by the EAD, but funding gap still needs to be	SC (VB, JN)

New | Ongoing/In progress | Amended | Achieved/Partially Achieved | Dropped

Action	Timeline/Urgency	Indicator	Responsibility	Update	Notes / Comments	Updated by Institution (Individual)
					filled.	
2.4. Incorporate dama gazelle conservation in all site management plans (MP's)	M	MPs produced	Government agencies		No update.	
2.5. Monitor route of the Great Green Wall and potential impact on movements of dama gazelle	Low	Recommendations on changes to route made to governments, as appropriate		New	• See Naia, M. et al (2021) for possible impacts of the GGW on the dama gazelle. • Unclear whether impact on dama will be positive. • No tree planting as of yet in OROA although theoretically it could occur across the reserve. • Maintain a watching brief.	
Are not 3. Reintroduce to new sites						
3.1. Gadabedji BR: conduct feasibility study	M	Study produced	DFCAP, SC		• Feasibility study was produced in December 2022.	SC (VB, JN, CP)
3.2. Ennedi NCR: conduct feasibility study	M	Study produced	DFCAP, APN		• Study not yet conducted. • World Heritage site managed by African Parks. There is a current collaboration between AP and SC on addax restoration. Dama are part of longer-term plans for rewilding. Plenty of atypical dama habitat, water and vegetation, capable of supporting a small population, similar to other massif populations. • High resources and manpower in place for protection.	JN (SC)
~~3.3. Errachidia: conduct feasibility study~~	~~M~~	~~Study produced~~	~~DEF~~	Dropped	• No longer relevant.	DEF (LS)
~~3.4. Boujdour-Safia ABC: conduct feasibility study~~	~~M~~	~~Study produced~~	~~DEF~~	Dropped	• No longer relevant.	DEF (LS)
3.5 Mhemid el Ghizlaine	H	Animals released successfully	ANEF	New	• Reintrodcution proposed, not yet taken place. • Addax released in 2019.	ANEF
4. Reinforce wild populations						

New | Ongoing/In progress | Amended | Achieved/Partially Achieved | Dropped

Action	Timeline/Urgency	Indicator	Responsibility	Update	Notes / Comments	Updated by Institution (Individual)
4.1. OROA: conduct feasibility study	H	Study produced	DFCAP, EAD, SC	In progress	• 5 animals transferred from EAD/Abu Dhabi in 2022. • Passive capture of 5 OROA animals. • 6 animals from the breeding group released in Jan 2024. • Detailed breeding and release plan under development with stakeholders.	SC / EAD (VB, JN, JC)
SEMICAPTIVE						
5. Secure and expand semi-captive populations						
5.1. Katane				In progress	EEZA signed an agreement in 2024 with the government.	
5.1.1. Extend area to 5000 ha	H	Extension created and fenced	DPN		• No information since 2021 review.	DPN (SF, BY)
5.1.2. Conduct drone survey	M	Survey report	ABZC, DPN		• No information since 2021 review.	DPN (SF, BY)
5.1.3. Conduct training programme	H	Programme completed	ABZC, DPN		• No information since 2021 review.	DPN (SF, BY)
5.1.4. Conduct feasibility study on obtaining new animals	M	Study produced	DPN	In progress	• See 5.1.	DPN (SF, BY)
5.1.5. Conduct research on movement patterns, population dynamics and diet	M	Results produced	DPN, partners	In progress	• No information since 2021 review.	DPN (SF, BY)
5.2. Guembeul: Evaluate role in dama conservation and need for new stock	M	Study produced	DPN	Achieved	• See 5.1.	DPN (SF, BY)
5.3. Safia & M'Cissi: Continue government programme	M	Breeding continues	ANEF	Ongoing	• Further releases in Safia are not planned. • M'Cissi breeding population is continuing to increase. 22 individuals at Safia. A larger enclosure has been proposed. • In 2021 one female dama was killed by a dog that jumped in the enclosure.	ANEF / EEZA (LS, TA, ZA)

New | Ongoing/In progress | Amended | Achieved/Partially Achieved | Dropped

Action	Timeline/Urgency	Indicator	Responsibility	Update	Notes / Comments	Updated by Institution (Individual)
~~5.4. Assa: Continue government programme~~	~~M~~	~~Enclosure created~~	~~DEF~~	Dropped	• Reintroduction now focused on Mhemid el Ghizlaine.	
5.4. Mhemid el Ghizlaine: continue government reintroduction programme	H	Animals released		New	• Enclosure constructed. • 10 dama transferred to the site.	ANEF /EEZA (LS, ZA, TA)
5.5. R'Mila: Continue breeding programme	H	Breeding continues	ANEF	Ongoing	• Work is ongoing to establish a breeding centre in R'Mila to manage genetic diversity. • A census in March 2021 showed that more than 100 dama are currently present. • Numbers are increasing. • To provide more space for dama gazelle breeding, the dorcas gazelles are being transferred to another site. • New revised national ungulate strategy published in June 2024.	ANEF / EEZA (LS, TA, ZA)
5.6. Conduct feasibility study into possible reintroduction in Algeria	L-M	Study produced	ANN, DGF		• Investigations have been carried out in Hoggar looking at carnivores and ungulate prey. • No updates since 2021 review.	UB (FB)
5.7. Conduct feasibility study on establishment of a breeding group at Haddej NP, Tunisia	H	Study produced	DGF, MW		• No update since the 2021 review.	
5.8. Conduct feasibility study of establishing new ex-situ facility for dama gazelle in Africa	M	Study completed		New	• The importance of increasing capacity for dama gazelle ex-situ management in African countries was highlighted. • There are good opportunities for zoos and ranches in the US and Europe to assist.	
CAPTIVE AND SEMICAPTIVE OUTSIDE RANGE						
6. Maximise the effectiveness of captive populations						
6.1. Minimise loss of genetic diversity of captive populations.	H	Genetic diversity managed in all populations	SSP and EEP coordinators, SPA, EWA, others	Ongoing in AZA and EAZA	• New census of Texan holders needed. • Husbandry manual for EEP in progress.	EAD *SAF / EWA (ECM) EAZA, AZA

New | Ongoing/In progress | Amended | Achieved/Partially Achieved | Dropped

Action	Timeline/Urgency	Indicator	Responsibility	Update	Notes / Comments	Updated by Institution (Individual)
						(*SAF being restructured under a new name)
6.1.1. Exchange animals between Al Ain Zoo and EAD	H	Exchanges completed	AAZ, EAD		• Awaiting results of genetic analysis of EAD animals to inform exchanges. • No update, since the 2021 review.	EAD / AAZ
6.1.2. Transfer animals from EAZA to AAZ	H	Transfers completed	AAZ, EAZA, Studbook keeper	Amended Ongoing EEP coordinator	• Action changed from "exchange" to "transfer" • More information about the affiliation of the AAZ population is necessary. • High potential to send dama to increasing number of safari parks/mixed exhibits.	EEZA (TA, SD)
6.1.3. Exchange animals between Morocco and EEZA	H	Exchanges completed	ANEF, EEZA	Ongoing EEZA	• No exchanges as yet, but still planned.	EEZA (TA, SD, LS)
6.1.4. Transfer addra from US to AAZ/EAD	H	Exchanges completed	AZA, SPA, EWA, AAZ, EAD	Amended and ongoing	• Action changed from "AAZ" to "AAZ/EAD" • Animals available for reintroduction to Chad from USA if requested. • No animals have been moved from US to EAD since 2018. • Funding is a bigger challenge than the animals themselves - maybe 250,000 USD per small group of animals. • Is cryopreservation of semen and transfer an option?	EAD SPA/EWA
6.1.5. Develop a metapopulation management plan for animals in the UAE	M	Plan developed	All regional holders	Amended	• Action changed from "Arabian Peninsula" to "UAE" • Suggestion to transfer some dama from AAZ to Sharjah Safari. • No updates, see above.	
6.1.6. Evaluate role of mixed animals in reintroduction and reinforcement operations	L-M	Evaluation conducted	AAZ, Key stakeholders	Ongoing	• Need to take into account social and genetic needs. • Decision taken to ask IUCN SSC ASG to convene a formal task force to evaluate all available evidence regarding subspecies (including IUCN CGSG members).	EEZA (TA)
6.1.7. Identify collections in Texas with rare haplotypes and recommend	H	Animals identified Transfers arranged	RZSS, SCBI Studbook keepers		• Gooley et al 2022 paper highlighted genetic value of different management strategies. • Call for ranches to send sample to Smithsonian. • Article will be produced in the EWA	SPA (AE)/ EWA Wildlife Partners (Amber Boy)

New | Ongoing/In progress | Amended | Achieved/Partially Achieved | Dropped

Action	Timeline/Urgency	Indicator	Responsibility	Update	Notes / Comments	Updated by Institution (Individual)
appropriate animal transfers or exchanges					newsletter asking for samples following protocol. • Sampling protocol is provided as an appendix to the update.	Smithsonian (KK)
6.2. Continue to develop the C2S2 consortium	Ongoing	Increased number of holders and of animals	C2S2, SPA, EWA	Ongoing	• Expansion continues. • SPA has been static because of lack of census data.	SPA/ EWA C2S2 (AE), Partnership for Species.
6.3. Continue the breeding experiment at Al Ain Zoo	M-H	Results available	AAZ	Ongoing	• Details of cross breeding experiment have been provided by AAZ (see Appendix). • Recommendation to continue for now pending outcome of taxonomy taskforce.	AAZ (MF)
6.4. Increase range state capacity for dama husbandry and management	M	Trained teams in each facility	Government agencies	Ongoing (Morocco)	• Ex-situ population in OROA has been established with EAD/SC (Chad). • Existing experience in Morocco. • See new action 5.8.	Government agencies, AZA, EAZA
6.4.1. Establish a training programme	2019-2020	Training courses provided	ANEF, EAD, EEZA	Ongoing	No update since 2021 review.	EEZA / DEF (TA, SD, TS)
6.4.2. Circulate husbandry guidelines	M	Guidelines circulated	EEZA	Ongoing	• In progress. Can be circulated to dama network once produced. • Potential for regional collaboration on husbandry.	EEZA (TA, SD)
6.4.3. Translate guidelines into French	M	Translation available	EEZA, NGOs			
6.5. Carry out PVA and metapopulation management planning to evaluate different strategies of management and produce enough animals for release operations	L-M	PVA conducted	SPA, EWA, Studbook keepers, others	Amended	• Clarification: evaluate mhorr, addra and mixed animals separately and consider joint evaluations. • Needs detailed discussion within/between EEP and SSP. • Recommend that a long-term management plan (LTMP) is done for the Mhorr EEP.	ASG / AAZ / RZSS (DM, LB, HS) SPA / EWA
6.6 Develop contacts with ZAA	M	Contact established	AZA, SPA	New		
~~6.6. Produce a long-term plan for producing enough animals for release operations~~				Dropped	• Merged with 6.5	

New | Ongoing/In progress | Amended | Achieved/Partially Achieved | Dropped

Action	Timeline/Urgency	Indicator	Responsibility	Update	Notes / Comments	Updated by Institution (Individual)
~~6.7. Review development of wider metapopulation models~~				Dropped	• Covered by 6.5	
7. Obtain new founders						
7.1. Obtain privately held animals in range countries				Amended	• Action amended by adding 'in range countries' for clarity. • No update.	
7.1.1. Monitor possible captive animals in Chad and Niger	L-M	Captive animals obtained	DFAP, DFCAP		No records.	
7.1.2. Develop a protocol and holding facilities	L-M	Protocol developed	DFAP, DFCAP, NGOs		Holding facilities developed in Chad (OROA)	SC
7.2. Capture wild animals from Manga	2019-2020	New founders obtained	DFCAP, SCF, others	Achieved	• 3 Manga females successfully captured and relocated to holding facilities in OROA. • Female group supplemented with 1 male captured in OROA. • Subsequent loss of 2 females due to nutrition issues. • Remaining female and male have produced 3 calves (1.2) • These calves have produced 14 surviving young • Group supplemented by 5(2.3)passively caught wild dama • See also section 2.3. • No further operations in Manga planned. • 2023 survey found no animals.	SC / DFCAP (VB, JN, SP, MHH)
7.2.1. Conduct scoping survey	2019-2020	Survey results	DFCAP, SC	Achieved		SC (VB, JN)
7.2.2. Feasibility study on capture methods	Done 2019	Study published	SPA, EAD, SC	Achieved		SC (VB, JN)
7.2.3. Plan capture operation	Done 2019	Plan developed	DFCAP, SC, others	Achieved	• See comments in 1.2	Noé / SC (SP, VB, JN)
7.2.4. Ensure suitable holding facility available in OROA	Done 2019	Facility available	DFCAP, SC, EAD	Achieved		SC (VB, JN)

New | Ongoing/In progress | Amended | Achieved/Partially Achieved | Dropped

Action	Timeline/Urgency	Indicator	Responsibility	Update	Notes / Comments	Updated by Institution (Individual)
7.3. Collate all capture and veterinary information in US	L-M	Summary available	SPA, AZA	Partially achieved	Information collated for the OROA capture (protocols are available from AE).	
7.4. Train range state personnel in gazelle handling and management (see 6.4.1)	L-M	Training courses provided	DEF, EAD, EEZA	Partially achieved / ongoing	• Tunisian staff visited Almería in 2017, 2018, 2019 and trained in live capture of mhorr and other gazelle and staff from Almería went to Tunisia (Serg NP) to train staff.	EEZA / DEF (TA, SD, TS)
7.5 Assess feasibility of capturing additional wild founders from Manga	H	Decision taken	DFCAP, SC, Noé, others	New	Not feasible.	
7.6 Develop a plan for ex-situ population at OROA	H	Plan developed	EAD, SC, RZSS, ASG, others	New	• Ensure optimal use of new founder genetic diversity and minimise inbreeding. • Mid to long-term plan for breeding and release under development. • Session on OROA breeding held at SSIG 2024. • Decision taken to attempt to put information into Zims and form small group to inform breeding management and ensure founder contributions from different sources are managed optimally.	SC (VB) Gov Agency ZSL (TW), RZSS (JHM, HS), White Oak (MT), Fossil Rim (AE), SC
OTHER						
8. Continue genetic research						
8.1. Record morphological data and take genetic samples from all museum specimens with locality data	Ongoing	Data available	NMS, RZSS	Ongoing	• Hybrid capture array developed for use on museum and wild faecal samples. • Data produced, analysis in progress anticipated reporting at SSIG meeting in 2025.	RZSS (HS, KD, JHM)
8.2. Continue genome sequencing	Ongoing	Results available	SCBI, RZSS, partners	Ongoing	• Hybrid capture data under analysis. • 6 genomes plus optical genome mapping data produced for analysis of structural variation. Plan for further genomes (Smithsonian). Genomic data indicates very recent divergence of addra and mhorr. Paper due to be published early 2025. • Wild dama gazelle genome submitted to Org.1 (RZSS).	RZSS, SCBI (HS, KD, KK)

New | Ongoing/In progress | Amended | Achieved/Partially Achieved | Dropped

Action	Timeline/Urgency	Indicator	Responsibility	Update	Notes / Comments	Updated by Institution (Individual)
8.3. Include option of gamete preservation in any wild capture operations	L-M	Protocol developed	SCBI, RZSS		Investigate feasibility of the Smithsonian banking semen from animals in OROA.	Smithsonian BP/SC
8.4. Obtain and analyse new samples	Ongoing	Samples analyzed	RZSS	Ongoing	• Continued analysis of all captive animals in OROAFR (EAD).	RZSS / EAD (HS, KD, JC)
8.6. Continue genetic and morphological research into intraspecific structure, using nuclear markers	Ongoing	Analyses published	RZSS	Ongoing	• Hybrid capture array developed for use on museum samples and wild faecal samples. • Data produced, analysis in progress anticipated reporting at SSIG meeting in 2025.	RZSS (HS, KD)
8.7. Carry out genetic analysis on any untested captive populations (Morocco)	M	Analyses conducted	RZSS, ANEF		• Potential partnerships and funding are being sought.	ANEF (LS), RZSS (HS)
8.8. Continue breeding experiment and carry out genetic analysis, semen analysis, and karyotyping on offspring	Ongoing	Results available	AAZ, RZSS	Partially achieved	• Genetic analysis on mixed animals is complete. • Semen analysis and karyotyping delayed due to lack of a local collaborator and Covid-related travel restrictions. • A potential collaboration on semen analysis is being investigated (BP could do this). • Potential for genomics investigation on the mixed animals to be explored. • Ongoing recording of the captive breeding programme by AAZ. • Recommend veterinary research institute in Dubai.	AAZ (LB)
9. Conduct research on biology and conservation of dama gazelle						
9.1. Compile lists of in-situ and ex-situ research needs	L-M	Lists available	Done at Al Ain workshop	Achieved	• Available in the strategy document.	
9.2. Continue research in Texas on movements and population dynamics	Ongoing	Some results available, some in progress	SAF, EWA	Ongoing	• Paper on movement data is under development. • Research notes large circular movements by male and female dama. • See Appendix 3 for some recommendations collated by CM.	EWA (ECM)

New | Ongoing/In progress | Amended | Achieved/Partially Achieved | Dropped

Action	Timeline/Urgency	Indicator	Responsibility	Update	Notes / Comments	Updated by Institution (Individual)

9.3. Analyse radio-collaring data from the Safia release	Ongoing	Analysis available	EEZA, DEF	Achieved in 2020	• Results and data published in:
					  • Abáigar et al (2019): e00680
					  • Abáigar et al (2020): e01389
						EEZA (TA, SD)

9.4. Conduct research into interspecific interactions and competition at OROA and other sites	L-M	Research results available	DFCAP, SCF	Ongoing		DFCAP /SC/ZSL/Smithsonian
9.5. Review release operations to date and reasons for success and failure	M	Review published	EEZA, Government agencies	Ongoing	• Article published in Gnusletter 38(1) (Abáigar, 2021). • Update due to be written up on OROA releases by SC.	EEZA / ANEF (TA, SD, LS)/SC

9.6. Evaluate feasibility of other research actions		Review produced	ECM
			SC, others
				New	• Conduct diet analysis. Dama forage on seemingly unpalatable plants on Texas rangeland.
					• Data is being gathered for the wild in OROA
					  • Systematic research on causes of mortality /fence strike would be useful
					  • Disease research ongoing
					  • Include information on hand rearing methodologies in husbandry manuals	

9.7. Investigate the use of drones to receive GPS data uploads from animal collars	L	Trial results available	ECM. EEZA, others	NEW		
9.8. Assess the role of cryobanking and AI	L	Study published	SCBI, Texas ranchers	Updated	• The technology to collect and preserve sperm from dama gazelles exists • The ideal conditions for getting successful pregnancies from artificial insemination need to be identified Running a trial on hand raised individuals to test methodology would be useful.	Smithsonian (PC/ BP) Texas ranchers (ECM)
9.9. Investigate use of AI	S	Offspring produced by AI in USA	Smithsonian	NEW		

New | Ongoing/In progress | Amended | Achieved/Partially Achieved | Dropped

Action	Timeline/Urgency	Indicator	Responsibility	Update	Notes / Comments	Updated by Institution (Individual)
10. Implement the strategy effectively						
10.1. Continue and expand Dama network	Ongoing	Key stakeholders participate Regular updates produced	RZSS, ASG	Ongoing	Update email list after meeting. Circulate update.	RZSS (HS)
10.2. Maintain 'Dama-library' (Google Groups etc.)	Ongoing	Library up-to-date	RZSS, ASG	Ongoing	• Website is updated • Updates can be sent to hsenn@rzss.org.uk	RZSS (HS)
10.3. Hold a review meeting in Texas	2024	Meeting to be held	SAF, EWA	Achieved in 2024		SAF / EWA (ECM)
10.4. Publish and distribute the 2019-2028 strategy	H	Strategy published in EN and FR	AAZ, ASG, RZSS	Achieved in 2019	• PDF versions are available here.	AAZ, ASG, RZSS (LB, DM, HS)
10.5. Initiate an education and awareness programme on dama gazelle and ecosystem in range countries (schools, media, public)	L-M	Programmes established	Government agencies, NGOs	Ongoing (Morocco)	• Poster on dama produced by SC. • Resources produced by Teresa Abáigar for Senegal and Morocco.	DEF (LS)
10.6. Develop and implement Monitoring & Evaluation Plan for the strategy	M	M&E Plan available	AAZ, ASG, RZSS	Ongoing	• Added "and implement" • Plan developed (see section 3.0) • 5-year review of the plan held in 2024	ASG / AAZ / RZSS (DM, LB, HS)
10.7. Obtain adequate resources for each component	2019-2028	Resources obtained Actions implemented	All	Partially achieved	• Funding has been obtained for some activities. • Conduct full funding audit in advance of the next strategy meeting (2028).	ASG/RZSS
10.8 Develop a funding ladder for smaller items to facilitate easy giving		List of costed items produced	SSP (AE)/ SC	New		
10.9 Raise awareness within stakeholder groups, translate awareness into funding		Number of communications items	All	New	• Communicate outcome of planning meetings to relevant networks e.g EWA, C2S2, SPA, EEP, SSP, ASG.	All
10.10 Use international SHO day to raise awareness for dama		Number of orgs celebrating	All	New	• SC to communicate messaging to network • All to consider relevant actions	SC/ All

New | Ongoing/In progress | Amended | Achieved/Partially Achieved | Dropped

Action	Timeline/Urgency	Indicator	Responsibility	Update	Notes / Comments	Updated by Institution (Individual)
10.11 Hold next planning meeting in Africa, with attendance from all key range states		Meeting held, range state delegates attended	All	New	• Morocco is a good option from the aspect of visas and flight options (if ANEF agrees)	All
10.12. Audit funding sources and needs conducted in advance of the next action plan	By 2028	Audit completed	All	New		
11. Increase the involvement of US ranchers who own populations of dama gazelles (NEW)						
11.1 Establish two-way communication between the dama network and dama gazelle owners in the USA to discuss and address matters of common interest		Regular communication established	ECM, EWA, Dama Network	New		
11.2 Arrange exchanges between Texas veterinarians and other vets in the USA and Europe having knowledge of typical dama problems		Exchanges take place	ECM, EWA, SPA, EEZA, AZA, EAZA	New		
11.3. Provide advice to new ranchers on how best to get started raising dama gazelles		Summary document compiled and available	ECM, EWA, SPA, EEZA, AZA, EAZA	New		
11.4 Repeat census of dama gazelle held across Texas ranches		Survey complete	EWA/ Texas state statistical service	New	- Last survey conducted in 2015	

New | Ongoing/In progress | Amended | Achieved/Partially Achieved | Dropped