Global Integrated Collection Assessment and Planning Workshop for Canids and Hyaenids

Omaha, NE, US, 19 – 20 March 2016

Final Report

IUCN SSC Species Survival Commission
CONSERVATION PLANNING SPECIALIST GROUP Changing the Future for Wildlife
IUCN SSC Canid Specialist Group
IUCN Hyaena Specialist Group
A Member of the Species Survival Commission of The World Conservation Union
Central Zoo Authority
ZOO AQUARIUM ASSOCIATION
ASSOCIATION OF ZOOS & AQUARIUMS
ALPZA Asociación Latinoamericana de Parques Zoológicos y Acuarios
PAAZA Pan-AFRICAN ASSOCIATION of ZOOS and AQUARIA
EAZA
JAZA
JAPANESE ASSOCIATION OF ZOOS AND AQUARIUMS

Workshop organized by: AZA Canid and Hyaenid Taxon Advisory Group; EAZA Canid and Hyaenid Taxon Advisory Group; ZAA Carnivore Taxon Advisory Group; IUCN SSC Canid Specialist Group; IUCN SSC Hyaenid Specialist Group; and the IUCN SSC Conservation Planning Specialist Group (CPSG).

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Row 1: African wild dog (Yorkshire Wildlife Park); Swift fox (M. Sovada); Darwin fox education (M. Zordan); Fennec fox research (Fitbit; R. Meibaum);

Row 2: Culpeo fox (Zoologico Nacional – Parque Metropolitano de Santiago, Chile); spotted hyena (Colchester Zoo); bush dog (M. Jacob); maned wolf (Temaiken Foundation);

Row 3: Dhole (B. Gupta); Mexican wolf (J. Fallon); striped hyena (T. Rehse); black-backed jackal (Amersfoort Zoo)

A contribution of the IUCN SSC Conservation Planning Specialist Group

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SECTION 1

Executive Summary

Executive Summary

The global zoo community faces the continuous challenge of assessing and modifying their collections and conservation programs to better address the conservation needs of species in the wild. Ideally, each species would have an integrated conservation plan developed using the One Plan approach (OPA) to which zoos could turn for guidance. Such a plan would indicate which *ex situ* activities, if any, are recommended to support conservation of the species based on the IUCN *Guidelines on the Use of* Ex situ *Management for Species Conservation*. However, the majority of species are not yet covered by such an integrated plan, although formal application of the OPA and the IUCN *ex situ* guidelines in species conservation planning is gaining momentum, and the IUCN Species Survival Commission (SSC) is striving to scale up the development of such conservation action plans. In the meantime, to help address this issue, a joint effort between the IUCN SSC Conservation Planning Specialist Group and regional zoo associations has resulted in a new process called ICAP, or Integrated Collection Assessment and Planning workshop. Developed in the spirit of the One Plan approach, the ICAP process brings *in situ* and *ex situ* communities together to apply the decision process of the IUCN SSC Guidelines on the Use of *Ex situ* Management for Species Conservation to the task of regional or global collection planning. The ICAP process is designed to be flexible and applicable to large or small groups of taxa, with the resulting analyses and recommendations being more general or detailed as appropriate.

Over 30 participants representing six zoo associations (AZA, EAZA, ALPZA, PAAZA, ZAA and CZA), the IUCN SSC Canid and Hyaenid Specialist Groups, IUCN, wildlife agencies, field researchers, and recovery team members gathered in Omaha (19-20 March 2016) for the inaugural Global Integrated Collection Assessment and Planning (ICAP) workshop for Canids and Hyaenids. The workshop was organized in collaboration with the AZA Canid and Hyaenid Taxon Advisory Group (TAG), the corresponding EAZA and ZAA TAGs, and the IUCN SSC Canid, Hyaenid and Conservation Planning Specialist Groups.

All 43 canid and hyaenid taxa, including those not held in captivity, were assessed. Before the workshop, an information sheet was prepared for each taxon, which included a summary of the *in situ* status and threat processes, *ex situ* demographic and genetic status (globally and regionally), and previous recommendations for *ex situ* management for conservation as stated in existing action plans. These taxon sheets also included feedback from *in situ* experts who provided information through a carefully designed survey (based on the IUCN *ex situ* guidelines) regarding potential roles for *ex situ* management in the overall conservation of their focal taxa. During the ICAP workshop the participants assessed this information and through a facilitated plenary discussion identified potential direct and indirect *ex situ* conservation roles for each taxon. Each potential role was rated with respect to its relative conservation benefit to the taxon as well as the relative feasibility and risks of developing an *ex situ* program to meet the role. Based on a rapid analysis of the benefits vs feasibility and risks, the group reached consensus on which of the potential *ex situ* roles identified (if any) are recommended for each taxon, and formulated general and, where appropriate, regional zoo association-specific recommendations.

Threatened taxa: All eight threatened taxa with large (usually multi-regional) populations were recommended for one or more *ex situ* conservation roles (median # roles = 6) and some level of level of *ex situ* population management. Many of these taxa involved established regionally managed programs with existing *in situ* conservation links. ICAP recommendations broadened existing *ex situ* roles and options and helped to identify regional priorities for these taxa.

Six threatened taxa have small or no existing *ex situ* populations. Development of sustainable *ex situ* breeding populations generally was not recommended due to low feasibility and/or high risk;

however, for some taxa proactive activities were recommended to develop husbandry expertise, monitor wild populations, and establish criteria to trigger *ex situ* population establishment if conditions or status in the wild change. *Ex situ* roles not requiring live animals (e.g., local education outreach, *in situ* support) were often recommended for these threatened taxa.

Non-threatened taxa: Nine non-threatened taxa are held in relatively large numbers within zoos (>100 individuals). ICAP recommendations within this category included: reduction or elimination of the *ex situ* population and replacement with another taxon; limited, well managed *ex situ* population with targeted conservation education messages; regional program only for locally threatened subspecies; and *in situ* support.

For many of the 20 non-threatened taxa with a small or no *ex situ* population, no *ex situ* population or role was identified, with the caveat that this should be re-evaluated if status in the wild changes. Several exceptions emerged, however, such as recommended regional programs utilizing confiscated or rescued animals that provide opportunities for benefits with high feasibility and low risk and costs, and identified roles to use non-threatened taxa as surrogates for research, husbandry and conservation education for threatened taxa.

In total, ten of the 43 taxa evaluated were recommended for some degree of interregional collaboration to either: a) build global/multi-regional long-term breeding insurance populations of threatened species (African wild dog, maned wolf, bushdog and dhole - the first three of which have an international studbook (ISB)); or b) make management of some non-threatened species more effective (sustainability) and efficient (space) (fennec fox, spotted hyena, bat-eared fox); or c) develop targeted education messaging across all four hyaenid taxa. Regional *ex situ* populations (in range countries only) were recommended for an additional 19 taxa to best address conservation needs. Eleven taxa (mostly non-threatened taxa currently held in large numbers) were recommended to maintain well managed but limited *ex situ* numbers; these represent instances in which there is little conservation cost (e.g., exhibit spaces not readily available to other species), some conservation benefit (as surrogates for threatened species or for conservation messaging), and/or taxonomic uncertainties under investigation. Ten taxa were recommended for no *ex situ* management unless status in the wild changes.

Following the ICAP workshop, each representative was tasked with bringing these recommendations to the relevant bodies within their respective regional zoo and aquarium associations for discussion, and ideally for incorporation within the regions' structures and processes for regional collection planning and *ex situ* program management. The result of this global ICAP workshop is intended to enhance the conservation of canid and hyaenid species by: a) providing guidance to zoos and aquariums on conservation priorities for collection planning, conservation education messaging, research, *in situ* field support, and integration of *in situ* and *ex situ* efforts; and b) promoting collaboration among regional zoo associations, field-based conservationists, and IUCN SSC Specialist Groups. By providing a facilitated process for implementation of the IUCN *ex situ* guidelines, the ICAP resulted in recommendations that, in comparison with previous 'traditional' RCPs, were more varied, detailed and tailored to the conservation needs for the species as determined by consensus among an international group of *in situ* and *ex situ* experts. The ICAP also lead to a better understanding among all stakeholders of the spectrum of possible *ex situ* contributions to conservation.

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SECTION 2

ICAP Process

The ICAP Process: Canids and Hyaenids

Introduction

The world is continuing to experience rapid losses of species and populations. Many of the extant populations are undergoing significant declines (Schipper *et al*. 2008; Ceballos *et al*. 2015; WWF 2016) and are becoming increasingly small and fragmented and thus vulnerable to genetic and demographic stochasticity (Gilpin and Soulé 1986; Soulé *et al.* 1986; Lacy 2000). A growing number of species can thus be expected to require intensive management of individuals and populations alongside other conservation actions to ensure their long term persistence (IUCN SSC 2014). Furthermore, the traditional dichotomy between *in situ* and *ex situ* conservation is becoming much more of a continuum of intensive management circumstances (Redford *et al*. 2012, 2014). Institutions and organizations specializing in intensive management at the level of individuals and populations, such as professional zoos and aquariums and their regional and global associations, therefore have increased opportunities and impetus to contribute to conservation.

Two recent developments are particularly important to help zoos and aquariums meet this renewed call for contribution to *ex situ* conservation.

The professional zoo and aquarium world is currently experiencing a paradigm shift (Baker *et al.* 2011; CBSG 2011; Barongi *et al*. 2015). Since the mid-1980s cooperative breeding programs in zoos and aquaria largely followed the "ARK paradigm". The default goal typically was to maintain (mostly) closed, long-term insurance populations that are demographically stable and large enough to maintain 90% of the gene diversity of the source population for 100-200 years (Soulé *et al.* 1986). Animals that are part of these programs would predominantly be kept on exhibit in many different zoos and aquaria within a region. Regional evaluations of the progress of programs against the ARK paradigm's default genetic and demographic goals showed that many did not reach these self-sustainability criteria (Lees and Wilcken, 2009; Leus *et al*., 2011; Long *et al.* 2011). On the one hand, this led to increased efforts and new initiatives to improve population sustainability (e.g. the AZA Task Force on the Sustainability of Zoo-based Collections (Dorsey *et al*. 2013); PVA analysis of AZA's animal programs (Johson *et al*. 2014), and the establishment of WAZA's Global Species Management Plans (Gusset 2013). Perhaps more importantly, it caused a growing realization that a "one size fits all" approach (an *a priori* assignment of the same role, goals and structure to each program) was perhaps no longer the most appropriate way forward (e.g. Baker *et al*. 2011; de Man *et al*. 2016).

Simultaneously, the concept of integrated conservation is being given renewed attention. Conservation planning processes for *in situ* and *ex situ* populations often run largely in parallel (Redford *et al*. 2012, 2014); *in situ* stakeholders come together to develop conservation strategies and action plans to ensure viable *in situ* populations, and *ex situ* stakeholders do the same to ensure viable *ex situ* populations. This parallel approach may result in both communities missing out on the opportunity to make use of each other's wide range of expertise and experience: *in situ* plans may pay insufficient attention to the potential need for intensive population management (*in situ* and/or *ex situ*), while *ex situ* plans may not be optimally designed to make the strongest conservation contribution. Rather, the precise roles and goals of each *ex situ* program should be carefully defined within the overall conservation plan for the species, by all parties involved, and its form and function should be tailored to maximize the chances of fulfilling the role(s) identified (de Man *et al.* 2016; Traylor-Holzer *et al.* 2018). To help facilitate this more integrated approach to conservation, the Conservation Planning Specialist Group (CPSG) of the Species Survival Commission (SSC) of the International Union for Conservation of Nature (IUCN) has coined and is promoting the "One Plan Approach" (OPA) to species conservation planning: "the joint development of management strategies and conservation actions for all populations of a species by all responsible parties to produce a single, comprehensive conservation plan for a species" (Byers *et al.* 2013).

This process of evaluating when it would be appropriate for the conservation plan for a threatened species to include *ex situ* management, and what precise form this should take, is challenging. To assist conservation practitioners with this, the IUCN SSC recently revised its "Guidelines on the Use of *Ex situ* Management for Species Conservation", designed to help conservationists evaluate if, when and how *ex situ* management would be a valuable component of the overall conservation strategy for a particular taxon. The five-step process outlined in the guidelines provides a more formal, informed, and transparent decision-making process on if *ex situ* activities are a beneficial and appropriate component of an overall species conservation strategy, and ensures that *ex situ* activities that are recommended are tailored in form and function to the conservation needs of the species (Traylor-Holzer *et al.* 2013; McGowan *et al*. 2017).

Ideally all threatened species would be covered by an integrated conservation action plan, developed according to the One Plan approach (OPA) and applying the IUCN *ex situ* guidelines. This would make it clear to professional zoos and aquaria which species require some form of *ex situ* management for conservation and which of those are best delivered by the zoo community. Despite a steady growth in the number of taxa for which this is the case, and current aim of the IUCN SSC to scale up the development of such conservation action plans, the majority of species are not yet covered by such an integrated plan. In the meantime, zoos and aquaria face the continuous challenge of managing their living collections and of assessing and modifying their *ex situ* efforts to better serve the conservation of species in the wild.

To help address this issue, a joint effort between CPSG and regional zoo associations has resulted in a new process called ICAP, or Integrated Collection Assessment and Planning workshop. Developed in the spirit of the OPA, the ICAP process brings *in situ* and *ex situ* communities together to apply the decision process of the IUCN *ex situ* guidelines to the task of regional or global collection planning. The ICAP process is designed to be flexible and applicable to large or small groups of taxa, at global or regional/local level, with the resulting analyses and recommendations being more general or detailed as appropriate.

This Global ICAP for Canids and Hyaenids marks the launch of this new process. The workshop was organized in collaboration with the AZA Canid and Hyaenid Taxon Advisory Group (TAG), the corresponding EAZA and ZAA TAGs, and the IUCN SSC Canid, Hyaenid and Conservation Planning Specialist Groups. All 43 canid and hyaenid taxa, including those not held in captivity, were assessed by ICAP participants representing six zoo associations, the Canid and Hyaenid Specialist Groups, wildlife managers, and field researchers. The list of participant to the workshop, as well as a list of non-participants that were contacted for input before the workshop, can be found in Appendix 1.

Five-step decision process in the IUCN SSC Guidelines

Both the pre-workshop preparation and the actual workshop workflow of the ICAP process is structured around the IUCN SSC Guidelines on the Use of *Ex situ* Management for Species Conservation, which utilizes a five-step decision process to determine if and which *ex situ* activities might be appropriate to be included in overall conservation strategy for the species. These five steps are (IUCN 2014; McGowan *et al.* 2017; Traylor-Holzer *et al*. 2018):

1. Conduct a thorough status assessment (of both *in situ* and any known *ex situ* populations) and threat analysis.
2. Identify potential roles that *ex situ* management can play in the overall conservation of the species.

3. Define the characteristics and dimensions of the program needed to fulfill the identified potential conservation role(s).
4. Define the resources and expertise needed for the *ex situ* management program to meet its role(s) and appraise the feasibility and risks.
5. Make an informed and transparent decision as to which *ex situ* roles and activities (if any) to retain within the overall conservation strategy of the species

The description of the methodology below describes how this step process was adjusted and applied in the context of the ICAP workshop.

Taxon sheets

For each of the 43 Canid and Hyaenid taxa assessed, the data gathered and recommendations made were recorded on a taxon sheet (see Sections 4-6). Before the workshop, information gathered on the *in situ* and *ex situ* status, *in situ* threats, and previously published *ex situ* roles/recommendations was summarized on the taxon sheets, as was the feedback received through email consultation among *in situ* colleagues regarding potential *ex situ* roles for conservation. During the workshop, each partially completed taxon sheet was reviewed and discussed. This formed the basis for the generation of the list of potential direct and indirect conservation roles for *ex situ* management and the evaluation of the program characteristics and relative benefit, feasibility and risk of each of the roles. Following the workshop, the identified roles and their evaluation, as well as additional comments and the final recommendations made, were added to each taxon's sheet. Details on the methodology for each of these steps can be found below.

Pre workshop preparation

In situ status

For each taxon, the IUCN Red List category of threat and population trend was recorded, as well as a summary of the status information on the full Red List account. In 2015 the Red List information was updated for all of the hyaenids and most of the canids. In 2017, the IUCN Red List status for Darwin's fox was changed from Critically Endangered (CR) to Endangered (EN). For this report, the status was left as Critically Endangered as this was the listing at the time of the global ICAP workshop; the recommendations made are relevant to either status. No Red List assessments were available for the Mexican and Iberian wolf subspecies, but given their importance to respectively the AZA and EAZA communities, these taxa were also included in the ICAP workshop. Because relatively few taxa were threatened according to the IUCN definition (Critically Endangered, Endangered or Vulnerable), for the global Canid and Hyaenid ICAP specifically, taxa listed as Near Threatened were included in the threatened category. Throughout this ICAP report any counts for the number of threatened species therefore include those in the Near Threatened category.

In situ threats

Ex situ activities can help to address the threats or challenges that a species is experiencing in four different ways (IUCN 2014; McGowan *et al*. 2017; Traylor-Holzer *et al*. 2018):

- *By addressing the causes of primary threats* (for example through specifically designed research, training or conservation education activities that directly impact the causes of these threats).
- *By offsetting the impact of primary and/or stochastic threats* on the population (for example through activities that help to improve survival (of particular life stages), reproductive success and/or gene diversity retention or gene flow).
- *By buying time* in cases where the wild population is in severe decline and the chance of sufficiently rapid reduction of primary threats is slim or uncertain or has been inadequately successful to date (for example through rescue or insurance populations)

- *By restoring wild populations* once primary threats have been sufficiently addressed (for example by reintroductions).

In order to precisely identify *ex situ* roles that best address the threats and challenges faced by the taxon, it is therefore important to not merely consider the IUCN Red List category of threat, but to also consult the more detailed descriptions of the threat processes in the full Red List account and, where relevant, to consult additional sources or data obtained through *in situ* stakeholders. A summary of the main threats faced by each taxon, extracted from the above sources, was recorded on the taxon sheet.

Potential *ex situ* roles

Under the principle of the OPA, *in situ* and *ex situ* specialists should together evaluate the most appropriate actions to save a species and, within that, identify any direct or indirect roles for *ex situ* conservation. However, in the context of an ICAP workshop where a large number of taxa is being evaluated at the same time, it is not possible or effective to invite all *in situ* specialists for all taxa. In order to canvas as wide a representation of the *in situ* community as possible, *in situ* specialists were surveyed by email ahead of the workshop.

Using the knowledge of the TAGs, zoo associations and the IUCN SSC Canid and Hyaenid Specialist Groups, a list was created of 57 *in situ* specialists working with particular taxa. Regardless of whether they would attend the ICAP workshop or not, each was sent a survey asking them to identify potential direct and indirect conservation roles for *ex situ* activities within the conservation needs of the canid and hyaenid species of their expertise. The survey was sent for both threatened and non-threatened taxa because: a) there might be recent changes in status and threats that are not yet reflected in the IUCN Red List; and b) non-threatened species can play a role in the conservation of threatened species, for example as model species. Twenty-four of the 57 (42%) *in situ* specialists completed the survey (Appendix I).

The survey package sent was composed of the following (see Appendix II):

- a cover letter with an introduction to the ICAP workshop;
- a document defining and describing the different kinds of direct conservation roles (based on the role descriptions in the IUCN *ex situ* guidelines (IUCN 2014) and the Amphibian Ark Conservation Needs Assessment Process (http://www.amphibianark.org/pdf/AArk_Conservation_Needs_Assessment_tool.pdf)) and indirect *ex situ* conservation roles;
- an advanced draft of the relevant taxon sheet(s) with the summary of the *in situ* status and threats, the *ex situ* status, and any previously published *ex situ* roles or recommendations; and
- a questionnaire with seven questions that asked the *in situ* expert to identify potential direct and indirect *ex situ* conservation roles for the taxa of their expertise.

All feedback from the survey was summarized on the taxon sheets.

Prior *ex situ* recommendations

With the help of TAGs, zoo associations, CPSG and the IUCN SSC Canid and Hyaenid Specialist Groups, published canid or hyaenid conservation strategies and action plans were gathered and consulted to extract any existing *ex situ* recommendations or mandates. This included documents such as regional, national or local governmental plans, IUCN SSC Canid or Hyaenid Specialist Group plans, CPSG Population and Habitat Viability Assessments (PHVAs), CPSG Conservation Assessment and Management Plans (CAMPs), and plans by international or local NGOs or conservation alliances. Information on existing *ex situ* recommendations or mandates was summarized on the taxon sheets.

Ex situ status

The main global, regional or national zoo associations with managed *ex situ* programs were contacted to inquire if they were maintaining a studbook or *ex situ* program for one or more of the canid and hyaenid species. For those species with a studbook or managed program, they were asked to submit as many of the following data sources as possible:

- A backup of the SPARKS or PopLink studbook database (with a notification of the currentness date, the geographic or association filter that should be used to delineate the managed population, and the date span that should be selected for demographic analysis);
- The most recent studbook publication;
- The most recent yearly report or equivalent report for the region;
- The most recent breeding and transfer plan, long-term management plan or equivalent document for the region; and
- Any other region specific documents/registries that contain population information and/or that indicate the roles and goals of the *ex situ* population in the region. In preparation for the ICAP meeting, the ALPZA and JAZA regions conducted a canid and hyaenid survey among their member institutions. In addition, the Central Zoo Authority (CZA) of India provided information from their registry and studbook databases.

In cases in which no studbook is held or no studbook data were available, and no region specific survey or census/registry data was available, the species holdings report and population overview report of the Species360 Zoological Information Management System (ZIMS) database was consulted for data from Species360 member institutions from that region (as of March 2016). The studbook datasets, ZIMS database, and other documents were analyzed to extract the following population parameters when they were available and sufficiently reliable:

- Population size (males, females, unknown sex)
- Number of living wild-born individuals
- Current gene diversity retained (% of the wild source population)
- Number of founders (unrelated wild-born individuals with living descendants)
- Number of potential founders (living unrelated wild-born individuals without living descendants)
- Percentage of the pedigree known
- Population trend or, when available, lambda. In the *ex situ* status table “lambda” refers to a short-term lambda (yearly growth rate) of the last 5 years. For some taxa there is also a ‘LT’ or long-term lambda value stated in this field, which is for a variable time period, judged by the analyst (using census data) to cover the period when the population of that taxon was of sufficient size to be able to calculate a valid lambda.
- Number of holding institutions
- Level of population management within the region
- Data source

When a parameter was not available, could not be calculated, or was insufficiently reliable due to data quality issues, a “?” was recorded. When more than one data source was available for a region (e.g. both international and regional studbooks), the most current and comprehensive source was selected to complete the *ex situ* status for that region. The *ex situ* status of the taxon was summarized in a few lines above the *ex situ* status table.

Workshop process

At the start of the workshop, participants were presented with:

a) the taxon sheets, which included for each taxon the summary of the *in situ* status and threats, the *ex situ* status, potential *ex situ* conservation roles identified through the pre-workshop survey and any previously published *ex situ* roles or recommendations;
b) a workshop manual (Appendix III) containing:
   - definition of the One Plan approach;
   - five decision steps in the IUCN SSC Guidelines on the Use of *Ex situ* Management for Species Conservation;
   - nine questions investigating potential direct and indirect *ex situ* conservation roles sent to the *in situ* experts prior to the workshop;
   - descriptions of the main types of direct conservation roles (based on the role descriptions in the IUCN *ex situ* guidelines (IUCN SSC 2014) and the Amphibian Ark Conservation Needs Assessment Process (http://www.amphibianark.org/pdf/AArk_Conservation_Needs_Assessment_tool.pdf) and indirect *ex situ* conservation roles; as well as a number of questions to investigate potential non-conservation roles for *ex situ* management;
   - guidance to determine characteristics and resources of the *ex situ* population needed to fulfil proposed roles – and to examine relative benefit, feasibility and risks;
   - guidance on what to take into account when trying to reach consensus as to which *ex situ* roles to recommend for the taxon;
   - list of the canid and hyaenid taxa ranked by their evolutionary distinctiveness score; and
   - table of the canid and hyaenid taxa ordered according to their threat status, population size and presence in captivity.

The agenda of the ICAP workshop can be found in Appendix III. The meeting opened with welcoming remarks, participant introductions and several introductory presentations. Then all 43 taxa were discussed, beginning with the threatened canid species, followed by all four hyaenid species and concluding with the non-threatened canid species

For each species the following process was followed:

1. Presentation of the previously gathered information on the taxon sheet. Suggested comments/changes/additions from the workshop participants were recorded.
2. Facilitated plenary discussion to identify potential direct and indirect *ex situ* conservation roles, and rating of the benefit to the conservation of the species of any roles proposed.
3. If at least one role was identified, facilitated plenary discussion to:
   a) Identify the characteristics, scope, and resources of the *ex situ* population needed to fulfil the identified role(s);
   b) Rate the feasibility (considering, for example, existing *ex situ* population, husbandry challenges, technical or logistical challenges, availability of skilled staff, availability of sufficient financial and other resources) and risks (e.g. vulnerability to catastrophes, consequences for wild population, occupying *ex situ* space for other species that need it more, human health and safety risks, political risks, risks for social or public conflicts) of each proposed role; and
4. Formulation of recommendations:
   a) Reaching consensus on which of the potential *ex situ* roles identified (if any) are recommended, based on an analysis of the benefits vs feasibility and risks.
   b) Formulating of recommendations generally, and where appropriate, for specific regional zoo association(s).

The results of this process are reported in the *ex situ* role table, comments/issues section and recommendations section of each taxon sheet.

At the end of the workshop, time was taken to survey all species for which direct and/or indirect conservation roles were recommended (generally or for one or more specific regions) and to evaluate the overall feasibility of implementing those roles.

Post-workshop follow up

Following the workshop, each representative was tasked with bringing formulated recommendations to the relevant bodies within their respective regional zoo and aquarium associations for discussion, and ideally for incorporation within the regions' structures and processes for regional collection planning and *ex situ* program management. The result of this global ICAP workshop is intended to enhance the conservation of canid and hyaenid species by: a) providing guidance to zoos and aquariums on conservation priorities for collection planning, conservation education messaging, research, *in situ* field support, and integration of *in situ* and *ex situ* efforts; and b) promoting collaboration among regional zoo associations, field-based conservationists, and IUCN SSC Specialist Groups.

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SECTION 3

Summary Results

Summary of ICAP Workshop Results

The ICAP process save guarded against automatic assumptions regarding: a) which taxa to maintain, phase out, not acquire or replace simply based on numbers already in zoos and the threat status; and b) the *ex situ* conservation role to be assigned to each taxon. It resulted in much more tailored and variable recommendations across the 43 taxa, with different (or no) roles assigned to different taxa and the same taxon often receiving variable roles for different regions involved (Table 1). Carefully relating potential roles to the status and threat analysis of the taxa also provided much needed detail. For example, rather than a role simply being described as "education", "awareness" or "research", details such as target audiences, core messages and research topics were identified.

The workshop recommendations can be summarized as follows:

- All eight threatened taxa with large (usually multi-regional) populations were recommended for one or more *ex situ* conservation roles (median # roles = 6) and some level of *ex situ* population management. Many of these taxa involved established regionally managed programs with existing *in situ* conservation links (e.g., Mexican wolf). ICAP recommendations broadened existing *ex situ* roles and options and helped to identify regional priorities for these taxa.
- Six threatened taxa have small or no existing *ex situ* populations. Development of sustainable *ex situ* breeding populations generally was not recommended due to low feasibility and/or high risk; however, for some taxa proactive activities were recommended to develop husbandry expertise, monitor wild populations, and establish criteria to trigger *ex situ* population establishment if conditions change. *Ex situ* roles not requiring live animals (e.g., local education outreach, *in situ* support) were often recommended for these threatened taxa.
- Nine non-threatened taxa are held in large numbers within zoos (>100 individuals). ICAP recommendations within this category included: reduction or elimination of the *ex situ* population and replacement with another taxon; limited, well managed *ex situ* population with targeted conservation education messages; regional program only for locally threatened subspecies; and *in situ* support. This global ICAP workshop did not systematically investigate non-conservation roles that taxa can be assigned, such as biological education, basic research, attractive exhibit species, etc. However, the same five-step process can be used to evaluate the suitability and feasibility of such roles. Regional Collection Planning (RCP) processes with an ICAP-based format (or starting from the outcome of a global ICAP workshop) may wish to consider incorporating the investigation of non-conservation roles.
- For many of the 20 non-threatened taxa with a small or no *ex situ* population, no *ex situ* population or role was identified, with the caveat that this should be re-evaluated if status in the wild changes. Several exceptions emerged however, such as recommended regional programs utilizing confiscated or rescued animals that provide opportunities for benefits with high feasibility and low risk and costs, and identified roles to use non-threatened taxa as surrogates for research, husbandry and conservation education for threatened taxa.

In total, ten of the 43 taxa evaluated were recommended for some degree of interregional collaboration to either: a) build global/multi-regional long-term breeding insurance populations of threatened species (African wild dog, maned wolf, bushdog and dhole- the first three of which have an international studbook (ISB)); or b) make management of some non-threatened species more effective (sustainability) and efficient (space) (fennec fox, spotted hyena, bat-eared fox), or c) develop targeted education messaging across all four hyaenid taxa. Regional *ex situ* populations (in range countries only) were recommended for an additional 19 taxa to best address conservation

needs. Eleven taxa (mostly non-threatened taxa currently held in large numbers) were recommended to maintain well managed but limited *ex situ* numbers; these represent instances in which there is little conservation cost (e.g., exhibit spaces not readily available to other species), some conservation benefit (as surrogates for threatened species or for conservation messaging), and/or taxonomic uncertainties under investigation. Ten taxa were recommended for no *ex situ* management unless status in the wild changes. These results benefited from the global scope of the assessment, as there were substantial regional differences in recommendations across these taxa

Table 1. Summary of the *ex situ* conservation roles and programs recommended by the Global Canid and Hyaenid ICAP, broken down into threatened vs non-threatened taxa, and according to relative size of current *ex situ* holdings. Threatened = EW/CR/EN/VU/NT; Non-threatened = LC for IUCN Red List category of threat. Italicized numbers represent potential future roles.

	Threatened		**Not Threatened**	
Recommended Roles	**Large *Ex Situ* Population (N=163-696) (8 taxa)**	**Small *Ex Situ* Population (N=0-13) (6 taxa)**	**Large *Ex Situ* Population (N=127-1172) (9 taxa)**	**Small *Ex Situ* Population (N=0-65) (20 taxa)**
DIRECT				
Insurance (living)	6	1 *(+1)*	0	3
Insurance (GRB)	2	1	0	0
Source	2-3 *(+2)*	0	0	0
Rescue	*1*	*1*	0	0
Research	4	0	1	2
Genetic analysis	6	1	3	1
Training	2	1	0	0
Education	7	4	4	5
INDIRECT				
Research	4	1	0	5
Education	5	1	5	8
In situ support	3	3	2	7
Median # roles/taxon	6	2	2	1
***Ex Situ* Living Population Recommendation**				
Multi-regional metapopulation	4	0	3	0
In-range country only/ rescues	3	3	0	8
Limited *ex situ* numbers	2	1	7	1
Potential in-range population	0	1	1	3
No *ex situ* population	0	1	1	8

Global Integrated Collection Assessment and Planning Workshop for Canids and Hyenids

Omaha, NE, USA
19 – 20 March 2016

Final Report

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SECTION 4

Taxon Sheets: Large Canids

Taxon Sheets: Large Canids (≥ 10 kg)

14 Taxa Assessed

For the purposes of this ICAP workshop, we have included the Red List category of Near Threatened (NT) under "Threatened" taxa along with Vulnerable (VU), Endangered (EN), Critically Endangered (CR), and Extinct in the Wild (EW). Using this categorization:

Seven of the 14 large canid taxa are listed as Threatened on the IUCN Red List. Six of these are held in captivity in significant numbers (i.e., at least 100 individuals).

- Three taxa are actively managed in multiple regions, with an International Studbook for two of these three.
- Two taxa are actively managed only in their native range (and in conjunction with *in situ* recovery programs).

Of the seven non-threatened taxa, three are held in captivity in significant numbers, most notably the gray wolf (~1200 individuals in 8 regions).

The table below lists the estimated global *ex situ* population size for each large canid taxon (in parentheses). Taxon sheets are presented in alphabetical order, first for threatened taxa and then for non-threatened taxa. These sheets summarize *in situ* status and threats, *ex situ* demographic and genetic status, prior *ex situ* conservation recommendations, and ICAP assessment of potential *ex situ* roles, benefit, risks, feasibility, and recommendations.

	Current *Ex Situ* Population Size			
Status	**Large pop (>100)**	**Small pop (40-100)**	**Very small pop (<40)**	**Not in captivity**
Threatened	African wild dog (696) Dhole (277) Dingo (163) Maned wolf (371) Mexican gray wolf (243) Red wolf (202)			Ethiopian wolf
Non-threatened	Coyote (127) Golden jackal (200) Gray wolf (1172)	Iberian wolf (50)	Black-backed jackal (33) Side-striped jackal (1) Singing dog (37)	

AFRICAN WILD DOG
Lycaon pictus

THREATENED SPECIES
IUCN Red List: Endangered
Population trend: Declining

Disappeared from much of their former range throughout Sub-Saharan Africa. Virtually eradicated from North and West Africa and greatly reduced in Central and Northeast Africa. Largest remaining populations are in Southern Africa.

Threats: Primary threat is habitat fragmentation, which increases contact with humans and domestic animals, resulting in conflict and transmission of infectious disease. Low densities and conflict with other large predators (interspecific competition, direct mortality) make the species vulnerable to stochastic events. Techniques for effective disease prevention is among the knowledge gaps.

Potential Ex Situ Roles:
Direct Conservation: Insurance Population, Research, Training, Conservation Education.
Vaccination and reproduction research. Training vets and technical assistance. Insurance population, particularly in range states. Workshops linking *in situ* and *ex situ* conservation efforts. Genetic analysis.
Indirect Conservation: Technical Expertise, Fundraising.
Providing funds and technical equipment to *in situ* projects.

Ex Situ Status:
Present in captivity in most regions (global *ex situ* population = 696 animals). Successful breeding in captivity; stable global population; International Studbook maintained by PAAZA. In addition, semi-free ranging packs are intensively managed in small reserves in Africa as a meta-population. Techniques for effective contraception in these small reserves is a knowledge gap.

	AZA / North America	ALPZA / Latin & SAmerica	EAZA / Europe	PAAZA / Africa	AZAA / UAE	SEAZA / Singapore	JAZA / Japan	ZAA / Austral-asia	Total Global *Ex Situ* Pop
Population size (M.F.U)	**154 (84.70)**	**5 (4.1)**	**275 (158.114.3)**	**157 (95.58.4)**	**22 (10.10.2)**	**8 (7.1)**	**10 (5.5)**	**65 (28.31.6)**	**696 (391.290.15)**
Living wild-born	?	?	?	?	?	?	?	?	?
Gene diversity	92.9%	?	87%	94%	76.7%	72.3%	76.3%	87.9%	96.2%
# Founders	24	?	23	38	22	9	8	23	47
# Potential founders	0	?	0	0	0	0	0	0	0
% pedigree known	91%	?	51%	85%	78%	69%	100%	84%	72%
Population trend/ lambda	1.054 LT 0.917	1.05	1.063	1.056 LT 0.973	1.051	1.05	1.051 LT 0.969	1.052 LT 0.902	1.073 (LT 1.00)
# institutions	37	2	47	11	2	1	1	10	111
Management	SSP managed program	No formal program	EEP managed program	No longer formal program	No formal program	No formal program	No formal program	ASMP managed program	
Data source	*2016 ISB*	*2016 ISB*	*2016 ISB*	*2016 ISB*	*2016 ISB*	*2016 ISB*	*2016 ISB*	*2016 ISB*	*2016 ISB*

M.F.U = # males.females.unknown sex

Workshop Assessment of Ex Situ Roles and Activities:

The following direct and indirect conservation roles were identified at the ICAP workshop. Roles selected to pursue following benefit/feasibility/risk analysis are marked in green.

Direct Role(s)	Benefit	Feasibility	Risk	Notes
Insurance	**MODERATE**	**HIGH**	**MODERATE**	Keep large, genetically diverse *ex situ* population as insurance. At present no interest/need in range states to use as a source for population restoration. Boom/bust growth a challenge in zoos. Some genetic and reproductive health issues.
Research Vaccine trials; distributing vaccines to free-range dogs; *ex situ* reproductive control (effects on physiology and pack dynamics); molecular genetics	**HIGH**	**HIGH (genetics)** **MODERATE (health)**	**MODERATE**	Molecular genetics to map *in situ* and *ex situ* gene diversity/structure to guide management. Much can be done with *ex situ* population (studying/recording/ sharing experiences w/ management interventions already happening).
Training Field restraint and veterinary techniques	**HIGH**	**HIGH**	**LOW**	Expertise already exists in some range countries; needed in others
Education In range	**Not rated**	**Not rated**	**Not rated**	Done by in-country NGOs
Indirect Role(s)	**Benefit**	**Feasibility**	**Risk**	**Notes**
Education Outside range	**HIGH**	**HIGH**	**LOW**	Improve public perception of large carnivores
Support in situ work Financial, resources and/or expertise	**HIGH**	**HIGH**	**LOW**	Happening already but good to expand.

Comments/Issues:

- There are additional individuals in semi *ex situ*/*in situ* meta-population situation in South Africa – they are in the wild, but in protected areas and managed. Individuals can be identified but are not tracked regularly. There is reluctance to move dogs between zoos and these populations in either direction. The original founders of the metapopulation were of zoo population origin.
- Consistent reproduction is a challenge in some regional zoo populations. There is still much to be learned regarding the effects of various methods of reproductive control on physiology, anatomy and pack dynamics. The "boom and bust" population dynamics (large litters followed by no reproduction) often require additional institutional space.
- A considerable amount of work has already been carried out *ex situ* with regard to vaccine testing and other veterinary protocols. *Ex situ* community needs more specific requests – is more needed or are the results not reaching the right stakeholders?

Workshop Recommendations:

1. Increase collaboration between regional zoo populations to manage the global *ex situ* population. With a more unified *ex situ* plan, potentially the larger regional populations could be sources to smaller regions (SEAZA, JAZA, etc.) in order to manage space more effectively, stabilize reproduction, and increase population sustainability.
2. Continue to work with semi-*ex situ* meta-populations in South Africa with a view to using *ex situ* animals as a source population should the need for that arise.

3. Continue/complete molecular genetics research to map *in situ* and *ex situ* gene diversity/ structure and resolve pedigree gaps, in order to guide management (ensuring *ex situ* gene diversity is representative of *in situ* diversity).
4. Continued research in reproduction and contraception.
5. Discuss with *in situ* partners what specific aspects of disease ecology, veterinary medicine and/or vaccine testing needs remains to be completed.
6. Increase support for *in situ* conservation.
7. Improve education initiatives in all regions (outside and inside range countries).

DHOLE
Cuon alpinus

THREATENED SPECIES
IUCN Red List: Endangered
Population trend: Declining

Native to South and SE Asia.

Threats: Declining in most areas due to prey base depletion, habitat loss, persecution due to livestock depredation, disease transmission from domestic dogs, and possibly interspecific competition.

Potential Ex Situ Roles:

Direct Conservation: Insurance Population, Research, Training, Conservation Education. Zoos can raise awareness of the threats to this species and its ecosystem and use their expertise (social science) in dealing with human-dhole conflicts.

Indirect Conservation: Technical Expertise, Fundraising. Provide expertise and raise funds for *in situ* conservation efforts. IUCN SSC Canid Specialist Group (CSG) Dhole Working Group recommends a PHVA to gather data and develop conservation and research priorities for the species (funding for PHVA needed).

Prior Ex Situ Recommendations: Recommended for Nucleus I population (50-100 animals with GD ≥98%, requiring periodic immigrants from wild) (1992 CAMP). 1998 Mammals of India CAMP recommended an *ex situ* population with 90% GD for 100 years for *C.l. laniger* and *C.l. primaevus* with periodic reinforcement. *C.l. dhekhanensis* recommended for education, research and husbandry. Research on reproductive biology and behavior has been conducted in captivity; much research still needed (2004 CSG Action Plan).

Ex Situ Status:

Present in captivity in Europe with small populations in several other regions (estimated global *ex situ* population = 363 animals). Good reproduction in captivity with growing global population. Managed program in EAZA. Subspecies status is unclear and likely mixed in captivity; EEP recommends managing putative northern (e.g., China) and southern (e.g., India, Cambodia) groups separately.

	AZA / North America	EAZA / Europe	CZA / India	SEAZA/ SE Asia	JAZA / Japan	Total Global *Ex Situ* Pop
Population size (M.F.U)	**33 (12.15.6)**	**279 (144.118.17)**	**64**	**31 (19.11.1)**	**9 (3.6)**	**363 (185.154.24)**
Living wildborn	?	?	Many	?	?	?
Gene diversity	?	?	?	?	?	~83.9%
# Founders	?	?	?	?	?	7
# Potential fdrs	?	?	?	?	?	?
% pedigree kn	0%	Low	?	?	?	Very low (3%?)
Pop lambda	1	1.04	?	?	?	1.044
# institutions	5	46	7	3	5	62
Management	No formal program	EEP managed	No formal program	Not managed	No formal program	
Data source	*2016 EAZA Regional SB*	*2016 EAZA Regional SB*	*2016 CZA info*	*2016 ZIMS*	*2016 JAZA report*	*2016 EAZA Regional SB*

M.F.U = # males.females.unknown sex

Workshop Assessment of Ex Situ Roles and Activities:

The following direct and indirect conservation roles were identified at the ICAP workshop. Roles selected to pursue following benefit/feasibility/risk analysis are marked in green.

Direct Role(s)	Benefit	Feasibility	Risk	Notes
Insurance	**HIGH**	**HIGH (CZA);** **MODERATE(EAZA)** High if managed as a species-level insurance population	**LOW (CZA)** **HIGH (EAZA)**	CZA likely one subspecies; does not replace another species or harm wild pop; EAZA status dependent on outcome of genetic testing
Source	**Not rated**	**Not rated**	**Not rated**	Future potential for release in India
Research Genetic, taxonomic, health	**HIGH**	**MODERATE** Genomics project started in Europe	**LOW**	Need institutional support and resources; samples unlikely from the wild
Training Field restraint	**HIGH**	**HIGH (AZA)**	**LOW**	Already occurring in AZA
Education In range	**HIGH (India)**	**HIGH** Either on-site or outreach (underway)	**LOW**	Target government to increase support; control feral dogs; active outreach
Indirect Role(s)	**Benefit**	**Feasibility**	**Risk**	**Notes**
Education Outside range	**HIGH**	**HIGH**	**LOW**	Improve public perception of large carnivores
Fundraising	**HIGH**	**MODERATE**	**LOW**	Funds for *in situ* projects (India); AZA research

Comments/Issues:

- Taxonomic status (# of subspecies) is unclear; the decision to manage on the species or subspecies level will have implications for feasibility, value and structure of *ex situ* programs.
- CZA: zoos periodically receive problem/rescue animals, which may be a source of new founders. Began a breeding program 4 years ago and they maintain a studbook. Likely Indian subspecies.
- EAZA: Managed as two subspecies (Northern and Southern); molecular work is needed to sort out taxonomy and pedigree; if mostly Northern, then unique from Indian population.
- AZA: Animals originally came from EAZA, so may be a genetically less valuable population and will need genetic testing. AZA and smaller regions (SEAZA and JAZA) could provide resources and funds as well as support the larger regional populations.

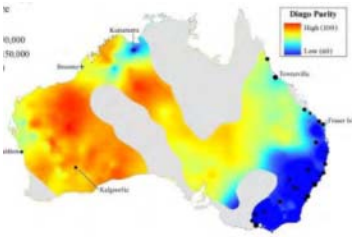
Workshop Recommendations:

1. Molecular analysis needs to be completed to determine taxonomic status for dholes.
2. CZA is recommended to maintain and possibly expand an intensively-managed *ex situ* breeding population as an insurance population and potential future source population.
3. EAZA is recommended to maintain an intensively-managed *ex situ* breeding population as an insurance population (pending results of molecular work).
4. AZA is recommended to maintain their current population; likely role is training and research if genetically redundant (testing needed) and therefore could remain as a small population supporting larger populations (together with SEAZA and JAZA).
5. Research, Education and Fundraising roles can be applied in all regions.
6. Regional programs are encouraged to support *in situ* projects. Contact Brij Gupta regarding projects in India (to secure habitat and prey); contact Nucharin Songsasen regarding projects in SE Asia.

DINGO
Canis lupus dingo

THREATENED SPECIES
IUCN Red List: Vulnerable (due to hybridization)
Population trend: Decreasing

Native to Australia, with extensive hybridization with domestic dogs. Considered a subspecies of gray wolf, as is the domestic dog *C. l. familiaris*.



Threats: Persecution, habitat loss and hybridization with domestic dogs

Potential Ex Situ Roles: No responses for this species prior to workshop

Prior Ex Situ Recommendations: Recommended for Nucleus I population (50-100 animals with GD ≥98%, requiring periodic immigrants from wild) as part of species meta-population (1992 CAMP). Extensive hybridization means that DNA testing is necessary to determine purity of captive individuals used for a breeding program (2010 Dingo Report, Australian government).

Ex Situ Status:
Present in captivity in 3 regions (global *ex situ* population = 163 animals); degree of hybridization unclear. Dingos and dingo hybrids breed well in captivity. Many breeding sites outside of zoos, including the Dingo CARE Network (100 pure individuals) and Bargo Dingo Sanctuary.

	AZA / North America	EAZA / Europe	ZAA/ Australasia	Total Global *Ex Situ* Pop
Population size (M.F.U)	**29 (14.15)**	**50 (17.33)**	**84 (35.48.1)**	**163 (66.96.1)**
Living wild-born animals	?	?	?	8
Gene diversity	?	?	?	?
# Founders	?	?	?	?
# Potential founders	?	?	?	?
% pedigree known	?	?	?	5%
Population trend/ lambda	?	?	?	Increasing
# institutions	10	15	23	48
Management	Not managed	Not managed	Not managed	
Data source	*2016 ZIMS*	*2016 ZIMS*	*2016 ZIMS*	*2016 ZIMS*

M.F.U = # males.females.unknown sex

Workshop Assessment of Ex Situ Roles and Activities:

The following direct and indirect potential conservation roles were identified at the ICAP workshop. Roles selected to pursue following benefit/feasibility/risk analysis are marked in green.

Direct Role(s)	Benefit	Feasibility	Risk	Notes
Education (ZAA region) Messaging about risk of loss through hybridization; unique subspecies vs. reputation as "pest"	**HIGH**	**HIGH**	**LOW**	If solely education role for now, taxonomic purity of current *ex situ* population less important; an education program may facilitate the transition to additional roles in future (if required) by building/keeping public engagement.

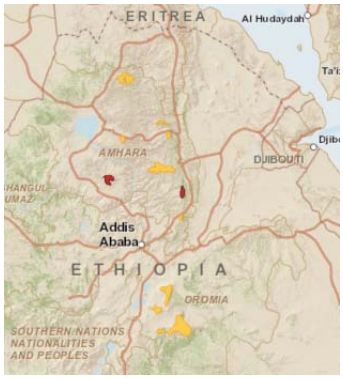
Comments/Issues:

- Considered a pest species in many regions of its native range; currently not considered a conservation priority by the Australian government or ZAA.
- In other regions the species is/can be held as geographical/cultural representative; this type of messaging can utilize the current population regardless of its unclear hybridization status. No managed program is needed at this time.

Workshop Recommendations:

1. If the taxon does become a conservation priority and *ex situ* activities for conservation are appropriate/required (for insurance or other roles), this will be taken on by ZAA and partners, in cooperation with the Australian government.
2. An *ex situ* population of this species in other regions (non-ZAA) is not actively encouraged, as it could impact *ex situ* space needed for other species (including non-canids). However, if an institution does have the species, educational messaging should be linked to that utilized in ZAA.

ETHIOPIAN WOLF
Canis simensis



THREATENED SPECIES
IUCN Red List: Endangered
Population trend: Declining

Restricted to seven isolated mountain enclaves in the highlands of Ethiopia. 2004 CSG Action Plan lists as the most threatened canid with least amount of genetic variation.

Threats: Continuous loss of habitat due to high-altitude subsistence agriculture and overgrazing is the major threat. Recent declines due to disease epizootics, with road kills and persecution as secondary threats. Rabies and distemper are concerns. Threats exacerbated by species' specialization to the Afro-alpine ecosystem. Just below the threshold for uplisting to Critically Endangered.

Potential Ex Situ Roles: **Direct Conservation: Captive Breeding**
An in-country program may be the only option for an *ex situ* breeding program, if needed, as plans to establish breeding programs abroad have been repeatedly rejected by Ethiopia.
Indirect Conservation: Funding, Education. Zoos can help fund research to address knowledge gaps in behavior, physiology and ecology under human disturbance so that impacts are understood and can be mitigated. Zoos can raise public awareness of rare species (through surrogate captive species) and need for habitat protection.

Prior Ex Situ Recommendations:

1992 Canid, Hyaena and Aardwolf CAMP: Recommended that an *ex situ* population be established to preserve 90% GD for 100 years, developed with 1-5 years (Nucleus I). Resolution by AZA Canid TAG, CSG and others to establish an integrated in-country and out-of-country captive breeding program, with pledged support from foreign zoos to assist in-country program development. Ideally populations to be managed as a meta-population along with *in situ* populations. WCS submitted proposal to establish nucleus population in the US. Neither initiative was supported by Ethiopian government to allow exportation for out-of-range populations.

1997 Ethiopian Wolf Status Survey: Potential role for captive breeding to mitigate species extinction risk as part of a meta-population management strategy. Feasibility assessment concluded that population management is essential, with *ex situ* breeding required: 1) to develop a genetically pure population as insurance against species extinction; and 2) to produce potential founders for eventual release into the wild (reintroduction and reinforcement). Proposal for an in-country captive breeding facility was developed in concert with Born Free Foundation, and a recommendation was made to develop a gamete bank. Problem-oriented research is needed to manage wolves *in situ* and *ex situ*. Zoos in breeding program to provide financial and technical support *to in situ* conservation needs. Use as a flagship species for conservation education for Ethiopian wildlife.

1999 Ethiopian Wolf PHVA: No *ex situ* population needed yet, but maintain preparedness for captive breeding facility construction if it becomes a higher priority (lower priority action).

2004 Canid Status Survey and Conservation Action Plan: Recommendation to consider the feasibility of establishing a captive breeding population to provide insurance against extinction in the event of catastrophe (whether political or climatic), weighed against the option of accomplishing this through intensive management of wild populations; must not replace, hinder or compromise *in situ* conservation efforts. Examine possibility of preserving gene diversity through cryopreserved gamete bank (with collection done opportunistically and without negative impacts on species *in situ* conservation).

2011 Ethiopian Wolf National Action Plan: Collection and long-term storage of sperm to retain genetic diversity and provide options for genetic supplementation and meta-population management.

Ex Situ Status:
Not represented in captivity in ZIMS database or surveyed regional zoo associations. No historical holdings recorded. Attempts to create a captive population were abandoned around 2004 due to lack of permission from the government of Ethiopia. Status of an in country GRB unknown; no GRB for this species is known to exist outside Ethiopia, although training of Ethiopians in this area by AZA and other scientists has occurred as recently as 2014. See reports listed above for captive plan proposals.

Workshop Assessment of Ex Situ Roles and Activities:

The following direct and indirect conservation roles were identified at the ICAP workshop. Roles selected to pursue following benefit/feasibility/risk analysis are marked in green.

Direct Role(s)	Benefit	Feasibility	Risk	Notes
Insurance (GRB)	**LOW (w/out captive pop) MODERATE (w/captive)**	**LOW (w/out captive pop) MODERATE (w/captive)**	**HIGH - MODERATE**	Would require: - technical expertise, protocols, facilities, biosecurity, good record keeping, etc. - sustainable, secure banking - financial investment - access to wolves to develop techniques (can develop to some degree with other species) and collect samples; sampling of wild individuals holds risk.
Insurance (Living)	**HIGH**	**LOW**	**HIGH**	May be more difficult to breed/manage; limitations in applying husbandry expertise from other species. Would need to obtain founders, which may hold risks to the wild population. Best to occur in range country; holds socio/ political/ stability challenges. Would require skilled staff, facilities, funding, security. Cumulative risk is considerable.
Training (GRB)	**LOW**	**HIGH**	**LOW**	Benefit could become moderate if an *ex situ* population existed. Skilled people available.
Indirect Role(s)	**Benefit**	**Feasibility**	**Risk**	**Notes**
Research Vaccines	**Not rated**	**Not rated**	**Not rated**	If an *ex situ* population were established, conduct research regarding vaccines. Risky to do with new *ex situ* population during learning/ startup phase. Currently vaccines are being provided to domestic dogs and Ethiopian wolves in the wild.

Comments/Issues:

- Given the small, fragmented nature of this population, workshop participants believed an *ex situ* insurance population could have strong conservation benefits (mitigate against catastrophes in the wild etc.), should the correct circumstances present themselves.
- Look into PAAZA member in Ethiopia; could this facility play a role for education and funding?

Workshop Recommendations:

1. The global zoo community supports the continued recommendation for an *ex situ* insurance population (live individuals and/or GRB) in Ethiopia, should there be support for this among the species specific stakeholder group and should the right circumstances be present.
2. The global zoo community is available to help draft a plan for an insurance population (living individuals and/or GRB) that thoroughly analyses feasibility and develops risk mitigates strategies. It may be beneficial to have such a plan available in case the need arises quickly. Work together with Ethiopian Wolf Conservation Programme, IUCN SSC Canid Specialist Group and PAAZA (and if possible/suitable PAAZA member(s) in Ethiopia).
3. Work with Ethiopian Wolf Conservation Programme and the IUCN SSC Canid Specialist Group to identify other *in situ* needs (e.g. rabies vaccine testing) and funding and technical support.
4. Continue support, or increase as needed, for in country capacity building for GRB.

MANED WOLF
Chrysocyon brachyurus

THREATENED SPECIES
IUCN Red List: Near Threatened
Population trend: Unknown

Native to South America (Argentina, Bolivia, Brazil, Paraguay, Peru, Uruguay)

Threats: Habitat loss and alteration (to agriculture), human persecution due to livestock losses and cultural beliefs, increasing vehicular traffic (road kills), and pathogens contracted from domestic animals.

Potential Ex Situ Roles: **Direct Conservation: Conservation Education**, ***Ex situ* research and Training**. In case threats in the wild fail to be managed, then: **Insurance Population**, **Population restoration** and **Assisted colonization**.
Indirect Conservation: **Research** in reproduction and epidemiology; **Training** in field vet procedures, **Expertise:** testing new identification and monitoring tags, **Education/awareness** in zoos (e.g. Friends of the Maned Wolf campaign in SZB 2015); destruction of savannah; **Fundraising** for educational materials and to continue the Friends of the Maned Wolf Project (and expand globally).

Prior Ex Situ Recommendations: Continue collaborative international efforts to maintain an *ex situ* population sufficient to retain 90% GD for 100 years, developed within 1-5 years (1992 CAMP). As of 2004, captive research had been done on physiology, nutrition, disease, behavior and husbandry, with some research still ongoing. 2005 PHVA recommended *ex situ* population conservation roles that included research as a base to studies in the wild, accommodation of non-releasable confiscated animals, and possible genetic source for future reintroduction. Zoos can assist in preparing education material to be distributed in protected areas, tourism agencies, lodges and hotels, containing orientations about how to reduce possible ecotourism's negative impacts over maned wolf populations. The Maned Wolf Argentine Group held regional workshops that developed recommendations for conservation in the wild and management in captivity and efficient conservation education strategies.

Ex Situ Status:
Present in captivity in 3 regions in significant numbers, with small numbers held in Africa and Asia (global *ex situ* population = 371 animals). Successful breeding in captivity; stable population; International Studbook maintained by EAZA.

	AZA/North America	ALPZA/Latin & So America	EAZA / Europe	JAZA / Japan	ZAA / Australasia	Other (misc.)	Total Global *Ex Situ* Pop
Population size (M.F.U)	**88 (45.43)**	**106* (45.61)**	**136 (69.65.2)**	**5 (3.2)**	**21 (13.8)**	**15 (7.8)**	**371[1] (182.187.2)**
Living wild-born	0	51*	0	0	0	0	51[1]
Gene diversity	92.2%	96.4%	93.5%	69.3%	79.8%	n/a	96.5%[2]
# Founders	31	62	34	26	28	n/a	75[2]
# Potential fdrs	0	50	0	0	0	0	50[1]
% pedigree kn	100%	91%	100%	100%	100%	n/a	97%[2]
Pop trend	Stable/1.0	0.920	Declining	Declining	Stable	n/a	Stable[2]
# institutions	31	40	65	1	4	6	147[1]
Management	SSP managed	No formal program	EEP managed	No formal program	Monitored program	Not managed	International Studbook (ISB)
Data source	*2014 AZA B&T plan*	*2014 ISB*	*2014 ISB*	*2014 ISB*	*2014 ISB*	*2014 ISB*	*[1]Column sums; [2]2014 ISB*

M.F.U = # males.females.unknown sex

**2016 ALPZA survey indicates 20 (11.9) individuals in 6 institutions, with 14 institutions interested in holding species*

Workshop Assessment of Ex Situ Roles and Activities:

The following direct and indirect conservation roles were identified at the ICAP workshop. Roles selected to pursue following benefit/feasibility/risk analysis are marked in green.

Direct Role(s)	Benefit	Feasibility	Risk	Notes
Education In range: Agro-business; link between soy production and other industrial agriculture and loss of grassland/ savannah Wolf killing/poaching Car collision	**HIGH**	**HIGH**	**MODERATE**	By range state zoos; Agro-business: target local governments, producers/industries, as well as consumers Killing and road kill: target local population (already an education program in place in Brazil – bring people to the zoo so they can see the wolves)
Insurance	**MODERATE**	**HIGH**	**LOW**	Currently not yet of critical importance; however potentially local population declines and extinctions. Some taxonomic/genetic uncertainty.
Indirect Role(s)	**Benefit**	**Feasibility**	**Risk**	**Notes**
Education Outside range: Agro-business: link between soy production and loss of grassland/ savannah	**MODERATE**	**HIGH**	**LOW**	By non-range state zoos; target mainly importers and consumers
Research Epidemiology/sensitivity to pathogens/disease ecology Assisted reproductive technologies Genetic structure both *in situ* and *ex situ*	**HIGH**	**HIGH**	**MODERATE**	Disease risk from domestic dogs/animals. Disease/ vaccine research already happening in Brazil. AR techniques could help with intercontinental gene exchange. Bank genetic samples *ex situ.*

Comments/Issues:

- There is concern that the population in the wild is (at least locally) declining, with potential local extinctions.
- The *ex situ* population in Brazil is very aged. Despite the high number of wild origin individuals, breeding has been restricted because of space limitations. There also seems to be some loss of husbandry expertise.
- If the currently large, genetically diverse, global *ex situ* population is left to deteriorate, it would be much harder to rebuild later, should the situation *in situ* become/turn out to be more drastic.
- Conservation education is needed to educate the local governments, producers/companies, as well as consumers about the link between soy products and other industrial scale agriculture and loss of the savannah habitat needed for maned wolves. This message is being brought to the public by some zoos within the species range, even some without maned wolves, but it needs to expand. Perhaps ZAA could share some advice from their successful palm oil campaign regarding targeting large corporations?
- Some research efforts relating to disease epidemiology and assisted reproductive techniques are under way. Taxonomic issues related to possible sub-species have been raised, but not answered. Any significant genetic structure/subspecies taxonomy identified would have consequence for the *ex situ* program.

Workshop Recommendations:

1. While the insurance role is not yet critical, it is recommended to maintain the already large, genetically diverse, *ex situ* population, in case the fear for (at least regional) population decline and local extinctions is validated.
2. Organize discussion among all regional zoo associations holding this species to identify how best to cooperate to make the global *ex situ* population as efficient and connected to *in situ* efforts as possible.
3. Develop a more formal program within the Brazilian Zoo Association (SZB)/ALPZA. Brazil holds large numbers of wild origin individuals and, while space is restricted, it is important that these individuals can breed and pass on the "captured" genetic diversity to future generations before they are too old to do so. Descendants could be sent to other regional zoo associations to improve the (genetic) insurance value of the global population, thereby also reducing the total number of spaces needed worldwide. All of this would likely involve the appointment of a studbook keeper based in South America to better manage the population and provide a central point of communication with international partners.
4. All regions: carry out conservation education related to the effects of industrial agro-business on habitat loss for the species (target local governments, producers/industries, consumers as appropriate).
5. Brazil/ALPZA: carry out conservation education related to retaliatory wolf killing and road kill.
6. All regions: bank biosamples (for genetic/taxonomic research).
7. All regions: discuss possible collaborations to further the research on pathogen susceptibility, vaccines etc., as well as AR techniques development – involve veterinary advisors.

MEXICAN GRAY WOLF
Canis lupus baileyi


Photo: Arizona Game &

THREATENED SPECIES

IUCN Red List: Least Concern as a species; regionally threatened subspecies (Extinct in the Wild, except for two reintroduced populations)

Population trend: Increasing through 2014

Native to southwest US and Mexico. Functionally extinct in the wild in 1970s. Small reintroduced populations established in the US (1998) in Arizona and New Mexico, and in Mexico (2012), from SSP-managed captive-bred stock. Wild population 2015 estimate is 97 wolves.

Threats: Ongoing persecution and restricted available habitat for re-establishment of populations; potential inbreeding impacts especially in wild.

Potential Ex Situ Roles: **Direct Conservation: Ark, Rescue, Population Restoration, Insurance Population, Research, Education.** A few wild wolves were captured in Mexico 1977-1980 to establish a captive breeding program (ark). This captive population remains the sole source population for reintroduction efforts, and can provide genetic migration between reintroduced populations in the US and Mexico until they become naturally connected. A secure *ex situ* population allows a 'nonessential experimental' status for the wild population, which allows greater flexibility in managing this politically challenging species. Recovery in the wild is highly reliant on the continued success of this program. Captive breeding facilities conduct most of Mexican wolf education and awareness programs, reaching many millions of people annually.

Prior Ex Situ Recommendations: 1990 PHVA and 1992 CAMP outlined requirements for an *ex situ* program that would serve as a genetic reservoir and also source population for restoration.

Ex Situ Status: Present in captivity only in the US and Mexico (global *ex situ* population = 243 animals). Managed by the AZA SSP in collaboration with Mexico (binational program) and with USFWS (USA) and SEMARNAT (Mexico). Reproduction in captivity and source population for reintroduction and reinforcement to the wild. Challenges with low reproduction and demographic instability related to space issues. Gamete banking underway in US and Mexico (since 1991 for sperm and 2008 for oocytes). Research topics include infertility, taste aversion, and morphology (2014 Mexican Wolf Recovery Program Report).

	AZA/ALPZA/AZCARM/AMACZOOA	Total Global *Ex Situ* Pop
Population size (M.F.U)	**243 (112.121.10)**	**243 (112.121.10)**
Living wild-born founders	0	0
Gene diversity	83.3%	83.3%
# Founders	7	7
# Potential founders	0	0
% pedigree known	99.3%	99.3%
Population trend/ lambda	Stable	Stable
# institutions	54	54
Management	SSP managed	
Data source	*2015 AZA B&T report*	*2015 AZA B&T report*

M.F.U = # males.females.unknown sex

Workshop Assessment of Ex Situ Roles and Activities:

The following direct and indirect conservation roles were identified at the ICAP workshop. Roles selected to pursue following benefit/feasibility/risk analysis are marked in green.

Direct Role(s)	Benefit	Feasibility	Risk	Notes
Source	**HIGH**	**HIGH**	**MODERATE**	Needs for release can affect feasibility and risk
Insurance Living wolves & GRB	**HIGH**	**HIGH**	**LOW short-term** **MODERATE** to **HIGH** long-term	Low founder base limits this role in the long term
Research Genetic, taste aversion, assisted reproduction	**HIGH**	**HIGH**	**MODERATE**	Benefits are high especially for ART and GRB
Education At local level	**MODERATE**	**HIGH**	**LOW**	Target local people (especially children of ranchers) on how to live with wolves
Assisted Colonization	Not rated	Not rated	Not rated	Currently under discussion

Comments/Issues:

- North American program currently in 'population restoration' phase.
- If releases are reduced or stopped, the *ex situ* population is affected because of space constraints, the necessity to reduce reproduction, and potential resulting negative impacts on future reproductive success.

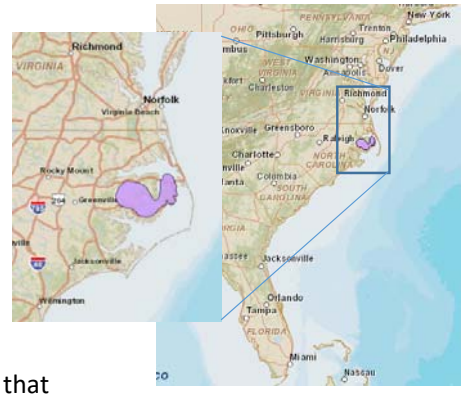
Workshop Recommendations:

1. Recommend to continue the high intensity program in the US and Mexico.
2. Maintain or expand the population, with a goal of 300 wolves.
3. Increase the number of institutions within this region.
4. Increase the number of breeders and effective population size (Ne).

RED WOLF
Canis rufus

THREATENED SPECIES
IUCN Red List: Critically Endangered
Population trend: Increasing

Native to southeastern US. Extinct in the wild by 1980, but was reintroduced in 1987 into a restricted area (peninsula) in eastern North Carolina from captive-bred stock.



Threats: Lack of available habitat for population expansion and hybridization with coyotes are primary threats. Human-induced mortality (road kills and hunting) can be significant.

Potential Ex Situ Roles: **Direct Conservation**
Genetic Reservoir, Source Population for Restoration

Prior Ex Situ Recommendations: Maintain *ex situ* population that retains 90% GD for 100 years (1992 CAMP). 1999 PHVA recognized the increasingly significant role of the *ex situ* population as the only repository of the original genetic composition of the species in the face of hybridization in the wild. Recommendations included increased breeding and population expansion, demographic and genetic considerations as a source population for release, and the development of a Genome Resource Bank (GRB) action plan. The 2004 CSG Action Plan reiterated the roles to safeguard the genetic integrity of the species and provide animals for reintroduction or reinforcement. Management strategies include gamete banking and cross-fostering of captive-born pups to wild females. A meta-population PVA (both *in situ* and *ex situ* populations) is underway as a collaborative effort between USFWS and the zoo community (SSP and population modelers).

Ex Situ Status:
Present in captivity only in the US (global *ex situ* population = 202 animals). Reproduction in captivity and source population for restoration to the wild.

	AZA/ North America	Total Global *Ex Situ* Pop
Population size (M.F.U)	**202 (91.111)**	**202 (91.111)**
Living wild-born animals	0	0
Gene diversity	89.1%	89.1%
# Founders	12	12
# Potential founders	0	0
% pedigree known	100%	100%
Population trend/lambda	Stable	Stable
# institutions	45	45
Management	SSP managed	SSP managed
Data source	*2015 AZA B&T report*	*2015 AZA B&T report*

M.F.U = # males.females.unknown sex

Workshop Assessment of Ex Situ Roles and Activities:

The following direct and indirect potential conservation roles were identified at the ICAP workshop. Roles selected to pursue following benefit/feasibility/risk analysis are marked in green.

Direct Role(s)	Benefit	Feasibility	Risk	Notes
Insurance	**HIGH**	**MODERATE**	**LOW**	PVA results suggest at least 330 individuals. Space limitations
Rescue In case loss of socio-political support to conserve taxon in the wild	**HIGH**	**MODERATE**	**MODERATE**	Creating emergency spaces is feasible. Risk to *ex situ*: coyote hybrids, overrepresented alleles, disease. Risk to *in situ*: loss of wild population and their "political space" in the landscape
Indirect Role(s)	**Benefit**	**Feasibility**	**Risk**	**Notes**
Research Assisted reproduction techniques, inflammatory bowel disease, taxonomy	**MODERATE**	**HIGH**	**LOW**	
Education Advocacy, raising profile/awareness	**HIGH** (especially local)	**HIGH**	**LOW**	

Comments/Issues:

- Fewer than 50 individuals left in the wild. Last reintroduction in North Carolina in summer 2015; currently no further releases planned.
- While taxonomy continues to be debated and researched, the IUCN SSC Canid Specialist Group and other experts currently still consider them a distinct species.
- PVA modeling suggests the *ex situ* insurance population should hold at least 330 wolves.
- Socio-political issues are raising doubts/discussion as to whether to continue conserving this taxon in the wild. Genetic drift may have resulted in different alleles being retained in the *in situ* population than the *ex situ* population. In the worst case scenario there may be a need to rescue a subset of the *in situ* individuals to conserve potentially rare genetics; it would also provide a demographic (reproductive) boost to the *ex situ* population.
- The majority of the remaining individuals of this species on Earth are living *ex situ* in one country and regional zoo association. The spread over different institutions mitigates stochastic demographic risks. However, finding and reliably keeping sufficient space in one region may be a challenge. Involving more than one region may benefit space capacity but brings increased logistical complexity of genetically managing a pack living species across regions/countries.

Workshop Recommendations:

1. Maintain the high intensity program in US for now while trying to expand the population within AZA. Consider/discuss the possibility of a population in other regional zoo association to assist with space and sustainability goals.
2. A written plan should be in place for a rescue scenario.
3. Maintain and/or increase research and educational efforts.

BLACK-BACKED JACKAL
Canis mesomelas

NON-THREATENED SPECIES
IUCN Red List: Least Concern
Population trend: Stable

Endemic to Africa in two separate subpopulations in East Africa and in southern Africa. Generally widespread and opportunistic.

Threats: No major threats. Persecuted for livestock depredation and as rabies vectors (very susceptible to rabies and may transmit it to livestock), but control efforts have little effect on population numbers.

Potential Ex Situ Roles: No responses for this species prior to the workshop.

Prior Ex Situ Recommendations: Black-backed Jackals have been maintained in captivity for species diversity in African plains exhibits and for testing rabies vaccine efficacy in the past (2004 CSG Action Plan).

Ex Situ Status:
Present in small numbers in captivity in 4 regions (estimated global *ex situ* population = 33 animals). Reproduction in captivity. Monitored species in EAZA.

	AZA / No America	EAZA / Europe	PAAZA / Africa	JAZA / Japan	SEAZA / SE Asia	Total Global *Ex Situ* Pop
Population size (M.F.U)	**5 (3.2)**	**13 (10.3)**	**5 (4.1)**	**3 (2.1)**	**7 (3.4)**	**33[1] (22.11)**
Living wild-born animals	?	?	?	?	?	5[2]
Gene diversity	?	?	?	?	?	?
# Founders	?	?	?	?	?	6[2]
# Potential founders	?	?	?	?	?	?
% pedigree known	?	?	?	?	?	15%[2]
Population trend/ lambda	?	Declining	?	?	?	Stable[2]
# institutions	2	8	2	2	3	17[1]
Management	Not managed	Monitored EAZA program	Not managed	No formal program	Not managed	
Data source	*2016 ZIMS*	*2015 EAZA report*	*2016 ZIMS*	*2016 JAZA report*	*2016 ZIMS*	*[1]column sums; [2]2016 ZIMS*

M.F.U = # males.females.unknown sex

Workshop Assessment of Ex Situ Roles and Activities:
No direct and or indirect conservation roles were identified at the ICAP workshop.

Comments/Issues:

- Monitored in EAZA, because of its role as an education species to highlight African habitat. AZA uses bat eared fox for this role.
- Enigmatic on display; yet interest by the public in jackals waxes and wanes so it is hard to keep them at a minimum level required for a sustainable population, especially if a region has multiple jackal species, e.g., EAZA.
- EAZA decided in their last regional collection plan (RCP) that they would phase this species out so the space could be utilized by golden jackals.
- There may be some benefit to hold a small global population, especially within the species' range countries, for educational messaging about canids and carnivores.

Workshop Recommendations:
No *ex situ* population or role identified at this time; should re-evaluate if status in the wild changes.

COYOTE
Canis latrans

NON-THREATENED SPECIES
IUCN Red List: Least Concern
Population trend: Increasing

Widespread distribution throughout North America, Mexico and into Central America. Abundant throughout its range and increasing in distribution as humans modify the landscape. Able to exploit human-modified environments.

Threats: No current threats throughout the range. Hybridization with dogs may be a threat near urban areas. May hybridize with gray wolves in the northeast US and with red wolves in the southeastern US.

Potential Ex Situ Roles: **Indirect Conservation: Education, Research**
Currently used beneficially in various education and research activities.

Prior Ex Situ Recommendations: Research into possible introgression with red wolf (2004 CSG Action Plan).

Ex Situ Status:
Present in captivity in 2 regions (global *ex situ* population = 127 animals). Not managed. Good reproduction and survival in captivity. IUCN Red List states >2,000 in zoos, wildlife centers and other *ex situ* facilities throughout their range.

	AZA / North America	ALPZA / AMACZOO Latin & South America	Total Global *Ex Situ* Pop
Population size (M.F.U)	**107 (59.46.2)**	**17(+3) (12.8)**	**127[1] (71.54.2)**
Living wild-born animals	?	?	76[2]
Gene diversity	?	?	?
# Founders	?	?	4[2]
# Potential founders	?	?	72?[2]
% pedigree known	?	?	63%[2]
Population trend/ lambda	?	?	Declining[2]
# institutions	34	8	42[1]
Management	Not managed	Not managed	
Data source	*2016 ZIMS*	*2016 ALPZA report & 2016 ZIMS*	*[1]column sums; [2]2016 ZIMS*

*M.F.U = # males.females.unknown sex. *additional contracepted individuals indicated in ()*

Workshop Assessment of Ex Situ Roles and Activities:
No direct and or indirect conservation roles were identified at the ICAP workshop.

Comments/Issues:

- IUCN Red List states >2000 in zoos, wildlife centers, and other *ex situ* facilities throughout their range – this is clearly an educated guess as most of these facilities do not participate in ZIMS or other census type databases. It is unlikely there will ever be a method to obtain an accurate *ex situ* number outside of ZIMS and/or zoo associations.
  - An additional challenge is that many of the coyotes held in non-zoos (or unaccredited zoos) are non-permanent, e.g. rescue and release.
  - Best way to proceed is to make certain that what is under our control is accurately accounted for.
    - ALPZA survey is current as of 2016; AZA census will be updated as part of the AZA-wide survey for canid and hyaenids scheduled in 2017.
- AZA has not recommended a coyote population for over a decade, no AZA institution is breeding coyotes, but active phase out and replacement with a threatened canid species has not been a past focus.
  - AZA needs to investigate if coyote spaces are suitable for canids in managed programs, and how many of these are confiscated/rescued and are legally required to be held at that institution.
- Most, if not all, of the research questions for coyote are being handled at Utah State (Dr. Eric Gese), so this is not a primary role needed for zoo populations, although the zoo population can be used for genetic research (previous research has been done).
- Coyote are very appealing to the public and thus are used to discuss our connection with nature. Also they can be utilized to discuss educational messaging about human-adapted species (in contrast to threatened species that decline in human dominated landscapes).

Workshop Recommendations:

1. No *ex situ* population or role identified at this time; should re-evaluate if status in the wild changes.
2. AZA should investigate space and current role of coyotes in AZA institutions and actively work to reduce coyote numbers such that more spaces are available to managed species.
3. Institutions with this species should be encouraged to focus on conservation messaging.

GOLDEN JACKAL
Canis aureus

NON-THREATENED SPECIES
IUCN Red List: Least Concern
Population trend: Increasing

Native to North and East Africa; Middle East; and Central, South and Southeast Asia.

Threats: Wide ranging and opportunistic. However, steady decline in all non-protected areas due primarily to change in land use (industrialization, intensive agriculture and urbanization).

Potential Ex Situ Roles: No responses for this species prior to the workshop

Prior Ex Situ Recommendations: Recommended for use in education and awareness to emphasize differences with wolves and to raise awareness of the jackal in the Arabian peninsula (2000 Arabian Carnivore CAMP). Low priority for *ex situ* breeding.

Ex Situ Status:
Present in captivity in 4 regions (estimated global *ex situ* population = 200 animals). Reproduction in captivity. Common in Indian zoos.

	EAZA / Europe (incl. AZAA)	PAAZA / Africa	CZA / India	ZPO / Thailand	SEAZA (other than ZPO)	Total Global *Ex Situ* Pop
Population size (M.F.U)	**45 (16.19.10)**	**13 (5.4.4)**	**93 (25.27.41)**	**31 (13.13.5)**	**18 (3.4.11)**	**200[1] (62.67.71)**
Living wild-born animals	?	?	?	?	?	44[2]
Gene diversity	?	?	?	?	?	?
# Founders	?	?	?	?	?	23[2]
# Potential fdrs	?	?	?	?	?	>30?[2]
% pedigree known	?	?	?	?	?	41%[2]
Population trend/ lambda	Declining	?	?	?	?	Stable[2]
# institutions	16	2	16	4	6	47[2]
Management	Monitored EAZA program	Not managed	No formal program	No formal program	Not managed	
Data source	*2015 EAZA report*	*2016 ZIMS*	*2016 ZIMS*	*2016 ZIMS*	*2016 ZIMS*	*[1]column sums; [2]2016 ZIMS*

M.F.U = # males.females.unknown sex

Workshop Assessment of Ex Situ Roles and Activities:
No direct and or indirect conservation roles were identified at the ICAP workshop.

Comments/Issues:

- There have been suggestions that there may be 2-3 subspecies (African vs. South Asia) or (African vs. South Asia vs. SE Asia).
  - The CZA animals are of Asian origin and PAAZA animals are of African origin. However, not all EAZA animals are of known origin. This could have implications, if there is ever a need to manage by subspecies, e.g., due to local extinctions, and therefore if EAZA is to focus on this species (in lieu of black-backed jackals), this should be examined.
- Institutions with this species should be encouraged to focus on raising awareness of jackals, their role in the ecosystem, and their similarities/differences from other canids.

Workshop Recommendations:

1. Investigate the origin of animals in the EAZA population via records or molecular work.
2. CZA and EAZA should consider if a reduction in numbers of golden jackals would benefit the *ex situ* dhole population during regional planning.

GRAY WOLF
Canis lupus

NON-THREATENED SPECIES
IUCN Red List: Least Concern
Population trend: Stable

Native to North America, Europe and Asia. Originally the world's most widely distributed mammal, but is now extinct in much of Western Europe and the US (loss of about one third of historic range). Regionally threatened or extirpated.

Threats: Deliberate persecution and poisoning due to depredation on livestock along with habitat loss and fragmentation.

Potential Ex Situ Roles: **Conservation education** relating to public attitudes towards wolves and their persecution. **Fund raising** for *in situ* conservation research.

Ex Situ Status:
Present in captivity in all regions (estimated global *ex situ* population = 1172 animals) for all subspecies except for *C.l. baileyi* (Mexican) and *C.l. signatus* (Iberian). Good reproduction in captivity. Historically increasingly globally but recent stabilization/slight decline.

	AZA / North America	ALPZA / Latin & So. America	EAZA / Europe	AZAA / UAE	CZA / India	SEAZA / SE Asia	JAZA / Japan	KAZA / South Korea	Total Global *Ex Situ* Pop
Population size (M.F.U)	**155 (80.74.1)**	**23(+2) (13.12)**	**807 (432.347.28)**	**54 (21.33)**	**47 (23.24)**	**9 (6.3)**	**59 (29.30)**	**16 (5.11)**	**1172[1] (609.534.29)**
Living wild-born animals	?	?	?	?	?	?	?	?	~50?[2]
Gene diversity	?	?	?	?	?	?	?	?	?
# Founders	?	?	?	?	?	?	?	?	>100[2]
# Potential founders	?	?	?	?	?	?	?	?	?
% pedigree known	?	?	?	?	?	?	?	?	<12%[2]
Population trend/lambda	?	?	?	?	?	?	?	?	Stable/ decline[2]
# institutions	46	7	155	4	12	4	12	1	241[1]
Management	Not managed	Not managed	Not managed	Not managed	Not managed	Not managed	Not managed	Not managed	
Data source	*2016 ZIMS*	*2016 ALPZA rpt*	*2016 ZIMS*	*2016 ZIMS*	*2016 ZIMS*	*2016 ZIMS*	*2016 JAZA rpt*	*2016 ZIMS*	*[1]column sums [2]2016 ZIMS*

M.F.U = # males.females.unknown sex

**additional contracepted individuals indicated in ()*

Workshop Assessment of Ex Situ Roles and Activities:
The following direct and indirect conservation roles were identified at the ICAP workshop. Roles selected to pursue following benefit/feasibility/risk analysis are marked in green.

Direct Role(s)	Benefit	Feasibility	Risk	Notes
Education In range	**MODERATE?**	**HIGH**	**HIGH**	Conservation education to change public attitude, reduce persecution, and promote recovery
Indirect Role(s)	**Benefit**	**Feasibility**	**Risk**	**Notes**
Education Outside range	**MODERATE?**	**HIGH**	**HIGH**	Conservation education to change public attitude toward wolves

Comments/Issues:

- Largest *ex situ* global population of all canid species.
- Not all gray wolf 'space' can be utilized for other wolf taxa due to governmental restrictions, program requirements and standards (e.g., requirements for potential release candidates for Mexican wolves, red wolves).
- As a Least Concern species it is not a conservation priority except for certain regional/subspecies populations, such as Iberian and Mexican wolves.
- Some gray wolf space should be made available to other species in need; this needs active investigation.

Workshop Recommendations:

1. Genetic analysis is needed for the EAZA population. Phase out generic wolves and focus on specific subspecies (e.g., Iberian, Scandinavian).
2. Zoo regions are recommended to focus their efforts on regional wolf subspecies or species over generic gray wolves.
3. Regions should evaluate the consequences and benefits of their current investment in gray wolves and compare the conservation benefits of focusing these resources on different species.
4. There is no recommendation to eliminate the *ex situ* gray wolf population completely, but the generic population should be reduced and better managed taxonomically and genetically, especially where it takes resources from other, more conservation needy taxa.

IBERIAN WOLF
Canis lupus signatus

NON-THREATENED SPECIES
IUCN Red List: Least Concern as a species; regionally threatened subspecies
Population trend: Uncertain

Subspecies of gray wolf that inhabits the forest and plains of the Iberian Peninsula (northern Portugal and northwestern Spain).

Threats: Illegal hunting and persecution

Potential Ex Situ Roles: An insurance population for potential reintroductions from zoos and breeding centers. Research to improve husbandry techniques and management of the subspecies, which will aid potential reintroductions. Regional education programs to highlight threats to this regional subspecies.

Ex Situ Status:
Present in captivity only in Europe (global *ex situ* population = 50 animals). Managed by the EAZA EEP. Reproduction in captivity, with strong historical growth but recent decline (aging population). Additional rescued animals held in ex situ facilities in Portugal.

	EAZA / Europe	Total Global *Ex Situ* Pop
Population size (M.F.U)	**50 (31.17.2)**	**50[1] (31.17.2)**
Living wild-born founders	1?	1?[2]
Gene diversity	?	?
# Founders	13	13[2]
# Potential founders	?	?
% pedigree known	22%?	22%?[2]
Population trend/ lambda	Declining	Declining[2]
# institutions	13	13[1]
Management	EEP managed program	
Data source	*2015 EAZA report & 2016 ZIMS*	*[1]2015 EAZA report; [2]2016 ZIMS*

M.F.U = # males.females.unknown sex

Workshop Assessment of Ex Situ Roles and Activities:

The following direct and indirect conservation roles were identified at the ICAP workshop. Roles selected to pursue following benefit/feasibility/risk analysis are marked in green.

Direct Role(s)	Benefit	Feasibility	Risk	Notes
Insurance	**HIGH**	**HIGH**	**LOW**	Held in regional, in-country zoos and rescue centers
Research Husbandry	**HIGH**	**HIGH**	**LOW**	Research to improve *ex situ* husbandry and management
Education In range	**HIGH**	**HIGH**	**LOW**	Awareness of a regionally distinct wolf subspecies

Comments/Issues:

- Aggression in *ex situ* population needs to be addressed.
- Additional rescued wolves are held in non-EAZA *ex situ* facilities; there is collaboration but currently no exchange of animals between these facilities and EAZA.
- Regional countries/range states to manage this subspecies.

Workshop Recommendations:

1. Regional countries should continue to manage an *ex situ* population for this subspecies at a regional level.
2. Collaboration between zoos and rescue centers is recommended to maintain an insurance population.
3. Research is recommended to improve husbandry practices and reduce aggression issues.

SIDE-STRIPED JACKAL
Canis adustus

NON-THREATENED SPECIES
IUCN Red List: Least Concern
Population trend: Stable

Native to Sub-Saharan Africa, from West Africa to southern Africa.

Threats: High reproductive rate and dietary flexibility allow this species to adapt and recover from population crashes. Its only vulnerability would be cases of extreme habitat modification or intense disease epidemic.

Potential Ex Situ Roles: No responses for this species prior to the workshop.

Prior Ex Situ Recommendations: Captive specimens of this species were used for testing rabies vaccine efficacy in the past. Less is known about this species compared to the other two jackal species, but a study in Zimbabwe investigated their role in rabies transmission (2004 CSG Action Plan).

Ex Situ Status:
Only 1 living specimen (captive-born female) in captivity in South Africa (PAAZA). Past holdings and breeding in US (1960s) and South Africa (1990s, 2008).

Workshop Assessment of Ex Situ Roles and Activities:
No potential *ex situ* conservation roles were identified at the ICAP workshop.

Comments/Issues:
Due to the lack of specimens in captivity and the relatively stable and widely distributed wild population, there is no direct conservation value of developing an *ex situ* program for this species. *Ex situ* resources can be better used if invested in other species.

Workshop Recommendations:
Not recommended for *ex situ* management unless status in the wild changes (declines).

SINGING DOG
Canis lupus hallstromi

NON-THREATENED SPECIES
IUCN Red List: Not assessed
Population trend: Unknown

Native to New Guinea, with likely only a small number left in the wild. Controversial taxonomy; hybridizes with domestic dogs. Serve as companion animals.

Threats: Hybridization, unknown status in the wild.

Potential Ex Situ Roles: No responses for this species prior to the workshop

Prior Ex Situ Recommendations: Ongoing captive studies on hybridization (2004 CSG Action Plan).

Ex Situ Status:
Present in captivity in 2 regions (global *ex situ* population = 37 animals).
None held in native Australia.

	AZA / North America	EAZA / Europe	Total Global *Ex Situ* Pop
Population size (M.F.U)	**32 (19.13)**	**5 (2.3)**	**37 (21.16)**
Living wild-born animals	0	0	0
Gene diversity	?	?	?
# Founders	?	?	?
# Potential founders	0	0	0
% pedigree known	0%	0%	0%
Population trend/ lambda	Aging pop	Aging pop	Aging pop
# institutions	14	3	17
Management	Not managed	Not managed	
Data source	*2016 ZIMS*	*2016 ZIMS*	*2016 ZIMS*

M.F.U = # males.females.unknown sex

Workshop Assessment of Ex Situ Roles and Activities:
No direct and or indirect conservation roles were identified at the ICAP workshop.

Comments/Issues:

- Not assessed on IUCN Red List due to controversial taxonomy; currently considered a subspecies of grey wolf.
- Aging *ex situ* population due to lack of breeding recommendations in AZA zoos. Species has not been recommended in last two AZA Regional Collection Plans due to IUCN Red Listing, plus there has been no request for an *ex situ* population from the IUCN SSC Canid Specialist Group.
- Companion Animal Society in America readily breeds this species. There is some question if the 32 singing dogs in North America are in AZA zoos or in Companion Animal Society in America facilities. This will be determined during the AZA-wide survey for canid and hyaenids scheduled in 2017.
- For Australian-themed exhibits, singing dog are interchangeable with dingos, and this species is of less conservation concern than pure lineage dingos.

Workshop Recommendations:

1. No *ex situ* population or role identified at this time; should re-evaluate if status in the wild changes, but any *ex situ* work should be focused in ZAA.
2. If a canid is needed for Australian-themed conservation messaging, then the priority should be on pure lineage dingos.

Global Integrated Collection Assessment and Planning Workshop for Canids and Hyenids

Omaha, NE, USA
19 – 20 March 2016

Final Report

SECTION 5

Taxon Sheets: Small Canids

25 Taxa Assessed

For the purposes of this ICAP workshop, we have included the Red List category of Near Threatened (NT) under "Threatened" taxa along with Vulnerable (VU), Endangered (EN), Critically Endangered (CR), and Extinct in the Wild (EW). Using this categorization:

Five of the 25 small canid taxa are listed as Threatened on the IUCN Red List. Of these:
- One taxon is held in significant numbers and in multiple regions (with at least one region actively managing the taxa), and has an international studbook.
- Two taxa are held in captivity in low numbers and only in their native range.
- Two taxa are not currently held in captivity.

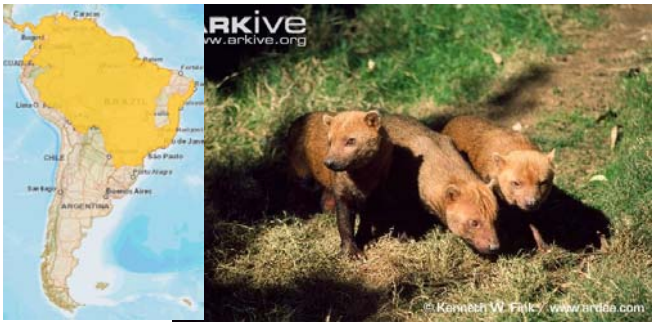
For the purposes of this ICAP workshop, we have included the Red List category of Near Threatened (NT) under "Threatened" taxa.

Of the 20 non-threatened taxa, five are held in captivity in significant numbers, four in modest numbers, eight in low numbers, and three are not currently present in captivity.

The table below lists the estimated global *ex situ* population size for each small canid taxon. Taxon sheets are presented in alphabetical order, first for Threatened taxa and then for non-threatened taxa. These sheets summarize *in situ* status and threats, *ex situ* demographic and genetic status, prior *ex situ* conservation recommendations, and ICAP assessment of potential *ex situ* roles, benefit, risks, feasibility, and recommendations.

	Current *Ex Situ* Population Size			
Status	**Large pop (>100)**	**Small pop (40-100)**	**Very small pop (<40)**	**Not in captivity**
Threatened	Bush dog (163)		Island fox (5) Sechura fox (13)	Darwin's fox Short-eared dog
Non-threatened	Arctic fox (155) Bat-eared fox (169) Fennec fox (362) Raccoon dog (300) Red fox (435)	Corsac fox (65) Grey fox (48) Sand fox (49) Swift fox (65)	Bengal fox (7) Blanford's fox (28) Cape fox (6) Chilla (4) Crab-eating fox (20) Culpeo fox (22) Kit fox (15) Pampas fox (3)	Hoary fox Pale fox Tibetan fox

BUSH DOG
Speothos venaticus



THREATENED SPECIES
IUCN Red List: Near Threatened
Population trend: Declining

Native to northern and central South America into Panama. Widespread but rare. Almost qualifies as Vulnerable.

Threats: Serious perceived threats include: 1) human encroachment and habitat conversion; 2) decline in prey due to illegal poaching and predation by domestic dogs; and 3) increased risk of lethal disease contracted from domestic dogs. Disease can have serous impacts due to its group living social system.

Potential Ex Situ Roles:

Direct Conservation: Insurance Population, Research, Conservation Education. *Ex situ* program in professional zoos. Assurance against disease risk to the wild population. Captive studies help understand species like bush dogs that are difficult to observe in the wild. Valuable in raising public awareness in this seldom seen species within its range and potentially reduce disease threats from domestic dogs. Potentially in future: **Population restoration; Assisted colonization**.

Indirect Conservation: Conservation Education, Research, Fundraising. Valuable in raising public awareness in this unique, little known and seldom seen, species inside and outside of its range and its conservation threats. Research in reproduction and epidemiology. Fund raising for education materials and for existing and additional local projects, including through the IUCN SSC Canid Specialist Group (CSG) project's page and also the IUCN Amazonian Canid Working Group.

Prior Ex Situ Recommendations: Recommended for Nucleus I population (50-100 animals with GD ≥98%, requiring periodic immigrants from wild) as part of species meta-population (1992 CAMP). Brazilian National Action Plan (in prep.) calls for *ex situ* conservation program to be developed by subcommittee.

Ex Situ Status:
Present in captivity in 4 regions (global *ex situ* population = 200 animals). Successful breeding in captivity; growing population; cooperative management regionally and inter-regionally; International Studbook maintained by EAZA.

	AZA / North America	ALPZA / Latin & South America	EAZA / Europe	JAZA / Japan	Total Global *Ex Situ* Pop
Population size (M.F.U)	**21 (15.6)**	**36 (20.13.3)**	**115 (58.52.5)**	**28 (15.13)**	**200 (108.84.8)**
Living wild-born	?	5 (5.0)	?	0	5+
Gene diversity	74.0%	81.2%	79.1%	76.1%	87.6%
# Founders	8	1	11	10	15
# Potential fdrs	0	3	0	0	3
% pedigree kn	100%	97%	100%	100%	100%
Population trend	0.981	0.982	1.01	0.983	1.021
# institutions	8	10	26	6	50
Management	SSP managed program	No formal program	EEP managed program	JAZA managed program	
Data source	*2015 ISB*	*2015 ISB*	*2015 ISB*	*2015 ISB*	*2015 ISB*

*M.F.U = # males.females.unknown sex; *additional contracepted individuals indicated in ()*

Workshop Assessment of Ex Situ Roles and Activities:

The following direct and indirect conservation roles were identified at the ICAP workshop. Roles selected to pursue following benefit/feasibility/risk analysis are marked in green.

Direct Role(s)	Benefit	Feasibility	Risk	Notes
Insurance	**HIGH**	**LOW-MODERATE**	**MODERATE**	*Ex situ* population is small/ declining in some regions. Few founders now and few coming in. Challenges in husbandry and husbandry skills transfer. But important role in light of current conditions.
Source	**HIGH**	**LOW**	**MODERATE**	Ideally from *ex situ* population in range countries, but this is not feasible until this is more robust.
Research Transfer of and susceptibility to domestic dog diseases; genetic structure/ taxonomy	**HIGH**	**LOW-MODERATE**	**MODERATE**	Provide samples, expertise, resources, veterinary/ research network.
Education In range: make people aware of the consequences of human actions on bush dogs and their habitat	**HIGH**	**MODERATE**	**LOW**	Messaging: risks from domestic dogs, hunting of bush dog prey for human consumption, industrial agribusiness, etc.
Indirect Role(s)	**Benefit**	**Feasibility**	**Risk**	**Notes**
Research General biology, life history, demographics	Not rated	Not rated	Not rated	Also assist with developing methods to be used *in situ* (e.g., for tracking)
Education Outside range: consumer awareness of the impact of sugar cane and soy extraction on habitat	Not rated	Not rated	Not rated	Target mainly importers and consumers.

Comments/Issues:

- Despite increasing field studies (employing camera traps, scat detection dogs, etc.) still relatively little is known about the precise status (e.g. census numbers, population sizes and trends) and biology of this species in the wild. This can be partly explained by their highly nomadic nature.
- Bush dogs appear to be highly susceptible to a number of domestic dog diseases:
  - In Brazil, researchers have been following populations for 10-15 years, and from time to time all individuals seem to disappear. They found high infection rates with, and mortality from, sarcoptic mange in areas where bush dogs have close contact with domestic dogs. It is suspected that sometimes the population is not able to recover.
  - A few years ago there was an outbreak of leishmaniasis that killed a large part (and most of the founders) of the Brazilian *ex situ* population.
  - Research is needed to address the disease transfer problems from domestic dogs, including mange, throughout the range, not just in Brazil.

- At least in Brazil (outside the Amazon), there appear to be areas of suitable habitat for the bush dog if the population could be increased/restored. Camera trap studies suggest that the distribution in the Amazon is less patchy (fewer "empty" areas), but there is no clear information on population trends there.
- Considering the declining population trend overall, the relative scarcity of information from the wild, and their apparent susceptibility to domestic dog diseases, an *ex situ* insurance population is seen to be a high priority for this species. However, the global *ex situ* population needs to be strengthened for it to fulfil that role. The current population is too small, with too few founders and faces challenges such as social group management (pair formation, cooperative rearing, etc.) and short reproductive life span.
- There are indications that subpopulations in the wild may have genetic particularities that need to be investigated. Zoos could assist with providing molecular tools and research support to address this question. Results could be of consequence to the *ex situ* population and its proposed role as insurance or source.

Workshop Recommendations:

1. All regional zoo associations: hold discussions to determine how to build a global meta-population that is robust enough to function as an insurance and source. This includes somewhat increasing the size of regional populations (apart from EAZA) and strengthening *ex situ* efforts within the range countries (Brazil/ALPZA). These are the regions that would receive any new founders and that would be best placed to function as source populations. Other regional zoo associations should assist with this goal in any way possible (skills, technology and information transfer, etc.).
2. All regions: investigate ways to contribute to research into disease issues, genetic structure/taxonomy and general life history (demographic parameters). Work together where possible.
3. Increase and focus educational messaging (domestic dog disease transmission, industrial agriculture, hunting prey species, etc.).

DARWIN'S FOX
Pseudalopex fulvipes

THREATENED SPECIES
IUCN Red List: Critically Endangered
Population trend: Declining

Endemic to Chile (Los Lagos), South America. Disjunct distribution with two populations: an island population in Chiloé National Park (90% of population) and in coastal mountains of Nahuelbuta National Park on the mainland.

Threats: Island population is relatively safe inside the park; foxes in surrounding areas are vulnerable to logging, fragmentation and poaching. The small mainland population is vulnerable to the presence of domestic dogs in the park as potential disease vectors or direct attack. Total population size (both populations) is fewer than 250 mature individuals.

Potential Ex Situ Roles:
Direct Conservation: Population Restoration, Insurance Population, Research, Training
An *ex situ* program based in Chile, either in a specific *ex situ* facility or in in-country professionally managed zoo(s) – would be most desirable, because it would target the specific public that may advocate the mitigation of the major threats to the conservation of this fox. Some roles could be played by zoos outside of Chile, where fundraising could be more profitable (e.g., US).
Indirect Conservation: Education. There is a need for awareness of this species. Conservation education and fundraising initiatives could be implemented by the zoo community.

Prior Ex Situ Recommendations:
Recommended for Nucleus I population (50-100 animals with GD ≥98%, requiring periodic immigrants from wild) as part of species meta-population (1992 CAMP). The 2004 CSG Action Plan recommends captive breeding as a component of the urgent conservation action needed for this species. Genetic work needed to assess potential interbreeding with other mainland fox species and to investigate past bottlenecks to inform future management.

Ex Situ Status:
Not represented in captivity in ZIMS database or surveyed regional zoo associations. Only one record of a captive specimen in ZIMS (male, in 1973 in the US). Temuco Zoo held a male and a female until their release in October 2000 in Chiloé. Currently (as of 2016), the only known captive Darwin's Foxes are kept by Fundación Fauna Andina near Villarrica, Chile. These animals have been rescued from dog attacks and illegal ownership. Fortunately, in this facility successful reproduction has been achieved in two consecutive years.

Workshop Assessment of Ex Situ Roles and Activities:

The following direct and indirect conservation roles were identified at the ICAP workshop. Roles selected to pursue following benefit/feasibility/risk analysis are marked in green.

Direct Role(s)	Benefit	Feasibility	Risk	Notes
Prepare to be ready for Insurance if needed Not recommended currently but be prepared if need arises	**HIGH (of the insurance)**	**LOW – MODERATE (of the insurance)**	**MODERATE – HIGH (of the insurance)**	Focus in range country. Currently none in zoos and only a few elsewhere *ex situ*. Some experience with rescued individuals and good experience with other fox species. PVA could help determine feasibility of starting new population without harming *in situ* population. Risks could be reduced with a good plan. Would take considerable resources.
Prepare to be ready for Rescue if needed Currently only individuals rescued for individual welfare reasons (e.g. injured in dog attacks or illegally owned)	**HIGH (to be prepared)**	**MODERATE (to be prepared)**	**LOW (to be prepared)**	Such individuals and the husbandry experience gathered with them, have the potential to form the nucleus of a rescue population for conservation. Monitor the wild population and *ex situ* specialists to develop a plan and "trigger criteria" to "switch on" the conservation rescue role when needed.
Education In range: Target audience to help mitigate threats (domestic dogs, poaching, killing by landowners/farmers, habitat destruction)	**HIGH**	**HIGH**	**LOW**	Do not need live Darwin foxes for this; can be done without foxes or by using other species. There is already a National Day of Darwin Foxes that is celebrated by local zoos (without having foxes).
Training Sampling wild foxes, learn husbandry skills with sporadic rescue individuals or other fox species	**HIGH**	**MODERATE**	**MODERATE - HIGH**	Need expertise from captive community; socio-political issues involved with removing Darwin's foxes from wild and brings risk to wild population. Can use other species as model.

Comments/Issues:

- There was a reassessment meeting held in Chile in Oct 2015. Camera traps identified individuals in new locations between northern and southern distribution. This information was shared with IUCN, and post-ICAP workshop this species was reclassified as Endangered on the IUCN Red List. However, given this is a small fragmented population, caution is merited.
- In the wild domestic dogs come into contact with, and hunt foxes (injuries and disease risks). Local governments are vaccinating domestic dogs, but private people owning dogs are not always open to this.
- Some hybridization with Chilean foxes is assumed.
- Chile is working on Action Plan for this species.
- Genetic research is needed to determine if island and mainland populations are different subspecies; this would be of consequence for any insurance/rescue plans in future.

Workshop Recommendations:

1. *In situ* support and any *ex situ* efforts should be focused within Chile.
2. No managed *ex situ* population is recommended at this moment, but preparations should be in place to react quickly if needed. The *in situ* population should be monitored and *ex situ* specialists in collaboration with ALPZA are recommended to draft a plan and a set of "trigger criteria", so that if implementation of a rescue population (or insurance population) is needed quickly, the plan details needed actions. The international zoo community can help with advice, technical expertise, planning expertise, population modelling financial support, etc.
3. Continue and expand educational initiatives in range country/local zoos targeted towards threat mitigation.
4. Both range and non-range zoos are recommended to support training activities and support *in situ* research and monitoring.

ISLAND FOX
Urocyon littoralis (clementae)

THREATENED SPECIES
IUCN Red List: Near Threatened
Population trend: Increasing

Restricted to six of the California Channel Islands off the coast of southern California, US. Four sub-species suffered catastrophic declines in the mid- 1990s, but all have since recovered due to captive breeding and reintroduction, relocation of golden eagles, and vaccination against canine diseases.

Threats: Restricted range and low genetic variability leave these small populations vulnerable to new diseases from the main-land and other stochastic processes. Considered a 'conservation reliant' species, requiring careful monitoring and rapid management interventions to persist.

Potential Ex Situ Roles: No responses for this species prior to the workshop

Prior Ex Situ Recommendations: San Nicholas, San Miguel and San Clemente ssp. recommended for Nucleus I population (50-100 animals with GD ≥98%, requiring periodic immigrants from wild) (1992 CAMP). *Ex situ* breeding on the Channel Islands began in 1999 on San Miguel, and then on Santa Rosa (2000), Santa Catalina (2001), and Santa Cruz (2002), with assistance from AZA zoos. Reintroductions occurred from 2001-2008 and were very successful in combination with concurrent efforts to reduce threats due to predation and disease. Foxes reached pre-decline levels on San Miguel and Santa Cruz 12 years after declines brought them perilously close to extinction. The *ex situ* population also served as a research population for reproductive, genetic and disease research (2004 CSG Action Plan).

Ex Situ Status:
Present in captivity only in the US (global *ex situ* population = 5 animals), San Clemente Island subspecies. Research on captive populations led to important understanding of unique reproductive biology of the species. Captive stock of several subspecies (Santa Cruz, Santa Rosa, San Miguel) were returned to the wild.

	AZA /North America	Total Global *Ex Situ* Pop
Population size (M.F.U)	**5 (3.2)**	**5 (3.2)**
Living wild-born animals	3	3
Gene diversity	?	?
# Founders	?	?
# Potential founders	?	?
% pedigree known	?	?
Population trend/ lambda	Declining	Declining
# institutions	4	4
Management	??	??
Data source	*2016 ZIMS*	*2016 ZIMS*

M.F.U = # males.females.unknown sex

Workshop Assessment of Ex Situ Roles and Activities:
The following direct and indirect conservation roles were identified at the ICAP workshop. Roles selected to pursue following benefit/feasibility/risk analysis are marked in green.

Direct Role(s)	Benefit	Feasibility	Risk	Notes
Education	**HIGH**	**HIGH - w/ foxes** **LOW - w/out foxes**	**LOW**	Having foxes in AZA zoos is not required for the educational messaging, but it would make this easier and studies show it makes the message more effective.
***In situ* support** Technical expertise, community rescue preparedness, monitoring, etc.	**HIGH**	**HIGH**	**LOW**	Few staff members on the island. Lots of help from Santa Barbara Zoo already. Risk for zoos to put efforts elsewhere as status of the species improves (species perceived to no longer need (much) help.

Comments/Issues:

- All *ex situ* breeding was on the islands prior to the down listing; AZA facilities were key to the captive breeding efforts by providing expertise as well as funding as needed. Current California law prohibits an *ex situ* breeding population on the mainland of the US (as species is listed as Endangered in CA).
- AZA facilities still help with trapping and with projects on islands.
- Three populations were delisted and one down-listed, but this means that the USFWS funding and support may decrease/end, which would then be needed from elsewhere. These island populations will likely remain vulnerable. Each island is managed by different entities (sometimes even more than one for each island).
- Animals that are non-releasable do come into zoos, but in low numbers. There is currently an SSP for this species, but with the restrictions from the state of CA, this may not continue. Regardless, AZA should have a written plan in place if the need arises again to provide expertise or space for island foxes.
- Existing extensive educational efforts by AZA zoos are important to the conservation of this species.

Workshop Recommendations:

1. Education efforts are more powerful by having an island fox for the public to see, but the low numbers in AZA are not sustainable so educational messaging should not rely on the species in mainland zoos. Gray fox may be a good alternative educational surrogate.
2. Educational messaging has and continues to be vital to the conservation of this species. Efforts should be focused within CA, but can include other states.
3. Maintain support for funding, technical expertise and in-kind support (veterinary, surveys, etc.).
4. AZA should have a written plan in place if the need again arises to provide expertise or space for island foxes.

SECHURA FOX
Pseudalopex sechurae

THREATENED SPECIES
IUCN Red List: Near Threatened
Population trend: Unknown

Native to the coastal zones of Northwestern Peru and Southwestern Ecuador (South America).

Threats: Primary threats in Peru are the illegal market for pups, amulets and handicrafts made from body parts and persecution due to perceived predation on domestic fowl, goats and guinea pigs and stored goods. In Ecuador the primary threat is habitat loss and degradation due to agriculture and urbanization.

Potential Ex Situ Roles: No responses for this species prior to the workshop.

Prior Ex Situ Recommendations: Recommended for Nucleus I population (50-100 animals with GD ≥98%, requiring periodic immigrants from wild) as part of meta-population (1992 CAMP). Taxonomy being researched at the University of Lima (2004 CSG Action Plan).

Ex Situ Status:
Present in captivity only in South America (global *ex situ* population = 13 animals). Some reproduction in captivity.

	ALPZA / Latin & South America	Total Global *Ex Situ* Pop
Population size (M.F.U)	**7(+6) (3.4)**	**7(+6) (3.4)**
Living wild-born animals	6 (3.3)	6 (3.3)
Gene diversity	?	?
# Founders	?	?
# Potential founders	?	?
% pedigree known	?	?
Population trend/ lambda	Stable	Stable
# institutions	3	3
Management	Not managed	
Data source	*2016 ALPZA report*	*2016 ALPZA / ZIMS*

M.F.U = # males.females.unknown sex

**additional contracepted individuals indicated in ()*

Workshop Assessment of Ex Situ Roles and Activities:

The following direct and indirect conservation roles were identified at the ICAP workshop. Roles selected to pursue following benefit/feasibility/risk analysis are marked in green.

Indirect Role(s)	Benefit	Feasibility	Risk	Notes
***In situ* support** Better understand current status	**HIGH**	**HIGH**	**LOW**	Does not require living individuals of this species. Could also be done with other fox species.
Research Understand species biology and husbandry requirements	**MODERATE**	**MODERATE**	**LOW**	By ALPZA range area institutions, using individuals that are brought in as rescues.
Education Especially on illegal wildlife trade and use for cultural purposes	**Not rated**	**Not rated**	**Not rated**	By ALPZA range area institutions, using individuals that are brought in as rescues – towards targeted audience.

Comments/Issues:

- Not confident the IUCN information about the species is current and/or accurate; current information is needed.
- Very restricted range (between Andes and the ocean).
- Little known about the species.
- Come into ALPZA zoos in range areas as rescued individuals; tend not to breed with these individuals (many are permanently contracepted).

Workshop Recommendations:

1. A proactively managed *ex situ* population inside or outside of range countries is not recommended currently. If status in the wild changes, there are animals within ALPZA to potentially start a formal program.
2. Recommended that ALPZA encourage local zoos that receive rescued individuals to:
   - Conduct conservation education to targeted audiences about illegal wildlife trade and use for cultural purposes.
   - Attempt limited breeding and develop/document husbandry practices to better understand species biology and husbandry requirements; because this species lives in a different ecotype it is not known if there is another "fox model" for this taxon – their husbandry requirements may be different. It would be valuable to have this established in case *in situ* work shows them to more severely threatened than previously thought.
3. Both ALPZA and other regions: encourage and support/fund field studies for this species to more confidently understand their current status (and biology).

SHORT-EARED DOG
Atelocynus microtis

THREATENED SPECIES
IUCN Red List: Near Threatened
Population trend: Declining

Scattered distribution in South America, from Colombia to Bolivia and Ecuador to Brazil. Favors undisturbed rainforests in the Amazonian lowlands.

Threats: Major threats are habitat loss (especially due to large-scale conversion in Amazonia), prey base depletion from hunting, and disease. No reports of widespread persecution.

Potential Ex Situ Roles: No responses for this species prior to the workshop.

Prior Ex Situ Recommendations:
1992 CAMP: Recommendation to develop a Nucleus I population (50-100 animals), with the goal to retain 90% GD for 100 years, assuming periodic immigration from the wild.

Ex Situ Status:
Not represented in captivity in ZIMS database or surveyed regional zoo associations. Past holdings and breeding in the US and France (1970s).

Workshop Assessment of Ex Situ Roles and Activities:
No direct and or indirect conservation roles were identified at the ICAP workshop.

Comments/Issues:

- There is some doubt/uncertainty whether the species is as rare as previously thought and whether it is "declining" or not. Identification in many camera trap studies. This species has a much broader range than Sechura fox. More *in situ* information is needed.
- Broad range in Amazon, but little known about this species.
- No one known to be currently working with this species *in situ*.
- No record of them recently in *ex situ* institutions, except for one in Lima, Peru several years ago.

Workshop Recommendations:
No *ex situ* population or role identified at this time; should re-evaluate if status in the wild changes.

ARCTIC FOX
Alopex lagopus

NON-THREATENED SPECIES
IUCN Red List: Least Concern
Population trend: Stable

Circumpolar distribution in all Arctic tundra habitats. Most populations fluctuate widely between years in response to varying lemming numbers. Global population of several 100,000 animals.

Threats: Hunting for fur is a major mortality factor. May be affected by indirect threats such as disease and persistent organic pollutants if connected to marine ecosystems.

Potential Ex Situ Roles:
Education: Climate change.

Ex Situ Status:
Present in captivity in 2 regions in significant numbers (global *ex situ* population = 155 animals). Reproduction in captivity.

	AZA / North America	ALPZA / Latin & So America	EAZA / Europe	PAAZA / Africa	SEAZA / SE Asia	JAZA / Japan	Total Global *Ex Situ* Pop
Population size (M.F.U)	**64 (26.38)**	**1 (0.1)**	**75 (33.41.1)**	**1 (1.0)**	**10 (3.7)**	**4 (2.2)**	**155[1] (65.89.1)**
Living wild-born animals	?	?	?	?	?	?	6[2]
Gene diversity	?	?	?	?	?	?	?
# Founders	?	?	?	?	?	?	17[2]
# Potential founders	?	?	?	?	?	?	?
% pedigree known	?	?	?	?	?	?	13%[2]
Population trend/ lambda	?	?	?	?	?	?	Increasing[2]
# institutions	29	1	29	1	1	1	62[1]
Management	Not managed	Not managed	Monitored EAZA program	No formal program	Not managed	No formal program	
Data source	*2016 ZIMS*	*2016 ALPZA report*	*2016 ZIMS*	*2016 ZIMS*	*2016 ZIMS*	*2016 JAZA report*	*[1]column sums; [2]2016 ZIMS*

M.F.U = # males.females.unknown sex

Workshop Assessment of Ex Situ Roles and Activities:
The following direct and indirect conservation roles were identified at the ICAP workshop:

Indirect Role(s)	Benefit	Feasibility	Risk	Notes
Education	Not rated	Not rated	Not rated	Climate change messaging
***In situ* support**	Not rated	Not rated	Not rated	For this species and other arctic species

Comments/Issues:

- Do not always make a good *ex situ* exhibit. Can be held in mixed species exhibits or outdoor exhibits in cold climates so does not necessarily take space away from priority species.
- EAZA and AZA have this species primarily for climate change educational messaging, but it is also a hardy cold tolerant small canid species.
- Small threatened subpopulation in Sweden and Norway, but this subspecies is not found in zoos.
- Arctic Fox Working Group exists within the IUCN SSC Canid Specialist Group, and there are *in situ* projects that zoos can to link to and/or provide resources for.

Workshop Recommendations:

1. A proactively managed *ex situ* population is not recommended currently; should re-evaluate if status in the wild changes.
   - AZA and EAZA should consider limiting population to a low number.
2. Institutions with this species should be encouraged to focus on climate change messaging.
3. Consider support of *in situ* projects.

BAT-EARED FOX
Otocyon megalotis

NON-THREATENED SPECIES
IUCN Red List: Least Concern
Population trend: Stable

Disjunct distribution across the arid and semi-arid regions of Eastern and Southern Africa.

Threats: No major threats, but subject to subsistence hunting for pelts or due to being perceived as predators of small livestock. Populations fluctuate due to disease (especially rabies and canine distemper) or drought (which depresses insect numbers).

Potential Ex Situ Roles: No responses for this species prior to the workshop

Prior Ex Situ Recommendations: Recommended for Nucleus II population (i.e., 25-100 animals, good management of existing *ex situ* population) as part of meta-population management (1992 CAMP).

Ex Situ Status:
Present in captivity in several regions (estimated global *ex situ* population = 164 animals). Reproduction in captivity with historical growth; recent stabilization/slight decline globally. Managed programs in AZA and EAZA, with inter-regional collaboration. Importations have occurred throughout the history of the captive program along with successful breeding since 1970. Bat-eared foxes can co-exist well with other species and are frequently used in African plains zoo exhibits.

	AZA / North America	EAZA / Europe	PAAZA / Africa	CZA / India	ZPO / Thailand	SEAZA / Singapore	JAZA / Japan	Total Global *Ex Situ* Pop
Population size (M.F.U)	**54 (26.28)**	**83 (42.38.3)**	**10 (6.4)**	**2 (1.1)**	**13 (6.7)**	**2 (1.1)**	**1 (0.1)**	**165[1] (82.80.3)**
Living wild-born animals	?	?	?	?	?	?	?	7[2]
Gene diversity	91.1%	89.3%	?	?	?	?	?	?
# Founders	20	11	?	?	?	?	?	65[2]
# Potential founders	0	4	?	?	?	?	?	4?[1]
% pedigree known	85%	100%	?	?	?	?	?	?
Population trend/ lambda	Stable (0.991)	Stable	?	?	?	?	?	Recent decline[2]
# institutions	25	34	3	1	2	1	1	67[1]
Management	SSP managed program	EEP managed program	Not managed	Not managed	No formal program	Not managed	Not managed	Cooperation btn EAZA and AZA
Data source	*2015 EAZA combined SB*	*2015 EAZA SB*	*2016 ZIMS*	*2016 ZIMS*	*2016 ZIMS*	*2016 ZIMS*	*2016 JAZA report*	*[1]column sums; [2]2016 ZIMS*

M.F.U = # males.females.unknown sex

Workshop Assessment of Ex Situ Roles and Activities:
The following direct and indirect conservation roles were identified at the ICAP workshop. Roles selected to pursue following benefit/feasibility/risk analysis are marked in green.

Indirect Role(s)	Benefit	Feasibility	Risk	Notes
Education	Not rated	**HIGH**	**LOW**	Importance of species to ecosystem, and threats to African savannah habitats

Comments/Issues:

- AZA and EAZA share a studbook database. Pending an MOU between AZA and EAZA, this species will be cooperatively managed with the main population in EAZA and a satellite population in AZA.
- The population in EAZA is thought to have come from the same general area in the wild, which would suggest most (or all) are of the same subspecies. This is not necessarily true for the AZA animals, and subspecies should be confirmed for all AZA and EAZA animals. A project to do this is pending. Depending on the results, a decision will need to be made if the *ex situ* population will be managed at the species level or if *O.m. virgatus* and *O.m. megalotis* will be managed separately.
- This species has the highest Evolutionary Distinctiveness score among canids.
- Discussions with the IUCN SSC Canid Specialist Group and carnivore biologists based in Africa suggest there are no *in situ* projects currently focused on this species.
- Not clear what species could replace this species in existing bat-eared fox enclosures, since they are typically mixed with other species.
- Share same niche as black-backed jackals and other carnivores, so fill educational role relating to African ecosystems and savannah habitats well, especially as they can be exhibited in naturalistic mixed species enclosures.

Workshop Recommendations:

1. Continue to work towards collaborative management of the AZA and EAZA populations with the intent of managing jointly to create a small, efficient and sustainable population.
2. Identify specific conservation education messaging, and share the conservation message about this species, African ecosystems and savannah habitats, and the threats to both canids and hyaenids and their habitat.

BENGAL (INDIAN) FOX
Vulpes benegalensis

NON-THREATENED SPECIES
IUCN Red List: Least Concern
Population trend: Declining

Endemic to the Indian Sub-Continent
(Bangladesh, India, Nepal, Pakistan)

Threats: Loss of habitat due to agricultural and industrial uses, along with disease risk, low population density, population fluctuations due to prey availability, and sensitivity to human modification of habitat, may cause local extinctions.

Potential Ex Situ Roles: No responses for this species prior to the workshop

Prior Ex Situ Recommendations: Captive population recommended for education, research and husbandry; not needed for genetic or demographic contributions (1998 Mammals of India CAMP). Research is needed on disease transmission, species ecology, population dynamics and behavior (2004 CSG Action Plan).

Ex Situ Status:
Present in captivity only in India (global *ex situ* population = 7 animals listed in ZIMS). Not managed. Reproduction in captivity in India in the past.

	CZA / India	Total Global *Ex Situ* Pop
Population size (M.F.U)	**7 (3.4)**	**7 (3.4)**
Living wild-born animals	2	2
Gene diversity	?	?
# Founders	0	0
# Potential founders	2	2
% pedigree known	33%	33%
Population trend/ lambda	Stable	Stable
# institutions	4	4
Management	Not managed	
Data source	*2016 ZIMS*	*2016 ZIMS*

M.F.U = # males.females.unknown sex

Workshop Assessment of Ex Situ Roles and Activities:
No direct and or indirect conservation roles were identified at the ICAP workshop.

Comments/Issues:

- Assumed that there are more in India, but in non-ZIMS/CZA facilities.
- An *in situ* researcher is working with this species – K. Bauman will contact them to follow up and put them in touch with EAZA and CZA.
- An *ex situ* population was recommended twice for research - in 1998 for husbandry and disease, and in 2004 for disease transmission, species ecology, population dynamics and behavior - but with no specifics nor a researcher to lead these initiatives it is hard to justify building an *ex situ* population, especially when *ex situ* small canid spaces for Asian species are uncommon outside of the species range. Therefore, it is left up to CZA to consider during their regional planning.
- Need to follow up with CZA to try to get accurate *ex situ* numbers, including those animals in non-ZIMS/CZA facilities.
- Given the declining trend locally, continue to monitor if *in situ* research projects are needed in that region that may need support or resources from the *ex situ* community.

Workshop Recommendations:
No *ex situ* population or role identified at this time; should re-evaluate if status in the wild changes or CZA feels differently from their regional perspective.

BLANFORD'S FOX
Vulpes cana

NON-THREATENED SPECIES
IUCN Red List: Least Concern
Population trend: Stable

Disjunct distribution, in southwestern Asia and in arid mountainous regions in the Arabian Peninsula.

Threats: No obvious major threats range-wide. Habitat loss, due mainly to expanding settlement and tourism development, and human persecution and indirection mortality pose localized threats.

Potential Ex Situ Roles: No responses for this species prior to the workshop

Prior Ex Situ Recommendations: Recommended for Nucleus I population (50-100 animals with GD ≥98%, requiring periodic immigrants from wild) as part of species meta-population (1992 CAMP). Recommendations were made for research on reproductive behavior and for education and awareness to raise the profile of the species (2000 Arabian Carnivore CAMP). Better understanding is needed regarding susceptibility to disease and role in disease transmission (Sillero-Zubiri *et al*. 2004).

Ex Situ Status:
Present in captivity primarily in the UAE (global *ex situ* population = 28 animals). Not managed. Reproduction in captivity in the past in the US and Europe in the 1970s and 1980s. Successful breeding in the past at the Breeding Centre for Endangered Arabian Wildlife (UAE), Tel Aviv University Zoo, and Hai Bar Breeding Centre (Israel).

	EAZA / Europe	AZAA/ UAE	Total Global *Ex Situ* Pop
Population size (M.F.U)	**2 (1.1)**	**26 (16.10)**	**28 (17.11)**
Living wild-born animals	?	?	5
Gene diversity	?	?	?
# Founders	?	?	22
# Potential founders	?	?	?
% pedigree known	?	?	85%
Population trend/ lambda	?	?	Increasing
# institutions	1	4	5
Management	Not managed	Not managed	
Data source	*2016 ZIMS*	*2016 ZIMS*	*2016 ZIMS*

M.F.U = # males.females.unknown sex

Workshop Assessment of Ex Situ Roles and Activities:
No direct and or indirect conservation roles were identified at the ICAP workshop.

Comments/Issues:

- Never in large *ex situ* numbers outside their native range, with successful breeding at institutions within UAE.
- *Ex situ* population is reputed to be used for educational messaging about local wildlife, and some recent research into life history characteristics and disease at the Breeding Centre for Endangered Wildlife (Sharjah, UAE).
- Focus for the *ex situ* population should remain in range countries.

Workshop Recommendations:
No *ex situ* role identified at this time; should re-evaluate if status in the wild changes or AZAA feels differently from their regional perspective.

CAPE FOX
Vulpes chama

NON-THREATENED SPECIES
IUCN Red List: Least Concern
Population trend: Stable

Widespread in the central and western regionals of Southern Africa (Angola, Botswana, Namibia, South Africa).

Threats: No major threats. Changing agriculture practices have resulted in range extensions, as has expansion of semi-arid karroid vegetation during desertification. Widespread illegal indiscriminate use of agricultural poisons on commercial farms pose the main threat.

Potential Ex Situ Roles: No responses for this species prior to the workshop

Prior Ex Situ Recommendations: None

Ex Situ Status:
Present in captivity only in one facility in Europe (global *ex situ* population = 6 animals listed in ZIMS). Not managed. Some reproduction in captivity in Europe in the past.

	EAZA / Europe	Total Global *Ex Situ* Pop
Population size (M.F.U)	**6 (3.3)**	**6 (3.3)**
Living wild-born animals	4	4
Gene diversity	?	?
# Founders	?	?
# Potential founders	3?	3?
% pedigree known	67%	67%
Population trend/ lambda	Stable	Stable
# institutions	1	1
Management	Not managed	
Data source	*2016 ZIMS*	*2016 ZIMS*

M.F.U = # males.females.unknown sex

Workshop Assessment of Ex Situ Roles and Activities:
No direct and or indirect conservation roles were identified at the ICAP workshop.

Comments/Issues:
- Only six held globally – all in Europe, but EAZA has no additional information these individuals. EAZA has recommended that institutions not hold this species, and are planning to phase the species out to focus instead on fox species with recommended *ex situ* roles.

Workshop Recommendations:
No *ex situ* population or role identified at this time; should re-evaluate if status in the wild changes.

CHILLA (SOUTH AMERICAN GREY FOX)
Pseudalopex griseus

NON-THREATENED SPECIES
IUCN Red List: Least Concern
Population trend: Stable

Widespread in the plains and mountains on both sides of the Andes in Chile and Argentina, South America. Introduced on Falkland Islands.

Threats: Main threat in the past was commercial hunting, but hunting intensity appears to have declined. Illegal trapping still occurs in some areas to control predation on small livestock. The species is hunted for its pelt.

Potential Ex Situ Roles: **Indirect Conservation: Education**
Given the poor representation of the Darwin's fox and other South America foxes in professional zoos across the world, it would be advisable to set up an *ex situ* program, especially focusing on the need to mitigate the conflicts between foxes and local ranchers, a widespread problem for all these foxes.

Prior Ex Situ Recommendations: Recommended for Nucleus II population in range states (i.e., 25-100 animals, good management of existing *ex situ* population) by 1992 CAMP.

Ex Situ Status:
Present in captivity only in South America (global *ex situ* population = 6 animals). Some reproduction in captivity.

	ALPZA / Latin & South America	Total Global *Ex Situ* Pop
Population size (M.F.U)	**2(+4) (4.2)**	**2(+4) (4.2)**
Living wild-born animals	1 (1.0)	1 (1.0)
Gene diversity	?	?
# Founders	?	?
# Potential founders	?	?
% pedigree known	?	?
Population trend/ lambda	Declining	Declining
# institutions	2	2
Management	Not managed	
Data source	*2016 ALPZA report*	*2016 ALPZA report / ZIMS*

M.F.U = # males.females.unknown sex

**additional contracepted individuals indicated in ()*

Workshop Assessment of Ex Situ Roles and Activities:

The following direct and indirect conservation roles were identified at the ICAP workshop. Roles selected to pursue following benefit/feasibility/risk analysis are marked in green.

Indirect Role(s)	Benefit	Feasibility	Risk	Notes
Education	**HIGH**	**MODERATE**	**LOW**	
Insurance	Not rated	Not rated	Not rated	Model species?
Research disease	Not rated	Not rated	Not rated	

Comments/Issues:

- Only in ALPZA – 4 according to survey, but a lot in South America that are not listed. No knowledge of them being prevalent in Brazilian zoos.
  - Similar to other fox species in South American zoos – they come in as rescues, and some are not able to be released back to the wild (political or veterinary reasons).
- Although rescued chilla in zoos are not typically turned in from same region as Darwin's fox (even though the two species are sympatric), chilla could be a possible model species for Darwin's fox (and other less common South American fox species), providing an opportunity to develop husbandry protocols and small canid expertise at those institutions.
  - Whether ALPZA zoos have this capacity since many of the chilla are confiscations with a required hold by local government would need to be evaluated. Whether chilla would be a suitable model species for ALPZA should be considered during regional planning.
- There is very little known about disease risk/prevalence and transmission in this species; potential for the *ex situ* population to provide samples for a disease ecologist based at a university within the species range.
- An education message about South American fox species in general and living with canids, especially in agricultural areas, should be encouraged for all institutions that have this species.

Workshop Recommendations:

1. A proactively managed *ex situ* population outside of range countries is not recommended currently; should re-evaluate if status in the wild changes.
2. There are animals within ALPZA to potentially start a formal program. ALPZA should consider if this species might be a suitable model species and how it best fits within their regional plan for canids.
3. Recommended that ALPZA encourage local zoos that receive rescued individuals to:
   - Conduct conservation education to targeted audiences about foxes and discuss methods of coexistence.
   - Attempt limited breeding and document husbandry practices.
   - Possibly utilize the *ex situ* population to address questions about disease prevalence.

CORSAC FOX
Vulpes corsac

NON-THREATENED SPECIES
IUCN Red List: Least Concern
Population trend: Unknown

Native to the arid steppes of Northern and Central Asia. Generally widespread and common species. Little population information. May fluctuate greatly over short time periods in response to climatic events and in response to intensive harvesting. Listed as Near Threatened on Mongolian Red List due to decline resulting from overhunting.

Threats: Primary threat is overharvesting. Species is hunted intensively for its pelt, both traditionally and commercially. Other threats include livestock overgrazing and landscape development (which may reduce habitat quality), domestic dogs and disease.

Potential Ex Situ Roles: **Indirect Conservation: Research, Education**
Small scale funding for research projects by the zoo community would be useful, especially in areas where the species is declining. Zoos could promote awareness of the species and steppe ecosystems in Asia, highlighting that once common species, like corsac foxes, are declining in some areas due to some extent to consumer choices in the West.

Prior Ex Situ Recommendations: None recommended (2004 CSG Action Plan)

Ex Situ Status:
Present in captivity only in Europe (global *ex situ* population = 65 animals listed in ZIMS). Not managed. Breeds well in captivity. Easily habituated to humans.

	EAZA / Europe	Total Global *Ex Situ* Pop
Population size (M.F.U)	**65 (32.30.3)**	**65 (32.30.3)**
Living wild-born animals	0?	0?
Gene diversity	?	?
# Founders	4	4
# Potential founders	0?	0?
% pedigree known	4%	4%
Population trend/ lambda	Increasing	Increasing
# institutions	15	15
Management	Monitored EAZA program	
Data source	*2016 ZIMS*	*2016 ZIMS*

M.F.U = # males.females.unknown sex

Workshop Assessment of Ex Situ Roles and Activities:

The following direct and indirect conservation roles were identified at the ICAP workshop. Roles selected to pursue following benefit/feasibility/risk analysis are marked in green.

Indirect Role(s)	Benefit	Feasibility	Risk	Notes
Education	Not rated	HIGH	LOW	Importance of and threats to steppe ecosystem
***In situ* support**	Not rated	Not rated	Not rated	For this species and other Asian species

Comments/Issues:

- Held in EAZA and non-EAZA zoos in Europe, but currently this species does not occupy space that could be used for other species (kept in mixed species exhibits).
- Used for education messaging as a representative of Asian steppe habitat. May be the only species in EAZA zoos from this habitat type. Can deliver the message about the importance of steppe ecosystem, threats, and how even common species can decrease under threat conditions.
- There is an active field project in Mongolia that may benefit from *ex situ* collaboration and small scale fundraising.

Workshop Recommendations:

1. Institutions holding this species should share the conservation message about this species, the Asian steppe habitat, and the threats to both foxes and their habitat.
2. Consider linking with *in situ* projects.

CRAB-EATING FOX
Cerdocyon thous

NON-THREATENED SPECIES
IUCN Red List: Least Concern
Population trend: Stable

Native to north and eastern South America; relatively common throughout its range, occupying most habitats. No population estimates are available but thought to be stable.

Threats: Main potential threat, albeit localized, is pathogenic infection from domestic dogs (contact with dogs at human refuse dumps in Serra da Canastra National Park). Fur is short and coarse and of no commercial value.

Potential Ex Situ Roles: **Indirect Conservation: Education, Research**
Given the poor representation of the Darwin's fox and other South America foxes in professional zoos across the world, it would be advisable to set up an *ex situ* program, especially focusing on the need to mitigate the conflicts between foxes and local ranchers, a widespread problem for all these foxes. Teach differences between fox species and that some are threatened – opportunity for range state zoos. Research on genetics and epidemiology can be important because species is sympatric with other canids.

Prior Ex Situ Recommendations: Recommend phase out of captive program (1992 CAMP)

Ex Situ Status:
Present in captivity only in South America (global *ex situ* population = 26 animals). Breeds well in captivity. Present in many zoos and private collections through South America.

	ALPZA / Latin & South America	Total Global *Ex Situ* Pop
Population size (M.F.U)	**22(+4) (14.12)**	**22(+4)[1] (14.12)**
Living wild-born animals	11	11[1]
Gene diversity	?	?
# Founders	7?	7?[2]
# Potential fdrs	4?	4?[2]
% pedigree known	61%?	61%?[2]
Population trend/ lambda	Stable?	Stable?[2]
# institutions	6	6
Management	Not managed	
Data source	*2016 ALPZA report & 2016 ZIMS*	*[1]2016 ALPZA report; [2]2016 ZIMS*

*M.F.U = # males.females.unknown sex. *additional contracepted individuals indicated in ()*

Workshop Assessment of Ex Situ Roles and Activities:
The following direct and indirect conservation roles were identified at the ICAP workshop. Roles selected to pursue following benefit/feasibility/risk analysis are marked in green.

Indirect Role(s)	Benefit	Feasibility	Risk	Notes
Education	**MODERATE**	**HIGH**	**LOW**	
Research	**Not rated**	**Not rated**	**Not rated**	As needed to supplement existing publications

Comments/Issues:
- No data available at the time of the ICAP meeting for holdings in Brazilian zoos that do not belong to ALPZA, but known to be very common in Brazilian zoos.
- Should be replaced with a species of more conservation concern with a defined *ex situ* role, e.g., Sechura or hoary fox, where possible (some confiscated individuals are required to be held by law).
- Active exhibit species, so good opportunity to educate guests (and guests love them).
- Research colony at the National Zoo in the late 1970s and 1980s, so husbandry should be well worked out for this species. There are many publications on this species, including spatial and disease ecology, diet, reproduction, vocalizations, natural history, and a few genetic studies. Question was posed as to whether researchers and zoo staff in range countries have easy access to these publications, if not, could those be provided to ALPZA as a resource?

Workshop Recommendations:
1. A proactively managed *ex situ* population is not recommended currently; should re-evaluate if status in the wild changes.
2. For the animals existing within ALPZA and Brazilian zoos, and rescue foxes:
   - If ability to change this species for another species exists, replace with another South American fox species of greater conservation concern.
   - If the ability to change is not legally allowed, then utilize the species for conservation education (to targeted audiences) about foxes and discuss methods of coexistence.
   - Utilize the *ex situ* population on an 'as needed' basis to address research questions not currently in the scientific literature, such as genetics or additional epidemiological questions.

CULPEO FOX
Pseudalopex culpaeus

NON-THREATENED SPECIES
IUCN Red List: Least Concern
Population trend: Stable

Native to the Andes and hilly regions of South America (Argentina, Bolivia, Chile, Ecuador, Peru); largest fox.

Threats: Main threats are hunting and trapping for fur and persecution to reduce predation on livestock and poultry. Appears to withstand intensive hunting with the ability to rebound when hunting pressure is reduced. Predation by feral and domestic dogs may be a problem in some areas.

Potential Ex Situ Roles: No responses for this species prior to the workshop

Prior Ex Situ Recommendations: None

Ex Situ Status:
Present in captivity only in South America (global *ex situ* population = 22 animals). Reproduction in captivity. Common in zoos in Chile and Argentina.

	ALPZA / Latin & South America	Total Global Ex Situ Pop
Population size (M.F.U)	**21(+1) (12.9)**	**21(+1) (12.9)**
Living wild-born animals	7 (4.3)	7 (4.3)
Gene diversity	?	?
# Founders	?	?
# Potential founders	?	?
% pedigree known	?	?
Population trend/ lambda	Increasing	Increasing
# institutions	5	5
Management	Not managed	
Data source	*2016 ALPZA report*	*2016 ALPZA report / ZIMS*

M.F.U = # males.females.unknown sex

**additional contracepted individuals indicated in ()*

Workshop Assessment of Ex Situ Roles and Activities:
The following direct and indirect conservation roles were identified at the ICAP workshop. Roles selected to pursue following benefit/feasibility/risk analysis are marked in green.

Indirect Role(s)	Benefit	Feasibility	Risk	Notes
Education	**MODERATE**	**HIGH**	**LOW**	Importance of foxes and mitigation of threats
***In situ* support**	**Not rated**	**Not rated**	**Not rated**	For this species and other South American species

Comments/Issues:

- Common in zoos in Chile and Argentina.
  - Many are rescues and they are neutered or contracepted right away.
- High exhibit value given regional pride for this great species.
- Its size and charismatic nature provides a connection with guests, so the opportunity to utilize this species for education about foxes in general and/or conservation action that is needed, e.g. Darwin's fox, is high.
- Mange in domestic dogs affects culpeo foxes in wild.
  - Education about pet responsibility is a key message for this species.
- Potential role: capacity building to establish husbandry protocols and staff training but could do that with other species.
- Currently only a few *in situ* projects on this species being conducted within range countries.

Workshop Recommendations:

1. A proactively managed *ex situ* population is not recommended currently; should re-evaluate if status in the wild changes.
2. For the animals existing within ALPZA, and rescue foxes:
   - Utilize the species for conservation education (to targeted audiences) about conservation action for Darwin's fox and about South American foxes in general, focusing on methods of coexistence and responsible pet ownership (reduce disease transmission from domestic dogs).
3. Consider linking to *in situ* projects.

FENNEC FOX
Vulpes zerda

NON-THREATENED SPECIES
IUCN Red List: Least Concern
Population trend: Stable

Native to sandy deserts and semi-deserts of North Africa; smallest fox.

Threats: No known major range-wide threats causing population decline. Vulnerable to road kill with new construction. Trapped for exhibition or sale to tourists locally. New permanent human settlements may lead to local disappearance. Disturbance due to oil and gas drilling may become a future threat.

Potential Ex Situ Roles: **Indirect Conservation: Research, Education**
Studies of reproduction, nutrition, disease and genetics in captivity have helped better understand species biology. These projects also have helped develop and validate techniques for use with other fox species, such as the Darwin's fox. Zoos have sponsored field projects through WildCRU and Sahara Conservation Fund (SCF) for this little known species. Captive fennec foxes are charismatic education animals and valuable for illustrating canid biology and ecology, taxonomic differences in canids, and desert adaptations and ecosystems. Opportunities exist for an integration of *in situ* and *ex situ* strategies for this species.

Prior Ex Situ Recommendations: Recommended for Nucleus II population (i.e., 25-100 animals, good management of existing *ex situ* population) as part of meta-population management (1992 CAMP).

Ex Situ Status:
Present in captivity in almost all regions, with large populations in North America and Europe (estimated global *ex situ* population = 356 animals). Reproduction in captivity.

	AZA / North America	EAZA / Europe	PAAZA / Africa	ZPO / Thailand	SEAZA / SE Asia (excl. ZPO)	JAZA / Japan	ZAA / Australasia	Total Global *Ex Situ* Pop
Population size (M.F.U)	**146 (80.66)**	**150 (81.69)**	**4 (1.3)**	**9 (5.3.1)**	**4 (2.2)**	**30 (16.14)**	**13 (6.7)**	**356[1] (191.164.1)**
Living wild-born animals	?	?	?	?	?	?	?	21[2]
Gene diversity	93.8%	92.8%	?	?	?	?	?	?
# Founders	24	19	?	?	?	?	?	42[2]
# Potential fdrs	4	?	?	?	?	?	?	4+[1]
% pedigree kn	89%	53%	?	?	?	?	?	22+%[2]
Population trend/ lambda	1.08	1.03	?	?	?	?	?	Increasing[2]
# institutions	45	49	2	1	2	10	6	115[1]
Management	SSP managed	ESB managed	Not managed	No formal program	Not managed	No formal program	Not managed	
Data source	*2015 AZA B&T plan*	*2015 EAZA Regional SB*	*2016 ZIMS*	*2016 ZIMS*	*2016 ZIMS*	*2016 JAZA rpt*	*2016 ZIMS*	*[1]column sums; [2]2016 ZIMS*

M.F.U = # males.females.unknown sex

Workshop Assessment of Ex Situ Roles and Activities:

The following direct and indirect conservation roles were identified at the ICAP workshop. Roles selected to pursue following benefit/feasibility/risk analysis are marked in green.

Indirect Role(s)	Benefit	Feasibility	Risk	Notes
Education	**HIGH**	**HIGH**	**LOW**	Importance of the Saharan ecosystem and threats; charismatic ambassador species for threatened species native range
Research	**MODERATE**	**HIGH**	**LOW**	Model for other fox species; much has already been accomplished, more could be done
***In situ* support**	**Not rated**	**Not rated**	**Not rated**	For this species and other North African species
Insurance	**Not rated**	**Not rated**	**Not rated**	Only *ex situ* desert fox species with good numbers and gene diversity

Comments/Issues:

- In Niger, at 2009 field study site, suggestion that increased oil and gas mining may have a negative effect; how significant an effect has not yet been quantified.
  - AZA and EAZA raised funds for the first ever field project of this species (and other Saharan small carnivores) in Niger.
  - The fennec has been utilized in garnering public interest in critically endangered species in the same region, e.g. addax.
- PAAZA numbers are not accurate; AZAA (Arabian Zoo and Aquarium Association) have fennecs that may not be included in the EAZA numbers – need to verify numbers to obtain an accurate global census.
- EAZA and AZA should discuss a target population size suitable for both regions with AZA likely reducing numbers some in the next 5 years.
- Model species for other fox species in zoos, especially in areas of husbandry and research (reproduction and behavior).
- Can be charismatic display and very popular education species (in AZA).
- Fennec spaces could possibly be used in the future for other species that are of a higher priority; in the meantime, knowledge can be gained.
  - Some spaces, especially those used for fennecs in an educational role in AZA, may not be easily exchangeable for other species (indoor only and/or size).

Workshop Recommendations:

1. The global *ex situ* population should be evaluated strategically to make sure that spaces and animals are managed effectively among the regions.
2. Zoo associations should work with the Sahara Conservation Fund, IUCN SSC Canid Specialist Group, and other regional zoo association Taxon Advisory Groups to develop a comprehensive, targeted educational program that can reach both range country and outside audiences and can be utilized for all species of desert fox and threatened Saharan species, e.g., addax, scimitar horned oryx, cheetah, red necked ostrich, vulture spp., etc.
3. Support *in situ* research, as so little is known about this species (and all Saharan carnivores), and continue to utilize the *ex situ* population to address research questions (for fennecs and other fox species), as needed.

GREY FOX
Urocyon cineroargenteus

NON-THREATENED SPECIES
IUCN Red List: Least Concern
Population trend: Stable

Ranges from southern Central and Eastern Canada through much of the US and Central America to northern South America. Common in habitat less densely populated by humans or edge of urban settlements, where it is not excluded by other predators (coyotes and bobcats).

Threats: Habitat loss, fragmentation, and degradation may be problematic in regions of rapid human population growth with resulting habitat conversion to agricultural, industrial and urban uses.

Potential Ex Situ Roles: No responses for this species prior to the workshop

Prior Ex Situ Recommendations: Recommend to phase out captive population (1992 CAMP).

Ex Situ Status:
Present in captivity in 2 regions (global *ex situ* population = 48 animals). Not managed. Reproduction in captivity. Common on display at wildlife farms and in private collections. Fare well in captivity.

	AZA / North America	ALPZA / Latin & South America	Total Global *Ex Situ* Pop
Population size (M.F.U)	**40 (21.17.2)**	**6(+2) (4.4)**	**48[1] (25.21.2)**
Living wild-born animals	?	3	36[2]
Gene diversity	?	?	?
# Founders	?	?	5[2]
# Potential founders	?	?	31?[2]
% pedigree known	?	?	74%[2]
Population trend/ lambda	?	?	Stable[2]
# institutions	22	4	26[1]
Management	Not managed	Not managed	
Data source	*2016 ZIMS*	*2016 ALPZA report*	*[1]Column sums; [2]2016 ZIMS*

M.F.U = # males.females.unknown sex

**additional contracepted individuals indicated in ()*

Workshop Assessment of Ex Situ Roles and Activities:
No direct and or indirect conservation roles were identified at the ICAP workshop.

Comments/Issues:

- Strong suspicion that the ZIMS numbers for North America reflect primarily non-AZA institutions; guess for AZA is 20-25 grey foxes, but an AZA-wide survey for canid and hyaenids is scheduled in 2017 so exact numbers will be known then.
- Very common species in nature, but very little known about the species so the *ex situ* population could provide information for research projects, if needed.
- Hard to justify holding this species beyond facilities within its range. Even within the range questionable role for conservation, if not tied to island or another threatened fox species.
- Only conservation purpose might be as a representative for grey fox in general (*Urocyon cineroargenteus* AND *Urocyon littoralis*):
    - Could try to strategically place them where they could be transitioned to Island fox, if needed in the future.
        - May be a good "starter fox" for new institutions to hold before getting island foxes.
    - Look similar, but not identical to Island fox.
    - Could also be effective surrogate for Island fox educational messaging.

Workshop Recommendations:
No *ex situ* population or role identified at this time; should re-evaluate if status in the wild changes or AZA feels differently from their regional perspective.

HOARY FOX
Pseudalopex vetulus

NON-THREATENED SPECIES
IUCN Red List: Least Concern
Population trend: Unknown

Native to the cerrado habitats of central Brazilian plateau and peripheral transitional zones.

Threats: No major threats at this time. Habitat loss of cerrado is 3% per year primarily due to agriculture; however, foxes may adapt to livestock pasture. Deforestation possibly not to have negative impact but requires monitoring.

Potential Ex Situ Roles: **Indirect Conservation: Research, Education:** Little known about this species (2004 CSG Action Plan). Research on reproduction, health, epidemiology and physiology needed. Little known to society – awareness.

Prior Ex Situ Recommendations: Recommended for Nucleus I population (50-100 animals with GD ≥98%, requiring periodic immigrants from wild) as part of species meta-population (1992 CAMP). No plans to reintroduce this species as of 2004 (CSG Action Plan).

Ex Situ Status:
Not represented currently in captivity in ZIMS database or surveyed regional zoo associations. Past holdings and reproduction in Brazil in the 1990s (ZIMS). Past *ex situ* population had high pup mortality possibly due to starvation (2004 CSG Action Plan).

Workshop Assessment of Ex Situ Roles and Activities:
The following direct and indirect conservation roles were identified at the ICAP workshop:

Indirect Role(s)	Benefit	Feasibility	Risk	Notes
***In situ* support**	Not rated	Not rated	Not rated	For this species and other South American species
Insurance	Not rated	Not rated	Not rated	

Comments/Issues:

- Although there are no records of this species in zoos currently (ZIMS or ALPZA member zoos), R. Cunha de Paula reported that a recent survey of Brazilian zoos (non-ALPZA members) listed 9 individuals (all rescues).
- Hoary foxes are often confused with the pampas fox.
- There are several studies of this species ongoing in the wild, being conducted primarily by Brazilian scientists. There is some evidence of population decline, and there is a proposal to change the species' status to Near Threatened (pending).
- There has been interest expressed in establishing an insurance population in Brazilian zoos.

Workshop Recommendations:

1. A proactively managed *ex situ* population outside of range countries is not recommended currently; should re-evaluate if status in the wild changes.
2. There are animals in Brazilian zoos to potentially start a formal program. The Brazilian Zoo Association and ALPZA should consider if this species might be a suitable model species and how it best fits within their regional plans for canids.
3. Support of *in situ* projects through funding and other resources.

KIT FOX
Vulpes macrotis

NON-THREATENED SPECIES
IUCN Red List: Least Concern
Population trend: Declining

Native to western US and Mexico (North America). San Joaquin subspecies is only found in California

Threats: Main threat to long-term survival is habitat conversion, mainly to agriculture but also to urban and industrial development. Population densities fluctuate with annual environmental conditions. Populations of the Endangered (USFWS) San Joaquin kit fox subspecies are likely still declining due to continuing habitat loss, fragmentation and degradation.

Potential Ex Situ Roles: **Direct Conservation: Conservation Education**
Indirect Conservation: Funding, Expertise. Assistance in treating and rehabilitating San Joaquin kit foxes afflicted with sarcoptic mange (active epidemic). Expertise and funding for this effort.

Prior Ex Situ Recommendations: Recommended for Nucleus II population (i.e., 25-100 animals, good management of existing *ex situ* population) for the species in general. San Joaquin subspecies is recommended for Nucleus I population (50-100 animals with GD ≥98%, requiring periodic immigrants from wild) as part of species meta-population (1992 CAMP). Research on the San Joaquin kit fox subspecies is very active.

Ex Situ Status:
Present in captivity only in the US (global *ex situ* population = 15 animals listed in ZIMS). Not managed. Reproduction in captivity since the 1960s.

	AZA / North America	Total Global *Ex Situ* Pop
Population size (M.F.U)	**15 (9.6)**	**15 (9.6)**
Living wild-born animals	12	12
Gene diversity	?	?
# Founders	6	6
# Potential founders	10?	10?
% pedigree known	100%	100%
Population trend/ lambda	Stable	Stable
# institutions	6	6
Management	Not managed	
Data source	*2016 ZIMS*	*2016 ZIMS*

M.F.U = # males.females.unknown sex

Workshop Assessment of Ex Situ Roles and Activities:
The following direct and indirect conservation roles were identified at the ICAP workshop. Roles selected to pursue following benefit/feasibility/risk analysis are marked in green.

Direct Role(s)	Benefit	Feasibility	Risk	Notes
Education In range	**HIGH**	**HIGH**	**LOW**	For endangered San Joaquin subspecies; discuss effect of habitat loss/conversion
Indirect Role(s)	**Benefit**	**Feasibility**	**Risk**	**Notes**
***In situ* support**	**HIGH**	**HIGH**	**LOW**	Zoos can provide expertise and resources and assistance for injured or sick individuals
Education Out of range	**HIGH**	**HIGH**	**LOW**	For endangered San Joaquin subspecies; discuss effect of habitat loss/conversion

Comments/Issues:

- Climate change and alternate energy implementation in current range could lead to species becoming of concern in the future.
- If an insurance population is required in the future, it could compete for space with swift foxes, but they have similar husbandry so we would be well positioned, if needed.
- An *ex situ* population of kit foxes is not required to discuss the educational messaging about this species regarding the threat from habitat loss/conversion to agriculture; swift fox (or other fox species) can be utilized for this.
- There is some question if the 15 kit foxes in North America are in AZA zoos. If they are, they may be part of rescue/rehabilitation programs in AZA zoos in California. This will be determined during the AZA-wide survey for canid and hyaenids scheduled in 2017.
- AZA zoos have the resources and expertise to assist with field-based animal needs, a point person should be identified to assist with these requests, as is being done with Island and Sierra Nevada red fox.

Workshop Recommendations:

1. A proactively managed *ex situ* population is not recommended currently; should re-evaluate if status in the wild changes.
2. For the animals existing within AZA, and rescue foxes:
    - Investigate the possibility of shifting any AZA kit foxes in zoos to swift fox. Any remaining kit foxes should be within the range states, and combine holding this species with direct education and connection to the wild population through assistance with expertise and resources.
3. AZA should work with the IUCN SSC Canid Specialist Group Swift and Kit Fox Working Group to develop a comprehensive, targeted educational program that can reach both range states and outside audiences and can be utilized for both species.
4. As needed, AZA should work to provide resources for *in situ* efforts.

PALE FOX
Vulpes pallida

NON-THREATENED SPECIES
IUCN Red List: Least Concern
Population trend: Unknown

Native to semi-arid Sahel of Africa, bordering the Sahara to the north.

Threats: No major threats known, although they may be persecuted locally. Road kills and disturbance due to oil and gas drilling might become a future threat. Locally common.

Potential Ex Situ Roles: **Indirect Conservation: Research**
One of the least understood canids (2004 CSG Action Plan). Recent field research in Niger from WildCRU and Sahara Conservation Fund (SCF) sponsored by zoos (in connection with fennec fox project).

Prior Ex Situ Recommendations: None

Ex Situ Status:
Not represented in captivity in ZIMS database or surveyed regional zoo associations.
Past holdings in Europe (1960s).

Workshop Assessment of Ex Situ Roles and Activities:
No direct and or indirect conservation roles were identified at the ICAP workshop.

Comments/Issues:

- This is one of the least studied canids, but studies are difficult to conduct in many of the countries within the species' range for political and safety reasons; this is also true for fennec fox, which co-exists in most areas where the pale fox is found.
- Where possible, research for this species should be coupled with studies of other sympatric canids or focused on desert carnivores, as so little is known about all of these species.
    - A good example of this is the project WildCRU conducted in Niger (~2009-2011) in collaboration with the Sahara Conservation Fund; this project was organized and funded by zoos in AZA and EAZA, and included radio-collaring and monitoring of pale, fennec and Ruppel's foxes along with sand and African wild cats.
- Conservation education messaging about North Africa, the Sahara, and/or desert-adapted species should include this species, e.g., using fennec fox or addax as proxy, but an *ex situ* population is not needed at this time.

Workshop Recommendations:

1. No *ex situ* population or role was identified at this time; should re-evaluate if status in the wild changes.
2. Support *in situ* research as so little is known about this species (and all Saharan carnivores).

PAMPAS FOX
Pseudalopex gymnocercus

NON-THREATENED SPECIES
IUCN Red List: Least Concern
Population trend: Increasing

Native to South America (Argentina, Bolivia, Brazil, Paraguay, Uruguay). Tolerant of human disturbance and common rural areas, where introduced exotic mammals may form the bulk of its diet.

Threats: Non-selective control measures promoted by ranchers represent a threat to this species as well as bounty systems in the absence of scientific study on population dynamics and human impacts. Direct persecution is common even where illegal. The species appears to have adapted to massive habitat alteration throughout its range.

Potential Ex Situ Roles: **Indirect Conservation: Education, Research**
Given the poor representation of the Darwin's fox and other South America foxes in professional zoos across the world, it would be advisable to set up an *ex situ* program, especially focusing on the need to mitigate the conflicts between foxes and local ranchers, a widespread problem for all these foxes. Teach differences between fox species and that some are threatened – opportunity for range state zoos. Research on genetics and epidemiology can be important because species is sympatric with other canids. Taxonomic identification may be required in captivity because often confused with other species such as crab eating fox and hoary fox.

Prior Ex Situ Recommendations: 2004 CSG Action Plan notes that research is needed, as species ecology is largely unknown and taxonomy needs to be resolved.

Ex Situ Status:
Present in captivity only in South America (global *ex situ* population = 3 animals). The IUCN Red List notes that the species has been successfully bred in captivity in Argentina and (in 1999) was the best represented carnivore species in captivity in the country.

	ALPZA / Latin & South America	Total Global *Ex Situ* Pop
Population size (M.F.U)	**3 (1.2)**	**3 (1.2)**
Living wild-born animals	3	3
Gene diversity	--	--
# Founders	--	--
# Potential founders	3	3
% pedigree known	--	--
Population trend/lambda	Stable	Stable
# institutions	2	2
Management	Not managed	
Data source	*2016 ALPZA report*	*2016 ALPZA report / ZIMS*

M.F.U = # males.females.unknown sex

Workshop Assessment of Ex Situ Roles and Activities:
The following indirect conservation roles were identified at the ICAP workshop. Roles selected to pursue following benefit/feasibility/risk analysis are marked in green.

Indirect Role(s)	Benefit	Feasibility	Risk	Notes
Research genetics	Not rated	Not rated	Not rated	To identify individuals in collections as well as address questions about hybridization and taxonomy
Education	Not rated	Not rated	Not rated	
Insurance	Not rated	Not rated	Not rated	Model species?
***In situ* support**	Not rated	Not rated	Not rated	For this species and other South American species

Comments/Issues:

- There are more individuals in South American zoos than what was found in ZIMS and the ALPZA survey. R. Cunha de Paula reports there are at least 20 in Brazilian zoos (non-ALPZA members).
- Frequently misidentified as crab-eating and hoary foxes (or the reverse); there is some suspicion that pampas and hoary foxes species can hybridize.
    - Research is needed to investigate this as well as other taxonomic issues.
- Although pampas foxes are not sympatric with Darwin's foxes, they could be a possible model species for Darwin's fox or other less common South American fox species, providing an opportunity to develop husbandry protocols and small canid expertise at those institutions.
    - Chilla may be a better choice for this.
- Individuals in zoos should be utilized to promote educational messaging about the diversity of South American fox species and co-existence with humans, especially in agricultural and ranching areas.
- There is very little known this species.
    - Potential for the *ex situ* population to provide samples for research conducted at a university within the species range should be considered. However, individuals in zoos should be definitively identified (may require genetic testing) prior to any sample/data collection.
    - Support for *in situ* projects could be beneficial.

Workshop Recommendations:

1. Survey presence in zoos in Brazil and other range countries (non-ALPZA facilities) so we have accurate global *ex situ* numbers for this species, especially given the fact pampas fox can be misidentified.
2. A proactively managed *ex situ* population outside of range countries is not recommended currently; should re-evaluate if status in the wild changes.
3. There are animals in zoos to potentially start a formal program. The Brazilian Zoo Association (SZB) and ALPZA should consider if this species might be a suitable model species and how it best fits within their regional plans for canids.
4. For individuals currently in zoos, institutions should be encouraged to:
    - Promote education educational messaging about the diversity of South American fox species, co-existence with humans, especially in agricultural and ranching areas.
    - Participate in research, as needed.
    - Support *in situ* projects through funding and other resources.

RACCOON DOG
Nyctereutes procyonoides

NON-THREATENED SPECIES
IUCN Red List: Least Concern
Population trend: Stable

Native to North and East Asia, including Japan; widely introduced into Europe.

Threats: Road kills, persecution, government attitudes, disease epidemics (scabies, distemper and rabies), and pollution are the major threats to the species across it range. Commercially farmed for fur in Finland.

Potential Ex Situ Roles:
Education: Regional/range state level management.

Ex Situ Status:
Present in captivity in 3 regions (global *ex situ* population = 300 animals). Reproduction in captivity. Japan maintains mostly Japanese subspecies *N.p. viverrinus* (n=138).

	EAZA / Europe	SEAZA / Southeast Asia	JAZA / Japan	Total Global *Ex Situ* Pop
Population size (M.F.U)	**137 (66.51.20)**	**8 (2.6)**	**155 (71.84)**	**300[1] (139.141.20)**
Living wild-born animals	19	?	14+	33+[1]
Gene diversity	?	?	?	?
# Founders	11	?	?	11+[1]
# Potential founders	8?	?	?	?
% pedigree known	24%	?	?	?
Population trend/ lambda	Increasing	?	Stable?	Increasing[2]
# institutions	41	1	40	82[1]
Management	Not managed	Not managed	No formal program	
Data source	*2016 ZIMS*	*2016 ZIMS*	*2016 JAZA report*	*[1]column sums; [2]2016 ZIMS*

M.F.U = # males.females.unknown sex

Workshop Assessment of Ex Situ Roles and Activities:
No potential *ex situ* conservation roles were identified at the ICAP workshop.

Comments/Issues:

- Taxonomy (subspecies) may be an issue, especially outside of Japan.
- The raccoon dog is under consideration to be added to the EU's list of alien invasive species and therefore is being phased out in EAZA/European zoos. EAZA should coordinate with JAZA to ensure that any individuals from EAZA needed for the JAZA population are made available during the phase out.
- Spaces currently occupied by raccoon dogs in European zoos are appropriate for cold-tolerant species (perhaps bush dogs or non-canid small carnivores).

Workshop Recommendations:

1. Phase out raccoon dogs in European zoos (in consultation with JAZA).
2. Identify cold-tolerant species that could replace raccoon dogs in European zoos (consult with Small Carnivore TAG regarding potential replacements).
3. Defer to JAZA on the regional decision how to manage this native species within Japanese zoos.

Supporting Documents

http://ec.europa.eu/environment/nature/invasivealien/index_en.htm

RED FOX
Vulpes vulpes

NON-THREATENED SPECIES
IUCN Red List: Least Concern
Population trend: Stable

Distributed across the entire northern hemisphere from the Arctic Circle to North Africa, Central America, and the Asiatic steppes. Introduced to Australia and New Zealand. Widest geographic range of any carnivore. Opportunistic and well adapted to agricultural and urban areas. Currently not under threat.

Threats: Main threats include habitat degradation, loss and fragmentation, exploitation, and direct and indirect persecution.

Potential Ex Situ Roles: *Identified only for the Sierra Nevada red fox (V.v. necator)*

Direct Conservation: Captive Breeding. This sub-species is in need of consideration for conservation interventions, potentially including *ex situ* breeding and translocations. A Sierra Nevada red fox conservation working group has been formed, including representatives of land and wildlife management agencies and academic institutions, and they are beginning a conservation strategy that will incorporate assessing the feasibility of such actions. Breeding could be at zoos or in species range.

Indirect Conservation: Capacity Building, Fundraising, Lobbying and Legislation. Zoos potentially can: provide knowledge, experience or training to build capacity for captive breeding; fundraising to contribute to high priority *in situ* projects; and networking and lobbying to influence opinions and legislation.

Prior Ex Situ Recommendations: Recommend phase out of captive populations (1992 CAMP).

Ex Situ Status:
Present in captivity in most regions (estimated global *ex situ* population = 389+ animals). Reproduction in captivity. Japan maintains mostly Japanese subspecies *V.v. japonica* (n=44). Widely kept in fur farms, small wildlife parks and zoos. Extremely shy and therefore often poor exhibit animals.

	AZA/North America	ALPZA/Latin & So Amer	EAZA / Europe	PAAZA / Africa	JAZA / Japan	KAZA/South Korea	Others ZPO & ZAA	Total Global *Ex Situ* Pop
Population size (M.F.U)	**94 (50.44)**	**6 (4.2)**	**178 (85.63.30)**	**9 (1.0.8)**	**48 (25.23)**	**46 (15.22.9)**	**8 (4.4)**	**389[1] (184.158.47)**
Living wild-born	?	?	?	?	?	?	?	129+[2]
Gene diversity	?	?	?	?	?	?	?	?
# Founders	?	?	?	?	?	?	?	39[2]
# Potential fdrs	?	?	?	?	?	?	?	?
% pedigree kn	?	?	?	?	?	?	?	45%[2]
Pop trend	?	?	?	?	?	?	?	Increasing[2]
# institutions	49	1	49	1	23	1	2	126[1]
Management	Not managed	Not managed	Not managed	Not managed	Not managed	Not managed	Not managed	
Data source	*2016 ZIMS*	*2016 ZIMS*	*2016 ZIMS*	*2016 ZIMS*	*2016 JAZA report*	*2016 ZIMS*	*2016 ZIMS*	*[1]column sums [2]2016 ZIMS*

*M.F.U = # males.females.unknown sex; *additional contracepted individuals indicated in ()*

Workshop Assessment of Ex Situ Roles and Activities:

The following direct and indirect conservation roles were identified for the Sierra Nevada sub-species at the ICAP workshop. Roles selected to pursue following benefit/feasibility/risk analysis are marked in green.

Direct Role(s)	Benefit	Feasibility	Risk	Notes
Education In range	**HIGH**	**MODERATE**	**LOW**	For Sierra Nevada red fox sub-species
Indirect Role(s)	**Benefit**	**Feasibility**	**Risk**	**Notes**
Education Outside range	**HIGH**	**MODERATE**	**LOW**	For Sierra Nevada red fox sub-species
***In situ* support**	**HIGH**	**MODERATE**	**LOW**	Zoos can provide expertise and resources as needed

Comments/Issues:

- Strong suspicion that the ZIMS numbers for North America reflect primarily non-AZA institutions; the estimate for AZA is 25-40 red foxes, but a AZA-wide survey for canid and hyaenids is scheduled in 2017 so exact numbers will be known then.
- EAZA has a large population; they had already planned to recommend a phase-out in order to use those spaces for another small canid species with higher conservation need.
- Recently discovered Sierra Nevada subspecies is apparently in steep decline and the newly formed working group would like an *ex situ* population. This would not be a rescue situation, but more of a population restoration.
    - Questions exist about the feasibility of this request given the restrictions imposed by California Department of Fish and Game for threatened species and what has been the history of the Island fox program in that state.
    - Very little information was known about the specific needs at the time of the ICAP meeting, which is why feasibility is listed as moderate.
- Generally a challenging species to have in zoos as they are skittish, nervous, and shy. Reproduction does occur with the proper husbandry conditions. Note there is some overlap in husbandry knowledge with swift fox.
- Hard to justify holding this species beyond facilities within its range. Even within the range questionable role for conservation, if not tied to newly discovered subspecies in decline (Sierra Nevada red fox).
- An *ex situ* population of red fox is not required to discuss the educational messaging about this species or the Sierra Nevada subspecies; other canids can be utilized for this.
- AZA zoos have the resources and expertise to assist with the request for assistance from the Sierra Nevada Working Group to mitigate threats to this subspecies. A point person should be identified to assist with these requests, as has being done with Island and kit fox.

*Workshop Rec*ommendations:

1. Not recommended as an *ex situ* program at this time unless status in the wild changes.
2. Specific to the Sierra Nevada red fox subspecies, AZA should name a point person located at an AZA zoo in California to be the point of contact for the Sierra Nevada Red Fox Working Group. Resources and expertise should be provided as needed to this group.
3. Educational messaging should be targeted in California about the Sierra Nevada red fox subspecies.

SAND (RUPPELL'S) FOX
Vulpes rueppellii

NON-THREATENED SPECIES
IUCN Red List: Least Concern
Population trend: Stable

Native to desert and semi-desert regions of North Africa and mountains and fringes of the Sahara Desert. Thinly distributed across the Arabian Peninsula.

Threats: Direct and indirect persecution by hunting and indiscriminate use of poisons. In some regions, displaced by expanding red fox populations with human settlements.

Potential Ex Situ Roles: No responses for this species prior to the workshop

Prior Ex Situ Recommendations: Maintain captive breeding populations in the UAE for public awareness and education (2000 Arabian Carnivore CAMP).

Ex Situ Status:
Present in captivity in 2 regions (global *ex situ* population = 49 animals). Not formally managed. Some reproduction in captivity in the region.

	EAZA (Europe) Other than UAE	AZAA/ EAZA In UAE	Total Global *Ex Situ* Pop
Population size (M.F.U)	**7 (3.4)**	**42 (20.22)**	**49 (23.26)**
Living wild-born animals	?	?	1
Gene diversity	?	?	?
# Founders	?	?	26
# Potential founders	?	?	?
% pedigree known	?	?	34%
Population trend/ lambda	?	?	Increasing
# institutions	1	4	5
Management	Not managed	No formal program	
Data source	*2017 ZIMS*	*2017 ZIMS*	*2017 ZIMS*

M.F.U = # males.females.unknown sex

Workshop Assessment of Ex Situ Roles and Activities:
The following indirect conservation role was identified at the ICAP workshop. Roles selected to pursue following benefit/feasibility/risk analysis are marked in green.

Indirect Role(s)	Benefit	Feasibility	Risk	Notes
Education	Not rated	Not rated	Not rated	Focus on in-range conservation messages

Comments/Issues:

- There was some question regarding the *ex situ* numbers listed, as most EAZA animals are physically located in UAE. Update: ZIMS (April 2017) shows 7 (3.4) at one EAZA-member facility in Spain and 42 in the UAE (updated numbers are presented in the table).
- This species is used for public awareness and education in the UAE (its native range).
- Conservation education focus should be on in-range education messages.
- Little attention is paid to North African habitats and animals in North American zoos; potential to collaborate with other TAGs (e.g., felids, antelope, etc.) on messaging.

Workshop Recommendations:

1. Encourage AZAA (Arabian Zoo and Aquarium Association) to continue to manage and address local education messages as they deem appropriate.
2. Encourage conservation messages for North African species and habitat (similar conservation message as for fennec fox). Perhaps collaborate with other TAGs (e.g., felids, antelope) on this.
3. Do not acquire in zoos outside of native range (UAE) unless status in the wild changes.

SWIFT FOX
Vulpes velox

NON-THREATENED SPECIES
IUCN Red List: Least Concern
Population trend: Stable

Native to short-grass and mixed-grass prairies of the Great Plains in North America. Populations are fragmented over much of its distribution. Extirpated from Canada by 1938; reintroductions since 1983 have established a small population in Alberta and Montana (sourced from captive breeding programs as well as wild-to-wild translocations). Reintroductions are being implemented in South Dakota and Montana.

Threats: Ongoing conversion of grassland prairies to cropland threatens to reduce and further fragment populations, primarily through impacts on prey availability, increased vulnerability of foxes to predation, and interspecific competition with other carnivores. Oil and gas development, urbanization, changes in farming practices and other ongoing habitat and land use changes are likely to negatively impact this prairie specialist species. Knowledge gap in disease transfer between sympatric canids (wild and domestic).

Potential Ex Situ Roles:

Direct Conservation: Conservation Education. Conservation education focused on landowners and managers in the prairies could increase the ability to successfully recover this species (viewed negatively as a nuisance).

Indirect Conservation: Education, Surrogate. Conservation education for zoo visitors could have a positive impact on swift fox recovery by enhancing understanding that the species is beneficial to regional biodiversity and to crop-growers by consuming insects and rodents. Non-releasable foxes are suitable for education programs and for gaining husbandry experience. Foxes from secure or increasing populations could serve as a surrogate for research applying to rarer fox species.

Prior Ex Situ Recommendations: Recommended for Nucleus II population (i.e., 25-100 animals, good management of existing *ex situ* population); possible reintroduction (1992 CAMP). The Swift Fox Conservation Team is reviewing the potential for reintroduction and other conservation actions.

Ex Situ Status:

Present in captivity in 2 regions (global *ex situ* population = 65 animals). Managed by AZA SSP program.

	AZA / North America	EAZA / Europe	Total Global *Ex Situ* Pop
Population size (M.F.U)	**60 (23.35.2)**	**5 (1.4)**	**65[1] (24.39.2)**
Living wild-born animals	2?	?	?
Gene diversity	91.5%	?	?
# Founders	18	?	18+[1]
# Potential founders	?	?	?
% pedigree known	97%	?	89%+[2]
Population trend/ lambda	1.03	?	Stable[2]
# institutions	22	2	24[1]
Management	SSP managed	Not managed	
Data source	*2015 AZA B&T plan*	*2016 ZIMS*	*[1]column sums; [2]2016 ZIMS*

M.F.U = # males.females.unknown sex

Workshop Assessment of Ex Situ Roles and Activities:

The following direct and indirect conservation roles were identified at the ICAP workshop. Roles selected to pursue following benefit/feasibility/risk analysis are marked in green.

Direct Role(s)	Benefit	Feasibility	Risk	Notes
Education	**HIGH**	**HIGH**	**LOW**	Good message Focus on landowners
Indirect Role(s)	**Benefit**	**Feasibility**	**Risk**	**Notes**
Education	**HIGH**	**HIGH**	**LOW**	Increase public understanding of prairie ecosystem and swift fox's role
Surrogate species	**HIGH**	**HIGH**	**LOW**	Serve as surrogate for research applying to rarer fox species
***In situ* support**	**Not rated**	**Not rated**	**Not rated**	
Insurance	**Not rated**	**Not rated**	**Not rated**	

Comments/Issues:

- Due to increasing population, swift foxes have been down-listed to threatened in Canada yet prairie ecosystems are under threat.
- US Swift Fox Conservation Team is monitoring the wild population in all 10 states; future reinforcement likely to use wild stock, so source population not needed.
- Captive population was started based on a recommendation from this team; SSP formed to support Swift Fox Conservation Team through educational efforts and was designed to be maintained as a small population, maintained at a sustainable level as an insurance population due to periodic imports/rescues, on an as needed basis.
    - Therefore, education should be the primary focus of this population given Team request and *in situ* needs. Messaging should be about this species (and potentially kit fox), and the threat from habitat loss/conversion to agriculture and the prairie ecosystem.
- AZA zoos have the resources and expertise to assist with field-based animal and research needs, in addition to potentially assisting with funding support.
- Husbandry practices for swift (and fennec fox) should be well documented to be utilized as the basis (with fennec fox husbandry) for any newly established *ex situ* fox program.

Workshop Recommendations:

1. A proactively managed *ex situ* population is recommended for this species to represent swift (and North American) foxes; continue a close association with the US Swift Fox Conservation Team.
2. AZA to work with the IUCN SSC Canid Specialist Group Swift and Kit Fox Working Group and the US Swift Fox Conservation Team to develop a comprehensive, targeted educational program that can reach both range states and outside audiences.
3. As needed, AZA should work to provide resources and assistance for *in situ* efforts.

TIBETAN FOX
Vulpes ferrilata

NON-THREATENED SPECIES
IUCN Red List: Least Concern
Population trend: Unknown

Native to the steppes and semi-deserts of North and Central Asia (China, India and Nepal).

Threats: No major threats, although poisoning programs of pikas (major prey species) in much of the Tibetan plateau is a concern and potential threat if continued. Mortality due to domestic dogs can be a threat in some areas.

Potential Ex Situ Roles: No responses for this species prior to the workshop

Prior Ex Situ Recommendations: None

Ex Situ Status:
Not represented in captivity in ZIMS database or surveyed regional zoo associations. No information to indicate historical holdings in captivity.

Workshop Assessment of Ex Situ Roles and Activities:
No potential *ex situ* conservation roles were identified at the ICAP workshop.

Comments/Issues:
Due to the absence of this species currently or historically in captivity, the lack of availability of individuals for an *ex situ* population, and non-threatened status of this species in the wild, there is no direct conservation value of developing an *ex situ* program. *Ex situ* resources can be better used if invested in other species.

Workshop Recommendation:
Not recommended for *ex situ* management unless status in the wild changes (declines).

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SECTION 6

Taxon Sheets: Hyaenids

Taxon Sheets: Hyaenids

4 Taxa Assessed

For the purposes of this ICAP workshop, we have included the Red List category of Near Threatened (NT) under "Threatened" taxa along with Vulnerable (VU), Endangered (EN), Critically Endangered (CR), and Extinct in the Wild (EW). Using this categorization:

Two hyaenids are listed as Threatened on the IUCN Red List, one of which is held in captivity in significant numbers (i.e., at least 100 individuals) and in multiple regions. Two hyaenids are non-threatened, one of which is held in captivity in significant numbers.

For the purposes of this ICAP workshop, we have included the Red List category of Near Threatened (NT) under "Threatened" taxa.

The table below lists the estimated global *ex situ* population size for each hyaenid. Taxon sheets are presented in alphabetical order, first for Threatened taxa and then for non-threatened taxa. These sheets summarize *in situ* status and threats, *ex situ* demographic and genetic status, prior *ex situ* conservation recommendations, and ICAP assessment of potential *ex situ* roles, benefit, risks, feasibility, and recommendations.

	Current *Ex Situ* Population Size			
Status	**Large pop (>100)**	**Small pop (40-100)**	**Very small pop (<40)**	**Not in captivity**
Threatened	Striped hyena (253)		Brown hyena (13)	
Non-threatened	Spotted hyena (275)		Aardwolf (6)	

BROWN HYENA
Hyaena brunnea

THREATENED SPECIES
IUCN Red List: Near Threatened
Population trend: Stable

Native to Southern Africa.

Threats: Deliberate and incidental persecution, related to perceived livestock depredation and traditional medicine use. Decline of mature individuals. Persecution led to local extinction in parts of southeastern Namibia, where increasing human-wildlife conflict may lead to further decline. Increased efforts to educate farmers and pastoralists that brown hyenas pose very little risk to livestock is likely to enhance conservation of this species.

Potential Ex Situ Roles:
Direct Conservation: Range State Education. Use *ex situ* individuals in range states to reduce reputation as livestock killers and to reduce keeping hyenas as pets in backyard zoos.
Indirect Conservation: Education, Fundraising, Expertise. Target education efforts to improve knowledge and image inside and outside of range states. Zoos can educate visitors in their own facilities and produce education materials for range state facilities. Use to raise funds for high priority *in situ* projects, in particular for range state researchers. Share expertise (e.g., research, capture veterinary assistance).

Prior Ex Situ Recommendations: Recommended for Nucleus I population held in Africa (50-100 animals with GD ≥98%, requiring periodic immigrants from wild) as part of meta-population (1992 CAMP).

Ex Situ Status:
Present in small numbers in captivity in 3 regions (global *ex situ* population = 13 animals). Not managed. Reproduction in captivity.

	EAZA / Europe	PAAZA / Africa	SEAZA (Taiwan)	Total Global *Ex Situ* Pop
Population size (M.F.U)	**7 (4.3)**	**4 (2.2)**	**2 (1.1)**	**13 (7.6)**
Living wild-born	?	?	?	5 (3.2)
Gene diversity	?	?	?	?
# Founders	?	?	?	4
# Potential fdrs	?	?	?	?
% pedigree kn	?	?	?	65%
Population trend/ lambda	?	?	?	Declining
# institutions	3	1	1	5
Management	Not managed	Not managed	Not managed	
Data source	*2016 ZIMS*	*2016 ZIMS*	*2016 ZIMS*	*2016 ZIMS*

M.F.U = # males.females.unknown sex

Workshop Assessment of Ex Situ Roles and Activities:

The following direct and indirect potential conservation roles were identified at the ICAP workshop. Roles selected to pursue following benefit/feasibility/risk analysis are marked in green.

Direct Role(s)	Benefit	Feasibility	Risk	Notes
Education In range	HIGH	LOW	LOW	Counter (perceived) livestock conflict issues; help improve public perception of hyenas (as worth saving). Since there are low numbers in zoos, this role will largely have to be delivered through other hyena species
Training/expertise / *in situ* support	HIGH	HIGH	LOW	Make expertise (e.g. on immobilizations, etc.) and resources available to *in situ* projects.
Insurance Potentially in future but currently not needed	LOW	LOW	HIGH	*In situ* population is stable; there is no established *ex situ* population to use as a basis; an expanded population of this species could take up space (and other resources) of other species more in need.
Indirect Role(s)	**Benefit**	**Feasibility**	**Risk**	**Notes**
Education Outside range	HIGH	LOW	LOW	Counter (perceived) livestock conflict issues; help improve public perception of hyenas (as worth saving) and channel carnivore conservation funding towards hyenas as well. Since there are low numbers in zoos, this role will largely have to be delivered through other hyena species

Comments/Issues:

- The population in the wild is currently stable and for most part needed habitat is intact and not overlapping with humans.
- Education is the primary need for this and all hyena species – to increase understanding of their role in the ecosystem, their relationship with other carnivores in terms of carcass availability, help people perceive them as worth conserving and help make carnivore conservation funding available to hyenas as well. Although brown hyenas pose little threat to livestock, they are still killed because of the perceived threat. Given the small population of brown hyenas, educational messaging will largely have to be achieved with striped or spotted hyenas.
- The Kansas City Zoo is supporting a brown hyena project on the Namibian coast. It would be very valuable to expand this type of support.
- Given the Near Threatened status, it would seem wise to continue monitoring if an insurance population may be needed in the future.

Workshop Recommendations:

1. Currently no proactive recommendation to increase the *ex situ* population of this species.
2. Zoo associations to use the populations of striped and spotted hyenas (as well as the few brown hyenas kept) to increase support (expertise, in kind and financial) to *in situ* projects on brown hyenas.
3. Zoo associations to use the populations of striped and spotted hyenas (as well as the few brown hyenas kept) to (in collaboration with the IUCN SSC Hyena Specialist Group) develop a comprehensive, targeted educational program that can reach both range country and outside audiences and can be utilized for all species of hyena.
4. Remain in contact with the IUCN SSC Hyena Specialist Group to monitor the potential future need for an insurance population of brown hyena.

STRIPED HYENA
Hyaena hyaena

THREATENED SPECIES
IUCN Red List: Near Threatened
Population trend: Declining

Native to North and East Africa, Middle East, and South Asia. Patchy distribution.

Threats: Deliberate and incidental persecution (especially poisoning) coupled with a decrease in wild and domestic carrion provided by other large carnivores in decline and changing livestock practices. Local extinctions in many localities and declining throughout its range. Almost qualifies as Threatened.

Potential Ex Situ Roles:

Direct Conservation: Range State Education. Use *ex situ* individuals in range states to reduce reputation as livestock killers and to reduce keeping hyenas as pets in backyard zoos. Well-designed public awareness programs have been very successful in changing attitudes to promote conservation (IUCN RL).

Indirect Conservation: Education, Fundraising, Expertise. Target education efforts to improve knowledge and image inside and outside of range states. Zoos can educate visitors in their own facilities and produce education materials for range state facilities. Use to raise funds for high priority *in situ* projects, in particular for range state researchers. Share expertise (rescue team and rehabilitation of injured animals, handling animals in the field, improved welfare in Iranian zoos).

Prior Ex Situ Recommendations: Recommended for Nucleus II population in range states (i.e., 25-100 animals, good management of existing *ex situ* population) as part of meta-population management (1992 CAMP). Maintain current collection for education purposes (2000 Arabian Carnivore CAMP).

Ex Situ Status:
Present in captivity in almost all regions (estimated global *ex situ* population = 243 animals). Managed program in EAZA. Good reproduction in captivity and stable/increasing slightly globally.

	AZA / No Amer	ALPZA/Latin & So Amer	EAZA / UAE & Europe	PAAZA/ Africa	CZA / India	SEAZA/ SE Asia	JAZA / Japan	Total Global *Ex Situ* Pop
Population size (M.F.U)	**23 (11.12)**	**24 (11.13)**	**79 (30.43.6)**	**9 (2.7)**	**86 (40.36.10)**	**16 (6.8.2)**	**6 (4.2)**	**243 (104.121.18)**
Living wild-born	?	?	?	?	?	?	?	>35
Gene diversity	?	?	88.3%	?	?	?	?	?
# Founders	?	?	13	?	?	?	?	24+
# Potential fdrs	?	Some?	1	?	Many?	?	?	Some
% pedigree kn	?	?	39%	?	?	?	?	?
Population trend/ lambda	?	?	1.038 (LT stable)	?	Declining	?	?	Increasing
# institutions	9	4	33	3	30	3	2	84
Management	Not managed	Not managed	EEP managed	Not managed	No formal program	Not managed	Not managed	
Data source	*2016 ZIMS*	*2016 ALPZA rpt*	*2015 EAZA ESB*	*2016 ZIMS*	*2016 CZA report*	*2016 ZIMS*	*2016 JAZA rpt*	*[1]column sums; [2]2016 ZIMS*

M.F.U = # males.females.unknown sex

Workshop Assessment of Ex Situ Roles and Activities:

The following direct and indirect potential conservation roles were identified at the ICAP workshop. Roles selected to pursue following benefit/feasibility/risk analysis are marked in green.

Direct Role(s)	Benefit	Feasibility	Risk	Notes
Education In range	**HIGH**	**HIGH**	**LOW**	Counter (perceived) livestock conflict issues. Help improve public perception of hyenas (as worth saving). In zoos, requires good attractive exhibits to improve image and a targeted effort.
Research Taxonomic	**MODERATE**	**MODERATE**	**MODERATE**	The taxonomy both *in situ* and *ex situ* needs clarification. Zoos can contribute with samples, expertise, resources.
Insurance Potentially in future but not currently needed	**LOW**	**MODERATE**	**MODERATE**	Currently low priority (still appear to be doing ok in many locations). Lack of taxonomic clarity and certainty complicates this.
Indirect Role(s)	**Benefit**	**Feasibility**	**Risk**	**Notes**
Research General species biology	**MODERATE**	**HIGH**	**LOW**	Relatively little known about this carnivore: research on zoo animals + support graduate students & project staff in range countries (modest funds reach a long way)
Education Outside range	**HIGH**	**HIGH**	**LOW**	Counter (perceived) livestock conflict issues. Help improve public perception of hyenas (as worth saving) and channel carnivore conservation funding towards hyenas as well (all species). In zoos, requires good attractive exhibits to improve image and a targeted effort.

Comments/Issues:

- Results of IUCN SSC Hyena Specialist Group supported camera trap studies in new locations (e.g.,in African and Nepal) suggest that the wild population may be in better shape than originally thought - the species was found in all locations studied. India may be an exception. There are a lot of human/hyena conflicts - the striped hyenas damage livestock, resulting in retaliatory killing and a declining population.
- There are likely different subspecies in the wild, but the *in situ* taxonomy is still unclear and uncertain and requires more research/ genetic testing. It is also not clear if certain subspecies are more vulnerable than others.
- The global zoo population counts almost 250 individuals, in seven regional zoo associations. There is no international studbook and both the taxonomic status of, and the level of genetic diversity within, the global population is unclear.
- The majority of the EAZA population is of unknown origin/subspecies and are likely a mix from African and Asian origins. A small subset is thought to be *H. h. sultana* (no molecular confirmation) and these are managed separately as a precaution, until taxonomy of the species is more clear. Breeding success seems to have declined in past few years, possibly due to inbreeding?
- CZA zoos only hold individuals from the Indian subspecies; they enter the zoos through rescues etc. Reproduction is very low. There are also individuals in rescue centers and non-CZA collections. With extra attention there is the potential to create a managed breeding population in CZA.
- There were recent imports to AZA from ZAA.

- This is one of few large carnivores about which relatively little is known. Zoos could really help build knowledge about their general biology (even with individuals of uncertain subspecies status).
- Education is the primary need for this and all hyena species – to increase understanding of their role in the ecosystem, their relationship with other carnivores in terms of carcass availability, help people perceive them as worth conserving and help make carnivore conservation funding available to hyenas. Hyenas can be popular –people travel to see them in the wild.

Workshop Recommendations:

1. Zoo associations to work with the IUCN SSC Hyena Specialist Group to develop a comprehensive, targeted educational program that can reach both range country and outside audiences and can be utilized for all species of hyena.
2. Conduct taxonomic investigation of the individuals *ex situ* and contribute to clarifying the *in situ* taxonomy.
3. Evaluate methods for increased communication between all regional zoo associations holding his species to manage cooperatively at a low level of intensity. Europe, UAE, and CZA have the largest focus on this species and it might make most sense for them to continue to provide the majority of the spaces for this taxon; AZA is likely to play a lesser, more supporting role with a very small population.
4. Conduct research into the general biology of the species.
5. Provide technical (e.g. veterinary) expertise and support as needed for smaller regional zoo associations or range countries (e.g. Iran) – e.g. help for injured and rescued individuals.

AARDWOLF
Proteles cristata

NON-THREATENED SPECIES
IUCN Red List: Least Concern
Population trend: Stable

Native to Sub-Saharan Africa in two distinct areas (northern and southern subspecies), dependent upon *Trinervitermes* termite distribution (principle food source).

Threats: Widespread (although not common) in numerous protected areas with no major threats leading to range-wide decline. Urbanization and farming practices that destroy termites may have negative impacts.

Potential Ex Situ Roles: **Indirect Conservation: Education, Fundraising**
Education efforts with aardwolves to improve knowledge and image inside and outside of range states can help other hyaenid species. Zoos can educate visitors in their own facilities and produce education materials for range state facilities. A surrogate species to raise funds for threatened hyaenids.

Prior Ex Situ Recommendations: Recommended for Nucleus II population in range states (i.e., 25-100 animals, good management of existing *ex situ* population) as part of species meta-population management (1992 CAMP). *Ex situ* population has since decreased from 36+ to 6.

Ex Situ Status:
A few specimens present in captivity in 2 regions (global *ex situ* population = 6 animals). Not managed. Reproduction in captivity in the past in the US and Europe in the 1970s and 1980s.

	AZA / North America	EAZA / Europe	Total Global *Ex Situ* Pop
Population size (M.F.U)	**2 (1.1)**	**4 (2.2)**	**6 (3.3)**
Living wild-born animals	2 (1.1)	4 (2.2)	6 (3.3)
Gene diversity	--	--	--
# Founders	0	0	0
# Potential founders	2	4	6
% pedigree known	100%	100%	100%
Population trend/ lambda			
# institutions	1	2	3
Management	Not managed	Monitored program	
Data source	*2016 ZIMS*	*2016 ZIMS*	*2016 ZIMS*

M.F.U = # males.females.unknown sex

Workshop Assessment of Ex Situ Roles and Activities:
The following direct and indirect conservation roles were identified at the ICAP workshop. Roles selected to pursue following benefit/feasibility/risk analysis are marked in green.

Indirect Role(s)	Benefit	Feasibility	Risk	Notes
Education	**LOW**	**LOW**	**HIGH**	Poor exhibit value

Comments/Issues:

- Smaller in size (and exhibit needs) than other hyaenids, but do not exhibit well. Striped or spotted hyaenas make better exhibits to link to identified educational needs for all hyaenids.
- Maintained in EAZA as a monitored species for education about hyaenid conservation, but most institutions would select another species to hold.
- Difficult species to maintain well in captivity (welfare concerns).
- If education (to improve the image of hyaenids) and not taxonomic uniqueness is the focus, then another hyaenid is a better choice.
- There is some husbandry knowledge to start a program if one is needed in the future.

Workshop Recommendations:
Not recommended for *ex situ* management unless status in the wild changes (declines).

SPOTTED HYENA
Crocuta crocuta

NON-THREATENED SPECIES
IUCN Red List: Least Concern
Population trend: Declining

Native to Sub-Saharan Africa.

Threats: Continuing decline outside protected areas (and within some protected areas) due to habitat loss and persecution (culling, trapping and poisoning). A pressing threat is the hyena's bad reputation, and a lack of knowledge and understanding of the status, threats and ecology of all hyena species.

Potential Ex Situ Roles: **Indirect Conservation: Education, Fundraising**
Education efforts with spotted hyenas to improve knowledge and image inside and outside of range states can help other hyaenid species. Zoos can educate visitors in their own facilities and produce education materials for range state facilities. A surrogate species to raise funds for threatened hyaenids.

Prior Ex Situ Recommendations: Recommended for Nucleus II population in range states (i.e., 25-100 animals, good management of existing *ex situ* population) as part of species meta-population management (1992 CAMP).

Ex Situ Status:
Present in captivity in almost all regions in modest numbers (estimated global *ex situ* population = 265 animals). Managed programs in AZA and EAZA. Good reproduction in captivity and increasing globally.

	AZA / North America	ALPZA / Latin & So America	EAZA / Europe	PAAZA / Africa	ZPO / Thailand	SEAZA / SE Asia	JAZA / Japan	ZAA / Austral-asia	Total Global *Ex Situ* Pop
Population size (M.F.U)	**55 (30.25)**	**26 (9.17)**	**102 (44.47.11)**	**20 (5.8.7)**	**21 (8.4.9)**	**13 (8.3.2)**	**15 (10.4.1)**	**13 (9.3.1)**	**265[1] (123.111.31)**
Living wild-born animals	?	18	?	?	?	?	?	?	8[2] (4.4)
Gene diversity	91%	?	91.4%	?	?	?	?	?	High?
# Founders	19	?	15	?	?	?	?	?	43[2]
# Potential fdrs	2	?	?	?	?	?	?	?	?
% pedigree known	66%	?	92%	?	?	?	?	?	36%[2]
Population trend/ lambda	0.938	?	1.042	?	?	?	?	?	Increasing[2]
# institutions	22	5	30	5	5	1	10	4	82[1]
Management	SSP managed	No formal program	EEP managed	Not managed	Not managed	Not managed	No formal program	Not managed	
Data source	*2015 AZA B&T plan*	*2016 ALPZA rpt*	*2015 EAZA Regional SB*	*2016 ZIMS*	*2016 ZIMS*	*2016 ZIMS*	*2016 JAZA rpt*	*2016 ZIMS*	*[1]column sums; [2]2016 ZIMS*

M.F.U = # males.females.unknown sex

Workshop Assessment of Ex Situ Roles and Activities:

The following direct and indirect potential conservation roles were identified at the ICAP workshop. Roles selected to pursue following benefit/feasibility/risk analysis are marked in green.

Indirect Role(s)	Benefit	Feasibility	Risk	Notes
Education In and outside range	**HIGH**	**HIGH**	**LOW**	Help improve public perception of hyenas (as worth saving) and channel carnivore conservation funding towards hyenas as well (all species). In zoos, requires good attractive exhibits to improve image and a targeted effort.
***In situ* support**	**Not rated**	**Not rated**	**Not rated**	Fundraising, especially for projects for threatened taxa (e.g., striped or brown hyenas)

Comments/Issues:

- Only hyaenid species managed in AZA.
- Eighteen of the 26 individuals in ALPZA are wild caught from Namibia (as part of an agreement between Cuba and Namibia).
- Active, social attractive exhibit species and is used to present carnivore biology in general; also have unique adaptations and has been used in non-conservation research.
- Education is the primary need/role for this and all hyena species – to increase understanding of their scavenger role in the ecosystem, their relationship with other carnivores in terms of carcass availability, help people perceive them as worth conserving and help make carnivore conservation funding available to hyenas. Messaging could be more closely linked to on-going field efforts.

Workshop Recommendations:

1. Zoo associations to work with the IUCN SSC Hyena Specialist Group to develop a comprehensive, targeted educational program that can reach both range country and outside audiences and can be utilized for all species of hyena.
2. Regional zoo programs should work together to manage each hyaenid species at the appropriate level using good demographic and genetic management.
3. Regional associations should collaborate with the IUCN SSC Hyaenid Specialist Group regarding transfer of conservation funds to support *in situ* conservation efforts for hyaenid species.

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SECTION 7

Reference Material for Assessment

References Used for ICAP Assessment

Population Biology and Management / Conservation

Baker, A., R.C. Lacy, and K. Traylor-Holzer. 2011. Intensive management of populations for conservation. *WAZA Magazine* 12: 40-43.

Barongi, R., F.A. Fisken, M. Parker and M. Gusset, Editors. 2015. *Committing to Conservation: The World Zoo and Aquarium Conservation Strategy.* WAZA Executive Office, Gland.

Byers, O., C. Lees, J. Wilcken, and C. Schwitzer. 2013. The 'One Plan Approach': The philosophy and implementation of CBSG's approach to integrated species conservation planning. *WAZA Magazine* 14: 2-5.

CBSG. 2011. *Intensively Managed Populations for Conservation Workshop Report*. IUCN SSC Conservation Breeding Specialist Group: Apple Valley, MN. 102pp.

Ceballos, G., P.R. Ehrlich, A.D. Barnosky, A. García, R.M Pringle, T.M. Palmer. 2015. Accelerated modern human–induced species losses: Entering the sixth mass extinction. *Science Advances* 19 Jun 2015: Vol. 1, no. 5, e1400253DOI: 10.1126/sciadv.1400253.

de Man, D., K. Leus, and B. Holst. 2016. Creating a flexible future*. Zooquaria* Spring 2016. Issue 93. Special Issue. 26-27.

Dorsey, C., D.E. Luke and P. Boyle. 2013. Cooperative Science Programs. Pg. 555-562 in: *Zookeeping: an introduction to the science and technology,* Irwin, M.D., Stoner, J.B. & Cobaugh, A.M. (eds.). University of Chicago Press: Chicago.

Gilpin, M. E. & M. E. Soulé. 1986. Minimum viable populations: processes of species extinction. Pg. 19-34 in *Conservation Biology: The Science of Scarcity and Diversity*, ed. M.E. Soulé. Sunderland: Sinauer Associates.

Gusset, M. 2013. Global Species Management Plans: whence and wither. *WAZA News* 1/13: 20.

IUCN SSC. 2014. *Guidelines on the Use of Ex Situ Management for Species Conservation. Version 2.0*. Gland, Switzerland: IUCN Species Survival Commission.

Johson, B., N. Clausen, N. and L. Faust. 2014. Assessing the sustainability of AZA's animal programs using population viability analysis. *Connect* August 2014: 8-11.

Lacy, R.C. 2000. Considering threats to the viability of small populations using individual-based models. *Ecological Bulletins* 48: 39-51.

Lees, C. M. and J. Wilcken. 2009. Sustaining the Ark: the challenges faced by zoos in maintaining viable populations. *International Zoo Yearbook* 43: 6-18.

Leus, K., L.B. Lackey, W. van Lint, D. de Man, S. Riewald, A. Veldkam and J. Wijmans. 2011. Sustainability of European Association of Zoos and Aquaria Bird and Mammal Populations. *WAZA Magazine* 12: 11-14.

Long, S., C. Dorsey and P. Boyle. 2011. Status of Association of Zoos and Aquariums cooperatively managed populations. *WAZA Magazine* 12: 15-18.

Mallon, D. P. and M.R. Stanley Price. 2013. The fall of the wild. *Oryx* 47(4): 467–468.

McGowan, P.J.K., K. Traylor-Holzer and K. Leus. 2017. IUCN Guidelines for determining when and how *ex situ* management should be used in species conservation. *Conservation Letters*. doi:10.1111/conl.12285

Redford, K. H., Amato, G., Baillie, J., Beldomenico, P., Bennett, E. L., Clum, N., Cook, R., *et al.* 2011. What does it mean to successfully conserve a (vertebrate) species? *Bioscience* 61: 39–48.

Redford, K. H., D. B. Jensen, and J. J. Breheny. 2012. Integrating the captive and the wild. *Science* 338: 1157-1158.

Redford, K.H, D.B. Jensen and J.J. Breheny. 2014. The long overdue death of the *ex situ* and *in situ* dichotomy in species conservation. *WAZA Magazine* 14: 19-22.

Schipper, J., J.S. Chanson, F. Chiozza, N.A. Cox, M. Hoffmann, V. Katariya, J. Lamoreux *et al.* 2008. The Status of the World's Land and Marine Mammals: Diversity, Threat, and Knowledge. *Science* 322: 225-230.

Scott, J. M., D.D. Goble, A.M. Haines, J.A. Wiens and M.C. Neel. 2010. Conservation-reliant species and the future of conservation. *Conservation Letters* 3: 91–97.

Soulé, M., M. Gilpin, W. Conway, and T. Foose. 1986. How long a voyage, how many staterooms, how many passengers? *Zoo Biology* 5: 101-113.

Traylor-Holzer, K., K. Leus, and P. McGowan. 2013. Integrating assessment of *ex situ* management options into species conservation planning. *WAZA Magazine* 14: 6-9.

Traylor-Holzer, K., K. Leus, and O. Byers. 2018. Integrating *ex situ* management options as part of a One Plan Approach to species conservation. In: *The Ark and Beyond*. B. Minteer *et al.* (eds.). University of Chicago Press.

WWF. 2016. *Living Planet Report 2016*. Risk and resilience in a new era. Gland, Switzerland: WWF International.

Multiple Taxa

ALPZA. 2016. Survey of canid inventory in ALPZA zoos. Asociación Latinoamericana de Parques Zoológicos y Acuarios (ALPZA).

Bauman, K (ed.). 2011. *Canid/Hyenid Taxon Advisory Group Regional Collection Plan 2010 – 2013 Fifth Edition.* Association of Zoos and Aquariums: Silver Spring, MD.

Conservation Breeding Specialist Group (SSC/IUCN). 2000. *Conservation Assessment and Management Plan for Arabian Carnivores and Population and Habitat Viability Assessment for the Arabian Leopard and Tahr: Draft Report.* CBSG, Apple Valley, MN.

CZA. 2015. Hyena data in Indian zoos 2014-2015. Central Zoo Authority (B. Kishor Gupta).

Ginsberg, J.R. and D.W. Macdonald. 1990. *Foxes, Wolves, Jackals, and Dogs: An Action Plan for the Conservation of Canids.* IUCN SSC Canid Specialist Group & Wolf Specialist Group: Gland, Switzerland.

Grisham, J., A. West, O. Byers, and U.S. Seal. 1992. *Canid, Hyena, and Aardwolf Conservation Assessment and Management Plan (CAMP). Final Draft Report.* Conservation Breeding Specialist Group: Apple Valley, MN.

Holst, B., A. Ahmed, A. A. Aouled, A. A. Mohamed, A. Laurent, A. M. Aman, A. Desbiez, B. Mulot, B. Lafrance, C. Gibault, D. Mallon, E. Ruivo, H. A. Rayaleh, K. Leus, P. Moehlmann, P. McGowan (eds.). 2013: Conserving Djibouti's Priority Land Animals – a Seminar and Conservation Workshop. Final Report. IUCN SSC.

IFAW, Panthera, IUCN/SSC Canid Specialist Group, IUCN/SSC Cat Specialist Group, Wildlife Conservation Society. 2011. *The fading call of the wild - A status update on 15 species of disappearing wild cats and canids.* IFAW: Yarmouth Port, Massachusetts.

JAZA. 2016. Inventory of canid species in Japanese zoos. JAZA (K. Takami).

Molur, S., P.O. Nameer, & S. Walker (eds.). 1998. *Report of the Workshop "Conservation Assessment and Management Plan for Mammals of India"*. BCPP - Endandered Species Project, Zoo Outreach Organisation, Conservation Breeding Specialist Group, India: Coimbatore, India.

Nigam, P., Srivastav, A. and Tyagi, P.C. (2012). Development and maintenance of studbooks of selected endangered faunal types in Indian zoos. Final Project Report (No. TR-2012/001). Wildlife Institute of India and Central Zoo Authority. Pp. 106.

Seal, U. (ed.). 1991. *Genome Resource Banking For Wild Species Conservation.* IUCN/SSC Conservation Breeding Specialist Group: Apple Valley, MN.

Sheikh, K. M. & Molur, S. 2004. (Eds.) Status and Red List of Pakistan's Mammals. Based on the Conservation Assessment and Management Plan. 312pp. IUCN Pakistan: Islamabad, Pakistan.

Sillero-Zubiri, C., Hoffmann, M. and Macdonald, D.W. (eds). 2004. *Canids: Foxes, Wolves, Jackals and Dogs. Status Survey and Conservation Action Plan.* IUCN/SSC Canid Specialist Group. Gland, Switzerland and Cambridge, UK. x + 430 pp.

Large Canids

Australian Government. 2010. 2010 Nomination – *Canis lupus* ssp. dingo. Australian Government, Department of the Environment, 43pp.

AZA. 2014. *2014 Population Analysis and Breeding Plan Maned Wolf (Chrysocyon brachyurus) Species Survival Plan*. Association of Zoos and Aquariums: Silver Spring, MD.

AZA. 2015. *Population Analysis and Breeding and Transfer Plan: Mexican Wolf (Canis lupus baileyi) AZA Species Survival Plan, Yellow Program.* Association of Zoos and Aquariums: Silver Spring, MD.

AZA. 2015. *Population Analysis and Breeding and Transfer Plan: Red Wolf (Canis rufus gregoryi) AZA Species Survival Plan, Yellow Program.* Association of Zoos and Aquariums: Silver Spring, MD.

AZA. 2016. *Population Analysis and Breeding and Transfer Plan: African Painted (Wild) Dog (Lycaon pictus) AZA Species Survival Plan, Yellow Program.* Association of Zoos and Aquariums: Silver Spring, MD.

Barnes, R. 2015. African Painted Dog EEP 2014-15 Report (summary ppt). Submitted to EAZA.

Cunha de Paula, R., P. Medici, and R. Gonçalves Morato (eds.). 2008. *Maned Wolf Action Plan Population and Habitat Viability Assessment.* ICMBio: Brasilia.

EAZA. 2009. EAZA Quick Captive Population Assessment for Dhole *Cuon alpinus* in EAZA/European region. European Association of Zoos and Aquaria: Amsterdam, Netherlands.

EAZA. 2009. EAZA Quick Captive Population Assessment for Iberian wolf in EAZA/European region. European Association of Zoos and Aquaria: Amsterdam, Netherlands.

EAZA. 2009. EAZA Quick Captive Population Assessment for Maned Wolf *Chrysocyon brachyurus* in EAZA/European region. European Association of Zoos and Aquaria: Amsterdam, Netherlands.

EAZA. 2015. EAZA Quick Population Assessment for African wild dog, *Lycaon pictus.* European Association of Zoos and Aquaria: Amsterdam, Netherlands.

Ewins, P., M. de Almeida, P. Miller and O. Byers (eds.). 2000. *Population and Habitat Viability Assessment Workshop for the Wolves of Algonquin Park: Final Report*. IUCN/SSC Conservation Breeding Specialist Group: Apple Valley, MN.

Fascione, N., O. Byers, U.S. Seal (eds.) 2000. *Wolves in the Northeast? A Workshop to Exchange Views. Final Report.* IUCN/SSC Conservation Breeding Specialist Group: Apple Valley, MN.

Gopi.G.V, Salvador Lyngdoh and K. Muthamizh Selvan (2010). Conserving the endangered Asiatic Wild Dog *Cuon alpinus* in Western Arunachal Pradesh: fostering better coexistence for conservation. Final Technical Report Submitted to Rufford Small Grant Program, UK. 54 pp.

Hayashi, K. 2015. *Japanese Studbook for Wolf (Canis lupus)*. 31 Dec 2015. Japanese Association of Zoos and Aquariums.

Holland, R. 2014. *International Maned Wolf Studbook (Chrysocyon brachyurus)*. Zoo Leipzig: Leipzig, Germany.

Holland, R. 2015. Maned Wolf EEP Report (summary ppt). Submitted to EAZA.

IUCN/SSC. 2007. Regional Conservation Strategy for the Cheetah and African Wild Dog in Eastern Africa. IUCN/SSC, Gland, Switzerland.

IUCN/SSC. 2007. Regional Conservation Strategy for the Cheetah and African Wild Dog in Southern Africa. IUCN/SSC, Gland, Switzerland.

IUCN/SSC. 2012. Regional Conservation Strategy for the Cheetah and African Wild Dog in Western, Central and Northern Africa. IUCN/SSC, Gland, Switzerland.

IUCN/SSC Canid Specialist Group. 2011. *Strategic Plan for Ethiopian Wolf Conservation*. IUCN/SSC Canid Specialist Group. Oxford, United Kingdom.

Johnson, B., Songsasen, N., Goff, D., and Bauman, K. 2016. Maned Wolf (*Chrysocyon brachyurus*) AZA Animal Program Population Viability Analysis Report. Lincoln Park Zoo, Chicago, IL.

Kelly, B., M. Brown and O. Byers (eds.). 2001. *Mexican Wolf Reintroduction Program Three-Year Review Workshop: Final Report*. IUCN/SSC Conservation Breeding Specialist Group, Apple Valley, MN.

Kelly, B.T., P.S. Miller, and U.S. Seal (eds.). 1999. *Population and Habitat Viability Assessment Workshop for the Red Wolf (Canis rufus)*. Apple Valley, MN: Conservation Breeding Specialist Group (SSC/IUCN).

Maisch, H. 2014. Dhole EEP Report (summary ppt). Submitted to EAZA.

Mechak, L., Quick, M., Rhodes, S., Bauman, K., and Goff, D. 2016. African Painted Dog (*Lycaon pictus*) AZA Animal Program Population Viability Analysis Report. Lincoln Park Zoo, Chicago, IL.

Mechak, L., Siminski, P., Kiseda, J., and Bauman, K. 2015. Mexican Gray Wolf (*Canis lupus baileyi*) AZA Animal Program Population Viability Analysis Report. Lincoln Park Zoo, Chicago, IL.

M.G.L. Mills, S. Ellis, R. Woodroffe, A. Maddock, P. Stander, A. Pole, G. Rasmussen, P. Fletcher, M. Bruford, D. Wildt, D. Macdonald and U. Seal (Eds.). 1998. *Population and Habitat Viability Assessment African Wild Dog (Lycaon pictus) in Southern Africa*. *Final Workshop Report.* IUCN/SSC Conservation Breeding Specialist Group: Apple Valley, MN.

Phillips, M., N. Fascione, P. Miller and O. Byers. 2000. *Wolves in the Southern Rockies. A Population and Habitat Viability Assessment: Final Report*. IUCN/SSC Conservation Breeding Specialist Group: Apple Valley, MN.

R. Woodroffe, J.R. Ginsberg, D.W. Macdonald and the IUCN/SSC Canid Specialist Group. 1997. *The African Wild Dog - Status Survey and Conservation Action Plan*. IUCN, Gland, Switzerland. 166 pp.

Seal, U.S. 1990. *Mexican Wolf Population Viability Assessment: Review Draft Report of Workshop*. IUCN SSC Conservation Breeding Specialist Group: Apple Valley, MN.

Sillero-Zubiri, C., D.W. Macdonald and the IUCN/SSC Canid Specialist Group. 1997. *The Ethiopian Wolf—Status Survey and Conservation Action Plan.* IUCN, Gland, Switzerland. 123 pp.

Sillero-Zubiri, C., J. Malcom, S. Williams, J. Marino, Z. Tefera, K. Laurenson, D. Gottelli, A. Hood, D. Macdonald, D. Wildt and S. Ellis. 2000. *Ethiopian Wolf Conservation Strategy Workshop: Final Report*. IUCN SSC Conservation Breeding Specialist Group: Apple Valley, MN.

Siminski, P. 2015. *Mexican Wolf (Canis lupus baileyi) International Studbook.* 31 July 2015. The Living Desert: Palm Desert, CA.

Simonis, J. L., L. J. Faust, R. B. Harrison, S. T. Long, D. R. Rabon Jr., and W. T. Waddell. 2015. Red Wolf (*Canis rufus*) AZA Animal Program Population Viability Analysis Report. Lincoln Park Zoo, Chicago, IL.

United States Fish and Wildlife Service. 2014. *Mexican Wolf Recovery Program: Progress Report #17.* United States Fish and Wildlife Service: Albuquerque, NM.

Waddell, W. 2015. *Red Wolf (Canis rufus) International Studbook.* Point Defiance Zoo and Aquarium: Tacoma, WA.

Wild Dog Advisory Group of South Africa. 2016. *Revised National Wild Dog Managed Metapopulation Strategy and Action Plan* – draft.

Yadid, Y. 2015. Italian Wolf Monitoring Report 2014-2015 (summary ppt). Submitted to EAZA.

ZAA. 2015. African Wild Dog *Lycaon pictus* Population Management Program Annual Report and Recommendations. Zoo and Aquarium Association: Mosman, Australia.

ZAA. 2015. Maned Wolf *Chrysocyon brachyurus* Monitored Program Annual Report. Zoo and Aquarium Association: Mosman, Australia.

ZIMS. 2016. African Hunting Dog (*Lycaon pictus*) Population Overview Report. 28 Jan 2016. Zoological Information Management System, Species360: Bloomington, MN.

ZIMS. 2016. Coyote (*Canis latrans*) Population Overview Report. 28 Jan 2016. Zoological Information Management System, Species360: Bloomington, MN.

ZIMS. 2016. Dhole (*Cuon alpinus*) Population Overview Report. 28 Jan 2016. Zoological Information Management System, Species360: Bloomington, MN.

ZIMS. 2016. Dingo (*Canis lupus dingo*) Population Overview Report. 28 Jan 2016. Zoological Information Management System, Species360: Bloomington, MN.

ZIMS. 2016. Gray Wolf (*Canis lupus*) Population Overview Report. 28 Jan 2016. Zoological Information Management System, Species360: Bloomington, MN.

ZIMS. 2016. Iberian Wolf (*Canis lupus signatus*) Population Overview Report. 28 Jan 2016. Zoological Information Management System, Species360: Bloomington, MN.

ZIMS. 2016. Maned Wolf (*Chrysocyon brachyurus*) Population Overview Report. 28 Jan 2016. Zoological Information Management System, Species360: Bloomington, MN.

ZIMS. 2016. Mexican Wolf (*Canis Lupus Baileyi*) Population Overview Report. 28 Jan 2016. Zoological Information Management System, Species360: Bloomington, MN.

ZIMS. 2016. Red Wolf (*Canis Rufus*) Population Overview Report. 28 Jan 2016. Zoological Information Management System, Species360: Bloomington, MN.

Small Canids

AZA. 2015. *Population Analysis and Breeding and Transfer Plan: Fennec Fox (Vulpes zerda) AZA Species Survival Plan, Yellow Program.* Association of Zoos and Aquariums: Silver Spring, MD.

AZA. 2015. *Population Analysis and Breeding and Transfer Plan: Swift Fox (Vulpes velox) AZA Species Survival Plan, Yellow Program*. Association of Zoos and Aquariums: Silver Spring, MD.

Buck, N. 2014. *International Studbook for the Bush Dog Speothos venaticus (Lund 1842)*. Port Lympne Wild Animal Park: Lympne, UK.

Buck, N. 2015. Bush Dog EEP 2015 (summary ppt). Submitted to EAZA.

EAZA. 2009. EAZA Quick Captive Population Assessment for Bush Dog in EAZA/European region. European Association of Zoos and Aquaria: Amsterdam, Netherlands.

EAZA. 2009. EAZA Quick Captive Population Assessment for Fennec Fox in EAZA/European region. European Association of Zoos and Aquaria: Amsterdam, Netherlands.

Mechak, L., Rein, T., Shotola, K., and Bauman, K. 2016. Swift Fox (*Vulpes velox*) AZA Animal Program Population Viability Analysis Report. Lincoln Park Zoo, Chicago, IL.

Mekarska, A. 2014. Fennec Fox ESB 2014 (summary ppt). Submitted to EAZA.

Ruske, K. 2015. Golden Jackal Monitoring Report (summary ppt). Submitted to EAZA.

Usui, M. 2015. *Regional Studbook of Bush Dog (Speothos, venaticus)*. 31 March 2015. Japanese Association of Zoos and Aquariums.

Willems, G. 2015. Black-backed Jackal Monitoring Report (summary ppt). Submitted to EAZA.

Willems, G. 2015. Black-backed Jackal (*Canis mesomelas*) EAZA Annual Report 2014/2015. Submitted to EAZA.

Woolham, M. 2015. 2015 Bat-eared Fox ESB Report (summary ppt). Submitted to EAZA.

ZIMS. 2016. Arctic Fox (*Vulpes lagopus*) Population Overview Report. 28 Jan 2016. Zoological Information Management System, Species360: Bloomington, MN.

ZIMS. 2016. Argentine Grey Fox (*Lycalopex griseus*) Population Overview Report. 28 Jan 2016. Zoological Information Management System, Species360: Bloomington, MN.

ZIMS. 2016. Bat-eared Fox (*Otocyon megalotis*) Population Overview Report. 28 Jan 2016. Zoological Information Management System, Species360: Bloomington, MN.

ZIMS. 2016. Bengal Fox (*Vulpes bengalensis*) Population Overview Report. 28 Jan 2016. Zoological Information Management System, Species360: Bloomington, MN.

ZIMS. 2016. Black-backed Jackal (*Canis mesomelas*) Population Overview Report. 28 Jan 2016. Zoological Information Management System, Species360: Bloomington, MN.

ZIMS. 2016. Blanford's Fox (*Vulpes cana*) Population Overview Report. 28 Jan 2016. Zoological Information Management System, Species360: Bloomington, MN.

ZIMS. 2016. Bush Dog (*Speothos venaticus*) Population Overview Report. 28 Jan 2016. Zoological Information Management System, Species360: Bloomington, MN.

ZIMS. 2016. Cape Fox (*Vulpes chama*) Population Overview Report. 28 Jan 2016. Zoological Information Management System, Species360: Bloomington, MN.

ZIMS. 2016. Channel Islands Fox (*Urocyon littoralis*) Population Overview Report. 28 Jan 2016. Zoological Information Management System, Species360: Bloomington, MN.

ZIMS. 2016. Colpeo Fox (*Lycalopex culpaeus*) Population Overview Report. 28 Jan 2016. Zoological Information Management System, Species360: Bloomington, MN.

ZIMS. 2016. Corsac Fox (*Vulpes corsac*) Population Overview Report. 28 Jan 2016. Zoological Information Management System, Species360: Bloomington, MN.

ZIMS. 2016. Coyote (*Canis latrans*) Population Overview Report. 28 Jan 2016. Zoological Information Management System, Species360: Bloomington, MN.

ZIMS. 2016. Crab-eating Fox (*Cerdocyon thous*) Population Overview Report. 28 Jan 2016. Zoological Information Management System, Species360: Bloomington, MN.

ZIMS. 2016. Fennec Fox (*Vulpes zerda*) Population Overview Report. 28 Jan 2016. Zoological Information Management System, Species360: Bloomington, MN.

ZIMS. 2016. Golden Jackal (*Canis aureus*) Population Overview Report. 28 Jan 2016. Zoological Information Management System, Species360: Bloomington, MN.

ZIMS. 2016. Grey Fox (*Urocyon cinereoargenteus*) Population Overview Report. 28 Jan 2016. Zoological Information Management System, Species360: Bloomington, MN.

ZIMS. 2016. Hoary Fox (*Lycalopex vetulus*) Population Overview Report. 28 Jan 2016. Zoological Information Management System, Species360: Bloomington, MN.

ZIMS. 2016. Kit Fox (*Vulpes macrotis*) Population Overview Report. 28 Jan 2016. Zoological Information Management System, Species360: Bloomington, MN.

ZIMS. 2016. Raccoon Dog (*Nyctereutes procyonoides*) Population Overview Report. 28 Jan 2016. Zoological Information Management System, Species360: Bloomington, MN.

ZIMS. 2016. Red Fox (*Vulpes vulpes*) Population Overview Report. 28 Jan 2016. Zoological Information Management System, Species360: Bloomington, MN.

ZIMS. 2017. Sand Fox (*Vulpes rueppellii*) Population Overview Report. 15 Apr 2017. Zoological Information Management System, Species360: Bloomington, MN.

ZIMS. 2016. Sechura Fox (*Lycalopex sechurae*) Population Overview Report. 28 Jan 2016. Zoological Information Management System, Species360: Bloomington, MN.

ZIMS. 2016. Side-striped Jackal (*Canis adustus*) Population Overview Report. 28 Jan 2016. Zoological Information Management System, Species360: Bloomington, MN.

ZIMS. 2016. Singing Dog (*Canis lupus hallstromi*) Population Overview Report. 28 Jan 2016. Zoological Information Management System, Species360: Bloomington, MN.

ZIMS. 2016. Swift Fox (*Vulpes velox*) Population Overview Report. 28 Jan 2016. Zoological Information Management System, Species360: Bloomington, MN.

Hyaenids

AZA. 2015. *Population Analysis and Breeding and Transfer Plan: Spotted Hyena (Crocuta crocuta) AZA Species Survival Plan, Yellow Program.* Association of Zoos and Aquariums: Silver Spring, MD.

EAZA. 2009. EAZA Quick Captive Population Assessment for Brown Hyenas *Hyaena brunnea* in EAZA/European region. European Association of Zoos and Aquaria: Amsterdam, Netherlands.

EAZA. 2009. EAZA Quick Captive Population Assessment for Spotted Hyenas *Crocuta crocuta* in EAZA/European region. European Association of Zoos and Aquaria: Amsterdam, Netherlands.

EAZA. 2009. EAZA Quick Captive Population Assessment for Striped Hyenas *Hyaena hyaena* in EAZA/European region. European Association of Zoos and Aquaria: Amsterdam, Netherlands.

Houssaye, F. 2015. Striped Hyenas ESB Report (summary ppt). Submitted to EAZA.

Hyaena Specialist Group (IUCN/SSC). 2011. Hyaena Specialist Group Profile. IUCN SSC.

Johnson, B., Genter, H., Leeds, D., Bauman, K., and Goff, D. 2015. Spotted Hyena (*Crocuta crocuta*) AZA Animal Program Population Viability Analysis Report. Lincoln Park Zoo, Chicago, IL.

Meer, R. van der. 2015. Spotted Hyena ESB Report 2015 (summary ppt). Submitted to EAZA.

Mills, M.G.L. and Hofer, H. (compilers). 1998. *Hyaenas. Status Survey and Conservation Action Plan.* IUCN/SSC Hyaena Specialist Group. IUCN, Gland, Switzerland and Cambridge, UK. vi + 154 pp.

ZIMS. 2016. Aardwolf (*Proteles cristata*) Population Overview Report. 28 Jan 2016. Zoological Information Management System, Species360: Bloomington, MN.

ZIMS. 2016. Brown Hyaena (*Hyaena brunnea*) Population Overview Report. 28 Jan 2016. Zoological Information Management System, Species360: Bloomington, MN.

ZIMS. 2016. Spotted Hyena (*Crocuta crocuta*) Population Overview Report. 28 Jan 2016. Zoological Information Management System, Species360: Bloomington, MN.

ZIMS. 2016. Striped Hyaena (*Hyaena hyaena*) Population Overview Report. 28 Jan 2016. Zoological Information Management System, Species360: Bloomington, MN.

Global Integrated Collection Assessment and Planning Workshop for Canids and Hyenids

Omaha, NE, USA
19 – 20 March 2016

Final Report

APPENDIX I

Workshop Participants and Agenda

ICAP Workshop Participant List

Participant	Institution	Email
Karen Bauman	Saint Louis Zoo (AZA)	Kbauman@stlzoo.org
Rogério Cunha de Paula	CENAP/ICMBio	rogerio.paula@icmbio.gov.br
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Candice Dorsey	AZA	cdorsey@aza.org
Lisa Faust	Lincoln Park Zoo (AZA)	lfaust@lpzoo.org
Todd Fuller	University of Massachusetts (IUCN Canid Specialist Group)	tkfuller@eco.umass.edu
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Don Goff	Beardsley Zoo (AZA)	dgoff@beardsleyzoo.org
Brij Gupta	Central Zoo Authority India (CZA)	brijkishor68@yahoo.com
Christina Gorsuch	Cincinnati Zoo (AZA)	
Katharina Herrmann	EAZA	Katharina.Herrmann@eaza.net
Kay Holkamp	Michigan State University (IUCN Hyaenid Specialist Group)	holekamp@msu.edu
Kristin Leus	EAZA; CPSG (IUCN SSC)	krl@zoo.dk
Keith Lovett	Buttonwood Park Zoo (AZA)	KLovett@newbedford-ma.gov
Simon Marsh	Yorkshire Wildlife Park (EAZA)	s.marsh@yorkshirewildlifepark.com
Jennifer Mickelberg	Conservation Planning Specialist Group (IUCN SSC)	jmickelberg@zooatlanta.org
Kira Mileham	IUCN SSC	kira.mileham@iucn.org
Mike Quick	Sedgewick County Zoo (AZA)	Michael.Quick@scz.org
Tracy Rehse	National Zoological Gardens of South Africa (PAAZA)	tracy@nzg.ac.za
Tracy Rein	Endangered Wolf Center (AZA)	trein@endangeredwolfcenter.org
Kristine Schad	EAZA	kristine.schad@eaza.net
Adrián J. Sestelo	Jardín Zoológico de la Ciudad de Buenos Aires (ALPZA)	asestelo@zoobuenosaires.com.ar
Peter Siminski	The Living Desert (AZA)	psiminski@livingdesert.org
Gert Skipper	Adelaide Zoo (ZAA)	gskipper@zoossa.com.au
Nucharin Songsasen	Smithsonian Conservation Breeding Institute (AZA)	songsasenn@si.edu
Sara Sullivan	AZA Population Management Center (AZA)	Sara.Sullivan@CZS.org
Kathy Traylor-Holzer	Conservation Planning Specialist Group (IUCN SSC)	kathy@cpsg.org
Raymond van der Meer	Amersfoort Zoo (EAZA)	rvandermeer@dierenparkamersfoort.nl
William Waddell	Point Defiance Zoo and Aquarium (AZA)	William.waddell@pdza.org
Sam Wilson	Nebraska Game and Parks (US Swift Fox Conservation Team)	sam.wilson@nebraska.gov
Martin Zordan	Latin American Association of Zoological Parks and Aquariums (ALPZA)	direccion@alpza.com

Pre-Workshop Participant List

Pre-workshop survey materials were sent to a list of *in situ* experts prior to the meeting. The list of experts was generated by the Chairs of the IUCN SSC Canid and Hyaenid Specialist Groups. We gratefully acknowledge below those experts, who took the time to provide their expert opinions.

Name	Institution	Affiliation
Alireza Mahdari	Islamic Azad University	Member, IUCN SSC Hyaenid Specialist Group
Axel Moehenschlager	Calgary Zoo	Reintroduction& Translocation Working Group Chair, IUCN SSC Canid Specialist Group
Ben Sacks	University of California Davis	Taxonomy & Nomenclature Working Group Co-Chair, IUCN SSC Canid Specialist Group
Brian Cyper	Endangered Species Recovery Program California State University-Stanislaus	Island, Kit & Swift Fox Working Group Chair, IUCN SSC Canid Specialist Group
David Mech	U.S. Geological Survey, and University of Minnesota	Advisor to the Chair, IUCN SSC Canid Specialist Group; Past Chair Wolf Specialist Group
Eileen Dowd-Stukel	SD Game, Fish and Parks	Member, US Swift Fox Conservation Team
Greg Wilson	Canadian Wildlife Service	Member, US Swift Fox Conservation Team
Harriet T. Davies-Mostert	Endangered Wildlife Trust	Head of Conservation, Endangered Wildlife Trust
Ingrid Wiesel	Brown Hyena Research Project	Member, IUCN SSC Hyaenid Specialist Group
Jed Murdoch	University of Vermont	Program Coordinator, IUCN SSC Canid Specialist Group
Jerry Apker	Colorado Parks and Wildlife	Member, US Swift Fox Conservation Team
John Newby	Sahara Conservation Fund	CEO, Sahara Conservation Fund
Jorgelina Marino	University of Oxford	Ethiopian Wolf Working Group Chair
Karen DeMatteo	Washington University	Program Officer & Amazonian Canids Working Group Chair, IUCN SSC Canid Specialist Group
Kay Holkamp	Michigan State University	Chair, IUCN SSC Hyaenid Specialist Group
Maggie Dwire	U.S. Fish and Wildlife Service	Assistant Recovery Coordinator Mexican Wolf Program, U.S. Fish and Wildlife Service
Mauro Lucherini	Universidad Nacional del Sur	Southern Cone (Foxes) Working Group Chair, IUCN SSC Canid Specialist Group
Mike Phillips	Turner Endangered Species Fund	Wolf (North American) Working Group Chair, IUCN SSC Canid Specialist Group
Nucharin Songsasen	Smithsonian's National Zoo and Conservation Biology Institute	Dhole Working Group Chair, IUCN SSC Canid Specialist Group
Oliver Hoener	Leibniz Institute for Zoo and Wildlife Research	Member, IUCN SSC Hyaenid Specialist Group
Richard Yarnell	Nottingham Trent University	Member, IUCN SSC Hyaenid Specialist Group
Rogerio Cunha de Paula	CENAP/ICMBio	Maned Wolf Working Group Chair, IUCN SSC Canid Specialist Group
Stephanie Dloniak	Michigan State University	Member, IUCN SSC Hyaenid Specialist Group
Todd Fuller	University of Massachusetts Amherst	Member, IUCN SSC Canid Specialist Group

We also gratefully acknowledge all the regional zoo associations which contributed expertise and *ex situ* data prior to the meeting including: ALPZA, AZA, CZA, EAZA, JAZA, PAAZA, and ZAA.

Integrated Collection Assessment and Planning (ICAP) Workshop for Canids and Hyaenids

Omaha, 19-20 March 2016

DRAFT AGENDA
SATURDAY 19 MARCH

(8:00 am –5:00 pm)

8:00-8:15: Welcome and introduction to the workshop (*Karen Bauman, AZA Canid TAG, and Kathy Traylor-Holzer, CBSG*)

8:15-8:45: Participant introductions

8:45-9:00: Applying the One Plan Approach and the IUCN SSC Guidelines on the Use of *Ex Situ* Management for Species Conservation to collection planning (*Kristin Leus, CBSG Europe/EAZA*)

9:00-9:30: Workshop process:

- Preparations before the workshop (*Kathy Traylor-Holzer and Jennifer Mickelberg, CBSG North America/Zoo Atlanta*)
- Process during the workshop (*Kathy Traylor-Holzer and Kristin Leus, CBSG Europe/EAZA*)

9:30-5:00: ICAP process for the Threatened Canid and Hyaenid species (see workshop manual p. 8)

10:00-10:15am: Break
12:00-1:00pm: Lunch
3:00-3:15pm: Break

Process for each species:

1. Presentation of previously gathered information on the species
2. Facilitated plenary discussion on potential conservation and non-conservation roles, and rating of benefit of any roles identified (see manual pages 2, 3 and 4)
3. Facilitated plenary discussion to (see manual page 5):
    a) **Identify the characteristics, scope, and resources of the *ex situ* population needed to fulfil the identified role(s)**
    b) **Assess feasibility and risks**
4. Formulation of recommendations (see manual page 6):
    a) Reaching consensus on the which of the potential *ex situ* roles identified (if any) are recommended, based on an analysis of the benefits *vs* feasibility and risks
    b) Identifying recommended actions. These recommendations are non-binding and intended to be discussed post-workshop within the relevant regional zoo association.

SUNDAY 20 MARCH

(8:00 am – 5:00 pm)

8:00-5:00: ICAP process for the Non-Threatened Canid and Hyaenid species (see workshop manual p. 8)

10:00-10:15am:	Break
12:00-1:00pm:	Lunch
3:00-3:15pm:	Break

Process:

A. **For each species with a large or small population** (see manual page 8):

1. Presentation of previously gathered information on the species
2. Facilitated plenary discussion on potential conservation and non-conservation roles, and rating of benefit of any roles identified (see manual pages 2, 3 and 4)
3. Facilitated plenary discussion to (see manual page 5):
    a. **Identify the characteristics, dimensions, resources of the *ex situ* population needed to fulfil the identified role(s)**
    b. **Assess feasibility and risks**
4. Formulation of recommendations (see manual page 6):
    a. Reaching consensus on the which of the potential *ex situ* roles identified (if any) will be retained, based on an analysis of the benefits *vs* feasibility and risks
    b. Identifying recommended actions. These recommendations are non-binding and intended to be discussed post-workshop within the relevant regional zoo association.

B. **For species with a very small population or not present in zoos** (see manual page 8):

- Facilitated plenary discussion: generalized recommendation for the groups, or species by species approach
- In case of species by species approach, follow process under A in working groups – feedback in plenary session.

Global Integrated Collection Assessment and Planning Workshop for Canids and Hyenids

Omaha, NE, USA
19 – 20 March 2016

Final Report

APPENDIX II

Ex Situ Conservation Role Pre-Workshop Survey

Dear [*in situ* specialist – not attending the ICAP workshop]

We are contacting you because **we would like to call on your expertise to help us gather preparatory information** for an international multi-stakeholder meeting focused on global *ex situ* conservation for canid and hyaenid species, which is being convened by the IUCN SSC Conservation Breeding Specialist Group (CBSG), in collaboration with the IUCN SSC Canid and Hyaenid Specialist Groups and the Canid and Hyaenid Taxon Advisory Groups (TAGs) from the world's zoo associations. This new CBSG meeting format will integrate work of the various SSC Specialist Groups, *in situ* species specialists, and their corresponding regional zoo association partners in the application of the IUCN SSC *Guidelines for the Use of Ex Situ Management for Species Conservation*.

Some key objectives of this workshop include:

- To review and assess the conservation needs of canid and hyaenid species and identify any potential conservation roles for *ex situ* activities;
- To assess the current status of regional and global canid and hyaenid *ex situ* populations and their relative viability and management needs;
- To provide a framework for prioritization of *ex situ* resources to support canid and hyaenid conservation;
- To create opportunities for communication and networking among professionals working with canids and hyaenids; and
- To promote the One Plan approach to create an integrated conservation plan for canids and hyaenids by developing species-specific recommendations useful to strategic planning by the field conservation community and regional zoo associations.

We would specifically like to ask for your help with identifying any potential conservation roles for *ex situ* activities within the conservation needs of canid and hyaenid species so that this information can be considered during the workshop discussions.

The attached Document A describes a series of potential conservation roles of *ex situ* activities. The additional documents are separate information sheets for those species for which we would like your help and provide information for each regarding its current regional and global status in zoos. **For each of the species, we ask that you carefully consult the potential conservation roles outlined in Document A and use these, together with your expertise on the *in situ* status and threats for the species involved, to formulate your opinion on the 7 questions below.** We are extremely grateful for your valuable expert opinion and time spent to help identify *ex situ* conservation priorities for these species.

Please send your responses to these questions and any documentation to me (KBauman@stlzoo.org) **by 10 March**. Please let us know if you will not be able to respond and/or if you have suggestions for additional important contact persons for these species.

Best regards,

Karen Bauman
Chair, AZA Canid & Hyaenid TAG, and meeting co-convener

Dear [*in situ* specialist – attending the ICAP workshop]

Thank you for accepting our invitation to attend the international multi-stakeholder meeting focused on global *ex situ* conservation for canid and hyaenid species in Omaha, Nebraska (USA) on 19-20 March 2016. This workshop is being convened by the IUCN SSC Conservation Breeding Specialist Group (CBSG) in collaboration with the IUCN SSC Canid and Hyaenid Specialist Groups and the Canid and Hyaenid Taxon Advisory Groups (TAGs) from the world's zoo associations.

This new CBSG meeting format will integrate work of the SSC Specialist Groups, *in situ* species specialists, and their corresponding regional zoo association partners in the application of the IUCN SSC Guidelines for the Use of *Ex Situ* Management for Species Conservation. We are contacting you to help us gather some preparatory information, which will help us to structure the discussion and decision process at the workshop. Specifically, we are asking for your help with assessing and identifying any potential conservation roles for *ex situ* activities within the conservation needs of canid and hyaenid species. Preliminary compilation of information is essential in order for us to address over 40 taxa during the two-day meeting.

The attached Document A describes a series of potential conservation roles of *ex situ* activities. The additional documents are separate information sheets for those species for which we would like your help and provide information for each regarding its current regional and global status in zoos. **For each of the species, we ask that you carefully consult the potential conservation roles outlined in Document A and use these, together with your expertise on the *in situ* status and threats for the species involved, to formulate your opinion on the 7 questions below.** We are extremely grateful for your valuable expert opinion and time spent to help identify *ex situ* conservation priorities for these species.

Please send your responses to these questions and any documentation to me (KBauman@stlzoo.org) **by 10 March**. Please let us know if you will not be able to respond and/or if you have suggestions for additional important contact persons for these species.

Best regards,

Karen Bauman
Chair, AZA Canid & Hyaenid TAG, and meeting co-convener

FOR THREATENED SPECIES (defined for this task as EW, CR, EN, VU, NT on the IUCN Red List)

DIRECT CONSERVATION (i.e. the animals (or their biological samples) in the *ex situ* population play a conservation role)

1. Is there an existing conservation strategy/action plan for this species that calls for some form of *ex situ* management in support of conservation? If yes, please provide a copy of (the relevant section of) the plan.

2. Do you feel (and/or does an existing strategy/plan state) that *ex situ* management with one or more of the direct conservation roles described in Section I of Document A would be required for this species – and if so, which roles? *(One* ex situ *program may serve several conservation roles – either simultaneously or consecutively)*

   If yes, do you feel that the zoo community should help with:
   - Implementing an *ex situ* program located elsewhere than on zoo grounds (e.g. in a range country facility or another non-zoo environment)

   And/or:
   - Implementing an *ex situ* program in professionally managed zoos (this can range from one, to a few zoos, to a large cooperative program regionally or globally)

INDIRECT CONSERVATION (i.e. ways in which the expertise, knowledge, materials, staff, fund raising etc. present in the zoo community can contribute to *in situ* conservation activities).
Please note that a threatened species may be eligible for indirect conservation support from the zoo community even if it is currently not held by zoos.

3. After reading Section II of Document A, do you see a specific need for expertise, knowledge, materials, staff or other in-kind support from the zoo community to help implement a particular *in situ* conservation action, or address a particular *in situ* problem?

4. Is there a high priority *in situ* project for which small scale funding from the zoo community could make a lot of difference for the conservation of the species (that might perhaps have difficulty attracting funds from other sources?)?

5. Are there particular messages that you feel would be good for zoos to include in general conservation educational activities for the zoo visitors?

FOR NON-THREATENED SPECIES

6. Do you have reason to believe that this taxon, which is currently not listed as either EW, CR, EN, VU or NT, might recently have run into significant trouble, such that its current threat status might be more severe than is evident from its current IUCN Red List category?
   - If yes, please specify and answer questions 1-5 above

7. Do you think feel there is a need for this non-threatened species to function as a model, through *ex situ* activities, for a threatened species, for example to gain husbandry experience, for conservation-targeted research, conservation-targeted education, or "ecological replacement" (see Section I of Document A)?

Document A
Ex situ Conservation Roles

I. Direct Conservation Roles for *ex situ* management

These are situations in which living individuals (or their biological materials, such as a Genome Resource Bank) in the *ex situ* population play a direct conservation role. *Ex situ* management may take place either within or outside the species' geographic range, but is in a controlled or modified environment for some period of time (short term or long term) for a clearly defined conservation purpose at the population, species, or ecosystem level (see *IUCN SSC Guidelines for the Use of Ex Situ Management for Species Conservation* for more detailed explanation).

Simply keeping and/or breeding threatened Canid or Hyaenid species in captivity does not in itself equate to *conservation*. As part of a genuine Canid or Hyaenid conservation initiative, potential *ex situ* management strategies proposed should address the causes or consequences of one or more specific threats or constraints to the species' viability and conservation, as identified in a status review and threat analysis, and target improvement of its conservation status. This does not preclude these *ex situ* populations for conservation from having additional roles that are not necessarily, or only indirectly, related to conservation. Whenever an *ex situ* conservation role involves a conservation translocation, the *IUCN SSC Guidelines for Reintroductions and other Conservation Translocations* also apply.

In essence, *ex situ* management can support species conservation and prevent extinction by:

a) counteracting the impacts (such as reduced survival, poor reproduction and genetic isolation) of primary or stochastic threats on the population;
b) addressing the causes of primary threats;
c) gaining time in situations where threats are not under control or mitigation is not successful (enough); and
d) by using *ex situ* populations for population restoration or conservation introduction.

COMMON *EX SITU* CONSERVATION ROLES

Descriptions of these roles are based on a combination of the role descriptions in the IUCN SSC Guidelines on the Use of Ex Situ Management for Species Conservation and those in Appendix I of the Amphibian Ark Conservation Needs Assessment Process.

Ark

Maintenance of a long-term *ex situ* population after extinction of all known wild populations and as a preparation for reintroduction or assisted colonization if and when feasible.

Rescue (temporary or long term)

A species that is in imminent danger of extinction (locally or globally) and requires *ex situ* management, as part of an integrated program, to ensure its survival. The species may be in imminent danger because the threats cannot/will not be reversed in time to prevent likely species extinction, or the threats have no current remedy. The rescue may need to be long term or temporary (for example, to protect from catastrophes or predicted imminent threats that are limited in time, e.g. extreme weather, disease, oil spill).

Demographic manipulation

Improving a demographic rate (survival or reproduction) or status (e.g. skewed sex ratio), often of a particular age, sex, or life stage. For example, head-start programs that remove individuals from the wild to reduce high mortality during a specific life stage and then subsequently return them to the wild.

Population restoration

Source for population restoration, either to re-establish the species to part of its former range from which it has been extirpated, or to reinforce/supplement an existing population (e.g. for demographic, behavioral or genetic purposes).

Ecological replacement

Re-establish a lost ecological function and/or modify habitats. This may involve species that are not themselves threatened but that contribute to the conservation of other taxa through their ecological role.

Assisted colonization

Introduce the species outside of its indigenous range to avoid extinction.

Insurance population

Maintaining a long-term viable *ex situ* population of the species to prevent predicted local, regional or global species extinction and preserve options for future conservation strategies. These are typically species that are threatened and for which it is unsure whether *in situ* threat mitigation will have the sufficient effect in a sufficient timeframe to prevent the extinction of the species or to prevent a dramatic decline in the numbers, populations and/or genetic diversity of the species. An *ex situ* population may be desired as an insurance population from which individuals can be extracted for genetic and/or demographic supplementation or other conservation translocations as required, but these are not yet actively planned the foreseeable future.

Ex situ research and/or training

Ex situ populations that are used for research and/or training that will directly benefit conservation of the species, or a similar species, in the wild (e.g. monitoring methods, life history information, nutritional requirements, disease transmission/ treatment). The research/training addresses specific questions essential for success of the overall conservation strategy for the species. This can include non-threatened species serving as a model for more threatened species, or establishing *ex situ* populations of a threatened species to gain important species-specific husbandry and breeding expertise that is likely to be needed in the future to conserve the species.

Conservation Education

The *ex situ* management forms the basis for an education and awareness program that addresses specific threats or constraints to the conservation of the species or its habitat. The education addresses specific human behavioral changes that are essential for the success, and an integral part of, the overall conservation strategy for the species. This primarily involves *ex situ* locations visited by the intended human audience.

Others?

If you see a need for an *ex situ* management role that is not covered by the role descriptions provided above, please specify in your reply to the survey.

II. Indirect Conservation Roles for *ex situ* management

These are situations in which the zoo community can contribute to conservation by:

- **making available its expertise, knowledge, materials, staff, fund raising, etc. to help implement *in situ* conservation actions, and/or**
- **carrying out general awareness and conservation education activities aimed at the zoo visiting public**

Indirect conservation contributions can be made for a species regardless of whether or not it is held in captivity.

Examples of indirect conservation roles include:

- Providing knowledge, experience or training to build capacity for veterinary care or handling of individuals in the field (e.g. radio collar application, transport, etc.) or in the context of law enforcement (rescue centers, human wildlife conflicts etc.)
- Making available existing zoo education materials or education/behavior change expertise to teams developing awareness programs for local communities *in situ*.
- Carry out education and awareness about the status of and threats to the species. Increase interest in the species and its habitat/ecosystem.
- Networking and lobbying to influence opinions, legislation processes, etc.
- Small scale fundraising to contribute to high priority *in situ* projects or IUCN SSC Specialist Group activities
- And others …

III. Non-Conservation roles for *ex situ* management

Zoos also have other roles in addition to conservation and may therefore select to maintain certain species for non-conservation reasons such as general biological education, addressing a particular cultural/socio-economic interest or significance, building attractive exhibits, or for use in non-conservation related research. While this will be addressed during the workshop, it is not the focus of this survey and does not require your response.

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APPENDIX III

Workshop Manual

Integrated Collection Assessment and Planning (ICAP) Workshop for Canids and Hyaenids

Omaha, 19-20 March 2016

WORKSHOP MANUAL

ONE PLAN APPROACH

A 'One Plan' approach (OPA) to species conservation promotes the joint development of management strategies and conservation actions for all populations of a species by all responsible parties to produce one comprehensive conservation plan for the species, with the ultimate goal of supporting the species' conservation in the wild (Byers *et al.* 2013)[1].

IUCN SSC GUIDELINES ON THE USE OF *EX SITU* MANAGEMENT FOR SPECIES CONSERVATION[2]

Five-step decision making process to decide when *ex situ* management is an appropriate conservation tool within the overall conservation strategy for a taxon:

STEP 1. **Compile a status review of the species, including a threat analysis.**

STEP 2. **Define the role(s) that *ex situ* management will play in the overall conservation of the species.**

STEP 3. **Determine the characteristics and dimensions of the *ex situ* population needed to fulfil the identified conservation role(s).**

STEP 4. **Define the resources and expertise needed for the *ex situ* management program to meet its role(s) and appraise the feasibility and risks.**

STEP 5. **Make a decision that is informed (i.e. uses the information gathered above) and transparent (i.e. demonstrates how and why the decision was taken).**

[1] Byers, O., C. Lees, J. Wilcken, and C. Schwitzer. 2013. The "One Plan Approach": The philosophy and implementation of CBSG's approach to integrated species conservation planning. *WAZA Magazine* 14: 2-5.

[2] IUCN SSC. 2014. Guidelines on the Use of Ex Situ Management for Species Conservation. Version 2.0. Gland, Switzerland: IUCN Species Survival Commission.

INVESTIGATING POTENTIAL *EX SITU* CONSERVATION ROLES

FOR THREATENED SPECIES (for this project defined as EW, CR, EN, VU, NT on the IUCN Red List)

DIRECT CONSERVATION (i.e. the individuals in the *ex situ* population play a conservation role – see page 3)

1. **Is there an existing conservation strategy/action plan for this species that calls for some form of *ex situ* management in support of conservation?**

2. **Do you feel (and/or does an existing strategy/plan state) that *ex situ* management with one or more direct conservation roles would be required for this species – and if so, which roles? *(One* ex situ *program may serve several conservation roles – either simultaneously or consecutively)***
    a. **If yes, do you feel that the zoo community should help with:**
        i. Implementing an *ex situ* program located elsewhere than on zoo grounds (e.g. in a range country facility or another non-zoo environment)
    b. **And/or:**
        i. Implementing an *ex situ* program in professionally managed zoos (this can range from one, to a few zoos, to a large cooperative program regionally or globally)

INDIRECT CONSERVATION (i.e. ways in which the expertise, knowledge, materials, staff, fund raising etc. present in the zoo community can contribute to *in situ* conservation activities – see page 4). Please note that a threatened species may be eligible for indirect conservation support from the zoo community even if it is currently not held by zoos.

3. **Do you see a specific need for expertise, knowledge, materials, staff or other in-kind support from the zoo community to help implement a particular *in situ* conservation action, or address a particular *in situ* problem?**

4. **Is there a high priority *in situ* project for which small scale funding from the zoo community could make a lot of difference for the conservation of the species (that might perhaps have difficulty attracting funds from other sources?)?**

5. **Are there particular messages that you feel would be good for zoos to include in general conservation educational activities for the zoo visitors?**

NON-CONSERVATION ROLES

6. **Do you see any important non-conservation roles for this species (see page 4)**

PLEASE RATE the conservation benefits of any conservation roles chosen as well as the benefit to the zoo community of any non-conservation roles chosen (see page 4)

FOR NON-THREATENED SPECIES

7. **Do you have reason to believe that this taxon, which is currently not listed as either EW, CR, EN, VU or NT, might recently have run into significant trouble, such that its current threat status might be more severe than is evident from its current IUCN Red List category?** If yes, please specify and answer questions 1-5 above

8. **Do you think feel there is a need for this non-threatened species to function as a model, through *ex situ* activities, for a threatened species, for example to gain husbandry experience, for conservation-targeted research, conservation-targeted education, or "ecological replacement"?**

9. **Do you see any important non-conservation roles for this species (see page 4)**

PLEASE RATE the conservation benefits of any conservation roles chosen as well as the benefit to the zoo community of any non-conservation roles chosen (see page 4)

COMMON DIRECT CONSERVATION ROLES FOR *EX SITU* MANAGMENT

Descriptions of these roles are based on a combination of the role descriptions in the IUCN SSC Guidelines on the Use of Ex situ Management for Species Conservation and those in Appendix I of the Amphibian Ark Conservation Needs Assessment Process.

Ark
Maintenance of a long-term *ex situ* population after extinction of all known wild populations and as a preparation for reintroduction or assisted colonization if and when feasible.

Rescue (temporary or long term)
A species that is in imminent danger of extinction (locally or globally) and requires *ex situ* management, as part of an integrated program, to ensure its survival. The species may be in imminent danger because the threats cannot/will not be reversed in time to prevent likely species extinction, or the threats have no current remedy. The rescue may need to be long term or temporary (for example, to protect from catastrophes or predicted imminent threats that are limited in time, e.g. extreme weather, disease, oil spill).

Demographic manipulation
Improving a demographic rate (survival or reproduction) or status (e.g. skewed sex ratio), often of a particular age, sex, or life stage. For example, head-start programs that remove individuals from the wild to reduce high mortality during a specific life stage and then subsequently return them to the wild.

Population restoration
Source for population restoration, either to re-establish the species to part of its former range from which it has been extirpated, or to reinforce/supplement an existing population (e.g. for demographic, behavioral or genetic purposes).

Ecological replacement
Re-establish a lost ecological function and/or modify habitats. This may involve species that are not themselves threatened but that contribute to the conservation of other taxa through their ecological role.

Assisted colonization
Introduce the species outside of its indigenous range to avoid extinction.

Insurance population
Maintaining a long-term viable *ex situ* population of the species to prevent predicted local, regional or global species extinction and preserve options for future conservation strategies. These are typically species that are threatened and for which it is unsure whether *in situ* threat mitigation will have the sufficient effect in a sufficient timeframe to prevent the extinction of the species or to prevent a dramatic decline in the numbers, populations and/or genetic diversity of the species. An *ex situ* population may be desired as an insurance population from which individuals can be extracted for genetic and/or demographic supplementation or other conservation translocations as required, but these are not yet actively planned the foreseeable future.

***Ex situ* research and/or training**
Ex situ populations that are used for research and/or training that will directly benefit conservation of the species, or a similar species, in the wild (e.g. monitoring methods, life history information, nutritional requirements, disease transmission/ treatment). The research/training addresses specific questions essential for success of the overall conservation strategy for the species. This can include non-threatened species serving as a model for more threatened species, or establishing *ex situ* populations of a threatened species to gain important species-specific husbandry and breeding expertise that is likely to be needed in the future to conserve the species.

Conservation Education
The *ex situ* management forms the basis for an education and awareness program that addresses specific threats or constraints to the conservation of the species or its habitat. The education addresses specific human behavioral changes that are essential for the success, and an integral part of, the overall conservation strategy for the species. This primarily involves *ex situ* locations visited by the intended human audience.

INDIRECT CONSERVATION ROLES FOR *EX SITU* MANAGMENT

These are situations in which the zoo community can contribute to conservation by:

- **making available its expertise, knowledge, materials, staff, fund raising, etc. to help implement *in situ* conservation actions, and/or**
- **carrying out general awareness and conservation education activities aimed at the zoo visiting public**

Indirect conservation contributions can be made for a species regardless of whether or not it is held in captivity.

Examples of indirect conservation roles include:

- Providing knowledge, experience or training to build capacity for veterinary care or handling of individuals in the field (e.g. radio collar application, transport, etc.) or in the context of law enforcement (rescue centers, human wildlife conflicts etc.)
- Making available existing zoo education materials or education/behavior change expertise to teams developing awareness programs for local communities *in situ*.
- Carry out education and awareness about the status of and threats to the species. Increase interest in the species and its habitat/ecosystem.
- Networking and lobbying to influence opinions, legislation processes, etc.
- Small scale fundraising to contribute to high priority *in situ* projects or IUCN SSC Specialist Group activities
- And others …

NON-CONSERVATION ROLES FOR *EX SITU* MANAGMENT

Questions that can be asked to investigate non-conservation roles for *ex situ* management in zoos and aquaria:

- Is this species required/suited to let holders gain experience in canid/hyaenid husbandry before taking on more difficult species? Specify which type of experience.
- Is the species important for research that is not conservation related (basic and applied research)? Specify the research fields.
- Is the species particularly valuable for non-conservation education (specific aspects of canid/hyaenid biology)? Specify the education topics.
- Does the species have an above average evolutionary distinctiveness score (see page 7 and 8)?
- Is the species colorful/distinctive/diurnal/active and particularly attractive as a zoo exhibit?
- Does the taxon have a special human cultural value (e.g. as a national or regional symbol, in a historic context, featuring in traditional stories, etc.) or economic value (e.g. traditional medicine, tourism, hunting) within its natural range or in a wider global context, and does this give the species a particular value for education or exhibit?

RATING OF ROLES

Conservation benefit of any direct conservation roles chosen (as a group): High/Medium/Low

Conservation benefit of any indirect conservation roles chosen (as a group): High/Medium/Low

Importance of the species to the zoo community, unrelated to conservation: High/Medium/Low

DETERMINING CHARACTERISTICS AND RESOURCES OF THE *EX SITU* POPULATION NEEDED TO FULFIL THE IDENTIFIED ROLE(S)

1. **General characteristics**
   - Does the program likely need to be long, medium or short term?
   - Is a release phase already planned for the foreseeable future?
   - Is proximity to the natural habitat crucial or beneficial?
   - Do the *ex situ* activities involve whole living organisms and/or live bio-samples?
   - What level of human proximity or interaction is desirable?

2. **Founders and population size**
   - Is the founder base of the current *ex situ* population likely already sufficient or are more founders required?
   - Can additional founders or unrelated individuals be (legally and logistically) obtained? From wild? Other zoo regions? Other *ex situ* collections?
   - Can the population be kept at, or grown to, the required population size?

3. **Genetic and demographic management**
   - Is the taxonomy clear *in situ* and *ex situ*? What is the taxonomic scope of the *ex situ* program?
   - Will reproduction be required in the *ex situ* program?
   - Is retention of a high proportion of gene diversity of high, medium or low importance?
   - Is control over the population size/growth and age/sex structure of high, medium or low importance?
   - Is the species best managed at individual or group level?
   - Will breeding and transfer recommendations be necessary? If yes, how important is it that these are mandatory?
   - How likely are ownership and access issues likely to impede success of the program?

4. **Location and scale**
   - Geographic location and scale? Range country involvement?
   - Do (some) non-zoo association members or non-zoo institutions play a role? If yes, what level of commitment is required from them?
   - If work required across regions, is there a need for a formal framework for this or is more informal collaboration sufficient?

5. **Catastrophes**
   - Biosecurity needs?
   - Specific requirements to reduce impact of other potential catastrophes?

6. **Research** or **Training** setup/equipment needed?

7. Particular **welfare** issues to be addressed?

Feasibility: High / Medium / Low
(existing ex situ population, husbandry challenges, technical or logistical challenges, availability of skilled staff, availability of sufficient financial and other resources, …)

Risks: High / Medium / Low
(sensitivity to catastrophes, consequences for wild population, occupying ex situ space for other species that need it more, human health and safety risks, political risks, risks for social or public conflicts …)

SUGGESTED RECOMMENDATION CATEGORIES

a) Reaching consensus whether or not to go ahead with *ex situ* activities with these roles:

- **For conservation roles**: Considering the relative importance/weight of potential conservation benefit (also compared to alternative conservation actions or inaction) *vs.* likelihood of success, costs and risks, what is the recommendation for *ex situ* management, if any, for conservation? Potential factors that can influence the relative weighting:
  - Severity of threats/risk to the wild population
  - Value of the species (ecological, cultural, sociological, economic, evolutionary distinctiveness, potential as flagship species, etc.)
  - Legal and political mandates,
  - Etc.

- **For non-conservation roles**: Considering the relative importance/weight of the benefit of the species to the zoo community (unrelated to conservation) *vs.* likelihood of success, costs and risks – ESPECIALLY the cost of occupying enclosure space for canids/hyaenids, or for other taxa with similar requirements, what is the recommendation for *ex situ* management, if any, for non-conservation reasons?

➔ **Final roles selected (if any) are**: ……..

b) In order to fulfil the roles selected under a (if any) and build an *ex situ* program with the characteristics defined earlier, which of the actions below is recommended for this species (more than one may apply)? These are non-binding recommendations to be discussed within relevant regional association collection planning and program management structures.

- **Do Not Obtain Globally**
- **Do Not Obtain Regionally** (specify which region(s))
- **Phase out Globally**
- **Phase out Regionally** (specify which region(s))
- **Develop/continue regional studbook** (temporary – for further research – then phase into one of other categories)
- **Develop/continue international studbook** (temporary – for further research – then phase into one of other categories)
- **Develop/continue regional high intensity program** with characteristics defined during workshop process. (In as much as this is possible within regional association *ex situ* program structures and rules.)
- **Develop/continue regional low intensity program** with characteristics defined during workshop process. (In as much as this is possible within regional association *ex situ* program structures and rules.)
- **Develop/continue informal multi-regional program** with characteristics defined during workshop process. (In as much as this is possible within regional association *ex situ* program structures and rules.)
- **Potential candidate for development of formal multi-regional program (e.g. GSMP, RSMP)**

Evolutionary Distinctiveness scores (from ZSL http://www.edgeofexistence.org/)

CANID Species	Common names	GE Score	ED Score
Otocyon megalotis	Bat-eared Fox	LC	8,846867958
Nyctereutes procyonoides	Racoon Dog	LC	7,872139452
Urocyon littoralis	California Channel Island Fox, Channel Islands Fox, Island Fox, Island Gray Fox, Island Grey Fox	CR	6,471532391
Urocyon cinereoargenteus	Grey Fox, Gray Fox, Tree Fox	LC	6,471532391
Vulpes chama	Cape Fox, Silver Fox, Silver Jackal	LC	5,454765503
Vulpes bengalensis	Bengal Fox, Indian Fox	LC	5,405492285
Vulpes cana	Blanford's Fox, Afghan Fox, Corsac, Dog Fox, Hoary Fox, Steppe Fox	LC	4,590209815
Vulpes zerda	Fennec Fox	LC	4,590209815
Lycaon pictus	African Wild Dog, Cape Hunting Dog, Painted Hunting Dog, Wild Dog	EN	4,221528043
Cerdocyon thous	Crab-eating Fox, Common Fox, Common Zorro, Crab-eating Zorro, Forest Fox, Savannah Fox	LC	4,174530331
Speothos venaticus	Bush Dog, Savannah Dog, Vinegar Dog	NT	4,154607202
Chrysocyon brachyurus	Maned Wolf	NT	4,13820942
Atelocynus microtis	Short-eared Dog, Short-eared Fox, Small-eared Dog, Small-eared Zorro	NT	4,084189876
Cuon alpinus	Dhole, Asiatic Wild Dog, Indian Wild Dog, Red Dog	EN	4,001419045
Alopex lagopus	Arctic Fox, Polar Fox	LC	3,911300991
Canis mesomelas	Black-backed Jackal, Chacal À Chabraque, Silver-backed Jackal	LC	3,663512913
Vulpes macrotis	Kit Fox, Desert Fox	LC	3,568916036
Vulpes velox	Swift Fox	LC	3,568916036
Canis aureus	Golden Jackal, Asiatic Jackal, Common Jackal	LC	3,568733385
Canis adustus	Side-striped Jackal	LC	3,568733385
Vulpes vulpes	Red Fox, Cross Fox, Silver Fox	LC	3,560572771
Vulpes rueppellii	Rüppell's Fox, Rueppell's Fox, Rüeppell's Fox, Rüppel's Fox, Rüppell's Sand Fox, Rüppell's Sand Fox, Sand Fox	LC	3,560572771
Vulpes corsac	Corsac Fox, Corsac	LC	3,557949386
Vulpes ferrilata	Tibetan Fox, Sand Fox, Tibetan Sand Fox	LC	3,557949386
Pseudalopex vetulus	Hoary Fox, Hoary Zorro, Small-toothed Dog	LC	3,338245655
Canis simensis	Ethiopian Wolf, Simien Fox, Simien Jackal	EN	3,323787763
Canis latrans	Coyote, American Jackal, Brush Wolf, Prairie Wolf	LC	3,309152245
Canis lupus	Grey Wolf, Arctic Wolf, Common Wolf, Gray Wolf, Mexican Wolf, Plains Wolf, Timber Wolf, Tundra Wolf	LC	3,295050397
Pseudalopex griseus	Argentine Gray Fox, Grey Zorro, South American Grey Fox	LC	2,936270142
Pseudalopex fulvipes	Darwin's Fox	CR	2,936270142
Pseudalopex gymnocercus	Pampas Fox, Azara's Fox, Azara's Zorro, Azara's Fox	LC	2,856731824
Pseudalopex sechurae	Sechura Fox, Peruvian Desert Fox, Sechura Desert Fox	NT	2,85047486
Pseudalopex culpaeus	Culpeo, Andean Fox	LC	2,844044765
		Average:	**4,18952783**
HYAENID Species	**Common names**	**GE Score**	**ED Score**
Proteles cristata	Aardwolf	LC	29,11644048
Crocuta crocuta	Spotted Hyaena	LC	20,6948818
Hyaena hyaena	Striped Hyaena	NT	20,52750819
Hyaena brunnea	Brown Hyaena	NT	20,52362391
		Average	**22,7156136**

CANID AND HYAENID SPECIES ORDERED BY THREAT CATEGORY AND SIZE OF POPULATION IN ZOOS

	***Ex Situ* Status (global pop size)**				
Status	**Large Pop (>100)**	**Small Pop (~50-100)**	**Very Small (<40)**	**Not in captivity**	**Total Taxa**
Threatened	**8**	**0**	**3**	**3**	**14**
Non-Threatened	**9**	**5**	**12**	**3**	**29**
Total Taxa	**17**	**5**	**15**	**6**	**43**

	***Ex Situ* Status (global pop size)**			
Status	**Large Pop (>100)**	**Small Pop (~50-100)**	**Very Small (<40)**	**Not in captivity**
Threatened	African wild dog (696) Bush dog (200) Dhole (363) *Dingo (163)* Maned wolf (371) Mexican gray wolf (243) Red wolf (202) Striped hyena (243)		Brown hyena (13) Island fox (5) Sechura fox (13)	Darwin's fox Ethiopian wolf Short-eared dog
Non-Threatened (Least Concern)	Arctic fox (155) Bat-eared fox (165) Coyote (127) Fennec fox (356) Golden jackal (200) Gray wolf (1172) Raccoon dog (300) Red fox (389) Spotted hyena (265)	Corsac fox (65) Grey fox (48) Iberian wolf (50) Sand fox (49) Swift fox (65)	Aardwolf (6) Bengal fox (7) Black-backed jackal (33) Blanford's fox (28) Cape fox (6) Chilla (6) Crab-eating fox (26) Culpeo fox (22) Kit fox (15) Pampas fox (3) Side-striped jackal (1) Singing dog (37)	Hoary fox Pale fox Tibetan fox

Underlined = non-threatened species with above average Evolutionary Distinctiveness score (from ZSL http://www.edgeofexistence.org/)
Canid and Hyaenid averages calculated separately within these groups – see page 7