



IUCN Species Survival Commission Guidelines on the Use of *Ex situ* Management for Species Conservation



International Union for Conservation of Nature



IUCN Species Survival Commission
Guidelines on the Use of *Ex situ*
Management for Species Conservation

Version 2.0

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Drafting process and acknowledgements

A working group was established to revise the *IUCN Technical Guidelines on the Management of Ex Situ Populations for Conservation* to clarify the process and bring the guidelines into line with developments that had taken place since their publication in 2002. This process started with an analysis of decision-making steps for evaluating *ex situ* activities for conservation benefit during the Annual Meeting of the IUCN Species Survival Commission (SSC) Conservation Breeding Specialist Group (CBSG) in Cologne, Germany in October 2010. This analysis was undertaken by individuals involved in a range of taxonomic and disciplinary SSC Specialist Groups, *in situ* conservation organisations, and the zoo and aquarium community. Subsequently, a drafting team was formed under the auspices of CBSG, comprising Kristin Leus (CBSG Europe, Copenhagen Zoo), Kathy Traylor-Holzer (CBSG), and Philip McGowan (Galliformes Specialist Group). They were supported by representatives from all SSC Subcommittees, namely Mike Maunder (Plant Conservation Subcommittee), Yvonne Sadovy (Marine Conservation Subcommittee), Paul Pearce-Kelly (Invertebrate Conservation Subcommittee), Topiltzin Contreras MacBeath (Freshwater Conservation Subcommittee), and Mark Stanley Price (Species Conservation Planning Subcommittee). In addition, Mike Jordan represented the Reintroduction Specialist Group. Mike Hoffmann served as the SSC Steering Committee liaison for this project.

A first draft was presented to the 2011 CBSG Annual Meeting in Prague, Czech Republic, and a series of drafts were submitted for increasingly wide review between 2011 and 2013 to the SSC Steering Committee, its Subcommittees, all Specialist Groups and Task Force Chairs, and Red List Authority Focal Points. A consultation was held during the SSC Chairs' meeting in February 2012. The consultative and open review process was reported in the SSC e-bulletin and presented at the 2012 World Conservation Congress in Korea. The consultation included a range of non-IUCN entities, including wildlife health professionals; botanical collections and botanical gardens; national, regional and global zoo and aquarium associations; and national and international organisations, including, but not restricted to, International Fund for Animal Welfare, Royal Society for the Prevention of Cruelty to Animals, Royal Society for the Protection of Birds, Pan African Sanctuary Alliance, UN Food and Agriculture Organisation, BirdLife International, Wildlife Conservation Society, and the Leibniz Institute for Zoo and Wildlife Research. The final draft was submitted to and approved by the SSC Steering Committee on 29 August 2014.

The drafting team (Kristin Leus, Kathy Traylor-Holzer and Philip McGowan) would like to express heartfelt thanks to each and every person that contributed to the development of the guidelines. We also acknowledge the support of home institutions and organisations of all contributors for allowing them the time to carry out this work. We hope that these guidelines contribute to the evaluation and, where appropriate, application of *ex situ* management for effective species conservation.

Guidelines

Section 1: Introduction

As habitats and ecosystems become increasingly altered and populations evermore impacted by human activities, a growing number of species will require some form of management of both individuals and populations to ensure their survival. Effective species conservation planning should consider all options when assessing what actions are necessary to address the conservation pressures facing a particular species. *Ex situ* management (see Section 2 for definition) is one possible option that can contribute to the conservation of threatened species. The range of *ex situ* scenarios and tools is diverse and can target different conservation needs and roles and, therefore, serve various purposes.

Ex situ management has been used to deliver conservation benefit for threatened species. Species extinctions have been prevented and for an increasing number of species there have been conservation restorations or introductions following periods of *ex situ* management. However, the need for, and suitability of, an *ex situ* programme must be carefully evaluated as part of an integrated conservation strategy. In order to be successful, *ex situ* programmes need to be carefully planned and implemented in a way that provides conservation benefit. In addition, as conservation challenges become more complex and urgent, the need to further develop scientifically based and innovative approaches to *ex situ* conservation will increase.

Not all species will require an *ex situ* component as part of their conservation strategy, and not all *ex situ* populations will have a direct conservation purpose. These guidelines are intended to be used in situations in which *ex situ* management is being considered as part of an overall integrated species conservation strategy.

The aim of these guidelines is to provide practical guidance on evaluating the suitability and requirements of an *ex situ* component for achieving species conservation objectives. They should not be misconstrued as promoting *ex situ* management over any other form of conservation action, and specific elements should not be selected in isolation to justify *ex situ* management for conservation. Indeed they are intended to ensure that proposals for any such activities are rigorously designed and scrutinised, whatever the taxon or scale of operation. Accordingly, the need for risk assessment and sound decision making processes in all *ex situ* management for conservation is emphasised, but with the level of effort in proportion to the scale, risk and uncertainties around any such activity.

These guidelines replace the 2002 IUCN Technical Guidelines on the Management of *Ex Situ* Populations for Conservation. In addition, aspects of these guidelines merge with many other disciplines in contemporary conservation, which also have their own guidelines or policies. Within IUCN, these guidelines should be seen as complementary to, and consistent with, the following key works:

- *IUCN Guidelines for Reintroductions and Other Conservation Translocations* (2013)¹. In those cases where individuals are used for population restoration or conservation introduction following a period of *ex situ* management, these guidelines should be consulted together.
- *IUCN Guidelines for the Prevention of Biodiversity Loss Caused by Alien Invasive Species* (2000)¹.
- IUCN (2008). *Strategic Planning for Species Conservation: A Handbook*¹.

¹ http://www.iucn.org/about/work/programmes/species/publications/iucn_guidelines_and_policy_statements/

- IUCN (2000). *The IUCN Policy Statement on Sustainable Use of Wild Living Resources*¹
- OIE and IUCN (2014). *Guidelines for Wildlife Disease Risk Analysis*¹
- IUCN World Commission on Protected Areas (2012). *Ecological Restoration for Protected Areas: Principles, guidelines and best practices*²
- IUCN Red List³

It should also be noted that many other organisations have developed their own guidelines for activities in the spectrum from species reintroduction to ecosystem restoration.

These guidelines are in line with the Convention on Biological Diversity and its Strategic Plan for Biodiversity (the Aichi Biodiversity Targets).

Section 2: Scope and definitions

The term “*ex situ*” can be problematic to define in some circumstances, just as it is sometimes difficult to distinguish precisely the conditions that define “wild” or “managed” in today’s increasingly altered landscapes. Consequently, in many contexts there is now a gradient of management interventions between no management at one end and intensive management of individuals at the other, and between the traditional *in situ* and *ex situ* categories. Many populations both within and outside protected areas are subject to varying intensities of management such as anti-poaching interventions, predator or pathogen control, the provision of supplementary nutrition, habitat modification (e.g. controlled burning or flooding), the application of assisted reproduction, restriction of natural migration and dispersal, meta-population management, population regulation, etc., that show some characteristics in common with those used in the intensive management of *ex situ* populations. While we encourage the evaluation of the full “*in situ* to *ex situ*” spectrum of population management options in the process of identifying the most suitable conservation strategies for a species, these guidelines are designed to provide guidance for situations towards the *ex situ* end of the spectrum.

For the purpose of these guidelines, “ex situ” is defined as conditions under which individuals are spatially restricted with respect to their natural spatial patterns or those of their progeny, are removed from many of their natural ecological processes, and are managed on some level by humans. In essence, the individuals are maintained in artificial conditions under different selection pressures than those in natural conditions in a natural habitat. These are generally circumstances in which humans exercise control over many of the natural dynamics of a population, including control of climate and living environments, access to nutrition and water, shelter, reproductive opportunities, and protection from predation or certain other natural causes of mortality. Ex situ management may take place either within or outside the species’ geographic range, but is in a controlled or modified environment. This may include highly artificial environments where individuals are stored as dormant in subzero conditions (e.g. seedbanks, genome resource banks), or semi-natural conditions where individuals are subject to near natural environments.

² http://www.iucn.org/about/work/programmes/gpap_home/gpap_capacity2/gpap_bpg/?10734/Ecological-Restoration-for-Protected-Areas

³ <http://www.iucnredlist.org/>

These guidelines are specifically intended for situations in which *individuals (or live bio-samples) of any species (or other taxonomic unit) are present ex situ for any period of time for a clearly defined conservation purpose.*

For simplicity, the guidelines use the terms of “individual” to represent both individuals and live bio-samples and “species” to represent any taxonomic unit of conservation interest. These guidelines apply to:

Ecological contexts

- All taxonomic groups (animals, plants, fungi, bacteria, protozoa, etc.);
- All taxonomic levels (e.g. species, subspecies or different groupings of these);
- All population levels (e.g. all individuals of a species, single population, multiple populations);
- All live entities (not only whole living organisms, but also gametes, seeds, living cell lines, etc.); and
- All geographic levels (e.g. local, national, global).

Management contexts

- Both situations in which individuals need to be taken from the wild and brought under *ex situ* management, and situations in which the management of existing *ex situ* populations may be utilized or adapted for conservation benefit;
- The complete spectrum of very short term to very long term *ex situ* phases that may or may not include all life stages or reproduction; and
- Only *ex situ* populations with clearly defined conservation goals and objectives that contribute to the viability of the species as a component of its overall conservation strategy. While many different types of *ex situ* populations exist, with many different and sometimes overlapping roles and contexts, *ex situ* management for conservation only applies to those *ex situ* populations that have conservation as their primary aim. The *ex situ* activities must benefit a population, the species, or the ecosystem it occupies and the primary benefit should be at a higher level of organisation than the individual. The conservation goals and objectives can be diverse and may include not only providing individuals for reintroduction or other conservation translocations, for genetic rescue or as insurance against extinction, but also for allowing tailored conservation education, conservation research and training that targets the reduction of threats or the accrual of conservation benefits for the species. This does not preclude these *ex situ* populations for conservation from having additional roles that are not necessarily, or only indirectly and generally, related to conservation.

Section 3: *Ex situ* management as a conservation tool

Not all species conservation strategies will require an *ex situ* component, in the same way that other management interventions may or may not be required to conserve a species. In some cases *ex situ* management will be a primary part of a conservation strategy and in others it will be of secondary importance, supporting other interventions. It is necessary, therefore, to consider how *ex situ* management may contribute to the overall conservation objectives set for the species and to document this clearly.

Often primary threats such as habitat loss, invasive species, or overexploitation lead to small isolated populations, which then in turn become highly susceptible to additional stochastic threats that can lead to a feedback loop of population decline and eventual extinction (often referred to as the ‘extinction vortex’). It is in such instances that intensive management, including but not restricted to *ex situ* management, can be of particular conservation value if deemed appropriate for the species and situation.

Ex situ conservation has the potential to:

Address the causes of primary threats

Ex situ activities can help reduce primary threats such as habitat loss, exploitation, invasive species or disease when specifically designed conservation research, conservation training or conservation education activities directly and effectively impact the causes of these threats (e.g. training in the recognition of specific life stages or gender characteristics for preferential exploitation, education to limit the spread of an invasive species, or research into disease epidemiology or treatment).

Offset the effects of threats

Ex situ activities can improve the demographic and/or genetic viability of a wild population by ameliorating the impacts of primary or stochastic threats on the population. Small populations that are vulnerable to primary threats and stochastic processes may require some form of intensive management of individuals and populations to improve demographic and genetic viability and avoid extinction. Challenges faced by small populations (e.g. reduced survival, reduced reproduction, decreased population size, and genetic isolation) can be counteracted by a range of population management options, such as head start programmes to address high juvenile mortality, or population reinforcement to balance age and sex distribution.

Buy time

Establishment of a diverse and sustainable *ex situ* rescue or insurance population may be critical in preventing species extinction when wild population decline is steep and the chance of sufficiently rapid reduction of primary threats is slim or uncertain or has been inadequately successful to date. Examples include *ex situ* populations in response to severe disease threat, catastrophic events or continued habitat degradation.

Restore wild populations

Once the primary threats have been sufficiently addressed, *ex situ* populations can be used for population restoration (reinforcement or reintroduction) or conservation introduction (assisted colonisation or ecological replacement). As such, these guidelines should be seen as complementary to, and consistent with, the IUCN Guidelines for Reintroductions and Other Conservation Translocations¹, and any *ex situ* programme for conservation that includes a return of individuals from *ex situ* conditions to natural conditions must equally refer to these.

For a growing number of taxa *ex situ* management may play a critical role in preventing extinction as habitats continue to decline or alter and become increasingly unsuitable. Furthermore, it should be acknowledged that even under the most optimistic of climate change impact and adaptation scenarios, an increasing percentage of species (for example, polar and mountain species; reef corals and their dependent species) may have little likelihood of long-term persistence in the wild, despite the option of assisted colonisation in certain carefully selected cases. At present, many threat assessment processes are inadequate in predicting the complex impacts of climate change and ocean acidification on the potential persistence of a species *in situ* (either within its current or a new range).

Section 4: Integrating *in situ* and *ex situ* conservation planning

There is an increasing need to ensure the integration of *in situ* and *ex situ* conservation planning to ensure that, whenever appropriate, *ex situ* conservation is used to support *in situ* conservation to the best effect possible. These guidelines would therefore ideally be used as an integral part of, and complementary to, existing species conservation planning processes (Figure 1). Any *ex situ* conservation support should follow a logical process from initial concept to design, feasibility, risk assessment, decision-making, implementation, monitoring, adjustment and evaluation. Furthermore, the Species Survival Commission's approach to conservation planning for species¹ requires the specification of goals, objectives and actions:

- A goal is a statement of the intended result in terms of conservation benefit;
- Objectives give clear and specific details for how the goal will be realised; and
- Actions are statements of what should be done to meet the objectives.

When used strategically *ex situ* conservation can be a potent tool for species conservation that does not undermine, but complements, the imperatives of field conservation. Potential *ex situ* goals, objectives and actions should therefore be evaluated alongside potential *in situ* activities in the process of conservation planning to ensure that they are used appropriately and to best effect. More specifically, before an *ex situ* conservation programme is developed or continued, it is important to consider the roles it can play, the characteristics and dimensions it should take, and what factors will impede or likely contribute to conservation success. As is the case for conservation planning in general, these evaluations are ideally made by a multi-stakeholder group, including both *in situ* and *ex situ* expertise and experience.

These guidelines outline five steps (Figure 1) to evaluate the appropriateness of *ex situ* management as part of a comprehensive species conservation strategy. They explore the conservation role and design, feasibility, and risk assessment, and guide a final decision on whether or not to proceed with an *ex situ* programme for conservation. The five-step process also provides input for the formulation of clear goals, objectives and actions for any *ex situ* conservation programme undertaken after the decision making process.

FIVE-STEP DECISION MAKING PROCESS

to decide when *ex situ* management is an appropriate conservation tool

Ex situ management should be applied to the conservation of a species where, on balance, stakeholders can be confident that the expected positive impact on the conservation of that species will outweigh the potential risks or any negative impact (which could be to the local population, species, habitat or ecosystem), and that its use will be a wise application of the available resources. This requires an assessment of the potential net positive impact, weighted by how likely it is that this potential will be realised, given the expertise, level of difficulty or uncertainty, and available resources.

The following five-step outline provides a logical decision-making process that can be applied to evaluate the appropriateness of *ex situ* management as a tool to support the conservation of a species and to identify the form that such management would need to take. All steps of the process should be documented for transparency and clarity.

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

A detailed review should be undertaken of all relevant information on the species, both in the wild and ex situ, with the aim of assessing the viability of the population(s) and to identify and understand threats that affect the species. This is a normal step in any conservation planning process and may therefore for some species already be available in existing conservation strategies or action plans. If not, this process would ideally be conducted in the wider framework of the creation of one integrated conservation strategy for a species.

- a. The status review should contain information on all factors that are appropriate to the life history and taxonomy, current population status, and other factors that are relevant to the demographic and genetic viability and ecosystem function of the species being considered. The structure of the status review (and threat analysis – see b. below) should, wherever possible, be consistent with IUCN processes that also compile information on status, such as the IUCN Red List Assessments³ and the IUCN/SSC Species Conservation Planning approach¹. The character and scale of the status review will vary depending on the precise circumstances, including data availability and relevance. Important information gaps concerning the status should be noted.
- b. A threat analysis should be undertaken to identify the specific historical, current and likely future primary direct and indirect threats as well as stochastic threats facing the species in the wild and the constraints limiting its viability and conservation. This analysis should, wherever possible, utilise the rapidly growing data knowledge on anticipated climate change scenarios to predict likely changes in status. This provides the framework for evaluating specifically how *ex situ* management of the species may contribute to its conservation.
- c. Genetic and demographic modelling should where possible be used to assess the viability of the wild population. This can be very valuable to guide population management by identifying the effects and relative importance of threats (including stochastic processes) and the strategies that may address them effectively.
- d. The status of any free-living populations living outside of the species' indigenous range, as well as the status of existing *ex situ* population(s) (if any), should be reviewed, including current population size, demographic and genetic characteristics, provenance and history, taxonomy, and any programme goals and management methods if applicable.
- e. In the absence of sufficient data for a thorough assessment, other information may be considered as evidence suggestive of current or impending population decline or reduced viability, such as population trends, likelihood of future habitat loss, vulnerability to climate change, projected impact of invasive species, and restricted range to one or few locations.

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

The potential ex situ management strategies proposed should address one or more specific threats or constraints to the species' viability and conservation as identified in the status review and threat analysis, and target improvement of its conservation status.

a. There should be a clear statement on how the proposed *ex situ* programme will contribute quantifiable benefits to the conservation of the species and address certain specific threat(s) and/or constraints to its viability as identified in the status review and threat analysis. This should include quantifiable goal(s) and objectives, and how success towards those objectives will be measured and assessed. When sufficient data and expertise are available, population modelling can be effective in assessing the potential impact of the *ex situ* programme on the viability of the wild population.

b. Potential roles (purpose/function) that an *ex situ* programme might serve for the conservation of a species generally fall into the four categories of *Addressing the causes of primary threats, Offsetting the effects of threats, Buying time, and Restoring wild populations* (see Section 3) and more specifically include but are not restricted to:

- **Insurance population** (maintaining a viable *ex situ* population of the species to prevent predicted local, regional or global species extinction and preserve options for future conservation strategies);
- **Temporary rescue** (temporary removal from the wild to protect from catastrophes or predicted imminent threats, e.g. extreme weather, disease, oil spill, wildlife trade). This could be appropriate at either local or global scale;
- Maintenance of a **long term *ex situ* population** after extinction of all known wild populations and as a preparation for reintroduction or assisted colonisation if and when feasible;
- **Demographic manipulation** (e.g. head-start programmes that remove individuals from the wild to reduce mortality during a specific life stage and then subsequently return them to the wild);
- **Source for population restoration**, either to re-establish the species into part of its former range from which it has disappeared, or to reinforce an existing population (e.g. for demographic, behavioural or genetic purposes);
- **Source for ecological replacement** to 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;
- **Source for assisted colonisation** to introduce the species outside of its indigenous range to avoid extinction;
- **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); and
- Basis for an **education and awareness programme** that addresses specific threats or constraints to the conservation of the species or its habitat.

c. One *ex situ* programme may serve several conservation roles – either simultaneously or consecutively.

It is recognised that an *ex situ* population can also serve to avoid extinction of a species that has no chance in the foreseeable future for persistence in the wild (for example in the face of climate change). In such circumstances a careful appraisal of the allocation of available resources should be made, and a prioritization based on conservation benefits and other values may assist in the decision making.

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

The identified conservation purpose and function of the ex situ programme will determine its required nature, scale and duration.

a. **Biological factors** that are important in assessing requirements for achieving the programme's aim and objectives include:

- The number of founders (unrelated individuals of wild origin) required to attain the genetic and demographic goals of the *ex situ* population. This may involve making use of founders (and their descendants) of existing *ex situ* populations and/or sampling (additional) individuals (and where appropriate propagules or biomaterials from individuals) from the wild, across different habitat types, populations, etc.;
- The number of individuals or bio-samples to be maintained or produced *ex situ*;
- Whether reproduction or propagation is required during the duration of the programme;
- The likely required length of programme (in generations and in years) where possible;
- The relative risk for artificial selection/adaptation (genetic, phenotypic, etc.) during consecutive generations in *ex situ* conditions;
- Whether the *ex situ* phase is envisaged to be followed by a release (which has consequences for the required characteristics of the *ex situ* environment); and
- The type of environment required to maintain the individuals in a suitable condition during the length of the programme.

b. These lead to the following **practical considerations** that should be evaluated:

- The most suitable geographic location and scale for the *ex situ* activities (for example, inside vs. outside of the current/indigenous range; a centralized vs. a multi-facility programme; etc.). Where possible *ex situ* management should be undertaken within the range states and under similar climatic regimes to the wild population. However, because the current distribution of *ex situ* facilities and professional capacity generally does not match with the geographic areas of greatest species loss, the need for capacity building and the availability of material resources and suitably trained and committed personnel requires consideration;
- Whether whole living organisms and/or live bio-samples (e.g. tissue or gametes/seeds/spores) will need to be maintained *ex situ*;
- Whether whole living organisms and/or live bio-samples will need to be marked and tracked and if so, how;
- Whether individuals from existing *ex situ* populations (potentially with other, or additional, roles than conservation) can be included in the *ex situ* conservation programme, thus reducing the risks to the wild population associated with the removal of individuals;
- The intensity of genetic and demographic management required to achieve the roles and goals of the *ex situ* programme;
- The potential bio-security risks associated with the project, both at the *ex situ* location(s) and in any subsequent population restoration or conservation introduction if this is planned;
- The welfare issues associated with the programme;
- The potential options for, and benefits of, maintaining individuals on public display vs. in non-public facilities that restrict access, visibility or disturbance;

- The degree of human proximity and interaction that can be allowed in terms of the potential for habituation of *ex situ* individuals to people, due to the management approach chosen and/or exposure to the public;
- The legal and regulatory requirements for removing individuals or biomaterials from the wild and/or transporting them regionally, nationally or internationally;
- The ownership of, and access to, individuals and bio-samples and the degree of assurance of ongoing commitment to the programme by both holding and owning parties; and
- The fate of any individuals or bio-samples remaining in the *ex situ* programme when its purpose has been achieved.

Population models may be used to determine the necessary population size, composition and level of management needed to meet the conservation role(s) of the population.

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

*It is not sufficient to know the potential value of an *ex situ* programme designed to meet a specific conservation role – it is also critical to evaluate the resources needed, the feasibility of successfully managing such a programme, the likelihood of success at all steps of the programme, including where relevant any subsequent return to the wild, and the risks, including risks to the species in the wild and to other conservation activities. These should be balanced against the risks of failing to take appropriate conservation action.*

a. It is essential to assess the **resources** required to establish and maintain an *ex situ* population with the characteristics defined in Step 3 in order to achieve the aims and objectives stated in Step 2. These should be considered in detail at this stage. Some of the practical factors that will determine the overall scale of resources required include:

- The facilities, infrastructure and space required;
- The staffing required (in terms of numbers, skills and continuity);
- The risk for the spread of disease (need for biosecurity, quarantine, diagnostics, research on pathogens and disease, etc.);
- The risk of catastrophes impacting the *ex situ* programme (natural or human-caused catastrophes, such as fire, civil unrest, etc.); and
- The finances required for all essential activities over an adequate period of time (in proportion to the expected total length of the programme).

b. Other factors that need to be determined to investigate the **feasibility and risks** of the proposed project include:

- The probability of obtaining the required resources, including technical experts and project managers with the required skill sets. Effective *ex situ* management for conservation will require effective multidisciplinary teams within the biological, technical and social skill sets;
- Competition for resources with other programmes for the same or other taxa as well as opportunities for cost sharing;
- Available expertise in husbandry/disease control/cultivation/propagation/banking for relevant life stages for this and/or for related/comparable taxa. In some areas of the world, particularly in regions facing the highest rates of biodiversity loss, the capacity for skills in *ex situ* conservation may need to be strengthened. Similarly, the increasingly diverse range of candidate species and challenges to be addressed may require additional tools and techniques;
- The degree of stability in, or level of agreement about, the taxonomy of the taxon in question and the degree of knowledge on evolutionary significant units, genetic population structure and risks for inbreeding and outbreeding depression;
- The critical governmental and non-governmental partner institutions and the probability of successful collaboration among these (including partners responsible for field conservation);
- The degree of compatibility of the ecological, demographic, behavioural or other characteristics of the species with the type of *ex situ* management proposed;
- Requirements to ensure the welfare of any living individuals *ex situ*. *Ex situ* conservation programmes should adhere to internationally accepted standards for welfare, and efforts should be made to reduce stress or suffering;
- All legal and regulatory requirements for the project (so that the intended *ex situ* management is approved and supported by all relevant agencies) and how likely

they can be fulfilled. An *ex situ* conservation programme may need to meet regulatory requirements at any or all of the international, national, regional or sub-regional levels. This may among others involve regulations for the capture or collection of individuals from the source populations, for the movement of individuals across international borders (e.g. CITES) and across jurisdictional or formally recognised tribal boundaries, for dealing with benefits arising from the use of genetic resources and/or traditional knowledge (e.g. Nagoya Protocol), for veterinary and phyto-sanitary aspects, and for the holding of wild individuals in *ex situ* conditions;

- Any formal endorsements required for the project from relevant *in situ* and/or *ex situ* entities, and how likely they can be obtained;
- Where relevant, assessment of the impact of the removal of individuals from the wild on the remaining wild source population (e.g. through modelling);
- The likely impact on the remaining wild population and its habitat of establishing, or not establishing, an *ex situ* population. Special consideration may be given to situations in which all remaining wild individuals may need to be removed due to a very high probability of extinction in the wild that cannot be mitigated in time;
- The ecological risks (e.g. containment of potentially invasive species, hybridisation risks) and what is required to minimise them;
- Any health and safety risks (for people and/or other species) and what is required to minimise them; and
- Any potential political, social or public conflicts of interest and how they can be dealt with. A review of the cultural status of the species should be conducted to ensure that any *ex situ* conservation management is compatible with local traditions and values and supported by local communities at the source location(s) and/or the *ex situ* location(s). Mechanisms for communication, engagement and problem-solving between the public (especially key individuals most likely affected by or concerned about the removal of individuals from nature or the maintenance of individuals *ex situ*) and *ex situ* managers should be established.

A review of the factors mentioned above will allow the assessment of an overall probability of the *ex situ* programme achieving the intended results in terms of conservation benefit.

The scope of the risk assessment should be proportional to the level of identified risk. Where data are poor, the risk assessment may only be qualitative but it is necessary, as lack of data does not indicate absence of risk.

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).

The decision to include ex situ management in the conservation strategy for a species should be determined by weighing the potential conservation benefit to the species against the likelihood of success and overall costs and risks of not only the proposed ex situ programme, but also alternative conservation actions or inaction.

The relative importance (weight) of potential conservation benefit vs. likelihood of success, costs and risks will vary for each species and situation, according to factors such as, but not limited to:

- The severity of threats and/or risk of extinction of the wild population;
- The significance of the species (ecological, cultural, sociological, economic or evolutionary distinctness, value of the species in leveraging large scale habitat conservation, etc.); and
- Legal and political mandates.

In general, any conservation management strategy including *ex situ* management is warranted when potential conservation benefit is both high and likely to be achieved. Similarly, *ex situ* management is not warranted if there is little conservation benefit, feasibility is low, and costs and risks (especially to the wild population) are high.

If the decision to implement *ex situ* management of a species is left until extinction is imminent, it is frequently too late to implement effectively, thus increasing the chance of failure and risking permanent extinction of the species. This reinforces the need for comprehensive strategic planning for species to be undertaken as early as possible.

Documentary evidence of information gathered and decisions made for Steps 1 through 5 is highly important, *regardless of whether the decision to proceed with the ex situ management is positive or negative*. Archiving of documents in publicly accessible libraries and on public web sites is recommended.

SECTION 5: Programme implementation, monitoring, adjustment and evaluation

Implementation

If a decision is made to establish or continue an *ex situ* management programme, further considerations that are important in the development of this programme include:

- Actions needed to achieve the identified goals and objectives of the programme should be formulated and implemented (including actions to mitigate the most important risks identified in Step 4). Actions should be specific, measurable, have time schedules attached, and indicate the resources needed and parties responsible for their implementation;
- Data collection and management protocols for all important aspects of the programme should be developed in order to enable adequate monitoring;
- Any *ex situ* management programme should be developed within national, regional and international conservation infrastructure, recognizing the mandate of existing agencies, legal and policy frameworks, organisational conservation strategies, national biodiversity action plans or existing species recovery plans. Of noteworthy mention in the context of these guidelines are the Convention on Biological Diversity (CBD), the International Agenda for Botanic Gardens in Conservation, the Global Strategy for Plant Conservation, the International Treaty on Plant Genetic Resources for Food and Agriculture, the World Zoo and Aquarium Conservation Strategy, the Global Plan of Action for Animal Genetic Resources and the Interlaken Declaration;
- Any *ex situ* conservation programme should adhere to national and international obligations with regard to access and benefit sharing (as outlined in the CBD);
- The *ex situ* programme should consult during its planning, implementation, monitoring and evaluation stages with all relevant stakeholder groups, professional associations and organisations, both with regard to the indigenous range of the species and the location of the *ex situ* programme;
- The *ex situ* programme personnel should stay up to date with relevant scientific work and scientific publications;
- Where multiple bodies such as government agencies, non-government organisations, academia, private organisations, informal interest groups, etc. all have statutory or legitimate interests in an *ex situ* programme, it is essential that mechanisms exist for all parties to play constructive roles. This may require establishment of special teams working outside formal, bureaucratic hierarchies that can guide, oversee and respond swiftly and effectively as management issues arise. Different parties involved in an *ex situ* project may have their own mandates, priorities and agendas that need to be aligned through effective facilitation and leadership in order not to undermine the success of the project. A memorandum of understanding with appropriate parties defining the collaboration structure, ownership issues and responsibilities may be beneficial. Inter-project, inter-regional or international communication and collaboration is encouraged as relevant. The programme should consult with external experts as needed;
- The *ex situ* project should have a clear and appropriate time frame established.

Monitoring, adjustment and evaluation

There should be regular evaluations of the *ex situ* programme, not only of its own success, but also of its role within the overall conservation strategy for the species, which is likely to change over time.

The management of an *ex situ* programme is a cyclical process of implementation, monitoring, feedback and adjustment of both biological and non-biological aspects until either the goals are met or the *ex situ* programme is deemed unsuccessful. Despite thorough planning and design, inherent uncertainty and risk will lead to both expected and unexpected situations. The monitoring is the means to measure the performance of the *ex situ* programme against objectives, to assess conservation impacts, and provide the basis for adjusting objectives or adapting management regimes or activating an exit strategy. In addition to refining an ongoing *ex situ* programme, the conclusions from monitoring may guide other *ex situ* programmes.

Adequate resources for monitoring should be part of financial feasibility and commitment. The purpose and duration of monitoring of the *ex situ* populations and the species' situation in the wild (especially those aspects that the *ex situ* population is trying to address) should be appropriate to each situation.

Learning from *ex situ* conservation programme outcomes can be improved through application of more formal adaptive management approaches, whereby alternative models are defined in advance and are tested through monitoring. This process means that the models used to decide management are based on the best possible evidence and learning.

SECTION 6: Dissemination of information

Regular reporting and dissemination of information should start from the intention to initiate *ex situ* activities for conservation and throughout subsequent progress. It serves many purposes both for each *ex situ* project and collectively:

1. To create awareness and support for the *ex situ* programme amongst all parties;
2. To meet any statutory requirements; and
3. To contribute to the body of information on, and understanding of, *ex situ* management for conservation. Collaborative efforts to develop *ex situ* management science are helped when reports are published in peer-reviewed journals (as an objective indicator of high quality), and include well-documented but unsuccessful *ex situ* projects or methods as well as successful ones.

The means of dissemination are many (e.g. publications, press, interpretation in public institutions). The media, formats and languages used all should be appropriate for the target audience.

Figure 1: Incorporation of the five-step decision process outlined in these guidelines (yellow numbers) into the species conservation planning process to develop an integrated conservation strategy for a species.

