



World Association of Zoos
and Aquariums | **WAZA**
United for Conservation®

COMMITTING TO CONSERVATION

THE WORLD ZOO AND AQUARIUM CONSERVATION STRATEGY





MOUNTAIN GORILLA
RWANDA

MISSION STATEMENT

*WAZA is the voice of a global community of
zoos and aquariums and a catalyst for their
joint conservation action*

CREDITS

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The World Zoo and Aquarium Conservation Strategy*

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With more than 700 million visitors annually passing through the gates of zoos and aquariums of the world, affiliated through regional associations of the World Association of Zoos and Aquariums (WAZA), zoological facilities have an unrivalled platform to engage the general public in conservation.

In addition, it is well known that through their living collections, zoological institutions contribute significantly to conservation research. The breadth of research carried out by zoos and aquariums is truly impressive, from behaviour science to visitor learning, and the impact of such research on conservation is well recognised. This research is fundamental to the protection and preservation of our most endangered species.

And yet, given the scale and immediacy of the global conservation challenges we face—none more than the extinction crisis already upon us—we cannot expect our zoos and aquariums to carry the burden of conservation within their gates alone.

I would therefore like to congratulate WAZA on this most timely and critical document—*Committing to Conservation: The World Zoo and Aquarium Conservation Strategy*, which outlines the key role zoos and aquariums can play in supporting conservation in the wild.

The Strategy serves as a crucial reminder that visitors who better understand the connection with conservation in the wild are more likely to support the work of zoos and aquariums. The Strategy is also an important tool for practitioners to use as they endeavour to bridge the worlds of zoos and aquariums and the wild.

Much work has already been done on this front. Several WAZA members are providing critical financial support to field-based conservation and significant investments are made in wildlife conservation every year. The Strategy provides the vision and practical tools for scaling up this approach and helping zoos and aquariums respond to the conservation finance gap that remains perilously wide.

IUCN is proud to have WAZA as a member since 1949. WAZA has become a key partner of the IUCN Global Species Programme, the IUCN Species Survival Commission and *The IUCN Red List of Threatened Species*.

I encourage WAZA members and other like-minded zoological facilities to use this Strategy to ensure the wealth of knowledge and potential for public engagement is fully supportive of the wider conservation mission.



Inger Andersen

Director General, International Union for Conservation of Nature (IUCN)
June 2015

The biodiversity of our planet faces growing threats from the illegal trade in wildlife, climate change and habitat degradation. The one commonality in these threats is that they are all related to 'us' as human beings and, therefore, the power and responsibility to change course lies in our hands. The *World Zoo and Aquarium Conservation Strategy* highlights not only the importance of field conservation of species but also shows how zoos and aquariums can play a key role by encouraging people distant from the wild, to become more engaged in conservation actions.



Achim Steiner

Executive Director, United Nations Environment Programme (UNEP)

Zoos and aquariums have evolved from being simply exotic attractions to prioritising research, education and conservation to the degree that they now play several critically important roles. Through the 'Biodiversity is Us' campaign, WAZA supports the objectives of the United Nations Decade on Biodiversity 2011–2020 and the achievement of the Aichi Biodiversity Targets by educating the public about the importance of safeguarding biodiversity, and what we as individuals can do to protect and use it sustainably. The *World Zoo and Aquarium Conservation Strategy* takes a holistic, 'one plan' approach to conservation *ex situ* and *in situ*. The expanding role played by zoos and aquariums is not only about cultivating appreciation, empathy and knowledge of living creatures but also forms a central part of conservation by, among other things, helping to protect against species going extinct and providing platforms for critical research. With the ongoing global threats to the environment this will be more important than ever, and zoos and aquariums are expertly positioned to support global conservation initiatives and to serve as portals through which society can become involved in the active protection of wild populations.



Braulio Ferreira de Souza Dias

Executive Secretary, Convention on Biological Diversity (CBD)

The *World Zoo and Aquarium Conservation Strategy* is timely and highly relevant as it provides comprehensive directions to enhance the role of the world's zoos and aquariums in the conservation of wild animals. CITES and WAZA formalised their long-standing collaboration in support of the implementation of CITES by concluding a Memorandum of Understanding in 2011. WAZA and its members have expertise in the fields of animal breeding and care, marking and tracing animals, transport of live animals, field conservation, sustainable use, education, training and research, all of which are particularly pertinent to CITES. There is clearly great potential for WAZA to help strengthen CITES; for example, through providing practical assistance to Parties, sharing know-how or capacity building. We are pleased that the Strategy lays out Visions and Recommendations that touch upon each of these areas, and hope that it will provide further practical guidance to us all for the years to come.



John E. Scanlon

Secretary-General, Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)

CMS welcomes the role that zoos and aquariums play in raising awareness of our endangered wildlife and migratory species. Improving community understanding of the importance of international wildlife conservation is an important role that WAZA has played over the last few years of collaboration with CMS. Specific programmes between WAZA and CMS have included the 2009 Year of the Gorilla and 2011–2012 Year of the Bat campaigns. The *World Zoo and Aquarium Conservation Strategy* is a vital building block to strengthen further the contribution made by the zoo and aquarium community to the global conservation of migratory species, and I thank WAZA for this important work.



Bradnee Chambers

Executive Secretary, Convention on the Conservation of Migratory Species of Wild Animals (CMS)

The Ramsar Convention on Wetlands welcomes the *World Zoo and Aquarium Conservation Strategy*, which is rich in best-practice information to help tackle some of the major conservation issues in our climate-challenged world. The campaigns to win over hearts and minds, such as WAZA's 'Biodiversity is Us' campaign, are key to making new friends and more allies are needed from the world outside the convinced few. We wish you the utmost success in explaining the beauties of this planet to a wide public, and inspiring young and old to support efforts that can help preserve species and reintroduce them into the wild when better conditions exist. I hope that we can combine forces to make the importance of wetlands be prominent in your future work, and thank all those dedicated individuals and organisations working to save animals in the wild and in human care. This is not only the right thing to do but is exactly what the living world needs us to do.



Christopher Briggs
Secretary General, Ramsar Convention on Wetlands

ICOM NATHIST is a strategic partner with WAZA in recognition of the pivotal role that zoos and aquariums play in field conservation and the survival of species. Like zoos and aquariums, natural history museums are inherently allied not only in creating visitor experiences that represent biological systems, but also in their pivotal opportunity to promote the ethos of wildlife conservation to the general public. The *World Zoo and Aquarium Conservation Strategy* makes an important contribution to global efforts to promote healthy ecosystems and environmental sustainability. One of the strengths of this Strategy is its encouragement to integrate conservation activities into every aspect of day-to-day operations. This consistency of message to both internal and external stakeholders ensures its authenticity and universal uptake. The Strategy is not only timely but also very necessary as a worldwide statement of commitment. It is only by acting in concert that a strong enough message can be voiced and tangible achievements be made.



Eric Dorfman
President, International Council of Museums Committee for Museums and Collections of Natural History (ICOM NATHIST); Director, Carnegie Museum of Natural History

Conservation International wholeheartedly endorses the *World Zoo and Aquarium Conservation Strategy*. The Strategy gives testimony to the commitment of zoos and aquariums to conserving species in the wild as well as those in their care. Indeed I see the wild and captivity not as separate constructs, but as a continuum across which we must all work to achieve long-term conservation success. Zoos and aquariums are stepping up to our shared challenge of helping to build a healthier, more prosperous and more productive planet—for the benefit of everyone on earth.



Russ Mittermeier
Executive Vice-Chair, Conservation International

The World Association of Zoos and Aquariums (WAZA) is pleased to deliver an updated and invigorated statement of the imperative that our community must increase its focus on creating positive conservation outcomes. *Committing to Conservation: The World Zoo and Aquarium Conservation Strategy* is concise and compelling. The objective is to inspire leaders, personnel and supporters of our institutions, and promote greater intellectual and financial investment in the multifaceted suite of activities that can help to stem the seemingly inexorable tide of wildlife and habitat loss. It has long been stated that zoos and aquariums, with their enormous global audiences, are uniquely positioned to effect positive change. Less frequently mentioned is that the failure to act more forcefully and effectively will threaten the business model and social licence that allow our institutions to exist and thrive. This Strategy provides links to other resources and conservation success stories that will enable the zoological community to articulate, plan and implement the best possible approaches to conservation, in order to achieve its full potential. The 2015 *World Zoo and Aquarium Conservation Strategy* is integrated more effectively with other global conservation strategies and initiatives, motivating zoos and aquariums to collaborate, rather than compete, with other like-minded organisations and agencies. It is time for zoos and aquariums to maximise their impact and become true conservation leaders in the efforts to save wildlife and habitats.



World Association of
Zoos and Aquariums
WAZA | United for
Conservation®

Lee Ehmke

President, World Association of Zoos and Aquariums (WAZA)

2013-2015

Cotton-top tamarin





NIASSA NATIONAL RESERVE
MOZAMBIQUE



COMMIT

This Strategy contains a wealth of best-practice information to assist you in dealing proactively with the external and internal changes occurring in our world, and the imperilled wildlife we are all dedicated to protecting. Committing more resources to saving animals in the wild is not only the right thing to do, but this is what our local and global communities expect of us.

“CONSERVATION”

(as defined by WAZA)

Securing populations of species in natural habitats for the long term.

As the leader of your institution there are many demands on your time and attention: animal husbandry and welfare issues; budgets and fundraising; board and government relations; visitor services and personnel issues; business operations; media and marketing; design and construction. Furthermore, we all hope for strong economies and good weather! No one said your job was easy but short-term priorities must not compromise our long-term vision and our commitment to conservation ... or there will be no future.

Zoos and aquariums must take an action-driven, leadership role in the conservation of wildlife. Zoological institutions must create sustainable business plans to support field-conservation efforts while simultaneously facilitating pro-environmental behaviour change. This balanced approach is the only way to address effectively human threats to wild populations.



MASAI MARA, KENYA

Zoological institutions can become the portal through which society becomes connected to, and involved in, wildlife conservation.

One key fact we have discovered since 2005, when the last WAZA conservation strategy was published, is that when visitors understand that zoos and aquariums are working to save animals in the wild, their support of us improves dramatically. Therefore, the zoological community needs to demonstrate our commitment to protect species in the wild, while delivering the very best in 21st century animal care and guest experience.

Our conservation commitments also help to bolster the perception of zoos and aquariums in the minds of government officials who enact and enforce the laws that affect our operations. It is essential that we gain the trust, confidence and support of the multiple authorities that control and regulate activities that directly impact our future.

As zoological professionals who care for animals as our core function, it is critical that we give highest priority to increasing our commitment to the conservation of wild populations. This focus emphasises why we exist, but it does not alter who we are. We have become active partners in field conservation, working collaboratively with communities, other zoological facilities and similar conservation-orientated organisations, while still being informal learning centres that inspire visitors to connect with the natural world. We are cultural and tourism assets that provide compelling visitor experiences. Learning and inspiration are only the first steps by which we fight extinction and ultimately save animals in their wild habitats. Our mission is not fulfilled until we change people's attitudes and behaviours, and they become exemplary advocates for conservation.

“

As zoological professionals who care for animals as our core function, it is critical that we give highest priority to increasing our commitment to the conservation of wild populations.

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The Living Planet Index in the 2014 WWF *Living Planet Report* showed an overall decline of over 50% in global vertebrate populations between 1970 and 2010, so a concerted undertaking to strengthen our conservation efforts could not be more urgent. As the leader of your institution, there are seven steps you can take to move your zoo or aquarium forward as a publicly respected and trusted conservation organisation.

Increasing our commitment to conservation will require choices to be made. However, given the alarming state of populations of species and habitats in the wild, an increased commitment to conservation becomes the only rational, ethical and practical choice. Zoos and aquariums have the opportunity to focus their business strategies better, and join together to become one of the greatest forces for wildlife conservation in the world, in terms of both breadth of programmes and size of expenditure. Worldwide, we have an estimated potential to generate US\$1 billion annually for conservation, if we commit to the Seven Steps to Conservation Leadership.

Working together, with the proactive methods outlined in this Strategy, we can finally realise the enormous potential of our zoological institutions to become 'conservation powerhouses', universally respected by all sectors of society. The questions must not overshadow the commitment because the rewards far outweigh the sacrifices. However, we must act now while there is still time to save the species and habitats we cherish so dearly.

Sincerely,



Rick Barongi

*Chair, WAZA Conservation and Sustainability Committee
On behalf of 2015 WAZA Council*

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Step 1: Inform

Educate your governing authorities and staff about the status of wild populations of animals on a regular and ongoing basis, and demonstrate how everyone can play a noteworthy role in reversing the declines.



Step 2: Mission

Update the mission statement and strategic plan of your zoo or aquarium to include: a *declaration* that your institution exists for a higher purpose—wildlife conservation; a *pledge* that your institution will commit resources to this effort; a *plan* for creating a culture of conservation in your staff, communities, governing authorities and donors that gives everyone the opportunity to make a measurable difference.



Step 3: Budget

Assess how much your institution currently spends on field conservation according to the WAZA definition of conservation, and benchmark that with similar regional institutions.



Step 4: Revenue

Work with staff to identify dedicated streams of revenue that can be used for field-conservation programmes. Ideally, these are streams generated both internally (from operating budgets and events) and externally (visitor, donor or government funded).



Step 5: Partnerships

Leverage resources by collaborating and partnering with other zoological institutions, conservation organisations, centres of learning, government agencies and high-net-worth individuals that share our passion for animals and conservation.



Step 6: Priorities

Identify and prioritise species which allow you to deliver conservation victories that clearly demonstrate the impact the animals in zoos and aquariums have on our ability to save their wild counterparts. Connect your animals to field conservation with personal stories of organisational commitment, both financially and with staff expertise.



Step 7: Communication

Develop a communications plan that is positive and proactive about your commitments and actions. Cultivate respected, independent spokespersons to deliver conservation stories to visitors, the greater community and society.



AFRICAN ELEPHANTS
OKAVANGO DELTA, BOTSWANA



ACT



The World Association of Zoos and Aquariums (WAZA) represents a global community of zoological facilities united for the care and conservation of living fauna and flora. This status is shared locally and globally with botanic gardens, museums, protected areas and concerned communities. Successful conservation means all species, including humanity, thriving in healthy and sustainable ecosystems; that is, securing populations of species in natural habitats for the long term.

MAURITIUS KESTREL
ISLAND OF MAURITIUS

Ensuring the well-being of other species is essential if humans are to ensure their own. The quality of the land, air and water not only affects wild populations of animals and plants but will eventually determine humanity's fate as well. Quick and effective action must be taken to deal with the profound anthropogenic issues that confront natural ecosystems, such as growing human populations, continued pollution and over-exploitation of natural resources, and climate change. Human actions and lifestyle choices are threatening the planet and the life forms that inhabit it. To preserve the diversity of the world's wildlife, humans must change how they live, and how they apply knowledge and skills.

However, it has proven extremely difficult to mobilise and sustain the social and political will necessary to change behaviour for the benefit of wildlife and wild places. While many believe that species and habitat conservation are innately valuable, others need to be convinced of the material importance of conserving living fauna and flora. The key strategy for achieving the required revolution in attitudes and behaviours will be reconnecting the public with nature. People must be inspired to understand that life on earth is fragile; that the species that make up life on the planet depend upon each another to survive; and that human survival is reliant on the species populations in natural ecosystems. It must also be made clear that species conservation has economic value: the richer the diversity of life the greater the opportunity for medical discoveries, economic development and adaptive responses to the ominous impacts of global climate change.

THE ROLE OF ZOOS AND AQUARIUMS

Zoos and aquariums (accredited or otherwise designated members of the professionally recognised zoological community) are uniquely poised to con-

tribute to successful conservation of species and ecosystems. Extensive and diverse populations of species are cared for by zoological institutions, which attract high numbers of visitors who are delighted and inspired by such close encounters with nature.

The collective social, political and financial power of zoos and aquariums as a community, as well as the potential impact of such vast audiences, can be potent. Zoos and aquariums enjoy wide-ranging levels of public credibility and trust, and provide fun and intellectually stimulating destinations for visitors of all ages. Every year, an estimated 700 million visits are made to zoos and aquariums that are members of national or regional associations around the world.

Instilling in all visitors a strong sense of excitement about and a desire to care for life on earth will create a solid platform for fulfilling the promise to care for and conserve wildlife. Zoological facilities are uniquely positioned to use a social-science, evidence-based approach to influence pro-environmental behaviour. This Strategy provides guidance, inspiration and access to a set of techniques designed to help zoos and aquariums respond to the challenges of mobilising social and political will on behalf of wildlife, and embrace the opportunities available to facilitate a greater realisation of our potential.

To accomplish this, and to increase the effectiveness of global conservation efforts, zoos and aquariums are increasingly adopting a One Plan Approach. This conservation planning framework brings together experts from the global zoo and aquarium fraternity, local community representatives, governmental agencies, wildlife managers, conservation organisations, scientists and others in developing conservation strategies to achieve the common goal



*Over 700
Million Visits*
**TO ZOOS AND AQUARIUMS
AROUND THE WORLD EVERY YEAR**



*Over 300
WAZA Members*
AROUND THE WORLD



*Over 350 Million
US Dollars*
**SPENT ON WILDLIFE
CONSERVATION
EVERY YEAR**

Zoos and aquariums readily accept the responsibility that comes with maintaining and caring for animals.

WE HAVE A DUTY TO

- Provide the highest-quality care and management of wildlife within and across institutions
- Develop and adapt intensive wildlife-management techniques for use in protecting and preserving species in nature
- Support conservation-directed social and biological research
- Lead, support and collaborate with education programmes that target changes in community behaviour towards better outcomes for conservation
- Use zoological facilities to provide for populations of species most in need of genetic and demographic support for their continued existence in the wild
- Promote and exemplify sustainable practices in the management of animal populations, our facilities and the environment
- Provide a public arena to discuss and debate the challenges facing society as extinction accelerates and ecosystem services are degraded
- Act as rescue-and-release centres for threatened animals in need of immediate help, with the best knowledge and facilities to care for them until they are fit to go back to the wild
- Be major contributors of intellectual and financial resources to field conservation
- Provide ethical and moral leadership

of viable populations of the species thriving in healthy ecosystems. Through the One Plan Approach, all available resources are engaged in producing one comprehensive conservation plan for each target species (see *Population Management*). This integrated approach will result in more comprehensive actions, promote innovation in species conservation, cultivate greater collaboration between zoological facilities and with other conservation organisations, and allow for greater adaptability in the face of climate change.

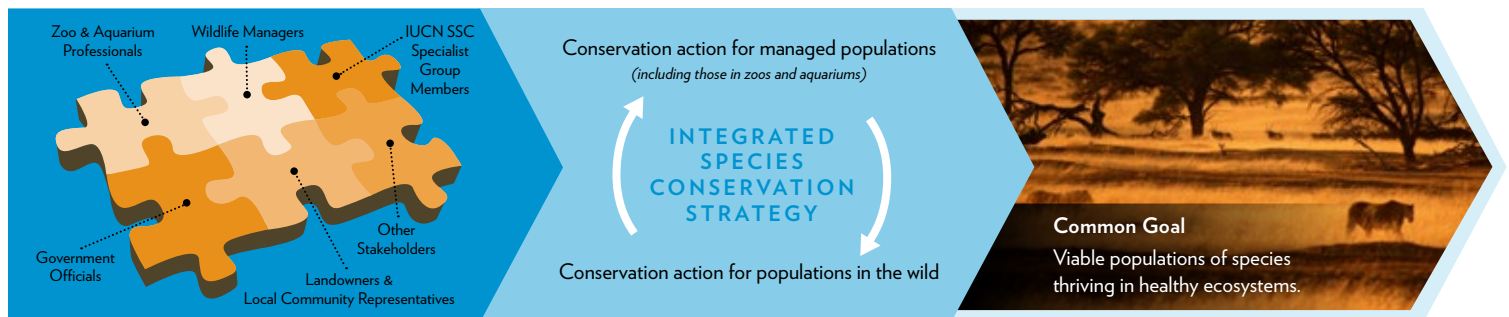
Zoos and aquariums can and must become models of integrated conservation (see *Creating a Culture of Conservation*). As animal-care specialists, conservationists, educators, communicators, wildlife advocates and scientists, zoo and aquarium professionals must also become powerful agents of change and encourage widespread application of the One Plan Approach. Their institutions must embrace the role of professional conservation organisations that operate sustainably (see *Modern Conservation Organisations and Animal Welfare*). Fulfilling this responsibility has never been more essential.

The One Plan Approach also mandates that animals maintained in zoological facilities play a conservation role that benefits wild counterparts (see *Saving Species in the Wild*). The One Plan Approach links researchers in zoos and aquariums with scientists and conservationists working directly with wild populations (see *Science and Research*). Likewise, education and capacity-building efforts must start with zoos and aquariums and expand to influence behaviour change for conservation in society (see *Engagement—Influencing Behaviour Change for Conservation*). Zoological facilities must work together, and be effective at partnering and collaborating with other conservation organisations to evaluate impacts and advocate for conserving biodiversity.

The partnership between the Amphibian Ark (AArk), the Amphibian Specialist Group (ASG) of the International Union for Conservation of Nature (IUCN) Species Survival Commission (SSC) and the Amphibian Survival Alliance (ASA) is an example of a One Plan Approach. The collective vision of these organisations

ONE PLAN APPROACH

Definition: Integrated species conservation planning that considers all populations of the species (inside and outside the natural range), under all conditions of management, and engages all responsible parties and resources from the start of the conservation-planning initiative.



is ‘amphibians safe in nature’. Their missions—protecting amphibians and their habitats through dynamic partnerships worldwide (ASA); providing the scientific foundation to inform effective amphibian conservation action around the world (ASG); ensuring the survival and diversity of amphibian species focusing on those that cannot currently be safe-guarded in their natural environments (AArk)—work synergistically to achieve the collective vision. ASG members around the world contribute their knowledge to AArk’s Conservation Needs Assessment (CNA) on a country-by-country basis as well as to the IUCN Red List for amphibians. The CNA identifies high-priority species for assurance populations, and AArk works with zoological institutions and other in-country entities to facilitate the establishment of these populations. ASA focuses on protecting habitats so that assurance populations can eventually be returned to the wild. By working together links are established between the excellent conservation work that goes on in zoos and aquariums and the conservation of species in their native habitats.

A CALL TO ACTION

The need for urgent action is clear. The United Nations *Strategic Plan for Biodiversity 2011–2020*—by far the strongest commitment ever made by the world’s governments to combat the escalating extinction crisis—includes 20 targets, collectively known as the Aichi Biodiversity Targets. Together these provide a framework for halting the loss of biodiversity. Major non-governmental conservation organisations and international conventions are aligning their activities with these targets.

WAZA membership at the 2011 Annual Conference endorsed the *Strategic Plan for Biodiversity*. WAZA and all its member zoos and aquariums, and other zoological facilities that want to conserve species and habitats, have a potentially powerful role to play in the achievement of many of these targets. As a community committed to educating people about the changing natural world zoos and aquariums must act responsibly, and inspire and mobilise society to respond. Otherwise, the tide of extinction, for both other species and humans, will not be reversed.

AICHI BIODIVERSITY TARGETS

Strategic Goal A

TARGET 1-4

Address the underlying causes of biodiversity loss by mainstreaming biodiversity across government and society

Strategic Goal B

TARGET 5-10

Reduce the direct pressures on biodiversity and promote sustainable use



Strategic Goal C

TARGET 11-13

To improve the status of biodiversity by safeguarding ecosystems, species and genetic diversity

Strategic Goal D

TARGET 14-16

Enhance the benefits to all from biodiversity and ecosystem services

Strategic Goal E

TARGET 17-20

Enhance implementation through participatory planning, knowledge management and capacity building

The vision for WAZA and the global community of zoological facilities is also clear. WAZA calls on all zoos and aquariums to adopt an integrated One Plan Approach to conservation. Animal welfare and conservation must be the primary purpose, and zoological institutions should be guided by this in everything they do (see *Appeal to Zoo and Aquarium Directors*). With vast living populations of animals, devoted and talented staff, and extraordinarily large, diverse and engaged audiences zoos and aquariums have the power to facilitate the vital work of caring for and conserving living wild animals and ecosystems.

The future is promising. This Strategy is intended to help make that promise become a reality. If successful, zoos and aquariums will rank among the most important forces for conservation on the planet; a conduit through which visitors and society can help to save species. Even more important, meaningful progress will be made towards the vision of all species thriving in healthy ecosystems.



African penguin



ORANGUTAN
HOUSTON ZOO, TX, USA



INSPIRE

I want to be a



VISION

By helping to create a culture of conservation in our communities, zoos and aquariums are a vital part of the process of generating the attitude and will needed to save species and maintain healthy ecosystems.

Conservation is often discussed in terms of science or financial resources. However, conservation of nature is really about protecting and restoring natural resources, including species, and people are a tool that can be used to deliver effective conservation. The perception of what is important in the lives of individuals, what internal value nature has to them, and the relationships, both close and distant, between groups of people are all part of this tool. The ‘will’ of any individual, group, institution, community or country to undertake conservation begins with attitude, which is then put into practice with action. By helping to create a culture of conservation in society, zoos and aquariums are an integral part of the process to generate the attitude and the will needed to save species and maintain healthy ecosystems.

Zoos and aquariums encounter hundreds of thousands of people every day and are generally embedded in local communities in ways that other conservation organisations can only envy, meaning zoological facilities are ideally placed to help implement Aichi Biodiversity Target 1. Zoos and aquariums do make a positive contribution to this Target but are they strategic in how they approach the idea of creating a culture of conservation?

There are three discrete groups that should be communicated with on a regular basis in order to build a culture of conservation: (1) *staff and governing authorities*, which form the foundation upon which the conservation culture is built, (2) *visitors*, who can build upon that foundation and provide access to (3) *the wider community*, giving zoos and aquariums the opportunity to interact with and influence the values of the societies in which they operate to benefit conservation.

“

Creating a conservation culture requires clear lines of communication to all personnel about the conservation work being undertaken, and celebrations of success when conservation objectives are achieved.

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AICHI BIODIVERSITY TARGET 1

Strategic Goal A: Address the underlying causes of biodiversity loss by mainstreaming biodiversity across government and society.

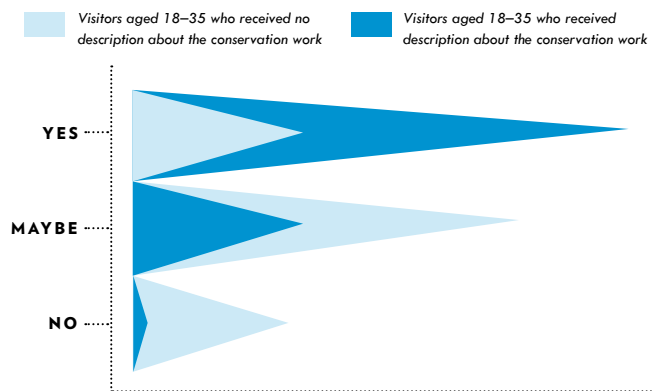
Target 1: By 2020, at the latest, people are aware of the values of biodiversity and the steps they can take to conserve and use it sustainably.

ZOOS AND AQUARIUMS

The staff, boards and governing authorities of zoological facilities must be fully committed to the conservation of the natural world in order to inspire others to engage in such a goal. This commitment is usually clearly apparent in those who work in animal departments or the scientific staff, who are often already dedicated conservationists with a long history of valuing nature from childhood. However, to be truly successful, this ethos and ethic of care for the natural world must be embedded in all departments. From the staff member who initially greets visitors at the entrance, to the caterer who provides lunch and the cleaner who makes certain the grounds are pristine, every visitor must feel that this is a team committed to the common cause of conservation.

Leadership (CEO/director and board/governing authorities) is essential to ensure that time and effort are spent creating an internal ethos to guarantee that everyone in the institution is committed to conservation. A conservation-training programme for all staff (ideally one that is repeated or reinforced periodically) is fundamental. Creating a conservation culture requires clear lines of communication to all personnel about the conservation work being undertaken, and celebrations of success when conservation objectives are achieved. The aim is for all staff to be proud to be part of any conservation triumphs, sharing them with close family and acquaintances in the wider community.

Members of the governing authorities in zoos and aquariums are not necessarily scientists but may be business leaders, lawyers, bankers and other professionals, including national or regional government officials. Zoos and aquariums must invest in the



ZOO AND AQUARIUM SURVEY

A recent survey by the Association of Zoos and Aquariums (AZA) asked people about their views on zoos and aquariums. Some were asked to place themselves into one of three categories: those having no objection to keeping animals in zoos and aquariums (YES), those who said it was all right to keep some animals but not certain very large or intelligent species (MAYBE), and those who said animals should never be kept in zoos or aquariums (NO). Others were first given a description of the conservation work being carried out collectively by AZA-member institutions. For visitors aged 18-35 who received no description about the conservation work, 25% had no objections, 51% had some objections and 24% said animals should never be kept in zoos or aquariums. However, for respondents who had been given the conservation-work description first, 69% had no objections, 26% had some objections, while only 5% said animals should never be kept in zoological institutions.

education of their governing authorities, by taking them out of the boardroom and into the field, in order to gain their support and establish a shared conservation vision that can be communicated to the entire community.

This culture of conservation should be prevalent every time a new development is planned within a facility. The pivotal question—*‘How does this planned new experience help the institution to achieve its conservation goals?’*—should be asked by all departments. Master planning should facilitate the One Plan Approach by orchestrating the strategic conservation plan in relation to the construction of infrastructure and facilities for conservation programmes, and the engagement of visitor experience with the conservation activities. When planning new developments, all parties involved, from the institution to the designers, builders and materials suppliers, should question their role in conservation.

The building industry (construction and operation combined) consumes more energy than any other sector and is among the largest contributors to climate change. However, using on-site renewable resources and sustainable building technologies it is possible to build for (net) zero energy consumption and a minimal carbon footprint. Innovative methods, such as Living Machine, can reduce energy-intensive life-support systems and maintaining species suited for the local climate can reduce the carbon footprint. The One Plan Approach should also be implemented when selecting species to make certain that any new development can and does link to and support conservation work in the wild and species with the greatest conservation need. Actions must reflect values when creating a culture of conservation.



BOTTOM LEFT:
CINCINNATI ZOO & BOTANICAL GARDEN, OH, USA
Cincinnati Zoo has installed a green roof on their Giraffe Ridge Barn as part of their institutional green initiative.

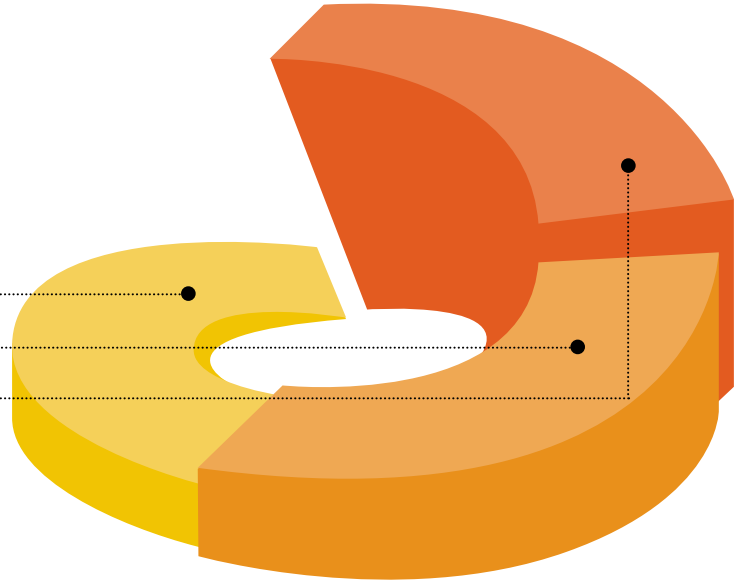
TOP RIGHT:
WOODLAND PARK ZOO, WA, USA
Zoo Doo is a fully composted blend of animal manures mixed with straw bedding, grass, leaves and wood chips from the grounds of the Zoo.

BOTTOM RIGHT:
VIENNA ZOO, AUSTRIA
A solar power plant installed on the roof of the elephant's living quarters produces around 90 megawatt hours of energy annually.

THE LEVELS OF INFLUENCE

Building a culture of conservation occurs through constant communication with three discrete groups.

- STAFF AND GOVERNING AUTHORITIES**
- VISITORS**
- THE WIDER COMMUNITY**



VISITORS

Once the foundation of an internal culture of conservation has been created, attention should be turned towards the visitors. Essentially people must understand and believe that visiting a zoological facility helps to save animals in the wild. However, rather than visitors seeing the animals at the zoo or aquarium, understanding the institution's conservation activities, and leaving happy and contented that there is nothing more to be done, they should learn enough to feel inspired and motivated to become active supporters of zoological facilities and advocates for conservation. Creating that ambience is not simply a matter of providing informational signs, important as they are; visitors must be engaged by applying all the knowledge that has been amassed from a burgeoning body of work in conservation psychology (see *Engagement—Influencing Behaviour Change for Conservation*).

The information provided to visitors walking through zoological facilities must be clear, helping them to engage with any ongoing conservation work related to the species in front of them and highlighting how they can become involved. It is essential to reach not only the minds but also the hearts of visitors. Enlisting staff and volunteers to recount conservation stories to visitors is an effective way to connect the animals in zoos and aquariums to field-conservation programmes. Such stories can be used to excite visitors about conservation efforts and successes, encouraging them to take direct action for conservation in their own daily lives.

Institutional commitment to conservation should be apparent to visitors as they walk around the grounds. Zoos and aquariums provide visitors with an opportunity to practice conservation actions that can be repeated in their daily lives. During a visit it should be easy to recycle waste, to choose restaurant food that has been ethically sourced and is sustainable, and to purchase goods from the shop knowing that these further conservation goals, all of which are important aspects of creating the culture of conservation. The identification of ways in which to engage visitors in actions that enforce their own awareness of not being

wasteful will help them to achieve small conservation actions that develop into long-term conservation commitments. Experiences and opportunities for visitors to contribute directly to the conservation of species in the wild must be created using a conservation-messaging framework, supported by behaviour-change tools and techniques.

Zoos and aquariums can be living laboratories where visitors view a world designed for conservation. Buildings should highlight sustainable building practices and lead by example in reducing the carbon footprint. For example, the landscape around zoological facilities should demonstrate to visitors how their lawns, parks and cities could look if measures were taken to improve water quality with green infrastructure, such as bioswales (landscape elements that remove silt and pollution from surface run-off water), healthy ecosystems without invasive species, and habitat for native flora and fauna. Information alone does not create change; culture is transmitted through experience and participation.

THE WIDER COMMUNITY

Once there is a strong internal culture of conservation within an institution, and a community of visitors committed to conservation has been created, it will be necessary to engage with people and organisations outside the perimeter fence. Zoos and aquariums are part of a larger society where their influence can be used to create a culture of conservation. Neighbours, suppliers, local, regional and national governments, the media and other conservation-orientated partners are all there to interact with. Well-planned public-engagement strategies and integrated conservation messaging can be used effectively to increase social awareness of specific conservation efforts, and social media makes it possible to disseminate such information widely.

In any community where a zoological facility is located there will be a variety of corporate neighbours with which to engage. As environmentally friendly products are increasingly incorporated into zoological operations, the goals, progress and experiences should be shared with local businesses in the community. These may



become new suppliers or partners to disseminate the conservation message and actions further afield. The opportunity should be taken to work with the printing shop across the road to encourage them to use environmentally friendly inks or the local garden centre to develop user-friendly information about invasive plants for their customers. Zoos and aquariums could develop as local hubs of conservation practice, using policy statements to declare the conservation message to society. By inviting corporate and non-corporate neighbours into zoological facilities to attend social events and functions that highlight specific issues, new, non-traditional conservation relationships will be created, providing further opportunities to work together to change the community culture.

Among all zoos and aquariums in organised associations there is a powerful ‘buying’ group. Supply-chain activism is beginning to be effective in issues such as palm oil, sustainable feed for animals and humans in zoological facilities, and building materials. Individual endeavours could be further enhanced by neighbouring zoos and aquariums joining together to work with and stress the need for suppliers that source more ethical and sustainable materials for use in conservation organisations, thus sending a powerful message to visitors and the wider community.

Local and national media are always happy to print images of young animals—and powerful images can tell compelling stories—but any interaction with the media to talk about conservation should be used to let people know that a modern professional zoo or aquarium is more than a nice day out. Conservation is an exciting story.

ZOOS VICTORIA, AUSTRALIA

Creating a culture of conservation among visitors to zoological institutions starts by connecting them to animals, exciting them about conservation efforts and successes, and encouraging them to take direct action for wildlife in their own daily lives.



HOUSTON ZOO, TX, USA
Cell-phone display shows guests where components for electronics derive from and how recycling a cell phone prolongs the life of usable phones thereby decreasing the need for more coltan mining. Equally it educates visitors, especially children, about the connection between cell phones and gorillas as eighty per cent of the coltan (columbite-tantalite) / tantalum in electronic devices is mined in the Democratic Republic of the Congo. This region is also prime gorilla habitat.

One of the most important aspects of the wider community is interaction with elected representatives and the advocacy for nature that can be engendered. If a successful culture of conservation is created in staff, visitors and neighbours in the wider community, collectively this group of people will ask for conservation to be higher on the political agenda—if zoos and aquariums provide the right tools. A first step is to develop a strong relationship between the zoological facility and local governmental representatives. A simple way to capture their attention is to highlight the economic impact a zoological institution has in the community. This conversation can then transition into a discussion about conservation. Politicians should be invited into zoos and aquariums on a regular basis, and shown what these institutions are doing for society and for nature.

CONCLUSION

Conservation takes conversations—between individuals, groups, communities and countries. Local coalitions of zoological facilities, botanical gardens, museums and universities can help with either a local biodiversity focus or a global project. By engendering a culture of conservation in all aspects of operations, zoos and aquariums help to make the important conversations happen. Being strategic about creating this culture of conservation and understanding how cultural transmission takes place will be key to an optimistic conservation future.

RECOMMENDATIONS

- Talk about conservation throughout the institution, including with staff, volunteers, governing bodies, boards, trustees, visitors and the wider community, and incorporate proven social-science techniques to facilitate the uptake of pro-environmental behaviours that reduce human impacts on wild populations.
- Engage corporate neighbours and suppliers in order to broadcast the conservation message and promote sustainability in the supply chain, including a commitment to creating green sustainable environments.
- Use media contacts to disseminate the conservation message.
- Establish relationships with local members of government by inviting them into the institution and advocate for conservation.
- Publicise every success, however small, to endorse the mission and status of the zoo or aquarium in the community.



American bison



LEATHERBACK SEA TURTLE
BIOKO ISLAND, EQUATORIAL GUINEA



HOPE



VISION

Zoos and aquariums are redefined by society as organisations that save populations of species in the wild, while delivering the highest standards of care and welfare for their resident animals, and providing exceptional, behaviour-changing, guest experiences.

VANCOUVER ISLAND MARMOT
VANCOUVER ISLAND, BC, CANADA

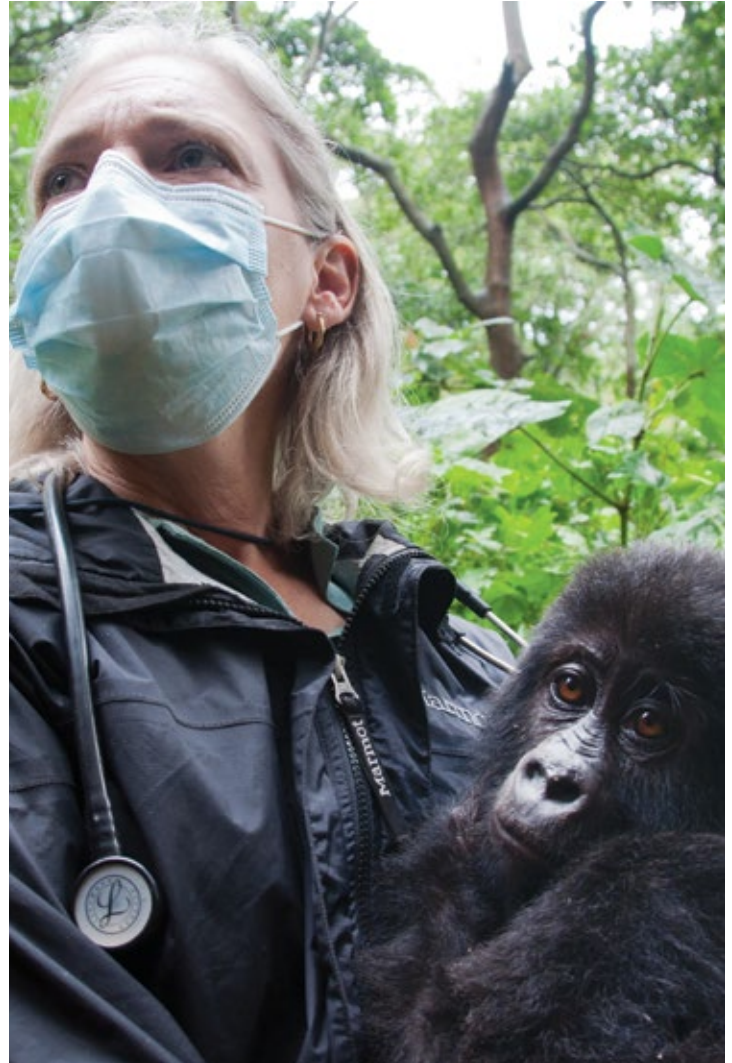
Many modern, accredited zoos and aquariums are working to make sure that the range of species they care for is supported by meaningful conservation actions linked to the survival of species in the wild. While resources may not extend to providing support for every species, conservation actions taken for the most threatened populations will have a positive impact on all species within that habitat. The proactive strategy would be to deliver crystal-clear examples of the essential role that zoological institutions play in protecting species in nature. Connecting animal experiences in zoological facilities to conservation in the wild is now being effectively confirmed with a One Plan Approach to species conservation.

Gathering the information that is necessary to measure the impact of the collective power of zoological organisations to save animals is critical. The way in which zoos and aquariums collect information to quantify the impact of their conservation activities is an emerging discipline. Being recognised as results-driven conservation organisations will attract a wider membership and donor base, providing the business rationale for supporting field-conservation programmes. However, mission-driven institutions have additional responsibilities.

Zoos and aquariums are conservation resource centres that recruit, train and endorse staff to support conservation efforts outside their facilities (see *Appeal to Zoo and Aquarium Directors*). Collectively, WAZA-member zoos and aquariums employ more wildlife-husbandry experts, veterinarians and scientists than any other conservation organisation. The small-population management skills and techniques (e.g. baseline physiological data collection, application of technology to field-research needs, conservation medicine) acquired in zoological facilities could be critical for assisting IUCN Red List species assessments and strategic plans, local governments, national parks and reserves to formulate long-term management plans and strategies to protect depleted and fragmented populations in nature. The most effective response to the extinction crisis will be a coherent international conservation entity (zoos and aquariums working with other conservation organisations) that supports and expands existing protected areas, and secures additional protected areas for the future.

Wildlife health (including research and veterinary expertise) is an important issue in the conservation of wild populations (see *Science and Research*). New and emerging diseases and pathogens are becoming an urgent concern, epitomised by the catastrophic declines in amphibians (chytridiomycosis), and the pandemic diseases that threaten both humans and animals (e.g. Ebola virus disease, avian influenza, severe acute respiratory syndrome). Individuals selected for reintroductions or translocations require testing, treatment and evaluation to make certain that animals can be safely moved between habitats and countries without spreading or introducing disease.

As environmental threats become ever greater, zoos and aquariums are ideally positioned to be species champions. With over 13,000 species in the care of zoological facilities, a concerted effort to enhance and study these populations will have significant consequences for the future survival of wild populations. Animals in zoos and aquariums act as ambassadors that, if leveraged effectively, can provide impact and reach to the support accredited zoo and



GORILLA DOCTORS
Veterinary staff at Gorilla Doctors care for wild gorillas in Rwanda, Uganda and the Democratic Republic of the Congo.

aquarium communities give to wildlife conservation. It is essential to provide visitors with clear explanations about the conservation impact their everyday behaviour is having on wild populations, both locally and globally, and to focus behavioural-change campaigns on the behaviour changes that will be most positive for biodiversity conservation.

Zoological institutions are already playing a major role in the global conservation of species and this will grow as their conservation missions are integrated into every aspect of operations. The One Plan Approach builds on the strengths and motivations to synergistically link all the skill sets and experience of zoo and aquarium staff to individuals and organisations working in the field. Advances in animal care and research with intensively managed small populations in zoological facilities are being applied to larger global issues.

Acting as 'Arks' or reservoirs to facilitate replacing extinct wild populations is a means by which zoos and aquariums achieve species conservation rather than a goal in itself. However, populations of species in the wild, even in pro-

tected areas, are in decline, and it takes time to establish reliable protocols for managing and breeding wild animals. Zoos and aquariums have acted as ‘lifeboats’ for the survival and subsequent reintroduction of zoo- and aquarium-bred individuals, preventing the extinction of some species. However, zoological facilities can play an even greater role by protecting wild species in their natural habitats. For many reasons, it is preferable to manage populations proactively before their numbers decline precipitously or they disappear completely from the wild, and to support healthy species so they remain resilient in the face of threats.

The ability to predict species conservation problems may well diminish as time passes and ecology in the human-dominated world becomes more complex. However, conservation is something zoos and aquariums are equipped to achieve, and this skill should be expanded to make sure that it can be used in the future if the situation in nature becomes critical. The IUCN SSC *Guidelines on the Use of Ex Situ Management for Species Conservation* outline a wide range of ways in which zoo and aquarium programmes can contribute to conservation.

The zoological community is a perfect venue for implementing and achieving some of the Aichi Biodiversity Targets in order to achieve a healthier planet for all people and animals. To align our conservation activities with Aichi Biodiversity Target 12, a recent horizon scan led by WAZA identified emerging issues with potential impact upon threatened-species

conservation by 2020, in a manner important to policy makers and practitioners in zoos and aquariums. Some global scientists and conservationists are already convinced there are no

real wild areas remaining, as every ecosystem is impacted by human activities. This makes an even stronger case for the importance of the participation of zoos and aquariums in influencing governments at all levels and in sustainable-management activities for natural habitats, including providing habitat for wild native species within and around the grounds of institutions, and citizen-science initiatives. Habitat management should be carried out by cooperative teams from zoos and aquariums with complementary expertise in water, vegetation, invasive species and community development. Restoring, expanding, creating and protecting habitat are fundamental to our ability to save species in the wild for the long term.

Wildlife conservation is not only about saving animals but also is concurrently directed at improving the lives and health of local communities that share the same resources and ecosystems. Educating and empowering front-line people to identify growing threats and mitigate human-wildlife conflicts must be a priority in every long-term conservation strategy. Holistic programmes of sustainable development with economic incentives that focus on quality-of-life issues are crucial to the success of any conservation initiative.

To assure that the collective efforts of zoological facilities are having a significant effect on saving animals and habitats, zoo and aquarium biologists have devel-



CONSERVATION FUSION, MADAGASCAR
Local communities participate in reforestation efforts in Madagascar to preserve lemur habitat.

AICHI BIODIVERSITY TARGET 12

Strategic Goal C: To improve the status of biodiversity by safeguarding ecosystems, species and genetic diversity.

Target 12: By 2020 the extinction of known threatened species has been prevented and their conservation status, particularly of those most in decline, has been improved and sustained.

oped impact-assessment methodologies; for example, the Project Conservation Impact Tool, designed to provide an easy standardised format to summarise project achievements and progress. WAZA has used such criteria to evaluate the efficacy of WAZA-branded conservation projects, showing that the evaluated projects are helping to improve the conservation status of high-profile threatened species and habitats in biodiversity-rich regions of the world. The WAZA project branding scheme, with more than 250 branded projects, serves to showcase what zoos and aquariums do for wildlife conservation. Tapping into the adaptive management and decision-making frameworks adopted by other conservation organisations is also appropriate. It is important that we measure the individual and collective impacts of saving animals in the wild, to demonstrate that zoos and aquariums are the conservation force that they claim in their mission or vision statements, and to facilitate their communication efforts to foster greater support for conservation.

Tackling such enormously complex environmental and political challenges will require a united effort and effective collaboration with many other organisations, including governmental agencies and non-governmental organisations. In addition to scientific collaborations, the zoological community has a wealth of experience in communicating messages and stories. These interpretive assets can be applied to advocating support with the public and governmental agencies. Zoos and aquariums can become more effective behaviour-change agents by delivering success stories to a broader and better-informed audience (see *Creating a Culture of Conservation*). A group of zoological key performance indicators for conservation can be developed and incorporated into institutional annual reports to give a measurable

indication of achievements. Saving species in the wild requires planning at the landscape level, whether the recovery programmes are regional or international.

Conservation success requires long-term commitments and the establishment of trusting relationships with the people living alongside threatened species. Many zoos and aquariums are unable to make multi-year or multi-decade commitments, or do not have the resources to employ staff to develop such deeply personal relationships. However, zoological institutions are well suited for attracting donors and raising the funds necessary to support wildlife-conservation organisations that are able to maintain a presence in range-country communities and work towards saving wildlife.

As the zoo and aquarium community takes on more responsibilities for threatened species across a wide variety of locations and with an increasing range of partners, there will be a concomitant need for funding conservation outcomes. While money and donations do not always translate into quality conservation efforts, funds are still an essential requirement for the implementation of conservation action. It is estimated that US\$350 million are raised annually for direct support of wildlife conservation by zoos and aquariums in organised associations around the world. The opportunity to attract new donors and supporters for conservation is enhanced by clearly defining the conservation work carried out by zoos and aquariums. The Association of Zoos and Aquariums (AZA) provides another good toolkit, which outlines simple ways to raise more conservation funds for an institution and determine how that facility compares with other similar-sized organisations.

If the zoological community can align some of its conservation objectives with human-development goals, its work will resonate more strongly with political and philanthropic ambitions and the perceived relevance of support required for species conservation, and the protection of biodiversity and ecosystem services. However, this is a delicate balance between aligning the work of zoos and aquariums with human-development goals, and occasions where biodiversity responsibilities have to be supported.

CONCLUSION

It is imperative that all zoos and aquariums increase their contribution to and impact on saving species in the wild, including provision of skills, and technical and financial resources. Creating a clear connection between a live animal in a zoological facility and a conservation project in the field should be integrated into every master-planning process to make certain that adequate support is generated for saving species in the wild.

RECOMMENDATIONS

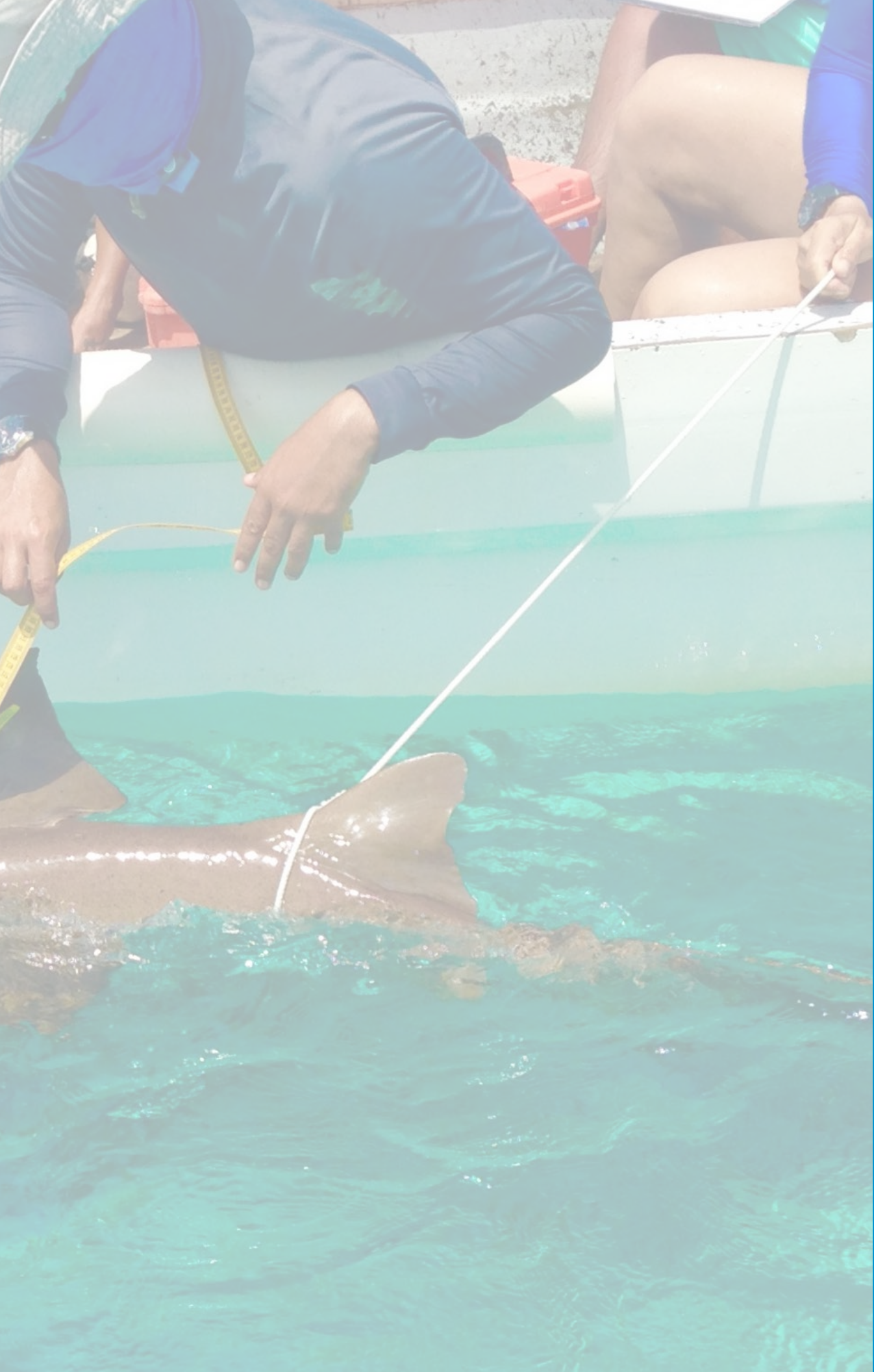
- Develop an institution-wide conservation strategy that integrates conservation actions into every aspect of operations, including protection and preservation of natural habitat for native species around the grounds of the institution.
- Develop an operational budget that supports conservation over the long term (e.g. at least 3% of annual operating budget) and is not solely dependent on external donations (soft money).
- Partner with other biodiversity institutions in order to implement proven best practices and with conservation organisations to maximise efforts outside of the facility, especially identifying trusted conservation organisations that will be responsible for implementing conservation action on the ground to which multi-year support can be provided.
- Liaise with and make use of the existing formalised WAZA partnerships with international conservation bodies, liaise with government agencies to bring about transformations that rely on legislative change, and utilise individual staff skills to support conservation programmes.
- Use a rigorous selection procedure to make sure that the best conservation effort is being made for the money available and reassess each project to report the impact on biodiversity that has been gained.



ASSOCIATION OF ZOOS AND AQUARIUMS (AZA), USA

The mission of SAFE: Saving Animals From Extinction is to combine the power of zoo and aquarium visitors with the resources and collective expertise of AZA members and partners to save animals from extinction. This mission is achievable because accredited zoos and aquariums are uniquely positioned to become a force for global conservation-with more scientists, more animals, and more ability to activate the public than any other non-governmental institution. SAFE is built on aquarium and zoo's 100-year track record of success saving endangered species from extinction.





COLLABORATE



VISION

Every zoo and aquarium contributes to conservation-relevant research to further its conservation mission, and maximises opportunities to engage in conservation-relevant research.

GREVY'S ZEBRA
KENYA

Zoos and aquariums provide a unique opportunity to increase understanding of wildlife species, their environmental needs and their ability to adapt. This can fill an important gap in knowledge that cannot be gained from wild populations because of cryptic animal behaviour, inaccessible environments, limited access to the animals, prohibitive costs of studying enough individuals and the likelihood of the study itself impacting on the animals being observed. Zoo- and aquarium-based populations provide access to individuals on a long-term basis, providing context and life-history parameters to understand the significance of samples taken at a single point in time. The hands-on work of zoo and aquarium professionals also provides a singular training ground to develop expertise in animal handling, containment, specialised veterinary medicine, breeding and husbandry of wildlife populations. Zoos and aquariums provide an important venue for scientists and the public to meet and communicate, providing a platform for interpreting the outcome of research and explaining the implications for conservation action. Through the animals and the expertise of staff, zoos and aquariums have a tremendous potential to conduct and participate in research that leads to better management of the animals in their care and wild populations, and thus contribute to the viability of species in a world that faces an enormous conservation crisis.



SCOPE OF CONSERVATION-RELEVANT RESEARCH

Ultimately, conservation-relevant research benefits the conservation of natural populations and ecosystems. The research itself furthers a facility's conservation mission, and may range from research on populations and their natural habitats led and/or supported by zoological facilities to studies on the animals at or visitors to zoos and aquariums. As conservation efforts are increasingly likely to pursue a One Plan Approach, conservation-relevant research must also be coordinated between zoological settings and range habitat.

CARRYING OUT CONSERVATION-RELEVANT RESEARCH

Academic researchers, government-agency scientists, and zoo and aquarium staff conduct conservation-relevant research, and there are aspects of significant overlap among the agendas of each community.

Contributions of academic science to the conservation mission of zoos and aquariums. Many aspects of zoo and aquarium operations pose relevant research questions that are interesting to academic researchers. Collaborations with academic experts can expand access to the latest specialised equipment and generate novel ideas for assessment, diagnosis and treatment of health, reproductive, genetic, nutritional, welfare and behavioural issues of animals cared for by zoological facilities. Examples include the assessment and treatment of an individual's health by experts in their field, the development and improvement of contraception and assisted-reproductive techniques (including cell preservation), and the development of appropriate nutrition and environmental-enrichment programmes.

Zoo and aquarium animals can be a valuable resource to academic-community researchers. To the academic community, research areas include understanding the basic biology, life history, cognition and behaviour of threatened species, the calibration of non-invasive methods to assess physiological states relevant to the health and reproductive status of individuals, testing tolerance and preference of nutritional and environmental conditions, and genetic and taxonomic work to support population management and to unravel

MARIANAS AVIFAUNA CONSERVATION (MAC),
PACIFIC BIRD CONSERVATION
Translocating the golden white-eye between the Northern Mariana Islands.



What is 'conservation-relevant' scientific research?

Conservation-relevant research by zoos and aquariums is essentially a form of applied research to serve an institution's conservation mission and may cover a wide range of collaborating disciplines, from biological and veterinary science to social sciences, conservation psychology, and educational and communication sciences. There are at least two types of research that zoos and aquariums undertake when conducting conservation-relevant research.

TYPE 1

Aims to support field conservation directly; that is, the conservation of species and their habitats in the wild, including their viability or sustainability. This will usually be field research but is not necessarily limited to this if such research generates knowledge that directly contributes to the conservation of wild populations. For instance, nutrition studies conducted on species that are part of a reintroduction programme may provide critical information for ensuring reproduction of multiple, healthy generations, in which some animals from each generation are reintroduced into the wild.

TYPE 2

Has the purpose of gathering new knowledge to serve the institution's conservation mission. This covers research that may assess visitor attitudes and preferences, and how their interest in and attitudes towards conservation and sustainability may be improved, and benefit efficient approaches to communicating conservation goals and environmental education.

Conservation-relevant research may also involve other species, not necessarily solely those that are threatened, which may serve as a 'model' to test and improve conservation-relevant actions and procedures applicable to threatened species. The One Plan Approach may help to decide, on a case-by-case basis, whether a particular project should be regarded as conservation-relevant research and how essential its contribution is likely to be. Where there are no formal integrated conservation-management plans of the One Plan kind for a particular species, One Plan thinking may still be helpful to assess the necessity and priority of proposed conservation-related research.

the systematic relationship of little-known taxa. Using zoo and aquarium animals for academic research is only acceptable as long as researchers understand that their studies must not compromise the well-being of animals, the benefit in terms of gained knowledge will outweigh any potential temporary reductions in welfare, and such research benefits the conservation mission of zoos and aquariums. To this end, all zoological institutions should formulate or have access to a research committee that reviews potential research applications.

Application to conservation management. Scientists dedicated to animal management and species recovery may benefit from zoo and aquarium staff and resources. In those instances where recovery plans require conservation breeding and reintroduction, zoos and aquariums have the husbandry expertise, the researchers to improve breeding success and the facilities to manage such tasks. They are also primed to support the management of small populations, be it from population declines or fragmentation. In the field, zoos and aquariums can offer unique benefits, ranging from financial support for cash-strapped management plans to veterinarian expertise for the safe capture and handling of animals. Zoos and aquariums also serve as platforms for scientists to report their goals, findings and progress to the public.

Scientific advances have resulted in new research techniques and technologies that are not routinely available to zoos and aquariums. Unless individual zoological institutions are willing to invest in the development of their own research facilities, access to these scientific skills and tools requires a commitment to building long-term partnerships with academic, public and private laboratories. There are now numerous successful partnerships between the academic community and zoos and aquariums, which will assure improved conservation breeding and animal welfare, increase our understanding of species resilience, encourage high-quality scientific research, and strengthen the scientific credibility of zoos and aquariums. Scientific research is essential for establishing self-sustaining wildlife populations.

DATABASES AND BIOBANKS

Databases and biomaterial banks are essential tools for an evidence-based approach to conservation research and action, and should be considered a priority for all zoos and aquariums. A well-organised animal database and living collection, and appropriate storage and documentation of samples of dead or live animals (biobank) from zoological institutions or the wild, are feasible for most facilities at modest costs. Databases and biobanks will not only increase the efficiency of management operations but also provide a supply of reference material and genetic diversity. Furthermore, improvements in genome resource banks and reproductive technologies have the potential to overcome space issues and problems with maintaining genetic diversity (i.e. sustainable populations) over time.

Globally, zoos and aquariums are collecting and storing in regional biobanks the genetic resources of species in their facilities, including collaborative projects such as the Frozen Ark. Such tools are made more valuable by widespread participation and access, and by being compatible with each other where possible. The Zoological Information Management System (ZIMS), provided by the International Species Information System (ISIS), is an excellent, class-leading

database for recording information and facilitating data sharing. With nearly 900 institutions participating in ISIS, the population-level information essential for population management and the large sample sizes needed to establish veterinary norms are readily available.

SCIENCE AND RESEARCH STAFF

Some zoos and aquariums have research departments or staff employed to make sure that research targets are met. Others provide long-term support to researchers unaffiliated with zoological facilities. In both of these instances, zoos and aquariums are able to guarantee that conservation-related research is part of their overall research portfolio. Facilities that respond to ad-hoc, often externally driven research requests may find that their own research portfolio is of limited conservation relevance.

Once a request has been generated, staff (curators, keepers, researchers, veterinarians) must determine whether a study is of value to the management, understanding or conservation of a species. Institutional investment is essential to the success of any study as it makes certain that research is carried out with sufficient support and consistency. Withdrawing support from a project not yet



LEIBNIZ INSTITUTE FOR ZOO AND WILDLIFE RESEARCH (IZW), GERMANY
Faeces of an African wild dog, collected as part of a project in the Ruaha ecosystem, Tanzania, supported by various conservation organisations, including Minnesota Zoo, MN, USA. Faeces reveal many things about an animal in addition to what it eats; for example, species identity, sex, individual identity, physiological stress level, reproductive stage, parasite load and contamination with environmental pollutants.



finished prevents an evidence-based conclusion from being reached. This wastes resources already committed and reduces the perceived value of science to provide clear answers. The following elements of a project should be considered when weighing the benefits and costs.

- What is the problem that generated the question?
- What is the specific research question?
- Is the answer going to be important to informing zoo or aquarium operations?
- How will the research be carried out?
- Does the research need and have ethics approval?
- What will the project cost and how will those funds be secured?
- Who will assist with the project and what experience do they have?
- How will the results be published or presented?
- What are the overall benefits to the zoo or aquarium (e.g. staff development)?

If zoos and aquariums have dedicated science and research staff, they can support the development of a research policy, proposing research priorities and evaluating prospective research projects on their suitability in line with the institution's conservation mission. Staff should have a solid academic-research background and the capability to build collaborations with external research facilities. Such collaborations will help the institution realise its full potential in conservation-relevant research.

ESTABLISHING CONSERVATION-RESEARCH PRIORITIES

The establishment of priorities for conservation-relevant research will be informed by the capacity, resources and conservation mission of a given zoo or aquarium. All areas of operations, as well as conservation-outreach programmes, will benefit from such research; therefore, all staff should be informed about and directly involved in research, when appropriate and feasible.

Collaboration among institutions is essential. When effectively harnessed, the global network of accredited zoological facilities offers an impressive conserva-

LEIBNIZ INSTITUTE FOR ZOO AND WILDLIFE RESEARCH (IZW), GERMANY
Blood-sucking insects are a highly successful minimally invasive tool to obtain blood samples from endangered species in a stress-free manner. This process was demonstrated during the conservation breeding and reintroduction programme of the Iberian lynx carried out by Spanish and Portuguese zoological institutions.



IZW, GERMANY, AND SFD & SWD, MALAYSIA
Camera trap image of an otter civet in Deramakot Forest Reserve, Sabah, Malaysian Borneo, taken during a project largely funded by zoological institutions.



PROYECTO TITI, COLOMBIA
The Proyecto Titi field team prepares cotton-top tamarin faecal samples for analysis. Proyecto Titi seeks to ensure the survival of the cotton-top tamarin in Colombia and is partially supported by zoological institutions.

tion-research resource. Carefully designed and executed research projects that operate across zoos and aquariums, incorporating both large and small institutions, will generate augmented sample sizes as well as opportunities to assess the influence of a wider range of variables than would otherwise be possible. This will improve the quality and value of research results. Collaboration among zoos and aquariums on conservation-research programmes in the field will assure greater efficiency and more sustainable resources, and provide opportunities for meaningful engagement by smaller institutions that may otherwise be unable to establish and fund their own field-based conservation research.

Zoological facilities should become integrated components of national and global efforts for conservation research, by improving and formalising relationships with organisations charged with evaluating and determining conservation priorities and research issues. These include government wildlife and development-planning agencies, IUCN SSC specialist groups, and well-established, conservation-focused non-governmental organisations and academic societies. Implementing the relevant Aichi Biodiversity Targets through conservation research is also a priority. Local, regional and global frameworks for zoo- and aquarium-based conservation-relevant research can be set up or strengthened by establishing partnerships with these organisations, and finding agreement within the research and zoological communities as to how to translate the recommendations of these organisations into research plans based at zoos and aquariums. These research plans could operate at global, regional and institutional levels, and their conservation impact should be evaluated regularly.

THE IMPORTANCE OF PUBLISHING

Even small-scale studies that provide a better understanding of wildlife biology and management strategies should be published. This helps to avoid duplication of effort, provides evidence-based information to guide global management decisions, increases understanding in the wider community as to the complexities of wildlife management, and provides evidence of the value of research to managers and peers. Results of studies that do not provide positive outcomes will often not be submitted for publication but, assuming the science was conducted well, the work should still be published to prevent repetition and guide future studies.

CONCLUSION

All zoological facilities should assess their potential for and improve their contributions to conservation-relevant research, and build their own conservation-research strategy with realistic and achievable goals. Zoos and aquariums can facilitate conservation-relevant research at every stage of development, although the research capacity of individual zoological facilities will vary and lead to different levels of research output. Institutional conservation-research plans should be developed to align with and contribute to the conservation mission of an institution.

RECOMMENDATIONS

- Assess and invest in the research capacity of the zoo or aquarium, and the potential to develop a conservation-research strategy, which would serve the field-conservation mission and address the research needs of populations of species in the wild and those in the institution. Research capacity could be improved by developing partnerships and links to organisations that have research as a core business.
- Set up or utilise well-structured data-collection and management systems (e.g. ZIMS), and well-organised specimen-sample collection and long-term storage (biobanks).
- Develop a research policy and conservation-research strategy fitting the field-conservation mission of the institution.
- Consider developing partnerships with academic institutions and/or other zoos and aquariums with research resources, and take a leadership role in developing the next generation of conservation biologists, including creating opportunities for children to aim for careers in science, technology, engineering and mathematics.
- Ensure priority is given to research that can achieve impactful results and has clear implications for improving conservation efforts for species in the wild.



Yangtze alligator

CHECKLIST

Below is a checklist to improve zoo and aquarium operations to maximise opportunities for conservation-relevant research while ensuring high animal-welfare standards.

CONSERVATION RESEARCH AS A CORE TASK OF ZOOS AND AQUARIUMS

- Do you have a list of research priorities and questions for your institution? If so, does it include conservation-relevant issues?
- Have you established rules for prioritising research topics on conservation-relevant issues?
- Have you set up your own biobank, or do you contribute regularly to a centrally coordinated biobank with standardised protocols and data tracking, based on a specific purpose and strategy?
- Do you encourage your staff (curators, keepers, researchers, veterinarians) to conduct (and publish) case studies that have the potential to improve conservation actions and support an evidence-based approach to conservation activities?
- Are there research activities or research opportunities that you could introduce to improve your capacity to contribute to conservation research?

LINKING SCIENTIFIC RESULTS AND AN EVIDENCE-BASED APPROACH TO CONSERVATION TO OPERATIONAL PROCEDURES

- Do you regularly review your operations, policies and procedures to make sure that they are based on the most recent scientific findings on conservation planning?
- In your plans for new developments, including (off-show) animal houses, do you incorporate infrastructure and space with conservation-research needs in mind, which might also double as enrichment options; such as (automated) observation facilities, experimental food dispensers, collecting devices for individual urine or faecal samples, or medical chutes?
- Have you considered incorporating conservation-relevant research in your visitor-education programmes?

ENSURING THAT ANIMALS IN CONSERVATION-RESEARCH PROJECTS THAT YOU SUPPORT ARE IN POSITIVE ANIMAL-WELFARE SITUATIONS

- Do your back-of-house and research-animal holding areas meet high animal-welfare standards?
- Are your research animals subject to the same level of welfare focus as other animals at your institution?
- Have your research and conservation partners agreed that they maintain high animal-welfare standards while carrying out their conservation research?
- Do your research and conservation partners require support to make certain that during their research they maintain high animal-welfare standards?

STAFF

- Have you considered allowing staff at all levels time to volunteer on a field or research project to build skills in a particular area?
- Have you considered hiring qualified research staff to drive conservation-relevant research as part of your institution's conservation mission?
- Do your staff know how to train animals so that behavioural and health monitoring as well as research experiments can be carried out without causing stress to the animal (e.g. classical and operant conditioning, medical training)?
- Are your research staff trained to observe behaviour and monitor the welfare of animals in their care?
- Does your public-relations team understand the purpose of research experiments, the guidelines that the researchers follow to maintain high animal-welfare standards and the expected outcomes in terms of conservation-research results?

CONSERVATION RESEARCH AND POSSIBLE LEGAL REQUIREMENTS

- Have you confirmed that all necessary paperwork and reviews are filled out for the appropriate government agencies supervising research in your area or the area of your field-conservation research?
- Do you have a (conservation) research committee?
- Is a research committee consulted on proposed research activities at your institution? If so, does the committee have external members, such as a welfare expert or a member of the public?
- Is the approval of research projects linked to a commitment that assures high animal-welfare standards for study individuals?

NOTES:



SEA LION EXHIBIT
SAINT LOUIS ZOO, MO, USA



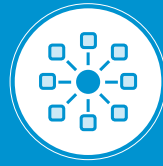
ENGAGE



VISION

Zoos and aquariums are trusted voices for conservation, and are able to engage and empower visitors, communities and staff measurably to save wildlife.

WESTERN POND TURTLE
OREGON ZOO, OR, USA



Methodology

There are many different ways for modern zoos and aquariums to engage visitors, students, staff and communities.

What do zoological facilities do to save animals in the wild? It is not enough to respond that zoos and aquariums inspire people to care more about animals. In most cases, compassion and awareness building do not lead to action unless a continuous process of engagement and incentive is implemented. However, long-term conservation success will be linked to how zoos and aquariums engage with their visitors and change behaviour.

Zoos and aquariums are in an excellent position to influence their visitors to support (directly and indirectly) the Aichi Biodiversity Targets, through education and public programmes, marketing and public relations. Zoological facilities are able to leverage the special emotional connections between animals and visitors to provide formal and informal learning opportunities in conservation education and the broader environmental-education sciences that reinforce the missions of zoos and aquariums. WAZA and many regional zoo and aquarium associations now mandate that each facility should have dedicated education staff who provide conservation-education experiences relevant to visitors in their daily lives.

Zoological facilities are able to open the hearts and minds of their visitors, providing a relevant venue to convey the threats to wildlife, and to inspire, engage and guide positive environmental action. Visits to zoos and aquariums can deepen understanding and enable people to act in new, positive ways to save biodiversity and protect the environment. The remit for educators in zoological facilities is not only to inform visitors about species in the institution, and to raise awareness about threats in the wild and the issues causing the rapid loss of biodiversity, but also to promote conservation-based behaviour action and field conservation. Proven social-science tools and techniques can be used to stimulate pro-environmental behaviours that reduce the impact humans have on wild populations.

In order to accomplish their full potential to save wildlife, zoological facilities are learning from the social marketing and psychology disciplines that underpin health-and-safety campaigns. Community-based social marketing (CBSM) and other communication tools reach, influence and engage wider audiences by employing social-science methodology. Psychology studies have shown that by understanding human attitudes and values towards the natural environ-

ANIMALS

Well-designed environments for healthy animals are strong vehicles by which to engage visitors (see *Modern Conservation Organisations and Animal Welfare*).

SIGNS

Clear information about the animals, their home range and their IUCN Red List status. While fewer than 25% of visitors will read a sign in its entirety, the information is still essential but should be reinforced through personal interpretation and interactive elements.

PRESENTATIONS

Engaging and informative presentations that deliver a strong conservation message can be the most effective means to raise the 'intent to conserve' of a visitor because of the length of time staff interact with them.

INTERACTIVE GRAPHICS

Involving the visitor in the learning process reinforces their memory.

TECHNOLOGY

Linking to the Internet through bar and QR codes, use of social media and other technological means, appeals to today's audiences and can be a powerful tool to showcase animals and behaviours that cannot be easily seen, thus reinforcing the conservation message of zoos and aquariums about saving wild species and habitats.

CAMPAIGNS

WAZA has established the 'Biodiversity is Us' outreach project to raise awareness of the importance of biodiversity to humans and promote simple individual actions for its preservation. Special events involving visitors and the local community are a good way of encouraging engagement in conservation.

RESEARCH & EVALUATION

All education and interpretation interventions must be studied and evaluated for efficacy.

ment, educational programmes can be developed to empower staff, visitors and communities to change behaviours in ways that can potentially reduce human-driven pressures on the world's limited resources, threats to wildlife and rate of biodiversity loss.

Extinction is not inevitable or natural at its current rate. Habitat fragmentation, alteration or destruction, over-exploitation, pollution, invasive species, conflict and climate change are all human-induced threats. Society can reduce these threats through conscious changes in daily activities that support a sustainable lifestyle, meaning each individual can make a difference. Advocacy with manufacturers and industry can lead to positive changes in business practice, while lobbying governments acts as a catalyst to increase pro-environmental legislation and enforcement.

USING SOCIAL SCIENCES TO UNDERSTAND BEHAVIOUR CHANGE

Zoological facilities have been utilising principles from the social sciences, including conservation and environmental psychology, to understand what motivates people to act for and against the conservation of biodiversity. Conservation psychology has been defined as:

'the scientific study of the reciprocal relationships between humans and the rest of nature, with a particular focus on how to encourage conservation of the natural world ... [using] psychological principles, theories, or methods to understand and solve issues related to human aspects of conservation.'

Implied in this multi-disciplined field is the need for cultural relevance and socio-economic understanding in order to save biodiversity and use our natural resources and ecosystems sustainably.

Conservation psychology takes into consideration the information presented, and how people identify with their peers, family and friends, the degree of trust in the institutions providing the information and recommendations, as well as what barriers to action there are and what motivates people to act. The more that is learned about visitors and how to influence them, the more effective zoological facilities will be at saving wildlife and wild places; especially if positive messages are used to link conservation to what people can do themselves to make a difference.

ASPIRATIONS

In order to effect social change, the commitment of a zoological facility to conservation education and advocacy should be incorporated into a policy for engagement and integrated throughout the institution, from the director to staff in every department (see *Creating a Culture of Conservation*). Furthermore, it is possible to advance conservation advocacy by supporting and training students who may go on to work in biodiversity conservation.

The policy for engagement, particularly the need for conservation-sensitive behaviour, should be incorporated into the design process at the planning stage. Interpretive stories, graphics, learning spaces, as well as formal and informal learning experiences, should all be considered when planning the functionality of a new development, both front and back of house. Technology should also be considered at the design stage and integrated in ways that make the experience more impactful for visitors, and the outreach wider; for example, through social media and earned media.

LEARNING PROGRAMMES

There are educational opportunities at each experience, in restaurants, retail shops and gardens in all zoological institutions. Engaging and meaningful experiences (either structured lessons or chance encounters) that facilitate behaviour change can encourage ongoing conservation action after a visit to a zoo or aquarium. Formal and informal programmes should include the possibility for visitors to showcase their actions and keep connected through social media, to encourage long-term behaviour change.

When developing a community-engagement experience designed to influence conservation action, zoos and aquariums should clearly articulate what defines success, prior to offering the experience publicly. Campaigns should be based on environmental and conservation issues that each institution believes they can best impact through access to relevant target audiences, desired outreach and capacity to influence. Working in partnership with local government, wildlife trusts, supermarkets and water boards would strengthen the environmental and conservation messaging and potential for behaviour change.

ACTIONS

For human-caused threats, zoological facilities need to develop a clear understanding of what they can do to influence behaviour change and inspire new behaviours to reduce the impact people have on the environment. For example, identify and reframe community behaviours; understand the influences on audiences for such behaviour; identify barriers and benefits for the requested behaviour; develop a new model of influences for positive behaviour change; build a marketing strategy to trigger the desired behaviour; develop a communication-strategy campaign.

TRAINING

All zoological facilities should have appropriate training programmes for staff who communicate with visitors and the wider community. These staff should be trained in the skills necessary to develop programmes and engage audiences, including communication-skills training. Underpinning this, they also need to understand the basic biology, ecology and conservation status of the animals

ENVIRONMENTAL ACTIONS

Six steps to achieve behaviour change.

- Reduce, reuse and recycle
- Take a pledge to reduce a human threat
- Support conservation through volunteering or donations
- Advocate with politicians and industries to make changes that support a sustainable future
- Make wise consumer choices that have a direct impact on wild animals and wild places
- Change your own behaviour, and that of your friends and contacts

Monterey Bay Aquarium Seafood Watch®



MONTEREY BAY AQUARIUM, CA, USA

Programmes such as Seafood Watch guide zoos, aquariums, and other mission-aligned organisations to help them empower consumers and businesses to purchase seafood caught or farmed in ways that support a healthy ocean and diverse marine ecosystems.



WILDLIFE CONSERVATION SOCIETY, NY, USA

Visitors to zoological institutions can participate in simple advocacy activities, such as this petition to end the trade in ivory and the death of African elephants.



ZOOS VICTORIA, AUSTRALIA
Connecting visitors to animals is one of our biggest assets in the fight to save species from extinction.

within the institution, and what is being done to help save wild populations of these species. Training in drama and storytelling can also be useful when engaging visitors and the wider community.

Job shadowing in the animal-care, marketing and public-relations departments would provide all staff with a deeper understanding of the needs and constraints of the animals, as well as the institution’s interface with the visitors. Providing similar opportunities for the marketing and public-relations departments would increase the understanding and ability of how best to reach the wider communities. Staff should be supported to travel to other institutions, to regional and international conferences, and to attend training events, where ideas can be exchanged, and new approaches and techniques learned. When and where possible, education staff should visit conservation projects to gain first-hand experience of the conservation and environmental challenges many communities face in adopting sustainable lifestyles while coping with issues such as habitat degradation and human–wildlife conflict. This gives credibility to staff with the responsibility for communicating with visitors and allows them to speak from first-hand experience.

EDUCATION RESEARCH AND EVALUATION

A recent WAZA-led global evaluation of the educational impacts of visits to zoos and aquariums, part of the ‘Biodiversity is Us’ outreach project, found that a significant number of people end their visit with higher biodiversity understanding and a greater knowledge of actions to help protect biodiversity. These results are the most compelling evidence to date that visits to zoos and aquariums contribute to increasing the number of people who understand biodiversity and know actions they can take to help protect biodiversity, thereby making a positive contribution to Aichi Biodiversity Target 1.

Biodiversity is Us

We are all connected

You are part of the exciting web of life that includes millions of species of plants and animals.
We call this ‘biodiversity’.
But it is shrinking fast, putting our planet – its people and animals – at risk. You can help stop this. Through your daily actions, you can make the world a better place.
What will you do today?
Biodiversity is Us.

Download the ‘Biodiversity is Us’ app and discover what you can do today.

Download the app
QR code
facebook.com/BiodiversityUs
twitter.com/BiodivUs

World Association of Zoos and Aquariums
WAZA
2011-2020
Decade on Biodiversity

WAZA, SWITZERLAND
WAZA’s ‘Biodiversity is Us’ outreach project is timed to support the United Nations Decade on Biodiversity 2011–2020, by providing tools for raising awareness about biodiversity.

This type of evaluation provides critical information both at the global level and for each zoo and aquarium. Each institution should evaluate the effectiveness of their programmes in influencing pro-conservation and consumer behaviours. Salient behaviours, misconceptions, what visitors expect and which messages best resonate with the desired target audience can all be obtained via market research or pre-assessments. Evaluation materials include surveys, focus groups, interviews, and pre- and post-tests, and make it possible to measure the effectiveness of the guest experience, learning objectives and intent for behaviour change for conservation. Summative evaluations are a beneficial tool and can help guide future enhancements.

Post-visit evaluations allow people to reflect on their visit and report on any behaviour change they have undertaken subsequent to their visit. This is now easier than ever before because data can be harvested, and social media, text messaging and email used to contact visitors when they leave the institution, although the inherent weakness of self-reporting should be acknowledged. The next challenge will be to find ways to evaluate the long-term behaviour change of visitors unobtrusively and in as non-biased a way as possible (e.g. to minimise the impact of guests wanting to please the person conducting the survey).

MATCHING CONSERVATION STRATEGY AND ACTIONS

If zoos and aquariums are asking visitors to change their behaviour then these institutions also need to behave in the optimal way for conservation. Zoological facilities are significant business operations and have the ability to lead the way in sustainable business practices by setting goals to reduce their carbon footprints, and insisting on sustainable practices, sustainable products and other pro-conservation actions within supplier agreements, including becoming



WAZA, SWITZERLAND
Cheetah as part of a special collection of plush toys in support of WAZA's 'Biodiversity is Us' outreach project.



HOUSTON ZOO, TX, USA
Zoos and aquariums can educate their guests about environmentally sustainable choices, such as using reusable shopping bags, while providing them with the capacity to make long-term behavioural changes.



SNOW LEOPARD CONSERVANCY, RUSSIA
Influencing behaviour change for conservation takes place both within zoological institutions and around the world with the partner conservation projects; for example, the Snow Leopard Festival in Russia.

certified carbon neutral (see *Creating a Culture of Conservation*). 'Zoos and Aquariums for 350' provides guidance for greening portfolios and institutions (e.g. by divesting from fossil-fuel companies and reinvesting in solutions that align with conservation missions) as individuals and communities come together to combat climate change.

CONCLUSION

Zoological facilities are uniquely placed to interact with visitors, communities and society on conservation issues in an entertaining environment. Zoos and aquariums are able to influence and inspire positive conservation behaviours, and make important differences that support their core mission: to conserve biodiversity. A goal of all zoological facilities should be to engage with visitors, other zoos and aquariums and conservation organisations, and communities to encourage conservation-sensitive behaviours that support biodiversity conservation. This goal can be achieved by influencing desired attitudes and knowledge, and by drawing on conservation psychology. By laying out clear, measurable objectives, it will be possible to evaluate the impact of such interactions between zoos and aquariums and their visitors. The importance of connecting people with nature is vital to building support for conservation.

RECOMMENDATIONS

- Create a measurable institutional engagement framework at all levels (staff, volunteers, visitors and communities) for conservation education, advocacy and cultural relevancy of the issues related to loss of biodiversity.
- Utilise the latest findings in social marketing, research and conservation psychology to design programmes that engage visitors in pro-conservation behaviours, especially local issues that may affect or impact visitors.
- Invest in the education strategy and evaluation skills of staff and facilitate cross-department exposure, and interpret how the engagement programmes are related to national and local education standards.
- Define the targeted behaviours and how they will be communicated to the visiting public (e.g. young children, school groups, adults), and specify how impact will be evaluated, and establish a system of utilising information on animal welfare, the composition of zoo and aquarium species and animal behaviours to engage visitors in pro-conservation behaviours.
- Seek collaborations with universities, museums, other zoos and aquariums, and conservation organisations to contribute more research, evaluation, partnerships and data sharing in the areas of conservation education and influencing pro-environmental behaviours.



Black-footed ferret



ATELOPUS LIMOSUS
PANAMA



PRESERVE



VISION

As centres of expertise in small-population management, zoos and aquariums are engaged in collaborative, science-based, population-management programmes involving stakeholders to achieve viable populations of selected species both in human care and in the wild.

BLUE-BILLED CURASSOW
HOUSTON ZOO, TX, USA

“

No other group of institutions has the scientific knowledge and practical experience to keep and breed thousands of animal species, thereby offering enormous potential for contributing to wildlife conservation.

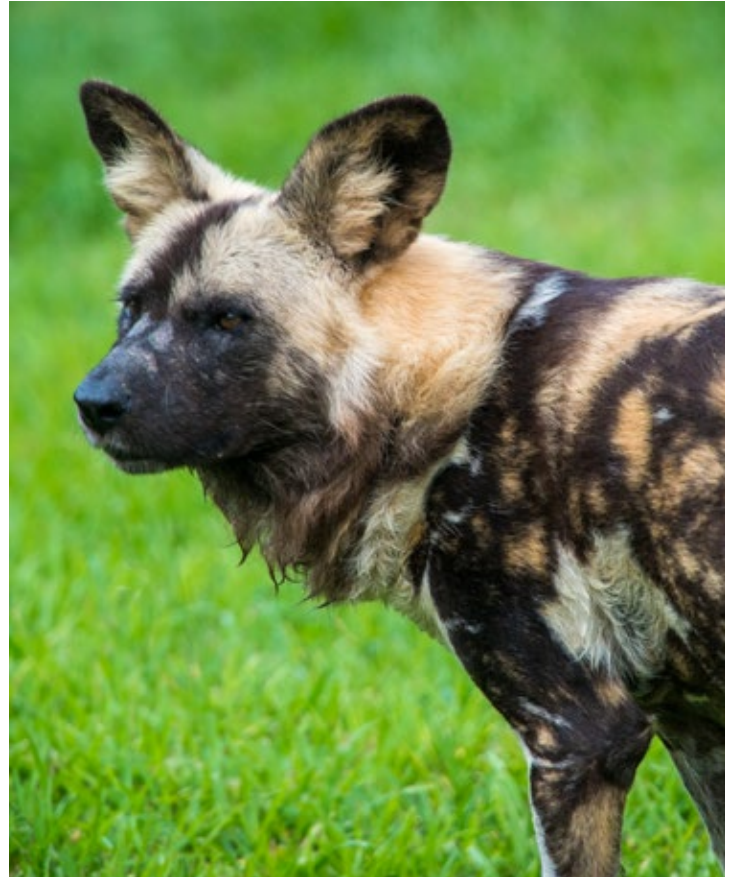
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The Aichi Biodiversity Targets aim primarily to preserve biodiversity in natural habitats. However, because human impacts now affect all ecosystems, a rising number of species will benefit from, and increasingly require, intensive population management. This trend emphasises the need for zoos and aquariums to be more directly involved in the intensive management of an increasing number of species both in zoological facilities and in the wild. As zoos and aquariums engage in increased conservation breeding for the purpose of preserving biodiversity, careful species selection should be used to focus limited resources on those for which a long-term and broadly protective difference can be made.

IUCN has recognised that conservation breeding by zoos and aquariums has played a role in the recovery of one-quarter of the 64 vertebrate species whose threat status was reduced according to *The IUCN Red List of Threatened Species*. Breeding animals in human care followed by reintroducing them into the wild as part of a coordinated recovery plan was one of the most frequently cited conservation actions that led to improvements in IUCN Red List status. For birds, conservation breeding and reintroduction helped prevent the extinction of six out of 16 species that would probably have been lost in the absence of conservation measures. For mammals, conservation breeding and reintroduction have been more successful in improving conservation status than other conservation actions, and contributed to the genuine improvement in IUCN Red List status of at least nine species. Threats to wild populations, and the potential for zoo and aquarium programmes to mitigate these threats, can be identified during a formal species-conservation planning process and/or with application of the revised IUCN SSC *Guidelines on the Use of Ex Situ Management for Species Conservation*.

CURRENT STATE OF POPULATION MANAGEMENT

Zoos and aquariums have assumed increased leadership and responsibility for conservation-breeding programmes over the years. No other group of institutions has the scientific knowledge and practical experience to keep and breed thousands of animal species, thereby offering enormous potential for contributing to wildlife conservation. These zoo- and aquarium-based skills and resources are most effective for achieving conservation outcomes when applied through extensive and cross-disciplinary partnerships.



TOP:
HOUSTON ZOO, TX, USA
African wild dog

MIDDLE:
HOUSTON ZOO, TX, USA
Red panda

BOTTOM:
HOUSTON ZOO, TX, USA
Aruba Island rattlesnake

To fulfil the full suite of conservation roles required, wild-animal populations in human care must be demographically robust, the animals must be behaviourally competent and genetically representative of wild counterparts, and the breeding programme must be able to sustain these characteristics for the future. Individuals making up viable populations should be healthy in every respect, including a positive animal-welfare state (see *Modern Conservation Organisations and Animal Welfare*), and be sourced legally, sustainably and ethically.

Small populations are rarely sufficient for securing long-term persistence of a species. Conservation-breeding programmes at the regional or global level can help form larger populations, if needed. Most programmes are managed at the regional level for logistical and regulatory reasons. A new way of fostering collaboration inter-regionally is being tested through Global Species Management Plans (GSMPs) administered under the auspices of WAZA. A GSMP involves the management of a particular taxon with a globally agreed set of goals, while building upon and respecting existing regional processes.

International and regional studbooks provide the data that can help facilitate the coordination of such conservation-breeding efforts across zoological institutions. Studbooks are repositories of pedigree and demographic data on animals managed internationally or regionally. International studbooks are administered under the auspices of WAZA. ZIMS is an application that keeps track of individual animals throughout their lives. New features have been added to ZIMS to help studbook keepers, and well-run and up-to-date studbooks will improve the animal and population data ZIMS offers within the application. As ISIS members enter data into ZIMS, they contribute to efficient population management across the zoological community. Furthermore, applying this type of living records system to small populations in reserves could advance the One Plan Approach and make a direct contribution to sustaining wildlife in nature.

It is vital to recognise that space for holding and breeding larger populations of many species is the greatest impediment to building long-term sustainability. This issue over available space was recognised in the 1980s, yet it remains a critical need in building sustainable populations today, with a demand for caring for more species in zoos and aquariums. Another crucial matter is the difficulty that zoological professionals encounter in moving animals (or gametes) for breeding purposes. Regulatory hurdles continue to make trans-regional movement of animals difficult. This threatens the successful implementation of GSMPs and other collaborative inter-regional programmes. In addition, it thwarts cooperative management of species maintained in different regions whose collective population would be sustainable, if individuals in the isolated, regional populations could be moved predictably for breeding purposes. Stronger efforts should be made to influence legislation in regards to moving animals (or gametes) for breeding purposes.

If the zoological community is to succeed in building sustainable populations, the vital importance of cooperative population management, carried out by programme leaders and studbook keepers, must be recognised and supported. In an environment where financial and other resources are limited, collection planning is crucial and resource allocation is restricted, cooperative population management is integral to the long-term success of zoos and aquariums. Programme

leaders and studbook keepers are essential to the conservation of biodiversity and they provide an immeasurable service to the zoological community.

FUTURE OF POPULATION MANAGEMENT

In the *WAZA Vision and Corporate Strategy Towards 2020*, the first operational objective states that a clear link should be established and communicated between field conservation, and the conservation work carried out in zoos and aquariums. In line with this objective, this Strategy postulates the dawning of the era of increasing focus on a more holistic approach to integrated species conservation—the One Plan Approach to species conservation planning. Integrated conservation works along a continuum of management intensity, including little, if any, human intervention in wild populations all the way to intensively managed populations in some reserves and in zoos and aquariums. Furthermore, in order to build sustainable populations, zoological facilities must commit to supporting and training the staff who implement cooperative population management.



COPENHAGEN ZOO, DENMARK
Conservation breeding and reintroduction of natterjack toads in Denmark and Estonia.

Increasingly, as a result of habitat loss, and habitat and population fragmentation, many wild populations have similarities to populations in human care—small in size, fragmented and with limited gene flow between them. For example, animals reintroduced into relatively small, fenced reserves, have necessitated periodic translocation of individuals to mimic natural dispersal and maintain gene flow. This model is referred to as a managed metapopulation, as natural metapopulation processes such as dispersal are subject to human intervention. Metapopulation management involves managing a set of interacting populations under a common conservation goal. Its components may include multiple regional populations managed in human care (including range-country breeding programmes), multiple wild populations (including reintroduced populations) and genome resource banks.

Long-term population viability often requires transfers of animals (or gametes) for breeding. Traditionally, this included the exchange of animals between holders of the population in human care, import of animals from the wild to either bolster existing or establish new populations in human care, and export of animals from populations in human care to the wild. These transfers can be combined under one umbrella of interactive exchanges of animals (or gametes) between populations in the wild and in human care for achieving coincident conservation outcomes. This greatly enhances the capacity to sustain viable populations both in zoological facilities and in the wild. For the sake of effective population management, legislation at national and international levels (including Convention on International Trade in Endangered Species of Wild Fauna and Flora [CITES] regulations) should be adapted and enforced to provide opportunities for such interactive exchanges.

The science of managing small populations in human care is of direct relevance to field-conservation programmes that require intensive wildlife-management techniques. For example, fencing can be highly effective for preventing human-wildlife conflicts in wild-animal populations adjacent to settled areas. However, fenced populations will require human intervention to be viable in the long term. Similarly, fragmented and small populations may require translocation of animals among the few remaining sites to restore gene flow. As land-use change and, increasingly, climate change progress habitat fragmentation, deterioration and destruction, translocation is likely to become an increasingly important conservation tool. This includes considering the role zoos and aquariums may play in the emerging concept of 'rewilding', with an aim of restoring ecological processes to recreate functional ecosystems. Strategic guidance is provided in the revised IUCN SSC *Guidelines for Reintroductions and Other Conservation Translocations*.

As the biodiversity crisis intensifies, an increasing number of species will likely require some form of intensive population management (human intervention) in order to avoid extinction. Guidance on if and when activities in zoos and aquariums can be a beneficial component of an overall species-conservation strategy is provided in the revised IUCN SSC *Guidelines on the Use of Ex Situ Management for Species Conservation*. These guidelines outline a five-step decision-making process that defines potential conservation roles that populations in human care may play, the type of activities needed to fulfil those roles, and the feasibility, risks and likelihood of success. Population management can be used more effectively as a conservation tool if the specific ways in which it can improve population viability or prevent extinction are identified and critically evaluated as part of an integrated approach to species-conservation planning.

In addition to advancing tools for the behavioural, reproductive, genetic, health-related and welfare-related management of intensively managed populations, innovative approaches are needed to enhance the capacity to sustain viable populations both in human care and in the wild, as identified in a recent WAZA-led horizon scan for species conservation by zoos and aquariums. There are existing challenges that also need attention, such as the management of group-living species, low reproductive success, metapopulation management and adaptation to being kept in human care. Research and new technological advances (e.g. genomics) are emerging that have the potential to significantly change and improve how populations are managed (see *Science and Research*). There will be the need to develop

new ways and software tools to incorporate these findings and technologies into population management. These would include, for example, off-site breeding centres, extractive reserves and genome resource banks. Developing sustainable, genetically diverse populations is an obligation that serves field conservation and conservation work carried out in zoological facilities, and animal-welfare goals (see *Science and Research*).

A significant way to improve population sustainability and conservation benefit is to improve population management in the range countries of threatened species. Similarly, maintaining good partnerships with the managers of wild populations is paramount to increasing the impact of the breeding programmes. Agreements should be made with the management authority to ensure that everyone knows what targets need to be met to reach the recovery-team goals and which tasks are the responsibility of each institution.

CONCLUSION

Sustainable population management is one of the most critical issues for modern zoos and aquariums, and visitors may find it difficult to differentiate between the needs of an individual animal (animal welfare) and the conservation needs of a species (population management). Population management within zoological facilities regularly requires animal transfers, mate selection, social-group composition, euthanasia or contraception, and these requirements should be clearly explained to all stakeholders in conservation and welfare terms.

RECOMMENDATIONS

- Because lack of space is the greatest impediment to building long-term sustainable populations, zoos and aquariums should dedicate space devoted to holding and breeding cooperatively managed species as a primary commitment to sustainability.
- Conservation-breeding programmes should be evaluated, both qualitatively and quantitatively, on a regular basis in terms of their success in meeting stated goals and sustainability, and for their potential conservation impact.
- Integrated species-conservation programmes should further advance collaborations between zoos and aquariums, non-governmental organisations, academic institutions, government agencies and other like-minded partners when intensive population management is deemed appropriate for achieving positive conservation outcomes.
- To achieve meaningful conservation outcomes, zoos and aquariums should focus their attention on threatened species for which they can make a difference. Where relevant, regional breeding programmes should link together to address global species-conservation strategies.
- Good husbandry practice and animal welfare are prerequisites for successful breeding programmes and, thus, must be a foundation for all of the work of zoos and aquariums, both within the institutions and in the field; including training and support for the personnel who carry out population management at all levels.



PACIFIC WALRUS CALF
WILDLIFE CONSERVATION SOCIETY, NY, USA



CARE



VISION

Every zoo and aquarium demonstrates a clear and core commitment to excellent animal welfare, which supports effective shared wildlife-conservation goals.

EASTERN BARRED BANDICOOT
ZOOS VICTORIA, AUSTRALIA

*World Zoo and Aquarium
Animal Welfare Strategy*

Excellent animal welfare is fundamental to achieving a shared wildlife-conservation goal. Demonstrating that the welfare of animals is of the highest possible standard is crucial and must be conspicuous in all zoos and aquariums. While conservation of wildlife is the core purpose of zoological facilities, positive animal welfare is their core activity. A more detailed summary of zoo and aquarium animal welfare is outlined in *Caring for Wildlife: The World Zoo and Aquarium Animal Welfare Strategy*. Modern zoological facilities strive to provide for the complex needs of animals and aim, as far as possible, to allow species in their care to express as wide an array of natural behaviours as possible.

The human perception of and emotional responses to the welfare of zoo and aquarium animals is distinct from other animal-management industries, such as for domestic or farm animals for which traditional animal-welfare paradigms were developed. In zoos and aquariums, staff form close bonds with the animals, often caring for them for many years. Modern zoological facilities typically house small numbers of individual animals of high conservation value. The animals themselves have high intrinsic value and, additionally, are often loved by visitors—and can become a focus of intense public interest and emotional engagement.

ACHIEVING POSITIVE ANIMAL-WELFARE STATES

Animal welfare refers to the state of an animal, including the subjective feelings and sensations it experiences within itself as a result of its physical, psychological and behavioural health, and surrounding influences. Advances in knowledge in animal welfare have confirmed not only physical states but also the importance of considering the psychological states of animals when assessing welfare over time. Therefore, it is this integration that aims to meet the behavioural needs of animals.

Positive animal welfare describes the general state experienced by an animal when its physical and psychological needs are met, and when the environment provides it with rewarding challenges and choices over time. Zoos and aquariums must actively manage and promote 'positive welfare states' for animals in a measurable and transparent manner, using rigour, research, staff expertise, veterinary care and monitoring skills.

“

Zoos and aquariums have a responsibility to achieve high standards of animal welfare in support of their goals as modern conservation organisations.

”

COMMUNICATING ABOUT ANIMALS

It is widely held that animals in zoos and aquariums are 'ambassadors' for animals in the wild and assist in communicating key messages to society on the conservation of biodiversity. By presenting wildlife in simulated natural settings, visitors are encouraged to learn about conserving wildlife and be inspired to take actions to conserve the natural world. The trend for immersive exhibits, where visitors share the same environment as the animals, affords a multi-sensory experience and perceived intimacy with the natural world. This promotes emotional learning and by creating an emotional connection to wildlife research has found that visitors are more likely to support and donate to wildlife conservation, to change their behaviour and, perhaps, even become stewards and champions of conservation. (See *Appeal to Zoo and Aquarium Directors* and *Engagement—Influencing Behaviour Change for Conservation*.)

That zoos and aquariums care positively for all animals in their facilities affirms the connection between animals and visitors, and strengthens and confirms the vital message about wildlife conservation (see *Creating a Culture of Conservation*). In communicating conservation messages, zoological facilities must always communicate respect for the animals. As such, where zoo and aquarium animals are used in animal demonstrations or interactions with the public, strong conservation messages should also be communicated and the process must always be undertaken in such a way that the welfare of individual animals is not compromised. Such activities must be overseen by a veterinarian or trained staff who closely monitor the ongoing welfare of the animals. If negative welfare states are detected at any point, animals must be withdrawn from such interactions.



HOUSTON ZOO, TX, USA
Meerkats are provided with enrichment opportunities to encourage natural behaviours that they would exhibit in the wild.

CONSERVATION WELFARE AND MODERN ZOOS

‘Conservation welfare’, a term that has been developed within the zoological world over the past ten years, applies to ensuring positive animal-welfare states at the same time as aiming to achieve conservation objectives, such as wild-life-research activities or release-to-the-wild programmes. Excellent animal welfare supports effective conservation through, for example, improved husbandry practices and reintroduction success, and greater visitor engagement. This ‘compassionate conservation’ approach highlights a core principle of considering the welfare of individual animals while working to save species.

The commitment of zoos and aquariums to animal welfare should go beyond internal institutional responsibility. This commitment should be widely disseminated to the public through education, interpretation, social media and all forms of communication. Vigorous research and evaluation into the public perception of animal welfare is essential to make certain that visitors understand what animal welfare and population management entail.

Because of the conservation urgency and the requirements of intensive species management, while one welfare priority may be to minimise ‘stress’ in animals, this may not always be applicable in a context of conservation welfare. For example, breeding programmes for release to the wild must necessarily foster wild behaviours that may be considered by some as ‘stressful’ for individual animals and/or against their positive welfare. Yet this is central to the survival of individuals in a wild environment—and linked to the conservation of a species more broadly. Many breed-for-release programmes undertake pre-release conditioning, which may include pre-release predator training that instigates flight responses; the manipulation of diet to replicate food availability in the wild; or introducing live prey items.

For the individual animals involved in intensive management and associated conservation actions, this strategic and higher-level conservation outlook must be acknowledged and managed. Controversial practices should be subjected to ethical review or a critical-evaluation process to make sure that the end justifies the means. As

positive welfare represents a net accumulation of positive over negative experiences in the life of an animal, the transient nature of these strategies are acceptable in that they meet the broader strategic objectives of conservation welfare.

TOOLS TO BUILD POSITIVE ANIMAL WELFARE

In all aspects of animal care, zoos and aquariums must apply the latest validated approaches to managing wild animals to maximise their welfare. This includes ensuring training methodologies such as positive reinforcement, welfare-focused exhibit design, employing highly skilled and trained staff, providing the highest possible levels of veterinary care, using environmental enrichment, continually reviewing diet, ongoing and informed management, a research focus and ongoing monitoring of animal-welfare states. The conservation-welfare implications of acquiring individual animals that have experienced negative capture, transport or social disruption need to be considered. Partnering with other zoos and aquariums, universities, and animal-welfare and scientific organisations are important tools for building and improving animal welfare,

increasing internal knowledge and practice, and continually updating staff skills.

There should be a move towards quantifiable animal-based outputs, such as assessments of hormones, behavioural diversity or heart rate, that produce quantifiable and replicable results, to provide a more comparative and analytical level to animal welfare.

Accreditation programmes of regional or national zoo and aquarium associations are an effective way to demonstrate good welfare standards, and zoos and aquariums should seek to achieve accreditation when it is available. Where accreditation is not available, zoos and aquariums should demonstrate welfare achievement through other methods by partnering and benchmarking with others. A primary goal is to meet all local legislated and/or regulated animal-welfare and animal-holding requirements. The desired approach is to exceed them.

Additionally, animal ethics and welfare committees within zoos and aquariums provide useful and objective points of reference for decision-making about animal welfare and conservation welfare. Such committees may include



SHEDD AQUARIUM, IL, USA
Aquarium medical professionals perform an operation on a ray.

key staff members, such as veterinarians and animal-management staff, as well as external members from the scientific and general community. Zoos and aquariums that use such committees report that they help to assure transparency in decision-making processes on animal welfare; and enable the incorporation of the community perspective on specific welfare issues and conservation welfare.

Another fundamental aspect of ensuring positive animal welfare is to establish a strong welfare and planning-orientated organisational culture. Thorough and informed planning that considers the welfare of animals for breeding events, transfers and movements, design of exhibits and holding areas, environmental enrichment and related standard operating procedures help build confidence and expertise in animal welfare.

CONCLUSION

An animal-welfare charter or commitment statement can be a powerful mechanism for zoo and aquarium staff to understand and appreciate the management's commitment to animal welfare, and also be a clear commitment to visitors and the wider community. A commitment statement has been adopted by WAZA as a part of *Caring for Wildlife: The World Zoo and Aquarium Animal Welfare Strategy*.

RECOMMENDATIONS

- Commitment and success in animal care and welfare are central to the credibility of zoos and aquariums, and should be at the centre of all operations in zoological facilities.
- Positive animal welfare must be delivered to the animals in human care as described in *Caring for Wildlife: The World Zoo and Aquarium Animal Welfare Strategy*, this being fundamental to the modern zoo and aquarium.
- All animal interactions or animal presentations should be linked to conservation messages and information about natural behaviours, and should be overseen and managed by trained professional staff to make certain that positive animal-welfare states are achieved.
- Assure the balance of welfare and conservation activities, and build understanding of the importance of integrated species-conservation frameworks to include and acknowledge animal welfare and conservation welfare.
- Zoological institutions should build an organisational culture that is committed to continual review of animal-welfare standards and includes a high level of planning for all aspects of the life of an animal.

WORLD ZOO AND AQUARIUM ANIMAL WELFARE STRATEGY COMMITMENT

OUR COMMITMENT IS TO:

- Strive to achieve high welfare standards for the animals in our care;
- Be animal-welfare leaders, advocates and authoritative advisers; and
- Provide environments that focus on the animals' physical and behavioural needs.

IN DOING THIS, WE COMMIT TO:

- Treat all animals in our zoos and aquariums with respect;
- Make high animal-welfare standards a major focus of our husbandry activities;
- Ensure that all husbandry decisions are underpinned by up-to-date animal-welfare science and veterinary sciences;
- Build and share with colleagues animal-care and welfare knowledge, skills and best-practice advice;
- Comply with specific animal-welfare standards set out by regional zoo and aquarium associations and WAZA; and
- Comply with jurisdictional and national codes of practice, regulations and legislation as well as international treaties relating to animal care and welfare.



Rodrigues fruit bat

BIBLIOGRAPHY

CBD (2010)

Strategic Plan for Biodiversity 2011–2020 and the Aichi Targets: “Living in Harmony with Nature”. Montreal, QC: Secretariat of the Convention on Biological Diversity.

CBSG (2011)

Intensively Managed Populations for Conservation Workshop Report. Apple Valley, MN: IUCN SSC Conservation Breeding Specialist Group.

CBSG (2012)

The One Plan Approach: Integrated Species Conservation Planning. Apple Valley, MN: IUCN SSC Conservation Breeding Specialist Group.

Conde, D. A., Flesness, N., Colchero, F., Jones, O. R. & Scheuerlein, A. (2011)

An emerging role of zoos to conserve biodiversity. *Science* 331: 1390–1391.

Conde, D. A., Colchero, F., Gusset, M., Pearce-Kelly, P., Byers, O., Flesness, N., Browne, R. K. & Jones, O. R. (2013)

Zoos through the lens of the IUCN Red List: a global metapopulation approach to support conservation breeding programs. *PLoS ONE* 8: e80311.

Conde, D. A., Colchero, F., Güneralp, B., Gusset, M., Skolnik, B., Parr, M., Byers, O., Johnson, K., Young, G., Flesness, N., Possingham, H. & Fa, J. E. (2015)

Opportunities and costs for preventing vertebrate extinctions. *Current Biology* 25: R219–R221.

Conway, W. G. (2011)

Buying time for wild animals with zoos. *Zoo Biology* 30: 1–8.

Dick, G. & Gusset, M. (eds) (2010)

Building a Future for Wildlife: Zoos and Aquariums Committed to Biodiversity Conservation. Gland: WAZA.

Dick, G. & Gusset, M. (2013)

Conservation biology. In: *Zookeeping: An Introduction to the Science and Technology* (ed. by Irwin, M. D., Stoner, J. B. & Cobaugh, A. M.), pp. 533–543. Chicago, IL: University of Chicago Press.

Fa, J. E., Funk, S. M. & O’Connell, D. (2011)

Zoo Conservation Biology. Cambridge: Cambridge University Press.

Fa, J. E., Gusset, M., Flesness, N. & Conde, D. A. (2014)

Zoos have yet to unveil their full conservation potential. *Animal Conservation* 17: 97–100.

Gusset, M. & Dick, G. (2010)

‘Building a Future for Wildlife’? Evaluating the contribution of the world zoo and aquarium community to in situ conservation. *International Zoo Yearbook* 44: 183–191.

Gusset, M. & Dick, G. (2011)

The global reach of zoos and aquariums in visitor numbers and conservation expenditures. *Zoo Biology* 30: 566–569.

Gusset, M. & Dick, G. (eds) (2011)

WAZA Magazine 12: Towards Sustainable Population Management. Gland: WAZA.

Gusset, M. & Dick, G. (eds) (2012)

WAZA Magazine 13: Fighting Extinction. Gland: WAZA.

Gusset, M. & Dick, G. (eds) (2013)

WAZA Magazine 14: Towards Integrated Species Conservation. Gland: WAZA.

Gusset, M. & Dick, G. (eds) (2015)

WAZA Magazine 16: Towards Positive Animal Welfare. Gland: WAZA.

Gusset, M. & Lowry, R. (eds) (2014)

WAZA Magazine 15: Towards Effective Environmental Education. Gland: WAZA.

Gusset, M., Fa, J. E., Sutherland, W. J. & the Horizon Scanners for Zoos and Aquariums (2014)

A horizon scan for species conservation by zoos and aquariums. *Zoo Biology* 33: 375–380.

Hosey, G., Melfi, V. & Pankhurst, S. (2013)

Zoo Animals: Behaviour, Management, and Welfare, 2nd edn. Oxford: Oxford University Press.

IUCN (2015)

The IUCN Red List of Threatened Species. Gland and Cambridge: IUCN. <http://www.iucnredlist.org>

IUCN Species Survival Commission (2013)

Guidelines for Reintroductions and Other Conservation Translocations. Version 1.0. Gland: IUCN Species Survival Commission.

IUCN Species Survival Commission (2014)

Guidelines on the Use of Ex Situ Management for Species Conservation. Version 2.0. Gland: IUCN Species Survival Commission.

IUDZG/CBSG (1993)

The World Zoo Conservation Strategy: The Role of the Zoos and Aquaria of the World in Global Conservation. Chicago, IL: Chicago Zoological Society.

Kleiman, D. G., Thompson, K. V. & Kirk Baer, C. (eds) (2010)

Wild Mammals in Captivity: Principles and Techniques for Zoo Management, 2nd edn. Chicago, IL: University of Chicago Press.

Lacy, R. C. (2013)

Achieving true sustainability of zoo populations. Zoo Biology 32: 19–26.

Maple, T. L. & Perdue, B. M. (2013)

Zoo Animal Welfare. Berlin: Springer-Verlag.

Mellor, D. J., Hunt, S. & Gusset, M. (eds) (2015)

Caring for Wildlife: The World Zoo and Aquarium Animal Welfare Strategy. Gland: WAZA.

Moss, A., Jensen, E. & Gusset, M. (2014)

Zoo visits boost biodiversity literacy. Nature 508: 186.

Moss, A., Jensen, E. & Gusset, M. (2015)

Evaluating the contribution of zoos and aquariums to Aichi Biodiversity Target 1. Conservation Biology 29: 537–544.

Penning, M., Reid, G. McG., Koldewey, H., Dick, G., Andrews, B., Arai, K., Garratt, P., Gendron, S., Lange, J., Tanner, K., Tonge, S., Van den Sande, P., Warmolts, D. & Gibson, C. (eds) (2009)

Turning the Tide: A Global Aquarium Strategy for Conservation and Sustainability. Berne: WAZA.

Redford, K. H., Amato, G., Baillie, J., Beldomenico, P., Bennett, E. L., Clum, N., Cook, R., Fonseca, G., Hedges, S., Launay, F., Lieberman, S., Mace, G. M., Murayama, A., Putnam, A., Robinson, J. G., Rosenbaum, H., Sanderson, E. W., Stuart, S. N., Thomas, P. & Thorbjarnarson, J. (2011)

What does it mean to successfully conserve a (vertebrate) species? BioScience 61: 39–48.

Redford, K. H., Jensen, D. B. & Breheny, J. J. (2012)

Integrating the captive and the wild. Science 338: 1157–1158.

Rees, P. A. (2011)

An Introduction to Zoo Biology and Management. Oxford: Wiley-Blackwell.

WAZA (2005)

Building a Future for Wildlife: The World Zoo and Aquarium Conservation Strategy. Berne: WAZA.

WAZA (2009)

WAZA Vision and Corporate Strategy Towards 2020: Voice of the Global Zoo and Aquarium Community. Berne: WAZA.

WWF (2014)

Living Planet Report 2014: Species and Spaces, People and Places (ed. by McLellan, R., Iyengar, L., Jeffries, B. & Oerlemans, N.). Gland: WWF.

Zimmermann, A., Hatchwell, M., Dickie, L. & West, C. (eds) (2007)

Zoos in the 21st Century: Catalysts for Conservation? Cambridge: Cambridge University Press.



CORAL RESTORATION FOUNDATION, FL, USA
Aquarium specialists provide assistance to a coral conservation project using their expertise in coral propagation.

ACRONYMS AND WEBSITES

AArk Amphibian Ark	United Nations Strategic Plan for Biodiversity 2011-2020: Aichi Biodiversity Targets
Association of Zoos and Aquariums (AZA) Saving Animals From Extinction (SAFE)	WAZA World Association of Zoos and Aquariums
Association of Zoos and Aquariums (AZA) Toolkit for Increasing AZA-Accredited Zoo & Aquarium Contributions to Field Conservation	ZIMS Zoological Information Management System
AZA Association of Zoos and Aquariums	Zoos and Aquariums for 350
CBD United Nations Convention on Biological Diversity	
CBSG IUCN SSC Conservation Breeding Specialist Group	
CBSM Community-based Social Marketing: Fostering Sustainable Behavior	
CITES Convention on International Trade in Endangered Species of Wild Fauna and Flora	
Conservation Psychology	
Frozen Ark	
GSMP Global Species Management Plan	
ISIS International Species Information System	
IUCN International Union for Conservation of Nature	
IUCN Red List of Threatened Species	
Living Machine	
Project Conservation Impact Tool	
SSC IUCN Species Survival Commission	

GLOSSARY OF TERMS

The definitions provided here are determined by the context within this Strategy. These definitions aim to provide clarity and confidence about the meanings within this document.

Animal welfare

How an animal copes with the conditions in which it lives. A good state of welfare (as indicated by scientific evidence) results in an animal that is healthy, comfortable, well-nourished, safe, able to express innate behaviour and not suffering from unpleasant states, such as pain, fear and distress.

Aquarium

Permanently sited facility, primarily open to and administered for the visiting public, with living wildlife and other species.

Biobank

A large collection of biological or medical data and tissue samples, amassed for research purposes.

Biodiversity

The variability among living organisms from all sources, including inter alia, terrestrial, marine and other aquatic ecosystems, and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems (CBD definition).

Captivity (from a zoological perspective)

A situation where an animal is maintained in a man-made habitat and solely or partially dependent on human care.

Carbon footprint

Amount of carbon dioxide released into the atmosphere as a result of the activities of a particular individual, organisation or community.

Collection planning

Strategic planning process at an institutional, regional or global level, to identify and prioritise taxa suitable for human intervention and care, determined by the conservation and educational value of that taxa, and an ability to provide adequate care; collection planning envisions the future of the institution, and takes into account organisational resources and limitations.

Climate change

Change in global or regional climate patterns, attributed largely to the increased levels of atmospheric carbon dioxide produced by the use of fossil fuels, that is forcing the climate system of the planet into a chaotic transitional state.

Conservation

Securing populations of species in natural habitats for the long term (WAZA definition).

Conservation breeding

The process of breeding animals for conservation purposes outside their natural environment in conditions under human care.

Conservation outcomes

Quantitative, qualitative and otherwise demonstrable conservation results at the species and/or habitat level, either in human care or in the wild.

Conservation psychology

The scientific study of the reciprocal relationships between humans and the rest of nature, with a particular focus on how to encourage conservation of the natural world.

Conservation welfare

Ensuring positive animal-welfare states at the same time as aiming to achieve conservation objectives, such as wildlife-research activities or release-to-the-wild programmes.

Ecosystem

A biological community of interacting organisms and their physical environment.

Ecosystem services

Natural processes, such as provision of clean air, clean water, nutrient cycling and soil production, that benefit people and maintain the conditions for life on earth.

Emerging disease

New or previously unrecognised bacterial, fungal, viral and other parasitic diseases.

Environmental education

Teaching and learning experiences that promote understanding and appreciation of the natural world.

Environmental sustainability

Responsible interaction with the environment to avoid depletion or degradation of natural resources, and allow for long-term environmental quality; environmental sustainability helps to ensure that the needs of today's population are met without jeopardising the ability of future generations to meet their needs.

Euthanasia

The humane, painless and distress-free termination of life, using a method that produces concurrent loss of consciousness and central nervous system functioning.

Field conservation

Directly contributing to the long-term survival of species in natural ecosystems and habitats.

Genome resource bank

Archive of genetic information from species from a variety of biological samples, especially gametes (oocytes and sperm).

GLOSSARY OF TERMS

Genomics

Identification and plotting of genes, and the study of the interaction of genes with each other and the environment.

Habitat fragmentation

Clearing or degradation of habitat where once continuous areas are split into isolated sections; these may only support reduced populations and suffer from edge effects and changed microclimates.

Horizon scan

Systematic examination of potential threats, opportunities and likely future developments that are at the margins of current thinking and planning.

Integrated conservation

Projects that link biodiversity conservation both inside and outside the natural range, and take account of all stakeholders.

Invasive species

A species that competes with native species for space and resources; usually exotic or introduced.

One Plan Approach

Integrated species conservation planning that considers all populations of the species (inside and outside the natural range), under all conditions of management, and engages all responsible parties and resources from the start of the conservation-planning initiative.

Metapopulation

A group of populations that are separated by space, but consist of the same species, and interact as individual members move from one population to another.

Metapopulation management

Management of a group of (partially) isolated populations of the same species by, for example, exchanging individuals or genes between wild populations and those in human care.

Modern zoo or aquarium

Contemporary zoo or aquarium (as defined within this glossary) that strives to achieve high standards of wildlife conservation, animal welfare and environmental education.

Population fragmentation

When groups of animals living in the wild become separated from other groups of the same species, and are no longer connected in a way that allows for gene flow between groups; often the result of habitat fragmentation.

Protected area

A clearly defined geographical space, recognised, dedicated and managed through legal or other effective means, to achieve the long-term conservation of nature with associated ecosystem services and cultural values.

Range

The area over which a species is distributed.

Reintroduction

Restoring a species to parts of its natural range from which it has been lost.

Studbook

Detailed records of births, deaths and genetic relationships and other biological data that, when analysed, allow management of a population.

Supply-chain activism

The action of organisations joining forces to exercise substantive influence on suppliers of goods and services for wider conservation benefit.

Sustainable practices

Actions that reduce negative environmental impacts, and enhance ecological and social benefits.

Translocation

The deliberate movement of organisms from one site for release in another; intended to yield a measurable conservation benefit at the population, species or ecosystem level.

Zoo

Permanently sited facility, primarily open to and administered for the visiting public, with living wildlife and other species.



California condor

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LEIPZIG ZOO, GERMANY
Participants in the WAZA Conservation Strategy revision workshop hosted by Leipzig Zoo, Germany, in 2014.

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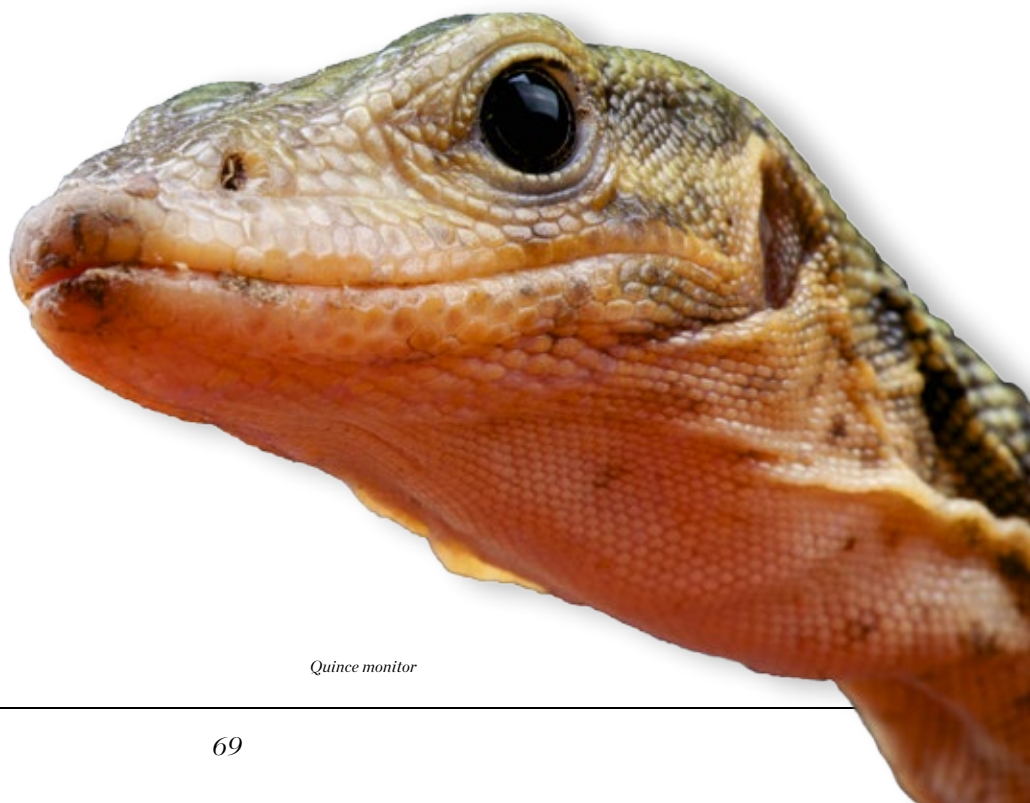
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