Summary of WAZA community climate change engagement activities

(WAZA/CBSG Climate Change Task Force review April 2012)

The World Association of Zoos and Aquariums (WAZA) is the unifying organisation for the world zoo and aquarium community. WAZA members include 24 national and regional zoo and aquarium associations, over 250 leading zoos and aquariums, affiliate organisations and corporate partners from around the world. With more than 700 million zoo and aquarium visitors annually, together we are 'United for Conservation'.

Our community is responding to the climate change threat through a diverse range of engagement activities. These range from single member institution initiatives through to national, regional and global collaborative programmes. The following thematically grouped summaries illustrate the engagement spectrum of our work that either directly pertains to climate change issues or is highly relevant to them.

Serving as repositories, conduits and forums for reliable, science-based information and training resources for our staff, research partners, public, students and policy makers: These include libraries, global databases and website networks, hosted meetings, workshops, symposia and education materials. Our zoological and conservation information is increasingly informing efforts to better determine species sensitivity to climate change threat scenarios. We have also developed significant climate change reference tools, which are shared across the conservation and climate science community to help effective collaborations and engagement with public and policy makers. This information gathering and dissemination effort is an ongoing commitment, together with increased collaboration with the climate science community and wider stakeholders. Examples include:

- An Iterative Reference List of Climate Change Science, Policy and Related Information http://www.waza.org/files/webcontent/1.public_site/5.conservation/climate_change/Climate%20Change%20Reference%20List_14%20Feb2012.pdf
- Biodiversity and climate change information database Bioclimate www.bioclimate.org
- Climate Interpreter http://climateinterpreter.org
- AZA Green Guide http://www.aza.org/sustainable-practices
- AZA Green Practices Toolbox http://www.aza.org/green-practices
- AZA Green Award http://www.aza.org/Membership/detail.aspx?id=17624
- AZA Green Affinity Purchasing programmes http://www.aza.org/affinity-programs.aspx
- South Asia Climate Change Network http://www.zooreach.org/Networks/ZOO_CCnetwork.html
- ISIS Zoological Management Information System http://www.isis.org/pages/default.aspx

Communicating with public, students and policy makers on climate change science, threat and response issues: With particular emphasis on the impacts on biodiversity and the importance of biodiversity in mitigation and adaptation efforts, we are committed to realising our tremendous potential for raising awareness and effective engagement with our 700 million annual visitors and wider audiences, collaborators and partners. In addition to the educational expertise of the International Zoo Educators' Association (IZE), we work closely with many government agencies (including UNEP and IUCN) and NGOs to ensure that our ability to communicate these often complex climate change issues is as effective as possible. The unique engagement asset of our living collections and outreach programmes are especially valuable for realising this key objective. Examples include:

- The Climate Literacy Zoo Education Network (CliZEN) http://www.clizen.org
- The Ocean Project http://theoceanproject.org
- Birch Aquarium Feeling the Heat exhibition http://aquarium.ucsd.edu/Exhibits/Feeling_the_Heat
- IZE climate change and biodiversity site http://www.izea.net/education/climate%20change.htm
- New England Aquarium National Network for Ocean and Climate Change Interpretation (NNOCCI) http://www.neaq.org/conservation_and_research/projects/project_pages/global_climate_change_and_ocean_education.php
- AZA Arctic Ambassador Centers http://www.aza.org/arctic-ambassador-centers
- AZA Climate and Wildlife Initiative http://www.aza.org/climate-disruption
- Polar Bears International http://www.polarbearsinternational.org/programs

Researching the biodiversity impacts of climate change: In addition to contributing to terrestrial and aquatic species threat evaluations, the WAZA community has a strong record of investigating emerging infectious diseases, such as chytrid fungus infections in amphibians and West Nile virus and avian malaria in birds. How climate change is exacerbating wildlife health issues, such as the increasing spread of disease vectors due to shifting climate zones, are important research areas that we are engaged with in collaboration with a wide range of partners. The bio-surveillance potential of our sites is also being realised to identify changes in native and non-native species' range distributions, seasonal abundances and behaviours. Examples include:

- The Living Planet Index http://static.zsl.org/files/1-2-1-living-planet-index-1062.pdf
- WCS climate change and wildlife programme http://www.wcs.org/conservation-challenges/climate-change/climate-change-and-wildlife.aspx
- ZSL and CMS climate change vulnerability of migratory species project http://www.cms.int/bodies/ScC/17th_scientific_council/Inf_09_Climate_Change_Vulnerability_of_MSpecies_Eonly.pdf
- Zoo Outreach Organisation and IUCN: The Status and Distribution of Freshwater Biodiversity in the Eastern Himalaya http://cmsdata.iucn.org/downloads/iucn_eastern_himalaya_report_30dec__2_.pdf
- San Diego Zoo wildlife disease laboratories http://www.sandiegozooglobal.org/icr/wildlife_disease_laboratories
- Normalised Difference Vegetation Index (NDVI) http://www.zsl.org/conservation/tools/satellite-images,1631,AR.html
- Oceanographic Research Institute climate change impacts on coral reefs http://www.ori.org.za/prog.html
- Project MOSI: international mosquito monitoring programme http://www.waza.org/files/webcontent/1.public_site/5.conservation/climate_change/Project%20MOSI%20Briefing%20Notes.pdf

Using our local, national and regional networks to host, encourage and support a range of climate change focused specialist groups and biological recording initiatives: In collaboration with a wide range of agency and NGO partners, WAZA member organisations provide a central record base for species recording initiatives. These include professional and 'citizen science' initiatives that are of increasing value to climate change research and education efforts. Examples include:

- FrogWatch USA: citizen science programme at AZA http://www.aza.org/frogwatch
- RECORD Biodiversity Information System at Chester Zoo http://www.cylex-uk.co.uk/company/record-biodiversity-information-system-ltd-14570580.html
- National biobank (for tissues and feathers) and post-mortem database for African penguins at the National Zoological Gardens of South Africa in Pretoria http://www.nzg.ac.za
- CBSG Europe at Copenhagen Zoo (Denmark) and CBSG Mesoamerica at Simon Bolivar Zoo (Costa Rica) http://www.cbsg.org/cbsg/networks

Providing well informed views on climate change issues and lobbying for beneficial change: Our community has a strong record of imparting authoritative information and holds a position of public trust. Our climate change engagement in this area has included a petition to world leaders via the UN Secretary General on the dangers of climate change, a community-wide position statement and supporting resolution along with a wide range of regional association and individual member initiatives. Examples include:

- WAZA petition to world leaders in advance of CoP15 of the UN Climate Change Conference http://www.waza.org/en/site/conservation/climate-change/petition
- WAZA climate change position statement http://www.waza.org/en/site/conservation/climate-change/position-statement
- WAZA Resolution 65.1: Recognising the severity of the climate change threat and the response imperatives http://www.waza.org/files/webcontent/1.public_site/5.conservation/climate_change/RES%2065.1%20Climate%20Change.pdf
- Statement of the Coral Reef Crisis Working Group Meeting http://static.zsl.org/files/statement-of-the-coral-reef-crisis-working-group-890.pdf and public engagement initiative https://www.zsl.org/science/news/join-the-campaign-to-save-the-worlds-coral,1209,AR.html
- Monterey Bay Aquarium Climate Observer initiative http://climateobserver.org
- ZSL climate change position statement http://www.zsl.org/conservation/tools/climate-change
- GLOBE International http://www.globeinternational.info

Organising and delivering large scale: awareness raising initiatives and marketing campaigns related to climate change mitigation and adaptation: Building on our strong track record of developing campaigns for a wide range of conservation issues, including bush meat, the amphibian extinction crisis, the coral reef crisis, turtles and gorillas. These campaigns have included signature petitions and other initiatives to help inform debates and influence governmental and intergovernmental policy. Examples include:

- IZE Press the Button public engagement initiative http://www.izea.net/education/climate%20change.htm
- Zoos Victoria Don't Palm Us Off campaign http://www.zoo.org.au/palmoil
- Supporting the 2011–2020 Decade on Biodiversity initiative http://www.waza.org/en/site/conservation/un-decade-on-biodiversity
- EAZA 2011: Proposed mandatory labelling of palm oil adopted by European Parliament http://www.eaza.net/News/newsblog/Lists/Posts/Post.aspx?ID=86
- PAAZAB Climate Change Challenge http://www.paazab.com/dec09newsletter/10-climatechallenge.html

Providing temporary refuge for animal and plant species negatively impacted by climate change: There are well documented examples of how the zoo and aquarium community has contributed to the conservation of species through intensively managed population (IMP) programmes. According to the latest evaluation of the conservation status of terrestrial vertebrates, at least 13 of the 68 species that improved in status benefited from captive breeding as a major conservation action (Hoffmann et al., 2010). The zoo and aquarium community was directly involved in the recovery of those species (Conde et al., 2011). However, there are other examples of species that, while they did not improve in conservation status, their extinction was prevented. As species-level climate change impact evaluations become more common, the number of species requiring conservation breeding and wider management assistance (incl. assisted colonisation) is likely to dramatically increase. Examples include:

- WAZA community conservation projects http://www.waza.org/en/site/conservation/waza-conservation-projects
- The Amphibian Ark http://www.amphibianark.org
- ZSL Fish Net http://www.zsl.org/conservation/regions/habitats/marine/fish-net

See appendix for fuller IMP review.

Manage and breed animals *ex situ* in the long term with a view to restocking in the wild: As more climate change impact evaluations are conducted, the number of species requiring intensive conservation management, including long-term *ex situ* breeding programmes, is likely to dramatically increase. Our community's extensive conservation experience and programme initiatives are increasingly important for informing effective responses to the climate change threat. Current programme examples include:

- WAZA community conservation projects http://www.waza.org/en/site/conservation/waza-conservation-projects
- The Amphibian Ark http://www.amphibianark.org
- SECORE http://www.secore.org
- CORALZOO http://www.coralzoo.org/home
- Recovery Plan for the Mountain Pygmy-possum http://www.environment.nsw.gov.au/resources/nature/recoveryplanMountainPygmy-possum.pdf
- African Penguin Chick Bolstering Project http://penguins.adu.org.za/content.php?serial=13&mn=99

See appendix for fuller IMP review.

Engage in habitat management and restoration projects: The zoo community annually contributes an estimated US$ 350 million to *in situ* conservation activities, including very significant habitat management and restoration initiatives. Working in close collaboration with a wide range of partner agencies, organisations and local communities, WAZA member organisations are actively engaged in *in situ* conservation initiatives around the world. Examples include:

- WSC climate change and landscapes programme http://www.wcs.org/conservation-challenges/climate-change/climate-change-and-landscapes.aspx
- ZSL community-based mangrove rehabilitation project in the Philippines http://www.zsl.org/conservation/regions/asia/mangrove-philippines/community-led-mangrove-rehabilitation-in-the-philippines,913,AR.html
- San Diego Zoo Wildlife Conservancy field station programme http://www.sandiegozooglobal.org/field_stations
- Zoos South Australia Kimberley programme http://zoossa.com.au/conservation-ark/conservation/conservation-programs?program=Kimberley
- Slapton Ley National Nature Reserve http://www.slnnr.org.uk/about-us.aspx
- Mauritian Wildlife Foundation http://www.mauritian-wildlife.org/application
- Saint Louis Zoo WildCare Institute programmes http://www.stlzoo.org/conservation/wildcare-institute
- Durrell Wildlife Conservation Trust Madagascar and Comoros programme http://www.durrell.org/in-the-field/regions/madagascar
- Chagos Marine Reserve http://www.zsl.org/conservation/news/chagos-marine-reserve-1st-anniversary,808,NS.html
- The BIAZA Reserve in Brazil: partnership between BIAZA and the World Land Trust http://www.biaza.org.uk/conservation/biaza-reserve and http://www.biaza.org.uk/uploads/Publications/LIFELINES%20No%20111.pdf

Striving to be exemplars of best sustainability practice and engaging our visitors and wider community with alternative (non-carbon) energy options and associated initiatives: At the member institution level this challenge is being addressed by gaining international environmental management standards ISO14001 and BREEAM environmental building standards and a wide range of initiatives. Examples include:

- Paignton Zoo environmental programme http://www.paigntonzoo.org.uk/conservation/our-environment.php
- New England Aquarium greening initiative http://www.neaq.org/conservation_and_research/climate_change/green_team.php
- uShaka Sea World Eco House initiative www.seaworld.org.za/eco-house

Acting as a supporting community to address climate change impact issues: Irrespective of geographical and political boundaries the WAZA community works to assist with restoration of institutional capacity of other members' facilities. Similar examples include:

- Prague Zoo flood http://www.zoopraha.cz/en/about-zoo/flood-2002
- JAZA support following tsunami http://www.waza.org/en/site/pressnews-events/press-releases/zoos-and-aquariums-affected-by-earthquake-and-tsunami-in-japan

Engagement with collaborators: Our community works closely with a wide range of environmental agencies and organisations including UNEP, IUCN and its Species Survival Commission's specialist groups and, through its respective members, a wide range of climate change agencies and organisations. Examples include:

- Botanic Gardens Conservation International http://www.bgci.org
- Convention on Migratory Species http://www.cms.int
- IUCN Species Survival Commission http://www.iucn.org/about/work/programmes/species/who_we_are/about_the_species_survival_commission_
- Ramsar Convention http://www.ramsar.org/cda/en/ramsar-home/main/ramsar/1_4000_0__
- Royal Society http://royalsociety.org/events/2009/barrier-reef
- Scripps Institution of Oceanography http://sio.ucsd.edu
- UK Met Office Hadley Centre http://www.metoffice.gov.uk/climate-change/resources/hadley
- UK Energy Research Centre http://www.ukerc.ac.uk/support/tiki-index.php
- Convention on Biological Diversity http://www.cbd.int

Examples of WAZA-linked climate change publications

Conde, D. A. et al. (2011) An emerging role of zoos to conserve biodiversity. Science 331:1390–1391. http://www.sciencemag.org/content/331/6023/1390

Conde, D. A. et al. (2011) Zoos and captive breeding – response. Science 332: 1150–1151. http://www.sciencemag.org/content/332/6034/1150

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. http://onlinelibrary.wiley.com/doi/10.1111/j.1748-1090.2009.00101.x/abstract

Junhold, J. & Oberwemmer, F. (2011) How are the animal keeping and conservation philosophy of zoos affected by climate change? International Zoo Yearbook 45: 99–107. http://onlinelibrary.wiley.com/doi/10.1111/j.1748-1090.2010.00130.x/abstract

Khela, S. & Pearce-Kelly, P. (2011) An Iterative Reference List of Climate Change Science, Policy and Related Information. ZSL and WAZA/CBSG Climate Change Task Force. http://www.waza.org/files/webcontent/1.public_site/5.conservation/climate_change/Climate%20Change%20Reference%20List_14%20Feb2012.pdf

Mendelson, J. R. et al. (2006) Confronting amphibian declines and extinctions. Science 313: 48. http://www.sciencemag.org/content/313/5783/48.summary

Veron, J. E. N. et al. (2009) The coral reef crisis: the critical importance of <350 ppm CO_2. Marine Pollution Bulletin 58: 1428–1436. http://static.zsl.org/files/1c-the-coral-reef-crisis-the-critical-importance-of-350-ppm-co2-967.pdf

Zippel, K. (2010) Climate change and amphibians. Animal Keepers' Forum 37: 537–540. http://amphibianark.org/pipermail/newspublications_amphibianark.org/attachments/20110104/0331421a/attachment-0001.pdf?bcsi_scan_F3293F689D82B9C2=0&bcsi_scan_filename=attachment-0001.pdf

Appendix: Further information on WAZA community species conservation work

Intensively managed populations of highly threatened species

There are clear examples of how the zoo and aquarium community has contributed to the conservation of particular species through intensively managed population (IMP) programmes. According to the latest evaluation of the conservation status of terrestrial vertebrates, at least 13 of the 68 species that improved in status benefited from captive breeding as a major conservation action (Hoffmann et al., 2010). Notably, the zoo and aquarium community was directly involved in the recovery of at least nine of those species (Conde et al., 2011). However, this evaluation does not include those species whose extinction was prevented. In Table 1 we present some of the most striking examples of how the zoo and aquarium community has contributed to those species' conservation.

Table 1. Species saved from extinction or categorised as Extinct in the Wild and reintroduced. VU = Vulnerable, EN = Endangered, CR = Critically Endangered, EW = Extinct in the Wild (threatened = VU, EN and CR) from the IUCN Red List of Threatened Species, version 2011.2.

Name	IUCN Red List Status 2011	Source
European bison (*Bison bonasus*)	EN – VU EW but some survived in the wild	Olech, W. & Perzanowski, K. (2002) A genetic background for reintroduction program of the European bison (*Bison bonasus*) in the Carpathians. Biological Conservation 108: 221–228. Reversal of fortunes for Europe's 'gentle' giant, BBC News, October 2011 http://news.bbc.co.uk/2/hi/programmes/from_our_own_correspondent/9604413.stm Bison Specialist Group
Hawaiian goose (*Branta sandvicensis*)	Threatened – VU	Black, J. M. & Banko, P. C. (1994) Is the Hawaiian goose saved from extinction? In: Creative Conservation: Interactive Management of Wild and Captive Animals (ed. by Mace, G. M. et al.), pp. 394–410. Chapman and Hall, London. Black, J. M. et al. (1991) The current status of the Hawaiian goose (*Branta sandvicensis*) and its recovery programme. Wildfowl 42: 149–154.
Laysan teal (*Anas laysanensis*)	VU – CR	Reynolds, M. H. et al. (2008) Translocation and early post-release demography of endangered Laysan teal. Animal Conservation11: 160–168.
Black-footed ferret (*Mustela nigripes*)	EN – EW	Wisely, S. et al. (2008) Genotypic and phenotypic consequences of reintroduction history in the black-footed ferret (*Mustela nigripes*). Conservation Genetics 9: 389–399. Biggins, D. E. et al. (1999) Influence of prerelease experience on reintroduced black-footed ferrets (*Mustela nigripes*). Biological Conservation 89: 121–129. USFWS and Wyoming Fish and Game
California condor (*Gymnogyps californianus*)	EW – CR	Snyder, N. F. R. & Schmitt, N. J. (2002) California condor (*Gymnogyps californianus*). In: The Birds of North America, No. 610 (ed. by Pool, A. & Gill, F.). The Philadelphia Academy of Natural Sciences and The American Ornithologists' Union, Washington, D.C. Meretsky, V. J. et al. (2000) Demography of the California condor: implications for reestablishment. Conservation Biology 14: 957–967. San Diego Zoo and Los Angeles Zoo
Guam rail (*Gallirallus owstoni*)	Threatened – EW	Fontenot, D. K. et al. (2006) Health assessment of the Guam rail (*Gallirallus owstoni*) population in the Guam Rail Recovery Program. Journal of Avian Medicine and Surgery 20: 225–233. Philadelphia Zoo
Père David's deer (*Elaphurus davidianus*)	CR – EW	Hu, H. & Jiang, Z. (2002) Trial release of Père David's deer *Elaphurus davidianus* in the Dafeng Reserve, China. Oryx 36: 196–199.
Przewalski's horse (*Equus ferus przewalskii*)	EW – EN	Souris, A.-C. et al. (2007) Time budget, behavioural synchrony and body score development of a newly released Przewalski's horse group, *Equus ferus przewalskii*, in the Great Gobi B strictly protected area in SW Mongolia. Applied Animal Behaviour Science 107: 307–321. Cologne Zoo
Red wolf (*Canis rufus*)	EN – CR	USFWS (1989) Red Wolf Recovery Plan. USFWS, Atlanta.
Arabian oryx (*Oryx leucoryx*)	EN – EN	Marshall, T. C. & Spalton, J. A. (2000) Simultaneous inbreeding and outbreeding depression in reintroduced Arabian oryx. Animal Conservation 3: 241–248.
Scimitar-horned oryx (*Oryx dammah*)	EW	Gilbert, T. (2005) International Studbook for Scimitar-Horned Oryx (*Oryx dammah*), 1st edition. Marwell Preservation Trust, Winchester.
Mauritius kestrel (*Falco punctatus*)	Threatened – EN – VU	Jones, C. G. et al. (1995) The restoration of the Mauritius kestrel *Falco punctatus* population. Ibis 137: S173–S180. Nicoll, M. A. C. et al. (2004) Comparison of survival rates of captive-reared and wild-bred Mauritius kestrels (*Falco punctatus*) in a re-introduced population. Biological Conservation 118: 539–548. Durrell Wildlife Conservation Trust

Polynesian tree snails (*Partula* spp)	EW	Pearce-Kelly, P. et al. (2010) Conservation in a snail shell: working together to save some of Polynesia's most remarkable species. In: Building a Future for Wildlife: Zoos and Aquariums Committed to Biodiversity Conservation (ed. by Dick, G. & Gusset, M.), pp. 167–172. WAZA, Gland

Hoffmann, M. et al. (2010) The impact of conservation on the status of the world's vertebrates. Science 330: 1503–1509. http://www.sciencemag.org/content/330/6010/1503.abstract
Conde, D. A. et al. (2011) Zoos and captive breeding – response. Science 332: 1150–1151. http://www.sciencemag.org/content/332/6034/1150

Examples of species managed as IMPs in the long term with a view to restocking in the wild

1. CORALZOO

In order to improve the methodology for growing and maintaining corals in captivity, a consortium of European zoos, aquariums and academia executed a four-year public/private collaborative research and innovation project (CORALZOO) on the breeding and husbandry of stony corals. CORALZOO comprised the following topics:

1. Sexual and asexual breeding of corals in captivity, including techniques for propagation, feeding and induction of natural coral colony morphogenesis.
2. Coral husbandry: development of generic bioassays to evaluate biotic and abiotic husbandry parameters and to monitor coral health, elaboration of methods for identification and treatment of coral diseases and optimisation of transport and acclimation procedures.

Another aim of CORALZOO was to reduce pressure on coral reefs by reducing the need for harvesting of corals for the ornamental trade. The CORALZOO protocols are now being implemented by a Dutch company (EcoDeco), which is currently building the largest indoor coral culture facility in the world.

2. SECORE

SECORE (SExual COral Reproduction) is an international initiative of scientists and public aquariums to promote coral reef conservation. It has been initiated by Rotterdam Zoo (The Netherlands) about 10 years ago; in 2004, Columbus Zoo and Aquarium joined to primarily coordinate US public aquariums. Over the years, SECORE has developed into a platform for knowledge exchange stimulating collaboration between different players in coral reef conservation.

SECORE mitigates climate change indirectly, as it influences the public opinion of millions of people through the education and outreach programmes of SECORE's more than 60 member institutions. *Ex situ* and *in situ* projects such as reef restoration using sexual reproduction, establishing *ex situ* populations in public aquariums and cryopreservation and, for example, fundamental research in population genetics to better understand resistance for higher temperatures, address the consequences of climate change and might help to preserve endangered species.

3. African Penguin Chick Bolstering Project

Introduction

The African penguin (*Spheniscus demersus*) is the only penguin species found in Africa. Historically, the species has ranged along the Western and Eastern Cape of South Africa from Port Elizabeth to Namibia. It has, however, been hit by a number of human-related activities over the years, with devastating effects on the populations. The colony on Dyer Island for instance saw a decline of 94% during the last 30 years, from around 25,000 breeding pairs in the 1970s to just 1,513 breeding pairs in 2007. The Namibian population declined from 42,000 breeding pairs in 1956/57 to 3,000 breeding pairs in 2006/07. Overall, the wild penguin population declined from 68,726 breeding pairs in 1979 to 27,835 breeding pairs in 2008, having led to the species being red-listed as Endangered. The remaining breeding pairs left in the wild are distributed in 27 colonies (ADU, 2007), but only a handful of these colonies seem to be viable in the long term. It is clear that unless drastic action is taken there is a substantial risk that the species will become extinct.

There have been large, long-term changes in regional populations of African penguins, which are thought to have been influenced by changes in the availability of food (Crawford, 1998, Crawford et al., 2001). For example, during and following the collapse of the Namibian stock of sardine (*Sardinops sagax*), numbers of penguins breeding in Namibia to the south of Lüderitz dropped from 40,000 pairs in 1956 to about 1,000 pairs in 2000 (Crawford et al., 2001). The reason for the recent population decline is thought to be a lack of food due to overfishing and movement of fish stocks away from the remaining nesting beaches. The latter is probably the consequence of an ecosystem shift in the current around the South African Cape, the southern

Benguela upwelling system, which itself may be due to anthropogenic factors including global warming. As a result, the penguins cannot reach their main food resources, anchovy and sardine, while nesting. This has impacted significantly on the ability of parent birds to raise viable offspring.

The formation of new colonies of African penguins is a rare event, recorded only three times (excluding recolonisation of two islands) in the last 150 years. It is desirable to maintain extant colonies of African penguins, so that they can provide foci for immigration of birds in the event of future changes in the distribution of prey resources. The loss of a colony may not be reversible in the short term. For example, African penguins stopped breeding at Robben Island in the late 1700s and breeding did not recommence there until 1983 (Crawford et al., 1995).

Project description

Evidence from recent research suggests that the (re)introduction of fledgling chicks can have a significant impact on conserving wild penguin populations (Barham et al., 2008); chicks that have been hand-reared and released have shown higher survivorship to breeding age and higher fecundity than parent-reared birds. This therefore suggests that increasing the number of fledgling birds, using hand-rearing as a tool to aid wild populations, could help arrest the decline in overall numbers. We do not currently know which factors lead to the establishment of new penguin colonies through birds dispersing from existing ones. African penguins show a marked site fidelity, but it is unknown at which point exactly in a penguin's life history this is determined. If we learn which factors lead to breeding site fidelity and to the colonisation of previously unpopulated areas, this will give us a powerful tool to artificially establish new colonies of African penguins in places closer to their main food resources in the future, if and when this becomes a necessity.

Investigation of this strategy has been recommended in the most recent Penguin Conservation Assessment and Management Plan (IUCN Workshop held in Ushuaia, Argentina in 2004; Griffin, 2004) and by Marine and Coastal Management, a branch of the South African government's Department of Environmental Affairs and Tourism (MCM, 2004). It is one of the proposed conservation actions for the African penguin listed in the IUCN Red List 2008.

On several islands, including Dyer and Robben Islands, chicks that hatch late in the season (September onwards) are frequently abandoned by their parents when the parents get into moult. These chicks would be unlikely to survive if left in the wild; the majority of them would die through a lack of food or unfavourable conditions. End-of-season penguin chicks that are at least half grown will be collected at the end of the breeding season. By bringing them under local captive conditions these chicks will have a very high survival rate. The fledglings will then be reintroduced to the wild in the following December, when conditions are most suitable for survival. These birds will be banded and released into their colonies of origin or into different extant colonies, and their breeding behaviour will then be closely monitored to determine the factors that lead to breeding site fidelity in the species.

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Griffin, J. (2004) To the end of the world and back: fifth International Penguin Conference, Ushuaia, Argentina. Bird Numbers 13: 36–37.

MCM (Marine and Coastal Management) (2004) Management of seal-seabird interactions in South Africa. Unpublished report on a meeting held by the task group of MCM's Ecosystem Approach to Fisheries Working Group, 28.07.2004.

4. Wattled Crane Recovery Programme

The wattled crane (*Bugeranus carunculatus*) is threatened by habitat degradation (wetlands and adjacent grasslands, often lost to aforestation), agricultural activities (especially burning of wetland/grasslands during breeding season), collision with fences or power-lines, illegal trade, human encroachment, feral hunting dogs and accidental or intentional poisoning.

IUCN/SSC CBSG Southern Africa conducted a full PHVA for the species in 2000 to set conservation targets and a PHVA review in 2009 to assess progress and revise conservation actions. Conservation actions

include: Harvesting of abandoned eggs to establish a managed *ex situ* breeding programme and possibly in the future for release also (approximately 15% of wattled cranes lay a second egg, which is abandoned when the first egg hatches; it is these second eggs that are harvested); research to develop a greater understanding of the biophysical requirements of wattled cranes; lobbying for strict legal protection; restoration of wetlands; conservation of grasslands; establishment of wattled crane focused nature reserves; identification and communication of appropriate habitat conservation practices for farmers and other private landowners; fitting power-lines with deterrent devices to prevent collisions and the placement of new lines in areas where they will have minimal impact on wattled cranes; and working with landowners, farm workers and local communities to reduce or eliminate accidental or intentional poisoning.

Institutions involved in this recovery programme in South Africa include the African Association of Zoos and Aquaria (Johannesburg Zoo, National Zoological Gardens of South Africa, Mitchell Park Zoo, Umgeni River Bird Park, Tygerburg Zoo and Treehaven Waterfowl Trust), Ezemvelo KwaZulu-Natal Wildlife, Endangered Wildlife Trust and KwaZulu-Natal Crane Foundation.

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5. Japanese Ptarmigan Breeding Programme

The Japanese ptarmigan (*Lagopus mutus japonicus*) is the southernmost distributed sub-species of ptarmigans. They live at high altitudes – their breeding sites are at around 2500 m above sea level – and are thus impacted by global warming. Their habitat is decreasing and the population is estimated to be less than 3,000 animals. It is one of the most famous decreasing bird species in Japan. Their Japanese name is raichou, meaning “thunderbird”.

Ueno Zoo in Tokyo started to master keeping techniques using a similar sub-species. They imported eggs from a sub-species in Norway, the Svalbard ptarmigan (*Lagopus mutus hyperboreus*). They learned keeping and breeding techniques from a researcher at Tromso University in 2008. They brought 23 Svalbard ptarmigan eggs to Ueno Zoo and put them in an incubator. Five of the eggs hatched and two of the chicks have grown up. The following year, they imported 87 eggs from Tromso University; 50 of them hatched and 26 of the chicks have grown up.

Breeding success has improved and no further eggs are imported. The current situation is promising. Although the climate in Japan is more humid and warmer than in Norway, there have never been any serious infection problems. The second generation born at Ueno Zoo started breeding. Ueno Zoo has started cooperative work with other zoos in Japan, some of them close to the habitat of the Japanese ptarmigan.

6. Mountain Pygmy-possum Recovery Programme

The mountain pygmy-possum (*Burramys parvus*) is Australia’s only hibernating marsupial. There are thought to be less than 2,000 mountain pygmy-possums left in the wild and the species is listed as Critically Endangered. All three declining populations occur in the alpine and sub-alpine regions of periglacial rock scree and boulder fields: in the Bogong High Plains and Mt Hotham in Victoria and Mt Kosciusko in New South Wales. The populations are genetically distinct and are managed separately. The population at Mt Buller was discovered in 1996 and is the most vulnerable to extinction.

Zoos Victoria became involved in the Mountain Pygmy Possum Recovery Programme in 2007. Captive breeding may be an important method of recovering mountain pygmy-possums, particularly the Mt Buller population. Healesville Sanctuary currently holds a breeding population of 45 mountain pygmy-possums and successfully bred young in 2008/09, 2009/10 and 2010/11.

The overall objective of the Mountain Pygmy-possum Recovery Programme is to achieve down-listing of the mountain pygmy-possum from Endangered nationally to a lower threat category based on 1994 IUCN Red List criteria of population size and trends, extent of occurrence and probability of extinction.

Zoos Victoria’s key roles in the recovery of this species are to:

- Develop a captive management programme for the species and supplement wild populations through captive breeding for reintroduction
- Maintain an insurance population in captivity
- Assist with population monitoring programmes

- Increase community awareness of the plight of the mountain pygmy-possum and community support for its conservation

Conservation background
The mountain pygmy-possum is the only Australian mammal species confined to alpine environments. It occurs in periglacial boulder fields overlain with mountain plum pine heathland and adjacent alpine and sub-alpine communities at high altitudes (> 1400 m above sea level).

Mountain pygmy-possums feed on Bogong moths, other invertebrates, seeds and fruits and gain weight rapidly before hibernating for 5–7 months under the snow. They are only found in three small areas in south-eastern Australia – a total area of less than 6–7 km^2:

- Between Mt Bogong and Mt Higginbotham, Victoria
- Mt Buller, Victoria
- Mt Kosciusko region of NSW

Populations in 2005 were approximately 1,700 adult females and 550 adult males, but populations are thought to have decreased significantly since then (expected to be less than 2,000 individuals).

Conservation status
IUCN Red List of Threatened Species – *Critically Endangered*
Environment Protection and Biodiversity Conservation Act 1999 (Federal) – *Endangered*
Flora and Fauna Guarantee Act 1988 (Victoria) – *Threatened*
DSE Advisory List of Threatened Vertebrate Fauna in Victoria 2007 – *Critically Endangered*

All three geographically isolated populations are threatened by:
- Habitat loss due to habitat destruction (for downhill skiing and road, dam and aquaduct construction), erosion and weed invasion
- Predation by feral animals, including dogs, foxes and cats
- Catastrophic events; for example in 2007, bushfires came close to burning the remaining mountain pygmy-possum habitat at Mt Buller
- Competition with other small mammals such as the bush rat may also have increased

Climate change may also affect the long-term survival of the mountain pygmy-possum because they rely on snow as an insulation barrier against cold weather during their hibernation. Following hibernation animals emerge to breed and feed on Bogong moths (which migrate to the alpine region during summer). If climate change affects snowfall patterns or the timing of Bogong moth migration, this could have serious implications for the survival of the mountain pygmy-possum.

Recovery programme
The specific objectives of recovery for the mountain pygmy-possum are to:
- Ensure habitat security and undertake habitat restoration and enhancement, and ensure that land use activities will not impinge on the survival of the mountain pygmy-possum
- Monitor and control pest and predator species
- Undertake annual monitoring of the population and record population changes
- Undertake a captive breeding programme specifically for the purpose of producing mountain pygmy-possums for reintroduction to Mt Buller to establish a secure and self-sustaining population
- Increase our understanding of mountain pygmy-possum biology and ecology, and potentially threatening processes that may be detrimentally affecting the species, in order to better manage the species and its habitat and to mitigate threats to the species
- Encourage community awareness and support for mountain pygmy-possum conservation

Conservation partners
The Mountain Pygmy-possum Recovery Team includes representatives from:
- Department of Sustainability and Environment (Victoria)
- Department of Environment, Climate Change and Water (NSW)
- Mount Buller and Mount Stirling Alpine Resort Management Board and Buller Ski Lifts Pty Ltd
- Parks Victoria
- Zoos Victoria
- University of Melbourne

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