

QUARTERLY PUBLICATION OF THE EUROPEAN ASSOCIATION OF ZOOS AND AQUARIA

ZOOQUARIA

SPRING 2014

ISSUE 85



RAINFOREST ADVENTURE

WELCOME TO AN EXCITING
NEW OKAPI EXHIBIT



Mountain adventure

FUNDRAISING ON THE SLOPES OF KILIMANJARO

Island adventure

A NEW APPROACH TO CONSERVATION THINKING



MARINE

nutrition

sustaining life

HERRING	<i>Clupea harengus</i>
SPRAT	<i>Sprattus sprattus</i>
MACKEREL	<i>Scomber scomber</i>
WHITING	<i>Merlangius merlangus</i>
TREVALLY	<i>Pseudocaranx dentex</i>
SANDEEL	<i>Ammodytes marinus</i>
POUTING	<i>Gadus luscus</i>
PACIFIC SAURY	<i>Cololabi Saira</i>
CAPELIN	<i>Mallotus villosus</i>
ROACH	<i>Rutilus rutilus</i>
TROUT	<i>Oncorhynchus mykiss</i>
PANGASIU	<i>Pangasius Pangasius</i>
TILAPIA	<i>Oreochromis Niloticus</i>
SIGNAL CRAYFISH	<i>Pacifastacus leniusculus</i>
SHRIMP	<i>Crangon crangon</i>
KRILL	<i>Euphausia superba</i>
KRILL	<i>Euphausia pacifica</i>
ARTEMIA	<i>Artemia Salina</i>
MYSIS	<i>Mysis relicta</i>
PEELER CRAB	<i>Portinus pelagicus</i>
HERMIT CRAB	<i>Pagurus bernhardus</i>
EDIBLE CRAB	<i>Cancer pagurus</i>
SHORE CRAB	<i>Carcinus naenas</i>
CLAM	<i>Paphia undulate</i>
MUSSELL	<i>Mytilus edulis</i>
COCKLES	<i>Erastoderma edule</i>
RAZOR	<i>Ensis ensis</i>
DAY OLD CHICKS	<i>Gallu gallus domesticus</i>
HORSE	<i>Equus</i>
RABBIT	<i>Cuniculus</i>
MICE	<i>Mus, Muris</i>
RATS	<i>Rattus</i>
OCTOPUS	<i>Octopus vulgaris</i>
SQUID	<i>Loligo Opalescens</i>
BLOODWORM	<i>Chironomus sp</i>
CYCLOPS	<i>Cyclops cyclops</i>
POLYCHAETES	<i>Perinereis aibuhitensis</i>
LUGWORMS	<i>Arenicola defodiens</i>
SALMON	<i>Salmo salar</i>
RED PLANKTON	<i>Calanus Finmarchicus</i>
BREAM	<i>Abramis brama</i>
LAMPREY	<i>Lampetra fluvitallas</i>

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4 From the Director's chair

Reassessing the spirit of conservation

5 Announcements

A round-up of news from EAZA as well as a selection of exciting births and hatchings from across the collections

9 Fundraising

How Kilimanjaro was conquered in the name of the saola

13 Interview

Meet Dave Neale, the Animal Welfare Director of Animals Asia Foundation

14 Exhibit design

The new Okapi Sanctuary at Doué la Fontaine is proving to be an excellent example of a combined exhibit

16 Breeding programmes

How genetics can, and could, be used to help manage collections; plus captive breeding of white-spotted eagle rays

22 Endangered animals

Possible improvements in the complicated world of painted dog conservation

24 Communications

How an animated film, starring Durrell's famous dodo, got to the heart of extinction

26 Conservation

An island reserve for New Zealand wildlife off the coast of Auckland is an example of current and developing conservation ideas

28 Education

Bio-inspiration, the study of the natural world to develop applications for ourselves, can enhance interest in conservation and biodiversity, too

Zooquaria

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From the Director's Chair

I recently returned from visiting Laos PDR and Vietnam, two countries I had not previously had the opportunity to visit. I was there to discuss further steps in saola conservation and collaboration between EAZA and the IUCN Saola Working Group (SWG), begun so convincingly during the two years of the joint EAZA/IUCN SSC Southeast Asia campaign. I was accompanied by Terry Hornsey of Africa Alive!, EAZA Cattle and Camelid TAG chair and our host was Bill Robichaud of the SWG.

After a mammoth journey, taking in Cambodia on route, we arrived in Vientiane, the capital of Laos, in stifling heat with temperatures of over 35°C. Later in the week we would head onto Hanoi, and in both countries we met with the relevant government departments to discuss saola conservation and how EAZA could assist in their transboundary conservation aims. During our stay in both cities we had the opportunity to meet with colleagues from the Wildlife Conservation Society, TRAFFIC and World Wildlife Fund, hearing first-hand about their in-country work.

So, lots of information and politics and biological facts to absorb – pretty much what you would expect on such a trip. But my abiding impressions are about the people and culture. While in Vientiane Bill Robichaud kindly set up a lunch with a group of young, enthusiastic Lao conservationists, so that we could hear about their work and get to know them beyond just names on emails. It was a timely reminder that while we focus on saving species when we talk about conservation during our fundraising campaigns, conservation is ultimately about people. People in all their various guises, from those that do not care for conservation of our natural world, either through greed, apathy or difficult circumstance to those who devote their lives to working to conserve the finite world we rely upon.

We were struck by their enthusiasm and expertise and also humbled by remembering that their road to conservation work is not straightforward, as their opportunity to attend high-end educational establishments is more limited and often means travelling overseas to access the teaching they need and want. It was also fantastic to meet Olay, the young graduate student who has received funding from the Southeast Asia campaign to set up a complex array of camera traps in a site in the Annamite mountains to try and establish further detail of where saola are still found. Some of the camera traps will not only take still images but can record



SPIRIT HOUSE OUTSIDE A VIENTIANE HOME

film, too. Our fingers and toes are crossed that Uli will be successful and we look forward to seeing a saola walking through the forest. Later in *Zooquaria* you will read an article about the fundraising Kilimanjaro climb and I am discussing with the SWG how the funds I raised could help support young scientists working in the Annamite mountains.

Another feature of Vientiane that visitors cannot fail to notice, and be intrigued by, are the 'spirit houses' found outside homes and businesses. These tiny ornate structures are there to provide homes for the restless or bad spirits

that reside on the property and who could cause problems if not appeased. They come in various designs from very simple to extremely ornate, in plain wood to rich colours. The offerings can be anything that the owner believes appropriate, including open bottles of soft drinks with straws to help the spirits drink.

This got me thinking – if we were to build spirit houses for conservation who or what would be the spirits and would we appease them... or would we try and defeat them? I'm thinking here of the spirits of greed, of indifference; the spirits that do not place a high value on species or habitat, and ride roughshod over the subsistence needs of local people who depend directly on forests and seas; the spirits that value material goods above personal relationships. They surround us every day and to defeat them we need to keep up our own spirits. Bill Robichaud of the SWG has spent years devoted to helping a species he has seen in real life only once. That kind of commitment is needed for conservation to ultimately triumph over the bad spirits and is a lesson in perseverance from which we all can learn.



Dr Lesley Dickie
Executive Director, EAZA

NOTICEBOARD

EAZA AND THE MEDIA

THE COMMUNICATIONS DEPARTMENT spent much of February handling media inquiries from the world's press, regarding euthanasia within the context of breeding programme management. The office conducted interviews with outlets including CNN and BBC, and produced detailed information regarding EEPs, Collection Planning and other relevant topics. In addition to press statements published on the website and distributed to media, editorial pieces were also commissioned by CNN.com and other outlets, providing a strong platform for EAZA to react to traditional and social media opinion. EAZA also succeeded in persuading a major national UK newspaper to retract its incorrect story about the suggested culling of a second giraffe at a non-member zoo in Denmark. Despite initial adverse reactions from the media to the case, we were able to inform public opinion among non animal rights activist audiences and build considerable support for management practices including euthanasia in most regions.

TECHNICAL ASSISTANCE MANUAL

The new technical assistance manual, 'The Modern Zoo: Foundations for Management and Development' was printed in March. The book, which outlines all the main priority areas for Candidates for Membership, is an essential resource for employees at all levels, and lays the groundwork for cooperation between the institution and their mentor. The book is available in electronic format under Technical Assistance on the EAZA Activities page at www.eaza.net.

EU MANIFESTO

In association with the EU Policy Manager, EAZA produced the European Parliamentary election manifesto, which was distributed to candidates for the election in May. The document gauges the position of candidates on a range of issues important to EAZA, including welfare, health, and biodiversity among others. Specific questions related to upcoming EU legislation on livestock drugs, deep sea trawling and invasive alien species are all covered. The document was distributed to national associations and is available on request from EAZA.

CONFERENCES

The Annual Conference in Budapest is now open for registration at www.eaza2014.com. With early bird rates available until mid-June, EAZA recommends registering immediately. The conference, which will be hosted by Budapest Zoo, one of the oldest and grandest collections in Central Europe, at the Hilton hotel in the historic and spectacular heart of the old city's castle district is set to be the biggest ever,

following the record number of delegates at Edinburgh 2013.

The Joint TAG Chairs meeting and EAZA Mid-Year TAG meetings at Avifauna at Alphen aan de Rijn, Netherlands will take place between 1-6 June. The meeting will bring TAG chairs from around the world to discuss conservation programmes for animals in human care. Registrations are now closed, but indicate that this inaugural meeting will lead the way to many other international collaborations between TAGs.

21st CENTURY TIGER

Campaign with 21st Century Tiger on Global Tiger Day 29 July 2014 and together we will build awareness for wild tiger conservation. Start planning your Tiger Day now and encourage a 'Wear Your Stripes' campaign in your local community to raise funds for 21st Century Tiger. You can find out more about 21st Century Tiger by visiting www.21stCenturyTiger.org or simply by contacting 21stcenturytiger@zsl.org.



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NOTICEBOARD

EAZA ACADEMY

WE ARE DELIGHTED TO ANNOUNCE that the EAZA Academy is now offering online learning opportunities to our Members. The site (<https://collaboration.net/eaza>) has been developed in cooperation with learning management system developer CypherWorx and contains over 300 self-directed courses and recorded webinars from the San Diego Zoo Global Academy.

Of particular interest to many will be the series of Animal Care online courses. These interactive courses each take one to two hours to complete and cover topics such as: Introduction to Nutrition, Zoological record keeping, Fundamentals of animal learning, and Zoonotic disease. Institutions such as San Diego Zoo are using these courses to provide cost-effective, standardised, professional development training for all their keepers.

For the low price of €125 EAZA Members receive 12 months access to an extensive catalogue of courses in a wide range of topics from animal husbandry to human resource management,



education, leadership and more. The site is constantly developing with the aim of adding more EAZA specific courses in the future. You can access the EAZA Academy: Online site via the EAZA Academy pages on the EAZA website.

We hope you take advantage of this new professional development opportunity from the EAZA Academy, and would be grateful if you could ensure that this information is forwarded to as many of your staff and interested colleagues as possible. If you want to know any more about the site please contact the EAZA Academy Manager at Myfanwy.Griffith@eaza.net.

NEW WEBSITE IN DEVELOPMENT

EAZA is moving forward with the commissioning and implementation of a new website, which will streamline the use of TAG, Committee, conservation and other resources and databases.

The new platform, which will be designed to improve the speed of access and navigation around the site, will also act as a powerful new tool for increasing the profile of our breeding programmes, education, research and conservation work with the public.

EAZA is working with focus groups, designers and staff to improve the user experience and ensure that the site will act as the association's reliable central resource into the future.

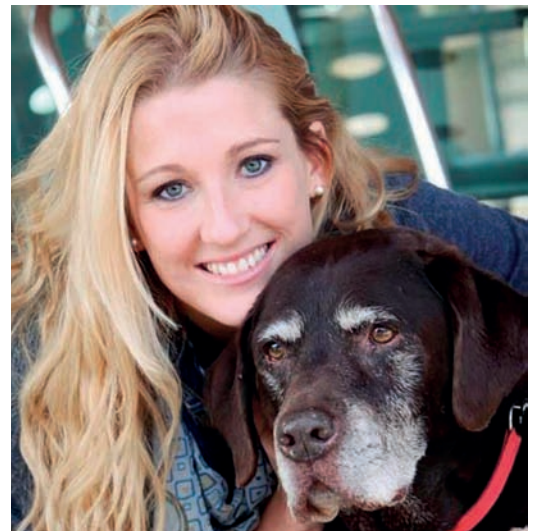
The website will also feature a public-facing site which will provide resources to schools, zoo visitors, conservationists and the media, and will be linked to our social media channels.

We will provide you with further information as the new website approaches its launch – so keep your eyes peeled.

EAZA APPOINTS NEW ANIMAL WELFARE TRAINING OFFICER

THANKS TO A GENEROUS GRANT from Fondation Segré, EAZA has welcomed Sally Binding to the team; working within the EAZA Academy to support zoos in animal welfare best practice, her title is Animal Welfare Training Officer. Sally joined EAZA in early April from Sparsholt College Hampshire, UK, where she lectured on Animal Management on subjects ranging from Animal Welfare to Anatomy and Physiology. Prior to this Sally worked as a Bear Manager at Animals Asia's China Bear Rescue Centre in Chengdu which cares for 147 bears rescued from the bear bile trade.

Sally has a particular interest in the role of enrichment in captive animal management and consequently managed the enrichment programme for the Bear Centre. Previous volunteer work includes working with cheetahs at Australia Zoo, teaching in Zambia and conducting marine conservation surveys in Madagascar. Sally has a BSc in Biology from the University of Bath, UK and continued her studies with an MSc in Wild Animal Biology from the Royal Veterinary College, London and Zoological Society of London, with her thesis focusing on the effectiveness of ambassador cheetahs in outreach conservation education in South Africa.

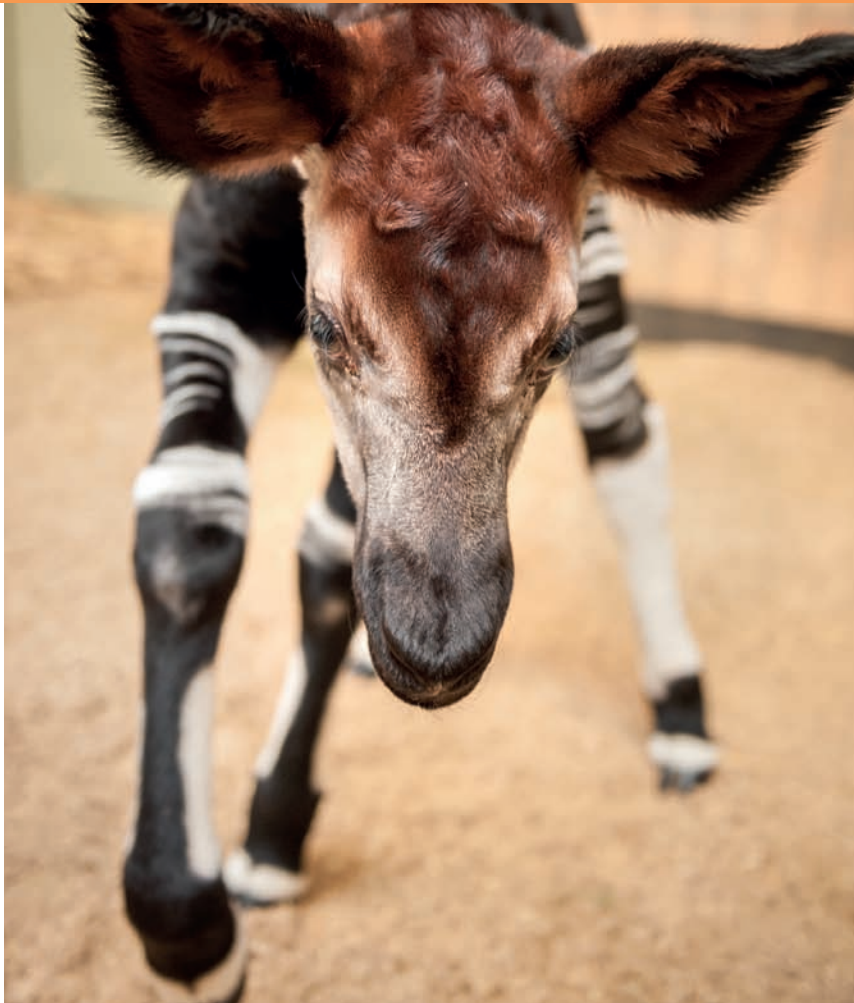


WILDLIFE CRIME

THE EUROPEAN PARLIAMENT adopted on 15 January 2014 a resolution on combating wildlife crime where it underlined that wildlife crime was a serious transnational organised criminal business with an annual turnover of at least USD 19 billion, and was now the fourth largest illegal activity in the world, after drug trafficking, counterfeiting and human trafficking. Stressing that the EU was a major transit destination for illegal wildlife products such as ivory and live animals, and therefore in a privileged

position to control this trade, the Parliament urged the European Commission to establish an EU plan of action against wildlife crime and trafficking, including clear deliverables and timelines. In reaction to the adoption of this resolution, the European Commission published in February a communication including a consultation on wildlife crime. EAZA took this opportunity to share its views on this topic and sent a contribution which can be downloaded here: <http://bit.ly/1jvREnx>.

BIRTHS AND HATCHINGS



JONAS VERHULST

OKAPI'S HALF-CENTURY

AT THE END OF LAST YEAR, Antwerp Zoo in Belgium welcomed the 50th okapi (*Okapia johnstoni*) to be born at the zoo since the arrival of the first animal in 1919. Weighing in at 28kg, the healthy female, the second to be born to its mother, is now part of a group of eight okapis in the zoo. Antwerp is the largest facility to hold the species in Europe and the population of okapis is also the oldest on the continent.

Breeding programmes for okapi have been in existence in Europe since 1977, and the species EEP is a model for cooperation and conservation. Despite the recent reclassification of the okapi on the IUCN Red List from Vulnerable to Endangered, efforts to protect the species are bolstered by excellent links between *in situ* and *ex situ* conservationists, and by the establishment of a worldwide studbook that includes all accredited *ex situ* facilities. These institutions also contribute generously to *in situ* programmes and coordinate breeding programmes globally; indeed two of

BRIAN JORDAN

Antwerp's animals have recently moved to Basel in Switzerland and Wrocław in Poland to assist with the establishment of breeding herds at each site. As studbook holder and coordinator of the okapi EEP, Antwerp provides assistance to other holding institutions in terms of advice on habitat recreation, social behaviour, nutrition, health and transport. As the okapi is known to be a highly challenging animal to keep in zoos, Antwerp's consultancy is sought by zoos worldwide.

There are currently 170 okapis kept in zoos, with 66 of those (35 males, 31 females) being in Europe. Since 1995, the number of animals in *ex situ* facilities has risen by roughly 60 %, and the target population number for the international breeding programmes (including the EEP) is 270 animals, a number which guarantees a stable, genetically healthy population in the long term. This means that 13 calves need to be born every year worldwide to achieve this target: Antwerp's latest addition will help to achieve these targets.

THE TIGERS OF LONDON

THREE OF THE WORLD'S rarest tiger cubs made their public debut at the end of March this year, exploring the outdoor paddock of their home at ZSL London Zoo's Tiger Territory. The cubs, which were born seven weeks earlier, explored the paddock with their mother casting a protective eye over the proceedings.

The cubs had been eagerly awaited by the staff at ZSL following the loss of their mother's first cub last year. Keepers took shifts to monitor the progress of the newborns via closed circuit cameras, and extensive precautions were taken to ensure the safety and wellbeing of the cubs.

The Sumatran tiger, whose habitat is the forests and jungles of Sumatra, Indonesia, is now classified as Critically Endangered. Facing threats of poaching, habitat loss and human-conflict Sumatran tigers face a daily battle for survival. In the 1970s, there were estimated to be 1,000 Sumatran tigers in the wild, but today's figures suggest that there are just 300 left. Should their numbers continue to decline at this rate, Sumatran tigers will face the very real threat of extinction within the next decade. ZSL coordinates the EEP for Sumatran tigers and the birth of these cubs is an important step in the conservation of the species. ZSL's head of regional conservation programmes, Sarah Christie, also coordinates the Global Species Management Programme (GSMP) for the species, a programme which was set up in 2008 under the aegis of WAZA.



BIRTHS AND HATCHINGS

SAKI FAMILY GROWS

GAIAZOO HAS HOUSED a family group of white-faced sakis (*Pithecia pithecia*) for the past nine years. Living in a free range outside enclosure together with grey-winged trumpeters, the sakis breed well, with a youngster born almost every winter. The latest addition to the population at the zoo was born on 29 March, and thanks to unseasonably warm temperatures, the mother was able to take her youngster outside on the very first day. The family group at GaiaZOO now consists of father, mother and four offspring born over the course of the last few years from 2011 to 2014. Earlier offspring were relocated to other zoos.



HORNBILL HATCHING

SUCCESSFUL REPRODUCTION in the larger members of the family of hornbills (*Bucerotidae*) is still anything but a routine event in EAZA institutions, and the most spectacular, the great Indian hornbill (*Buceros bicornis*) appears to be the most difficult of all, writes Günther Schleussner. The last full reproductive success dates back to 2008 and the number of deaths exceeds the number of hatchings year by year. Such a background makes every single chick count, and therefore Wilhelma, Stuttgart Zoological and Botanical Garden is very pleased to announce the birth and rearing of a *Buceros bicornis* chick in 2013, its fifth chick since 2003.

What makes the event even more special is the fact that it is the first reproductive success by one of the females hatched in 2003, with a male hatched in Dublin zoo in 2005. The pair is housed in an off-exhibit aviary and the birds showed some interest in their nestbox of the famous 'Stuttgart washing machine' design (an almost cubic wooden box with a full circle entrance hole centered in the front side) in early December 2012. The pair had not shown



YVONNE EDER

any reproductive behaviour before, so we did not take this too seriously and did not consider the installation of a nestbox camera in time. Starting around Christmas, however, several copulations were observed by the keepers, and on 30 January 2013, the female entered the nestbox and was sealed in. On 14 March begging calls were heard for the first time, indicating a hatching. The female left the nest on schedule on 23 April, and the healthy and well-developed chick fledged on 2 June.

IMPORTANT LITTLE GIRL IN APENHEUL



RAOZY, BORN ON 5 FEBRUARY 2014, is the fifth crowned sifaka born in Apenheul and the second female. Of the five, one died 13 days after birth, while two have moved on to other zoos, leaving two at Apenheul.

In November 2008, female Holly arrived pregnant in Apenheul from Paris together with male Lockey. She had been a breeding female in Paris but because of a nipple defect, she had always been unable to nurse her own offspring. Paris trained Holly and developed a protocol which enabled keepers to bottle-feed the baby. Apenheul keepers have used this protocol for all Holly's offspring. Born light (79g) but healthy, Raozy put on weight fast thanks to the bottle-feeding, and was reunited with Holly after two weeks. By day 70, Raozy weighed 270g, and is still receiving seven bottles a day from keepers.

The crowned sifaka is Critically Endangered, with only a few in the wild and a small population in Madagascar and EAZA zoos, and the death of a young male in Port Lympne last year underlines the parlous situation for the species. The EEP works in close cooperation with partners in Madagascar on *ex situ* and *in situ* conservation activities, and EAZA members are very active in raising funds for these projects. Members should contact EEP Coordinator Delphine Roulet at Parc Zoologique de Paris to aid in the vital conservation work being done for the species.

Climbing for conservation: a Kilimanjaro adventure

HOW FAR WOULD YOU GO TO RAISE MONEY FOR YOUR CAUSE? ONE GROUP OF ZOO COLLEAGUES WENT AS FAR AS THE ROOF OF AFRICA

Lesley Dickie (Executive Director, EAZA)

In January 2014, from a slightly chilly Heathrow airport in London, 10 zoo colleagues set out to journey to Tanzania, in an attempt to climb the highest mountain in Africa, the highest free-standing mountain in the world, one of the world's highest volcanoes: the majestic Mount Kilimanjaro, which rises like an empress above the Serengeti.

It all started at the Innsbruck annual conference (we think) when Rebecca Willers of Shepreth Zoo in the UK said: 'What about climbing Kilimanjaro for conservation fundraising?' Rebecca is no stranger to acts of derring-do for conservation, having also taken part in a swim across the channel between England and France. It wasn't long

before this intriguing 'climbing for conservation' idea was also being linked to the Pole to Pole campaign: a snow-capped mountain, halfway between the two poles, but sadly showing signs of the impact of climate change as its famous glaciers retreat year on year. Would there be a time when the snowy cap of Kilimanjaro was but a distant memory?

After lots of email exchange and finding guides and picking suitable times we ended up with a group of 10 all fundraising for a range of species from saola to langurs. All based in the UK, we met for training climbs in the Snowdonia National Park and the Peak district. But nothing would truly prepare us for 'Kili'.

With such a vast mountain there

were several routes we could take and we would be choosing the Machame route, sometimes known as the 'whiskey route' as it is amongst the toughest routes, particularly in comparison to the Marangou or 'coca cola route'. The Machame route is typically six days (four up, two down) but we decided to take seven days to further aid acclimatisation to the high altitudes. We hoped this would increase the chances of all 10 of us reaching Uhuru, at 5,895m, the highest point on the Kibo peak and the highest point in Africa. The Machame route also had other benefits as it is said to be the most beautiful route to climb, and we would be passing through rainforest, temperate forest, alpine moorland and high desert





CLOCKWISE FROM TOP LEFT: FIRST SIGHTING OF A SAOLA IN AFRICA; ALL OF US AT THE TOP; TOILET TENT WITH VIEW OF THE SHIRA PLATEAU! PROBABLY THE BEST PORTABLE LOO IN THE WORLD; OUR TRAIL DOWN INTO THE KARANGA VALLEY; THE ROOF OF AFRICA – MAWENZI PEAKING THROUGH THE CLOUDS; GLACIERS ON THE CRATER RIM



as we climbed higher. At over 10,000ft, 75% of climbers experience some level of Acute Mountain Sickness (AMS), and we would be climbing to nearly twice that height in a 'forced ascent'. We were all on the look-out for symptoms and importantly our group of fantastic professional Tanzanian guides (Tunzo, Benjamin, Emmanuel, Hamza and Ziggy) took these issues seriously – each night they would measure our resting pulse rate, our blood oxygen levels and ask us what our pee looked like! In matters of health on the mountain there is no room for coyness so discussing our bodily functions and the need to keep well hydrated became very normal. We were attempting to drink at least 3-4 litres of water a day – a feat more difficult than it sounds.

STARTING POINT

We set off from Moshi, a nearby town where we had stayed overnight, in high spirits. We were heading for Machame Gate to begin our climb. There we were greeted by the enormous white-necked ravens (*Corvus albicollis*) that would be our familiar companions on the mountain, but also a particularly cheeky blue monkey (*Cercopithecus mitis*), attempting to steal last-minute snacks from the assembling groups who would be leaving from Machame Gate. It was there that we also first saw the enormous group of porters required to get us up the mountain – for 10 of us there would be our five lead guides plus 40 porters and cooks. Their strength and agility in getting up the mountain carrying all the equipment needed for the trek was daunting and we were immensely grateful to them.

Day 1 took us from Machame Gate (1,820m) to Machame Camp (3,015m). This walk through lush rainforest was beautiful – and then it started to, well, rain. We endured a proper tropical storm where we got soaked and arrived in camp damp and perhaps a little disheartened (one of our group already starting to feel the effects of the altitude). Day 2 was more up, up, up to the Shira Camp (3,840m). Now the forest had thinned dramatically and from this camp we had dramatic views to the spectacular craggy Shira Plateau and uninterrupted views of Kibo, the rounded dome of Kilimanjaro, towering above us. That view of Kibo would be an almost

constant feature as we moved from camp to camp. This had been a hard day for those of us with dodgy knees (me) but we were in good spirits.

Day 3 was an important acclimatisation day as we would be walking to Barranco Camp (3,965m) but going up to the Lava Tower, at 4,600m. This 'climb high, sleep low' strategy was designed to help us acclimatise to the altitude and adjust to the strain on our breathing. A long slow walk down to the Barranco camp took us past amazing vegetation, such as the distinctive *Lobelia deckeni*, and at Barranco we got our first view of the slightly overwhelming Great Barranco Wall, 300m straight up, blocking our way to Kibo. Tunzo, our lead guide did tell us that he had seen trekkers in the past who had got to the Barranco wall and refused to go up it – it would take us about 1½ to 2 hours to climb the wall, scrambling from point to point. Day 4 arrived and was cold with frost on our tents – wall day was with us! But as it turned out most of us enjoyed the scramble up – one team member had an acute fear of heights but battled on and got to the top triumphant. From Barranco we walked to our 'extra day camp' at Karanga, at some 4,000m elevation. We were certainly not the fastest group on the mountain but we did take to heart the mantra of the mountain 'pole pole', not a reference to the Pole to Pole campaign, but the Swahili for 'slowly, slowly'. This would be said to us constantly by our guides and passing porters, alongside shouts of 'Jambo!'.

THE FINAL PUSH

Day 5 – the big day. We woke just before 7am and packed our bags. At this height we were all finding it a bit of an effort just to roll our sleeping bags up, let alone aim for the summit. But we were excited as we walked from Karanga to the Barafu Hut (4,640m), our last stop before the top. We had hoped to be able to have lunch at Barafu and then walk on a further hour up a steep rock face to reach the High Barafu camp, thus cutting out part of the summit climb, but this was not possible. After lunch we packed and repacked our bags, read, chatted, and generally tried to relax for the afternoon. At an early dinner our 10 guides assembled with Tunzo

and Benjamin both giving speeches to help get us in the right frame of mind (climbing to the summit is a mental as well as physical challenge). Benjamin, a calm and highly experienced guide, said: 'We are not going up as individuals, you are not a team of 10, we are a team of 20 and if we work as a team we will get to the top'. It was inspiring stuff to send us back off to our tents at 7pm. We would be woken at 10pm, assemble for tea and biscuits and then set off after 11pm.

Most of us did not sleep for those three hours, being far too excited and nervous about what was to come. At 11.30pm on Day 5 we eventually set off, with ice quickly forming on our jackets. With our head torches on we walked single file, dutifully looking at the feet in front of us. Occasionally looking up we would see a line of tiny bright dots in the night, head-torches shining higher and higher into the darkness as other groups made the arduous climb – after a while it was best to stop looking, as it just made the feat seem impossible.

Summit night is hard to explain. You walk on for hours, gasping for breath, cold, in the dark, up and up, legs straining. It seems to last forever. Every now and then Benjamin, who was leading us out, would call a 'shorty break', where we would gratefully drink some water and eat energy sweets or biscuits. And then we would be off again. At one point, perhaps sensing we were flagging a bit, our guides started singing to us in Swahili – try and imagine a climb like this, challenging as it was, but it seems we were being accompanied by a choir! They started adding our names into the songs to help us. It was a magical experience. As the sunrise broke across the mountain we stopped for hot sweet tea and biscuits, gazing out at the clouds below us – a rest before the final push.

One thing to remember when climbing Kilimanjaro – for the last 30 minutes to the crater it gets even steeper, and you become even more breathless, climbing on loose scree, trying not to slip backwards. It seemed endless but all of a sudden we were there on the crater rim at Stella Point, the second highest peak, at about 7.30am. I mentioned earlier that climbing Kilimanjaro is not only

physical but mental. Well, it turns out that it is very emotional, and there were quite a few tears shed at Stella Point after the efforts to get this far – I even spied some manly tears being brushed aside. It would be another hour's walk to reach Uhuru, along the vast crater rim, past the glaciers and snow, but there was no way we were not going to get there having worked so hard to get to Stella Point. And all 10 (or should that be 20) of us did. We had brought with us our Pole to Pole banner and unfurled that at the famous Uhuru sign, in the biting wind but bright and glorious sunshine.

THE RETURN JOURNEY

This was Day 6, and now began the climb down. Now, if like me you have bad knees, this is when it gets really tough. Going down is worse than going up – I got back to the camp about 20 minutes after the others in our group, having received lots of help from our guides. My poor old knees felt like they were in bits (and others in the group who didn't start with bad knees certainly had painful ones by the end). After a 40-minute sleep (more of a collapse into a mini coma) we had to get up, pack and start going to the next camp, Millennium Camp. It was an exhausting day and eventually when we got into our sleeping bags that night we had been awake for nearly 36 hours and had been walking for more than 20 of them.

Day 7 and our journey was coming to an end. With an early start we thanked all our porters who then sang us a song (with some enthusiastic dance moves added in) and began the 5-hour walk back to Mweka Gate, the end of the line. More down, down, down for the knees but we were bolstered by seeing a group of black and white colobus (*Colobus guereza caudatus*) along the way and then in spectacular close-up at the Mweka Gate. We signed out of the park, triumphant. At a celebratory dinner back in Moshi that evening we were presented with our certificates – all 10 of us, against the odds, had done it. We had climbed Kilimanjaro. The secret is perhaps to go in with a open heart, to be sensible, to drink lots (even when it's difficult), to listen to the excellent guides and to go 'pole pole'. Getting to the top of Kilimanjaro is not a race, it's a journey.



THE 10 WHO TOOK THE CHALLENGE
 ALAN BINNING
(Shepreth Zoo – hedgehogs and tigers)
 LESLEY DICKIE
(EZA – Saola Working Group)
 SARAH FORSYTHE
(Colchester Zoo – Action for the Wild)
 ANDREW HOPE *(Belfast Zoo – Francois Langurs)*
 CHERYL MIDGELY
(Shepreth – Wildlife Vets International)
 TRACEY MOORE *(Banham Zoo – AEECL)*
 JOHN PULLEN *(Marwell Wildlife – rhinos)*
 KIM SIMMONS *(Linton Zoo – lions)*
 LYNN WHITNALL *(Paradise Wildlife Park – Wildlife Heritage Foundation)*
 REBECCA WILLERS
(Shepreth Zoo – hedgehogs and tigers)

It was an amazing experience, one that we will all remember for the rest of our lives. Yes, there were points that were hard, but it was overall a joy to be on the mountain with such a great bunch of people, all challenging ourselves to raise money for the species we love. Our climb was self-funded and

so all the donations we received would go to the charities we were supporting. By the time we came down, we had collectively raised over €21,000, with funds still being donated.

And what's next – we are all bitten by the adventure, the challenge bug. The Inca trail in 2016, anyone?



THE GREAT BARRANCO WALL BLOCKING THE ROUTE

Dave Neale

Position: Animal Welfare Director, Animals Asia Foundation

Hobbies: Walking and birdwatching

Last book read: *Ethics And Animals*, Lori Gruen

Last movie seen: *Blue Jasmine*

Last concert attended: Jamie Cullum

Last trip made abroad: Singapore to speak at the Asia for Animals conference 2014



QUESTIONS:

How did you become involved in the issues relating to zoos in China and what do you see as Animals Asia's role?

I first became involved with the situation in Chinese zoos after carrying out an investigation into the use of wild animals in circus performances in zoos and safari parks in 2009/10. The investigation highlighted the severe suffering for many thousands of animals across the country forced to perform meaningless circus tricks and endure a life of deprivation and in many cases abuse.

Our role started as a campaign to end the use of wild animals in circus performances. We developed a positive relationship with the Chinese Association of Zoological Gardens (CAZG) and we quickly learnt that improving animal welfare in zoos and ending the circus performances was also a long-term goal of the association. This led to the development of a programme of capacity building workshops for Chinese zookeepers to improve their skills and knowledge with regards to the care of animals in captivity.

Our role is to continue to campaign for change within Chinese zoos and safari parks and to inform the general public about the issues which cause animal suffering within the zoos.

Do you envisage a way for EAZA to help improve standards for animal welfare in Chinese zoos?

The role of EAZA can be to encourage and support the CAZG, and the senior zoo directors, in setting up a formal training programme for Chinese zookeeping staff, to help to professionalize the zookeeping industry within China. A formal training programme will improve the knowledge of animal managers and so improve the welfare of the animals they manage. It will also aid continued international collaboration and help Chinese zoos to adopt the advanced skills being used within many zoos globally.

Should the eradication of wildlife crime and the improvement of animal welfare be led by government in Asian countries, or local populations?

Local populations must take the lead on habitat and species conservation programmes. Government initiatives, while welcomed, often provide too little, too late, and in many cases are open to wide scale corruption. Therefore, committed people within such governing agencies are often forced to adopt a

'firefighting' approach rather than one of strategic development and community involvement which is often needed.

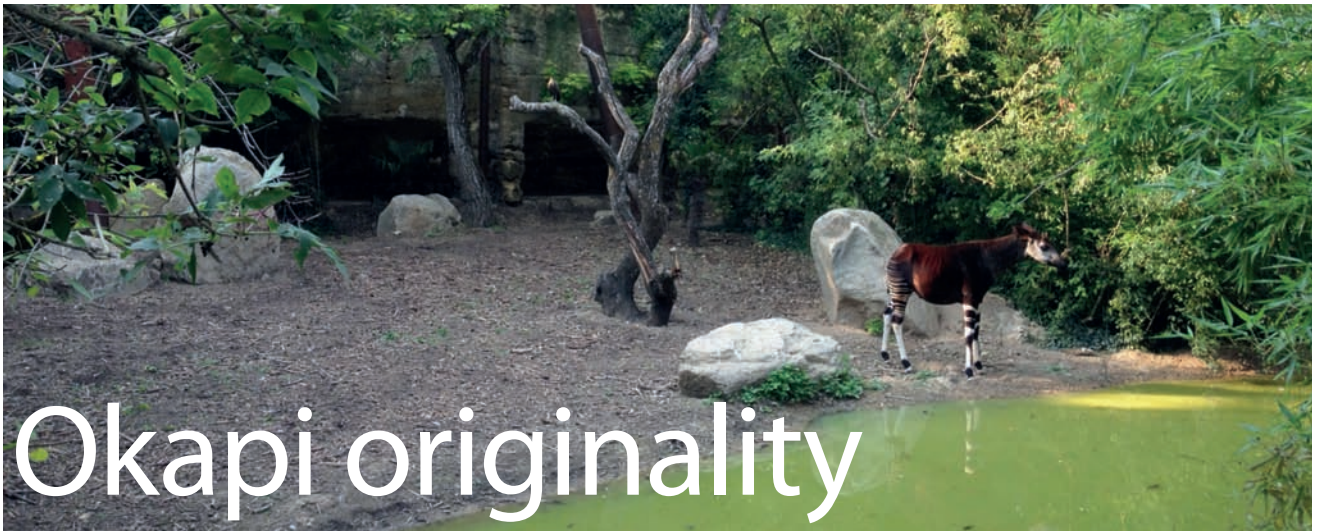
How can we help mobilise communities to take an active role in protecting animals that could prove tempting targets to traffickers?

Community-led protection has to involve two major components. The animals and the habitat need to be valued in their own right by the community: if they are seen as a 'resource' which can benefit people, they will be continually impacted through poaching and deforestation activities. To achieve this switch requires the development of an appreciation for the local environment and empathy for the individual animals within these environments. The starting point for this is 'Humane Education'. This is a holistic education approach which incorporates animal protection alongside environmental protection. One of our most important roles as animal protectionists is to support the development of Humane Education initiatives and to train teachers in the development and delivery of a Humane Education approach which encourages communities to value habitats and animals for what they are rather than for what they can provide us with.

Is there any hope for animals in a continent that contains so many people and such a high demand for resources?

There is little hope unless we see a widespread adoption of the Humane Education approach. Without this we will continue to teach our children that the most important thing in their lives is 'academic' and subsequently 'economic' success. Whilst we encourage our children to race each other to the proverbial 'top' they will not be encouraged to see the environmental damage and animal suffering that can result from their actions. Humane Education can help to reverse this trend, encouraging children to be successful and be in harmony with the environment and with wildlife.

Our children can be the generation which slows down and ultimately halts the decline of species and the rate of habitat destruction that we see globally, but they will not achieve this if we continue along our current educational path. This has to be fundamentally restructured to give us any hope of reversing the current trends.



THE NEW OKAPI SANCTUARY AT DOUÉ LA FONTAINE IS AN EXCELLENT EXAMPLE OF A COMBINED EXHIBIT

Peggy Lavergne, Conservation manager, Bioparc de Doué la Fontaine

The Okapi Sanctuary, a forest space devoted to the iconic okapi and the biodiversity of its native region, is the only one of its kind in the world. Our Great South American Aviary, delighting visitors with the chance to see birds close up and in flight, has been a great success and we wanted to repeat this enthralling experience by creating a new total immersion space. So we designed a new aviary with a mixture of species, the first of its kind to share the same space as okapis. This new landscaped area brings visitors right into its heart and perfectly reflects the philosophy of Bioparc de Doué la Fontaine.

Doué la Fontaine had been awaiting the arrival of okapis for more than 30 years, ever since Louis and Pierre Gay toured around the zoos of Europe in the quest to learn from their colleagues. But it was François who had the chance to realise the family dream when he was approached in 2012 by Sander Hoffman, coordinator of the okapi breeding programme.

With the opening of the Sanctuary in July 2013, the Bioparc joined the ranks of the handful of European zoos to host okapis, becoming the only one to have them cohabiting with other species. The first two males, one from Stuttgart Zoo and the other from Lisbon Zoo, share their enclosure with over 20 species of bird and two other mammals – the owl-faced monkey and the Natal red duiker, a forest antelope.

We wanted to give our okapis the most densely planted environment

to allow them to spend all their time moving about in the undergrowth, as in their natural habitat. Our choice focused on our oldest quarry, clearing away all vestiges of the 1961 zoo and laying the foundations for the future Bioparc – turning this unique troglodyte setting with its open quarries into a series of enclosures where visitors immerse themselves in the animals' spacious surroundings.

This choice was also guided by the location of the quarry where the giraffes live, as giraffes and okapis are the only remaining representatives of the *Giraffidae* family. In their positions facing each other, these two spaces highlight the contrasts between these two animals, one with its dry, open surroundings and the other with its forest cover.

The Sanctuary contains impressive vegetation, including a bamboo plantation, large walnut trees and locust trees. The rocky limestone walls, on average 7m high, are cloaked in ivy while a waterfall cascades from one of their peaks. This vast 4,000 m² space has been covered with a stainless steel net suspended 20m from the ground. As a tribute to the okapi, the imposing and encompassing aviary is built of Corten steel; with its rust-brown colour echoing the coat of the okapi, it integrates perfectly with the dense vegetation.

Designing and building huge aviaries has become a particular skill at the Bioparc, the first example being the Great South American Aviary built in

2009. The knowledge gained is now being used in other parts of the zoo by the Bioparc Design Office.

Supported on piles, a walkway stretches across the vast quarry through the clumps of bamboo to the central observation hut. This walkway takes visitors right into the forest space without impairing its richness, respecting the environment and providing a stunning viewpoint.

On either side of the hut, the okapis move in and out of two clearings that can be joined or kept separate. The first time they ventured into the enclosure, the two males moved cautiously with their ears pricked up. But with the encouragement of their keepers, they had soon inspected every corner of their new home, settling in together and moving freely from one clearing to the other. The naturally shy duikers are increasingly being seen emerging into the open areas.

AVIAN LIFE

The Sanctuary's large flying space soon became busy as the birds were released and it is now home to 25 species of birds. The group of Abdim storks like to perch on top of the locust tree with the ibis. The pair of spur-winged geese has taken over the pond with the hottentot teals and the comb ducks. Nearby, the huge Goliath heron watches the coming and going of the amphibians. The elderberry bushes are popular with the *Colombidae* and turacos after their berries, while the silvery-cheeked hornbills prefer the

walnut trees. Just a few months after they arrived, the hamerkops set to work building two spectacular nests from branches and leaves. The hadada ibis and yellow-billed storks provide the morning chorus, joined by the turacos for a colourful spectacle!

The turacos are an essential feature of this space – in every tropical African clearing a flash of red can be seen as they fly past. The red of their wings, visible in full flight, comes from a water-soluble pigment called turacin found only in these birds: the colour can wash out in heavy rains and lose its brilliance. The Sanctuary has eight species of turaco, included Ross's turaco with its royal blue plumage and a yellow beak, topped with a red crest.

The aviary is criss-crossed by a kilometre of 'creeper-ropes' providing ample aerial perches for all the birds and primates.

A 300m² building provides five stalls for the okapis' night-time accommodation. Another 250m² shelter on two levels houses the winter quarters of the duikers, primates and birds, and can be used to keep the okapis separate from the main stables.

This spring sees the arrival of owl-faced monkeys, a primate classified as Vulnerable, which has the same geographical distribution as the okapis. Another newcomer will be the jabiru, a species of stork rarely seen in zoos; the Sanctuary will offer it the chance to fly and breed.

The birds are fed at several times during the day and at different sites inside the aviary so visitors can observe them. A member of staff is on hand at all times to provide information on the Sanctuary and its residents.

True to our philosophy, the Okapi Sanctuary marries the notions of visitor immersion, dense vegetation and diversity of species – not forgetting the preservation of biodiversity that is our constant goal through breeding programmes and our Nature Projects. By providing a home for our okapis, we are now supporting the work of the OCP Okapi Conservation Project in the Democratic Republic of the Congo.

The video Opening of the Okapi Sanctuary can be seen at www.bioparc-zoo.fr/fr/webmag/videos. For further information visit BIOPARC Doué la Fontaine at www.bioparc-zoo.fr.



The science of species conservation

HOW ZOOS AND AQUARIUMS MANAGE POPULATIONS ACROSS EUROPE

Rob Ogden, Director of Conservation, Royal Zoological Society of Scotland and Kristine Schad, EAZA Population Biologist

The changing role of zoos and their animal collections remains an active debate both within and outside the zoo and aquarium community. The extension from simple visitor attractions to organisations with responsibility for public education and wildlife conservation is widely welcomed, but has brought with it the need to develop and implement best practices in *ex situ* animal population management. EAZA's 190 European Endangered Species Programmes (EEPs) and 198 European Studbooks (ESBs) are vital for the success of EAZA institutions and require responsible, scientific management. Proper population management will increase the long-term survival of these populations and health of the individual animals, but what does this mean in practice and how is it achieved?

The goals of small population management are to maintain genetic diversity for the long-term, minimise inbreeding, and sustain a demographically healthy population. Diversity is important, as it provides a population with the capacity to adapt to future change; inbreeding can lead to a loss of individual fitness and in some cases reduced survival, while an evenly distributed and robust age and sex structure will make the population less susceptible to random events. Genetic diversity is naturally lost every generation, because an individual is not likely to pass on all of its genes to its offspring. In large, stable populations, the rate of loss is very slow and roughly matched by mutations that generate diversity; but in small populations, this loss can be a serious problem.

To limit the loss of diversity from populations, they are managed according to both genetic and demographic criteria. The most genetically valuable individuals are prioritized for breeding and matched with their least related counterparts,

using a measure known as 'mean kinship'. This information is combined with demographic factors and logistical considerations (eg mate compatibility, distance between institutions, exhibit requirements, institutional wants) to create breeding recommendations for each programme. Only by having a successful *ex situ* population can EEPs and ESBs achieve their overall objectives of assisting wild populations through education, support of field conservation initiatives, research, and providing animals for potential reintroduction.

So, that's the theory; but how does this work in practice? Studbook databases are the foundation of genetic and demographic management in ESBs and EEPs. Studbooks are maintained for each species by a dedicated studbook keeper and include each individual animal's name, parents, date of birth, transfers between institutions, other relatives in the population and reproductive activity. The studbook data is analysed using specialised software to produce population reports and breeding recommendations. These recommendations are communicated to zoos and aquariums throughout Europe where the animals are held.

PERFECTING THE STUDBOOK

Population management should start with a 'perfect' studbook, containing a complete and accurate pedigree. But in practice such a studbook is rarely available. Data on ancestral relationships is often missing, or may be inaccurate, particularly for species kept in large groups. Studbooks also often assume that the original animals, or founders, are not closely related, when in fact this may not be the case. For some species, all of this means that the basic studbook data is of limited use for pairing animals, although population managers have a few tricks up their sleeves to improve the situation.

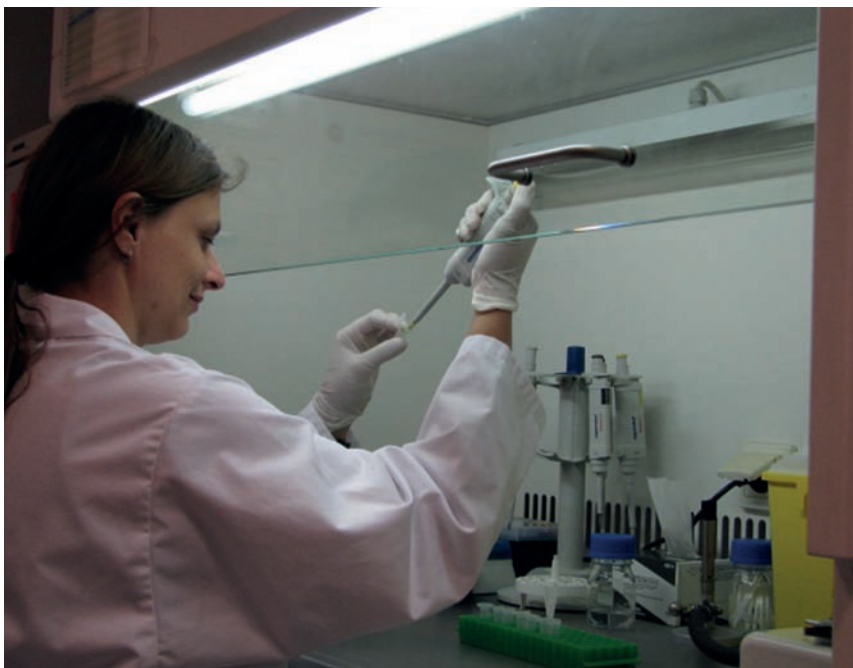
Where there are gaps in the pedigree

data, we often have a fairly good idea of which animals are actually involved and with a bit of detective work based on records of zoo and aquarium transfers, dates of birth and wild captures, it's often possible to fill a pedigree gap or at least narrow down the options. Changes outside the true studbook data are called pedigree assumptions and can be incorporated into the studbook analysis to improve breeding recommendations.

An example of this is the Cotton-topped Tamarin EEP. This species (*Saguinus oedipus*) is Critically Endangered in the wild and the EEP is managed as an insurance population. Due to most of this population descending from biomedical research laboratories that were unable to provide complete records, many of the living tamarins have unknown pedigrees. In 2009, the EEP population had less than 50% known ancestry. EEP Coordinator Miranda Stevenson worked with the EAZA Population Management Advisory Group (EPMAG) to analyse existing data and create pedigree assumptions by narrowing down the possible parents. After all this hard work, the known ancestry has increased to 88%, which is sufficient to do a genetic analysis for a long-term management plan.

USING MOLECULAR GENETICS

Pedigree assumptions can assist population managers a great deal, but at some point the assumptions should be tested. Molecular genetic methods, such as DNA parentage testing, have the potential to directly address studbook questions and are becoming increasingly important in zoo population management. Within Europe, several zoo-based organisations now operate their own DNA laboratories where work includes the assessment of studbooks and animal relationships through genetic analysis. So when we're not quite sure which



chimpanzee, zebra, dorcas gazelle or penguin is the true father, we can now call the lab for help. Through such profiling, the additional information the lab provides can either substantiate or correct existing pedigree data.

Will DNA analysis ever replace the traditional studbook approach? In the short term, probably not. Current methods limit our ability to reconstruct historic family relationships with complete confidence and we are largely restricted to assessing first- or second-order relatives. However, since the turn of the century, the genomic revolution has cascaded from human genetics through agricultural research into wildlife conservation, and may soon provide the potential to address some of these limitations. But while the technology is on our doorstep, the resources are not, and may arguably be better spent elsewhere. So for now, the challenge faced by zoo population managers is how to combine studbook-based computer dating with genetic profiling, which is proving to be as complicated as it sounds!

REORGANISING THE POPULATION

Both *ex situ* and *in situ* conservation rely on conservationists having a very clear picture of what it is they are trying to conserve. It may seem surprising, but questions as fundamental as 'what is a species?' still perplex zoologists, leaving the taxonomy of many animal groups fairly confused. This has practical

implications when it comes to population management of endangered species: do we mix different populations and risk hybridisation of separately evolving forms? Or do we keep populations apart and increase the risks of inbreeding within each one? Once again, DNA analysis has a role to play in addressing these questions, enabling zoos to make sensible breeding decisions.

One example of this is in the Chimpanzee EEP. In Africa, the chimpanzee (*Pan troglodytes*) is divided into four subspecies, but only one of these, the western, *P.t. verus*, is geographically isolated from the others. Research by Danish researchers at the university and zoo in Copenhagen has shown that while the western population is genetically distinct, the other three subspecies all have some degree of intermixing. In the European population, there has historically been much more mixing of subspecies, with hybrids of all four subspecies found in different collections.

Combining the genetic data from wild and captive animals, it has been possible to identify genetically pure western verus chimpanzees within EAZA that are now managed as a separate EEP.

MAKING THE BEST OF IT

There are some populations that even once we are aware of the current genetic and demographic status of the population, there is very little to be done to improve it (eg, no additional founders available, low genetic diversity, inbreeding, previously created hybrids taking up institutional space that could be used by pure known species, etc). When these populations are prioritised due to conservation status, taxonomic uniqueness, or other reasons, we can still genetically and demographically manage them as best we can to increase the chances of the population enduring longer than if they were not managed.

So, with population genetic modelling, computer software and the latest DNA-profiling techniques, it's clear that zoo population management has become a fairly hi-tech process allowing us to support some of the world's rarest wildlife. The system is by no means perfect, studbooks still have gaps and molecular data is not available for many species, but there is continual improvement and the work of EAZA's EEP and ESB programmes ensure that the best scientific practice is applied to the conservation of biodiversity throughout Europe's zoos.

WHAT DO YOU THINK?

A survey has asked TAG and EEP chairs and coordinators about their use and need for molecular tools in breeding programmes. Turn the page to discover the results.

Molecular tools to the rescue?

WHAT DO THE EEP COORDINATORS, TAG CHAIRS AND KEEPERS THEMSELVES NEED FROM MOLECULAR TECHNIQUES IN THE FUTURE? A SURVEY HAS FOUND THE RESULTS

Zjef Pereboom, Centre for Research and Conservation and Royal Zoological Society of Antwerp;
Kristin Leus, EAZA, CBSG Europe and Copenhagen Zoo

The success of *ex situ* breeding programmes in zoos often relies on intensive management practices of our zoo populations. Traditionally these programmes were primarily managed from a demographic perspective, but genetic management is becoming ever more important. Unfortunately, making adequate genetic management decisions for most of our programmes sometimes proves impossible because pedigree records that are essential to genetic management are frequently incomplete or unreliable. However, for studbooks with low-quality data, DNA-analyses can considerably improve the knowledge of a population's genetic make-up and contribute to improving the retention of genetic diversity.

In recent years, molecular techniques and tools used to study DNA have become readily available to the zoo and the conservation community alike, and they have become relatively affordable. This now opens up a huge range of possibilities for the use of molecular genetics in the management of *ex situ* breeding programmes. But within the zoo and conservation communities, the proximity of this 'Brave New World' seems to cause both excitement and dread, optimism and uncertainty.

To get a rough idea of the 'concerns' and 'needs' in our community we prepared a very rough and ready survey asking all EAZA TAG chairs, EEP coordinators, and ESB keepers whether they were involved in molecular genetics projects for their programmes/taxa, what the aim of the project was, and which labs were involved. In addition they were questioned about needs and concerns related to molecular tools and their species/taxa programmes, and the more general concerns or worries regarding the use of molecular genetic tools. Although the analyses are very basic, they give a pretty good idea of what goes on in



EAZA breeding programmes, which labs are involved and what the main needs and concerns are with respect to DNA analyses.

CLEARLY A HIGH DEMAND

The response was quite good, which probably shows that molecular tools are on many programme managers' and TAG chairs' minds. Overall, we received 102 unique replies (unique persons) to the survey, representing 70 EAZA member institutions, and covering 36 TAGs and 176 species. This covers approximately 88% of the EAZA TAGs and 46% of the species in EAZA breeding programmes. What was quite encouraging is that about 62% of the respondents indicated that molecular tools were or are being used for their programmes. The actual genetic analyses were carried out by no fewer than 65 different labs spread all over the globe.

Based on the survey we were able to distinguish the following nine categories of application of molecular tools in EAZA *ex situ* breeding programmes: 1) establishing paternity,

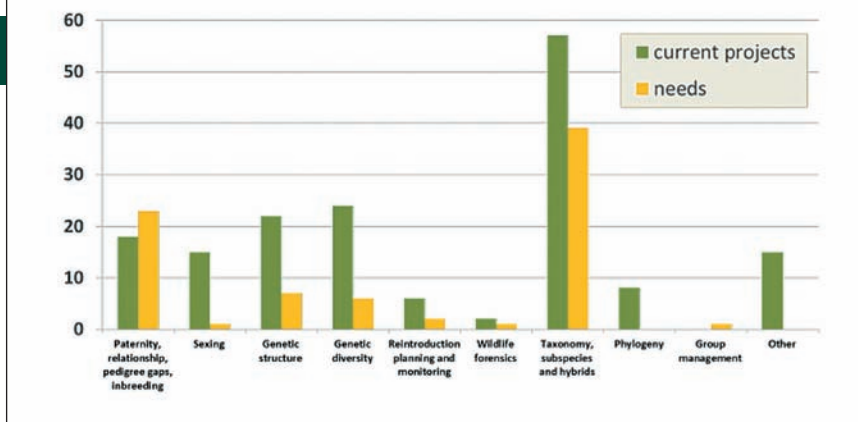
relationship, pedigree gaps or inbreeding; 2) sexing; 3) establishing genetic population structure; 4) determining the level of genetic diversity retained; 5) reintroduction planning and monitoring; 6) wildlife forensics; 7) taxonomy and subspecies or hybrid identification; 8) phylogeny and 9) group management. About one third of the programmes that had already implemented molecular genetic analyses focused on taxonomic issues and the identification of subspecies and/or hybrids. The establishment of genetic population structure and genetic diversity came in second place, and establishing paternity, relationships, pedigree gaps and levels of inbreeding came third (see Figure 1). When examining the needs that we have as a community for using molecular genetics, one can see similar results. Taxonomic issues yet again took up the first place with just under half of the respondents mentioning a need for resolving taxonomy. In second place came the establishment of paternity and resolving pedigree gaps.

NOT YET A TROUBLE-FREE ZONE

The main concerns that were reported all relate to a lack of knowledge of how molecular tools can be used in *ex situ* breeding. The respondents experience a general lack of understanding about 1) the basics of DNA and molecular genetics; 2) what molecular genetics can or cannot achieve; and 3) what to conclude from the results provided by the lab. With regards to taxonomic issues – the category that was indicated as being the most needed – the main concern was that different techniques used for resolving taxonomy seem to give different answers, and that the interpretation of the results seems to depend on ‘the eye of the beholder’. Closely linked to that issue is the question of what happens when species X becomes species Y based on the results of DNA-analyses, and how to deal with the management consequences of such a species change.

Other general concerns that were mentioned include how to identify a laboratory or research group that is not only able and willing to do the research and the analyses, but also has a good understanding of the principles of pedigree-based management in EAZA breeding programmes. Even if the right laboratory can be identified the next issue that arises is how to go about sample collection, storage, administration and transport. And even if all appears to go smoothly, the adventure may end with disappointment for both the lab and zoo world, if at the results stage, it appears each party had different expectations of how the outcome could or would be interpreted and used. Finally, while generally the costs of routine molecular genetic techniques have fallen sharply in recent time, this still represents a substantial expense for most institutions and programmes,

FIGURE 1: OVERVIEW OF THE NUMBER OF TIMES A PARTICULAR CATEGORY OF APPLICATION OF MOLECULAR GENETICS WAS MENTIONED, EITHER IN CURRENT PROJECTS OR AS PERCEIVED FUTURE



and these costs are considered an important obstacle for using such tools.

Suggestions for ‘first aid’

Overall, the survey revealed a general wish for obtaining more basic information about the use of DNA analyses in *ex situ* breeding. The responses to the survey also included some very useful suggestions to make life easier in future. A clear desire was expressed for the founding of a group of people who can liaise between the universities/laboratories and the users, and who can translate between ‘geek speak’ and ‘zoo speak’ in both directions. This would help to make clear in which cases what type of molecular genetics could help, and it would help prevent the mismatch of expectations on either side. The availability of technical advisors, eg at TAG level, would also allow for a more correct interpretation and implementation of results delivered by the laboratory. Finally, it was suggested by several respondents that it would be helpful to generate a list of laboratories and/or academic institutions that zoos, breeding programmes and/or TAGs are working with or have worked with successfully in the past.

The plenary session on molecular tools during the 2013 Edinburgh Annual Meeting of EAZA was a first step towards the general request for more information, and staged some examples of what kind of molecular work already takes place in the

framework of the activities of an ESB/EEP/TAG, including some of the possibilities and impossibilities of such studies. The presentations highlighted that molecular genetics is already playing a useful and important role, and can be worthwhile, as long as all parties have a realistic view of the time, resources and expertise required.

WHAT’S IN THE PIPELINE?

EAZA, CBSG, and the Royal Zoological Societies of Edinburgh and Antwerp (RZSS and RZSA) are preparing a three-day specialist symposium on ‘Molecular Genetics for Species Management in Zoos and Aquaria’ in October 2014 (for more information please contact one of the authors).

During these three days we aim to bring together experienced and interested professionals to review the current state of affairs, challenges and opportunities for using molecular tools in *ex situ* breeding, and to identify a way forward to increase and improve the use of molecular genetics in *ex situ* programmes.

Ultimately, the goal of this meeting is to produce a series of practical outputs to help the zoo community in applying molecular tools, eg by producing sampling protocols, or establishing a network of advisors or experts who assist and advise on the use of or interpretations of molecular tools, taxonomic issues etc. No doubt all of this will help us make the best use of this ‘Brave New World’!

CLOCKWISE FROM ABOVE: BIRTH OF AN EAGLE RAY; MEASURING THE WINGSPAN OF A NEWLY BORN EAGLE RAY; CAPTURING AN ADULT EAGLE RAY; EAGLE RAY TWINS; DNA SAMPLING FOR THE POISONOUS SPINE IN THE BASE OF THE TAIL.



JOINING UP THE SPOTS

CAPTIVE BREEDING OF WHITE-SPOTTED EAGLE RAYS WITHIN AN ESB OPENS NEW DOORS FOR COLLABORATIVE RESEARCH ON THIS IMPRESSIVE FISH. **ALL PICTURES:** MAX JANSE

Max Janse, Curator, Burgers' Zoo, Arnhem, White-spotted Ray ESB studbook keeper, and FAITAG vice-chair

The white-spotted eagle ray (*Aetobatus cf. narinari*) is a charismatic ray species with a maximum 2m wingspan, and a long slender tail that can attain a length of up to three times the wingspan. It is found in tropical waters all over the world, and in 2010 its ESB was started by the author. From a mere eight participants in the first year the studbook has grown to 14 within Europe and the Middle East, and its current living population is 27 males and 34 females. To date two aquariums have bred with this species: Atlantis Aquarium in Dubai which has had two young in the last year; and Burgers' Zoo which has had 30 young in the last four years. Worldwide, another seven aquariums have successfully reproduced this species in captivity, and AZA is currently looking into the launch of a breeding programme.

BREEDING GROUP IN ARNHEM

At Burgers' Zoo a group of six young eagle rays (two males and four females) arrived 13 years ago, originally coming from the waters around the Maldives. After eight years the first young was born, followed by more in the following years from all four females. Each litter contained just one or two young, although in the wild the ray is known to have up to four. Eagle rays are ovoviviparous fish species, which means they lay an internal egg, in which the embryo is fed during the first three months on yolk. After that the female produces a uterine fluid to feed the embryo by using microvillie. When only one young is born it's a large individual with a wingspan of nearly 50cm and a weight of 2.5kg, while when two young

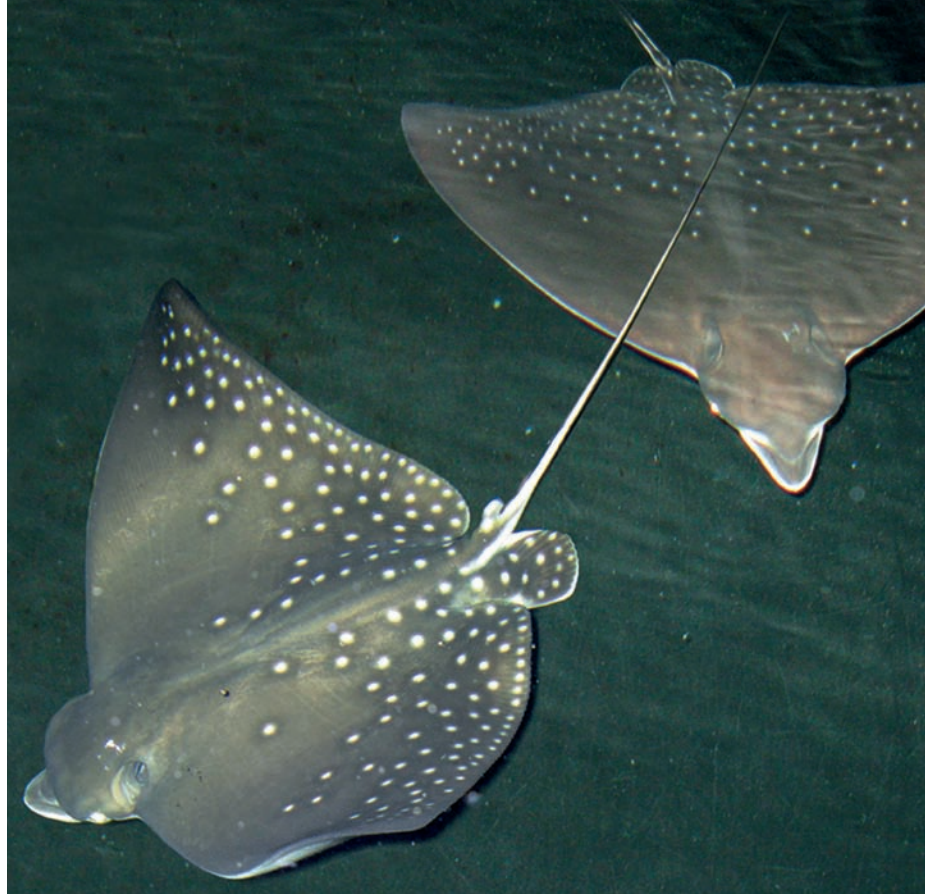
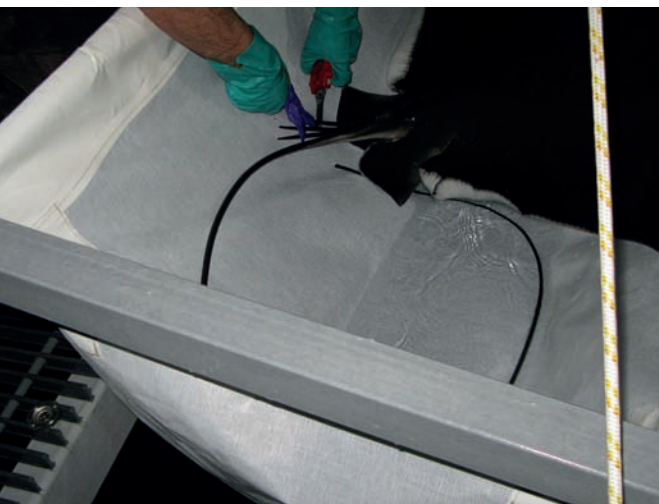
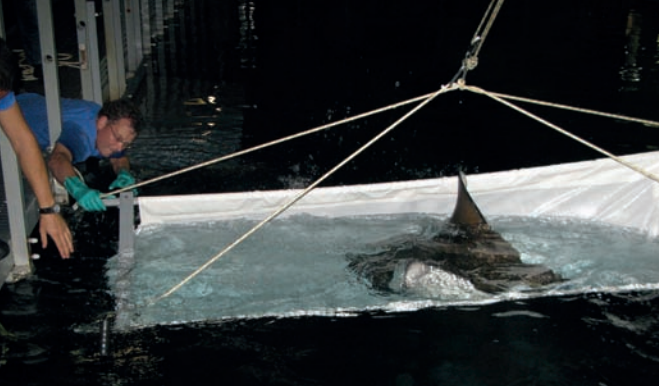
are born they are around 1.1 to 1.5kg each. Of the 30 young rays over the years, only one young was still-born, while a few young died due to a sepsis.

Once born the young are removed from the display tank, as parental care is unnecessary in this species. Over the next three weeks they're kept in quarantine where they learn to eat, then after two to three months they're ready to be moved to public aquariums. About 31% of the current living population is born in captivity.

PATERNITY RESEARCH

When managing an ESB genetics are very important. Since nearly all animals originate from the wild we can assume genetic independence, but the captive-born animals need more attention. Being an ovoviviparous species it's known who the mother is in each case, but with multiple males in the group the father is unknown.

To obtain DNA material in fish it's possible to do a finclip or blood sampling, although both procedures are invasive and stressful for the animal. As eagle rays have a poisonous sting on the base of the tail, therefore, it was decided to use part of that sting to obtain DNA. Trials in this procedure took place in collaboration with Gendika, a genetics lab in the Netherlands, where they found out it was indeed possible to obtain DNA material from epidermal tissue of the sting. Since the sting will grow back on and it's very easy to remove part of it with scissors, this non-invasive technique worked very well for eagle rays, and sting rays, too.



The paternity research provided some really interesting information: two females only mated with one particular male; one female only mated with the other male, and the fourth female showed no preferences and had young with both males. One set of twins was even shown to be from two different males, a form of multipaternity that has been described in various elasmobranch species (see Janse *et al.*, 2013, *Journal of Fish Biology* 82:1082-1085).

HUSBANDRY

Eagle rays are easily stressed, making them a challenge to keep, so compiling husbandry knowledge is very important to increase the survival. It's a fish which needs a lot of space to swim as it's naturally semi-pelagic, spending most of its life swimming and rarely lying at the bottom of the sea. When young or new to the aquarium, eagle rays find it very difficult to adapt to their captive environment, and failure to feed due to stress is the major cause of death. Eagle rays are also very susceptible against monogenea parasites (flatworms) on the skin, gills or mouth cavity, and different species-specific monogenans have been described for this species.

In 2004 the first Elasmobranch Husbandry Symposium was hosted by SeaWorld Orlando, which led to the publication of the Elasmobranch Husbandry Manual (available via the Fish and Aquatic Invertebrate TAG page on the member area of the EAZA website). This manual is now used as a standard for many aspects of elasmobranch captivity care. A second Elasmobranch Husbandry congress was held at Monterey Bay, USA in November last year, at which further species-specific presentations were made, which will also be published in book format. Three talks and two posters of the total 59 talks were about eagle rays, which showed the popularity of this species.

The Living Seas (Walt Disney World) and SeaWorld Orlando presented their own breeding results from their eagle ray populations, including data from multiple facilities that helped to quantify key information such as breeding

pair morphometrics, population ratio, exhibit size, diet, and behavioural husbandry. This could all help to create basic guidelines for the successful reproduction of this species. Another talk was made by Tanya Kamerman from The Seas Disney (USA) about the development of a scoring process for the spotted eagle ray. A score from 1 to 5 is defined for various aspects of body condition, and the formula is being tried in different public aquariums this year, in the hope it might grow into a global standardised technique for eagle ray health evaluation.

WHAT NEXT

Paternity research helps to control a genetic healthy population within the studbook. Some captive young are put together with original wild-caught animals, producing potential breeding couples for the future. But now a new problem has arisen: the species, white-spotted eagle ray (*Aetobatus narinari*) has long been described all over the world in subtropical and tropical waters, albeit with colour variations from region to region. In the last two years different scientific studies have been published on the taxonomy of the genus *Aetobatus*, showing that it possibly contains quite a complex of species. Even within the studbook different colour morphs are found, some with white spots, some partly with white spots and some with none at all.

When running a studbook it's important to know whether we work with one or multiple species. Other than two animals all wild-caught animals in the studbook have a known origin, ranging from the Indo-Pacific to the Red Sea, and current thinking is that they might be different species.

New genetic research within the studbook therefore started in 2013, and sting samples have been taken from 15 individuals for analysis by Gendika, this time for possible species splits. This may result in the near future in a split of the studbook: it could be that some 'white' spotted eagle rays are possibly 'white' spotted no longer, but another species yet to be given an English name.

Painting the picture

IN *SITU* PAINTED DOG CONSERVATION IN ZIMBABWE IS COMPLEX AND MULTI-DISCIPLINARY, BUT 2013 TURNED OUT TO BE A GOOD YEAR

Peter Blinston, Managing Director of Painted Dog Conservation

I think I will refer to 2013 as the 'year of the goat'. The life of one goat, sadly killed by a small pack of two painted dogs near the village of Makwandara became a tipping point for Painted Dog Conservation (PDC) in 2013. This was the first recorded incident in more than 20 years of painted dogs killing livestock in our area of Zimbabwe. I feared the worst and was astonished and delighted when I was informed that the villager who lost the goat had nothing but praise and appreciation for PDC. He considered the loss of one goat to be nothing compared to the benefits that the organisation delivered to his community at large. This is the sort of behavioural change that we need to ensure a future for the painted dogs.

As an organisation PDC has evolved beyond all recognition from its origin. A series of programmes has been designed and developed over time to address the complexity of factors impacting painted dogs and their prey and habitat. It's a constant cycle of design, implementation, development and redesign. Factors we have no control over, such as the sudden resignation of a key partner and ally at

National Parks, world economic woes or political agendas can turn any plans on their head in an instant, causing us to sit back, reevaluate and then move forward. Adapt and survive is the name of the game for PDC as much as it is for the wildlife!

The sole purpose of our existence is to create an environment where the dogs can thrive. The strategic plan we developed at the end of 2011 and rolled out in 2012 has constructed a virtual frame around the work we undertake. However, nothing has really changed as such, and we constantly evaluate the work we are doing and the methods we use to try and ensure we are achieving our objectives or that we are at least on track towards achieving them. When obstacles arise it is not a case of changing the goal but changing the direction to get there.

In land management, we engaged with students from the Geography and Population Studies department at Lupane State University, who undertook the first of the surveys we require to tell us if we are achieving the attitudinal and behavioural changes we believe are necessary if we are going to

reach the desired environment where the dogs can thrive. This survey was all about firewood collection, which contributes to habitat loss, and the results were a real eye-opener about the enormity of the task ahead.

Women from the villages are allowed to enter the Hwange National Park forest every Thursday and collect as much firewood as they can carry. Conservative estimates show that more than 12,000 tons of wood are collected for household use every year for the immediate area, representing around 18,000 trees. It's a major resource for local people and is unlikely to be affected by the proposed introduction of electricity to the local township of Dete.

The dog news is much brighter. 2013 was arguably the best year we have had in a long while with three packs that we know of having pups in the Main Camp area (two additional packs had pups but they did not survive) and a new pack of seven dogs taking up residence (hopefully permanently) in the area. The packs in the western region of Hwange National Park (HNP) seem to be doing reasonably well and we are getting reports of regular sightings of dogs in and around the Zambezi National Park. While average pack sizes in HNP remain a concern, Mana Pools continues to be one of the best places in the world to see painted dogs, with large packs of 20 or more ensuring plenty of action.

Our rehabilitation facility experienced a quiet year for the treatment of injured animals, but thanks to our collaboration with institutions such as Sea World and Houston Zoo, staff at the centre have received wonderful training in enrichment techniques with the dogs. These techniques also develop trust between the dogs and staff and facilitate the movement and treatment of minor ailments. Additional training in vet lab techniques and methodologies was



EAZA AND THE PAINTED DOG

EAZA's Painted Dog EEP has a population of over 300, and is at the forefront of the worldwide zoo community's strong activities in research, conservation and education. Recent workshops in Europe and the US explored how zoos can contribute to integrated One Plan conservation, highlighting the role that painted dogs in human care can play in helping field conservation efforts via research into areas such as vocalisation, diet and more. A worldwide approach to *ex situ* conservation, coupled with new educational initiatives such as Gaia Zoo's schools programme, reflect an increasing understanding of the pressures the dog faces and its growing popularity with the public. EAZA zoos will continue to play a vital role in building the profile and conservation of painted dogs.

TARGETING CRIME

In 2013 we continued with gathering intelligence for targeted patrols to arrest poachers. In order to support this initiative, priority was given to joint patrols with the Forestry Protection Unit (FPU), Zimbabwe Parks and Wildlife Management Authority (ZPWMA) and Zimbabwe Republic Police (ZRP).

The primary source of wire for poachers' snares is copper telephone lines so a joint five-day operation was conducted with national phone company Tel One to remove a total of 1,500kg of wire, equivalent to 45,000 snares!

Regular daily patrols were conducted on the PDC estate and this served to keep the area free from snares, and we are working with authorities to establish APU patrols in a neighbouring river area to the east which is a major wildlife hub. PDC has also helped ZPWMA in combating cyanide poaching of elephants, which could have major repercussions for scavenging species such as the painted dog. Thankfully, to date there is little evidence that painted dogs have been seriously affected, and new sentencing regulations in Zimbabwe for wildlife crime are also starting to improve the outlook for efforts against poaching.



carried out by Liza Marie Avendano from Houston Zoo. The value of this training was shown when Cynthia Mapandere, who completed her PDC sponsored degree in 2013, conducted a hugely popular session for children during our Special Bush Camp in November, using skills she had acquired at the sessions. She taught the children how to collect fecal samples for analysis, which in conjunction with DNA samples taken from immobilized dogs are being used to evaluate stress hormone levels and parasite loads.

Other outreach included our work with HIV clinics for local populations, bush camps aimed at teaching children about conservation and other disciplines including wildlife photography, conservation clubs, arts and crafts teaching, garden programmes and, last but not least, lobbying and cooperation with the authorities to shape legislation. These initiatives build strong relations with the local community and are aimed

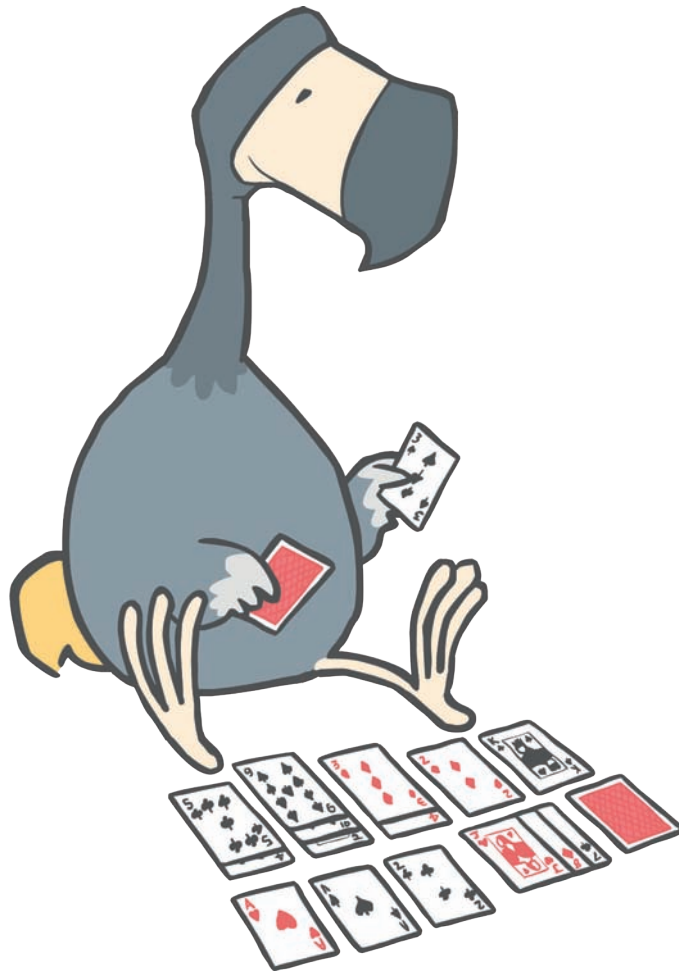


at reducing the direct threats of road kills, shootings, wood collection and logging, the impact of mines and dams, illegal hunting, and the frequency and intensity of veldt fires. Lobbying activities resulted in ZPWMA applying for painted dogs to be listed on CITES Appendix 3, reduced hunting quotas for prey species, and slow progress being made on revising road regulations to help cut the number of painted dogs killed by motor traffic.

The PDC base camp, our centre of operations, is gradually growing, with additional accommodation and facilities being built, despite a lack of building materials and other

restrictions.

In all, then, 2013 was a positive year for PDC, and we hope that as 2014 progresses, our efforts across the spectrum of activities needed to provide a sustainable habitat for painted dogs will bear further fruit. *In situ* conservation is a multi-faceted challenge, especially in Africa, and even more especially in Zimbabwe. Working together with the local population, the authorities and other partners, we are hopeful that the future for painted dogs will continue to brighten. If 2013 was the year of the goat, we are aiming to make 2014 the year of the painted dog!



The dodo effect

IF ANY ONE BIRD COULD MAKE A DIFFERENCE,
IT MIGHT JUST BE THE STAR OF DURRELL'S THE LONELY DODO CAMPAIGN

Kelly Barker and Suzanne LeLay, Durrell Wildlife Conservation Trust

He's not your typical movie star – in fact he's been extinct for several hundred years – but *The Lonely Dodo* struck a real chord with audiences around the world when he hit our screens in 2013.

Ever since, his endearing digital media campaign to highlight the plight of endangered species has proved a massive success for Durrell's marketing team and it's expected to be the charity's most successful fundraising campaign ever.

The comical creature came to life in April 2013 with the help of Academy award-winning animation studio Aardman – the creators of *Wallace & Gromit*. He's the 'frontman' of Durrell's innovative and inspiring campaign to increase awareness of the conservation organisation and its work, and to generate income for the charity. The campaign has been successful at reaching its target audience and beyond, effectively portraying Durrell's message and communicating its mission to 'save species from extinction.'

The campaign was developed through a collaboration between Durrell's marketing team, Aardman and brand agency TheFrameworks. Discussing the thinking behind the initial campaign concept David Alexander, senior designer

at TheFrameworks explained: 'We were moved by footage of the last Tasmanian Tiger, lonely and resigned to extinction. Pairing this idea with the dodo, which is central to Durrell's brand and a symbol of extinction, led us to the concept of *The Lonely Dodo*.'

If you haven't seen it yet, the campaign consists of an animated film supported by an interactive microsite that is entertaining, educational and informative. The film sees *The Lonely Dodo* as the last of his kind on earth. We watch as he sets off from Mauritius, travelling across the globe in a fruitless quest to find a mate. Along the way he meets some of the Critically Endangered species the renowned charity works with such as the Hispaniolan solenodon, pied tamarin, mountain chicken frog, ploughshare tortoise, Floreana mockingbird and the pink pigeon.

Adding a new dimension to Durrell's communications techniques, the short film was specifically scripted and produced to engage with viewers on an emotional level, tugging at heart strings and hopefully, in turn, purse strings as, along with awareness-building, the campaign was also introduced to generate much needed monetary support.



VOICE TALENTS

Celebrities Stephen Fry and Alistair McGowan are long-term supporters of Durrell and were keen to join the cast. Fry's dry narration is superb, conveying the film's serious message in an amusing but memorable way. Commenting on his involvement, he said: 'We know that currently there are more species either in the process of becoming extinct or in grave danger of doing so, than ever before in the history of man. Stemming this otherwise inevitable flow towards the loss of nature and all that it provides requires engaging the next generation. I wholeheartedly support the work of Durrell as they aim to inspire young hearts and minds to empathise with, and thus care, for the plight of endangered species.'

It is Alistair McGowan who entertainingly brings the lonesome dodo to life as he realises he is in fact the very last of his kind. Discussing the role he said: 'It's not often one is asked to become a dodo, especially given that we already know how that story ends! Durrell Wildlife Conservation Trust exists to make sure that it doesn't go the same way for other endangered species, so I became their dodo to help spread that message! Glad to say that I'm still here, and it was actually rather fun, despite the seriousness of the subject!'

Discussing the project Aardman director Matthew Walker said: 'It was a truly wonderful experience working with Durrell to create The Lonely Dodo. They gave us the freedom to produce what we hope is a funny and informative film, which is significantly enhanced by the exceptional vocal talents of Stephen Fry and Alistair McGowan. We really hope that it reaches the global audience it deserves!'

The lonesome dodo is certainly proving popular so far with almost 300,000 views of the film to date, exceeding the target set of 250,000 for the first year.

But that's not all: in 2013 the creative campaign has scooped three prestigious awards. In September The Lonely Dodo took top spot for the 'Best Use of Digital Media' in the Third Sector Awards for Excellence. The campaign was also shortlisted for the 'Best Communications Campaign' category. Judged by independent experts, the Third Sector awards have rapidly gained pre-eminence as 'the awards to win' in the

dynamic and challenging sector of registered charities, not-for-profits, social enterprises and campaigning groups.

Just two months later the campaign picked up 'Best Use of Media' in the Jersey Chartered Institute of Marketing (CIM) Awards along with scooping the overall 'Judges Choice' title. Plus it was shortlisted in the UK CIM Awards.

But perhaps the icing on the cake was when the campaign was awarded an industry 'Oscar', taking the title of 'Best Marketing Project' at the annual BIAZA awards in November.

Dr Kirsten Pullen, CEO of BIAZA, said: 'The BIAZA awards highlight the crucial work carried out in zoos and aquariums. All of this year's award-winning projects show the exceptional contributions our members are making to animal husbandry and welfare, wildlife conservation and public understanding for species both in the UK and overseas.'

The Durrell team spent more than a year focusing on this campaign and is delighted with the response so far. Kelly Barker, Head of Marketing and Commercial said: 'The Lonely Dodo campaign was the first of its kind for Durrell, as we aimed to harness the power of social media to bring an emotive and engaging message to a new audience. Naturally we're thrilled that The Lonely Dodo has struck a chord with the public and has succeeded in generating awareness and income for Durrell but it's also pleasing to see that this innovative campaign has been recognised as excellent by leaders in our field. It's a massive achievement for a relatively small marketing team within a charity.'

The film may only last four minutes but Durrell hopes The Lonely Dodo will inspire viewers to support the charity and sign up to 'The Lonely Dodo Crew', a new and specifically designed committed-giving programme.

The Dodo continues to be as relevant to the charity today as it was when Gerald Durrell set up the Trust in 1963. There was never going to be a happy ending for the star of this show but The Lonely Dodo could help change the fortunes of all those species facing extinction today.

Find out more about the campaign at www.thelonelydodo.com.

Rethinking conservation goals

A PROJECT TO ESTABLISH AN ISLAND RESERVE FOR NEW ZEALAND WILDLIFE OFF THE COAST OF AUCKLAND IS AN EXAMPLE OF CURRENT AND DEVELOPING CONSERVATION IDEAS

Jonathan Wilcken, Director, Auckland Zoo

Broadly speaking, conservation efforts mostly focus either on preventing extinction, or on re-establishing an area to a former 'healthy' ecological state, or on both. However, these goals may be limiting our thinking about what conservation success could look like.

Whilst preventing extinction is a critical emergency response, it is essentially an uncreative goal aimed solely at avoiding a negative. More creatively, many long-term conservation efforts aim to re-establish habitat to a former ecological state so that it can support species that were previously secure. However, ecosystems and species distributions change naturally over time, and so this goal begs the question: which former state and which species? What is our reference point for a 'healthy' ecosystem?

We usually assume that such restoration goals refer to a time before the destabilising influence of humans. However, this can be problematic. In many instances the extinction of important species makes a former state impossible to achieve. Also, in practice, our conservation efforts are usually forced to be more pragmatic, focusing on achieving the best possible biodiversity outcomes within human-affected environments. Indeed, sometimes we are entirely blind to whether human influence is implicated in a species decline. For example, the Tasmanian devil (*Sarcophilus harrisi*) is threatened with extinction by an emerging disease: Devil Facial Tumour Disease. The origin of the disease, whether 'natural' or as a result of human activity, is not considered relevant when planning a conservation response.

Indeed, the IUCN itself is conflicted in its approach to human-influenced environments. On the one hand, the IUCN effectively devalues a circumstance where, through human intervention, a species is found only in 'feral' populations 'well outside its past range'; these species are considered Extinct in the Wild. On the other hand,

the IUCN's own translocation guidelines cautiously promote the conservation value of introducing species outside their 'natural range' in specific circumstances.

More importantly, if we define conservation success as an ecological return to a state relatively undisturbed by humans, we raise significant and unresolved philosophical questions. Why do we separate out human influence from that of all other species, casting it as inherently detrimental? Where does that leave humans in a vision of ecological restoration? Do we envisage people only as onlookers to an ecologically 'healthy' world?

EXPERIMENTS IN A NEW STEWARDSHIP

Some conservation thinkers are now calling for a more inclusive vision of conservation success; one that sees humans integral to the management of 'novel ecosystems'; one that recognises that human influence is not only pervasive and impossible to reverse, but that it can also be turned to positive ends.

Auckland Zoo, in New Zealand, is a partner in a project that aims to explore, in practice, this new thinking. We are doing so in a unique partnership with the Rotoroa Island Trust, a body that oversees the management of an island in Auckland's Hauraki Gulf. Together, Auckland Zoo and the Trust are aiming to create a new type of wildlife reserve; one where, by design, people take on a new stewardship role in sustaining a rich and diverse assemblage of wildlife. The sanctuary will be managed, through intervention, to sustain a richer diversity than would be expected historically or naturally; school students and island visitors will participate in the island's ecological recovery, and the island's wildlife populations will be managed interactively for genetic exchange with those on other islands, and in Auckland Zoo, in much the same way as we manage species programmes across multiple zoos.

The overall aim is to demonstrate an interventionist approach to ecological management, illustrating the changing relationship between people and wildlife.

ISLAND RESERVES IN NEW ZEALAND

One of the world's biodiversity hot spots, New Zealand has an exceptionally high rate of species endemism. A key threat to New Zealand wildlife is from the widespread presence of introduced species, particularly mammal species such as rats, cats, weasels, stoats, and brush-tailed possums. Since the arrival of such species, over 40% of all endemic bird species and over 9% of all endemic reptile and amphibian species have become extinct.

A key conservation strategy in New Zealand, therefore, involves the creation of 'pest-free' areas, either islands or managed mainland sites, which can then be developed as wildlife reserves for species most affected. Rotoroa Island is one of more than 20 Hauraki Gulf islands in the north of New Zealand. Mammalian predators have already been removed from a number of these islands and work on restoring pre-pest ecologies is underway.

A DIFFERENT TYPE OF WILDLIFE RESERVE

Rotoroa Island, in the Hauraki Gulf, was home to a former drug and alcohol rehabilitation centre for 100 years. Farming was the main land use on the island, resulting in a significantly altered ecology and the loss of endemic plant and animal diversity.

Since 2008, 20,000 exotic trees have been removed and 400,000 plants sourced from local seed, propagated and planted on the island. All mammalian predators have been removed from the island, and on-going pest survey and control measures have been established.

Even after the removal of mammalian predators, though, the island's relatively small size (82ha) and lack of mature forest would normally provide for only a few species. The return of native species



would be slow and limited. However, an active interventionist approach to the on-going management of wildlife on the island will enable us to establish a wider range of species, and in greater abundance than would naturally occur.

All New Zealand endemics have been evaluated for suitability for translocation to the island, their ability to survive either with or without on-going support and for their ability to enable trials and demonstrations of new techniques within a managed ecology. Twenty species of birds, reptiles, fish and invertebrates have been identified for release to Rotoroa within the next four years, with the first releases planned for 2014. These species will be managed to support a range of activities which showcase the work of ecological management. Island rangers will be able to demonstrate the active management required to maintain the high diversity and abundance of native species and, where possible, to involve visitors with the work. Expert tutors

and field biologists will be able to guide students in building an understanding of current wildlife restoration theory and putting it into practice.

Species-support infrastructure is planned to enable the coexistence of a wider range of species, earlier in ecological succession, than would otherwise be possible. These will include protective enclosures (eg 'head-start' facilities), fenced species-exclusion zones, sites with designed complexity to limit inter-species interactions, structures that help regulate temperature (eg artificial shade structures), feeding stations and structures that promote breeding (eg artificial nesting and burrow sites).

Once established, wildlife populations on the island will be managed for long term sustainability, supported either by the island's developing ecosystem, or with the assistance of a range of active management techniques. This means that the selection of species will not be restricted solely to those known, or

likely, to have occurred previously on the island. Nor is the aim to establish species only where they have a prospect of persisting on the island without human assistance.

Programmed and on-going species management within the wildlife reserve includes active population management techniques such as translocation, captive rearing, supplement feeding, and competitor and predator management. Managed genetic exchange, between populations occurring across other pest-free Hauraki Gulf islands as well as the zoo, will be used to ensure long-term population sustainability.

The Rotoroa Island wildlife management strategy envisages long-term and on-going management to sustain an island ecosystem abundantly representative of New Zealand's biological diversity. Such an approach will provide the opportunity to use the island to demonstrate and further develop the practice of interventionist conservation management to help secure New Zealand's unique biological diversity. In this way, Rotoroa Island can help enhance biological diversity within the Hauraki Gulf Marine Park and promote community understanding and awareness of the need to manage the environment in such a way that wildlife can be sustained and can thrive.

We hope it will also help promote a new environmental stewardship.



Harnessing nature's best ideas

BIO-INSPIRATION IS THE STUDY OF THE NATURAL WORLD TO DEVELOP APPLICATIONS FOR OUR OWN. IT'S A GREAT WAY TO ENHANCE INTEREST IN CONSERVATION AND BIODIVERSITY, TOO

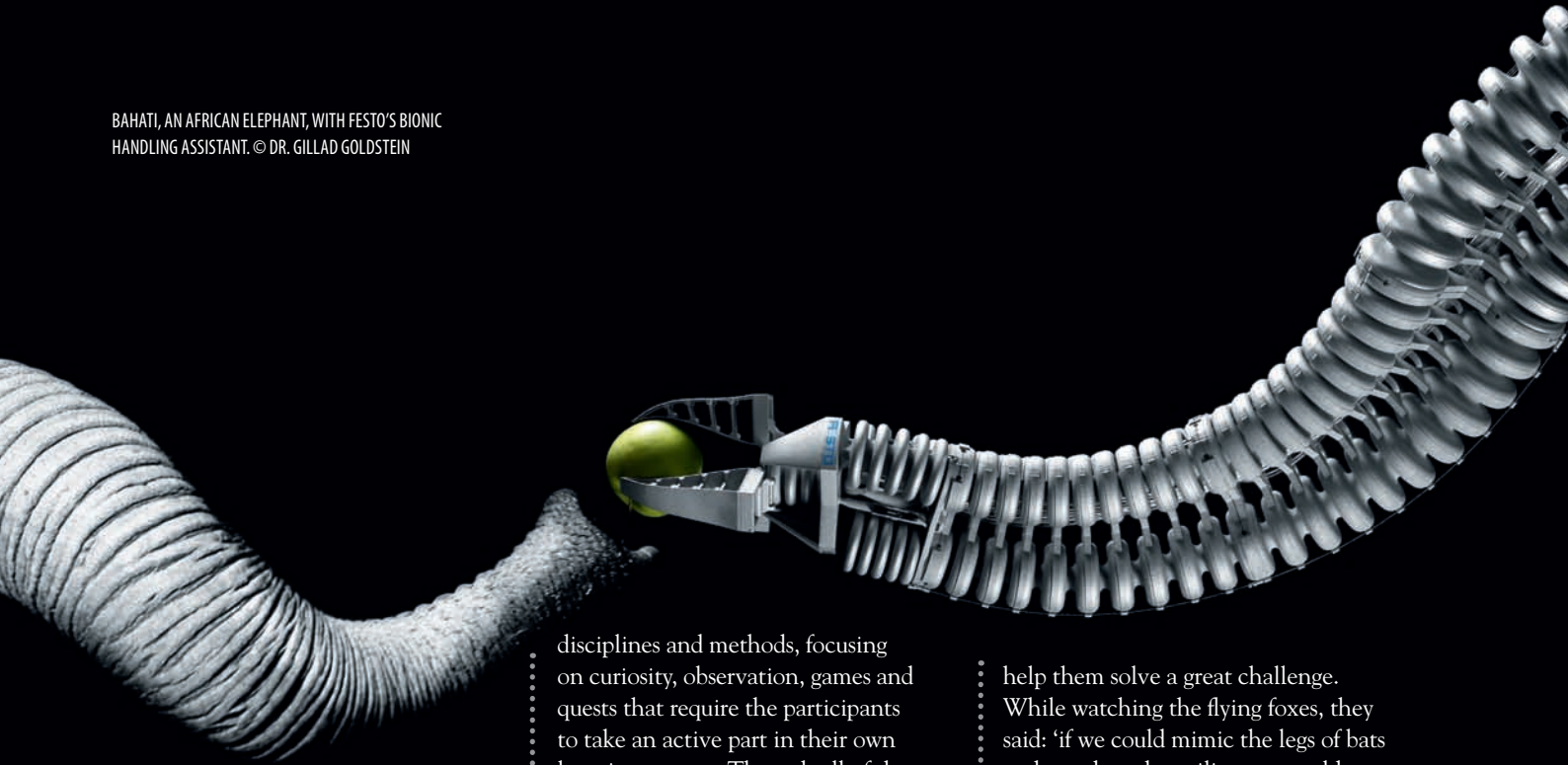
Dr Gillad Goldstein, Curator and Michal Topaz, Bio-inspiration coordinator, Zoological Centre, Tel Aviv

Once upon a time, a teenager named Peter Parker was bitten by a radioactive spider and became endowed with amazing superpowers. They enabled him to climb most surfaces and gave him superhuman strength. In another time and place Bruce Wayne decided on a bat-themed costume while fighting crime, and Clark Kent began to fly like a bird!

The powers and talents of these fictional characters who are dedicated to protecting the public are modeled after some of nature's finest creatures. As far as we know, human superheroes are not real, but their model of inspiration that feeds our imaginations is found among us, in the natural world. If superheroes

get their inspiration from nature's best ideas, can animals then be classified as superheroes? Can we embrace these stories, with a few adjustments, and turn them from fiction to science, creating our own 'superpowers' inspired by animals? Can we use this as a scientific approach to justify and recruit visitors to our ideology and dedication to protect biodiversity, conservation and sustainability?

Many of the challenges in our everyday lives have answers in nature's genius. Animal and plant adaptations offer us a library of inspiration to generate innovative, sustainable solutions in different fields. Bio-inspiration (or biomimicry) is a multi-



and inter-disciplinary methodology in which biological and ecological principles are applied to problem-solving. Biological forms, mechanisms, processes and functions are used to develop inventions and applications in diverse disciplines, and there are many examples: the Eastgate Centre in Harare, Zimbabwe is a building inspired by the termite's conical mound that is able to maintain temperature control without an air-conditioning system; the Bionic Handling Assistant by FESTO is a freely movable, handling robotic system inspired by the elephant's trunk; applied chemistry research on the red sweat of the hippopotamus has created the potential for a 3-in-1 antibiotic, sunscreen, and insect repellent. There are many more.

Zoological centres provide a microcosm of the living world and invite visitors to explore a new kind of learning: not just about nature but from nature. Our zoos can be used as fun interactive 'research labs for creativity and ideas', inspiring our diverse visitors. Our goal in Tel Aviv is to build an interdisciplinary platform that bridges the natural world and human challenges, and to encourage our visitors to be more conscious of conservation and nature.

Our bio-inspiration educational unit at the Safari offers various activities for visitors of all ages, from a one-day introduction to more intensive annual and biannual courses. The approach is an exploration through different

disciplines and methods, focusing on curiosity, observation, games and quests that require the participants to take an active part in their own learning process. Through all of these methods, and by creating enrichment materials for our animals, the students track biological functions and adaptations, develop creative thinking and innovative ideas, and apply the principle of learning from nature to human challenges.

RESEARCH AND DEVELOPMENT

In one course, students searched the zoo for the birds that inspired the Japanese bullet train or 'Shinkansen'. They raised many creative ideas before discovering that both the kingfisher and the barn owl had helped inspire this successful design. Another meeting focused on FESTO's 'Aqua Penguin' bionic application. The students observed a hand-reared African penguin chick, investigated the hydrodynamic shape of her wings, beak and legs, and observed her movement both in and out of the water. By the end of the year, the students started implementing the principle of learning from nature. One of them even designed a robotic application to lift heavy objects, inspired by the gecko's feet and the spider's web. His family was in the process of moving into a new house, so heavy lifting was on his mind. With the hope that his application will become successful, he promised to donate 20% of all profits to the animals at the zoo, where he first gained the inspiration.

In another instance, while talking about animal movement, physical structure, adaptations and biomimetic applications, two six-years old girls thought of an application that would

help them solve a great challenge.

While watching the flying foxes, they said: 'if we could mimic the legs of bats and stand on the ceiling, we could create much better surprise parties!' This application will clearly not solve global warming and world climate changes, but it definitely inspired these two imaginative girls with their biggest problem – planning a friend's party.

One middle school class of students were given an unusual task. They were divided into two groups, and the first team was asked to act as engineers trying to locate the most suitable animal in the Safari that could provide inspiration for a search and rescue challenge. After examining the advantages of several different animals such as spiders, cockroaches, caterpillars and mice, they chose the snake as their source of inspiration for a robotic application to deal with this issue. The snake's kinematics, adaptations to changing conditions and ability to move through narrow voids made it the best model for their design. You can imagine the children's surprise when they were then shown a film of some snake-like robots, invented by Professor Wolf et al at the Biorobotics and Biomechanics Lab in the Technion, Israel. The students were amazed to see the similarities. Prof. Wolf himself was also curious about this exercise and suggested the class join a robotics middle school project.

The second team acted as biologists researching bats. They were asked to suggest as many problem-solving applications as possible. Among many ideas and after reading about the bat's navigation conditions, the students proposed a device to help the visually impaired. They came up with a guide-



CLOCKWISE FROM TOP LEFT: BIONIC HANDLING ASSISTANT © FESTO; THE ROBOTIC AQUA PENGUIN BY FESTO. © DR. GILLAD GOLDSTEIN; BAHATI, AN AFRICAN ELEPHANT, IS LEARNING WITH THE KIDS ABOUT FESTO'S BIONIC HANDLING ASSISTANT © DR. GILLAD GOLDSTEIN; ROBOTIC SNAKE – BIROBOTICS AND BIOMECHANICS LAB, TECHNION ISRAEL INSTITUTE OF TECHNOLOGY © PROF. ALON WOLF, HEAD OF BRML.

cane that transmits sound waves, absorbs the bounce-back, and points to obstacles in the area through vibration or sound. Once again, they were surprised when photographs and videos were shown to them. The UltraCane, for example, transmits signals to the environment and translates their return into vibration; another example is the Bat K-Sonar, which operates in a similar manner and provides a spatial map of the environment through sound, indicating the obstacles that are in the area and their distance. In this session, the young students demonstrated their 'childlike' creative thinking, together with their growing understanding and knowledge of technologies and real life challenges, and the biological knowledge they acquired in the Safari, which led to creative practical ideas in different fields. These meetings enabled the students to fly with their imagination. Who knows, maybe one of them will make their own significant scientific breakthrough?

NOT JUST FOR KIDS!

Our bio-inspirational approach is actually aimed mainly at adults, both professionals and non-professionals. We see an increasing interest in our lectures, daytrips and workshops from educators, science teachers and school principals, engineers and other professionals. Aerospace engineers were fascinated by the inner structure of the great hornbill's beak and helmet. Biomedical and biotechnology engineers were amazed by the natural hexagon structure of the scutes on the tortoise carapace, and the science and technology administration unit in the Israeli Ministry of Education was inspired by the giraffe's rough and leathery tongue.

'Bio-inspiration for Non-Professionals' is a series of 10 inter-disciplinary meetings at the zoo. It focuses on



promoting innovation for sustainability and developing ideas inspired by nature. This includes 'behind the scenes' observations, accompanied by theoretical presentations of different case studies in medicine, architecture, materials, flight, and management strategies. During this course Israeli biomimetics researchers, designers and professionals lectured to us about their work.

Academic collaboration with The Shenkar College of Engineering and Design's Department of Textile Design, led to a shared bio-inspiration class, taking place both at the college and at the Safari for the second year. In this programme, students come to the Safari to learn about animal structures, functions, process and behaviours, and create textile applications inspired by the animals or plants in our collection. For example, the leopard's tongue inspired a 'face-cleaning peeling towel', while the giant anteater's stiff tail fur provided ideas for a new and improved camping mattress.

The benefits of bio-inspired design are enormous. They promote new optimism about non-patented natural solutions

to sustainable design, energy and waste reduction. The bio-inspiration point of view clarifies the inseparable connection between economy, society and the natural world. This approach brings new types of visitors and provides a clear economic justification for conservation to those who look at the natural world from an anthropocentric point of view, and ask: 'what good is biodiversity and conservation for us?'

Bio-inspiration is an expanding part of the Safari's educational offering. In collaboration with the San Diego Zoo Global Centre for Bio-inspiration and the Centre of Biologically Inspired Design at Georgia Tech, we have joined in promoting bio-inspiration in the world of zoo education. Through the context of 'culture, fun, learning and enjoyment', project-based and active learning, with myriads of bio-inspirational examples and activity for every animal and many plants in our collection, we can reach our main goal of bringing people closer to nature. They have the chance to meet the real superheroes of the living world, giving them another reason for valuing conservation and biodiversity.



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