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Numbers of the critically endangered hawksbill turtle (*Eretmochelys imbricata*) have increased in BIOT over the past decade



Rachel Jones, Project Manager, ZSL

A DECADE OF LEARNING

Findings from 10 years in the
British Indian Ocean Territory

WHEN the British Indian Ocean Territory (BIOT) was established by the UK Government 10 years ago it was the biggest marine protected area (MPA) in the world, spanning 640,000km² of the cleanest seas ever recorded. At its heart are the 55 scattered islands of the Chagos Archipelago, the world's biggest living atoll reef – home to an abundance of marine life, from turtles to reef sharks, to manta rays and over 300 species of coral.

Designated a no-take zone, with all fishing activity banned, BIOT has allowed ZSL's scientists and our partners to study the relatively pristine and isolated marine ecosystem. Ten years in and over 70 scientists from the programme, led by ZSL, have published a review paper looking back at the last decade.

"It's important to share what does and doesn't work to help all marine protected areas – which cover a relatively small portion of our oceans," says ZSL Project Manager Rachel Jones.

For example, one of the project's studies, led by Lancaster University, investigated the relationship between seabirds on a rat-free island and the surrounding coral reef. The study found that the seabirds' nutrient-rich guano contributed to the health and resilience of the reef.

"At a time when reefs all over the world are facing mass bleaching events, rising temperatures and acidity levels, practical science that can provide hope for coral reefs is like gold dust," explains Rachel. "If rats can be removed from islands, allowing sea birds to nest, this may give other reefs around the world more resilience in the face of turbulent times to come."

The safety of the MPA has also proved essential for many species. Numbers of critically endangered hawksbill turtle (*Eretmochelys imbricata*) have increased dramatically over the past decade, and tracking tags have given us a new insight into the lives of reef sharks. Grey reef sharks have been shown to move between atolls, spending their lives within the protected area.

"The behaviour of these sharks is encouraging because it suggests that an MPA this size provides complete protection for some groups throughout their entire life, offering a safe haven for threatened species," says Rachel.

But findings have also shown that even an MPA as large as BIOT, while capable of supporting many species, cannot single-handedly protect populations of overfished pelagic species, such as tuna.

Tuna numbers have continued to drop in the region, with fishing representing the greatest threat to many species. "If you've fished your immediate ecosystem clean, you're going to have to go further afield," explains Rachel. "MPAs will only become more attractive to illegal fishing." And, as human populations around the Indian Ocean basin grow, the pressure on BIOT's resources, and its one patrol ship, grows with it.

But, as the project looks ahead to the next decade for BIOT, with both its challenges and potential, Rachel reflects on their achievements so far. "I'm really proud of the science we've done, supported by the Bertarelli Foundation. The last ten years of protection has made a massive difference to these animals and habitats, many of them endangered species." **TZ**



Andrew Terry, Director of Conservation and Policy, ZSL

DEAR FELLOWS

THIS autumn, we should be part-way through the so-called ‘super year’ for biodiversity conservation, with a renewed global vigour and imperative set around revised global goals and commitments. Instead, our lives were turned on their heads, by the very thing conservationists have been warning about: the over-exploitation of ecosystems and the wildlife they contain. The only silver lining is that the impacts of COVID-19 will provide additional urgency to the agreement of bold targets to protect our natural world.

As you will have seen, ZSL was massively impacted by the lockdown. Our main income, that underpins the science and conservation we deliver, was completely removed and, while our Zoos are now open, recovering from this will take a long time. As Fellows of ZSL you are core to the Society and are critically important to our future. Your support has been invaluable during this difficult period.

The impacts of COVID-19 have been felt deeply across the world and within the very areas that we seek to support. A recent survey of protected areas in Africa showed the extent to which they have lost their funding, largely associated with the loss of tourism revenues. This has led to widespread job losses and reductions in fundamental protection efforts. These protected

areas will form a core part of global biodiversity commitments and therefore diversifying their income sources, supporting their communities and increasing their resilience to future change must all become priorities. We are able to highlight some of the experiences of our team in Tsavo West National Park in this issue.

However, during this difficult time, we have continued to deliver conservation results. This issue of *The Zoologist* documents successes like the expanding tiger populations in Thailand, 10 years of conservation efforts in the British Indian Ocean Territory and the launch of a new project to restore native oysters in the UK’s waters. It also highlights the Society’s important role in generating the knowledge and guidance upon which so much effective conservation is based, for example on translocations, red listing and wildlife health assessments.

Going forward, ZSL’s strategy of addressing the fundamental challenges facing wildlife health, the relationship between wildlife and people and bringing wildlife back from the brink remains critical. I hope you enjoy this issue and I want to thank you again for all your support.

Contact fellowship@zsl.org and 0344 225 1826 if you want to support us further, or visit zsl.org/support **TZ**

TIGERS RESURGENT IN THAILAND

New arrivals spark hope in West Thailand’s forests

IN the forests of Western Thailand, ZSL and its partners are working to protect one of the world’s two known breeding populations of Indochinese tigers (*Panthera tigris corbetti*). Six years into the project – protecting tiger corridors, supporting and training law enforcement officers, using camera traps and improving ranger patrolling – they’ve snapped a new success.

Three new male tigers have been photographed, on camera traps, using a ZSL-monitored corridor to travel into the southern portion of Thailand’s Western Forest Complex, known as WEFCOM. This brings the southern area’s total to four tigers, and it is the first time in four years new tigers have entered the landscape. The hope is the new males will establish territories and breed.

There’s just one problem: “We’re still waiting for a female to move into the area,” says ZSL Chief Technical Advisor, Eileen Larney. “It’s a bit of a boys’ club at the minute.” And with less than 4,000 adult tigers left in the wild, a decrease of 96% in the last 100 years, every cub counts.

ZSL has been working to protect Thailand’s wildlife in the WEFCOM since 2013. Home to a 200-strong Asian elephant population (*Elephas maximus*) and the elusive Sunda pangolin (*Manis javanica*), it remains a stronghold for some of Asia’s most threatened wildlife, but its growing success requires the buy-in of local people to thrive.

“A lot of the people here were aware conservation work had been happening, but felt quite isolated from what was going on and the decisions being made about the surrounding areas,” explains Eileen. “We’ve been working

to change that by engaging them, sharing the data, and helping people get involved with the landscape management.”

ZSL staff and partner organisations have individually tailored their approach to communities in 35 local villages. This ranges from securing cattle from tiger attacks to throwing ‘pangolin parties’ – using traditional Thai puppetry to promote the little-known species.

The forests face the daily threat of poaching, logging and extraction of resources, while surrounding villages experience human-wildlife conflict when elephants raid crops, or cattle get attacked. Working with local people to understand

and mitigate these threats gives protected areas a first line of defence and allows communities to protect both the forests and their livelihoods.

Human development is increasing and there is a long road ahead. But the Thailand team remains hopeful for the future of Thailand’s wildlife.

“To witness apex predators, like tigers, returning to forests means the ecosystem is recovering, which is good for all wildlife,” says Eileen.

“The situation for tigers worldwide remains precarious, but successes like this show that, through our work with communities and governments, we can see populations start to recover.” **TZ**



Three new tigers (*Panthera tigris corbetti*) have been observed in the southern WEFCOM

GARDENERS OF THE FOREST

Uncovering the Baird's tapir, with the help of Instant Wild users

THE Baird's tapir (*Tapirus bairdii*) has earned a reputation for green fingers; it has helped to shape the forests of Central and South America over millennia through its role as a far-ranging seed disperser. Despite this importance, and their position as South America's largest land animal, there is very little known about the Baird's tapir. Marina Rivero, Nat Geo Photo Ark EDGE Fellow, is on a mission to change that and hopes to learn more about their numbers in Mexico with the help of camera traps and users of ZSL's *Instant Wild* app.

"Tapirs are crucial for distributing the seeds of large tree species important for carbon sequestration," explains Marina. "This makes the tapir one of the most important species in the fight against climate change."

"However, there is no reliable information on population density and size across most of the species' range. It has been estimated that Baird's tapir populations have decreased by more than 50% in recent decades, mainly due to habitat loss and poaching. It is also estimated that there are around 3,000 mature adults throughout the species' entire range, but some recent studies suggest there may be 2,600 tapirs in just Mexico."

"Their reproduction cycle – a 13-month gestation with just one offspring per litter – makes them incredibly vulnerable to habitat loss. Areas

of forest across Mexico are being converted for livestock and it is crucial we understand more about their numbers now, before it is too late."

To limit the disturbance for the Baird's tapir – a naturally shy animal – Marina has set up a series of camera traps in the Protected Area La Frailescana (PA-LF), part of the Sierra Madre le Chiapas mountains in southern Mexico. With the help of *Instant Wild* users, who have analysed Marina's 426 photos, and using statistical models, Marina now estimates 160 tapirs live in the entire mountain range – a decline of 30% in 10 years.

Proving the existence of tapirs, and their vulnerability, is more vital than ever, says Marina. "There are now plans to build a highway through the middle of PA-LF that would irreparably damage habitat connectivity and the survival of the tapir population in the mountains."

Marina remains optimistic though. "We are working closely with local communities, and integrating them into the decision-making process for the conservation of the Baird's tapir. Local and federal governments, NGOs and local communities must collaborate to strengthen protected areas."

Visit instantwild.zsl.org to find out how you can get involved with camera-trap projects like Marina's, or go to zsl.org/EDGE to learn more about our EDGE Fellows. **TZ**



Very little is known about the number of Baird's tapirs (*Tapirus bairdii*) remaining today. © Nick Hawkins

BACKING FOR WILD OYSTERS

New funding to restore UK's ocean superheroes



The native oyster (*Ostrea edulis*) is a powerhouse for marine conservation

THE native oyster (*Ostrea edulis*) might not be the flashiest of marine species, admits ZSL marine conservationist Celine Gamble, but they are mighty. Oysters are capable of making transformative changes to our marine environment. ZSL's new Wild Oysters project is determined to change public perception of these unassuming animals.

ZSL has partnered with the Blue Marine Foundation and British Marine, with funding from the players of People's Postcode Lottery, to restore the UK's native oyster reefs and celebrate oysters as the ocean superheroes they are. Working in three locations, in England, Scotland and Wales, the project will install 10,000 native oysters housed in specialised nurseries underneath marinas, restoring the seabed and creating self-sustaining oyster reefs. It will also be engaging local schools and communities while working alongside the marine industry and lobbying the UK government.

"One oyster can filter 200 litres of water per day – so just imagine what reefs of them can do for the health of our seas," explains Celine. "They absorb nutrients like nitrates and phosphates, which at high levels can be harmful to fish and humans, and filter them down to sediment – cleaning our oceans."

When oysters form reefs they offer young fish a safe haven to develop and create a habitat for

other marine life to thrive; species like sea bass, critically endangered European eels, spiny seahorses and crabs. "Our marine habitats have been severely degraded. By starting with oyster reefs, we can restore the services they offer our oceans: keeping our waters healthy and resilient," Celine says.

Although the project starts with six marinas, the aim is to inspire other marinas and piers to join the mission by developing a freely available 'How to' guide. "Everyone has a role to play in keeping our oceans healthy, but we need to work together to achieve it. We want marinas and the general public to act on their doorstep and protect their local environment, creating a space for nature."

Celine is particularly keen to share these ocean superheroes with over 12,000 local students, over the project's three years, as part of their 'Oyster Love' campaign. "I'm really excited to see them getting hands on with the project, and inspiring a new generation of marine stewards. That's what will make the project a long-term success."

Wild Oysters kicks off in November with 135 oyster nurseries being fitted beneath the marinas' pontoons. Each nursery will contain 60 native oysters, which are expected to release a combined nine billion oyster larvae over the next three years. Watch this space for the oyster revival. **TZ**

TAKING THE PLUNGE

Net-Works becomes Coast 4C

THE Net-Works™ initiative, began by ZSL and its partners in 2012, is launching as an independent entity this year. The eight-year project, designed to bring together coastal restoration and local people, will be re-launching under the new name Coast 4C and seeking new forms of investment to scale up its impact.

“Net-Works’ approach to incentivising conservation action and reducing dependence on philanthropic funding has been hugely successful,” says Programme Manager Nick Hill. “Since launch, we’ve exported 250 tonnes of fishing nets, worked in 32 Philippine communities, and even took the model to Cameroon’s Lake Ossa. Now is the time to build on that success and attract new forms of investment.”

The programme established a business model that underpins the conservation of precious coastal habitats, primarily focussing on the Philippines – *the* global hotspot for marine biodiversity, but also one of the world’s most pressured marine habitats. Initially launched as a partnership with carpet manufacturer Interface, Net-Works incentivised Filipino coastal communities to collect discarded fishing nets, which are then sold and used to manufacture carpet tiles. Meanwhile, Net-Works also helped participating communities establish larger and more effective, locally managed marine protected areas – benefitting biodiversity and improving the catch of local fishers – and provided training in sustainable livelihoods and aquaculture.

The project has since helped create six major marine protected areas and expanded into seaweed farming. Bringing to bear the expertise of University of Philippines’ Marine Science Institute and industry expertise from Cargill, Coast 4C will help farmers establish sustainable and climate-change-resilient protocols for seaweed farming, while livelihoods research has informed the design of Coast 4C’s work with communities.

“Interest in seaweed is taking off, and our research provides the scientific basis for its sustainable production,” explains Nick. “It’s consumed as food around the world, and the ingredient carrageenan is widely used in food manufacture. Coast 4C already has interest from carrageenan producers and offers often-exploited farmers access to a transparent supply chain and prices.

“The launch as Coast 4C will help us leverage private funding streams and move to the next phase of impact, while ZSL will continue to be closely involved as a foundational partner.”

ZSL’s Conservation & Policy Director Andrew Terry, a board member of Coast 4C, hopes to extend Coast 4C into more communities across the Philippines and replicate it in Indonesia. “The programme balances the objectives of coastal communities, many of them living in poverty, with our aims to restore marine habitats,” says Andrew. “To ensure a world where wildlife thrives, we must scale up successful conservation models to have broader impact. Spinning out Net-Works so that it can grow and access resources not available to ZSL is an important step to realising that vision.”



No black rhinos (*Diceros bicornis*) were lost in Tsavo West during lockdown

LIFE UNDER LOCKDOWN IN KENYA’S TSAVO WEST

No black rhinos lost during lockdown, with ZSL support

MOSSES Wekesa, ZSL’s Field Manager in Kenya’s Tsavo West National Park, spent just over two months living within the park during lockdown. Like many rangers in the Kenya Wildlife Service (KWS) – and in national parks around the world – he experienced isolation from his family and faced the problems presented by trying to safeguard a protected area during a lockdown. However, he believes that the true impacts of COVID-19 on national parks like Tsavo West will be long term, and could be felt for many years to come.

“Some of our staff, including drivers and mechanics, were locked out of the park,” explains Moses. “Logistically, lockdown presented a huge challenge – ensuring KWS’s rangers were able to carry out their patrols took a huge effort, and normal office duties had to come second.

“Human activity initially increased in the park but, down to the hard work of all those involved, no black rhinos were lost to poachers during lockdown. We managed to keep ground and aerial patrols going, and even intensified patrols in some areas, knowing that poachers could try to take advantage of the unstable situation.”

Lockdown also impacted ZSL’s work in the wider community, with those living on the edges of the national park. “Public gatherings were banned, so our human-wildlife coexistence and sustainable livelihood workshops had to be suspended. We did our best to stay in touch with the communities we support throughout

lockdown, via Skype and phone calls, but project activities were all delayed.”

It is here – in the wider community – where Moses sees the greatest problems posed by COVID-19, and believes it could also place more pressure on the park itself. “Generally, all hotels, bars, lodgings and barber shops closed during the lockdown, and many are struggling with unemployment. This is likely to pressure people into seeking other income or subsistence opportunities, such as charcoal burning, small game poaching, big game poaching or other forms of wildlife crime – all of which thrive in times of socio-economic depression.

“At the same time, the National Park is also experiencing an acute shortage of funding from the government and NGOs. The total closure of national parks to tourists for three months, and the continued lack of tourists, has had a huge impact on revenue, and Tsavo West will continue to feel the ripple effects for years to come.

“For now, almost all non-security related activities in the park – such as research and infrastructure projects – have been halted. Longer-term, the pandemic and its impact on wildlife and people could lead Kenya to experience a significant loss in its heritage and wildlife.”

Although the full impact of the pandemic on Tsavo’s wildlife and people is still unknown, ZSL is committed to supporting KWS and local communities through this crisis, and safeguarding the future security of this vital black rhino population. **TZ**

REMEMBERING LORD MAY OF OXFORD, ZSL HONORARY FELLOW

By Professor Sir John Beddington, ZSL President

LORD Robert May, or Bob May to just about everyone, was the leading scientist of his generation in a plethora of fields, known especially for his application of mathematics to ecological problems.

Lord May started his scientific career in the 1950s at the University of Sydney, in the city where he grew up, before moving to Harvard University – where he would meet his wife Judith. His main interest in those early years was in plasma physics but, on returning to Australia in 1962, he became interested in ecological problems. He corresponded with Robert MacArthur, then head of Theoretical Biology at Princeton, and on MacArthur's untimely death was appointed to his Chair in 1973.

He began to forge strong links with a number of ecologists in the UK and would visit regularly to collaborate on problems posed in ecology and in practical applications in disease control.

From Princeton, Lord May moved to the UK in 1988 and took up positions at both Oxford and Imperial College. He met regularly with academics from both universities, as well as academics like myself working at the UK's northern universities.

In 1995 he was then appointed as the UK Government's Chief Scientific Advisor, where he reported to the Prime Minister for five years – a position I would take up myself in 2008. On leaving he was elected President of the Royal Society and was awarded a knighthood and later a peerage as Lord May of Oxford.

Of particular relevance to ZSL was his work on the wave of extinctions that were being driven by humanity, his mathematical characterisation of the problem is still much-used and quoted today.

In today's COVID-19 threatened world, his work with Roy Anderson is hugely relevant to the situation we find ourselves in now. Their work together is a stunning achievement that sets out the fundamental framework for disease analysis. It is the underlying basis of much of today's investigations.

Lord May was an inveterate walker who took to exploring much of the UK and, later, Europe. Accompanied by a group of mainly ecologists, he took in Snowdonia, the Three Peaks in Yorkshire, the Lake District, Scotland, the Alps and the Dolomites. His walking style, as in many other facets of his life, was highly competitive, so also was the conversation in various drinking holes afterwards. I reflected recently that all those on the early walks became Fellows of the Royal Society. No causal link is claimed.

Other commentators have referred at various levels of delicacy to his Australian style of conversation, certainly true, but he was also exceptionally kind and many students and young scientists benefitted from his help and mentoring.

His tragic death has left a major gap in the lives of those of us who knew him well, we miss his no-nonsense style of discussion, his kindness and his formidable intellect. **TZ**

THIRD OF FRESHWATER MOLLUSCS AT RISK

First global study identifies pollution and habitat modification as key factors

COMPILING an accurate Red List Index for an entire animal group offers an opportunity to understand how the group is faring globally. However, for species-rich animal groups like the freshwater molluscs, with over 6,000 known species, a Sampled Red List Index is a more efficient way of gaining insight. Using a sample of 1,500 freshwater mollusc species, ZSL has published the first global assessment of freshwater molluscs.

The study found that a third of freshwater molluscs – a group that includes snails and mussels – are under threat, particularly in eastern North America, Europe and Australasia. For example, the endangered freshwater pearl mussel (*Margaritifera margaritifera*), a species occurring in the UK and Europe, has seen declines throughout its range, particularly in Europe.

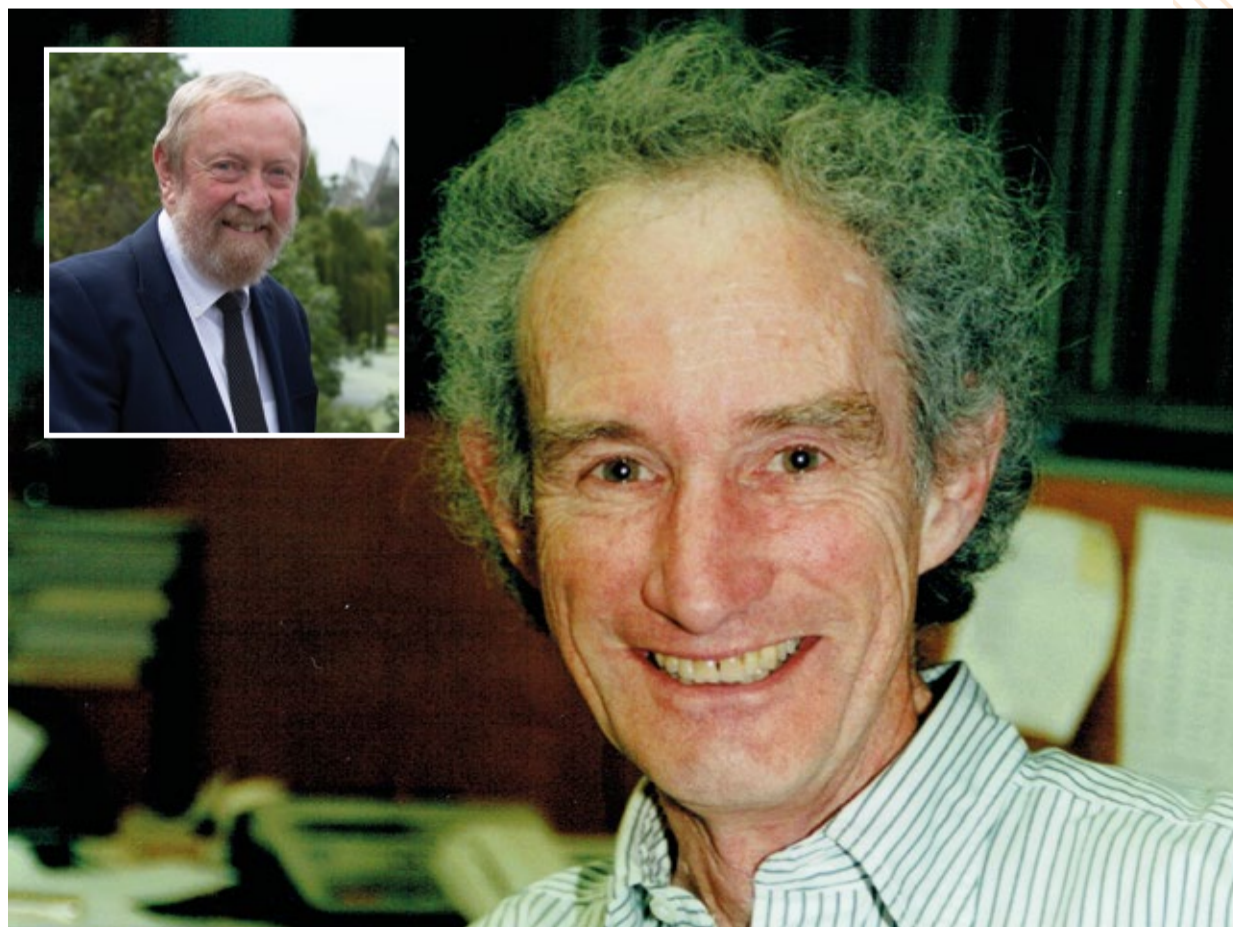
But that might not be the full story, explains Monika Böhm, Research Fellow at ZSL's Institute of Zoology. "We know much less about species in Asia or South America," she says. "They may be facing similar threats, and I hope that we can fill those data gaps in the next assessment."

The Sampled Red List also points to habitat modification, through dams and water abstraction, and pollution as the two biggest threats facing freshwater molluscs. Invasive species, urbanisation and energy production are also playing a major part. "Freshwater habitats are extremely complex, and highly interlinked. Rivers act like highways for pollution and invasive species, while the many species that are restricted to small ponds or single lakes are very vulnerable to change." Climate change does not feature quite as much yet, says Monika, but is likely to play a bigger part in the future.

"Molluscs are incredibly important for freshwater habitats. They filter vast amounts of water through their bodies, aid nutrient cycling and support a great number of other species. Some mollusc species are also an important food source for many people.

"Of the 1,500 freshwater mollusc species we studied, 26 were already found to be extinct. A further 20, classified as Critically Endangered, were flagged as possibly extinct. We will continue to lose species at an alarming rate and, ultimately, we might approach a point of no return for some freshwater habitats.

"Freshwater habitats are being hammered quite comprehensively, and the *Living Planet Report* we publish with WWF has been reporting a terrifying decline in freshwater biodiversity since 1970. Given that we as a species rely on healthy freshwater systems, we must take action to protect them now," concludes Monika. **TZ**



Lord Robert May of Oxford, ZSL Fellow. Inset: Professor Sir John Beddington, ZSL President

MONGOLIA'S LAST WILD CAMELS

Camera trap study finds Bactrian camels may be in decline

IN southwestern Mongolia, near the border with China, lies the Great Gobi A Strictly Protected Area (GGASPA). Covering 46,000km² of Gobi steppe, this vast and inhospitable landscape is the last hope for one of the rarest large animals in the world – critically endangered Bactrian camels (*Camelus ferus*).

Wild camels were once common across Central Asia but now fewer than 1,000 remain, surviving only in GGASPA and pockets of northern China. The sad truth revealed by ZSL's recent camera trap study, is that they're getting even rarer.

"We expected to find more. The 180 individuals we recorded isn't many given that this is likely the largest surviving population of the world's last wild camels," says Dr Tungalag Ulambayar, ZSL Mongolia Country Director. "While 180 might sound like quite a lot, a similar ZSL survey in 2014 found more than twice that number, estimating between 400 and 500 lived here at the time."

ZSL's research shows they still face many threats. The wild camels are displaced from grazing lands by livestock and becoming mixed with domestic camels. They are also suffering as a result of climate change. As temperatures increase the desert steppe becomes even drier, making grazing more difficult, and reducing the number

of water holes. With fewer places for animals to drink, the camels are forced to risk their lives travelling large distances and can no longer avoid predators. Young calves are particularly vulnerable to wolves.

Studying so few animals in such a huge area is challenging to say the least. "Over the past two years we deployed camera traps at random points throughout the protected area, as well as around water holes and along the border," says Munkhzul Tserendorj, ZSL Mongolia Conservation Biologist. "A few were damaged by animals and a couple were stolen, but we managed to survey 260 different locations. We wanted to find out how many camels there were, whether they cross into China, and identify the main threats to wildlife in the Gobi. Camera traps were the only option."

It was painstaking work. With special expeditions needed to change the memory cards, and with support from National Geographic Society, Gaia Nature Fund and ZSL's EDGE of Existence programme, the team collected a total of 951,684 images. Following months of analysis, they identified the 180 individual wild camels living alongside other species including Mongolian wild ass, black-tailed gazelles, wolves, lynx, and Gobi bears.



Mongolia's Bactrian camels (*Camelus ferus*) – which can be seen at ZSL Whipsnade and London Zoos – could be in decline

"The situation is very serious," adds Tungalag, "but there is hope. Through our community work we see that Gobi people are very proud of the wild camels and keen to work with us to save the 'desert ships', as Mongolians call them. The more we study the camels, and the more people we tell about them, the greater chance we can bring the species back from the brink of extinction." **TZ**

FAILURE TO HATCH

New research into bird reproduction

THE failure of some eggs to hatch is a natural part of reproduction for all bird species on every continent. On average, 10% of all bird eggs don't hatch, and it has often been assumed that failed eggs were infertile. But hatching failure becomes a far greater problem for threatened bird species, where failure rates can rise as high as 70%. New research conducted by ZSL's Institute of Zoology could shed fresh light on the poorly understood phenomenon.

"Using a technique of fluorescent microscopy, we can examine the yolk of an unhatched egg, even if it has become degraded, and learn what is driving

egg-hatching failure," says PhD Researcher Ashleigh Marshall. "If the eggs are assumed to be infertile it's common to blame the male – assuming they are not producing healthy sperm or not copulating properly – and separate the pair.

"But separation won't work if the problem isn't fertility, and can have a big impact on the behaviour of birds, particularly those who breed in the same pair for life. The method we use allows us to work out whether an unhatched egg is truly infertile or if it has actually suffered early embryo mortality. Identifying other causes, like unsuccessful incubation, behavioural problems or

genetic incompatibility, allow us to suggest ways to improve the egg hatching rate."

The applications for the research could be huge for conservation breeding of threatened birds, says Ashleigh. "If we can give more accurate information to the curator or the project manager, we can help zoos breed healthier populations, and contribute greater numbers of birds to recovery programmes."

Ashleigh is already working alongside ZSL's Curator of Birds, Gary Ward, to investigate hatching failure in ZSL's Zoos. Unusually for zoos, both Whipsnade and London post-mortem eggs that do not hatch – providing Ashleigh with a huge amount of data to investigate.

She has also been to New Zealand to apply the new method to the critically endangered kakī (*Himantopus novaezelandiae*) – the world's rarest wading bird. The kakī has recovered from 23 adult birds in 1981 to 169 adults today, but the population remains on a knife edge. Early indications are that the problem could be genetic.

"Around 20-25% of kakī eggs fail to hatch when artificially incubated," says Ashleigh. "But during the field season I was there, I found that infertility was not the issue with 99% of the eggs that did not hatch – suggesting it could be a lack of genetic diversity or a problem with incubation."

Long-term, Ashleigh's aim is to build a set of protocols for investigating egg-hatching failure, that will then inform conservation breeding. "If we can improve hatching rates and get more chicks into the population in the first place, that could be a big step for birds like the kakī." **TZ**



Research into egg-hatching failure could be game-changing for species like the kakī (*Himantopus novaezelandiae*)

A PERFECT STORM

Pollutants impacting the development of porpoises in UK waters

THE continued pollution of the UK's waters by polychlorinated biphenyls (PCBs), banned in 1989, could be having a greater effect on marine mammals than first understood, according to new research from ZSL. A study into young harbour porpoises (*Phocoena phocoena*) found that PCBs transferred via their mothers' milk could be affecting their brain development at an early age.



PCBs could be impacting harbour porpoise (*Phocoena phocoena*) young at an early age

"PCBs are a collection of 209 different chemicals, each with their own biological effects," says Rosie Williams, PhD Researcher at ZSL's Institute of Zoology. "Our findings suggest the milk of nursing harbour porpoise mothers contains a higher proportion of the PCBs known to impact brain development, hormones and intelligence."

PCBs have also been shown to impact the immune system in marine mammals, and were linked by another ZSL study to higher parasitic loads in harbour porpoises. "For each milligram of PCB [per kilogram of blubber], we estimated a 5% increase of risk of death by infectious diseases," says Rosie. "The average UK harbour porpoise currently faces a 41% increased risk of death by infectious disease. In 2016, we found a harbour porpoise so contaminated by PCBs its risk of mortality by infectious disease had risen by 900%."

The concern now is that many European countries could fall short of their 2025 commitment to dispose of PCBs, agreed at the 1989 Stockholm Convention, and that the chemicals will continue to impact marine life. In 2015, the UN estimated that, globally, 14 million tonnes of PCBs still required disposal. "They are still in use, even in the UK, in energy networks and buildings," says Rosie. "PCBs exist within electrical transformers, manufacturing

equipment and sealants, and if equipment isn't disposed of properly when it reaches its end of life then the chemicals can leak into the environment."

Harbour porpoises are the UK's most common cetacean and, despite facing a number of anthropogenic pressures, latest estimates suggest the population is steady. But Rosie studies them as a proxy for species with fewer numbers, where the impact of the neurotoxins on developing young could be far more critical.

"Common dolphins are under a huge amount of bycatch pressure in Europe, for example. Meanwhile, our resident killer whales have been reduced to one pod of eight individuals, living off Scotland's west coast. These populations, already heavily impacted by other anthropogenic pressures, are put at even greater risk by PCBs."

"It is a perfect storm of threats – bycatch, noise disturbance, climate change, massively reduced prey – and the impact of PCBs on their immune systems and the health of their young could stop any chance they have to recover."

"The Stockholm Convention was a great achievement," adds Rosie. "But we are losing momentum, and the UK is forfeiting the ability to lobby other nations to take action when our own back garden isn't clean." **TZ**

BEAVERING AWAY

ZSL vets helping to safely reintroduce nature's ecosystem engineers

AVITAL disease risk analysis has been conducted on populations of European beavers (*Castor fiber*) by ZSL's vets as part of nationwide plans to reintroduce the iconic native species to England.

Following an unofficial release of the mammals in Devon, Natural England commissioned a report to assess the beaver's impact and sought support from ZSL's Disease Risk Analysis and Health Surveillance (DRAHS) team. The DRAHS team is responsible for identifying the disease risks of rewilding beavers in England – a project made more complex because 78 different disease hazards have had to be considered.

"Protecting the health of both the animals being reintroduced and existing wildlife at the reintroduction site is DRAHS' role, and the marker of any successful reintroduction project," says Dr Helen Donald, a ZSL wildlife vet.

Famed for their impressive construction abilities, beavers are considered ecosystem engineers. Their dams create habitats for other species, reduce flooding and can even improve water quality. Hunted to extinction in England in the 16th century, there is an eagerness among many to see the herbivores thriving in the English countryside once again. This enthusiasm has, however, led to some unregulated reintroductions taking place;

occurrences the DRAHS team are keen to avoid repeating because of the risk of disease.

"One of the first steps is comparing the disease risks of bringing beavers from the continent, Norway, with translocating beavers from Scotland to England. We endeavour to mitigate the effects of parasites that could present a risk to local wildlife or people if reintroduction happens," says Helen.

There is uncertainty about the exact origin of some of the beavers that have already been released in the UK – for example, it's not known if they came into contact with exotic species, or introduced exotic parasites – so the team are prioritising disease surveillance. They plan to conduct post-mortem examinations of individuals to gain an insight into the health status of the existing populations. Looking for evidence of parasites will help the team to advise on reintroduction strategy and assess the risk from existing populations.

It's known that beavers are particularly susceptible to stress – seven of the 14 disease hazards assessed of highest risk were linked to stress – and that high stress levels can increase their vulnerability to disease. Consequently, mitigation of stressors will need to be a particular focus of DRAHS if translocation proceeds.

"Moving wild animals is always complex, but the more we know and plan for, the greater



ZSL is part of plans to reintroduce the European beaver (*Castor fiber*) to the UK

the likelihood of a successful reintroduction," concludes Helen. "Our work doesn't end there though – after a reintroduction we continue to monitor animals and habitat to try to ensure it's a healthy, sustainable population that will thrive for years to come. I can't wait to see what the future holds for the European beaver."

Visit zsl.org/DRAHS to learn more about ZSL's health surveillance work. **TZ**



The successful hihi (*Notiomystis cincta*) reintroduction programme has proved a model for other species



John Ewen, Senior Research Fellow, ZSL's Institute of Zoology

SCIENTISTS' CORNER

Q&A with John Ewen

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JOHN Ewen is a Senior Research Fellow at ZSL's Institute of Zoology. Part of the IUCN's Conservation Translocation Specialist Group, and Chair of the Hihi Recovery Group, John specialises in small population recovery and works across a broad range of species around the world.

TZ: What goes into a successful translocation?

JE: The most successful translocation projects are the ones in which science is embedded in the management of that species from the start. In the case of the hihi (*Notiomystis cincta*), a colourful passerine from New Zealand, the Institute has been working with our partners there since 2004. We use an adaptive management process, which means we model the populations' demography before each release and then monitor the birds in their new habitat. The monitoring data updates our knowledge, informs whether management needs to change and improves our ability to select future translocation sites. The hihi programme is hugely successful and is frequently used as an example in the training we provide through the IUCN to conservation translocation practitioners. From just one tiny population on an off-shore island, the hihi have returned to seven reintroduction sites – most recently, the Auckland mainland.

TZ: How can we minimise the risks involved in translocations?

JE: One of the most important things in any recovery programme is to acknowledge our own biases, and build in ways to mitigate these. Working with rare animals is tricky, not least because they often come with a lot of unknowns. They inspire incredibly passionate beliefs and carry a huge amount of risk due to uncertainty in the outcomes from any interventions. We can confront these challenges using decision-support tools. This includes being up-front about our species recovery objectives (things we care about). It may sound

strange, but only one of the objectives in any translocation will be the recovery of that species. Other objectives may include wider ecosystem impacts (like causing disease in other species), protecting the rights of indigenous people or mitigating human-wildlife conflict. If we decide recovery actions based only on the species, and ignore the other important things we care about, we will likely make a poor decision that could actually do more harm than good for a species.

TZ: What techniques can we use to predict how a species will behave?

JE: With rare species, or animals that are already Extinct in the Wild, there is often very little available data to inform our decisions. We frequently draw on the knowledge of experts, or another option is to use surrogates – trial methods with a common species before using rarer ones. Drawing on all of the available knowledge we can will help us to make the best decision under uncertainty and to learn while doing so; this is adaptive management. There will always be uncertainty, so we need to work with it!

TZ: Are reintroductions and translocations increasingly common?

JE: Absolutely. Climate change and invasive species are making existing habitat unsuitable for many species, and rewilding is becoming progressively popular, so the need to move animals is only going to increase. Islands are often at greatest risk, and are home to unique species, so once a home becomes uninhabitable we have to look at new islands. This is exactly what we are doing with the extinct-in-the-wild Guam kingfisher, or sihek (*Todiramphus cinnamominus*). Its home is currently not suitable because of invasive tree snakes, so we are working with partners to find alternative islands without impacting the species already living there. **TZ**

Climate change and invasive species are making existing habitat unsuitable for many species, so the need to move animals is only going to increase

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