BIAZA

BRITISH & IRISH ASSOCIATION OF ZOOS & AQUARIUMS

BIAZA

CREATURES UNSEEN

Booklet

British and Irish Association of Zoos and Aquariums 2023

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Contents

Introduction | BIAZA 4

Civets, consumers, and conservation | Jes Hooper, The Civet Project Foundation 6

How can such a mega bat go so unseen? | Lucy Edwards, Northumberland Zoo 9

Meet the cloud rats! | Sophie Sharman Frost, Moulton College 11

Recognition for the little fish! | Rachel Gordon, St Andrews Aquarium 13

The new slow lorises | Professor Anna Nekaris, Little Fireface Project 16

The mighty mouse | Peter Watson, Chester Zoo 20

Tropical World and zookeeping for nocturnal life | Abigail Hardwick, Tropical World 22

Hot mammals and the cold reality of arboreal nocturnal surveys | Trevor Hughes, CREA 23

Save our hedgehogs | Lucy Hodges, SWCC Hedgehog Hospital 26

Earth aglow | Maria Carbin, BIAZA 28

Lakeland Wildlife Oasis' blind cavefish navigate by their lateral line to detect changes in water pressure.

INTRODUCTION

Why BIAZA is illuminating the world of 'Creatures Unseen'

When the sun goes down, the world is theirs.

Nocturnal species dominate half the Earth's daily cycle. A third of all vertebrates and two thirds of invertebrates are either fully or partially nocturnal - and yet they remain hidden and relatively unknown to so many of us. Zoos and aquariums play an important role in bringing these species into the limelight to garner fascination towards them, permit vital research, and protect species whose wild night-time niches are fast disappearing.

When we think of quintessential nocturnal animals we think of owls, bats and rodents. These are all fantastic animals with their own 'unknowns' and threats, but the wonderful thing about 'Creatures Unseen' is that it can encompass any taxa. And not necessarily just the nocturnal species, too. Hidden animals could include those which live in caves, in the depths of the ocean, underground, are miniscule, or simply overlooked.

We're (sadly) unable to cover everything in this booklet, but hopefully we can spread the message that zoos/aquariums aren't just about the big cats, the primates, and the turtles (lovely as they are).

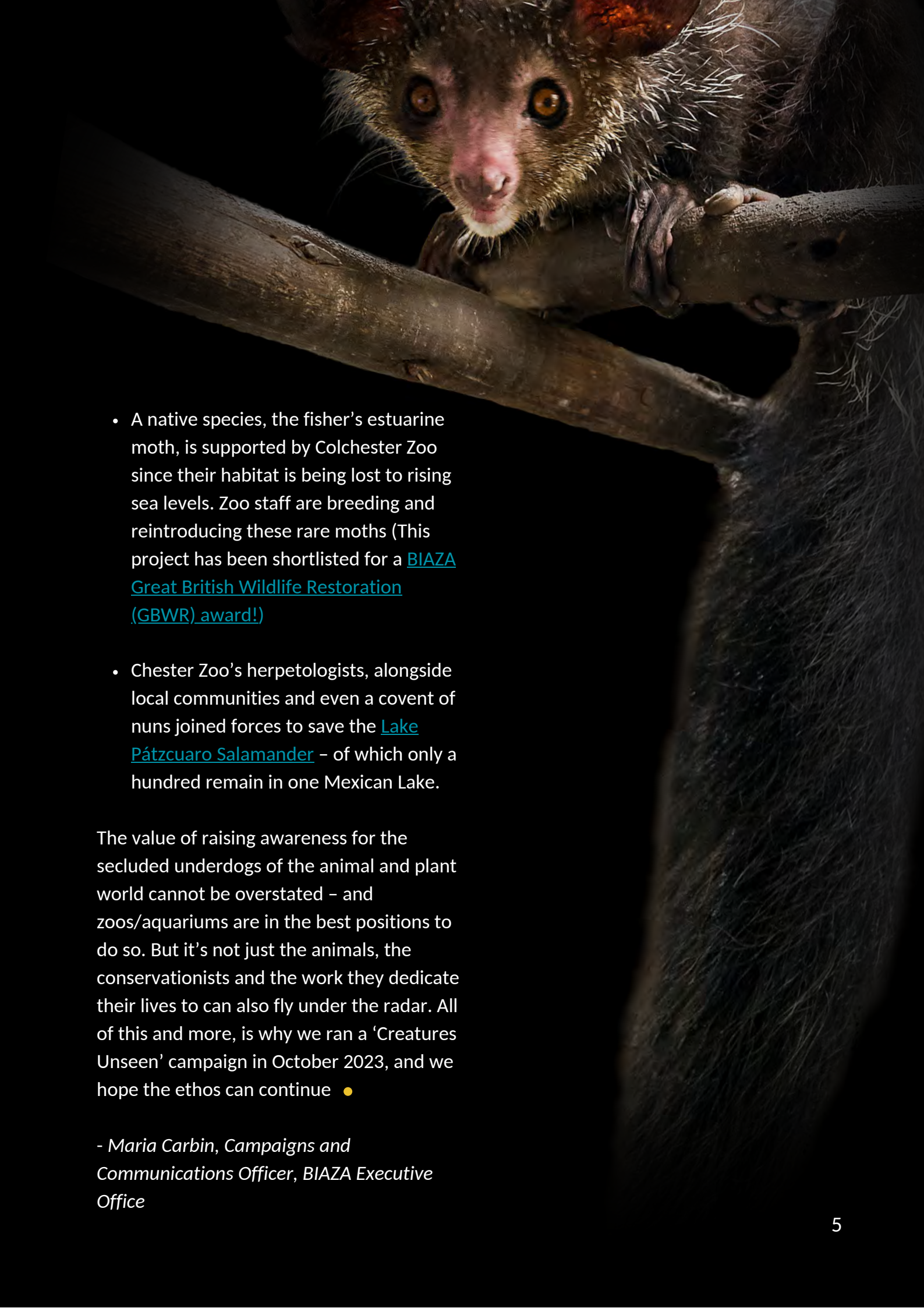
Creatures Unseen and this series of articles can also serve as a springboard for people in the sector to share their own passion for 'overlooked' animals in their care. The theme of zoos/aquariums being depositories of education on all taxa ought to be continual.

Below are just a few of the many, many ways zoos are supporting the 'unknowns' and night-time dwellers of the animal kingdom:

- The Hawk Conservancy Trust has been creating over a thousand nest boxes for native bird species including barn owls, little owls and tawny owls. This combines with research on how they nest in these boxes, so we can better learn how to protect them from decline.

- Dublin Zoo received aye-ayes from Bristol Zoo this year, continuing support for this enigmatic Endangered species. Dublin Zoo also supports lemur conservation out in Madagascar ▶

Header image: The Hawk Conservancy Trust's Raptor Box Project



- A native species, the fisher's estuarine moth, is supported by Colchester Zoo since their habitat is being lost to rising sea levels. Zoo staff are breeding and reintroducing these rare moths (This project has been shortlisted for a BIAZA Great British Wildlife Restoration (GBWR) award!)

- Chester Zoo's herpetologists, alongside local communities and even a covent of nuns joined forces to save the Lake Pátzcuaro Salamander – of which only a hundred remain in one Mexican Lake.

The value of raising awareness for the secluded underdogs of the animal and plant world cannot be overstated – and zoos/aquariums are in the best positions to do so. But it's not just the animals, the conservationists and the work they dedicate their lives to can also fly under the radar. All of this and more, is why we ran a 'Creatures Unseen' campaign in October 2023, and we hope the ethos can continue

- Maria Carbin, Campaigns and Communications Officer, BIAZA Executive Office

The Civet Project

CIVETS, CONSUMERS, AND CONSERVATION

Could zoos disrupt civet coffee consumer demand?

***"What are civets?"* This is the question that so frequently follows the answer to the first question: *"what is your PhD research about?"* I almost always give the same answer, that civets are the animals who are famous for creating civet-coffee, the coffee that comes from civet poop. And, as if on cue, I'm then met with generous nods and comments concerning the novelty of civet coffee and its acclaim as the most expensive, rare, and unique coffee in the world. Yet civets are so much more than civet coffee, and civet coffee is so much less unique or rare than you might think.**

Civets belong to the family "Viverridae", an ancient line of Feliformia or "cat-like" animals, found in Africa and Asia. Whilst they look like cats, however, Viverrids have specialist adaptations that set them apart. Most Viverrids have longer muzzles, they have tufts of whiskers that run along the lower jaw, they have shorter legs, and five toes on their hind feet. Viverrids also have less developed carnassial teeth than cats as they are not obligate carnivores and so have not developed the same dentition to shred meat. In fact, it is their varied diets that led to the discovery of civet coffee.

I find it interesting how most people can recognise civets, but only in reference to the coffee they are so famously associated with. Why is this? Well, civets and their Viverrid relatives (genets, oyans, linsang, and binturong) are highly elusive. They are nocturnal, secretive, and solitary. Many Viverrid species are also arboreal and so spend most of their time concealed from view high up in the forest canopy. In short, it's difficult to spot civets in the wild, and even more difficult to study them. Many species of civets are considered to be common. As such, few zoos house them and they receive little in-situ focus. Scientific knowledge is, therefore, somewhat lacking for civets compared to other carnivores. In effect, the most common way people will see civets is in the adverts of civet coffee ▶

Civet coffee beans

Civet coffee is coffee that has passed through the digestive tract of civets. Their specialised digestive enzymes are said to strip the coffee cherry of protein, creating a smoother (albeit less caffeinated!) coffee. A laboratory study of civet coffee in 2004 found that civet coffee was structurally unique to non-digested varieties. It had tiny, microscopic holes ("micro-pitting") that scientists theorised was from the process of enzymatic protein extraction. However, this research has since been contested based on dubious methods and unreliable sourcing of the coffee. The coffee that was tested in 2004 may have never even seen a civet! Even more shocking, the same methods applied to coffee that had been digested by humans found the same characteristic micro-pitting as found in civet coffee- based on these findings, even humans can create poop coffee with the same properties as civet coffee. Maybe civet coffee isn't unique after all!

Poster by the Civet Project Foundation [download link]

Civet coffee certainly isn't rare. It is now produced on an industrial scale across southeast Asia. Civets are captured from the wild, caged, and force-fed coffee in a bid to meet rising consumer demand. Whilst the animal welfare implications of civet coffee are well documented, the scale of the industry is now also having dire consequences for wild populations. Harvesting quotas go ignored, legal civet coffee farms are used as cover for smuggling endangered civet species, and capture methods often include indiscriminate snaring that impacts wide varieties of animal taxa.

With the civet coffee industry expected to reach a market worth of $10billion US dollars by 2030, the industry shows no signs of slowing and so immeasurable numbers of animals and their habitats will continue to be impacted. Public education is therefore key. By sharing the message of civet protection, we can begin to disrupt the consumer demand for caged civet coffee.

Zoos offer an ideal platform for civet-focussed education initiatives. BIAZA zoos alone, hold 72 Viverrid individuals, each one offering the opportunity for enhanced educational messaging about civet coffee, ethical consumerism, and civet conservation[1].

Zoos have already been instrumental in the promotion of ethical, pro-conservation, consumerism. For example, zoos have an excellent track record for promoting sustainable palm oil and smartphone/coltan recycling, both of which engage zoo visitors and inform them of the tangible ways that their own consumer behaviour can make a real-world difference for animals ▶

Newquay Zoo - Owston's civet 'Bao'

Whilst many civet species are currently listed as Least Concern by the IUCN, we know that the vast majority of these are experiencing declining populations, and civet coffee is certainly contributing. If we begin to raise awareness of their threats now, then we will be best positioned to protect civet species from needing to be reclassified as *Vulnerable* to extinction.

If more zoos were to act now and integrate civet coffee education into their zoo-based education strategies, then we might just prompt the end of caged civet coffee farming. By doing so, we might help people better recognise civets as the illusive, mysterious, and interesting species they are. We might help move the conversation from coffee, towards the ancient family of small carnivores that are so much more than the coffee picked from their poop ●

About the Author:

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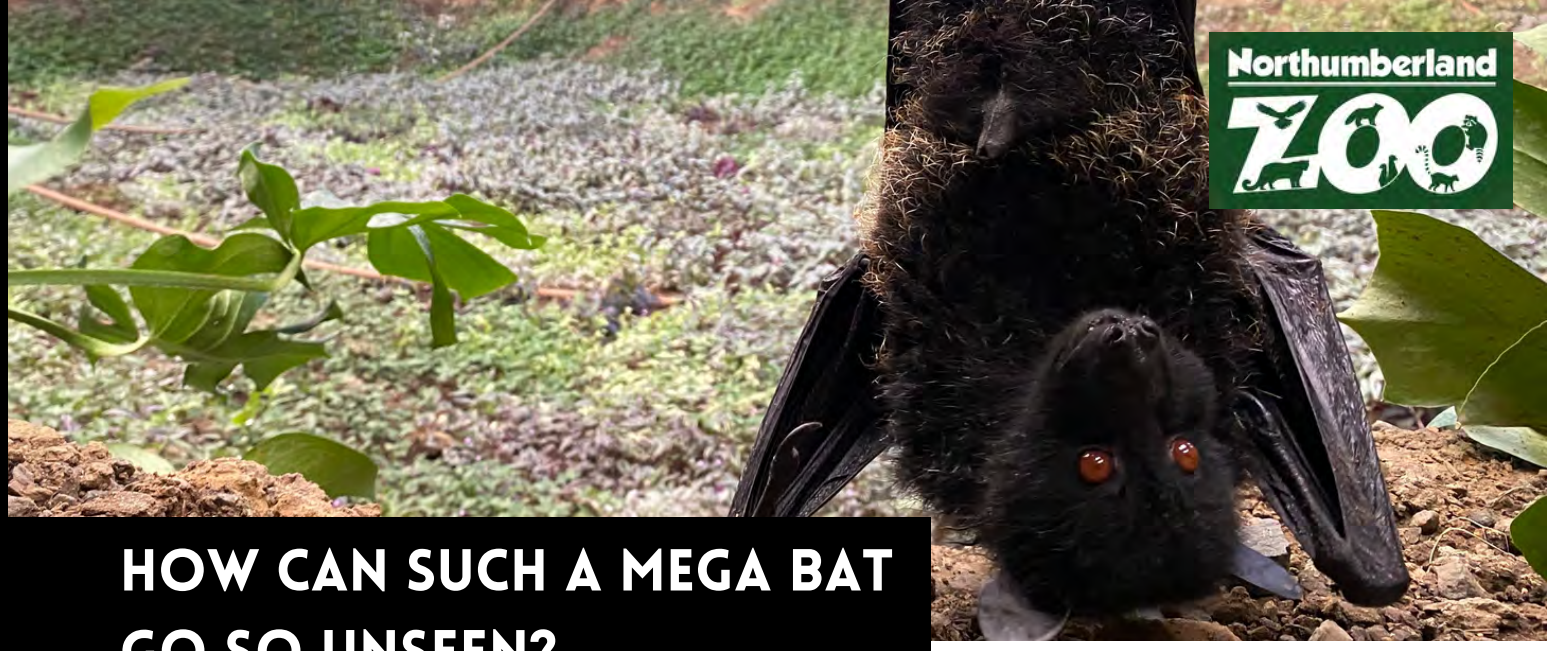
[1] ZIMS Species Holdings. Species360 Zoological Information Management System. Available online: https://species360.org/ (accessed on 18 April 2023).



HOW CAN SUCH A MEGA BAT GO SO UNSEEN?

Livingstone's fruit bats are the third largest bat in the world, found on two of the Comoros islands, just off of Madagascar. They are classed as Critically Endangered and are in fact the most endangered bat in the world for reasons related to climate change and habitat destruction.

The Comoros islands are not exactly a popular holiday destination and with so few numbers, these bats are rarely seen in the wild. Zoos can play a part in allowing visitors to experience species they may not necessarily have the opportunity to see in the wild and to raise much needed awareness and fundraising for conservation.

There are just three zoos that hold Livingstone's fruit bats; Jersey Zoo, Biotropica and Northumberland Zoo, so it is a very unique animal to see and for the most part goes 'unseen.'

It's quite common for zoos to house bats in nocturnal exhibits, which makes sense for some species as they are actually nocturnal. However, mega fruit bats are active during the day too, making them much easier to see.

In all three zoos that house Livingstone's fruit bats, they are exhibited in diurnal, tropical house style exhibits, as this highlights the species in a natural setting that allows them to fly around, wing walk and roost. Visitors can appreciate these wonderful animals and observe their stunning size, beauty - and let's face it, cuteness.

Fruit bats are one of my favourite animals to talk to visitors about because not only are they incredibly interesting animals but the public opinion of bats is often that they will suck your blood or get caught in your hair - thanks Bram Stoker!

Lucy Edwards, Curator at Northumberland Zoo

When visitors enter the fruit bat house, they can often be a little anxious about what they are going to experience and are also a little put off by the smell. As soon as they see the sweet, fox-like faces of the bats and feel the draft from their huge wings, their opinion quickly changes and the smell is soon forgotten.

They begin to take more of an interest and find themselves asking more and more questions about the bats, taking note of the interpretation & giving us the perfect opportunity to raise awareness. Everyone leaves the fruit bat house more excited by a species that often goes unseen. How brilliant is that?!

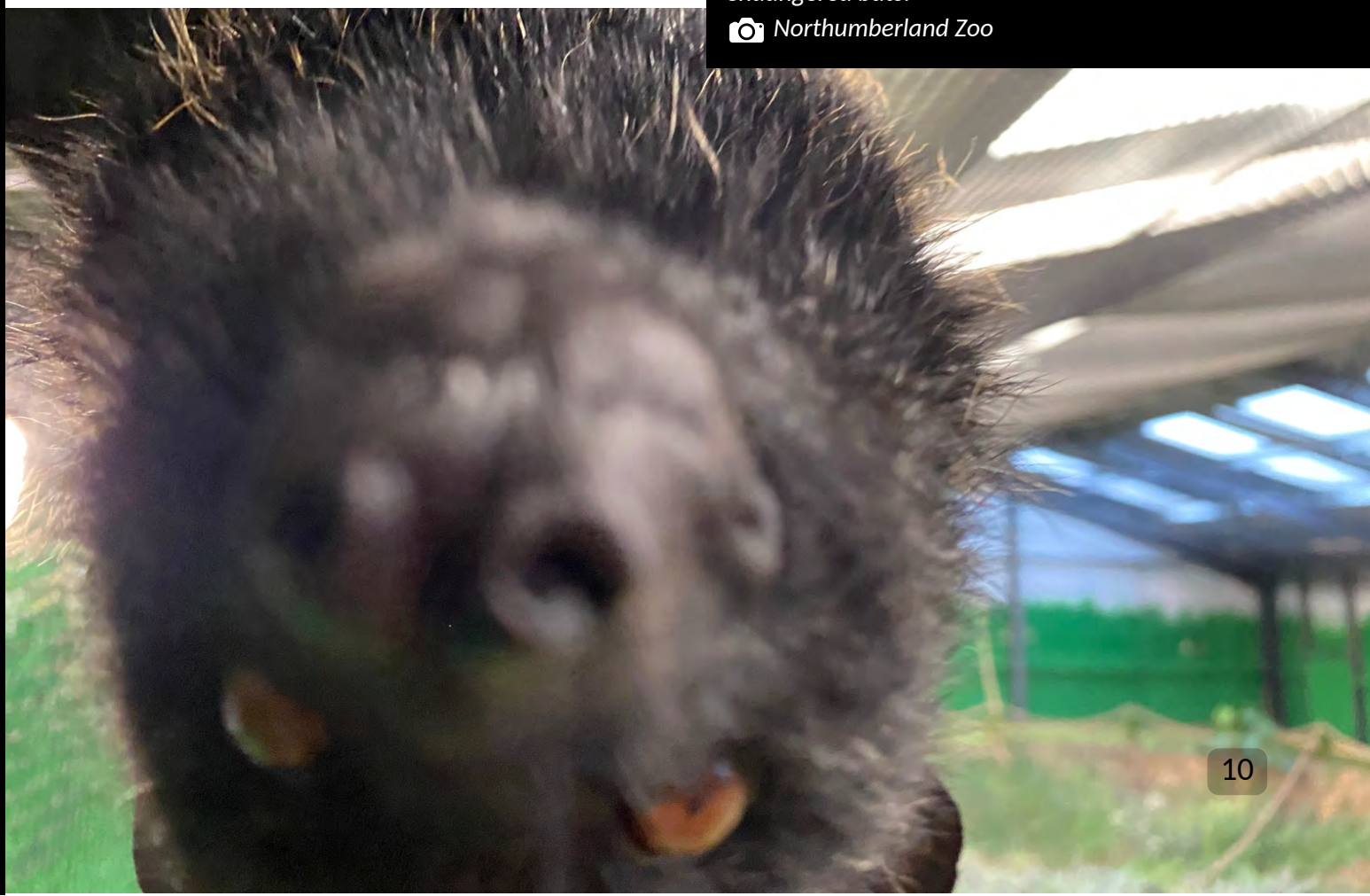
The fruit bats are also very inquisitive animals and have big characters. As keepers, we get to experience their personalities up close, very close on occasion.

One of our boys, Acer, is a bit of an attention seeker and it is not unknown for him to land on you and hitch a ride on your back. Visitors also get to experience the bats inquisitiveness as the viewing area has an open outlook into the bat house where they can fly over or wing walk on the netting directly in front of the public.

Currently this species is going very much unseen but we hope that with more visitors having the opportunity to see these incredible animals up close and with the successful conservation work taking place in the wild, this species will no longer be unseen

- Lucy Edwards, Curator at Northumberland Zoo

Livingstone's fruit bats - one of the world's most endangered bats.
Northumberland Zoo



MEET THE CLOUD RATS!

For over 15 years I have been able to work with a selection of nocturnal mammals, this has included rats, sugar gliders, chinchillas and an Asian Palm Civet but this last couple of years have given me so much joy as a keeper where we introduced the Northern Luzon Giant Cloud rat to the collection, within a college setting. Being an unusual rodent, we were keen to house this fascinating species which are rarely seen in UK collections and are happy to share our knowledge with our student body.

In 2021 we collected our first Northern Luzon Giant cloud rat named Haggis and closely followed by a second called Thistle. Although I had encountered and worked with some large rodents before, I can only describe the pair as huge, fluffy, cute, chewers, who greeted us with a growl.

This species is endemic to the island of Luzon in the Philippines, where they spend most of their time in the canopy. Here we provide them with two large enclosures within our nocturnal centre, this is where the light cycle is switched in reverse. With this adaptation to their light cycle, we have been able to see and monitor behaviours whilst they are awake and more active.

Being around 2.5kg in weight we give them multiple fixed branches for them to explore, moving on all fours and even using their strong limbs and hands to hold branches upside down or hanging down to reach browse and other tasty treats. They receive a mixed diet of browse, leafy greens and a specialist diet called leaf eater. Spending most of their time up high in the trees we provide them with browse, they particularly love Bamboo and Hornbeam. They will spend time chewing the small stems and eating their leaves.

During December of 2022 we began to see mating from the pair and have since had one young born at the centre at the start of the Summer. During this time the Female spent a considerable amount of time collecting leafy browse and taking it into the nest box leading up to the baby's arrival ▶

Luzon Island, Philippines

After a gestation of approx. 65 days, one youngster was born and we found mum and baby in the nest box, baby feeding and Haggis cleaning them.

As a small family group, they come together during feed time and move from each area to rest, groom, explore and socialise with each other. With little grunts and growls they communicated to each other, and Thistle gives us a growl in the morning to greet us, eagerly waiting for breakfast.

Being a strict hands-off animal, our students learn how to work closely with this species at a suitable distance. Students are able to service our animals throughout the day where they change waters, feed using different suitable enrichment devices within the canopy area to replicate natural foraging behaviours and skip waste products from around the enclosure. Learning how to identify suitable browse, learning about their origin, natural habitat and behaviours and how we can replicate and enhance that within a captive environment.

We use different training aids and methods to allow the animals to move around the enclosure freely which then allows us to ensure we are able to maintain regular weigh ins, to ensure the group are in tip top condition, here we use a hatch to separate the individuals from us where they walk to scales and we present a small treat item for their successful weigh in.

We are now eagerly waiting to be able to sex our youngster with our exotic's vet so we can give them an official name! ●

- Sophie Sharman Frost, Animal Keeper - Industry Skills Supervisor at Moulton College

RECOGNITION FOR THE LITTLE FISH!

The Twig Catfish is popular both within the pet trade and the aquarium industry. The species makes for a very popular ornamental fish but being an exotic fish found in the amazon river basin, they are also popular to house in many aquariums. However, in my experience, they are often overlooked by the casual aquarium visitors.

The twig catfish therefore makes for an interesting species to shed light on during the “Creatures Unseen” campaign. The twig catfish, although not nocturnal, displays an incredible ability to camouflage into submerged foliage. However, in an aquarium setting with food provided and the removal of predation the twig catfish will show some level of activity and yet still appear to be bypassed by many visitors.

It could be argued that the hidden nature of this fish causes visitors to take less time over their display. However, in my experience many visitors would spend larger periods of time searching for better-known animals such as the Chameleon or the Marmosets, but this does not seem to be the case for lesser-known animals, such as the Twig Catfish.

It is important to address that the position of a display in a facility will play a part in the level of visitor interaction. For example, our Twig Catfish are the initial display when entering the Amazon Area at St Andrews Aquarium, however they are followed by large tanks housing Giant Pacu and Red-Tailed Catfish, an obvious distraction. However, when watching customers interacting with the displays it appears that once absorbed by the larger animals, customers are unlikely to double back to the small tanks they missed to begin with.

On the surface this may seem unproblematic, but the “Creatures Unseen” campaign may help collections highlight gaps in education and conservation within their facility, prompting some to ask how much the smaller, hidden animals are benefiting from their current existence in collections if visitors are still passing them by?

In recent years the ability of zoos and aquariums to provide high quality education has become a huge priority. Notably, BIAZA itself has just made their conservation education documentation a policy for their members rather than guidelines to ensure this quality is being delivered (BIAZA, 2023) ▶

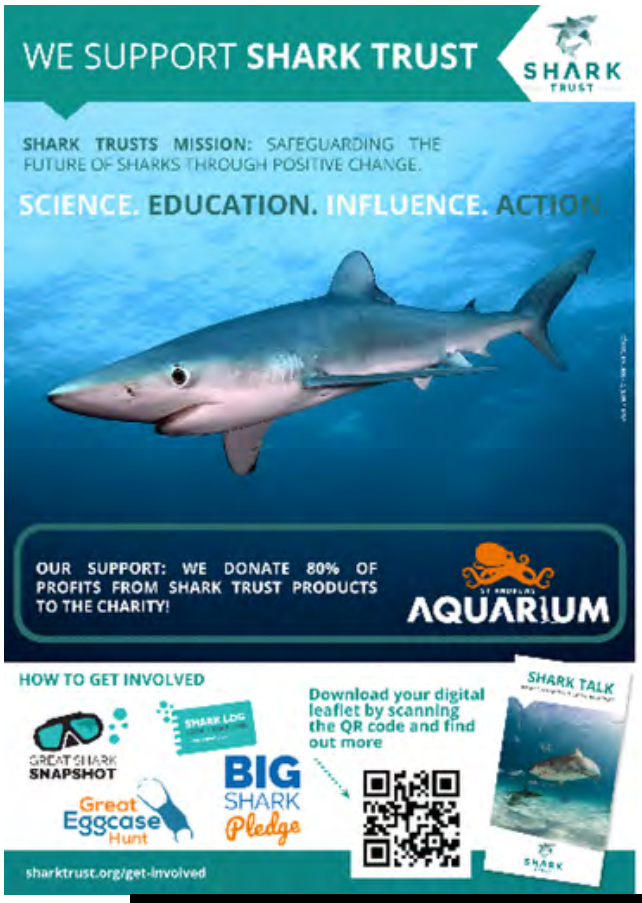
Conservation education is being implemented through a variety of strategies whether it's through school groups or interactive exhibits; visitor-led education, such as reading signage, will be limited by visitors themselves and often will be biased against smaller, hidden creatures, particularly those which are non-mammalian (Carr, 2016).

Many collections, in the strive for better conservation education, have already recognised this bias and are trying to rectify it. For example, at St Andrews Aquarium the "Adopt an Animal" packages were expanded to not only include the charismatic animals (seals and meerkats) but now include species such as the Golden Mantella frog, bringing attention to a "hidden" animal. In addition to bringing more attention to hidden animals, many collections have altered signage and lesson plans from a species-specific approach to an ecosystem-based approach, offering inclusive conservation messages for the large and small creatures (National Zoo Academy, 2022).

However, these changes and the "Creatures Unseen" campaign have further highlighted the lack of representation within the aquarium industry for smaller, hidden species, specifically fish species such as the Twig Catfish. Education touching on lesser-known fish species would typically occur though the previously mentioned formal education (lessons) or visitor-led education, which relies on visitors thoroughly reading all signage which is often not the case (Roe *et al*, 2014).

In terms of promoting conservation education to their general audience (i.e., not formal education), aquariums still seem to be catered towards larger, charismatic species or very broad topics. For example, the Shark Trust is a fantastic charity for aquariums to support and promote to their audience, particularly as the Starry Smooth hound is itself a "hidden" species, but the focus is still on large charismatic fish which most visitors would likely be familiar with to some extent (i.e., a "shark").

Additionally, campaigns such as "Which Fish?" provide comprehensive education on overfishing and simple advice to help visitors change their own behaviours, an essential component of conservation education, but this is a broad scale topic regarding overfishing ▶



A Shark Trust sign being displayed at St Andrews Aquarium, designed to be eye catching for visitors.

Upon investigation, there doesn't currently appear to be any campaigns or charities which are widely promoted within UK aquariums to their general visitors to support the lesser-known fish species. The Big Fish Campaign is important but focuses on hobbyists, the Which Fish? Campaign is vital but focuses on widely commercial species. The "Creatures Unseen" campaign seems to be a fantastic tool for aquariums to shed light on fish species, such as the Twig Catfish, which do not fit in with these other campaigns but that do still deserve recognition ●

- Rachel Gordon, Animal Keeper, St Andrews Aquarium

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Donovan Lewis - Blue Planet Aquarium

THE NEW SLOW LORISES

The 'decontextualisation' which threatens lorises, during the discovery of a new genus

Asia is home to several species of small, large eyed, slow moving, and unique primates – the lorises.

These tended to be divided into slender and slow lorises – the former sometimes endearingly named 'bananas on stilts', with the Sri Lankan northern grey form of the three species seen now and then in zoos.

The slow lorises have increased in notoriety in the last two decades. But, they're still under threat for a variety of reasons, ranging from extreme habitat loss to their hundreds of uses in Asian traditional medicines to a growing illegal pet trade, to their use as tourist photo prop. One would think that captive breeding programmes for these Endangered and Critically Endangered species would be well established.

Only one "species" however was relatively common in zoos – the pygmy loris – yet breeding has often been difficult, and numbers are declining. But as with many cryptic nocturnal animals, who do not rely on vision themselves to identify their own species, this most famous of the lorises was revealed in the last year to contain yet more "creatures unseen"!

In March 2023, along with a team of geneticists and loris researchers led by Mary Blair, I was one of a team to name a new species of pygmy loris. This research came on the tail of a paper from just one year before, where we provided substantial genetic, behavioural, and morphological evidence to show that pygmy lorises deserved to be in their own genus. We named this *Xanthonycticebus*, or the golden night monkey, reflecting the more yellowish and golden nature of the pygmy loris fur.

Also, it was exciting to have a genus that started with the letter X!

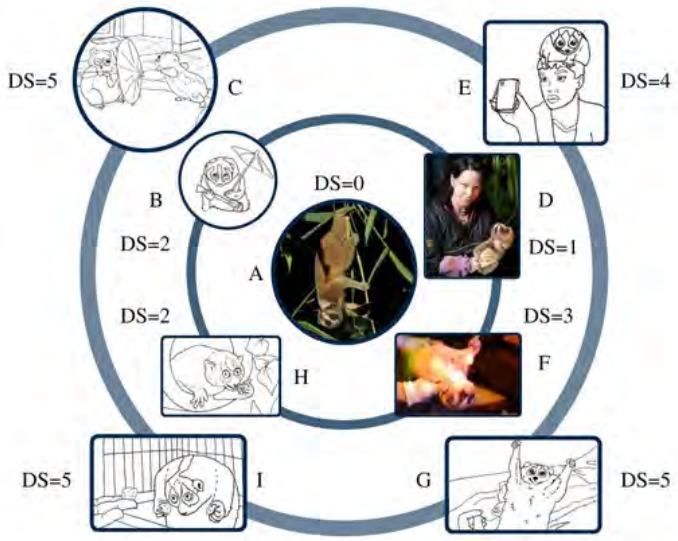
Interestingly, a main argument *against* the new genus, despite having separated some 11 million years from the other slow lorises, was a lack of desire for "monospecific" genera – or a genus containing a single species.

We already knew, however, that the work was being done to show the substantial differences between the Northern and Southern pygmy lorises. Indeed, during a field study of the Southern pygmy loris (which retains the name *X. pygmaeus*), ▶

- we sent photos of our study animals to researchers from Northern Vietnam, who said it did not look like any pygmy loris they had ever seen! Well, indeed they do not; *X. intermedius*, or the northern form, has often been distinguished as rounder, cuter, and having more substantial coat colour changes during the cold winter months.

I had come across these "round" pygmies before in discussion with wildlife traders in Japan, who reported that their clients only wanted to purchase the "cute" lorises (e.g., the Northern form) rather than the "dog-faced ugly ones" of the south! (see header image)

I do feel a bit guilty now that one of our study animals was even called Mr Ugly



Examples of levels of decontextualization - from Nekaris-authored paper: *Normal redefined: Exploring decontextualization of lorises (Nycticebus & Xanthonycticebus spp.) on social media platforms*

'Each image is shown with a corresponding decontextualization score (DS) ranging from zero, indicating no elements of decontextualization to five, indicating the presence of all elements of decontextualization.'

(though this also came from a series of venomous bite wounds, as pygmy lorises, just like the slow lorises, are venomous... though the chemical composition of their venom also differs!). But Mr Ugly's appearance simply heralded the announcement of his group of lorises as a separate species!

Of course, such a change has major implications for the conservation of these animals. First, we need to reassess their captive breeding programmes, identify hybrids, and reform pairs of the correct species.

Next, pygmy lorises have already received an IUCN Red List assessment as Endangered. Although an assessment of Critically Endangered seems unlikely at this point for either species, we have strong evidence that the Northern pygmy loris is almost extirpated from China, whereas the Southern is still subject to relentless hunting for traditional medicines in Cambodia. Here it is believed that although western medicines may cure symptoms, only loris medicines can cure the actual disease.

Like many nocturnal animals, lorises are not well considered in action plans. Furthermore, they often occur on forest edges rather than interiors so can be "falsely accused" of being more abundant than they are, which field surveys are only carried out on these edges.

This is also where they are easily caught, and it is thus no surprise they continue to show up in illegal wildlife markets, despite their declining numbers ▶

Demand for them as pets leads to international trade with a variety of issues, including their being confiscated in countries where they are not native and even translocated there in large numbers – Thailand and Taiwan being two cases in point.

Yet another issue looms for pygmy lorises and was the subject of yet another paper my team and I published this year. For nearly two decades now, lorises have consistently appeared on social media as “cute and cuddly” pets.

Often clearly illegal, in that they appear in countries where no loris was ever legally imported to be sold as a pet, this has never stopped social media channels for allowing the content to continue.

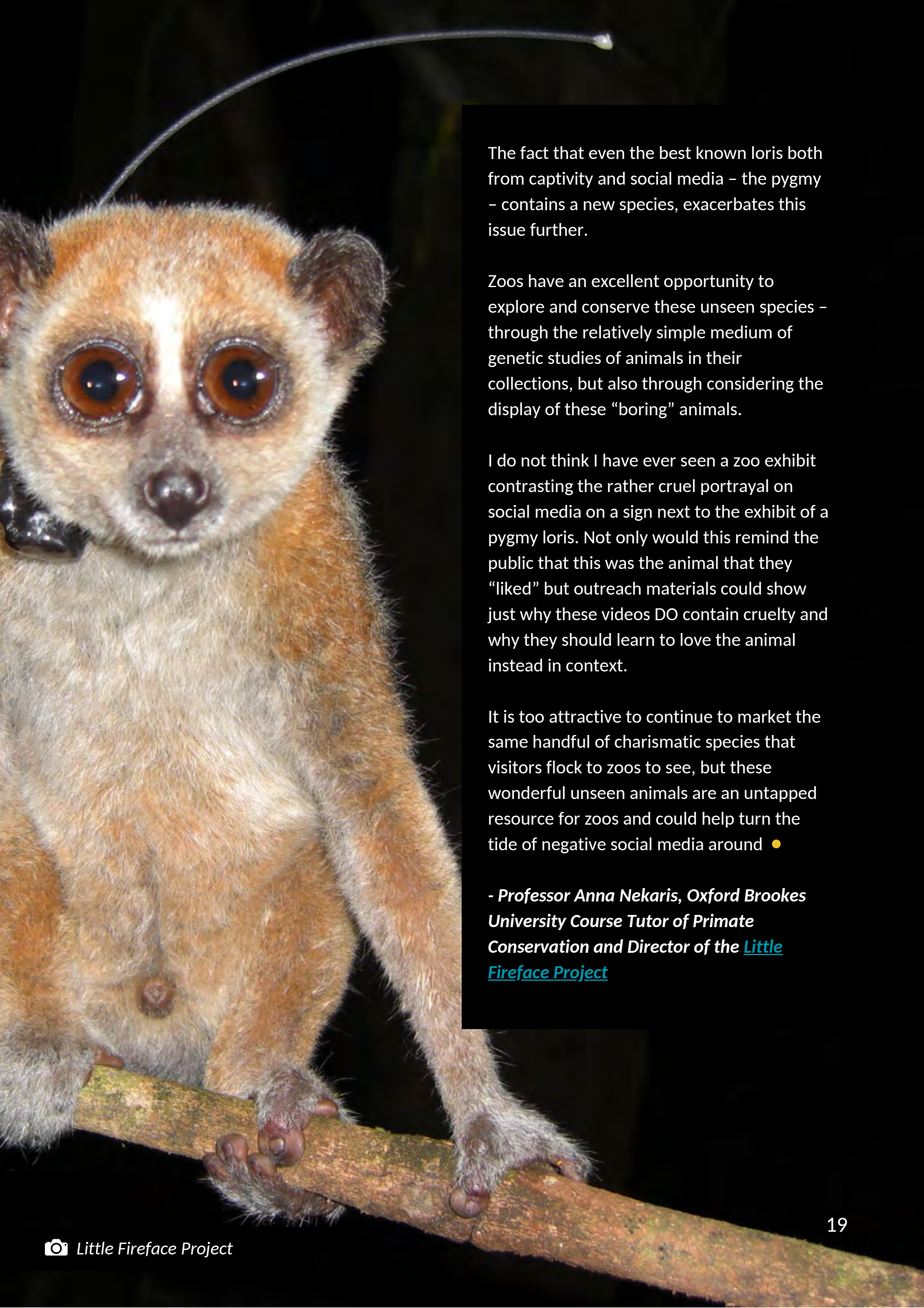
And the lorises most often seen as pets are the pygmy lorises, and most of these are of the Northern variety. It is safe to say that based on the millions upon millions of views these images and videos receive, more people have seen a loris as a pet than they have ever seen one in a zoo or in the wild. And despite scientific studies showing the suffering, stress, poor welfare and often ill health of these animals, these videos and memes still garner millions of likes, making the slow loris singularly one of the most popular illegally traded animals on the internet.

We suggest that this inappropriate imagery can lead to decontextualisation of the animal from its wild state, with the average person who can recall a loris imagining it holding a cocktail umbrella, eating a rice ball, or simply sitting in clothing in a cage rather than in the wild.

This normalisation of household captivity has been shown to link to public perception of how endangered the animal is (e.g., that is NOT globally threatened); to considering it normal to have one as a pet; and even to consider the animal is safer or happier in a human home than in the forest.

With a specialised animal like a loris, however, which has strong social bonds with family; which eats a very unusual gum diet; which never sits on the flat but always clings to branches; and which is dangerous in that its venom can kill or maim a human, this decontextualisation takes on a new level, with poor welfare and very short lifespans to lorises who end up in trade ▶

Cathy Oetegenn -Paignton Zoo



The fact that even the best known loris both from captivity and social media – the pygmy – contains a new species, exacerbates this issue further.

Zoos have an excellent opportunity to explore and conserve these unseen species – through the relatively simple medium of genetic studies of animals in their collections, but also through considering the display of these "boring" animals.

I do not think I have ever seen a zoo exhibit contrasting the rather cruel portrayal on social media on a sign next to the exhibit of a pygmy loris. Not only would this remind the public that this was the animal that they "liked" but outreach materials could show just why these videos DO contain cruelty and why they should learn to love the animal instead in context.

It is too attractive to continue to market the same handful of charismatic species that visitors flock to zoos to see, but these wonderful unseen animals are an untapped resource for zoos and could help turn the tide of negative social media around ●

- Professor Anna Nekaris, Oxford Brookes University Course Tutor of Primate Conservation and Director of the Little Fireface Project

Little Fireface Project

THE MIGHTY MOUSE

As a child I was lucky to grow up within easy reach of Chester Zoo. It was here that my passion for animals and the natural world was ignited with regular visits whenever I could persuade my parents to take me.

During these visits I would always enjoy seeing Asian elephants, black rhinos, chimpanzees, and many other zoo "ABCs", however it was an unintended zoo occupant that provided me with my earliest zoo memory, the unassuming house mouse. Each visit would be an excited race to the old parrot house, where, with a little patience at the hyacinth macaw indoor aviary a small house mouse would appear from behind the radiator collect some fallen seed and then retreat to its hiding place. I could happily watch this activity over and over, until it was time to move on.

It was perhaps predictable and somewhat inevitable that I would acquire something of an obsession for any small and weird mammal, especially small rodents. This obsession has led me into a career working with animals in the place that started it all, Chester Zoo. Here I have been lucky to work with some amazing species and found myself surrounded by like-minded people.

Rodents account for around 50% of all mammal species, however, they often receive a bad press for being 'dirty' or 'pests', but as with all living organisms they serve an important role in any ecosystem. Perhaps due to this bad reputation and that many rodents are "little brown jobs" they are often overlooked in zoos, being deemed as boring or of no interest to the public. I have often heard the argument that many rodents aren't of conservation value and so don't have a place in the modern conservation zoo. I always point these people towards the huge diversity of non-threatened carnivores, primates or ungulates that are maintained, leaving this argument dead in the water!

When I first arrived at Chester as a Keeper almost 10 years ago, we had just three rodent species on display, with a couple more off show. Through the passion of a like-minded team and the support of senior staff we have grown our rodent species count to twelve, ten of which are on display. Something that seemed to initially come as a surprise to many was how a large group of small mice can make a very active and engaging display ▶

One of our most recent additions is the Barbary striped grass mouse (*Lemniscomys barbarus*), a very striking species native to North Africa. This species is housed inside Fruit Bat Forest, within an area that had previously been empty for several years. Since their arrival they have more than fulfilled their role within the collection as a visitor connection species, with a small crowd of people gathered around the viewing window almost constantly throughout the day.

It is refreshing to walk past and hear positive comments from visitors amazed at how interesting they have found a small mouse. Just this week I was happy to be told by a parent that they must head to Fruit Bat Forest first on every visit as their five-year-old son just wants to see the little stripey mice, something that felt very reminiscent of my own early zoo memory.

As we continue to develop the zoo, I am excited to see rodents and other small mammals included right from the outset. Our Heart of Africa development will showcase a number of new rodent species, helping to highlight and hopefully encourage people to appreciate even the smallest of animals.

I am a strong supporter of a conservation-led collection, but I am also a fierce advocate of a diverse and representative collection. There is huge potential for zoos supporting conservation efforts for small rodent species, but even for those species that don't have a direct conservation role they more than make up for that in their ability to inspire the next generation of animal keepers and conservationists. So, as we shine a spotlight on all creatures unseen, I would urge anyone not to underestimate the power of the mighty mouse!

- ***Peter Watson, Lead Keeper at Chester Zoo***

Another nocturnal rodent, this one homed by Tropical World, Leeds

TROPICAL WORLD

& zookeeping for nocturnal life

Night-time is when most of us are tucked in bed asleep, but for many nocturnal animals they are busy exploring or showcasing their marvellous hunting skills in their dark environment. Usually, we don't have the opportunity to naturally observe many nocturnal animals, however zoos may house some exotic species in a nocturnal house.

Tropical World is a small to medium sized zoo located near Leeds City Centre. It hosts a variety of taxa from primates, meerkats, birds, amphibians, porcupines and a crocodile! The team of animal keepers work hard to care for over 250 animals housed at the zoo, within the different biodomes; Waterfall house, Rainforest Canopy, Desert and Creature Cavern.

To maximise the chances of visitors witnessing wonderful, nocturnal animals being active, zoos will reverse the lighting within the animal enclosures. This tricks the animals into reversing their daily activity cycle, resulting in them being active during our daytime whilst their lighting is dark, then sleeping in our night-time once their lights are switched on.

To allow visitors to still see these sometimes-secretive creatures in the dark, red lights are often used.

Non-human animals either do not see the red light, i.e. their environment remains dark, or it does not interfere with their vision as it isn't as invasive as a white light.

Nocturnal houses within zoos provide an ideal opportunity for visitors to learn about many nocturnal animals and their adaptations. Can you spot their large eyes to bring in more light to assist with vision? Or perhaps they have enormous ears to provide an ideal way to direct the sound. Sometimes they have a large nose which could be used for sniffing out prey or detecting their predators' scent and avoiding capture. Many nocturnal animals are also camouflaged with their surroundings making them tricky to spot if they are stationary.

Leeds City Council runs two zoos in Leeds, both of which have a dedicated nocturnal section. In Tropical World's Creature Cavern zone, you can find a beaded lizard, tarantula, scorpion, stick insects and lesser hedgehog tenrecs. Lotherton Wildlife World has a purpose-built nocturnal house with fruit bats, armadillo, kinkajou and cloud rats. It also has other nocturnal animals such as porcupines and tapir

- Abigail Hardwick, Animal Officer, Tropical World

HOT MAMMALS AND THE COLD REALITY OF ARBOREAL NOCTURNAL SURVEYS

A researcher's perspective

Tonight, I am struggling and I don't feel normal at all.

I am 25 meters up a tree in the Panamanian rainforest a few hours walk from base camp. Its 3am, its dark and I am tired from surveying. I have a motion sickness feeling that is not quite right which is most annoying as it's starting to affect my concentration. I hope it's not parasitic worms again.

Deciding to call it a night, I turn the red headtorch on and the mystery of my motion sickness is revealed. The tree is swaying not backwards and forwards but in a large figure of 8 pattern. I abseil down, stop 2m off the forest floor, check the landing is clear of any Bushmaster snakes or lurking Jaguars, before continuing to the ground. Packing the harness and optics in the dark, I start the walk back to base camp feeling better knowing that I will be back at base camp for breakfast.

Observing arboreal rainforest mammals at night is not easy and instantly gratifying, it's difficult, time consuming and frustrating.

Traditionally, researchers have ignored arboreal nocturnal mammals for these very reasons. Fortunately, technology to help us is becoming more accessible to conservation sized budgets.

CREA's Margay Project-Panama, with the support of Welsh Mountain Zoo and Shaldon Wildlife Trust, is currently in the process of a comparative study of some of this available technology. We are using thermal and night vision optics in conjunction with an arboreal and terrestrial camera trap array. Is one more efficient in terms of resources and time or is a combination better? Is it species dependent? How do they perform in the high humidity of the jungle? Questions upon questions.

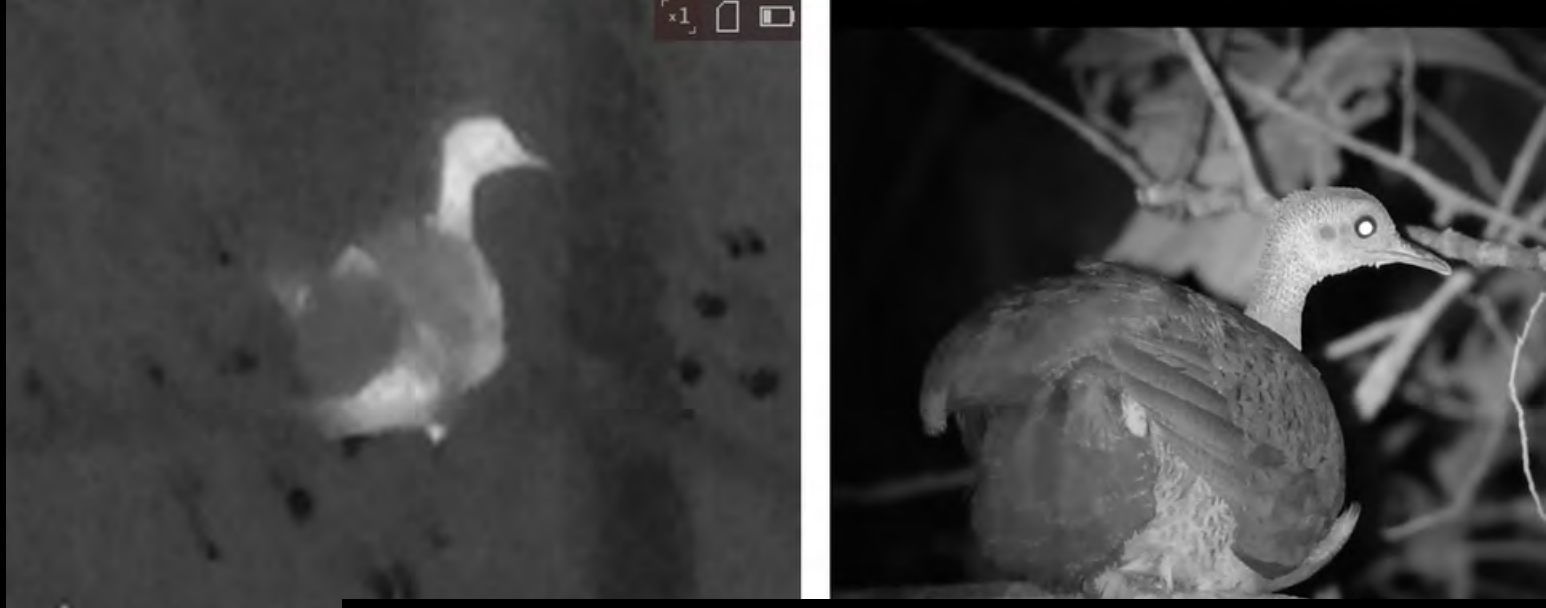
Using arborist rope access equipment, we were not only able to set the cameras in the canopy but also install small tree seats or tree stands from which to conduct nocturnal observational surveys. The idea was it would then be a simple case of walking to the remote locations and climbing them in the dark, sitting and observing. Whilst partially true, the cold reality we found was different ▶

Header images: Margays from Shaldon Wildlife Trust, Nocturnal surveying by CREA

In our neotropical location the visible scanning zone is foreshortened as the vegetation often closes the direct line of sight to less than 20m to 30m from the observation platform. The field of view through the optics at this distance is relatively small. It requires performing visual sweeps in layers around 270 degrees, stopping, listening, waiting a few minutes then repeating, hour after hour. The brutal fact is that nocturnal surveying in a 3D arboreal environment through a thermal monocular is very tiring.

However, when one of the sweeps passes over a mammal the target tends to "jump out" at you. Scan one way nothing, then back and a Tamandua is suddenly visible 20m away. Following porcupines and opossums through the canopy or around a strangler fig is easy, just follow the bright white mammal on the grey black background. Nothing can hide if it's in direct line of sight and, importantly for us, mammals we observed with thermal technology did not flee or alter their behaviour whilst being watched ▶

Trevor Hughes observing from the tree stand



Great Tinamou taken first with a thermal and second with night-vision highlighting the differences of the two optics for nocturnal work.

We anticipated that some levels of identification and behavioural observations might not be possible with thermal and so we decided to combine night vision optics with the study. We would locate the mammals with thermal optics and then observe with night vision. In our first season 93% of mammals observed nocturnally were found with thermal optics.

Night vison optics proved much better for full identification but it was noted that some mammals reacted to the infra-red illuminator light, some opossums and sloths altered their behaviour and actively moved away from the survey area as soon as the night vision illuminator was activated.

Our project was focused on the Margay, observing a semi-arboreal, nocturnal cat in the neotropical forest was never going to be easy. When one considers the difficulty of working at night in such environments, it's no wonder that many nocturnal, arboreal mammals often have data deficient, little known or understudied in their description.

After the first season it seems the golden ticket does not yet exist. Thermal and night vision equipment was not developed with wildlife researchers needs in mind, however our experience showed they can be very valuable tools. This season, we will be trialling models that should perform better at the shorter distances needed in the rainforest. We hope we can begin to illuminate the lives of these often-ignored 'creatures unseen' and that our collective findings can be cascaded on for studying other diverse cryptic mammals such as Andean Porcupine or the iconic Clouded Leopard.

I foresee many more long nights, up trees in the rainforest feeling perfectly normal

- Trevor Hughes, Wildlife Researcher, The Margay Project

SAVE OUR HEDGEHOGS

Working in a specialist wildlife hospital

Hedgehogs are one of the UK's most recognisable and well-loved species – I remember from a young age the thrill of being allowed to stay up late to watch them snuffle around the garden, looking for beetles, worms and stray cat biscuits. Any sudden movement or noise would illicit their distinctive defensive curl as they raised their spines and waited, motionless, for the danger to pass.

The fact that we had so many hedgehogs visiting our garden (five adults a night sometimes) meant it was a great shock when I first found out about the plight of these beautiful creatures. Since the start of the 21st century the species has been in continuous decline, with a nationwide reduction of 30-75% of the population. Loss and fragmentation of their woodland and hedgerow habitats, pesticides removing invertebrate prey, and increasing vehicles on our roads are all thought to have contributed to the decline of hedgehogs, culminating in the species being placed on the GB IUCN Red List as 'Vulnerable' in 2020 – that is, facing a high risk of extinction in the wild.

Discovering the dramatic losses of our native species highlighted to me the importance of wildlife conservation, and only increased my young ambition to one day work in that field. Fast forward, and I have now been working for over a year for Shepreth Wildlife Conservation Charity in their dedicated Hedgehog Hospital. The hospital runs year-round, treating and rehabilitating hedgehogs suffering from all manner of injures, illnesses and other issues, and since opening has admitted well over 5000 individuals.

Working at the hospital is a varied job and no two days are the same. Each patient presents its own challenges, whether it be a stubborn hog which refuses to uncurl, a hyperactive youngster that won't stay still, or a fussy eater that ignores all but a particular food. Aside from cleaning out, feeding and medicating, there are vet runs, phone calls and emails, new admittances, parasitology checks, and the continuous cycle of keeping everything clean. Then there is the public-facing side. Each hog needs a release site found, usually a suitable garden. Maintaining the social media is a must, as is running events for education and to raise funds and awareness ▶

It's a rewarding job, but always on the go. You can never assume you've seen everything either. After a year I am still encountering new things, like the alarming swelling effects of balloon syndrome, and just how proud you can feel knowing you saved a life, even if it did mean getting up every two hours through the night to feed orphaned baby hoglets.

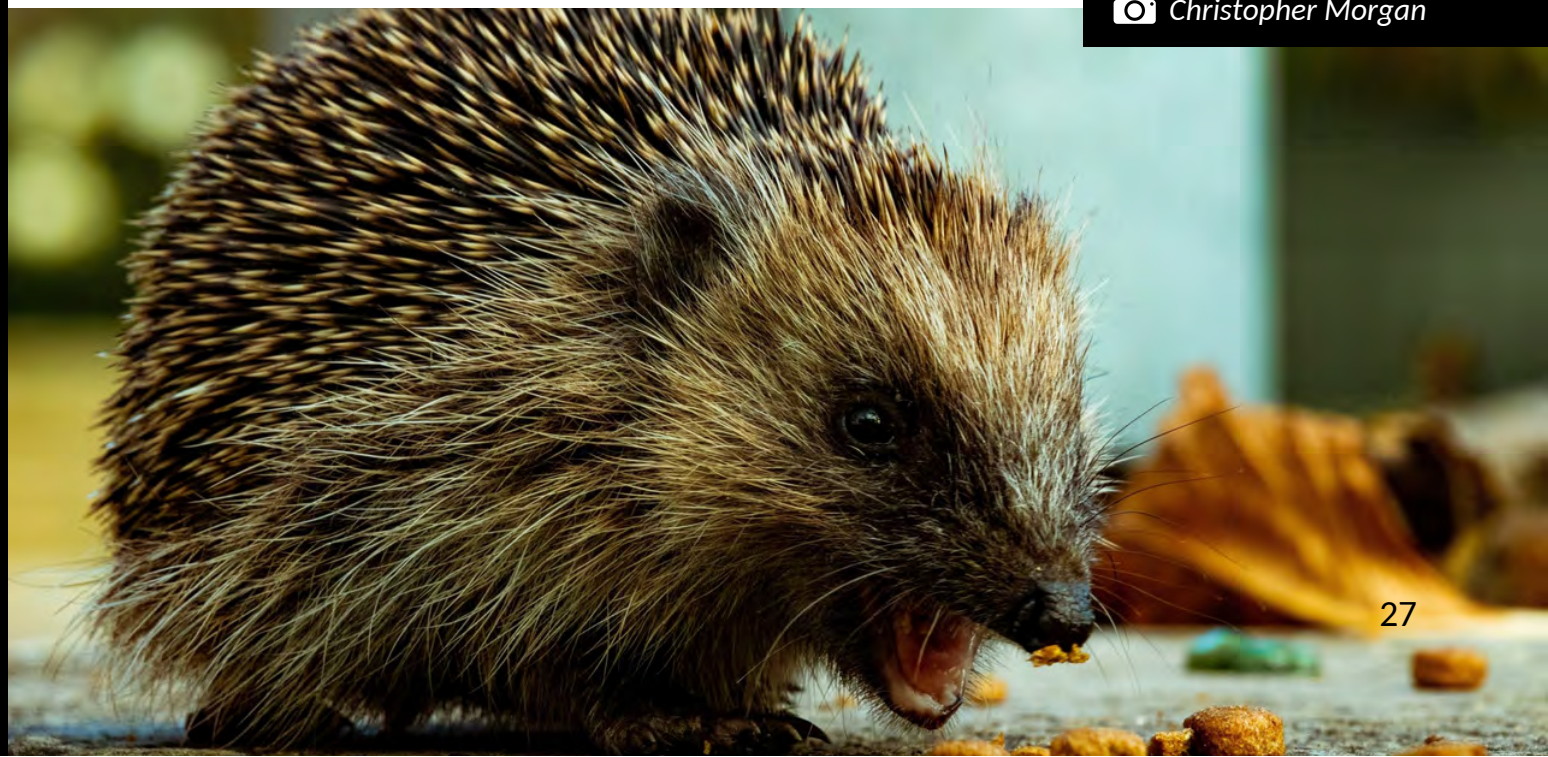
It would be wrong to say every case is a success. As anyone who has worked with wildlife casualties knows, no matter how hard you try there are some that can't be saved. But some of the survival stories are inspirational. One that sticks with me most is a tiny young male, only around 4 weeks old, who arrived to us cold, thin and dehydrated, and suffering from flystrike. While I was removing the parasites he suddenly jerked in my hand in a violent seizure, and then lay limp and still. Convinced he was dead, I placed the little body into a holding box and turned away to compose myself. After a minute I looked into the box – and there he was, walking about and looking interestedly back up at me. The young hog went on to make a full recovery and was released a few weeks later back into the wild.

It isn't only the hedgehogs that inspire me though. All the people who dedicate their time to helping wildlife: our hard-working volunteers, parasitology testers, vets and vet nurses, outreach workers and educators, home carers and release sites. Our hospital manager who works tirelessly and is always there on the end of the phone, even when she is supposed to be on holiday! Every member of the public who has listened, and let that unused corner of their garden grow, left a gap in the fence for the hedgehogs to pass, checked their bonfires for animal inhabitants, or left out food and water. To each and every one of you: thank you, and keep going. You give me hope

- Lucy Hodges, Welfare Assistant, SWCC Hedgehog Hospital.

The SWCC Hedgehog Hospital is funded and operated by the Shepreth Wildlife Conservation Charity, and proudly supported by BIAZA member Shepreth Wildlife Park.

Christopher Morgan



EARTH AGLOW

The ironically unseen pollution

When we think of the many factors which contribute towards the decline of nature; urbanisation, leaching chemicals, large scale farming, climate change, invasive species etc., light pollution often comes pretty far down the list.

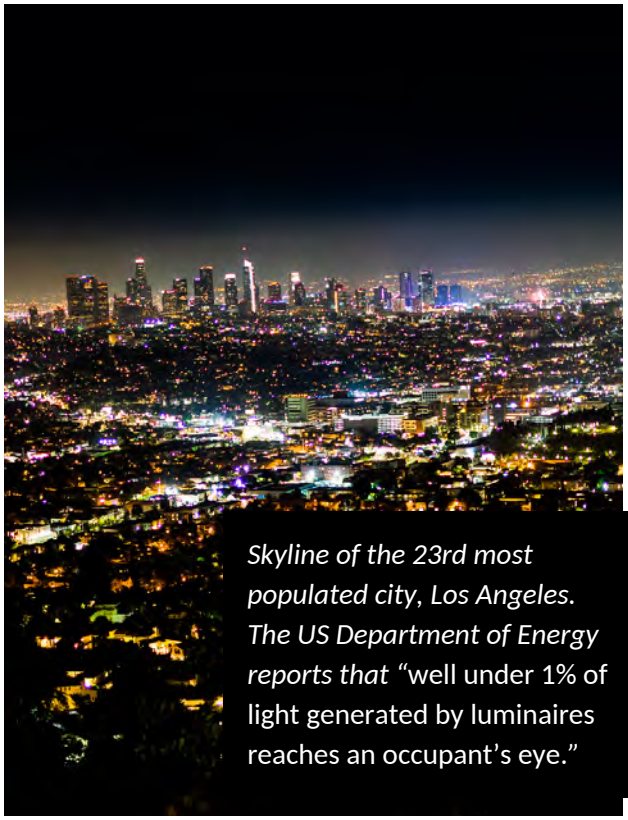
And yet our reliance on our sense of sight and the need for illumination has fundamentally changed planet Earth. We've all seen satellite imagery of clusters and criss-crossed lights from the roads and cities of our most populated areas, spreading roots across highways, into towns and villages.

85% of people live under light-polluted skies – and that's increasing at a rate of 2% per year, roughly double the rate of population growth. Today, little is truly dark - and humanity is dragging the natural world under its glow.

The scattering of urban light can be seen hundreds of kilometres from the source. So even specially assigned havens, nature reserves, aren't completely untouched by light pollution. And the issues towards wildlife are severe.

For insects, a single artificial light hacks into their desire to navigate using moonlight and incapacitates their normal activity, leaving them confusedly flittering under a lamp.

This means they expend huge amounts of unnecessary energy required to survive. Every light is a population sink "*sucking insects out of the landscape night after night*" (Goulson, 2022). Bats and other animals then take the opportunity to feast on these exhausted insects ▶



Skyline of the 23rd most populated city, Los Angeles. The US Department of Energy reports that "well under 1% of light generated by luminaires reaches an occupant's eye."

Anthropogenic light prompts birds sing in the middle of the night. Trees accellerate leaf growth and delay their leaf drop. Migratory birds, already pushed to the limit by their journey, lose their bearings and can perish as a result. Notoriously, Baby turtles get confused by the lights of the beach promenade and move in the opposite direction to the sea. Underwater, vulnerable corals which spawn by the light of the moon like clockwork, are disrupted, meaning their eggs are less likely to be fertilised.

For us, light signifies safety - but in excess it can adversely affect our own mental health. Light disturbs our own circadian rhythm; something innate in us which has evolved for millions of years, and upsetting this balance can provoke mood disorder.

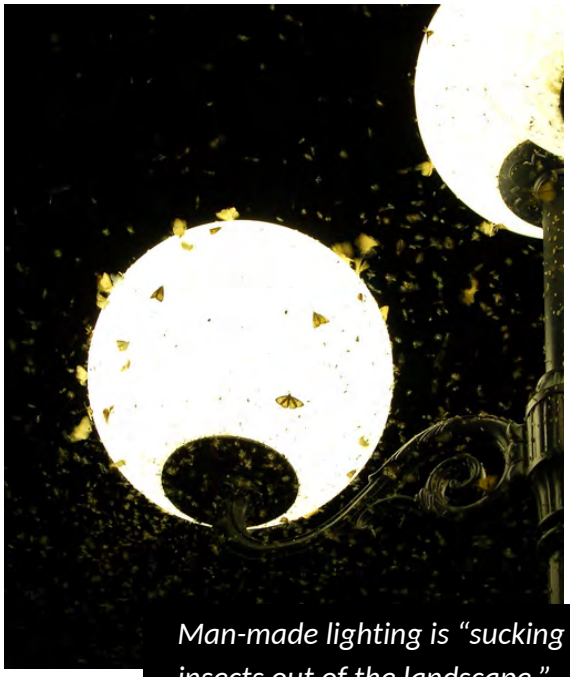
How can zoos, aquariums, and the general public help? Lighting doesn't need to be diminished entirely - we can dim the lights and make things more amiable to natural conditions whilst meeting our own needs.

Plus, we can:

- Shield lights with caps so they don't beam upwards,
- Avoid blue or white wavelengths*
- Take part in WWF's Earth Hour to turn off all the lights for an hour in March.
- Communicate and inspire an awe in the clear, night sky - and the animals which thrive under it.

With unending talk of UK being so nature depleted, as we consider how to share our spaces with nature, we must also decide how to spare our light - so creatures can thrive, unseen, in the dark

- Maria Carbin, Campaigns and Communications Officer, BIAZA



Man-made lighting is "sucking insects out of the landscape."

*Though no wavelength is perfect. Red is better for bats and insects but in high places, like air traffic control, can confuse migratory birds. Yellow affects insects less but salamanders more. However, blue and white LED-type light can travel and scatter furthest, attracting swathes of insects.

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Out of sight, out of mind?

Even cloaked in shadow, nocturnal animals are a vital part of Earth's ecosystems both across the continents, and here at home.

Many British and Irish zoos and aquariums offer a peek into the hidden lives of normally unseen creatures. This series of articles written for BIAZA's 'Creatures Unseen' campaign illustrates both the wonder and the necessity of these elusive, overlooked species.

Fisher's Estuarine Moth, a threatened UK moth supported, bred and released by Colchester Zoo (photo Micky Andrews)

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