Echoes & Whispers

A Creative Evaluation

Stephen Rutt

A Problem

"It's the tales that you hear. People tell you that they're going to fly down and land in your hair and that would be them stuck, tangled… yeah, you're no getting them out. It makes you wary. I think from there, it sort of stems on, you go on family trips to zoos or wildlife parks where they've got the bat houses and aye, I would say it does make me a wee bit wary about going in. Even when you see them flying over the garden, you think errr... And I would go and pass that on to my children despite the fact it's probably entirely false."

Jordan Todd

Bats are strange mammals. They live their lives as our shadows: they wake as we go to sleep; they sleep as we awake (and they sleep upside down too, their feet the highest part of their body). They see through sound: they navigate and hunt by the echoes of their own voices. They are as strange and magnificent as any of Scotland's more obviously charismatic fauna – yet they are ignored. They lurk on the periphery of public consciousness.

Species on the Edge is a conservation project of the peripheries: focused on the coastal edges of Scotland, it has a hinterland of concern for neglected species. Down in the Solway project area – Scotland's often forgotten southern coastline – we are isolated from the rest of the project by the southern uplands and the central belt: we are possessed of a different climate and range of species. The project is interested in a range of rare species. But it is also interested in those that are not necessarily rare but 'data deficient'. Such as the bats. Soprano and common pipistrelle, Daubenton's bat, and brown long-eared bat. Four species we should know well but don't. Four species that are figureheads for all we don't know about our immediate environment.

The philosopher Thomas Nagel wrote an influential paper called 'What Is It Like To Be a Bat?'. It is about the mind-body problem, or broadly, how we understand consciousness. He chose a bat because of its taxonomic position: bats are mammals, and as we are not too distantly related, we assume it *experiences* the world. But at the same time, to see a bat is, in Nagel's phrase, 'to encounter a fundamentally *alien* form of life.'[1] His series of comparisons runs from human to bat to Martian. The argument he makes is that we can

[1] Thomas Nagel, 'What Is It Like To Be a Bat', *The Philosophical Review*, Vol.83.4 (October 1974), pp. 435-450, p.438.

only ever imagine what being a bat is like, we can never truly know. The gap between their shadow lives and ours is too great; too fundamental to be bridged.

Even scientists agree. In an unusually punchy opening to a paper on bat ecology, researchers Victoria Todd and Laura Williamson begin: 'Bats are unusual animals with an arcane ecology that engenders human emotions ranging from apathy to fear'.[2]

While I was undertaking this project across the summer of 2025, Ozzy Osbourne, the self-described Prince of Darkness and guiding spirit of heavy metal music, died. For his final performance he sung from a throne decorated with giant jewel-eyed bats, their ears exaggerated and horn-like, their wings outstretched in the heraldic style. Osbourne's music was always designed to shock, to plumb the depths of human darkness: from apathy to fear, dread and loathing – the musical equivalent of a horror film. The shadow life of bats was the perfect accompanying iconography: the outriders of those arcane emotions.

Over the summer of 2025, I shadowed Species on the Edge's bat work on the Solway project area to perform a creative evaluation for them. I spoke to the project officers, collaborators, trainees, attendees at bat walks, and volunteers between Kilsture and Dumfries. This is what I discovered.

[2] Victoria L. G. Todd and Laura D. Williamson, 'Habitat usage of Daubenton's bat (Myotis daubentonii), common pipistrelle (Pipistrellus pipistrellus) and soprano pipistrelle (Pipistrellus pygmaeus) in a North Wales upland river catchment', *Ecology and Evolution*, Vol. 9.8 (April 2019), pp.4853-4863, p.4853.

Echoes (*Data Deficient*)

Soprano pipistrelle

Pipistrelle. The word comes from the Italian for bat, but its roots stretch deeper into a confusion: *Vespertillio* – roughly meaning 'bird of the evening'. When Linnaeus made the first taxonomic description of bats, they were all placed in the *Vespertillio* genus. A blurry beginning. Bird-like in the half-light of dusk.

It seems inevitable to begin like this, trying to make sense of bats from more familiar species.

The Soprano pipistrelle is the standard bat of the Solway region. It is everywhere: it flies around your house at night; it flies loop-the-loops around puddles of light, picking off insects lured by streetlights. It probably lives in your attic, or your neighbour's. You could describe it as the size of a robin, but that is misleading – they might have the same wingspan, a shared power of flight and an insect diet, but they are in the wrong format. There is something two-dimensional about a bat: their bodies are flat and small – a robin's is three to four times longer and four times the weight of a pipistrelle. Bats are mouse-like to the point where their German name, *Fledermaus*, means flying mouse. An old English name for them, the reremouse, ignores the literal for a description of their movement – rere meaning shake or stir in an archaic sense.

But we lack the data to back up the evidence of our eyes, our experience of them as a common species.

Which is why we are here at Threave, a National Trust for Scotland nature reserve, a wooded wetland on the edge of Castle Douglas, where the sun is just clipping the horizon. Its rays wash gold over the petals of the ox-eye daisies in front of me; swallows chatter as they swirl through a dusty sky; a few clumps of grey cloud turning peach at the edges, evening tuning into sunset. The long grasses are turning to golden seed and swaying in the breeze. A pair of belted Galloway cattle move placidly through the field. Foxgloves rise above the drystone dykes, contours of hot pink through the landscape.

We are here to survey for bats.

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Before I get too far in, some British bat basics. They are nocturnal insect eaters. They are mammals, so they give birth to live young and lactate. The British winter is too harsh for them, so they must hibernate. They are not much to look at in daylight: variations of brown and grey fur; variations of ears, from elf-like to rugby player, and variations of dog-like faces. The front of a bat is an adaptation to a life spent echolocating: emitting noises and hearing its echoes. In Scotland there are definitely nine species of bat, potentially ten – of course, we don't quite know enough.

British bats don't carry the rabies that you think of when you think of rabies – two of our species carry a variant of it, and even then, you need to be scratched, bitten or have its saliva come into contact with your mucous membranes. Bats are fragile and fear people, so this is not a situation that should ever occur.

One more thing: some people can still hear bats. I very occasionally hear slight strange squeaks from the larger species. But that's not a reliable method of finding them. A heterodyne detector is what is needed. They have a dial on the front that you turn, and it tunes to the ultrasonic signal that the detector produces. Turn on the detector and it buzzes with white noise. It picks up the ultrasonic frequencies that the bats' echolocation makes – and I'll be honest, I don't understand the science of how this works – heterodynes them or mixes the signals. The difference between the bat's frequency and what the detector is tuned to produces sound at a frequency we can hear. In effect, they are translators of bats as they call around you; you hear them in real time. There are other prohibitively expensive methods, and while these aren't particularly cheap – about £100 – they are user-friendly and make the job easier, which is handy when you are surveying bats and the light is constantly dimming.

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We are carrying out a field survey. Liam Templeton, a Species on the Edge project officer, is running training for bat surveyors to pass on competence and confidence so others can contribute. Alison and Fiona Rogerson, the trainees, have joined us at the reserve, a wetland with woods on the edge of Castle Douglas. The field survey aims to find pipistrelles and noctules – our littlest and largest bat species – on a series of walks and timed stops. Twenty

minutes after sunset, we walk roughly 100 metres with our detectors tuned for noctules. Then we stop for two minutes, dialling up the detectors to catch passing pipistrelles. We repeat this twelve times until the night is as dark as it gets in the Scottish midsummer, and we walk back to where we began, the slowest kilometre-and-a-bit walk you can do. Liam tells me we are doing this because Dumfries and Galloway has Scotland's greatest diversity of bats. The key objective of the project is to achieve a greater understanding of the populations of the four species it is targeting. Data deficiency – not knowing what we know and what we don't know – is a problem that stalks bats. People say you can't save what you don't love: well, you can't love, let alone save what you don't know in the first place. The problem is that the threats facing bats are varied and everyday: the loss of old trees, repairs to old buildings, dwindling insect populations, changes in land use. Without regular monitoring in the first place, there is no baseline to know how things are doing.

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Fiona and Alison are members of the local bat group. I wanted to know about their motivations for being here.

"Do you have any early memories of bats?"

"Probably just watching them at home. We used to go outside and watch them flying, I took a great interest in nature from a really young age. It's interesting to get involved with counting and seeing them, and finding out about the species."

"How long have you been part of the bat group?"

"Mum and I, we're pretty new to it. We've always had an interest in surveying and finding out what species there are and how many. We've just recently done our level one training online and then we did our level two."

"And what do the level one and level two training involve?"

"Learning about bats, how their frequencies are on the bat detector, and the different species within Dumfries and Galloway that we can look for."

Fiona is referring to the training offered by the National Bat Monitoring Programme to share the skills required to take part in their surveys. But it is better to do in-person than over

Zoom, which is why we are here at Threave, twenty minutes after sunset, detectors buzzing with white noise as we walk into the teeth of a suddenly quite cold breeze. No noctules. We stop at the first point. Dial up to pipistrelle frequency. Nothing happens. Walk on.

Alison and her daughter Fiona are an irrepressible combination: a pair who belie their assessment as being 'pretty new to it' with an exceptional enthusiasm for all nature, a generosity with snacks, and an excellent habit of taking the mick out of me and Liam for dressing like hipsters, particularly when I am visibly shivering.

Soprano and common pipistrelle come as a pair, too. Not quite parent and child but the closest possible cousins: close enough that it wasn't until 1993, that it was finally discovered that there wasn't one pipistrelle flitting through the night sky but two distinct pipistrelles echolocating at different rates. It took until a paper from a 1999 issue of the Bulletin of Zoological Nomenclature to make it formal: one pipistrelle became scientifically two, named and described. At 45khz, the common pipistrelle retained its name as the first pipistrelle known to science. At 55khz, the soprano pipistrelle – so called because it echolocates at a higher frequency – is the glamorously new one, though its scientific name, *Pipistrellus pygmaeus*, stems back to 1825, England, and an over-excited naturalist finding an infant pipistrelle and thinking it a wholly new type. He was right, but not in the way he thought.

Species that look the same but are different are known as cryptic species. It seems entirely appropriate to me that bats – mammals that we should know better – have cryptic species, only known about because they sound different, in sounds we can't even hear in the first place. It doesn't get more data deficient than not even knowing they exist.

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Stop. Dial up to pipistrelle. Wait two minutes. Silence – other than the detector's static, the blackbirds hammering out their dusk *pink-pink* calls, some distant feral geese honking, and the secondary white noise of leaves rustling in the breeze. Walk on as a mostly full moon rises. Repeat. Same result.

And then, at the next stop, a bat does stir – shaking free of the leaves, parting the crowns of the trees. It spins on a wing, fleeting. Another cuts across: they fly with controlled chaos, the eye not seeing the control, only the chaos. Disappearing against dark trees then detaching

into the still-light sky, their erratic jinking is dizzying, unpredictable, flying in fast-forward. Suddenly, from the buzz of the detector, other sounds emerge as if this small black box was suddenly speaking in tongues: garbled, glitching, like your tongue smacking the roof of your mouth but quicker than humanly possible, like the sound you might make when something you need to say or think is painfully just out of reach. Then another sound – the rattle reaches a sharp crescendo, and then a beat of silence. A feeding buzz – the echolocation locking on to a life and the bat taking it.

There is rhythm to the survey. The walk and the waiting. Once the first pipistrelles have appeared, more come at each stop – and we confirm them all as soprano by shifting the detector's dial to 55khz, the sounds growing stronger as we do so.

Away from the woodland, they skim along the hedgerows: bats like to navigate along the features of a landscape rather than out into the open. A hedge reads like a highway to them – blank spaces are as featureless as the open sea. The pipistrelles follow the treeline beside the marsh of meadowsweet and sweetgrass, fly parallel to the river and past the 14th-century castle, ignoring the moored boat in the middle of the River Dee.

One of the stops aligns with the end of the hedge. By now, the moon is dimly veiled with light cloud; the detector pulsing its strange rhythms, its weird bat disco. Soprano pipistrelles flying along the hedge, turn at the end, spin on a wing above our heads and disappear into the near distance. We have all seen soprano pipistrelles before – but still the strange magic of bats takes our breath away.

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The night is sublime. Sometimes it is ridiculous. Sometimes it is neither. After our first field survey, we are aware of headlights flying down the entrance track. A cop car pulls into the car park and stops behind our vehicles. The window winds down. We explain that we are here on a bat survey.

"Ah, so you no here fir the doggin?" asks the cop.

After the next survey, blue lights come flying down the track again. Police with blindingly bright torches walk toward us, describing a missing person we haven't seen.

The night can be a place to hide.

Common pipistrelle

The ecosystem runs for 24 hours. But still, I did not expect my involvement in the project to begin here, in the car park of Kilsture Forest, a community woodland on the Machars peninsula: the clear light of early afternoon dancing across Wigtown Bay to the hills opposite. The car park is nestled in a ring of trees, muffling sounds from the country lanes nearby, the bark and clatter of paws from dogs in the wood. The beech trees are coming brightly into leaf and the bluebells smell hypnotically sweet.

And all is almost still and peaceful but for the muffled wheezing of saws biting into raw timber, the squeal of a power-drill and six teenagers. When the teenagers, members of the Police Scotland Youth Volunteers, arrived, they were initially reserved, sitting around while Species on the Edge's Jack Barton and Elaine Rainey from Kilsture Forest community group spoke about the basics of bats and the woodland. But as soon as the tools came out, they warmed up. Initial reticence – complaints of hand-eye coordination, a lack of skills, the 'I can't do this' before they have even tried – dissolved in noise and sawdust and the joy of doing.

They are building bat boxes. The beeches here, as Elaine Rainey explains, are 100 years old. Or rather, young: young in the life of a tree. Despite their impressive stature, they have yet to shed limbs or gain the fissures and cracks a bat needs to roost. The boxes – rough panels of wood screwed together with bat sized gaps between, are a replacement for time and a shortcut to habitat. The teenagers have done well, problem solving as they go. Suddenly, they are talking like experts. Artisans of the bat box.

Later, Elaine leads us through the forest, a nature walk for beginners: basic spring botany and the names of trees and the singing birds: other lives that utilise the same space, the same basic food type at different times of the day. She paints the scene for the teenagers – the purpose of why they are here, risking splinters – imagining the wood at night and conjuring the bats into their minds.

But did the teenagers enjoy it? I asked Amy Macgregor, wildlife crime officer for Stranraer, who accompanied us today.

Oh yeah definitely, they've definitely picked up a bit of knowledge about bats as well, but also the skills they've been able to pick up today. I was really impressed with some of their drill work, so that's always good to know! But yeah, they've definitely enjoyed it and it's been really informative.

I couldn't resist asking her if she ever dealt with bats in her day job. Her answer – that she hadn't on her Stranraer beat – was heartening. To the best of everyone's knowledge, people in the west of the area at least are living alongside bats without breaking the law.

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After the volunteers left, I spoke to Jack and Elaine about the project's purpose in a place like Kilsture.

E: *So, today we've been out with Police Scotland Youth Volunteers, the Galloway branch, and this is part of our Kilsture 1000-citizen science project, where we're trying to get as many people into the wood, recording as many species as we can, so that we can find out more about the diversity of the woodland. The idea is that the more we can find out, and the more we know about the woodland, the better we'll be able to protect it for future generations. So, as part of that project, we're working with various organisations, collaborations and partnerships, and one of those is Species on the Edge.*

J: *And through Species on the Edge, one of the target species or group of target species is bats, which include common pipistrelle, soprano pipistrelle, Daubenton's bat and the brown long-eared bat. And so, we thought it would be a brilliant idea to get the Youth Volunteers to help build some bat boxes. I brought along some materials today to construct those bat boxes. Some of them were pre-cut, and we also did some cutting, and the volunteers helped build those boxes and put them together.*

S: *I think a key part of conservation is trying to capture people's attention but also give them some involvement in what you're doing, and I think the kids today really appreciated that.*

J: *Yeah, I think it was really great to get hands-on, everyone stuck in and using the tools – as well as learning about the bats and the requirements of bats. So, we learned about why boxes can be useful. And putting them in habitats where there might not be many natural cracks or crevices for the bats to roost or hibernate in. We learned about that, but then also*

getting stuck in and putting them together makes you think about… an important activity that you're doing.

E: *I think the big thing about this session is that we tried to pull it all together, so it's not just one thing in isolation. So, if we had the group in a workshop maybe making the boxes, it would have been a totally different experience, whereas this has been immersive and, you know, they've really gone away with an understanding of the place of bats within Kilsture and all the other things that are linked to their presence. We're certainly keen to get more people, more young people into the woodland as well, because they need to start experiencing it so they can form connections with it. Those future generations are going to be the ones that need to protect it, so the sooner we can start that work the better.*

S: *How many species of bats do you have here in Kilsture?*

E: *We have six on record, although through the Species on the Edge project, we're going to be doing a bat talk and a walk as well, as part of the Kilsture 1000-citizen science project, so hopefully we'll be able to pick up some more species, but Jack could speak more about the actual species.*

J: *The most frequent bats here are likely to be the common pipistrelle and the soprano pipistrelle. They're generally found in a wide range of habitats, so they'll be feeding along hedgerows, and in the fields, as well as in the wood, especially along open spaces in the woodland rides. And then there are a few waterways and ponds in the woods, so we'll get the Daubenton's bats in those areas. Daubenton's feed over water, and they're amazing to watch as they weave their way across the water. And there are brown long-eared bats, typically a woodland species, so we'll get those as well.*

S: *Bats are a great, eloquent voice for our nocturnal environment, aren't they?*

J: *Yeah, exactly. They can tell us about the health of the woodland and the environment in which they're in, and how many insects and invertebrates there are – all sorts.*

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There is something in the work we did at Kilsture that afternoon. There was the literal level: we made bat boxes, gave them some extra space. Then there was the less tangible level: for those volunteers, giving their time for the bat project, we helped combat that unknowability.

Each left with a new understanding of the lives of bats. Their volunteering might typically be in the human community – but here, eyes were opened to something new.

And I feel it working on me. I've borrowed a bat detector. It switches on with a light buzz, but as turn up the volume and twist the dial, the static gets worse: a harsh, unpleasant sound that puts me on edge. It is an odd experience: being outside, looking for wildlife and intentionally making a horrible noise. I am walking down the local cycle path that runs alongside the railway line, twisting the dial. A pipistrelle flits between the darkness of trees.

And there, the dial lighting at 55khz, its harsh buzz leaps into life, a rhythm resolving out of it. Soprano, not common.

The common pipistrelle is a curious question here. I asked Liam about why I'm not finding them.

"Based on my understanding and my observations, the soprano pipistrelle is by far more common in Scotland than the common pipistrelle – in our case, a bit of a misnomer. And again, having seen various distribution maps, it seems that's further punctuated the further north you go in Scotland. I think the common pipistrelle is absent all together and its exclusively soprano pipistrelle, and I don't know for what reason exactly. Perhaps there are certain adaptations that the soprano pipistrelle has that gives it a competitive advantage or ability to adapt to colder climates."

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A few weeks later, I was back at Kilsture. After a talk, we headed out on a bat walk with the forest community group, retracing the steps we took with Elaine and the teenagers. The bluebells are over now: pale seed-heads, like ghost plants in the shadow-light; the setting sun picking out the north-west-facing sides of the beech trunks; the canopy closed with a dense coverage of leaves. Blackcaps still singing. The crunch of forty feet walking across gravel and leaf litter.

I fell into step with Christa Whatmough.

"Why have you come on the bat walk?"

"Because I've been helping out with the Kilsture project, and I'm fascinated by bats and wildlife generally. I thought it would be a good opportunity to learn more about bats and listen to the professionals."

"Well, you have a very professional looking app. Can you tell me about it?"

"Yes. This is an echo touch meter. You get an app on your phone and basically plug this touch meter into the USB-C port on your phone, and it records the bats echo locations and tells you what kind of bat it is… so yeah, its fascinating because I've got bats living in my loft, but this is the first time I've used it away from my house, so it'll be interesting to see the different species here."

"Can you tell me about the bats in your attic?"

"Yes. They are a mixture of common and soprano pipistrelles, and they've been there since I've lived in the house, which is four years, and I see them every spring and summer. Last time I counted them, there were 59, but there will be more than that now, so I need to give them a proper count and see exactly how many more, which I am intending to do in a couple of weeks."

"How do you feel about sharing your house with bats?"

"Very, very privileged. I know a lot of people wouldn't like it, but I absolutely love it. They don't do any harm, they don't chew your wires, they just quietly sit there. The only thing is that I will occasionally find a little dropping on my kitchen worktop that has come through the little gap in the ceiling of my kitchen. You know, it's all good. I am that weird that I get the dropping and put it under a microscope to see what's in it."

"Amazing. And what is in it?"

"Bits of wings and legs and general bits of fly, basically. It's interesting."

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I drift down the narrow path, past the dying ash trees, my detector set for sopranos, trying to escape the hubbub of the group's cooing, excitable chatter, coughing and shuffling feet. I am trying to record the sounds of the detector. I get dazzled by sopranos skimming the narrow path either side of my head, the loud chattering of the detector as they pass; my

own rapt attention, not breathing in case I make a sound. It does not feel right to make a sound.

I return to the group. They've had a common pipistrelle pass that doesn't return.

Sometimes things are good at hiding in the night.

Whispers (*something in the night*)

Daubenton's Bat

Louis Jean-Marie Daubenton died on New Year's Day, 1800. Seventeen years later, he was remembered in the name of a bat described as new to science by Heinrich Kuhl, a twenty-year-old German naturalist, working in The Netherlands. Kuhl would die in Indonesia, three days shy of his 24th birthday: a death attributed to over-work, a life lived in a blaze of scientific description, the paperwork defining new species, the act of giving names – words – to life, making them new. Without words, things remain inchoate, fleeting presences that are hard to grasp. Daubenton did not give us his bat, Kuhl did.

It is in the *Myotis* genus, the 'mouse-eared bats'. If pipistrelles are 'birds of the evening' the unknowability of bats extends even further. Even their ears – perhaps every bat's defining characteristic – aren't their own, but metaphors for more familiar mammals.

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There is still a glimmer of light in the sky.

It is twenty minutes after sunset, and I am walking to the River Nith. Big streaks of dark grey cloud against the silvery sky. A storm is forecast for tomorrow, an August storm: forty-mile-an-hour winds, 100 per cent chance of rain, a fine Scottish summer's day. So, I am completing a bat survey by myself.

This isn't right, you're thinking. Structurally, this project has led you to believe that I see the bats after I've spoken to a conservationist. But sometimes, I have to be that person. The storm will likely cancel tomorrow's survey, so I have stepped in to do it a day earlier than planned: I live next to the site anyway, I walk it regularly, I know the species is there. In the 19th century, Shelley thought that 'poets were the unacknowledged legislators of the world', but in this prosaic century, we know that logistics and health and safety are what legislate for everything. But this is only because the magic of bats has translated to me, struck a chord deep inside, legislating for the fact that the person surveying the surveyors, has become the person doing the survey. I'm not sure if there's a greater sign of success for a conservation effort than that.

The survey is the National Bat Monitoring Programme's Waterway Survey. The Daubenton's bat is the water bat: it is tied to water flanked with trees, whether rivers, canals, lochs, or ponds. Wherever the water is smooth and near trees for roosting and perching, the bat should be found. In Scotland, where the water is extensive and often calm and beside trees, Daubenton's bats are widespread and can be common. But their presence within that range – verified by surveys – is patchier. The distribution map shows them as scattered across the main river valleys of the south, densely present across the slow rivers and canals of the central belt; then tracking the major towns up the east coast, with a cluster around Inverness and the Great Glen, and a sporadic scattering of sightings elsewhere in the Highlands. But we only know what we know when people carry out the surveys. Otherwise, data deficiency strikes again.

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For the Waterway Survey, I take a kilometre of riverbank, and at ten different points down that riverbank, I stop for four minutes and count the amount of Daubenton's bats that pass me. I'm going to begin this near the A75 bridge, so the static of the bat detector will briefly be overshadowed by the static of 60mph traffic. When my phone alarm – the bane of my mornings – goes off, it's time to move on.

Despite the forthcoming storm, it is a still evening: no hint of what is to come. There are no movements in the willow leaves above me, the last of the jackdaws are flying off to their roosts, and there are midges and other flying insects buzzing around the streetlights. It should be a good night for bats.

The sky is darkening. On average, it takes Daubenton's over an hour after sunset to emerge, but this survey requires seeing them. Water holds light late: you can see the bats skittering over the reflected sky longer than you would against the night sky. And when even the water fades to black, there is help from the beam of the torch and the squalling white noise of the detector. It is 9.50pm now. Time to begin.

This riverbank is familiar to me. I walk it weekly at least, if not more frequently in the long light evenings of summer. I have watched it go from the first flourish of wild garlic in late winter, to the cow parsley of spring. Now we are at summer's height, and the vegetation has grown rank: Japanese knotweed proliferates between stands of Himalayan balsam; yellow

loosestrife and great willowherb flanks the banks; bindweed stems snake their way around nettle and hogweed. It is a riot of dominating, competing life. (Mostly) good for insects and therefore good for the things that eat insects, like the trout and grayling in the river that share the same food as the Daubenton's: caddis and mayflies that break free of the water, *Chironomid* midges; things that feed fish and birds by day are bat food by night. Beech and birch, oak and ash, alder and elder, all offer perches either side of the river. It is the scrappy edge of town: not a wilderness, of course, but with its own wild, impenetrable energy. A fly-tipped tent and the burn mark from a campfire next to a wooden bench by a car park make sense here.

I begin between the bridges: the old railway and the new A-Road; stone and concrete. I dial down the detector to 35khz. Set my phone alarm for four minutes. The detector's white noise blurs with the road, blurs with the murmurs of the river which here runs shallow over riffles, the least calm section of the River Nith above Nunholm. Daubenton's like calm water. Insects are more frequent over ruffled water, but echolocation is confused by the irregular movement of ripples. In the dwindling light, my detector buzzes only for a pipistrelle skimming the bank not the water. A heron moves within the thick shadow of the far bank, an apparition night fishing. My phone alarm goes – an aggravatingly sweet, penetrating tinkle. Four minutes up. No Daubenton's.

Under the A75 bridge, I don't see a fish jump but hear it and see the rings spreading, reaching the foam swirling in the eddies, showing the disturbed flow of the river. It is deeper here, the water still disturbed but not rippling like earlier. The first Daubenton's shoots down the river here, a flicker over the pale foam, the detector in my hand suddenly resolving a *DAG A DAG A DAG A* out of the static.

The next stop wrings noctules out of the night, air-kissing through the static; glimpses of black above the trees on the far bank. Pipistrelles chatter. The lack of Daubenton's beginning to worry me (having been confident in my abilities, I'm now worried my detector is faulty, worried that the banks are too thick, the river too wide here, that my bat knowledge isn't good enough).

And then a shingle beach opens up on the inside of a meander, just down from the confluence of the Cluden and the Nith. I line up with a gap in the opposite trees, the river

the deep blue of the almost-dark, the only movement in its water the little rings of insects dappling and a small fish jumping. The Daubenton's begin as a glimpse. A squeal on the detector and a black flicker low over the water. They fly in straighter lines than other bats but with the same manic speed, streaking across the blue water and vanishing into the black. Five shoot across in four minutes.

I try again at the meander's end.

One of the interesting things about bats is how suburban they can be. I am standing by the bank of the Nith, and in front of me is a semi-detached pebble-dash house, kitchen light still on. Next to it is a floodlit industrial unit, and if I look to my left, I can see another crossing of the A75, over the river, next to a factory. And yet here in this highly unpromising location, bats. There are trees, calm river water and insects; I can feel them flitting over my skin. Six Daubenton's bats are passing over the river. It's too dark for me to see them without torch light, but the detector translates their presence in that staccato squalling.

When you're out at night looking for bats, your senses become heightened. After dark, each sound becomes important. Even with the buzzing of the bat detector, its constant, tinnitus like crackle, and other sounds –vehicles, jackdaws late to roost, owls distantly hooting – become amplified. And you become keenly aware of touch. Large yellow underwing moths flutter against my face, the touch of a midge, the brush of something bigger, the stroke of a plant I didn't see as it reached out across the path. Senses become heightened. You almost wish you were a bat so you could properly read the landscape at night. See how they do it. Be able to master this sort of alien world, this shadow life that they do so well.

For the next few stops, the vegetation thickens. The bat detector still picks out a handful. And then the final stop. Under the pedestrian bridge, the streetlights mean there's no need for a torch. A tawny owl breaks free of the trees and flaps silently over the river, like a very big, very slow, very precise bat. I see the Daubenton's as flickering brown sparks, somewhere between the river and the sky as they catch the wider sweep of light than the torch produces. The detector's staccato squalling has become a heavy rainfall of bat sound. They almost look like a swarm of insects gathering over the water. It is a relief and a release: a relief because I knew Daubenton's were plentiful here, I had seen them before, but the earlier difficulties detecting them had me worried. A release because in the moment, all the

stress of stumbling down a dark riverbank dissipates, and all I need to do is count the bats' passing tune among the constant chatter of the detector.

This stretch of river, on the edge of the biggest town in the Scottish Solway region, had not been surveyed before. Now it has. This is probably my biggest contribution to the project: putting these Daubenton's on the record, a data point that helps steer them away from being inchoate, fleeting things. It helps makes them real, graspable, known.

*

After the storm passed, I spoke to Liam about Daubenton's bats and the Waterway Survey.

L: *"The Waterway Survey is exclusively for watercourses or rivers or burns, that sort of thing. Not lochs, for whatever reason, but I have observed Daubenton's foraging over lochs."*

S: *"My first Daubenton's were at Stirling University, where I studied, and Airthrey loch there. We used to use night vision goggles to watch them."*

L: *"Oh really? Wow"*

S: *"From what I've seen, they're widespread in Scotland, but the actual records of them seem to be tied down here to the major rivers, a couple of major rivers on the borders, and then solidly across the central belt. Then it tracks up the east coast, with a cluster around Inverness and then sporadic across the Highlands, which I presume is observer bias."*

L: *"I'm not entirely sure. I've seen distribution maps as well, and another factor is to do with elevation or altitude. I wonder if those sorts of routes you describe are tied to either river courses or distribution or habitat use and have been influenced by canalisation of watercourses – there are probably canal routes and systems that have facilitated that distribution or spread. I think a major factor in their status would be tied to river health and aquaculture. Certainly things like pollution would be a major factor, run off from agricultural activity, anything that would negatively impact river health or the invertebrate assemblage on which they would forage.*

I guess one of the things underpinning a project like Species on the Edge is communicating the importance of having a good baseline of data, so a major output of this project in particular is engaging with communities and equipping them with the skills and confidence

to participate more readily in projects such as the National Bat Monitoring Project, so they can contribute valuable data to inform conservation action."

S: *"One of the things that really struck me when you were talking about observer bias is when I went on to the Waterways Survey website to get my spot, I noticed that this place has never been surveyed before. And there are others up the River Nith, which runs through the biggest town in the Solway region, a town stacked full of people who are interested in nature. I looked on the map to find one that had been surveyed, and I found one near Lockerbie that was last surveyed in 2013. So that's something interesting as well, isn't it?"*

L: *"With the Nith and the Annan, there are squares dotted fairly regularly from source to sea almost. I would attribute the fact that many of them haven't been surveyed to the fact that up until now, there has been a lack of capacity in organisations like the BCT to sufficiently advertise or promote projects like the NBMP. And to recruit surveyors to provide adequate training to surveyors and have them feel confident enough to participate in that manner."*

Brown long-eared bat

I am sheltering under a tree with Mary Smith.

"Have you had any amazing bat encounters at Threave?"

"I think my favourite would have been doing general bat surveys. Sitting on the other side of this wall looking for emergence and then re-entry and walking up through the woods at the reserve and then … bat! Doing bat walks over there, and you get no bats, no bats, and then suddenly it's bat bats bats! Pipistrelles, noctules: it's just the sheer number of them."

"And people respond well to them?"

"Oh yeah, they love it. It's special. Everyone gets bat neck from looking up."

Mary is a National Trust for Scotland ranger on the Threave estate. We are back here: Liam, Alison, Fiona and me, with Mary supervising us. We are not on the nature reserve side now, but in the ornamental gardens around the manor house. To be more precise – like the Daubenton's prefer the scrappy edge of town – we're on the scrappy edge of the gardens, outside the wall, where visitors don't walk. A place where lean-tos slump against walls and tool sheds come up against toilet blocks and compost heaps. Threave, with seven of the nine bat species found in Scotland – it is Scotland's only bat reserve – is a beautiful place to explore. But life gets everywhere, even by the bins, and sometimes you need to be there to find it. Although, actually, I don't expect to find anything here this evening because:

"There're some spits of rain. I was worried it was going to rain tonight – I'm hoping it's not going to get any worse," says Liam.

"Will they come out?" asks Alison.

"Maybe if it's just drizzling like this, but if it gets too wet, we might need to abandon the count. But I'm hopeful. The forecast I saw said it was only about 20% chance of rain, rising to 40 or 50 by 11pm."

*

The brown long-eared bat lives beside us, though you wouldn't know it. It might well live in your roof, clinging to the timbers, eating the larger moths that share the night. If it lives alongside you, you're lucky. Like the other species, the brown long-eared bat is nominally

common and widespread, except it's not. Declining and elusive, it is a mysterious species. A whispering bat that mumbles its echolocation, notoriously difficult to pick up on a detector; it is also part of the evolutionary tussle between predator and prey. Its giant ears, the length of its body, negate the need for ultrasound to find prey; it can hear movements and pick insects from the surface of a leaf – useful, as some moths have the ability to jam ultrasonic frequencies or emit their own, disorienting warning noises.

This is the second count of a maternity roost. A maternity roost is one of those facets of being a bat that makes their otherness seem laughable. They are mammals, so they give birth to live young. The maternity roost is a birthing ward: mother and pup, sleeping in the same nooks in the roof of a lean-to, the pup suckled until it can steer its wings in flight and forage for its own food. We count them as they wake for the night and slip out of the roost. Male brown long-eared bats spend time in the roost too, unusually committed for bat dads.

I had to miss the first count. (I was busy being a committed human dad.) Fiona and Alison, fizzing with their usual enthusiasm for all wildlife, were keen to fill me in on the full experience.

F: "It was great, enjoying it as the night drew in. It also makes you aware of other species that are around, while you're out surveying one species."

A: "Yeah, the blackbirds were really noisy weren't they!"

F: "And we had a massive crow/rook/jackdaw roost watching us from up in the trees."

L: "And we had a hare."

F: "And we had a hare as well!"

L: "With a leveret?"

F: "I think maybe it was, Liam."

A: "It's just good mindfulness, sitting and being and watching."

F: "Definitely. Is that a blackbird? I think it is, isn't it."

[Everyone takes a moment.]

S: "What was it like seeing a brown long-eared bat? Had you seen a brown long-eared bat before?"

A&F: "No"

F: "That was the first time we'd seen them and yeah, it was pretty epic, and once they all eventually started… was it nine of them?"

A: "Nine"

F: "It was great. We were standing with the bat detectors, and we could all try out the different frequencies because there were others, pipistrelles flying over, so yeah, it was great. It's just great to be out with likeminded people that are interested in what species are around."

S: "Do you have an idea of the threats facing brown long-eared bats or bats in general?"

F: "I think it comes to land and how it's manned out there. I think not just bats, but a lot of species are at risk of how the land is manned: fertilisers, getting rid of insect life, silage, insects, pesticides. Obviously you've got the insects that the bats enjoy, so that's a jeopardy. There's the roost sites – if they're not surveyed properly, there's a risk of devastation of the roosts, populations, trees as well, deforestation. You know, they enjoy the trees and roost in them, so there are a lot of things."

A: "Locally, where I am, bat roosts have been destroyed by building, the removal of trees for housing. There are no preservation orders on the trees so that's it, and the buildings are removed, no proper ecology survey done, so … it's a battle for them, it really is."

F: "Definitely. I think this comes back to the surveys that are so important to see how many is there and what's about. Basically, it's just all of us coming together as a community for bats and advocating for them and being a voice out there in the world, where they can't do that. I think these groups coming together, like-minded people, to stand for one or two hours to surveys bats, I think is really important. We're delighted to be involved with that and look forward to doing more surveys and keeping the advocacy for bats alive"

*

But Liam, why are we here particularly?

"We've struggled with brown long-eared on the Solway because for me there were so few known sites, so few known roost sites that would inform our survey efforts. The roost count is different from the Field Survey and Waterway Survey on the National Bat Monitoring Programme, because rather than those sites being randomly allocated and then selected or adopted, most of them are self-declared. You need to know of a roost site, and ideally it would be a site you have permission to survey, or its on your own property. I was surprised to learn from the data we were given from the Bat Conservation Trust that there were only two or three known brown long-eared bat roost sites, two of which we had considered to survey because of their geographic location on the Solway coast (Species on the Edge being a coastal and island project). The landowners associated with those sites were approached and either didn't respond, or didn't give permission for those sites to be surveyed."

"It was only really anecdotally through my interaction with the bat group in Dumfries and Galloway Bat Group that I learned of a handful of other brown long-eared sites. I followed those tips as far as I could and was mainly met with confusion."

"So that's been a real challenge. Even knowing where to start. It can seem like a needle in a haystack, as it's mainly just through people's anecdotal stories. Quite often, when you do inquire, people will say yeah, we have bats, I see bats, but not everyone will think to record that or do anything with the information. The third place recommended to me was Logan Botanic Gardens. There was a potting shed that seemingly had a brown long-eared roost. I got a telephone number for someone there, and when I spoke to them, they had asked their colleague who was sure it was pipistrelle. Sometimes you'll find the opposite. It can almost feel like a leading question, so if you tell someone you're looking for brown long-eared bat, they'll say 'I'm sure its brown long-eared we have', but they're pipistrelles. So, very likely, there are people that know they have bats or see bats emerging from their property or a building nearby, but don't know what species they are and not think to record that."

"So, you're chasing whispers of bats?"

"Yeah! It does feel like that a lot."

Liam thinks for a bit and then says:

"For some homeowners, it can initially be quite concerning to them. A lot of people ask, 'How do I get rid of bats?' and the answer being, well, answering with a question of why do they want to get rid of them, and promoting this culture of cohabitation where they accept living alongside the bats. But you do find that people are overcome with curiosity and end up feeling more of a sense of kinship. I suppose like that paper you referenced earlier ['What is like to be a bat?', by Thomas Nagel], it is interesting that they chose a bat over another mammal. In fact, there's a lot that we do share with bats, and a lot of misconceptions about bats. Bats' vision is as good as human vision, well, maybe not quite as good. They're certainly not blind, but because they're out at night, they've evolved an ability to echolocate. They lactate like other animals. Anatomically speaking, we've spoken before about the arrangement of a bat's wing; it's strikingly similar to a human's hand, its digits… so there is a relatability in that."

*

No fanfare. It just happens mid-conversation. I am looking the wrong way. Alison and Fiona exclaim as a detector crackles. Mary and Liam and me: our heads snap around in sync with the detector's beat. A black flash of bat appearing and disappearing in one fluid movement, from under the raised tile to the black understorey of a tree too dense for the last light to penetrate. Unseen, it gleans its rich pickings of the insects also seeking shelter from the murky smirr of late evening. The detector taps out the morse code of its call. A rattle – methodical, slow, precise – a mayday for mayflies.

Again. This is not a typical bat, if there even is such a thing. Their broader wings are slow, their bodies look rounder, although we are watching them fly across us rather than above us, as pipistrelles almost always are. There is something butterfly-like about them – the same sheer improbability of their slow, broad-winged flight, suspending them in air. There is something incredibly improbable about them being bats in the first place; somehow slower, more deliberate, more physical than the other species I've seen during the project.

And for all that – their slower, more deliberate flight – they are more elusive, less knowable. The detector taps out the translation. They take a couple of seconds to slip from the roof to the trees, our viewing window always fleeting in the now dead light of heavy clouds at night.

We count ten. An improvement on two weeks ago. But that's not the full story because of what we saw between bats eight and nine:

"…a bat emerging from the roost, and it seemed to come into close contact with another bat in flight. One of the observers thought that one bat looked smaller than the other. I explained that the reason we do two counts throughout June is because we're usually counting maternity roosts. My understanding is that towards the end of June, the young will be at a stage where they're ready to leave the maternity roost, so I hypothesised that we observed a mother interacting with its adolescent offspring. And probably what it was doing was making its presence aware and sort of…"

Fiona finds a phrase: *"Flying lessons"*.

"Yeah, that's a nice way of putting it"

The detector crackles as the tenth bat leaves the roost, loops over the space between us and disappears into the trees. We gasp.

Conclusion

An echo: a sound returning, slightly changed, in response to its environment.

The aspiration for the project is to enable people to assist in discovering more about the region's bats: to encourage the recording of data, or the step before – to kindle a love of bats that becomes a data point that then becomes an informed conservation action.

The success of Liam and Jack's work relies on echoes. It relies on interventions and offering opportunities: doing things and hoping for a change in return. Whether that be from Jack's presentations and teenage volunteers armed with power tools, or following in Liam's footsteps, learning field survey techniques on a reserve, or detectors chattering with pipistrelles.

The issue of data deficiency is difficult to challenge. It is solved by small steps. Little actions and their echoes. I saw in it the teenagers, suddenly turned on to the task at hand, by the new purpose of providing for bats; by the attendees of the bat walks engaged in the sensory experience of the detector's sounds, and the glimpses of flickering wings in the dusk, the scent of evening flowers and midge repellent. And in Alison and Fiona and other trainees on the survey programmes, a step further on in their love for and involvement with bats, receiving the training – a demonstration of the routes and actions for their own echoing, in their own corners of the countryside.

A whisper: a message from the breath, not the throat, soft and secretive.

Bats don't make it easy. They are fragile and hard to know, hiding behind whispers of otherness, even though that is not true.

In the company of Liam, Jack, and all the other volunteers and collaborators, I consider myself a guinea pig experiencing my own awakening about bats. I can say that the project is working, though I may, as a naturalist, be something of an open goal, though all the bat-devotees I spoke with begun as naturalists who turned to bats, lured by something in the night. And one of the things that struck me is the enthusiasm of the converted – that once demystified, bats in the attic are a gift not a curse. They are a portal to a night less mysterious, more interesting. Where the strange music of the detector is hypnotic in the half-lit beauty of dusk, as the stars emerge and meadowsweet glows like a fen fog in

moonlight. Or the busy road in town, where the late-night traffic rumbles and the half-cut stumble down the pavement as a pipistrelle spins loops around the streetlights, snatching insects. Half wild, half suburban, half mysterious, but waiting to be known.

And this was true for me, for the beginners on bat walks, and the experienced, learning new survey techniques, all stopping to whisper *wow* at another close passing.

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