Chapter 3

'Putting Nature Back Together Again'

Stuart Pimm in Conversation

Stuart Pimm

Nicholas Chare: As you know, we're interested in issues of representation (in a broad sense of the term) as they relate to extinction.[1] To begin, could you tell us a little about the ways you employ images and/or imaging techniques in your own work?

Stuart Pimm: There are two sides to this; on one I use a huge number of remote sensing maps and visualizations, on the other I also use pictures of gloriously charismatic animals. So where do you want to go with that?

NC: Do you find that you ever combine both? Do you think that you use them for different reasons?

SP: Yes, absolutely. One of the things that I try to instil in the classes I teach is that these days we face the challenge of those who violate science, violate facts, violate common sense, and do so for a catchy soundbite. We have to be cognizant of all this, and we have to recognize that we need to be compelling communicators of what we do. And then the challenge becomes how to intersect good communication with good science. You want to make sure the science is good, and it's credible, and it's justified. But it also has to be something that people can quickly understand. I do think that's a challenge, and I think good imagery can be very important in that context. If there's one thing that's certain, it is that a difficult graph or

chart isn't going to convince anybody. But interestingly, you know, a good map can. My group spends a lot of time worrying in general about how we make our imagery, particularly our maps, so that we can clearly show people what we're doing. Most people can understand maps, but far fewer are good at looking at charts and tables and such things.

NC: So charts and tables are for a particular readership then, for a scientific audience?

SP: When you phoned, I was in the middle of working on paperwork where the key elements are tables, and there is a need to get them right. But even there, we scientists are incredibly busy people, and if you pick up a paper and you can't understand it, then you're likely to put it down again. If you pick up a paper and you understand the graphics, the tables, the charts, the maps, the figures, it's much more likely to have an impact. My group does rather well at that, because we go to a lot of trouble to make sure that our graphical items are easy to understand.

Valérie Bienvenue: Just briefly, could you give us a sense of what makes for a good chart or table? What might form a bad use of graphics or visual mapping?

SP: Near enough, a good chart or table should make sense even if it's labelled in another language! A scatter plot showing that Y increases as X increases makes sense in almost any language, albeit with simple labels of what Y and X are. We produce maps with red showing where there are more species, blue fewer. Everyone gets those – including people who find charts hard work! Bad charts need pages of explanation of text. Brilliant charts explain several ideas simply and intuitively – and I collect those when I come across them, to use as models for my own work.

NC: And when would the other kind of imagery come into play? The 'charismatic animals', the striking pictures of animals or birds that you include in some of your articles?

SP: One of the things that I worry about a lot – I'm working on a paper on giant pandas now – is that it's easy to include a drop-dead gorgeous picture of a giant panda that you want to go up to and cuddle. In reality, it would probably scratch the hell out of you if you did! So it's good to have that kind of imagery, but you want to use it in a sensible way. If you want to work on giant pandas that's fine, but how do you communicate biodiversity and species going extinct without constantly showing pictures of

giant pandas and other things. How do we get the balance right, to get the species portrayed, but not rely on it as a crutch?

NC: How do we get away from that difficulty? The fact that certain animals have become iconic, like the panda, and are taken to be striking or viewed as cuddly, whether that's the reality or not. . . Does the existence of what might be called 'species aesthetics' – the way people fixate on particular animals because they view them as more beautiful or cute or visually interesting than others – create a problem?

SP: Yes, and there's both good and bad sides to that. Working with my Chinese colleagues, we know that all the efforts put into protecting giant pandas protect something like 70 per cent of all China's endemic birds, and mammals and amphibians at the same time. So that's good, the panda is a very real umbrella species. . . But yes, the danger is that because some species become so familiar, we tend to think that they are not in trouble.

I have a colleague, Brian Hare, who works on chimpanzees. Chimpanzees are often portrayed as almost human and are given human attributes. Brian shows that this actually diminishes people's expectation or understanding that they are really critically endangered. So the more you make a species familiar, the more you show quite adorable movies of fifteen baby giant pandas playing with each other in the captive breeding facility outside of Chengdu, the less likely you are to realize that pandas are extremely rare because of massive habitat destruction. So there is definitely a problem in how you handle that. It can cut both ways. It can engage people and it can give them a false sense of security.

NC: I hadn't actually thought of it that way myself, the fact that an animal becoming iconic causes a predicament in terms of people seeing it all the time and therefore believing that there isn't a problem in terms of its endangerment. Isn't there also the dimension that there are certain kinds of species, like small mammals, like rodents, that people have a negative perception of and prefer not to see or think about?

SP: Yes, that's an issue too. For many years I worked on an endangered bird in the Everglades in Florida called the Cape Sable seaside sparrow.[2] The fact it's called a sparrow doesn't help, because people think of sparrows as little obscure brown birds. In fact, it *is* a little obscure brown bird. On the other hand, the reality that it's declining dramatically is the best indication that we have that we are mismanaging the Everglades on a very large scale. It could be worse, I could work on some sort of species of rat, which would have even worse connotations.

NC: At least a rat registers with people, while plants, for example, seem very much overlooked. I guess orchids have a certain appeal because there's a perception that they're beautiful. Is it possible to conceive of a plant becoming iconic in conservation terms?

SP: I think that the kind of species that always comes up when the politicians are trying to trash the Endangered Species Act is called the Furbish's lousewort.[3] You know with a name like lousewort, you've got an uphill battle! Yes, it's difficult to engage people. My conservation group, a nonprofit that I run in my spare time, Saving Nature, is working in the western Andes in an area that's got exceptional plant diversity, and it doesn't help that there are more species of orchids than you can shake a stick at. Nor that one of the really interesting genera of orchids there is called *Dracula*.[4] And *Dracula* orchids can be spectacularly beautiful – purple and black and white. They are really funny looking, beautiful orchids, and you sigh in relief because you've got a plant that is as charismatic as could be, and which has a great name.

NC: So in a sense, now that issues around naming are recognized, memorable names can become important in a conservation context. Wasn't there a recently discovered primate nicknamed Skywalker?

SP: I've seen it! It's an absolutely wonderful gibbon.[5] The population that I saw is now down to two adults and a youngster. I think there might be a couple more adults, but there's no more of them. Five individuals in this very isolated population in Yunnan. And I was watching and photographing them in early May. And yes, it looks like Luke Skywalker in the latest movie, with a sort of hood over his head and scowling.

NC: But is that choice of name simply because some of the scientists involved like *Star Wars*, or is there a desire to exploit the publicity that such a name will generate?

SP: I know those guys very well. I do not think there is a desire to exploit. If you saw a picture of this thing and the latest *Star Wars* movie, you'd make the connection easily. It's got this sort of brooding, hooded look about it. And incidentally, that's not its scientific name. It's just a name that people have put on it because it resonates. And when I saw them, and I looked for them several times – this year we looked for them several times, finally found them on the last day – yes, that's a really good common name.

NC: It has helped its profile, in the sense that people have heard of the animal through the 'media buzz' generated by that name.[6] The issue of naming is something that you think about quite frequently in your work although more in the context of the many things that haven't yet been named and some of the issues arising from that. Could you talk a little about naming in that context?

SP: Where we work, particularly in the western Andes, we are discovering new species all the time. And I have absolutely no shame in trying to sell the naming rights of those species so that we can raise money to protect their habitats. My elder daughter is a plant taxonomist, who describes new species of orchids. And this is a subject that we do not discuss, because she thinks her dad is totally wrong on this and that it cheapens the profession. And I fight back and say that if you look back over the history of naming, all sorts of bird species were named after Lord Rothschild and Lord Derby and other wealthy donors. And she says: 'Well, Dad, that's not now'. And so we agree to not talk about it. My feeling is that if it saves the species from extinction, it's all worth it.

NC: Staying with naming, in your work on plants with Peter Raven you've considered the difficulties that come with invisibility, with undiscovered plants not having a name and being absent from the taxonomic list.[7] Could you talk a little about how that poses problems for conservation?

SP: Yes, there are two problems. One of them is how many more species are there that remain to be discovered. And when it comes to plants, it turns out that Peter and I agree. We don't always agree! Peter's approach to find out how many remain to be discovered is to ask all his plant taxonomist friends, and my approach is to build mathematical models of the rates of species descriptions. In this case, we have a happy convergence. We both agree that about 15 per cent more species of plants remain undiscovered. That's a relief to me because it means I know that my elder daughter will have a career in naming new species of orchids and that she's not going to run out of them anytime soon. But more seriously, the question then is, if you know how many are out there, where are they? Because as a practical conservation biologist, I want to know where those missing species are, because I want to add them to the list of species so we that can prioritize the right places for conservation.

NC: Is it difficult in terms of securing funding when you're talking about something that you don't even know is there for certain? We've already

discussed issues raised by endangered animals becoming iconic, but what about in the case of undiscovered species when there is nothing to represent, at least not yet?

SP: The interesting thing, it could work against you; it could well be we predict that there are lots of missing species in places we don't expect. But it's working out. The places where we believe the missing species to be are already the places we think are important. And what that means is that the places we already think are important are even more important than we think they are. Of my top three priorities where I think missing species of plants occur, the first would be the northern Andes of South America, the second would be the Atlantic coastal forests in Brazil, and the third would be the mountains in the eastern Himalayas and south-western China, many of which are already safeguarded by the fact that we're protecting pandas. We're probably not going to describe many new species of plants in Connecticut, and so I think basically what we know about the patterns of missing species helps us reinforce the conservation priorities that we already have.

NC: But is it difficult to build momentum for conservation when you're talking about hypothetical species?

SP: I'm not sure. I do think there's a dimension to this that's exciting. In one of the Saving Nature projects that we have in the western Andes, a colleague sent me an email a couple of days ago that said, 'Look we have six new species of frogs. We collected them and we had no idea what they were. We took a toe snip, ran the DNA and there's nothing like these species'. That we have new species such as these, some of which are quite exciting, I think adds to what we're doing. We're working in that area, we're buying up land, we're restoring land, and the land contains species that we have not yet named scientifically. That's very exciting. And I think our donors understand and appreciate that too.

NC: So narratives regarding the continuing possibility of discovery, of the excitement of something being out there that we do not yet know, can be helpful?

SP: Absolutely, and I still live in hope that one day, on some remote mountain top, I'll see a bird and I'll say 'I have no idea what that is'. And nobody else will have an idea what it is either. There's still part of me that fantasizes about being a naturalist back in the 1880s.

NC: Although I guess the naturalists back in the 1880s probably did a lot of harm as well as good?

SP: That may be true. I would have been equipped with my shotgun, and whatever it was I would have shot it. . .! But you know, there's still that frustrated adventurer within us. I think that most of the people that I know, there's a part of us that says we'd love to go into a new part of the world and find something really exciting.

NC: Staying with the topic of undiscovered species, for some of these species that you go in search of, you arrive too late. In one of your articles, 'Species, extinct before we know them', which you co-authored with Alexander Lees, you discuss unknown species of birds in Brazil's coastal rainforests, and you refer to some of the kinds of evidence we have for the existence of birds for which there are no physical specimens.[8] Obviously in that context, representations, be they textual or visual, hold great importance. Can you tell us more about that research?

SP: Yes, one of the things that has worried me greatly, because I like to put numbers on things, is how many species have gone extinct before we knew what they were. And I've done that for places like Pacific islands. If you look across the Pacific, there is a scattering of very remote islands that have either a species of rail, a species of pigeon, or a species of parrot – and sometimes all three. And so you can say, where did rails get to, where did parrots get to, where did pigeons get to? The answer is almost everywhere. And then you ask how many islands still have parrots, or pigeons, or rails? The answer is not many. And you can say that we, we being Polynesians, probably wiped out a couple of thousand species of birds spread across the Pacific. In a place like Brazil, we know that in the last couple of hundred years the deforestation has wiped out 95 per cent of the coastal rain forest and that some species have gone extinct. But we don't always know what the species that went extinct are, that's the challenge. And that paper that I did with Lees noted that there have been one or two things that people have discovered by going back to the museums and looking at specimens and realizing that those specimens weren't the species that people thought they were, but were something else. They were given a scientific name posthumously. And I would love to have a method to estimate how many species like that there are, but I have no idea how to do that. It's clear, however, that there could have been a substantial number of species that got wiped out in coastal Brazil and in Madagascar, the Philippines, and a variety of other places, where humans came in and their actions did massive envi-

ronmental harm, and we've never found the species for which depictions exist. For some of the Caribbean islands, there were oil paintings done in the 1600s depicting species, and we have no idea what they are – but they are probably birds that are now extinct.[9]

NC: So am I right in thinking that in Brazil, as well as revisiting museum holdings, researchers found eyewitness accounts and drawings that enabled them to posthumously identify birds that had gone extinct?

SP: In this particular case, it's a kind of Ovenbird.[10] They knew there was this rare species of Ovenbird up in the north-east, and when they went to the museum specimens and realized that the specimens that had been put into the drawer, labelled whatever this thing was, actually consisted of two clearly quite separate species, and they had just overlooked it.

NC: So one of those misidentified birds in the drawer then became the taxon for the species, is that right?

SP: Exactly so.

NC: With other birds where there's no physical specimen, like those birds in the Caribbean, they'll never become a species because there's no taxon, is that the case? A painting of the bird wouldn't do?

SP: That's an interesting question, because you might wonder if it's just a bad painting, and that could indeed be the case. With some of the Caribbean specimens it's pretty obvious you are looking at a new species. There's a macaw, it might have been the Cuban macaw or the Jamaican macaw, just a bloody big parrot, and you look at the oil painting, and it's clearly a large macaw, it's absolutely unmistakable.[11] It was obviously found and shot and stuffed on that particular island. So in those cases, I think we can be pretty sure that that's what it is.

The first map to have the word 'America' on it is from 1507, and it's by the cartographer Martin Waldseemüller. He produced a map of the New World and labelled South America 'America'. It's the first time the word America appears. And on the map in the Americas, there's a drawing of a bird, and it's clearly a macaw; it's got a face like a macaw, and a long tail. It's labelled in Latin, red parrot [*rubei psittaci*].[12] What fascinates me is that here's this guy producing a state-of-the-art map, defining America, and he has time to put a parrot on his artwork. I mean it's clear that people were fascinated by biodiversity when they first encountered it. You know, some sailor arrives from Spain or Portugal on the Brazilian coast, and suddenly

this bloody big macaw flies overhead. It's not surprising there's a drawing of it. They're loud and they're noisy and they're big, and people from Europe had not seen anything remotely like them.

NC: Has the Caribbean macaw you mentioned got a Latin binomial?

SP: I think one of those does, but you can imagine that people get hot under the collar debating whether or not that's the right thing to do.

NC: Has it happened that a species has been identified based solely on anecdotal evidence, or must there be a physical specimen for it to be named?

SP: I am 99 per cent sure that there are species that have been recognized from anecdotal evidence.[13]

NC: So in certain circumstances materials such as drawings and paintings of extinct species can assume considerable value when it comes to scientific classification? I knew there was a strong emphasis on the specimen, on the taxon, but clearly in the absence of a physical specimen, representation can serve an important function as a means of identifying a species.

SP: Yes, I'm just trying to think how easy it would be for me to look that up, but I do believe it shouldn't be too hard to find the list of extinct birds, and then work out which ones actually do not have material, do not have skins, do not have skeletons to go with them.

VB: And I imagine that with newly discovered critically endangered species there might be arguments made against procuring a physical specimen to use for classification purposes, unless or until one of the species dies naturally. Perhaps in those circumstances images such as photographs would offer a valuable alternative for classification purposes. . . I know that for some of your work in the Pacific islands, there are fossilized remains that you can turn to in order to identify extinct species.

SP: Yes, this is how we know where rails and pigeons and parrots were. A lot of our knowledge comes from that kind of material. And there are some islands where people heard rails. Rails, birds such as corncrakes, tend to make funny sorts of noises at night. So people would arrive at an island and they'd hear this thing calling in the night, and from it they knew it was the Something Island rail, and they would never see one. So in addition to the fossil record, there's one or two sort of putative species claimed in that way – birds heard rather than seen.

NC: Ear-witness accounts of species, that's really interesting. Going back to the Ovenbird, you mentioned that specimens held in a museum collection enabled the ultimate identification of two distinct species. In the paper 'Can we defy nature's end?', which you were lead author for, you discuss museums and herbaria in the context of knowing enough about biodiversity and how to protect it.[14] Clearly museums are important knowledge resources and form a crucial interface between stakeholders and the wider public, but do you think institutions such as natural history museums can do more to raise awareness of environmental science and conservation issues? Or should they be doing things differently?

SP: There's clearly a downside. There are certainly some museum collections that have an excessive list of rare specimens, and I do think that's a serious problem. In some parts of the world there are many people who don't want collectors coming anywhere near the places where endangered species live. So there is still a real and present danger from overzealous collecting. On the other hand, museum collections are the basis on which we make our taxonomic catalogues, so we can't do without them. What we can do without is an excessive zeal when it comes to collecting.

NC: I hadn't thought of museums in those terms before. I didn't know that there was still a problem with overzealous collecting. That's something that I had associated more with the Victorian naturalists, who would go out and shoot various animals and bring them back for the collections. That said, I was in a museum in the United States recently where they pulled out a draw filled with numbats, with twenty or so examples of the same species.[15] It does pose the question, how many examples do you need of a given species?

SP: The argument is that we need to understand the geographical variation of the species. That's OK, but why do you need twenty specimens from one place? And you know, I am not compelled by the argument that the need for that science trumps the need to make sure you don't completely eliminate that species. I mean it's a problem for birds, but it's really a problem for amphibians and reptiles, that might have very tiny populations. In those circumstances, you might be able to go out in the space of an hour or two and collect a significant fraction of the world's population. There are some legitimate concerns there that lead to very energetic debates between conservation biologists like me on the one hand, and museum scientists on the other.

VB: Yes, perhaps part of the problem is the kind of knowledge of animals that is privileged, with morphology emphasized over behaviour? The truth

of a species is perceived to lie in its bones and, nowadays, its DNA, and not in how it actually lives and acts in a given habitat. Does part of this debate therefore revolve around the kind of knowledge that you can glean from a specimen, which is very different from the kind of knowledge you can glean from studying a species in situ, in the wild?

SP: Exactly so, and I would argue that there's a huge amount of information that you cannot get from the species if it's dead.

NC: So, a problem is the enduring drive to collect, the need to become comprehensive. There's an ongoing competition to have the best collection.

SP: Yes.

NC: But there are also immensely positive things to be said about museums. For example, here at the Montréal Science Centre we recently had an exhibition that had toured from Australia, from the Australian Museum, about spiders, 'Spiders: From Fear to Fascination', which aimed to overcome aversion to arachnids. Can't museums play an important role in that kind of way?

SP: Yes, without museum collections we wouldn't have the basis for what we do. Most of the conservation I do is based on birds, because we know birds best. And I worry a great deal about how the actions that we take might lack appropriate representation because we're concentrating on birds. But we have learned an enormous amount about how to do conservation, and where to do conservation, because we know birds so well. Part of that is due to the fact there are millions of birdwatchers. But part of that is also that by 1900 we had 90 per cent of the world's birds described. The period from 1815 to 1900 took us from 10 per cent of the world's bird species being known to 90 per cent. Lord Rothschild, Lord Derby, those wonderful Victorian collectors, incredibly eccentric, sent out their chaps to every corner of the planet to shoot, stuff, and bring specimens back. And because they did that, and because they established those collections, we've got a good taxonomic catalogue and we can do the kinds of conservation that I do. So, I totally understand the importance of having collections, for birds, but especially for insects, which are really hard to identify. In this day and age, you can identify a bird from a photograph, but you can't begin to understand, say butterfly diversity, unless you've collected the thing and stuck a pin through it.

NC: The taxonomic catalogue, the museum as a repository for scientists, is one dimension of a museum's role, certainly incredibly important, but

surely of equal importance is the public-facing side, how that collection is used and displayed.

SP: I think that museums, zoos too, have an important role in engaging the public, to show them how spectacular biodiversity is. I'm hugely fortunate that I can walk through the Brazilian rain forest, I can go to New Guinea, I can see all these wonderful species, but for a great many people they're only ever going to see them as museum specimens or as live animals in the zoo.

VB: I was wondering, Stuart, if you could tell us a little bit about the word 'extinction', what it means to you? Is the way it is sometimes framed in scientific discourse one that obscures human responsibility for species disappearances?

SP: My story is very simple. After I got my PhD, I was very conscious of the fact that I would never want to work in a place like Hawai'i, because I knew that the Hawaiian Islands were so badly beaten up ecologically. I thought that I needed to go and study the ecology in places where the ecology is pristine: the Amazon, the desert, places like that. And in one of those sorts of events that make you believe in magic fairies that fly around and tap you on your shoulder, I found myself out in Hawai'i, and it totally changed my life. I went out for an eight-month period in 1978, expecting to do fieldwork six days out of every eight. I was confident that anything that was in Hawai'i, any bird that was in Hawai'i, I would see. I was a very good fieldworker, and I thought I would learn the species there very quickly, and their calls. But, I didn't: there were some species that I did not see, however hard I tried. That absolutely grabbed my attention. I realized that the species were going extinct, that some of the species that people thought might survive were almost certainly extinct. I was working on a species that had dramatically declined. And those experiences made me what I am today, which is a conservation biologist.

A few years later, Michael Soulé – I didn't then know who he was then – phoned up, introduced himself, and said, 'I'd like you to come to a meeting on conservation biology', and I said 'What's that?' And he said 'Well, whatever "that" is, you're doing it'.[16] And so I was there at four o'clock on a Thursday afternoon when the Society of Conservation Biology was voted into existence. So for me, the experiences of working out in Hawai'i and seeing some species that are now extinct, not seeing other species that I wanted to see, species that were either already extinct or that are extinct by now, absolutely changed my whole career.

NC: Picking up on Valérie's question, there's a moment in your article 'The Dodo Went Extinct (And Other Ecological Myths)' where you state that the dodo did not go extinct, rather 'humanity bludgeoned it into oblivion', as if you thought that the term extinction was too cold and detached, and that it didn't really capture the violence behind what happened in Mauritius.[17]

SP: Exactly so, and I got that definition from, shame of shame, the Oxford English Dictionary, of which I have three copies: one at work, one at home, and one online. So here we have the great repository of the English language, and it says that the dodo 'became extinct'. It's as if it was the dodo's own bloody fault that it went extinct. Well, that's not the case. We drove it to extinction. This isn't something about which we should in any way be passive.

NC: No, your choice of words certainly leaves no ambiguity as to how the dodo ceased to exist in contrast to 'went extinct' which, in the context, seems an inadequate euphemism that deflects attention from the violent historical reality.[18] Linked with the need to be alert to language, is there a danger that sometimes in scientific discourse extinction is framed in a way that risks obscuring that human responsibility behind species disappearances? It seems to us that that's what you're working against in the article by choosing to foreground the dodo's fate in that way.

SP: Absolutely. One of the experiences that I encounter when I'm testifying in some congressional committee in the US is people saying, 'Well, species have always gone extinct!' That's true but we're driving species to extinction a thousand times faster than they would go extinct naturally. You always find people out there who say: 'Well, *c'est dommage*, *tant pis*, extinction is part of life. Let's just get on with it'. Well, no.

NC: Unsurprisingly, given you've told us that you've got three copies of the Oxford English Dictionary, your choice of language in your writings seem very careful and considered. You're well aware of the power that words have. In some of your writings, you mention 'wimp species'.[19] How did that kind of negative description of species come about?

SP: There was a time when Sir David Attenborough was rather dismissive of bird extinctions, because he thought they were mostly birds on islands. The notion is that birds on islands are like dodos, they're sort of wimpy, they're not well protected. I mean, look at the great auk. All you had to do was row up to an island, the islands off New England and Canada, and

bludgeon the things. That gave rise to the idea 'what a bunch of stupid species'. And that attitude is out there, that these extinct species, as it were, were wimpy, that they had it coming to them, they were really never going to survive the modern era. And I think that's a view that we have to reject very forcefully.

NC: I guess that reinforces how even scientific language regarding extinction can't escape the presence of stereotypes. They're there, and you have to work against them.

SP: The answer is yes. We need to be very careful and we do not want to stereotype species. We don't want to stereotype dodos as being stupid, we don't want to stereotype chimpanzees as being just clever little subhumans, and they really are friends and pets, and they're OK. That's not true.

NC: And these do seem to be issues of representation in the broad sense. Scientists have got to negotiate this issue, the different ways of representing species.

SP: I think you're absolutely right. I think we have to be very careful about how we look at this.

VB: Speaking of looking carefully, could you tell us a little bit about your passion for birdwatching, and how, if at all, it informs your approaches in your research?

SP: Well, I grew up in a home in the north of England where my parents loved to hike and walk and explore nature whenever they could. I became a fanatic birdwatcher when I was twelve years old. That's sixty years ago – I haven't changed much. And I do think that birdwatching and other kinds of natural history really does give you an extraordinary insight into what's going on in the environment. I would not have become a conservation biologist if I had not gone out to Hawai'i as a birdwatcher and realized what a desperate state the Hawaiian birds were in.

NC: Are there qualities that birdwatching as a leisure activity, a pastime, necessitates that then play into your approach to conservation, to your research?

SP: Absolutely. I think that what it does is it's the one hobby where you can go anywhere and have an almost immediate assessment of the environment around you. If I'm out in the field with Stephanie, my elder daughter,

who is a plant taxonomist, she is a very good tropical biologist but it's hard work for her when she finds a plant. She will look at the plant and have a very good idea of what family it is, and perhaps what genus it is, and then she'll whip out her guide to flora, and maybe after a bit of work she'll figure out what it is. Whereas for my walk this morning – three kilometres for my cup of coffee at the nearby Bean Traders and three kilometres back – I can rattle off the list of species that I saw, the list of species that I heard. The fact that there were some wood thrushes singing tells me it's actually quite a big patch of forest I'm walking past, because wood thrushes don't do very well in small patches. I heard barred owls calling the other day. That's a good sign, because to have barred owls you have to have prey around. On and on and on. And I can do that essentially anywhere in the world. I can go out with my ears and my binoculars, and I can come up with a list of species that can tell me a lot about that environment. And I think that's sort of a unique feature of birdwatchers that's hard to replicate within the other taxa.

VB: It seems to me that your passion is giving you sensory superpowers! It's great that you can listen and look, and then extrapolate so much information from what's around you.

SP: I hadn't sort of put it in the superpower context!

VB: Super vision . . . I think most people don't notice this richness of nature that is often present in our everyday surroundings.

SP: As I walk out to get my cup of coffee in the morning, I see people with their headsets on, and I think, 'You dummies, you're missing everything!' And for me, I want to be hearing it. Is that a species I haven't heard before? What's happened to my great crested flycatcher? You know, there are all sorts of things going on that you can be alert about. As a birdwatcher, I can have experiences of this kind anywhere in the world.

NC: I think you're telling us what a scientist can bring to the experience of birdwatching, in that you can hear the wood thrush, and upon hearing it, based on your knowledge of its habitat, you can estimate the density of wood thrushes in a particular area. That sounds like a scientist at work as they watch and listen to birds. Is there anything that goes the other direction? Is there a way that the birdwatching informs the scientist? I don't watch birds myself, so I don't know what kind of qualities are needed for it. In my ornithological imaginings, I envisage qualities like patience, or perseverance, or having a particular eye for detail to be able to identify species as being important?

SP: I'm not sure I have any of those qualities. I'm not sure I'm particularly patient, and I'm not sure I have got a great eye for detail, but what I definitely do have, formed over sixty years of being a birdwatcher, is a passion for birds. And a fascination for them. All the people that I think of as being my peers share this fascination . . . Paul Ehrlich is an enthusiastic birdwatcher. For much of his life he was an enthusiastic butterfly watcher. Peter Raven is enthusiastic about plants. Tom Lovejoy is enthusiastic about birds. Jared Diamond is enthusiastic about birds. Pat Wright is enthusiastic about lemurs. I've been in the field with all of those people, and being in the field with them is fantastic because you're constantly seeing nature through their eyes. I learn a huge amount of stuff with my elder daughter. It's a very different experience looking at plants. You go out there and you're seeing stuff continuously, and I think that absolutely shapes the science that I do. It's those experiences in the field that lead to the scientific questions. I became a conservation biologist asking the obvious question: why do some species go extinct and others not? Those first conservation questions that I asked came directly from field observations, or the lack of them.

VB: There's clearly continuity across birdwatching and your field research in terms of that first-hand encounter with nature, and the questioning and the quest for answers it can provoke. Staying with birdwatching, you talked earlier about your formative experiences in Hawai'i, about expecting to see some species, striving to see them, but then never doing so. Some birds you failed to see you now believe to be extinct. With that in mind, are you left feeling melancholy at the current state of affairs regarding the conservation of biodiversity?

SP: People tend to phone me up to talk because they know that when Al Gore says 'Species are going extinct a thousand times faster than they should', that he got that from me. What drives what I do is an enormous sense of optimism. I believe that we can prevent species from going extinct, that we can solve environmental problems. Sometimes journalists say, 'How on earth do you get up in the morning when you're the purveyor of bad environmental news?' I get up in the morning because I want to effect solutions. And so I think the deep sense of loss I have when a species goes extinct is very much weighed against the deep sense of accomplishment I get from the kinds of things we do at my non-profit, Saving Nature – things like rebuilding habitat corridors between isolated forest fragments to put nature back together again. And that image of restoration and of bringing species back, that's the powerful image that drives what I do every day.

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Notes

1. This interview was conducted by telephone on 22 September 2019 and then by email. We are very grateful to David Sume for transcribing the initial phone conversation.
2. See, for example, Boulton et al., 'Endangered Cape Sable Seaside Sparrow'; Curnutt et al., 'Population Dynamics'; Pimm et al., *Sparrow in the Grass*.
3. The Endangered Species Act of 1973 (ESA) 'recognized that some fish, wildlife, and plants were endangered by economic growth and development' and thus 'provided for conserving endangered and threatened species and the ecosystems they depend upon'. See Yellowstone National Park, 'Wolves for Yellowstone?', 2. For a discussion of Furbish's lousewort in the context of the ESA, see Macior, 'The Furbish Lousewort'. For a general discussion of the plant and its rarity, see Fiedler and Ahouse, 'Hierarchies of Cause', 36–38.
4. For a copiously illustrated discussion of Dracula orchids in the western Andes, see Orejuela-Gartner, 'Orchids of the Cloud Forests'.

5. The gibbon (*Hoolock tianxing*) is described in Fei-Fan et al., 'Description of a New Species'. Fei-Fan et al. suggest the name 'Skywalker' – of which the name 'Tianxing' is a pinyin translation – derives from the 'unique locomotory mode of gibbons' (ibid.: 9). Mark Hamill, however, tweeted his pride at having the gibbon named after his Luke Skywalker character, and media reports suggested the name was inspired by the scientists being fans of *Star Wars*.
6. The high public profile the gibbon attracted upon its discovery is discussed in Fan and Bartlett, 'Overlooked Small Apes'.
7. See Pimm and Raven, 'The Fate of the World's Plants'. See also Pimm and Joppa, 'How Many Plant Species'. Pimm has recently revisited the issue of taxonomic comprehensiveness in 'What We Need to Know to Prevent a Mass Extinction of Plant Species'.
8. Lees and Pimm, 'Species, Extinct Before We Know Them?'
9. A noted example of such artworks, albeit one where an identification of the bird has been offered, is the Guadeloupe macaw (*Ara guadeloupensis*), which is portrayed in an engraving by Sébastien Le Clerc for Du Tetre, *Histoire générale des Antilles habitées*, in a plate that appears between pages 246 and 247 (the plate is missing from some digitized copies of the manuscript that appear online). There are also numerous textual references to this macaw. See Clark, 'Note on the Guadeloupe Macaw', 377; Wiley and Kirwan, 'The Extinct Macaws of the West Indies'.
10. Two specimens of the bird, the cryptic treehunter (*Chiclocolaptes mazarbarnetti*), had been wrongly identified as the Alagoas foliage-gleaner by the National Museum of Brazil. See Lee and Pimm, 'Species, Extinct Before We Know Them?', R-179.
11. A 1765 painting by L.J. Robins has variously been claimed to depict the Cuban macaw and the hypothetical extinct species the Jamaican red macaw. Samuel Turvey discusses another painting from 1765 of a red macaw, this time by John Lindsay, that is now in the collections of Bristol City Museum and Art Gallery. Turvey speculates that the macaw in the painting was likely an ornamental bird traded to the island. Turvey, 'A New Historical Record of Macaws'.
12. Beneath the parrot, Waldseemüller has written '*rubei itaci*', with the first few letters of *psitacci* elided. Charles Short and Charlton T. Lewis provide Pliny's *Natural History* as an early example of the use of the word *psitaccus*. See Short and Lewis, *A Latin Dictionary*, 1483. We are indebted to Kristine Tanton for sharing her insights regarding Waldseemüller's map. The macaw also occurs as a subject in modern art. Georgina Moura Andrade du Albuquerque, for instance, includes the bird in her undated oil on canvas work *Moças e Arara* [Young women and macaw]. We are grateful to Camila de Oliveira Savoi for drawing our attention to this painting. Manoel Santiago also includes a macaw in his oil painting *Tatuagem* [Tattoo] (1929), where he portrays a bare-breasted Indigenous woman lying languorous in a hammock, the bird perched on her upraised left hand. Here the macaw is seemingly employed as a primitivist stereotype, used to symbolize the woman's proximity to nature. *Tatuagem* is analysed at length in Neto, 'Manoel Santiago vai a Paris'.
13. The Highland mangabey (*Rungwecebus kipunji*), for example, was named in 2005 on the basis of a photograph, although genetic material was subsequently sourced in 2006 from a specimen killed by a farmer. See Davenport et al., 'A New Genus of African Monkey'. A similar situation occurred with the macaque *Macaca munzala*. See Sinha et al., '*Macaca munzala*'. In the context of birds, the holotype for *Liocichla bugunorum* was a bird that was photographed and from which some plumage was obtained before it was released; see Atheyra, 'A new species of *Liocichla*'. The flatworm *Leptoplana mediterranea* was described from drawings first published in 1884 and acknowledged as a species in 2012; see Krell and Marshall, 'New Species Described from Photographs'.

In botany, type specimens may occasionally be illustrations because of the difficulty of preserving some species of plant. In this context, some of the engravings by Pierre-Joseph Redouté of plants from the *Liliaceae* family serve as holotypes; see Daston, 'Type Specimens and Scientific Memory', 160.

14. Pimm et al., 'Can We Defy Nature's End?' For a fresh examination of biodiversity management, see Pimm, 'What Is Biodiversity Conservation?'
15. For a discussion of numbats and their rarity, see Friend and Thomas, 'Conservation of the Numbat'.
16. Michael Soulé was a conservation biologist and a co-founder of the Society for Conservation Biology. Soulé outlines his vision for conservation biology in 'What Is Conservation Biology?'
17. Pimm, 'The Dodo Went Extinct', 196.
18. For a discussion of how dictionaries embody values through 'the apparently neutral and non-partisan process of defining and arranging information', see Rifkin, 'Ingres and the Academic Dictionary', 265.
19. See, for example, Pimm et al., 'Bird Extinctions in the Central Pacific'. When first used (31), 'wimps' is in scare quotes to signal it is a problematic term. In the context of a discussion of recently extinct and endangered birds on Pacific islands, Michael Jeffries refers to 'wimp species' (which he places in scare quotes) as species 'vulnerable to human pressures' (Jeffries, *Biodiversity and Conservation*, 115).

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