

COVID-19 and the opportunities for research

The lockdowns' impacts on wildlife, ecology and conservation biology, and the humanities

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Almost all research has been affected in some way or another by the COVID-19 pandemic, at the very least by challenging collaboration and interaction. But some areas have been affected more than others. Ecology and conservation biology experience a real boon as ongoing lockdowns have presented unique opportunities to study the impact of human activities on animals and ecosystems. This has not just galvanised research but also promises to leave a legacy of networks and collaborations to explore means to reduce negative human impacts on biodiversity long after the pandemic has subsided. In the social sciences and humanities, however, the pandemic is raising fundamental questions about their ability to contribute meaningfully to inform policy and public health responses.

Lockdowns and wildlife

Indeed, the pandemic has led to aspirations to develop a more integrative approach to study the effect of lockdowns on wildlife, rather than numerous isolated incidents with individual species. The aim to identify large-scale trends on a more global basis inspired a major metastudy, the COVID-19 Bio-Logging Initiative, that is still gathering momentum. Financed by the Gordon and Betty Moore Foundation and the US National Geographic Society, it was founded on the premise that lockdowns present an unprecedented opportunity to assess how wild animals respond to interactions with humans. It also aspires to identifying ways of instigating realistic changes in the relationship between people and wildlife to better protect the latter.

The project has now recruited hundreds of scientists in multiple countries, who are gathering data from 200 different species and more than 300 populations, according to one of its founding members, Matthias-Claudio Loretto from the Max Planck Institute of Animal Behaviour in Germany. As some of the studies predated the pandemic, first results were available quite early during the first round of lockdowns, especially in Europe and North America. “Now with this pandemic and our ideas, it really worked well to bring a large field together”, Loretto said. “This by the way is something we hope to gain from in the future. Completely independent of COVID, it’s a great opportunity to really showcase what you can do with such a large-scale collaboration”. Loretto’s colleague in the COVID-19 Bio-Logging Initiative and a principal founder, Christian Rutz from the Centre for Biodiversity, University of St Andrews, UK, emphasised that these are still early days for the initiative. “We are still in the phase where interesting data sets are being generated”, he cautioned.

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There are two sides to the equation when studying the impact of lockdowns on

animals. The first is tracking the animals through fitting of geologgers and cameras in the field. In the case of fish or aquatic mammals, as Loretto pointed out, tracking is sometimes accomplished by implants generating acoustic signals picked up by hydrophones in the water. The other side is human behaviour, the study of which requires monitoring movements of people to correlate changes with the behavioural response of animals. Rutz and Loretto agreed that this side of the equation is the most challenging, given the difficulty tracking movements of people in the same way as animals.

One of the main sources of human tracking information is Google’s COVID-19 Community Mobility Reports, which use anonymised data from Google Maps to record people’s movements. But such data are reliant on smartphones and do not provide as high a resolution as researchers would like. For this reason, the COVID-19 Bio-Logging Initiative has partnered with human geographers to obtain finer-grained pictures of movements and behavioural changes on the ground. “They are experts in collating and analysing this data”, Rutz explained. “One of the sub projects we have within this broader initiative is the Human Mobility Group and they have spent the last few months researching what data sets are available and how they can be leveraged for these kinds of analyses. We are from an ecological and wildlife research point of view in completely uncharted territory”.

Songbirds in the city

Although these are still early days, there has already been a scattering of interesting

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findings from individual studies that give an inkling of what else might come. One of the first reports confirmed expectations that songbirds would take advantage of quieter urban conditions to reduce volume and range as well as modulation of their songs to attract potential mates (Derryberry *et al.*, 2020). The authors compared both the bird songs themselves and the background soundscape or acoustic space against which they had to be heard by fellow birds, in the San Francisco Bay Area during the spring lockdown of 2020. They found that as traffic noise levels in the city subsided to levels typical of the mid-1950s, birds responded quickly by delivering higher performance songs at lower amplitudes, which increased both range and salience, which is richness or diversity. This amplified selective elements that had previously been subdued by the need to overcome high levels of background noise. The findings also illustrated how behavioural traits can alter rapidly in response to changing conditions, and the authors speculated this indicated a resilience to long-standing anthropogenic pressures such as noise pollution.

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As always in research, the results generated further questions, such as about the degree of adaptability between different species. Such questions have been addressed in subsequent larger-scale studies, but firm answers are not yet available, other than to confirm that there are indeed significant variations between species. This would explain why some species have been much more successful at adapting to urban environments in the first place or been able to adapt over a shorter time scale.

Roaming wildlife

Another intriguing challenge concerned the impacts of lockdown on animals in both rural and urban settings that had come to depend on humans in various ways. This has led to anecdotal reports of changing

behaviour by wild or semi-wild animals, as when wild goats were observed roaming through an empty town in Wales, UK (<https://www.theatlantic.com/photo/2020/03/photos-llandudno-goats/609160>). More dramatically, deprivation of food waste left by tourists led macaques to war over scraps in Thailand (<https://www.livescience.com/macaque-fight-thailand-temple-coronavirus.html>).

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Generally, the lockdowns in the wake of the pandemic encouraged many animals to roam more freely as in the case of brown bears in the area of Trentino, Italy. “The brown bear population was reintroduced there about 10 years ago and since then been closely monitored”, observed Francesca Cagnacci, Senior Researcher at the Fondazione Edmund Mach in Italy. “In particular, a complete census of damage events to human property or sightings has been kept through the years. Brown bears started to be active during the lockdown, which in Italy was particularly severe. By applying a Before-After Control design, we could verify a marked increase of events during 2020, likely because brown bears were undisturbed and literally did not see humans around”.

Another example of how drastic changes in human behaviour have unexpected positive consequences for one species and negative ones for another was reported from an iconic seabird colony in the Baltic that is normally heavily frequented by tourists (Hentati-Sundberg *et al.*, 2021). After tourists abstained from the area in 2020, white-tailed eagles *Haliaeetus albicilla* became seven times more abundant than usual around the colony, which had a knock-on effect on common murrelets (*Uria aalge*) and reduced their reproductivity by 26%. Although the eagles did not prey on the murrelets, their presence disturbed them and delayed egg laying. Moreover, the murrelets suffered from increasing predation of their eggs by both herring gulls *Larus argentatus* and hooded crows *Corvus cornix*. This suggests that the

presence of humans as tourists inadvertently guarded the seabird colonies from the disruptive presence of eagles and other predators. The authors argue that this requires a social-ecological systems perspective for successful long-term management of protected areas. “This was a very good example of cascading effects of lockdowns, identifying humans as shields against natural predators”, commented Rutz, who was not directly involved in that study.

COVID-19 also presented opportunities for observing differential effects of lockdown regimes between or even within countries with similar ecosystems. This happened over the winter of 2020/2021 in the skiing areas of Austria, Germany and Switzerland. “In Austria, ski areas have stayed open, in Germany they have been closed, and in Switzerland it depends where you are”, Loretto said. However, even where ski areas were open, facilities such as ski lifts remained closed. Skiers had to hike up the mountain, which disturbed animals such as grouse and red deer. As Loretto pointed out, this has affected chamois in particular as this common mountain goat lowers its metabolic rate in winter to conserve energy. When encountering humans, they tend to become stressed and need to find extra food reserves. These observations are being made through both GPS tags to monitor movement and analysis of faeces to identify metabolic markers of stress.

Less noise in the oceans

A number of researchers in and around conservation biology were drawn into lockdown-related studies when the lockdowns led to curtailment or postponement of their existing projects. This was the case for Art Friedlaender, a marine ecologist at the University of California, who was forced to return from Antarctica where he had been studying the impacts of tourism and fishing on humpback whales. Back in California amid initial disappointment, Friedlaender realised he could extend and complement his work by studying how whales in the nearby Monterey Bay responded to a dramatic reduction in boat traffic and noise that disrupts the animals' communications.

“At this point, we are working to assess whether stress hormone levels in whales changed as a result of changes in boat use and ocean noise associated with human activity”, Friedlaender explained. “We postulate

that there was a reduction in the number of vessels and the amount of sound in the environment around Monterey Bay and Stellwagen Bank National Marine Sanctuaries and that these resulted in lower stress levels for humpback whales". Friedlander and colleagues collected about 100 skin/blubber biopsy samples from whales during the early and late feeding season of 2020, along with sound recordings from the same regions. "We are in the process of analysing these data and then will put the pieces together and compare these against samples that we will collect this year when conditions have changed to more typical ocean use by people", Friedlaender added.

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In this case, the changes in human behaviour occurred earlier in the pandemic when many people assumed that the world would return to relative normality by the end of the year. Yet, many countries engaged in subsequent lockdowns towards the end of 2020, especially in the Northern Hemisphere. This presented further opportunities for studying human impacts on animal behaviour, sometimes in slightly different contexts, commented Nicola Koper, professor of conservation biology at the University of Manitoba, Canada. "This will definitely result in further opportunities for research on what happens when we alter human activities over the long term", she said. "While many of the initial studies focused on migrating birds, these later lockdowns give us some new opportunities to study impacts on resident birds that hold territories year-round". While the continuing lockdowns are affecting economies and human societies, they are often good news for wildlife and the researchers studying it. "One study I really wish someone could look at, and that I haven't heard of anyone doing, is to study how the tremendous reduction in cruise ship traffic has affected the environment and wildlife", Koper added. "Cruise ships produce many types of pollution, including light pollution at night, which

some previous studies have demonstrated can confuse migrating birds, for example".

Challenges for the social sciences

Another aspect that has not been studied so much is the data overlap between conservation and humans' conformance to public health measures such as lockdowns. This overlap occurs because conservation impacts can often only be studied given detailed knowledge of how human behaviour and movements change during lockdowns, and that varies greatly over time and by geography and demographic. There is a general consensus that conformance to restrictions has been waning during the latest round of lockdowns partly as a result of pandemic weariness, according to Rutz.

This then would require input from the humanities and social sciences, which themselves have been affected profoundly by the pandemic. This has taken on nearly an existential dimension as some social scientists have questioned their own value and methodologies. It culminated in a widely reported paper arguing that the social sciences needed a much more rigorous platform for assessing the quality of evidence or advise before governments should trust its recommendation for matters of life and death, as in the ongoing pandemic (IJzerman *et al*, 2020). The authors, social scientists themselves, urged adoption of an equivalent to the US National Aeronautics and Space Administration (NASA)'s system of "technology readiness levels" for estimating the maturity and reliability of new technologies.

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Not surprisingly, the paper drew criticism from peers in the field, along the lines that a system appropriate for space missions was largely irrelevant for the social sciences. One such critic is Pete Lunn, Head of the Ireland-based Behavioural Research Unit at the Economic and Social Research Institute. In a

response, Lunn argued that policymakers do not depend only on the reliability of causal relationships, because societal decisions are more complex. They embed priorities, values and preferences regarding risk, uncertainty and time, while depending on public acceptance. He argues that "idealised systems for assessing evidence and converting it into replicable technologies for policy use are nonapplicable, impractical, even naïve, given the dynamic, complex context of real policymaking" (<https://socialscience.s.nature.com/posts/on-the-alleged-unsuitability-of-behavioural-science>).

To some extent, this is an internal spat, but it does reflect the uncertainties and doubts within the social sciences. One of the authors of that paper urging caution in applying behavioural sciences, especially psychology, to policy decisions, Patrick Forscher from the Department of Psychological Science, University of Arkansas in the United States, argues that his field needs to learn from other data-driven areas of research. "I think psychology could learn a lot from areas of science that do have more influence on policy", he said. "For example, economists often have a big influence on the policy-making process. One reason for this, I think, is that economists work with a lot of outcome variables that policy-makers are interested in. This includes money, but also things like death rates. In contrast, psychologists spend a lot of time working with survey responses. Survey responses can be useful, but if you're a policy maker trying to figure out what policy will lower Covid death rates, you'll be a lot more interested in a study that uses death rates as an outcome than a study that uses survey questions on whether people say they intend to follow social distancing recommendations". Forscher does not see these problems as insurmountable but wants them to be acknowledged so they can be addressed.

One thing all sides can agree on, and which brings together the humanities with conservation biologists, is that the COVID-19 pandemic will leave behind a huge boon of data that many research fields can tap into. "What we can say, by now, is that animal behaviour is complex, and that the variability of human activity during lockdown has been equally heterogeneous and varied. Hence, complex behavioural responses have to be expected", commented Cagnacci. Even if the lockdowns eventually come to an end, the data gathered will enable more findings from ecology research and the social

sciences to inform future directions for conservation and ecology.

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