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COVID-19 restrictions provide a brief respite from the wildlife roadkill toll

Michael M. Driessen

School of Technology, Environments and Design, University of Tasmania, Private Bag 50, Hobart, Tasmania 7001, Australia

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ABSTRACT

The COVID-19 pandemic provides a rare opportunity to reveal the impact of reduced human activity on wildlife. I compared traffic volume and wildlife roadkill data along 18 km of highway before, during and after a 3-month period of COVID-19 restrictions with baseline data from the previous four years. Three marsupial herbivores comprised 89% of the 1820 roadkills recorded during the 4.5-year survey period: rufous-bellied pademelon Thylogale billardierii (31.5% of total), common brushtail possum Trichosurus vulpecula (29.8%) and red-necked wallaby Notamacropus rufigriseus (27.9%). During April 2020, when human activity was most restricted in the study area, traffic volume decreased by 36% (i.e. by an average 13,520 vehicle movements per day) and wildlife roadkill decreased by 48% (i.e. from 44 to 23 roadkills). However, when restrictions eased, traffic volume and wildlife roadkill returned to baseline levels indicating that the respite was brief in terms of animal welfare and of limited conservation value for these widespread and abundant species. Nevertheless, the results of this study suggest that even short periods of traffic reduction or road closures could be used as part of a management strategy for the conservation of endangered wildlife populations and re-wilding programs where roadkill is a risk factor.

1. Introduction

Restrictions on human activities to control the spread of COVID-19 have led to a spate of reports around the world about the possible benefits and impacts for wildlife (Gardner, 2020; Manenti et al., 2020; Rutz et al., 2020) although not all reports of species appearing in urban areas were as unusual as claimed in the media (Dayly, 2020; Manenti et al., 2020). These restrictions provide an unprecedented opportunity to gain insights into how human activity affects wildlife, and have led to calls to maximise the scientific insight that arises from this pandemic by comparing baseline datasets collected before the pandemic with datasets collected during and after the pandemic (Corlett et al., 2020; Rutz et al., 2020). In response, Manenti et al. (2020) presented data suggesting that reduced human disturbance associated with the COVID-19 lockdown in Italy allowed the crested porcupine Hystric cristata to increase its proportional use of urban areas, the Kentish plover Charadrius alexandrinus to build nests in more disturbed areas of a beach, and the species richness of waterbirds to increase on a small lake normally used for recreational activities.

In many countries around the world, wildlife deaths caused by collisions with vehicles on roads (roadkill) are a significant issue for wildlife welfare and conservation as well as for human welfare and property damage (Hobday and Minstrell, 2008; Taylor and Goldingay, 2010; Taylor-Brown et al., 2019; Pagany, 2020). Several authors have suggested that wildlife roadkill may have decreased during COVID-19 lockdowns due to less traffic (Gardner, 2020; Watts, 2020). In support of this suggestion, Manenti et al. (2020) reported 386 fewer amphibian roadkills in 2020 than in 2019 across eight Italian sites where amphibian road crossings occur. In a review of factors influencing wildlife roadkill, Pagany (2020) found that, of 51 studies that investigated traffic volume, 75% found that roadkill increased with increasing traffic volume, 12% decreased and 17% did not find a link between traffic volume and wildlife roadkill (note, one study reported both a positive relationship and no relationship).

Wildlife roadkill is unfortunately common in the island state of Tasmania, Australia, and one study has found that Tasmania has a higher density of roadkill than estimated in comparable surveys in other parts of Australia and North America (Hobday and Minstrell, 2008). This abundance of roadkill has been largely attributed to the abundance of wildlife, particularly marsupial herbivores (Magnus et al., 2004; Hobday and Minstrell, 2008; Fox et al., 2013). Here, I investigate the effect of reduced human activity due to COVID-19 restrictions on traffic volume and wildlife roadkill. Because traffic volume is often an important predictor of roadkills (Driessen et al., 1996; Taylor and Goldingay, 2010; Visentin et al., 2017; Pagany, 2020), I expected that reduced traffic volume would lead to a reduction in wildlife roadkill.

E-mail addresses: Michael.Driessen@utas.edu.au, Michael.Driessen@dpipwe.tas.gov.au.
2. Methods

As part of my frequent commuting along a highway, known as the Southern Outlet, between the city of Hobart and the suburb of Kingston in southern Tasmania, Australia (Fig. 1), I recorded wildlife roadkills from January 2016 to July 2020. The Southern Outlet is a dual-carriageway highway separated by a median strip of variable width (1–75 m), with two traffic lanes on each carriageway. For about 4 km the median strip is wide and supports trees and associated undergrowth. Most of the highway (about 80%) traverses native forest interspersed with ‘5-acre’ residential blocks containing lawns and pastures, with the remainder (about 20%) passing through high-density residential suburbs (Fig. 1). The speed limit is 100 km/h along 68% of the surveyed part of the highway and the remainder is 80 km/h.

Key dates for COVID-19 restrictions and their easing for Tasmania were obtained from the Tasmanian Department of Health’s Facebook page (Tasmanian Government, 2020a) and the Tasmanian Government’s Roadmap to Recovery (Tasmanian Government, 2020b) (Table 1).

Traffic volume (number of vehicle movements per day) totalled across all four lanes was recorded by the Tasmanian Department of State Growth using a continuous counter (A0171110P) located approximately halfway along the survey route (Fig. 1). Public holidays are excluded when calculating traffic volume for each month. Since 2016, the annual average traffic volume has exceeded 36,000, 50% on each carriageway, and has increased by c. 1000 per year (2016–2019). Traffic volume is mostly consistent along the length of the Southern Outlet because there are only three entry/exit points for vehicles on each carriageway that service a small number of residents (<2000 people).

Roadkills were surveyed separately on each of the 9 km-long carriageways (total = 18 km). I detected and identified roadkills during daylight hours while driving at speeds of up to 80 km/h and the roadkills were recorded by a passenger. Although a study has found that roadkill detection rates can decrease significantly above 50 km/h, especially for small (rat-sized) animals (Collinson et al., 2014), this was partly compensated for by undertaking regular repeated surveys as roadkills may remain on the road from days to weeks (Hobday and Minstrell, 2008; author, unpublished data). To ensure each roadkill was not double counted, the species was identified, and its carriageway, distance from defined starting points and position on the carriageway (left, middle, right) were recorded. Not all roadkills that occur can be counted because some animals die away from the road out of sight and some animals may be removed by other animals or people before they can be counted. The average number of surveys per month was 13.3 (95% CI = 1.1, range = 9–19, n = 28) for January–July 2019 (baseline data) and 12.6 (95% CI = 1.1, range = 11–15, n = 7) for January–July 2020. I specifically targeted days at the start and end of each month to be confident of assigning roadkills to a month. There were 17 occasions during the five-year survey when there were 7–11-day gaps between surveys due to field work and leave, with only one 7-day gap during 2020. Thus, there is potential that roadkill counts in 2016–19 were underestimated relative to 2020. Although I have recorded roadkills on this highway since 1995, only data from 2016 onwards are presented because daily traffic volume data are available only since January 2016.

I compared monthly traffic volume, monthly roadkill counts (combining roadkill counts from both carriageways) and monthly roadkill species richness (number of species) before (1/1/20–29/2/2020) and during (1/3/2020–31/5/2020) and after (1/6/2020–31/7/2020) a 3-month period of COVID-19 restrictions in 2020 with mean monthly traffic volume, roadkill counts, and roadkill species richness for the same period of months in 2016–2019 (baseline data). One-way analysis of variance was used to test if traffic volume, number of roadkills and roadkill species richness during the 3-month period of COVID-19 restrictions differed from those during the two months prior to and after this period by subtracting the monthly values for 2020 from the monthly means for 2016–2019 and using time (month) as replicates. Where there was an impact of COVID-19 restrictions on these variables, weekly values for March 2020 were compared with mean weekly values for March 2016–2019 to determine if in March 2020 the restrictions began to have an impact.

3. Results

A total of 1820 wildlife roadkills were recorded in January–July 2016–2020 comprising 14 mammal species and eight bird species, with an average 6.3 ± 0.6 (95% CI) roadkill species recorded each month. Three marsupial herbivores comprised 90% (1344) of the 1497 roadkills recorded in January–July 2016–2019 and 86% (278) of the 323 roadkills recorded over the same span of months in 2020. They were the rufous-bellied pademelon (Thylologe billardieri, 32.6% of 2016–2019 total, 26.6% of the 2020 total), the common brush-tailed possum (Trichosurus vulpecula, 30.3%, 27.6%) and the red-necked wallaby (Notamacropus rufogriseus, 26.9%, 32.2%). These three species were recorded in every survey month of every year. The next most commonly recorded species were the European rabbit (Oryctolagus cuniculus, 3.5% of 2016–2020 total number of wildlife roadkills), common ringtail possum (Pseudochersus peregrinus, 1.9%), eastern bettong (Bettongia gaimardi, 1.1%), eastern barred bandicoot (Perameles gunnii, 0.9%) and the Tasmanian native hen (Tribonyx mortierii, 0.7%). Three species listed as threatened under the Australian Environment Protection and Biodiversity Conservation Act 1999 were recorded as roadkill: the Tasmanian devil (Sarcophilus harrisii, endangered), the eastern quoll (Dasyurus viverrinus, endangered) and the eastern barred bandicoot (vulnerable).

Differences in traffic volume and roadkill counts between 2020 and the mean of 2016–19 were significantly greater during March–May than during January–February and June–July (Fig. 2; traffic volume: F(1,5) = 11.61, P = 0.019; roadkill count F(1,5) = 26.41, P = 0.004). Monthly species richness did not differ significantly between 2020 and the mean of 2016–19 (Fig. 3, F(1,5) = 0.50, P = 0.51).

During January and February 2020, prior to any COVID-19 restrictions on human activity, traffic volume and number of roadkills were similar to baseline data (Fig. 2). COVID-19 restrictions commenced on 17th March 2020 when the Tasmanian Government declared a State of Emergency and advised the community to stay at home if they were showing symptoms of cold, flu or COVID-19. Some Tasmanians began to self-isolate. There were 2800 (7%) fewer traffic movements per day during March 2020 (36,480) compared with the mean for March 2016–2019 (39,280) (Fig. 2). Most of this decrease occurred during the last two weeks of March soon after restrictions were imposed (Fig. 4). The 43 wildlife roadkills in March 2020 were 39% fewer than the mean of 71 for March 2016–2019 (Fig. 2). On 31st March 2020, in response to increasing cases of COVID-19, greater restrictions were imposed on the Tasmanian community who were required to stay at home except for prescribed activities (e.g. work, shopping, exercise). During April 2020 there was a large reduction in both traffic volume and wildlife roadkill compared with baseline data; traffic volume decreased by 36% (from 37,290 to 23,767 vehicles movements per day) and wildlife roadkill decreased by 48% (44 to 23 roadkills) (Fig. 2). Easing of restrictions began to occur on the 11th May 2020; this included allowing visits to national parks and other reserves within 30 km of homes. On 18th May 2020 gatherings were allowed to increase from two to ten people, and restaurants, cafes and playgrounds were re-opened. There was a corresponding increase in traffic volume and roadkill in May, but both remained lower than the baseline averages (Fig. 2). Between the 25th May and 9th June 2020, students returned to schools, and on 15th June 2020 gatherings could increase from ten to twenty people. Tasmanians could undertake indoor and outdoor sport and visit their holiday homes. By June, traffic volume and number of roadkills had largely returned to baseline levels (Fig. 2). On 13th July 2020 restrictions were eased further, with gatherings of 50–100 people allowed, and markets and food courts opening. July traffic volumes and number of roadkills had returned to baseline levels (Fig. 2).
Fig. 1. Location of Southern Outlet between Hobart and Kingston. The section of highway surveyed for wildlife roadkill is shown by the red lines. The red arrow indicates the position of traffic counter. (For interpretation of the references to color in this figure legend, the reader is referred to the web version of this article.)
4. Discussion

Consistent with most previous studies (see reviews by: Taylor and Goldingay, 2010; Pagany, 2020), changes in traffic volume on the Southern Outlet due to COVID-19 restrictions on human activity resulted in changes, in the same direction, in the number of wildlife roadkills. However, unlike these previous studies which used a spatial distribution approach, the COVID-19 restrictions on human activity provided a rare opportunity to assess the impact of changes in traffic volume on the rate of wildlife roadkill on a major highway with large traffic volumes using a before-after-control-impact design (Stewart-Oaten et al., 1986). In contrast to what might be expected, I found no change in roadkill species richness following changes in traffic volume. One other study in Lithuania has investigated the relationship between traffic volume and roadkill species richness (Balciauskas et al., 2020) and found that there were more roadkill mammal species on main roads with greater traffic volume (AADT = 5035–9413) than on regional roads with lower traffic volumes (AADT = 296–390). There are several factors that may account for the different findings between the two studies such as experimental design, traffic volume and number of species, and more studies are required to understand the relationship between traffic volume and roadkill species richness.
The percentage decrease in roadkill during March 2020 was large compared with the decrease in traffic volume. This may be partly explained by a greater decrease in traffic volume at night during the second half of March 2020, particularly between 18:00 and 24:00 h (28% for 15th–21st March and 53% for 22nd–31st March), than during daylight hours (7% for 15th–19th March and 25% for 22nd–31st March) (Tasmanian Department of State Growth, unpublished data). In Australia, dusk and night time is when mammal roadkill predominantly occurs because this is when the species are typically active (Magnus et al., 2004; Hobday and Minstrell, 2008; Van Dyck and Strahan, 2008; Bennie et al., 2014). Another possible contributing factor is that the form of the relationship between traffic volume and roadkill rate for the Southern Outlet may be non-linear, as was found by Sadleir and Linklater (2016) in their New Zealand study. Thus, it may be possible that a small decrease in traffic volume may result in a proportionally larger decrease in wildlife roadkill.

Red-necked wallabies, rufous-bellied pademelons and common brushtail possums are the most commonly recorded roadkill in Tasmania (Hobday and Minstrell, 2008; Fox et al., 2018; Englefield et al., 2019; Nguyen et al., 2019). They are also widespread and abundant (Jarman and Calaby, 2008; Johnson and Rose, 2008; Kerle and How, 2008) and long-term (<15 years), broadband scale population monitoring indicates their populations are either stable or increasing at regional and statewide scales (DPPWPE, 2020). Consequently, there is limited incentive to reduce roadkill for these species from a conservation perspective. However, this may not be the case for species that have small populations and particularly for threatened species (Hobday and Minstrell, 2008). For example, a Tasmanian study found that collisions with vehicles following a road upgrade caused the local extinction of an eastern quoll population and the halving of a Tasmanian devil population (Jones, 2000). Programs aimed at re-wilding Tasmanian devils within Tasmania (Anon., 2015) and eastern quolls from Tasmania to the Australian mainland (Rewilding Australia, 2020) have also been adversely affected by collisions with vehicles. Several endangered species were recorded as roadkill along the Southern Outlet but in numbers too low for any effect of a decrease in traffic volume to be detectable.

Even if roadkill is not causing population declines, roadkill should be reduced where possible from an animal welfare standpoint because collisions with cars often don’t result in instantaneous death and dependent young of marsupials cannot sustain themselves if their mothers are road-killed. Road trauma was the predominant cause for reporting either injured or orphaned animals to a wildlife rescue service within Tasmania, with brushtail possums, red-necked wallabies and rufous-bellied pademelons the most frequently reported species (Heathcote et al., 2019).

Another important reason to reduce roadkill is damage to vehicles and injury to people. In Tasmania, between 1993 and 2003, three human fatalities and an annual average of 7.2 injury-causing accidents and 46.2 car damage incidents arising from collisions with wildlife were reported to police (Magnus et al., 2004). Roadkill will continue to be an issue for both wildlife and people post COVID-19. While there are many roadkill mitigation measures, some of which have been employed in Tasmania, their efficacy has been shown to be variable or questioned (Fox et al., 2018; Englefield et al., 2019). Large-scale overpasses and other expensive mitigation measures have not been employed in Tasmania, Hobday and Minstrell (2008) found that a reduction in speed below 80 km/h could potentially reduce overall roadkill by 50%.

It is reasonable to assume that the roadkill toll decreased on roads more broadly across Tasmania during the COVID-19 restrictions on human activity. This is because the state has many roads like the Southern Outlet with large traffic volumes, running through comparable habitats and supporting similar wildlife species. In addition, weekly traffic volumes at 41 permanent monitoring sites on roads across Tasmania decreased by 39–49% during April 2020 (Tasmanian Department of State Growth, unpublished data). Studies have demonstrated that roads can result in significant genetic subdivision of animal populations (e.g. Epps et al., 2005; Riley et al., 2006), thus it could be argued that a reduction in roadkill due to COVID-19 restrictions may have had a conservation benefit by temporarily removing restrictions on gene flow within populations.

COVID-19 restrictions occurred during the time in Tasmania when there is normally a seasonal reduction in roadkills. However, the decrease in wildlife roadkill during the period of COVID-19 restrictions exceeded the usual seasonal reduction, particularly during April. In Tasmania, roadkill counts are highest over summer and early autumn and lowest in winter (Hobday and Minstrell, 2008; author, unpublished data) probably because the seasonal timing for weaning and dispersing for most young possums, wallabies and pademelons commences in late spring and early summer. Had the COVID-19 restrictions occurred over summer then there might have been an even greater reduction in the roadkill toll.

This study provides a clear demonstration of how a reduction in road traffic caused by the COVID-19 restrictions on human activity resulted in a substantial reduction of wildlife mortality due to collisions with cars. Unfortunately for wildlife conservation and welfare, this reduction in mortality was brief (3 months), with traffic volumes and roadkill counts returning to baseline levels soon after restrictions were eased. However, the results of this study suggest that even short periods of traffic reduction can decrease the roadkill toll and that traffic reduction or road closures could be used as part of a management strategy for the conservation of endangered populations and re-wilding programs where losses due to collisions with cars is a major risk.

CRediT authorship contribution statement

Michael Driesen: Conceptualization; Data curation; Formal analysis; Investigation; Resources; Methodology; Validation; Visualization; Writing.

Declaration of competing interest

The author declares that he has no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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5
