RSPCA
for all creatures great & small

RESEARCH REPORT:
The impact of climate change on the welfare of animals in Australia

APRIL 2020

CONTENTS

1. INTRODUCTION

Climate change is a global crisis[1] and there is scientific consensus that it is caused by greenhouse gas emissions from human activities[2]. Trends associated with climate change include an increased frequency, intensity and duration of extreme events[3] such as heatwaves[4], droughts[5] and bushfires[6].

Climate change can have a profound negative impact on animal welfare. Companion animals[7], animals in sport[8], farm animals[9] and wildlife[10] can be directly and indirectly affected by climate change across terrestrial (land), aquatic (freshwater)[11] and marine (saltwater) environments[12]. Many animals have and will continue to suffer and die from the effects of climate change[13].

The RSPCA has an important role to play in helping to address the effects of climate change in policy and in practice. This research report summarises observed and projected climate change, the impact on animal welfare and identifies opportunities for the RSPCA to help address this impact.

2. GREENHOUSE GAS EMISSIONS

Greenhouse gases (GHG) including carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O) and synthetic GHG (e.g. chlorofluorocarbons, perfluorocarbons) entrap heat thus increasing the temperature of the Earth's atmosphere, oceans and land mass (the greenhouse effect). Increasing anthropogenic (human) GHG emissions since the industrial revolution have resulted in an enhanced greenhouse effect (global warming) and long-term changes in climatic variables including temperature and rainfall (climate change)[3,14].

Increasing anthropogenic GHG emissions are largely due to consumption of fossil fuels such as coal, gas and oil[15] and activities such as agriculture, industry and waste processing[3]. While this report focuses on the impact of climate change on animals, it is noted that the scientific literature also examines the major contribution of animal agriculture[16] and to a lesser extent companion animals'[75] to climate change.

Total anthropogenic GHG emissions continue to increase at an accelerated rate. At the beginning of the industrial revolution (~1750AD), the mean global concentration of CO_2 in the atmosphere was ~280ppm (as determined from air trapped in Antarctic ice samples)[18]. Global CO_2 concentration has risen rapidly over the past few decades[3]. In January 2020, NASA measured peak concentration of CO_2 in the atmosphere at 413ppm[19]. CO_2 equivalents, the metric used to measure the greenhouse effect created by different types of GHG[20], is the highest it has been in at least the last 800,000 years[3]. In 2019, the mean global concentration of CO_2 equivalents was 454 ppm[21].

The Intergovernmental Panel on Climate Change (IPCC) warns that global warming must not exceed 1.5°C above pre-industrial levels by 2100 if climate change risks are to be managed[22]. If GHG continue to increase at the current rate, peak concentrations required to stay below 1.5°C warming could be reached within the next two to twelve years[21]. In the absence of effective climate change policies and action, the Organisation for Economic Co-operation and Development (OECD) predicts that the global mean concentration of GHG will reach almost 685ppm CO_2 equivalents by 2050 which would correspond to global warming of 3 to 6°C with catastrophic and irreversible consequences for all living organisms and systems[23].

3. CLIMATE CHANGE

3.1 Temperature

Climate change entails significant and unprecedented long-term changes in climate variables such as temperature[3,14]. In January 2020, the US National Oceanic and Atmospheric Administrations (NOAA) measured the hottest January land and ocean temperatures on record (in 141 years) at 1.14°C above the twentieth century average[24]. In Australia, the climate has warmed by over 1°C since 1910 with associated increases in the severity, frequency and duration of heatwaves[14] and bushfires[25]. Australia is predicted to experience warming slightly higher than the global average[14]. 2019 was Australia's warmest year on record[26].

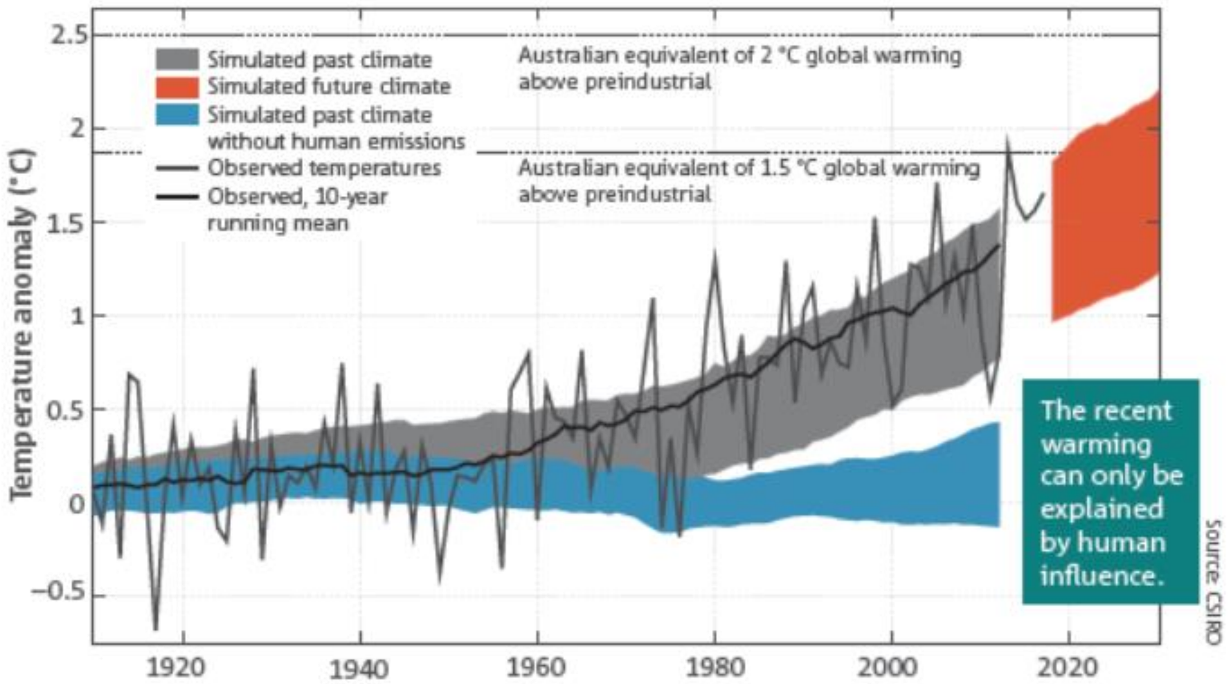

Figure 1. Australia's average annual temperature relative to the 1861-1900 period. Australia's average annual temperature relative to the 1861–1900 period. The grey line represents Australian temperature observations since 1910, with the black line the ten-year running mean. The shaded bands are the 10–90% range of the 20-year running mean temperatures simulated from the latest generation of Global Climate Models. The grey band shows simulations that include observed conditions of greenhouse gases, aerosols, solar input and volcanoes; the blue band shows simulations of observed conditions but not including human emissions of greenhouse gases or aerosols; the red band shows simulations projecting forward into the future (all emissions scenarios are included). Warming over Australia is expected to be slightly higher than the global average. The dotted lines represent the Australian equivalent of the global warming thresholds of 1.5 °C and 2 °C above preindustrial levels, which are used to inform possible risks and responses for coming decades. *Source:* *CSIRO-BOM State of the Climate 2018*

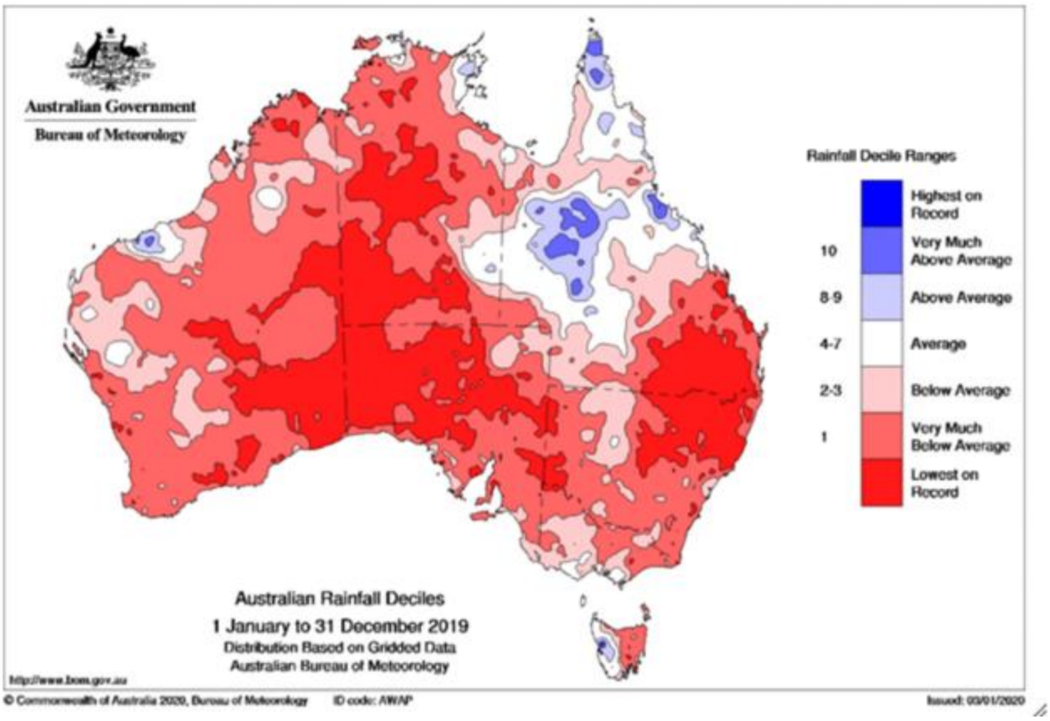

Figure 2. Australian rainfall map 2019. The driest year on record and an increase in rainfall extremes. *Source:* *Bureau of Meteorology Annual Climate Statement 2019*.

3.2 Rainfall

Climate change is associated with rainfall extremes[27]. There is a strong trend towards wet areas becoming wetter and dry areas becoming drier[28]. Overall, 2019 was Australia's driest year on record[26]. There was record low rainfall across southern regions, decreased streamflow and more severe and prolonged drought. The reverse changes were observed in some northern regions with record high humidity, rainfall and flood risk (Figure 2). The Australian Bureau of Meteorology (BOM) concluded that even if GHG emissions stay within international targets, there may still be ongoing disruption of rainfall patterns and associated drought and flood risks[29,30].

3.3 Wind

Interactions between climate change and wind patterns receive less attention compared to temperature and rainfall but are nonetheless significant[31]. Thermodynamic changes associated with climate change influence wind speeds, direction, geographic distribution and variability throughout and between years. Climate change modelling predicts that cyclones are likely to decrease in frequency overall but increase in intensity[32].

3.4 Drought

Drought (prolonged absence or marked deficiency of rainfall)[3] and desertification (land degradation to a point it cannot support life) are exacerbated by climate change[33]. For example, there is evidence that climate change played some part in the catastrophic Millennium Drought 2001 to 2009 in south-eastern Australia[5]. In 2019, much of Australia was affected by drought particularly NSW where 95% of the state was drought affected[34].

3.5 Fire

Climate change increases bushfire risk[35]. Australia is particularly vulnerable to bushfire risk associated with climate change[6]. While fire risk can vary by location and time of the year, many areas have increased fire risk due to factors such as high temperatures, low rainfall and altered wind patterns[35]. There is an increasing number of very high to extreme fire danger days, longer fire seasons and more intense fires[25]. Climate change may also be linked to increased risk of pyroconvection events (firestorms)[36] and compound events such as intersecting drought, heatwaves and bushfires[14]. The BOM concluded that 2019 was Australia's warmest and driest year on record and this was a key factor influencing the 2019/2020 bushfires which burnt over 19 million hectares across several states[26,37].

3.6 Flood

Climate change entails an increasing risk of sudden periods of heavy rainfall and flooding such as the 2019 north Queensland floods[14]. The NSW and ACT Regional Climate Modelling (NARCliM) Project reports that peak precipitation (rainfall, hail etc.) within storms may increase in a changing climate[27].

3.7 Sea temperature, oxygenation and acidification

The majority of accumulated heat is stored in the world's oceans particularly in the southern hemisphere14. The average temperature of waters off Australia has increased by 1°C since 1910[14]. Ocean warming disrupts global weather patterns for example El Niño and La Niña, two opposite extremes of the El Nino Southern Oscillation (ENSO), are predicted to become more frequent in a changing climate further increasing the risk of extreme weather events[38].

Climate change contributes to longer and more frequent marine heatwaves. In December 2019, the most widespread marine heatwave (since satellite monitoring began) extended from the Kimberley in northern WA all the way to SA[39]. Ocean warming leads to low oxygen dissolvability and the expansion of oxygen minimum zones where there is insufficient oxygen to support marine life[40].

Absorption of increased CO_2 in the atmosphere by the ocean has altered seawater chemistry including ocean acidification. Prior to the industrial revolution, average ocean pH was ~8.2 (0 = most acidic, 14 = most alkaline on a logarithmic scale). If GHG emissions continue to increase at the current rate, average ocean pH is expected to decline to 7.8 which equates to a 150% increase in the ocean's acidity relative to the pre-industrial levels[41].

3.8 Sea levels

Climate change leads to rising sea levels via several mechanisms including ocean warming and expansion, and the melting of glacier and polar ice. The global mean sea level (MSL) has risen by over 20cm since 1880 and has been rising faster in recent decades increasing the risk of inundation of low lying areas[14].

4. ANIMAL WELFARE RISKS FOR ALL ANIMALS

Considering the Five Domains model of animal welfare (a framework that considers positive and negative physical and affective states)[42], climate change has wide-ranging negative effects on the welfare of all animals (Table 1). There appears to be a general lack of peer-reviewed literature systematically assessing the present and future animal welfare risks of climate change. The following sections extrapolate information from existing peer-reviewed and lay sources.

Table 1. The animal welfare risks of climate change using the Five Domains Model. *Source: Mellor D & Beausoleil N (2015) Extending the 'Five Domains' model for animal welfare assessment to incorporate positive welfare states. Animal Welfare* ***24****, 241–253.*

Physical/functional domains

(1) Nutrition	**(2) Environment**	**(3) Health**	**(4) Behaviour**
Food intake Food quality Food variety Water intake Water quality	Acidification & deoxygenation of water Atmospheric pollutants e.g. bushfire smoke Damage & loss of shelter Thermal extremes Unpredictable extreme conditions/events	Disease: acute, chronic Functional impairment Injury: acute, chronic	Constraints on environment focused activity Disrupted social dynamics Inescapable sensory impositions Limits on threat avoidance and/or escape Limitations on sleep/rest

Affective experience domain

(5) Mental state				
Nutrition	***Environment***	***Health***	***Behaviour***	
Thirst Hunger Malnutrition Gastrointestinal pain Starvation	Airway and eye irritation Thermal discomfort e.g. overheating Breathlessness & air hunger	Death Malaise Nausea Pain Weakness	Anxiety Depression Discomfort Distress Exhaustion Fear	Frustration Helplessness Isolation and loneliness Panic

4.1 Nutrition

Animals may suffer thirst, hunger, malnutrition, gastrointestinal pain, starvation and death as climate change threatens global food and water security for both humans and animals[22]. Higher ambient temperatures associated with climate change also have a direct effect on appetite and thirst[9].

4.2 Environment

Climate change affects all aspects of animals' environment. Animals will suffer during and after more frequent and intense extreme weather events such as floods and fires. These events cause direct mortality as well as prolonged suffering where habitats have been destroyed leaving little food, water or shelter. As a result, animals are likely to experience fear, distress, discomfort and pain which in many cases will be unpredictable, inescapable and/or prolonged[43,44].

4.3 Health

Climate change can have profound direct and indirect effects on animal health. Traumatic death in extreme events such as bushfires and floods is perhaps the most dramatic direct effect of climate change on animals[45].

Direct effects of climate change on animal health include exertional and non-exertional heat-related illness including heat stress (hyperthermia that evokes a physiological response), heat stroke (emergency life-threatening hyperthermia) and related metabolic disturbances[9]. All animals have a thermoneutral zone (TNZ), a range of ambient temperatures that are consistent with function and survival[46]. For example, the reported TNZ for the domestic dog is 20°C to 30°C[47]. Above the TNZ, animals must expend energy to maintain normal body temperature and if unable to do so will suffer hyperthermia. Climate change will lead to conditions that exceed the TNZ of many species. As a result, animals may suffer a range of negative affective states including discomfort, frustration, fear and distress.

Indirect effects of climate change on animal health include the spread of parasites and the expansion of insects that carry diseases (vectors)[9]. Climate change is associated with thermal (temperature related), physiological (hormone related) and oxidative (free radical related) stress in animals which can compromise immune function and leave animals more susceptible to infectious diseases[9,48]. For example, prolonged exposure to ocean pH below 8 (as predicted for the year 2100) disrupts the function of crustaceans' immune system [49].

4.4 Behaviour

Climate change poses several potential behavioural challenges to animals including constraining environment-focused activity (e.g. fish unable to swim as water bodies dry up), disrupting social dynamics (e.g. separation of kin during extreme weather events), inescapable sensory impositions (e.g. inescapable heat) and limitations on sleep/rest (e.g. due to the destruction of rest sites by bushfires).

4.5 Mental state

There is ample research indicating that climate change has a negative impact on human mental health[50] but little to no attention has been given to the effects of climate change on the overall mental state of other species. There are accounts of Australian native wildlife in the aftermath of bushfires, demonstrating behavioural responses consistent with shock such as standing still and staring into space[51]. It is likely that climate change has and will continue to cause animals negative experiences including anxiety and fear but research is required to characterise the extent to which climate change affects animals' mental state.

5. IMPACT OF CLIMATE CHANGE ON COMPANION ANIMALS

Climate change is a potential risk to the welfare of Australian companion animals including an estimated 5.1 million dogs, 3.8 million cats, 11.3 million fish and 5.6 million birds[52].

Increasing ambient temperatures associated with climate change place pets at high risk of heat-related illness particularly when: they are transported or exercised, in circumstances where they are not provided with adequate shade, shelter and water, when they are confined to enclosures or vehicles and where adequate cooling systems are not in place.

Risk of heat-related illness in a changing climate is affected by factors such as age, body condition, health, reproductive status and breed. For example, obese and flat faced (brachycephalic) breeds such as pugs and bulldogs are at high risk due to decreased capacity to thermoregulate (maintain normal body temperature)[53].

Guinea pigs and rabbits are also at high risk of heat-related illness. The TNZ of guinea pigs is 18 to 26℃ and clinical signs of heat stress are commonly seen at ambient temperatures above 28℃[54].

Increasing ambient temperatures correspond to increased surface temperatures, putting pets at risk of traumatic injuries such as burns. At an ambient temperature of 25℃, asphalt can reach temperatures in excess of 50℃[55]. Due to the urban heat island effect (higher temperatures in cities), animals in cities may be at high risk of heat-related illness and injury in a changing climate[56].

Climate change influences the geographical distribution, infection patterns and risk of infectious disease and parasites in animal populations including dogs and cats[57]. For example, climate change creates conditions more conducive to the spread and persistence of arthropod insects such as mosquitos, fleas, ticks, mites and lice[58]. There are suggestions that climate change related changes in humidity and temperature in Queensland are contributing to continued heavy flea burdens[57]. It is expected that pets will be at higher risk of irritation and allergies caused by arthropod insects and greater risk of diseases that they can spread (vector-borne diseases) such as heartworm in dogs spread by mosquitos[57].

Pets are at risk of displacement due to extreme weather events. Owners may delay evacuating if pets cannot be accommodated. This is particularly concerning in SA and WA where pets (other than assistance animals) are not permitted in evacuation centres[59]. The welfare of pets may be put at risk when they are left behind during evacuations due to extreme weather events[60].

Increased ambient temperatures can lead to frustration when an individual cannot keep cool irrespective of what they do. Lack of control over their environment and frustration are markers of poor animal welfare[61]. In addition, frustration can manifest as aggression (frustration-aggression hypothesis)[62]. Research is required to explore the implications of the frustration-aggression hypothesis for aggression in and between domestic animals in a changing climate. There are established links between increased ambient temperatures and increased rates of interpersonal violence[63] but it remains to be seen whether there are increased risks for pets in situations of domestic violence and animal cruelty.

6. IMPACT OF CLIMATE CHANGE ON FARM ANIMALS

Climate change puts the welfare of Australia's estimated 800 million farm animals at risk and the viability of marginal pastoral land has been questioned in a changing climate[64].

Heat stress has been described as one of the most pressing challenges facing animal agriculture[62]. Farm animals, particularly rapidly growing and high-producing livestock, are vulnerable to the effects of climate change in part because their internal heat load is already high[62]. Farmed ectotherms (body temperature fluctuates with ambient temperature e.g. fish), those that are unable to thermoregulate (e.g. piglets, hatchling poultry) and those with a particularly narrow TNZ (e.g. dairy cattle and pigs 16°C to 25°C) are also at particularly high risk[65]. In a changing climate, more farm animals across a wider area will be subject to heat-related illness and associated negative affective states including thirst, frustration and discomfort[9]. Animals intensively farmed indoors (e.g. layer hens, meat chickens, pigs and indoor dairies) are reliant on humans to manage temperature, ventilation and humidity and if systems fail, large numbers of animals can suffer and die in a short period of time[66].

Water and shade become even more critical for livestock in a changing climate. For example, dairy cattle will seek shade and increase water intake by 1.2L for every degree Celsius above minimum ambient temperature indicating their need for additional water and shade. An increased need for water will occur as climate change simultaneously makes cool drinking water scarce. In extreme cases, animals' mental state can be altered by hyperthermia and they may be incapacitated from seeking out essential resources even where they are available[62].

Livestock nutrition may be affected (positively or negatively) by climate change via effects on pasture growth, quality and annual variability. Decreased pasture growth and quality in marginal areas[64] may put stock at increased risk of hunger and starvation. If supplementary concentrates are fed routinely (e.g. feedlot) or in an attempt to compensate for lack of pasture, this may elevate protein digestion which increases body temperature and may exacerbate heat-related illness[62]. Heat stress suppresses appetite (subjective desire for food) in livestock including meat chickens, layer hens, pigs and cattle via several mechanisms including influencing expression of ghrelin (a hormone that regulates hunger). Subsequent decreased food intake can result in negative energy balance (energy intake does not meet demands), weight loss, lethargy and malaise[62].

Ruminants (e.g. cattle, sheep, goats) have unique physiology which makes them susceptible to a suite of complex animal welfare issues associated with climate change. Increased ambient temperatures place ruminants at higher risk of debilitating conditions including lameness and metabolic disorders. Higher ambient temperatures have been linked to painful lameness via mechanisms including: increased standing time, decreased time lying down[62], ruminal acidosis (increase in stomach acidity) from altered feed intake, respiratory alkalosis (decrease in blood acidity due to increased respiration rate) and altered energy balance[9].

Higher ambient temperatures are associated with higher livestock mortality rates and in some cases, mass deaths[9,13]. For example, during a single heatwave event in January 2019, 2000 layer chickens died at a single Adelaide farm[67]. The death toll is expected to take some time to calculate accurately but over 100,000 livestock are estimated to have died in the NSW and VIC bushfires in 2019/2020[68] and an estimated 600,000 cattle perished in the 2018 Queensland floods[69]. Prompt access to animals to alleviate pain and suffering is also a concern during and after extreme weather events.

Climate change can have indirect effects on the health of livestock. For example, climate change is associated with an increased risk of parasitic and vector-borne diseases and contamination of feed by fungal toxins[9]. These health risks can have serious animal welfare implications. For example, fly strike is a painful and debilitating condition and for every 3°C increase in average temperature, the incidence of flystrike doubles in lambs and quadruples in ewes[70]. Climate change has been identified as a potential contributor to emerging infectious diseases in livestock[71]. Should outbreaks occur, there will be animal welfare issues associated not only with infection itself but also with disease control measures such as culling[72].

Animals farmed in aquaculture systems are also vulnerable to the effects of climate change including: salinity changes, toxic algal blooms, reduced water quantity and quality, decreased dissolved oxygen, increased water temperature, acidity, disease risk and mass mortalities[73]. These changes may be linked to negative affective states in fish such as pain and distress[74].

7. IMPACT OF CLIMATE CHANGE ON ANIMALS IN SPORT, RECREATION AND WORK

In a changing climate with higher ambient temperatures, animals in sport, recreation and work are at increasing risk of heat related illness in housing and during training, transport, competition and work. These animals are at high risk of exertional heat related illness because exertion increases an animals' metabolic rate (in some cases over ten times resting/basal metabolic rate[75]) with a subsequent increase in body temperature[76]. Thoroughbred race horses experience a rapid increase in body temperature of 1℃ per minute during racing[76] and the body temperature of racing greyhounds in Australia post-race has been found to increase by over 2°C even after less than a minute of racing[75]. The risk of heat related illness is even higher when competition or work proceeds during heatwaves[77]. Provision of shade, active cooling, ventilation, veterinary oversight, responsible heat policies and the postponement/cancellation of events are critical.

The 'track rating' (state of the ground on a racecourse) is largely determined by weather[78] and irrigation that relies on water availability. The track rating can influence animal welfare as it affects impact forces and lameness[79,80]. However, research is required to determine if and how climate change may affect track rating and the welfare of racing animals.

A small number of deaths of military working dogs and livestock guarding dogs[81,82] from heat related illness have been recorded in the literature.

8. IMPACT OF CLIMATE CHANGE ON WILDLIFE

Mass mortalities involving the death of thousands of birds[83], fish[84] and mammals[10,85] have been linked to extreme weather events (eg. heatwaves, bushfires). It is estimated that over 1 billion terrestrial mammals, birds and reptiles were killed in bushfires in 2019/2020[10]. Approximately 23,000 spectacled flying foxes (almost one third of the total population) died in a single heatwave event in 2018[86], one of many heat related bat mass mortality events recorded in Australia since the 1990s[85]. Up to 10,000 koalas (a third of the total NSW koala population) are feared to have died in the 2019/2020 bushfires and as many as 25,000 koalas (more than half the island's total koala population) died in the 2019/2020 Kangaroo Island bushfires[87]. These mass mortality events are perhaps the starkest illustration of the effects of climate change on the welfare of wildlife in Australia. The death of wildlife located over 50km away from bushfires due to smoke inhalation has been confirmed[88]. Extreme weather events are predicted to become more frequent and severe with climate change. Thus wildlife, at an individual and population level, are likely to suffer repeat trauma without time to recover.

In addition to direct trauma and death, climate change is likely to be associated with diminishing availability, quality and quantity of basic resources including tolerable ambient temperature, clean air, shelter, food and water[89]. Unable to access these basic resources, wildlife may experience a range of negative affective states including fear, thirst and hunger. Concerns are held about wildlife dying from starvation in the aftermath of bushfires[90]. Wild animals who do not succumb immediately may suffer secondary complications such as kidney failure associated with heat related illness and dehydration[43].

Generalist species (able to thrive in a variety of environments) may adapt to climate change (eg. range shift[91]). However, many native Australian animals are specialised to live in specific conditions and are therefore at high risk of extinction with individual animals suffering distress, debility and death in a changing climate[89]. Other processes threatening wildlife (e.g. habitat loss and fragmentation, invasive species) also limit wild animals' ability to cope with the effects of climate change[92] and may have a cumulative detrimental effect[93].

Migratory species are vulnerable to the effects of climate change. For example a systematic review concluded that climate change will affect the timing of migratory behaviour and migratory species may face increased hazards across a destabilised network of sites[94].

Climate change leads to many animals being brought into captivity for rescue and rehabilitation some of whom may never be fit for release or for whom release sites are unviable[44]. Animals are brought into care due to immediate welfare concerns but by doing so, they are exposed to stressors such as capture, confinement, handling and transport[95]. Animals release after rehabilitation are exposed to stressors associated with translocation[96].

Climate change puts the welfare of wildlife in Australia's marine environment at risk. For example, a record-breaking marine heatwave off the coast of WA in 2011 led to mass mortalities of fish and up to 12.2% declines in the survival rates of Indo-Pacific bottlenose dolphins[12]. While there has been attention given to the destructive effects of climate change on Australian coral reefs, investigation is required into the impact on the welfare of the animals that inhabit those reefs.

The distribution and abundance of invasive species is also affected by climate change[91]. From an animal welfare perspective, this may increase the number of animals harmed by invasive species (eg. preyed upon, poisoned by) and the number of target and non-target animals affected by control methods.

Zoos represent a unique challenge in a changing climate as they keep animals from a variety of climatic zones. Climate change is likely to affect collection planning, enclosure and exhibit design and daily husbandry including keeping zoo animals within their TNZ[97].

Climate change can affect wildlife health in a myriad of ways[93]. For example, resource limitations, prolonged drought and associated chronic stress are suspected to be major risk factors for chlamydiosis in koalas[98].

Climate change is a One Health[99] and One Welfare[100] issue, that is an issue that affects the environment and the health and welfare of people and animals. Climate change and other anthropogenic threats to wildlife precipitate emerging infectious diseases (EID)[101]. For example, climate change (via effects on bat habitat, nutrition, behaviour, stress and immune function) may be a driver of Hendra virus[102] (transmitted from bats to horses to people) and could increase its geographic extent[103].

9. CLIMATE CHANGE AND ANIMAL TRANSPORT

Transport is a widely acknowledged stressor to animals[104] and climate change poses additional stressors including heat related illness and death of animals transported by road, air and sea. Livestock transported for long distances are routinely deprived of food and water prior to, during and after road transport[105]. Water and food deprivation can exacerbate the impact of heat related illness[106]. Animals in sport, recreation and work are often transported in confined vehicles[107] and are at increased risk of heat related illness in a changing climate. The risks will increase for companion animals transported on a daily basis, particularly in circumstances where dogs are left in cars[108]. Unable to thermoregulate properly, brachycephalic breeds are a high-risk group for transport (particularly air travel) in a changing climate[109]. Finally, heat related illness is well-recognised as a major contributor to unacceptably poor welfare and mass mortalities in the live export industry[110] and these animal welfare risks will continue to increase with climate change.

10. CONCLUSION

From wildlife affected by bushfires, to racing animals competing in hot weather and fish experiencing air hunger in deoxygenated waters, climate change has serious implications for the welfare of all animals.

Community concerns about the impact of climate change on animals in Australia is increasing. Animals are and will continue to be affected by climate change in many ways including heat related illness, disease, pain, injury and traumatic death. Further research will be required to investigate the range and extent of animal welfare risks posed by climate change.

Based on existing information, it is clear that climate change poses an immediate and future risk to the welfare of all animals and urgent action must be taken now to manage and prevent those risks. By engaging with the community, researchers, industry and government, the RSPCA can help increase awareness and drive action on climate change as an animal welfare issue. The RSPCA can also play a role in addressing animal welfare concerns relating to climate change by integrating these concerns into policy, operations, advocacy, communications and research.

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