

Spring 2014

Sustainable Kangaroo Harvesting: Perceptions and Consumption of Kangaroo Meat Among University Students in New South Wales

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Sustainable Kangaroo Harvesting: Perceptions and consumption of kangaroo meat
among university students in New South Wales

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Submitted in partial fulfillment of the requirements for Australia:
Rainforest, Reef, and Cultural Ecology, SIT Study Abroad,
Spring 2014

Abstract

Kangaroos have been cherished as a source of meat for over 40,000 years by Aboriginal Australians and for many years by Europeans once they invaded the continent, but somewhere along the way kangaroos lost their status as an important resource and came to be regarded as a pest, and then a national icon which was considered taboo to hunt (Jackson et al., 2010; Mulvaney et al., 1999). It wasn't until the 1950's that a kangaroo meat industry began, and in the past few decades Australians have re-realized the great potential of kangaroo meat, and conservationists have begun promoting the sustainability and environmentally-friendly nature of kangaroos. The kangaroo industry is doing well (Kelly, 2013), but there is still much room for improvement (Ampt et al., 2008), and consumption still needs to increase in order for “sheep replacement therapy” to be realized (Grigg, 1987; Grigg, 1988; Grigg, 2002).

This study used surveys administered to students at two universities in Sydney, Australia to determine whether the young adults of today's generation would be more likely to consume kangaroo meat than the overall Australian population, which would indicate that the Australian population's kangaroo consumption is increasing over time. The study also aimed to investigate students' awareness of kangaroo sustainability and harvesting issues, in order to determine whether increased awareness and education would cause increased consumption. It was found that students' kangaroo consumption is very similar to the kangaroo consumption of the general population of Australia, as determined by comparing results to the 2008 study done by Ampt et al. This study also found a high proportion of students to be unsure about many aspects of kangaroo meat and kangaroo harvesting, and increased education and awareness does seem to be likely to increase the consumption of kangaroo meat. This paper suggests that better promotion, marketing, and visibility of kangaroo meat would have a strongly positive affect on the industry.

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Acknowledgments

I'd like to thank Professor Michael Archer for being my advisor and for helping me throughout this entire project. I'd like to thank my academic director Tony Cummings for coordinating and helping with every logistical aspect of this project and for providing encouragements when I needed it most. I'd also like to thank Peter Ampt for giving me such a helpful and insightful interview, and for sending out my survey to his students at the University of Sydney. Thank you to George Wilson, John Kelly, and Gordon Grigg for agreeing to answer my questions and for sending me useful information. Thank you to all the professors at the University of New South Wales who handed out my survey to their students, and last but certainly not least, thank you to all of the students at University of Sydney and University of New South Wales who took the time to participate in my survey. This project would not have happened without the help of all those involved!

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Abbreviations Used

CSU – Conservation through Sustainable Use
 THINKK – The Think Tank for Kangaroos
 UNSW – The University of New South Wales
 USyd – The University of Sydney
 ISP – Independent Study Project
 NSW – New South Wales
 TAFE-accredited

1. Introduction

1.1 Climate change and the ecological crisis

On Earth, we are facing a global ecological crisis. Ten thousand years of agriculture, thousands of years of destructive reshaping of the world's landscapes, and a couple centuries of industrialization have brought us to where we are today – at the tipping point, a crucial moment in Earth's history. Human industrialization has caused a major greenhouse gas problem on our planet, which in turn is causing global warming and catastrophic climactic change (Justus et al., 2001; Karl et al., 2003). Gas emissions are produced by nearly every aspect of our modern lives, from the cars we drive to the food we eat. Fossil fuel is now used at every stage of modern crop and meat production (Garnett, 2011; Keith, 2009; Pollan, 2006), and cattle and sheep produce methane (Garnett, 2011; Johnson et al., 2005; Mäkinemi et al., 2013; McMichael et al., 2010; Wilson et al., 2008). Agriculture is also part of the growing problem of topsoil loss, and is restructuring the face of our planet and turning fertile lands into deserts and dead zones (Brown, 1981; Brown, 1984; Keith, 2009). Growing annual monocrops destroys topsoil (nutrient dense soil teeming with living bacteria and microorganisms – essentially the “stuff of life”) causing desertification, ruining ecosystems, and causing the extinction of many animal species (Archer, 2011; Keith, 2009). Additionally, growing grain to feed livestock causes a huge net loss of energy and is cruel to the animals because they are not biologically adapted to feed on grain (Keith, 2009; Pollan, 2006). Keeping them in high unnatural densities also causes land degradation and erosion (Barson et al., 2000; Grigg, 1987; Grigg, 1988).

The continent of Australia is no exception to these problems. Currently, Australia is the largest per-capita emitter of greenhouse gas in the world (O'Connor et al., 2008). The country also has substantial land degradation problems, some citing it as Australia's single-largest rural problem (Barson et al., 2000; Jackson et al., 2010). Fortunately, Australia has a unique resource that may be a partial solution to some of the country's environmental and ecological problems. Environmentalists generally

agree that one of the best things individuals can do to help combat climate change and ecological destruction is to [sustainably] utilize resources that occur naturally and locally where you live. In Australia, the kangaroo is an abundant resource that lives throughout the continent, and there is increasing awareness of the sustainability and environmentally friendly nature of eating kangaroo meat. It was previously thought that the best way to ensure the survival of habitats and species was to leave them alone and protect them from humans completely, but many conservationists are now realizing that conservation through sustainable use (CSU) is a much better and more practical way of ensuring ecosystem health (Archer, 2002; Archer et al., 1997; Archer et al., 2004). The controlled harvesting of kangaroos is a perfect example of this strategy at work.

1.2 A short kangaroo history

“Kangaroo” is a vernacular term generally referring to species of the genus *Macropus*, of the family Macropodidae, a large family of 65 species of hopping macropods found in Australia and New Guinea (Jackson et al., 2010). The oldest known macropod fossil is at least 23 million years old; today, there are around 77 extant species of macropods (Jackson et al., 2010). Like all other macropods, the kangaroo is a marsupial mammal, meaning that it gives birth to live, underdeveloped young, which the mother will then carry around for months in a pouch, or “marsupium,” as the offspring grows and develops (Jackson et al., 2010).

At least 40,000 years ago, Aboriginal Australians colonized the continent, and the kangaroo became immediately important to their culture (Jackson et al., 2010; Mulvaney et al., 1999). Some Aboriginal tribes' most important and well-known Dreamtime stories revolve around the kangaroo (Knudtson et al., 1992), and these macropods have been some of the most vital animals in Aboriginal diets (Jackson et al., 2010). When Europeans invaded Australia they, too, found value in the kangaroo as a resource, and it quickly became a staple meat; however, somewhere along the way between the 1800s and present day, kangaroos lost their place on the European dinner plate and became increasingly

thought of as a pest (Jackson et al., 2010). This is perhaps because European settlers never quite lost their taste for the exotic animals they were familiar with, and as they began to import and farm sheep and cattle, the farmers began to view kangaroos as pests who competed with their exotic livestock species for resources. European invasion displaced Aboriginal tribes and reduced dingo populations, thereby limiting the natural predators of kangaroos in some places. This, coupled with increased water provided for cattle and sheep which was consequently also used by kangaroos, meant that kangaroo populations exploded, worsening their reputation as pests (Jackson et al., 2010).

The commercial kangaroo industry began in the 1950s, but in the 1970s kangaroo meat was banned for human consumption in most states, and it wasn't until 1993 that it was re-legalized for human consumption in all states of Australia (Jackson et al., 2010; Kelly, 2013).

1.3 Why kangaroo meat is environmentally friendly

Since the start of the commercial kangaroo industry in the 1950s, conservationists began realizing the sustainability of the harvest and its environmental benefits. In 1987 Gordon Grigg brought forth the idea of “sheep replacement therapy” in the rangelands (Grigg, 1987). This idea has been reiterated and expounded upon countless times since Grigg's first proposal, and kangaroo harvesting is now widely accepted by Australian scientists to be a sustainable, environmentally beneficial practice (Archer, 2002; Archer et al., 2004; Cooney, 2011; Cooney et al., 2011; Grigg, 1988; Grigg, 2002; Jackson et al., 2010; Kelly, 2013; Wilson et al., 2008).

Land degradation caused by soil erosion has been cited as Australia's worst rural problem (Grigg, 1987; Jackson et al., 2010). It is estimated that out of Australia's 3.5 million square kilometers, approximately 1.85 million square kilometers has been degraded by domestic stock overgrazing, and one-quarter of the degraded area is at risk of becoming desert (Jackson et al., 2010); the degradation causes about 3-5 billion dollars in damage every year (Archer, 2002). Sheep, in particular, cause severe damage through grazing, ground abrasion caused by their hard hooves, and soil compaction from the

pressure of their feet (Grigg, 1987; Grigg, 1988; Grigg, 2002). Kangaroos, on the other hand, have relatively soft feet, and have evolved with the natural Australian terrain for millions of years, and consequently do very little damage to the rangelands in the way of erosion (Archer et al., 2004; Cooney, 2011; Cooney et al., 2011; Grigg, 1987; Grigg, 1988; Grigg, 2002; Jackson et al., 2010). The idea originally proposed by Grigg (1987) was that increasing the price of kangaroo products via a greater investment in marketing would provide graziers with a supplemental income, thereby allowing them to decrease their stock of sheep. In theory, this would reduce the total grazing pressure on the land, and increased valuing of kangaroos would provide an incentive for landholders to protect and maintain the native vegetation (Cooney et al., 2011; Grigg, 1987; Grigg, 2002). An experiment at Fowlers Gap Station found that after removing sheep from the land for just two years, the biomass and diversity of plants increased dramatically (Grigg, 1987).

One of the most notable reasons why kangaroos are so environmentally friendly is their lack of methane production (Archer et al., 2004; Cooney, 2011; Cooney et al., 2011; Jackson et al., 2010; Kelly, 2013; Wilson et al., 2008). Cows and sheep burp methane (as much as 250-500L per day) as a process of their ruminant digestive system (Jackson et al., 2010; Johnson et al., 1995). This enteric methane accounts for approximately 67% of Australia's agricultural greenhouse gas emissions (Wilson et al., 2008), and 10-25% of the country's total annual emissions (Cooney, 2011; Wilson et al., 2008). Methane as a greenhouse gas is of particular concern because it is 20-25 times better at trapping heat in the atmosphere than carbon dioxide (Cooney, 2011; Jackson et al., 2010; Kelly, 2013; Wilson et al., 2008). Kangaroos and ruminants have similar digestive systems in that their stomachs both contain microorganisms which ferment the grass they eat, and produce hydrogen as a byproduct of this process; however, while ruminants' microorganisms turn the hydrogen into methane, kangaroos' stomachs have a different composition of microorganisms which instead turn hydrogen into acetate (Jackson et al., 2010; Wilson et al., 2008). In the study done by Wilson et al. (2008), it was estimated that the rate at

which kangaroos produce greenhouse gases is about 0.003 tonnes/individual/year, or about 6.5L/individual/year – a negligible amount when compared to cows and sheep, which produce 250-500L of methane *per day* (Johnson et al., 1995).

Besides their lack of methane production and their low-impact soft feet, there are numerous other reasons why kangaroos are a good resource. For one, kangaroo populations fluctuate naturally with rainfall, meaning that in drought years their numbers will decline and there will be no risk of overgrazing, unlike sheep and cattle which frequently overgraze the land, especially during droughts (Caughley et al., 1985; Cooney, 2011; Jackson et al., 2010; Kelly, 2013). Kangaroos are also more efficient at producing usable meat than sheep and cattle, as they have lower water and energy requirements per kilogram of body weight (Cooney, 2011; Cooney et al., 2011; Grigg, 2002); it has been shown that sheep can eat as much as almost 3 kangaroos, and use 4.1 times more water (Cooney, 2011; Munn et al., 2008).

1.4 Additional benefits of kangaroo meat

Contrary to the beliefs of some animals rights activists, kangaroo harvesting is an extremely humane practice – the RSPCA has found it to be one of the most humane forms of animal slaughter (Archer, 2002; Kelly, 2013). Cattle and sheep are penned, transported, and then killed at slaughterhouses, whereas kangaroos live freely in nature, and are shot on-site by TAFE-accredited shooters; they are shot directly in the head, resulting in an instantaneous, unanticipated, stress-free death (Archer, 2002; Cooney 2011; Grigg, 1987; Grigg, 2002; Kelly, 2013; Wilson et al., 2008).

On top of all of this, kangaroo meat is also extremely healthy for humans; the meat has only 1-2% fat, is very low in cholesterol, and contains virtually no diseases which can be transmitted to humans (due to marsupials and placental mammals being evolutionarily about 200 million years apart) (Archer, 2002; Archer et al., 2004; Grigg, 1987; Grigg, 2002).

1.5 Why kangaroo harvesting is a sustainable species conservation practice

There are four species of kangaroos in Australia which are legally harvested by the commercial industry: the red kangaroo (*Macropus rufus*), the eastern grey kangaroo (*Macropus giganteus*), the western grey kangaroo (*Macropus fuliginosus*), and the common wallaroo (*Macropus robustus*), although the first three are more commonly harvested than the common wallaroo (About Australia, 2008). The commercial harvesting of kangaroos is not only beneficial for the environment, but it is also beneficial for the kangaroos themselves. The European invasion of Australia displaced many native Aboriginal tribes; this, coupled with the shooting of dingos by Europeans, significantly reduced the number of both human and animal predators killing kangaroos, thus causing kangaroo populations to increase a great deal (Jackson et al., 2010). European sheep and cattle farming increased the number of available watering points, which helped to further increase kangaroo populations (Jackson et al., 2010). Today, government regulated kangaroo harvesting is needed to keep population levels in check. Without harvesting, natural resources wouldn't be able to support the artificially high numbers of kangaroos caused by European invasion and farming, and kangaroos would quickly overgraze the land, eventually leading to starvation of many individuals; this is especially true during drought conditions (P. Ampt, pers. comm., 2014).

The harvesting of kangaroos is sustainable because the quota of individuals that can be killed is set at a percentage of the total population of each species, usually 10-15% (Cooney, 2011; Jackson et al., 2010; Kelly, 2013; Wilson et al., 2008). The populations are monitored via aerial surveys, and quotas are adjusted based on various factors including rainfall and population trends (Grigg, 2002; Jackson et al., 2010; Kelly, 2013). Today, kangaroos are one of the most abundant large mammals on Earth (Kelly, 2013).

1.6 Justification for the study

Even with all the evidence to support kangaroo meat as an ecologically and environmentally

sustainable food source, there are still very few Australians who regularly eat kangaroo (i.e. more than four times a year), and an increase in demand is needed to increase the value of the meat enough to make Grigg's "sheep replacement therapy for the rangelands" theory a reality (Grigg, 1987; Grigg, 1988; Grigg, 2002). According to Grigg (2002), "the low price of kangaroo meat ... is a major impediment to implementing 'sheep replacement therapy for rangelands,' and only when prices rise significantly will landholders choose to reduce sheep numbers and invest their hopes in kangaroos." In order to increase demand thereby raising prices, it is necessary to find out who is buying kangaroo products and why or why not so that future strategies may be developed to promote consumption of kangaroo.

A 2008 study done by Ampt et al. found that 47.8% of respondents had eaten kangaroo at least once and would eat it again in the future, and 21.1% of respondents hadn't eaten kangaroo, but would be willing to try it. The number of respondents who had tried kangaroo was slightly higher than in a similar study done in 1997, and showed that kangaroo consumption is slowly increasing (Ampt et al., 2008). Interestingly, New South Wales was found to have the highest number of objectors (Ampt et al., 2008).

It is also necessary to find out which and how many Australians actually support kangaroo harvesting to determine if kangaroo consumption could be positively impacted by increased awareness of the benefits of the industry. Today, there are still opponents of kangaroo, one of the most outspoken being the organization THINKK (The Think Tank for Kangaroos) (see Ben-Ami et al., 2010). It is possible that there are many Australians that feel similarly to the THINKK group, but as Archer et al. pointed out in their book *Going Native* (2004), it is also possible that "the very small minority of Australians who oppose sustainable harvesting ... spend extraordinary amounts of time and money making their minority views heard."

This study seeks to investigate the attitudes of university students in New South Wales towards

kangaroo meat, and to determine if attitudes and consumption behaviors are related to knowledge about the kangaroo industry. This study also aims to determine whether younger generations (i.e. university students) will be more likely to consume kangaroo meat than the general population, which will indicate whether or not consumption of kangaroo meat is likely to increase in the near future. This will be done by surveying students at two universities in New South Wales about their kangaroo consumption behaviors and their knowledge about kangaroo harvesting and related issues pertaining to traditional farming. A comparison will be made with the study done by Ampt et al. (2008) to determine if level of consumption is higher among university students than among the general population surveyed by Ampt et al. (2008).

2. Methodology

In order to study university students' perceptions of the kangaroo industry and their consumption of kangaroo meat, surveys were administered to students at the University of New South Wales (UNSW) and the University of Sydney (USyd). A total of 261 survey responses were gathered over the period of about a week. Paper copies of the surveys were given out to UNSW students in six different courses (1st year environmental systems and processes, 2nd year vertebrate zoology, 2nd year data analysis for life and Earth sciences, 2nd year geographic information systems, 3rd year evolution, and postgraduate geographic information systems), comprising a total of 143 students. An electronic version of the survey was sent out via email by Peter Ampt to USyd students in AGEN 1001 (1st year, "Shaping our Landscapes"), a class of approximately 360 students, of which 118 students answered the survey.

Some parts of the format of this survey were adapted from the survey used in the ISP conducted by Alex Mass (2006). The first part of the survey used in this study consisted of a series of questions intended to collect demographic information, including gender, age, nationality, major/concentration,

political orientation (question adapted from Mass, 2006), diet, and a question that asked students to rate their personal level of environmental consciousness (question adapted from Mass, 2006). The next question was a multiple choice question intended to gauge students' kangaroo meat consumption habits.

The remainder of the survey consisted of 18 statements about kangaroo harvesting, kangaroo meat, cattle and sheep farming, and conservation, and students were asked to indicate whether they strongly disagreed with the statement, mildly disagreed, mildly agreed, strongly agreed, or were unsure about the statement (rating format adapted from Mass, 2006). In accordance with the ethical guidelines set forth by the School for International Training, participants were informed by their respective professors and/or by a statement at the top of the survey that the survey was completely anonymous and voluntary, and that he or she reserved the right to terminate their participation at any time during the survey. See the Appendix on page 32 for a complete copy of the survey administered in this study. To sort and analyze the data, all responses were manually recorded using the website, SurveyMonkey.

3. Results

A total of 261 university students participated in this survey. All students were between the ages of 18 and 29 years old, with 90% being between 18-24. (Because this study was intended to collect data on university-age young-adults, a cut-off was established at 30 years old, so that any surveys in which the participant indicated they were 30 years old or older were not included in the results.) Of the participants, 59% identified as female, and 41% identified as male. Australian students comprised 68% of the participants; the remaining 32% indicated they were from other countries (i.e., study-abroad students or international students). For the question asking students to give their political orientation, approximately 29% identified as left wing or left moderate, 23% identified as moderate, 8% identified as right wing or right moderate, 28% identified as apathetic/apolitical, and 10% of students did not indicate an answer.

When students were asked to rate their personal level of environmental consciousness, 57% indicated they were more conscious than most people, 30% felt they had an average level of consciousness, 11% felt they were extremely conscious, and only 2% indicated an answer of less than average (Figure 1). Very little difference was found in environmental consciousness between women and men.

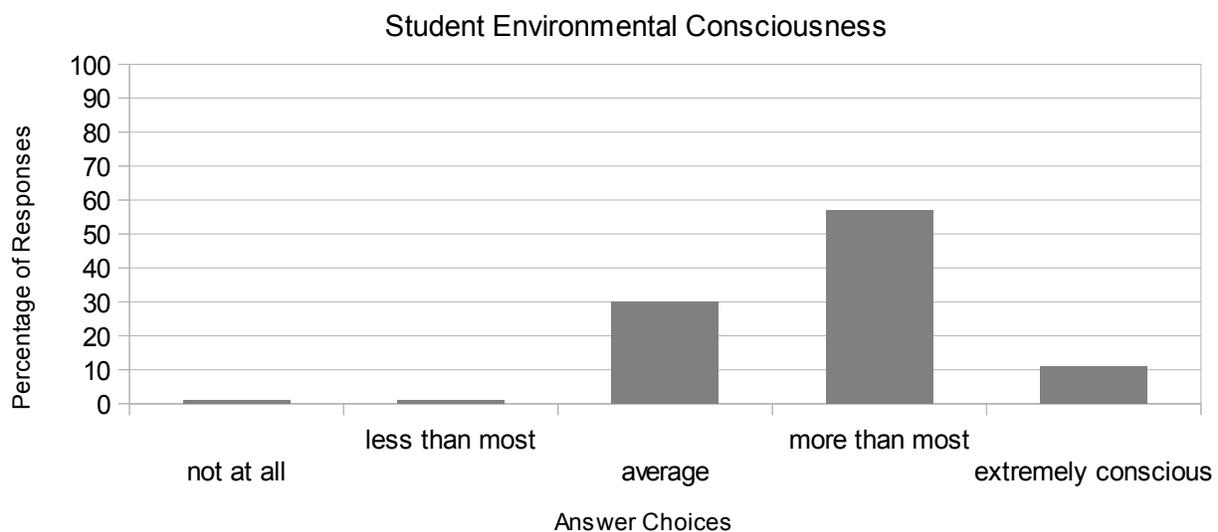


Figure 1. *Percentage of total student responses under each category of environmental consciousness (not at all conscious, less conscious than most, average consciousness, more conscious than most, or extremely conscious).*

When asked about their dietary habits, most students indicated they were omnivores (80%), followed by carnivores (7%) or vegetarians (7%); very few students identified as either vegan (1%) or kangatarian (1%) (Figure 2). Women and men were found to be equally likely to be omnivores (78% of women and 81% of men), but women were found to be more likely to be vegetarians (10%) than men (3%) (Figure 2). It is also interesting to note that the two participants who indicated they were kangatarians were both men (Figure 2).

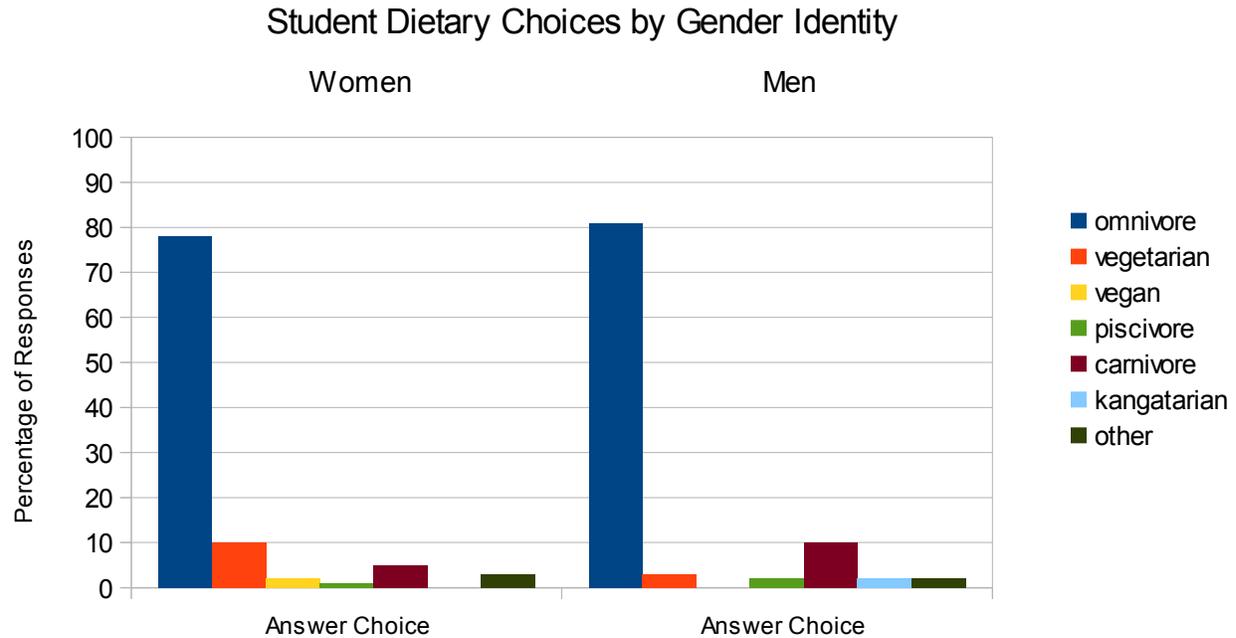


Figure 2. *Percentage of total female and percentage of total male students in each category of dietary habits (omnivore, vegetarian, vegan, piscivore, kangatarian, or other).*

Of the students surveyed, 48% have at least tried kangaroo meat (20% have eaten it once, 11% eat it rarely, 7% eat it sometimes, and 10% eat it regularly), 26% have never eaten kangaroo but would be open to trying it, 9% have eaten it but will not eat it again, and 17% are opposed to eating kangaroo (2% have never eaten it for health reasons and 15% have never eaten it for moral or ethical reasons). A significantly higher percentage of men than women were found to have eaten kangaroo at least once and not be opposed to eating it again (37% of women, 60% of men), and women were more likely to be opposed to eating kangaroo (26% of women, 5% of men) (Figure 3).

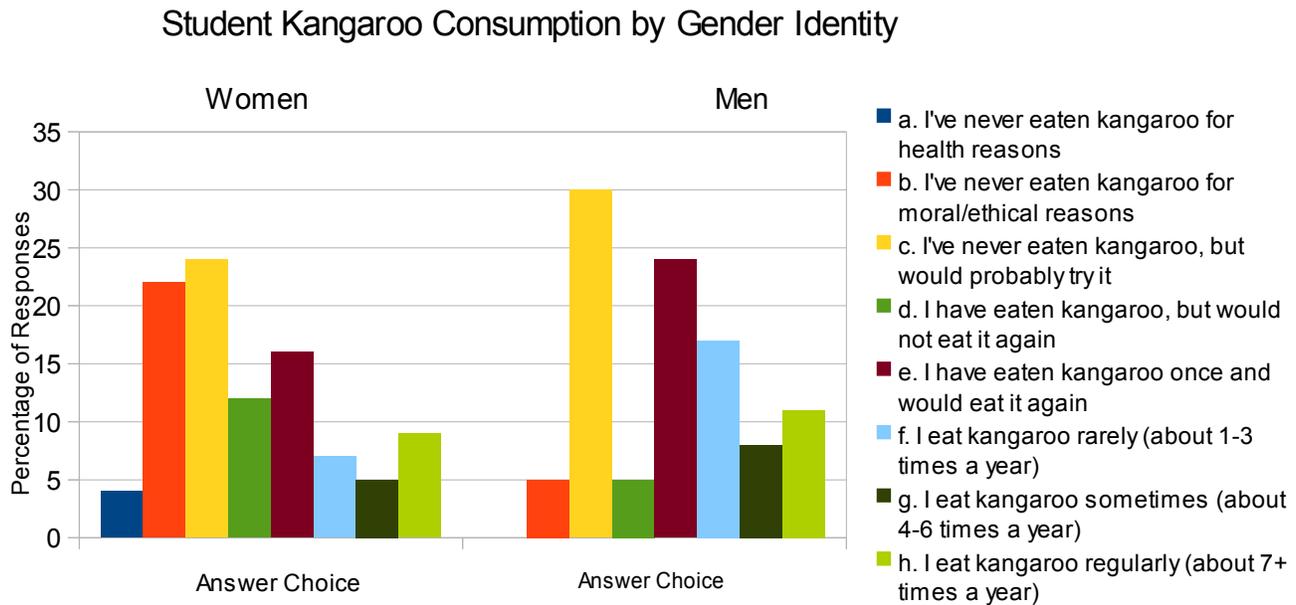


Figure 3. Percentage of total female and total male students in each category of kangaroo consumption.

Table 1. shows a complete summary of the results for statement-rating questions. Most students answered all 18 of the statement-rating questions, but there was a small percentage of students that did not indicate an answer to some questions (particularly #10-18), and it is assumed that most of these were because students did not see questions 10-18, which were on the reverse side of the page. Less than half (46.8%) of all students surveyed indicated they were aware of the issues surrounding kangaroo harvesting in Australia, although a higher percentage (61.7%) agreed that kangaroo is a sustainable source of meat (Table 1). Of those students who agreed they were aware of the issues, 58% had eaten kangaroo at least once and would it eat again, indicating a possible correlation between perceived personal awareness and likelihood of consuming kangaroo. Further, of those who agreed that kangaroo meat is sustainable, 63% had eaten it at least once and would it eat it again; of those who were unsure about the sustainability of kangaroo meat, only 28% had eaten kangaroo at least once, while 36% had not eaten kangaroo but were willing to try it.

Statements	Percentage of Responses per Answer Choice:			
	Disagree	Unsure	Agree	Unanswered
1. I am aware of issues surrounding the on going debate about kangaroo harvesting in Australia	30.7	22.6	46.8	0.0
2. Kangaroo is an environmentally sustainable source of meat	12.6	25.7	61.7	0.0
3. A meat-free diet is more environmentally sustainable than one that includes meat	46.4	14.9	38.7	0.0
4. Kangaroo meat is healthier for humans than beef or mutton	9.6	39.1	51.4	0.0
5. Conventional farm animals (cattle, sheep) contribute to the greenhouse gas problem	8.1	8.9	82.7	0.4
6. Kangaroos produce less methane than cows and sheep	1.2	46.7	52.1	0.0
7. Farm animals like cattle and sheep have no impact on the native Australian environment	89.7	5.8	4.6	0.0
8. Kangaroos compete for resources with sheep stock	14.5	35.6	49.4	0.4
9. Kangaroo meat is expensive to buy from the grocery store	19.1	52.1	28.8	0.0
10. Kangaroos when harvested are normally killed humanely, as judged by the RSPCA	8.4	67.1	23.0	1.5
11. Cattle and sheep are killed more humanely than wild-harvested kangaroos	19.2	63.6	15.8	1.5
12. If a large kangaroo is not harvested, it will die a peaceful, painless death of old age	44.4	32.6	21.5	1.5
13. Animal liberation and animal rights groups are doing the right thing in trying to make kangaroo harvesting illegal	53.3	25.3	20.0	1.5
14. Kangaroos are harvested based on a percentage of the population, rather than a raw number	1.9	70.5	26.1	1.5
15. The kangaroo harvesting rate is adjusted each year according to environmental factors impacting populations	3.1	64.4	30.7	1.9
16. Shooters for the kangaroo industry take any large individuals they see no matter what their sex	16.5	66.3	15.8	1.5
17. Humans can catch “mad cow” disease from eating kangaroo meat	47.5	49.0	1.9	1.5
18. The best way to conserve all wildlife is to leave it strictly alone	75.8	5.4	17.2	1.5

Table 1. Results for survey questions #1-18, showing the percentage of students indicating they disagree, agree, or are unsure of the statement, and percentage of students who did not respond to the question. Where appropriate, gray highlighted boxes indicate the response that was being sought after for each question.

Unsurprisingly, students appeared to be somewhat equally divided on whether or not a meat-free diet is more environmentally sustainable than one that includes meat; 38.7% of students agreed a meat-free diet is more sustainable, and 46.4% disagreed (Table 1).

The majority of students (51.4%) agreed that kangaroo meat is healthier for humans than beef or mutton, although a high percentage (39.1%) were still unsure, and many (49.0%) were also unsure as to whether humans can catch mad cow disease from kangaroo meat (Table 1). Of those students who had eaten kangaroo at least once, most (73%) agreed that kangaroo is healthier; of those who had not eaten kangaroo but are willing to try it, most (53%) were unsure about the healthiness of kangaroo. This indicates a possible correlation between perceived healthiness of kangaroo and likelihood of consumption. Similarly, of those who had eaten kangaroo at least once, 63% were aware that you cannot catch mad cow disease from kangaroo meat, while of those who had not eaten kangaroo meat but were open to trying it, only 37% were aware of this information.

Students appear to be aware of the impact of cattle and sheep on the environment, but less aware that kangaroos have less impact than cattle and sheep; the overwhelming majority of students agreed that farm animals contribute to the greenhouse gas problem (82.7%) and disagreed that farm animals have no impact on the Australian environment (89.7%), but only about half (52.1%) of students agree that kangaroos produce less methane than cows and sheep, and the other half (46.7%) were unsure (Table 1). Interestingly, the students surveyed still seem to be under the impression that kangaroos compete for resources with sheep stock, as 49.4% agreed with this statement (Table 1). The majority of students were unsure about statements 14, 15, and 16, which all pertained to kangaroo harvesting regulations (Table 1).

The majority of students were either unsure about the price of kangaroo meat (52.1%), or agreed that it is expensive to buy from the store (28.8%) (Table 1). Interestingly, of those students who had eaten kangaroo once but would not eat it again, 65% were unsure about the price of kangaroo, and

only 26% agreed that kangaroo is expensive. This indicates that those who try kangaroo and then never eat it again are most likely doing so for reasons of taste or change in opinions, rather than because of price.

Most students were unsure about statements 10 and 11, regarding whether kangaroos are killed humanely (67.1% unsure) and whether cattle and sheep are more humanely killed than kangaroos (63.6% unsure) (Table 1). Most students (53.3%) did, however, disagree that animal liberation and animal rights groups are doing the right thing by trying to make kangaroo harvesting illegal (Table 1). Interestingly, even of those who had never eaten kangaroo for moral or ethical reasons, 72% were unsure as to whether kangaroos are harvested humanely. This indicates that either students are making decisions about the morality/ethics of kangaroo harvesting with little knowledge about the ethics of the industry, or that students' moral/ethical reasons for not eating kangaroo pertain to something other than humane killing (such as ingrained cultural values).

4. Discussion

4.1 Discussion of important findings

This study found that among 261 students surveyed at UNSW and USyd, 48% of participants had eaten kangaroo meat at least once and would eat it again, and 9% had eaten it once but would not eat it again. This compares with the results obtained in the study done by Ampt et al. (2008), which found that approximately 48% of participants had eaten kangaroo at least once and would eat it again, and 11% had eaten it once but would not eat it again. These results indicate that overall students are not more likely to consume kangaroo than the general public. This study did find, however, that students had a slightly higher percentage (17%) of medium to high consumers (classified by Ampt et al. as eating kangaroo at least four times per year) than the general population (14.5%). This study also found that 26% of students surveyed had never eaten kangaroo, but would probably try it, which is slightly

higher than in the study done by Ampt et al. (2008), of which 21% had not eaten kangaroo but would try it. This study found that 17% of students were opposed to eating kangaroo (either for health or moral/ethical reasons, classified as objectors), which is lower than the 21% of the general population found to be opposed (Ampt et al., 2008).

Interestingly, this study also found relative percentages of male and female student consumers to be the same as those found in the general population by Ampt et al. (2008). Approximately 37% of female students and 60% of male students surveyed had eaten kangaroo at least once and would eat it again, compared to 38% of women and 59% of men in the study by Ampt et al. (2008) (Figure 3). This study also found that women were more likely to be objectors than men (26% of women, 5% of men), which is similar to that found in the general population (28% of women, 12% of men) (Figure 3).

The results found in this survey all indicate that there is the same or a very similar pattern of kangaroo consumption among university-aged students as among the general population of Australian consumers. It was hypothesized that since the study done by Ampt et al. (2008) found that kangaroo consumption is slowly increasing (as shown by an increase in percentage of consumers from 1997 to 2008), today's younger generation (i.e., university-aged young adults) might perhaps have a higher level of consumption than the population surveyed in 2008, which would indicate that kangaroo consumption is still increasing, and that future generations would be more likely to consume kangaroo meat. This, however, was not found to be true.

This study aimed to investigate current students' perceptions of kangaroo harvesting and the kangaroo industry, to determine if education is needed to increase awareness and thus increase consumption. The survey conducted in this study found that for most questions, a high percentage of students responded that they were unsure about the statements, indicating that more awareness is indeed needed. Approximately 54% of students were not aware of issues surrounding kangaroo harvesting (Table 1). Of those students who agreed that kangaroo is a sustainable source of meat, 63%

had eaten kangaroo at least once and would eat it again, which indicates that students who are made aware of the sustainability of kangaroo will have a good chance of being future consumers.

The survey found that 67% of students were unsure about whether or not kangaroos are killed humanely, and a further 8% believed that kangaroos are not killed humanely. This indicates that the kangaroo industry could benefit from a greater awareness of the extremely humane nature of kangaroo harvesting. Even 72% of students who responded that they had never eaten kangaroo meat for moral or ethical reasons also responded that they were unsure as to whether kangaroos are killed humanely, indicating that some students may change their mind about not eating kangaroo if they were made more aware of the ethical nature of the industry. As suggested by Wilson et al. (2008), it is also possible that the status of kangaroos as a national icon is still an impediment to kangaroo meat consumption; some students may choose not to eat kangaroo simply for this reason.

Approximately 29% of students surveyed felt that kangaroo meat was expensive to buy from the grocery store, but of those students, 80% had eaten kangaroo at least once and would eat it again or had not eaten kangaroo but would probably try it (Table 1). This indicates price is not a significant barrier to consumption of kangaroo meat. Interestingly, more than half of all students surveyed (52%) were unsure about the price of kangaroo meat (Table 1). This indicates that a large proportion of students have either not looked for kangaroo meat in the store, or have looked for it but could not find it; thus, a perceived lack of availability or a lack of visibility is a potential issue preventing consumption of kangaroo. Indeed, the study by Ampt et al. (2008) found that 49% of consumers in NSW and the Australian Capital Territory stated that kangaroo is not available every time they would like to buy it, and 19% have looked for kangaroo but have not found it.

4.2 Implications of findings

This study found students to be equally likely to consume kangaroo as any Australian in the general population; therefore, it does not appear as though the younger generations today will lead to

increased kangaroo consumption in the general population in the future. However, it is possible that consumption increases with age, and does not remain stagnant throughout one's life. Ampt et al. (2008) did not find a significant difference in kangaroo consumption between age groups, although there were fewer 18-25 year olds in the medium-high consumer category than other age groups. If it is indeed not the case that kangaroo consumption increases with age, then this study would appear to indicate that an increase in education and awareness about food sustainability and kangaroo harvesting is needed to increase the consumption of kangaroo meat. Even though 48% of participants had eaten kangaroo at least once and would eat it again, only 10% eat it "regularly," where regularly was defined as 7 or more times a year; therefore, there is certainly still room for improvement in the way of increasing consumption.

The high percentages of students who answered "unsure" to questions on the survey indicates that awareness of issues surrounding kangaroo harvesting is still somewhat low, and better promotion is needed to educate consumers about the sustainability of kangaroo meat. Since almost all students in this study rated themselves as at least average for environmental consciousness, and most rated themselves as above average, it does not seem to be a lack of desire to make environmentally-friendly or sustainable food choices (Figure 1). John Kelly, executive officer of the Kangaroo Industries Association of Australia (KIAA), gave a similar opinion in a correspondence with the author: "markets could grow more strongly yes, doing so requires a lot of things, one of which is the continual voice of ecologists stressing that the harvest is well managed, sustainable and humane" (J. Kelly, pers. comm., 2014). Similarly, George Wilson, professor at the Fenner School of Environment & Society for the Australian National University, and author on various papers about the sustainability of kangaroo meat, stated that "greater awareness of the impact of cattle and sheep on the Australian environment" is needed to increase kangaroo meat consumption (G. Wilson, pers. comm., 2014). Studies have found that a barrier to consumer purchase of sustainable goods is the unclear and conflicting information that

is presented to consumers on a daily basis, and without straightforward and reliable information, consumers cannot be expected to know what the real “sustainable option” is (Bakker et al., 2011; Fahlquist et al., 2009; Vermeir et al., 2006). Grigg (2002) similarly cited the need to better publicize Australia's land degradation problems, the conservation benefits from kangaroo harvesting, and the humane nature of the industry.

One possible reason for the low percentages of regular kangaroo meat consumers, and the high percentage of participants who are open to eating kangaroo meat but have not done so, is a phenomenon known as the “attitude-behavioral intention gap.” This phenomenon seems to indicate that with regard to environmental and sustainable purchases, consumer behavior is not always consistent with attitudes (Bakker et al., 2011; Vermeir et al., 2006). Consumers may wish to purchase the more sustainable food items, but may not do so because of the numerous other factors affecting food choices, such as convenience, habit, prices, and brand familiarity (Bakker et al., 2011; Vermeir et al., 2006). It may be possible to actively influence consumers to choose kangaroo meat by altering the marketing techniques. In an interview with the author, Peter Ampt, manager of the FATE program (Future of Australia's Threatened Ecosystems) and author on studies done about kangaroo harvesting and kangaroo meat, cited inconsistency and a lack of visibility as the main barriers to kangaroo meat consumption (P. Ampt, pers. comm., 2014). Ampt cited the positioning of kangaroo meat in the game section of grocery stores as an impediment to visibility of the meat, and believed that positioning kangaroo near beef in stores would increase visibility and allow consumers to see kangaroo as an alternative to beef products (P. Ampt, pers. comm., 2014).

Another significant impediment to consumer kangaroo consumption is the tendency of women to be less likely to consume kangaroo than men, and more likely to be opposed to kangaroo meat. This is possibly due to the deeply ingrained cultural associations between meat and masculinity, where in many cultures meat is a symbol of patriarchy, manhood, and power (Ruby et al., 2011). A study done

by Ruby et al. (2011) found that both omnivorous and vegetarian participants rated vegetarians as less masculine than omnivores. Because there are so many fewer female consumers of kangaroo meat than male consumers, women show a significant market group for potential increase in kangaroo meat consumption. Unfortunately, the only way to remove cultural associations of meat with masculinity is to completely dismantle patriarchal society, but that is beyond the scope of this study. It is possible, however, to increase kangaroo consumption via increased marketing toward female-identified consumers, although it is the opinion of the author that non-gendered marketing techniques are the best option for increasing visibility.

5. Conclusions

The goal of this study was to determine whether university students, being the younger generation, are more likely to consume kangaroo meat than the general population. This study also aimed to investigate the attitudes of university students towards kangaroo meat and kangaroo harvesting, and to determine if attitudes and consumption behaviors are related to knowledge about the kangaroo industry. It was found that patterns of student kangaroo consumption do not significantly differ from those in the general population of Australia, as determined by comparison of the results of this study with those found by Ampt et al. (2008). This indicates that future generations may not be more inclined to consume kangaroo as a matter of course; therefore, Australian consumers' kangaroo consumption cannot be expected to simply increase with time, and improved marketing strategies for increased visibility of kangaroo meat and increased awareness of the sustainability of kangaroo meat is needed to increase consumption. This study also found that a high percentage of students are unsure about many aspects of kangaroo harvesting, but that increased education about the industry shows promise for increasing kangaroo meat consumption. Most students who were aware of the issues surrounding kangaroo harvesting and agreed that kangaroo meat was sustainable had eaten kangaroo at

least once and would eat it again. Of all students surveyed, most who had eaten kangaroo meat at least once were aware of the healthiness of the meat, and were aware that humans cannot catch “mad cow” disease from kangaroo meat. These results indicate that awareness about the sustainability of kangaroo harvesting and benefits of kangaroo meat increases the likelihood of kangaroo meat consumption. Overall, university students rated themselves as average or above average with regards to environmental consciousness, and thus show a desire to make environmentally-friendly and sustainable food choices; therefore, increased marketing of the sustainability and environmental benefits of kangaroo meat is not only needed, but would likely be well received among NSW university students.

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Personal Communications

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Appendix

Please see the next two pages for a copy of the survey administered in this study.

Kangaroo Harvesting Survey – April 2014

This survey is completely anonymous and voluntary. As such, you reserve the right to refuse to participate in any aspect of the study and to terminate participation at any time.

Gender:

Age:

Nationality:

Major/Concentration (if uni grad or current student):

Political Orientation: left wing left moderate moderate right moderate right wing apathetic/apolitical

Diet: omnivore vegetarian vegan piscivore carnivore kangatarian other

How would you rate yourself on a scale of environmental consciousness?

1 - not at all 2 - less than most 3 - average 4 - more than most 5 - extremely conscious

Please rate your kangaroo meat consumption (Circle one answer):

- a. I've never eaten kangaroo for health reasons
- b. I've never eaten kangaroo for moral/ethical reasons
- c. I've never eaten kangaroo, but would probably try it
- d. I have eaten kangaroo, but would not eat it again
- e. I have eaten kangaroo once and would eat it again
- f. I eat kangaroo rarely (about 1-3 times a year)
- g. I eat kangaroo sometimes (about 4-6 times a year)
- h. I eat kangaroo regularly (about 7+ times a year)

Below are some statements about kangaroo harvesting. For each statement, please indicate whether you strongly disagree, mildly disagree, are unsure, mildly agree, or strongly agree.

1. I am aware of issues surrounding the on going debate about kangaroo harvesting in Australia
strongly disagree mildly disagree unsure mildly agree strongly agree
2. Kangaroo is an environmentally sustainable source of meat
strongly disagree mildly disagree unsure mildly agree strongly agree
3. A meat-free diet is more environmentally sustainable than one that includes meat
strongly disagree mildly disagree unsure mildly agree strongly agree
4. Kangaroo meat is healthier for humans than beef or mutton
strongly disagree mildly disagree unsure mildly agree strongly agree
5. Conventional farm animals (cattle, sheep) contribute to the greenhouse gas problem
strongly disagree mildly disagree unsure mildly agree strongly agree
6. Kangaroos produce less methane than cows and sheep

- | | <u>strongly disagree</u> | <u>mildly disagree</u> | <u>unsure</u> | <u>mildly agree</u> | <u>strongly agree</u> |
|--|--------------------------|------------------------|---------------|---------------------|-----------------------|
| 7. Farm animals like cattle and sheep have no impact on the native Australian environment | <u>strongly disagree</u> | <u>mildly disagree</u> | <u>unsure</u> | <u>mildly agree</u> | <u>strongly agree</u> |
| 8. Kangaroos compete for resources with sheep stock | <u>strongly disagree</u> | <u>mildly disagree</u> | <u>unsure</u> | <u>mildly agree</u> | <u>strongly agree</u> |
| 9. Kangaroo meat is expensive to buy from the grocery store | <u>strongly disagree</u> | <u>mildly disagree</u> | <u>unsure</u> | <u>mildly agree</u> | <u>strongly agree</u> |
| 10. Kangaroos when harvested are normally killed humanely, as judged by the RSPCA | <u>strongly disagree</u> | <u>mildly disagree</u> | <u>unsure</u> | <u>mildly agree</u> | <u>strongly agree</u> |
| 11. Cattle and sheep are killed more humanely than wild-harvested kangaroos | <u>strongly disagree</u> | <u>mildly disagree</u> | <u>unsure</u> | <u>mildly agree</u> | <u>strongly agree</u> |
| 12. If a large kangaroo is not harvested, it will die a peaceful, painless death of old age | <u>strongly disagree</u> | <u>mildly disagree</u> | <u>unsure</u> | <u>mildly agree</u> | <u>strongly agree</u> |
| 13. Animal liberation and animal rights groups are doing the right thing in trying to make kangaroo harvesting illegal | <u>strongly disagree</u> | <u>mildly disagree</u> | <u>unsure</u> | <u>mildly agree</u> | <u>strongly agree</u> |
| 14. Kangaroos are harvested based on a percentage of the population, rather than a raw number | <u>strongly disagree</u> | <u>mildly disagree</u> | <u>unsure</u> | <u>mildly agree</u> | <u>strongly agree</u> |
| 15. The kangaroo harvesting rate is adjusted each year according to environmental factors impacting populations | <u>strongly disagree</u> | <u>mildly disagree</u> | <u>unsure</u> | <u>mildly agree</u> | <u>strongly agree</u> |
| 16. Shooters for the kangaroo industry take any large individuals they see no matter what their sex | <u>strongly disagree</u> | <u>mildly disagree</u> | <u>unsure</u> | <u>mildly agree</u> | <u>strongly agree</u> |
| 17. Humans can catch "mad cow" disease from eating kangaroo meat | <u>strongly disagree</u> | <u>mildly disagree</u> | <u>unsure</u> | <u>mildly agree</u> | <u>strongly agree</u> |
| 18. The best way to conserve all wildlife is to leave it strictly alone | <u>strongly disagree</u> | <u>mildly disagree</u> | <u>unsure</u> | <u>mildly agree</u> | <u>strongly agree</u> |

Thank you for participating!