1 *Article*

2 # Online relinquishments of dogs and cats in Australia

3 **Susan J. Hazel ¹*, Caitlin J. Jenvey¹ and Jonathan Tuke ²**

4 ¹ School of Animal & Veterinary Sciences and Animal Welfare Science Centre, University of Adelaide;
5   susan.hazel@adelaide.edu.au
6 ² School of Mathematical Sciences, University of Adelaide; simon.tuke@adelaide.edu.au
7 * Correspondence: susan.hazel@adelaide.edu.au; Tel.: +61-8-8313-7828

9   **Simple Summary:** The aim of this study was to analyse dog and cat advertisements on a popular
10 online trading website in Australia in February, 2016. A total of 2640 ads for dogs and 2093 ads for
11 cats were classified as being relinquished on gumtree.com.au. There were 23% of dog ads and 62%
12 of cat ads for free animals. The median age was 1.42 years in dogs and 0.9 years in cats. Compared
13 to the human population there were proportionately more ads in Queensland and fewer ads in
14 Victoria. In comparison to pets from animal shelters advertised on petrescue.com.au there were
15 more pure bred dogs on gumtree.com.au, although the common breeds were similar. Fifteen people
16 who had relinquished a dog or cat on gumtree.com.au were interviewed. They used
17 gumtree.com.au because they believed shelters were full, they wanted to see/interview the new
18 owner, or because they originally got the animal on gumtree and it works. These results shed light
19 on a hitherto under-studied population of relinquished dogs and cats.

20 **Abstract:** While traditionally people relinquish their pets to an animal shelter or pound, the internet
21 provides a newer method to re-home. We analysed advertisements (ads) on the largest website in
22 Australia for trading dogs and cats, gumtree.com.au. Data was collected in 2016. Dogs were
23 sampled on February 7, 16 and 24, 2016 and cats on February 9, 19 and 26, 2016 with 2640 ads for
24 relinquished dogs, and 2093 ads for relinquished cats. It was estimated >31,000 puppies/dogs and
25 >24,000 kittens/cats are relinquished on gumtree.com.au per year. The median age of dogs was 1.42
26 and cats 0.9 years of age. There were 23% of dog ads and 62% of cat ads for free animals. Compared
27 to the human population there were proportionately more ads in Queensland and fewer ads in
28 Victoria. A total of 15 people were surveyed who had relinquished a dog or cat using
29 gumtree.com.au. The dog owners used gumtree.com.au because they believed the shelters were full
30 (n=4), and; they wanted to see/interview the new owner (n=2). For cat owners it was because they
31 had originally got the cat on gumtree.com.au (n=2); they use gumtree.com.au for other things, and
32 it works (n=2), and; they wanted to see/interview the new owner (n=2). The data collected will be
33 valuable for implementation of policy and interventions to protect the welfare of un-wanted dogs
34 and cats.

35 **Keywords:** relinquishment, dog, cat, online, Australia

36

37 **1. Introduction**

38   Australia has an owned dog and cat population of approximately 4.8 million and 3.9 million,
39 respectively [1]. However, it is likely that the total population of dogs and cats is higher, as un-owned
40 animals - strays, and those in registered or independent shelters or pounds would also contribute to
41 the total population. In addition, the ownership of an animal may be transferred through sale or other
42 trade, and animals in a shelter or pound can be rehomed. This results in a complex network of animals
43 transferred between the owned and un-owned populations, and between different owners. Animals
44 leave the care of their owners through being lost, surrenders to a shelter or pound, being abandoned,
45 being given away or being sold. Worldwide there have been attempts to measure the un-owned

46 population of dogs and cats in shelters [2,3], but there is a lack of research into the dogs and cats that
47 are transferred between owners and between owned and un-owned populations in other ways.

48 Much of what we know about the flow of animals from the owned and un-owned populations
49 comes from rescue shelters and pounds. Larger rescue organisations collect data on numbers of
50 surrendered dogs and cats each year. There were 55,570 cats admitted to RSPCA shelters around
51 Australia in 2015/16, with numbers rising in the last few years. In contrast there were 45,256 dogs
52 admitted to RSPCA shelters in the same year and numbers are declining [4]. However, the RSPCA
53 represents only a portion of the surrendered population. The total number of both stray and
54 surrendered dogs in Australia in 2012/13 from shelter and local municipal facilities, has been
55 estimated at 211,655 dogs admitted, with 101,037 of these reclaimed [2]. There is no data available
56 estimating the total numbers of stray and surrendered cats in Australia, although it is likely to be
57 even higher. The incidence of unowned dogs and cats is a worldwide problem, with an estimated
58 129,743 dogs and 131,070 cats entering UK shelters in 2009 [3], and a study from South Korea
59 reporting over 10,000 abandoned dogs in Seoul [5]. In the US, it was estimated that 4.4% of dog- and
60 3.8% of cat-owning households had relinquished a pet to a shelter in the previous year [6].

61 The relinquishment of pets represents a significant cost to society in a number of ways. In
62 Australia in 2004 there was an estimated $AUS180 million spent annually by animal welfare agencies
63 (ACAC 2006), while in the United Kingdom expenditure by animal welfare organisations was
64 approximately £340 million in 2010 [7]. Local governments in Australia in 2004 spent $AUS83 million
65 on animal management (ACAC 2006); in the UK in 2011 the comparable figure was £57.5 million [8].
66 While local government costs include dog registrations and dealing with dog attacks, a large portion
67 of these figures would be expected to arise from stray and relinquished animals.

68 As well as the economic costs there are also emotional costs as people may be forced to relinquish
69 their pets due to external influences, such as a relationship breakdown or inability to find rental
70 accommodation that will allow a pet [9,10]. There are also emotional costs experienced by staff
71 involved in euthanizing large numbers of pets at shelters, with shelter workers struggling with the
72 moral dilemma of their job, often resulting in mental health problems and high staff turnover [11-13].
73 Finally, un-owned dogs and cats are at an increased risk of impaired welfare using both physical and
74 psychological measures of welfare [14,15], as well as the emergence of diseases, demonstrated by an
75 outbreak of virulent systemic feline calicivirus in cats [16], and of *Streptococcus equi* pneumonia in
76 dogs [17].

77 If we are to design evidence-based strategies to reduce the numbers of dogs and cats
78 relinquished, as well as protect the welfare of pets in which relinquishment cannot be avoided, we
79 need to know more about the population of dogs and cats involved. Some shelters survey owners
80 who are relinquishing pets to determine their reasons for relinquishment [18,19], and also collect
81 demographic data on the age, sex and breed of the relinquished animal [4,18,19]. While this
82 information is not perfect (for example, owners may not be truthful about the behaviour of their pet
83 if they think it will negatively impact the likelihood of that pet finding a new home), it has been
84 helpful in designing interventions. For instance, knowing that sometimes pets are relinquished
85 because owners cannot find rental accommodation that allows pets has resulted in real changes, with
86 the Australian state of Victoria recently announcing modifications to rental agreements to make it
87 easier for people to rent with pets [20].

88 Pets are given away or sold through advertisements in newspapers, bulletin boards and using
89 the internet. In Australia, Gumtree (gumtree.com.au) has the highest volume of online ads for dogs
90 and cats, followed by Trading Post (tradingpost.com.au). Breeders of pure breed dogs also advertise
91 on DogzOnline (dogzonline.com.au), although this site represents a smaller number of animals
92 compared to Gumtree and Trading Post. Other forms of social media, such as Facebook®, also

93   advertise pets for sale or to find new homes. These online sites advertise both puppies and kittens
94   being sold by a breeder, and animals being relinquished.

95   There has been limited research into online trading of dogs and cats. In a US study, dog breeders
96   who advertised puppies on the internet were less knowledgeable about health issues specific to their
97   breed/s and less likely to screen their animals for heritable diseases compared to dog breeders who
98   did not advertise their puppies on a puppy internet site [21]. To our knowledge, no published studies
99   have focussed on pets being relinquished online. The aims of the present study were to: 1) estimate
100   the total numbers and prices of dogs and cats relinquished online on gumtree.com.au; 2) analyse the
101   breed and Australian State/Territory of origin of dogs and cats relinquished on gumtree.com.au and
102   compare with animals presented to petrescue.com.au (an online charity advertising pets from a
103   shelter or rescue organisation in Australia) and the RSPCA; and 3) interview a sample of pet owners
104   relinquishing their pets on gumtree.com.au to determine their reasons for relinquishment and why
105   they chose to advertise their pet online.

106   **2. Materials and Methods**

107   *2.1 Extraction of data*

108   Data from gumtree.com.au were collected over approximately three weeks for both dogs and
109   cats: February 8, 17 and 25, 2016 for dogs and February 9, 19 and 26, 2016 for cats. Data were extracted
110   using the BeautifulSoup module in python (version 3.2.1, released Feb 17 2012) to parse the ads, then
111   cleaned and analysed using R (R Core Team 2017) and Pivot tables in Microsoft Excel®(2013).
112   Cleaning was completed within Excel®(2013) by scrutinising individual ads to remove duplicates or
113   ads that were not for dogs or cats (e.g. equipment, pet sitting services). Data for the dog and cat breed
114   and cross/purebred status, owner status (owner/breeder), age, price and State/Territory were
115   collected. Where the town, but not the State or Postcode, were provided, an internet-based Postcode
116   finder (http://auspost.com.au/postcode) was used to determine the State/Territory. If there was more
117   than one place with the same name in more than one State/Territory then the ad was left as
118   State/Territory unknown. An estimate of the number of dogs and cats in each ad was made by
119   generating random numbers using R and then analysing the average number of dogs/cats per ad in
120   those random ads. There were 50 random ads used for both dogs (1.9% of total ads) and cats (2.4% of
121   total ads). Data on neuter, microchip and vaccination status were not collected as a minority of ads
122   reported on these factors.

123   *2.2 Analysis of relinquishment ads*

124   Dogs and cats advertised on the internet represent a mixture of puppies/kittens being sold
125   alongside pets being relinquished or traded. Many ads request a sum of money for the pet, even when
126   it appears the pet is being relinquished. The definition of relinquishment used for this study was the
127   Oxford   definition: 'Voluntarily   cease   to   keep   or   claim;   give   up'
128   (https://en.oxforddictionaries.com/definition/relinquish). Dogs were defined as being relinquished if:
129   1) there was a statement within the ad confirming that a new home was being sought (e.g. seeking
130   new home, very sad to part with…, need to find a new forever home); 2) they were being offered for
131   free at any age; or 3) if the dog was older than 16 weeks of age and there was no indication it had
132   been advertised as a puppy and was still looking for a home (''X' is a 6 year old pure bred Sheffield
133   Blue Heeler. He is very friendly and good with other dogs and children. Microchipped and wormed.
134   To good home only.'). On gumtree.com.au sellers are classified as owner, breeder or shelter and the
135   shelter animals were not included in the present study. It is possible that some very small shelters
136   were advertising as an owner rather than as a shelter, but there was no way to differentiate these
137   types of sellers. Both owner and breeder categories were included as there were some breeders who
138   were relinquishing pets using the above criteria (e.g. *'Owner breeder out of work and no petmanent (sic)*
139   *home, current home being sold by owner(,) cannot find another suitable home.'* or *'Three female blue amstaffs*

140   *mother and her two daughters ive raised my intentions were to bread (sic) them but things have changed there*
141   *pedigree papered registered ect (sic) spent alot $ for these lines call for more info ect (sic)').* The same criteria
142   were used to determine a cat being relinquished. In some ads there was more than one animal
143   advertised. In those cases, data was collected only from the first animal mentioned in the ad (e.g.
144   breed, age, price), and the other animal/s were not included.

145   The relinquished ads on Gumtree per State/Territory were compared with data provided by John
146   Bishop, Co-Founder and Joint CEO of PetRescue (https://www.petrescue.com.au/), for the same time
147   period as the Gumtree data were collected, published figures on total dog surrenders to shelters and
148   councils in 2012/13 [2] and published RSPCA statistics for cats from 2015/16 [4].

149   *2.3 Surveys of owners who had relinquished dogs or cats*

150   An email was sent through gumtree.com.au informing people about the study that we were
151   conducting and asking if they would be willing to participate. Ads were chosen from those available
152   online using the criteria for identifying a relinquished dog, outlined above. These were selected
153   starting from the first ads shown on each day. Due to the high numbers not all ads for relinquished
154   dogs or cats were included on each day. A total of 324 emails were sent to dog owners between May
155   11 and June 14, 2016 and 299 emails to cat owners between May 17 and June 14, 2016. The owners
156   responded to the email either by return email or by phone. Surveys were performed either on the
157   phone or in written form via email, depending on the preference of the respondent. Questions
158   included: the demographics of the animal (age, breed, sex, neuter status, microchip); two Likert type
159   scale questions on satisfaction with the health and behaviour of the animal (1 is very dissatisfied and
160   5 is very satisfied); Where did you get pet's name from originally?; What was the main reason you
161   advertised pet's name?; Why did you decide to advertise on Gumtree instead of going to a shelter;
162   Did you advertise pet's name anywhere else?; Have you successfully found a new owner for pet's
163   name yet?; If yes, do you know anything about the new owner? Participants were also given an open
164   ended question at the end of the survey to add any other details they wished to share. Approval for
165   this study was provided by the University of Adelaide Human Ethics Committee (H-2016-036).

166   *2.4 Statistical Tests*

167   Comparisons between groups where the data was not normally distributed were made using Mann-
168   Whitney tests. Categorical data was compared used Chi-square tests. Data are presented as Mean ±
169   SEM unless otherwise stated. A significance level of $p<0.05$ was used for statistical testing.

170   **3. Results**

171   *3.1. Dogs on Gumtree*

172   A total of 2640 individual ads were identified for dogs being relinquished on gumtree.com.au
173   between February 7 and 24, 2016. There were 1328 ads on February 7, 1411 ads on February 16 and
174   1450 ads on February 24. Of these, 650 were new ads on Feb 16, and 663 were new ads on Feb 24,
175   giving an estimate of 82 new ads/day, or by extrapolation (x 365) 29,930 ads per year. The average
176   number of dogs per ad in 50 random ads was 1.06 (all ads were for single dogs excepting 3 ads for
177   two dogs), giving an estimate of 31,726 dogs advertised on gumtree.com.au per year.

178   Most of the dogs on Gumtree were classified as pure bred (n=1361, 51.4%) with 1188 (44.6%)
179   cross bred dogs, and 103 (3.9%) ads in which it was not clear if dogs were pure or cross bred. The
180   most common dog breeds advertised on Gumtree and on PetRescue in the same time period are
181   shown in Table 1. The top two breeds in order for both Gumtree and PetRescue were the Staffordshire
182   Terrier and Kelpie, representing just over 20% of the total ads for both sources. The third most
183   common breed for Gumtree was the American Staffordshire Terrier (#4 for PetRescue), with the

184   Greyhound the third most common breed for PetRescue (#24 for Gumtree). Unlike Gumtree,
185   approximately three quarters (75.8%) of the ads on PetRescue were for cross breed dogs, with only
186   23.8% representing pure breed.

187   **Table 1.** Dog breeds in which 20 or more individuals were relinquished on gumtree.com.au or
188   petrescue.com.au from February 8 to February 24, 2016 (In 103 dogs the pure breed status was
189   unknown)

	gumtree.com.au			petrescue.com.au			
	#[1]	Total	Pure	Cross	#[1]	Total	Pure	Cross
Staffordshire Terrier	1	325 (12.3)	163 (6.1)	162 (6.1)	1	234 (11.5)	48 (9.9)	186 (12.1)
Kelpie	2	219 (8.3)	119 (4.5)	100 (3.8)	2	181 (8.9)	40 (8.3)	141 (9.1)
American Staffordshire Terrier	3	182 (6.9)	132 (5.0)	50 (1.9)	3	91 (4.5)	14 (2.9)	77 (5.0)
Bull Arab	4	135 (5.1)	37 (1.4)	98 (3.7)	7	74 (3.7)	7 (1.4)	67 (4.3)
Border Collie	5	120 (4.5)	64 (2.4)	56 (2.1)	5	85 (4.2)	11 (2.3)	74 (4.8)
Mastiff	6	103 (3.9)	28 (1.1)	75 (2.8)	9	64 (3.2)	4 (0.8)	60 (3.9)
Rottweiler	7	101 (3.8)	73 (2.8)	28 (1.0)	15	37 (1.8)	7 (1.4)	30 (1.9)
German Shepherd	8	98 (3.7)	74 (2.8)	24 (0.9)	12	50 (2.5)	24 (5.0)	26 (1.7)
Siberian Husky	9	87 (3.3)	66 (2.5)	21 (0.8)	19	25 (1.2)	18 (3.7)	7 (0.5)
Great Dane	10	77 (2.9)	26 (1.0)	51 (1.9)	13	50 (2.5)	10 (2.1)	40 (2.6)
Labrador	11	75 (2.8)	34 (1.3)	41 (1.6)	10	64 (3.2)	17 (3.5)	47 (3.6)
Cattledog	12	71 (2.7)	45 (1.7)	26 (1.0)	6	84 4.1)	9 (1.9)	75 (4.9)
Bulldog	13	62 (2.3)	52 (2.0)	10 (0.4)	N	0	0	0
Chihuahua	14	55 (2.1)	39 (1.5)	16 (0.6)	16	30 (1.5)	8 (1.7)	22 (1.4)
Jack Russell Terrier	15	53 (2.0)	26 (1.0)	27 (1.0)	8	74 (3.7)	16 (3.3)	58 (3.8)
American Bulldog	16	42 (1.6)	27 (1.0)	15 (0.6)	21	20 (1.0)	1 (0.2)	19 (1.2)
Maltese	17	41 (1.6)	12 (0.5)	29 (1.1)	11	63 (3.1)	9 (1.9)	54 (3.5)
Bull Terrier	18	38 (1.4)	19 (0.7)	19 (0.7)	25	13 (0.6)	6 (1.2)	7 (0.5)
Shar Pei	19	35 (1.3)	18 (0.7)	17 (0.6)	22	20 (1.0)	3 (0.6)	17 (1.1)
Fox Terrier	20	35 (1.3)	21 (0.8)	14 (0.5)	18	28 (1.4)	5 (1.0)	23 (1.5)
Pomeranian	21	31 (1.2)	23 (0.9)	8 (0.3)	23	18 (0.9)	4 (0.8)	14 (0.9)
Malamute	22	27 (1.0)	21 (0.8)	6 (0.2)	26	13 (0.6)	6 (1.2)	7 (0.5)
Blue Heeler	23	25 (0.9)	12 (0.5)	13 (0.5)	27	5 (0.2)	1 (0.2)	4 (0.3)
Greyhound	24	25 (0.9)	23 (0.9)	2 (0.1)	3	109 (5.4)	98 (20.2)	11 (0.7)
Rhodesian Ridgeback	25	24 (0.9)	5 (0.2)	19 (0.7)	17	30 (1.5)	0	30 (1.9)
Maremma	26	20 (0.7)	17 (0.6)	3 (0.1)	28	4 (0.2)	1 (0.2)	3 (0.2)
Irish Wolfhound	27	20 (0.7)	2 (0.1)	18 (0.7)	24	14 (0.7)	1 (0.2)	13 (0.8)
Poodle	28	19 (0.7)	15 (0.6)	4 (0.2)	20	23 (1.1)	10 (2.1)	13 (0.8)
TOTAL		**2640 (100)***	**1357 (51.4)**	**1180 (44.7)**		**2027 (100)**	**484 (23.8)**	**1543 (75.8)**

190   [1] Ranking of breeds from most common to least common; N: not relevant

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192   Most dogs on Gumtree were offered by the owner (n=2480, 93.5%) with 172 ads from breeders
193   (6.5%). The median age for the dogs was 1.42 years, with a range of 0.2 to 14.2 years (n=2640; Table
194   3). The most common age group was 1 to 2 years (32% of ads), with dogs that were 6 months to one
195   year of age and two to five years of age both representing 26% of the ads. Dog ages were not normally
196   distributed, with a right skew; with 10% of the ads for dogs over 5 years of age and 21 of the ads for
197   dogs of 10 years of age or more. Dogs that were cross bred were advertised at a significantly lower
198   age than pure bred dogs (2.0 ± 1.9 years, median 1.3 years) versus 2.3 ± 2.0, median 1.6 years,
199   respectively; p<0.0001 Mann-Whitney).

200   The median price for each dog was $AUS200, with a range from 0 to $AUS7000. Almost one
201   quarter (n=575, 23%) of dogs were advertised for free, with 43% of dogs advertised for $AUS100-
202   499 (Table 2). There were 147 ads in which no price was given. Pure bred dogs were advertised
203   for a significantly higher price than cross bred dogs ($AUS562 ± 727 vs $AUS198 ± 266,
204   respectively; p<0.0001 Mann-Whitney).

205   **Table 2.** Age and price categories of dogs relinquished on Gumtree from February 8 to 24, 2016

Age Range	N (%)	Price Range (AUS $)	N (%)
Up to 16 weeks	20 (0.8)	0	575 (23.1)
16 weeks to 6 months	131 (5.0)	1-499	1181 (47.4)
6 months to 1 year	680 (26.1)	500-999	480 (19.3)
1 to 2 years	832 (32.0)	1000-1999	187 (7.5)
2 to 5 years	679 (26.1)	2000-2999	44 (1.8)
>5 years	260 (10.0)	3000-7000	26 (1.0)
TOTAL	**2602 (100)**	**TOTAL**	**2493 (100)**

206   [1] Tables may have a footer.

207   The majority of Gumtree ads were from NSW (35.6%) and Queensland (34.8%), giving a total of
208   approximately 70% of all Gumtree ads in Australia coming from those two States (Figure 1). The
209   proportion of ads from Gumtree and PetRescue and published figures on dogs surrendered in
210   2012/13 [2] were compared with the State/Territory human population sizes, using data from the
211   Australian   Bureau   of   Statistics
212   (http://www.abs.gov.au/AUSSTATS/abs@.nsf/allprimarymainfeatures/3ADCB8E8492A9156CA2580
213   8900122529?opendocument). There was a significant difference between the State/Territory human
214   populations and the proportions of dogs advertised on Gumtree ($\chi^2(7) = 566.6$, $p < 0.0001$), PetRescue
215   ($\chi^2(7) = 507.4$, $p < 0.0001$) and the estimated total dog surrenders [2] ($\chi^2(7) = 4345.2$, $p < 0.0001$).
216   Compared to the proportion of the State/Territory human population, there were more ads for
217   Gumtree in Queensland and NSW and fewer ads for Gumtree in Victoria. Queensland had a higher
218   proportion of all three (Gumtree, PetRescue and total surrenders) versus the State human population
219   (Figure 1). The proportions of dogs advertised were significantly different between Gumtree and
220   Petrescue ($\chi^2(7) = 158.9$, $p < 0.0001$).

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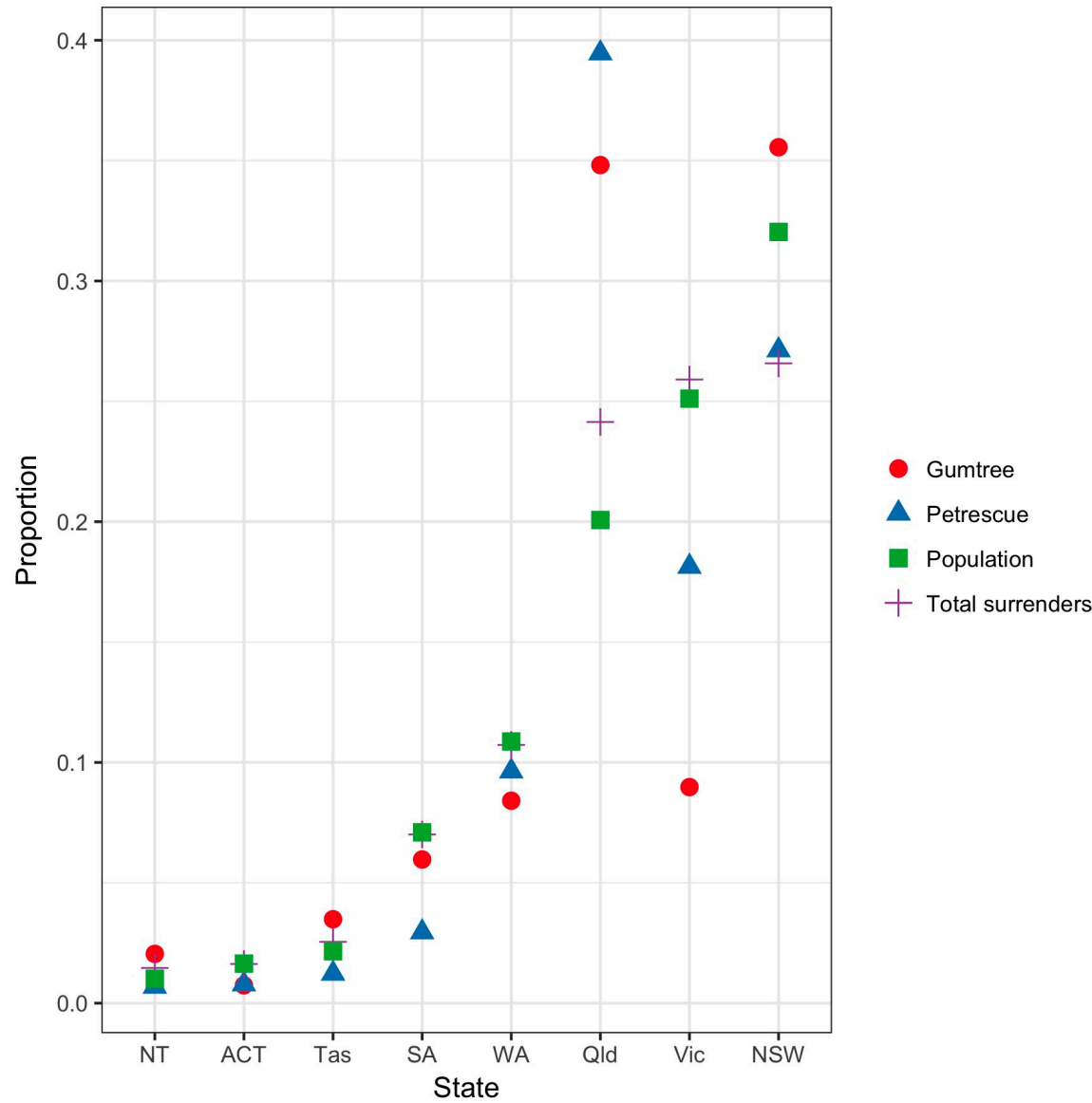
224   **Figure 1.** Proportions of total ads for relinquished dogs on gumtree.com.au and petrescue.com.au
225   from February 8 to February 24 2016, and total surrenders from Chua, Rand and Morton 2017 [2] for
226   each Australian State/Territory. States/Territories are ordered in increasing proportion of total
227   population. The square symbol is the proportion of the Australian population for each State/Territory.
228   (Note: The proportion of the Australian population in each State/Territory is: NSW 31.7%, Vic 24.9%,
229   Qld 19.9%, WA 10.8%, SA 7.0%, Tas 2.1%, ACT 1.6% and NT 1.0%)

230

231   The per capita values for each marketplace and State/Territory are shown in Figure 2. The per capita
232   number of Gumtree ads are highest for the Northern Territory and lowest in Victoria, while
233   PetRescue and total surrender figures per capita are highest in Queensland. Per capita rates for total
234   surrenders are higher than for Gumtree and PetRescue. The ACT per capita figures for Gumtree,
235   PetRescue and total surrenders are 0.04, 0.04 and 8.7 per 1000 residents, respectively.

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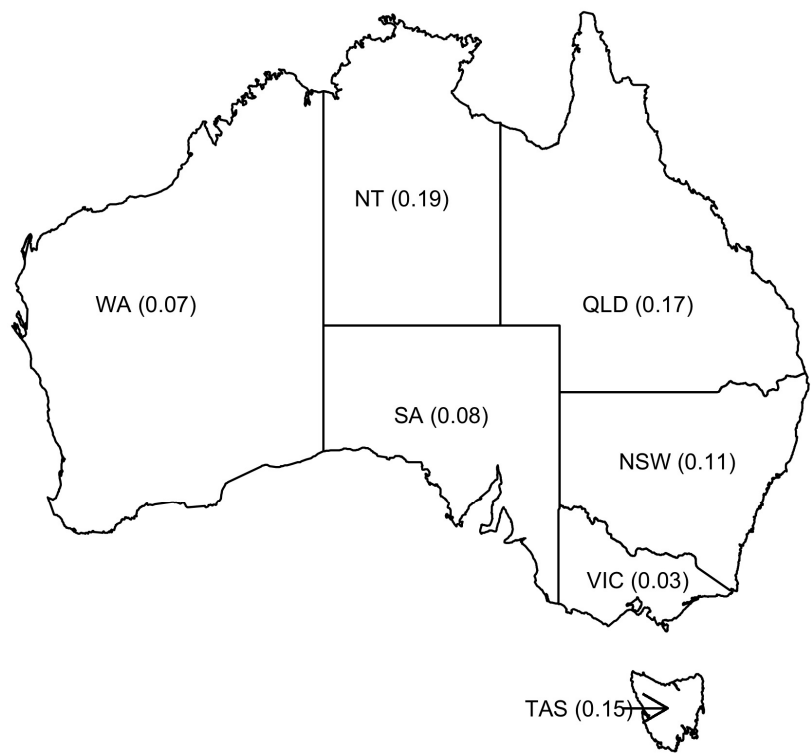
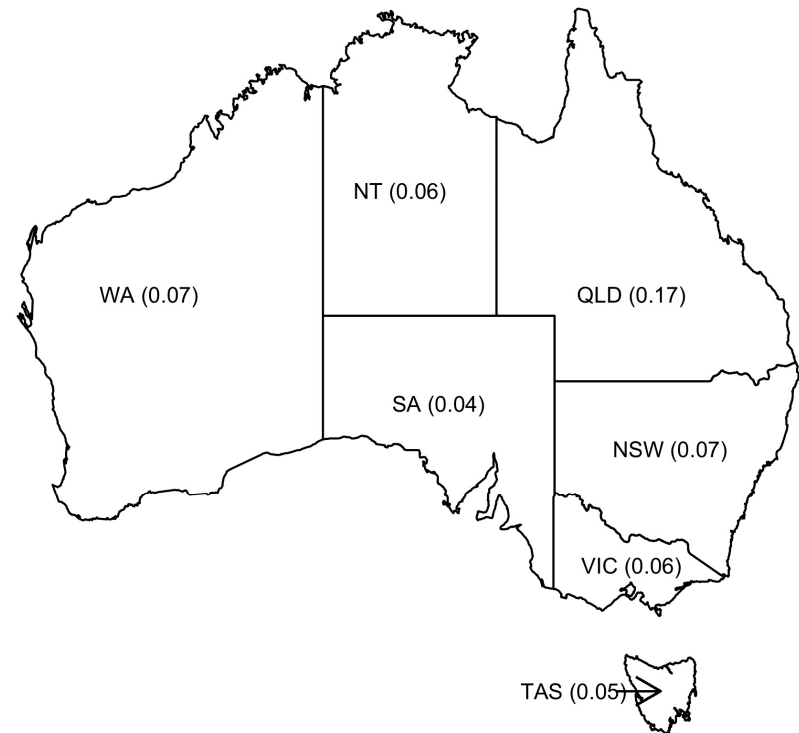
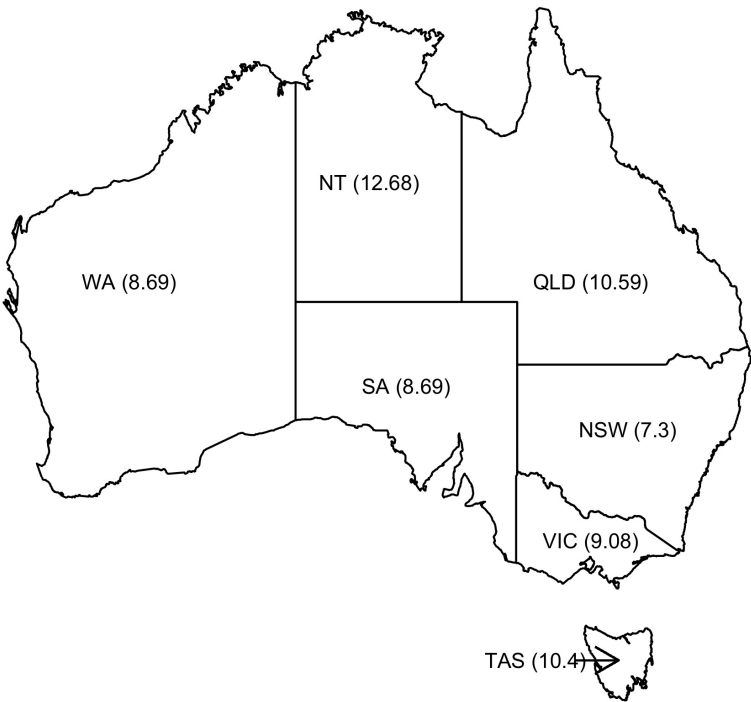
237

238   **Figure 2.** Numbers per capita (1,000) of relinquished dogs on gumtree.com.au (A) and
239   petrescue.com.au (B) from February 8 to February 24 2016, and total dog surrenders from Chua, Rand and
240   Morton 2017 (C) for each Australian State/Territory.

241   A.

242

243   B.

244

245   C.

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247   The prices of advertised dogs in each State/Territory are shown in Table 3. There was a
248   significant difference in price category between states $\chi^2(12) = 89.7$, $p < 0.0001$ (data for the ACT was
249   not included as there were insufficient cases per category for analysis). The highest proportion of free
250   dog ads was in Qld (34.5%) followed by the NT (31.9%) with the lowest proportion of free ads in WA
251   (22.3%). The highest proportion of ads for dogs costing >$AUS500 was in Victoria (47.6%) with the
252   lowest proportion in Tasmania (16.3%).

253   **Table 3.** Price range (AUS$) of dogs advertised on Gumtree between February 7 and 26, 2016 and
254   their Australian State or Territory. Percentages represent the proportion of dogs within that
255   State/Territory in each price category.

	$0 N(%)	$1-499 N(%)	>$500 N(%)
NSW	189 (23.2)	420 (50.2)	217 (26.6)
Qld	276 (34.5)	331 (41.4)	192 (24.0)
Vic	51 (24.8)	57 (27.7)	98 (47.6)
WA	43 (22.3)	79 (40.9)	71 (36.8)
SA	39 (28.5)	64 (46.7)	34 (24.8)
Tas	24 (30.0)	43 (53.8)	13 (16.3)
NT	15 (31.9)	22 (46.8)	10 (21.3)
TOTAL	**637**	**1006**	**635**

256   *3.2. Cats on Gumtree*

257   A total of 2093 individual ads identified as cats being relinquished were posted between
258   February 9 and 26, 2016. This included 1353 ads on February 9, 1397 ads on February 19 and 1465 ads

259 on February 26. There were 408 new ads on February 19 and 332 new ads on February 26, giving an
260 estimate of 44 new ads per day or 16,060 ads per year (44 x 365). The average number of cats per ad
261 in 50 random ads was 1.51 (37 ads for single cats/kittens, 8 ads for two cats/kittens, 3 ads for five
262 cats/kittens and one ad for six kittens; no number provided in one ad), giving an estimate of 24,250
263 cats advertised on gumtree.com.au per year.

264 A minority of 508 ads provided any information on whether a cat was a pure or cross breed,
265 with 61% of these pure breed (n=310) and 39% cross breed (n=198). The breeds for which there were
266 at least 15 ads on Gumtree are shown in Table 4 in comparison to cats advertised on PetRescue in the
267 same time period. The Ragdoll and Domestic Shorthair were the most common breeds mentioned in
268 the Gumtree ads, however, Domestic Shorthair and Domestic Medium Hair were by far the most
269 common breeds on PetRescue.

270 **Table 4.** Cat breeds relinquished on gumtree.com.au from February 9 to February 26, 2016 in
271 comparison to those advertised in the same period on petrescue.com.au

272

	gumtree.com.au				petrescue.com.au			
	#[1]	Total	Pure	Cross	#[1]	Total	Pure	Cross
Ragdoll	1	148	116	32	4	30	24	6
DSH	2	81	0	81	1	1894	0	1894
Bengal	3	37	28	9	12	2	0	2
Persian	4	32	12	20	8	8	5	3
Siamese	5	29	19	10	5	16	15	1
Russian Blue	6	26	14	12	6	12	12	0
Burmese	7	24	19	5	8	8	8	0
British Shorthair	8	16	15	1	9	6	5	1
Manx	9	14	11	3	7	9	9	0
Birman	10	9	9	0	10	5	5	0
Himalayan	11	9	7	2	N	0	0	0
Devon Rex	12	9	7	2	N	0	0	0
Oriental	13	8	5	3	7	9	4	5
Tonkinese	14	8	6	2	11	3	2	1
Domestic Medium Hair	15	7	0	7	2	375	0	375
Maine Coon	16	5	5	0	12	2	2	0
Domestic Long Hair	17	4	0	4	3	38	0	38
Chinchilla	18	4	4	0	13	1	1	0
Sphynx	19	4	3	1	N	0	0	0
Snowshoe	20	0	0	0	11	3	2	1
Australian Mist	21	0	0	0	10	5	1	4
TOTAL		508	310	198		2426	95	2331

273 [1] Ranking of breeds from most common to least common

274

275   Most cats were offered by the owner (n=2003, 95.7%) with 90 ads from breeders (4.3%). The
276   median age for the cats was 0.9 years, with a range of 0.0 to 18.2 years (n=2093). The most common
277   age group was up to 16 weeks (23.6% of ads) with around half of the ads (53%) for cats that were one
278   year of age or less (Table 5). Cat ages were not normally distributed, with a right skew; 10% of the
279   ads were for cats over 5 years of age, and there were 9 ads for cats of over 15 years of age. Cats that
280   were cross bred were advertised at a significantly lower age than pure bred cats (2.2 ± 2.7 years,
281   median 1.3 years versus 2.5 ± 2.5, median 1.6 years, respectively; $p<0.01$ Mann-Whitney).

282   **Table 5.** Price and age ranges of kittens and cats sold on Gumtree from February 9 to February 26,
283   2016. There were 11 ads in which no age was provided and 90 ads in which no price was provided.

Age Range	N (%)	Price Range (AUS $)	N (%)
Up to 16 weeks	492 (23.6)	0	1298 (62.0)
16 weeks to 6 months	414 (19.9)	1-499	617 (29.5)
6 months to 1 year	201 (9.7)	500-999	73 (3.5)
1 to 2 years	373 (17.9)	1000-1999	13 (0.6)
2 to 5 years	391 (18.8)	2000-2999	2 (0.1)
>5 years	211 (10.1)		
TOTAL	**2082 (100)**	**TOTAL**	**2003 (100)**

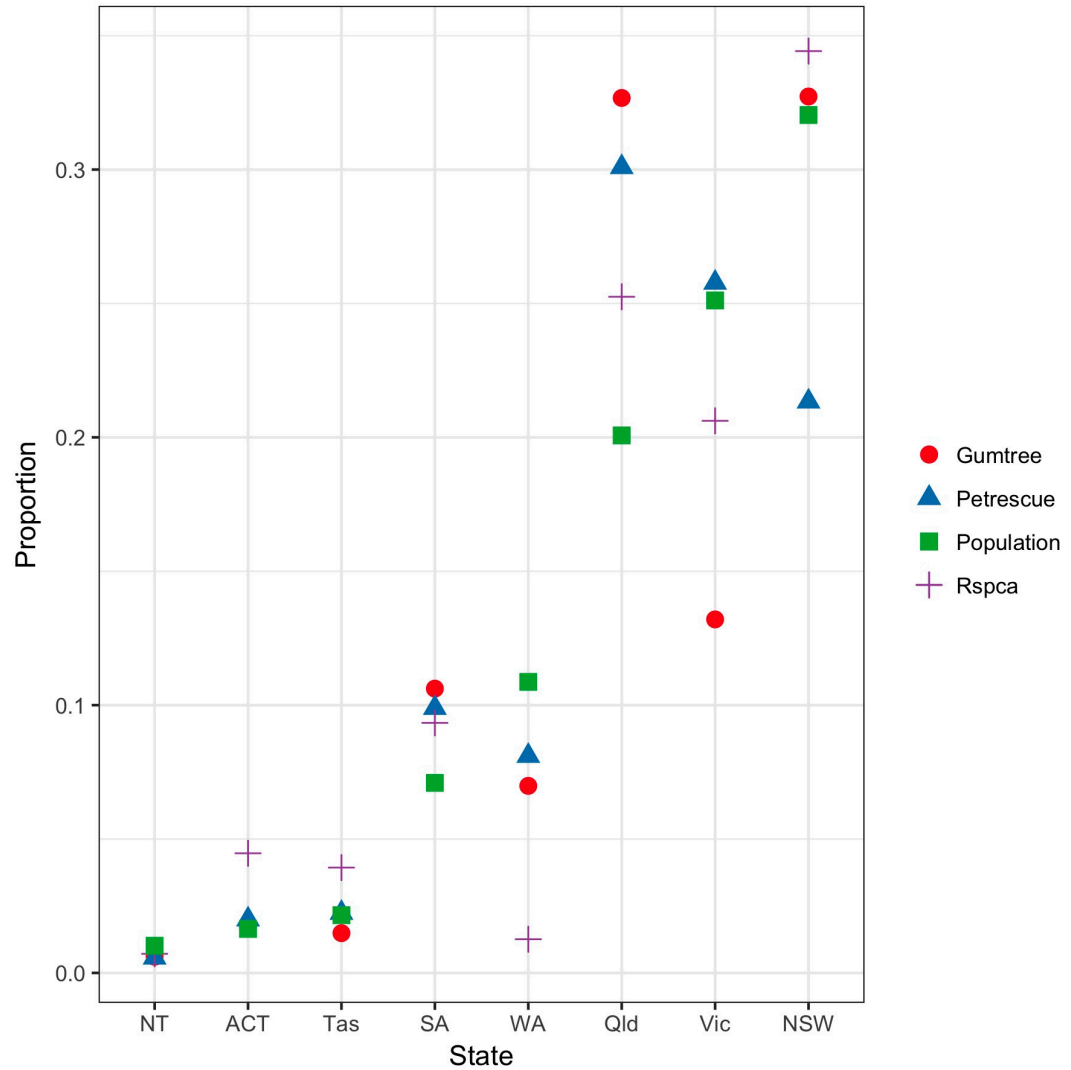
284
285   The median price for each cat was $AUS0, with a range from 0 to $AUS2500. Almost two thirds
286   (n=1298, 62%) of cats were advertised for free, with 30% of cats advertised for $AUS1-499 (Table 6).
287   Pure bred cats were advertised for a significantly higher price than the cross bred cats ($AUS351 ±
288   331 vs $AUS66 ± 99, respectively, n=508; $p<0.0001$ Mann-Whitney).

289   The same proportion of cat ads on Gumtree were from NSW and Queensland (32.7% each;
290   Figure 3). The proportion of cat ads from Gumtree and PetRescue were compared with the
291   State/Territory human population sizes
292   (http://www.abs.gov.au/AUSSTATS/abs@.nsf/allprimarymainfeatures/3ADCB8E8492A9156CA2580
293   8900122529?opendocument). There was a significant difference between the State/Territory human
294   populations and the proportions of cats advertised on Gumtree ($\chi^2(7) = 566.6$, $p < 0.0001$), PetRescue
295   ($\chi^2(7) = 507.4$, $p < 0.0001$) and the RSPCA ($\chi^2(7) = 9969.9$, $p < 0.0001$). In Queensland the proportion of
296   cats from all three sources was higher than the Queensland human population, while in Victoria
297   PetRescue and Gumtree represented a lower proportion than the State human population. In WA
298   Gumtree, PetRescue and the RSPCA were a lower proportion than the human population, while in
299   NSW only the proportion of PetRescue ads was substantially lower than the State human population.
300   The proportions of cats advertised was significantly different between Gumtree and Petrescue ($\chi^2(7)$
301   = 158.9, $p < 0.0001$). Compared to PetRescue, there were more Gumtree ads in NSW, SA, Tasmania
302   and the Northern Territory than expected, and fewer ads in Victoria than expected.

303

304

305   **Figure 3.** Proportions of total ads for relinquished cats on gumtree.com.au and petrescue.com.au from
306   February 9 to February 26 2016, and RSPCA shelter admissions for each Australian State/Territory.
307   States/Territories are ordered in increasing proportion of total population. The square symbol is the
308   proportion of the Australian population for each State/Territory (Note: The proportion of the
309   Australian population in each State/Territory is: NSW 31.7%, Vic 24.9%, Qld 19.9%, WA 10.8%, SA
310   7.0%, Tas 2.1%, ACT 1.6% and NT 1.0%)

311

312   The per capita values for each marketplace and State/Territory are shown in Figure 4. The per capita
313   number of Gumtree ads are highest for the Northern Territory and lowest in Victoria, while
314   PetRescue and RSPCA figures per capita are highest in Queensland. Per capita rates for the RSPCA
315   are higher than for Gumtree and PetRescue. The ACT per capita figures for Gumtree, PetRescue and
316   the RSPCA are 0.08, 0.12 and 6.3 per 1000 residents, respectively. The per capita rate of cat admissions
317   to RSPCA shelters is higher in the ACT than any other State/Territory.
318

319   **Figure 4**. Numbers per capita (1,000) of total ads for relinquished cats on gumtree.com.au (A) and
320   petrescue.com.au (B) from February 9 to February 26 2016, and RSPCA shelter admissions (C) for each
321   Australian State/Territory.

322   A.

323

324   B.

325

326   C.

327

328

329   The prices of advertised cats on Gumtree in each State/Territory were compared using three
330   categories: $AUS0, $AUS1-499 and >$AUS500. The data for the ACT, NT and Tasmania were not
331   included as there were insufficient cases per category. There was a significant difference in price
332   category between states $\chi^2(8) = 38.6$, p < 0.0001. The highest proportion of free cat ads came from
333   Victoria (77%) and SA (67%) with the lowest proportion of free ads in WA (54%; Table 6). Victoria
334   had a lower proportion of Gumtree ads for cats $AUS1-499 (16% vs >30% for other States), and the
335   highest proportion of ads for cats costing >$AUS500 (7%). The proportions of Gumtree ads for cats
336   >$AUS500 was low overall (3-7%).

337   **Table 6.** Price range of cats advertised on Gumtree between February 7 and 26, 2016 and their
338   Australian State or Territory. Percentages represent the proportion of cats within that State/Territory
339   in each price category.

	$0 N(%)	$1-499 N(%)	>$500 N(%)
New South Wales	356 (62.2)	190 (33.2)	26 (4.5)
Queensland	366 (64.3)	183 (32.2)	20 (3.5)
Victoria	178 (77.1)	36 (15.6)	17 (7.4)
Western Australia	65 (53.7)	50 (41.3)	6 (5.0)
South Australia	125 (67.2)	56 (30.1)	5 (2.7)
TOTAL	**1090 (64.9)**	**515 (30.7)**	**74 (4.4)**

340   *3.3. Interviews*

341   Most interviews took place on the phone (n=11), with four people emailing back a survey. There
342   were 15 responses in total, a response rate of 2.5% (8/324) for dogs and 2.3% (7/299) for cats. In
343   addition, 16 people responded to the email to notify that they would not be involved, giving reasons
344   such as not having time, or that the situation was too distressing.

345   There was a mix of dog and cat breeds being relinquished by the respondents (Table 7). Five of
346   the dog owners had desexed dogs, with two dogs entire, and one in which the response was unclear.
347   All dogs were microchipped, excepting one in which the response to this question was also unclear.
348   Six dog owners scored a 4/5 (satisfied or highly satisfied) with their dog's health. Five dog owners
349   also responded on their dog's behaviour, with three of the five highly satisfied and two giving a 3 or
350   3.5, i.e. neither satisfied nor dissatisfied. Four of the dogs were originally obtained online – three from
351   Gumtree and one from tradingpost.com.au. Only one cat was entire, with the owner not clearly
352   stating neuter status in one other cat. All cat owners were highly satisfied with their cat's health, but
353   one owner scored their cat's behaviour a 2/5 and another owner 3/5 (Table 7).

354   **Table 7.** Demographic factors for the dogs and cats being relinquished by the 16 people participating
355   in surveys of why they relinquished their pets on Gumtree (X represents a cross breed). Responses to
356   the pet's Health and Behaviour were scored on a 1-5 Likert-type scale where 1 was very dissatisfied
357   and 5 was very satisfied. (NS = not stated)

Age (yrs)	Sex	Breed	Neut [1]	MC [2]	Health	Behav [3]	Original source
Dogs							
1	M	Pug x Jack Russell Terrier	NS	NS	NS	NS	Gumtree (rescue)
4	F	Greyhound	No	Yes	NS	NS	NS
1	F	Bull Mastiff X	No	Yes	5	NS	Gumtree
7	F	Siberian Husky	Yes	Yes	4	3-3.5	Friend as puppy
6	M/F	Maltese/Maltese X Pomeranian	Yes	Yes	4 & 5	5 & 5	TradingPost
NS	M/F	Beagle	Yes	NS	5 & 5	5 & 5	Gumtree (rescue)
4.5	M	Jack Russell	Yes	Yes	5	3	Registered breeder
1.5	M	American Staffordshire Terrier	Yes	Yes	5	5	Unregistered breeder
Cats							
1	M	Ragdoll X	Yes	Yes	5	5	Gumtree
0.33	F	NS	No	Yes	NS		Gumtree
4.5	M	DSH	Yes	Yes	5	2	Family litter
3	M	British Shorthair	Yes	Yes	5	5	NS
2	M	DSH	Yes	No	5	NS	Family with 2 Ragdolls
0.92	M	Ragdoll	Yes	Yes	5	3	Family
NS	NS	DSH	NS	NS	NS	NS	Strays

358   [1] Neutered; [2] Microchipped; [3] Behaviour

359   There were a variety of reasons given for relinquishment of the dogs and cats (Table 8). For the
360   eight dogs, the most common reasons were that they had rescued the dog and needed to find a new
361   home for it (n=2), and the behaviour of the dog (escaping in one dog and too interested in nearby
362   livestock in another). For two dog owners, two reasons were provided for the relinquishment, in
363   the other six cases, a single reason was provided. For the seven cats, the most common reasons for
364   relinquishment were that the pets in the house were not getting on (cats in two cases and a dog in
365   one case), and moving (n=2). For three of the cat owners, two reasons were provided for the
366   relinquishment, in the other four cases, a single reason was provided.

367   **Table 8.** Reasons for relinquishment given by dog and cat owners advertising their pet on
368   gumtree.com.au

Dogs	N	Cats	N
Rescue	2	Dog/cat not getting on	3
Behaviour	2	Moving	2
Dog injury (working dog)	1	Rescue	1
Own health	1	Allergy	1
Money	1	Expecting a baby	1
Relationship breakdown	1	Too many pets	1
Moving	1	Time	1
Time	1		

369

370   When asked the reason for using Gumtree rather than other places, the most common reason
371   for the dog owners was that they believed the shelters were full (n=4) and that they wanted to
372   see/interview the new owner of their dog (n=2; Table 9). The cat owners chose Gumtree as they
373   originally got the cat on Gumtree (n=2), because they use Gumtree for other things and it works
374   (n=2) and to see/interview the new owners of their cat (n=2). There were three dog owners and four
375   cat owners who gave two different reasons to choose Gumtree.

376   **Table 9.** Reasons people gave for choosing to advertise their relinquished pet on gumtree.com.au

Dogs	N	Cats	N
Shelters full	4	Got the animal on gumtree	2
To see/ interview the new owner	2	Use gumtree for other things	2
Lack of knowledge of shelters	1	To see and interview the new owner	2
It worked before	1	It worked before	1
Shelter is last resort	1	Shelter is last resort	1
Immediate posting and quick response	1	Would be put down at a shelter	1
Would be put down at a shelter	1	Shelter too hard on pet	1
		Don't drive so can't get to shelter	1

377
378   Relinquishing owners were also asked about the success of rehoming their pet on
379   gumtree.com.au. Of the eight dog owners, three had successfully rehomed their dog at the time of
380   completing the survey, and another owner had a prospective re-home organised. In one of the
381   successful re-homings, the owner had carried out two failed trials with the dog, with a third trial

being successful. For one dog owner there had been two responses with neither suitable, and in another there had been so many responses that they had had to take the ad down, although none had been successful at the time of the interview. In another two dog owners there had not yet been any responses. For the seven cat owners, one person had had 50 offers for the cat within ten minutes, and another had two potential homes within one day. Both of the cats in these examples were pure breeds. In another two cat owners there had been a single response, the three remaining owners had not yet received responses.

4. Discussion

The current study provides evidence about the numbers and types of dogs and cats relinquished on one popular website (gumtree.com.au) in Australia, filling an important gap in knowledge. It indicates that thousands of dogs and cats are being relinquished on gumtree.com.au per year. Information collected on their breed and age profiles allows comparison with other relinquished populations on petrescue.com.au and published RSPCA and surrender data [2,4]. Although there are similarities between the populations, such as the most common dog breeds on gumtree.com.au, petrescue.com.au and in published figures, there also appear to be differences suggesting pets relinquished on gumtree.com.au represent a sub-population of relinquished animals.

By extrapolation, the total number of dogs and cats relinquished via Gumtree ads was approximately 30,000 and 16,000, respectively. Recent estimates have indicated that 211,655 dogs were admitted to shelters and municipal facilities in Australia in 2012-13 [2]. Some of the dogs being offered on Gumtree may eventually be relinquished to a shelter or end up at a municipal pound if a new owner is not found. The estimated Gumtree ads represent a significant proportion (~14%) of the total number of dogs admitted to shelters and municipal facilities per year. This proportion would be even higher if one considered other online websites (e.g. DogzOnline, TradingPost), as well as Facebook®, and other private or closed websites advertising pets. The diverse and diffuse nature of online ads, as well as the fact some are closed websites, makes it impossible to estimate the total numbers of pets advertised online. If it is also considered that less than half of shelter relinquishments are owner surrenders (19% in dogs to Queensland RSPCA shelters in 2014 and 32% of cats between 2006 and 2009 in Queensland RSPCA shelters; [18,22]) then the online ads would represent an even higher proportion of owner surrenders.

There is a complex flow of dogs and cats between the owned and un-owned populations. The data presented from the gumtree.com.au ads, from petrescue.com.au (representing larger and smaller shelters and pounds) and from published data from the RSPCA, illustrate the complexity of movements of surrendered dogs and cats within and between Australian States/Territories. The human population for each State/Territory was used for comparison; if one assumes that a similar percentage of people in each State/Territory own a dog or cat, the human population is a proxy for the dog and cat population. If one then assumes that a similar proportion of dog and cat owners in each State/Territory relinquish their dogs or cats each year, the proportions should be similar. In fact they were not, and this may be because these two assumptions are not true, and that people in different States/Territories are more or less likely to own a dog/cat and to then relinquish it. In general, Queensland had an overrepresentation of the surrendered population of dogs and cats on Gumtree, PetRescue and the RSPCA compared to their human population, while Victoria tended to have an underrepresentation of relinquished dogs and cats compared to their population. An additional confounder is that RSPCA data is dependent on the numbers and sizes of shelters in each State/Territory, and the petrescue.com.au data depends on the market penetration of shelters/pounds using their website from each region. Internet access and hence access to Gumtree may be more uniform between States. To fully understand the flow of owned and un-owned dogs and cats within and between regions of Australia will require further research.

430 Although there were similar total numbers of ads for dogs and cats on Gumtree, there were
431 fewer new ads posted in the follow-up data sets for cats versus dogs. This suggests the turnover of
432 cat ads on gumtree.com.au is longer than for dogs. Of the dog and cat owners that were interviewed,
433 a higher proportion of dog owners had already successfully rehomed their pets versus the cat owners,
434 at the time of interview. Of the two cat owners who had multiple responses for relinquishment, and
435 had been able to successfully rehome their pets, both were pure bred cats. However, the very small
436 number of responses from owners relinquishing their pets on gumtree.com.au means that this data
437 is not likely to be representative of the entire population of relinquishing owners.

438 There are many risks involved with online trade in pets for both prospective owners and
439 animals, but as yet online sales of dogs and cats remain unregulated around the world. In some
440 countries voluntary standards for online sales of pets have been developed, with the Pet Advertising
441 Advisory Group (http://paag.org.uk/) in the UK, the Irish Pet Advertising Advisory Group
442 (http://ipaag.ie/) and the BelgPAAG (Belgian Pet Advertising Advisory Group) was recently
443 launched in Belgium [23]. The EU Dog & Cat Alliance released a report into the cost of online sales
444 in the EU recently [24].   The main findings were that online ads are now the most common way for
445 people to purchase a pet, that there are no regulations around Europe that cover this trade, and the
446 many risks involved. These include sale of unweaned animals and animals in poor health. There are
447 up to 269,620 dogs and 67,847 cats estimated as being advertised online in the European Union on
448 any given day [24]. A report issued by BBB® International Investigations Initiative presents evidence
449 on how online pet sellers scam pet buyers in the US [25]. The BBB ScamTracker contained 907 reports
450 on pet scams at the time the report was published, which was 12.5% of all online purchase fraud
451 complaints. Many of the scams do not involve a real animal, for example an ad for a free dog or cat
452 that urgently needs a new home may be posted. Once a person responds to the advertisement, costs
453 relating to transportation and care of the animal are requested. The report includes information from
454 other countries, with 337 pet complaints to the Australian Competition and Consumer Commission
455 in the first six months of 2017, and 377 complaints involving animals to the Canadian Antifraud
456 Centre in 2016, with estimated losses of $222,000 [25].

457 In addition to the risks relating to online sales of dogs and cats outlined above, there are other
458 risks relating specifically to dog and cat relinquishment. If an aggressive dog is relinquished to a
459 reputable shelter, the dog's behaviour will be assessed and the risk to new owners evaluated.
460 Although behavioural assessments performed in shelters are unreliable [26], prospective owners can
461 be educated on the behaviour of the dog and triggers of aggression prior to adoption, and post-
462 adoption support provided if behavioural problems arise. In addition, good shelters have access to
463 trainers and behaviourists who can implement programs to improve the behaviour of an animal. In
464 some of the ads it was possible to read between the lines and see that aggression was likely to have
465 been a problem (e.g. *'Urgent rehoming needed for Jack Russell cross, male, 10 years. Beautiful dog, very*
466 *friendly but best suited to a kid free home.'*) but there is nothing to prevent owners advertising and selling
467 pets with a behavioural problem without providing any warning or information to the new owner.

468 As well as the risk to new owners, there are also risks to the animals themselves. While not
469 perfect, shelters do question prospective new owners on their ability to look after a pet and may not
470 allow somebody to adopt a pet if they believe it will not be well cared for. Again, there is no obligation
471 when dogs and cats are traded online for this to occur. As people may have ready access to the
472 internet at any time of the day, and with the posting of cute photos, impulse buying may also be a
473 significant problem. The wording of some of the ads indicated an impulse purchase, for example *'6*
474 *month old Shar Pei puppy we brought him off gumtree two weeks ago and he's the best puppy ever but*
475 *unfortunately I have no time for him as I have three babies. He has had all he's (sic) needle are up to date.*
476 *Looking for a good home with someone who has plenty of time for him.'* An additional risk associated with
477 the Gumtree ads was that a large proportion were free, or a minimal cost. It has been suggested that
478 animals obtained at no or a low cost are at an increased risk of future relinquishment [27],
479 perpetuating the problem. However, a later study suggested that the attachment of people to cats did

not differ between free- and fee-based cat adoptions [28]. Further research will be needed to assess whether free animals adopted online are more or less at risk of being re-relinquished.

There is also an additional risk associated with offering dogs and cats free, or very low cost. One of the interview respondents discussed how they had been taking home dogs advertised on Gumtree free in order to find them a new home. This respondent felt that otherwise people involved in dog fighting would take them (they had rehomed approximately 80 animals in the past year). To our knowledge, there is no evidence of trade and use of dogs in dog fighting, although it should be considered as a possibility. There were a number of ads describing dogs suitable for pig hunting, which is illegal in some States of Australia [29]. In fact the Bull Arab, which is not a recognised breed by the Australian National Kennel Council [30], is a breed often associated with pig hunting, and a large number of Gumtree ads for Bull Arabs from Queensland (in which pig hunting is legal) were observed. The final risk for dogs and cats advertised free or for low cost online is from animal hoarders. Arluke et al (2017) describe three types of animal hoarders: the overwhelmed caregiver, rescue and exploiter. The rescue hoarder has a missionary zeal to save all animals and actively seeks to acquire animals [31]. Being exposed to advertisements of animals that need rescuing on Gumtree is likely to trigger a rescue hoarder, who can acquire multiple animals free or at minimal cost.

It is difficult to determine if the population of dogs and cats surrendered on Gumtree overlaps with the animals that are surrendered to the RSPCA or other shelters. Four of the people interviewed who had relinquished dogs on Gumtree stated that they used Gumtree as the local shelters were full, and while this was not given as a reason by any cat owners there was one person who said they used Gumtree because the cat would be 'put down' at a shelter. The animals advertised on Gumtree would represent the 'owner surrender' dog admissions to a shelter. Only 19% of the 11,967 dogs entering the RSPCA in Queensland in 2014 were owner surrender, with 24% classified as strays admitted by the public, and 34% from municipal councils [22]. However, some of the strays admitted by the public may represent owned animals, with owners avoiding paying shelter surrender fees, or not wanting people to know they are relinquishing their own pet. The top four breeds processed by RSPCA shelters in Queensland in 2014 were the Staffordshire Bull Terrier (20%), Australian Cattle Dog (8%), Kelpie (7%) and Bull Arab (7%). The top four breeds advertised on Gumtree in the current study were the Staffordshire Bull Terrier (12%), Bull Arab (8%), Kelpie (6%) and Australian Cattle Dog (5%). Thus the most popular breeds for the RSPCA and Gumtree are similar, and also to the dogs offered on petrescue.com.au which represent both larger and smaller shelters. Despite similarities in the breeds, the proportions of pure and cross breed dogs differ widely, with 92% of the dogs admitted to the RSPCA in Queensland in 2014 being cross bred, while only 46% of dogs from Queensland advertised on Gumtree cross bred. The median price of pure bred dogs was significantly higher in the Gumtree ads than for cross bred dogs.

There is an important difference in relinquishing online versus giving up a dog or cat at a shelter. At a shelter, owners may have to pay a fee to relinquish their pets, whereas on an online site, they can request a sum of money. However, based upon the definition of relinquishment being used in this study ('Voluntarily cease to keep or claim; give up') the owners are voluntarily giving up their dog or cat. Indeed, if a dog or cat has been purchased originally for a large sum of money, offering the pet online may allow the owners to make up for some of this loss. The general use of the term relinquishment describes an animal taken to a shelter. When devising the criteria to determine if a dog or cat was being relinquished, we originally planned to have a cap on price for the animals we included in our study. However, when reading the descriptions of the ads, there were ads in which the dog or cat was being traded for over $AUS1000, and yet the wording suggested that the decision of the owner to relinquish their pet had been difficult. Thus, it was not possible to use a cut-off price and say that all pets below that price were relinquished and above that price were not.

One reason provided by respondents for the use of Gumtree for relinquishing their pets was that they could speak to the new owners and see where their pet would live before agreeing to give their

529 pet a new home. One of the owners had even run trials of their dog with the prospective new owners,
530 and had two failed trials before having success with the third. Follow-up and control on the re-
531 homing of their pet is something that cannot be provided in a traditional shelter, where the animal is
532 left and no further information on where, and even if it has been rehomed, is provided. A novel dog
533 adoption program has been suggested in the US which involves placing dogs into foster homes, with
534 the foster carer tasked with finding the dog a new home [32]. There are obvious issues with protection
535 of privacy and the possibility of the new owners being harassed by the previous owner (or *vice versa*),
536 but this feedback is important for shelters to consider. To accommodate owners who want to know
537 where their pet goes and that it is being well looked after, innovative programs should be considered.

538 An important limitation of the current study was the limited number of relinquished owners
539 who responded. Of those who did respond, all would be classified as responsible pet owners who
540 were in positions in which they had no real choice but to relinquish their pet, and who were doing
541 their best to find a good home. One of the respondents had rescued the animal previously from an
542 ad on gumtree.com.au and believed that the owner was going to kill the animal if a new owner was
543 not found quickly (an unavoidable change in this persons living arrangements outside of their control
544 meant that they needed to relinquish the pet). It is likely the population of people relinquishing their
545 pets on gumtree.com.au are mixed, with some doing everything they can to find a good home, and
546 others not caring where their pet goes as long as they can dispose of it. Further research with
547 responses from a larger range of respondents would be difficult, as people who do not care for their
548 pet are also unlikely to respond to requests to participate in research. For the owners who were
549 relinquishing their pets, several were obviously upset about the difficult decision they had been
550 forced to make. It was also interesting that some owners felt it necessary to respond to the email to
551 notify us that they were not willing to participate as they found the situation too distressing. This
552 aligns with previous research that concluded that rather than giving their pet up at a shelter
553 thoughtlessly many people struggled with an unavoidable situation and really had no choice [19].

554 Research based on the use of big data from web scraping (automated collection of data from web
555 pages) provides both important research data but also ethical questions. Guidelines for internet
556 research have been published [33], and we believe the current study presents no significant ethical
557 problem using these guidelines. The respondents in the present study who were interviewed
558 provided their informed consent to participate, and no personal details are included that could be
559 used to identify them. However, owners whose data were used to estimate numbers and
560 demographics of the relinquished pets did not consent to this use. Although the data were publically
561 available on gumtree.com.au, it can be argued that people did not consent to other uses of their
562 information. However, risks to these people are minimal in the present study as aggregate data were
563 used that do not permit identification of individuals, and the direct quotes used in the paper are
564 unlikely to be able to be used to identify individuals as the ads are now more than a year old and are
565 taken down from gumtree.com.au once new owners are found or owners decide not to continue
566 advertising. The benefits of the research in understanding a population of relinquished pets that have
567 hitherto not been studies are also likely to outweigh the minimal risks to the individuals whose data
568 was used.

569 Another important limitation of the study is that not all information posted by the dog and cat
570 owners is accurate, for example some owners may not know the true age of their pet or may provide
571 false information on factors such as dog breed. Owners may also provide false reasons for the
572 relinquishment due to social pressure to have others think well of us [34]. Finally, the extrapolation
573 from the ads posted in February to the total number per year is likely to be inaccurate as numbers of
574 ads will vary from month to month. This is particularly relevant for cats, as they are seasonal
575 breeders.

576

5. Conclusions

The present study provides evidence that many thousands of dogs and cats are relinquished online in Australia each year. This population of pets has previously not been considered in policy or strategies to reduce the risk of relinquishment and protect the welfare of un-owned dogs and cats. Knowledge of online relinquishments adds detail to what we currently know about the complex flow of dogs and cats between owned and un-owned populations, and between different owners.

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