A survey of owners’ perceptions of fear of fireworks in a sample of dogs and cats in New Zealand

AR Dale*§, JK Walker*, MJ Farnworth*, SV Morrissey* and NK Waran*

Abstract

AIMS: To establish reliable information regarding the behavioural responses of dogs and cats to fireworks in New Zealand; record interventions used by owners, and their perceived efficacies; and establish the prevalence of fireworks-related injury, and quantify owners’ attitudes towards fireworks.

METHODS: A questionnaire targeting dog and cat owners was distributed via the Auckland Society for the Prevention of Cruelty to Animals (SPCA) Animals Voice magazine and 25 veterinary clinics. The questionnaire covered demographics of animals, fear of fireworks, severity of the fear, and behaviours exhibited. Also included were treatments tried, source and perceived efficacy, prevalence of injury, and owners’ attitudes towards the sale of fireworks for private use.

RESULTS: From a total of 8,966 questionnaires distributed, 1,007 valid questionnaires were returned, representing 3,527 animals. Of these 1,635 (46%) animals displayed a level of fear of fireworks recognisable to their owners. Owners of dogs identified a significantly higher fear response than owners of cats but the duration of these fear responses did not differ between species. Fear of fireworks frequently resulted in dogs exhibiting active fear behaviours, whereas cats were more likely to exhibit hiding and cowering behaviours. A significantly increased severity and duration of fear response over time in dogs and cats was associated with owners who comforted them when they displayed a fearful response. Only 141/890 (15.8%) of owners sought professional treatment from a veterinarian, animal behaviourist or animal trainer for their animals, with variable efficacy. Six percent (51/923) of animals had received physical treatments used by owners, and their perceived efficacy, prevalence of injury, and owners’ attitudes towards the sale of fireworks for private use.

CONCLUSIONS: The results provide valuable information that is, as yet, unsubstantiated in New Zealand, although potential biases exist due to the non-random selection of respondents. Differences between dogs and cats were likely due to differing responses to fear-provoking stimuli between the species. Owners’-reported increase in fearful response over time for comforted animals may indicate a negative impact on the longer-term psychological welfare of their animal.

CLINICAL RELEVANCE: The greater the awareness of effective treatment plans for animals that suffer from a fear of fireworks, the greater the possibility that this fear can be reduced.

Wider dissemination of effective owner behaviour and treatment programmes for firework fears is needed to improve levels of professional treatment for dogs and cats.

KEYWORDS: Dogs, cats, fear, fireworks, treatment

Introduction

In New Zealand, both public and private firework displays are common. The sale of fireworks for private use is governed by the Hazardous Substances and New Organisms Act 1996 (Anonymous 1996), which places limitations on such sale, designed to minimise potential harms. The fear of fireworks in animals was cited as an increasing problem in the United Kingdom due to the ubiquitous use of fireworks during many holidays and celebrations (Levine et al. 2005). Information pertaining to fear of fireworks in dogs and cats within New Zealand is not available but there remains a significant number of festivals either side of the legal period of sale (3 days prior to 05 November) which perpetuate the private and unpredictable use of fireworks.

Fear responses to fireworks are thought to occur due to unpredictable, intermittent and high-intensity noise (Cracknell and Mills 2008). Those authors stated that the effects of secondary stimuli such as light flashes, odours or even changes in barometric pressure on the behaviour, perception and physiology of animals remain largely unknown. Fears and phobias of noise among dogs are a behavioural problem that is commonly reported (Landsberg et al. 2003; Mills et al. 2003). For dogs, the most common fear-eliciting noises are thunder, fireworks and gun shots (Shull-Selcer and Stagg 1991; Landsberg et al. 2003). There are few publications on fear of noises in cats despite it being a significant issue in behavioural medicine (Bowen and Heath 2005), and none which directly addresses fear of fireworks.

Fear responses will differ between species. Dogs may, amongst other behaviours, vocalise, pant, eliminate, increase locomotion, tremble or cower (Sheppard and Mills 2003). Conversely, cats are more likely to hide, or exhibit a state of behavioural inhibition. This passivity may often be misinterpreted by cat owners as a lack of fear, especially if the cat is seen to engage in increased self-maintenance behaviour, such as displacement grooming (Bowen and Heath 2005). Therefore, the behavioural impacts of fear of fireworks are relatively unknown in cats compared with dogs.

If fear of noises is left to progress untreated then it can develop into phobias, and will frequently also generalise to other similar...
stimuli (Blackwell et al. 2005). It is essential that effective treat-
ment plans be implemented as animals that are repeatedly exposed
to fearful events may experience decreased levels of welfare (She-
pard and Mills 2003; Hydbring-Sandberg et al. 2004; Dreschel
and Granger 2005). Generic treatments, such as desensitisation
programmes, for fear of noises are widely available (Cracknell
and Mills 2008). Typically, fear of noises is resolved using a system of
desensitisation and counter-conditioning (Mills et al. 2003; Le-
vine et al. 2007; Levine and Mills 2008). The animal is gradually
exposed to increasing volumes of the trigger stimuli, usually in asso-
ciation with some form of reward, ensuring a fear response is not
elicited at any level (Overall 2002). This procedure typically takes
several weeks or months to complete (Cracknell and Mills 2008).

There are immediate control methods available to help manage
fear of noises in animals or to be used in conjunction with desen-
sitisation. These are appealing to owners as they provide a ‘quick fix’
although they can lead to many owners not treating the problem
in the long term (Mills et al. 2003). Veterinary medications such as
sedatives and benzodiazepines are a popular choice for owners
of noise-phobic dogs (Seksel and Lindeman 2001; Crowell-Davis
et al. 2003; Mills et al. 2003), even though the use of sedatives is
now considered outdated by some behaviourists in the field
(e.g. Overall 2002). Contrary to this, some owners find the use of
even appropriate medications unacceptable, and the use of
dog-appeasing pheromone (DAP; Ceva Santé Animale, Libourne
Cedex, France) (Levine et al. 2007; Levine and Mills 2008), herbal
preparations, Bach flower remedies and homeopathic treatments
(Cracknell and Mills 2008) have all been considered.

The aim of this research was to report on owner-identified fear
of fireworks in companion dogs and cats within New Zealand. In
addition, we aimed to investigate owners’ interpretations of their
animals’ fear responses, the use and perceived efficacy of distrac-
tive or preventative measures, incidences and severities of physical
injuries resulting from fireworks, and respondents’ views of the
sale of fireworks for private use. This information is integral to the
future management of the welfare of dogs and cats that exhibit
fear of fireworks.

Materials and methods

A non-probability questionnaire, designed to be answered in 5
minutes, was disseminated to 8,966 available subjects via the
Auckland SPCA’s Animals Voice magazine (Winter issue 2005),
and 25 small animal veterinary clinics throughout New Zealand
(randomly selected from a database of clinics). Each clinic was
sent a research information sheet and a letter requesting they dis-
tribute 100 questionnaires to their clients. Questionnaires were
returned in an unmarked, postage-paid envelope, so that it was
not possible to identify the source from which it was returned.
All aspects of this research were approved by the Unitec Depart-
ment of Natural Sciences Human Ethics Research Committee,
Auckland, New Zealand.

The questionnaire was divided into four sections (see Supple-
mentary Table 1). Although respondents included information
about all animals owned, only information pertinent to dogs and
cats that the owner recognised as fearful of fireworks is included
here. All other information was disregarded, with the exception of
that pertaining to supporting a ban on the sale of fireworks for
private use within New Zealand. Section 1 covered demographic
information about the respondents’ animal(s), including origin,
species, breed, age and sex of the animal(s). Dogs were assigned to
one of the New Zealand Kennel Club’s seven categories of group
of breed (see: www.nzkc.org.nz/dogselect), based on the owners’
descriptions of the breed. Cats were categorised as either pedigree
or domestic. Severity of fear of fireworks was recorded on a Likert
scale (Likert 1932), where 1 was slightly scared, 2 scared, 3 very
scared, and 4 extremely scared. Respondents were asked if the
level of fear had changed over time, and for information regarding
behaviours exhibited during fireworks displays (e.g. vocalising,
destructive behaviour, shaking/shivering, elimination, cowering,
and escape behaviours), and the duration of fear (1 = the dura-
tion of the fireworks, 2 = up to 2 hours after the fireworks display
ended, 3 = the next day, 4 = the next 2 days, 5 = for ≥1 week) in
relation to the fireworks display.

In Section 2, treatments sought by the owner were identified,
including the type, source and their perceived efficacy. This was
reported on a Likert scale, where 1 was not at all, 2 mildly suc-
cessful, 3 successful, 4 very successful, and 5 extremely successful.
If no treatment had been sought owners were invited to explain
why. Respondents were also asked to record any preventative
measures tried, and if fears had generalised onto other sounds.

In Section 3, respondents were asked to record the number, type
and severity of physical injuries to their pets caused by fireworks,
and whether they were accidental, indirect or deliberate.

Section 4 was concerned with respondents’ attendance at public
fireworks displays, and if they took their animal(s) with them, if
their family purchased fireworks for private use, and if they sup-
ported a ban on the private sale of fireworks.

A freepost address was provided and an advertisement placed in
Animals Voice magazine to encourage a high rate of return. A
preface to the start of the questionnaire explained the reasons for
the research, that the replies were anonymous as no personal in-
formation was gathered, and thanked the respondents for their
participation.

Statistical analysis

Data from the questionnaires relevant to fearful dogs and cats
were entered into a Microsoft Access database, attributing a
unique number identifier to each response. Statistical analysis
was performed using SPSS for Windows v17 (SPSS Inc, Chicago IL,
USA). If questions were not answered or answered ambiguously
they were registered as missing data. Simple descriptive statistics
were produced for all variables in the dataset. The data followed
a non-parametric distribution, and non-parametric statistical
tests were engaged. The pattern of distribution of the raw data
was established using the Kolmogorev-Smirnov test of normality.
Prevalence ratios of fearful behaviours were calculated with 95%
CI. Cross-tabulation and χ² tests of association (with Fisher’s ex-
act test, where appropriate) were used to investigate significant
associations between the animals’ fear responses and species,
breed, gender and source. Mann-Whitney U tests were used to
investigate differences between dogs and cats in relation to fear
behaviour, and Spearman’s rank correlation coefficient was used
in relation to the fireworks display.

Significance was taken at p<0.05.

1 http://www.sciquest.org.nz/node/69403
Results

Demographic data

Of the 8,966 questionnaires distributed 1,007 (11.2%) surveys were returned, representing 3,527 animals. Of the respondents, 890/1,001 (88.9%) owned animals that were fearful and 111/1,001 (11.1%) had no animals that were fearful of fireworks. Of those animals represented, 1,635 (46%) were identified, by their owner, as fearful of fireworks (684 dogs and 951 cats). These individuals were isolated for further analysis. The mean age of fearful animals was 6.9 (SD 0.17) years for dogs and 6.8 (SD 0.15) years for cats. Details of demographic data are summarised in Table 1.

Fear response to fireworks

Fear behaviours reported during displays included hiding, shivering/trembling, escaping or running away, vocalising, elimination, and destructive behaviour. Dogs were significantly more likely to perform destructive behaviours, shiver/tremble, vocalise, cower, and urinate or defaecate than cats. Cats, however, were significantly more likely than dogs to hide and/or attempt to escape (Table 2).

Table 2. Number (percentage) of dogs (n=684) compared with cats (n=951) that displayed fear behaviours identified by their owners as being subsequent to and associated with firework displays.

<table>
<thead>
<tr>
<th>Behaviour</th>
<th>Dogs</th>
<th></th>
<th>Cats</th>
<th></th>
<th>P-value</th>
<th>Prevalence ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Yes (%)</td>
<td>No (%)</td>
<td>Yes (%)</td>
<td>No (%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hiding</td>
<td>483 (71)</td>
<td>201 (29)</td>
<td>806 (85)</td>
<td>145 (15)</td>
<td>0.0001</td>
<td>0.83 (0.78-0.88)</td>
</tr>
<tr>
<td>Shivering/trembling</td>
<td>505 (74)</td>
<td>179 (26)</td>
<td>379 (40)</td>
<td>572 (60)</td>
<td>0.0001</td>
<td>1.85 (1.69-2.02)</td>
</tr>
<tr>
<td>Escape/run away</td>
<td>185 (27)</td>
<td>499 (73)</td>
<td>442 (46)</td>
<td>509 (54)</td>
<td>0.0001</td>
<td>0.63 (0.54-0.72)</td>
</tr>
<tr>
<td>Vocalising</td>
<td>185 (27)</td>
<td>499 (73)</td>
<td>119 (13)</td>
<td>832 (87)</td>
<td>0.0001</td>
<td>2.30 (1.89-2.86)</td>
</tr>
<tr>
<td>Urination/defaecation</td>
<td>37 (5)</td>
<td>647 (95)</td>
<td>28 (3)</td>
<td>923 (97)</td>
<td>0.014</td>
<td>1.84 (1.13-2.97)</td>
</tr>
<tr>
<td>Cowering</td>
<td>321 (47)</td>
<td>363 (53)</td>
<td>370 (39)</td>
<td>581 (61)</td>
<td>0.001</td>
<td>1.21 (1.07-1.35)</td>
</tr>
<tr>
<td>Destructive behaviour</td>
<td>39 (6)</td>
<td>645 (94)</td>
<td>18 (2)</td>
<td>933 (98)</td>
<td>0.0001</td>
<td>3.01 (1.70-5.12)</td>
</tr>
</tbody>
</table>

a Significance of difference between dogs and cats
b Estimated occurrence of behaviour in dogs relative to cats

On the Likert scale for severity of fear, the median for dogs was 3 (minimum 1, maximum 4), and the mean 2.89 (SD 0.04). For cats the median was 3 (minimum 1, maximum 4), and the mean 2.62 (SD 0.03). The distributions within the two groups differed significantly (z=5.6; p<0.0001), and comparison of the mean ranks indicated that dogs displayed a more owner-identifiable fear response to fireworks than cats.

The duration of fear for dogs (median 2, mean 1.83, SD 0.044) and cats (median 2, mean 1.92, SD 0.038) did not differ (z=1.587; p=0.112). There was a positive correlation between score for level of fear identified by owners and duration of fear response (r=0.407; p<0.01).

There was no association between sex and fear response for dogs (z=0.832; p=0.405) or cats (z=0.834; p=0.444). However, for dogs (r=0.210; p<0.01) but not cats (r=0.90; p=0.764) there were age-related effects. Investigation of the mean ranks suggested that dogs aged ≥10 years showed increased severity of fear responses compared with dogs <10 years. No significant associations were found between the severity of the fear response and the origin of the animal, e.g. SPCA, pet shop, breeder (χ²=2.133; df=3; p=0.545). The level of fear in 572/1,635 (35%) animals was reported to have increased over time; 735/1,635 (45%) had not increased over time, and the remaining 20% was unknown.

Owners’ interventions for dogs and cats displaying fear of fireworks

Distraction measures utilised by owners of the 1,635 dogs and cats during fireworks were keeping their animal inside (92.1%), comforting the animal (79.3%), keeping the curtains/blinds shut (71.3%), using music or television (58.0%), confining the animal to one room (23.6%), and not attempting any distraction measures (1.0%). Dog owners were more likely to use music or television as a distractive technique (χ²=11.513; df=1; p=0.001), whereas owners of cats were less likely to employ any type of distractive techniques (χ²=6.383; df=1; p=0.012).

The level of the fear response displayed by animals was associated with the percentage of owners who comforted their animals during firework displays (χ²=11.775; df=2; p=0.005), with animals receiving comfort from their owners showing an increased fearful response. Owners whose animals’ fear responses to fireworks had increased over time were more likely to have comforted their ani-
Table 3. Number (percentage) of responses for each category of source of treatment used, and perceived success, of treatments for dogs and cats fearful of fireworks. Only 141/890 respondents had sought any form of help, and not all gave an evaluation of efficacy. Discrepancies in the data are due to invalid or missing responses.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Total</th>
<th>None (%)</th>
<th>Mild (%)</th>
<th>Moderate (%)</th>
<th>Very (%)</th>
<th>Yes (%)</th>
<th>No (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Behaviourist</td>
<td>10 (7%)</td>
<td>4 (40%)</td>
<td>6 (60%)</td>
<td>0</td>
<td>0</td>
<td>3 (30%)</td>
<td>7 (70%)</td>
</tr>
<tr>
<td>Trainer</td>
<td>3 (2%)</td>
<td>1 (33%)</td>
<td>1 (33%)</td>
<td>1 (33%)</td>
<td>0</td>
<td>0</td>
<td>2 (67%)</td>
</tr>
<tr>
<td>Veterinarian</td>
<td>111 (79%)</td>
<td>28 (25%)</td>
<td>54 (49%)</td>
<td>17 (15%)</td>
<td>4 (4%)</td>
<td>81 (73%)</td>
<td>29 (26%)</td>
</tr>
<tr>
<td>Other</td>
<td>17 (12%)</td>
<td>2 (12%)</td>
<td>10 (63%)</td>
<td>4 (25%)</td>
<td>0</td>
<td>2 (12%)</td>
<td>14 (88%)</td>
</tr>
</tbody>
</table>

Discussion

Recent studies have utilised owners’ assessments as the primary source of information regarding behavioural problems (Gunn-Moore and Cameron 2004; Levine et al. 2007; Cracknell and Mills 2008), and it is thought to be the best way to estimate the actual prevalence of behavioural problems in companion animals (Fatjo et al. 2006). Ultimately, it is the owner’s impression of improvement that will dictate if a treatment is deemed useful (Levine et al. 2007). However, as with any retrospective study, the results from the study presented here should be viewed with some caution as they relied on owners’ recollections, sometimes over a number of years. Only 1,007 questionnaires were returned, however due to the method of distribution it was not possible to gauge how many of the original 8,966 questionnaires actually reached the target audience, and whether they originated from the magazine sample or from the selected veterinary practices. As such, the response rate cited above is highly conservative and may in fact have been much higher if, for example, not all of the 8,966 questionnaires did in fact reach animal owners. As no demographic information was collected about the owners themselves it is not possible to draw conclusions about the effects of owner variables on the perception of fear and likelihood of seeking professional help (see Supplementary Table 1). Given that the sampling vehicle used was a non-probability system using subjects available primarily through a welfare-focused organisation, it is possible that the results were biased towards those subscribed owners showing greater motivation for animal behaviour and welfare issues. Future research in this area may be better served by using a wider sample through careful selection of veterinary clinics or a larger sample of the general population.

This study revealed a high prevalence of fear of fireworks in the respondents’ dogs and cats, almost half of which displayed a fear response to fireworks. This is similar to levels reported previously of 45% (Blackwell et al. 2005) and 40% (Voith and Borchelt 1996). The number of dogs and cats in the study reported here which showed a fear response to fireworks was evidently higher than the number for which help was sought. This supports the assertion by Mills (2005) that such problem behaviours are frequently left untreated or unmanaged.

Results from the current study suggested owners were able to recognise fear in both dogs and cats. However, fear behaviour in dogs received a higher severity score on average than cats. Therefore, dog owners engaged in destructive and/or preventative measures more frequently. It may be easier for owners to identify active fear responses in their dog(s), such as destruction, vocalisation, escape behaviour and elimination. As cats display more passive fear re-
Few (14%) owners who reported their animal’s fear of fireworks presented here. Associations between the severity of the fear response and where the treatment data were collected in this questionnaire presents problems with interpretation. Respondents with multiple animals were not able to specify the individual animal receiving treatment, or the experiences of these different animals. As a result this survey was unable to identify if lack of success was associated with a dog, a cat or both. Future research is important to look at variations in efficacy of treatment between species.

There are a range of treatments that can be used for fear of fireworks in dogs and cats but the majority of respondents in the study presented here reported a low perception of efficacy of treatment. That may have been associated with the low level of usage of behavioural modification programmes, and predominance of the prescription of psychoactive medications. Research showed that maximal efficacy was often achieved through a combination of on-going behavioural therapy and pharmacological support (Crowell-Davis et al. 2003). In addition, an owner’s compliance with behavioural modification programmes is an essential factor in their success or lack thereof (Levine et al. 2007; Cottam and Dodman 2009).

The manner in which owners responded to their animals’ presentations of fear was associated with the fear responses. A causal relationship could not be established in the study presented here, however owners’ behaviours were previously identified as important influences on fear responses in the dog (Cottam and Dodman 2009). Likewise, our results showed an association between animals whose owners comforted them and higher levels of fear, increased duration of fear, and subsequently higher levels of fear over time. Genetic predisposition to be fearful of loud noises may also be a significant contributing factor for the animal’s behavioural response, however unintentional tactile or vocal reinforcement of fears commonly occurred in animals fearful of fireworks, often when the animal attempted to escape (Horwitz and Neilson 2007). Therefore owners could potentially have a negative impact on the welfare of their animal through rewarding fearful behaviours. Conversely, those animals displaying the greatest severity of fear may also be those most likely to elicit a response from their owner.

There was a small yet concerning number of animals that had physical injuries as a result of fireworks. Firework-related injuries to humans have been well documented worldwide (Clarke and Langley 1994; Eldad et al. 1995; Fogarty and Gordon 1999). The majority of the firework-associated injuries recorded in this study were indirect, or through accidental injury. Indirect injuries were commonly associated with attempts to escape from the stimulus, e.g. some dogs injured themselves as a result of striking doors, windows and fences while attempting to escape. Similar fear responses have been seen in other noise-phobia research (Crowell-Davis et al. 2003). These consequent injuries are a welfare concern.

Using fireworks as a means of deliberate abuse of animals was evident in five animals in this study. One cat was killed from having a sky rocket shot at it, and another was killed by a firework inserted in its ear. Severe injury was also noted after insertion of a firecracker under a dog’s collar. Beyond the direct animal welfare issues, given the well-established link between animal and human abuse (Muscari 2004) even this low level of deliberate firework-induced injury is concerning. This number may also have been low due to the difficulty in diagnosing non-accidental injuries in domestic animals (Munro and Thrufield 2001ab). Therefore further research is required to investigate the incidence and diagnostic criteria for injuries which occur as a result of the misuse of fireworks.

Of all 1,001 respondents to the survey the majority (83%) favoured a ban on the private sale of fireworks. Respondents also raised concerns over their animals’ abilities to cope with fireworks, risk of injury, and the stress they themselves had over-protected their animals during fireworks. The questionnaire did not distinguish between the effects of private vs public usage of fireworks,
but it is possible that only a ban on their sale for private use could reduce the amount of injuries to animals and people, reduce the fears that animals experience during and after them, and put New Zealand in line with several other countries that have reduced the availability of fireworks sold for private use.

In conclusion, although many dogs and cats displayed fear of fireworks relatively few owners sought treatment. The recognition of the severity of fear was greater for dogs than cats, possibly due to ease of identification. Owners’ responses to that fear may inadvertently have encouraged and reinforced negative behavioural responses and, in the long term, affected the welfare of both dogs and cats. Veterinarians are encouraged to recognise and treat conditions such as noise phobias, or refer to a veterinary referral behavioural service on first presentation, to address welfare issues, and to optimise successful management.

Acknowledgements

The financial assistance of the Auckland SPCA is gratefully acknowledged. The authors would like to thank the respondents to the survey for their time, and the veterinary clinics that participated in distributing some of the questionnaires.

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Submitted 06 January 2010

Accepted for publication 06 October 2011

*Non-peer-reviewed