

## Barking Management – Appropriate Noise Standards and Definitive Assessment

Dr. Dick Murray, Western Suburbs Veterinary Clinic

Mr. Shane Scriggins, Senior Local laws Officer, Caloundra City Council

### Abstract

This paper seeks to assist Local Government in the resolution of community bark-noise conflict. Excessive barking noise can be a nuisance in rural and suburban residential areas. Most barking problems can be resolved by skilful mediation together with the application of routine bark management protocols by competent Animal Management service providers. In the more difficult cases however, when resolution of the complaint can not be achieved by routine negotiation, council officers have no option but to executively decide whether or not the nuisance is real and then require one of the parties to provide the remedy.

This ultimate decision stage in the management of difficult barking complaint cases is impossible for local government to manage in a transparent, fair and evenhanded way unless the assessment of the nuisance level is made objectively. It is also impossible to manage these cases successfully in the absence of noise tolerance standards that have been calibrated for this particular sound and are consistent with community opinion.

### Introduction

The subject of community noise in general and the management of specific types of noise is immensely complicated. The noise nuisance caused by dogs that bark excessively is as complicated as any kind of community noise nuisance and arguably more complicated than most. Little has been published on this (barking noise) subject and the following "background" information for this paper has been taken from a large document titled Community Noise (Berglund and Lindvall, 1995). To provide a suitable perspective to the subject of barking in the context of community noise for this paper, the authors have selected a number of separate extracts from this comprehensive reference source.

- Sound is produced by a mechanical disturbance spreading out as a wave motion in the air at a speed of about 330 m/s. Acoustic waves entering the ear evoke a physiological response which causes nerve impulses to be transmitted to the brain. The brain interprets these impulses so that they can be perceived as sound....
- Noise is unwanted sound and thus implicitly refers to a subjective classification of sound. Sound can have a range of different physical characteristics, but it only becomes noise when it has an undesirable physiological or psychological effect on people. Nevertheless, it is important to understand the physical characteristics of sound since these characteristics determine the various ways we have of measuring and describing sound...
- The main physical characteristics are: sound pressure level, sound frequency, type of sound, and variation in time. Typical sound pressure levels range from 20dB LAeq in a very quiet rural area to between 50 and 70 dB LAeq in towns during the day time, to 90dB LAeq or more in noisy factories and discotheques to well over 120 dB LAmax near to a jet-aircraft at take-off....

- To understand noise we must understand the different types of noise, where noise comes from, the effect of noises on humans and the various ways we have of measuring both the sound as a cause of noise and the noise effects....
- The ability to identify the source is very important in determining community annoyance. These features can include tonal and harmonic qualities, impulsiveness, the relative balance of high and low frequencies and the steadiness or irregularity of the sound. There are a whole range of physical measurements which can express these different features in a more or less appropriate way for noise impact predictions....
- The content of the noise that affects perception is not fully disclosed by present-day noise measurements. This applies to the effect of pure tones, dynamic characteristics (period of increase, pressure variations, impulsive sound) and signals that are close to each other in frequency but somewhat staggered. In practice, frequent measurements are being made but often about aspects which are less essential for human health and comfort evaluations....
- In selecting the best method of (noise) measurement, the measures should correlate with the specific adverse effect, for example, speech intelligibility, loudness, annoyance, hearing loss, sleep disturbance, etc....
- Almost all noise effects are undesirable, yet in many cases it is not definite whether these effects must be judged as harmful and thus as unacceptable or not. Ultimately this is a normative and societal decision....
- In social surveys on annoyance, the main emphasis has been on elucidating the effects on exposed populations with respect to the ambient noise load. When analyzing response data over the past decades, the large variability is striking. There are so many sources of variability in an individual's exposure situation and reaction to noise that it is impossible to obtain useful mathematical relationships between noise and response without controlling for individual differences in exposure and response...
- The description of exposure to noise with present sound level meters does not provide an unambiguous answer concerning effects without supplementary information about the noise source and/or exposure situation. Different criteria for different sources/situations are required. However, modern electronics provide almost unlimited possibilities for the treatment of signals...
- There are a number of acoustic features such as relative frequency content, tonality, impulsivity, and regularity which determine the sound quality and might convey additional informational content to the listener. These features often specifically identify the sound to the listener and allow it to be distinguished from the residual background noise. There are cases where it is the specific feature itself which is the direct cause for complaint, and not the sound level per se....

<sup>1</sup> Community Noise, edited by Birgitta Berglund and Thomas Lindvall, 1995, published by WHO and placed on NPC Online Library with permission from WHO

- Noise annoyance may be defined as a feeling of displeasure evoked by a noise. The annoyance-inducing capacity of a noise depends upon many of its physical characteristics including its intensity, spectral characteristics, and variations of these with time. However, annoyance reactions are sensitive to many nonacoustic factors of a social, psychological, or economic nature, and there are considerable differences in individual reactions to the same noise exposure. Furthermore, community annoyance varies with activity (speech communication, relaxation, listening to radio and TV, etc.)....
- In general, there is no agreed measurement procedure to determine the presence or absence of such (nonacoustic) features, which must be left instead to the discretion of the investigating officer or other nominate officials, who has delegated regulatory powers. This situation is unsatisfactory and there is research in progress in a number of institutions around the world to attempt to rectify this deficiency...
- The knowledge about harmful and thus unacceptable impact of noise exposure has to be transformed into environmental standards. As noise protection standards are very consequential, the standard-setting institution must carefully act according to well-defined transparent principles....
- From a pragmatic viewpoint, efficient standards need to be:
  - i. Strict,
  - ii. Unambiguous,
  - iii. Transparent,
  - iv. Practically feasible, and
  - v. Controllable....
- Furthermore, protective guidelines must consider not only the general population but also subgroups which might be particularly vulnerable. The efficiency of the employed measures should be investigated by evaluation research.... (Berglund and Lindvall, 1995)

### Barking as a noise

On the subject of community response to noise and with specific reference to annoyance factors other than the noise itself, Fidel (1984) observed that "adverse attitudes towards noise sources are undoubtedly affected by factors other than physical exposure, including situational variables and other attitudes". Fiedel, in the same paper, also made the telling observation that when a dispute over a noise exposure issue has festered through hearings, petitions, lawsuits and media attention for a prolonged period of time, it often acquires a life of its own – that is, the disagreement becomes to a large extent independent of the original noise complaint itself.

**Most experienced Animal Management Officers will know from their own experience just how much all these "other" factors can colour perceptions of annoyance. Even though these "other" factors do undoubtedly have a big bearing on nuisance sensitivity, they are not assessable noise qualities.**

On the subject of individual and group differences in the response to noise nuisance, Jones and Davies (1984) commented that "since such a plethora of different effects have been ascribed to individual differences in annoyance, it is difficult to attempt a unifying thesis to cover the variation observed in any community". Jones and Davies, in the same

paper, went on to point out that many variables such as differing personality types, differing age groups, differing settings and so on, all go to create a multiplicity of (annoyance) effects.

**It is not possible for Animal Management Officers to objectively and consistently assess such intangible effects as these. So, while these effects are obviously important, they can not be reliably quantified and therefore used for noise nuisance assessment.**

Guski et al (1999) listed *all* the different types of expert opinions (to date) on the subject of the psychological and intellectual effects of noise annoyance. These theories, once gathered together by Guski et al, were categorized by them into five separate groups with each group being based on a different basic causal explanation. These five groups of noise annoyance theories were as follows:-

1. Noise as an emotion e.g. displeasure and fear
2. Noise as a result of disturbance e.g. interference with communication or concentration
3. Noise as an attitude e.g. perceptions of good and bad things
4. Noise as knowledge e.g. conceptual knowledge of sounds and their effects
5. Noise as a result of rational decisions in relation to the balance of several variables e.g. the sensibility of the associated noise making activity

**It is quite possible that all five of these theories are relevant in explaining urban and suburban residential barking noise annoyance. But once again, while they may assist in helping understand why different people see noise annoyance differently, they do not produce any kind of reliable measure for what might be considered excessive.**

The non-acoustic effects of noise are a real can of worms. While they are central to the concept of noise nuisance, they also make it very clear why everyone will perceive the level of nuisance differently. They help us understand noise nuisance but they give us little to use as a tool for regulation. While the perception that a dog's bark is unnecessary, or has no useful informational value, or interferes with concentration, or interrupts normal conversation, or intrudes on privacy, or is ignored by the owner and might all be real and significant irritation factors, these qualities can't be used as a basis for assessment or for the application of management.

**To effectively address barking nuisance complaints in a fair and evenhanded way local government has little choice but to turn away from the effects of and the psychological reasons for the noise annoyance and invest time, resources and seek community opinion in prescribing noise control standards in respect of barking dogs kept in our communities.**

The bottom line here, as stated in the publication cited in the introduction above: "*The knowledge about harmful and thus unacceptable impact of noise exposure has to be transformed into environmental standards. As noise protection standards are very consequential, the standard-setting institution must carefully act according to well-defined transparent principles*" (Berglund and Lindvall 1995).

Because it is not technically possible for authorised local government officers (even when empowered to do so by legislation) to make a valid judgments about the integrity of barking complaints simply on the basis of what various "in

contact" people might think or feel about it, the outcome is likely to often be unsatisfactory. Either one party or the other in dispute (perhaps even both) are always going to feel let down or victimized by a resolution process that isn't fair, evenhanded and technically transparent.

**At the end of the day, even the authorised officer's opinion is just another opinion – an opinion that is no better and no worse than anyone else that might be involved. In situations where nuisance disputes are assessed for validity on the basis of opinion rather than fact, outcomes are always going to be unsatisfactory / unfair for at least one of the parties in dispute.**

### Measuring noise

The typical approach to noise control standards is based on one or more of the following sound characteristics:

- (i) Loudness (sound pressure level) measured in decibels (dB)
- (ii) Frequency (pitch)
- (iii) Pitch weighted loudness (dBA, B or C scales)
- (iv) Duration (exposure time interval) measured in minutes or hours
- (v) Equivalent Continuous Sound Pressure levels eg LAeqT

**It is unfortunate that none of these sound characteristics really work for barking.**

### Loudness, frequency and pitch

Measures of loudness, frequency (and therefore also pitch weighted loudness) can all be ruled out as options or standards for managing barking in our community on the grounds that these particular acoustic qualities, although nicely measurable, are extremely variable for barking and not reliably linked to levels of annoyance. Like the annoyance caused by the sound of a persistently dripping tap, barking noise can be distressing to the listener even though the health effects of the sound itself is actually not a consistently important issue.

### Duration and equivalent continuous sound pressure

Measures of duration (and therefore Equivalent Continuous Sound Pressure levels) also struggle for application here. The bark sound is often a series of short sharp sound "spikes". It is not a continuous sound, or even a temporarily continuous sound. Barking sound can't effectively be measured in terms of sound load or the more simple measure of sound duration. Such sound load/duration measures may work well for aircraft noise for example, but they don't deliver for barking.

### Of speed and barking – choosing standards that work

At this stage, in our quest to find some way of fairly measuring "amounts" of barking, it is useful to step back from the immediate issues associated with the less than satisfactory methodology of the past. The authors think it is the time to step outside the square and perhaps start over from scratch with a whole new sheet on how we should approach bark measurement and bark management. Before all else in doing this, we need to bear in mind the following advice from our primary reference source in this paper:

- As noise protection standards are very consequential, the standard-setting institution must carefully act according to well-defined transparent principles....
- From a pragmatic viewpoint, efficient standards need to be:

1. Strict,
2. Unambiguous,
3. Transparent,
4. Practically feasible, and
5. Controllable.... " (Berglund and Lindvall 1995).

Up to now, standards used for bark noise control, have been neither well defined nor transparent. The five standards of efficient noise standards have never been adequately locked in to bark noise management process.

Traffic speeding laws are an ideal example of how satisfactorily a well structured standard can work. In the case of speeding, we are obviously talking about road safety and not noise control, but that does not matter here. There are very useful principles in speed regulation that can help us here.

### Speed standard function summary:

1. Traffic speed limits are set and posted as obvious signage; e.g. 60kph, 100kph, 40kph depending on the situation.
2. Motorists know what the limits are and can easily determine the speed they are traveling at all times by using the speedometer in the vehicle in which they are traveling.
3. Speed guns/cameras can accurately record incidents of noncompliance and everyone is aware of the rules and consequence of non compliance.
4. As a result, most people who might otherwise drive too fast don't ... and the roads are safer as a consequence.... It works!

It is important to note here that vehicle speed risk is as a complex matter. Vehicle speed risk is influenced by a whole basket of different, compounding variables. These variables which all complexly influence each other include things like:

- Different weights, sizes and types of vehicles;
- Different braking systems;
- Different degrees of vehicle roadworthiness;
- Different weather conditions;
- Different road surface conditions; and
- Different levels of driver experience.

While these "speed risk" variables *are all both real and significant*, none of them lends itself to being used as a basis for a speed risk management standard.... And so...They are not used for this purpose. Something else covers it nicely and that is simply to keep control of how quickly motorists drive.

There is no doubt that speed (on its own) is the basis of what is in reality an *imperfect* road safety standard. It is imperfect because it does not accurately accommodate for all the above mentioned important speed risk factors. But this is not an insurmountable problem. Managing speed risk by simply controlling speed is a system that works extremely well and it does so because it very satisfactorily fulfills the above 5 criteria of efficient standards without worrying with all the other "factor clutter".

All control standards are imperfect to some degree and the point of this example is that by using this simple and universal measure (speed *per se*), *the net effect* can still be both cost effective and efficient. So what can we learn for use with barking noise management from our speed control

model? There are a number of conclusions that come up right away.

1. The standard measure we seek can work well without having to embrace the *full* range of effects and consequences;
2. We do not necessarily have to factoring in *all* the variables that might be involved even though they might each be important effects in their own right;
3. Our standard will work best if *one* focal (central) characteristic of the nuisance can be found especially if that characteristic is itself, by its nature, directly consequential

**Clean page – do we need it?**

Provided it is acknowledged that the protocols and assessment standards currently being applied by local government to manage barking dog nuisance are not really working well enough, then improvement is needed. Provided it is accepted that current methodology including particularly the standards used to address barking nuisance does not satisfactorily deliver adequately fair and transparent remedies, then improvement is needed.

The authors feel strongly that with the right tool the business of managing barking dogs should and could be as direct and consequential as the traffic speed guns and cameras that are currently all over the world for traffic speed risk management.

**The Multivet bark counter prototype**

We think the answer came in Caloundra, August 2003, at the National Urban Animal Management Conference. At Caloundra, Anthony Beard from DLC Australia, a local distributor of Multivet products in Australia, commented that he had seen an interesting potential "outside the square" for one of Multivet's R&D projects. The device in question had been engineered in the first instance by Multivet's technical staff to test the effectiveness of Aboistop citronella collars during their development.

Anthony argued that both pet and non pet owners subject to barking dog conflict could be feeling dissatisfied with the current problem assessment methodology being used by Local Government. He suggested that by *not* using some sort of bark counter device, it could be argued that the current management practices employed by enforcement agencies for resolving barking dog conflict are:-

- failing to be applied objectively
- being argued on assumptions
- subject to highly emotive assessment
- causing community angst
- failing to deliver equity and transparency.

At that meeting, it was agreed that Caloundra City Council would trial the bark counter collar prototype to determine its effectiveness in a field trial for this application. It was also agreed that the trial would take place in the controlled environment of the back yard of a council officer whose dog had been the subject of a bark nuisance complaint.

**What is the bark counter collar?**

The bark counter collar is at this stage a prototype. It is collar mounted and by gravity, the microphone/recorder device naturally rests against the dog's throat and voice box.



Once barking is detected by the microphone in the counter box, a signal is transmitted by counting circuit to a microcontroller processor and then stored into an EEPROM (ELECTRONIC ERASABLE PROGRAMMABLE READ ONLY MEMORY)

The recording cycle can continue for a period of ten days and then starts again by overwriting the previous recording period.

If an owner or recording agency wants to know the barking tendency anytime prior to the ten days, the collar can be simply fitted to the neck of the animal and the data downloaded to the Personal Computer by serial connection.

The data is correlated and displayed in a Microsoft excel spreadsheet. The unit will show the number of barks per hour from hour 1 to hour 255. If after day 10, the data has not been downloaded, the program automatically writes over itself starting back at day one.

Though well advanced from its earlier stages, this unit is still a prototype and should be acknowledged by all that it is still just an experimental application with the potential for further significant development if that is deemed to be warranted by the manufacturer.

**Bark counter trial – a partial success**

The animal selected for the Caloundra field trial was a male, desexed, German Shepherd type dog. Before the trial began Anthony Beard from DLC flew up to Queensland and attended the home of our trial dog. Trial protocols were considered critical to ensure project credibility and to maximized outcomes. The protocols included but were not limited to the following:-

- the collar being used at predetermined times (where the owner was not at home);
- recording when the collar was removed and reapplied by the owner;
- keeping the collar free from contamination (water or vegetation); and
- ensuring the collar was recording at all times.

The group discussed other ways in which the bark count collar might be enhanced once the trial was finished.

A number of suggestions were sent to the design team at Multivet. Some suggestions for improvement included the:-

- system incorporating a sealed battery unit to prevent contamination;
- integration of a rechargeable battery unit; and

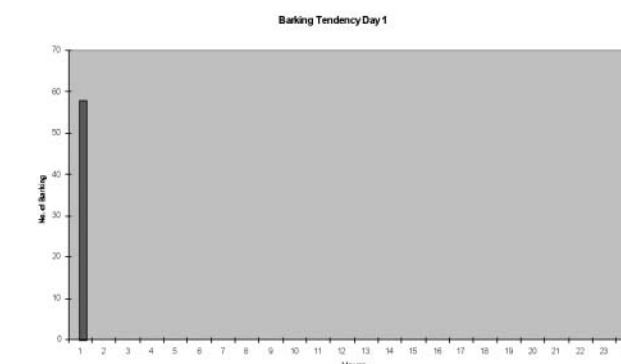
- development of a non removable collar to prevent owner intervention.

The bark count collar was placed on our test dog for a period of ten days, commencing in early April 2004. During this period South East Queensland was experiencing hot and humid conditions with some wet weather being experienced. The collar was removed several times during the trial to prevent water damage occurring. At the end of the tenth day the collar was removed from the test dog and was packed and freighted overnight to Melbourne for downloading of data at DLC.

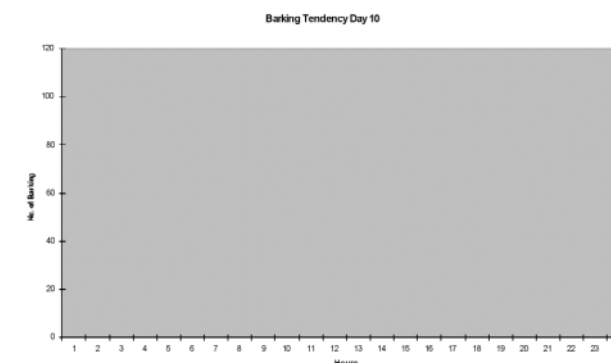
A diary detailing the frequency of the collar being applied to the dog is detailed below. Included at the bottom is a narrative from the dog owner advising that the dog had been heard to bark during the trial on several occasions.

Date	Times (on and off)
13/4/04	Collar set-up (battery installed) at 7.30am and placed on Barron at 7.45am, it was removed at 5.15pm
14/4/04	On- 7.45am Off- 5.15pm
15/4/04	On- 6.45am Off- 6.15pm
16/4/04	Not put on due to rain
17-18/4/04	Not put on due to weekend at home
19/4/04	On- 7.45am Off- 5.15pm
20/4/04	On- 7.45am Off- 6.15pm
21/4/04	On- 7.45am Off- 5.15pm
22/4/04	On- 7.45am Off- 5.15pm

*"On all days that the collar was on there was evidence of some form of barking through the day as the garden was often messed up. Michael had just recently been advised by a neighbour that his dog was becoming a nuisance as well which may or may not be indicated in the results".*



The results came back several days later with surprising results. The data indicated that the dog barked on day one for (around 50 barks in the first hour) and then on the tenth day it registered (around 100 barks total on that particular day).



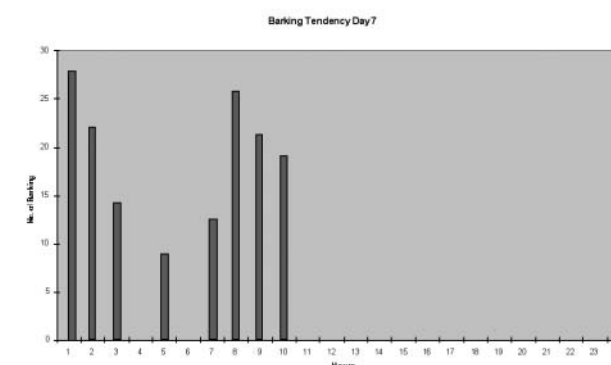
The data was sent to the engineers at Multivet in an attempt to shed some light on what was happening. We ourselves asked some questions of the trial:

1. Did the dog always have free access to the yard and was the yard secure? Answer; Yes
2. Were the pet owners the only people likely to have placed or removed the collar during the trial? Answer; Yes
3. Was the collar recording at all times? Answer; Yes it is believed so...testing protocols were always observed prior to the collars introduction on the dog
4. Was the collar slipping too far down the dog's throat region to record the data properly? Answer; Maybe.

**Conclusions and recommendations**

Time constraints leading up to paper deadlines for this conference precluded doing the retest which the authors expected would more satisfactorily demonstrate the potential of this device.

Hopefully, by the time of the conference itself in two months time, that work will be completed for presentation. In the charts below, the data has been fabricated for explanatory purposes only and to show the kind of results that are (God willing) expected.



**Discussion**

Clearly the bark counter's field trial failed. However, the concept of recording data in this manner for resolving barking dog conflict should not be dismissed. The authors are confident that this bark counter concept has a future in Urban Animal Management.

The authors believe that the Multivet bark counter concept has much to offer in the development not only of practical bark noise measurement but also in the definition of associated community tolerance standards. Without such

technological assistance and while ever bark noise nuisance cases continue to be assessed subjectively, there will continue to be a trail of "losers" (those deemed to have been at fault – who themselves don't think they were) who will feel like system victims.

This paper has attempted to showcase a concept that might be able to make bark noise disputes easier, cleaner and fairer to resolve. Provided the authors can satisfactorily prove the bark counter before the August '04 UAM conference, attending AMOs will then be able to give consideration to whether or not the prototype should be promoted for further development and ultimate completion as a marketable product. It will then still remain to be seen if local government in Australia is interested in promoting the transition of the device from prototype to finished product.

### Acknowledgements

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<sup>2</sup> DLC Australia Ltd. ACN 005 271 278. 17 - 19 Horne Street, Hoppers Crossing, Victoria, 3029. Phone (613) 9360 9700