MEMO

MARSHALL DAY Acoustics

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SUBJECT	Noise Effects on Animals – A literature review				

SUMMARY OF RESEARCH OF NOISE EFFECTS ON ANIMALS

A1 Introduction

The Effect of Noise on Wildlife: A Literature Review by A.L. Radle (1998) concludes "most researchers agree that noise can affect an animal's physiology and behaviour". However, a recent study by Warren et al (2006) points out that there is a "surprising dearth of research on the behavioural responses of animals to altered acoustic environments". One aspect of noise effects on animals which has been documented reasonably well is that noise has the greatest effect on wildlife which rely heavily on auditory signals for survival.

A2 Livestock

Cattle

The Memphis State University (1971) found that noise has little impact on livestock, and that there are no long term effects on either milk or meat production. The US Environmental Protection Agency reported in the same year that large livestock generally adapt well to consistent noise. Later research by Beyer (1983) supported the Memphis State University studies finding that during low-altitude flights over livestock, milk production and pregnancies of cows and heifers were not affected. Manci et al (1988) reports on studies which show that livestock are not affected by "normal" levels of noise—below about 80-90 dBA.

Our experience, and the report by Manci et al (1988), suggests that the only possible causes of disturbance for animals will be impulsive type noises such as blasting and pile driving. To ensure that any such effects of these activities are minimised, we recommend that noise levels are reduced to the criteria suggested for human exposure.

Horses

A case study by Huybregts from Marshall Day Acoustics observes that horses in stables exposed to $L_{Aeq,15min}$ of 54-70 dB generally show little response to music noise unless the noise is particularly impulsive. A noise criterion of 65 dB L_{Aeq} is recommended by Huybregts (2008). Le Blanc et al (1991) found that birth success of pregnant mares was not affected by F-14 jet aircraft noise. While the 'fright-flight' reaction was initially observed, the mares did adapt to the noise.

Race horses are known for being high-strung. However, Marshall Day Acoustics have observed horses grazing in paddocks directly under the main approach path of the Christchurch International Airport where noise levels are in excess of 90 dB (L_{Amax}) during an aircraft flyover. Although these horses are arguably "used to" the noise, there was generally little recognition by them of an aircraft passing, let alone any sign of disturbance. This tends to support the conclusions by Le Blanc et al (1991).

From the above information, we recommend a noise level criteria suggested for human exposure.

Poultry

A study by the U.S. Air Force 1994a suggested that the birds adapt fairly quickly to noise. Egg productivity was not badly affected by infrequent noise bursts, even at exposure levels as high as 120 to 130 dBA.

Pigs

Studies using simulated aircraft noise at levels of 100 dB to 135 dB found only minor effects on food intake, weight gain, and reproduction rates. Also, no injuries of inner ear changes were observed (Manci et al 1988; Gladwin et al 1988).

A3 Birds

In some respects, birds show that they are more adaptable to noise than humans. As an example, most bird scaring guns need to operate at random time intervals to avoid having birds perching on them between blasts. This is supported by a study by Pater et al (1999) on the response of woodpeckers to military training noise events such as artillery, small arms, helicopters and manoeuvre noise. The woodpeckers were observed to successfully adjust to these events.

The studies reported by Manci et al (1988) show that noise at levels around the human exposure criteria is extremely unlikely to cause startle or similar effects in birds, with blasting and pile driving the only likely causes of disturbance.

In 1995 and 1997, Marshall Day Associates studied the impact of noise on birds for the Avalon Air Shows at Avalon Airport near Geelong, Victoria. These studies found that the impact of noise on birds consisted primarily with the startle response following the initial transient signal, but a habituation to noise developed after continuous exposure to steady levels of noise.

The Avalon study indicated that for fixed wing aircraft and helicopters the chance of a response resulting in bird flight is rapidly increased when the maximum noise level exceeds 80 dBA. There was a 100% chance of flight when Lmax exceeded 90 dBA. Below 80 dBA there is a reduced chance of flight and with some degree of disturbance, such as looking or a break in feeding pattern, evident with noise levels as low as 60 dBA.

Dooling and Popper (2007) note that physical damage to birds' ears occur for single blasts of 140 dBA and 125 dBA for multiple blasts (both assumed to be L_{AFmax}, sound level descriptor not provided in study). The study also notes that birds' ears can suffer physical damage at continuous (>72 hours) exposure to noise above 110 dBA.

A4 Marine Wildlife

Fish

Fish do startle in response to low-flying aircraft noise. However they have been found to adapt to the sound of over flights (Gladwin, et al. 1988). EPCB guidelines state the threshold for behavioural response in fish is 120 dB ref 1 µPa. Other research has recommended a sound pressure level limit of 150 dB ref 1 µPa to ensure 'no harm' to fish (Hastings 1990).

A5 Reptiles

Researchers have summarised a few studies of reptile response to noise (Duflour 1980 and Manci, et al. 1988) under laboratory conditions. Following exposure to 95 dB for several minutes, these reptiles experienced at least temporary threshold shifts or hearing loss.

A6 Summary

Once animals become habituated to noise, especially when it is steady and associated with clearly non-threatening activity, they suffer very little adverse response.

It is therefore considered that noise levels up to 60 dBA do not result in negative or adverse response to impacted animals or livestock. Noise levels up to 80 dBA generate startle responses in birds and animals, and noise levels in excess of 90 dBA may cause negative impact. The response of birds, animals and livestock to noise will also depend on the character and duration of the sound and observations suggest that steady broad band noise will create less negative response than transient, intermittent, tonal sounds.

Loud, impulsive sounds such as blasting can damage birds' ears if exposed to multiple events above 125 dBA.

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