Discussion On Noise And Its Impact On Birds

Frank Babic[*1]
[1]Amec Foster Wheeler, Mississauga, Ontario, Canada.

1 Introduction

Birds usually perceive humans as potential predators and may leave their nests in response to being approached, or abort nesting because of stressful situations. There is a negative relationship between the human disturbance (both type and magnitude) experienced by a nesting bird or colony and its breeding success. Human generated noise, from construction, traffic or industry, is one type disturbance that needs to be addressed and regulated to ensure breeding success of nesting birds.

2 Environment Canada guidance

Environment and Climate Change Canada (ECCC) has a noise criteria related to birds [1]. This is specific to land birds; as a separate guideline [2] for noise impact was developed for sea and water birds. ECCC has identified the following noise criteria for assessing impact to land birds: disturbance to birds associated with noise when noise is either 10dB above ambient OR greater than 50dB. ECCC caveats this as advice only, is general information and is not official advice concerning legality of any specific activity. However, for the purpose of environmental assessment for noise impact related to birds, this has been adopted for review and approval purposes such that noise experts may be required to monitor and predict noise levels, and wildlife experts to provide assessment of ambient and predicted noise levels with respect to these criteria.

3 ECCC criteria review

The ECCC based the development of the 50 dB / 10 dB above ambient criteria for noise impact based on references [3 - 6], and [10]. Highlights of these references as related to the ECCC criteria include : impact for traffic noise based on the Moerkerken & Middendorp [7] traffic noise model, using an LAeq24 noise level [3] ; reference is at 0.5m above the ground surface [3] ; noise level investigated ranged from 59 +/- 6 dBA to 38 +/- 5 dBA [3] ; threshold value (note: Threshold is taken at a noise level where 1% of the bird population leaves an area) of 47 dBA for all species combined and 42 dBA for the black-tailed godwit [3] ; for songbird breeding and migration habitat, from April 1st through June 30th, reduce noise levels to 49 dBA or less within breeding habitat of songbirds to minimize the effects of continuous noise on species that rely on aural cues for successful breeding [4] ; to avoid disrupting auditory displays and nesting at occupied leks (note: a lek is an aggregation of male animals gathered to engage in competitive displays, lekking, that may entice visiting females which are surveying prospective partners for copulation. Leks are commonly formed before or during the breeding season), from March 15 through May 15, continuous or frequently intermittent noise should not exceed 10 dBA above the natural, ambient noise measured at the perimeter of any occupied sage-grouse lek [4, 5] ; for nesting & early brood-rearing habitats, from March 15 through June 30, sources of continuous or frequent intermittent noise should not exceed 10 dBA above natural ambient or background noises measured in any suitable nesting or broodrearing habitat within 2 miles of an occupied lek, or within identified nesting and brood-rearing habitats outside the 2 mile perimeter [4],[5].

4 Supplemental literature review

Supplemental reference [8] identified noise disturbance of meadow birds from railway noise, with the following items of note:

- Standard Dutch noise calculation scheme (not referenced) used for prediction of noise, using the LAeq24 assessment at 1m above ground
- Other noise metrics were reviewed (peak noise level) but correlation to disturbance did not improve
- Noted that threshold values varied little between species, though the uncertainty could be large (30-57 dBA for black-tailed godwit)
- Noted that for black-tailed godwit, area loss of between 16-23% of total area within 45 dBA of rail noise contour
- Threshold noise levels : Garganey 49 dBA ; Black-tailed godwit 45 dBA; Skylark 42 dBA; All Meadow Birds 44 dBA; All waders 45 dBA

Caltrans [9] developed interim compliance guidelines (presented in Figure 1 and Table 1). They have defined four Zones of Concern to address potential affects including behavioural and/or physiological effects, damage to hearing from acoustic overexposure and masking communication signals and other biologically relevant sounds:

a) Zone 1: Bird is close to noise source such as traffic and construction noise
b) Zone 2: Bird is at greater distance from the roadway, where hearing loss and permeant threshold shift are unlikely to occur
c) Zone 3: Bird is at even greater distance, where spectrum level is still at or above the natural ambient noise level, masking of communication signals from this added noise may occur.

[*]frank.babic@amecfw.com

d) Zone 4: Noise falls below ambient noise level in critical frequencies of communication (2-8kHz), masking is no longer an issue. However, faintly heard sounds such as low rumble of trucks or alarm, may lead to a chronic state of increased arousal, and thus, lead to other behavior and/or psychological effects

e) Beyond Zone 4: Energy in traffic and construction noise at all frequencies is completely inaudible (falls below the level of the ambient noise). Birds cannot hear this noise and thus, the noise has no effects of any kind on the bird.

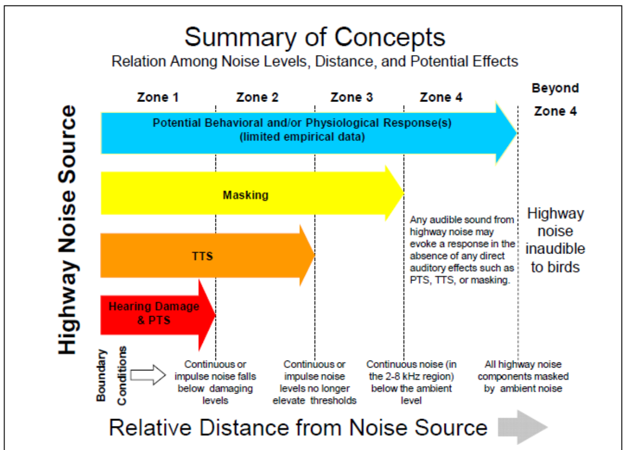

Figure ES2. Effects of Traffic and Construction Noise on Birds
Categories of traffic and construction noise effects on birds with distance from the source. Zone 1 is closest to the source while Zone 4 is farthest away. Sound level decreases farther from the source. See text for discussion.

Figure 1: Caltrans zones of concern for bird noise impact [9]

Table 1: Caltrans interim noise guidelines for potential effects on birds [9]

Table ES1. Recommended Interim Guidelines for Potential Effects from Different Noise Sources

Noise Source Type	Hearing Damage	TTS	Masking	Potential Behavioral/ Physiological Effects
Single Impulse (e.g., starter's pistol 6" from the ear	140 dBA[1]	NA[3]	NA[5]	Any audible component of traffic and construction noise has the potential of causing behavioral and/or physiological effects independent of any direct effects on the auditory system of PTS, TTS, or masking
Multiple Impulse (e.g., jack hammer, pile driver)	125 dBA[1]	NA[3]	Ambient dBA[6]	
Non-Strike Continuos (e.g., construction noise)	None[2]	93 dBA[4]	Ambient dBA[6]	
Traffic and Construction	None[2]	93 dBA[4]	Ambient dBA[6]	
Alarms (97 dB/100 ft)	None[2]	NA[2]	NA[7]	

TTS = temporary threshold shift
dBA = A-weighted decibel
PTS =permanent threshold shift
[1] Estimates based on bird data from Hashino et al. (1988) and other impulse noise exposure studies in small mammals.
[2] Noise levels from these sources do not reach levels capable of causing auditory damage and/or permanent threshold shift based on empirical data on hearing loss in birds from the laboratory.
[3] No data available on TTS in birds caused by impulsive sounds.
[4] Estimates based on study of TTS by continuous noise in the budgerigar and similar studies in small mammals.
[5] Cannot have masking to a single impulse.
[6] Conservative estimate based on addition of two uncorrelated noises. Above ambient noise levels, critical ratio data from 14 bird species, well-documented short-term behavioral adaptation strategies, and a background of ambient noise typical of a quiet suburban area would suggest noise guidelines in the range of 50–60 dBA.
[7] Alarms are non-continuous and, therefore, unlikely to cause masking effects.

5 Conclusion

For compliance with the ECCC guideline of 50 dB and 10dB above ambient for nesting birds: 1) a 50 dBA, LA24hreq criteria should be adopted, compliant with previous research methodology; 2) calculation of a 10 dB ambient increase should be considered on the basis of a LA24eq criteria, compliant with previous research methodology. Further, threshold ranges can be lower than 50 dBA for some bird species, and these threshold ranges, based on research from the black-tailed godwit, could have a wide range of impact (30 – 57 dBA). Because of these uncertainties, the 50 dBA criteria should be considered a potential threshold limit, to trigger investigation into the specific species impact and field investigation of impact on the local bird population. Also, the time of year (March 15 through June 30), should be considered with respect to the noise impact period. Further consideration should include noise assessment with respect to avian loudness contours.

For the purpose of environmental impact assessment of noise on birds, and further to the ECCC impact, adoption of the CALTRANS technical guidance document can be considered. This includes assessment of bird impact based on Zones (1-4) with respect to Classes of Potential Effects: Behavioural and/or physiological effects; Damage to hearing from acoustic overexposure; Masking of communication signals and other biologically relevant sounds.

References

[1] Environment Canada. Risk Factors for Migratory Birds, https://www.ec.gc.ca/paom-tmb/default.asp?lang=En&n=8D910CAC-1

[2] Environment Canada. Guidelines to Avoid Disturbance to Seabird and Waterbird Colonies in Canada. https://www.ec.gc.ca/paom-tmb/default.asp?lang=En&n=E3167D46-1

[3] Reijnen, R., R. Foppen, and H. Meeuwsen. 1996. The effects of traffic on the density of breeding birds in Dutch agricultural grasslands. Biological Conservation 75: 255-260.

[4] Ingelfinger, F. M. 2001. The effects of natural gas development on sagebrush steppe passerines in Sublette County, Wyoming. M.S. Thesis, University of Wyoming, Laramie, Wyoming.

[5] Nicholoff, S.H. 2003. Wyoming Bird conservation Plan, Version 2. Wyoming Partners in Flight. Wyoming Game and Fish Department, Lander, Wyoming.

[6] Wyoming Game and Fish Dept. 2009. Recommendations for development of oil and gas resources within important wildlife habitats. Wyoming Game and Fish Department. Cheyenne, Wyoming, USA

[7] Moerkerken, A & Middendorp, A. G. M (1981) *Berekening van wegverkeersgeluid*, Staatsuitgeverji, 's-Gravenhauge.

[8] E. Waterman, I. Tulp, R. Reijnen, K. Kirjgsveld, C. ter Braak, Noise Disturbance of Meadow Birds by Railway Noise, Internoise 2004

[9] California Department of Transportation Division of Environmental Analysis (CALTRANS), Technical Guidance for Assessment and Mitigation of the Effect of Traffic Noise and Road Construction Noise on Birds, June 2016

[10] Environment Canada. Petroleum Industry Activity Guidelines for Wildlife Species at Risk in the Prairie and Northern Region. Canadian Wildlife Service, Environment Canada, Prairie and Northern Region, Edmonton Alberta. 2009 (Updated 2011)