



Sandpiper Ecological Surveys

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Biodiversity Survey

Project Management

Impact Assessment

Ecological Monitoring

Specialist Surveys

Nicola Fraser
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Dear Nicola,

RE: Year 1 monitoring of microbat culverts and associated roost boxes at Woolgoolga to Halfway Creek (Section 1) Pacific Highway Upgrade.

Background

Sandpiper Ecological was contracted by OHLY JV to conduct construction phase quarterly monitoring of microbat excluded culverts and microbat roost boxes in accordance with the Microbat Management Plan (MMP) for Section 1 of the Woolgoolga to Ballina Pacific Highway Upgrade (Geolink 2014). The agreed scope of works, as detailed in the proposal submitted to NSW Roads and Maritime Services (RMS) and OHLY JV 13 November 2015 (Sandpiper 2015), included:

1. Inspection of microbat excluded drainage structures #46 (high conservation habitat value twin cell RCBC) and #49 (medium conservation habitat value single cell RCBC) following significant rainfall events or quarterly if no significant rainfall events for persistence of exclusion devices and use by microbats;
2. Quarterly inspection of non-excluded drainage structures #66 (high conservation habitat value triple cell RCBC) and #67 (medium conservation habitat value single cell RCP) for use by microbats;
3. Quarterly inspection of microbat roost boxes (n = 11) installed adjacent excluded drainage structures #46 and #49 for use by microbats.
4. Annual report submitted to OHLY JV and Roads and Maritime Services.

Following is a summary of methods, results and a brief discussion of year one (four quarterly inspections) construction phase monitoring.

Methods

Excluded drainage structures (impact sites), non-excluded drainage structures (control sites) and microbat roost boxes (11 boxes at the two excluded drainage structures) were inspected for microbats and exclusion material persistence quarterly by two ecologists. Inspections were conducted on foot with the aid of hand-held torches. To avoid disturbing bats roosting in boxes, individuals were not removed unless necessary for identification. Forest-dwelling long-eared bats (*Nyctophilus* spp.) were, therefore, identified to genus only.

Inspections occurred on 18 February 2016 (summer), 17 May 2016 (autumn), 11 & 22 August 2016 (winter) and 18 October 2016 (spring). Due to high levels of inundation, drainage structure #46 (winter) and #49 (summer & winter) were inspected from cell entrances and not entered.

Results

Excluded Drainage structures

Microbats were detected on only one occasion during inspection of excluded drainage structures (Table 1). A single little bentwing bat (*Miniopterus australis*) was recorded during the autumn inspection, roosting within a 150mm wide/350mm deep gap in the obvert between the end unit and outlet headwall of culvert #46. The emergent gap at this juncture was presumably a consequence of recent construction activity. Minor, old microbat scat piles were evident below excluded cell joints during spring, suggesting some limited roosting activity occurred there during winter. Culvert #49 did not feature any microbats but did feature moderate scat piles below excluded joints during autumn. Inspections during summer (culvert #49) and winter (culvert #46 & #49) were conducted from entrances. Signs of microbat presence (e.g. chattering, flying) were not evident during the inspection.

Exclusion material was largely retained in place during the inspection period and reinstalled on occasions where some detachment had occurred. Some remedial filling of an emergent gap between the headwall and end unit of the inlet and outlet of structure #46 was conducted during autumn and spring inspections. Whereas culvert #46 remained open during construction, the outlet of culvert #49 was blocked off prior to autumn inspection and at the inlet prior to the spring inspection (Plate 1 & 2). A temporary 750mm drainage pipe extended through the outlet blockage during this period. At the time of the spring inspection, new culverts had been constructed on the east and west side of #46 and the west side of #49 and construction was almost complete.



Plate 1: Western view of culvert #46 (Boney's Creek) at the time of exclusion (20/5/2015) (left) and 12 months later during construction of the new culvert (17/5/2016) (right).



Plate 2: Western view of culvert #49 at the time of exclusion (20/5/2015) (left) and 12 months later during construction of the new culvert (17/5/2016) (right).

Table 1: Results of quarterly inspections of microbat excluded drainage structures (impact sites) during year one construction phase monitoring. LBw = Little Bentwing bat.

Structure (W x Ht x L (m))	Inspection Season (Date)	Evidence of use	Species/no./breeding	Water present	Exclusion Devices	Notes
Impact #46 @ ch.13310 (2x RCBC: 3 x 3 x 18)	Summer (18/2/2016)	Nil	Nil	Nil	In place; headwall separating from end unit @ outlet & inlet creating 60mm gap; remedial filling	Creek bed level now ~1m below culvert floor;
	Autumn (17/5/2016)	No scats	LBw x1 @ outlet of old N cell in 150mm wide/350mm deep gap in obvert b/t end unit & headwall;	Old cells: muddy; New cells: E=700mm water; W=dry	In place; headwall separating from outlet end unit creating up to 150mm gap; unable to replace foam	New E & W culverts partly constructed; 10-30mm expansion joints in new cells (potential roost habitat)
	Winter (11 & 22/8/2016)	NA	No chattering or flying evident within culvert	+1100mm water @ outlet and inlet	NA	New E & W culverts mostly constructed; did not enter water (viewed from entrances); old cells partially blocked by construction material;
	Spring (18/10/2016)	Old scats under excluded jts in old S cell	Nil	Old cells muddy; New cells: E=700mm water; W=500-1000 mm	Foam detached from 10mm joint gap @ inlet end; end unit & headwall at inlet & outlet opening up ~200mm gap; foam rod placed in gap	New E & W culverts mostly constructed; open passageway through old & new culverts
Impact #49 @ ch.13850 (1x RCBC: 2.4 x 2.1 x 15)	Summer (18/2/2016)	Nil	No chattering or flying evident within culvert	+900mm water	In place	Did not enter water (viewed from entrances); outlet blocked except for temporary 750mm pipe
	Autumn (17/5/2016)	Old=mod scat piles below 3 joints; New=nil	Nil	Old=Muddy; new=dry	In place	Old cell outlet blocked; New W cell partly constructed
	Winter (11 & 22/8/2016)	NA	No chattering or flying evident within culvert	+900mm water @ outlet & inlet	NA	Old cell outlet blocked; New W cell partly constructed; did not enter (viewed from W end)
	Spring (18/10/2016)	New: covered in thick wet mud	Nil	thick mud	NA	Old cell outlet/inlet blocked; 750mm pipe projecting from outlet through batter at Service Rd; New W cell partly constructed & outlet blocked

Non-excluded Drainage structures

Both non-excluded (control) drainage structures featured microbats (Table 2). Triple-cell culvert #66 contained up to 500 little bentwing bats and eastern bentwing bats (*Miniopterus orianae*) during autumn and winter inspections (Plate 3). Drainage structure #67 (1200mm RC pipe) featured a single eastern horseshoe bat (*Rhinolophus megaphyllus*) during summer and autumn. On each occasion the individual was hanging from the obvert near the center of the cell.



Plate 3: Non-excluded triple cell box culvert #66 (left) featured up to 500 little bentwing and eastern bentwing bats during autumn and winter inspections (middle and right).



Plate 4: Non-excluded RC pipe #67 featured a single eastern horseshoe bat during summer and autumn (left). Approximately 400mm of water flowed through the pipe during winter (right).

Table 2: Results of quarterly inspections of non-excluded drainage structures (control sites) during year one construction phase monitoring. LBw = Little Bentwing bat; EBw = Eastern Bentwing bat; EH = Eastern Horseshoe bat; W = width; D = depth

Structure (W x Ht x L (m))	Inspection Season (Date)	Evidence of use	Species/no./breeding	Water present	Exclusion Devices	Notes
Control #66 @ ch.15950 (3x RCBC: 3.3 x 2.4 x 41)	Summer (2/3/2016)	Old & recent scats below inner joints all 3 cells; 10-18mm gaps with scats/scuff	LBw x1 on wall of Sth cell in centre; EH hanging from obvert in 300mm diam. side pipe	Nil; sand damp	Na	
	Autumn (17/5/2016)	Mod-heavy scat piles	LBw in 3 cells; N=300+ in joints 12-20mm W x 150-200mm D & clusters on joints; Mid=200-300 in 12-15 W x 150-200 D & clusters on joints; S=5 in 15x200 joint E end; EH x1 in S pipe	Floor moist; creek dry	NA	Centre of cells=20.6-22.8 degC/81-88% humidity; Outside entrance = 25.5 degC/55%
	Winter (11 & 22/8/2016)	Mod-heavy scat piles	Sth=5x LBw; Mid=98 LBw/EBw (2/3 in cell joints, 1/3 in clusters on wall); Nth=285 LBw/EBw (2/3 in cell joints, 1/3 in clusters on wall)	S=wet sand; Mid=30mm flowing water; N=10mm water	NA	
	Spring (18/10/2016)	Mod scat piles	LBw x3 on wall of S cell; N & M=nil	Floor moist in Mid, S & N dry; creek low flow	NA	
Control #67 @ ch.16000 (1x RCP: 1.2 x 40)	Summer (2/3/2016)	Some scats mostly below drain holes & joins	EH hanging from obvert west end	Nil	Na	Joint gaps: 20-50mm
	Autumn (17/5/2016)	Some scats mostly below drain holes & joins	EH hanging from obvert west end	Nil; creek dry	Na	
	Winter (11 & 22/8/2016)	Nil bats hanging from obvert	NA	+400mm flowing water; did not enter	NA	NA
	Spring (18/10/2016)	Some scats mostly below drain holes & joins	Nil	Nil; creek 300mm deep	Na	

Roosting Boxes

Microbats were detected during winter within two roosting boxes on the east side of drainage structure #46, Boney's Creek (Plate 4). Both boxes featured long-eared bats (probably Gould's long-eared bat *Nyctophilus gouldii*) with a total of six individuals recorded. No evidence of breeding was recorded.

Roosting boxes were mostly in good condition though some minor deterioration was evident. At the time of the final spring inspection, each of the three roost box sites featured one box displaying minor delamination of the ply side walls.



Plate 4: Microbat roost boxes on the east side of structure #46 at Boney's Creek (left) featured long-eared bats (probably Gould's long-eared bat *Nyctophilus gouldii*) during the winter inspection (right).

Table 3: Results of quarterly inspections microbat roost boxes adjacent excluded culvert structures #46 (Boney's Creek) and #49.

Box Location (number)	Summer (18/2/2016)		Autumn (17/5/2016)		Winter (11/8/2016)		Spring (18/10/2016)	
	Species/evidence	Box Condition	Species/evidence	Box Condition	Species/evidence	Box Condition	Species/evidence	Box Condition
#46 East (n = 4)	Nil	3 good, 1 minor deterioration	Peron's tree frog x1	3 good, 1 minor deterioration	Nyctophilus sp. x1; Nyctophilus sp. x5; Peron's tree frog x1	3 good, 1 minor deterioration	Peron's tree frog x1	3 good, 1 minor deterioration
#46 West (n = 5)	Nil	5 good	Nil	5 good	Peron's tree frog x1	4x good; 1x minor deterioration	Peron's tree frog x1	4 good; 1 minor deterioration
#49 west (n = 2)	Nil	2 good	Nil	2 good	Nil	2 good	Nil	1 good; 1 minor deterioration

Discussion

Seasonal inspections of excluded and non-excluded drainage structures along the W2HC Pacific Highway upgrade during 2016 have confirmed the effectiveness of exclusion measures in preventing microbat roost re-establishment. At the time of roost exclusion in May 2015, up to 110 little bentwing bats were roosting in drainage structure #49 (medium conservation habitat value) and up to 10 little bentwing bats were roosting in structure #46 (high conservation habitat value). Moreover, 478 little bentwing bats were recorded within structure #46 and large guano piles reported within structure #49 in July 2014 (Geolink 2014). During the four inspections carried out in

2016 only a single little bentwing bat was detected roosting within either excluded culvert. This individual was observed roosting within a crevice that developed during construction. Individuals may have been present during the winter inspection when, due to levels of water inundation, culverts were not entered. However, no chattering or flying was detected from culvert entrances suggesting that if microbats were present there were very few individuals. Importantly, the continued effectiveness of the roost exclusion is largely contingent on maintaining the existing exclusion material and minimising roosting habitat if/when it emerges during construction. For example, separation of the headwall from end unit at culvert #46 may require further exclusion management. A decision on this will be made after the summer 2016 inspection, in consultation with OHLY.

The effectiveness of the exclusion measures is further supported by the continued use of control drainage structures located approximately 2km north of excluded structures. Drainage structure #66 in particular, which is rated high conservation habitat value, featured roosting colonies of up to 500 individuals during autumn and winter. Structure #66 reportedly featured 111 little bentwing bats during July 2014 surveys (Geolink 2014). It is likely that some or even many of the little bentwing bats formerly using excluded structures #46 and #49 during 2014 and 2015 took up residence in #66 during 2016. This likelihood reinforces the importance of ensuring there are alternative nearby roosts to high conservation value roosts that are excluded.

Monitoring of the compensatory roost boxes installed adjacent excluded culverts #46 and #49 revealed use by long-eared bats, most likely Gould's long-eared bat. Long-eared bats are largely forest dwelling and known to use timber roosting boxes. They are not known to use concrete structures or caves and have not been recorded using road culverts. The two species of microbat recorded roosting in the excluded culverts - little bentwing bat and eastern bentwing bat - are both obligate cave roosting species that regularly utilise artificial structures, such as culverts, bridges, mines and tunnels (Van Dyck *et al.* 2013). To our knowledge, neither species has been recorded using timber or masonry roost boxes. Timber roost boxes targeting these species, therefore, offer very little in the form of roost compensation. Despite this, they may provide potential roosting habitat when installed within the culvert structure, as is proposed in the MMP (Geolink 2014). The MMP and Addendum (RMS 2016) further describes several habitat design features and culvert enhancements that are to be incorporated into structures replacing #46 and #49. It is our understanding that Pacific Complete will implement these roost enhancements.

References

- Geolink (2014). *Woolgoolga to Glenugie Pacific Highway Upgrade: Microbat management plan, sections 1 and 2*. Prepared for NSW Roads and Maritime Services.
- NSW Roads and Maritime Services (2016). *Addendum 1 - Woolgoolga to Glenugie Pacific Highway Upgrade Microbat Management Plan Sections 1 and 2 – Clarifications and Proposed Minor Changes to Microbat Management Plan*.
- Van Dyke, S., Gynther, I. & Baker, A. (2013). *Field companion to the mammals of Australia*. New Holland, Sydney.

Yours sincerely,



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