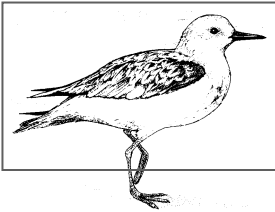


Microbat Culvert - Box Monitoring

2017 Annual Report

Pacific Highway Upgrade: Woolgoolga to Ballina

Section 1 – Construction Phase (Year 2)



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Impact Assessment

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26 February 2018

Dear Nicola,

RE: Year 2 construction phase 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 dated 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 to 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 two (four quarterly inspections) construction phase monitoring.

Methods

Two ecologists conducted quarterly inspections of excluded drainage structures (impact sites), non-excluded drainage structures (control sites) and microbat roost boxes (11 boxes at the two excluded drainage structures) for microbats and exclusion material persistence. 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 27 January 2017 (summer 2017) 2 May 2017 (autumn), 7 August 2017 (winter), 26 October 2017 (spring), and an additional summer inspection was carried out on 30 January 2018 (summer). Due to the presence of deep water, drainage structure #49 was not inspected during the autumn survey and drainage structure #46 was not inspected during the summer 2018 survey.

Results

Excluded Drainage structures

Microbats were detected on two occasions during inspection of excluded drainage structures (Table 1). A single eastern bent-wing bat was recorded in culvert structure #46 (Boney's Creek) in summer 2017. Culvert #46 was completed between the autumn and winter inspections and exclusion material removed/made redundant when old structures were demolished. Approximately 307 little bent-wing bats (*Miniopterus australis*) and 30 Eastern bent-wing bats (*Miniopterus schreibersii oceanensis*) were recorded roosting in the new structure during the winter inspection.

Sixty-one of these bats were recorded roosting in a single culvert join in the north cell and the remaining 276 individuals were roosting in five joins in the southern cell. Viable roosting joins between cell pieces ranged from 12mm to 50mm in width and approximately 350mm deep.

Of the four inspections on the nine bat boxes located in adjacent habitat at structure #46 (Boney's Creek), one long-eared bat (*Nyctophilus spp.*) was recorded in one box on the eastern side of the culvert during the spring inspection.

One little bent-wing bat was recorded roosting in culvert #49 in the winter survey whilst construction of the eastern half of the culvert was ongoing. Between the autumn and winter surveys, culvert cells had been placed but cell joins were still open to the sky and material was still to be placed over the culvert. Works on the culvert were complete by the spring inspection but no bats were recorded. No bats were recorded in either of the boxes located on the western side of structure #49 during any of the four surveys.



Plate 1: Western view of culvert #46 (Boney's Creek) during construction of the new culvert (17/5/2016) (L) and the same view of the completed culvert during the spring survey (26/10/17) (R).



Plate 2: Western view of culvert #49 whilst under construction during autumn inspection (17/5/2017) (L) and 5 months later the complete culvert (26/10/17) (R)

Table 1: Results of year two construction phase quarterly inspections of microbat excluded drainage structures (impact sites). LBw = Little Bent-wing bat. Ebw = Eastern Bent-wing 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 (27/1/17)	Nil	EBw x 1	1000-1500mm	Four joins need exclusion material replaced.	Bat appeared unwell (shaking and covered in mites).
	Autumn (2/5/17)	Nil	Nil	<100mm	New exclusion material installed immediately after inspection.	Minor corrective action with exclusion material requested and completed.
	Winter (7/8/17)	Scats below joins	LBw x 307 (approx.) EBw x 30 (approx.)	200-400mm	Exclusion material removed after completion of culvert.	All bats roosting in northern cell (71) in one join. Remaining bats in southern cell roosting in 5-7 joins.
	Spring 26/10/17	Nil	Nil	1300-1600mm	N/A – not installed in new culvert.	Limited access due to water inundation. Old scats washed away.
	Summer (30/1/2017)	N/A	N/A	>1800mm	N/A - not installed in new culvert.	Water too deep to check.
Impact #49 @ ch.13850 (1x RCBC: 2.4 x 2.1 x 15)	Summer (27/1/17)	Nil	Nil	300mm	N/A – Not installed in new culvert	Signs of extensive flooding (2+m) as eastern side is sealed off by 200mm of mud. Old welcome swallow nest. Numerous <i>Lit. latopalmata</i> tadpoles and froglets.
	Autumn (2/5/17)	N/A	N/A	1600-1700mm	N/A - Not installed in new culvert.	Water too deep to check. Water is blocked up as eastern side is sealed off.
	Winter (7/8/17)	Nil	LBw x 1	Ground damp but not pooling or flowing.	N/A - Not installed in new culvert.	New culvert complete but joins not sealed. New eastern half of culvert has roosting opportunities once sealed.
	Spring 26/10/17	Nil	Nil	Ground damp but not pooling or flowing.	N/A - Not installed in new culvert.	Fresh welcome swallow nest at western entrance.
	Summer (30/1/2017)	Nil	Nil	5mm running through centre.	N/A - Not installed in new culvert.	Welcome swallow nest still active.

Non-excluded Drainage structures

Both non-excluded (control) drainage structures featured microbats (Table 2).

Triple-cell culvert #66 contained 85 little bent-wing bats and two eastern horseshoe bats (*Rhinolophus megaphyllus*) during the autumn inspection and approximately 420 little bent-wing bats, five eastern bent-wing bats and two eastern horseshoe bats were recorded during the winter inspection (Plate 3). No bats were recorded during the spring survey and three eastern horseshoe bats were present during the summer survey. Old scats were evident on the culvert floor during all but the autumn survey.

Drainage structure #67 (1200mm RC pipe) featured two Eastern horseshoe bats roosting during the summer survey and no bats on the remaining three inspections. Both individuals were hanging from the obvert near the center of the cell. Vegetation and mesh fencing obscure the entrances to this pipe.



Plate 3: The middle cell of the non-excluded triple cell box culvert #66 (L). The culvert featured approximately 505 little bent-wing and five Eastern bent-wing bats during autumn and winter inspections (R).



Plate 4: Non-excluded RC pipe #67 featured two eastern horseshoe bats at the summer inspection (L). Approximately 50-300mm of water flowed through the pipe during winter (R).

Table 2: Results of quarterly construction phase inspections of non-excluded drainage structures (control sites). LBw = Little bent-wing bat; EBw = Eastern bent-wing bat; EH = Eastern horseshoe bat.

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 (27/1/17)	Old scat piles.	Nil	Ground damp	N/A	
	Autumn (2/5/17)	Nil	LBw x 85 EH x 2	200mm in central cell	N/A	Several small groups of little bent-wings roosting in clusters outside joints; horseshoe bats in side pipe.
	Winter (7/8/17)	Scat piles, wear/scuffing on ceiling.	LBw x 420 EBw x 5 EH x 2	100mm in central cell	N/A	Most bats roosting in joins. Numbers are approximate.
	Spring 26/10/17	Scat piles, wear/scuffing on ceiling.	Nil	50mm in central cell	N/A	
	Summer (30/1/2017)	Old scat piles	EH x 3	10mm in central cell	N/A	Fresh pig (<i>Sus sp.</i>) tracks and diggings.
Control #67 @ ch.16000 (1x RCP: 1.2 x 40)	Summer (27/1/17)	Few scats under three scuppers.	Nil	Nil	N/A	
	Autumn (2/5/17)	Nil	Nil	100-300mm	N/A	Joint gaps: 20-50mm. Mesh fencing and vegetation obscures flyway at both ends, limited entry.
	Winter (7/8/17)	Nil	Nil	50-300mm	N/A	Two Scincidae sp. present in joins, one bleating tree frog (<i>Litoria dentata</i>). Mesh fencing and vegetation obscures flyway at both ends, limited entry.
	Spring 26/10/17	Nil	Nil	Nil	N/A	Mesh fencing and vegetation obscures flyway at both ends, limited entry.
	Summer (30/1/2017)	Some scats mostly below drain holes & joins	EH x 2	Nil	N/A	Mesh fencing and vegetation obscures flyway at both ends, limited entry.

Roosting Boxes

Three Gould’s long-eared bats (*Nyctophilus gouldi*) were recorded in two boxes during the summer 2017 inspection. One microbat was recorded roosting in a box on the east side of drainage structure #46, Boney’s Creek (Plate 4) during the spring inspection. The bat took flight upon inspection but was identified as a long-eared bat (*Nyctophilus spp.*). No bats were recorded in any of the other boxes during seasonal inspections. No evidence of breeding was recorded.

Roosting boxes were mostly in good condition though some minor deterioration was evident. At the time of the last summer inspection all boxes were still functional for their intended purpose.



Plate 4: Microbat roost boxes on the east side of structure #46 at Boney’s Creek. Gould’s long-eared bat recorded in box on west side of Boney’s Creek (R).

Table 3: Results of year two construction phase quarterly inspections microbat roost boxes adjacent excluded culvert structures #46 (Boney’s Creek) and #49. FtG = Feathertail glider spp. Deter. = Deterioration, Cond. = Condition.

Box Location (number)	Summer (27/1/17)		Autumn (2/5/17)		Winter (7/8/17)		Spring (26/10/17)		Summer (30/1/2018)	
	Species/evidence	Box cond.	Species/evidence	Box cond.	Species/evidence	Box cond.	Species/evidence	Box cond.	Species/evidence	Box cond.
#46 East (n = 4)	Nil	3 good, 1 minor deter.	Nil	3 good, 1 minor deter.	Nil. FtG nest in one box.	3 good, 1 minor deter.	<i>Nyctophilus</i> spp. x 1. FtG nest in one box.	3 good, 1 minor deter.	Nil. FtG nest in one box.	3 good, 1 minor deter.
#46 West (n = 5)	<i>N. gouldi</i> x 3	5 good	Nil	5 good	Nil	5 good	Nil	4x good; 1x minor deter.	Nil	4 good; 1 minor deter.
#49 west (n = 2)	Nil	1 good; 1 minor deter.	Nil	1 good; 1 minor deter.	Nil	1 good; 1 minor deter.	Nil	1 good; 1 minor deter.	Nil	1 good; 1 minor deter.

Discussion

During year two of monitoring both culverts were demolished, with demolition completed in autumn 2017. Microbats were observed roosting in the new culverts in winter 2017 with approximately 337 individuals of two species, little and eastern bentwing bats, recorded in culvert #46. These observations serve to further illustrate the effectiveness of roost exclusion. As noted in the year one monitoring report microbats were present at the time of exclusion in May 2015 with up to 110 little bent-wing bats occupying culvert #46 (Sandpiper Ecological 2017). Moreover, 478 little bent-wing bats were recorded within structure #46 and large guano piles reported within structure #49 in July 2014 (Geolink 2014). Results show that bats were utilising the old structures before exclusion, occupation dropped off substantially during roost exclusion and increased once new culverts had been completed and were opened to the flyway.

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 as high conservation habitat value, featured roosting colonies of up to 515 individuals during autumn and winter 2017. This structure supported similar numbers in the same months of 2016 and reportedly featured 111 little bent-wing bats in July 2014 (Geolink 2014). In 2017, numbers show an influx to both culverts with 337 in #46 and approximately 420 in #66 in the winter 2017 survey. Some individuals excluded from culverts #46 and #49 in 2016 may have roosted in #66 and others may have dispersed elsewhere. Some individuals may utilise neighboring structures interchangeably.

Monitoring of the compensatory roost boxes installed adjacent to excluded culverts #46 and #49 revealed low occupation rates by microbats during the 2017 inspections and no occupation by target species. Three Gould's long-eared bats were recorded in the summer 2017 inspections and a single long-eared bat (*Nyctophilus spp.*) was recorded in spring 2017. Long-eared bats are largely forest dwelling and are known to use timber roosting boxes. They are not known to use concrete structures or caves and have not been recorded using road culverts (Churchill 2009). The two species of microbat recorded roosting in the excluded culverts - little bent-wing bat and eastern bent-wing bat, along with southern myotis (*Myotis macropus*) are obligate cave roosting species that regularly utilise artificial structures, such as culverts, bridges, mines and tunnels (Van Dyck *et al.* 2013). To our knowledge, these cave-dwelling species have not been recorded roosting in timber nest boxes located in forest environments. Myotis have been recorded using timber boxes installed beneath bridges and one bent-wing (*Miniopterus spp.*) was recorded roosting in a box installed in a fauna culvert in section 2 of the W2B upgrade (Sandpiper Ecological 2017; Sandpiper Ecological 2013; and Marshall 2011). Results suggest that southern myotis select roosts on the basis of overall structure rather than the type of roosting material present.

Use of timber boxes installed within, or beneath concrete structures show that it is relatively easy and inexpensive to supplement roosting habitat, as proposed in the MMP (Geolink 2014). The MMP and Addendum (RMS 2016) further describes several habitat design features and culvert enhancements that should be incorporated into structures #46 and #49.

Recommendations

Section 3.4.2 of the MMP recommends that bat boxes installed in habitat adjoining culverts be moved into the new drainage structures upon completion of work if those boxes were not being utilised by microbats. Long-eared bats were recorded in two adjacent habitat boxes in 2017. The following recommendations are proposed to comply with the MMP:

- The two adjacent habitat boxes utilised by long-eared bats should remain insitu to provide ongoing habitat for that species.
- The seven remaining bat boxes adjoining culvert #46 and two adjoining culvert #49 should be installed inside the respective culverts. Box distribution should be determined onsite. Boxes would be attached to culvert walls at ceiling level and positioned centrally where roosting conditions are optimal. Boxes would be installed so as to not impede water flow through the structure.
- 200mm wide strips of tiling grout or similar should be applied to the middle third of the obvert of each culvert around each join and roughened with a tiler's trowel or similar tool, as per the MMP.
- Monitoring of structures should be in accordance with the Microbat Management Plan.

If you have any questions regarding the year 2 microbat monitoring program please contact me on the number below.

Yours sincerely,



Dr David Rohweder

Principal Ecologist (david@sandpipereco.com.au | 0401 195 480)

References

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