2009 AERIAL SURVEY OF FERAL HORSES IN THE AUSTRALIAN ALPS

Report prepared for the Australian Alps Liaison Committee

Dr Michelle Dawson

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AUSTRALIAN ALPS NATIONAL PARKS

Summary

The feral horse population in the Australian Alps national parks (AANP), extending from the Australian Capital Territory (ACT), through New South Wales (NSW) and into Victoria, has been monitored using helicopter aerial survey in 2001, 2003 and most recently in 2009. These three surveys have been conducted using standardised methods to enable comparison of populations over time. Aerial surveys followed east-west transects spaced 2km apart across the main areas of the known distribution of horses in the Australian Alps national parks, excluding the Byadbo Wilderness in southern Kosciuszko NP and adjacent areas of the Alpine NP, and the Talbingo Dam area of north-west Kosciuszko NP. The survey only covered national parks, so feral horses in adjacent state forest and crown land were not included. Minor modifications to transects were made for the 2009 survey to account for some known changes in distribution since the previous survey in 2003.

Data from the 2009 survey was analysed using line transect techniques for two observers combined (after Walter & Hone 2003). The 2001 and 2003 surveys used this method, though an alternative method using mark-recapture distance sampling has recently been developed (Laake *et al.* 2008). The estimated size of the population from the 2009 survey is 7679 horses (coefficient of variation 25.4%). This represents an annual increase of 21.65% per annum since the previous estimate in 2003, which is close to the maximum intrinsic rate of increase for horses. If the population continues to grow at this rate it will reach over 13 800 horses by 2012, with a likelihood of increased environmental implications. The feral horse population has also increased its distribution since 2003.

Recommendations arising from this survey include:

- Monitoring of feral horse populations in the AANP continues with a suggested five year frequency. That is, the next monitoring survey be conducted in 2014.
- Re-analyse data for 2003 and 2009 using mark-recapture distance sampling (MRDS) (Laake *et al.* 2008).
- Distribution maps of feral horses in the AANP be updated with the results of this survey and other sources.
- Determine habitat preferences of horses in the AANP and predict areas where horses have the potential to spread to.
- Consider incorporating additional areas of feral horse distribution (including Byadbo, Talbingo, adjacent state forests) into future abundance monitoring.
- Group size estimation should be reviewed before conducting the next survey.
- Helicopter set-up should be reviewed before conducting the next survey.

Introduction

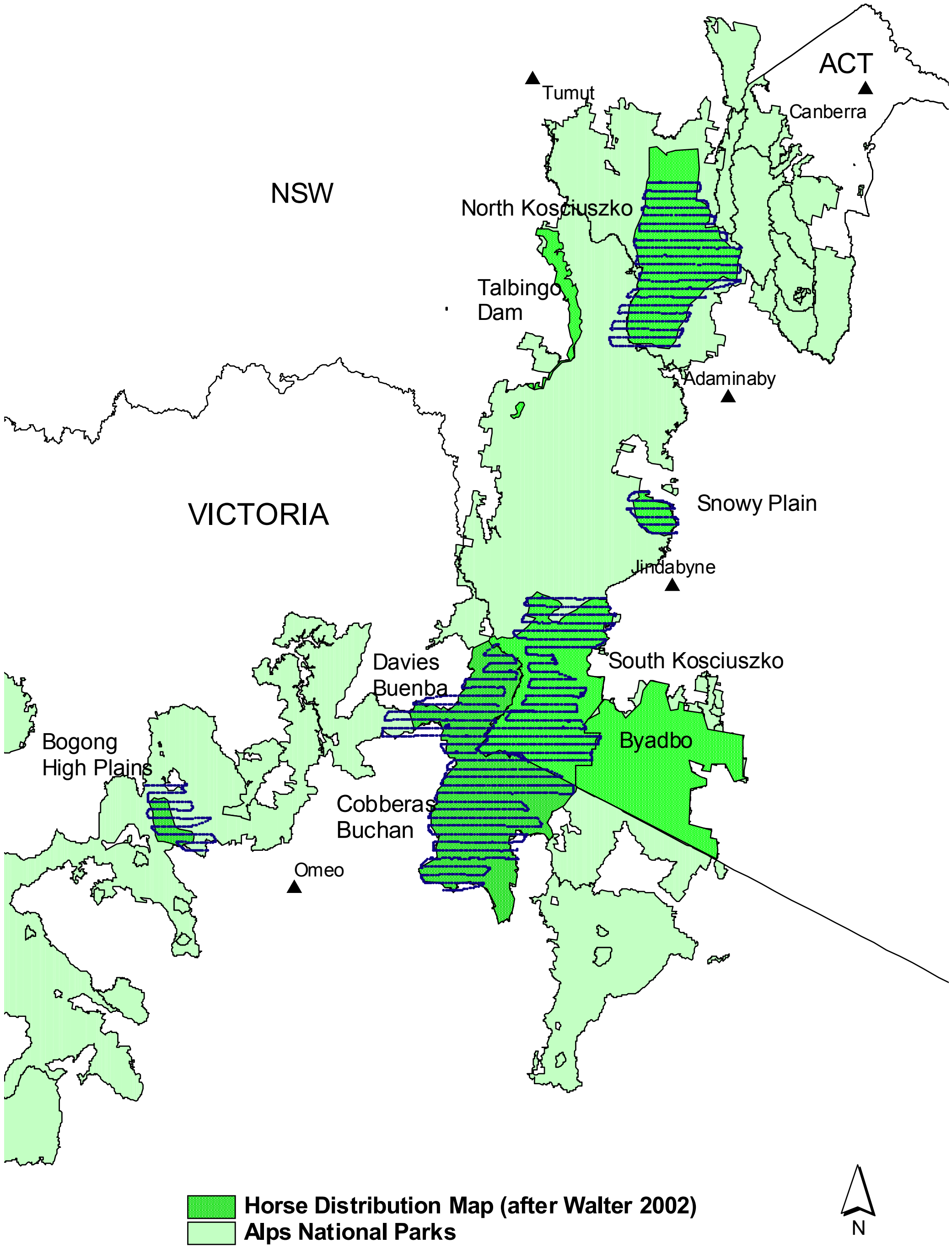
The first aerial survey of the feral horse population in the AANP was undertaken in 2001, resulting in an estimate of 5200 horses (coefficient of variation (CV) = 31.6%) (Walter & Hone 2003). The survey was re-run in 2003, after 71% of the distribution and habitat of the horse population was burnt by wildfire, and the population estimate was 2369 (CV = 33.8%) (Walter 2003). This report presents the findings of the most recent survey carried out in 2009.

Methods

The survey was conducted over 5 days from the 6-10th of April 2009, from a Bell Jet Ranger helicopter with the doors removed, with total flying time of 28 hours. The weather during flights was cold to cool (6- 16˚C), clear to partly cloudy with light winds. The time of year, aircraft and weather conditions are the same as previous surveys.

All surveys (2001, 2003 and 2009) were conducted at the same time of year, using standardised methods, so that population estimates can be compared over time and follow those described in Walter and Hone (2003). Transects run east-west, 2km apart following every odd gridline on a 1:100 000 topographic map (2009 transects are illustrated in Map 1 and tabulated in Appendix 1). The aircraft was flown at approximately 100kmhr^{-1} at a height of 100m above ground level. The survey used two observers on the left-hand side, one in the front left-hand seat and the second in the rear left-hand seat. The front observer (M. Dawson née Walter) has been consistent between all surveys, but the rear observer has changed (J. Hone in 2001 and 2003, and G. Symonds in 2009). On sighting a group of horses from the air, each observer independently noted the time along the transect, estimated the group size and assigned the group to one of four distance classes from the helicopter (0-50m, 50-100m, 100-150m, 150-200m). The classes were delineated using a bar attached to the underside of the helicopter, which was calibrated prior to the survey.

The 2009 transects were logged during flight (Map 1). There were minor modifications to transects that were flown in previous years to account for range expansion and to exclude areas that have been flown in the past but were not suitable horse habitat (transects that have been modified are indicated in Appendix 1).



Map 1: 2009 feral horse aerial survey transects (blue lines) logged during flight. The map also illustrates a feral horse distribution map within the Australian Alps national parks in 2001.

Analysis

This report analysed the data using line transect techniques for two observers combined (Walter and Hone 2003) because previous surveys used this method and comparisons between years can be made.

Estimates of density of horse groups were made using Program DISTANCE 5.0 (Thomas *et al.* 2006). The observations for both observers were combined into one data set (following Walter and Hone 2003). The 150-200m distance class was excluded from analyses in Program Distance because of an unexpectedly large number of groups sighted in this category. The likely causes of this were that the aircraft flew higher than 100m above the ground (thus we were including horses further that 200m away) or incorrect calibration of survey bar at the start of the survey.

Mean group size and standard error were estimated for each observer and compared to mean group size from previous aerial surveys and ground surveys. The product of estimated total number of groups and mean group size gave the estimated total number of horses. Variance was estimated by the exact variance of the product. The 2001 survey showed that observers underestimated group size because individuals within a group were missed (Walter and Hone 2003). Program DISTANCE's size biased regression group size estimates were also a poor fit and biased low. Therefore, I used mean group size estimates from ground surveys in 2001 (5.65 ± 0.51SE) in the 2009 calculations after comparing the observed group size of both observers in 2009 to 2001.

The total area surveyed (2860 km^2) was calculated as total transect length (1430 km) x 2, given that transects were 2km apart. The 150 m strip width used in the survey means that the survey sample represents 7.5% of the total survey area.

Results

The survey covered an area of 2860 km^2 (Table 1). Eighty-four unique groups of horses were observed (in the 200 m-wide strip) and the number of groups observed in each region ranged from 0.11 to 0.34 groups per km^2 of transect (Table 1). Observer 1 saw 58 groups while observer 2 saw 68 groups, 42 of these groups were seen by both observers. The proportion of groups seen by both observers gives an index of sightability in each region and is primarily a function of vegetation cover where continuous and denser vegetation reduces sightability. Sightability, was high on Snowy Plain and the Bogong High Plains (though there were very few samples) and low in Davies Buenba (Table 1).

Table 1: Area of regions surveyed for wild horses in the Australian Alps national parks in 2009 and the number of observed groups of horses (before analysis in Program Distance).

Region	Area (km^2)	Number of groups sighted	Number of groups per km^{2*}	Percent of groups seen by both observers
Snowy Plain	84	1	0.11	100
North Kosciuszko	774	26	0.34	58
South Kosciuszko	720	24	0.33	46
Davies Buenba	372	9	0.24	11
Cobberas Buchan	736	19	0.26	53
Bogong High Plains	174	5	0.29	80
TOTAL	**2860**	**84**	**0.29**	**50**

* Number of groups sighted along transects (200 m-wide)

The estimated density of groups of horses from Program DISTANCE was 0.475 groups per km^2 (CV = 23.9%), which when multiplied by the average group size of 5.65 equates to 2.69 horses per km^2. This gives a population estimate of 7679 horses over the survey area (CV = 25.4%). The probability of observing a group of horses in the survey area was 0.598. Program DISTANCE selected the negative exponential model with a minimum AIC value of 130.4335 to fit the 2009 data (Figure 1). The goodness of fit (probability of a greater chi square value) of the negative exponential model was 0.69.

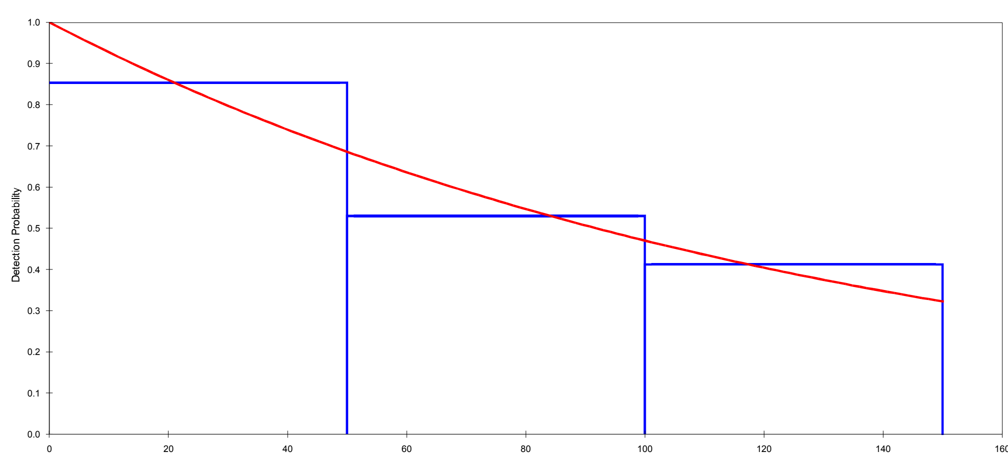


Figure 1: Negative exponential model fitted to line transect data collected in 2009 for both observers combined from 0-150m.

Sixty-one groups were included in line transect analysis. These represent all of the groups observed by either observer in the 0-50 m, 50-100 m and 100-150 m distance categories (see Appendix 2 for data including the 150-200 m distance category). Mean group size estimates were the same for both observers. Observer 1 saw 4.03 (± 0.37 SE) horses per group and observer 2 saw 4.00 (± 0.34 SE) (Figure 2). Observed group size of both observers in 2009 to 2001 was not significantly different (Figure 2).

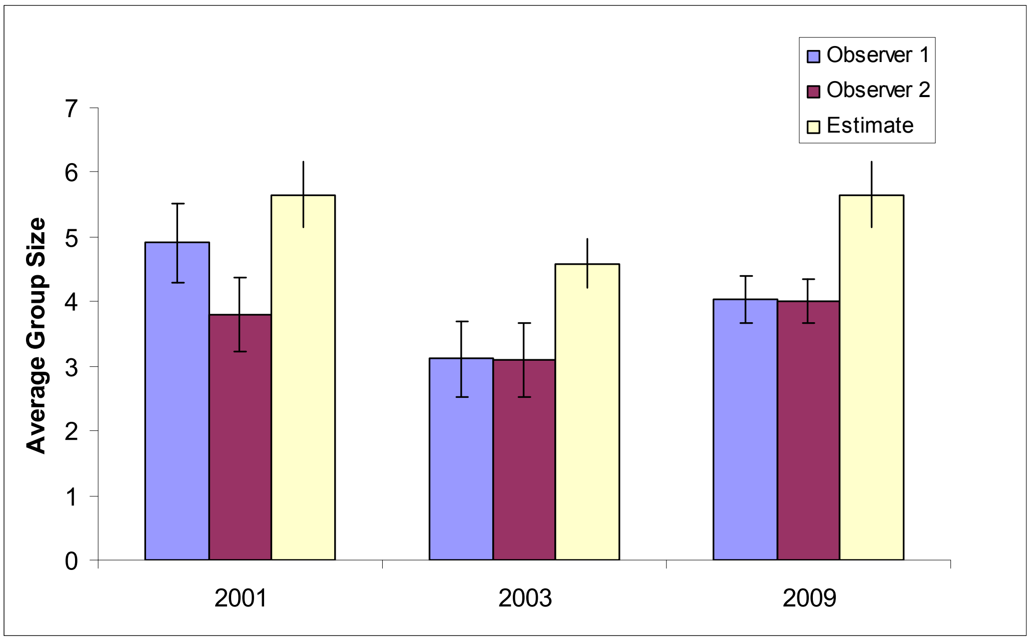


Figure 2: Average size (+/- SE) of horse groups for observers and the estimate of group size used in population estimation in each aerial survey.

There was no significant difference between the two rear-seat observers' (J. Hone - 2001 & 2003 and G. Symonds - 2009) abilities to observe groups or individuals within groups. The ratio of number of groups sighted, and observed group size compared to observer 1 (M. Dawson – all surveys) were similar (Figure 2).

I have observed an expansion of areas occupied by the feral horses over the last decade (on ground and aerial observations), which has been corroborated by park management staff from Environment ACT, NSW DECC and Parks Victoria. The distribution has expanded:

- In northern Kosciuszko in the Fiery Range, Yellow Bog, Kiandra, and on the ACT border;
- west of Snowy Plain in Kosciuszko NP;
- along the Murray River (near Tom Groggin) on the NSW/Victoria border;

- In Byadbo Wilderness, Kosciuszko and adjacent areas of Victoria; and
- On the Bogong High Plains, Victoria.

Discussion

Population Size

The role of feral horses in the Australian Alps ecosystem is increasing at a landscape level as the population is growing and spreading. The population estimate of 7679 horses (CV = 25.4%) in 2009 is the highest recorded for horses since monitoring began in 2001 and is likely to be the highest in the history of the Australian Alps. Feral horse populations were initially small after they were released in the mid-1800s and were subsequently controlled by leaseholding graziers. Evidence suggests that the sudden growth in the population is only recent (see Walter 2002: Chapter 2).

The feral horse population has fluctuated since monitoring began in 2001 (Table 2). The population size dropped dramatically between 2001 and 2003 coinciding with severe and extensive wildfires (Walter 2003). The estimated rate of increase in the feral horse population between 2003 and 2009 of 21.65% per annum (λ = 1.2165) is very close to the maximum intrinsic rate predicted by Walter (2002: p. 70) of λ = 1.22 for the Australian Alps. This indicates that there have been minimal factors limiting the growth of the feral horse population over the last 6 years. If the population continues to grow at this rate, it is predicted to exceed 13800 by 2012. A study on population dynamics of feral horses in the AANP at three localised sites suggested that populations may become food limited at densities of 6.4 horses/km^2 (Walter 2002: Chapter 4) (more than double the density estimate for 2009).

Table 2: Summary of results from feral horse aerial surveys in 2001, 2003 and 2009.

Year	**Area (km^2)**	**Density (horses / km^2)**	**Abundance**	**SE**	**CV**	**Source**
2001	2789	1.86	5200	1643	31.6%	Walter & Hone 2003
2003	2717	0.87	2369	800	33.8%	Walter 2003
2009	2860	2.69	7679	1950	25.4%	This study

The number of horses in each region surveyed can be generally estimated by multiplying the density of horses by the area of the region. Therefore the number of horses in Victoria and NSW (survey areas of 1578 and 1282 km^2, respectively) would be an estimated 3442 (± 874 SE) and 4237 (± 1076 SE) respectively. As the data set is larger in 2009 there are opportunities for running analyses separately for smaller land units. Preliminary analyses were made (for NSW and Victoria separately) and the results were not greatly different to what is presented here. However Program Distance selected different detection functions for different regions, goodness of fit was variable and group size estimates were different for each state. Table 1 illustrated that observers saw different densities of groups in different regions and that sightability differed by region. There may be opportunities to refine the results by stratifying the data to reflect patterns in the landscape. I would recommend stratifying areas with extensive open plains (such as the Bogong High Plains, Snowy Plain and parts of north Kosciuszko) from areas with more continuous woodland and forest because of the different sightability in these areas. Furthermore, groups appear to be larger on the open plains than in woodland and forest independent of sightability (pers. obs.).

Distribution

Horse distribution has changed since it was mapped 8 years ago (Walter 2002). This is supported by reports by parks staff across the AANP in Victoria (C. Pascoe pers. comm.), the ACT (ACT Parks, Conservation and Lands 2007) and in NSW (NSW National Parks and Wildlife Service 2008). The changing distribution of feral horses needs to be monitored along with abundance. Due to the low sampling intensity of aerial survey and its cost, it is not a suitable technique for mapping distribution. Distribution mapping should be done using expert knowledge as outlined in the recommendations, below.

The three aerial surveys undertaken to date have not incorporated estimates of horse numbers in Byadbo and adjacent areas of Alpine National Park or around Talbingo Dam because densities were very low in 2001 and the terrain is very steep (steep terrain reduces the effectiveness of this survey method because it is difficult to retain a survey height of 100m). Park managers have reported an increase in horse numbers in these areas. These areas should be considered for inclusion in future surveys. Horse populations on the boundary of the AANP often continue into adjacent State Forest and other land tenures. Consideration should be given to including these areas in future feral horse monitoring and management programs. Confining feral horse management and monitoring to just AANP tenures will restrict the effectiveness and completeness of such programs.

Knowledge of the potential spread of feral horses is important for a strategic approach to feral horse management. To date there has been no mapping of potential horse habitat that would indicate new areas that horses could colonise. Horses do not currently occupy all suitable habitat within the AANP. For example, there are areas within the

AANP that horses have occurred in the past, such as Namadgi National Park (Higgins 1994). Mapping areas that are suitable horse habitat in the AANP would address this.

Analysis

The 2001 feral horse aerial survey included all areas from the distribution maps for the AANP (Walter 2002), however as we flew the areas, we realised that they incorporated unsuitable habitat in parts of the Buckwong and Buchan Rivers in Victoria, and north of Broken Cart in northern Kosciuszko. Consequently, some were excluded in the 2003 survey and more were excluded in 2009 to expedite surveys. New areas were included in the 2009 survey due to range expansion (appendix 1) however no horses were observed in these areas, which is probably a result of low densities, and low sampling intensity. Adjustments to survey area could result in comparatively higher density estimates over time but this is unlikely to date because any increases from excluding unsuitable habitat has been compensated by adding new areas in which no groups were observed.

Excluding the 150-200m distance class from analyses was necessary however it meant that model fitting in Program DISTANCE was less reliable because fewer parameters could be used. Data and survey bars should be checked each day in future surveys to avoid this problem.

For line transect techniques for two observers combined, the negative exponential models gave the best fit to the data in both 2001 and 2009, while the half-normal model fitted the data best in 2003 (Walter and Hone 2003; Walter 2003). This pattern is intuitive given that vegetation was dense in 2001 and 2009 and sightability decreased rapidly with distance from the aircraft (see Figure 1 for illustration). In 2003 the fires dramatically improved sightability through the vegetation, and subsequently the proportion of horses detected further from the aircraft was high. The negative exponential model (unlike the half-normal) produces high estimates because the function does not cross the x-axis at 1.0. Thus the 2001 and 2009 estimates may be biased slightly high relative to 2003.

It is advisable to review methods for group size estimation. Group size estimation was based on 2001 ground surveys because group size estimates from Program DISTANCE are underestimates (Walter and Hone 2003). Group size has a strong influence on estimates of horse population size and density because they are made by multiplying estimated number of groups by group size.

Analyses in the current report used line transect techniques for two observers combined to allow for comparisons with the 2001 and 2003 surveys. It does not use mark-recapture theory (instead the data for the two observers are combined), but it does use line transect theory. Computer programs have been developed recently (using the 2001 feral horse dataset) to combine mark-recapture and distance sampling techniques (MRDS) (Laake *et al*. 2008), optimising the advantages of both techniques and minimising their limitations. In essence, mark-recapture theory is used to determine the number of groups sighted on the line (g(0)), and line transect theory is used to determine the detection function. It would be advisable to analyse all previous and future data sets using MRDS.

Recommendations

1) Monitoring of feral horse populations in the AANP continues with a suggested five year frequency. This would mean the next monitoring survey be conducted in 2014.
2) Re-analyse data for 2003 and 2009 using mark-recapture distance sampling (MRDS) (after Laake *et al.* 2008).
3) Carry out a review of distribution maps incorporating horse density and habitat mapping. The revised distribution map could be constructed using the information presented here and by using expert knowledge. Parks staff and others with knowledge of feral horses could illustrate on a map with a grid (of approximately $2km^2$) where horses are absent, at low densities, at high densities, or don't know.
4) Determine habitat preferences of horses and predict areas where horses have the potential to spread. The distribution map could be overlayed on a vegetation map to determine the habitat preference of horses. It could then be used as a basis for determining the potential spread of horses based on habitat suitability.
5) Byadbo and adjoining areas of the Alpine National Park, Talbingo Dam and adjacent State Forests in Victoria and NSW should be considered for inclusion in future surveys.
6) Group size estimation should be revisited before conducting the next aerial survey because it has a strong influence on population estimates and current estimates are extrapolated from 2001. Group size should be estimated from ground surveys or from other surveys where groups are followed such as aerial mark-recapture estimates of wild horses using natural markings (Dawson and Miller 2008). Alternatively, it may be possible through analytical means.

7) Helicopter set-up should be reviewed prior to undertaking future surveys. In the three surveys conducted to date, the transect bar attached to the helicopter prevents doors being attached. A modified survey boom would allow the rear right-hand door to be attached. As a result, safety, comfort and air movement within the air craft would be improved. The two left-hand doors should remain off to ensure observers have a clear view. The use of harnesses (instead of seatbelts) should also be considered for passenger safety.

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Appendix 1: Transects

NORTH KOSCIUSZKO

Transect	start		end		transect length (km)
	easting	**northing**	**easting**	**northing**	
NK1^	647000	6027000	631300	6027000	15.7
NK2^	630300	6029000	647000	6029000	16.7
NK3^	648000	6031000	630800	6031000	17.2
NK4^	631600	6033000	649000	6033000	17.4
NK5^	650000	6035000	632700	6035000	17.3
NK6^	633500	6037000	650000	6037000	16.6
NK7	653000	6039000	635000	6039000	18
NK8	638000	6041000	655000	6041000	17
NK9	662000	6043000	638000	6043000	24
NK10	638000	6045000	662000	6045000	24
NK11	662000	6047000	637000	6047000	25
NK12	637000	6049000	662000	6049000	25
NK13	662000	6051000	637000	6051000	25
NK14	637000	6053000	659000	6053000	22
NK15	658000	6055000	638000	6055000	20
NK16	638000	6057000	655000	6057000	17
NK17	655000	6059000	639000	6059000	16
NK18	639000	6061000	654000	6061000	15
NK19	653000	6063000	639000	6063000	14
NK20	640000	6065000	652000	6065000	12
NK21	652000	6067000	640000	6067000	12
					386.8

^ Transects lengthened for the 2009 survey.

Transect NK22 was not flown due to the lack of suitable habitat and because flying conditions were poor with low sun angle and rugged terrain.

SNOWY PLAIN

Transect	Start		end		transect length (km)
	easting	**northing**	**easting**	**northing**	
SP1	646000	5981000	641000	5981000	5
SP2	638000	5983000	647000	5983000	9
SP3	646000	5985000	637000	5985000	9
SP4	635000	5987000	646000	5987000	11
SP5	641000	5989000	635000	5989000	6
SP6	637000	5991000	639000	5991000	2
					42

SOUTH KOSCIUSZKO

Transect	start		end		transect length (km)
	easting	northing	easting	northing	
SK1	630000	5965000	611000	5965000	19
SK2	610000	5963000	630000	5963000	20
SK3	631000	5961000	610000	5961000	21
SK4	609000	5959000	631000	5959000	22
SK5	629000	5957000	607000	5957000	22
SK6	609000	5955000	629000	5955000	20
SK7	626000	5953000	610000	5953000	16
SK8	611000	5951000	616000	5951000	5
SK9	617000	5949000	611000	5949000	6
SK10	611000	5947000	617000	5947000	6
SK11	621000	5945000	611000	5945000	10
SK12	611000	5943000	624000	5943000	13
SK13	621000	5941000	610000	5941000	11
SK14	609000	5939000	622000	5939000	13
SK15	622000	5937000	606000	5937000	16
SK16	605000	5935000	623000	5935000	18
SK17	624000	5933000	601000	5933000	23
SK18	600000	5931000	628000	5931000	28
SK19	627000	5929000	599000	5929000	28
SK20	599000	5927000	626000	5927000	27
SK21	626000	5925000	610000	5925000	16
SK22*	614000	5923000	620000	5923000	
SK23*	622000	5921000	617000	5921000	
* not flown in 2009					**360**

DAVIES/BUENBA

Transect	start		end		transect length (km)
	easting	northing	easting	northing	
DB1	599000	5951000	606000	5951000	7
DB2	607000	5949000	598000	5949000	9
DB3	597000	5947000	607000	5947000	10
DB4	607000	5945000	595000	5945000	12
DB5	594000	5943000	604000	5943000	10
DB6	604000	5941000	591000	5941000	13
DB7	582000	5939000	602000	5939000	20
DB8	602000	5937000	576000	5937000	26
DB9	575000	5935000	602000	5935000	27
DB10^	601000	5933000	582000	5933000	19
DB11^	584000	5931000	600000	5931000	16
DB12	599000	5929000	589000	5929000	10
DB13	590000	5927000	597000	5927000	7
					186

^ Transects shortened for the 2009 survey.

COBBERAS/BUCHAN

Transect	start		end		transect length (km)
	easting	northing	easting	northing	
NV1	610000	5925000	592000	5925000	18
NV2	591000	5923000	614000	5923000	23
NV3	618000	5921000	590000	5921000	28
NV4	589000	5919000	621000	5919000	32
NV5	621000	5917000	588000	5917000	33
NV6	588000	5915000	608000	5915000	20
NV7	610000	5913000	587000	5913000	23
NV8	586000	5911000	613000	5911000	27
NV9	613000	5909000	586000	5909000	27
NV10	587000	5907000	614000	5907000	27
NV11	607000	5905000	588000	5905000	19
NV12	587000	5903000	607000	5903000	20
NV13	607000	5901000	587000	5901000	20
NV14^	584000	5899000	600000	5899000	16
NV15^	600000	5897000	584000	5897000	16
NV16^	585000	5895000	602000	5895000	17
NV17	592000	5893000	590000	5893000	2
					368

^ Transects shortened for the 2009 survey.

BOGONG HIGH PLAINS

Transect	start		end		transect length (km)
	easting	northing	easting	northing	
BHP0#	516000	5919000	526000	5919000	10
BHP1#	525000	5917000	517000	5917000	8
BHP2#	517000	5915000	527000	5915000	10
BHP3#	527000	5913000	517000	5913000	10
BHP4#	517000	5911000	532000	5911000	15
BHP5#	527000	5909000	518000	5909000	9
BHP6#	520000	5907000	532000	5907000	12
BHP7#	533000	5905000	524000	5905000	9
BHP8	527000	5903000	531000	5903000	4
					87

Transect added, shortened or lengthened for the 2009 survey

Appendix 2: 2009 feral horse survey data (Distance input file)

Study Area	Area	Transect name	Transect length	Distance	Cluster Size
Snowy Plain	84	SP1	5		
Snowy Plain	84	SP2	9		
Snowy Plain	84	SP3	9	175	4
Snowy Plain	84	SP4	11		
Snowy Plain	84	SP5	6		
Snowy Plain	84	SP6	2		
North Kosci	774	NK1	15.7		
North Kosci	774	NK2	16.7		
North Kosci	774	NK3	17.2		
North Kosci	774	NK4	17.4		
North Kosci	774	NK5	17.3		
North Kosci	774	NK6	16.6		
North Kosci	774	NK7	18	75	1
North Kosci	774	NK8	17	75	17
North Kosci	774	NK8		125	6
North Kosci	774	NK8		175	4
North Kosci	774	NK9	24		
North Kosci	774	NK10	24	175	4
North Kosci	774	NK10		25	6
North Kosci	774	NK11	25	175	1
North Kosci	774	NK11		25	3
North Kosci	774	NK12	25	125	11
North Kosci	774	NK12		75	6
North Kosci	774	NK13	25	25	1
North Kosci	774	NK13		25	5
North Kosci	774	NK13		175	7
North Kosci	774	NK13		175	4
North Kosci	774	NK13		125	3
North Kosci	774	NK13		125	4
North Kosci	774	NK14	22		
North Kosci	774	NK15	20	175	1
North Kosci	774	NK15		125	9
North Kosci	774	NK16	17	175	4
North Kosci	774	NK17	16	25	7
North Kosci	774	NK17		175	2
North Kosci	774	NK18	15	175	2
North Kosci	774	NK18		125	5
North Kosci	774	NK19	14	75	2
North Kosci	774	NK19		25	9
North Kosci	774	NK20	12	175	1
North Kosci	774	NK21	12		
South Kosci	720	SK1	19		
South Kosci	720	SK2	20		
South Kosci	720	SK3	21	25	2
South Kosci	720	SK4	22		
South Kosci	720	SK5	22	175	10
South Kosci	720	SK5		125	8
South Kosci	720	SK5		75	6
South Kosci	720	SK5		25	2
South Kosci	720	SK6	20	75	1
South Kosci	720	SK7	16	175	2
South Kosci	720	SK8	5	25	5

South Kosci	720	SK9	6	175	4
South Kosci	720	SK10	6		
South Kosci	720	SK11	10		
South Kosci	720	SK12	13		
South Kosci	720	SK13	11		
South Kosci	720	SK14	13		
South Kosci	720	SK15	16	75	8
South Kosci	720	SK16	18		
South Kosci	720	SK17	23	25	3
South Kosci	720	SK18	28	75	4
South Kosci	720	SK18		25	1
South Kosci	720	SK18		75	5
South Kosci	720	SK18		125	3
South Kosci	720	SK18		25	2
South Kosci	720	SK18		125	2
South Kosci	720	SK19	28	25	1
South Kosci	720	SK19		175	3
South Kosci	720	SK20	27	25	4
South Kosci	720	SK20		25	1
South Kosci	720	SK20		125	4
South Kosci	720	SK21	16	75	3
South Kosci	720	SK21		25	4
North Vic	372	DB1	7		
North Vic	372	DB2	9	25	1
North Vic	372	DB3	10		
North Vic	372	DB4	12	175	3
North Vic	372	DB5	10		
North Vic	372	DB6	13	175	3
North Vic	372	DB7	20	25	1
North Vic	372	DB8	26		
North Vic	372	DB9	27	25	1
North Vic	372	DB9		25	3
North Vic	372	DB10	19		
North Vic	372	DB11	16	25	2
North Vic	372	DB12	10	75	1
North Vic	372	DB13	7	75	1
North Vic	736	NV1	18	175	7
North Vic	736	NV1		25	6
North Vic	736	NV2	23	175	4
North Vic	736	NV3	28	25	3
North Vic	736	NV4	32	125	3
North Vic	736	NV5	33	175	1
North Vic	736	NV5		175	1
North Vic	736	NV6	20	75	3
North Vic	736	NV6		75	2
North Vic	736	NV7	23	75	5
North Vic	736	NV7		25	8
North Vic	736	NV7		75	2
North Vic	736	NV8	27	25	1
North Vic	736	NV9	27	25	1
North Vic	736	NV10	27		
North Vic	736	NV11	19		
North Vic	736	NV12	20	75	3
North Vic	736	NV12		25	2
North Vic	736	NV12		175	5

North Vic	736	NV13	20		
North Vic	736	NV14	16		
North Vic	736	NV15	16		
North Vic	736	NV16	17	75	3
North Vic	736	NV16		25	3
North Vic	736	NV17	2		
Bogong HP	174	BHP0	10		
Bogong HP	174	BHP1	8		
Bogong HP	174	BHP2	10		
Bogong HP	174	BHP3	10	125	4
Bogong HP	174	BHP3		175	6
Bogong HP	174	BHP4	15	25	6
Bogong HP	174	BHP5	9	125	3
Bogong HP	174	BHP6	12	125	8
Bogong HP	174	BHP7	9		
Bogong HP	174	BHP8	4		