Aerial baiting to control introduced predators on Lorna Glen - winter 2012

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Summary

- Unlike previous years, the aerial cat baiting program at Lorna Glen conducted in July 2012 appears to have been ineffective. The feral cat track activity index (TAI) fell from 14.7 to 12.9, the estimated number of individual cats recorded on sample lines fell from 26 to 23 post-baiting.
- Pre-bait dog activity was low and decreased slightly post-baiting. Dog TAI fell from 3.0 to 2.4 and the estimated number of dogs recorded on the transects fell from 10 to 8.
- It seems we may be victims of our own success - the poor baiting result is attributed to a) high levels of prey availability, especially mulgara and other small mammals and b) poor bait dispersal.
- Baiting is likely to be effective when the population of mulgara and other small mammals declines significantly and baits are well dispersed. It will be important to monitor live prey density as when the decline happens, cats are likely to intensify predation on reintroduced species such as bilby, bandicoot and perhaps possum. Targeted trapping to ease predation pressure may be warranted.
- The Edge Trap Bait Digital Callers (Edge callers) were again successful, although there are signs that once some cats (and dogs) have discovered that the callers are not edible prey, they tend to by-pass the stations. The callers work best on naïve populations.
- Pre-bait uptake by cats that visited a station was 51%, but this fell to 16% post-bait. Again, this is attributed to the cat population being wise and aware of the false nature of the lures at the bait stations, the same population having experienced them just 4 weeks previously.
- Mulgara activity (tracks) and distribution remains high with mulgara recorded at 61% of bait stations across all landsystems.
- As to be expected at this time of year, reptile activity was very low but birds (raptors, owls and passerines) were attracted to the stations by the Edge callers.
- It was encouraging to record tracks of bandicoot, bilby and possum.
- Large cage traps were trialed with the Edge callers, but while cats were readily attracted to the traps, they would not enter them. Work continues on novel ways to trap cats without harming non-targets (by-catch).

Recommendations (including as previously reported)

- Resources should be directed to intensive and targeted post-bait cat control especially since the cat population has the potential to increase rapidly on the back of a good season and abundant food.
- This should include intensive mop-up trapping using the Edge callers and leg hold traps following the post-bait survey and either opportunistic or systematic ground baiting through to mid-September, even though bait uptake is likely to be low (~16%). The priority for mop-up of cats should be a) around the compound, b) in the vicinity of the bandicoot reintroductions and c) in the vicinity of known bilby populations (see horse survey report).
- It would be very informative to run a survey on Earaheedy, which is unbaited, to assess a) cat and dog densities and b) mulgara density. This would assist with determining the contribution of seasonal (rainfall) effect and cat control on mulgara density.
- Catch and fit radio collars to at least 5 cats and 5 dogs prior to the 2013 aerial baiting to a) better understand their activity and seasonal movement patterns, b) the level of contact / avoidance, temporal and spatial interaction between dogs and cats, and c) baiting efficacy to complement the indirect track count measures. It will help answer the

questions: Are we turning cats and dogs over? What proportion of the cat / dog population is not taking the baits? What is the level of reinvasion?
- This baiting operation has demonstrated that there will be times of high prey availability when we cannot effectively control feral cats in the arid zone. This increases the urgency on extending the predator-proof compound (the inland island) to 5,000 ha as an important integrated strategy.

Introduction

Introduced predators (fox, cat, wild dog) on Lorna Glen have been successfully controlled on Lorna Glen by aerial baiting using the feral cat bait since 2003. Baiting has been carried out annually in winter when live prey availability is generally lower than other times of the year and the hungry cats are more likely to ingest a bait. Since aerial baiting commenced, the feral cat population has been maintained at about 20-25% of pre-bait levels (see Figure 1 below). This has allowed the successful reintroduction of some fauna species and there are strong indications that extant fauna, such as mulgara, echidna and some reptiles, including sand goanna, have benefitted from reduced predation pressure by increasing in abundance and distribution.

Method

The most recent aerial baiting was carried out over 4-5 July 2012. As usual, the effectiveness of baiting was evaluated by a pre-bait assessment of introduced predator activity carried out over five nights in 28 June - 2 July 2012 (a report has been prepared and circulated) and a post baiting assessment carried out 31 July - 4 August 2012 following the protocols are described by Algar and Burrows (see Western Shield Review) and appended to this report. Once again, an Edge caller (audio like a tweeting bird) was used with a non-toxic cat bait at the active stations. These callers have proven to be very effective at attracting cats and, unfortunately, other birds including owls and raptors.

The position (latitude, longitude) at first contact of every set of cat and dog footprints was recorded using a GPS to determine individual cats impacted by baiting and to assist with targeting follow-up trapping.

Baiting was timed to coincide with a full moon in the hope that this might increase bait uptake as there is some evidence that nocturnal hunting success of big African cats is diminished when the moon is full.

Results

Weather conditions leading up to, during baiting and in the first week post baiting were ideal with regard to temperature maxima and minima (see Figure 1 below). No rainfall was recorded for July.

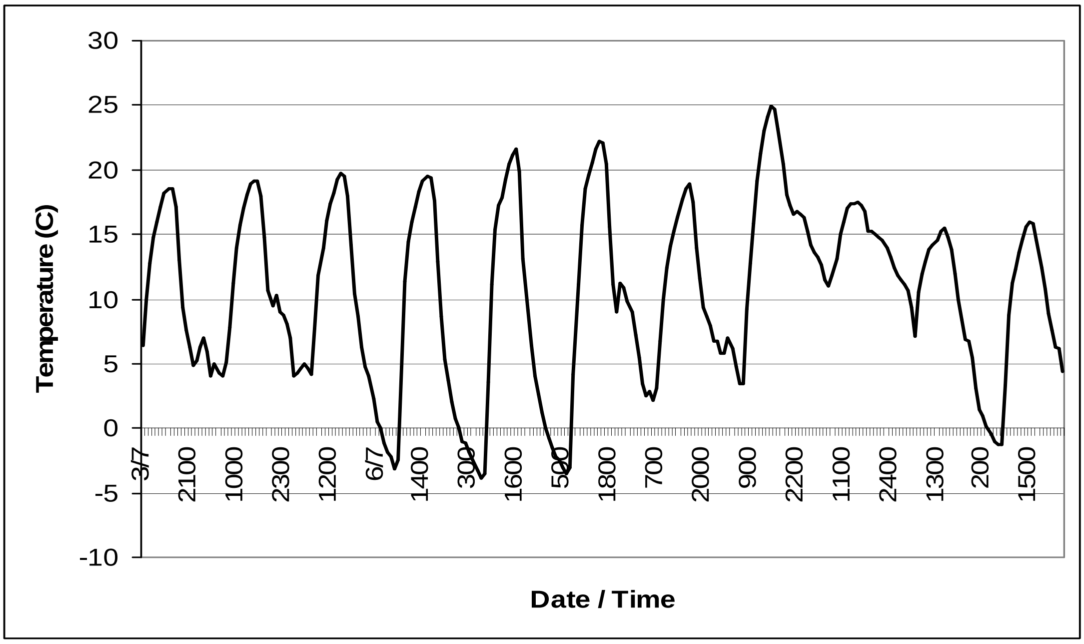

Figure 1: Hourly temperatures leading up to, during, and 7 days after baiting at Lorna glen. Source: AWS, LG airstrip.

Cat baits were delivered aerially along pre-determined flight lines. Overall baiting intensity was 50 baits km^{-2} although pilot trials over the airstrip indicated that baits were actually delivered in concentrated clumps over an area of ~50 m x 70 m rather than the prescribed dispersal of 50 baits over an area of 150 m x 350 m.

Results

The post-bait assessment was carried out over the period 31 July to 4 August 2012, some 30 days after the baiting operation. As can be seen from Table 1 below, the post-bait TAI was only 7.8% lower than the pre-bait TAI, which, at 12.9, is still lower than the TDI before baiting commenced in 2003 (Figure 2).

Summary of data and commentary

Table 1 (below): Trends in Track Activity Index (TAI)

- The mean pre-bait TAI was 14.7 and post-bait it was 12.9, representing an insignificant impact of baiting on feral cat activity.
- The poor baiting result is likely due to a) high prey availability and b) poor dispersal of baits.
- Most cat footprints were of medium size cats, with a few small-medium prints. No large footprints were recorded.
- Cat activity was greatest on Transect 8. Interestingly, there appears to be a significant reduction on T7, suggesting knockdown may have been patchy.
- The GPS locations of cat tracks before and after baiting supported observations that few feral cats were removed by baiting – essentially the same cats were recorded after baiting, with a few exceptions. For example, 2 very large cats were recorded pre-bait, but were not recorded post-bait.

Table 1: Summary of track activity (TAI) for cats before (Bfor) and after (Aft) baiting at Lorna Glen. The TAI is shown daily for 10 Transects, each of which are 10 km except for T4 which was 9km. Transects were assessed over five days. The TAI = (Total individual tracks X 100) /495)

Transect	**Day 1**		**Day 2**		**Day 3**		**Day 4**		**Day 5**		**Totals**	
	Bfor	Aft	Bfor	Aft	Bfor	Aft	Bfor	Aft	Bfor	Aft	Bfor	Aft
1	1	1	1	1	1	1	2	1	1	0	6	4
2	2	0	2	1	1	2	1	1	1	1	7	5
3	1	1	1	1	2	1	1	1	1	0	6	4
4	1	2	1	2	1	1	1	1	2	1	6	7
5	0	2	2	2	0	1	0	1	2	0	4	6
6	2	2	2	1	2	2	3	1	1	1	10	7
7	3	0	2	1	3	1	2	1	2	2	12	5
8	2	2	2	1	2	3	2	3	1	2	9	11
9	0	2	1	1	1	0	2	1	2	3	6	7
10	2	3	0	0	2	2	1	1	2	2	7	8
Total tracks	14	15	14	12	15	14	15	12	15	12	71	64
TAI	14.1	15.1	14.1	12.1	14.1	14.1	15.1	12.1	15.1	12.1		
										Mean TAI	**14.7**	**12.9**

Trend in cat density

Figure 2 shows the trend in cat density (based on track activity - TDI) at Lorna Glen since 2003. Notable features are:

- Significant reduction following the initial baiting in 2003.
- Sustained reduction of the TDI (mostly <10) as a result of annual aerial baiting.
- Modal trend associated with activity increase between baiting events.
- Inability to eradicate cats, therefore the potential for a relatively rapid increase following good seasons (e.g. 2011 / 2012).
- No significant impact of 2012 baiting operation on track activity.

Figure 2: Mean seasonal Cat Track Density Index (TDI) for Lorna Glen from 2003. Baiting commenced Winter 2003 (data pre 2010 modified from Algar et al. in press)

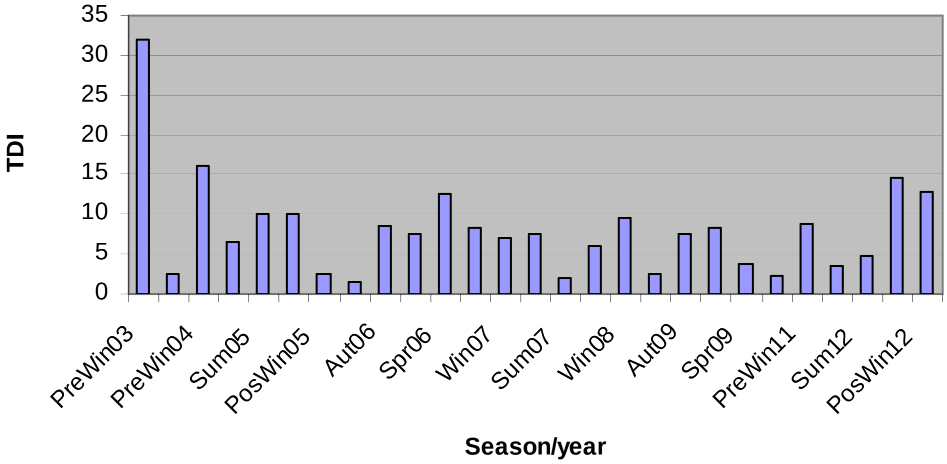

Table 2: Estimated number of individual cats before and after baiting on sample transects
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Transect	Individual cats before	Individual cats after
1	2	1
2	2	2
3	3	2
4	2	2
5	2	2
6	3	3
7	3	2
8	3	3
9	2	3
10	3	3
Total	**26**	**23**

Notes Table 2 (above): Estimates of individual cats on the sample transects

- Baiting has reduced the estimated number of individual cats encountered on the sample transects from 26 to 23, or an 11.5% reduction. Cat numbers were reduced on T1, T3 and T7, but an additional cat was recorded on T9. Other transects remain unchanged from the pre-bait assessment.

As reported previously, the track and active bait station inspection technique is providing valuable information about the distribution and abundance of other animals such as mulgara. Mulgara activity has increased exponentially since spring 2010 (Figure 2). The post-bait level of activity and distribution was similar to the pre-bait, suggesting that the baiting did not have any direct impact on mulgara. As with previous assessments, signs of mulgara (footprints) were found across almost all landsystems, including stony systems, although they are most abundant on the Bullimore (sand dune-plain) system. Based on footprint size, the population comprises a good mix of young (small footprint) and old (large footprint) individuals.

The increase in mulgara is most likely due to a combination of a good season (rainfall) in 2011 and sustained cat control since 2003 (although the most recent baiting operation was not successful). As can be seen from the historical rainfall data in Figure 3, the rainfall since 2003 has not been unusual. There was high rainfall in 2006 and again in 2010, but high variability in rainfall is a feature of the arid zone. Given that the rainfall trends this decade have not been particularly unusual, the increase in mulgara density and distribution may well be largely due to the control of introduced predators. To better understand this interaction, it would be very informative to run an assessment of some 50 km in an area that has not been baited, such as Earaheedy.

Consistent with the 'boom and bust' existence of some fauna groups in the arid zone, regardless of the drivers, it will be important to track and interpret the likely collapse of the mulgara population (and other mammals) over the coming years.

Figure 3: Mulgara track activity at active stations from spring 2010 to winter 2012

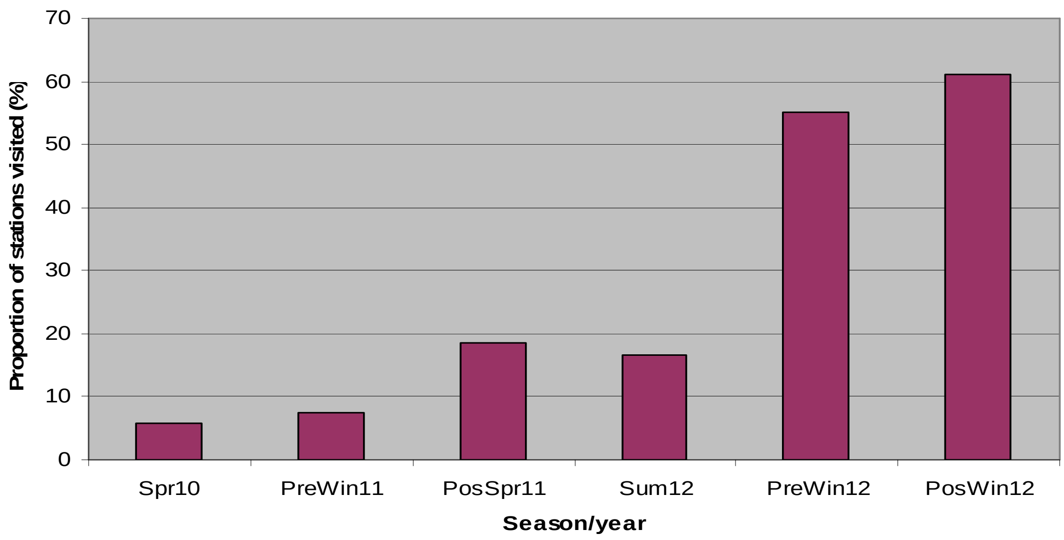

Figure 4: Annual rainfall for Lorna Glen

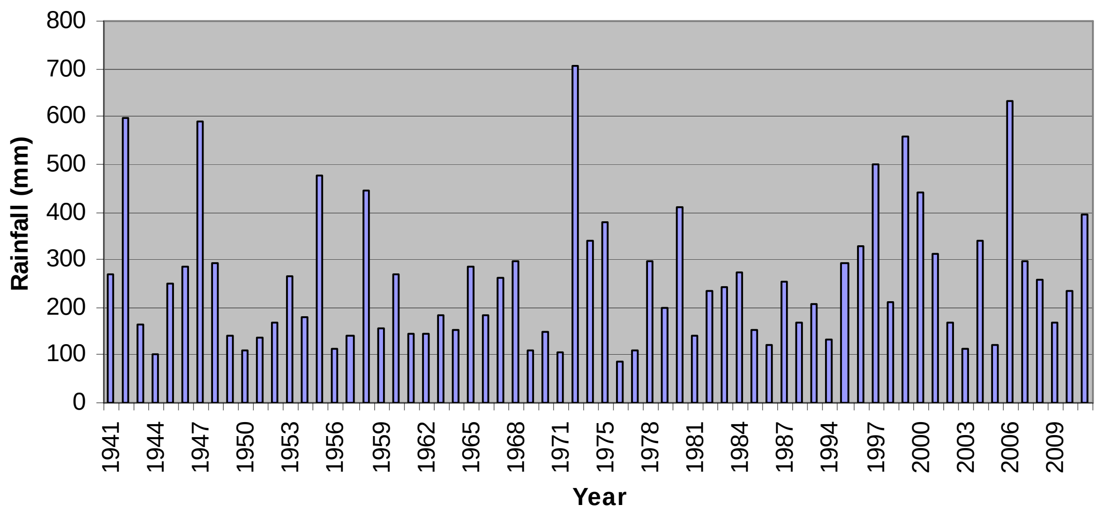

Table 3: Summary of activity on active sample stations (Edge callers, non-toxic baits (NTB)

Transect	Totals over 5 days			
	Nil activity (% of stations)	**Pass (% of stations)**	**Visit (% of stations)**	**Bait take (NTB) (% of stations)**
1 (n=50)	22%	Dog - 10%	Cat – 2% Bird – 8% Mulgara – 8% Ants – 6%	Mulgara – 56% Bird – 6% Bird or Mulgara – 4% Cat- 2%
2 (n=50)	12%	Dog – 4%	Bird – 4%	Mulgara – 70% Bird –4% Dog – 2%
3 (n=50)	0%	Dog -20%	0%	Mulgara – 96% Bird – 2%
4 (n=50)	38%	Cat – 2%	Cat – 4% Bird – 12% Bird & Ant – 2% Ant – 8%	Bird – 28% Mulgara – 8%
5 (n=50)	10%	0%	0%	Mulgara – 90%
6 (n=50)	30%	Cat -2% Dog -2%	Cat – 2% Mulgara-44% Bird – 4% Ant - 8% Bird & Ant – 2%	Mulgara – 44% Bird – 6% Bird or Mulgara – 4%
7 (n=50)	10%	Cat – 2%	Cat – 2% Bird – 4%	Mulgara – 70% Bird – 8% Mulgara or Bird –4% Ants-2%
8 (n=50)	52%	0%	Cat – 4% Mulgara -4% Bird – 4% Ants – 4% Bird & Mulgara – 2%	Cat – 2% Mulgara – 22% Bird – 2% Bird or Mulgara – 4%
9 (n=50)	10%	Dog – 2%	Cat –6% Bird – 4% Mulgara – 2%	Mulgara – 64% Bird – 6% Bird or Mulgara – 4%
10 (n=50)	28%	Cat-2%	Cat – 6% Bird – 6% Mulgara – 2% Mulgara & Bird – 2% Ants and Bird – 2%	Cat – 2% Mulgara – 48% Bird – 2% Bird or Mulgara – 2%
Total (n=500)	**21.2%**	**4.6%** Cat – 0.8% Dog- 3.8%	**16.2%** Cat – 2.6% Bird – 3.8%; Mulgara – 5.0%; Ants – 2.6% Mulgara & Bird – 0.4% Ant & Bird – 0.6%	**65.3%** Cat – 0.6% Mulgara – 55.4% Bird – 6.8% Mulgara or Bird 2.2% Dog – 0.2%

Notes Table 3 – Active sample stations

- The Edge Trap Bait Digital Callers continue to work well, attracting cats and other animals, particularly birds, into the bait stations. As discussed in the pre-bait report, historically, and across seasons, about 65% of bait stations recorded no activity, but since Edge callers have been in use, this has fallen to 14% and 21 % in the last two surveys.

- Post-bait visits to the bait stations by cats was considerably less than the pre-bait visitation rate. The pre-bait visitation by cats was 48 instances when a cat was recorded in the vicinity of a bait station with only 5 (~10%) instances when it walked past the station without showing interest. In 21 instances the cat visited the bait station and in 22 instances (51%), the cat removed the bait.
- Post-bait, there were only 19 instances when a cat either passed or visited the bait stations and of these, 4 (21%) instances when the cat actually walked past the station without visiting the lures. Nonetheless, in 79% of cases, the cat actually visited the station, but only took the non-toxic bait on 3 (16%) occasions. These statistics are quite different to those reported for the pre-bait survey (above), just 4 weeks earlier, when visitation rates and bait uptake rates were much higher. It is highly likely that cats became desensitized to the edge callers – that is, naïve cats, having initially visited the stations and learnt that the edge callers are not edible prey, may not be inclined to visit the stations again. This means that the Edge callers will work best at attracting naïve cats, or cats that have not been exposed to the callers for a long period of time, but may not be as successful when used on cats that have had recent prior exposure to the callers.
- A total of 325 non-toxic baits were removed (replaced), the highest level of bait removal since the commencement of monitoring in 2003. Of these, mulgara removed at least 56%, and possibly more. Where there was multiple species activity at a station, such as birds and mulgara, it was difficult to know which species took the bait.
- As reported earlier, mulgara activity has increased significantly, with mulgara footprints being recorded on all transects, on 81 of the 100 active sample stations and in all landsystems, although they were most abundant in the Bullimore landsystem and least abundant on landsystems with stony soils and sparse spinifex cover.
- There was a very low incidence of ant attack on baits, as to be expected at this time of year.

Dog activity

The pre-bait dog TAI was a low 3.0 and fell to 2.4 after baiting. There was an estimated 10 individual dogs on the sample lines pre-baiting and 8 post baiting, suggesting a small and possibly insignificant effect of baiting. However, dogs cover very large areas, so it is not known whether resident dogs are removed as a result of baiting and new dogs re-invade, or whether resident dogs are not being affected by the baits. Radio collaring of dogs would be valuable to answer this question.

As with cats, naïve dogs are readily attracted to the Edge callers, but once dogs have been exposed to the Edge callers and realize they are not live edible prey, they will mostly ignore them thereafter.

Echidna and rabbits

Echidna and rabbit track activity post-bait were similar to pre-bait levels.

Other fauna detected

It was very encouraging that bilby, possum and bandicoot tracks were detected. See Appendix 1 for GPS locations.

Acknowledgements

We thank Tony Woods for assisting with preparing / dragging sampling transects and with follow-up trapping.

Appendix 1 – GPS locations of fauna of interest – West circuit

latitude	longitude	date1:Ztime2	Waypoint GPS12	Transect	Species
26.275459	121.28128	2012-07-31T01:46:36Z	1	6	DOG
26.286089	121.281294	2012-07-31T01:53:30Z	2	6	CAT2
26.330675	121.281256	2012-07-31T02:15:15Z	3	6	CAT3
26.332772	121.281269	2012-07-31T02:17:14Z	4	6	CAT3
26.354894	121.240472	2012-07-31T02:45:05Z	5	10	CAT2
26.355418	121.213949	2012-07-31T02:57:09Z	6	10	CAT2
26.325336	121.192846	2012-07-31T03:20:12Z	7	10	CAT3
26.259253	121.194241	2012-07-31T03:56:44Z	8	8	CAT2
26.231903	121.194881	2012-07-31T04:12:56Z	9	8	CAT3
26.146362	121.19235	2012-07-31T05:00:04Z	10	9	DOG
26.125499	121.193228	2012-07-31T05:10:35Z	11	9	CAT2
26.09488	121.193978	2012-07-31T05:25:17Z	12	9	CAT3
26.237741	121.281309	2012-08-01T01:05:02Z	13	7	CAT2
26.26557	121.281296	2012-08-01T01:21:20Z	14	6	CAT1
26.246046	121.194494	2012-08-01T03:47:44Z	15	8	CAT2
26.157113	121.196698	2012-08-01T04:55:36Z	16	9	CAT1
26.146332	121.192365	2012-08-01T05:04:39Z	17	9	DOG
26.098482	121.193832	2012-08-01T05:33:30Z	18	9	DOG
26.19192	121.281357	2012-08-02T00:02:50Z	19	7	CAT1
26.285264	121.281311	2012-08-02T00:54:30Z	21	6	CAT2
26.346843	121.281256	2012-08-02T01:26:10Z	22	6	CAT3
26.354792	121.247435	2012-08-02T01:42:31Z	23	10	CAT1
26.355255	121.224158	2012-08-02T01:55:22Z	24	10	CAT2
26.285236	121.193462	2012-08-02T02:35:44Z	25	8	CAT1
26.262798	121.194109	2012-08-02T02:45:14Z	26	8	CAT2
26.228065	121.195047	2012-08-02T03:01:35Z	27	8	CAT3
26.115974	121.193446	2012-08-03T00:08:17Z	28	9	CAT2
26.223692	121.195074	2012-08-03T00:50:56Z	29	8	CAT3
26.243009	121.194606	2012-08-03T01:02:24Z	30	8	CAT2
26.25884	121.194311	2012-08-03T01:09:19Z	31	8	CAT2
26.263909	121.194106	2012-08-03T01:12:47Z	32	8	DOG
26.295692	121.19332	2012-08-03T01:30:07Z	34	8	DOG
26.355401	121.214705	2012-08-03T02:00:25Z	35	10	CAT2
26.28794	121.281242	2012-08-03T02:55:54Z	36	6	CAT2
26.234585	121.281314	2012-08-03T03:19:58Z	37	7	CAT2
26.169373	121.281404	2012-08-03T23:27:39Z	38	7	B/COOT1
26.172892	121.281406	2012-08-03T23:31:00Z	39	7	CAT1
26.183718	121.281372	2012-08-03T23:36:34Z	40	7	B/COOT2
26.196031	121.281351	2012-08-03T23:42:21Z	41	7	B/COOT3
26.231083	121.281333	2012-08-03T23:58:18Z	42	7	CAT2
26.288085	121.281282	2012-08-04T00:20:59Z	43	6	CAT2
26.354721	121.249591	2012-08-04T00:57:03Z	44	10	CAT1
26.353209	121.196658	2012-08-04T01:17:51Z	45	10	CAT2
26.291139	121.19336	2012-08-04T01:42:07Z	46	8	CAT1
26.256401	121.194455	2012-08-04T01:58:22Z	47	8	CAT2
26.146259	121.192471	2012-08-04T02:36:45Z	48	9	DOGS
26.129716	121.193086	2012-08-04T02:43:55Z	49	9	CAT2
26.103172	121.193804	2012-08-04T02:55:48Z	50	9	CAT2
26.086583	121.202339	2012-08-04T03:05:28Z	51	9	CAT3

latitude	longitude	date1:Ztime2	Waypoint GPS34	Transect	Species
26.173257	121.563047	2012-07-30T23:37:30Z	1	3	CAT1
26.067708	121.488351	2012-07-31T01:00:16Z	2	2	DOG
26.12706	121.519742	2012-07-31T01:52:54Z	3	1	CAT1
26.274452	121.4976	2012-07-31T03:19:03Z	4	4	DOG
26.290086	121.49745	2012-07-31T03:28:33Z	5	4	CAT2
26.303372	121.350772	2012-07-31T04:29:51Z	6	5	CAT2
26.303483	121.309158	2012-07-31T04:46:32Z	7	5	CAT1
26.303328	121.361839	2012-07-31T23:51:07Z	8	5	CAT2
26.303481	121.326376	2012-08-01T00:19:24Z	9	5	CAT1
26.283501	121.497555	2012-08-01T01:27:17Z	10	4	CAT2
26.244467	121.498041	2012-08-01T01:47:37Z	11	4	CAT1
26.140548	121.508106	2012-08-01T02:45:44Z	12	1	CAT1
26.067562	121.4716	2012-08-01T03:36:44Z	13	2	DOG
26.067903	121.507517	2012-08-01T03:51:54Z	14	2	CAT1
26.149678	121.557413	2012-08-01T23:20:12Z	15	3	CAT2
26.067886	121.506942	2012-08-02T00:25:42Z	16	2	CAT1
26.067699	121.487694	2012-08-02T00:36:30Z	17	2	CAT2
26.067702	121.473724	2012-08-02T00:42:57Z	18	2	CAT2
26.284485	121.497503	2012-08-02T02:54:50Z	19	4	CAT2
26.301045	121.40286	2012-08-02T03:41:35Z	20	5	CAT3
26.067662	121.482483	2012-08-03T00:37:15Z	21	2	CAT2
26.303223	121.40175	2012-08-03T03:36:44Z	22	5	DOG
26.303212	121.401213	2012-08-03T03:37:57Z	23	5	CAT3
26.185135	121.564446	2012-08-03T22:55:03Z	24	3	DOG
26.068448	121.548597	2012-08-03T23:55:37Z	25	2	DOG
26.067802	121.498505	2012-08-04T00:18:58Z	26	2	CAT1
26.124932	121.519471	2012-08-04T01:07:16Z	27		DOG
26.253072	121.497897	2012-08-04T02:11:47Z	28	4	POSSUM
26.303166	121.361717	2012-08-01T00:19:24Z	20	5	BILBY

Appendix 2
Explanatory notes - estimating introduced predator density

Feral cats, and to a lesser extent, wild dogs, are rarely seen and their populations are difficult to determine using trapping or spotlighting techniques. Therefore, indirect measures are used to estimate relative abundance. We use two measures, which rely on skilled observers and some sampling rule sets.

1. The Track Activity Index (TAI), which is calculated from the total number of sets of tracks (footprint sets) recorded over 5 nights for the 10 dragged transects each 10 km long. Algar and Burrows provide a rule set for determining whether a set of discontinuous track sets detected on a transect on the same day is counted as one or more track sets. In essence, if cat tracks are the same size, going in the same direction and are less than 2 km apart, we assume it is the same animal. The TAI is the measure currently used to set thresholds for free range fauna re-introductions (TAI<10.0).

TAI = (total number of track sets counted over 5 nights X 100) / 500).

Where cats have not been controlled in the arid zone, the TAI is usually 25-35. It can be as high as 55-65 in regions such as Shark Bay that sustains very high rabbit populations.

2. The Individual Density Index (IDI): This is calculated from the estimated number of <u>individual</u> animals (cats or dogs) detected by footprints along the dragged transects over 5 nights. That is, after 5 nights, we examine the data and estimate how many individual animals we think there are along the 100 km (10 transects x 10 km) of dragged transects and express this as a number per 100 km. This is estimated based on the size of the cat (or dog) and where along the transect it is detected each night. The IDI is calculated by:

IDI = (No. of individuals X 100) / 100.

The IDI is less reliable than the TDI because it requires somewhat subjective (expert) judgments and assumptions to be made about the actual number of individual animals on the transects over 5 nights.

To compare the TAI and the IDI, consider the following example:

After 5 nights of surveying a 10 km transect, we record one cat track set each night, so the TAI = (5 x 100) / 50 = 10.0. However, because of the size and location of the tracks, we conclude that the tracks have been made by 2 individual cats, so the IDI = (2 x 100) / 10 = 20.0. If we concluded that the tracks were made by 3 cats, then the IDI = (3 x 100) / 10 = 30.0, etc.