Government of **Western Australia**

REPORT ON STAGES 2 and 3 OF THE 'CHRISTMAS ISLAND CAT AND BLACK RAT MANAGEMENT PLAN'

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REPORT OUTLINE

The purpose of this program was to continue Stages 2 and 3 of the 'Christmas Island Cat and Rat Management Plan' (Algar and Johnston 2010). Stage 1 of the Management Plan which involved de-sexing, micro-chipping and registration of all domestic (owned) cats on the island was also revisited following the discovery of a number of non-registered cats being recorded during the annual domestic cat survey in May 2016. Documentation of the 2016 domestic cat survey and results of the subsequent veterinary program are provided in an additional report (Algar *et al*. 2016).

The primary aim of Stage 2 of the plan was to remove all stray cats within the residential, commercial and light industrial zones of Christmas Island. This also included cats at the Immigration Detention Centre (IDC), both at North West Point (NWP) and Phosphate Hill precinct. Without implementation of Stage 2 a significant source of cats, particularly natal recruits, would be available to disperse into or reinvade territories vacated across the rest of the island (i.e. the national park and Unallocated Crown Land). Stage 2 was required before an island-wide control program (Stage 3) could be implemented. Stage 2 is an ongoing requirement and is to be continued until cat eradication has been successfully completed.

Stage 3 commenced in 2015 and has continued this year. The program involves island-wide removal of feral cats through baiting, trapping and opportunistic shooting. Monitoring the outcome of this control effort is undertaken by Parks Australia. In this report we document control effort for each of these activities.

1 BACKGROUND

There is extensive evidence that the introduction of domestic cats (*Felis catus*), to both offshore and oceanic islands around the world can have deleterious impacts on endemic land vertebrates and breeding bird populations (see Ratcliffe *et al*. 2009; Bonnaud *et al*. 2010). Feral cats have been known to drive numerous extinctions of endemic species on islands and have contributed to at least 14% of all 238 vertebrate extinctions recorded globally by the IUCN (Nogales *et al*. 2013). In addition, predation by feral cats currently threatens 8% of the 464 species listed as critically endangered (Medina *et al*. 2011; Nogales *et al*. 2013). Island faunas that have evolved for long periods in the absence of predators are particularly susceptible to cat predation (Dickman 1992). Christmas Island—a high biodiversity island—is no exception.

Four of the five mammal species that were present on the island at settlement in 1888 have since become extinct. The diurnal native bulldog rat (*Rattus nativitatus*), for example, was reportedly common at the time of settlement; while the nocturnal Maclear's rat (*R. macleari*) was extremely abundant. The Christmas Island shrew (*Crocidura attenuata trichura*) has not been seen since 1985 and is believed extinct and, most recently, the Christmas Island pipistrelle (*Pipistrellus murrayi*) is thought to have become extinct in 2009 (Martin *et al*. 2012). While several factors are likely to have contributed to the demise of these native animals including disease, habitat destruction (land clearing and natural catastrophes such as cyclones) and the proliferation of the exotic yellow crazy ant (*Anoplolepsis gracilipes*), the introduction of exotic competitors and predators such as the cat and black rat (*R. rattus*) are also crucial factors.

In addition, several extant Christmas Island species are listed as being species likely to be adversely affected by cats and/or rats. These include the endemic Christmas Island emerald dove (*Chalcophaps indica natalis*) (listed under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) as endangered) and the red-tailed tropicbird (*Phaethon rubricauda*) (an EPBC listed marine species). In 2014, the EPBC listing of the white-tailed tropicbird (*P. lepturus*) was upgraded from threatened to endangered. The forest skink (*Emoia nativitatis*) and blue-tailed skink (*Cryptoblepharus egeriae*) were listed as critically endangered in early 2014. Lister's gecko (*Lepidodactylus listeri*) was upgraded to critically endangered from

vulnerable in early 2014 and the giant gecko (*Cyrtodactylus sadleiri*) listed as endangered.

This impact of cats in particular, and also rats on the biodiversity of Christmas Island was of significant concern to land management agencies and the broader community. As a consequence, a 'Management Plan for Cats and Black Rats on Christmas Island' (see Algar and Johnston 2010) was commissioned that would mitigate the environmental and social impacts of cats and black rats across all land tenures (shire-managed lands, Crown land including mine leases and Christmas Island National Park). A strategy was recommended that provided a staged approach to cat and black rat management and control leading to eradication of one or both target species. This document reports on the continuation of Stages 2 and 3 [see above Report Outline].

2 METHODOLOGY

2.1 Domestic Cat Survey

The `Management Plan for Cats and Black Rats on Christmas Island' (Algar and Johnston 2010) proposed a strategy to eradicate cats entirely from the island as the de-sexed domestic population died out. This was based on four actions:

1) to register and de-sex all domestic cats;
2) to destroy all non-domestic (i.e. stray and feral) cats;
3) to establish a 'cat prohibited area' along the Settlement shoreline to include the red-tailed tropicbird rookeries; and,
4) to prohibit the importation of new cats.

Cat registration was an essential first stage to two of these outcomes as it would: (i) ensure the release rather than destruction of domestic cats during trapping campaigns for stray and feral cats and (ii) to ensure the de-sexing of all domestic cats, preventing potential natal recruitment into the domestic, stray and feral populations.

To ensure that all domestic cats were registered it was necessary to conduct a survey for domestic cats (Algar *et al*. 2011a), across the entire residential area, before the commencement of the veterinary program. The veterinary program is described in detail in Algar *et al*. (2011b).

Surveys for domestic cats were conducted prior to veterinary programs in October 2010 at the commencement of the cat management program and again in May 2011 (Algar *et al*. 2011b). The final veterinary program was conducted in May 2012 following the survey that year (Algar *et al*. 2012; Algar *et al*. 2014). Subsequent surveys have been conducted in May 2013, 14, 15 and May this year. Documentation of the 2016 domestic cat survey and results of the subsequent veterinary program are not discussed further in this report but are provided in an additional report (Algar *et al*. 2016).

2.2 Baits and the Baiting Program

The feral cat baits used (*Eradicat*®, see detailed description in Algar and Burrows 2004; Algar *et al*. 2007) were manufactured at Parks and Wildlife's Bait Manufacturing Facility at Harvey, Western Australia. Baits were transported to Christmas Island and then kept in frozen storage. Toxic feral cat baits are dosed at 4.5 mg of sodium monofluoroacetate (compound 1080) per bait. Consistent with previous baiting programs, baits were suspended from 'Bait Station Devices' (BSDs) (see Algar and Brazell 2008).

The baiting program in 2016 adopted recommendations provided in the previous report. Baiting was to be conducted along the island's extensive road and track network. The baiting program commenced in May, with baits to be deployed over ten consecutive days along each site. BSDs were to be visited daily for the first five days and bait removal recorded. Baits were to be replaced on day 5 and bait removal recorded at the end of the 10-day period. Baiting was later scaled back to a five-day period only because of persistent rainfall. BSDs were located at 100 m intervals on both sides of the road/track, staggered at 50 m intervals across the road/track. A bait, comprising two *Eradicat*® sausages tied at the link, was suspended at a height of about 400 mm from each BSD using 6–8 lb fishing line. Baits were replaced when taken and also routinely

as required if phosphate dust raised by passing vehicles adhered to the baits and was considered likely to reduce palatability.

The baiting campaign aimed to bait the township perimeter twice, once at the beginning of the dry season and another final deployment in October when conditions were optimal. No BSDs were deployed within the 500 m township exclusion buffer, nor along Vagabond Rd / Phosphate Hill Section. All major haul roads, internal forest tracks, designated vegetation rehabilitation tracks and mine lease areas were to be baited from west to east across the island; the locations of BSDs are presented in Figure 1.

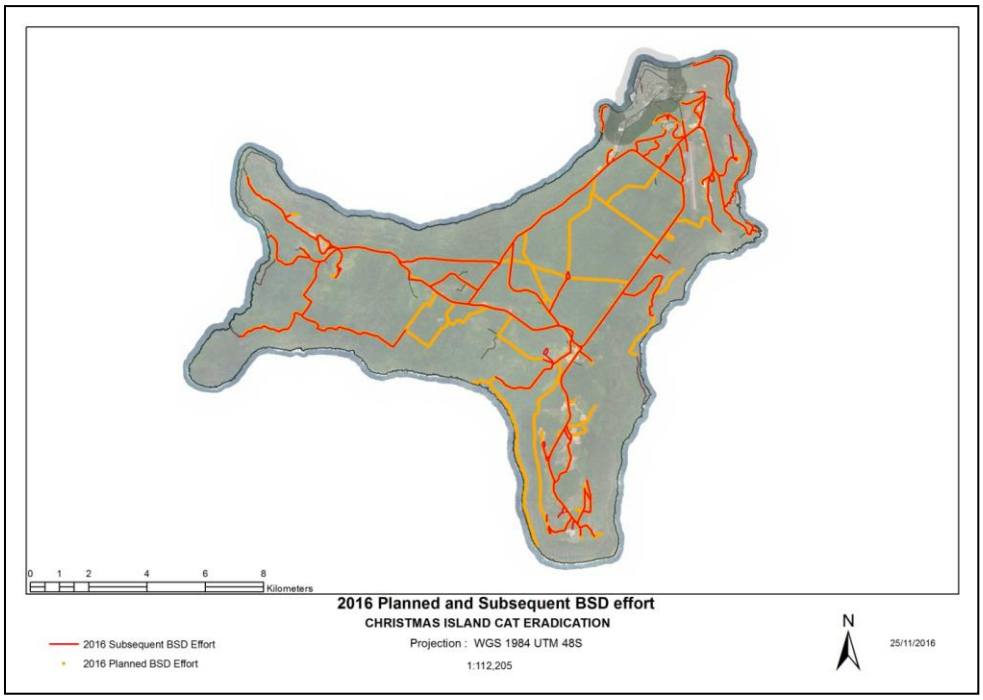

Figure 1. Location of planned BSD effort at the start of the season, overlayed with the subsequent BSD effort at the end of the season.

Due to unprecedented wet weather in the dry season from May to October (the wettest dry season on record), the planned baiting effort was scaled back and refined. Initial bait deployments around the township perimeter and western parts of the island indicated that prolonged wet/humid conditions and continued vegetation/canopy coverage provided a hostile microclimate for the baits. Visual inspection of baits along internal forested tracks showed that 'sweating' of the baits was inhibited, and mould affected the baits after day 2. These conditions

were likely to have significantly reduced palatability and potential effectiveness of the baits. Reduced sunlight and airflow with increased humidity were attributed to a decrease in baiting effectiveness in these areas. Main haul roads and open tracks experienced more sunlight and airflow, allowing the baits to sweat and last slightly longer. A decision was made to concentrate baiting effort along these open roads/tracks first and follow-up in the forested areas later in the season, should weather conditions improve. These notable observations and change in baiting strategy were discussed with CINP staff, which refined their forest baiting strategy accordingly. The planned and subsequent baiting effort is shown in Figure 1. Unfortunately, the inclement weather and unfavourable conditions prevented further bait deployment along the internal forested tracks.

During 2016, all main haul roads, including the perimeter of the township, commercial, light industrial area and NWP detention facility were baited at least once for the 5-day duration. A limited amount of vegetation rehabilitation tracks and mine lease area were baited also. Two sections of road were baited twice (Gaze Rd and Central Area/LB4 section). The location of BSD effort and bait uptakes are shown in Figure 2. Some tracks and mine areas could not be accessed due to boggy and/or overgrown conditions or operational activities.

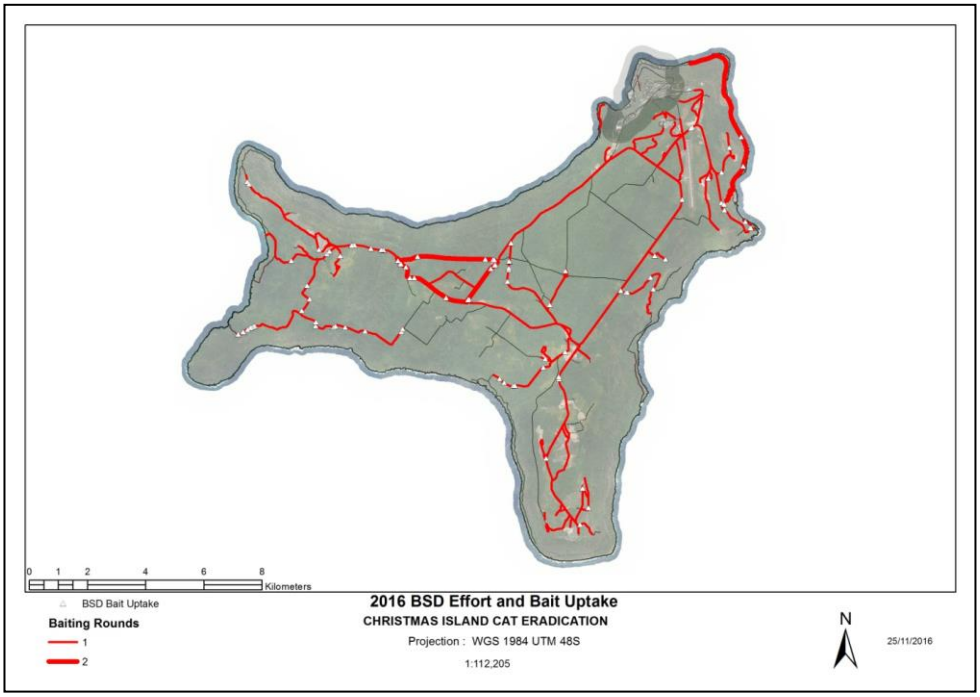

Figure 2. Location of roadside BSD effort for 2016 and resulting bait uptake across the island.

As bait station activity cannot be ascribed to individual feral cats, a value for the maximum and minimum number of cats poisoned was determined. The total number of toxic baits removed was considered to indicate the maximum number of individuals poisoned. The minimum number of individuals poisoned was calculated by ascribing bait removals from consecutive BSDs to the same animal, even if ten or more stations were involved. The actual number of feral cats poisoned during these programs would be between these two extremes. It was considered likely that some cats would visit multiple BSDs given the delay between bait consumption and onset of symptoms.

2.3 Trapping Program

The registration and de-sexing of domestic cats was the first stage of the management plan (Algar and Johnston 2010), with the second stage—the control of stray and feral cats in the residential, commercial and light industrial area—then able to proceed. Results from the previous cat control programs have defined areas preferred by stray cats which were targeted during the trapping program. In addition, the community continued their unrelenting support for the program and would inform us of areas where stray cats were present which were also targeted. Traps were strategically located within these sites, typically in areas likely to be food sources and thoroughfares.

Cats were captured using medium and large Sheffield wire cage traps with treadle plates (Sheffield Wire Products, Welshpool Western Australia). All traps were covered with a hessian sack or modified plastic phosphate bag to provide shelter and protection to the captured animals until they could be collected. The traps were usually baited with cooked chicken wings which were treated with the insecticide Coopex to maintain the longevity of the bait by deterring insects from consuming or spoiling the bait. The baits were cable-tied to the back of the cage to reduce trap failures by increasing the time animals spent inside a cage, thus increasing the likelihood of activating the treadle mechanism. Baits were replaced as necessary.

Targeted leg-hold trapping of feral cats along roadsides and tracks in forested areas was trialled in 2016, using elevated trap platforms (ETPs). The ETPs were either half cut 44 gallon steel

drums or 30 L plastic buckets. Again, the majority of trapping conducted, was informed by opportunistic cat sightings or reported spotlight sightings when a cat had quickly retreated before it could be shot.

Trapped feral cats were euthanized by a head-shot from a 0.22 calibre rifle. All animals captured were sexed, weighed and a broad estimation of age (as either kitten, juvenile or adult) was recorded according to their weight as a proxy for age. In addition, the pregnancy status of females was also used to determine whether the animal was an adult. The smallest weight recorded for a female that had recently given birth, at a time when sexually mature females had bred, was 2.0 kg and this was used as the minimum adult weight for female cats (see Algar and Hamilton 2012).

2.4 Shooting Program

Dedicated night time spotlighting and shooting was conducted using a 4WD vehicle, 12 volt Lightforce hand spotlight and a registered 0.22 calibre firearm (with scope and torch beam). This was conducted outside of the township area, mostly along the main haul roads and open tracks, driving at approximately 50 km/h. Details of feral cats shot, or sighted but not shot were recorded, as well as distance travelled each night. Details of feral cat sightings were used for targeted trapping efforts afterwards.

3 RESULTS

3.1 Domestic Cat Survey

Documentation of the 2016 domestic cat survey and results of the subsequent veterinary program are not discussed further in this report but are provided in an additional report (Algar *et al*. 2016).

3.2 Baiting Program

In 2016, 2382 BSDs were deployed across the island, compared to 2997 BSDs in 2015 (see Figure 3). Bait removal was recorded at 14 of the 750 BSDs (1.9%) deployed around the perimeter of the township, commercial, light industrial area and off-tracks. Bait removal was also recorded at 74 of the 1632 BSDs (4.5%) deployed along the main haul roads and open tracks in the forested areas. Of these, baits were removed at three BSDs on two separate occasions. In total, baiting removed between 69 (minimum) and 91 (maximum) feral cats this year. In areas of high robber crab (*Birgus latro*) activity, some baits were taken by robber crabs that had managed to traverse over the BSD white disc. High robber crab activity persisted all year in these areas due to wet conditions.

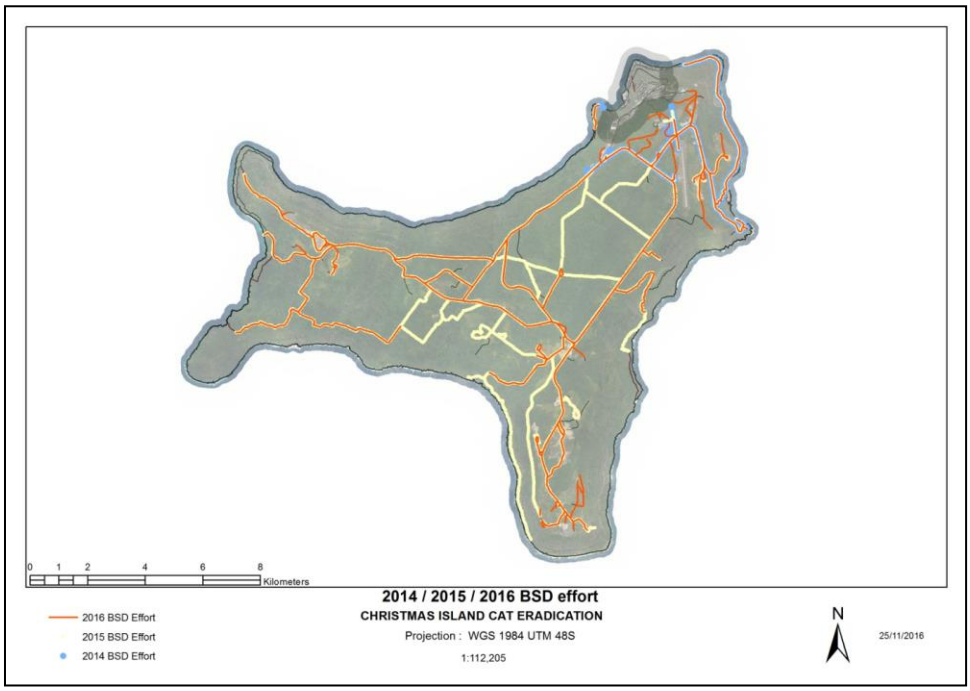

Figure 3. Map showing comparison of roadside BSD effort over the last three years.

There has been continued BSD effort over several years around the township perimeter, commercial and light industrial area, concentrating on the north-east inhabited corner of the island. Comparison of bait removal over the years has decreased, despite increased BSD effort in this area (see Figure 4).

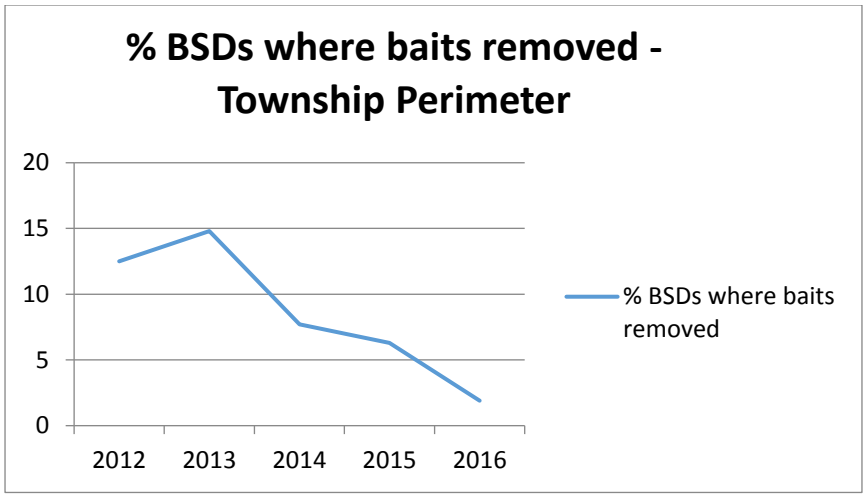

Figure 4. Decline of bait uptake on BSDs deployed around the perimeter of the township, commercial and light residential area over the last five years of control effort.

The first island-wide baiting effort was carried out in 2015, with a deployment duration of 10 days. In 2016, this was reduced to a 5-day duration, as inclement conditions prevailed and previous data suggested bait removal and cumulative percentage of baits removed, had peaked by then. Comparison of the first five days data from 2015 and 2016 show a similar trend, with this year being more pronounced. Negligible bait removal and cumulative percentage of baits removed after day 3 may be related to the reduced palatability of baits by this time (see Figures 5 and 6).

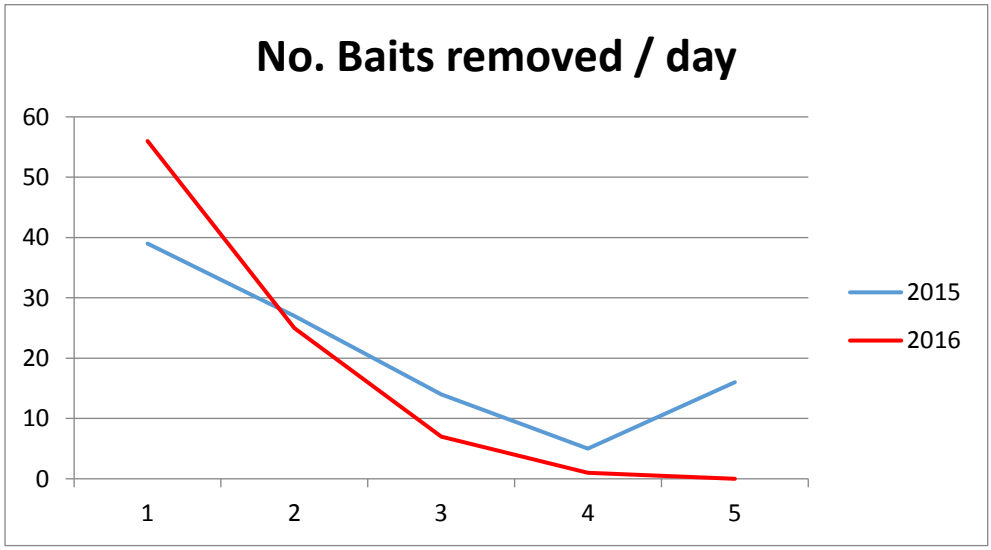

Figure 5. Number of baits removed each day over a 5-day deployment across the island.

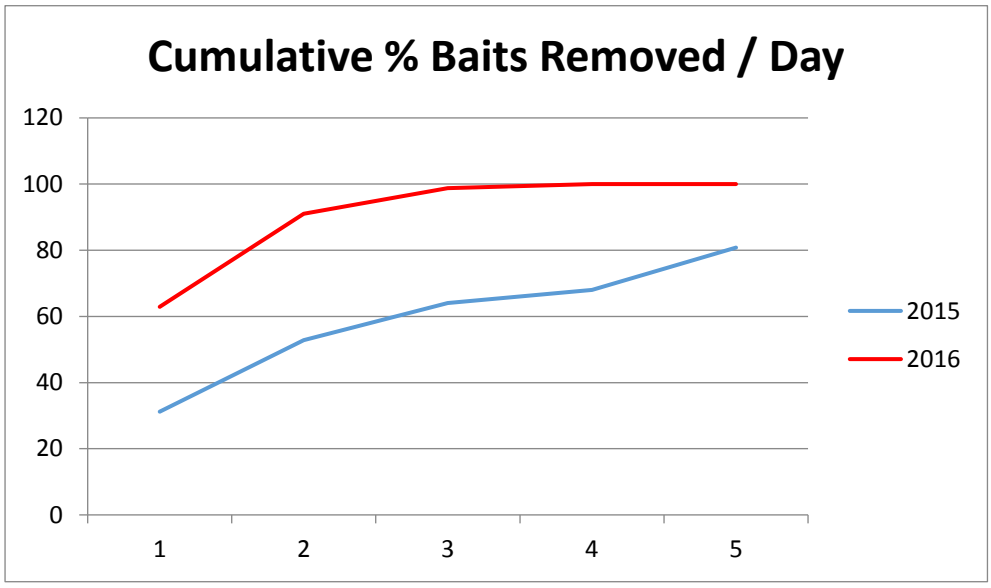

Figure 6. Cumulative rate of baits removed over a 5-day deployment for both years across the island.

3.3 Trapping Program

In 2016, 312 cage trap-nights were conducted across the township, commercial and light industrial areas (see Figure 7, Table 1). This resulted in the removal of 11 stray cats (7 female, 4 male), mostly from the refuse tip. Another 50–100 cage trap-nights were conducted within the NWP detention facility by a local pest controller who borrowed 10 large cage traps. This resulted in three male cats being removed. The shire rangers and local residents also assisted in collaborative cage trapping efforts throughout the year. This has resulted in four stray cats (2 female, 2 male) being brought in by the shire rangers and ten stray cats being brought in by residents (2 female, 8 male). One of these females also had a litter of four kittens. Targeted cage trapping, together with continued collaboration between local agencies and support from the community has removed a total of 29 stray cats (10 female, 15 male, 4 kittens) this year. During trapping operations, only one registered pet cat was caught. This was returned to its owner. An additional six stray/feral cats have been removed from around the island as recorded roadkill from vehicular traffic.

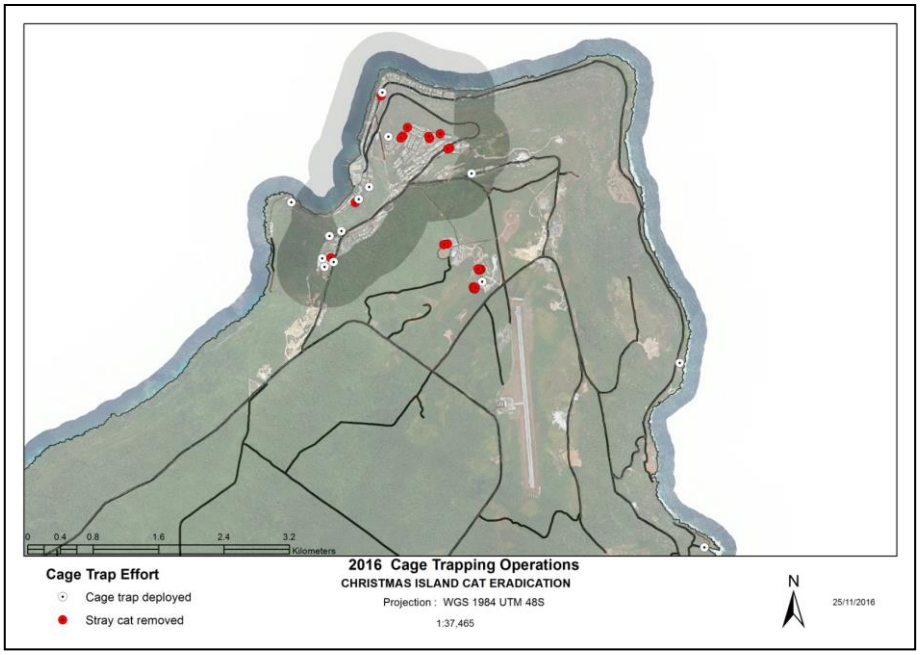

Figure 7. Location of cage trapping effort around the township area and stray cats removed by cage traps.

Table 1. Age and gender classes of stray cats removed by cage trapping.

Age Class	Female	Male	NA	Total
Kitten	1	1	4	**6**
Juvenile	5	3	0	**8**
Adult	4	11	0	**15**
Total	**10**	**15**	**4**	**29**

Sixty-five ETPs (25 drum, 40 bucket) were deployed for a total of 585 trap-nights, removing 12 stray/feral cats (see Figure 8). The drum ETP resulted in the removal of seven individuals over 250 trap-nights and the bucket ETP removed five individuals over 335 trap-nights (see Table 2).

Table 2. Age and gender classes of stray/feral cats removed with ETP leg-hold trapping.

Age Class	Female	Male	NA	Total
Kitten	0	0	0	**0**
Juvenile	1	1	0	**2**
Adult	2	8	0	10
Total	**3**	**9**	**0**	**12**

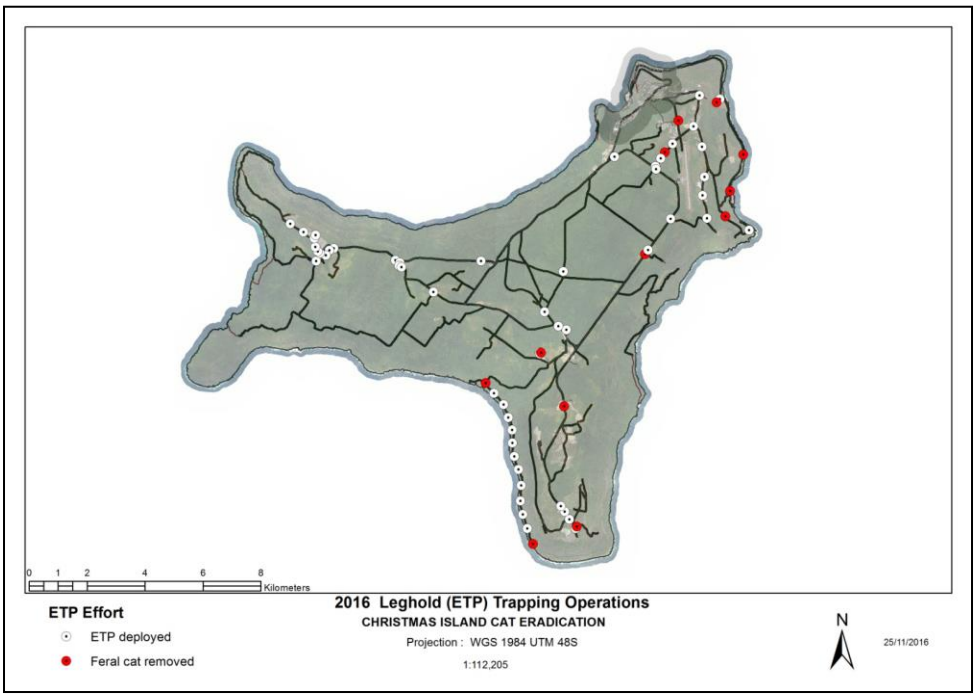

Figure 8. Location of deployed ETPs and feral cats removed using this method in 2016.

3.4 Shooting Program

In 2016, over 1,300 km of road and tracks were covered across the island over a total of 21 nights. This resulted in eight feral cats being removed, and a further 10 being sighted (see Figure 9). The number of nights spotlighting and distance travelled were limited due to weather conditions, thus limiting search effort. Significant dense vegetation on the edges of roads and tracks, which would have normally receded in the dry season, reduced visibility. A significant number of cats sighted were either out of range to accurately shoot, or retreated quickly into dense vegetation. Opportunistic sightings of cats, when carrying the firearm, led to three more feral cats being shot. Eleven cats were removed from shooting operations (see Table 3).

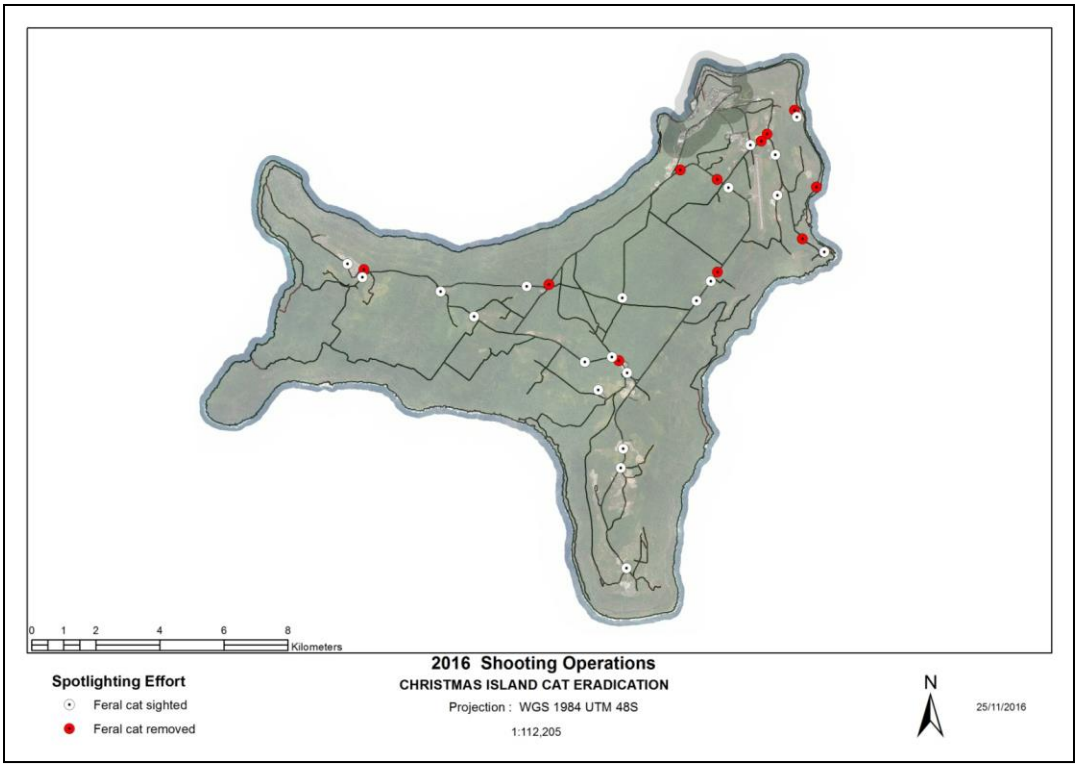

Figure 9. Location of feral cats sighted and removed during spotlighting efforts in 2016.

Table 3. Age and gender classes for stray/feral cats removed by shooting.

Age Class	Female	Male	NA	Total
Kitten	2	0	0	**2**
Juvenile	1	0	0	**1**
Adult	0	8	0	8
Total	3	8	0	11

4 DISCUSSION and RECOMMENDATIONS

Despite unprecedented wet weather this season hampering island-wide cat control operations, significant gains were made, reflecting the change in strategy. Long-term wet conditions this dry season has prolonged an unfavourable environment to bait along internal forested tracks. It has also maintained resource availability for feral cats, which may have contributed to reduced bait

uptake. The change in strategy included scaling back baiting effort along the forested tracks and concentrating in existing open roads and mine lease areas.

Targeted trapping continued in the township area and NWP detention centre area, while forest trapping effort was intensified to improve techniques and inform on future control methods. Substantial effort went towards refining trapping techniques, with designs to improve lure attractiveness, reduce land crab interference and withstand wet conditions being trialled. Targeted forest trapping from opportunistic and spotlight sightings throughout wet weather conditions, facilitated these trials. Significant improvements were made to ETP designs, optimising platform heights, substrates and weather resistance. Consideration was made to the feasibility of large-scale production and remote deployment of traps with wet season durability.

Control efforts comprised: baiting 118 km of road and track network using BSDs; trapping over 897 nights and spotlighting and shooting for 21 nights. Roadside BSDs removed between 69–91 feral cats, cage trapping removed 29 stray cats, ETP leg-hold trapping removed 12 and shooting accounted for a further 11 individuals. These control methods combined have removed between 121–143 stray/feral cats this season.

Reports of stray and feral cat sightings by CINP staff, Shire Rangers, local residents and visitors have assisted in site specific trapping and the observation database maintained by CINP will help inform on targeted control methods. Increased engagement to gather sighting information from the community and visitors will be of great value to future operations.

Key Recommendations for 2017

- Expand the road and track network for BSD baiting in the dry season, especially in forested areas to maximise baiting effort and spread across the island. This would require maintaining certain forested tracks including verge vegetation of rehabilitation and mine lease tracks for BSD deployment.

- Undertake an extensive roadside ETP trapping program, utilising the same extended road and track network across the island. This will involve three intensive trapping and shooting campaigns by Parks and Wildlife staff every second month to cover the entire road/track network. Additional transport, firearms and a considerable number of ETPs would be required.
- Outsource complete analysis of island-wide camera trapping data to an independent expert statistician for cat population monitoring. This would free up a significant amount of staff time to concentrate on extensive control efforts, whilst providing prompt impartial information for seasonal decision making.
- Conduct camera trapping along the road/track network in conjunction with operational activities to support and inform on specific management and effectiveness of control effort.
- Support dry season bait take trials to inform on targeted aerial baiting, rather than broad-scale baiting. This will assist in evaluating the potential option of strategic baiting in open mine lease areas.
- Continue to conduct the annual domestic pet cat survey in May. This could coincide with a community awareness update of the project. Investigating illegal pet ownership and targeted cage trapping in the township area for stray cats would also be conducted.
- Continue trials to refine the various control methods, especially in forested areas and under wet season conditions. This includes remote deployment in difficult to access areas.
- Maintain observation database and targeted trapping effort around the township perimeter and NWP detention facility area throughout wet season, to control cat numbers and protect project investment. This is required to limit re-incursion and likelihood of natal recruits from becoming illegal pets.
- Increase community engagement and participation for stray and feral cat sightings that will inform on targeted control, maintain support and awareness of the project.

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