Government of **Western Australia**

REPORT ON STAGE 2(c) OF THE 'CHRISTMAS ISLAND CAT AND BLACK RAT MANAGEMENT PLAN'

Prepared by

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REPORT OUTLINE

The purpose of this program was to continue Stage 2 of the 'Christmas Island Cat and Rat Management Plan' (Algar and Johnston 2010). Drafting the Management Plan was funded by the (then) Attorney Generals Department (later DRARDLG and now DRALGAS) in 2009/10. Following acceptance of the suggested revisions to the current local cat management laws (*Shire of Christmas Island Local Law for the Keeping and Control of Cats 2004*) under the Local Government Act 1995 (WA) (Ci) Stage 1 of the Management Plan which involved de-sexing, micro-chipping and registration of all domestic (owned) cats on the island commenced in October 2010 and the final program was conducted in May 2012 (Algar and Hamilton 2012; Algar *et al*. in review).

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). Rat management was also incorporated into Stage 2. Stage 2 was required before an island wide control program (Stage 3) could be implemented. Stage 2 has been subsequently divided into a series of sub-stages [Stage 2(a), (b) and (c)] because of funding issues:

Stage 2(a)—Occurred in May to June 2011 funded by Parks Australia which included a contract with the Western Australian Department of Parks and Wildlife (formerly Department of Environment and Conservation). The results of Stage 2(a) are documented in Algar and Hamilton (2012) and Algar *et al*. (in review).

Stage 2(b)—commenced implementation from 1 July 2011 and was to be completed by the end of the 2011/12 financial year. This stage formed the basis of the funding received from DRARDLG. Unfortunately the funding application for commencement of Stage 3, sent to the Commonwealth (Caring for our Country, DSEWPaC) was not granted. Following this decision, at a meeting of the various agencies involved, it was decided that it was imperative that Stage 2(b) should also include an intensive baiting program outward from the residential area. This would remove the majority of individual animals adjacent to the residential area and provide a buffer zone into

which dispersing cats would move. This control effort would, to a large extent, protect the significant investment and gains achieved in controlling stray cats until a new source of funding could be obtained the following financial year. The results of Stage 2(b) are documented in Algar and Hamilton (2012) and Algar *et al*. (in review).

Stage 2(c)—unfortunately in 2013/14, the funding application for commencement of Stage 3 was also not granted. The various land management agencies on the island each contributed funds to cover the costs of a short-term control program that would once again protect the significant investment and gains achieved in controlling stray cats until a new source of funding could be obtained. Stage 2(c) was conducted over the period 9 August–19 September 2013.

The scope of works over the Stage 2(c) period was essentially the same as Stage 2(b) therefore focused on: -

- continued removal of stray/feral cats in the residential, commercial and light industrial area that particularly focused on the landfill site;
- continued removal of stray/feral cats at the red-tailed tropicbird (*Phaethon rubricauda*) colonies located at the Sitting Room and Rumah Tinggi along the Settlement shoreline as recommended by Beeton *et al*. (2010);
- baiting outward from the residential area to remove the majority of cats adjacent to the residential area and provide a buffer zone into which dispersing cats would move.

This report documents the control effort for Stage 2(c) and also includes are the fourth survey for domestic cats conducted in May 2013. Over this period the control effort has primarily focussed on the removal of stray/feral cats. Cage trapping was the primary control technique employed to remove these cats. A baiting program along the roadsides/tracks that surrounded the residential and light industrial area was also conducted from 19 August–17 September 2013.

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); the Red-tailed Tropicbird (*Phaethon rubricauda*) (an EPBC listed marine species); and forest skink (*Emoia nativitatis*) and blue-tailed skink (*Cryptoblepharus egeriae*) which are not yet listed under the EPBC Act as threatened but are rapidly declining and under threat of extinction.

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 Stage 2, [Stage 2(c), see above Report Outline].

2 METHODOLOGY

2.1 Site Description

A site description for Christmas Island is provided in detail in previous reports and publications (Algar and Hamilton 2012; Algar *et al*. in review). The location of work conducted during this current program was primarily confined to the north-east corner of the island within the residential, commercial and light industrial areas. However, baiting was also conducted along roads surrounding the Immigration Detention Centre at North West Point.

2.2 Domestic Cat Surveys

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. The final veterinary

program was conducted in May 2012 following the survey that year. The latest survey was conducted in May 2013.

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. The trapping program in 2013 was conducted over a five-week period in August through to mid September. Results from the previous cat control programs (Algar and Hamilton 2012; Algar *et al*. in review) had 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 Sheffield wire cage traps (60x20x20 cm) with treadle plates (Sheffield Wire Products, Welshpool Western Australia). These traps were generally operated over five-day periods. All traps were covered with a hessian sack to provide shelter and protection to the captured animals until they could be collected. The traps were usually baited with cooked chicken wings (occasionally with fresh mulies (pilchards) 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.

Trapped feral cats were euthanized by a head-shot from a 0.22 calibre air 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). The weight groupings for the cat age classes are provided in Table 1

Table 1. The weight groups for the cat age classes of the trapped population

Category	Male	Female
Kitten	< 1.0 kg	< 1.0 kg
Juvenile	1.0–2.4 kg	1.0–1.9 kg
Adult	2.5+ kg	2.0+ kg

2.4 Baits and Baiting Programs

The feral cat baits used (*Eradicat*®, see detailed description in Algar and Burrows 2004; Algar *et al*. 2007) were manufactured at DPaW'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; Algar and Hamilton 2012; Algar *et al*. in review).

The baiting program in 2013 adopted recommendations provided in an earlier report (Algar *et al*. 2011a). In the current program only toxic baits were used, baiting along major roads was conducted over ten consecutive days. A network of BSDs was established along approximately 23 km of roadsides/tracks that surrounded the residential and light industrial area. Additional BSDs were placed at a number of road junctions where Christmas Island National Parks staff had seen cats over the past 12 months and also around the IDC at North West Point. 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. All BSDs were inspected daily over the baiting period to assess whether baits had been removed. Bait removal from the BSDs was used to determine the efficacy of the baiting program. Baits were replaced when taken and also routinely renewed each week because phosphate dust raised by passing vehicles adhered to the baits and was considered likely to reduce palatability. The locations of BSDs are presented in Figure 1.

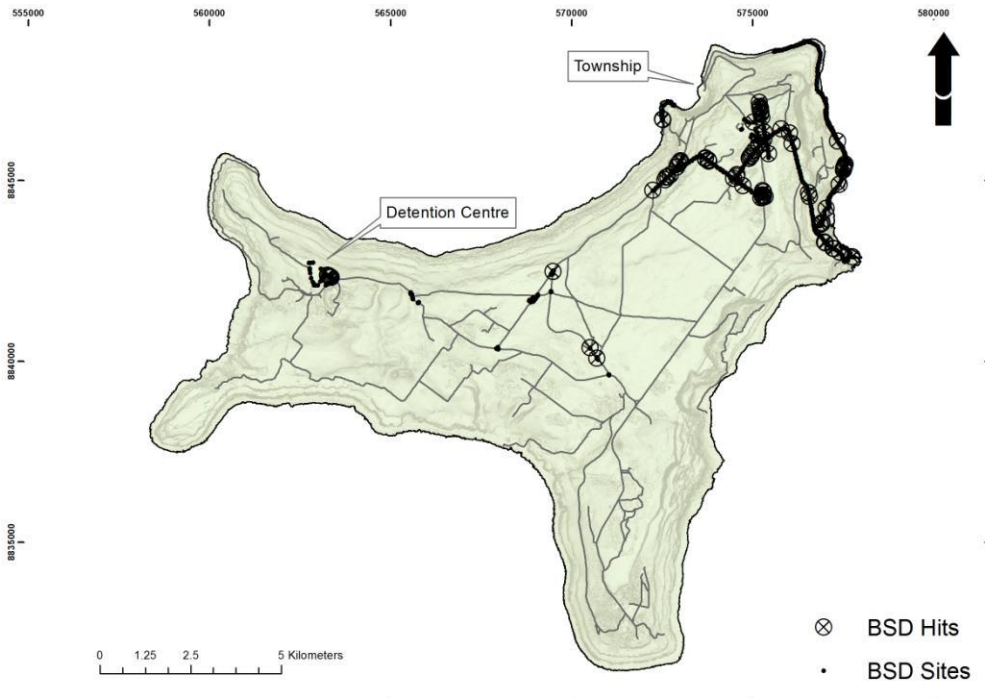

Figure 1. Network of Bait Suspension Devices surrounding the residential and light industrial area in 2013. Figure produced by D. Maple (CINP)

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 two 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.

3 RESULTS

3.1 Domestic Cat Surveys

Since October 2010, 164 cats have been registered following the three veterinary programs. The total number of domestic cats registered each year, the sex structure, the number of new registrations and number deregistered are presented in Table 2. The survey for domestic cats

conducted in May 2013 revealed that of the 135 domestic cats registered in 2012 only 111 were still present, 24 cats (11 females, 13 males) were deregistered at the conclusion of this survey. Deregistered cats had either died from natural causes, were road fatalities, destroyed as the owners had moved off island, transported to the mainland as their owners left island or had been missing for at least six months and were presumed dead.

Table 2. Total number of domestic cats registered each year, the sex structure, the number of new registrations and number deregistered

Date	No. registered			New registers			De-registers		
	Total	**Female**	**Male**	**Total**	**Female**	**Male**	**Total**	**Female**	**Male**
October 2010	N/A	N/A	N/A	136	66	70	N/A	N/A	N/A
May 2011	138	69	69	18	10	8	16	7	9
May 2012	135	66	69	12	5	7	15	8	7
May 2013	111	53	58	0	0	0	24	13	11

3.2 Trapping Programs

In 2013, 496 cage trap-nights were conducted across the residential, commercial and light industrial areas. The trapping program resulted in the removal of the majority of cats from this area, in total 43 stray/feral cats (21 females, 22 males), a biomass of 128.4 kg. In addition to these cats, a female cat was trapped by a local resident in Silvercity and handed to us for destruction; the same resident also captured a registered cat which we handed back to its owner. Six new-born kittens were found in a garden in Drumsite by the resident and also euthanized. A further 11 cats (six females, five males) comprising seven adult, three juvenile and one kitten were captured by the general public or Shire Ranger prior to our arrival and were euthanized by CINP Rangers.

The general location of all trap points, trap numbers and dates of commissioning and decommissioning are presented in Appendix 1. The age classes of the trapped population are provided in Table 3 and the general location of captures in Table 4.

Table 3. The age classes of the trapped population

Category	Male	Female	Total
Kitten	0	0	0
Juvenile	5	3	8
Adult	17	18	35

Table 4. The location of captures and number of cats removed

Location	Number of cats
Trax Tavern/construction site Drumsite	10
School	4
Tip, Rec. Centre, IDC (Phosphate Hill)	22
Kampong	2
Settlement	2
Casino	3

The male-to-female sex ratio of the total trapped population was 1.05, which did not differ significantly from unity ($\chi^2 = 0.02$, 1df, $P>0.1$). This was the case for all age classes (juveniles, $\chi^2 = 0.5$, 1df, $P>0.1$) and (adults, $\chi^2 = 0.02$, 1df, $P>0.1$).

Of the 18 adult females destroyed in 2013, 13 (72%) were pregnant, 0 (0%) were lactating and 5 (28%) were non-pregnant/non-lactating.

While conducting the trapping program, one registered cat was trapped and returned to its owner.

3.3 Baiting Programs

In 2013, bait removal was recorded at 75 of the 465 BSDs (16%) over the 10-day baiting period. The location of bait takes are shown in Figure 1. Of these, baits were removed at seven BSDs on two separate occasions and from one BSD on three different occasions giving a total of 83 baits taken (see Figure 2).

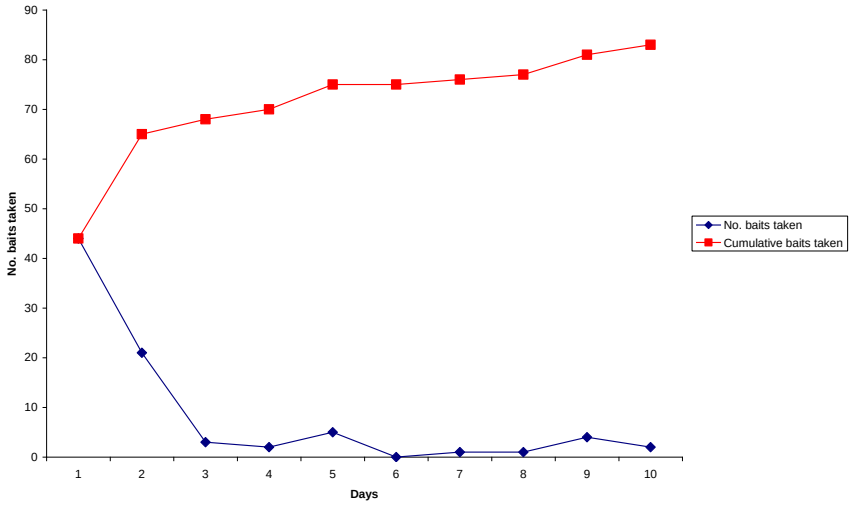

Figure 2. Number of baits removed from BSDs by feral cats in 2013

The total number of baits removed, and by inference the maximum number of individual feral cats poisoned, was 83. The minimum number of cats poisoned was 42 (Figure 3), allowing for individual cats that may have consumed baits from multiple BSDs. There were 18 occurrences when consecutive baits were removed from adjoining BSDs on the same day. On 14 of these occasions bait removal occurred on both sides of the road and on four occasions, bait removal was restricted to one side of the road only.

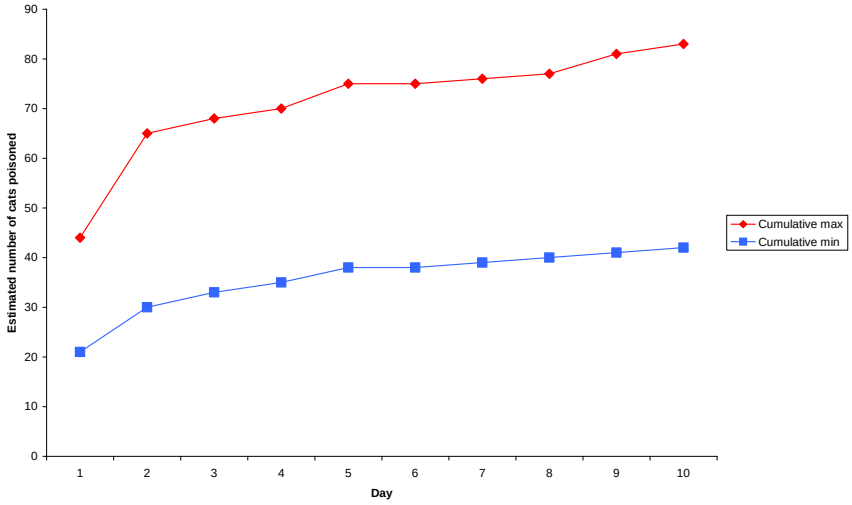

Figure 3. Estimated cumulative minimum and maximum number of feral cats poisoned following consumption of toxic *Eradicat* bait(s) in 2013

4 DISCUSSION AND RECOMMENDATIONS

One hundred and sixty six domestic cats have been registered since October 2010 to the present day. Of these registered animals, 55 (33%) are now deregistered within this three-year period. The surveys for domestic cats conducted over the past three years suggest that the 'model of domestic cat decrease over time', based on an average lifespan of 15 years, is underestimated. The model indicated that domestic cats would no longer be present on Christmas Island by 2024 (Algar *et al*. 2011b) however, the attrition rate is higher than predicted, particularly because of road fatalities, and the island is likely to be free of domestic cats much earlier.

The substantial cat control effort conducted in the residential, commercial and light industrial area prior to this year, primarily through cage-trapping, has resulted in the removal of 278 stray/feral cats from the area. A further 43 animals were removed this year resulting in a total of 321 stray/feral cats having been destroyed since the program commenced.

All baiting programs conducted over the past three years have demonstrated that control/eradication of the feral cat population on Christmas Island is feasible using *Eradicat*® baits delivered on BSDs. The 2011 baiting program, along 18 km of roadside/track around the periphery of the residential area, removed between 36 and 49 cats over the baiting period. In 2012, the more extensive baiting program resulted in the removal of a further 103–142 stray/feral cats along approximately 78 km of roadside/track. This year between 42–83 cats were poisoned during the baiting program along approximately 23 km of roadside/track.

In summary as a consequence of the combined trapping and baiting programs, between 502 and 595 stray/feral cats have been removed since the commencement of the management plan (this figure does not take into account kittens *in utero* that may have survived had the female cat not been destroyed).

The benefits of cat removal are already being observed particularly in the residential area where the majority of control effort has been focussed. In 2011, for the first time in a number of years, there was a dramatic increase in the nesting success rate of Red-tailed Tropicbird chicks along the Settlement shoreline (Algar *et al*. 2012). On Christmas Island, both domestic cats (identifiable by collars) and stray/feral cats have been photographed predating Red-tailed Tropicbird chicks. The euthanasia of a number of unwanted pet cats from residences along the Settlement shoreline in

October 2010 and removal of a number of stray/feral cats from the same area prior to the nesting season is likely responsible, at least in part, for the improvement in the status of this spectacular species (Algar *et al*. 2012). Further removal of stray/feral cats from the Settlement shoreline area in 2011, 2012 and 2013, the decline in domestic cats resident in the area and the implementation of a rat baiting programs in 2012 and 2013 from the Sitting Room to the Tourist Centre have resulted in continued Red-tailed Tropicbird nestling success (N. Hamilton unpub. data).

Removal of the majority of the stray/feral cat population has been noticed by much of the community who have commented on the success of the campaign and appreciate the decline in cat numbers. The return to owners of captured domestic cats, when trapped, and discussion of the program with the owners, has also received a positive response. Both these factors have resulted in the community at large having an optimistic and constructive view of the program. The enthusiasm with which the general community has embraced the program indicates that there will be further support which can only increase the probability of successful eradication (see Oppel *et al*. 2010).

The excellent achievements of the program are the result of a substantial effort by a number of dedicated people, made possible, in part, because of funding. Feral cat eradication programs that have failed in the past were usually attributed to lack of institutional and financial support (Campbell *et al*. 2011). Land management agencies on Christmas Island must secure the further funding required to see the project to its successful conclusion and ensure conservation of biodiversity. Successful cat eradication campaigns have varied in cost from US$4–431/ha (in 2009 US$, Campbell *et al*. 2011). Even at the upper end of this investment range, feral cat eradication can still be a cost-effective strategy for preventing species extinctions on islands (Nogales *et al*. 2013) with at least eight IUCN-listed endangered species having benefited from feral cat eradications (Medina *et al*. 2011; Nogales *et al*. 2013). The suggested cost of cat eradication on Christmas Island is likely to be middle of the range, costing approximately US$2,000,000.

Unfortunately in the present economic climate, where insufficient conservation funds exist, it may be prudent to adopt an interim control measure to eradication until the level of funding required can be secured. This proposed interim control measure would allow continuation of the existing program, that is, maintenance of Stage 2 to protect the significant investment and gains achieved and importantly demonstrate to the community that the program was still being

undertaken albeit at a reduced scale in the short-term. The island-wide program (Stage 3) could also be rolled out progressively over time which potentially would significantly reduce the costs of eradication. It is suggested that the revised program needs to be a collaborative approach between DPaW and CINP, managed by DPaW and coordinated by CINP. An outline of funding requirements for this interim control measure is documented in Appendix 2.

5 REFERENCES

Algar D., Angus G.J., Williams M.R. and Mellican A.E. (2007). Influence of bait type, weather and prey abundance on bait uptake by feral cats (*Felis catus*) on Peron Peninsula, Western Australia. *Conservation Science Western Australia* **6(1)**, 109–149.

Algar D. and Brazell R. I. (2008) A bait-suspension device for the control of feral cats. *Wildlife Research* **35**, 471–476.

Algar D. and Burrows N.D. (2004). Feral cat control research: Western Shield review, February 2003. Conservation Science Western Australia 5, 131–163.

Algar D. and Johnston M. (2010). *Proposed Management Plan for Cats and Black Rats of Christmas Island*. Western Australian Department of Environment and Conservation.

Algar D., Hamilton N., Holdsworth M. and Robinson S. (2012). Cat removal implicated in improved nestling success in iconic Red-tailed Tropicbird rookery. *LANDSCOPE* **27(4)**, 43–47.

Algar, D., Hamilton, N. and Onus, M. (2011a). Interim report on Stage 2 of the 'Management plan for cats and Black Rats on Christmas Island'. Unpublished Report to the Shire of Christmas Island and Christmas Island National Parks, Western Australian Department of Environment and Conservation.

Algar D., Hilmer S., Nickels D. and Nickels A. (2011b). Successful domestic cat neutering: first step towards eradicating cats on Christmas Island for wildlife protection. *Ecological Management and Restoration* **12(2)**, 93–101.

Beeton B., Burbidge A., Grigg G., Harrison P., How R., McKenzie N. and Woinarski J. (2010). Final Report of the Christmas Island Expert Working Group to Minister for the Environment Protection, Heritage and the Arts.

Bonnaud E., Zarzosa-Lacoste D., Bourgeois K., Ruffino L., Legrand J. and Vidal E. (2010). Top-predator control on islands boosts endemic prey but not mesopredators. *Animal Conservation* **13(6)**, 556–567.

Campbell K.J., Harper G., Algar D. Hanson C.C., Keitt B.S. and Robinson S. (2011). Review of feral cat eradications on islands. In: Island Invasives: Eradication and Management (eds. C.R. Veitch, M.N. Clout and D.R. Towns) pp 37-46. IUCN, Gland, Switzerland.

Dickman C.R. (1992). Conservation of mammals in the Australasian region: the importance of islands. In: *Australia and the Global Environmental Crisis*, (eds. J.N. Coles and J.M. Drew) pp. 175–214. Academy Press, Canberra.

Environment Australia (2002). Third Christmas Island National Park Management Plan. Environment Australia, Canberra.

Martin T.G., Nally S., Burbidge A.A., Arnall S., Garnett S.T., Hayward M.W., Lumsden L.F., Menkhorst P., McDonald-Madden E. and Possingham H.P. (2012). Acting fast helps avoid extinction. *Conservation Letters* **5**, 274–280.

Medina F.M., Bonnaud E., Vidal E., Tershy B.R., Zavaleta E.S., Donlan C.J., Keitt B.S., Le Corre M., Horwath S.V. and Nogales M. (2011). A global review of the impacts of invasive cats on island endangered vertebrates. *Global Change Biology* **17,** 3503–3510.

Nogales M., Vidal E., Medina F.M., Bonnaud E., Tershy B.R., Campbell K.J. and Zavaleta E.S. (2013). Feral cats and biodiversity conservation: the urgent prioritization of island management. *Bioscience* **63(10),** 804–810.

Oppel S., Beaven B.M., Bolton M., Vickery J. and Bodey T.W. (2010). Eradication of invasive mammals on islands inhabited by humans and domestic animals. *Conservation Biology* **25,** 232–240.

Ratcliffe N., Bell M., Pelembe T., Boyle D., White R.B.R., Godley B., Stevenson J. and Sanders S. (2009). The eradication of feral cats from Ascension Island and its subsequent recolonization by seabirds. *Oryx* **44(1)**, 20–29.

6 APPENDICES

6.1 Appendix 1 The general location of trap points, trap numbers and dates of commissioning and decommissioning

Location	Commissioned	Decommissioned	Trap Numbers	Trap Nights	No. Captures
Kampong, Block 401	10/08/2013	12/08/2013	4	12	2, (1)
Trax Tavern (4) + CIP workshop (3)	12/08/2013	16/08/2013	7	35	2
School Kindergarten/CIP office	12/08/2013	16/08/2013	7	35	4
Construction site, Drumsite	13/08/2013	17/08/2013	5	25	8
Lucky Ho, Poon Saan	13/08/2013	17/08/2013	5	25	0
Poon Saan Lodge west	15/08/2013	20/08/2013	5	35	0
Buddah Temple, Settlement	19/08/2013	23/08/2013	4	20	2
Trax Tavern	19/08/2013	23/08/2013	4	20	0
Construction site, Drumsite	20/08/2013	24/08/2013	5	25	0
Tip	20/08/2013	25/08/2013	12	72	15
Construction Campsite IDC (Phosphate Hill)	20/08/2013	30/08/2013	2	22	3
Rec Centre + IDC (Phosphate Hill)	26/08/2013	30/08/2013	7	35	4
Boatyard, Kampong	26/08/2013	30/08/2013	3	15	0
Quarry Rd., Crane site	2/09/2013	6/09/2013	5	25	0
Casino	2/09/2013	6/09/2013	5	25	1
Casino	9/09/2013	13/09/2013	10	50	2
Construction site, Drumsite	10/09/2013	13/09/2013	4	20	0
Totals				**496**	**43**

(*) denotes number of domestic cats returned to owner

6.2 Appendix 2 Outline of funding requirements for an interim control measure

The proposed collaboration between DPaW and CINP would involve six months work annually during the dry season (May–October) for the next four years. The efficacy of the control measures would be monitored annually using camera-traps for twenty-day periods pre- (May) and post-control (October). Application of control measures would be undertaken by two staff members operating for monthly periods, alternating between the two organizations. Thus, in total, each organization would provide two people for three months = 0.5 FTE annually. An overview of funding requirements for DPaW is tabled below.

Item	**Cost ($)**
Airline flights @$1,250 ea (x6)	7,500
Control work and preparation of report (in-part salaries offset; 12 weeks x 2 people)	60,000
Travel Allowance ($128.30/d/person)	23,400
Overtime overheads ($100/d/person)	18,000
Baits (20,000 bait station units)	20,000
Lures	6,000
Traps & maintenance	6,000
Freight	5,000
Sub-total	**@ $146,000**
Sundries (10% total)	15,000
Total	**@ $160,000**

*In addition 100 camera-traps will need to be provided/purchased at a cost of approximately $100,000. This equipment could be used by CINP for other purposes outside the designated monitoring periods. As always, a vehicle and accommodation would need to be provided for DPaW staff.