Results and Recommendations, from a Feasibility Study, to Control Feral Cats on Christmas Island

A Report to Christmas Island Phosphates

Plate 1. Mark Bennett (Environmental Manager) *right* **and Joy Wickenden (Environmental Adviser)** *centre* **from Christmas Island Phosphates**

D. Algar[1] and R.I. Brazell[2]

November 2003

[1]Department of Conservation and Land Management, Science Division P.O. Box 51, Wanneroo, Western Australia 6065.

[2]Department of Conservation and Land Management, South West Region, Wellington District, P.O. Box 809, Collie, Western Australia 6225.

Background

Parties responsible for the management of Christmas Island, expressed an interest in assessing the feasibility of a program to control feral/stray cats on the island. Through Joy Wickenden and Mark Bennett (Environmental Adviser and Environmental Manager respectively), of Christmas Island Phosphates, the Department of Conservation and Land Management (CALM), was approached.

Documented below is the outcome of this feasibility study and recommendations for a control strategy.

General Overview

Cats, (*Felis catus*), were taken to Christmas Island, at the time of first settlement in 1888 and a feral population became established soon thereafter (Tidemann *et al*. 1994). There is extensive evidence that the introduction of domestic cats to both offshore and oceanic islands around the world can have deleterious impacts on endemic land vertebrates and breeding bird populations (eg. van Aarde 1980, King 1985, Veitch 1985, Bloomer and Bester 1992, Bester *et al*. 2002; Pontier *et al*. 2002). Insular faunas that have evolved for long periods in the absence of predators are particularly susceptible to cat predation (Dickman 1996).

The presence of feral and stray cats can also affect the well-being of wildlife and potentially pose health problems to human populations as cats are hosts and reservoirs for a number of diseases such as *Toxoplasmosis*. *Toxoplasmosis* can cause spontaneous abortion and birth defects. One of the major reasons for conducting a cat control program on the Cocos (Keeling) Islands was the community's concern of potential health risks due to the presence of feral/stray cats (Algar *et al*. in press). Analysis of the cat population sampled indicated a high incidence of hookworm infection (Op cit.). Hookworm larvae can burrow into human skin causing a disease called cutaneous larval migrans, also known as "ground itch".

As a consequence of these impacts, control of feral cats is recognized as one of the most important fauna conservation issues in Australia today and as a result, a national 'Threat

Abatement Plan (TAP) for Predation by Feral Cats' has been developed (Anon. 1999). Under the Threat Abatement objectives and actions, the first two key objectives in the TAP, were listed as: -

- *Eradicate feral cats from islands where they are a threat to endangered or vulnerable native animals.*
- *Prevent feral cats occupying new islands in Australia where they may threaten species or ecological communities with extinction.*

The presence of feral/stray cats in residential areas also presents a significant nuisance problem through the night with cats caterwauling, fighting, urinating, defecating and raiding refuse bins around the houses.

CALM has been developing control strategies for feral cats under the umbrella program 'Western Shield' and is recognized both nationally and internationally as one of the leading agencies in feral cat control. This research has led to the successful design and development of an effective trapping technique and a bait that is readily consumed by cats and can be used over broad-scale areas for their control. Recently, successful feral cat eradication programs have been conducted on a number of islands: - Serrurier Island (Moro 1996); Hermite Island in the Montebellos (Algar and Burbidge 1999; Algar *et al*. 2002); Faure Island (Algar *et al*. 2001) and recently on Rottnest Island (Algar *et al*. 2002). A cat control program has also been established on the Cocos (Keeling) Islands (Algar *et al*. in press) and serves as an important example of how investment in research can lead to practical and valuable outcomes, for the benefit of the broader community.

Feasibility Study

A feasibility study was conducted to assess whether control and/or eradication of feral cats on Christmas Island was possible. The study was undertaken over the period 11-25 September 2003 and focused on the two priority areas essential to delivering an effective and cost-efficient cat control strategy for the island. Firstly, discussions were held collectively and individually with personnel from the main land managers on the island Christmas Island Phosphates (CIP), Parks Australia North (PAN) and the Christmas Island Shire Council (CISC). These discussions focused on various aspects of cat control strategies and the support that would be required by these organizations and the general community to achieve eradication of feral cats on the island.

Secondly, the feasibility of implementing a successful feral cat control program was assessed by undertaking a reconnaissance of the island. The reconnaissance was undertaken to determine vehicle accessibility, examine cat density and distribution and to confirm the efficacy of control techniques.

Discussion outcomes

There was enthusiastic support for an effective feral cat eradication campaign by the three major land managers. It was recognised that for the program to be successful there would need to be a high level of co-operation between the mining company, local government and federal agencies. The program would have to be driven by a management team from these organizations and the local community. Ownership of the project was seen to be critical to the program's success. Also it is unlikely that eradication would be completed within the short-term (eg. one month) and there would need to be an ongoing commitment by the lead organizations for the successful completion of the program. Specific technical aspects of the control program (eg. establishing the baiting and trapping campaigns outside the settlement areas) would need to be contracted to an outside agency (CALM) for a limited period of time. As part of this contract, training sessions would be conducted demonstrating the cat control techniques while on-island. These training sessions would be available to officers from the various land management agencies on the island that would be involved in cat control. Training of people on the island would enable utilization of local labour to continue and complete the control campaign and thereby significantly reducing control costs.

Plate 2. Training exercise in trap setting with Park Rangers

The program would require support and participation by the entire community, which would necessitate public education programs and liaison with the community to address potential community concerns and hopefully result in significant public awareness and co-operation to the benefit of the project. Discussions with the community at large would need to be initiated prior to the commencement of any control effort but only when the program was assured of taking place and there was a commitment to completion. It appears that, all to often, programs, especially cat control programs, are initiated but not taken to completion. An apathethetic reaction results when a new program is discussed. Once the control campaign is initiated, there would also need to be an ongoing commitment to inform the community of the program's progress.

One avenue of developing and fostering enthusiasm for the program was seen to be encouraging community participation. The best option was through an education and involvement program within the school system. Staff and students could conduct a survey of domestic cat numbers within the settlement areas, which would be of considerable benefit to the control effort, as this would of necessity, be the first stage in providing a long-term solution to the cat problem on the island. The census would involve determination of all the domestic cats present, recording the age and sex of cats and their fertility status as well as recording their owners' names and addresses. This information would be more reliable than most census techniques as the children within the community would know which cat belonged to whom. The census, if conducted as part of the curriculum, could encourage considerable positive discussion within the community and would be invaluable as a teaching aid across a broad range of subjects on the school syllabus.

The final and most important point that came from general discussion was that it was recognised that there were two different levels/areas of control required, control of domestic and stray cats within the settlement area and control of feral cats outside the settled areas. These are not discrete populations but would require different control strategies. Control of cats in the settlement was seen to be paramount prior to the implementation of any broad-scale program across the island. This aspect is discussed in more detail below.

Domestic and stray cats in the settlement area

A relatively large population of domestic/stray cats were observed within the settled and light industrial areas on the island. This is despite control effort conducted by the Shire Council

Ranger, who removed 100 stray or unwanted cats during the previous 12 months (J. Lee pers. comm.).

Domestic cats

The general consensus of opinion at the various meetings during our stay was that all domestic cats must be sterilized and identified by a coded identity chip. At the time of our visit, a veterinarian from the mainland was being appointed to conduct clinics on the island several times a year. Eddie Love (Manager Planning, Building and Health) from the Christmas Island Shire Council was submitting a proposal to council to enact by-laws to regulate registration of domestic cats; restriction on the number of cats in a household and compulsory sterilization of all cats. The data from the survey census, discussed earlier, would provide a convenient tool for enacting these regulations. The time-frame suggests that early in the new year, there is a real possibility that all domestic pets could be sterilized, thus preventing kittens entering the overall stray/feral cat population. The ability to identify domestic cats through a coded identity chip would also make removal of stray cats a less complicated and onerous task - if the animal does not contain a chip it is destroyed.

Stray cats

Considerably more effort will need to be placed on controlling and removing stray cats from within the settled and industrial areas. Effective control will only be achieved through increased and targeted effort. Increased resources of manpower and traps will be required and this can only be affected through collaboration between the three lead agencies. This was recognised during general discussions and there was agreement by CIP and PAN to assist the Shire Council. Trapping, in and around the settlement areas, cannot be conducted effectively and thoroughly until the bylaw regulations have been passed and the sterilization program has been conducted. In the interim, the industrial area, depots and refuse site should be targeted.

Cage traps are generally ineffective for trapping feral cats however they can be used to capture domestic and stray cats (Friend and Algar 1993; Lee 1994; Anon. 1999). We use wire cage traps (60x20x20 cm) with treadle plates to trap stray cats around accommodation, industrial and refuse areas. Traps are generally baited with fresh mulies (pilchards) daily however; any fresh meat-based attractant is suitable. We also spray the baits with an ant deterrent compound (Coopex®) at

a concentration of 12.5 g l^{-1} Coopex as per the manufacturer's instructions. Cage traps do not pose a threat to pet cats and will permit identification and release of these animals.

Critical to the success of any control measure is documentation of the control effort. Accurate and thorough records of trap placement should be maintained - date, bait type, numbers of traps used and so on. Captures must be recorded and include sex of animal, weight, location, bait type and date. In addition to these records, sightings of cats should be documented and include location, date and coat colour. The general public should be encouraged to contribute to these sighting records. This information, in combination, can then be used to assess the effectiveness and cost efficiency of the control strategy and refinements or target areas necessary to improve its success.

One concern raised during our discussions, with various people, was possible increases in the rat populations following cat control. There is no scientific evidence that cat predation is able to control prey populations, rather they are regulated by environmental conditions, which determine food abundance. An earlier study of cats on Christmas Island reported that cats rely, to a relatively small extent, on rats for food (van der Lee 1997). Food limitation and predation of nestlings by the extremely abundant land crab population is likely to restrict rat numbers. A broad measure of rat numbers and possible changes in populations levels during and post cat control, across the island, can be assessed (see Bait stations, described later). Within the settlement areas, regulatory factors are not so extreme and rat numbers are possibly higher. Removal of cats from the townsite may allow rats to become more numerous however; there are many effective methods of controlling rats and these could be implemented prior to or during the course of the cat control campaign.

A number of people commented on the fact that unwanted cats are frequently dumped across the island. We believe these stray animals often establish within the feral population and sustain its abundance. Effective removal of this source of recruitment into the feral population would have a significant impact on the feral population and its viability.

Feral cats outside the settlement area

Access, cat density and distribution

The effectiveness of broad-scale control of feral cats when a ground-based strategy is involved is largely dependent on vehicle accessibility. Reconnaissance of the island indicated a total of 122.6 km of road/track network to be present excluding a number of 4WD tracks in vegetation rehabilitation areas. This network comprises 36.1 km principal roads, 17.2 km minor roads and 46.7 km 4WD tracks outside the settlement area (ie. south of Hanitch Hill/airport). A further 22.6 km of road access fringes the settlement including the light industrial area and coastal road from the resort to the settlement. The road/track network provides excellent coverage of the island such that the vast majority of the island is within 1 km either side of any particular road. The home range of cats is generally greater than 1 km^2 especially when food resources are low. One would therefore expect virtually all cats to encounter the road network during their general home range movement patterns. The only area outside this 1 km of the road "sphere of influence" is the limestone pinnacles on the south east of the island. This area would appear to be unfavourable cat habitat however; if cats are present in this area they would soon disperse closer to the road sites as the resident animals were removed.

To provide some indication of cat density and distribution, a spotlight survey was conducted over three consecutive nights (15-17 September). The survey commenced just after darkness and took approximately three hours to complete. The survey route was restricted to the main haul roads and covered a distance of 35 km. A total of seven, four and five cats were observed over the three nights respectively providing 5.33 ± 0.88 cats/survey route or 0.15 ± 0.03 cats/km ($\mu \pm$ s.e.). The density of cats reported here is lower than that recorded in other studies on the island 0.3 cats/km Tidemann 1989 and 0.19 cats/km van der Lee 1997) however; these studies were of a much longer duration and no variance was provided. The 16 cat sightings in this study comprised 11 individual animals based on coat colour and location along the spotlight route and these sightings were distributed across the island. Spotlight surveys can only provide a somewhat limited snapshot of animal numbers at a single point in time. Reliance on spotlight data, particularly when surveys are conducted through areas of dense vegetation, can often lead to incorrect indices of abundance. For example, only two cats were observed between the Central Workshop Area and LB4 Lookout, a distance of 3.2 km. However, during the course of bait uptake assessment

along this road, a further three individual animals were sighted indicating that cat density is higher than we recorded from the spotlight survey.

Assessment of control techniques

In addition to assessing access on the island to be able to implement a broad-scale control program it was essential to confirm the efficacy and target specificity of control techniques that have proved successful on other islands where feral cat eradication and control programs have been conducted. Baiting is the most effective method of controlling feral cats (van der Lee 1997; Algar and Burbidge 1999; Anon. 1999; Algar *et al*. 2001; Algar *et al*. 2002), when there is no risk posed to non-target species. Trapping may also provide a useful technique to remove those individuals that survive a baiting program or where toxic baits cannot be located.

Bait and baiting technique

CALM researchers have developed a novel feral cat bait that has proven highly effective in controlling feral cats on the mainland and islands. The bait is similar to a chipolata sausage in appearance, approximately 20 g wet-weight, dried to 15 g, blanched (that is, placed in boiling water for one minute) and then frozen. The bait is composed of 70 % kangaroo meat mince, 20 % chicken fat and 10 % digest and flavour enhancers (Patent No. AU13682/01). Toxic baits are dosed at 4.5 mg of sodium monofluoroacetate (compound 1080) per bait. Baits are generally thawed and placed in direct sunlight prior to laying . This process, termed 'sweating', causes the oils and lipid-soluble digest material to exude from the surface of the bait. All baits are sprayed, during the sweating process, with an ant deterrent compound (Coopex®) at a concentration of 12.5 g l^{-1} Coopex as per the manufacturer's instructions. This process is aimed at preventing bait degradation by ant attack and deterring bait acceptance by the physical presence of ants on and around the bait medium. Feral cat baits are routinely manufactured at the CALM Bait Manufacturing Facility in Harvey.

Generally, baits are deployed aerially from an aircraft or on-track from a vehicle. Recent baiting exercises on the Cocos (Keeling) Islands (Algar *et al*. in press) have highlighted the potential problem of certain non-target species, particularly various land crabs, removing baits. Bait removal by non-target species reduces bait availability to feral cats and therefore control efficacy. On Cocos, preliminary trials with non-toxic baits placed on the ground resulted in all baits being removed overnight by non-target species. Land crabs (*Cardisoma carnifex*), which dominate the

forest floor, hermit crabs (*Coenobita perlata*) and black rats (*Rattus rattus*) along the coastal areas and feral chickens were responsible for removing the baits. Further trials, examining bait placement and non-target interactions, have indicated that suspending the baits on a line from a pole angled into the ground overcomes the problem. Baits suspended approximately 30-40 cm above the ground prevented non-target animals, except for black rats, from removing the baits while maintaining their attractiveness to feral cats. This new approach to baiting provided a relatively simple means to control feral cats where non-target species posed a problem.

As part of the feasibility study, it was necessary to confirm that this baiting technique was applicable to Christmas Island where the cats are, primarily of European origin rather than Asiatic, and there is a different suite of non-target species. It was anticipated that the abundant crab population, in particular robber crabs (*Birgus latro*) might be capable of removing suspended baits from the angled stakes. As such, a gantry device with a cover to exclude rats was developed on the mainland prior to our visit for testing on-island. Three of these devices (see Plate 3) were available and were deployed on the 4WD track north of Middle Point where robber crabs and red crabs (*Gecarcoidea natalis*) appeared most numerous. A number of baits placed on the ground, were rapidly consumed by both species of crab; other baits were attached to the gantry devices and to fence droppers angled into the ground (see Plate 4). Bait removal from the two suspension devices was examined over a five-day period. All baits were taken from the fence dropper arrangement (see Plate 5) but no bait was removed from the gantry devices despite the abundant crab population.

Plate 3. Gantry device with suspended baits on the track north of Middle Point where robber crabs and red crabs appeared most numerous

Plate 4. Fence dropper suspension device where baits have been consumed by robber crab below, red crabs present in the foreground

Plate 5. Robber crab removing bait from fence dropper suspension method

Further examination of the suitability of the suspension devices was conducted along the road between Central Workshop Area and LB4 Lookout, an area where feral cats were known to be present. Bait stations comprising either the gantry devices or fence dropper from which a non-toxic feral cat bait was suspended, approximately 30-40 cm above the ground, using fishing line were placed at 100 m intervals along the edge of the road. The road was not comprised of a sandy substrate that would permit identification of individual species tracks so a pad, using crushed rock phosphate dust, 40 x 40 cm, cleared of track activity was located beneath each bait. The gantry devices were often relocated to where cat activity had been observed, to maximize their exposure to cats. Each bait station was examined daily, over a five-day period, for bait removal and activity on the sand pads was noted.

Plate 6. Bait station with gantry device, suspended non-toxic baits and crushed rock phosphate pad

Plate 7. Cat tracks on pad following removal of bait

Robber crab distribution along the road was patchy but when present they were observed to remove baits from the fence dropper suspension method however; they were still unable to consume the baits on the gantry. Four cats were recorded encountering bait stations over the period. All cats consumed baits, whether they were attached to the gantry or fence droppers. Cats also removed baits from multiple bait stations along the line each day. These results confirm the method of presenting baits at bait stations using the gantry device prevents removal by robber crabs and does not hinder their take by cats.

The bait station not only provides a suitable method of presenting baits to control cats but also provides a technique to measure their density, distribution and thus importantly the success of the

control strategy over time. The use of the rock phosphate dust pad beneath the suspended baits will also enable recording information on non-target species in the area, in particular rat numbers and their distribution across the island. The proposed baiting strategy involves placement of bait stations at 100 m intervals along the entire 122.6 km of road network on the island. Baiting at this baiting intensity will maximise the likelihood of the cats finding the bait stations when they are hungry and therefore the success of the program.

Initially, a non-toxic bait will be suspended at each bait station until it is removed by a cat. After the bait is removed, toxic baits will be placed at this bait station and those either side. Toxic baits not consumed will be removed at first light and appropriately stored. Using baits in this manner significantly restricts the number and location of toxic baits in the field at any point in time and therefore the potential hazard. No toxic baits will be located within 1 km of the settlement (ie. north of Hanitch Hill/airport). Non-toxic bait stations will be located along the 22.6 km of road access fringing the settlement including the light industrial area and coastal road from the resort to the settlement to provide information on cat density and distribution. When the presence of cats is recorded at these bait stations, traps will be used to remove the animal (see below) rather than toxic baits.

It is anticipated that broad-scale deployment of the bait stations across the island will be for a one-month period. After this time bait stations will be located in strategic locations where cat activity is still present.

Prior to any baiting program being implemented, an experimental permit will be required from the Australian Pesticides and Veterinary Medicines Authority (formerly the National Registration Authority). Toxic baiting will only be permitted on the island following approval being granted by the relevant authority with the regulatory responsiblility for public health on Christmas Is. The " Code of Practise on the Safe Use and Management of 1080" developed by the Health Department of Western Australia shall be followed if the W.A. Commissioner of Health is the approving authority. If not this document would be a sound basis for any approval process.

The trap system and trapping program

Padded leg-hold traps are more effective than wire cage traps for catching feral cats. We use Victor 'Soft Catch' traps® No. 3 (Woodstream Corp., Lititz, Pa.; U.S.) and have found these traps provide both a very effective and humane trap type for cats.

The trapping technique that has been developed to capture feral cats utilises Victor Soft Catch traps, and generally the lures: - a Felid Attracting Phonic (FAP) and a blended mixture of faeces and urine (Pongo). The bait stations, described earlier, have also provided an effective lure beneath which traps can be placed. Each of these components and the trap set is described below.

Each trap site consists of a channel slightly wider than one trap and approximately 80 cm in length cleared into a bush to create a one-way (blind) trap set. Two Victor Soft Catch traps, one in front of the other, are positioned at the entrance of the blind set, at each trap site. A trap bed is made so that when lightly covered with soil, the traps are level with the surrounding ground surface. A guide stick is placed in front of the traps to force animals to lift their foot then push down onto the pressure plate. Both traps are secured in position by a chain of length 30 cm to an anchor peg of length 30 cm. A foam pad of dimensions (12x8x2 cm) is placed below the pressure plate to prevent soil from falling into the trap bed and compacting under the plate. The traps are then lightly covered with soil.

Cats are lured to the trap set initially by the audio signal produced by the FAP. The FAP is located at the back of the trap set, either concealed under leaf litter or hidden within the bush. As cats approach the trap set they are further enticed into the traps by the smell of 'Pongo'. The Pongo consists of a blended mixture of cat faeces and urine in a ratio of approximately 1:1. Approximately 20 ml of this mixture is placed in a shallow depression about 30 cm from the centre of the trap plate.

Trap sites are generally located at approximately 500 m intervals adjacent to the roads or tracks or where cat activity is observed. Traps using the FAP/Pongo lure combination are located at 1 km intervals and those employing the Pongo lure alone are positioned at the intervening 500 m intervals.

On the Cocos (Keeling) Islands, the bait station provided an effective trap lure (Algar *et al*. in press). The control strategy recommended for Christmas Island will also utilise bait stations as lures (as in Plate 5). As toxic baits will not be placed within 1 km of the settlement, cat activity on bait stations along the road access fringing the settlement including the light industrial area and coastal road from the resort to the settlement will result in traps being placed at these stations.

The trapping system using FAP/Pongo lure combinations will be employed at specific sites if cat activity indicates individual animals may not be taking baits.

The traps should not pose a threat to non-targets; rats and robber crabs are the only species likely to come into contact with them when bait stations are used. Robber crabs are unlikely to set off the traps (van der Lee 1997). The trapping system using FAP/Pongo lure combinations is essentially felid specific.

Plate 8. Trapped cat at bait station at Central Workshop Area

Summary of Key Recommendations for the Cat Eradication Strategy

A summary of the recommendations for cat eradication program on Christmas Island is provided below in chronological order.

1). Establish a management team, from the lead organizations and the local community, to instigate and drive the program to completion.
2). Submit proposal for Cat By-law regulations to the necessary authorities ASAP.
3). Define and secure funds to the eradication program's completion.
4). Initiate public education and awareness programs.
5). Develop protocols, recording systems and trapping teams and commence cage trapping the industrial area, depots and refuse site.

6). Commence education and involvement programs at the start of the new school year within the school system. Staff and students should conduct a survey of domestic cat numbers within the settlement areas. It may be necessary to have preliminary discussions with relevant people within the school system prior to the end of this year.

7). Proceed with cat sterilization program once Cat By-laws are enacted (all cats sterilized must be identity coded).

8). Proceed with thorough and strategic cage trapping of the settlement areas to remove all unwanted and stray cats once Cat By-laws are enacted.

9). Initiate a broad-scale eradication program across the island if the above have proceeded satisfactorily and it appears that the stray and domestic cats are under control. Timing of the program should occur in the dry season, which should allow a suitable timeframe for control of stray cats within the settlement areas. At this time, bait uptake is likely to be at a maximum.

10). Seek approval, under the 'Risk Assessment' guidelines of the State and Federal statutory regulations for the "Code of Practice on the Use and Management of 1080" to the implement a baiting program. An experimental permit will be required from the Australian Pesticides and Veterinary Medicines Authority.

11). Commence broad-scale control (September 2004) and train local staff in the various techniques and provide accreditation for 1080 use.

12). Continue broad-scale control program to completion. Local staff to take responsibility for control effort through guidance from Management Team.

*** **Once the control campaign is initiated, there must be an ongoing commitment to inform the community of the program's progress.**

Budget

The establishment of broad-scale baiting across the island and leg-hold trapping program will require the presence of three persons from CALM and it is proposed that these people be contracted for a four-week period. Also during this time, training sessions demonstrating the cat control techniques will be conducted and accreditation for 1080 use provided. Detailed below (Table 1), where costs are known, is the budget required for this contract. It will be necessary for

authorities on Christmas Island to cover these expenses. Other expenses such as the leg-hold traps and lures will be met by CALM.

Table 1. Budget required for establishment of broad-scale baiting across the island and leg-hold trapping program

Item	Cost/unit	Total cost
Airfares and medical evacuation insurance	@ $1800/person	$5,400
Accommodation	?????	??????
Food	$40/person/dayx3	$3,360
Vehicles + fuel	3 vehicles (tray-back) ????	????
Baits	15,000 baits @ 30c/bait	$4,500
Bait station gantry devices	1,200 units @ $10/gantry	$12,000
Rock phosphate dust	1,200 units x 4 replacements	??????
Shipping transport baits, trapping equip. etc	?????	?????
Signage and publicity: road signs, letter drop, publicity, etc	?????	?????
Salaries	3 persons @ $760/day x 8day week x 4weeks	$24,320
Total Cost		**$49,580 + ????**

Acknowledgments

We would like to acknowledge the financial support provided by Christmas Island Phosphate for this feasibility study. Thanks are extended to Mark Bennett (Environmental Manager), Joy Wickenden (Environmental Adviser) and Jude De Cruz (Rehabilitation Supervisor) from Christmas Island Phosphates; Alistair Graham (Government Conservator), Mick Jeffery (Natural Resources Manager), Azmi Yon (Senior Ranger) and Moho Eddly Johari (Trainee Ranger) from

Parks Australia North and Eddie Love (Manager Planning, Building and Health) and James Lee (Shire Council Ranger) from Christmas Island Shire Council for assistance while we were on-island. We would also like to thank the people of Christmas Island for their hospitality during our visit

References

Aarde, R.J. van (1980). The diet and feeding behaviour of feral cats, *Felis catus*, on Marion Island. *South African Journal of Wildlife Research* **10**, 123-8.

Algar, D. and Burbidge, A.A., (2000). Isle of cats: the scourging of Hermite Island. *Landscope* **15(3)**, 18-22.

Algar, D., Angus, G.J., Brazell, R.I., Gilbert, C. and Withnell, G.B. (2001.). Farewell Felines of Faure. Report to Australian Wildlife Conservancy. Department of Conservation and Land Management.

Algar, D. and Angus, G.J. (2002). Assessment of Feral Cat Abundance and Control Strategies on Rottnest Island: A Report to the Rottnest Island Authority. Department of Conservation and Land Management.

Algar, D., Burbidge, A.A. and Angus, G.J. (2002). Cat Eradication on the Montebello Islands. In: *Turning the Tide: the eradication of invasive species.* (eds. C.R. Veitch and M.N. Clout) pp14-8. Invasive Species Specialist Group of the World Conservation Union (IUCN). Auckland.

Algar, D., Angus, G.J., Brazell, R.I., Gilbert, C. and Tonkin, D.J. (in press). Feral cats in paradise: focus on Cocos. *Atoll Research Bulletin.*

Anon. (1999). Threat Abatement Plan for Predation by Feral Cats. Environment Australia, Biodiversity Group, Commonwealth of Australia.

Bester, M.N.; Bloomer, J.P.; van Aarde, R.J.; Erasmus, B.H.; van Rensburg, P.J.J; Skinner, J.D.; Howell, P.G. and Naude, T.W. (2002). A review of the successful eradication of feral cats from sub-Antarctic Marion Island, Southern Indian Ocean. *South African Journal of Wildlife Research* **32(1)**, 65-73.

Bloomer, J.P. and Bester, M.N. (1992). Control of feral cats on sub-Antarctic Marion Island, Indian Ocean. *Biological Conservation* **60**, 211-19.

Dickman, C.R. (1996). Overview of the impact of Feral Cats on Australian Native Fauna. Report to Australian Nature Conservation Agency.

Friend, J.A. and Algar, D. (1993). Methods of broadscale cat control and fox control at a numbat reintroduction site. Year 1, Final Report. Feral Pest Program, Project 11, Environment Australia, pp1-27.

King, W.B. (1985). Island birds: will the future repeat the past? *In*: Moors, P.J. (ed.) Conservation of Island Birds. ICBP Technical Publication No. 3. pp 3-15.

Lee, J.M. (1994). Feral cat research and control – Queensland. In 'Feral Cats – A National Approach Towards a Threat Abatement Plan'. Proceedings of a Workshop held by The Australian Nature Conservation Agency: March 1994. (Ed. D. Carter.) (Australian Nature Conservation Agency: Canberra.)

Lee, van der, G. (1997). The status of cats *Felis catus*and prospects for their control on Christmas Island. A Consultancy for the Australian Nature Conservation Agency. Dept. Ecosystem Management, Univ. of New England.

Moro, D. (1996) Removal of a feral cat from Serrurier Island. *Western Australian Naturalist* **21,** 153-6.

Pontier, D., Say, L., Debias, F., Bried, J., Thioulouse, J., Micol, T. and Natoli, E. (2002). The diet of cats (*Felis catus* L.) at five sites on the Grande Terre, Kerguelen archipelago. *Polar Biology* **25**, 833-7.

Tidemann, C.R. (1989). Survey of the tertrestrial mammals on Christmas Island (Indian Ocean). A Consultancy for Australian National Parks and Wildlife Service. Forestry Dept., Australian National University.

Tidemann, C.R., Yorkston, H.D. and Russack, A.J. (1994). Th diet of cats, *Felis catus*, on Christmas Island, Indian Ocean. *Wildlife Research* **21**, 279-86.

Veitch, C. R. 1985: Methods of eradicating feral cats from offshore islands in New Zealand. *In*: Moors, P.J. (ed.) Conservation of Island Birds. ICBP Technical Publication No. 3. pp 125-41.