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Client Report

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# A bait efficacy trial for the management of feral cats on Dirk Hartog Island

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Our environment, our future

Arthur Rylah Institute for Environmental Research
Department of Sustainability and Environment
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**Front cover photo:** Looking across Turtle Bay towards Cape Inscription, Dirk Hartog Island (Michael Johnston).

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# Acknowledgements

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# Summary

A field efficacy trial of a novel feral cat baiting technology was undertaken on Dirk Hartog Island, Western Australia. The objectives of the study were to investigate;

- the attractiveness and palatability of the Eradicat® bait,
- the acceptance of an encapsulated pellet that was implanted into the bait, and
- home range and activity patterns of feral cats.

This trial was initially planned to utilise an encapsulated pellet containing the toxicant para-aminopropiophenone (PAPP) and provide a direct assessment of baiting efficacy of the Curiosity® Feral Cat Bait in the semi-arid zone. However, supply of sufficient PAPP pellets was not received in time. Instead, an alternative method utilising similar pellets that contained non-toxic Rhodamine B dye (RB) was utilised to 'mark' animals that were expected to have died had PAPP pellets been available.

The processed meat baits, implanted with the RB pellet, were poisoned with 4.5 mg sodium fluoroacetate (1080) to enable collection of data on bait consumption by feral cats. All cat carcasses located after baiting were investigated to determine presence of dye marking indicating that the animal had consumed a RB pellet.

Baits were laid from an aircraft over the study site on 19 April 2009. Sixteen feral cats had been trapped within the study site, fitted with VHF transmitter / GPS data-logger collars and released three weeks before baiting. Activity plots were established and monitored for feral cat presence before and after baiting. Follow-up baiting was undertaken using hand distributed baits around feral cats that were still alive eight days after the aerial application of baits.

Monitoring and retrieval of carcasses of the radio-collared feral cats indicated that one animal died before baiting and that twelve died after eating a poison bait. Post mortem examination indicated that nine cats had consumed the RB pellet. Three cats were found to have died following consumption of a bait but had not consumed Rhodamine dye. The remaining three cats were shot at the conclusion of the trial, having failed to consume baits. Two additional uncollared feral cats were located following baiting and were also found to have died as a result of bait consumption indicated by the presence of RB dye.

Feral cat activity at the monitor plots indicated a twelve-fold reduction following baiting.

Monitoring of non-target species did not detect any negative impact on populations of resident raptor species. Our data suggests a decrease in goanna activity following baiting, but (given the high tolerance to 1080 exhibited by these reptiles) it is more likely that the apparent decrease was a result of a fault in the monitoring technique.

The results indicate that a pellet-delivered toxicant in Eradicat baits is appropriate for managing feral cat populations in the semi-arid zone. A proposed plan to eradicate feral cats from Dirk Hartog Island should include this bait type within the techniques considered for use.

Data from the GPS dataloggers is to be reviewed to determine whether the bait frequency, application rate and pattern used in this study will provide for optimum bait encounter rates for feral cats on Dirk Hartog Island.

# 1 Introduction

## 1.1 Study objective

The objective of this study was to assess the field efficacy of the 'Feral Cat Bait and Toxicant Delivery System' for the management of a feral cat (*Felis catus*) population on a semi-arid island.

Specifically, this involved investigation of;

- the attractiveness and palatability of the Eradicat® bait,
- the acceptance of an encapsulated pellet that was implanted into the bait, and
- home range and activity patterns of feral cats.

## 1.2 Background

The Australian Government, via the Department of Environment, Water, Heritage and the Arts, has supported the development of a humane and target-specific, bait-delivered toxicant system to assist with the management of feral cats. A collaborative research program between the Victorian Department of Sustainability and Environment, the Western Australian Department of Environment and Conservation and Scientec Research Pty Ltd has focused on the delivery of this system.

A new toxicant compound known as para-aminopropiophenone (PAPP) has been identified, and a formulation has been developed that has demonstrated efficacy in triggering the humane death of feral cats in pen studies (Johnston 2008). The toxicant formulation is presented in pellet form and is encased in a specifically developed hard polymer that provides moisture protection but also rapid degradation in acidic pH environments. This combination is known as a 'hard-shelled delivery vehicle' (HSDV). The pellet delivery technique has been demonstrated to exploit the differential feeding behaviours between feral cats and native animals (Marks et al. 2006) — that is, feral cats reliably consume large, hard items that many native species reject (Hetherington et al. 2007).

Field trials are required to test the efficacy of the new product in a range of climatic zones and habitat types, to provide information to regulatory authorities when seeking registration as an agricultural chemical. The first field trial was conducted in a 50 $km^2$ area in French Island National Park, Victoria, during April 2008, representing a temperate climate zone (Johnston 2008). A tropical island trial was undertaken during October 2008 in Christmas Island National Park in the Indian Ocean (Johnston et al. 2008).

This report describes a trial conducted at a site within the semi-arid climatic region on Dirk Hartog Island, Western Australia. Engineering issues prevented the use of PAPP HSDVs during this study (Scientec 2009) so non-toxic Rhodamine B (RB) HSDVs were used as a surrogate to identify animals that might have been expected to die had PAPP been available. The baits used in this study (Eradicat®) were also injected with 4.5 mg of directly injected sodium fluoroacetate (1080) so cats that ate baits were poisoned and change in cat activity at sandpad monitor plots could be measured.

Island sites were chosen for the initial field trials because of the absence of many native and exotic species that might take the bait, thus minimising complexity in bait efficacy assessments.

# 2 Method

## 2.1 Study Site

Dirk Hartog Island is approximately 850 km north of Perth, Western Australia, and covers an area of 620 $km^2$ (Figure 1). The study was conducted over a 250 $km^2$ area at the north of the island using the track between Sandy Point and Quoin Head as the southern boundary. A field station was established at the Sandy Point shearing shed. The climate is semi-arid, receiving an average rainfall of 224 mm annually with most of the rain occurring during May-July (Bureau of Meteorology). Vegetation is generally sparse, low and open. The Bureau of Meteorology collects daily weather observations at Denham which is approximately 50 km to the south-east of Sandy Point. The mean minimum and maximum temperatures recorded at Denham were 19 °C and 28 °C respectively between 19 April and 8 May, 2009. The lowest and highest temperatures during the study were 14 °C and 32 °C respectively. No rainfall was recorded during the study although brief showers occurred over the east coast on 23 April.

The island has been managed for grazing since the 1860s under a number of leaseholders. Herds of feral goats (*Capra hircus*) and sheep (*Ovis aries*) remain on the island. A list of extant fauna species occurring on the island is provided in Appendix 1.

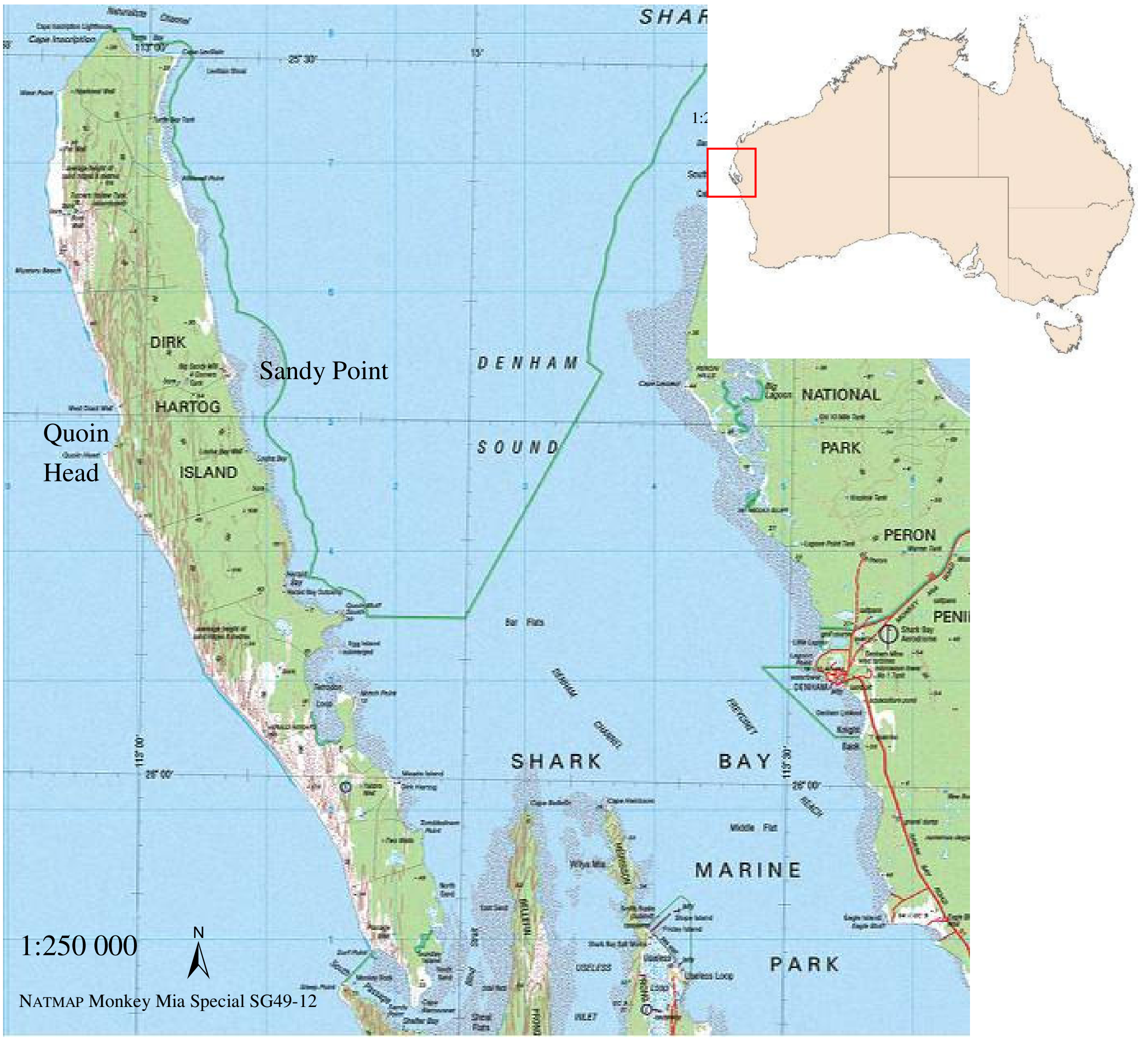


**Figure 1. Location map of Dirk Hartog Island.**

## 2.2 Trapping and radio-collaring of study animals

Feral cats were trapped at locations around the track network within the study area using leghold traps (Oneida Victor, size 3) with feline urine / faecal scent lure as the attractant. Sixteen cats were trapped and transported to the field station in cage traps. Animals were housed for a maximum of seven days during which time a DNA sample was taken, health and body condition was assessed by a veterinarian and a Sirtrack GPS datalogger radio-telemetry collar was fitted. The collars weighed 120 g and were only fitted to animals that exceeded a bodyweight of 2.4 kg (i.e. so that collars represented less than 5% of body mass). An iButton® temperature logger was surgically inserted into the omentum (the tissue surrounding abdominal organs) of eight feral cats to collect body temperature data as part of another study. Feral cats were released at their capture sites between 28 and 30 March, 2009 (see Figure 3).

## 2.3 Baits and baiting program

The DEC Bait Manufacturing Facility prepared 17 000 Eradicat baits containing 4.5 mg of directly injected 1080 and delivered these in a frozen state to Denham. All baits were laid on racks to thaw and sweat (i.e. allow aromatic oils to exude from the bait) the morning of 19 April. A RB HSDV was manually implanted into 3600 of the baits (i.e. 22.5% of total baits utilised). 'Coopex' residual insecticide (Bayer Crop Science) was sprayed over the baits using a handheld atomiser to reduce ant activity on the baits.

A baiting plan was prepared for the baiting aircraft which identified where baits were to be applied across the site. A light aircraft fitted with radio telemetry antennae was used to identify locations of all but one of the collared feral cats during the morning of 19 April. This data was incorporated into the baiting plan so that the baits containing the RB HSDVs were strategically dropped into the map grids immediately surrounding the locations of the collared cats. All other areas were baited with conventional Eradicat baits (i.e. without the RB HSDV). The plan also indicated 'bait exclusion zones' around camp sites where baits were not to be laid to ensure compliance with the guidelines for use of 1080 baits in Western Australia. No baits were applied within a 500 m radius of the following sites:

- Mystery Beach
- The Block / West Point
- Urchin Point
- Cape Inscription Lighthouse Keepers Reserve
- Sammys Camp
- Withnell Point.

A dedicated baiting aircraft deployed 16000 Eradicat baits (including the RB labelled baits) on the afternoon of 19 April (see Figure 4). The baiting aircraft flew at a speed of 130 knots at 500 feet ASL, and a GPS point was recorded on the flight plan each time bait left the aircraft. The bombardier released a bag of 50 baits into each map grid to achieve an application rate of 50 baits/km. The ground spread of each 50 baits is approximately 300 × 150 m (D. Algar, pers. comm.).

The remaining 1000 Eradicat baits were laid by hand in the vicinity of cats that were still alive on 27 April and 2 May. These baits did not have a RB HSDV. Cats surviving beyond 1 May were located using radio telemetry and shot to recover the GPS dataloggers and iButtons.

## 2.4 Monitoring activity of feral cats

Four track survey transects (i.e. spatial replicates) were established across the site. These transects were along existing tracks and each was 10 km long (Figure 2). The transects chosen provided a broad coverage of the study area.

Twenty marked sand plots, positioned across the width of the tracks at 500-metre intervals along each of the four transects, were used to survey feral cat activity. Each plot contained two attractants: a Feline Audio Phonic (Westcare Industries) and an olfactory cat scent lure. Each day, a record of the presence/absence of cat footprints was recorded for each plot. The plots were then swept to clear evidence of previous animal activity. Sand plot counts were conducted along each transect for eleven consecutive days prior to and five days following the application of baits.


**Figure 2. Location of transects (T1-4) and monitor plots (●).**

A continuous track count technique was also used to monitor daily activity along the length of four transects during sand plot inspection. Footprints of individual animals were differentiated on the basis of location on the track transect. A footprint was assigned as an individual animal if no other footprint was present on at least the previous 1 km of transect. Subsequent footprints were also assigned to that individual unless at least 1 km was traversed with no new footprints present, or the print could be clearly differentiated on the basis of size or the direction of travel or the direction of entry/exit to and from the transect. Each time new cat footprints were encountered along the transect, information was recorded on the direction of movement (i.e. whether the animal walked along the track or merely crossed it), distance of the footprints from the start of the transect, whether more than one animal was present, and the distance that the animal remained on the track transect. Transects were swept on the return journey using a section of heavy conveyer rubber and chains towed behind an ATV.

Footprints of Sand Goannas (*Varanus gouldii*) and Shingleback Lizards (*Tiliqua rugosa*) were recorded during the inspection of transects. Data were collected on the species and number of raptors observed, and incidental observations of other fauna were also recorded.

Daily monitoring of the 16 feral cats fitted with radio-telemetry collars was attempted from 21 April (i.e. two days after baiting). This was undertaken using either a handheld Yagi antenna or via a vehicle mounted omni-direction antenna connected to a VHF receiver. The death of cats was indicated by a change in pulse rate from the collars upon there being 24 hours of no movement (i.e. collar switched to mortality mode). All dead cats were located and inspected for RB staining of the gastro-intestinal (GI) tract, indicating consumption of a RB HSDV.

## 2.5 Statistical analysis of data

Track counts of feral cat activity were analysed using a Bayesian generalised linear mixed model (GLMM). It was assumed that the transect counts on a transect on a given day had a Poisson distribution, and that additive transect-level and day-level random effects influenced the counts. The model allowed for a different expected count before and after the baiting operation, to allow for changes in the index in response to baiting.

This statistical model can be described by the equation

$$Y_{it} \sim Poisson(\lambda_{it})$$
$$\log(\lambda_{it}) = \mu + \tau_t + \varepsilon_i + e_t$$

where $Y_{it}$ is the observed count at the i$^{th}$ transect on day $t$, $\lambda_{it}$ is the expected count, $\mu$ is the mean pre-treatment count, $\tau$ is a treatment effect, coding for the pre and post baiting phases of observation, and $\varepsilon_i$ and $e_t$ are normally distributed random effects of transect and times respectively.

The model was fitted to the data using Bayesian Markov Chain Monte Carlo (MCMC) methods with the software package OpenBUGS (Thomas et al. 2006). As measures of the effects of baiting on the index, we computed the mean expected index pre and post baiting, ($\lambda_{\text{pre}}$ and $\lambda_{\text{post}}$), and the proportional change in the index (denoted as $\theta$) in response to baiting, using the following equations:

$$\lambda_{pre} = \exp(\mu)$$
$$\lambda_{post} = \exp(\mu + \tau)$$
$$\theta = \frac{\lambda_{pre}}{\lambda_{post}}$$

Uncertainty in these derived values was computed using MCMC methods.

Data from the sand plot stations were also used to provide a ‘plot activity index’ (PAI). Sand plot stations have an index of usage expressed as the mean number of positive plots per night or the proportion of positive plots per line. The PAI is formed by calculating an overall mean from the daily means (Engeman et al. 1998).

Location data collected by the GPS datalogger collars was analysed using the Create Minimum Convex Polygon (MCP) function sourced from Hawths Analysis Tools for ArcGIS (Beyer 2007) within ArcGIS 9.1 to calculate MCP 100% and MCP 50% (i.e. 100 and 50% of all fixes closest to the harmonic mean centre).

# 3 Results

## 3.1 Trapping of feral cats

Twenty-one feral cats were trapped over a period of 10 days, comprising thirteen males and eight females, (Table 1, Figure 3). Mean body weight for males was 4.2 kg (sd 1.09) and 2.4 kg (sd 0.83) for females. Five cats were released without a collar as they were under the established collar to body mass ratio.

## 3.2 Aerial baiting of feral cats

Fifteen collared cats were known to be alive at the time of baiting. The GPS data-logger fitted to the cat B1 indicates that this animal moved out of the study area and died prior to bait application. A total of 16000 baits were dropped from the aircraft on the 19$^{th}$ April (Figure 4).

**Table 1. Morphological details and GPS datalogger collar activity period for feral cats trapped on Dirk Hartog Island.**

| Cat ID | Trap Date (Release date) | Sex (M/F) and body weight (kg) | Coat colour | GPS datalogger activity period (GPS sampling frequency ) | Comment |
|---|---|---|---|---|---|
| DH5 | 28/3 (28/3) | M, 5.1 | Black | 28/3 - 20/4 (10 mins) | iButton |
| DH5_1 | 22/3 (28/3) | M, 4.2 | Grey tabby | 28/3 – 16/4 (10 mins) | iButton |
| DH8 | 28/3 (28/3) | F, 2.0 | Grey tabby | Not collared | Released |
| DH12 | 22/3 (28/1) | M, 5.0 | Grey tabby | 28/3 – 15/4 (10 mins) | iButton |
| DH17 | 22/3 (28/3) | M, 5.0 | Grey tabby | 28/3 – 23/4 (10 mins) | iButton |
| DH26 | 27/3 (27/3) | F, 2.0 | Grey tabby | Not collared | Released |
| DH27 | 29/3 (30/3) | M, 5.1 | Grey tabby | 30/3 – 8/5 (40 mins) | |
| DH27_2 | 30/3 (31/3) | M, 4.5 | Black | 31/3 – 21/4 (40 mins) | |
| DH29 | 29/3 (30/3) | M, 4.7 | Grey tabby | 30/3 - 7/5 (80 mins) | |
| B1 | 23/3 (25/3) | M, 3.8 | Grey tabby | 25/3 - 19/4 (80 mins) | |
| B2 | 23/3 (29/3) | F, 3.5 | Grey tabby | 29/3 – 18/4 (10mins) | iButton |
| B3 | 25/3 (29/3) | F, 3.7 | Grey tabby | 29/3 - 24/4 (10 mins) | iButton |
| B5 | 28/3 (28/3) | M, <1.5 | Grey tabby | Not collared | Juvenile |
| MB1 | 22/3 (29/3) | F, 1.8 | Grey tabby | Not collared | Released |
| MB2 | 22/3 (29/3) | M, 3.2 | Grey tabby | 29/3 – 22/4 (80 mins) | |
| MB3 | 22/3 (25/3) | M, 3.2 | Grey tabby | 25/3 – 22/4 (80 mins) | |
| MB4 | 22/3 (22/3) | F, 2.7 | Grey tabby | Not collared | Released |
| MB5 | 24/3 (29/3) | F, 3.7 | Grey tabby | 28/3 – 10/4 (10 mins) | iButton |
| MB6 | 25/3 (29/3) | M, 4.7 | Grey tabby | 28/3 – 18/4 (80 mins) | |
| MB7 | 28/3 (29/3) | F, 3.5 | Grey tabby | 29/3 – 21/4 (80 mins) | |
| MB8 | 27/3 (29/3) | M, 5.5 | Grey tabby | 27/3 – 8/4 (10 mins) | iButton |


**Figure 3. Locations where feral cats were trapped.**

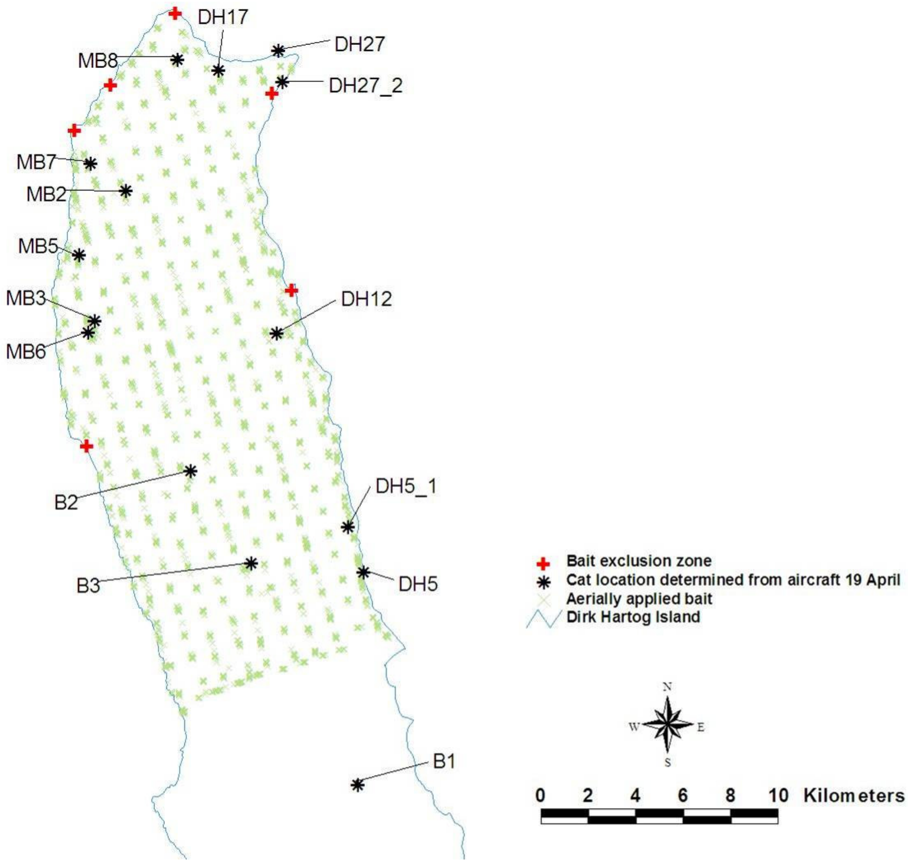


**Figure 4. Map showing location of collared feral cats determined from aircraft on 19th April with bait application pattern and exclusion zones. Note that B1 was dead and a position for DH29 was not determined.**

Nine of the collared feral cats died after consuming one (or more) aerially delivered Eradicat® baits and were observed to have RB stains throughout their GI tracts, (Table 2, Figure 5a). One cat, DH5.1, died following consumption of an aerially delivered Eradicat bait(s) but did not show any RB stains, (Figure 5b). It is not possible to determine whether this cat moved out of the zone where baits containing the RB HSDV had been applied or rejected the RB pellet during feeding as the collar had ceased collecting data.

Two collared feral cats, B2 and B3, died following consumption of Eradicat bait(s) that are assumed to have been distributed by hand in their vicinity on 27 April. Rhodamine staining was not evident in these animals.

Three collared feral cats, DH27, DH 29 and MB8, were shot to recover their collars and iButtons® after they had not consumed baits by 1 May (i.e. 12 days after aerial baiting). No RB banding was observed in the whiskers removed from these cats indicating they had not consumed baits with a RB labelled bait.

Two dead uncollared feral cats were located and both (c. 4 kg male, c. 3.5 kg female) showed RB stains in the GI tract.

**Table 2. Summary of causes of death for radio-collared feral cats.**

| Cat ID | Date body recovered | Cause of death | RB stained | Location |
|---|---|---|---|---|
| B1 | 19/4 | Unknown | No | 25 46.277S 113 03.467E |
| DH5 | 21/4 | Eradicat 1080 (aerial application) | Yes | 25 41.450S 113 03.208E |
| DH27_2 | 21/4 | Eradicat 1080 (aerial application) | Yes | 25 29.976S 113 00.353E |
| MB5 | 21/4 | Eradicat 1080 (aerial application) | Yes | 25 34.021S 112 56.295E |
| MB6 | 21/4 | Eradicat 1080 (aerial application) | Yes | 25 36.697S 112 56.581E |
| MB7 | 21/4 | Eradicat 1080 (aerial application) | Yes | 25 32.841S 112 56.026E |
| MB2 | 22/4 | Eradicat 1080 (aerial application) | Yes | 25 33.040S 112 57.664E |
| MB3 | 22/4 | Eradicat 1080 (aerial application) | Yes | 25 36.714S 112 56.510E |
| DH12 | 23/4 | Eradicat 1080 (aerial application) | Yes | 25 36.819S 113 02.410E |
| DH5_1 | 24/4 | Eradicat 1080 (aerial application) | No | 25 39.069S 113 02.369E |
| Uncollared 1♂ | 26/4 | Eradicat 1080 (aerial application) | Yes | 25 43.227S 112 59.695E |
| B2 | 29/4 | Eradicat 1080 (hand application) | No | 25 39.670S 112 59.708E |
| B3 | 29/4 | Eradicat 1080 (hand application) | No | 25 40.865S 113 00.550E |
| DH17 | 30/4 | Eradicat 1080 (aerial application) | Yes | 25 30.033S 112 58.260E |
| Uncollared 2 ♀ | 30/4 | Eradicat 1080 (aerial application) | Yes | 25 36.974S 113 02.284E |
| DH29 | 1/5 | Shot | No | 25 36.244S 113 01.420E |
| DH27 | 2/5 | Shot | No | 25 30.080S 113 01.030E |
| MB8 | 4/5 | Shot | No | 25 30.711S 112 57.556E |

**Figure 5. (a) Rhodamine stains in DH27_2. (b) No stains evident in DH5_1.**

Bait consumption was highest the day following bait application (Figure 6). However, aerially deployed baits remained palatable to at least 10 days following application given that cat DH17 consumed a RB-labelled bait on 29 April. Figure 6 presents the bait consumption data assuming cats B2 and B3 consumed hand-laid baits applied on 27 April rather than aerially laid baits applied on 19 of April (i.e. 27 April is considered as day 0 for these two cats).

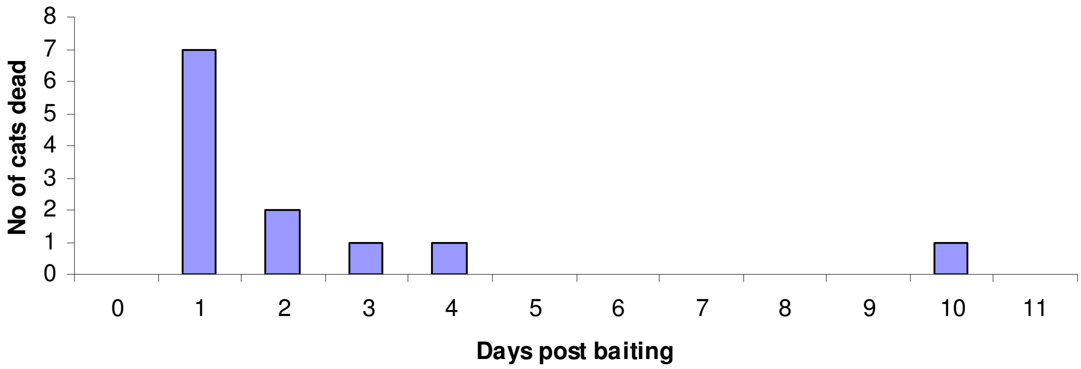


**Figure 6. Day of bait consumption by 12 radio-collared feral cats. Note that the 24-hour period between death and the collar switching to mortality mode has been accounted for.**

## 3.3 Activity at monitor plots

Clear differences in the track counts were observed prior to and following bait application (Figure 7, Table 3). The mean expected value for feral cat activity (i.e. number of individual cats crossing transect) on the plots prior to, and subsequent to, baiting was 2.52 (95% CI: 1.88–3.26) and 0.248 (95% CI: 0.078–0.5203) respectively. An almost 13-fold reduction (95% CI: 4.71–32.33) in feral cat activity was observed in the expected number of footprints per transect.

There was a significant difference in the PAIs before and after baiting ($z = 3.27$, $P < 0.001$), with an 83% reduction in plot activity following baiting.

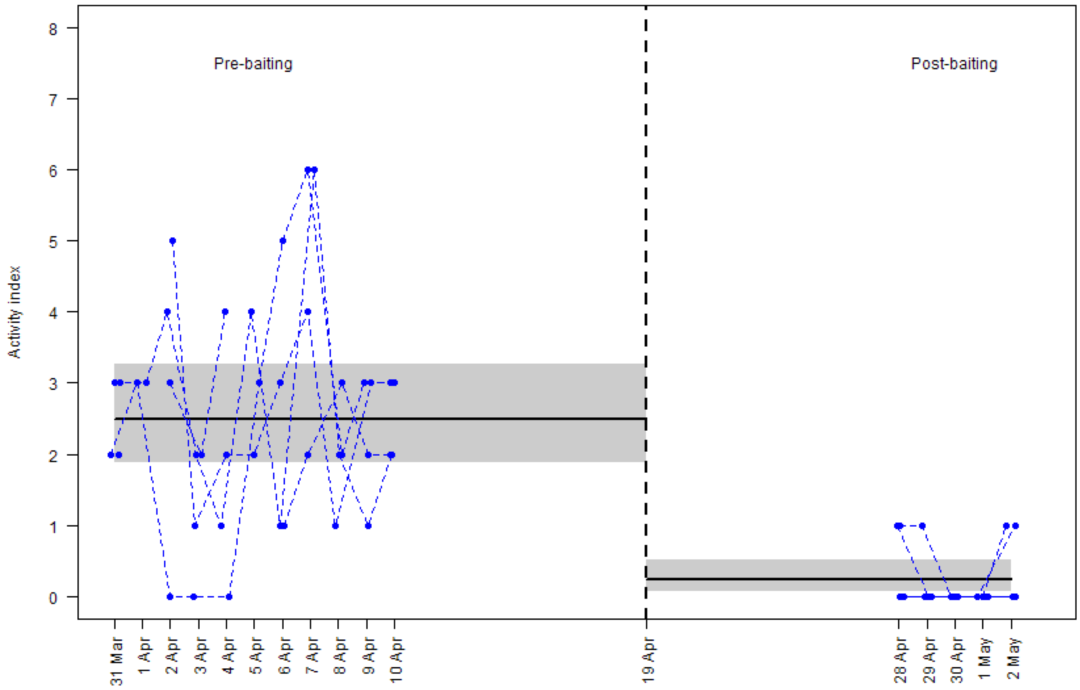


**Figure 7. Cat activity at four track survey transects within the baited area before and after baiting. Mean value is indicated by the solid line with 95% CI shown in shading. Note that no cat activity was observed on two of the four transects during the post bait monitoring.**

**Table 3. Plot Activity Index for feral cat activity at monitor plots.**

| Time | Plot Activity Index | Variation | Standard Error |
|---|---|---|---|
| Pre-baiting | 0.078947 | 0.000365716 | 0.01912 |
| Post-baiting | 0.013158 | 3.90086E-05 | 0.00625 |

Continuous track count data are summed over five days for the pre-baiting and post-baiting survey periods, for each transect (spatial replicate). There was a significant difference ($P < 0.001$) between the pre-baiting and post-baiting track counts, with a mean of 13.75 (s.e. 1.93) during the pre-bait survey and 1.25 (s.e. 0.63) during the post-baiting survey period. This equates to a reduction of more than 90% in measured cat activity on the continuous track transects following baiting.

## 3.4 Monitoring of non-target species

Observations of activity by large lizard species and diurnal raptors along the four transects were summed over five days before and after baiting (Table 4). The most commonly recorded species was the sand goanna with twelve observations prior to and one following baiting. A statistical analysis of the data was not possible because of the low number of observations.

## 3.5 iButton and DNA analysis

The analysis of iButton data and DNA samples will be undertaken by PhD candidates Stefanie Hilmer and Katrin Koch (University of Frankfurt, Germany) as part of their respective studies. The results are expected to be published in the future.

**Table 4. Observations of non-target species on all transects pre- and post baiting.**

| Species | Pre-bait | Post bait |
|---|---|---|
| Shingleback Lizard (*Tiliqua rugosa*) | 2 | 0 |
| Sand Goanna (*Varanus gouldii*) | 12 | 1 |
| Eastern Osprey (*Pandion cristatus*) | 2 | 3 |
| White-bellied Sea-Eagle (*Haliaeetus leucogaster*) | 2 | 3 |
| Nankeen Kestrel (*Falco cenchroides*) | 3 | 2 |
| Wedge-tailed Eagle (*Aquila audax*) | 2 | 1 |

## 3.6 GPS data

The 100% MCP of 15 cats and 50% MCP of 10 of the 15 cats was calculated. Insufficient data was collected for cat B1 to conduct either analysis. A 50% MCP could not be calculated for five cats; MB3, DH5, DH5_1, DH12 and DH17 because of the linear nature of their activity data. No significant difference in home ranges could be detected between male (mean: 12.7 km$^2$) and female cats (mean: 7.8 km$^2$, $t$-test: $P = 0.27$) nor in the size of the core area (male cats: 4.4 km$^2$, female cats: 3.2 km$^2$, $t$-test: $P = 0.63$).

A compilation of all location data obtained from the datalogger collars is shown in Figure 8. Appendix 2 presents location data for the 16 feral cats on an individual basis in relation to the bait application pattern applied from the aircraft. This data will be comprehensively analysed and incorporated into planning documents for the proposed eradication plan, and also published in a peer-reviewed paper.

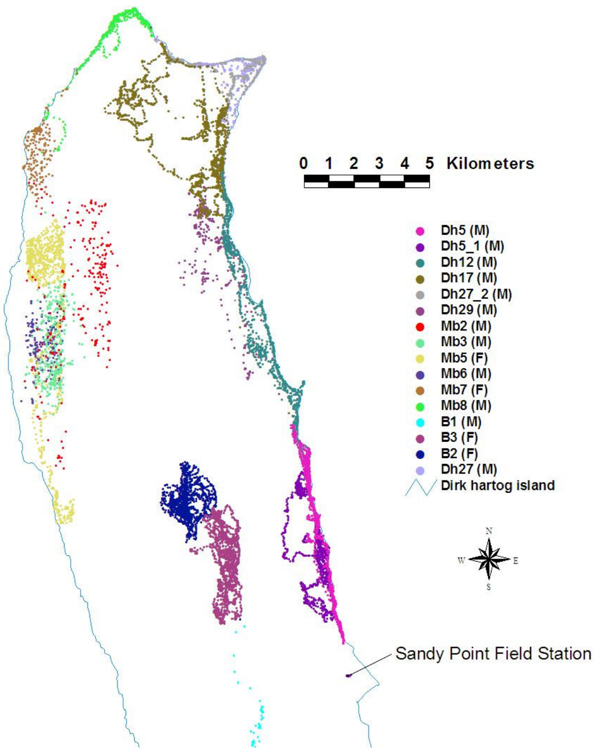


**Figure 8. Compilation of all data derived from GPS datalogger collars fitted to feral cats between 25 March and 5 May 2009.**

# 4 Discussion

It should be noted that there are limitations to the conclusions that can be drawn from the results in this trial given that (a) PAPP pellets were not available, and (b) only 22% of baits were implanted with RB HSDVs. A complete re-engineering of the equipment used to produce the PAPP formulation and HSDV doses was undertaken prior to the initiation of this study, which ultimately produced unusable product when required for this study. A separate report has been forwarded to DEWHA by Scientec Research that describes this situation (Scientec 2009).

A key assumption made in this study is that the PAPP HSDV dose will produce equivalent results as 1080. Pen and field trial results from PAPP studies do not yet provide sufficient evidence for this because of the larger body mass of the feral cats monitored during the Dirk Hartog Island (DHI) study. The largest cat that died following bait consumption of the current melt-processed 80 mg PAPP formulation weighed 4.6 kg. The DHI study involved monitoring survival of feral cats up to 5.5 kg in weight. Further pen studies are therefore required to confirm that heavier cats will succumb to PAPP toxicosis using this current formulation.

Despite the above limitations, the trial achieved very positive results in that 80% of the collared feral cats died following bait consumption. The New Zealand Food Safety Authority (in the absence of published requirements by the Australian Pesticides and Veterinary Medicines Authority) specifies an 80% kill for registration of new vertebrate pesticides. This result was achieved in this study. Of these, 75% were found to have RB stained gastro-intestinal tracts indicating that they had consumed the RB HSDV. Rhodamine, as an alternative pellet load provided a rapid and easily observed indicator of HSDV consumption.

The changes in feral cat activity on the transects following baiting varied slightly between the analysis techniques used but each indicates that a large and statistically significant decrease in activity (82% to more than 90%) was achieved (Figure 7, Table 3). This suggests that a large initial population reduction could be achieved if this bait was utilised as part of an eradication program.

Consumption of baits is a function of opportunity, hunger, attractiveness and palatability. All cats in this study should have had the opportunity to contact baits, because of the bait density and pattern flown by the aircraft. Only one bait that had been deployed from aircraft was found by field crews despite considerable distances walked. This bait was found within 5 m of a dead cat (MB2) on 26 April in good condition (i.e. attractive and palatable). There was no evidence on the bait of ant activity, which is known to reduce attractiveness and palatability to feral cats (Algar pers. comm.). Baits applied by hand near cats were observed frequently and exuded considerable amount of oils in days following application (Figure 9), suggesting that they were attractive and palatable but that the targeted cat was not hungry.

Optimal rates of bait consumption by feral cats are achieved during periods of food stress (Algar et al. 2007). It is possible that an improved bait efficacy rate could have been achieved at this site by delaying the baiting until cooler weather patterns were present. A high abundance of small reptiles (< 100 mm in length) were observed daily during the study (Johnston pers. obs.). Several radio-collared feral cats were implicated in predation of Loggerhead Turtle (*Caretta caretta*) hatchlings, evidenced by cat footprints around turtle nest excavations (Figure 10) and regurgitated stomach contents (Figure 11). The interaction and extent to which turtles provided a rich and readily accessible food resource was unanticipated.

**Figure 9. The Eradicat bait located seven days after aerial application. Note absence of ants and presence of stained twigs resulting from 'sweated' bait contents. (Image: David Hawke)**

**Figure 10. Imprints of turtle hatchlings fan out from a nest and are intersected by feral cat(s).**

All three cats that were shot were in excellent body condition and were obviously not food-stressed (Figure 12). Cat MB8 had considerable deposits of body fat, including all over its implanted iButton. Cat DH27 and DH29 were not inspected internally, but the presence of abundant body fat was evident. Cat DH29 was utilising other food sources as it was not thought to be accessing beaches where turtle hatchlings were available and apparently ignored the baits (both air and hand applied) that had been placed around it. The whiskers plucked from these three cats were not found to have any RB bands when examined using techniques described in Fisher et al. (1999), indicating that they had not consumed a bait and survived (G. Forster pers. comm.).

**Figure 11. Regurgitated Loggerhead Turtle hatchling found near cat DH27_2.**

The impact of the bait exclusion zones on the survival of MB8, DH27 and DH29 should be considered. These cats frequented one or more 'no bait areas' but also spent sufficient time in areas where bait encounter was likely, particularly given that they were encircled with hand-laid baits from 27 April.

The attractiveness and palatability of the Eradicat bait has been demonstrated in field studies throughout the arid zone (Algar and Burrows 2004, Algar et al. 2007), and it is now used as a control tool for feral cat management at several sites (D. Algar pers. comm.). Previous studies using this bait with PAPP have demonstrated that a pH-buffered variant of the Eradicat bait made on small-scale equipment was palatable to feral cats on French Island in Victoria (Johnston et al. unpublished data). However, the attractiveness of the bait decreased dramatically when manufactured on commercial-scale equipment, as supplied for the Christmas Island study (Johnston et al. 2008). The Dirk Hartog Island study was undertaken using the conventional version of the bait (pH approx. 5.0), so the HSDV encapsulation may have softened prematurely.

Five collared feral cats died from consuming aerially delivered baits within 24 hours of bait application. However, these baits remained palatable for 10 days, as indicated by DH17 which was observed to have RB staining in its GI tract. The distance between the cat's position determined by airborne radio tracking (and baits dropped) and the point where the body was recovered was approximately 2 km. However, ground observations indicate that this animal was highly mobile having moved in excess of 16 km between in the ten days following baiting. It is likely that DH17 consumed a bait 'intended' for MB8 given the 200 m distance between the location of body and the position observed for MB8 from the aircraft.

All 14 cats that died from bait consumption were dissected in the field to determine whether RB dye was present in the GI tract. None of these cats had anything in their stomachs other than bile due to the emesis induced during 1080 toxicosis. Poisoning of cats with 1080 inevitably results in vomiting of stomach contents. It is not possible to comment whether multiple baits may have been consumed by feral cats in this study, as was observed in the French Island study (Johnston 2008). However, vomited food items were located within 5 m of the body of DH27-2, consisting of a Loggerhead Turtle hatchling and a mouse (Figure 11). Both items had been consumed whole. The turtle hatchling was approximately 50 × 30 mm and provides further evidence of the size of food items that feral cats will consume entire (Marks et al. 2006, Hetherington et al. 2007).


**Figure 12. Cat MB8 at death. Note the body condition with respect to presence of body fat.**

Three cats, DH5.1, B2 and B3, were found to have died as a result of bait consumption but did not show any RB staining. The collars fitted to cats DH5.1 and B2 ceased collecting data prior to baiting which precludes determination of activity following bait application. Cat DH5.1 consumed aerially applied bait(s) but it is not possible to specify whether this animal consumed a bait that did not contain a RB pellet or rejected the pellet during feeding. Cats B2 and B3 are presumed to have consumed baits applied by hand (which did not contain RB HSDVs) on 27 April given their patterns of behaviour in the period following application of aerial baits. These cats were readily located in similar positions during daily checks between 21 and 27 April. However, both cats were recovered dead on 29 April, which (taking the activation of mortality mode on the radio collars into account) suggests that these cats had consumed bait(s) on the evening of 27 April. The home range inhabited by cat B3 was almost bounded by aerial bait transects, so this animal had relatively few opportunities to encounter a bait (Appendix 2). It would have experienced a greater bait encounter rate if the flight lines were at 500 m intervals rather than 1000 m.

The fate of juvenile and sub-adult feral cats following application of baits is difficult to assess because the collars used in this study were too heavy for cats weighing less than 2.4 kg. No data has been collected on the ranging behaviour of this cohort of animals. Imprints of a sub-adult cat were found on 21 April within 20 m of the body of DH27_2. This location was checked on several subsequent occasions, but no further small cat prints were found.

GPS datalogger collars were fitted to 11 male cats but only 4 females for the same reason (i.e. collar weight to body mass ratio). The home ranges of the study animals ranged from 4.36 $km^2$ (B2, female) to 30.61 $km^2$ (MB2, male) with a mean of 12.7 $km^2$ for males and 7.8 $km^2$ for females. It was not possible to calculate the core area for five of the 15 cats because of the concentrated activity on the beaches on the eastern side of the island. It is possible that a central point of the home range is not biologically significant for these cats.

The raptor observation data presented only reflects birds observed during the transect inspection which had been completed by 8.30 a.m. daily. However, raptors were frequently observed throughout the day across the island and they are not thought to have been adversely affected by the baiting. A raptor survey conducted several times a day is likely to have better demonstrated the absence of a negative impact. Regular sightings were made of a pair of Australian Bustards (*Ardeotis australis*) on the western transect and a single bird on the eastern transect throughout the study, suggesting that these birds were not impacted negatively by the baits either.

Too few large reptiles (Sand Goannas, Shingleback Lizards and snakes) were sighted throughout the study to comment on the impact that baiting may have had on these species. The apparent low abundance of these species across the study area may be the result of heavy predation by feral cats. Goannas and Shingleback Lizards have a high tolerance to 1080 (McIlroy et al. 1985), so the low detection of these species during the post-baiting monitoring period is unlikely to be related to declines caused by this baiting program. Other factors such as weather (including season) or observer skill may have lead to inaccuracies in this.

# 5 Conclusions and recommendations

The results obtained in this trial suggest that the Eradicat bait and HSDV delivery mechanism will provide an effective management tool for the populations of feral cats in the semi-arid zone of Australia.

However, a number of factors have become apparent from this work that may lead to improvements in experimental rigour, baiting efficacy and monitoring. Importantly, as an eradication program for feral cats is planned on Dirk Hartog Island it is critical that those involved in preparing the planning documents review the data generated in this study, including the data collection processes and also importantly identify data that was not collected that may be necessary for informed decision-making.

- Confirm that the melt-processed 80 mg dose PAPP formulation is effective in cats over 5 kg in weight.
- Decrease the activation time of 'mortality mode' on the VHF collars to 8–10 hours. The 24-hour delay used on collars in this study meant that a day was lost while waiting for the VHF transmitter to switch from 'alive' mode following the death of the cat.
- Baiting with Eradicat would be a useful management tool for initial population knockdown of feral cats on Dirk Hartog Island if an eradication program was attempted. Timing of bait application should be considered to allow for cooler weather (but not rain) and completion of turtle hatching.
- Seek exemption from the requirement to establish bait exclusion zones in future management programs, as these may provide a bait-free refuge for cats with small home ranges, such as juveniles and sub-adults. The home range and activity data presented in this study is biased towards heavier animals, because collars were not fitted to cats under 2.4 kg. All animals within the population should be targeted in the eradication program.
- Modify the bait application pattern to lay baits in narrower transects as well as more baits in complex topography such as dunes and swales.
- Improve the robustness of the data obtained in monitoring of non-target species by conducting searches for raptors at a range of times throughout the day.
- Identify improvements in the technique used for monitoring of goanna activity.

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# Appendix 1

Extant fauna list for Dirk Hartog Island sourced from Western Australian Museum.

| Common name | Scientific name | Observed during this study |
|---|---|---|
| ***Mammals*** | | |
| Common House Mouse | *Mus musculus* | ✓ |
| Ash-grey Mouse | *Pseudomys albocinereus* | |
| Sandy Inland Mouse | *Pseudomys hermannsbergensis* | |
| Little Long-tailed Dunnart | *Sminthopsis dolichura* | |
| Cat (feral) | *Felis catus* | ✓ |
| Goat (feral) | *Capra hircus* | ✓ |
| Sheep (feral) | *Ovis aries* | ✓ |
| ***Reptiles & Amphibians*** | | |
| Stimson’s Python | *Antaresia stimsoni stimsoni* | ✓ |
| Sandhill Frog | *Arenophryne rotunda* | |
| Clawless Gecko | *Crenadactylus ocellatus horni* | |
| Carnaby’s Wall Skink | *Cryptoblepharus carnabyi* | |
| Peron’s Snake-eyed Skink | *Cryptoblepharus plagiocephalus* | |
| Spotted Military Dragon | *Ctenophorus maculatus maculatus* | |
| Western Netted Dragon | *Ctenophorus reticularis* | |
| Western Limestone Ctenotus | *Ctenotus australis* | |
| | *Ctenotus fallens* | |
| | *Ctenotus lesueurii* | |
| | *Ctenotus youngsoni* | |
| Günther's Skink | *Cyclodomorphus branchialis* | |
| Western Slender Blue-tongue | *Cyclodomorphus celatus* | |
| | *Delma butleri* | |
| Black-necked Whipsnake | *Demansia calodera* | |
| Yellow-faced Whipsnake | *Demansia psammophis reticulata* | |
| White-spotted Ground Gecko | *Diplodactylus alboguttatus* | |
| | *Diplodactylus ornatus* | |
| | *Diplocactylus spinigerus spinigerus* | |
| Stokes’ Skink | *Egernia stokesii badia* | |
| Tree Dtella | *Gehyra variegata* | ✓ |
| Bynoe’s Gecko | *Heteronotia binoei* | |
| | *Lerista connivens* | |
| | *Lerista elegans* | |
| West Coast Line-spotted Lerista | *Lerista lineopunctulata* | |
| | *Lerista planiventralis planiventralis* | |
| | *Lerista praepedita* | |
| | *Lerista varia* | |
| | *Lerista spp.* | |
| Burton’s Snake-lizard | *Lialis burtonis* | |
| | *Menetia greyii* | |
| | *Morethia lineoocellata* | |
| Smooth Knob-tailed Gecko | *Nephrurus levis occidentalis* | |
| Keeled Legless Lizard | *Pletholax gracilis* | |
| Dwarf Bearded Dragon | *Pogona minor minor* | |

| Common name | Scientific name | Observed during this study |
|---|---|---|
| Mulga Snake | *Pseudechis australis* | |
| Western Brown Snake | *Pseudonaja nuchalis* | ✓ |
| Common Scaly-foot | *Pygopus lepidopodus* | |
| Southern Blind Snake | *Ramphotyphlops australis* | |
| | *Rankinia parviceps butleri* | |
| West Coast Banded Snake | *Simolepsis littoralis* | |
| Soft Spiny Gecko | *Strophorus spinigiros inornatus* | |
| | *Tympanocryptis adelaidensis* | |
| | *Tymanocryptis butleri* | |
| Shingleback | *Tiliqua rugosa* | |
| Barking Gecko | *Underwoodisaurus milii* | |
| Sand Goanna | *Varanus gouldii* | ✓ |
| Bandy Bandy | *Vermicella fasciolata fasciolata* | |
| Loggerhead Turtle | *Caretta caretta* | ✓ |
| Green Turtle | *Chelonia mydas* | ✓ |
| | | |
| ***Birds*** | | |
| Australian Pelican | *Pelecanus conspicillatus* | ✓ |
| Pied Cormorant | *Phalacrocorax varius* | ✓ |
| Eastern Reef Egret | *Egretta sacra* | ✓ |
| White-faced Heron | *Egretta novaehollandiae* | ✓ |
| Australian Shelduck | *Tadorna tadornoides* | ✓ |
| Grey Teal | *Anas gibberifrons* | |
| Brown Goshawk | *Accipiter fasciatus* | ✓ |
| Collared Sparrowhawk | *Accipiter cirrocephalus* | ✓ |
| Wedge-tailed Eagle | *Aquila audax* | ✓ |
| Australian Little Eagle | *Hieraaetus morphnoides* | ✓ |
| White-bellied Sea-eagle | *Haliaeetus leucogaster* | ✓ |
| Spotted Harrier | *Circus assimilis* | ✓ |
| Eastern Osprey | *Pandion cristatus* | ✓ |
| Black-shouldered Kite | *Elanus axillaris* | ✓ |
| Nankeen Kestrel | *Falco cenchroides* | ✓ |
| Brown Falcon | *Falco berigora* | ✓ |
| Painted Button-quail | *Turnix varia* | |
| Buff-banded Rail | *Gallirallus philippensis* | |
| Australian Bustard | *Ardeotis australis* | ✓ |
| Australian Pied Oystercatcher | *Haematopus longirostris* | ✓ |
| Sooty Oystercatcher | *Haematopus fuliginsus* | ✓ |
| Black-winged Stilt | *Himantopus himantopus* | ✓ |
| Banded Lapwing | *Vanellus tricolor* | ✓ |
| Inland Dotterel | *Peltohyas australis* | |
| Red-capped Plover | *Charadrius ruficapillus* | ✓ |
| Greater Sand Plover | *Charadrius leschenaultii* | ✓ |
| Grey Plover | *Pluvialis squatarola* | |
| Ruddy Turnstone | *Arenaria interpres* | ✓ |
| Caspian Plover | *Charadrius asiaticus* | ✓ |
| Whimbrel | *Numenius phaeopus* | ✓ |
| Eastern Curlew | *Numenius madagascariensis* | |
| Greenshank | *Tringa nebularia* | |
| Common Sandpiper | *Actitis hypoleucos* | |

| Common name | Scientific name | Observed during this study |
|---|---|---|
| Grey-tailed Tattler | *Tringa brevipes* | |
| Red Knot | *Calidris canutus* | |
| Sharp-tailed Sandpiper | *Calidris acuminata* | ✓ |
| Red-necked Stint | *Calidris ruficollis* | |
| Bar-tailed Godwit | *Limosa lapponica* | |
| Bush Stone-curlew | *Burhinus grallarius* | ✓ |
| Pacific Gull | *Larus pacificus* | ✓ |
| Silver Gull | *Chroicocephalus novaehollandiae* | ✓ |
| Caspian Tern | *Hydroprogne caspia* | |
| Roseate Tern | *Sterna dougallii* | ✓ |
| Fairy Tern | *Sterna nereis* | |
| Crested Tern | *Thalasseus bergii* | ✓ |
| Lesser Crested Tern | *Thalasseus bengalensis* | ✓ |
| Diamond Dove | *Geopelia cuneata* | |
| Laughing Dove | *Streptopelia senegalersis* | ✓ |
| Rock Dove | *Columba livia* | ✓ |
| Common Bronzewing | *Phaps chalcoptera* | |
| Little Corella | *Cacatua pastinator* | |
| Galah | *Cacatua roseicapilla* | |
| Cockatiel | *Leptolophus hollandicus* | |
| Rock Parrot | *Neophema petrophila* | |
| Little Crow | *Corvus bennetti* | ✓ |
| Grey Butcherbird | *Cracticus torquatus* | ✓ |
| Black-faced Wood Swallow | *Artamus cinereus* | ✓ |
| Masked Wood Swallow | *Artamus personatus* | ✓ |
| Little Woodswallow | *Artamus minor* | ✓ |
| Zebra Finch | *Taeniopygia guttata* | ✓ |
| Singing Honeyeater | *Lichenostomus virescens* | ✓ |
| Spiny-cheeked Honeyeater | *Acanthagenys rufogularis* | ✓ |
| White-browed Babbler | *Pomatostomus superciliosus* | ✓ |
| Crested Bellbird | *Oreoica gutturalis* | |
| Mistletoebird | *Dicaeum hirundinaceum* | |
| Silvereye | *Zosterops lateralis* | ✓ |
| Yellow White-eye | *Zosterops luteus* | ✓ |
| Brown Honeyeater | *Lichmera indistincta* | |
| White-fronted Chat | *Epthianura albifrons* | ✓ |
| Crimson Chat | *Epthianura tricolor* | |
| Orange Chat | *Epthianura aurifrons* | ✓ |
| Red-capped Robin | *Petroica goodenovii* | |
| Hooded Robin | *Melanodryas cucullata* | |
| Willie Wagtail | *Rhipidura leucophrys* | ✓ |
| White-winged Fairy-wren | *Malurus leucopterus leucopterus* | ✓ |
| Variegated Wren | *Malurus lamberti assimilis* | ✓ |
| Southern Emu-wren | *Stipiturus malachurus hartogi* | ✓ |
| White-browed Scrubwren | *Sericornis frontalis balstoni* | ✓ |
| Rufous Fieldwren | *Calamanthus campestris* | ✓ |
| Thick-billed Grasswren | *Amytornis textilis* | Unconfirmed sighting by NH |
| White-backed Swallow | *Cheramoeca leucosternum* | |
| Welcome Swallow | *Hirundo neoxena* | ✓ |

| Common name | Scientific name | Observed during this study |
|---|---|---|
| Tree Martin | *Hirundo nigricans* | |
| Australasian Pipit | *Anthus novaeseelandiae* | ✓ |
| Black-faced Cuckoo-shrike | *Coracina novaehollandiae* | |
| Brown Songlark | *Cinclorhamphus cruralis* | |
| Pallid Cuckoo | *Cuculus pallidus* | |
| Horsfield's Bronze-cuckoo | *Chrsococcyx basalis* | |
| Boobook Owl | *Ninox boobook* | |
| Spotted Nightjar | *Eurostopodus argus* | ✓ |
| Tawny Frogmouth | *Podargus strigoides* | ✓ |
| Stubble Quail | *Coturnix pectoralis* | |

# Appendix 2

The following pages provide maps that indicate the data obtained from the GPS datalogger collars fitted to 16 feral cats on Dirk Hartog Island during this study. Each map contains information pertinent to the particular cat, including;

- Cat identifier
- Body mass and sex
- Collar activity period – date that collar started and ceased collating data.
- GPS datapoint interval – either 10, 40 or 80 minutes.

Note that the dates that the collars were collecting and storing data vary according to when the animal was released and also with respect to how frequently the collars were programmed to collect a waypoint. Each cat that was fitted with an iButton was allocated a GPS datalogger that sampled every ten minutes so that the body temperature could be analysed in relation to activity. Data collected on the 40 and 80 minute sampling routine collars will be analysed to assist with design of monitoring techniques for the proposed eradication program.

Seven of the collars ceased collecting data before the 19$^{th}$ of April when baits were aerially applied. Maps for the remaining nine cats indicate the cat location prior to baiting in blue ink and following baiting in yellow.

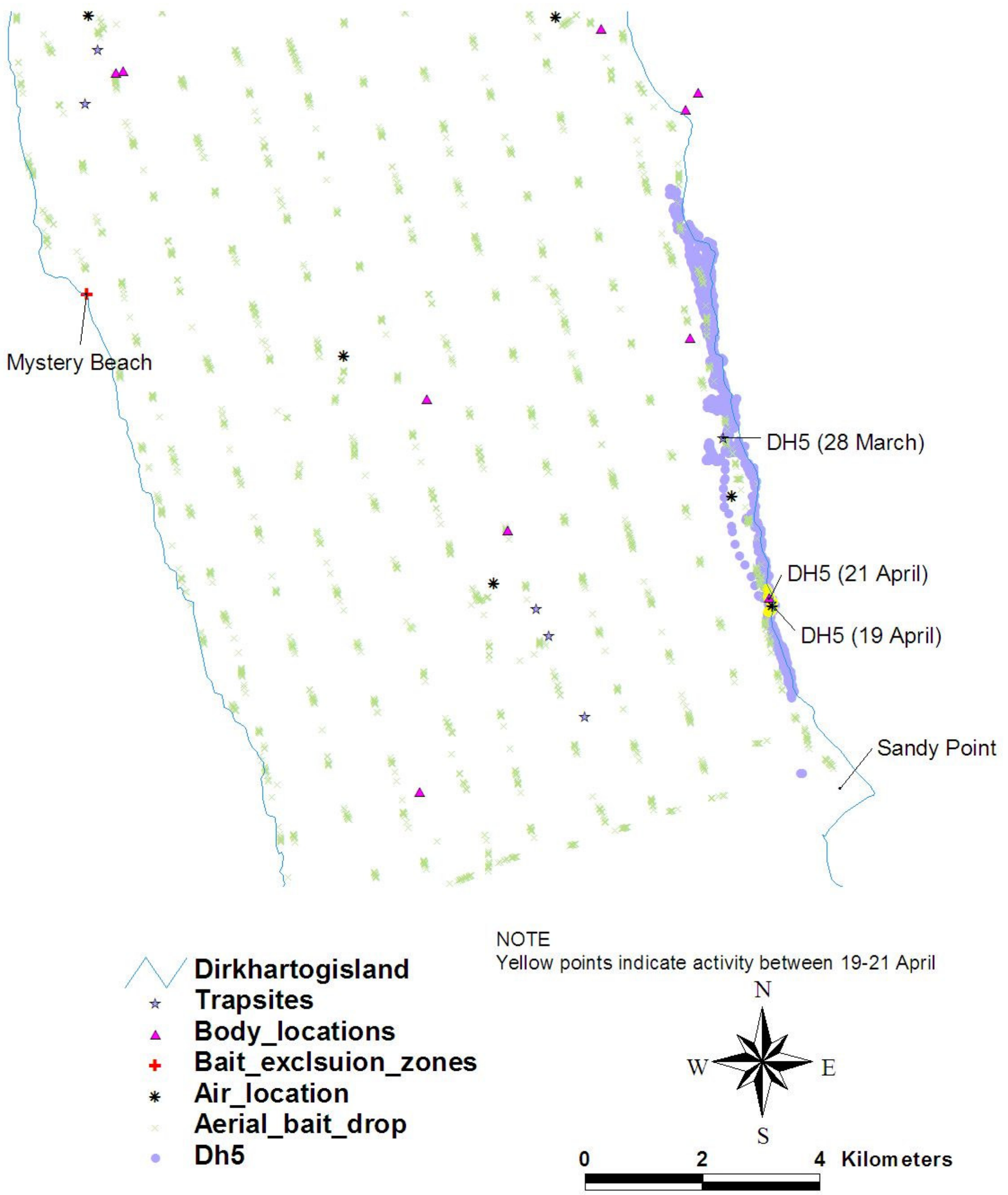
The maps indicate some data for all cats (trap sites, body locations and air location) but sites appropriate to each cat are indicated on the map with a date label and include;

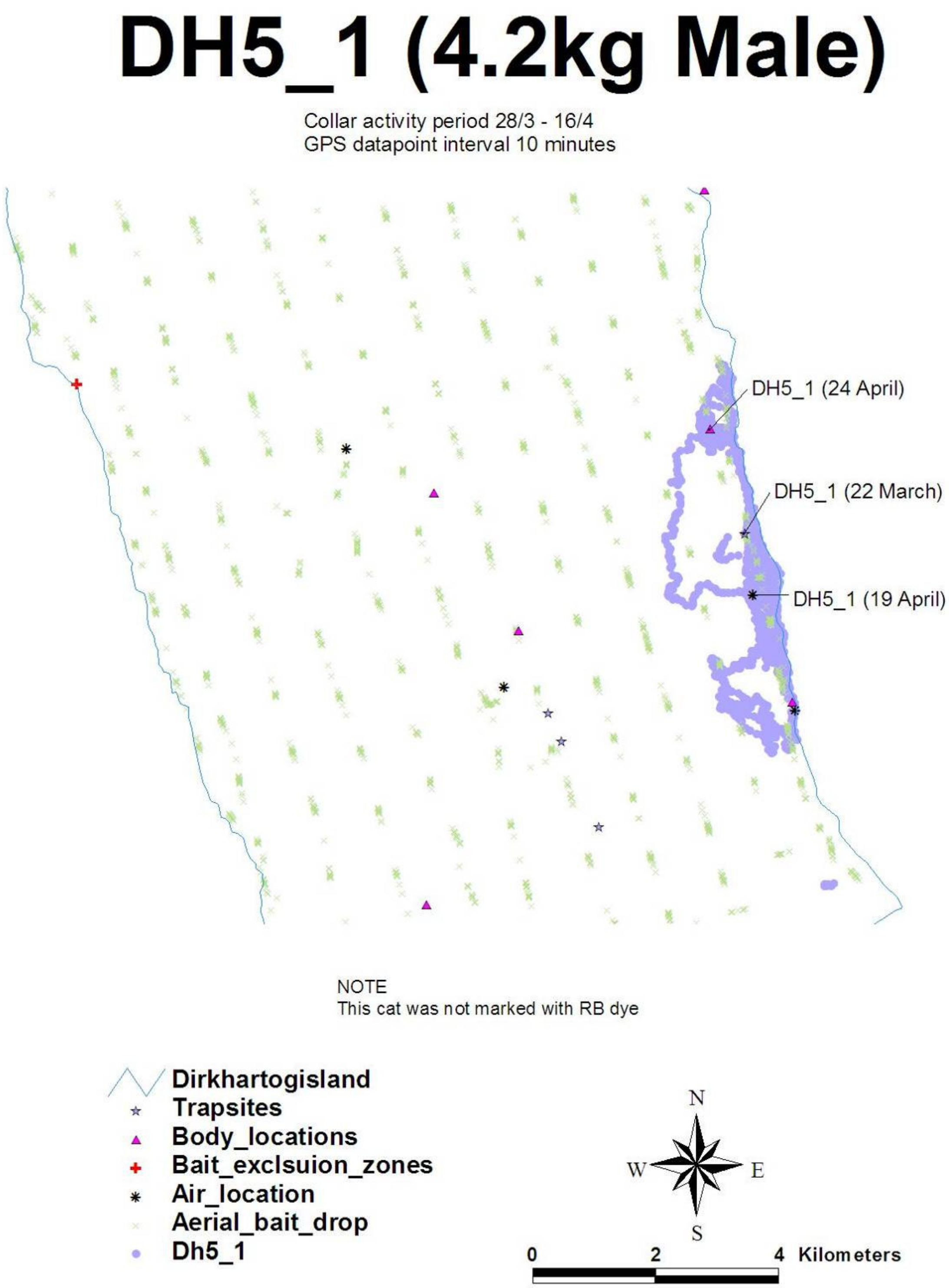
- where the cat was trapped,
- where the cat was on the day when aerial baits were applied (19$^{th}$ April)
- where the cat was found during ground based daily searches using VHF telemetry.
- where the cat's body was found.

Further analysis of these data will be undertaken as a separate paper to be published in the scientific literature.

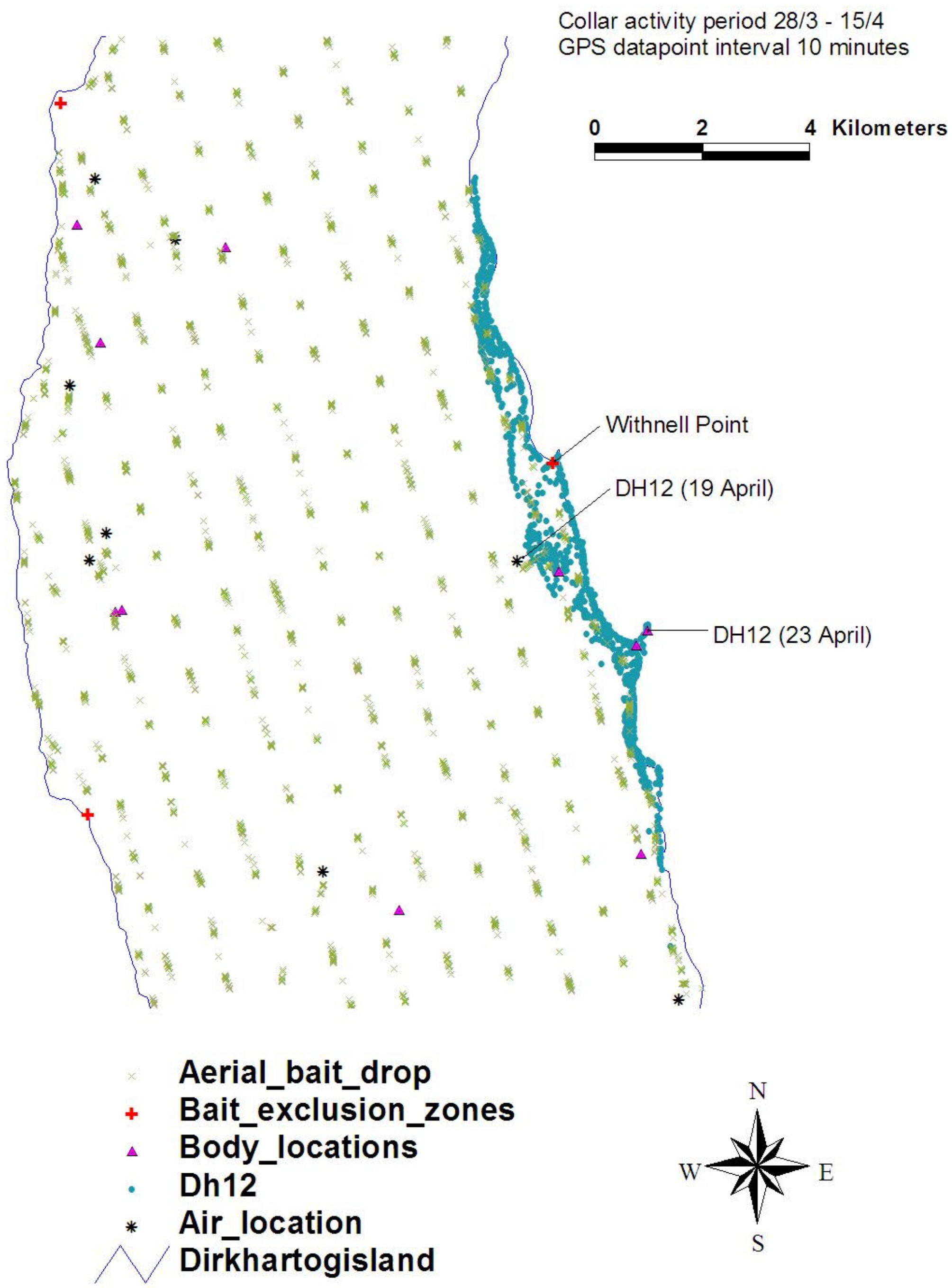
# DH5 (5.1kg Male)

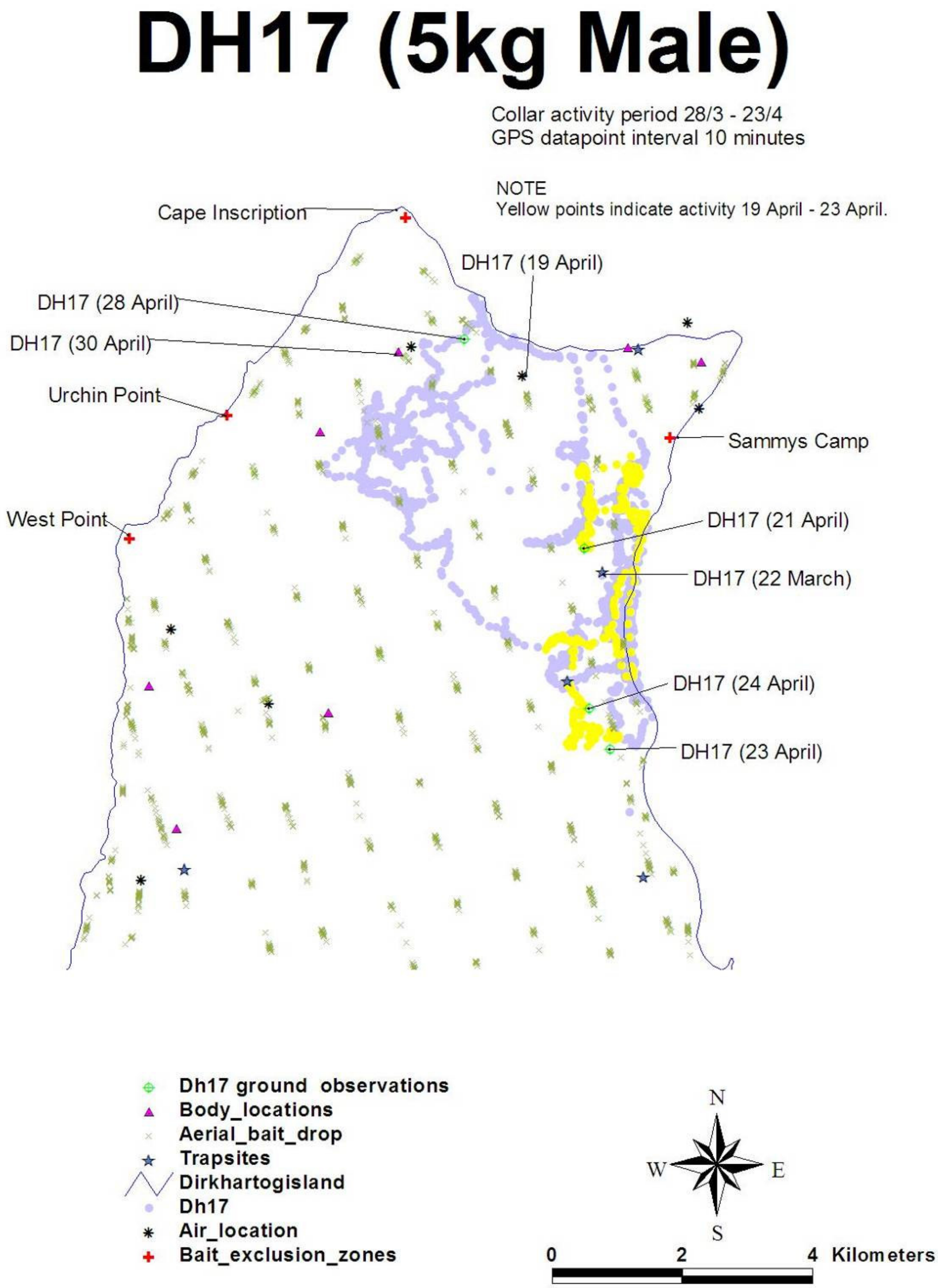
Collar activity period 28/3 - 20/4
GPS datapoint interval 10 minutes

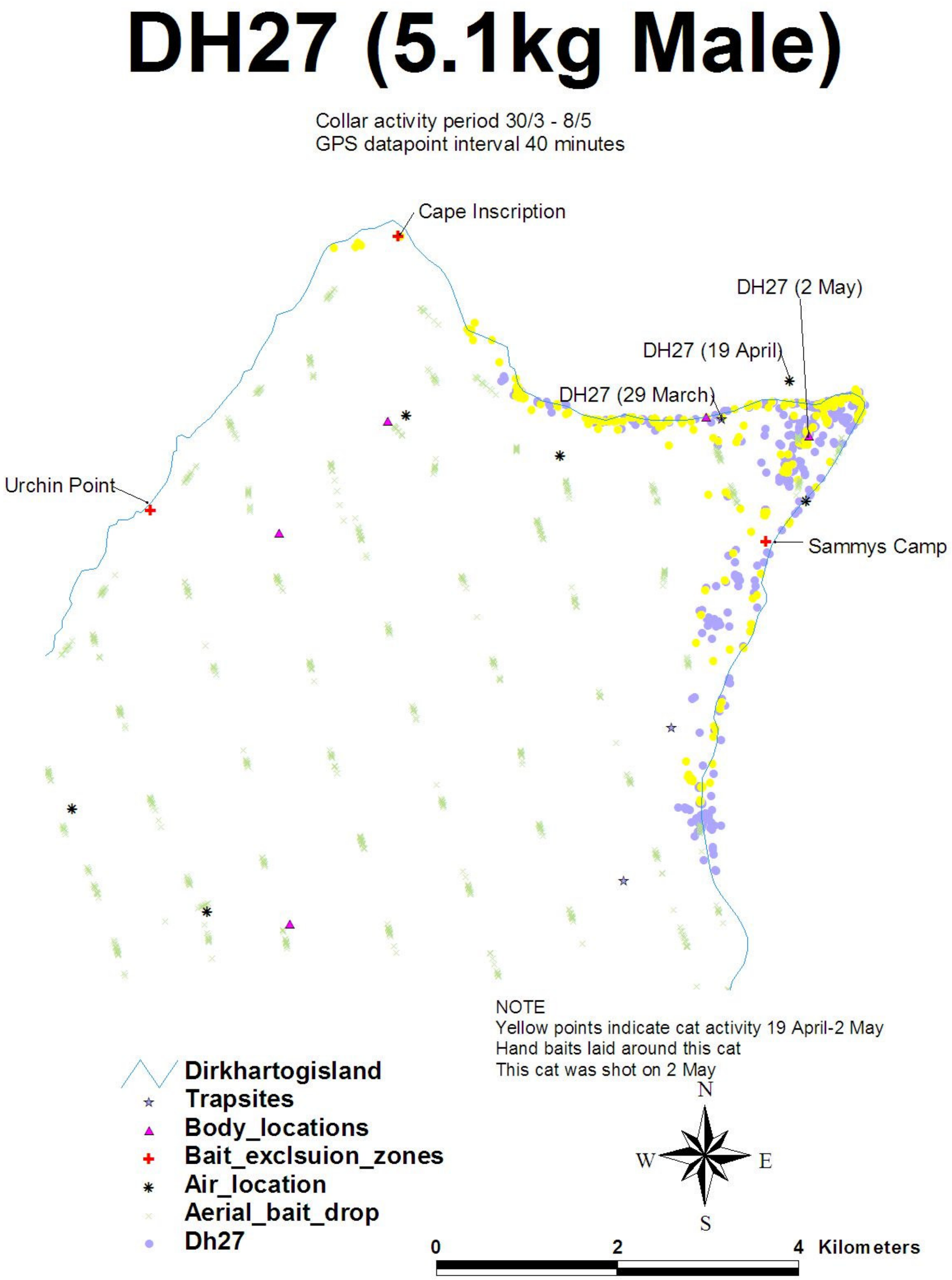



DH5_1 (4.2kg Male)
Collar activity period 28/3 - 16/4
GPS datapoint interval 10 minutes
DH5_1 (24 April)
DH5_1 (22 March)
DH5_1 (19 April)
NOTE
This cat was not marked with RB dye
Dirkhartogisland
Trapsites
Body_locations
Bait_exclsuion_zones
Air_location
Aerial_bait_drop
Dh5_1
N
W
E
S
0
2
4 Kilometers

# DH12 (5kg Male)



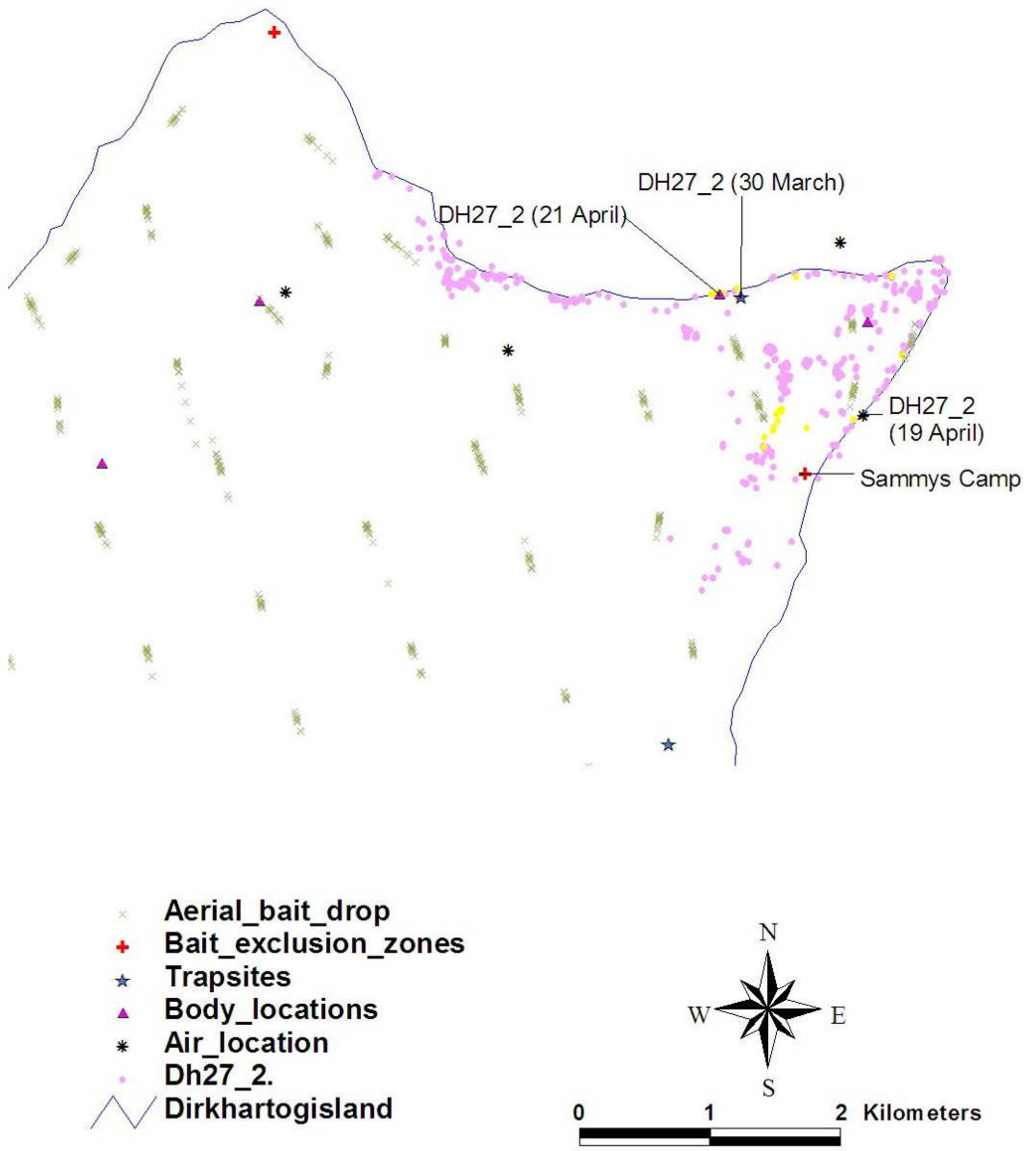

DH17 (5kg Male)
Collar activity period 28/3 - 23/4
GPS datapoint interval 10 minutes
NOTE
Yellow points indicate activity 19 April - 23 April.
Cape Inscription
DH17 (19 April)
DH17 (28 April)
DH17 (30 April)
Urchin Point
Sammys Camp
West Point
DH17 (21 April)
DH17 (22 March)
DH17 (24 April)
DH17 (23 April)
Dh17 ground observations
Body_locations
Aerial_bait_drop
Trapsites
Dirkhartogisland
Dh17
Air_location
Bait_exclusion_zones
N
W
E
S
0
2
4 Kilometers

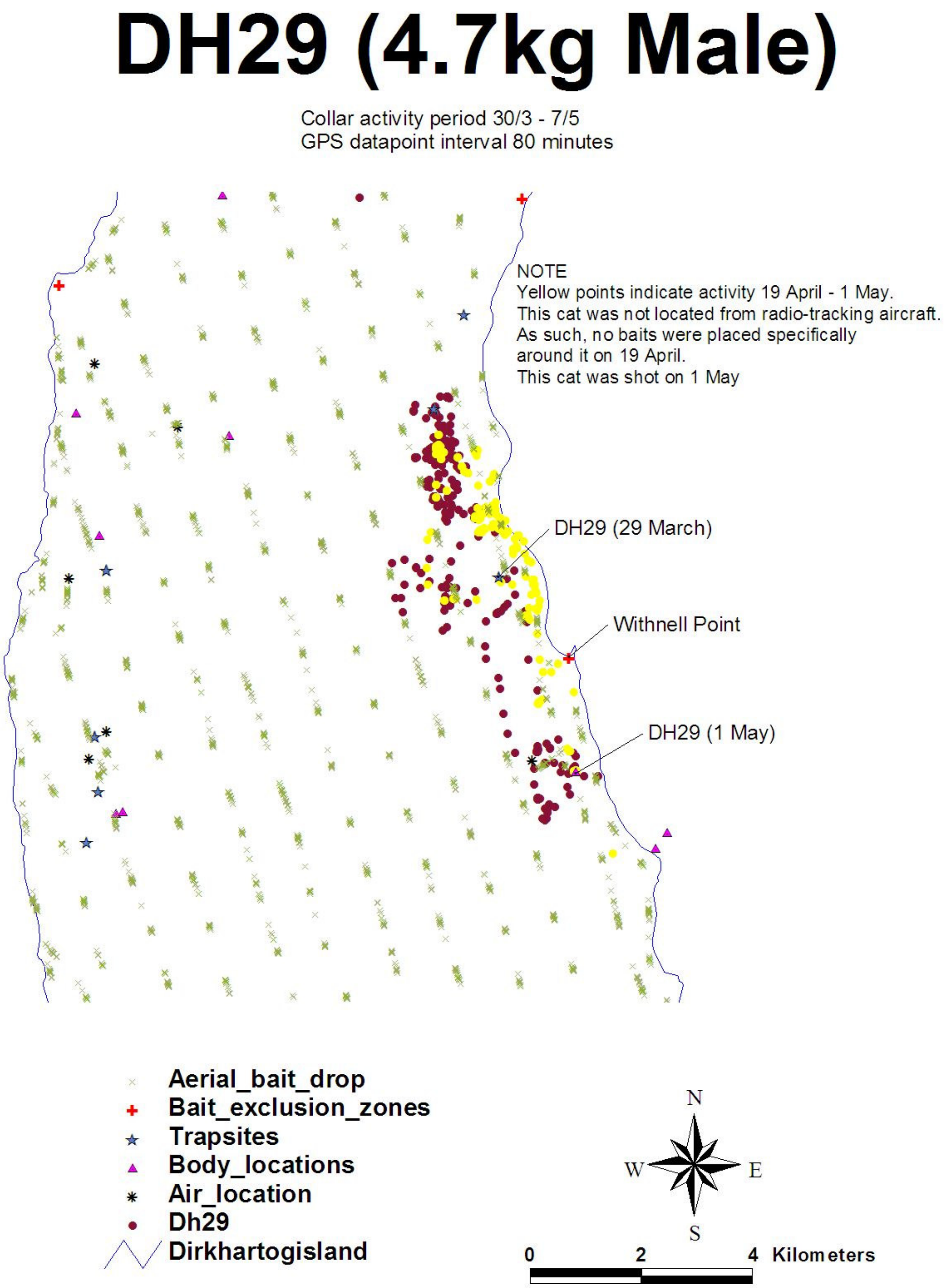

DH27 (5.1kg Male)
Collar activity period 30/3 - 8/5
GPS datapoint interval 40 minutes
Cape Inscription
DH27 (2 May)
DH27 (19 April)
DH27 (29 March)
Urchin Point
Sammys Camp
NOTE
Yellow points indicate cat activity 19 April-2 May
Hand baits laid around this cat
This cat was shot on 2 May
Dirkhartogisland
Trapsites
Body_locations
Bait_exclsuion_zones
Air_location
Aerial_bait_drop
Dh27
N
W
E
S
0
2
4 Kilometers

# DH27_2 (4.5kg Male)

Collar activity period 31/3 - 21/4
GPS datapoint interval 40 minutes

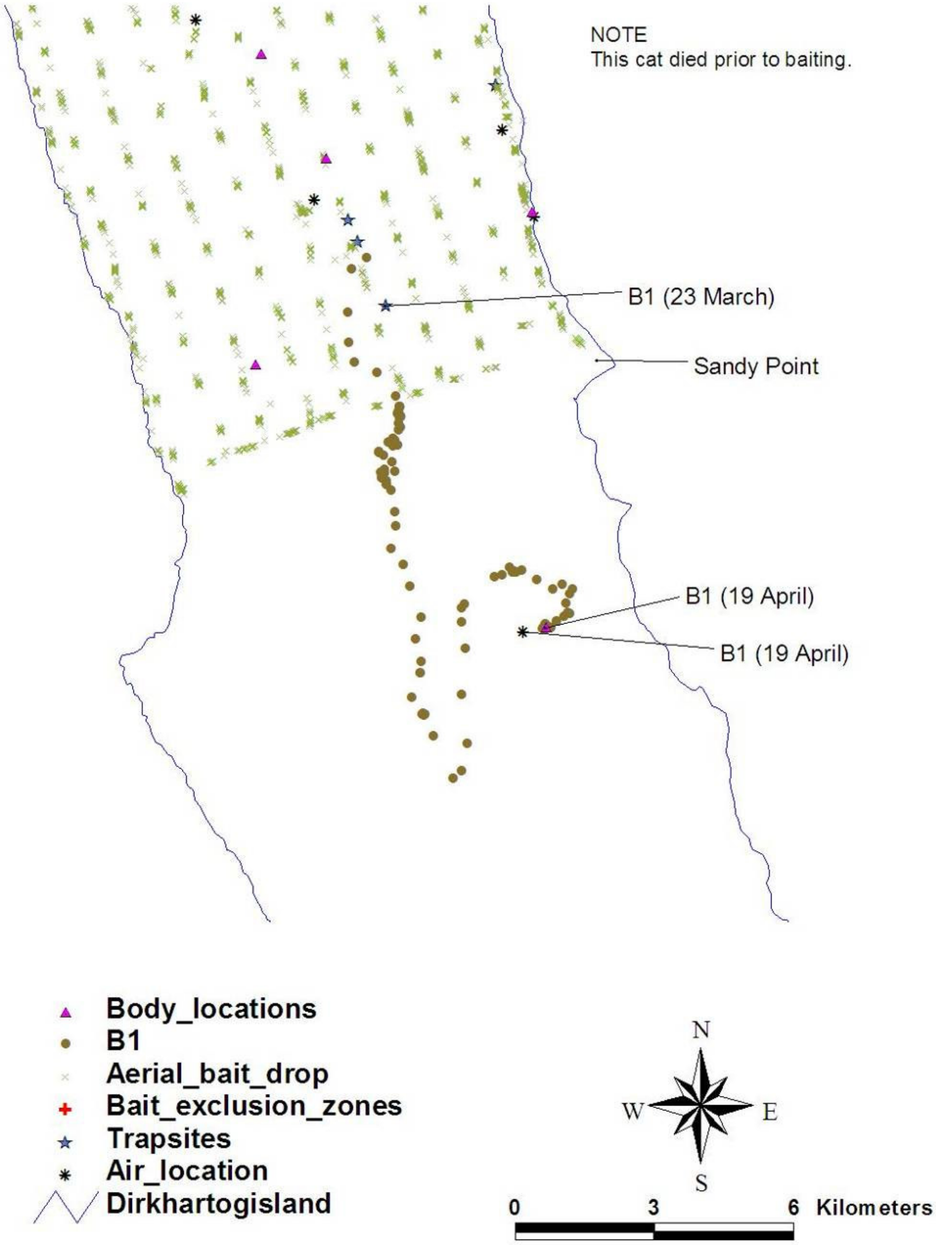
NOTE
Yellow points indicate activity 19 April - 21 April.

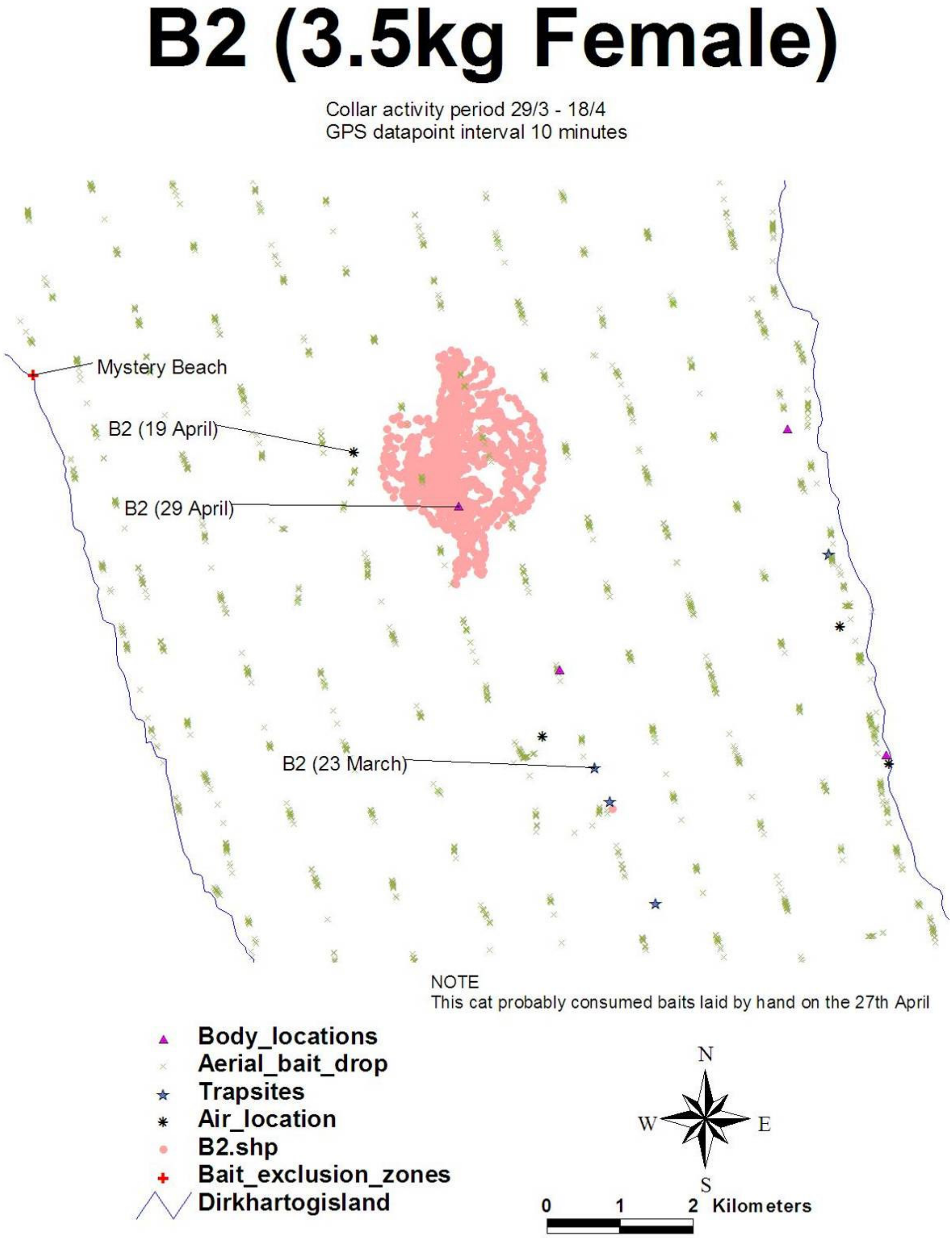


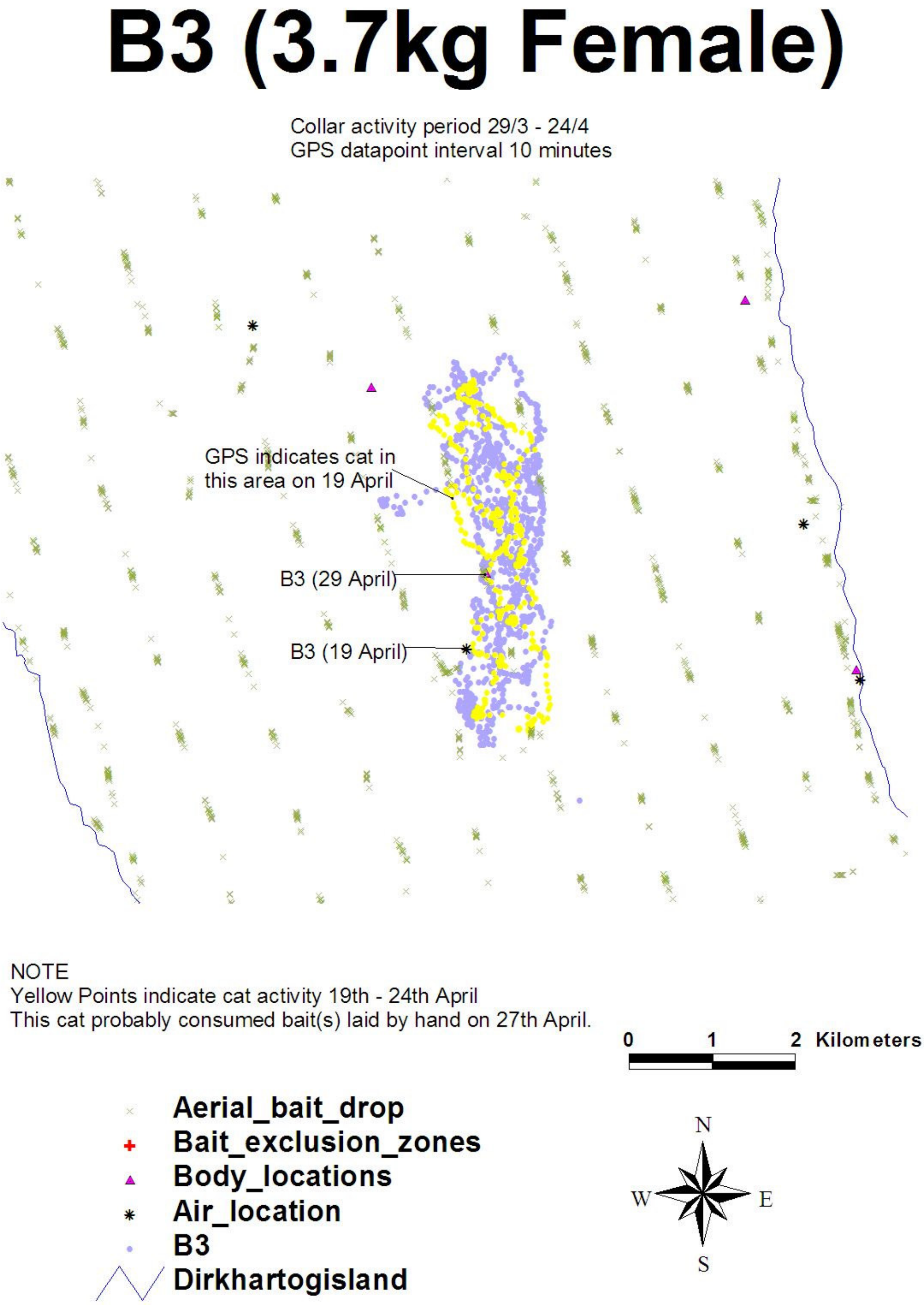

DH29 (4.7kg Male)
Collar activity period 30/3 - 7/5
GPS datapoint interval 80 minutes
NOTE
Yellow points indicate activity 19 April - 1 May.
This cat was not located from radio-tracking aircraft.
As such, no baits were placed specifically
around it on 19 April.
This cat was shot on 1 May
DH29 (29 March)
Withnell Point
DH29 (1 May)
Aerial_bait_drop
Bait_exclusion_zones
Trapsites
Body_locations
Air_location
Dh29
Dirkhartogisland
N
W
E
S
0
2
4
Kilometers

# B1 (3.8kg Male)

Collar activity period 25/3 - 19/4
GPS datapoint interval 80 minutes

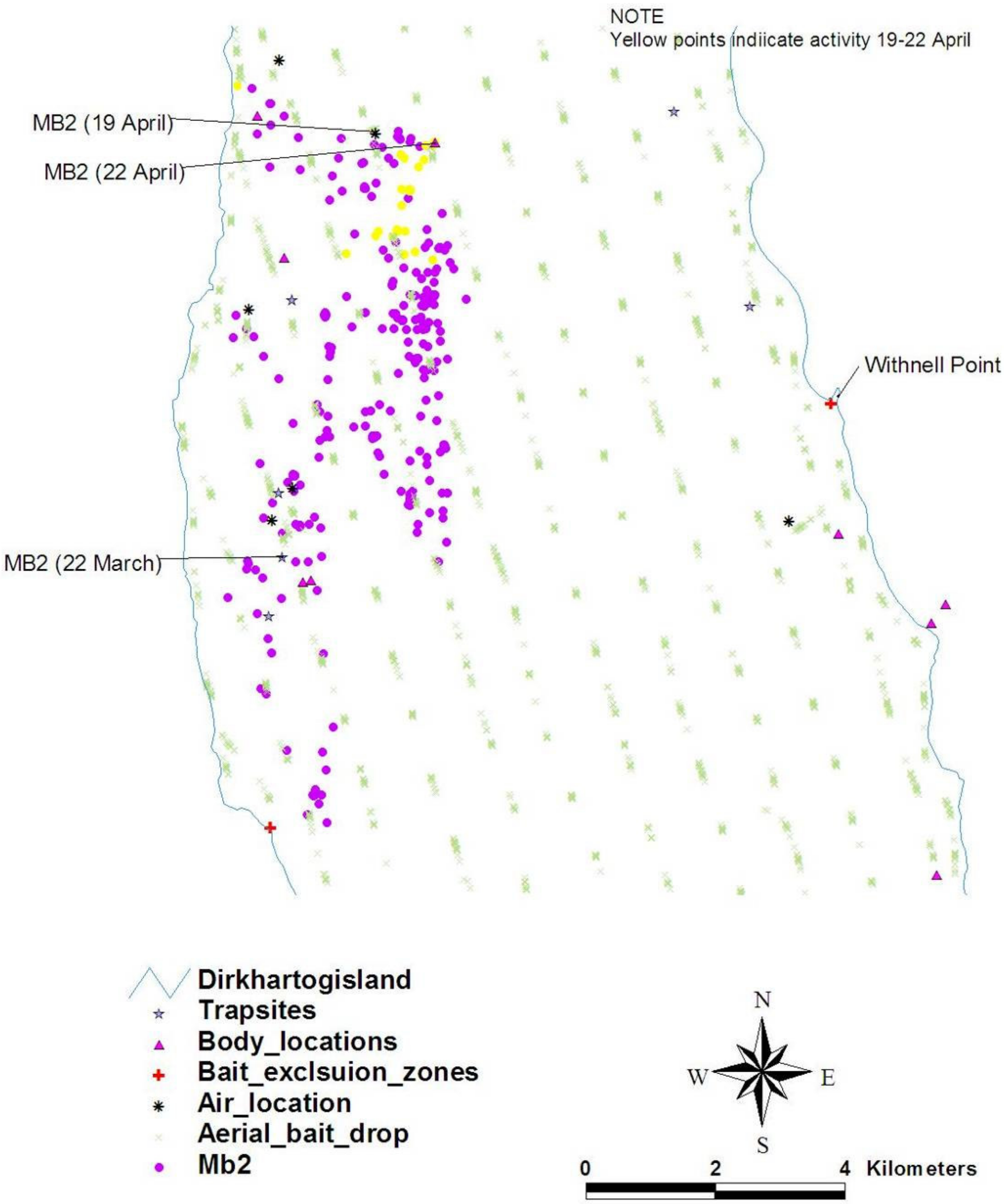


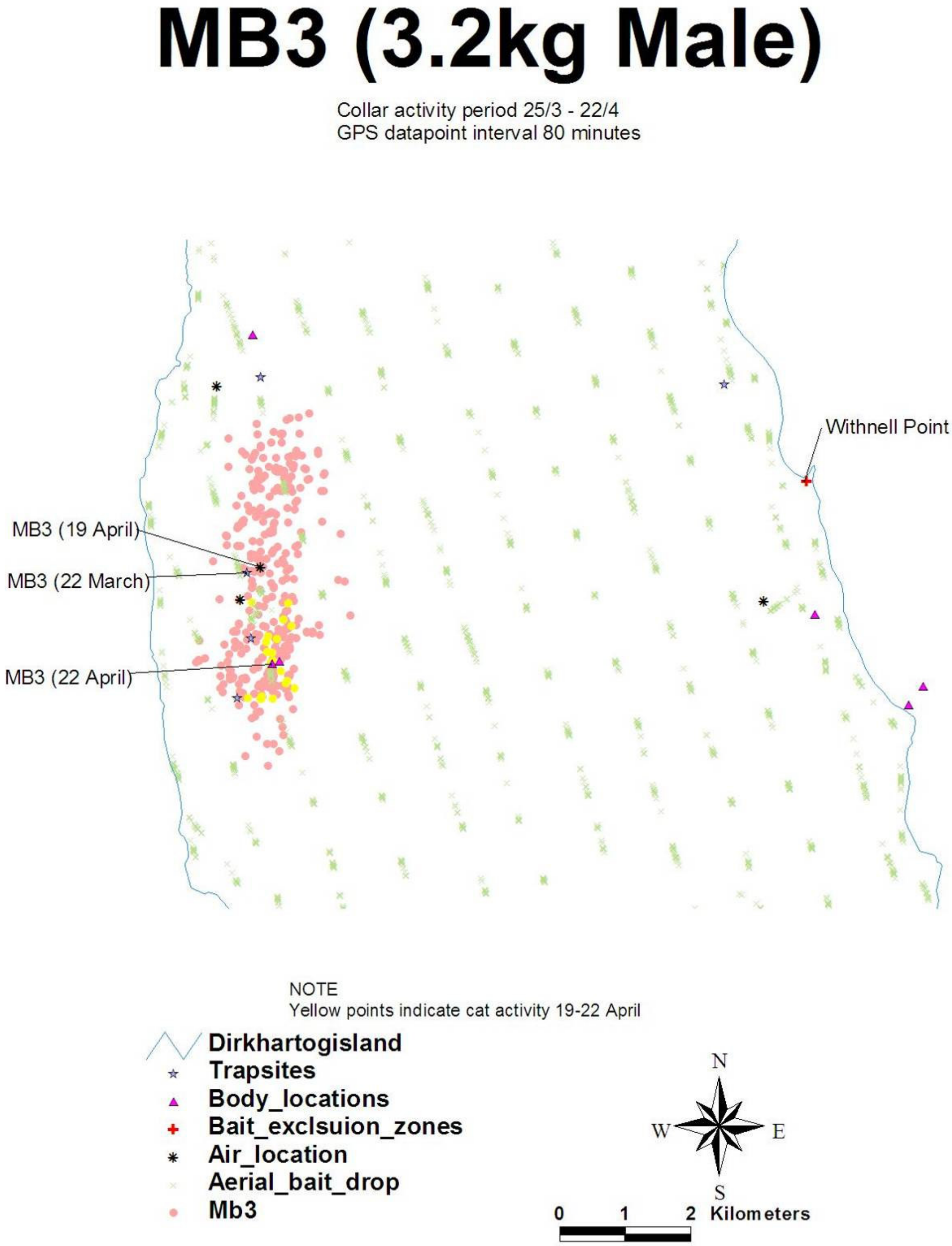

B2 (3.5kg Female)
Collar activity period 29/3 - 18/4
GPS datapoint interval 10 minutes
Mystery Beach
B2 (19 April)
B2 (29 April)
B2 (23 March)
NOTE
This cat probably consumed baits laid by hand on the 27th April
Body_locations
Aerial_bait_drop
Trapsites
Air_location
B2.shp
Bait_exclusion_zones
Dirkhartogisland
N
W
E
S
0
1
2 Kilometers


B3 (3.7kg Female)
Collar activity period 29/3 - 24/4
GPS datapoint interval 10 minutes
GPS indicates cat in this area on 19 April
B3 (29 April)
B3 (19 April)
NOTE
Yellow Points indicate cat activity 19th - 24th April
This cat probably consumed bait(s) laid by hand on 27th April.
0 1 2 Kilometers
Aerial_bait_drop
Bait_exclusion_zones
Body_locations
Air_location
B3
Dirkhartogisland
N
W
E
S

# MB2 (3.2kg Male)

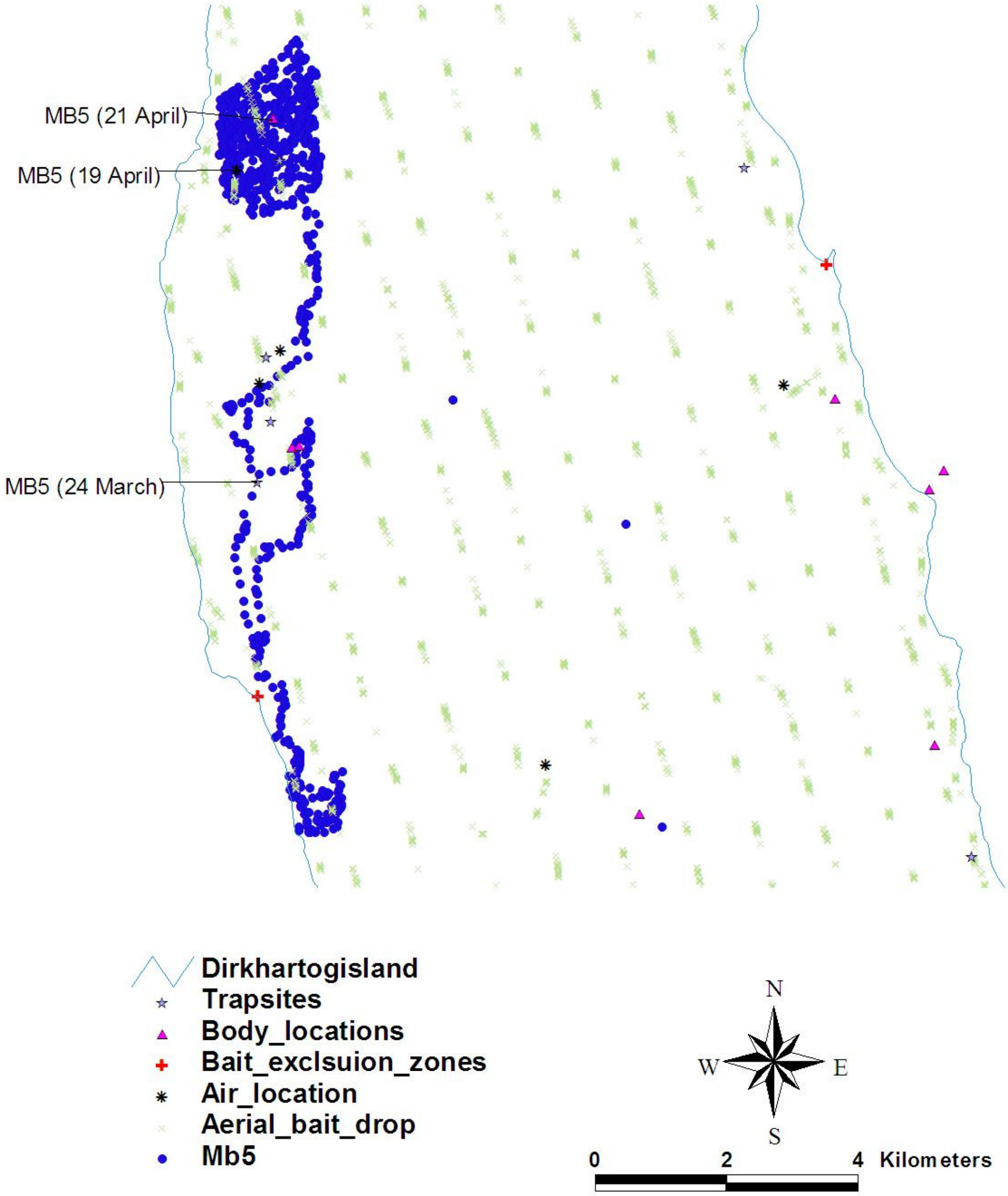
Collar activity period 29/3 - 22/4
GPS datapoint interval 80 minutes

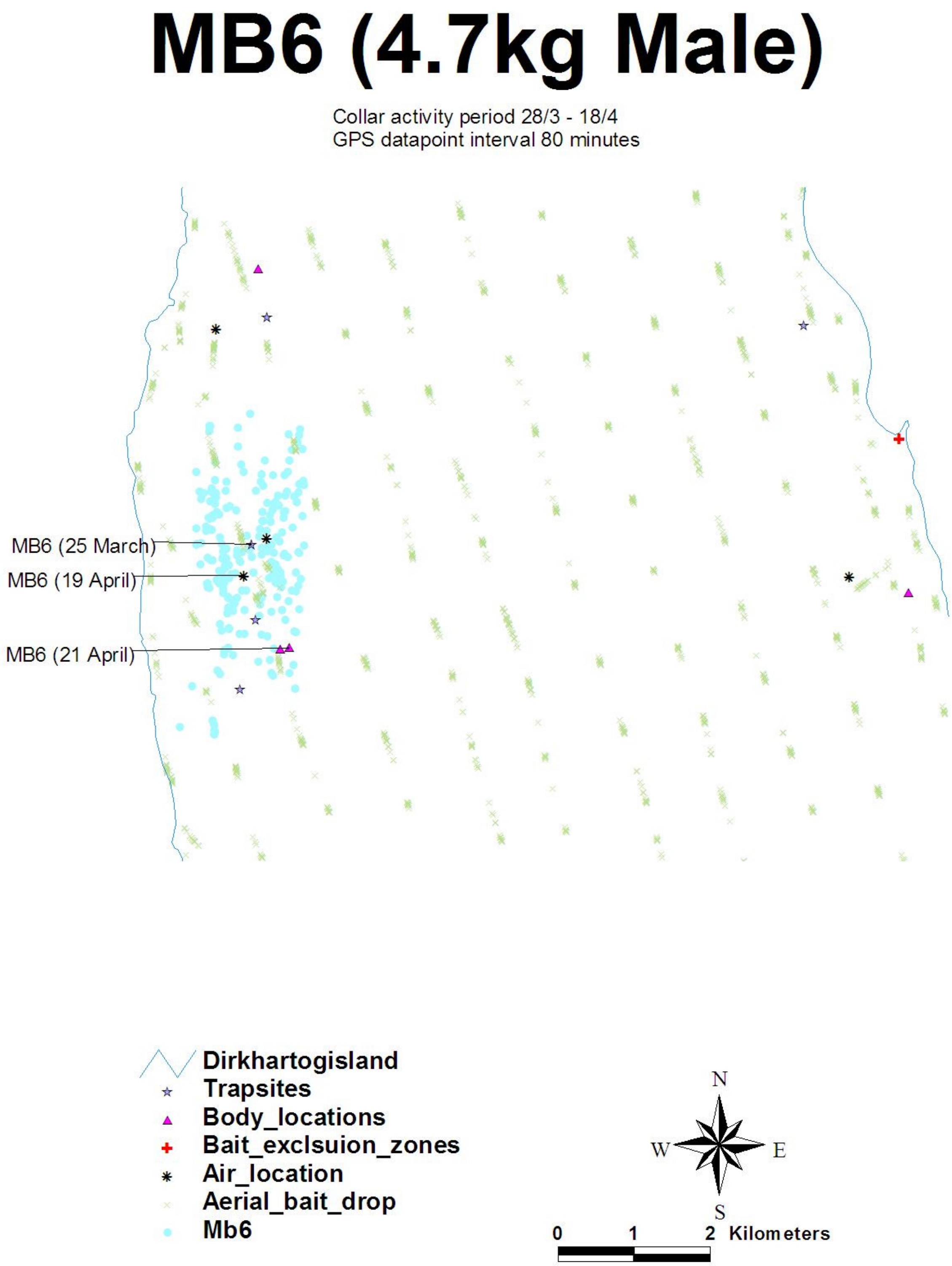


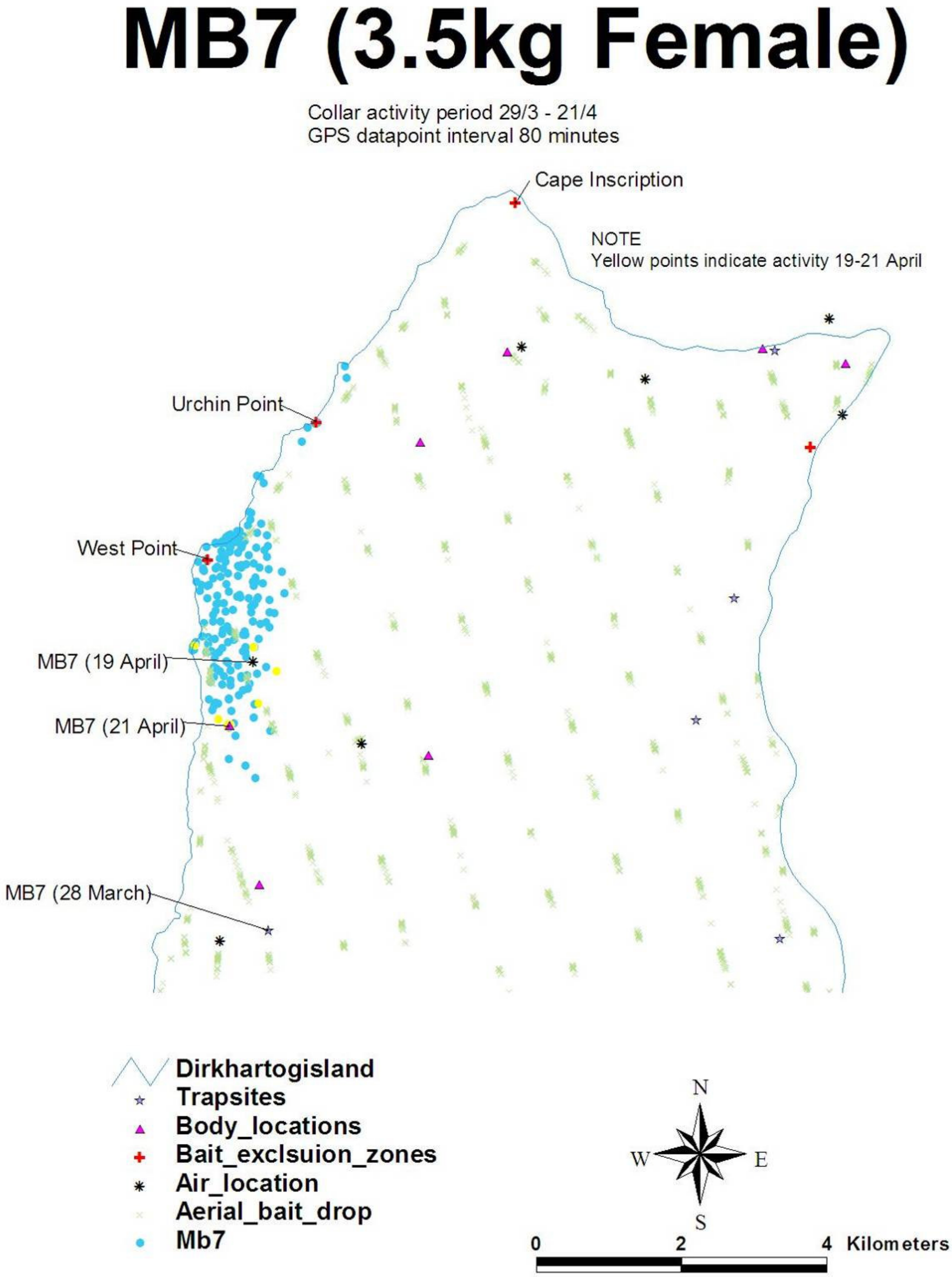

MB3 (3.2kg Male)
Collar activity period 25/3 - 22/4
GPS datapoint interval 80 minutes
Withnell Point
MB3 (19 April)
MB3 (22 March)
MB3 (22 April)
NOTE
Yellow points indicate cat activity 19-22 April
Dirkhartogisland
Trapsites
Body_locations
Bait_exclsuion_zones
Air_location
Aerial_bait_drop
Mb3
N
W
E
S
0
1
2
Kilometers

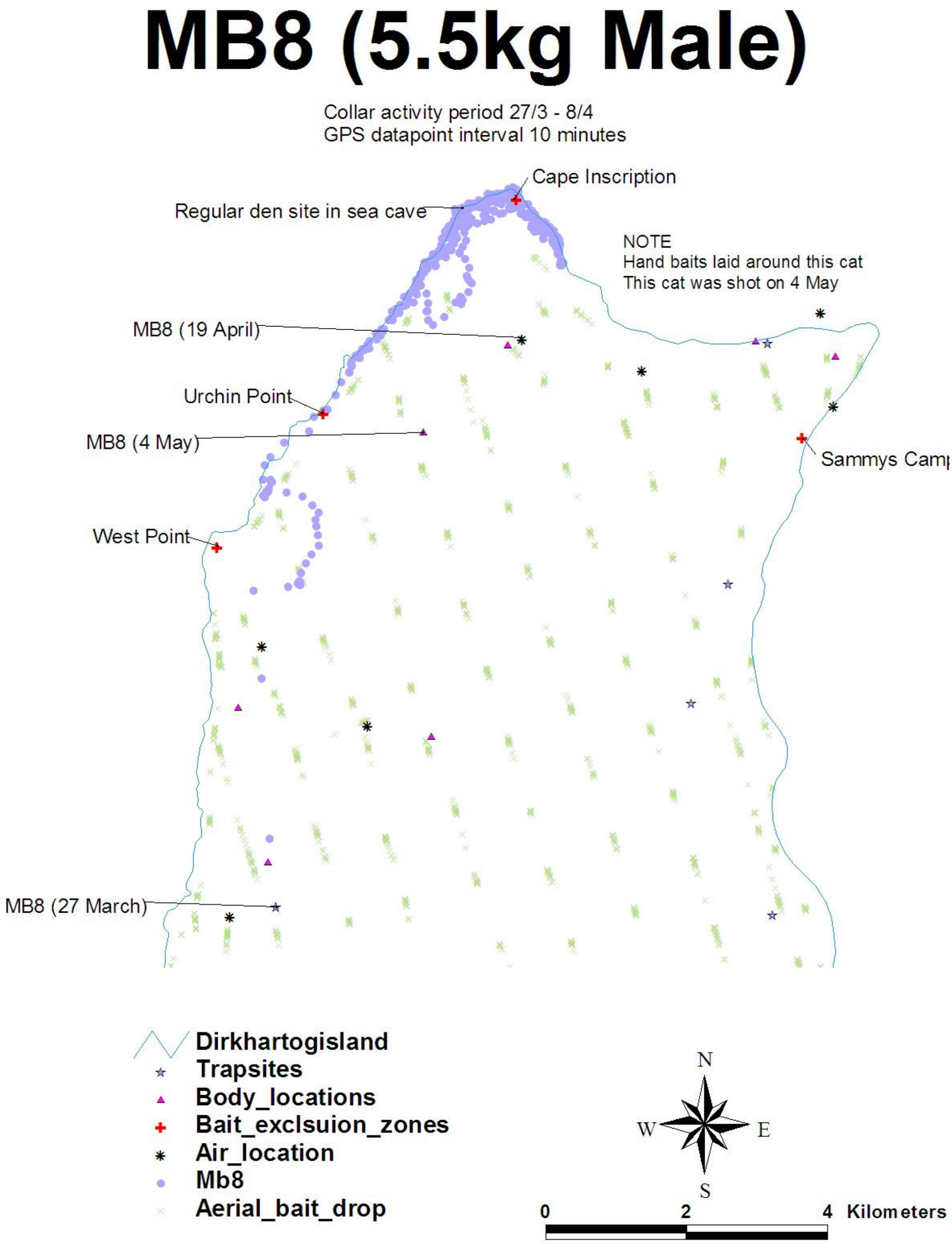
# MB5 (3.7kg Female)

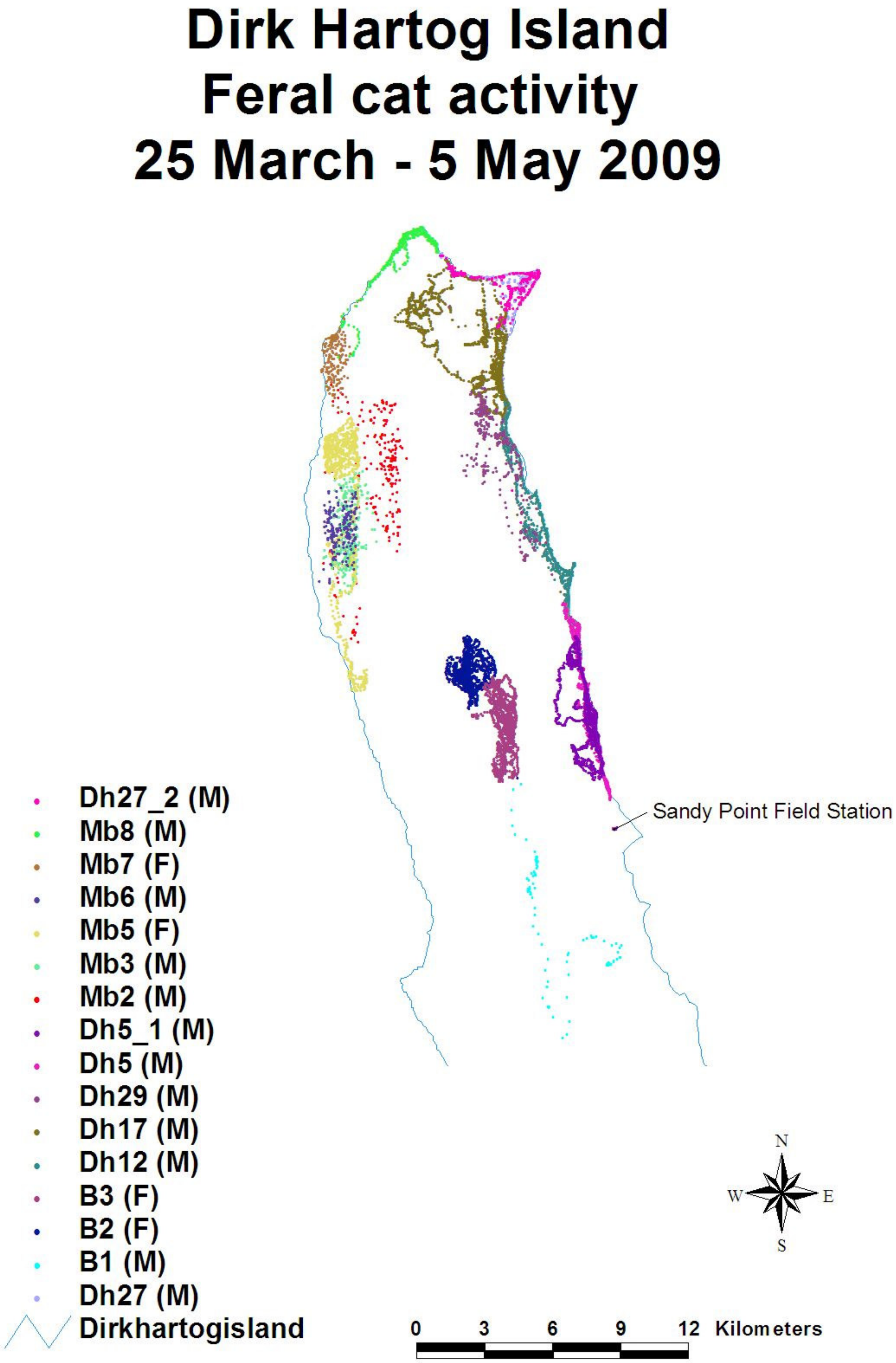
Collar activity period 28/3 - 10/4
GPS datapoint interval 10 minutes




MB6 (4.7kg Male)
Collar activity period 28/3 - 18/4
GPS datapoint interval 80 minutes
MB6 (25 March)
MB6 (19 April)
MB6 (21 April)
Dirkhartogisland
Trapsites
Body_locations
Bait_exclsuion_zones
Air_location
Aerial_bait_drop
Mb6
N
W
E
S
0
1
2 Kilometers


MB7 (3.5kg Female)
Collar activity period 29/3 - 21/4
GPS datapoint interval 80 minutes
Cape Inscription
NOTE
Yellow points indicate activity 19-21 April
Urchin Point
West Point
MB7 (19 April)
MB7 (21 April)
MB7 (28 March)
Dirkhartogisland
Trapsites
Body_locations
Bait_exclsuion_zones
Air_location
Aerial_bait_drop
Mb7
N
W
E
S
0
2
4 Kilometers


MB8 (5.5kg Male)
Collar activity period 27/3 - 8/4
GPS datapoint interval 10 minutes
Cape Inscription
Regular den site in sea cave
NOTE
Hand baits laid around this cat
This cat was shot on 4 May
MB8 (19 April)
Urchin Point
MB8 (4 May)
Sammys Camp
West Point
MB8 (27 March)
Dirkhartogisland
Trapsites
Body_locations
Bait_exclsuion_zones
Air_location
Mb8
Aerial_bait_drop
N
W
E
S
0
2
4
Kilometers


Dirk Hartog Island
Feral cat activity
25 March - 5 May 2009
Sandy Point Field Station
Dh27_2 (M)
Mb8 (M)
Mb7 (F)
Mb6 (M)
Mb5 (F)
Mb3 (M)
Mb2 (M)
Dh5_1 (M)
Dh5 (M)
Dh29 (M)
Dh17 (M)
Dh12 (M)
B3 (F)
B2 (F)
B1 (M)
Dh27 (M)
Dirkhartogisland
N
W
E
S
0
3
6
9
12
Kilometers